4H358D0250007

PA7300

AC Inverter

Installation and Operation Manual

230V Class	3Ø	5~125HP
460V Class	3Ø	5~500HP
600V Class	3Ø	5~100HP

For Quick Start Guide

"See Page iii Of This Instruction Manual"

TECO Westinghouse

BEFORE INSTALLATION & USE

1 Ensure that the nameplate data corresponds with the application requirements.
2. Ensure that the product is undamaged.

WARNING

The following safety precautions must be observed:

1. Electrical apparatus and incoming line supply can cause serious or fatal injury if the product is improperly installed, operated, or maintained. Responsible personnel must be fully trained to understand the hazards to themselves and others before being involved in installing, operating, maintaining, and decommissioning electrical apparatus.

   Particular industries and countries have further safety requirements. Refer to their trade safety bodies, British Standards Institution, Dept. of Trade & Industry, etc., for further information. In the USA, refer to NEMA MG2, the National Electrical Code, local safety requirements, etc. European Union Safety information can be obtained from such as:

   BS4999; EN60204-11 EN292-1 EN294
   IEE Wiring Regulations

2. When servicing, all power sources to the product and accessory devices should be de-energized and disconnected with all moving parts at standstill.

3. Safety guards and other protective devices must be neither bypassed nor rendered inoperative.

4. The apparatus must be grounded. Refer to relevant standards such as EN60204-1, IEE Wiring Regulation, etc.

5. A suitable enclosure must be provided to prevent access to live parts. Extra caution should be observed around apparatus that is automatically started, has automatic resetting relays, or is remotely started. In the event that these starting means have not been properly disabled, the apparatus could start unexpectedly.

WARNING

- Do not change the wiring while power is applied to the circuit.
- After turning OFF the main circuit supply, do not touch circuit components until the CHARGE LED is extinguished.
- Never connect power circuit outputs U (T1), V (T2), W (T3) to an AC power supply.
- When the auto restart function (Cn-36) is selected, the motor may restart suddenly after being stopped by momentary power loss.

CAUTION

- When mounting units in a separate enclosure, install a fan or other cooling device to keep the intake air temperature below 113 °F (45 °C).
- Do not perform a withstand voltage test to the AC drive.
- All the constants of the AC drive have been factory preset. Do not change the settings unnecessarily.

ATTENTION

If your PA7300 does not start properly...

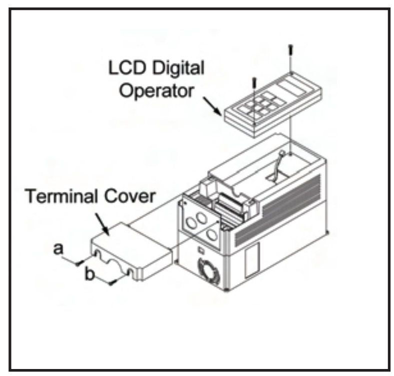
1. Review this **Quick Start Guide** or the **Instruction Manual**
2. Visit our website: **http://www.tecowestinghouse.com**
3. Call for factory support:
   1-800-451-8798 (ask for Drive technical support)

Quick Start Guide

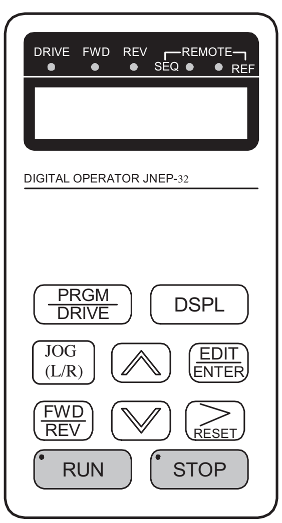
This guide is to assist in installing and running the inverter to verify that the drive and motor are working properly. Starting, stopping and speed control will be from the keypad. If your application requires external control or special system programming, consult the PA7300 Instruction Manual supplied with your inverter.

Step 1 Before Starting the Inverter

- Please review Safe Operation Notes (page 1) of the PA7300 Instruction Manual. Verify drive was installed in accordance with the procedures as described in PA7300 Handling Description on pages 3 through 17. If you feel this was improper, do not start the drive until qualified personnel have corrected the situation. (Failure to do so could result in serious injury).
- Check inverter and motor nameplates to determine that they have the same HPand voltage ratings. (Ensure that full load motor amps do not exceed that of the inverter.) Remove the terminal cover to expose the motor and power terminals. a. Verify that AC power is wired to L1, L2, and L3 (pages 11 & 12). b. Verify that Motor leads are connected to T1, T2, and T3 (pages 11 & 12). (The two leads may need to be reversed if motor rotation is not correct. Refer to pages 14-17).



names and functions shown as below:



operation mode indicators
DRIVE : lit when in DRIVE mode
FWD : lit when there is a forward run command input
REV : lit when there is a reverse run command input
SEQ : lit when the run command is enabled from the control circuit terminal or RS-485 option card (REMOTE mode)
REF : lit when the frequency reference from the control circuit terminals (VIN or AIN) or RS-485 option card enabled (REMOTE mode)

LCD Display
English Display: 2 row, each row has 20 characters at most

Keys (Key functions are defined in Table 11)

Step 2 Apply Power to the Drive

- Apply AC power to the Drive and observe Operator. LCD Display Line 1 should read "Freq. Cmd 0.00Hz". Line 2 should read "TECO".

STOP Key should have RED LED lit. Drive LED and FWD LED's will be lit.

Step 3 Set Drive to Run Mode

- If Red Drive LED is not on with AC power up, PressPGRM/DRIVE key until Red Drive LED is on. Inverter is now in the Run Mode.

Step 4 Check Motor Rotation Without Load

- Check LCD display to verify that line 1 displays Frequency Command "Freq. Cmd 0.00Hz". (If not displayed, press DISPLkey repeatedly until "Freq. Cmd X.XX Hz" is displayed.)
- Change frequency to low rotation speed (5Hz suggested) to check motor rotation. Observe flashing numeric character after Cmd. This character can be changed by pressing the up or down Arrow keys. To move right or pressing the up or down Arrow keys. left for next digit, press RESET key. Enter desired frequency up to 5Hz. Press the DATAENTER key to set the speed. (Numbers will stop flashing.)
- Press RUN key (Red LED should light) and check motor rotation. If it is not correct:
  Press STOP key.
  Remove AC power.
  Wait for LED "charge" lamp to extinguish.
  Reverse motor leads T1 and T2.
  Restart the drive and check new rotation.
- Press STOP key to stop the drive.

Step 5 Check Full Speed at 60Hz

- Repeat Step 4 by setting frequency to 60Hz.
- Press RUN key. Check drive acceleration to full speed.
- Press STOPkey to stop drive and check deceleration.

Step 6 Other Operations

- For information, see MA7200 InstruPlease refer to the following pages:

Set Accel..p.36
Set Decel .... p. 36
Set Max Speed ....p. 44
Set Min Speed ....p. 44
Set Motor Rated Current ....p. 44

CONTENTS

PART II OPERATION MANUAL Pages

APPENDIX:

LISTS OF FIGURES

FIGURE NO. Pages

PART I Installation Manual

PART II Operation Manual II

LIST OF TABLES

TABLE NO. Pages

PART I Installation Manual

PART Operation Manual II

PART I

INSTALLATION MANUAL

1. GENERAL

1.1 SAFE OPERATION NOTES

Read this installation manual thoroughly before installation, operation, maintenance, or inspection of the apparatus. Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement.

In this manual, notes for safe operation are classified as:

"WARNING" or "CAUTION".

WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury to personnel.

CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury to personnel and damage to equipment. It may also be used to alert against unsafe practices.

This AC drive has been placed through demanding tests at the factory before shipment. After unpacking, check for the following:

1. Verify that part numbers on the shipping carton and unit match the purchase order sheet and/or packing list.
2. Do not install or operate any AC drive which is damaged or missing parts.
3. Do not install or operate any AC drive which has no QC marking.

Contact your local distributor or TECO representative if any of the above have been found.

1.2 PRODUCT CHANGES

TECO-Westinghouse reserves the right to discontinue or make modifications to the design of its products without prior notice, and holds no obligation to make modifications to products sold previously. TECO-Westinghouse also holds no liability for losses of any kind which may result from this action.

2. RECEIVING

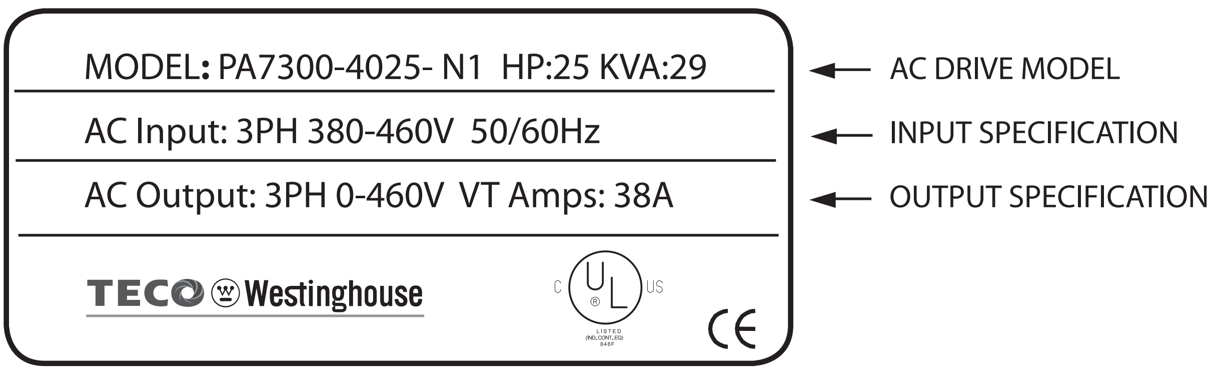
CAUTION

This PA7300 has been put through demanding tests at the factory before shipment.
After unpacking, verify the following:

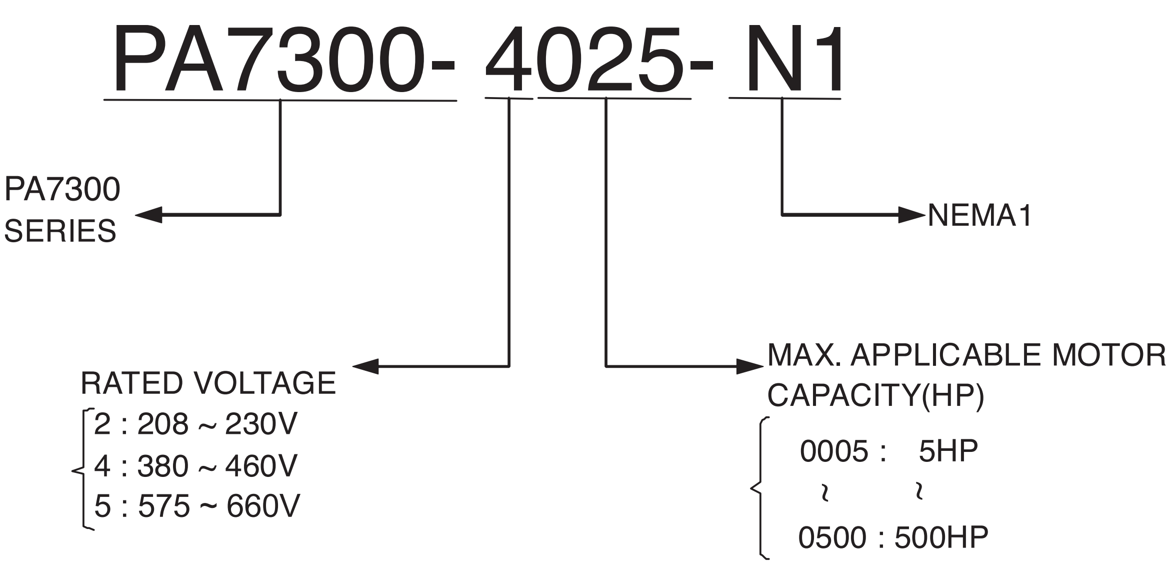
- Verify that the received product and the purchase order sheet (invoice) and/or packing is a match
- Transit damage.

If any part of the PA7300 is damaged or lost, immediately notify the shipper.

•NAMEPLATE DATA (460V CLASS 25HP example)



•MODEL DESIGNATION



3. INSTALLATION

CAUTION

- Never move, lift, or handle the PA7300 cabinet by the front cover.
- Lift the cabinet from the bottom
- Do not drop the AC Drive.

3.1 MOUNTING SPACE

Install the PA7300 vertically and allow sufficient space for effective cooling as shown in Fig. 1.

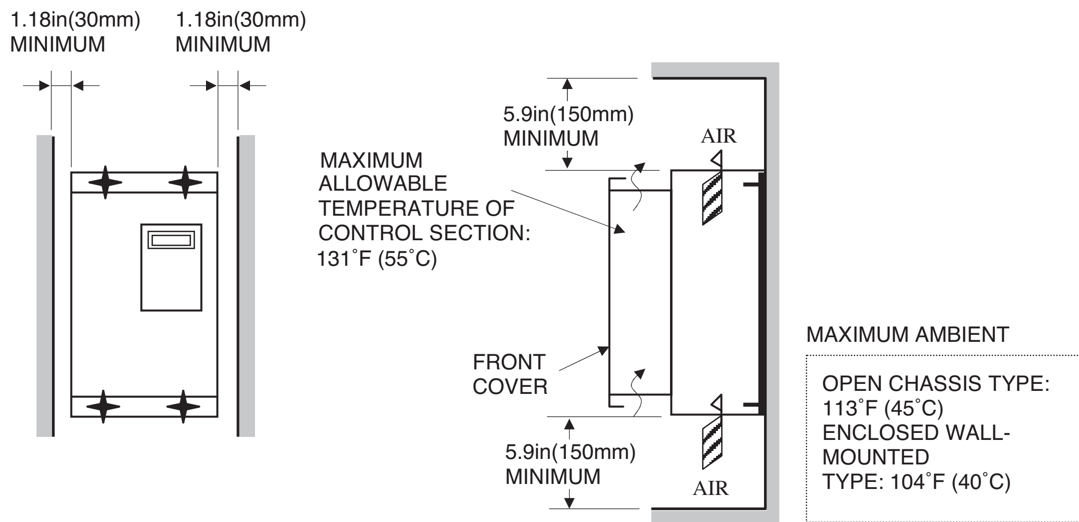


Figure 1 Mounting Spaces

(a) Front View (b) Side View

Note: For product external dimensions and mounting dimensions, refer to "DIMENSIONS" on page 8-1.

3.2 LOCATION

Location of the equipment is important to achieve proper performance and normal operating life. The PA7300 should be installed in areas where the following conditions exist:

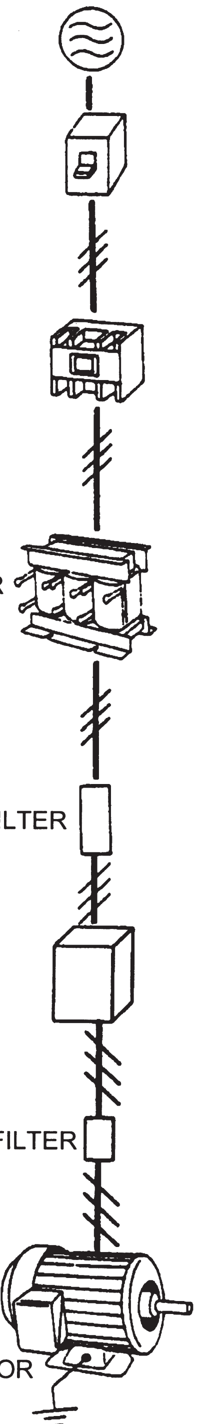
- Protection from rain or moisture.
- Protection from direct sunlight.
- Protection from corrosive gases or liquids.
- Free from airborne dust or metallic particles.
- Free from vibration.
- Free from magnetic noise (e.g. welding machines, power units)
- Ambient temperature:
  +14 to 104˚F, -10 to +40˚C (For enclosed type)
  +14 to 113˚F, -10 to +45˚C (For open chassis type)
- Free from combustible materials, gases, etc.

CAUTION

When mounting multiple units in a common enclosure, install a cooling fan or some other means to cool the air entering the AC Drive to at least 113ºF (45ºC) or below.

4. WIRING

4.1 NOTES ON WIRING TO PERIPHERAL UNITS



- **MCCB (molded case circuit breaker)**
  Please refer to Table 3. for MCCB selection.
  Do not use a circuit breaker for start/stop operation.
  When a ground fault interrupter is used, select one unaffected by high frequency. Setting current should be 200mA or above and the operating time at 0.1 second or longer to prevent malfunction.

- **MC (magnetic contactor)**
  It is not always necessary to have the MC on the input side. However, an input MC can be used to prevent an automatic restart after recovery from an external power loss during remote control operation.
  Do not use the MC for start/stop operation.

- **AC LINE REACTOR**
  To improve power factor or to reduce surge, install an AC line reactor. There is a DC choke built-in on PA7300, models 30HP (22KW), 230 VAC, 40HP (30 KW), 460VAC 30HP (22KW), 600VAC and larger. The 460V 350 ~ 500HP need to install AC reactor externally.

- **Input Noise Filter**
  When used with the specified input noise filter, the PA7300 can comply with EN55011 class A. Please refer to section 9.2 and the EMC technical manual for noise filter selection.

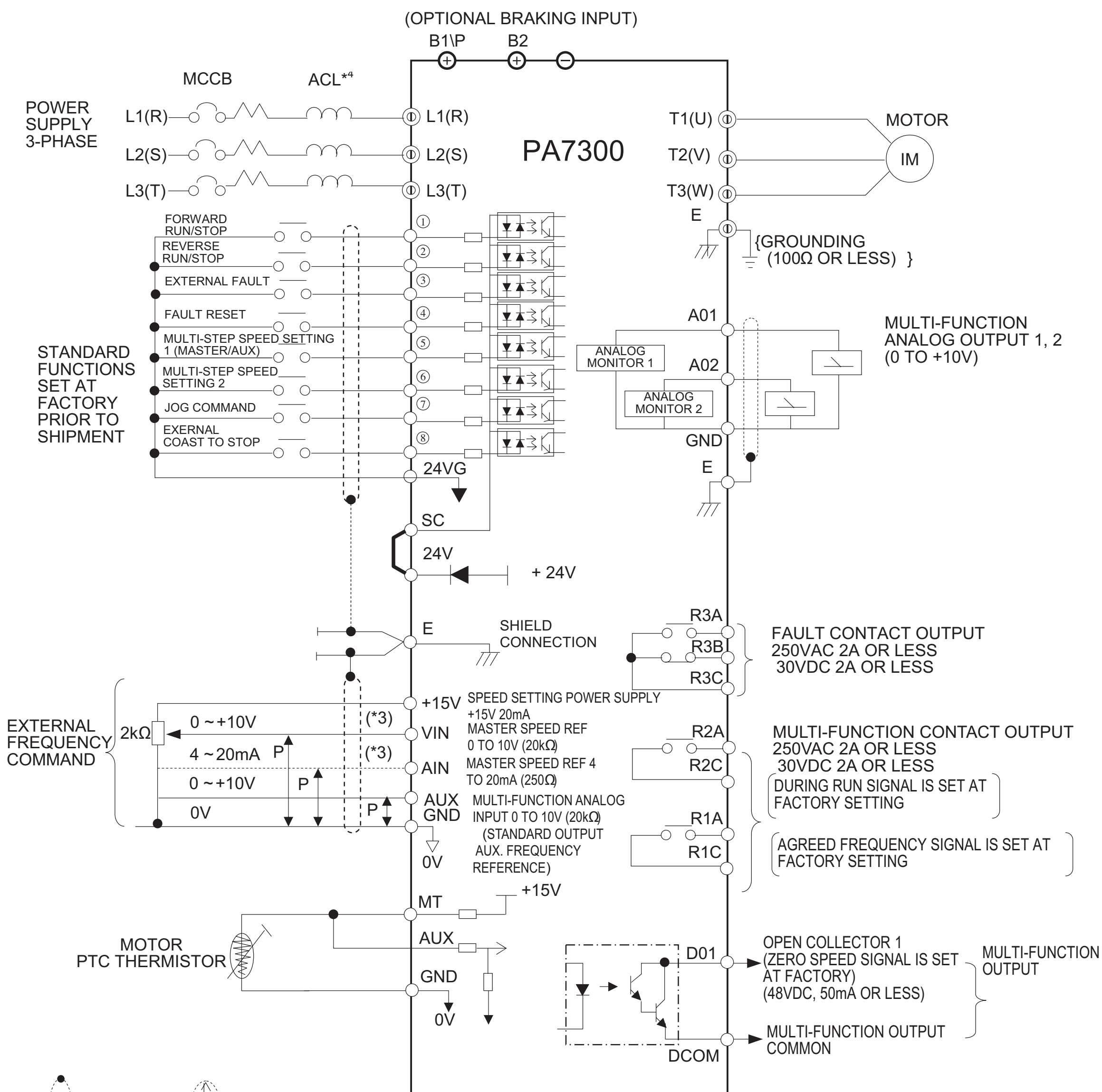
- **AC Drive**
  Wire input to terminals L1, L2, and L3 for three phase input. Make sure to connect the ground terminal to an appropriate safety ground.

- **Output Noise Filter (EMI Suppression zero core)**
  When used with output noise filter, radiated and conducted emissions may be reduced. See section 9.2.2.

- **Motor**
  When multiple motors are driven in parallel with an AC Drive, the AC Drive rated current should be at least 1.1 times the total motor rated current. Make sure that the motor and the AC Drives are separately grounded.

4.2 CONNECTION DIAGRAM

The following diagram shows interconnection of the main and control circuits.
When using the digital operator control, the motor can be operated by wiring the main circuit only.
(Terminal Symbols: ◎ indicates main circuit; ○ indicates control circuit).



* 1. shield wire P shield twisted wire

* 2. The terminal ① ~ ⑧ can be connected as SINK or SOURCE type input interface. (Ref. to Appendix D)

* 3. The terminal arrangement.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
24VG	24VG	1	2	3	4	5	6	7	8	SC	24V	E	15V	VIN	AIN	AUX	MT	GND	A01	A02	GND	D01	DCOM

1	2	3	4	5	6	7
R1A	R1C	R2A	R2C	R3A	R3B	R3C

* Shorted at factory

* 4. For 440V 350HP ~ 500HP need to install ACL externally.

Fig.2 Standard connection diagram

4.3 TERMINAL FUNCTION

4.3.1 MAIN CIRCUIT TERMINALS

Table 1. Main Circuit Terminals

TERMINALS	TERMINAL FUNCTION
R / L1	Main Circuit Input Power Supply
S / L2	
T / L3	
U / T1	AC Drive Output
V / T2	
W / T3	
B1/P	DC Power Supply Input or Braking Unit
⊖	
B2	B2-D:External Braking Resistor (For 230V up to 25HP, 460V up to 30HP, 600V up to 30HP)
E (PE,⏚)	Grounding Lead (3rd Type Grounding)

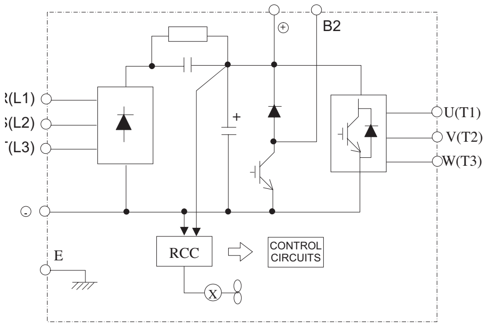
4.3.2 CONTROL CIRCUIT TERMINALS

Table 2. Control Circuit Terminals

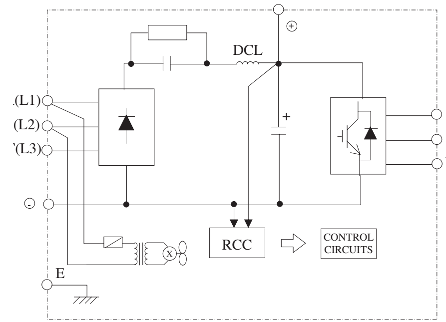
I/O	TERMINAL	FUNCTIONS	
Digital Input Terminals	1	Forward operation-stop signal.	
	2	Reverse operation-stop signal.	
	3	External fault input.	
	4	Fault reset.	
	5 6 7 8	Multi-function contact input: the following signals are available to select: Forward/reverse select, mode select, multi-speed select, jog frequency select, accel/decel time select external fault, external coast to stop, hold command, AC Drive overheat prediction, DB command, aux. Input effective, speed search, and enery-saving operation.	
	24VG	SINK Common (0V), ref to appendix D.	
	24V	SOURCE Common (24V), ref to appendix D.	
	SC	Sequence input Common (24V), ref to appendix D.	
Analog Input Terminals	+15V	+15V power supply for external frequency command.	
	VIN	Master speed voltage reference (0 to 10V).	
	AIN	Master speed current reference (4 to 20mA).	
	AUX	Auxiliary analog command: one of the following signals available to select. Frequency command, frequency gain, frequency bias, overtorque detection level, voltage bias, accel/decel rate, DB current.	
	MT	Motor temperature PTC thermistor. (active: 1330Ω, Return: 550Ω)	
	GND	Analog signal common.	
	E	Connection to shield signal lead. (frame ground)	
Digital Output Terminals	R3A	Fault contact output A (Closed at fault)	
	R3B	Fault contact output B (Open at fault)	
	R3C	Fault contact output common.	
	R2A-R2C R1A-R1C	Multi-function contact output: one of the following signals available to output. Output during running, zero speed, synchronized speed, arbitrary speed agreed, frequency detection, overtorque, undervoltage, run mode, coast to stop, braking resistor overheat alarm, fault.	
Analog Output Terminals	D01	Multi-function PHC (photo-coupler) output 1 (open collector,48VDC, 50mA)	The same functions as terminals R1A-R1C and R2A-R2C
	DCOM	Multi-function PHC output common.	
	A01	Analog multifunction output port: Frequency command, Output frequency, Output current, Output voltage, DC voltage, Output power.	0~11V max. 2mA or less
	A02 GND	Common lead for analog port.	

4.3.3 MAIN CIRCUIT SCHEMATIC

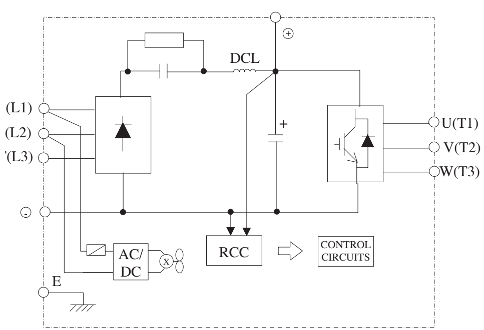
1. 230V : 5HP ~ 25HP
   460V : 5HP ~ 30HP
   575V : 5HP ~ 25HP



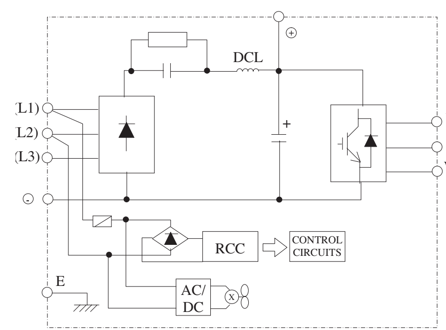
2. 230V : 30HP
   460V : 40HP, 50HP, 60HP
   600V : 30HP ~ 100HP



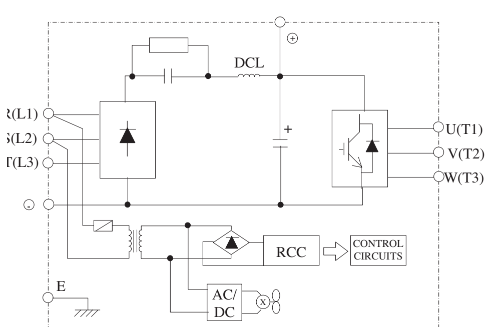
3. 230V : 40HP, 50HP
   460V : 75HP, 100HP



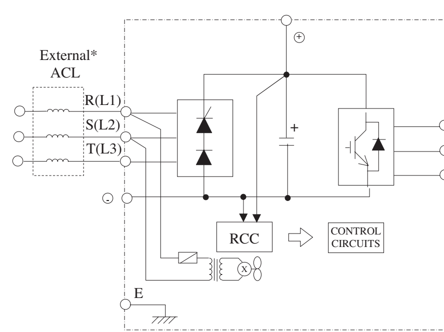
4. 230V : 60HP, 75HP, 100HP, 125HP



5. 460V : 125HP, 150HP, 175HP, 215HP
   250HP, 300HP



6. 460V : 350HP, 400HP, 500HP



* External ACL is necessary

4.4 WIRING PARTS

4.4.1 RECOMMENDED WIRING PRACTICE

Be sure to connect MCCBs between the power supply and PA7300 input terminals L1 (R), L2 (S), L3 (T). Recommended MCCBs are listed in Table 3.
When a ground fault interrupter is used, select one with no influence on high frequency. The current setting should be 200mA or higher and operating time at 0.1 second or higher to prevent malfunction.

Table 3 Applicable Wire and Contactor Size

(a) 230V SERIES

MAX. APPLICABLE MOTOR OUTPUT HP (KW) [NOTE 1]	CABLE SIZE - MM2 (AWG)			MOLDED-CASE CIRCUIT BREAKER [NOTE 4]	MAGNETIC CONTACTOR [NOTE 4]
	POWER CABLE [NOTE 2]	GROUND CABLE E [G]	CONTROL CABLE [NOTE 3]		
5(3.7)	5.5	5.5	0.5~2	TO-50EC (30A)	CN-16
7.5(5)	8	5.5~8	0.5~2	TO-100S (50A)	CN-18
10(7.5)	8	5.5~8	0.5~2	TO-100S (60A)	CN-25
15(11)	22	8	0.5~2	TO-100S (100A)	CN-50
20(15)	22	8	0.5~2	TO-100S (100A)	CN-65
25(18.5)	22 (4)	14 (6)	0.5~2 (20-14)	TO-225S (150A)	CN-80
30(22)	22 (4)	14 (6)	0.5~2 (20-14)	TO-225S (175A)	CN-100
40(30)	60 (2/0)	22 (4)	0.5~2 (20-14)	TO-225S (175A)	CN-125
50(37)	60 (2/0)	22 (4)	0.5~2 (20-14)	TO-225S (200A)	CN-150
60(45)	60×2P (2/0×2P)	22 (4)	0.5~2 (20-14)	TO-225S (225A)	CN-180
75(55)	60×2P (2/0×2P)	30 (2)	0.5~2 (20-14)	TO-400S (300A)	CN-300
100(75)	100×2P (4/0×2P)	50 (1/0)	0.5~2 (20-14)	TO-400S (400A)	CN-300
125(90)	100×2P (4/0×2P)	50 (1/0)	0.5~2 (20-14)	TO-400S (400A)	S-K400 (Note 5)

Note:
1. For constant Torque Load
2. Power Cable Includes Cables to the Control Terminals. R(L1), S(L2), T(L3), ⊕, ⊖, B2, U(T1), V(T2), W(T3).
3. Control Cable includes Cables to the Control Terminals.
4. The Molded-Case Circuit Breakers and Magnetic Contactors Shown in Table 3 are TECO Products and are for reference only. Other manufacturer's equivalents may be selected.
5. The Magnetic Contactors S-K400 and S-K600 are Mitsubishi Products and are for reference only. Other manufacturer's equivalents may be selected.

(b) 460V SERIES

Max. Applicable Motor Output HP (KW) [Note 1]	Cable Size - mm2 (AWG)			Moulded-Case Circuit Breaker [Note 4] E [G]	Magnetic Contactor [Note 4] [Note 3]
	Power Cable	Ground Cable [Note 2]	Control Cable		
5(3.7)	2~5.5	3.5-5.5	0.5~2	TO-50EC (15A)	CN-18
7.5(5)	3~5.5	3.5~5.5	0.5~2	TO-50EC (20A)	CN-18
10(7.5)	5.5	5.5	0.5~2	TO-50EC (30A)	CN-25
15(11)	8	8	0.5~2	TO-50EC (30A)	CN-25
20(15)	8	8	0.5~2	TO-100S (50A)	CN-35
25(18.5)	8 (8)	8 (8)	0.5~2 (20-14)	TO-100S (75A)	C-50L
30(22)	8 (8)	8 (8)	0.5~2 (20-14)	TO-100S (100A)	C-50L
40(30)	8 (8)	8 (8)	0.5~2 (20-14)	TO-100S (100A)	C-65L
50(37)	22 (4)	14 (6)	0.5~2 (20-14)	TO-125S (125A)	C-80L
60(45)	22 (4)	14 (6)	0.5~2 (20-14)	TO-225S (175A)	C-100L (170A)
75(55)	38 (1)	22 (4)	0.5~2 (20-14)	TO-225S (175A)	C-125G (170A)
100(75)	60 (2/0)	22 (4)	0.5~2 (20-14)	TO-225S (225A)	C-150G (200A)
125(90)	60 x 2P (2/0 x 2P)	30 (2)	0.5~2 (20-14)	TO-400S (300A)	C-300L (400A)
150(110)	60 x 2P (2/0 x 2P)	30 (2)	0.5~2 (20-14)	TO-400S (300A)	C-300L (400A)
175(125)	60 x 2P (2/0 x 2P)	50 (1/0)	0.5~2 (20-14)	TO-400S (400A)	C-300L (400A)
215(160)	100 x 2P (4/0 x 2P)	50 (1/0)	0.5~2 (20-14)	TO-400S (400A)	C-300L (400A)
250(185)	100 x 2P (4/0 x 2P)	50 (1/0)	0.5~2 (20-14)	TO-600S (600A)	S-K400 [Note 5] (450A)
300(220)	100 x 2P (4/0 x 2P)	60 (2/0)	0.5~2 (20-14)	TE-800S (800A)	S-K600 (800A)
350(270)	325x 2P (650 x 2P)	60 (2/0)	0.5~2 (20-14)	TE-1000 (1000A)	S-K600 (800A)
400(300)	325 x 2P (650 x 2P)	60 (2/0)	0.5~2 (20-14)	TE-1000 (1000A)	S-K600 (800A
500(375)	325 x 2P (650 x 2P)	60 (2/0)	0.5~2 (20-14)	TO-400S (1000A)	S-K800 (100A)

(c) 600V SERIES

Max. Applicable Motor Output Circuit Breaker HP (KW)	Cable Size - mm2 (AWG)			Moulded-Case [Note 4]	Magnetic [Note 4]
	Contactor Power Cable	Ground Cable	Control Cable		
5(3.7)	2~5.5	3.5~5.5	0.5~2	TO-50EC (15A)	CN-18
7.5(5)	3~5.5	3.5~5.5	0.5~2	TO-50EC (15A)	CN-18
10(7.5)	3~5.5	5.5	0.5~2	TO-50EC (15A)	CN-18
15(11)	8 (8)	8 (8)	0.5~2	TO-50EC (30A)	CN-25
20(15)	8 (8)	8 (8)	0.5~2	TO-50EC (30A)	CN-25
25(18.5)	8~14 (8~6)	8 (8)	0.5~2	TO-100S (50A)	CN-35
30(22)	8~14 (8~6)	14 (6)	0.5~2	TO-100S (50A)	CN-35
40(30)	8 (8)	14 (6)	0.5~2	TO-100S (100A)	CN-50
50(37)	14 (6)	14 (6)	0.5~2	TO-125S (100A)	CN-50
60(45)	14~22 (6~4)	22 (4)	0.5~2	TO-225S (125A)	CN-80
75(55)	38 (1)	22 (4)	0.5~2	TO-225S (175A)	CN-100
100(75)	38 (1)	22 (4)	0.5~2	TO-225S (175A)	CN-100

4.4.2 CAUTIONS FOR WIRING

CAUTION

The external interconnection wiring must be performed with the following procedures.
After completing PA7300 interconnections, be sure to check that connections are correct. Never use control circuit buzzer check.

(A) MAIN CIRCUIT INPUT/OUTPUT

(1) Phase rotation of input terminals L1 (R), L2 (S), L3 (T) is available in either direction. (Clockwise and counterclockwise).

(2) When AC Drive output terminals T1 (U), T2 (V), and T3 (W) are connected to motor terminals T1(U), T2 (V), and T3 (W), respectively, the motor rotates counterclockwise. (Viewed from opposite side of drive end, upon forward operation command). To reverse the rotation interchange any two of the motor leads.

(3) Never connect the AC main circuit power supply to output terminals T1 (U), T2 (V), and T3 (W). This may cause damage to the AC Drive.

(4) Care should be taken to prevent contact of wiring leads with the PA7300 cabinet. If this occurs, a short-circuit may result.

(5) Never connect power factor correction capacitors or noise filters to the PA7300 output.

(6) Never open or close contactors in the output circuit unless AC Drive is properly sized.

(7) The main circuit wiring should use suitable O-type terminals, and the width of each terminal must be less than the terminal block to insure that each terminal is isolated.

CAUTION

- Lead size should be determined by taking into account voltage drops of leads. Voltage drops can be obtained by the following equation: select lead size such that voltage drop will be within 2% of the normal rated voltage.

  Phase-to-phase voltage drop (V):
  $=\sqrt{3}$ x lead resistance (Ω /km) X wiring distance(m) x current(A) X 10^{-3}.
- Wiring length between AC Drive and motor:
  If total wiring distance between AC Drive and motor is excessively long and AC Drive carrier frequency (main transistor switching frequency) is high, harmonic leakage current from the cable could affect the inverter unit or peripheral devices. If the wiring distance between inverter and motor is long, reduce the AC Drive carrier frequency.

(B) GROUNDING (Protective Earth)

Ground the PC Drive through ground terminal E (PE).

(1) Ground resistance should be 100 ohms or less.

(2) Never ground the AC Drive in common with welding machines, motors, other high-current electrical equipment, or a ground pole. Run the ground lead in separate conduit from leads for high-current electrical equipment.

(3) Use the ground leads which comply with AWG standards, and make the sure the length is as short as possible.

(4) Where several PA7300 units are used side-by-side, it is preferable to ground each unit separately to ground poles. However, connecting all the ground terminals of the PA7300 in parallel while grounding only one of the PA7300s to the ground pole is also permissible (Fig. 3).
Be sure not to form a loop with the ground leads.

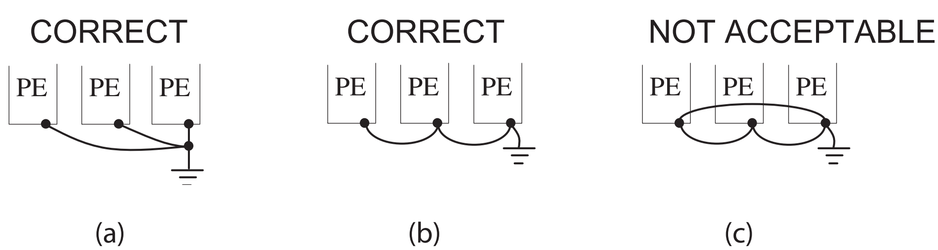


Fig 3. Grounding of Multiple PA7300 Drives

(C) CONTROL CIRCUIT

(1) Separation of control circuit leads and main circuit leads: All signal leads must be separated from power leads L1 (R), L2 (S), L3 (T), ⊕, ⊖, B2, T1 (U), T2 (V), T3 (W) and other power cables to prevent erroneous operation caused by noise interference.

(2) Control circuit leads R1A-R1B-R1C, R2A-R2C, and R3A-R3C (contact output) must be separated from leads 1 to 8, A01, A02, D01-DCOM, and 24V, SC, 24VG,VIN, AIN, AUX, MT, GND.

(3) Use twisted shielded or twisted pair shielded wire for the control circuit line, and connect the shield sheath to the AC Drive terminal E to prevent malfunctions caused by noise. See Fig.4.
Wiring distance should be less than 164ft (50m).

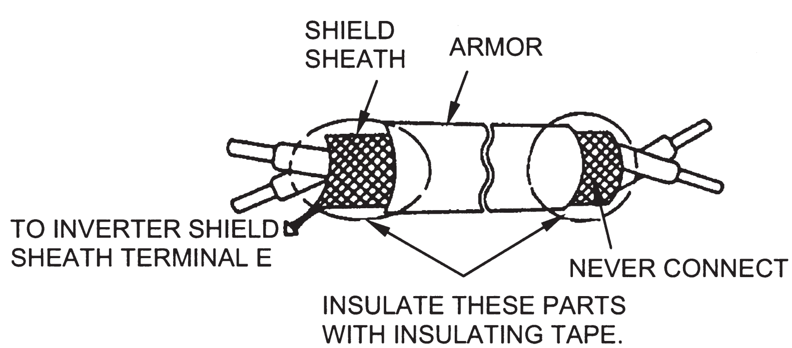


Fig. 4 Shielded Wire Termination

5. TEST OPERATION

To assure safety, disconnect the coupling or belt which connects the motor with the machine prior to test operation, so that motor operation is isolated. If an operation must be performed while the motor is directly connected to the machine, use great care to avoid any possible hazardous conditions.

5.1 CHECK BEFORE TEST OPERATION

After completion of the installation and wiring, check for

(1) proper wiring

(2) short-circuit due to wire clippings

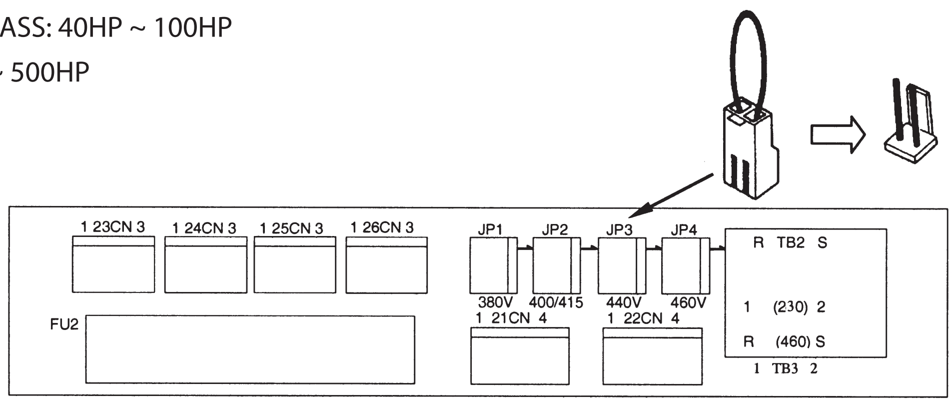
(3) loose screw-type terminals

(4) proper loading

5.2 SETTING THE LINE VOLTAGE JUMPER FOR 460V CLASS 40HP (30kW) AND ABOVE

The cooling fan line voltage jumper shown in Fig. 5 must be set according to the type of main circuit power supply. Insert the connector at the position showing the appropriate line voltage. The unit is preset at the factory to 440 line voltage.

(a) 460V CLASS: 40HP ~ 100HP
350HP ~ 500HP



(b) 460V CLASS: 125HP ~ 300HP

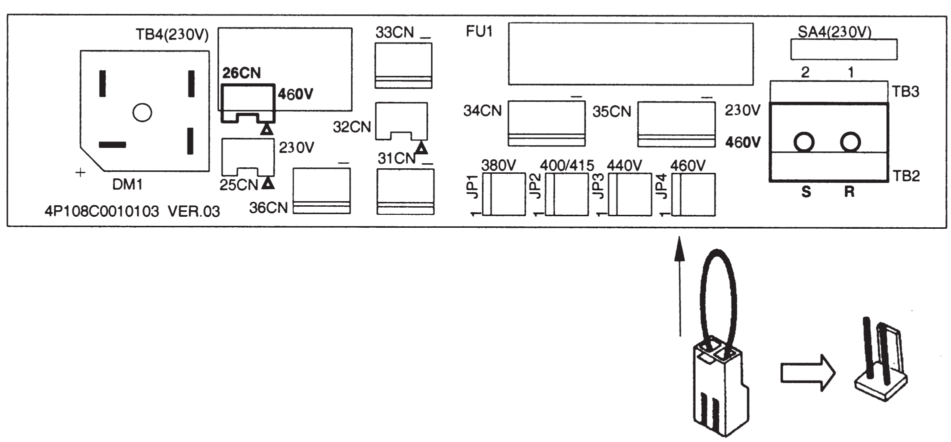


Fig. 5(a) Voltage Selection Jumper

5.3 SETTING THE LINE VOLTAGE JUMPER FOR 600V CLASS 30HP (22kW) AND ABOVE

The cooling fan line voltage selecting connector shown in Fig. 6 must be set according to the type of main circuit power supply. Insert the connector at the position showing the appropriate line voltage.

The unit is preset at the factory to 600V line voltage.

(a) 600V CLASS: 30HP ~ 100HP

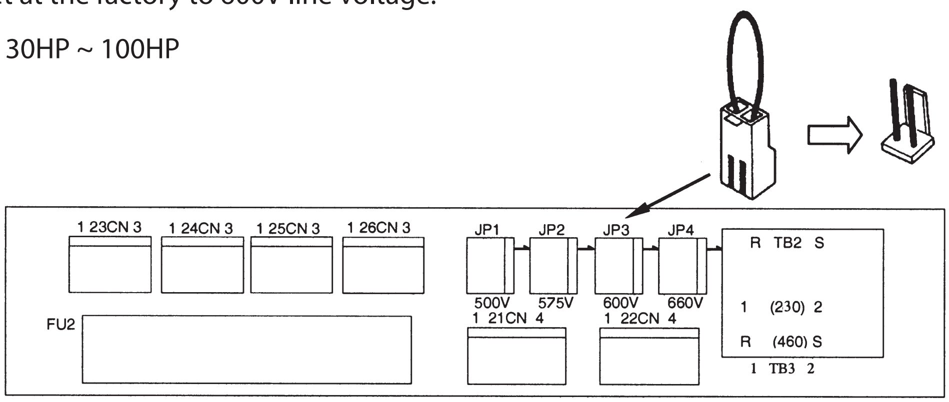


Fig. 5(b) Voltage Selection Jumper

6. MAINTENANCE

6.1 PERIODIC INSPECTION

The PA7300 requires very few routine checks. It will function longer if it is kept clean, cool, and dry. Observe precautions listed in “Location”, Section 3.2. Check for tightness of electrical connections, discoloration, or other signs of overheating. Use Table 4 as your inspection guide. Before servicing, turn OFF the AC main circuit power and make sure that the “CHARGE” lamp is OFF.

Table 4 Periodic Inspection

Component	Check	Corrective Act
External terminals, unit mounting bolts, connectors, etc.	Loose screws	Tighten
	Loose connectors	Tighten
Cooling fins	Build-up of dust and dirt	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (57 to 85psi.) pressure.
Printed circuit board	Accumulation of conductive dust or oil	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (57 to 85psi.) pressure. If dust and or oil cannot be removed, replace the board.
Cooling fan	Excessive noise and vibration, whether the cumulative operation time exceeds 20,000 hours or not.	Replace the cooling fan.
Power elements	Accumulation of dust and dirt	Blow with dry compressed air of 39.2×10^4 to 58.8×10^4 Pa (57 to 85psi) pressure.
Smoothing capacitor	Discoloration or odor	Replace the capacitor or AC Drive unit.

Note: Operating conditions as follows:

- Ambient temperature: Yearly average 30˚C , 86˚F
- Load factor: 80% or less
- Operating time: 12 hours or less per day

Standard Parts Replacement

Item	Replacement Cycle	Remarks
Cooling fan	2 or 3 years	Replace with a new product.
Smoothing capacitor	5 years	Replace with a new product. (Determine after examination)
Circuit Breakers and relays	-----	Determine after examination.
Fuse	10 years	Replace with a new product.
Aluminum capacitor on PC board	5 years	Replace with a new product. (Determine after examination)

Note: Operating conditions as follows:

- Ambient temperature: Yearly average 30˚C, 86°F
- Load factor: 80% or less
- Operating time: 20 hours or less per day

6.2 SPARE PARTS

As insurance against costly downtime, it is strongly recommended that renewal parts be kept on hand in accordance with the table below. When ordering renewal parts, please specify to your local distributor or TECO representative the following information: Part Name, Part Code No., and Quantity.

Table 5 Spare Parts for 230V Class

INVERTER DRIVE & PART NAME HP	SPEC	Control PC Board	Power Board	Main Circuit Transistor	Main Circuit Diode	Cooling fan	
5	MODEL	-	-	7MBP50RA060	DF50BA80	-	
	CODE	4P101C0070008	4P106C03900A7	277831660	277192233	-	
	Qty	1	1	1	1	-	
7.5	MODEL	-	-	7MBP50RA060	DF50BA80	AFB0824SH	
	CODE	4P101C0070008	4P106C03900B5	277831660	277192233	4H300D0200000	
	Qty	1	1	1	1	1	
10	MODEL	-	-	7MBP75RA060	DF50BA80	AFB0824SH	
	CODE	4P101C0070008	4P106C03900C3	277831678	277192233	4H300D0200000	
	Qty	1	1	1	1	1	
15	MODEL	-	-	7MBP100RA060	DF75LA80	AFB0824SH	
	CODE	4P101C0070008	4P106C03700A6	277831511	4M903D1480016	4H300D1440004	
	Qty	1	1	1	1	2	
20	MODEL	-	-	7MBP150RA060	DF100BA80	AFB0824SH	
	CODE	4P101C0070008	4P106C03700B4	277831520	277192110	4H300D1440004	
	Qty	1	1	1	1	2	
25	MODEL	-	-	7MBP160RTA060	DF150BA80	AFB0824SH	
	CODE	4P101C0070008	3P106C06500A5	277831708	277192179	4H300D1440004	
	Qty	1	1	1	1	2	
30	MODEL	-	-	CM200DU-12F	2P/DDB6U145N12L	A2123-HBT	ASB0624H
	CODE	4P101C0070008	4P106C02900B1	277810255	277190214	4M903D1890001	4H300D3330001
	Qty	1	1	3	1	2	1
40	MODEL	-	-	CM200DU-12F	2P/DDB6U145N12L	AFB1224SHE	ASB0624H
	CODE	4P101C0070008	4P106C02900B1	277810255	277190214	4M300D3670007	4H300D3330001
	Qty	1	1	3	1	2	1
50	MODEL	-	-	CM300DU-12F	2P/DDB6U205N12L	AFB1224SHE	ASB0824SH
	CODE	4P101C0070008	4P106C02900B1	277810263	277190231	4M300D3670007	4H300D3340007
	Qty	1	1	3	1	2	1
60	MODEL	-	-	CM300DU-12F	VUO190-08NO7	AFB1224SHE	ASB0824SH
	CODE	4P101C0070008	4P106C02900C9	277810263	277191539	4M300D3670007	4H300D3340007
	Qty	1	1	3	1	2	1
75	MODEL	-	-	CM400DU-12F	VUO190-08NO7	AFB1224SHE	ASB0824SH
	CODE	4P101C0070008	4P106C02900C9	277810271	277191539	4M300D3670007	4H300D3340007
	Qty	1	1	3	1	2	1
100	MODEL	-	-	CM600HU-12F	2RI00E-080	AFB1224SHE	A2123-HBT
	CODE	4P101C0070008	4P106C02700C8	277800233	277051516	4M300D3670007	4M903D1890001
	Qty	1	1	6	6	3	1
125	MODEL	-	-	CM600HU-12F	2RI100E-080	AFB1224SHE	A2123-HBT
	CODE	4P101C0070008	4P106C02700C8	277800233	277051516	4M300D3670007	4M903D1890001
	Qty	1	1	6	6	3	1

Table 6 Spare Parts for 460V Class

INVERTER DRIVE & PART NAME HP	SPEC	Control PC Board	Power Board	Main Circuit Transistor	Main Circuit Diode	Cooling fan	
5	MODEL	-	-	7MBP25RA120	7MBP25RA120	-	
	CODE	4P101C0070008	4P106C03800A1	277831716	277831716	-	
	Qty	1	1	1	1	-	
7.5	MODEL	-	-	7MBP25RA120	6RI30G-160	AFB0824SH	
	CODE	4P101C0070008	4P106C03800B0	277831716	277191067	4H300D0200000	
	Qty	1	1	1	1	1	
10	MODEL	-	-	7MBP50RA120	6RI30G-160	AFB0824SH	
	CODE	4P101C0070008	4P106C03800C8	277831686	277191067	4H300D0200000	
	Qty	1	1	1	1	1	
15	MODEL	-	-	7MBP50RA120	DF50AA160	AFB0824SH	
	CODE	4P101C0070008	4P106C03700C2	277831686	277192225	4H300D1440004	
	Qty	1	1	1	1	2	
20	MODEL	-	-	7MBP75RA120	DF50AA160	AFB0824SH	
	CODE	4P101C0070008	4P106C03700D1	277831538	277192225	4H300D1440004	
	Qty	1	1	1	1	2	
25	MODEL	-	-	7MBP075RA120	DF75LA160	AFB0824SH-B	
	CODE	4P101C0070008	4P106C03700D1	277831538	277192195	4H300D1440004	
	Qty	1	1	1	1	2	
30	MODEL	-	-	7MBP075RA120	DF75LA160	AFB0824SH-B	
	CODE	4P101C0070008	4P106C03700D1	277831538	277192195	4H300D1440004	
	Qty	1	1	1	1	2	
40	MODEL	-	-	CM100DU-24F	DF75LA160	A2123-HBT	ASB0624H
	CODE	4P101C0070008	4P106C02900A2	277810280	277192195	4M903D1890001	4H300D3330001
	Qty	1	1	3	1	2	1
50	MODEL	-	-	CM150DU-24F	DF100LA160	A2123-HBT	ASB0624H
	CODE	4P101C0070008	4P106C02900A2	277810298	277192217	4M903D1890001	4H300D3330001
	Qty	1	1	3	1	2	1
60	MODEL	-	-	CM150DU-24F	2U/DDB6U145N16L	A2123-HBT	ASB0624H
	CODE	4P101C0070008	4P106C02900A2	277810298	277190222	4M903D1890001	4H300D3330001
	Qty	1	1	3	1	2	1
75	MODEL	-	-	CM200DU-24F	2U/DDB6U145N16L	AFB1224SHE	AFB0824SH
	CODE	4P101C0070008	4P106C02900A2	277810301	277190222	4M300D3670007	4H300D3340007 6
	Qty	1	1	3	1	2	1
100	MODEL	-	-	CM300DU-24F	2U/DDB6U205N16L	AFB1224SHE	AFB0824SH
	CODE	4P101C0070008	4P106C02900A2	277810310	277190249	4M300D3670007	4H300D3340007
	Qty	1	1	3	1	2	1
125	MODEL	-	-	CM400HU-24F	2RI60G-160	AFB1224SHE	A2123-HBT
	CODE	4P101C0070008	4P106C02700A1	277800217	277051541	4M300D3670007	4M903D1890001
	Qty	1	1	6	6	3	1
150	MODEL	-	-	CM400HU-24F	2RI100G-160	AFB1224SHE	A2123-HBT
	CODE	4P101C0070008	4P106C02700A1	277800217	277051524	4M300D3670007	4M903D1890001
	Qty	1	1	6	6	3	1
175	MODEL	-	-	CM600HU-24F	2RI100G-160	AFB1224SHE	A2123-HBT
	CODE	4P101C0070008	4P106C02700A1	277800225	277051524	4M300D3670007	4M903D1890001
	Qty	1	1	6	6	3	1
215	MODEL	-	-	CM600HU-24F	2RI100G-160	EFB1524HHG	A2123-HBT
	CODE	4P101C0070008	4P106C02700A1	277800225	277051524	4M300D3680002	4M903D1890001
	Qty	1	1	6	6	3	1
250	MODEL	-	-	CM600HU-24F	2RI100G-160	EFB1524HHG	A2123-HBT
	CODE	4P101C0070008	4P106C02700A1	277800225	277051524	4M300D3680002	4M903D1890001
	Qty	1	1	6	6	3	1
300	MODEL	-	-	CM400HU-24F	2RI100G-160	EFB1524HHG	A2123-HBT
	CODE	4P101C0070008	4P106C02700B0	277800217	277051524	4M300D3680002	4M903D189000
	Qty	1	1	12	6	3	1
350	MODEL	-	-	Skiip1013GB122-2DL	SKKH330/E16	2RRE45250* 56R	
	CODE	4P101C0070008	3P106C0060009	4M903D2020001	4M903D1990006	4M903D1940009	
	Qty	1	1	3	3	1	
400	MODEL	-	-	Skiip1203GB122-2DL	SKKH500/E16	2RRE45250* 56R	
	CODE	4P101C00700A6	3P106C0060009	4M903D2030006	4M903D2000000	4M903D1940009	
	Qty	1	1	3	3	2	
500	MODEL	-	-	Skiip1513GB122-3DL	SKKH500/E16	2RRE45250* 56R	
	CODE	4P101C0070008	3P106C0060009	4M903D2040001	4M903D2000000	4M903D1940009	
	Qty	1	1	3	3	2	

Table 7 Spare Parts for 600V Class

INVERTER DRIVE & PART NAME HP	SPEC	Control PC Board	Power Board	Main Circuit Transistor	Main Circuit Diode	Cooling fan
5	MODEL	-	-	7MBR15SA140	-	AFB0824SH
	CODE	3K3Z2079	3K3Z2113	3K3A2834	-	4H300D0200000
	Qty	1	1	1	-	1
7.5	MODEL	-	-	7MBBR25SA140	-	AFB0824SH
	CODE	3K3Z2079	3K3Z2114	3K3A2835	-	4H300D0200000
	Qty	1	1	1	-	1
10	MODEL	-	-	7MBR25SA140	-	AFB0824SH
	CODE	3K3Z2079	3K3Z2114	3K3A2835	-	4H300D0200000
	Qty	1	1	1	-	1
15	MODEL	-	-	7MBR35SB140	-	AFB0824EHE
	CODE	3K3Z2079	3K3Z2075	3K3A2836	-	4H300D5590001
	Qty	1	1	1	-	2
20	MODEL	-	-	7MBR50SB140	-	AFB0824EHE
	CODE	3K3Z2079	3K3Z2116	3K3A2837	-	4H300D5590001
	Qty	1	1	1	-	2
25	MODEL	-	-	7MBR50SB140	-	AFB0824EHE
	CODE	3K3Z2079	3K3Z2116	3K3A2837	-	4H300D5590001
	Qty	1	1	1	-	2
30	MODEL	-	-	2MBI100PC_140	DF75LA160	A2123-HBT
	CODE	3K3Z2079	3K3Z2079	3K3A2839	277192195	4M903D1890001
	Qty	1	1	3	1	2
40	MODEL	-	-	2MBI100PC_140	DF75LA160	A2123-HBT
	CODE	3K3Z2079	3K3Z2076	3K3A2839	277192195	4M903D1890001
	Qty	1	1	3	1	2
50	MODEL	-	-	2MBI150PC_140	DF100LA160	A2123-HBT
	CODE	3K3Z2079	3K3Z2117	3K3A2840	277192217	4M903D1890001
	Qty	1	1	3	1	2
60	MODEL	-	-	2MBI150PC_140	DF100LA160	A2123-HBT
	CODE	3K3Z2079	3K3Z2117	3K3A2840	277192217	4M903D1890001
	Qty	1	1	3	1	2
75	MODEL	-	-	2MBI200PB_140	2U/DDB6U145N16L	A2123-HBT
	CODE	3K3Z2079	3K3Z2117	3K3A2841	2771990222	4M903D1890001
	Qty	1	1	3	1	2
100	MODEL	-	-	2MBI300P_140	2U/DDB6U145N16L	A2123-HBT
	CODE	3K3Z2079	3K3Z2118	3K3A2842	277190222	4M903D1890001
	Qty	1	1	3	1	2

7. SPECIFICATIONS

- **Basic Specifications**

230V CLASS

	AC INVERTER (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100	125
	MAX. APPLICABLE MOTOR OUTPUT HP (KW)*1	5 (3.7)	7.5 (5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)
Output Characteristics	AC Drive Capacity (KVA)	6.2	9.3	12.4	18.6	24.8	27.4	33	44	55	63	81	110	125
	Rated Output Current (A)	16	24	32	48	64	72	88	117	144	167	212	288	327
	Max. Output Frequency	3-Phase, 200/208/220/230V (Proportional to input voltage)												
	Rated Output Frequency	Up to 180Hz available												
Power Supply	Rated Input Voltage And Frequency	3-Phase, 200/208/230V, 50Hz 200/208/220/230V, 60Hz												
	Allowable Voltage Fluctuation	+10% ~ -15%												
	Allowable Frequency Fluctuation	±5%												

460V CLASS

	AC INVERTER (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	215	250	300	350	400	500
	MAX. APPLICABLE MOTOR OUTPUT HP (KW)*1	5 (3.7)	7.5 (5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (132)	215 (160)	250 (185)	300 (220)	350 (260)	400 (300)	500 (375)
Output Characteristics	AC Drive Capacity (KVA)	6.2	9.3	12.4	18.6	24.8	29	34	45	57	66	85	115	144	176	203	232	259	290	393	446	558
	Rated Output Current (A)	8	12	16	24	32	38	44	59	75	86	111	151	189	231	267	304	340	380	516	585	732
	Max. Output Frequency	3-Phase, 380/400/415/460V (Proportional to input voltage)																				
	Rated Output Frequency	Up to 180Hz available																				
Power Supply	Rated Input Voltage And Frequency	3-Phase, 380/400/415/440/460V, 50Hz																				
	Allowable Voltage Fluctuation	+10% ~ -15% Power Supply																				
	Allowable Frequency Fluctuation	±5%																				

• Based on 4 pole motor

600V CLASS

	AC INVERTER (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100
	MAX. APPLICABLE MOTOR OUTPUT HP (KW)*1	5 (3.7)	7.5 (5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)
Output Characteristics	AC Drive Capacity (KVA)	6.0	8.9	10.9	16.9	22	27	32	41	52	62	77	99
	Rated Output Current (A)	6.1	9.0	11	17	22	27	32	41	52	62	77	99
	Max. Output Frequency	3-Phase, 500/550/575/600V (Proportional to input voltage)											
	Rated Output Frequency	Up to 180Hz available											
Power Supply	Rated Input Voltage And Frequency	3-Phase, 500~600V 50/60Hz											
	Allowable Voltage Fluctuation	+10% ~ -15% Power Supply											
	Allowable Frequency Fluctuation	±5%											

• CHARACTERISTICS

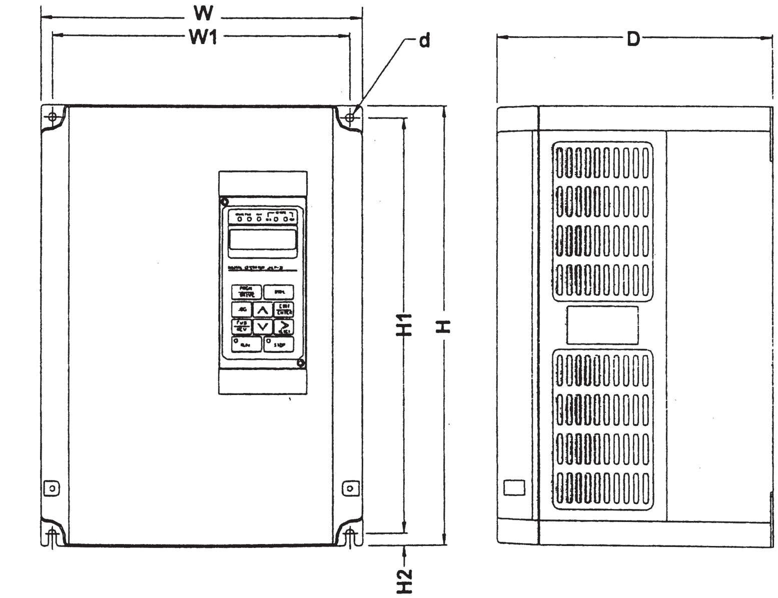
Control Characteristics	Control Method	Sine wave PWM
	Frequency Control Range	0.1 to 180Hz
	Frequency Accuracy	Digital command: 0.01% -10 to 40˚C\ +14 to 104˚F Analog command: 0.1% 25 ± 10˚C\77 ± 18˚F
	Frequency Setting Resolution	Digital operator reference: 0.01Hz, Analog reference: 0.06Hz/60Hz
	Output Frequency Resolution	0.01Hz (1/30000)
	Overload Capacity	110% rated output current for one minute.
	Frequency Setting Signal	0 to 10VDC (20KΩ), 4~20mA (250Ω), 0 ~ ± 10 VDC (option)
	Accel/Decel time	0.1 to 6000 sec (independent Accel/Decel time settings)
	Braking Torque	Approximately 20%
	Type of. V/Hz patterns (Total of 5)	1: For adjustable pattern. 4: For fans and pumps.
Protective Functions	Motor Overload Protection	Electric thermal overload relay
	Instantaneous Overcurrent	Motor coasts to stop at approx. 200% rated current.
	Overload	Motor coasts to stop after 1 minute at 110% rated output current.
	Overvoltage (230V class)	Motor coasts to stop if AC Drive output voltage exceeds 410VDC.
	Overvoltage (460V class)	Motor coasts to stop if AC Drive output voltage exceeds 820VDC.
	Overvoltage (600V class)	Motor coasts to stop if AC Drive output voltage exceeds 1050VDC
	Undervoltage (230V class)	Motor coasts to stop if AC Drive output voltage drops to 190VDC or below.
	Undervoltage (460V class)	Motor coasts to stop if AC Drive output voltage drops to 380VDC or below.
	Undervoltage (600V class)	Motor coasts to stop if AC Drive output voltage drops to 546VDC or below
	Momentary Power Loss	Motor coasts to stop after momentary power loss lasting over 15ms. (time-setting made before shipment).
	Motor Overheat Protection	Motor PTC thermistor (Active: 1330Ω, Return: 550Ω)
	Input Phase Loss	Single phase protection.
	Output Phase Loss	Provided by electronic circuit.
	Fin Overheat	Thermostat
	Stall Prevention	Stall prevention at acceleration/deceleration and constant speed operation.
	Ground Fault	Provided by electronic circuit.
	Power Charge Indication	Charge lamp stays ON until bus voltage drops below 50V.
Environmental Conditions	Location	Indoor (Protected from corrosive gases and dust)
	Ambient Temperature	Wall-mounted type: +14 to 104˚F (-10 to +40˚C),(not frozen) Open chassis type: +14 to 113˚F (-10 to +45˚C), (not frozen)
	Storage Temperature	-4 to 140˚F (-20 to +60) °C
	Humidity	95% RH (non-condensing)
	Vibration	1G at 10 to 20Hz, up to 0.2G at 20 to 50Hz.
Communication Protocols		RS-485 MODBUS, PROFIBUS (option), METASYS (option), LONWORKS (option)
Noise Interference Suppression		EN 61800-3 (2000) with specified noise filter
Noise Immunity		EN61800-3 (2000)

8. DIMENSIONS

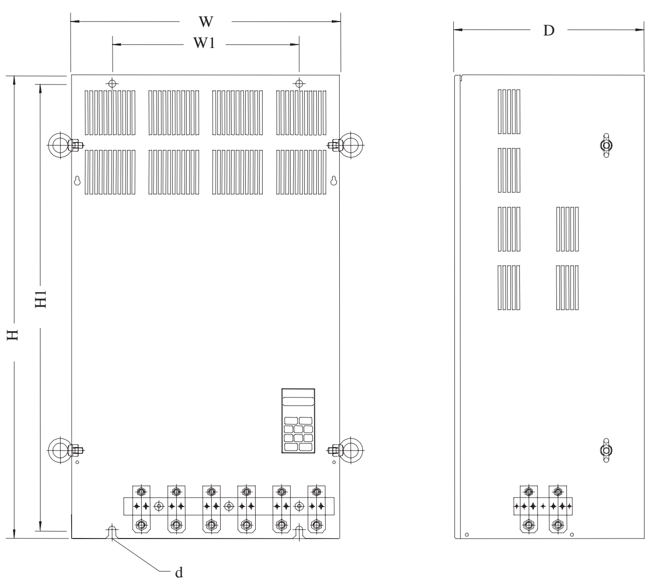
Table 8 Dimension and Weight

Voltage (V)	Inverter Capacity	Open Chassis Type (IP00) IN.						Weight (LB)	Enclosed Type (NEMA1) IN.						Weight (LB)	ACD/DCL	Referemce Figure
		W	H	D	W1	H1	d		W	H	D	W1	H1	d			
220V	5	8.32	11.81	8.46	7.56	11.26	M6	13	8.32	11.81	8.46	7.56	11.26	M6	13	External ACL (option)	(a)
	7.5																
	10																
	15	10.43	14.17	8.89	9.63	13.38	M6	27	10.43	14.17	8.86	9.65	13.39	M6	27	External ACL (option)	(a)
	20																
	25	10.43	14.17	8.86	9.65	13.38	M6	27	10.43	14.17	8.86	7.65	13.39	M6	27	External ACL (option)	(a)
	30	11.16	20.67	12.09	8.66	19.88	M8	80	11.48	29.33	12.09	8.66	19.88	M8	84	DCL Built-in (Standard)	(b)
	40							83									
	50							83									
	60	13.54	24.80	12.78	9.84	24.02	M8	108	13.86	37.20	12.78	9.84	24.02	M8	111	DCL Built-in (Standard)	
	75							112							115		
	100	18.07	31.10	12.78	12.60	29.92	M10	188	18.19	43.50	12.78	12.60	29.92	M10	192		
	125							188							192		
600V	5	8.32	11.81	8.46	7.56	11.26	M6	13	8.32	11.81	8.46	7.56	11.26	M6	13	External ACL (option)	(a)
	7.5																
	10																
	15	10.43	14.17	8.86	9.65	13.38	M6	27	10.43	14.17	8.86	9.65	13.38	M6	27	External ACL (option)	(a)
	20																
	25	10.43	14.17	8.86	9.65	13.38	M6	27	10.43	14.17	8.86	9.65	13.39	M6	27	External ACL (option)	(a)
	30							27							27		
	40	11.16	20.67	12.09	8.66	19.88	M8	83	11.48	89.33	12.09	8.66	19.88	M8	84	DCL Built-in (Standard)	(b)
	50							83							84		
	60	13.01	24.80	12.78	9.84	24.02	M8	108	13.86	37.20	12.78	9.84	24.02	M8	111	DCL Built-in (Standard)	
	75							108							111		
	100							108							111		
	125	18.07	31.10	12.78	12.60	29.92	M10	184	18.19	43.50	12.78	12.60	29.92	M10	195	DCL Built-in (Standard)	
	150							184							195		
	175							186							197		
	215	23.58	39.97	15.02	18.11	37.80	M12	294	23.70	51.38	15.02	18.11	37.80	M12	310	DCL Built-in (Standard)	
	250							294							310		
	300							303							319		
	350	28.74	48.43	15.04	27.16	36.61	M12	367	28.74	52.36	15.04	27.16	36.61	M12	381	External ACL (option)	(c)
	400							390							404		(d)
	500							436							450		
600V	5	8.32	11.81	8.46	7.56	11.26	M6	13	8.31	11.81	8.46	7.56	11.26	M6	12.32	External ACL (option)	(a)
	7.5																
	10																
	15	10.43	14.17	8.86	9.65	13.39	M6	27	10.43	14.17	8.86	9.65	13.39	M6	27	External ACL (option)	(a)
	20																
	25																
	30	11.16	20.67	12.09	8.66	19.88	M8	80	11.48	29.33	12.09	8.66	19.88	M8	84	DCL Built-in (Standard)	(b)
	40																
	50																
	60																
	75	13.54	24.80	12.78	12.60	29.92	M8	104	13.86	37.20	12.78	9.84	24.82	M8	111	DCL Built-in (Standard)	(b)
	100																

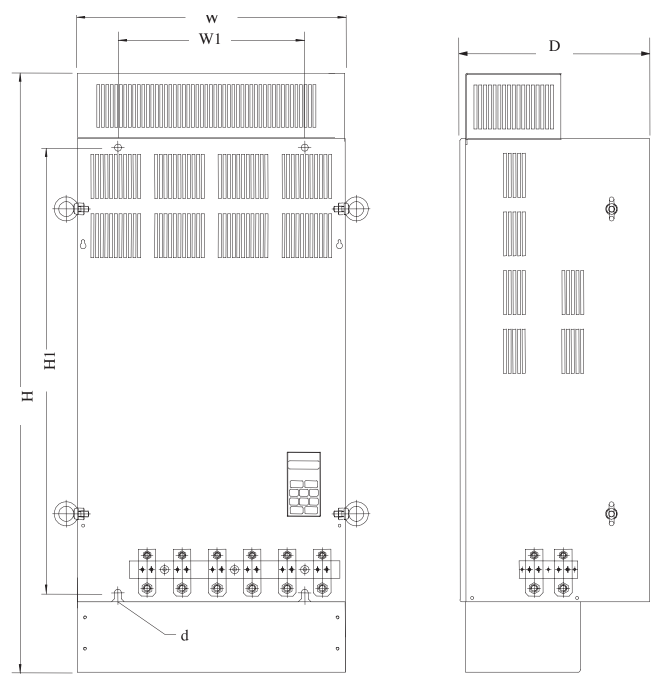
(a) 230V : 5 - 25HP
460V : 5HP - 30HP
600V : 5HP - 30HP



(b) 230V : 30HP - 125HP
460V : 40HP - 300HP
600V : 30HP - 100HP

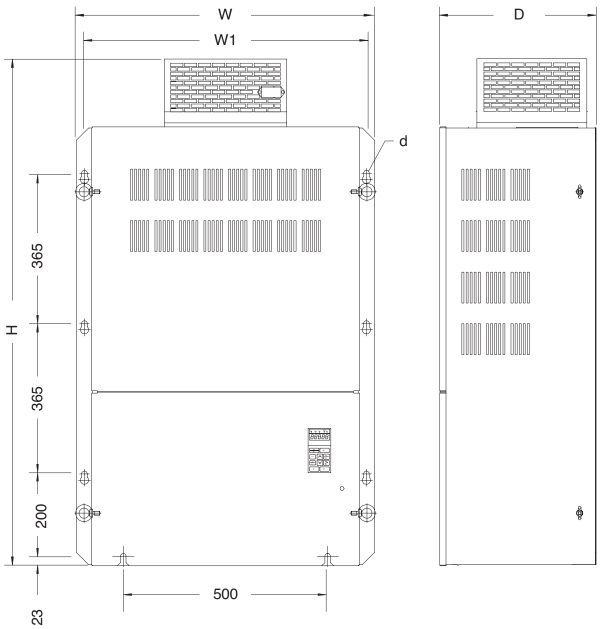


(Open Chassis Type - IP00)

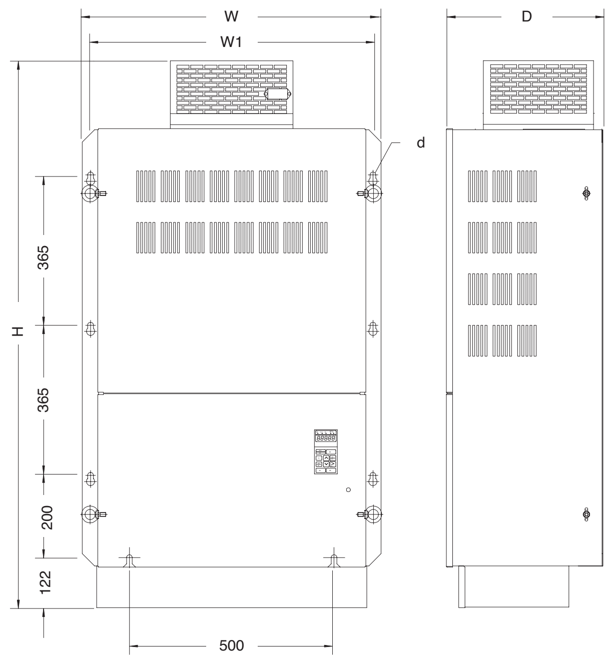


(Wall-mounted Type - NEMA1)

(c) 460V : 350HP - 500HP

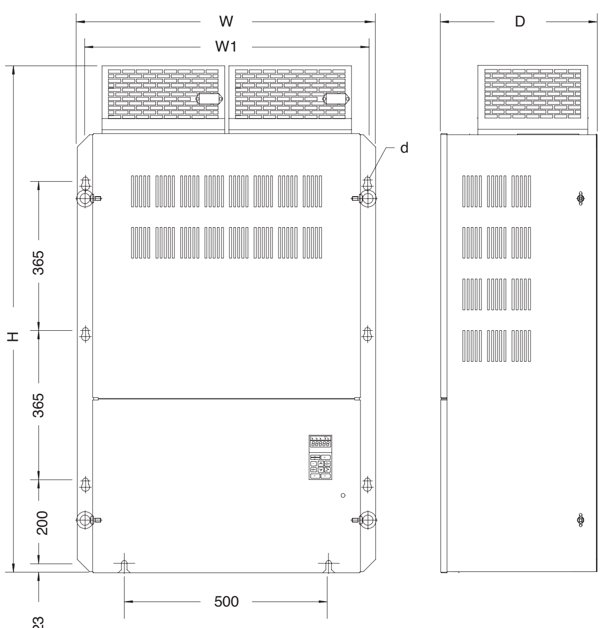


(Open Chassis Type - IP00)

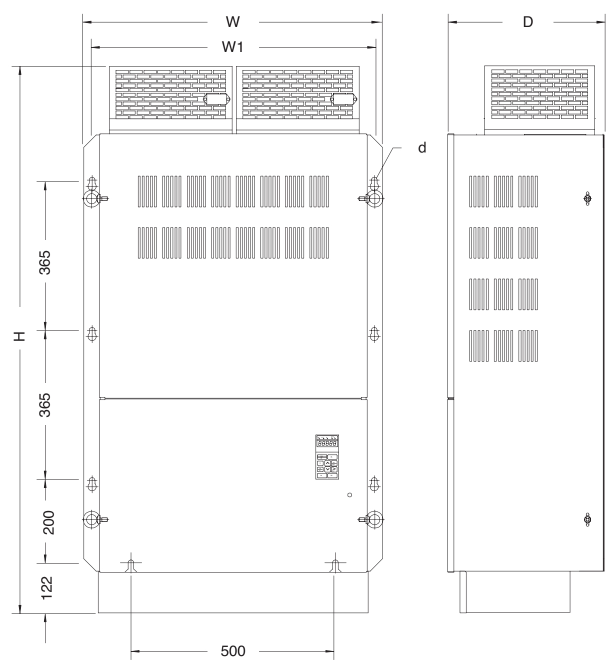


(Wall-mounted Type - NEMA1)

(d) 460V : 400HP, 500HP



(Open Chassis Type - IP00)



(Wall-mounted Type - NEMA1)

9. PERIPHERALS AND OPTIONS

9.1 AC LINE REACTOR

- When power capacity is significantly large compared to the AC Drive's capacity, or when the power factor needs to be improved, externally connect an AC line reactor.
- PA7300 230V 30 ~ 125HP, 460V 40 ~300HP and 600V 30 ~ 100HP, have built-in DC reactors as standard. (When the power factor needs to be improved, externally connect an AC line reactor).
- For 230V 5~25HP, 460V 5-30HP, and 600V 5~25HP drives, connect an optional AC reactor when the power factor needs to be improved.
- For 460V 350 ~500HP drives, connect an AC lines reactor externally when power quality considerations require improvements.

Table 9 AC LINE REACTOR

AC Drive			AC Reactor		
Voltage	HP	Rated current (A)	Current (A)	Inductance (mH)	Code NO.
230	5	16	20	0.53	3M200D1610056
	7.5	24	30	0.35	3M200D1610064
	10	32	40	0.265	3M200D1610072
	15	48	60	0.18	3M200D1610081
	20	64	80	0.13	3M200D1610099
	25	72	90	0.12	3M200D1610102
	30	88	90	0.12	3M200D1610102
	40	117	120	0.09	3M200D1610111
	50	144	160	0.07	3M200D1610269
	60	167	160	0.07	3M200D1610269
	75	212	240	0.044	3M200D1610285
	100	288	360	0.026	3M200D1610307
	125	327	360	0.026	3M200D1610307
460	5	8	10	2.2	3M200D1610161
	7.5	12	15	1.42	3M200D1610170
	10	16	20	1.06	3M200D1610188
	15	24	30	0.7	3M200D1610196
	20	32	40	0.53	3M200D1610200
	25	38	50	0.42	3M200D1610218
	30	44	50	0.42	3M200D1610218
	40	59	60	0.36	3M200D1610226
	50	75	80	0.26	3M200D1610234
	60	86	90	0.24	3M200D1610242
	75	111	120	0.18	3M200D1610251
	100	151	200	0.11	3M200D1610323
	125	189	200	0.11	3M200D1610323
	150	231	250	0.09	3M200D1610331
	175	267	330	0.06	3M200D1610340
	215	304	330	0.06	3M200D1610340
	250	340	400	0.05	4M200D0010008
	300	380	500	0.04	4M200D0020003
	350	516	670	0.032	4M200D0030009
	400	585	670	0.032	4M200D0030009
	500	732	800	0.025	4M200D0050000

Table 9 AC LINE REACTOR

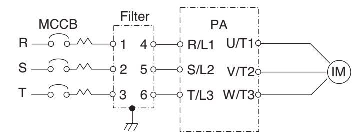
AC Drive			AC Reactor		
Voltage	HP	Rated current (A)	Current (A)	Inductance (mH)	Code NO.
600	5	6.1	10	3.7	Consult Factory For Part Numbers
	7.5	9	15	2.4	
	10	11	15	1.8	
	15	17	20	1.2	
	20	22	30	0.9	
	25	27	30	0.72	
	30	32	40	0.72	
	40	41	50	0.61	
	50	52	60	0.44	
	60	62	70	0.41	
	75	77	80	0.31	
	100	99	110	0.19	

9.2 NOISE FILTER

9.2.1 INPUT NOISE FILTER

- When the input noise filter is installed as indicated, the PA7300 will comply with the EN61800-3 (2000) noise interference suppression directive.

Input Noise Filter



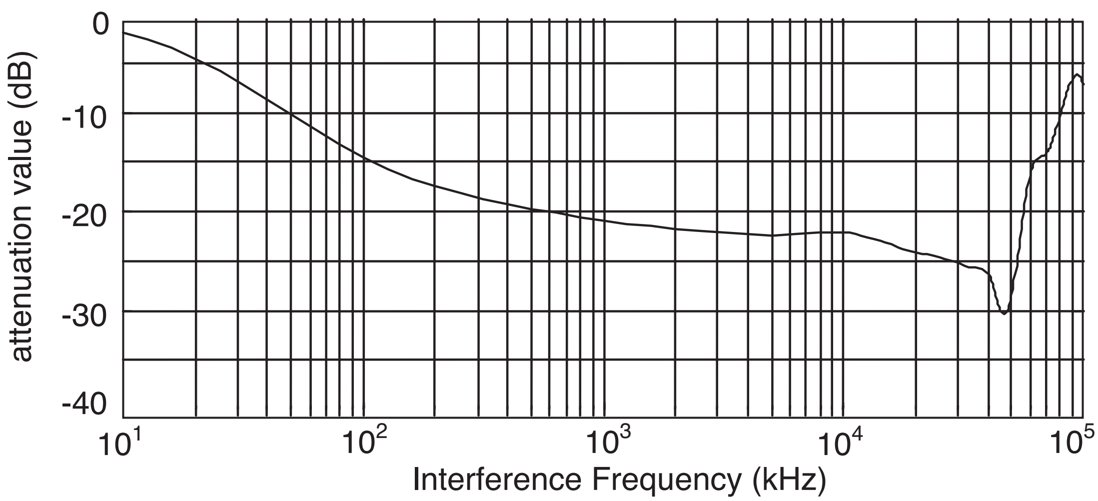
Input Noise Filter Connection Example

Table 10 Input Noise Filter

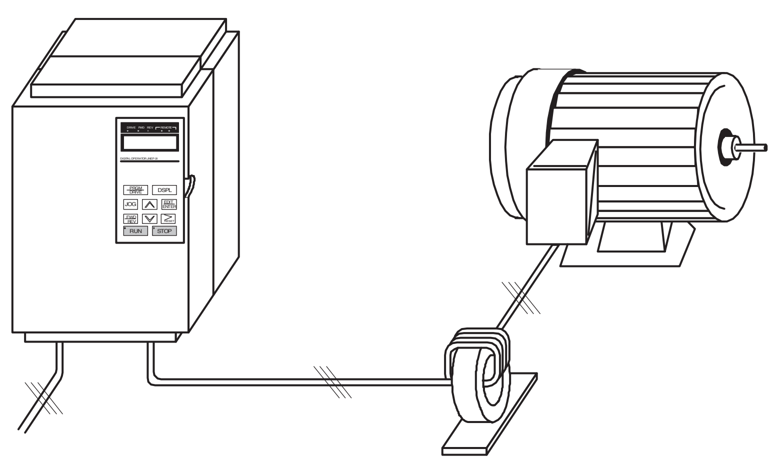
AC DRIVE VOLTAGE (V)	INPUT NOISE FILTER				
	HP	RATED CURRENT(A)	CODE NO.	MODEL NO.	RATED CURRENT (A)
230V	25	72	4H000D1690004	FS6100-90-34	90A
	30	88	4H000D1690004	FS6100-90-34	90A
	40	117	4H000D1710005	FS6100-150-40	150A
	50	144	4H000D1710005	FS6100-150-40	150A
	60	167	4H000D1720001	FS6100-250-99	250A
	75	212	4H000D1720001	FS6100-250-99	250A
	100	288	4H000D1750007	FS6100-400-99	400A
	125	327	4H000D1750007	FS6100-400-99	400A
460V	5	8	4H300D614000	KMF325A	25A
	7.5	12	4H300D6140009	KMF325A	25A
	10	16	4H300D6140009	KMF325A	25A
	15	24	4H300D6150004	KMF350A	50A
	20	32	4H300D6150004	KMF350A	50A
	25	38	4H000D1770008	FS6101-50-52	50A
	30	44	4H000D1770008	FS6101-50-52	50A
	40	59	4H000D1790009	FS6101-80-52	80A
	50	75	4H000D1790009	FS6101-80-52	80A
	60	86	4H000D1800004	FS6101-120-35	120A
	75	111	4H000D1800004	FS6101-120-35	120A
	100	151	4H000D1820005	FS6101-200-40	200A
	125	189	4H000D1820005	FS6101-200-40	200A
	150	231	4H000D1850001	FS6101-320-99	320A
	175	267	4H000D1850001	FS6101-320-99	320A
	215	304	4H000D1850001	FS6101-320-99	320A
	250	340	4H000D1880008	FS6101-400-99	400A
	300	380	4H000D1880008	FS6101-400-99	400A
	350	516	4H000D1900009	FS6101-600-99	600A
	400	585	4H000D1900009	FS6101-600-99	600A
	500	732	4H000D1910004	FS6101-800-99	800A
600V	CONSULT FACTORY				

9.2.2 EMI SUPPRESSION ZERO CORE

- Model: JUNFOC046S - - - - - - -
- Code No.: 4H000D0250001
- According to the required power rating and wire size, select the matched ferrite core to suppress the zero sequence EMI filter.
- The ferrite core can attenuate the frequency response at high frequency range (from 100KHz to 50MHz, as shown below). It should be able to attenuate the RFI from AC Drive to the outside world.
- The zero-sequence noise filter ferrite core can be installed either on the input side or on the output side. The wire around the core for each phase should be wound by following the same convention and one direction. The more winding turns, the better the attenuation effect. (Without saturation). If the wire size is too large to be wound, all the wire can be grouped and go through these several cores together in one direction.
- Frequency attenuation characteristics (10 windings case)



Example: EMI suppression zero core application example



Note: All the line wire of the U/T1, V/T2, W/T3 phases must pass through the same zero-phase core in the same winding sense.

9.3 BRAKING RESISTOR AND BRAKING UNIT

- The braking transistor of 230V 5~25HP and 460V 5~30HP units is built-in as standard. The braking resistor can be connected to main circuit terminals B2 and D directly. All other models without built-in braking transistors need to connect braking units with braking resistors externally.
- When connecting braking resistors or braking units with a braking resistor, set system parameter Sn-10=XX10 (i.e. stall prevention during deceleration not enabled).
- The braking resistor and braking unit selection table is shown below.

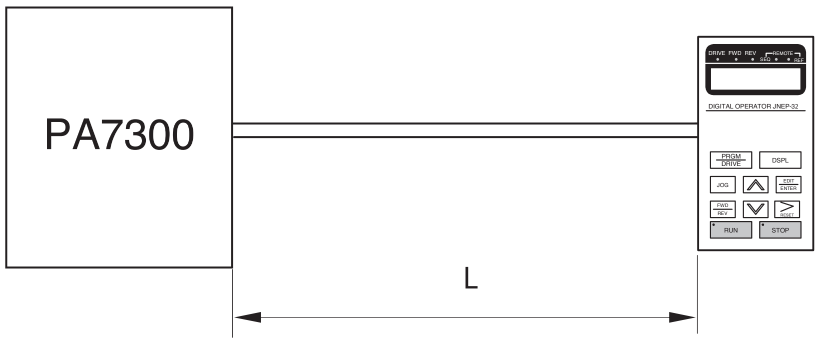
Table 11 Braking Resistor and Braking Unit

AC DRIVE			BRAKING UNIT		BRAKING RESISTOR			BRAKING TORQUE (%)
VOLTAGE	HP	RATED CURRENT (A)	TYPE NUMBER	USED	CODE NO.	SPECS.	NUMBER USED	
230V	5	16A	-	-	4H333D0040003	150W/62Ω	1	100%(3%ED)
	7.5	24A	-	-	4H333D0120007	600W/35Ω	1	100%(7%ED)
	10	32A	-	-	4H333D0130002	800W/25Ω	1	100%(8%ED)
	15	48A	-	-	4H333D0140008	2400W/17Ω	1	100%(10%ED)
	20	64A	-	-	4H333D0150003	3000W/13Ω	1	100%(10%ED)
	25	72A	-	-	3H333C0020086	3000W/10Ω	1	100%(10%ED)
	30	88A	JUVPLV-0060	1	3H333C0020108	4800W/6.8Ω	1	125%(10%ED)
	40	117A	JUVPLV-0040	2	3H333C0020086	3000W/10Ω	2	125%(10%ED)
	50	144A	JUVPLV-0040	2	3H333C0020086	3000W/10Ω	2	100%(10%ED)
	60	167A	JUVPLV-0060	2	3H333C0020108	4800W/6.8Ω	2	120%(10%ED)
	75	212A	JUVPLV-0060	2	3H333C0020108	4800W/6.8Ω	2	100%(10%ED)
	100	288A	JUVPLV-0060	3	3H333C0020108	4800W/6.8Ω	3	110%(10%ED)
	125	327A	JUVPLV-0060	3	3H333C0020108	4800W/6.8Ω	3	90%(10%ED)
460V	5	8A	-	-	4H333D0010007	150W/200Ω	1	110%(3%ED)
	7.5	12A	-	-	4H333D0160009	600W/130Ω	1	105%(7%ED)
	10	16A	-	-	4H333D0170004	800W/100Ω	1	100%(7%ED)
	15	24A	-	-	4H333D0180000	1000W/68Ω	1	100%(6%ED)
	20	32A	-	-	4H333D0190005	1600W/50Ω	1	100%(7%ED)
	25	38A	-	-	3H333C0190005	1600W/50Ω	1	80%(7%ED)
	30	44A	-	-	3H333C0190005	1600W/50Ω	1	70%(7%ED)
	40	59A	JUVPHV-0040	1	3H333C0020213	6000W/20Ω	1	125%(10%ED)
	50	75A	JUVPHV-0060	1	3H333C0020221	9600W/16Ω	1	125%(10%ED)
	60	86A	JUVPHV-0060	1	3H333C0020230	9600W/13.6Ω	1	125%(10%ED)
	75	111A	JUVPHV-0040	2	3H333C0020213	6000W/20Ω	2	135%(10%ED)
	100	151A	JUVPHV-0060	2	3H333C0020230	9600W/13.6Ω	2	145%(10%ED)
	125	189A	JUVPHV-0040	3	3H333C0020213	6000W/20Ω	3	120%(10%ED)
	150	231A	JUVPHV-0040	3	3H333C0020213	6000W/20Ω	3	100%(10%ED)
	175	267A	JUVPHV-0040	4	3H333C0020230	6000W/20Ω	4	115%(10%ED)
	215	304A	JUVPHV-0060	4	3H333C0020230	9600W/13.6Ω	4	140%(10%ED)
	250	340A	JUVPHV-0060	4	3H333C0020230	9600W/13.6Ω	4	120%(10%ED)
	300	380A	JUVPHV-0060	4	3H333C0020230	9600W/13.6Ω	4	100%(10%ED)
	350	516A	JUVPHV-0060	5	3H333C0020230	9600W/13.6Ω	5	110%(10%ED)
	400	585A	JUVPHV-0060	5	3H333C0020230	9600W/13.6Ω	5	100%(10%ED)
	500	732A	JUVPHV-0060	6	3H333C0020230	9600W/13.6Ω	6	95%(10%ED)
600V	5	16A	-	-	JNBR-800W 100	800W/100Ω	1	250% (9%ED)
	7.5	24A	-	-			1	170% (9%ED)
	10	32A	-	-			1	125% (9%ED)
	15	48A	-	-	JNBR-1R6KW50	1600W/50Ω	1	170% (9%ED)
	20	64A	-	-			1	125% (9%ED)
	25	72A	-	-			1	100% (9%ED)
	30	-	Consult Factory					
	40	-						
	50	-						
	60	-						
	75	-						
	100	-						

9.4 OTHER OPTIONS

9.4.1 DIGITAL OPERATOR WITH EXTENSION WIRE

- Used for the operation of LCD (or LED) digital operator or monitor when removed from the front of the PA7300 unit.



CABLE LENGTH	EXTENSION CABLE SET*1	EXTENSION CABLE SET*2	BLANK COVER*3
1m	4H332D0010000	4H314C0010003	4H300D1120000
2m	4H332D0030001	4H314C0030004	
3m	4H332D0020005	4H314C0020009	
5m	4H332D0040006	4H314C0040000	

*1 : Includes special cable for LCD (or LED) operator, blank cover, mounting screws, and installation manual.

*2 : One special cable for each digital operator.

*3 : A blank cover protects against external dust, metallic powder, etc.

- The physical dimension of the LCD (or LED) digital operator is shown below.

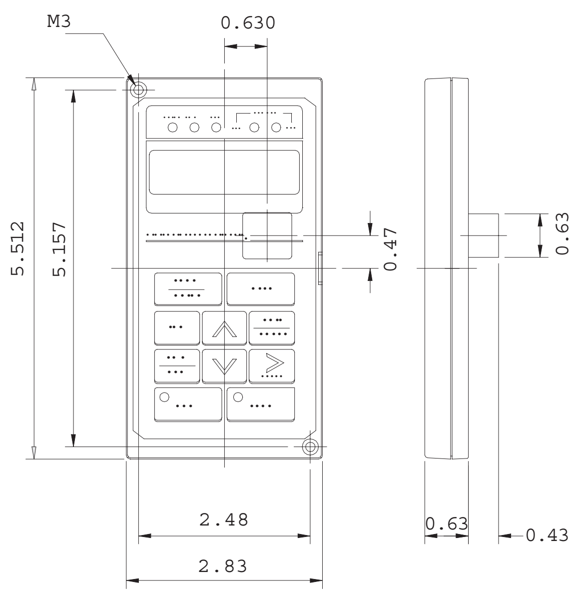
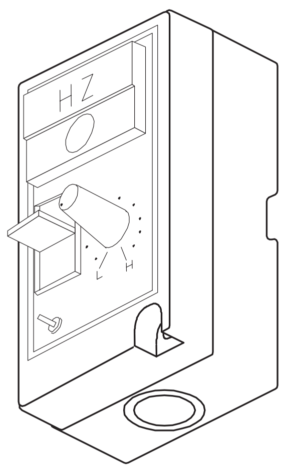


Fig. 6 LCD Digital Operator Dimension

9.4.2 ANALOG OPERATOR

All PA7300 Drives have the LCD (or LED) digital operator. In addition, an analog operator, JNEP-17, (shown in fig. 7) is also available and can be connected and wired as a portable operator.
The wiring diagram is shown below.



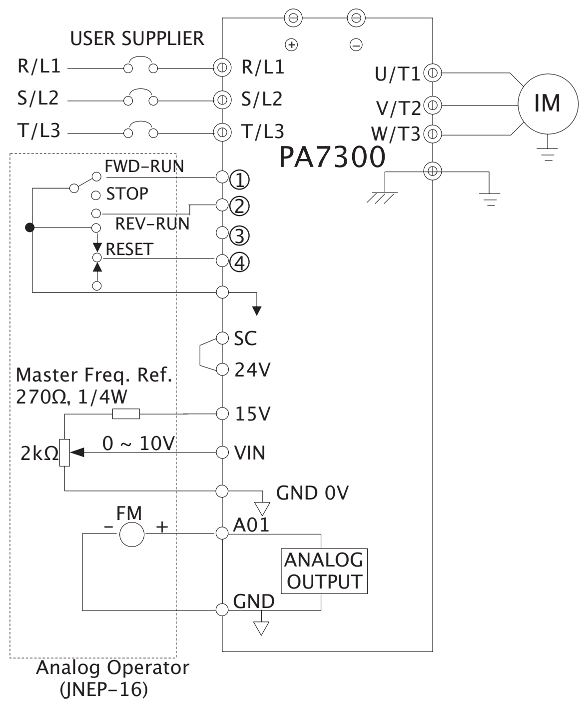


Fig. 7 Analog Operator

9.4.3 LED DIGITAL OPERATOR

- All PA7300 come standard with LCD digital operator, (JNEP-32). In addition, an LED digital operator JNEP-33 (shown in Fig. 9-b) is also available and can be connected through the same cable and connector.
- The LED digital operator has the same installation procedure and dimension as the LCD digital operator.

9.4.4 1-TO-8 PID RELAY CARD

- Used in a constant pressure water supply system.
- The 1-8 PID option card has the same installation procedure as the RS-485 communication option card (PA-M or PA-P).

9.4.5 COMMUNICATION OPTION CARD

NAME	CODE NO	FUNCTION	REFERENCE
PA-M	4P502C0050006	MODBUS protocol communication option card • Communication method: Asynchronous • Communication speed: 19.2Kbps (max.) • Interface: RS-485, RS-422	4H358D0150002
PA-P	4P502C0060001	PROFIBUS protocol communication option card • Communication method: Asynchronous • Communication speed: varies • Interface: RS-485	4H358D0170003
PA-L	4H300D5960003	LONWORKS protocol communication option card • Communication method: Asynchronous • Communication speed: 78 Kbps • Interface: Manchester	4H358D0150002
PA-C	4H300D5970009	MODBUS ASCII, METASYS N2 protocol communication option card • Communication method: Asynchronous • Communication speed: MODBUS ASCII: 19.2KBPS(max.) METASYS N2: 9.6KBPS • Interface: RS-485	4H358D0170003

- The Communication option cards can be mounted on the upper side of control board CN2 connector.
- Use the following procedure to install these option cards.
  1. Turn off the main-circuit power supply.
  2. Leave it off for at least one minute before removing the front cover of the AC drive. Check to make sure that the CHARGE indicator is OFF.
  3. Insert the spacer (Which is provided with the option card) into the spacer hole at the control board.
  4. Pass the spacer through the spacer hole at the option card. Check to make sure that it is precisely aligned with the CN2 position, and snap it into the proper position.

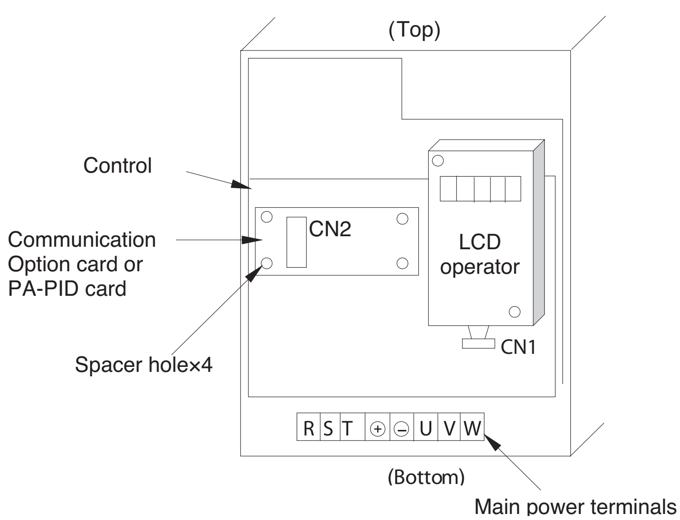


Fig. 8 Option card Installation

PART II

OPERATION MANUAL

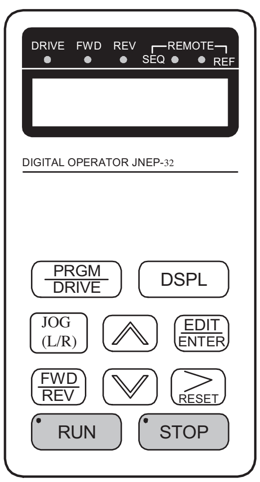
1. DESCRIPTION OF THE PA7300 OPERATOR DISPLAYS

1.1 Using the LCD (or LED) digital operator

- All PA7300's comes standard with the LCD digital operator JNEP-32. In addition, an LED digital operator JNEP-33 is also available. These two digital operators have the same operation functions except for the LCD and 7-segment LED display difference.

- The LCD and LED digital operators each have 2 modes: DRIVE mode and PRGM mode. When the AC drive is stopped, DRIVE mode or PRGM mode can be selected by pressing the key : PRGM/DRIVE. In DRIVE mode, the operation is enabled. In the PRGM mode, the parameter settings for operation can be changed but the operation is not enabled.

a. The LCD digital operator component names and functions are shown below:



Operation Mode Indicators

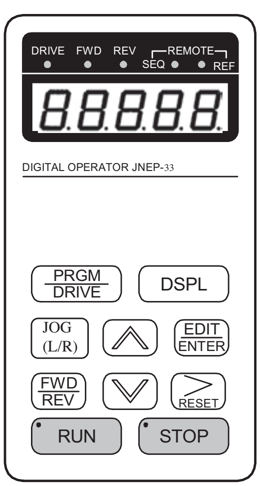
DRIVE : lit when in DRIVE mode
FWD : lit when there is a forward run command input
REV : lit when there is a reverse run command input
SEQ : lit when the run command is enabled from the control circuit terminal or RS-485 option card (REMOTE mode)
REF : lit when the frequency reference comes from the control circuit terminals (VIN or AIN) or RS-485 option card (REMOTE mode)

LCD Display
English Display: 2 rows, each row has 20 characters maximum

Keys (Key functions are defined in Table 11)

Fig 9-a LCD Digital operator component names and functions

b. The LED digital operator component names and functions are shown below:



Operation Mode Indicators

DRIVE : lit when in DRIVE mode
FWD : lit when there is a forward run command input
REV : lit when there is a reverse run command input
SEQ : lit when the run command is enabled from the control circuit terminal or RS-485 option card (REMOTE mode)
REF : lit when the frequency reference comes from the control circuit terminals (VIN or AIN) or RS-485 option card (REMOTE mode)

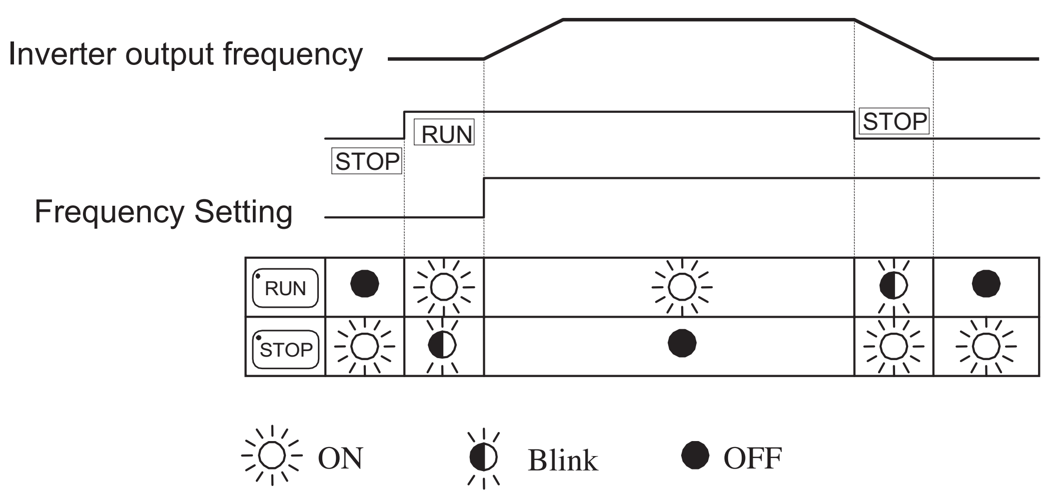
LED Display
5 digital 7-degment LED.

Keys (Key functions are defined in Table 11)

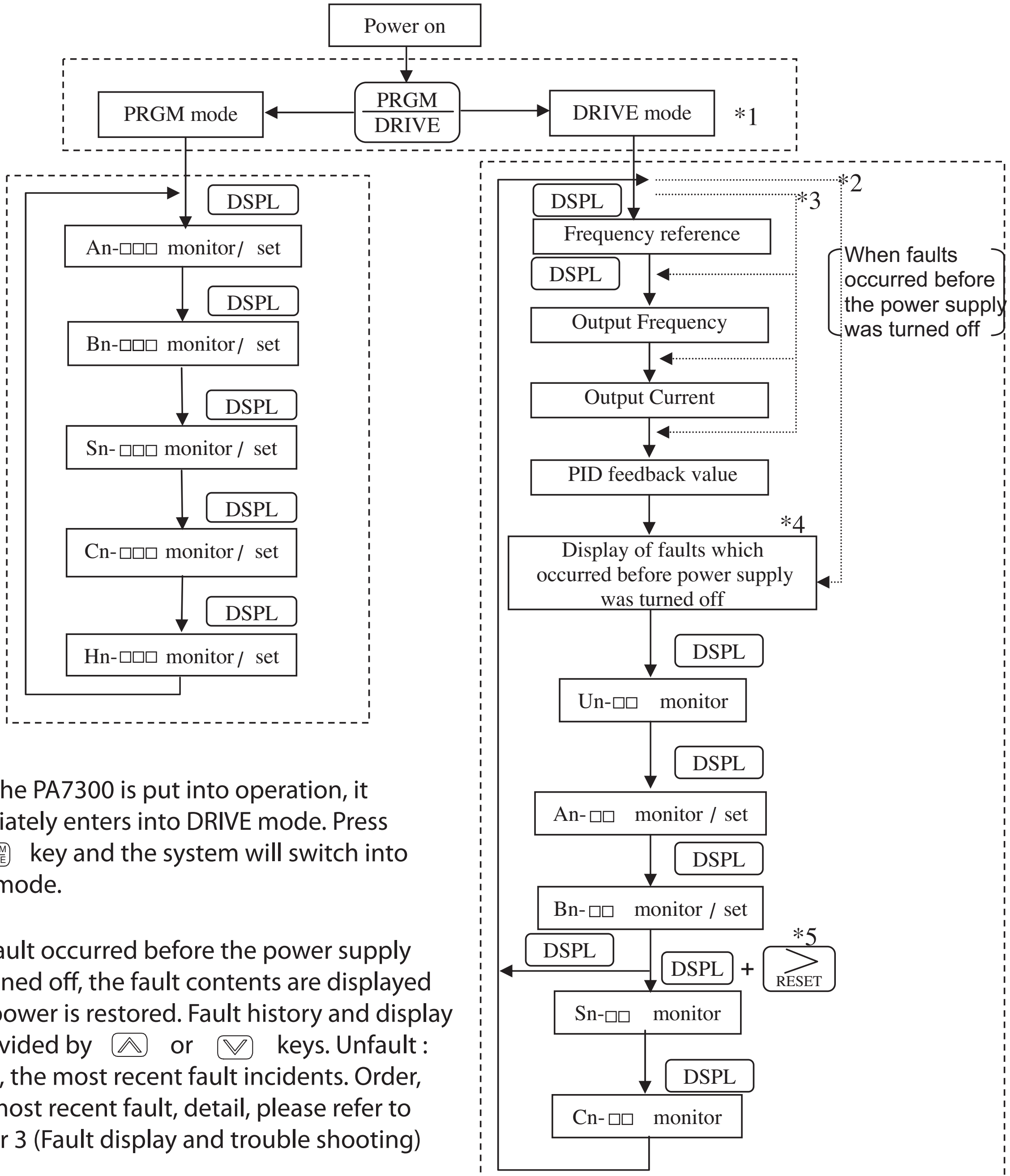
Fig 9-b LED Digital operator component names and functions

Table 12 Keypad Functions

KEY	NAME	FUNCTION
PRGM / DRIVE	PRGM/DRIVE	Switches between operation (PRGM) and operation (DRIVE).
DSPL	DSPL	Displays operation status
JOG (L/R)	JOG or L/R	Enable jog operation from digital operator (DRIVE). L/R (Local/Remote) key function set by Sn-05 (See page 2-37).
FWD / REV	FWD/REV	Select the rotational direction from the digital operator.
> RESET	RESET	Set the digit to adjust for user constant settings. Also acts as the reset key when a fault has occurred.
∧	INCREMENT	Select the menu items, groups, functions, user constant names, and increment set values.
∨	DECREMENT	Select the menu items, groups, functions, user constant names, and decrement set values.
EDIT / ENTER	EDIT/ENTER	Select the menu items, groups, functions, user constants names, and set values (EDIT). After finishing the above action, press the key (ENTER).
RUN	RUN	Start PA7300 operation in (DRIVE) mode when the local operator is used. The LED will operate per the diagram below.
STOP	STOP	Stop PA7300 operation from LCD digital operator. The key can be enabled or disabled by setting a constant Sn-05 when operating from the control circuit terminal (in this case, the LED will light per the below diagram. See page 2-37 for details on setting the control terminal).. RUN, STOP indicator lights or blinks to indicate operation status:



1.2 DRIVE mode and PRGM mode displayed contents



*1: When the PA7300 is put into operation, it immediately enters into DRIVE mode. Press the PRGM/DRIVE key and the system will switch into PRGM mode.

*2: If any fault occurred before the power supply was turned off, the fault contents are displayed when power is restored. Fault history and display are provided by ∧ or ∨ keys. Unfault : n =1~4, the most recent fault incidents. Order, fault : most recent fault, detail, please refer to Chapter 3 (Fault display and trouble shooting)

*3: If no fault occurred before the power supply was turned off, display the monitored data according to the Bn-10 setting (See page 2-5)

*4: This block will be bypassed if no fault occurred before the power supply was turned off or if a fault occured and was reset by RESET.

*5: When in the DRIVE mode, press the DSPL key and the RESET key. The setting values of Sn-□□ and Cn- □□ will only be displayed for monitoring, and cannot be adjusted.

1.3 Parameter Description

The PA7300 The PA7300 has 4 groups of user parameters:

Parameters*4	Description
An-□□	Frequency commands
Bn-□□	Parameter settings that can be changed while the PA 7300 is in RUN mode.
Sn-□□	System parameter settings (can be changed only after the PA7300 is stopped.)
Cn-□□	Control parameter settings (can be changed only after the PA7300 is stopped.)

The parameter setting for Sn-03 (operation status) will determine if the setting value of the different parameter groups are allowed to be changed or only monitored, as shown below:

Sn-03	DRIVE mode		PRGM mode	
	Settable	Monitored only	Settable	Monitored only
0000*1	An, Bn	Sn, Cn	An, Bn, Sn, Cn	-
0101*2 *3	An	Bn, Sn, Cn	An	Bn, Sn, Cn

*1: Factory setting

*2: When in DRIVE mode, the parameter groups Sn-, Cn- can only be monitored if the > RESET key and the DSPL key are to be pressed at the same time,

*3: After a few trial operations and adjustments, the setting value Sn-03 is set to “0101” to prevent further unwanted modifications.

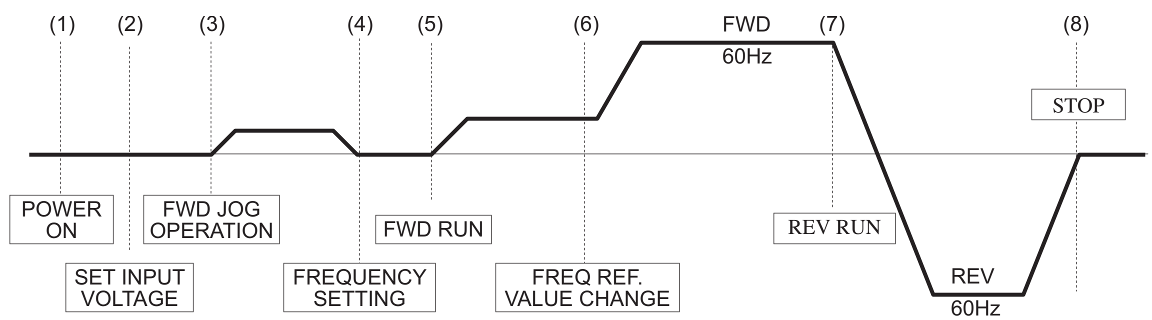
*4: The PA7300 has 2 groups of monitoring parameters and one group of order parameters in addition to the above 4 groups of user parameters.
Un-□□: Can be monitored when the PA7300 is in the DRIVE mode.
Hn-□□: Can be monitored when the PA7300 is in the PRGM mode.
On-□□: Order parameters can be monitored and changed by setting Sn-03=”1010” (See page 2-33).

1.4 Example for using the LCD digital operator

Note:	
Before operation:	Control parameter Cn-01 value must be set to the input AC voltage value. For example, Cn-01=380 if the AC input voltage is 380.

This example will explain the operating of PA7300 operation according to the following time chart.

- **OPERATION MODE**



Sample Operation

Description		Key Sequence	Digital Operator Display	Remarks
(1) On Power Up	• Select frequency reference value displayed		Feq. Cmd. 00.00Hz TECO	LED DRIVE OFF
	• Select PRGM mode	PRGM/DRIVE	An-01 Feq. Cmd. 1	
(2) Input volyage setting (e.g. AC input voltage is 380V)	• Select CONTROL PARAMETER	DSPL Press 3 Times	Cn-01- Input Voltage	
		EDIT/ENTER	Cn-01=440V Input Voltage	
	• Display Cn-01 setting	>/RESET ∧ ∨	Cn-01=380.0V Input Voltage	Display for 0.5 sec
	• Input Voltage 380V	EDIT/ENTER	Entry Accepted	
(continued)				

Description		Key Sequence	Digital Operator Display	Remarks
(continued)			Feq. Cmd. 00.00Hz TECO	
(3) FWD JOG	• Select DRIVE mode	PRGM DRIVE	Feq. Cmd. .0 Hz TECO	LED DRIVE ON
	• Select output frequency display	DSPL		LED FWD ON
	• Select direction of rotation (When power on, initially defaulted FWD)		O/P Freq. 6.00 HZ TECO	
	• Jog operation	JOG (L/R)	Feq. Cmd. 00.00Hz TECO	
(4) Frequency setting	• Select frequency cmd display	DSPL Press 6 Times	Feq. Cmd 15.00Hz TECO	
	• Change frequency cmd	RESET ∧ ∨	Feq. Cmd 15.00Hz TECO	
	• Set new frequency cmd	EDIT ENTER	Entry Accepted	Display for 0.5 sec confirm the display
	• Select O/P frequency display	DSPL	O/P Freq. .0 HZ TECO	
			O/P Feq. 15.00Hz TECO	
(5) FWD run	• RUNNING operation	RUN		LED RUN ON
(6) Frequency command change	• Select frequency cmd displayed	DSPL Press 6 Times	Feq. Cmd 15.00Hz TECO	
			Feq. Cmd 60.00Hz TECO	
	• Change reference value	RESET ∧ ∨	Feq. Cmd 60.00Hz TECO	
	• Enter new frequency cmd setting	EDIT ENTER	Entry Accepted	Display for 0.5 sec confirm the display
	• Select fequency cmd displayed	DSPL	O/P Feq. 60.00Hz TECO	
			O/P Feq. -60.00Hz TECO	
(7) REV RUN	• Change to REV	FWD REV		LED REV ON
(8) STOP	• Decrement to STOP	STOP	O/P Feq. .0 Hz TECO	LED STOP ON (Blinking while decel.) RUN

2. SETTING USER CONSTANT

2.1 Frequency command (in Multi-speed operation) **An-☐☐**

Under the DRIVE mode, the user can monitor the parameters and set their values.

Parameter No. *(3)	Name	LCD Display (English)	Setting Range	Setting*(1, 2) Unit	Factory*2 Setting	Ref Page
An-01	Frequency Command 1	An-01=000.00Hz Frequency Command 1	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	2-48 2-49 App-3
An-02	Frequency Command 2	An-02=000.00Hz Frequency Command 2	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-03	Frequency Command 3	An-03=000.00Hz Frequency Command 3	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-04	Frequency Command 4	An-04=000.00Hz Frequency Command 4	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-05	Frequency Command 5	An-05=000.00Hz Frequency Command 5	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-06	Frequency Command 6	An-06=000.00Hz Frequency Command 6	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-07	Frequency Command 7	An-07=000.00Hz Frequency Command 7	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-08	Frequency Command 8	An-08=000.00Hz Frequency Command 8	0.00 ~ 180.00 Hz	0.01Hz	0.00Hz	
An-09	Jog Frequency Command	An-09=006.00Hz Jog Command	0.00 ~ 180.00 Hz	0.01Hz	6.00Hz	

*1. The displayed "Setting Unit" can be changed through the parameter Cn-20.
*2. At factory setting, the value of "Setting Unit" is 0.01Hz.
*3. The setting of An-01~8 should be with the multi-function terminals 5~8.

2.2 Parameters That Can Be Changed during Run Bn- □□

In the DRIVE mode, the Parameter group can be monitored and set by the users.

Function	Parameter No.	Name	LCD Display (English)	Range Setting	Setting Unit	Factory Setting	Ref. Page
Acc/Dec time	Bn-01	Acceleration Time 1	Bn-01=0010.0s Acc. Time 1	0.0 ~ 6000.0s	0.1s	10.0s	2-4
	Bn-02	Deceleration Time 1	Bn-02=0010.0s Dec. Time 1	0.0 ~ 6000.0s	0.1s	10.0s	
	Bn-03	Acceleration Time 2 Acc. Time 2	Bn-03=0010.0s Acc. Time 2	0.0 ~ 6000.0s	0.1s	10.0s	
	Bn-04	Deceleration Time 2 Dec. Time 2	Bn-04=0010.0s Dec. Time 2	0.0 ~ 6000.0s	0.1s	10.0s	
Analog Frequency Command	Bn-05	Analog Frequency Cmd. Gain (Voltage)	Bn-05=0100.0% ~ Freq. Cmd. Gain	0.0 ~ 1000.0%	0.1%	100.0%	
	Bn-06	Analog Frequency Cmd. Bias (Voltage)	Bn-06=0000.0% ~ Freq. Cmd. Bias	-100.0% ~ 100.0%	0.1%	0.0%	2-4
Torque Boost	Bn-07	Auto torque Boost Gain (Ineffective in	Bn-07=1.0				
A01bias	Bn-08	energy-saving mode) Multi-Function Analog	Auto_Boost Gain Bn-08 =00.0%	0.0 ~ 2.0	0.1	1.0	2-4
A02 bias	Bn-09	Output A01 Bias Multi-Function Analog	~Output A01 Bias Bn-09 =00.0%	-25.0%~+25.0%	0.1%	0.0%	2-4
	Bn-10	Output A02 Bias Monitor No. After	~Output A02 Bias Bn-10=1	-25.0%~+25.0%	0.1%	0.0%	2-5
A01 Gain	Bn-11	power ON Multi-Function Analog	Power On Contents Bn-11=1.00	1 ~ 4	1	1	2-5
A02 Gain	Bn-12	Output A01 Gain Multi-Function Analog	~Output A01 Gain Bn-12=1.00	0.01 ~ 2.55	0.01	1.00	2-5
PID Control	Bn-13	Output A02 Gain PID Fedback Gain	~Output A02 Gain Bn-13=01.00 PID Det. Gain	0.01 ~ 2.55 0.01 ~ 10.00	0.01 0.01	1.00 1.00	2-5
	Bn-14	PID Proportional Gain	Bn-14=01.0 PID P-Gain	0.0 ~ 10.0	0.1	1.0	2-5 2-6
	Bn-15	PID Integral Gain	Bn-15=010.0s PID I-Time	0.0 ~ 100.0s	0.1s	10.0s	
	Bn-16	PID Differential Time	Bn-16=0.00s PID D-Time	0.00 ~ 1.00s	0.01s	0.00s	
	Bn-17	PID Bias	Bn-17=000% PID Bias	0 ~ 109%*1	1%	0%	
PID Sleep Mode	Bn-18	PID sleep Frequency	Bn-18=000.00Hz PID SLEEP FREQUENCY	0.00 ~ 180.00Hz	0.01Hz	00.00Hz	2-6 2-7
	Bn-19	PID sleep/Wake Delay Time	Bn-19=000.0s PID SLEEP TIME	0.0 ~ 255.5Sec	0.1s	0.00s	
	Bn-20	PID Wake Frequency	Bn-20=60.00 Hz WAKE UP FREQUENCY	0.00 ~ 180.00Hz	0.01Hz	60.00Hz	

*1. The value set in Cn-04 is to be the 100% level.

Function	Parameter No.	Name	LCD Display (English)	Range Setting	Setting Unit	Factory Setting	Ref. Page
PID Display unit	Bn-21	PID Feedback Display Bias	Bn-21=0.000 PID Det. DSPL Bias	-9.999~+9.999	0.001	0.000	2-8
	Bn-22	PID Feedback Display Gain	Bn-22=0.000 PID Det. DSPL Gain	0.000~9.999	0.001	0.000	2-8
1-8 PID Relay Card Control Function	Bn-23	Freq. Command Upper-Bound Delay Time	Bn-23=300s Up-Bound Delay Time	1~600sec	1s	300s	2-9
	Bn-24	Freq. Command Lower-Bound Delay Time	Bn-24=300s Low-Bound Delay Time	1~600sec	1s	300s	2-9
	Bn-25	MC ON/OFF Delay Time	Bn-25=1.00s MC ON/OFF Delay Time	0.10~2.00sec	0.01s	1.00s	2-9
	Bn-26	Pump ON/OFF Detection Level	Bn-26=00.0% Pump ON OFF Det. Level	0.0~20.0%	0.1%	0.0%	2-9

(1) Acceleration Time 1 (Bn-01)

- Acceleration time 1 is enabled when the accel/decel time change command of the multi-function terminal is "open", or the accel/decel time change function is not configured in the multifunction terminals. The acceleration time in which the frequency reference goes from 0% to 100% is set in the units of 0.1 second.

(2) Deceleration Time 1 (Bn-02)

- Deceleration time 1 is enabled when the accel/decel time change command of the multi-function terminals is configured and "open", or the accel/decel time change function is not configured in the multifunction terminals. The deceleration time in which the frequency reference goes from 100% to 0% is set in the units of 0.1 second.

(3) Acceleration Time 2 (Bn-03)

- Acceleration time 2 is enabled when the accel/decel time change command of the multi-function terminals is configured and "closed". The acceleration time in which the frequency reference goes from 0% to 100% is set in the units of 0.1 second.

(4) Deceleration Time 2 (Bn-04)

- Deceleration time 2 is enabled when the accel/decel time change command of multi-function terminals is "closed". The deceleration time in which frequency reference goes from 100% to 0% is set in the units of 0.1 second.

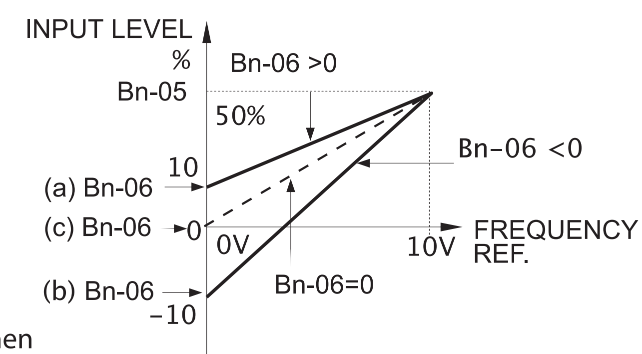
(5) Frequency Reference Gain (Bn-05)

- The input level when the frequency reference voltage is 10V is set in units of 0.1%. Examples are shown below.

(6) Frequency Reference Bias (Bn-06)

- The input level when the frequency reference voltage is 10V is set in units of 0.1%, as shown below.

<Example>
① Bn-05 = 50.0
② a: Bn-06 = 10.0
b: Bn-06 = -10.0
c: Bn-06= 0.0



(7) Torque Compensation Gain (Bn-07)

- The AC Drive can increase the output torque to compensate for load increase automatically via torque compensation. This feature is disabled when auto-energy savings mode is enabled (See Sn-09, Page 2-42)
- Torque compensation gain is set in units of 0.1.

(8) Multi-Function Analog Output A01 Bias (Bn-08)

(9) Multi-Function Analog Output A02 Bias(Bn-09)

- The output voltage of the Multi-function analog outputs A01 and A02 can be individually shifted up or down by Bn-08 and Bn-09 in units of %.

(10) Monitor No. After Turning on Power Supply (Bn-10)

- Data to be monitored after turning ON the power supply. These items will be displayed in the same format as shown in the Un-□□ parameters.

  ① Frequency reference (Bn-10=01 — Display: Freq. Cmd)

  ② Output frequency (Bn-10=02 — Display: O/P Freq.)

  ③ Output current (Bn-10=03 — Display: O/P I)

  ④ Scaled PID feedback
  (Bn-10=04 — Display: PID Det. Value). ref to page 2-8.

(11) Multi-function Analog Output A01 Gain (Bn-11)

(12) Multi-function Analog Output A02 Gain (Bn-12)

- Multi-function Analog Outputs A01 and A02 can be set for their individual voltage levels respectively.

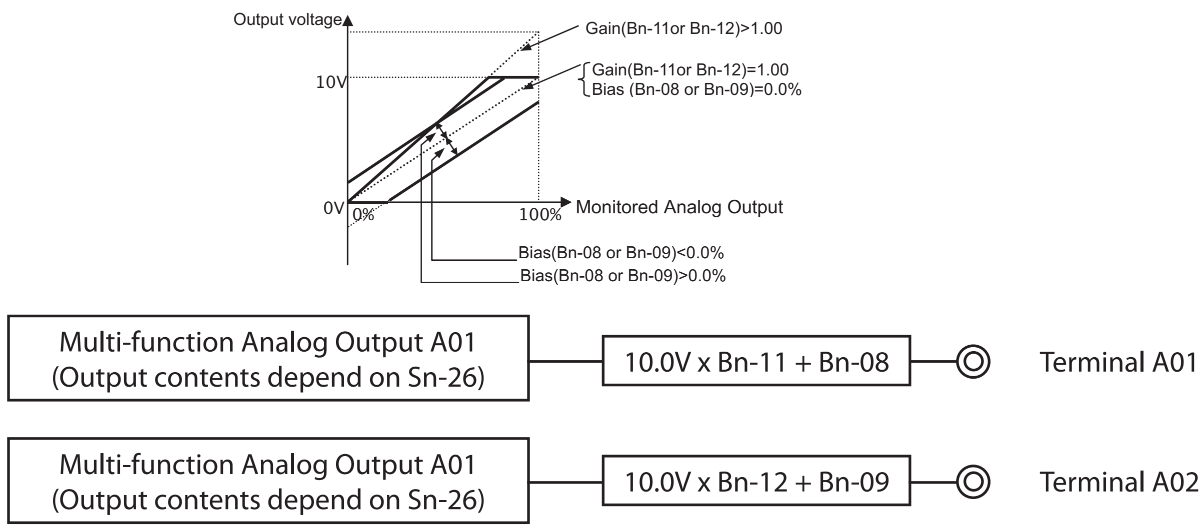


Fig.10 Multi-function Analog Output Diagram

(13) Feedback Gain Adjustment (Bn-13)

- The feedback value can be adjusted by the gain Bn-13 (See Figures 11-a, 11-b and Appendix B).

(14) Proportional Gain P (Bn-14)

- Output P is obtained by multiplying error value by the proportional gain Bn-14. No P operation occurs when Bn-14=0.0. Refer to page 2-6, the block diagram of the PID control section and Appendix B.

(15) Integral Time I (Bn-15)

- Output I is an integral value of error. The integral value obtained at every 7 msec can be calculated by the following equation:

$$\left(\text{Error} \times \frac{7\ \text{msec}}{\text{Bn-15 set value}} \right)$$

No. I operation occurs when Bn-15 = 0.0 sec. Refer to page 2-6, the block diagram of the PID control section. See Appendix B.

(16) Differential Time D (Bn-16)

- Output D is obtained by multiplying variation by D gain. Variation is defined as the output obtained by multiplying the difference between the prior value of deviation and the current value by a gain of (Bn-16 set value/7msec). No D operation occurs when Bn-16= 0.00 sec. Refer to Figure 11a, the block diagram of PID control section. After the output D is obtained, the current variation reading becomes the prior reading for the next reading See Appendix B.

(17) PID offset Adjustment (Bn-17)

- Constant Bn-17 adjusts the PID control offset. If both the set point value and the feedback value are set to zero, adjust the AC drive's output frequency to zero. See Appendix B.

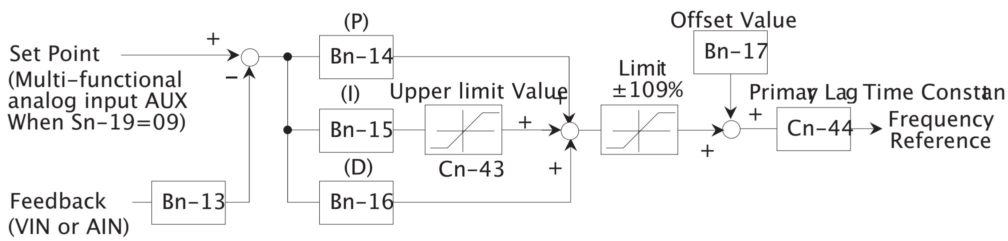


Fig 11-(a) Block Diagram of PID Control Section

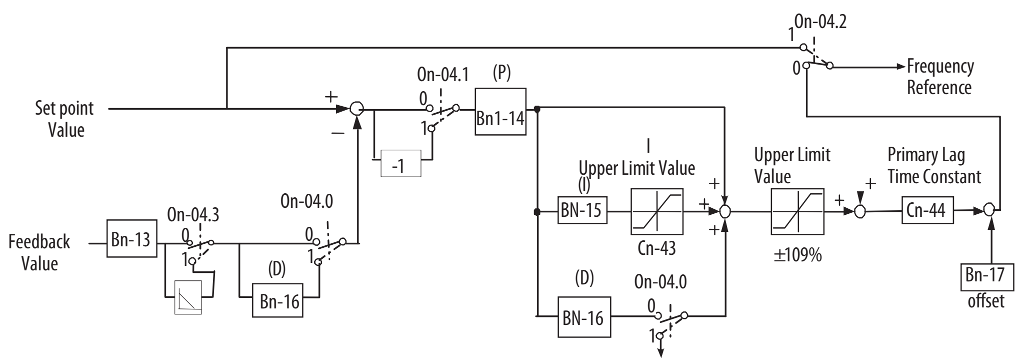


Fig 11-(b) Block Diagram of PID Control Section (For Versions×× and Later - Note 3))

Note 1) All PID calculations are executed every 7 msec.

2) The PID final outputs are all added.

3) See Parameter Un-10 for software version.

4) See Appendix B for detailed discussion of PID Control.

5) See page 2-70 for detailed discussion of parameter On-Ø4

(18) PID Sleep Frequency (Bn-18)

- Frequency level to activate the sleep function. When the PA output frequency drops below the PID sleep frequency set in parameter Bn-18, the PID sleep mode timer is started. The present output frequency (f_{out}) will follow the frequency command (f_{CMD}) until f_{min} is reached.

(19) Sleep/Wake Delay Time (Bn-19)

- This parameter is effective only when PID mode is active (Sn-19=09)
- This parameter enables the AC drive to stop and start running the motor if the load on the motor is minimal.
- Sleep / Wake time in Bn-19 starts when the output frequency (f_{out}) drops below the frequency set in Bn-18 or when the frequency command (f_{CMD}) exceeds the wake frequency (Bn-20)
- During the sleep mode (i.e. when the output frequency ≤Bn-18), when the time set in the timer has expired, the AC drive will ramp down the motor to stop. During the wake mode (i.e. when the frequency command ≥Bn-20), when the time set in the timer has expired, the AC drive will accelerate to frequency command. If the output frequency rises above the frequency set in Bn-18, or the frequency command drops below the set value in Bn-20, the timer is reset.

(20) PID Wake Frequency (Bn-20)

- This parameter is effective only when PID mode is active (Sn-19=09)
- Frequency level for deactivation of sleep function. When the frequency command (f_{CMD}) exceeds the wake frequency and after the time delay set in Bn-19, the AC drive restarts the motor.
- While the AC drive has stopped the motor in sleep mode, the PID control function is still working. When the frequency command rises above the wake frequency in Bn-20 and after the time delay set in Bn-19, the AC drive will restart the motor and the output frequency will ramp up to the frequency command.

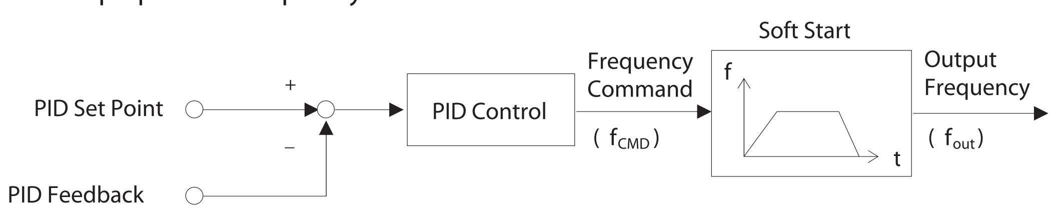


Figure 11-(c) Sleep Wake function in PID Mode

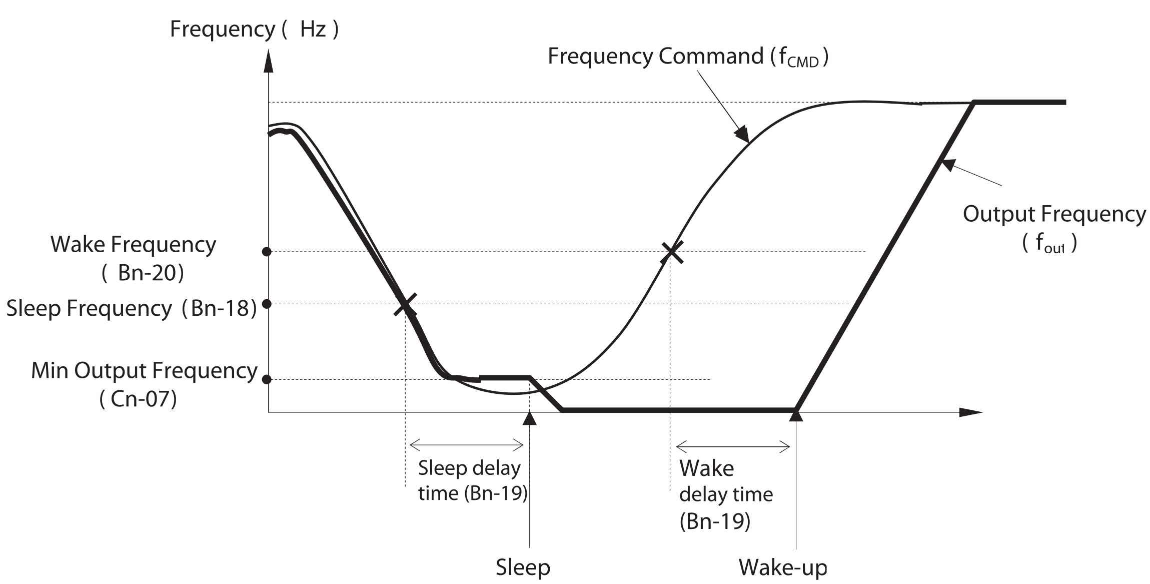


Figure 11-(d) Sleep/Wake Operation Mode

*1. The PID sleep function is deactivated when the PID control function is disabled (Sn-19≠09)

*2. When the timer runs out, the AC drive will stop the motor depending on the stopping method set in Sn-04.

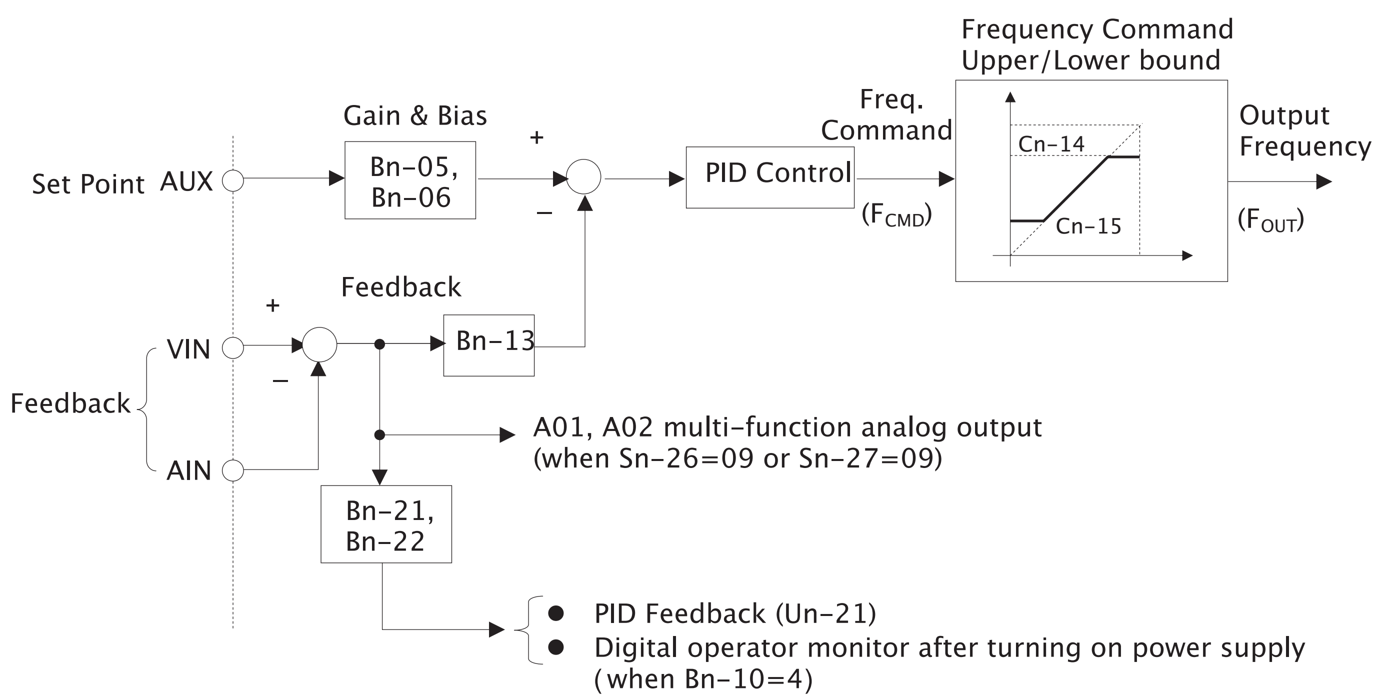
*3. The sleep function is not active in JOG mode.

*4. Sleep mode makes it possible to stop the motor when it is running at low speed and has almost no load. If power consumption in the system goes back up, the AC drive will re-start the motor and the power supply. Energy savings can be achieved with this function, since the motor is only operative when the system needs it.

(21) PID Feedback Display Bias (Bn-21)

(22) PID Feedback Display Gain (Bn-22)

- The PID Feedback value can be inputed from the control terminal as VIN (0~10V) or AIN (4-20mA). The Feedback value is the addition of VIN and AIN, when the this signal is input from VIN and AIN terminal simultaneously.
- The multi-function analog output can be set to monitor the PID feedback (When Sn-26= 09 or Sn-27=09)
- The PID Feedback can be monitored by the monitoring parameter Un-21, and the display unit can be set by Bn-21 and Bn-22 (eg. 0~10V or 4-20mA feedback can be set as a pressure signal unit, using Bn-21 to set the equivalent pressure value for 0V or 4mA PID feedback and Bn-22 to set the equivalent pressure value for 10V or 20mA PID feedback).
- The PID feedback also can be monitored by the digital operator after turning on the power supply. (When Bn-10=04).
- See Appendix B for detailed discussion of PID Control.



(23) Frequency Command Upper-Bound Delay Time (Bn-23)

- The 1-8 PID Relay option card application parameter, if the AC drive's PID output frequency exceeds the frequency command upper bound (the Cn-14 set value), the relay output on 1-8 PID Relay card will activate to increase the number of running pumps when the delay time set by Bn-23 has expired.
- The set value of Bn-23 depends on the pressure response of the water supply system. The set value should be set as low as possible to prevent mechanical shock and vibration.

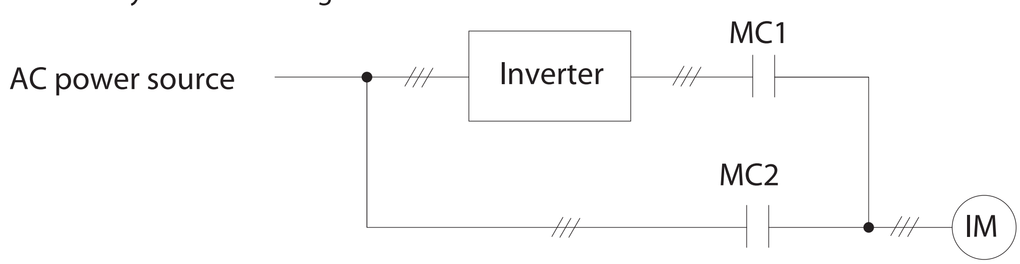
(24) Frequency Command Lower-Bound Delay Time (Bn-24)

- The 1-8 PID Relay option card application parameter, if the AC drive's PID output frequency drops below the frequency command lower boundry (the Cn-15 set value), the relay output on 1-8 PID Relay card will activate to decrease the number of running pumps when the delay time set by Bn-24 has expired.
- The set value of Bn-24 depends on the pressure response of water supply system. The set value should be set as low as possible to prevent mechanical shock and vibration.

  Please refer to "1-8 PID Relay Card instruction manual".

(25) MC ON/OFF Delay Time (Bn-25)

- The1-8 PID Relay option card application parameter. Please refer to "1-8 PID Relay Card instruction manual."
- When switching one inverter-driven motor (or pump) to AC line power source or vice versa, set the MC ON/OFF delay time (set value of Bn-25) to avoid the drive output and AC line source being short-circuited due to the possible varying delay times of MC1 and MC2.
- The delay time (Bn-25 set value) must be longer than the time of the MC ON/OFF controlled signal output from AC drive until the external MC operation is established.
- Generally, the MC operation time from OFF to ON is longer than ON to OFF time. Therefore, set the delay time according to the OFF to ON time.



(26) Pump ON/OFF Detection Level (Bn-26)

- The 1-8-PID Relay option card application parameter. Please refer to "1-8-PID Relay Card instruction manual".
- The set value of Bn-26 is the deviation level of PID set point and feedback values when using 1-8-PID Relay option card to increase or reduce the number of running pumps.
- Set the pump ON/OFF detection level in units of 0.1%. If the value is set to 0.0%, when the output frequency reaches the frequency upper boundry (the set value of Cn-14) the number of running pumps increases immediately. When output frequency drops to the frequency lower boundry (the set value of Cn-15) the number of running pumps decreases immediately.

2.3 Control Parameters Cn-□□

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Reference Page
V/F Pattern Setting	Cn-01	Input Voltage	Cn-01=220.0V Input Voltage	150 ~ 255.0V*1	0.1V	220.0V*2	2-13 2-32
	Cn-02	Max. Output Frequency	Cn-0=220.0V Max. O/P Freq.	50.0 ~ 180.0Hz	0.1Hz	60.0Hz*7	
	Cn-03	Max. Output Voltage	Cn-03=220.0V Max. Voltage	0.1 ~ 255.0V*1	0.1V	220.0V*2*7	
	Cn-04	Max. Voltage Frequency	Cn-04=060.0Hz Max. Volt Frequency	0.1 ~ 180.0Hz	0.1Hz	60.0Hz*7	
	Cn-05	Middle Output Frequency	Cn-05=030.0Hz Middle O/P Freq	0.1 ~ 180.0Hz	0.1Hz	30.0Hz*7	
	Cn-06	Voltage at Middle Output Frequency	Cn-06=055.0V Middle Voltage	0.1 ~ 255.0V*2	0.1V	55.0V*1*7	
	Cn-07	Min Output Frequency	Cn-07=001.5Hz Min O/P Freq.	0.1 ~ 180.0Hz	0.1Hz	1.5Hz*7	
	Cn-08	Voltage at Min. Output Frequency	Cn-08=008.0V Min. Voltage	0.1 ~ 255.0V*2	0.1V	8.0V*1*7	
Current Base	Cn-09	Motor Rated Current	Cn-09=031.0A Motor Rated I	*3	0.1A	31A*4	2-13
DC Braking Function	Cn-10	DC Injection Braking Starting Frequency	Cn-10=01.5Hz DC Braking Start Freq.	0.1 ~ 10.0Hz	1.5Hz	1.5Hz*7	2-13 2-14
	Cn-11	DC Braking Current	Cn-11=050% DC Braking Current	0 ~ 100%	1%	50%	
	Cn-12	DC Injection Braking Time At Stop	Cn-12=00.0S DC Braking Stop Time	0.0 ~ 25.5s	0.1s	0.0s	
	Cn-13	DC Injection Braking Time At Start	Cn-13=00.0s DC Braking Start T	0.0 ~ 25.5s	0.1s	0.0s	
Frequency Limit	Cn-14	Frequency Command Upper Bound	Cn-14=100% Freq Cmd. Up Bound	0 ~ 109%	1%	100%	2-14
	Cn-15	Frequency Command Lower Bound	Cn-15=000% Freq Cmd. Low Bound	0 ~ 109%	1%	0%	
Frequency Jump	Cn-16	Frequency Jump Point 1	Cn-16=000.0Hz Freq Jump 1	0.0 ~ 180.0Hz	0.1Hz	0.0Hz	2-15
	Cn-17	Frequency Jump Point 2	Cn-17=0.0Hz Frequency Jump 2	0.0 ~ 180.0Hz	0.1Hz	0.0Hz	
	Cn-18	Frequency Jump Point 3	Cn-18=0.0Hz Freq Jump 3	0.0 ~ 180.0Hz	0.1Hz	0.0Hz	
	Cn-19	Jump Frequency Width	Cn-19=01.0Hz Freq. Jump Width	0.0 ~ 25.5Hz	0.1Hz	1.0Hz	
Display Unit	Cn-20	Digital Operator Display Unit	Cn-20=00000 Disp.lay Unit 0.1Hz	0 ~ 39999	1	0	2-15
Agreed Speed Detection	Cn-21	Frequency Agree Detection Level	Cn-21=000.0Hz F Agree Det Level	0.0 ~ 180.0Hz	0.1Hz	0.0Hz	2-16
	Cn-22	Frequency Agree Detection Width	Cn-22=02.0Hz F Agree Det Width	0.1 ~ 25.5Hz	0.1Hz	2.0Hz	
Carrier Frequency	Cn-23	Carrier Frequency Upper Limit	Cn-23=6.0KHz Carry-Freq. Up Bound	0.4 ~ 6.0KHz*5	0.1KHz	6.0KHz*5	2-17
	Cn-24	Carrier Frequency Lower Limit	Cn-24=6.0KHz Carry-Freq. Low Bound	0.4 ~ 6.0KHz*5	0.1KHz	6.0KHz*5	
	Cn-25	Carrier Frequency Proportional Gain	Cn-25=00 Carry-Freq. P_Gain	0 ~ 99	1	0*5	

Function	Parameter No.	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Reference Page
OVER-Torque Detection	Cn-26	Overtorque Detection Level	Cn-26=160% Over Tq. Det Level	30 ~ 200%	1%	160%	2-17
	Cn-27	Overtorque Detection Time	Cn-27=00.1V Over Tq. Det Time	0.0 ~ 25.5s	0.1s	0.1s	
Stall Prevention	Cn-28	Stall prevention Level During Acceleration	Cn-28=150% ACC. Stall	30 ~ 200%	1%	150%	
	Cn-29	Not Used	Cn-29=000 Reserved	00 ~ 000	--	--	--
	Cn-30	Stall Prevention Level Frequency	Cn-30=130% Running Stall	30 ~ 200%	1%	130%	2-17
Commun-ication Fault	Cn-31	Communication Fault Detection Time	Cn-31=01.0s Comm. Flt Det. Time	0.1 ~ 25.5s	0.1s	1s	2-18
Frequency Detection	Cn-32	Frequency Detection 1 Level	Cn-32=000.0Hz Freq Det. 1 Level	0.0 ~ 180.0Hz	0.1Hz	0.0Hz	2-18
	Cn-33	Frequency Detection 2 Level	Cn-33=000.0Hz Freq. Det. 2 Level	0.0 ~ 180.0Hz	0.1Hz	0.0Hz	
--	Cn-34	Not Used	Cn-34=0 Reserved	0 ~ 0	--	--	--
	Cn-35	Not Used	Cn-35=0.0 Reserved	0.0 ~ 0.0	--	--	
Fault Retry	Cn-36	Number of Auto Restart Attempts	Cn-36=00 Retry Times	0 ~ 10	1	0	2-19 2-24
Ride-thru time	Cn-37	Power Loss Ride-thru Time	Cn-37=2.0s Ride-thru Time	0 ~ 2.0s	0.1s	2.0s*4	2-19
Speed Search Control	Cn-38	Speed Search Detection Level	Cn-38=150% SP_Search Level	0 ~ 200%	1%	150%	2-20
	Cn-39	Speed Search Time	Cn-39=0.20s SP_Search Time	0.1 ~ 25.5s	0.1s	2.0s	
	Cn-40	Min. Baselock Time	Cn-40=1.0s Min B.B Time	0.5 ~ 5.0s	0.1s	1.0s*4	
	Cn-41	V/F Curve in Speed Search	Cn-41=100% SP_Search V/F Curve	10 ~ 100%	1%	100%	
	Cn-42	Voltage Recovery Time	Cn-42=0.3s Voltage Recovery	0.1~ 5.0s	0.1s	0.3s	
PID Control	Cn-43	PID Integral Upper Bound	Cn-43=100% PID I-Upper	0 ~ 109%	1%	100%	2-21
	Cn-44	PID Primary Delay Time Constant	Cn-44=0.0s PID Filter	0.0 ~ 2.5s	0.1s	0.0s	
Energy-Savings Voltage Unit	Cn-45	Energy-Savings Voltage Upper Limit (60Hz)	Cn-45=120% Level 60Hz	0 ~ 120%	1%	120%	2-21
	Cn-46	Energy Savings Voltage Upper Limit (6Hz)	Cn-46=16% Level 6HZ	0 ~ 25%	1%	16%	
	Cn-47	Energy Savings Voltage Lower Limit (60Hz)	Cn-47=050% Level 60HZ	0 ~ 100%	1%	50%	
	Cn-48	Energy Savings Voltage Lower Limit (6Hz)	Cn-48=12% Level 6HZ	0~ 25%	1%	12%	

Function	Parameter Number	Name	LCD Display (English)	Setting Range	Setting Unit	Factory Setting	Reference Page
Energy Savings Tuning Operation	Cn-49	Tuning Operation Voltage Limit	Cn-49=0.0% Sav. Tuning V Limit	0 ~ 20%	1%	0%	2-22
	Cn-50	Tuning Operation Control Cycle	Cn-50=01.0s Sav. Tuning Period	0.1 ~ 10.0s	0.1s	1.0s	
	Cn-51	Tuning Operation Voltage Step (100% Output Voltage)	Cn-51=00.5% O/P Volt.100%	0.1 ~ 10.0%	0.1%	0.5%	
	Cn-52	Tuning Operation Voltage Step (5% Output Voltage)	Cn-52=00.2% O/P Volt. 5%	0.1 ~ 10.0%	0.1%	0.2%	
--	Cn-53	Not Used	Cn-53=00.000 Reserved	00.000 ~ 00.000	--	--	--
	Cn-54	Not Used	Cn-54=00.000 Reserved	00.000 ~ 00.000	--	--	--
	Cn-55	Not Used	Cn-55=00.000 Reserved	00.000 ~ 00.000	--	--	--
	Cn-56	Not Used	Cn-56=00.000 Reserved	00.000 ~ 00.000	--	--	--
	Cn-57	Not Used	Cn-57=00.000 Reserved	00.000 ~ 00.000	--	--	--
Energy Savings Coefficient K2	Cn-58	Energy Savings Coefficient K2 (60Hz)	Cn-58=115.74*6 Eg. Saving Coeff	0.00 ~ 655.35	0.01	115.74*6	2-22
	Cn-59	Energy Savings Coefficient Reduction Ratio (6Hz)	Cn-59=100% K2 Reduce Ratio	50 ~ 100%	1%	100%	2-23
	Cn-60	Motor Code	Cn-60=29*4 Reserved	00 ~ FF	--	29*0	2-23
--	Cn-61	Not Used	Cn-61=000 Reserved	000 ~ 000	--	--	--
Retry Time	Cn-62	Auto Restart Time Interval	Cn-62=00s Retry Time	0 ~ 20s	1s	0s	2-24
Motor Overheat Time	Cn-63	Motor Overheat Protection Time	Cn-63=060s Motor OH Time	1 ~ 300s	1s	60s	2-24

*1 1 For 230V Class, x2 for 460V, x2.5 for 600V.

*2 For 230V Class, x2 for 460V, x2.5 for 600V.

*3 Setting range becomes 10 to 200% of AC Drive rated current. The factory setting base on TECO AEEF standard 4 pole motor, 230V/60Hz, 460V/60Hz.

*4 Factory settings differ depending on AC Drive capacity (Sn-01 set value).
This example shows combination of TECO standard motor 460V 60Hz 25HP (18.5KW).
(Refer to the table on page 2-30 to 2-32)
At setting Sn-01, the set value changes to the factory setting. For any application other than TECO standard motors, set the value shown on the nameplate of the motor.

*5 Factory setting and setting range differ depending on AC Drive capacity (Sn-01 set value).

*6 Differs depending on Cn-60 set value.

*7 Factory setting differ depending on V/F curve selection (Sn-02).

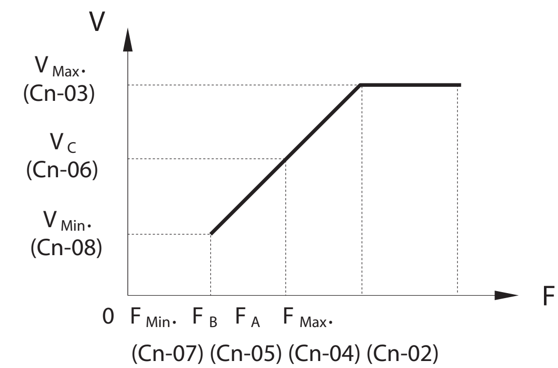
*8 The same value as Sn-01 is set.

(1) Input voltage (Cn-01)

- Set AC Drive input voltage. (In units of 0.1V).

(2) V/f constant (Cn-02 to Cn-08)

- Set AC drive output frequency/voltage characteristics (V/f characteristics.)
  (a) Changing V/f characteristics
  Sn-02 = 0 to 3 : V/f characteristics are determined by set value. Settings of CN-02 to Cn-08 cannot be changed.
  Sn-02 = 4 : Any V/f characteristic can be obtained by the set values of constants Cn-02 ~ Cn-08
  (b) Voltage values (Cn-03, Cn-06, Cn-08) displayed on the LCD operator depend on the set value of Sn-02 (V/f selection)
  (c) Sn-02 = 4 : The set value is displayed.
  (d) When V/F characteristics are a straight line, the same value as Cn-07 is set in Cn-05. The set value of Cn-06 is disregarded.



Notes:
1. The maximum output voltage is limited by the input voltage.
2. When the set values of Cn-02 to Cn-08 do not satisfy the conditionas stated above, a setting error occurs and an Invalid V/F OPE10 alarm is displayed.
   The set value is checked at power ON and switching from PRG mode to DRIVE mode.
   $F_{MAX.} \geq F_A > F_B \geq F_{Min.}$

(3) Motor rated current (Cn-09)

- Set motor rated current by the electronic thermal function in units of 0.1 A for motor overload protection. The range of setting is 10% to 200% of AC drive rated current.
  When the 1st digit of Sn-14 is set to 1, the electronic thermal function is disabled and the motor is not protected from overheating due to overload.

(4) **DC injection braking starting frequency (Cn-10)**

- Set a frequency for starting DC braking during deceleration to stop in units of 0.1 Hz.
  When a set value is not greater than Cn-07 (minimum output frequency), DC braking is started at the minimum output frequency.

(5) DC braking current (Cn-11)

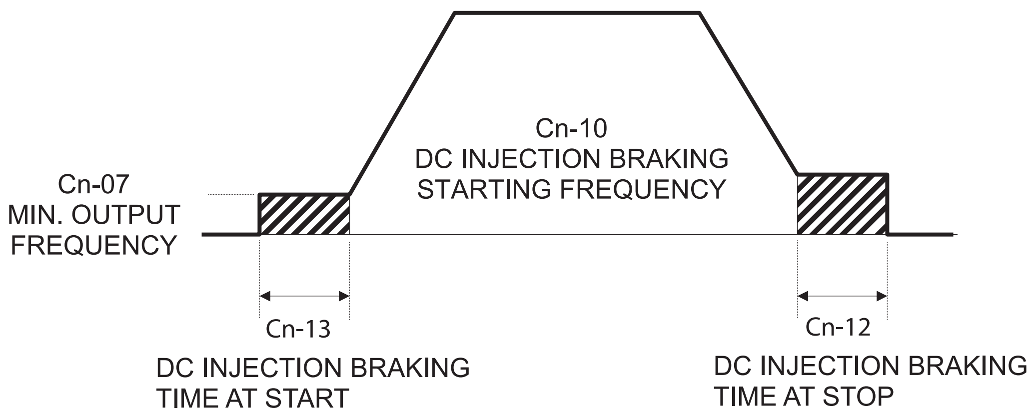
- Set DC braking current in units of 1%. AC drive rated current is 100%.

(6) DC injection braking time at stop (Cn-12)

- Set the duration of DC braking at stop in units of 0.1 second.
- When a set value is 0, DC braking is not performed, and DC drive output is shut off at the start of DC braking.

(7) DC injection braking time at start (Cn-13)

- Set the duration of DC braking at the start in units of 0.1 second.
- When a set value is 0, DC braking is not performed, and acceleration begins with the minimum output frequency.

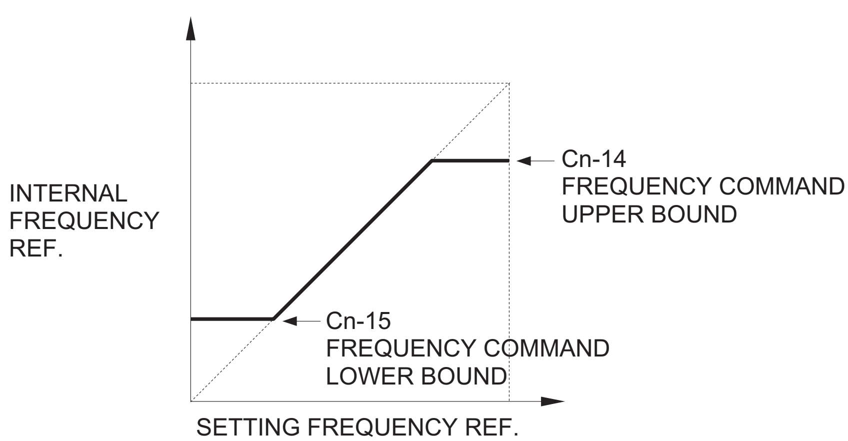


(8) Frequency command upper bound (Cn-14)

- Sets the upper limit of frequency reference in units of 1%. Cn-02 (maximum frequency) is regarded as 100%.

(9) Frequency command lower bound (Cn-15)

- Sets the lower limit of frequency reference in units of 1%. Cn-02 (maximum frequency) is regarded as 100%. When the run command is asserted with a frequency reference of 0, acceleration continues from the minimum frequency to the lower frequency reference limit, and operation continues at the lower frequency reference limit.



(10) Prohibit frequencies 1 to 3 (Cn-16 to Cn-18)

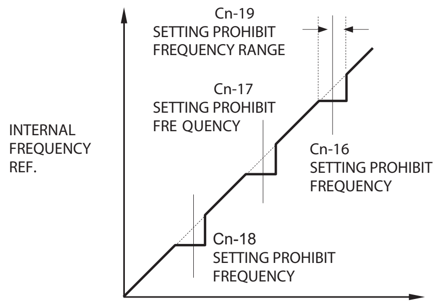
- Sets prohibit frequency in units of 0.1 Hz. A set value of 0.0 Hz disables this function.
- If the prohibit frequency ranges overlap, set prohibit frequency 1 to 3 as shown below:

Cn-18 ≤ Cn-17 ≤ Cn -16

(11) Prohibit frequency range (Cn-19)

- Set the range of prohibit frequency in units of 0.1 Hz. The range of the prohibit frequency is determined as follows, depending on combinations with Cn-16 to Cn-18.

(Cn-16 to Cn-18) - Cn-19 ≤ the range of the prohibit frequency ≤ (Cn-16 to Cn-18) + Cn-19



Note: Constant-speed operation is prohibited in the prohibit frequency range. Output frequency does not jump during acceleration or deceleration, which is performed smoothly.

(12) Digital Operator Display Unit (Cn-20)

- The setting unit of frequency references 1 to 8 and jog frequency reference depends on the set value of the operator display mode (Cn-20) as follows:

Cn-20	Setting / Reading Unit
0	Units of 0.01 Hz
1	Units of 0.01%
2 to 39	Set in the units of r / min (0 to 39999). r / min = 120 x frequency reference (Hz) / Cn-20 (Set the number of motor poles in Cn-20)
40 to 39999	The position of decimal point is set by the value of the 5th digit of Cn-20. Value of 5th digit = 0: Displayed as XXXX Value of 5th digit = 1: Displayed as XXX.X Value of 5th digit = 2: Displayed as XX.XX Value of 5th digit = 3: displayed as X.XXX A set value of 100% frequency is defined by the 1st digit to 4th digit of Cn-20. Example 1: When the set value of 100% speed is 200.0, Cn-20 = 12000 is set. 100% speed is displayed as 200.0 at Cn-29 = 12000. 60% speed is displayed as 120.0 Example 2: When the set value of 100% speed is 65.00, Cn-20 = 26500 is set. 60% speed is displayed as 39.00 at Cn-20 = 26500.

(13) Frequency agree detection level (Cn-21)

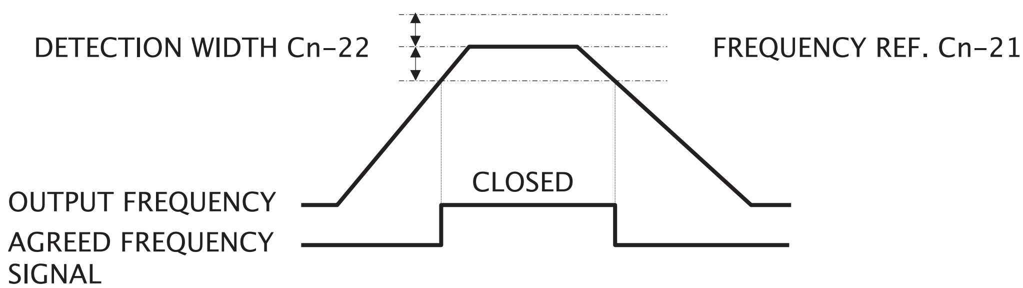
- Set an agreed frequency point in units of 0.1 Hz.

(14) Frequency agree detection width (Cn-22)

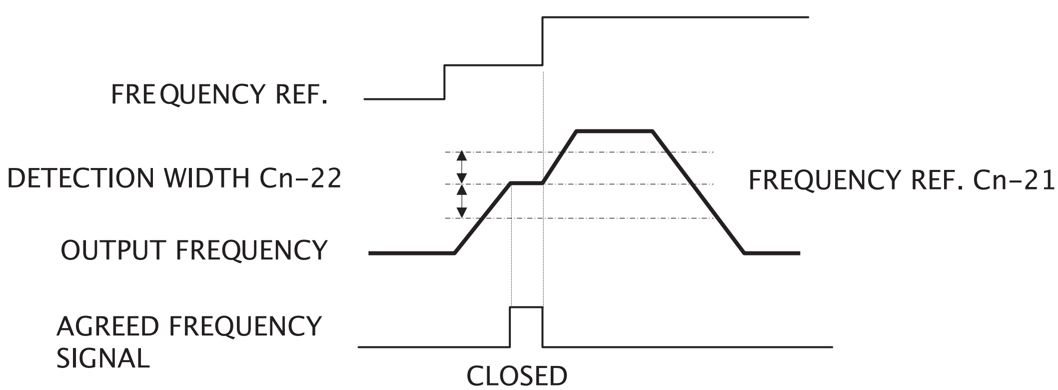
- Set an agreed frequency detection width in units of 0.1 Hz. The relation with multifunction contact outputs are shown in the four figures below (a), (b), and the frequency detection 1,2 (Cn-32,Cn-33) on page 2-18.

(a) Agreed frequency (set value of multi-function contact outputs Sn-20~22= 2)
This is "closed" when output frequency is within the detection width as shown in the following figure.

(Frequency ref. - Cn-22) ≤ Output frequency ≤ (Frequency ref. + Cn-22)
Cn-21: Agreed frequency point
Cn-22: Agreed frequency detection width



(b) Agreed frequency (set value of multi-function contact output Sn-20~22= 3)
This is "closed" when acceleration or deceleration is completed and output frequency is within the detection width shown in the figure below.



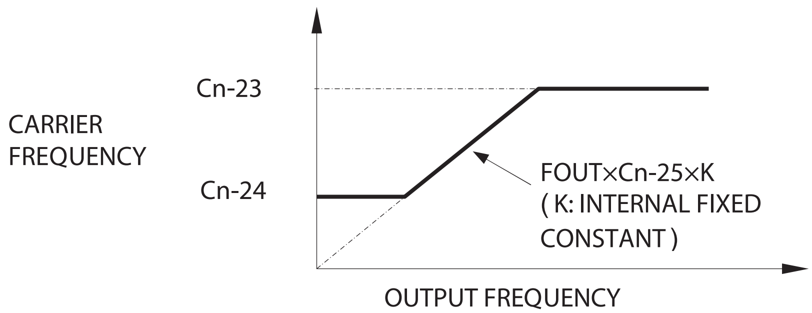
(Cn-21 - Cn-22) ≤ Output frequency ≤ (Cn -21 + Cn-22)
Cn-21: Agreed frequency point
Cn-22: Agreed frequency detection width

(15) Carrier frequency upper/lower limit, proportion gain (Cn-23 to Cn-25)

- The relationship between output frequency and carrier frequency is determined as follows from the set values of Cn-23 to Cn-25.

  (a) For constant carrier frequency (set value of Cn-23):
  • Set 0 in Cn-25 and set the same value in Cn-23 and Cn-24.

  (b) For variable carrier frequency: Carrier frequency changes according to Cn-23 to 25 set values and output frequency as shown below.



Invalid Fc (OPE11) is displayed in the following cases:
① Cn-25 > 6 and Cn-24 > Cn-23
② Cn-23 > 5kHz and Cn-24 ≤ 5 kHz

(16) Overtorque detection level (Cn-26)

- Set overtorque levels in units of 1%. AC drive rated current is regarded as 100%.

(17) Overtorque detection time (Cn-27)

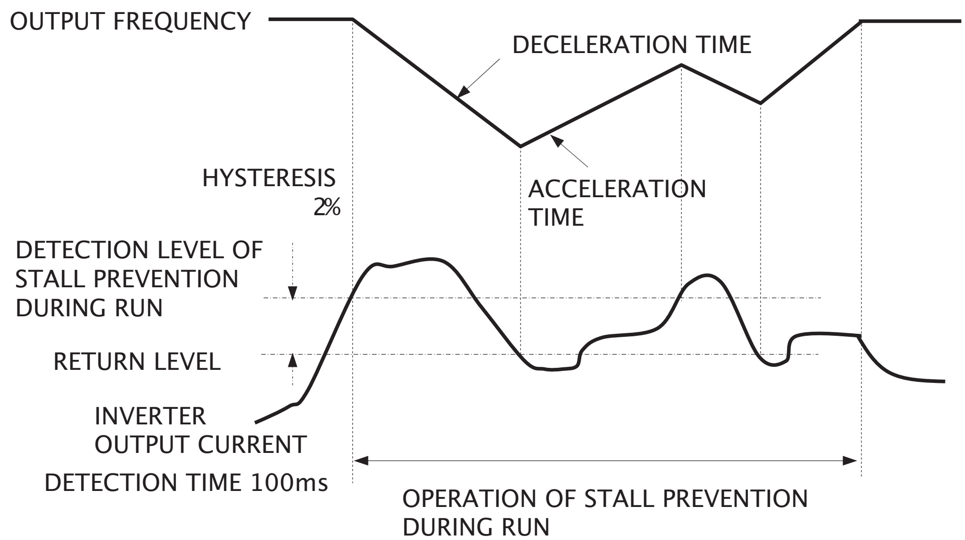
- Set overtorque detection times in units of 0.1 second.

(18) Stall prevention level during acceleration (Cn-28)

- Set stall prevention level during acceleration in units of 1%. AC drive rated current is regarded as 100%.

(19) Stall prevention level during run (Cn-30)

- Set a level for stall prevention level during run in units of 1%. AC drive rated current is regarded as 100%
- Stall prevention during run starts deceleration when the output current is greater than the setting value of Cn-30 (stall prevention level during run) for during agreed frequency for 100ms or more. The AC drive decelerates as long as the output current exceeds the setting value of Cn-30 (stall prevention level during run). When the output current goes below the setting value, the AC drive reaccelerates. The deceleration time selected in the 4th digit of Sn-10 is used.
- During stall prevention during run, stall prevention during deceleration and acceleration are still enabled.

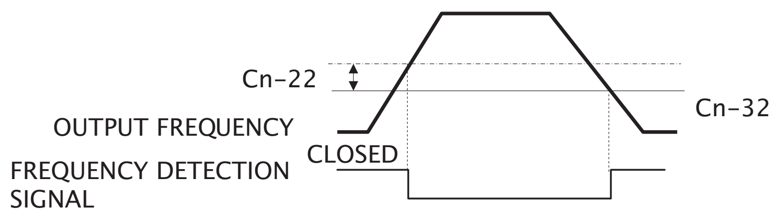


(20) Communication fault detection time (Cn-31)

- Please refer to the "PA7300 MODBUS or PROFIBUS application manuals."

(21) Frequency detection 1 level (Cn-32)

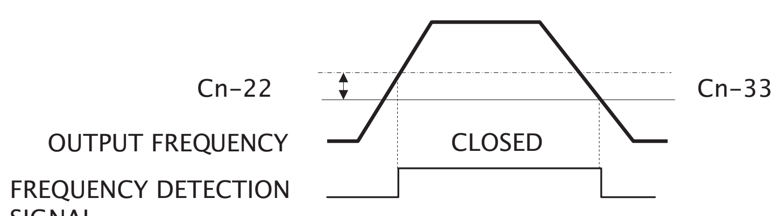
- When the set value of the multi-function contact output (Sn-20~22)=4, this contact closes when the output frequency is equal to or less than Cn-32, as shown in the figure below.



Output frequency ≤ Cn-32
Cn-32: Frequency detection 1 level
Cn-22: Agreed frequency detection width

(22) Frequency detection 2 level (Cn-33)

- When the set value of multi-function contact output (Sn-20~22)=5, this contact closes when output frequency is equal to or more than Cn-33, as shown in the figure below.



Output frequency ≥ Cn-33
Cn-33: Frequency detection 2 level
Cn-22: Agreed frequency detection width

(23) Number of auto restart attempts (Cn-36)

- Set the number of auto reset/restart operations. Setting to zero causes no auto reset/restart operation.
- Each time any OC, OV, OL1, OL2, OL3, OH, UV1, OC, GF, OV, rr or UV1 fault occurs, the number of auto reset/restart operations is incremented by 1, and auto reset/restart operation is performed according to the following procedure.
- Auto reset/restart operation sequence

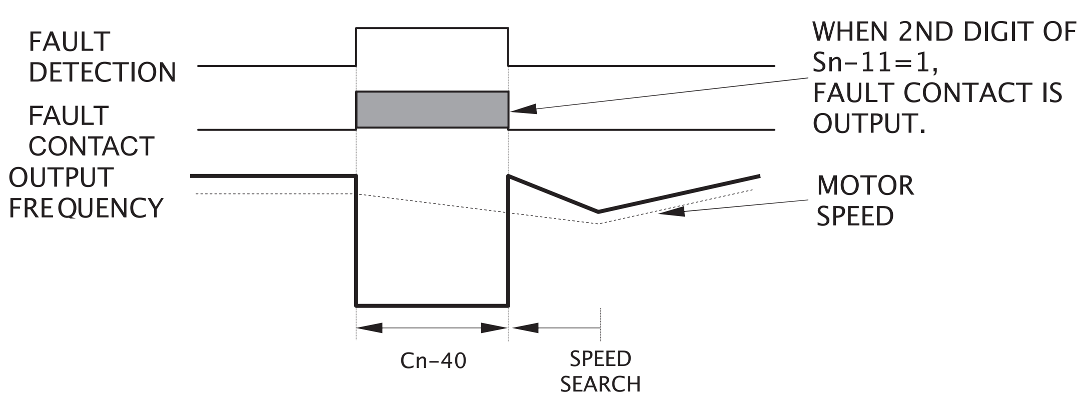
① When a fault is detected, the AC drive output is shut off for the minimum baseblock time (Cn-40). During shut off of the drive output, a fault occurring in the operator is displayed.
② When the minimum baseblock time (Cn-40) elapses, the fault is automatically reset, and speed search operation is performed with the output frequency at the time of the fault.
③ When the total number of faults exceed the number of auto restart attempts (Cn-36), automatic reset is not performed, and the AC drive output is shut off. At this time, fault contact output is activated.

- The number of auto reset/restart operations is cleared to zero when:

① No fault occurs for 10 minutes or more.
② A fault reset signal is inputed from the control circuit terminals or the digital operator.

- Auto reset/restart operation is not performed in the following cases:

① When operation not continued at momentary power loss (3rd digit of Sn-11=0) is specified, UV1 fault is not automatically reset.
② When OC or OV fault occurs due to external fault during deceleration stop or DC injection braking stop, the AC drive output is shut off.



(24) Power loss ride-thru time (Cn-37)

- Set in units of 0.1 second. The initial value depends on the AC Drive's capacity.

(25) Speed search detection level (Cn-38)

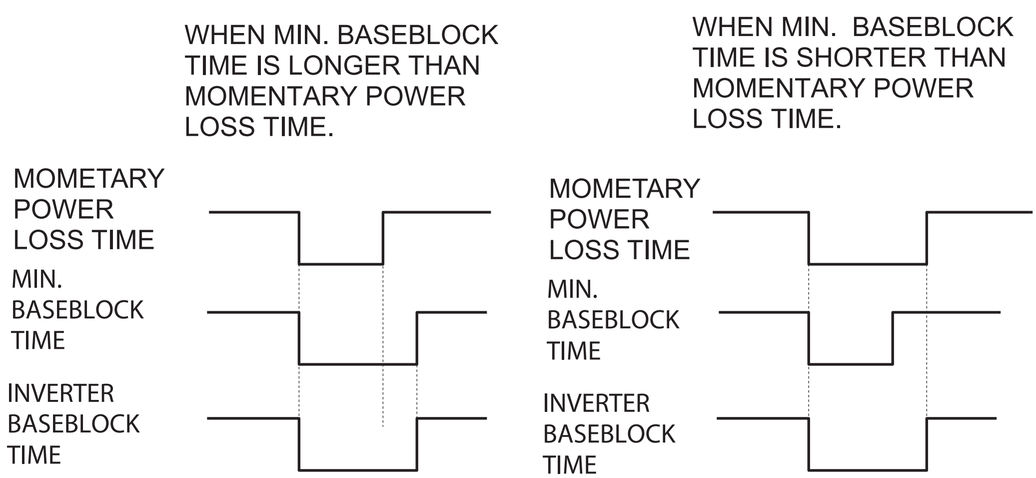
- Upon power recovery, when the AC drive output current is larger than the set value of Cn-38, speed search operation is started. When the AC drive's output current is smaller than the set value of Cn-38, the frequency is interpreted as a speed synchronization point, and acceleration or deceleration is resumed up to a specified frequency.

(26) Speed search time (Cn-39)

- Set deceleration time during speed search in units of 0.1 second. Setting of 0.0 second causes no speed search.

(27) Minimum baseblock time (Cn-40)

- On detecting momentary power loss, the AC drive shuts off output and maintains the baseblock state for a given time. Set time in Cn-40 when residual voltage is expected to be negligible
- When the momentary power loss time is longer than the minimum baseblock time, speed search operation is started immediately after power recovery.



(28) V/f speed search (Cn-41)

- To ensure that a fault such as OC does not occur during a speed search operation, V/f must be reduced during speed search operation, as compared with that during normal operation. Set V/f during speed search as follows by the set value of Cn-41: V/f during speed search = V/f at normal operation × Cn-41

(29) Voltage recovery time (Cn-42)

- Set in Cn-42 the time between completion of speed search operation and return to V/f at normal operation. The set of voltage recovery time is set as follows:
  230V Class: Time required to raise voltage from 0 to 230V
  460V Class: Time required to raise voltage from 0 to 460V
  600V Class: Time required to raise voltage from 0 to 600V

(30) PID integral upper bound (Cn-43)

- The upper limit value of value I can be set by Cn-43. To increase the control capability by integration, increase the value of Cn-43. Reduce the setting of Cn-43 if there is a risk of load damage or of the motor going unstable from the AC drive's response when the load suddenly changes. Set this constant as a percentage of the maximum output frequency, with the maximum frequency taken as 100%. If the control system vibrates and vibration cannot be eliminated even by adjusting the integral time (bn-15) or primary lag time constant (Cn-44), decrease the value of Cn-43. Please note: if the setting of Cn-43 is reduced too much, the target value and the feedback value will not match. Refer to page 2-6, the block diagram of PID control section. Also refer to Appendix B.

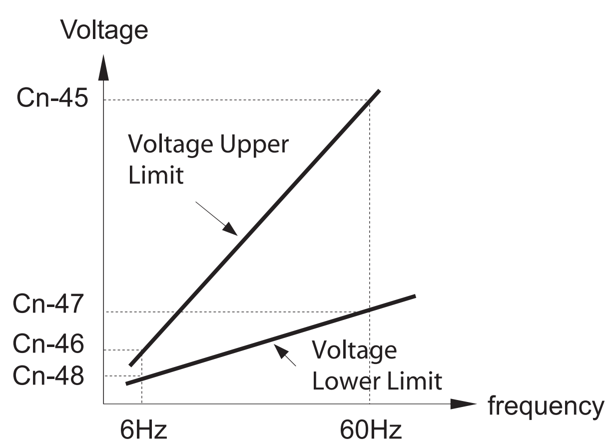
(31) PID primary delay time constant (Cn-44)

- Constant Cn-44 is the low-pass filter setting for PID control outputs and there is normally no need to change this setting. If the viscous friction of the mechanical system is high or if the rigidity is low, causing the mechanical system to oscillate, increase the setting so that it is higher than the oscillation frequency period. This will decrease the responsiveness, but it will prevent oscillation. Refer to page 2-6, the block diagram of PID control section. Also refer to Appendix B.

(32) Energy-savings voltage limit (Cn-45 to Cn-48)

- The upper and lower limits of output voltage are set. If the voltage reference value calculated in the energy-savings mode exceeds the upper or lower limit value, this upper or lower limit value is output as voltage reference value.
- The upper limit value is set in order to prevent over excitation at low frequency and the lower limit value is set in order to prevent stalling at a light load. Limit voltage values obtained at 6Hz and 60Hz are set: for any limit value other than at 6Hz and 60Hz, the values are calculated are done by linear interpolation of these values. Settings are made in % rated voltage.

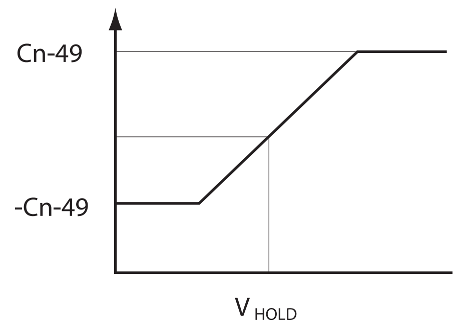
  Please refer to Appendix A for a detailed discussion of Energy-Savings Mode.



(33) Energy-savings tuning operation (Cn-49 to Cn-52)

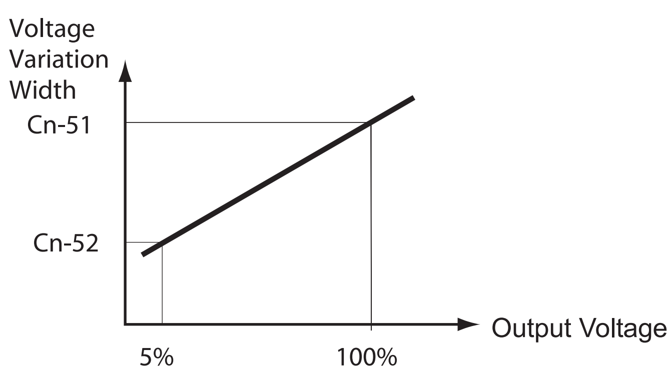
- In the energy-savings mode (Sn-09 = X1XX) the optimum voltage is calculated according to load power and the voltage is supplied to the load. However, since the motor settings differ depending on temperature variation or use of other manufacturers' motors, the output voltage is not always optimum. At tuning, operation is controlled so that the optimum operating status can be obtained by fine adjustment of voltage.

(a) Tuning Operation voltage Limit (Cn-49)
Limits the range where voltage is controlled by tuning operation. Setting is made in the units of % of rated voltage. By setting this value to 0, tuning operation is not performed.



(b) Tuning Operation Control Cycle (Cn-50)
Sets the control cycle of tuning operation.

(c) Tuning Operation voltage Step (Cn-51, 52)
Sets voltage variation width of one tuning operation cycle. Setting is made in the units of % of rated voltage. By increasing this value, rotation speed variation becomes larger. Initial values are100% and 5%. With other voltage values, voltage variation width obtained by linear interpolation is set.



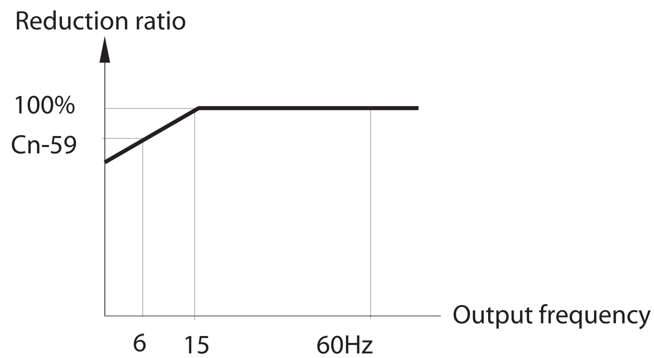
Please refer to Appendix A for a detailed discussion of Energy-Savings Mode.

(34) Energy-saving coefficient K2 (Cn-58)

- Voltage at which the motor efficiency will be the maximum is calculated by using this coefficient at operation in the energy-saving mode, and the resulting value is the voltage reference. This value is initially set to the value of a TECO-Westinghoue motor. By increasing the energy-saving coefficient, output voltage becomes larger.
- Please refer to Appendix A for a detailed discussion of Energy-Savings Mode.

(35) Energy-saving coefficient reduction ratio (Cn-59)

- In order to prevent over excitation in the low frequency area, this constant reduces output voltage at low frequency. Set the reduction ratio at 6Hz. Output voltage is reduced by the reduction ratio (Cn-59) when output frequency is 6Hz or obtained by linear interpolation between 6 and 15Hz as shown in the figure below.



Please refer to Appendix A for a detailed discussion of Energy-Savings Mode.

(36) Motor code (Cn-60)

- By setting this code, energy-savings coefficient is set to Cn-58 when a TECO motor is used. This motor code is the same as that used for motor constant setting (Sn-01). By setting the capacity and initializing by Sn-01, the same code is written to Cn-60. Therefore, when the AC drive and motor have the same capacity, this setting is not needed. When an exclusive use motor or some other manufacturer's motor is used and its motor constant is not known, or when the AC drive and motor have different capacities, set the motor code corresponding to the motor voltage and capacity to Cn-60. The motor codes are shown in the table below.

(230V class)

Cn-60	Motor Capacity	Cn-58 Initial value
04	5	122.90
05	7.5	94.75
06	10	72.69
07	15	70.44
08	20	63.13
9	25	57.87
0A	30	51.79
0B	40	46.27
0C	50	38.16
0D	60	35.78
0E	75	31.35
0F	100	23.10
10	125	14.85

(460V class)

Cn-60	Motor Capacity	Cn-58 Initial Value
24	5	245.80
25	7.5	189.50
26	10	145.38
27	15	140.88
28	20	126.26
29	25	115.74
2A	30	103.58
2B	40	92.54
2C	50	76.32
2D	60	71.56
2E	75	67.20
2F	100	46.20
30	125	41.22
31	150	36.23
32	175	33.88
33	215	30.13
34	250	29.20
35	300	27.13
36	350	24.45
37	400	21.76
38	500	16.38

(600V class)

Cn-60	Motor Capacity	Cn-58 Initial Value
44	5	353.33
45	7.5	272.40
46	10	208.98
47	15	202.51
48	20	181.49
49	25	166.37
4A	30	148.89
4B	40	133.02
4C	50	109.71
4D	60	102.86
4E	75	90.13
4F	100	66.41

- Please refer to Appendix A for a detailed discussion of Energy-Savings Mode.

(37) Auto Restart Time Interval (Cn-62)

- Set the auto reset / restart operation time interval when the number of auto reset /restart operations is more than 2.
- The setting range of Cn-62 is 0~20 sec. The auto restart time interval is minimum baseblock time (Cn-40) when the setting value of Cn-62 is 0.
- The auto restart time interval is the setting value of Cn-40 when the setting value of Cn-62 < Cn-40.
- The auto restart time interval is the setting value of Cn-62 when the setting value of Cn-62 > Cn-40.

(38) Motor Overheat Protection Time (Cn-63)

- Time delay for motor overheat protection when the detected temperature of PTC thermistor motor temperature sensor reaches the trip level.
- Generally, Cn-63 should not be adjusted. The factory setting is at 150%, 1 minute motor overheat capability.
- Refer to the motor overheat protection setting of Sn-19, on page 2-56.

2.4 System Parameters Sn- □□

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Reference Page
Capacity Setting	Sn-01	AC Drive Capacity	Sn-01=29 460V 25HP	AC Drive Capacity Selection	*1	2-30 2-31
V/f Curve	Sn-02	V/f Curve Selection	Sn-02=2 V/f Curve	V/f Pattern Selection	2	2-32
Operator Status	Sn-03	Operation Status	Sn-03=0000 Operate Setting	0000: Setting and reading of An- □□, Bn- □□ , Cn-□□ , Sn-□□ enabled 0101: Setting and reading of An-, Reading of Bn- □□,Cn-□□ , Sn-□□ enabled 1110: Contents Initialization (2-wire)*2 1111: Contents Initialization (3-wire)*2 1000: Initialize Un-11 contents 1001: Initialize Un-12 contents	0000	2-33
Operation Mode Select	Sn-04	Operation Mode Select 1 (RUN - STOP Selection)	Sn-04=0011 Stopping Method	- - -0: Frequency Command = Control circuit terminals VIN or AIN - - -1: Frequency Command = Frequency Command 1 (An-01) - -0 -: RUN/STOP Command = Control circuit terminals - -1 -: RUN/STOP Command = Digital Operator 00- -: Stopping method = Ramp to stop 01- -: Stopping method =Coast to stop 10- -: Stopping method = Full-range DC injection braking stop 11- -: Stopping method = Coast to stop (timer function provided)	0011	2-34 2-35 2-36
	Sn-05	Operation Mode Selection 2 (I/O Terminal Function Selection)	Sn-05=0000 I/O Term Function	- - -0: Stop key effective during operation from control terminal - - -1: Stop key disabled during operation from control terminal - -0 -: Reverse run enabled - -1 -: Reverse run disabled - 0- -: Control input terminals 1~8 are scanned twice. -1- -: Control input terminals 1~8 are scanned once. 0 - - -: Digital operator key = JOG (L/R) key function 1- - -: Digital operator key = L/R (Local/Remote) JOG (L/R) function	0000	2-37
	Sn-06	Operation Mode Selection 3 (S-curve and Frequency Reference Characteristics)	Sn-06=0000 S-curve & Cmd. Char.	- -00: S curve=0.2sec - -01: S curve=0.0sec (NO S curve) - -10: S curve=0.5sec - -11: S curve=1.0sec -0 - -: Reference command direct characteristics (0-10V or 4-20mA/0~100%) -1 - -: Reference command inverse characteristics (0-10V or 4-20mA/100~0%) 0- - -: Stop by reference input when frequency reference is missing 1- - -: Operation to continue at 80% of frequence reference when frequency reference is missing	0000	2-38 2-39 2-40

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Reference Page
Operation Mode Select	Sn-07	Operation mode Selection 4 (overtorque detection)	Sn-07=0000 Over Tq. Detect	- - -0: Overtorque detection disabled. - - -1: Overtorque detection enabled - -0 -: Enabled only if at agreed frequency - -1 -: Enable during operation (except during DC injection) - 0- -: Operation continued after overtorque is detected - 1- -: Coasts to stop if overtorque is detected	0000	2-40 2-41
	Sn-08	Operation Mode Selection 5 (RS-485 communication status selection)	Sn-08=0111 RS-485 Comm. Function	- - -0: Frequency reference input by RS-485 communication option card (PA-M or PA-P) - - -1: Frequency reference input by digital operator or control circuit input terminals - -0 -: RUN/STOP command input by RS-485 Communication option card (PA-M or PA-P) - -1 -: RUN/STOP command input by digital operator or control circuit input terminals 00- -: RS-485 communication fault, deceleration to stop (Bn-02) 01- -: RS-485 communication fault, coast to stop 10- -: RS-485 communication fault, deceleration to stop (Bn-04) 11- -: RS-485 communication fault, continue to run	0011	2-41 2-42
	Sn-09	Operation Mode Selection 6 (Energy Savings Func.)	Sn-09=0000 Eng. Saving Function	- 0- -: Energy-savings function disabled. - 1- -: Energy-savings function enabled*	0000	2-42
Protective Characteristics Select	Sn-10	Protective Characteristic Selection 1 (Stall Prevention)	Sn-10=000 Stall Select	- - -0: Stall prevention during acceleration enabled - - -1: Stall prevention during acceleration disabled - -0 -: Stall prevention during deceleration enabled - -1 -: Stall prevention during deceleration not enabled - 0- -: Stall prevention during run enabled - 1- -: Stall prevention during run disabled 0- - -: Decel time during stall prevention= Bn=02 set value 1- - -: Decel time during stall prevention= Bn=04 set value	0000	2-42 2-43
	Sn-11	Protective Characteristic Selection 2 (Retry and Momentary Power Failure Protection)	Sn-11=0000 Retry & Ride Thru	- -0 -: Fault contact is not energized during Retry operation - -1 -: Fault contact is energized during Retry operation -0 - -: Operation stopped by momentary power loss detection (UV1) -1 - -: Operation continues after momentary power loss	0000	2-43 2-44

Function	Parameter Number	Name	LCD Display (English)	Description	Factory Setting	Reference Pages
Protective Characteristic Select	Sn-12	Protective Characteristics Selection 3 (External Fault Signal Function)	Sn-12=0100 Extermal Faul	- - -0: External fault input (terminal 3): NO-contact input - - -1: External fault input: NC-contact input - -0 -: External fault signal: always detected - -1 -: External fault signal: detected during run only 00- -: External fault detected: Ramp to stop (major fault) by Bn-02 set value 01- -: External fault detected: Coast to stop (major fault) 10- -: External fault detected: Ramp to stop (major fault) by Bn-04 set value 11- -: External fault detected: operation to continue (minor fault)	0100	2-44
	Sn-13	Protective Characteristics Selection 4 (phase Loss Protection and Cooling Fan ON/OFF Control)	Sn-13=0000 Phase Loss & Fan Cont.	- - -0: Input phase loss protection function ineffective - - -1: Input phase loss protection function effective - -0 -: Output phase loss protection function ineffective - -1 -: Output phase loss protection function effective - 0- -: Cooling fan runs while AC Drive power ON - 1- -: Cooling fan runs when heat sink temperature exceeds 50°C	0000	2-44 2-45
	Sn-14	Protective Characteristics Selection 5 (Electronic Thermal Overload Protection)	Sn-14=0000 Over Load Select	- - -0: Motor overload (OL1) protection effective - - -1: Motor overload (OL1) protection ineffective - -0 -: Motor overload protection: s tandard motor - -1 -: Motor overload protection: AC Drive duty motor - 0- -: Motor overload protection time constants are standard time (8 minutes) - 1- -: Motor overload protection time	0000	2-45
Multi-Function Select	Sn-15	Terminal 5 Function	Sn-15=03 Term. 5 Function	00~66 Terminal 5 (factory preset for multi-step speed reference 1)	03	2-46 ~ 2-55
	Sn-16	Terminal 6 Function	Sn-16=04 Term. 6 Functio	00~66 Terminal 6 (factory preset for multi-step speed reference 2)	04	
	Sn-17	Terminal 7 Function	Sn-17=06 Term. 7 Functio	00~66 Terminal 7 (factory preset for jog frequency reference)	06	
	Sn-18	Terminal 8 Function	Sn-18=08 Term. 8 Functio	00~66 Terminal 8 (factory preset for external baseblock by NO contact input)	08	
	Sn-19	Terminal AUX Function	Sn-19=00 Multi-Fct Input	00~0C Terminal AUX (factory preset for auxiliary frequency command)	00	2-56 2-57
	Sn-20	Terminal R2A-R2C Function	Sn-20=00 Term. R2A Function	00~0F Terminal R2A-R2C (factory preset for run)	00	2-58 ~ 2-61
	Sn-21	Terminal D01 Function	Sn-21=01 Term. D01 Function	00~0F Terminal D01 (factory preset for zero speed)	01	
	Sn-22	Terminal R1A Function	Sn-22=02 Term. R1A Function	00~0F Terminal R1A (factory preset for Agreed frequency)	02	

Function	Parameter No.	Name	LCD Display (English)	Description	Factory Setting	Reference Page
RS-485 Comm. Function	Sn-23	Inverter Station Address	Sn-23=01 Inverter Address	Inverter address can be set betweem 1 and 31	01	
	Sn-24	RS-485 Comm. Protocol Setting	Sn-24=0011 RS-485 Protocol	- -00: No parity - -01: Even parity - -10: Odd parity - -11: not used parity setting 00- -: 2400 bps (bit/sec) 01- -: 4800 bps 10- -: 9600 bps 11- -: 19200 bps baud rate setting	0011	2-62
Language	Sn-25	LCD Language Displayed Selection	Sn-25=0 Language: Select	0: English 1: Chinese	0	2-63
Multi-Function Analog Output Selection	Sn-26	Multi-Function Analog Output AO2 Function Selection	Sn-26=00 Term. A01 Function	0: Frequency command (10V/max frequency command, Cn-02) 1: Output Frequency (10V/max Output frequency) 2: Output Current (10V/AC Drive rated current) 3: Output Voltage (10V/input voltage, Cn-01) 4: DC Voltage (10V/400VDC or 800VDC) 5: Output Power (10V/max. applicable motor capacity)	0	2-63
	Sn-27	Multi-Function Analog Output AO2 Function Selection	Sn-27=01 Term. A02 Function	0: Frequency command (10V/max frequency command, Cn-02) 1: Output Frequency (10V/max Output frequency) 2: Output Current (10V/AC Drive rated current) 3: Output Voltage (10V/input voltage, Cn-01) 4: DC Voltage (10V/400VDC or 800VDC) 5: Output Power (10V/max. applicable motor capacity)	1	2-63
--	Sn-28	Not Used	Sn-28=0 Reserved	--	--	--
--	Sn-29	Not Used	Sn-29=0 Reserved	--	--	--
PA-PID Card Function Selection	Sn-30	Pump Operation Mode Selection	Sn-30=0 Run-Mode Select	0: 1-8 PID Relay Card ineffective 1: Fixed inverter drive mode, stop all the pumps by first-run-last-stop sequence. 2: Fixed inverter drive mode, stop the pump driven by the AC Drive only. 3: Fixed inverter drive mode, stop all the pumps by first-run-first-stop sequence. 4: Cycled inverter drive mode, stop all the pumps by first-run-first-stop sequence. 5: Cycled inverter drive mode, stop the pump driven by the Inverter only.	0	2-64

Function	Parameter Number	Name	LCD Display (English)	Description	Factory Setting	Reference Page
1-8 PID Relay Card Relay Control	Sn-31	1-8 PID Relay Card Relay 2 Control	Sn-31=0 Invalid	0: Relay 2 Invalid 1: Relay 2 Valid	0	2-65
	Sn-32	1-8 PID Relay Card Relay 3 Control	Sn-32=0 Invalid	0: Relay 3 Invalid 1: Relay 3 Valid	0	
	Sn-33	1-8 PID Relay Card Relay 4 Control	Sn-33=0 Invalid	0: Relay 4 Invalid 1: Relay 4 Valid	0	
	Sn-34	1-8 PID Relay Card Relay 5 Control	Sn-34=0 Invalid	0: Relay5 Invalid 1: Relay 5 Valid	0	
	Sn-35	1-8 PID Relay Card Relay 6 Control	Sn-35=0 Invalid	0: Relay 6 Invalid 1: Relay 6 Valid	0	
	Sn-36	1-8 PID Relay Card Relay 7 Control	Sn-36=0 Invalid	0: Relay 7 Invalid 1: Relay 7 Valid	0	
	Sn-37	1-8 PID Relay Card Relay 8 Control	Sn-37=0 Invalid	0: Relay 8 Invalid 1: Relay 8 Valid	0	
Parameter Copy	Sn-38	Parameter Copy	Sn-38=0 Not Loaded	0: Not loaded (not copied) 1: Upload (from digital operator to inverter) 2: Download (from AC Drive to digital operator) 3: Inspect the EEPROM of digital operator	0	2-65

*1 Differs according to AC Drive capacity.

*2 Initialization (Sn-03 = 1110, 1111)
After depressing the ENTER key, input the initial value of An-□□, Bn-□□, Sn-□□, Cn-□□, (except Sn-01, Sn-02) into NV-RAM. When the value is written in without an error, “ Entry Accepted ” is displayed. When the value is written in with an error, “**Error ” is displayed. The values of Sn-15 to -18 differ as follows between initializations with Sn-03 = 1110 and with Sn-03 = 1111.

MULTI-FUNCTION TERMINAL	1110 (2 WIRE SEQUENCE)	1111 (3 WIRE SEQUENCE)
Terminal 5 (Sn-15)	3* (Multi-step speed command 1)	0 (FWD/REV run select)
Terminal 6 (Sn-16)	4* (Multi-step speed command 2)	3 (Multi-step speed reference 1)
Terminal 7 (Sn-17)	6* (Jog frequency reference)	4 (Multi-step speed reference 2)
Terminal 8 (Sn-18)	8* (External baseblock command)	6 (Jog frequency reference)

* Values have been factory-set.
** Contents depend on the parameter setting items.

Sn-XX = □ □ □ □

- 1st digit
- 2nd digit
- 3rd digit
- 4th digit

(1) AC Drive Capacity Selection (Sn-01)

- AC Drive capacity has been preset at the factory. However, if a replacement board is used, reset the AC Drive capacity referring to the table below. Control constant Cn- □□ factory setting values (initial values) differ according to Sn-01 setting.

Inverter Capacity Selection

230V Class

	Name		Sn-01 Value	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10
	PA 7300-2 □□□□			005	007	010	015	020	025	030	040	050	060	075	100	125
	AC Drive rated capacity		(KVA)	6.2	9.3	12.4	18.6	24.8	27.4	33	44	55	63	81	110	125
	Max. applicable motor capacity HP (kW)			5 (3.7)	7.5 (5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)
	AC Drive rated current		(A)	16	24	32	48	64	72	88	117	144	167	212	288	327
Factory Set	Cn-09	Motor rated current	(A)	13.5	20.1	25.1	36.7	50.3	62	73	97.4	118	141	176	227	284
Factory Set	Cn-23	Carrier frequency upper limit	(kHz)	10.0	10.0	10.0	10.0	10.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0	3.0
Factory Set	Cn-24	Carrier frequency lower limit	(kHz)	10.0	10.0	10.0	10.0	10.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0	3.0
Factory Set	Cn-25	Carrier frequency proportional gain		0	0	0	0	0	0	0	0	0	0	0	0	0
Factory Set	On-17	Motor phase-to-phase resistance (Ω)		0.684	0.444	0.288	0.159	0.109	0.077	0.060	0.041	0.033	0.028	0.019	0.007	0.005
Factory Set	On-18	Torque compensation iron loss	(W)	208	252	285	370	471	425	582	536	641	737	790	1800	2100
Factory Set	On-19	Torque compensation limit	(V)	50	50	50	50	50	50	50	50	50	50	50	50	50
Factory Set	Cn-37	Momentary power loss assurance time	(s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Factory Set	Cn-40	Minimum baseblock time	(s)	0.5	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Factory Set	Cn-41	V/f during speed search	(%)	100	100	100	100	100	100	100	80	80	80	80	80	80

Inverter Drive Capacity Selection

460V Class

	Name		Sn-01 Value	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	30	31	32	33	34	35	36	37	38
	PA7300-4 □□□ -N1			005	007	010	015	020	025	030	040	050	060	075	100	125	150	175	200	250	300	350	400	500
	AC Drive rated capacity		(KVA)	6.2	9.3	12.4	18.6	24.8	29	34	45	57	66	85	115	144	176	203	232	259	290	393	446	558
	Max. applicable motor capacity		HP (kW)	5 (3.7)	7.5 (5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)	125 (90)	150 (110)	175 (132)	215 (160)	250 (185)	300 (220)	350 (260)	400 (300)	500 (375)
	AC Drive rated current		(A)	8	12	16	24	32	38	44	59	75	86	111	151	189	231	267	304	340	380	516	585	732
Factory Set	Cn-09	Motor rated current	(A)	6.8	10.1	12.6	18.6	24.8	31	36	49	59	71	88	114	143	175	205	235	305	348	410	465	582
	Cn-23	Carrier frequency upper limit	(kHz)	10.0	10.0	10.0	10.0	10.0	6.0	6.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0
	Cn-24	Carrier frequency lower limit	(kHz)	10.0	10.0	10.0	10.0	10.0	6.0	6.0	6.0	6.0	6.0	6.0	3.0	3.0	3.0	3.0	3.0	3.0	2.0	2.0	2.0	2.0
	Cn-25	Carrier frequency proportional gain		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	On-17	Motor phase-to-phase resistance	(Ω)	2.735	1.776	1.151	0.634	0.436	0.308	0.239	0.164	0.13	0.110	0.074	0.027	0.036	0.023	0.020	0.022	0.014	0.012	0.01	0.009	0.007
	On-18	Torque compensation iron loss	(W)	208	252	285	370	471	425	582	536	641	737	790	1800	2900	2500	2600	2500	2600	2800	2400	3200	3600
	On-19	Torque compensation limit	(V)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	Cn-37	Momentary power loss assurance time	(s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Cn-40	Minimum baseblock time	(s)	0.5	0.7	0.7	0.7	0.7	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Cn-41	V/f during speed search	(%)	100	100	100	100	100	100	100	100	100	100	80	80	80	80	80	80	80	80	80	80	80

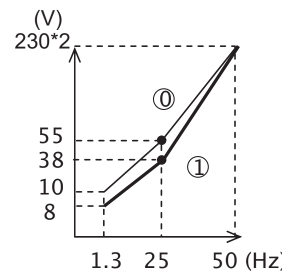
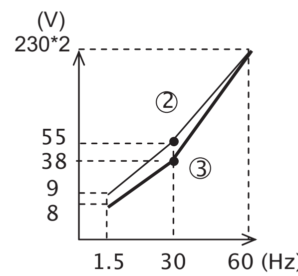
600V Class

	Name	Sn-01 Value		44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
	PA7300-4 □□□ -N1			5005	5008	5010	5015	5020	5025	5030	5040	5050	5060	5075	5100
	AC Drive rated capacity		(KVA)	6	8.9	10.9	16.9	22	27	32	41	52	62	77	99
	Max. applicable motor capacity		HP(kW)	5 (3.7)	7.5 (5)	10 (7.5)	15 (11)	20 (15)	25 (18.5)	30 (22)	40 (30)	50 (37)	60 (45)	75 (55)	100 (75)
	AC Drive rated current		(A)	6.1	9	11	17	22	27	32	41	52	62	77	99
Factory Set	Cn-09	Motor rated current	(A)	5.1	7.5	9.6	14.4	18.9	23.1	27.6	36.2	44.9	55.3	68.5	95
	Cn-23	Carrier frequency upper limit	(kHz)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	4.0
	Cn-24	Carrier frequency lower limit	(kHz)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	4.0
	Cn-25	Carrier frequency proportional gain		0	0	0	0	0	0	0	0	0	0	0	0
	On-17	Motor phase-to-phase resistance (Ω)		4.939	2.601	1.446	1.171	0.896	0.658	0.518	0.438	0.267	0.21	0.15	0.099
	On-18	Torque compensation iron loss	(W)	130	193	263	385	440	508	586	750	925	1125	1260	1600
	On-19	Torque compensation limit	(V)	143	143	143	143	143	143	143	143	143	143	143	143
	Cn-37	Momentary power loss assurance time	(s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Cn-40	Minimum baseblock time	(s)	0.5	0.5	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0
	Cn-41	V/f during speed search	(%)	100	100	100	100	100	100	80	80	80	80	80	80

(2) V/F Curve Selection (Sn-02)

- V/F curve is selected by the setting of Sn-02. When V/F curve is selected, always set input voltage of the AC drive to Cn-01.
- Sn-02= 0~3: pre-set V/F curve pattern.
  Sn-02= 4: V/F pattern is set by the user (see parameters Cn-02~Cn-08).

Table 12: V/F curve of 230V class

<table>
<tr><th>Sn-02 Setting</th><th>Specifications</th><th>V/F Pattern</th></tr>
<tr><td>0</td><td>50Hz, Saturation Variable Torque (quadratic monotonically decreasing curve)</td><td rowspan="2">
</td></tr>
<tr><td>1</td><td>50Hz, Saturation Variable Torque (cubic monotonically decreasing curve)</td></tr>
<tr><td>2</td><td>60Hz, Saturation Variable Torque (quadratic monotonically decreasing curve)</td><td rowspan="2">
</td></tr>
<tr><td>3</td><td>60Hz, Saturation Variable Torque (cubic monotonically decreasing curve)</td></tr>
</table>

*1. Consider the following items as the conditions for selecting a V/F pattern.
They must be suitable for:
① The voltage and frequency characteristic of the motor.
② The maximum speed of the motor.

*2. For 460V class, 2 times voltage value shown in table above.

(3) Operation status (Sn-03)

- Passwords (Sn-03=0000 or 0101)
  The ability to set or read the different groups of constants is determined by Sn-03 as shown below.

Sn03	DRIVE mode		PRGM mode	
	To be set	To be monitored	To be set	To be monitored Only
0000*1	An, Bn	Sn, Cn	An, Bn,Sn, Cn	--
0101*2	An	Bn, Sn, Cn	An	Bn, Sn, Cn

*1: Factory setting
*2: When in DRIVE mode, the parameter groups Sn-, and Cn- can only be monitored if the RESET key and the DSPL keys are to be pressed at the same time.
*3: After a few trial operations and adjustment, Sn-03 should be set to " 1111" to prevent unwanted changes.

- Constant Initialization (Sn-03=1110 or 1111)
  Except for parameters Sn-01~02, the parameter groups An-□□ Bn-□□ , Cn-□□, Sn-□□ and On-□□ can be initialized to factory settings. At the same time, terminals 5~8 can be set as 2-wire or 3-wire operation mode by varying the setting of Sn-03 (please see 2-/3-wire operation mode on page 2-46).

- Special mode (Sn-03=1010)
  The order parameters On-□□ can be set and read when setting Sn-03 to 1010. After changing or monitoring any of the On-□□ parameters, please set Sn-03=0000 or 0101.

- Initialize the contents of monitoring parameters Un-11 and Un-12 (Sn-03=1000 and 1001)
  The motor elapsed run hours (Un-11) and motor elapsed energy KWHR (Un-12) can be reset by Sn-03 to 1000 and 1001 individually.

- The LCD display, in response to each setting is shown below.

Sn-03 Setting	LCD Display
0000	Sn-03=0000 Allow Setting
0101	Sn-03=0101 Inhibit Setting
1110	Sn-03=1110 2-Wire Initialize
1111	Sn-03=1111 3-Wire Initialize
1000	Sn-03=1000 Reset Un-11
1001	Sn-03=1001 Reset Un-12

(4) Operation Mode Select 1 (Sn-04)

- **1st digit** (frequency reference select)
  1st digit = 0: Reference input from the control circuit terminals 15 or 16 is the master speed frequency reference.
  1st digit = 1: Frequency reference 1 (An-01) is the master speed frequency reference.

Note: For combination of multi-step speed operations, refer to pages 2-48 and 2-49.

- **2nd digit** (run command select)
  2nd digit = 0: Run command from the control circuit terminal is accepted.
  2nd digit = 1: Run command from the digital operator is accepted.

  Valid run command and frequency references differ as shown in the table below, depending on the combination of the 1st and 2nd digits.

CONSTANT REF	Sn-04	2nd digit 0 / 1st digit 0	2nd digit 0 / 1st digit 1	2nd digit 1 / 1st digit 0	2nd digit 1 / 1st digit 1
Control Terminal	Master Speed Frequency Ref.	Control circuit Terminal VIN, AIN	An-01	Control Circuit Terminal VIN, AIN	An-01
	FWD Run Command (Terminal 1)	○	○	×	×
	REV Run Command (Terminal 2	○	○	×	×
	External Fault (Terminal 3	○	○	○	○
	Fault Reset (Terminal 4)	*1	*1	*1	*1
	Terminal 5 Input	○	○ *2	*2	
	Terminal 6 Input	○	○	○	○
	Terminal 7 Input	○	○	○	○
	Terminal 8 Input	○	○	○	○
	Aux. Input	○	○	○	○
	Fault Contact Output (R1A-R1BR1C)	○	○	○	○
	Multi-function Contact Output	○	○	○	○
	(R2A, R3A)	○	○	○	○
	Multi-function PHC Output (D01)	○	○	○	○
Operator	RUN Key	×	×	○	○
	JOG Key	×	×	○	○
	STOP Key	*3	*3	○	○
	FWD/REV Key	×	×	○	○
	>/RESET Key	*1	*1	*1	*1
	DRIVE/PRGM Key	Valid only when the AC drive stops	Valid only when the AC Drive stops	Valid only when the AC Drive stops	Valid only when the AC Drive stops
	LED of REF	Lit	OFF	Lit	OFF
	LED of SEQ	Lit	Lit	OFF	OFF
	Monitor Display	○	○	○	○

○ = Enabled
× = Disabled

*1 Valid only when the AC drive stops. (FWD run command, REV run command, and DC injection braking command are "open".)

*2 FWD/REV run command is not accepted.

*3 When the STOP key is depressed, outcomes differ as follows, depending on the setting of-the 1st digit of Sn-05.

1st digit=0: During run via control circuit terminals, the STOP key from the operator is accepted.

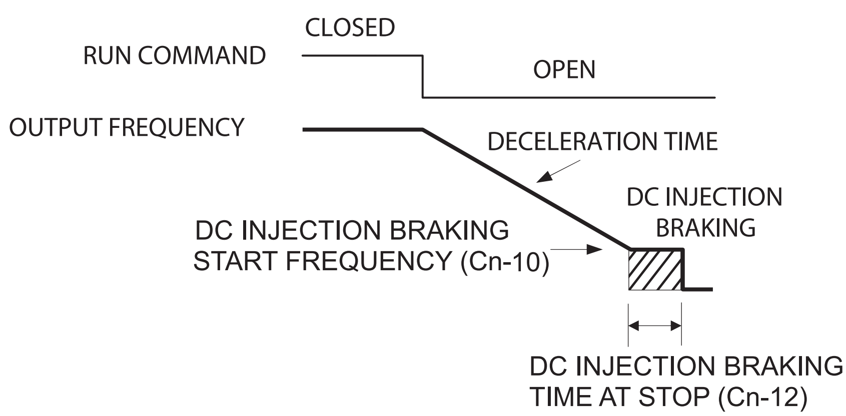
If the STOP key is depressed, the AC drive stops according to the setting of 3rd and 4th digits of Sn-04, while the STOP LED indicator blinks. This stop command is held within the AC drive until both the FWD run command and REV run command of control circuit terminals become "open", or another frequency reference is selected in the multi-step speed command or jog frequency reference section.

1st digit=1: During run via control circuit terminals, the STOP key from the operator is not accepted.

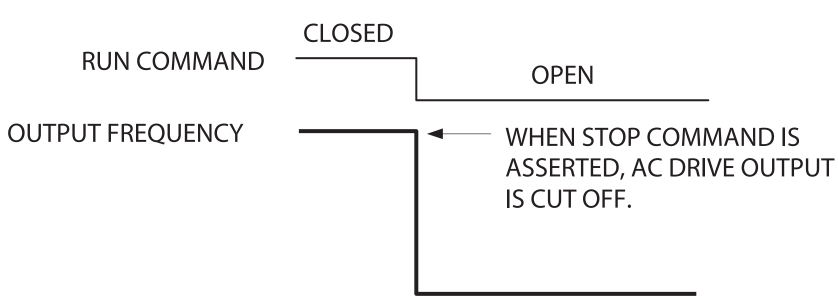
- **3rd digit, 4th digit** (drive stop method select)

Stop method differs by the setting of the 3rd and 4th digits as shown below.

① Sn-04=00 XX RAMP stop

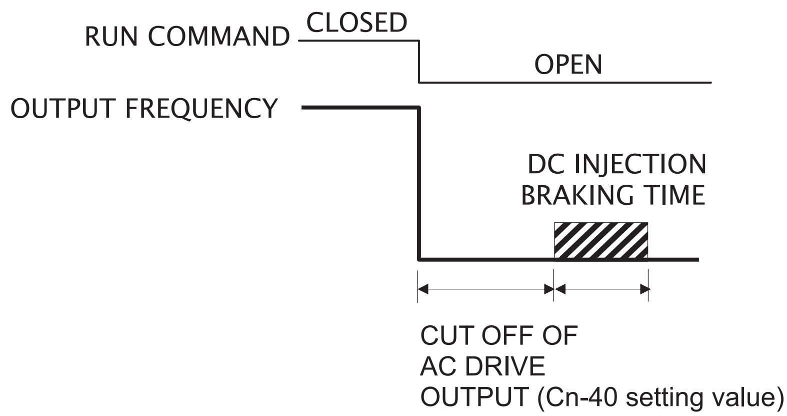


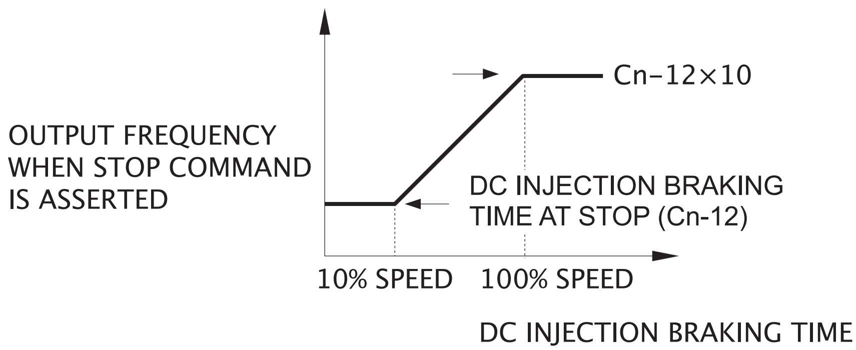
②. Sn-04=01 XX Coast stop



③ Sn-04=10 XX Full-range DC injection braking stop

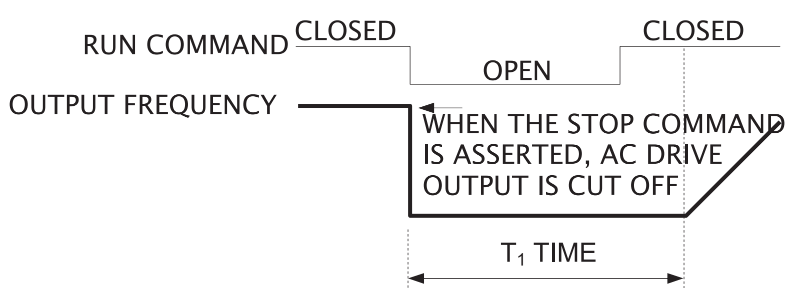
- DC injection braking time differs by the output frequency when the stop command is asserted as shown below.

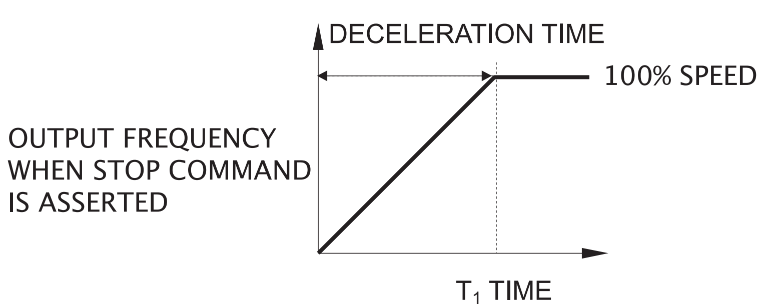




④ Sn-04=11 XX Coast Stop (timer function provided)

- Once stop command is asserted, the Run command is disregarded during time, T_1.





(5) Operation Mode Select 2 (Sn-05)

- **1st digit**

Select processing to be performed when the keypad STOP key is pressed during run via control circuit terminals.

1st digit = 0: During run via control circuit terminals, the keypad STOP key is accepted. If the STOP key is depressed, the AC drive stops according to the setting of the 3rd and 4th digits of Sn-04 while the STOP LED indicator blinks. This stop command is held until both the FWD run command and REV run command of the control circuit terminals become “open”, or another frequency reference is selected in the multi-step speed command or jog frequency reference section.

1st digit = 1: During run via control circuit terminals, the STOP key from the operator is not accepted.

- **2nd digit** (REV run prohibited)

2nd digit = 0: REV run command from control circuit terminals or the digital operator is accepted.

2nd digit = 1: REV run command from control circuit terminals or the digital operator is not accepted.

- **3rd digit** (selection of double scanning of sequence command)

3rd digit = 0: The sequence command (control circuit terminals I to 8) is scanned twice.

3rd digit = 1: The sequence command (control circuit terminals I to 8) is scanned once.

- **4th digit** (JOG (L/R) key functions select)

4th digit=0 : The digital operator JOG (L/R) key is used as JOG key function. (the JOG key function is enabled under Local mode)

4th digit=1 : The digital operator JOG (L/R) key is used as a Local/Remote (L/R) switch key.

* At the local mode, the AC drive operates by frequency reference and run command from the digital operator.

* At the Remote mode, if selected, the multi-function contact inputs (terminal⑤~⑧) can act as Local/Remote operation signal (i.e. the set value of Sn-15~18 is 0 1)

①. If terminal ⑤~⑧ =are open (Remote mode), the AC drive operates according to the settings of Sn-04 1st, 2nd digits and Sn-08 1st , 2nd digits (i.e. the JOG (L/R) key is used as a Remote key function.)

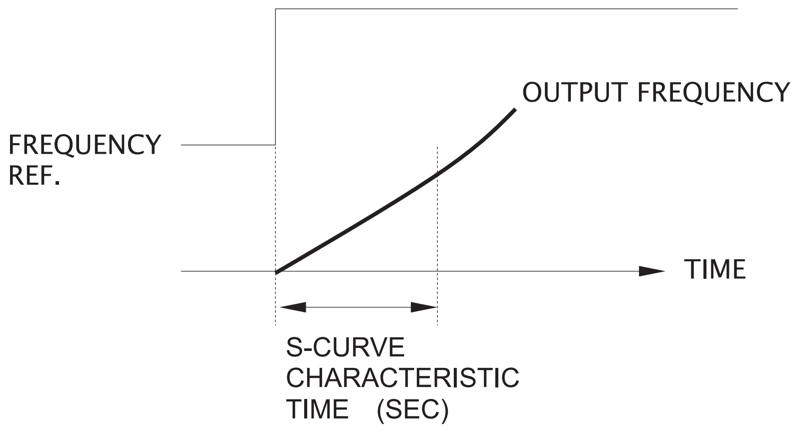
②. If terminal ⑤~⑧ are closed (Local mode), the AC drive operates by frequency reference and run command from the digital operator. (i.e. the Remote key function invalid)

* The Local/Remote (L/R) key function is enabled only when the drive is stopped.

(6) Operation Mode Select 3 (Sn-06)

- 1st digit, 2nd digit (s-curve selection of the soft starter)
  The S-curve characteristics of the the soft starter depend on the setting of the 1st and 2nd digits as follows:

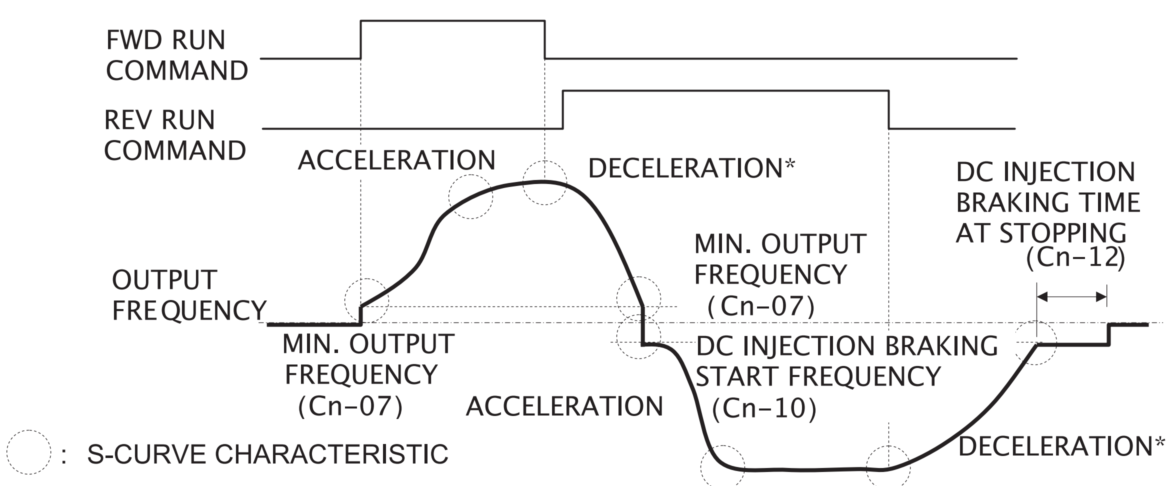
2nd Digit	1st Digit	Contents
0	0	The S-Curve characteristic is 0.2 seconds.
0	1	No S-Curve characteristics.
1	0	The S-Curve chararacteristic is 0.5 second.
1	1	The S-curve characteristic is 1 second



Note: S-curve characteristic time refers to the time from acceleration rate 0 to the time when a normal acceleration rate, determined by a specified acceleration time, is obtained.

(a) FWD/REV run changes with S-curve characteristics

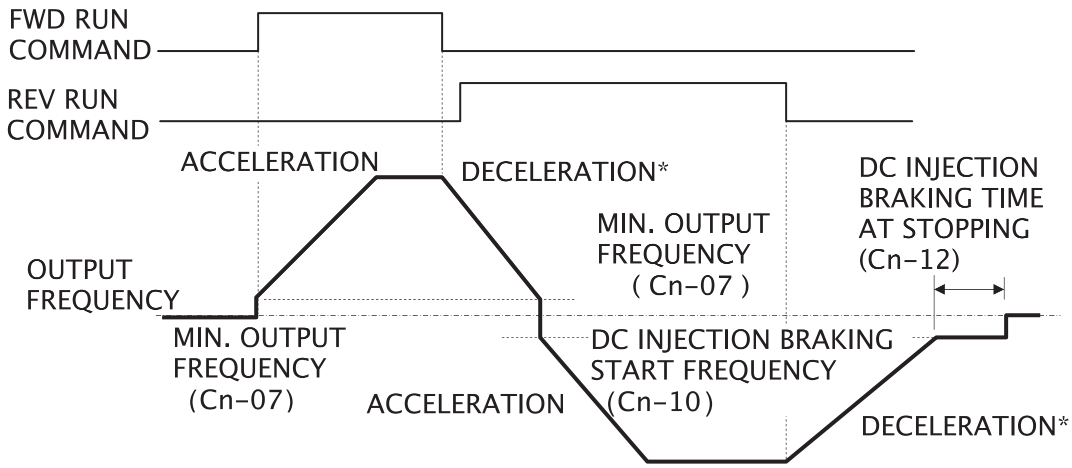
- The figure below shows the time chart at FWD/REV run change during deceleration and stop.



* When 1st and 2nd digits are 00, no S-curve characteristics occur at completion of deceleration.

(b) FWD/REV run changes without S-curve characteristics

The figure below shows the time chart at FWD/REV run change during deceleration and stop.

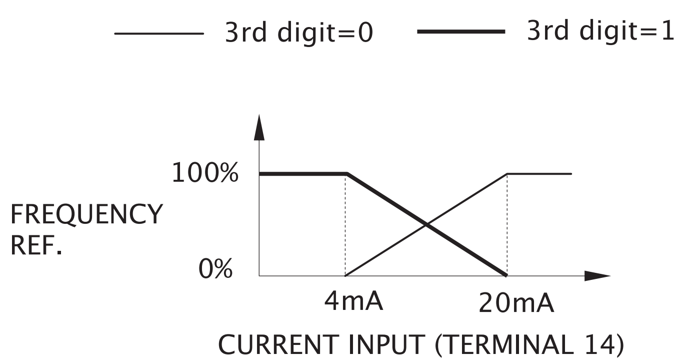


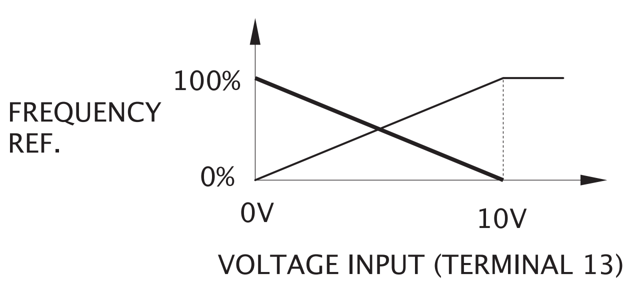
- **3rd digit** (inverse characteristics select)

The input characteristics of the master speed frequency reference depend on the set value as follows. For the reverse characteristics, only+input is valid.

3rd digit = 0: Normal characteristics (0-10V or 4-20mA/0-100%)

3rd digit = 1: Inverse characteristics (10-0V or 20-4mA/0-100%)





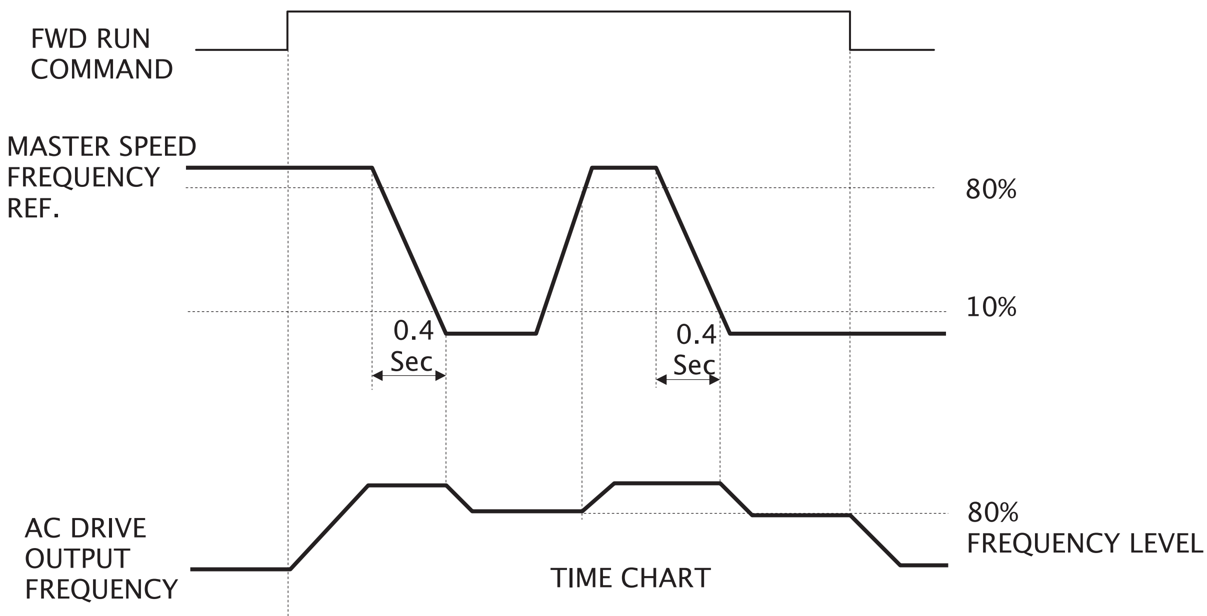
- **4th digit** (operation select upon loss of frequency reference)

  4th digit = 0: Normal operation (varies with change of reference)

  4th digit = 1: Operation continues at 80% of last known frequency.

  When the 4th digit = 1, the current master speed frequency reference is continuously compared with the reading that occurred 0.4 seconds prior. When the current master speed frequency reference goes below 10% of the prior reading, operation continues at 80% of the last known master speed frequency reference. Then the master speed frequency reference read becomes the prior current frequency reference. In the following cases, this operation is released and the AC drive returns to normal operation:

- Master speed frequency reference exceeding the 80% frequency is commanded.
- Stop command is asserted.
- The reference is missing during operation at less than 5% of maximum frequency.



(7) Operation Mode Select 4 (Sn-07)

Define the operation for overtorque detection. Overtorque is detected by the following formula:

AC drive output current overtorque detection level (Cn-26, Initial value: 160 %)
(Detection time Cn-27, Initial value: 0.1 second, Hysteresis fixed at 10%)

- **1st digit**

  1st digit = 0: Overtorque is not detected.

  1st digit = 1: Overtorque is detected.

- **2nd digit**

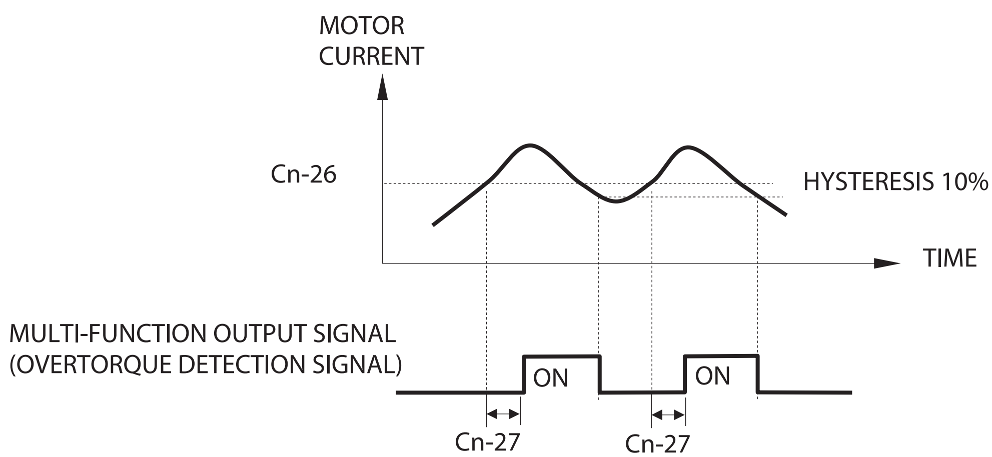
  2nd digit = 0: Overtorque is detected only during agreed frequency.

  2nd digit = 1: Overtorque is detected during stop or run except for DB.

- **3rd digit**

  3rd digit = 0: When overtorque is detected, "Over Torque OL3" blinks in the digital operator and the operation continues.

  3rd digit = 1: When overtorque is detected, "Over Torque OL3" is displayed on the digital operator and the AC drive output is shut OFF. A fault contact signal is asserted. (Treated as a fault)



Setting either Sn-20 to 22 to "OB" enables signal to be asserted at overtorque detection.

(8) Operation Mode Select 5 (Sn-08)

- **1st digit** (frequency reference input by an RS-485 option card or AC drive unit select)

  Specify whether an RS-485 option card (PA-C, PA-P, or PA-L), or AC drive frequency reference is used for operation.

  1st digit = 0: RS-485 Option card frequency reference is accepted.

  1st digit = 1: Frequency reference from AC drive control circuit terminals or the digital operator is accepted.

- **2nd digit** (RUN/STOP command input by an RS-485 option card or AC drive unit select)

  2nd digit = 0: The RS-485 option card RUN/STOP command is accepted.

  2nd digit = 1: The RUN/STOP command from AC drive control circuit terminals or the digital operator is accepted.

- **3rd, 4th digit (RS-485 stopping method after communication error)**

3rd digit	4th digit	Contents
0	0	Ramp stop by Bn-02, when RS-485 has communication error.
0	1	Coast to stop, when RS-485 has communication error.
1	0	Ramp stop by Bn-04, when RS-485 has communication error.
1	1	Operation to continue (will stop if the key stop is pressed)

Please Refer to Appendix C for a detailed discussion of Serial Communications.

(9) Operation Mode Select 6 (Sn-09)

- **1st, 2nd digit** (Not used)
- **3rd digit** (energy-savings function selection)

3rd digit = 0: Energy-savings function is ineffective and operation is performed with normal V/f control.

3rd digit = 1: Energy-savings function is effective.

- **4th digit** (Not used)

(10) Protective Characteristics Select 1 (Sn-10)

- **1st digit** (selection of stall prevention during acceleration)

1st digit = 0: Stall prevention during acceleration is enabled.

1st digit = 1: Stall prevention during acceleration is not enabled.

The function of stall prevention during acceleration automatically extends acceleration according to the load status (AC drive output current) thus preventing the motor from stalling during acceleration. The stall prevention level during acceleration is determined as follows:

$$\text{Acceleration stall prevention level of constant output field} = \frac{\text{acceleration stall prevention level (Cn-28)} \times \text{maximum voltage frequency (Cn-04)}}{\text{output frequency}}$$

When the 1st digit of Sn-10 is 1, the output frequency increases at the rate determined by the acceleration time:

- **2nd digit** (selection of stall prevention during deceleration)

2nd digit = 0: Stall prevention during deceleration is enabled.

2nd digit = 1: Stall prevention during deceleration is not enabled.

The function of stall prevention during deceleration automatically extends deceleration time according to the magnitude of the DC Bus voltage, thus preventing overvoltage during deceleration.

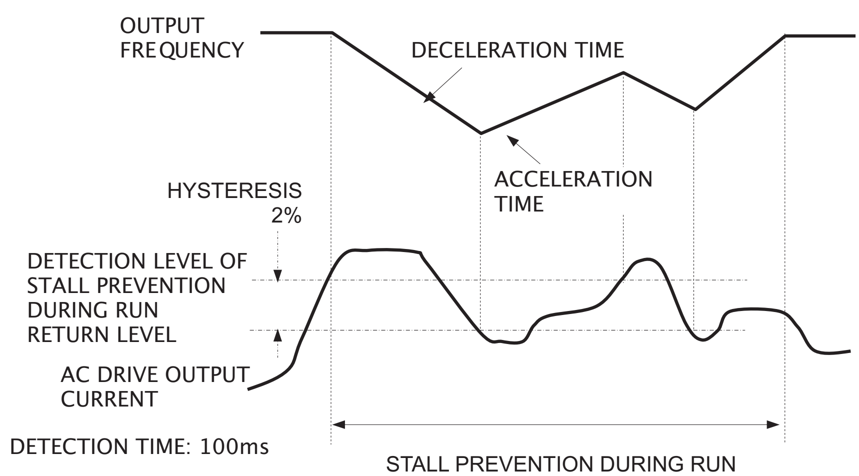
When the 2nd digit of Sn-10 is 1, the output frequency decreases at the rate determined by the deceleration time. For positioning applications, specify "stall prevention during deceleration not provided" (2nd digit = 1) in order to obtain stopping accuracy. With large load inertia, use a braking resistor (For 460V: 5HP~30HP and 230V: 5HP~25HP and 600V: 5~25HP) or braking transistor with braking resistor to prevent overvoltage.

- **3rd digit** (stall prevention during run)

3rd digit = 0: Stall prevention during run is enabled.

3rd digit = 1: Stall prevention during run is not enabled.

Stall prevention operation during run starts decelerating when the output current is greater than the set value of Cn-30 (operation level of stall prevention during running) for more than 100msec. The AC drive decelerates as long as the output current exceeds the set value of Cn-30. When the output current goes below the set value, the AC drive reaccelerates. The deceleration time selected in the 4th digit of Sn-10 is used. Even during stall prevention while running, stall prevention during deceleration and stall prevention during acceleration are enabled.



- **4th digit** (selection of deceleration time during stall prevention during run)

4th digit = 0: The AC drive decelerates for the time specified in bn-02.

4th digit = 1: The AC drive decelerates for the time specified in bn-04.

(11) Protective Characteristics Select 2 (Sn-11)

- **1st digit** (Not used)

* **2nd digit** (fault contact signal during auto reset/restart operation)

2nd digit = 0: A fault contact signal is not asserted during auto reset/restart operation.

2nd digit = 1: A fault contact signal is asserted during auto reset/restart operation.

- **3rd digit** (operation continued at momentary power loss)

  3rd digit = 0: When momentary power loss is detected, under-voltage fault (UV1) occurs and the AC drive output is shut off.

  3rd digit = 1: If momentary power loss time is within momentary power loss ride-thru time (Cn-37), the operation continues after the momentary power loss. If the momentary power loss ride-thru time is exceeded, under-voltage fault (UV1) occurs and the AC drive output is shut OFF.

  Notes:
  1. When the 3rd digit = 1, do not shut OFF the external sequence signal (e.g. FWD, REV)
  2. For lifters, do not use this function (set 3rd digit = 0)

- **4th digit** (Not used)

(12) Protective Characteristics Select 3 (Sn-12)

When an external fault signal of terminal 3 is asserted, "Ext. Fault 3 EF3" is displayed and a fault contact signal is immediately generated. The AC drive stops according to the setting of the 3rd and 4th digits. The external fault signal is held within the AC drive until a fault reset signal is input.

- **1st digit** (level selection of the external fault signal)

  1st digit = 0: NO-contact input (when "closed", the external fault operation is performed)

  1st digit = 1: NC-contact input (when "open", the external fault operation is performed)

- **2nd digit** (acceptance of the external fault signal)

  2nd digit = 0: External fault signals are always accepted.

  2nd digit = 1: External fault signals are accepted only during run. (Not accepted during baseblock)

- **3rd digit, 4th digit** (selection of processing at external fault detection)

3rd digit	4th digit	Contents
0	0	Ramp stop by Bn-02 (major fault).
0	1	Coast to stop (major fault)
1	0	Ramp stop by Bn-04 (major fault).
1	1	Operation to continue (minor fault).

. **(13) Protective Characteristics Selection 4 (Sn-13)**

- **1st digit** (Input Phase Loss Protection, IPL)

  The input phase loss protection, function is disabled when input phase loss detection level Cn-61=100%. The effectiveness or ineffectiveness of input phase loss protection function can also be selected by the 1st digit of Sn-13.

1st digit = 0: Input Phase Loss protection function ineffective.

1st digit = 1: Input Phase Loss protection function effective.

- **2nd digit** (Output Phase Loss Protection, OPL)

  The output phase loss protection function is disabled while the AC drive is stopped, during DC injection braking, or when AC drive output current ≤ 30% of AC drive rated output current. The effectiveness or ineffectiveness of output phase loss protection function can also be selected by the 2nd digit of Sn-13.

  2nd digit = 0: Output Phase Loss protection function ineffective.

  2nd digit = 1: Output Phase Loss protection function effective

- **3rd digit** (Heat Sink Cooling Fan ON/OFF Control)

  3rd digit = 0: AC drive heat sink cooling fan runs while the drive power is ON.

  3rd digit = 1: AC drive heat sink cooling fan runs only while the heat sink temperature is higher than 50 . ˚C

(14) Protective Characteristics Selection 5 (Sn-14)

- **1st digit (**motor protection)

  1st digit = 0: Electronic thermal motor protection is enabled.

  1st digit = 1: Electronic thermal motor protection is disabled.

- **2nd digit** (selection of electronic thermal characteristics)

  2nd digit = 0: Electronic thermal characteristics are in accordance with reduced torque motor (standard motor).

  2nd digit = 1: Electronic thermal characteristics are in accordance with constant torque motor (special motor).

- **3rd digit** (electronic thermal time constant)

  3rd digit = 0: Used for standard motors or special motors (standard-time ratings, 8 minutes)

  3rd digit = 1: Used for motors other than the above (short-time ratings, 5 minutes)

- The electronic thermal overload function monitors motor temperature, based on the AC drive output current and time, to protect the motor from overheating. When electronic thermal overload relay is enabled, an "OL1" error occurs, shutting off the AC drive output and preventing excessive overheating in the motor.

- When operating with one AC drive connected to a single motor, an external thermal relay is not needed. When operating several motors with one AC drive, install a thermal relay on each motor. In this case, set constant Sn-14=XXX1.

- **4th digit** (Not used)

(15) Multi-Function Contact Input Selection (Sn-15~Sn-18)

- Select the set values shown below for Sn-15 to -18.

Terminal No	Sn-[ ][ ]
Terminal 5	15
Terminal 6	16
Terminal 7	17
Terminal 8	18

Set Value	Function	LCD display (English)	Description
00	FWD / REV RUN select	3-wire RUN	3-wire sequence mode Open: FWD run, (00 set in Sn-15) terminal 1- run, Closed: REV run, 2-stop, 5 FWD / REV selection
01	Operation signal select Local / Remote	LOC / REMOT control	Open: Operation according to the setting of Sn-04 1st ,2nd digits and Sn-08 1 st ,2 nd digits. Closed: Operation by frequency reference and run command from digital operator. (Local mode)
02	Option / AC Drive referemce select	Opt. Card Switch	Open: Operation by the operation or frequency reference from option card. Closed: Operation by the operation or frequency reference from AC Drive.
03	Multi-step speed reference 1	Multi-Fct Command 1	Combination of multi-step speed references 1, 2 correspond to speed reference (master speed AN-01) and speed references 2 to 4 (An-02 to 04) Refer to "SYSTEM CONSTANT MULTI-STEP SPEED REFERENCE LIST"
04	Multi-step speed reference 2	Multi-Fct Command 2	
05	Multi-step speed reference 3	Multi-FCT Command 3	
06	Jog frequency reference select	JOG Command	Closed: Jog frequency reference is selected.
07	Accel / decel time select	Acc.&Dec. Switch	Open: Accelerates / decelerates with ACCEL time 1 and DECEL time 1. (Bn-01, Bn-02 set values) Closed: Accelerates / decelerates with ACCEL time 2 and DECEL time 2. (Bn-03, Bn-04 set values)
08	External baseblock (No-contact input)	Ext. B.B. NO-Cont.	Closed: AC Drive output is shut off. (Frequency reference is held.)
09	External baseblock NC (contact Input)	Ext. B.B. NC-Cont.	Open: AC Drive output is shut off. (Frequency reference is held.)
0A	Accel / decel speed prohibit command (HOLD command)	Inhibit Acc.&Dec.	Frequency reference is held. (SFS operation is stopped.)
0B	AC Drive overheat alarm	Over Heat Alarm	Closed: Over Heat OH2 blinks on operator and operation continues. (Minor fault)

Set Value	Function	LCD display (English)	Description
0C to OF	Not Used	Reserved	--
10	UP Command	UP Command	Closed: Output frequency increment
11	DOWN Command	DOWN Command	Closed: Output frequency decrement
12	FJOG Command	Forward Jog	Closed: Foreward Jog run FWD LED lights. Display: 6Hz
13	RJOG Command	Reverse Jog	Closed: Reverse Jog run Digital Operator: REV LED does not light Display 6Hz
14 to 1F	Not Used	Reserved	--
20 to 2F	External Fault 5	External Fault 5	External fault signal output
30 to 3F	External Fault 6	External Fault 6	
40 to 4F	External Fault 7	External Fault 7	
50 to 5F	External Fault 8	External Fault 8	
60	DC Injection braking Command (JOG with priority)	DC Braking Command	Closed: DC Injection braking applied when the frequency ouput is less than the DC injection start frequency and the DC injection braking command is closed.
61	Search 1	Max. Freq. Spd_Search	Closed: Search from max frequency
62	Search 2	Set Freq. Spd_Search	Closed: Search from set frequency
63~64	Not Used	Reserved	--
65	Integral value reset	I_Time Reset	Closed: Integral value reset at PID control
66	PID control cancel	PID Invalid	Closed: PID control cancelled.
67*	PID sleep control cancel	PID sleep mode Invalid	Closed: PID sleep control mode cancelled
68	Not Used	Reserved	--

When the following combination is set at Sn-15 to -18, set value fault (OPE03) occurs.

- Set values are not in a descending order.
- More than two search commands of set values 61 and 62 are set.
- UP/DOWN commands are not set simultaneously (only one command can be set.)
- UP/DOWN and accel/decel prohibit commands are set simultaneously
- More than two set values (except FF) are set.

* Sn-15~18=67, PID sleep control disabled, added from version 0307.

① FWD/REV run select (set value = 00)

- When 0 is set in Sn-15, the mode becomes 3-wire sequence mode.

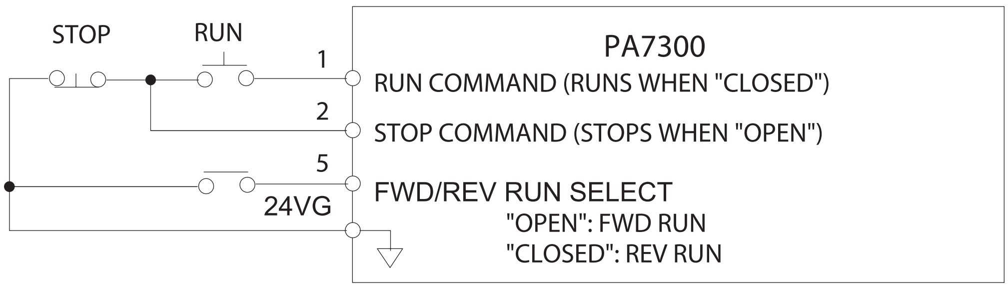


Fig. 12 3-wire sequence

② Operation signal select (set value = 01)

- Selection of operation signals is enabled only when the drive is stopped.
  Open: The AC drive operates according to the setting of Sn-04 1st, 2nd digits and Sn-08 1st, 2nd digits.
  Closed: The AC drive operates by frequency reference and run command from the digital operator.

<Example 1>

For local/remote mode select, set Sn-04 = × × 00 and Sn-08=× × 11.
Open: Frequency reference and run command from control circuit terminals are accepted (Remote mode).
Closed: Frequency reference and run commands from the digital operator are accepted (Local mode).

<Example 2>

For local/remote mode select, set Sn-04 = × × 00 and Sn-08=× × 00.
Open: Frequency reference and run command are input by RS-485 communication option card (Remote mode). Please refer to Appendix C for a detailed disscussion of RS485 communications.
Closed: Frequency reference and run/stop command are input by digital operator (Local mode)

③ Option card/AC drive reference select (set value = 02)

- Specify which of the option or AC drive references is used for operation. The option/AC drive selection is effective only when the drive is stopped.
  Open: Option card frequency reference and operation signals are accepted.
  Closed: Frequency reference and operation signals from the AC drive control circuit terminals or the digital operator are accepted.

④ Selection of multi-step speed references 1 to 3 and jog frequency select (set values = 3 to 6)

- Up to nine step speeds can be selected by combinations of multi-step speed references and jog frequencies.

Job Frequency Select	Multi-Step Reference			Frequency Reference
	3	2	1	
X	X	X	X	Master speed frequency reference*
X	X	X	○	Auxillary analog reference
X	X	○	X	Frequency reference 3 (An-03)
X	X	○	○	Frequency reference 4 (An-04)
X	○	X	X	Frequency reference 4 (An-05)
X	○	X	○	Frequency reference 4 (An-06)
X	○	○	X	Frequency reference 4 (An-07)
X	○	○	○	Frequency reference 4 (An-08)
○	--	--	--	Job frequency reference 4 (An-09)

* In the operator mode (1st digit of Sn-04 is 1), frequency reference 1 (An-01) is enabled.

When the multi-function analog input is selected by functions other than the frequency reference (Sn-19=0), frequency reference 2 (An-02) becomes effective. When the multi-function analog input is not used, set F to the set value.

- For multi-step speed operation with frequency reference by keypad, perform the following setting:

  1 Sn-04 = ×××1 An-01 becomes effective.

  2 Sn-19 ≠ 00 An-02 becomes effective.

⑤ Accel/decel time select (select value = 07)

- Accel/decel time is switched when "closed". Switching is permitted even during acceleration or deceleration.

Open: The accel/decel time is set by Bn-01 and Bn-02.
Closed: The accel/decel time is set by Bn-03 and Bn-04.

⑥ External baseblock (set value = 08)

- Baseblock is performed when "closed". External baseblock differs as follows depending on the input status of the run command:

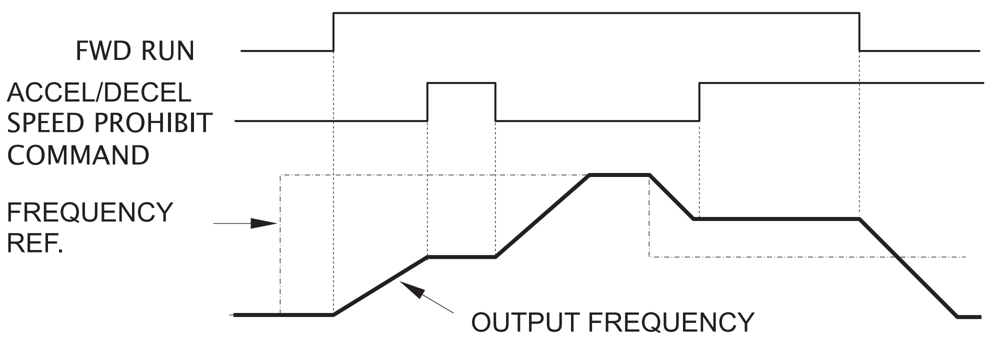
  When an external baseblock signal is input during run,"Ext. Baseblock bb" blinks at the digital operator and AC drive output is shut OFF. When the external baseblock signal disappears, the AC drive restarts with the frequency reference at that time. The voltage returns to the set value in the voltage recovery time. When a stop signal is input and an external baseblock signal is input while the AC drive is decelerating, "Ext. Baseblock bb" blinks at the digital operator, the AC drive output is shut OFF, and the output frequency is set to 0Hz.

⑦ External baseblock (set value = 09)

- Baseblock is active when "open". All other operations are the same as when set value = 8.

⑧ Accel/decel speed prohibit command (set value = 0A)

- As long as the accel/decel speed prohibit command is asserted, accel/decel speed is prohibited and the output frequency at that time is held. When a stop command is asserted, the accel/decel speed prohibit state is released and the system enters a stopped state. The figure below shows a time chart.



Note: If the run command is asserted again after the stop command, while the accel/decel prohibit command is inputed, the holding output frequency is stored unless the accel/decel prohibit command is released. Therefore, operation is performed at the stored output frequency. Also when the power supply is turned OFF in the accel/decel prohibit command input status, the holding output frequency is still stored.

⑨ AC drive overheat alarm (set value = 0B)

- As long as an AC drive overheat signal is asserted, the "Over Heat OH2" blinks at the digital operator.

⑩ UP command/DOWN command (set value = 10, 11)

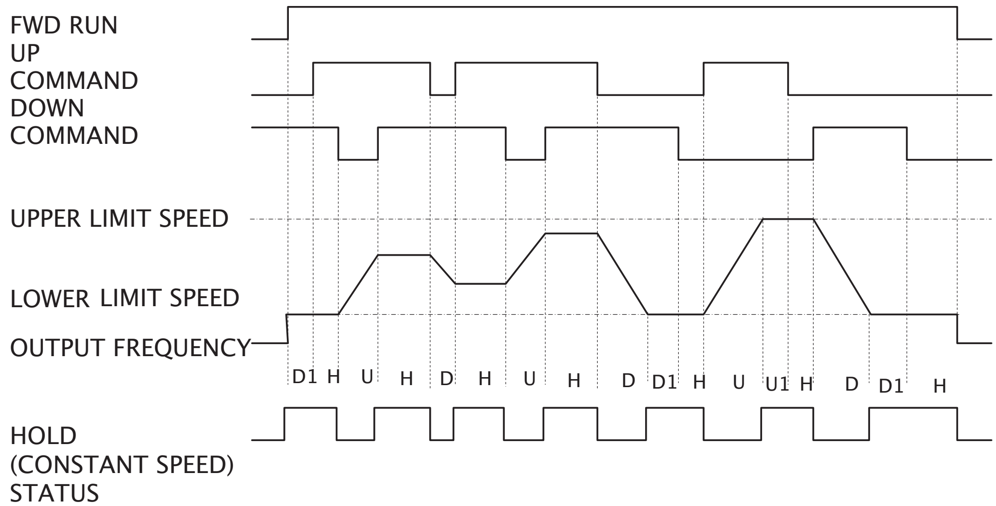
- Acceleration/deceleration is performed by inputting the UP/DOWN commands without changing frequency reference in the forward (reverse) run command input status, and operation can be performed at a desired speed.

  Set value = 10: UP command

  Set value = 11: DOWN command

UP command	Closed	Open	Open	Closed
DOWN command	Open	Closed	Open	Closed
Status	Accel (UP)	Decel(DOWN)	Hold	Hold

- The following shows the time chart when the UP/DOWN commands are used.



U = UP (accel) status

D = DOWN (decel) status

H = HOLD (constant speed) status

U1 = During clamp at upper limit speed even in UP status

D1 = During clamp at lower limit speed even in DOWN status

Notes:

1. When the UP/DOWN commands are used, set the Sn-04 1st digit. (frequency reference selection) as shown below.

   Set 1st digit = 0 without fail.

   Setting 1st digit = 1 disables the UP/DOWN commands.
2. When the UP/DOWN commands are selected, the upper limit speed is set disregarding frequency reference. Upper limit speed = maximum output frequency (Cn-02) × frequency reference upper limit (Cn-14)
3. The largest value among the minimum output frequency (Cn-07), the frequency reference lower limit (Cn-15), and main frequency reference input from the control circuit terminal VIN or AIN is employed as the lower limit speed.
4. By inputting the FWD/REV run commands, operation is started at the lower limit speed even if the UP/DOWN command is not asserted. When the power supply is turned OFF in the HOLD status, the held output frequency is stored. Therefore, by inputting the FWD/REV run commands in the HOLD status continuously after the power supply is turned ON, operation is performed at the stored output frequency.
5. When the jog run command is asserted during run by UP/DOWN commands, the jog run command has priority.

⑪ FJOG command, RJOG command (set value = 12, 13)

- Forward and reverse jog frequency operation is enabled.

  Set value = 12 FJOG command: Forward run by the jog frequency reference (An-09) when closed.

  Set value = 13 RJOG command: Reverse run by the jog frequency reference (An-09) when closed.

Notes:

1. When the FJOG command or RJOG command is asserted during run, the FJOG command or RJOG command has priority
2. When both FJOG and RJOG commands are closed for 500 ms or more, the AC drive stops according to the stopping method selected in (Sn-04).
3. FJOG or RJOG commands can be set individually.

⑫ External faults 5 to 8 (set values = 2X, 3X, 4x, 5X: X is 0 to F)

- When external faults 5 to 8 are asserted, Ext. Faults, 5 to 8 (EF5 to EF8) are displayed at the digital operator, and the AC drive operates according to combinations of four bits shown in the table below. The hexadecimal equivalent of combinations of the four bits show below are set in the 1st digit (x) (2X, 3X, 4X, 5X) of external faults 5 to 8.

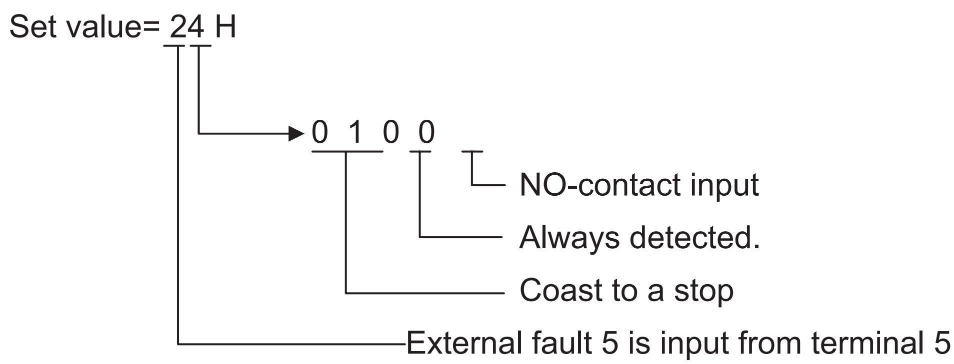
Bit No.	0	1
0	External fault input: NO - contact input	External fault input NC - contact input
1	External fault signal: Always detected	External fault signal Detected during running only
3, 2	Selection of processing at external fault detection	00: Ramp to a stop (major fault) 01: Coasting to a stop (major fault) 10: Ramp to a stop by bn-04 (major fault) 11: Operation to continue (minor fault)

<Example> External fault 5 is set to as follows :

--- NO-contact input (from terminal 5)

--- Signal is always detected

--- AC Drive will coast to a stop



The AC drive operates differently as described below when experiencing major faults as compared to minor faults. The digits in the error display Ext. Faults 5 to 8 (EF5 to EF8) indicate the terminal numbers in which external faults 5 to 8 are set.

Major faults

If an external fault is asserted, the fault is displayed and the AC drive stops according to process selection at external fault detection. The fault contact output relay activates immediately.

Minor faults

The fault display blinks only when an external fault is asserted (the display is made for 0.5 seconds even when the input is less than 0.5 seconds).

<Example> External faults 5 to 8 are set to multi-function terminals 1 to 4 (Nos. of terminal 5 to 8)

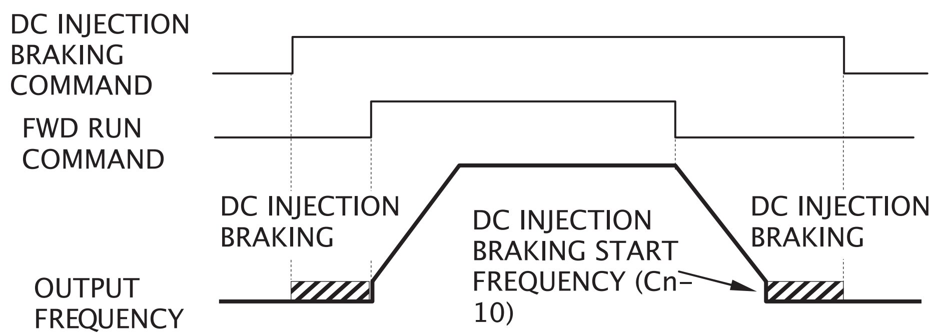
No. of Fault	Multi-function Terminal	Display of Digital Operator	
		(Major Fault)	(Minor Fault) Blinking
External Fault 5	Terminal 5	Ext. Fault 5 (Fault EF5)	Ext. Fault 5 (Alarm EF5)
External Fault 6	Terminal 6	Ext. Fault 6 (Fault EF6)	Ext. Fault 6 (Alarm EF6)
External Fault 7	Terminal 7	Ext. Fault 7 (Fault EF7)	Ext. Fault 7 (Alarm EF7)
External Fault 8	Terminal 8	Ext. Fault 8 (Fault EF8)	Ext. Fault 8 (Alarm EF8)

Additional Notes of External Faults

1. External fault reset is enabled in baseblock status.
2. The following shows the priority order of process selection when more than one external fault is asserted simultaneously.
   Coast to a stop > ramp to a stop by bn-04 > ramp to a stop by Bn-02
3. Fault retry is disabled when an external fault is asserted.

⑬ DC injection braking command (set value = 60)

- When DC braking command is asserted while the AC drive stops, DC braking operation is performed. When operation signal or jog operation command is asserted, the DC braking operation is stopped and the run or jog operation is started. (Privileged operation)



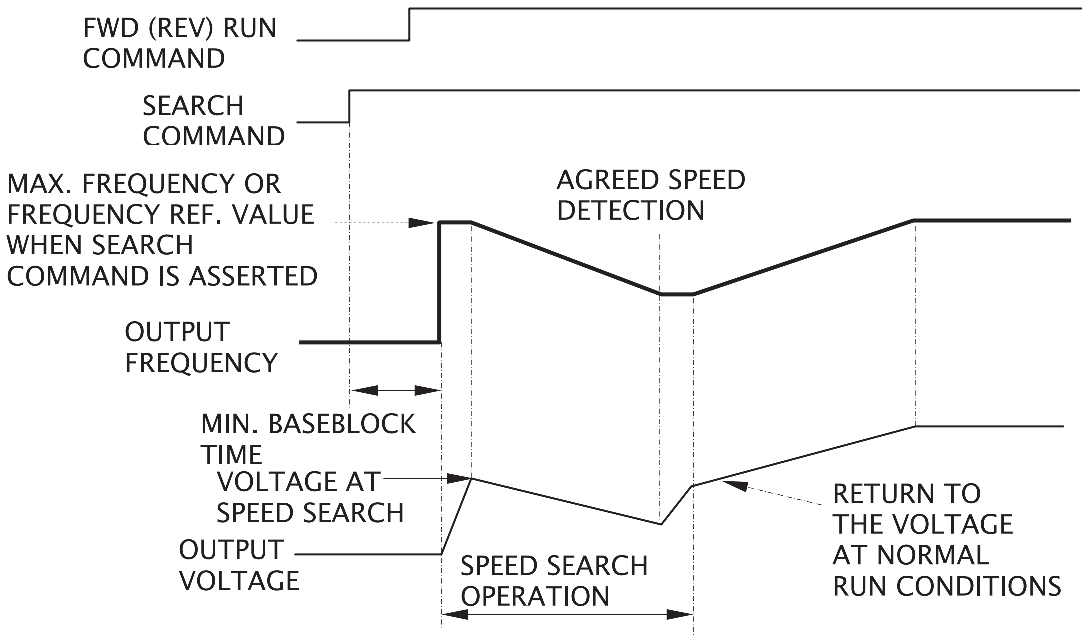
⑭ Search command (set value = 61,62)

- To start the motor during a coast when conditioning commercial power supply to the AC drive transfer operation is performed, the motor can be operated without tripping by using the speed search function.

  Set value = 61: Speed search starts with the maximum frequency.
  Set value = 62: Speed search starts with the frequency reference value when search command is asserted.

- Search commands with set values of 61 and 62 cannot be set at the same time.
- By inputting the run command with the search command "closed" during baseblock, speed search starts after shutting down the AC drive output for the minimum baseblock time (Cn-40)
- Speed search operation starts when AC drive output current is larger than the set value of the speed search operation level (Cn-38). The frequency at which the AC drive output current is lower is determined as the speed synchronous point: Re-acceleration/deceleration is performed in the set accel/decel time up to the set frequency.

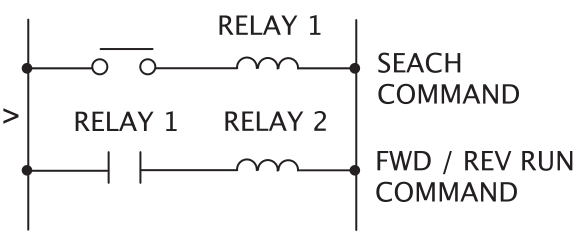
The following shows the time chart where the speed search command is asserted.



Notes:

1. During momentary power loss operation continuation mode, the speed search operation is performed beginning with the current output frequency, regardless of the setting for the search command. After completion of the speed search, the operation is performed according to the run command.
2. Determine a sequence so that the FWD/REV run command starts at the same time or later than search command.

< Example of Sequence>



3. More than two search commands with set values 61 and 62 cannot be set.

⑮ Integral value reset (set value = 65)

- Integral value, I, is reset to 0 when an integral value reset command is asserted from the multifunction contact inputs (terminal 5 ~ 8, set 65 either to Sn-15 to 18)

⑯ PID control cancel (set value = 66)

- The PID control circuit can be canceled by the multifunction contact input signal. Set 66 on either Sn-15 to 18 and close the contact (terminals 5 to 8) during run. Then the PID control circuit is canceled and the set point signal is used as a frequency reference signal without being changed. In this case, the signal input level is 0 the 10V (or 4 to 20mA)/0 to 100%.

(16) Multi-Function Analog Input Selection (Sn-19)

- The settings and functions for the multi-function analog input (terminal AUX) are listed as below.

SET VALUE	FUNCTION	LCD DISPLAY (ENGLISH)	REMARKS
00	AUX frequency reference*	Auxiliary Freq. Cmd.	Used for MASTER/AUX frequency reference selection
01	Frequency reference gain (F GAIN)	~ Freq. Cmd. Gain	Total gain: Internal gain (bn-05) × F GAIN
02	Frequency reference bias 1 (F BIAS 1)	Cmd. Bias 1	Total bias: Internal bias (bn-06) + F BIAS 1
03	Frequency reference bias 2 (F BIAS 2) (+ -)	Cmd. Bias 2	Total bias: Internal bias (bn-06) + F BIAS 2
04	Overtorque detection level	Over Tq. Level	Internal over torque detection level (Cn-26) ineffective
05	V BIAS †	V/F curve Bias	V BIAS addition after V/F conversion
06	Accel/decel time reduction coefficient	Acc.&Dec. coeff.	Accel/decel time varied by the analog input
07	DC braking current	DC Braking current	DC injection braking current varied by the analog input (10 V/AC Drive rated current) Internal DC braking current setting (Cn-11) ineffective
08	Stall level during run	Run stall Level	Stall level during running is set by analog input. Cn- 30 becomes ineffective.
09	PID control selection	PID Command	PID control active
0A	Frequency reference lower limit	Freq. Cmd. Low Bound	Frequency reference lower value is set by analog input. (Either Cn-15 set value or analog input whichever is larger becomes effective.)
0B	Setting prohibit frequency 4	Freq. Jump 4	Set prohibit frequency is set. (The fourth value in addition to frequency values set by Cn-16 to 18 can be set)
0C	Motor overheat protection	MTR OH protect	Motor temperature sensor PTC thermistor connected to terminal MT-AUX and GND. Motor overheat protection active when the resistor of PTC thermistor ≥1330Ω, return when ≤ 550Ω
0D~0F	Not used	Reserved	–

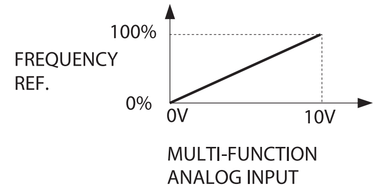
* Not to be used with An-02

460 class: V BIAS value 0 to 200 V.

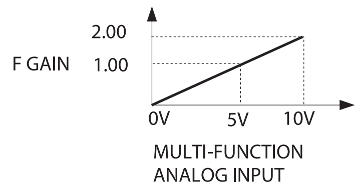
Note: For combinations of multi-step speed references at set value = 00. refer to pages 2-46 and 2-47.

Multi-function Analog Input Characteristics

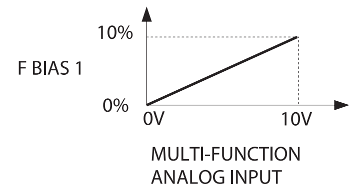
① Sn-19 = 00



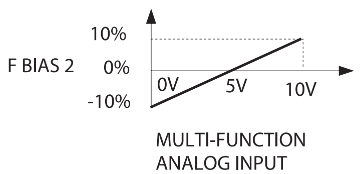
② Sn-19 = 01



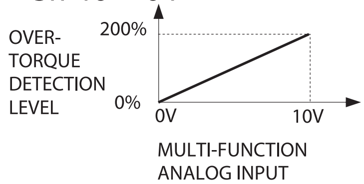
③ Sn-19 = 02



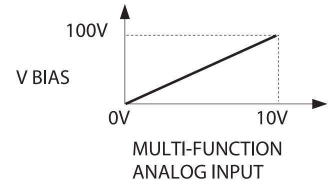
④ Sn-19 = 03



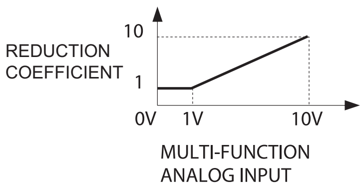
⑤ Sn-19 = 04



⑥ Sn-19 = 05

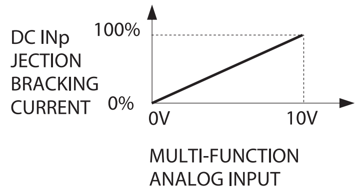


⑦ Sn-19 = 06

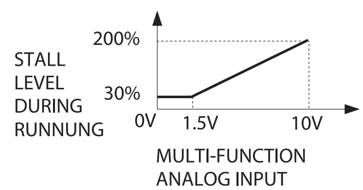


$$\text{Actual accel/decel time} = \frac{\text{Accel/decel time (Bn-01 ~ 04)}}{\text{Reduction coefficient}}$$

⑧ Sn-19 = 07



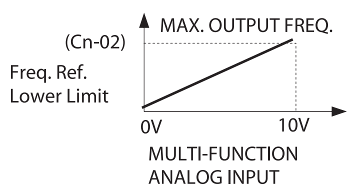
⑨ Sn-19 = 08



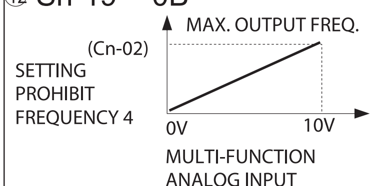
⑩ Sn-19 = 09

multi-function analog input (terminal be used as the setting of PID control set points(0~10V input)

⑪ Sn-19 = 0A



⑫ Sn-19 = 0B



⑬ Sn-19 =0C

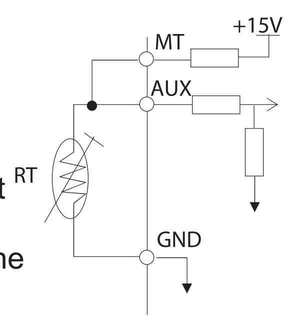
- The motor temperature sensor (PTC thermistor) R_T connect to terminal MT-AUX and GND.
- The motor overheat protection is active when $R_T \geq$ 1330Ω and the delay time is over the motor overheat protection time (Cn-63), the digital operator will display "Motor Overheat OH3" alarm and AC Drive stops the motor (depend on the stopping method set in the 3rd and 4th digits of Sn-12) and the fault contact signal is active.
- The motor overheat (OH3) alarm can be reset when $R_T \leq$ 550Ω.
- The typical characteristic of PTC thermistor R_T must follow the British Standard:

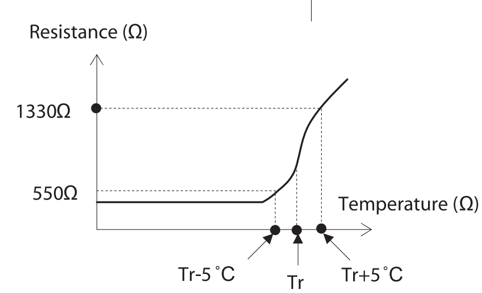
  Tr – 5˚C: RT≤ 550Ω

  Tr + 5˚C: RT≥ 1330Ω

  Tr – 20˚C: RT≤ 250Ω

  Tr + 15˚C: RT≥ 4000Ω





17). Multi-Function Contact Output Selection (Sn-20~Sn-22)

Select the set values shown below for Sn-20 to -22. Contact output for 0.1 sec. while detecting signal.

TERMINAL	NO SN-
Control circuit terminal R2A-R2C (Contact output)	Sn-20
Control circuit terminal D01-DCOM (Open collector output)	Sn-21
Control circuit terminal R1A-R1C (Open collector output)	Sn-22

SET VALUE	FUNCTION	LCD DISPLAY (ENGLISH)	DESCRIPTION
00	During run	Running	Closed: During run
01	Zero speed	Zero speed Closed:	Zero speed
02	Agreed frequency	Frequency Arrive	Closed: $\left\{ \begin{matrix} \text{Frequency ref.} \\ \text{ref.} \\ \text{-Cn-22} \end{matrix} \right\}$ ≥ Output Frequency ≤ $\left\{ \begin{matrix} \text{Frequency} \\ \text{+Cn-22} \end{matrix} \right\}$
03	Agreed frequency setting after accel/decel	Agreed F Arrive	Closed: Set value 2 in agreed frequency status and (Cn-21-Cn-22) ≥ output frequency ≤ (Cn -21 +Cn-22)
04	Frequency detection 1	Freq. Det. 1	Closed: Output frequency Cn ≤ -32
05	Frequency detection 2	Freq. Det. 2	Closed: Output frequency Cn ≥ -33
06	AC Drive operation ready	Run Ready OK!	Closed: AC Drive operation ready
07	During undervoltage detection	Low Volt Detect	Closed: During undervoltage detection
08	During baseblock	Output B.B.	Closed: During AC Drive output baseblock
09	Frequency reference mode	Ref. Cmd. Operator	Open: From control circuit terminal Closed: From operator
0A	Control command	Run Source Operator	Open: From control circuit terminal Closed: From operator
0B	Overtorque detection	Over Tq. Detect	Closed: During overtorque condition
0C	Frequency reference loss	Freq. Cmd. Missing	Closed: During loss of frequency reference
0D	Not used	Reserved	–
0E	Fault	Fault	Closed: Fault (except CPF 00, CPF 01)
0F	Not used	Reserved	–

① **Drive in "Run" mode (set value=0)**

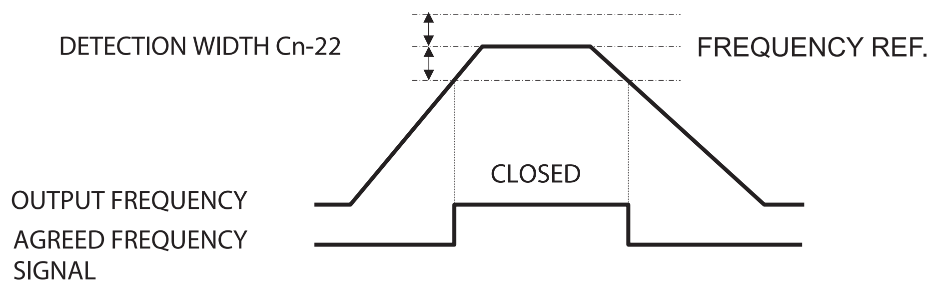
- The operation contact is "closed" when FWD or REV run command is inputed, or the AC Drive outputs voltage.

② **Zero-speed (set value=1)**

- The zero-speed contact is "closed" when AC Drive output frequency is less than the minimum output frequency.

③ **Agreed frequency (set value=2)**

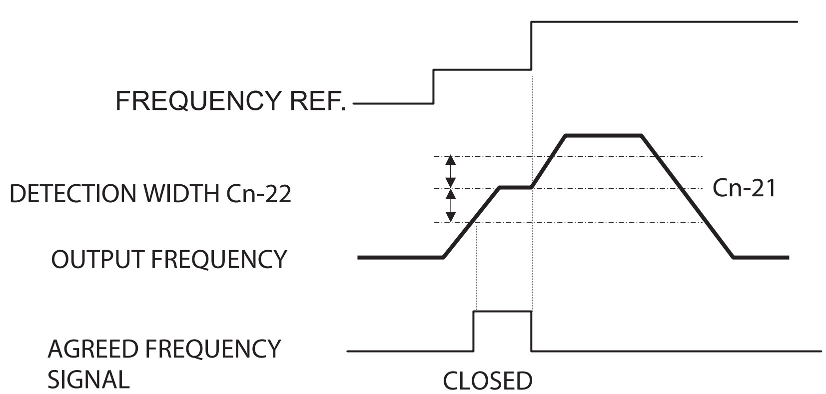
- This is "closed" when output frequency is within the detection width shown in the figure below.



(Frequency ref. - Cn-22) ≤ Output frequency ≤ (Frequency ref. + Cn-22)
Cn-22: Agreed frequency detection width

④ **Agreed frequency (Set value=3)**

- This is "closed" when acceleration or deceleration is completed and output frequency is within the detection width shown in the figure below.



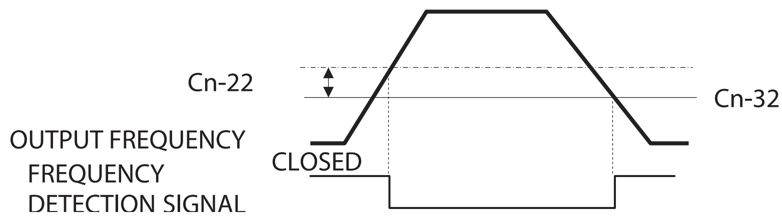
(Cn-21 - Cn-22) ≤ Output frequency ≤ (Cn-21 + Cn-22)

Cn-21: Agreed frequency point

Cn-22: Agreed frequency detection width

⑤ **Frequency detection (set value=4)**

- This contact is "closed" when output frequency is equal to or less than Cn-32, as shown in the figure below.



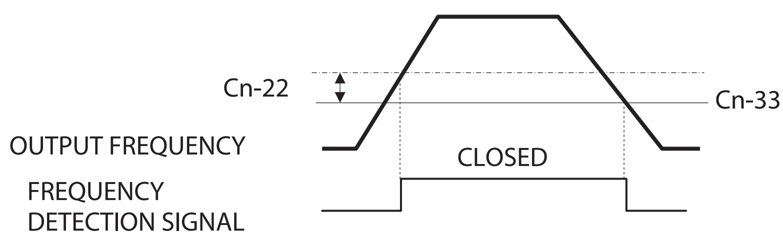
Output frequency ≤ Cn-32

Cn-32: Frequency detection 1 level

Cn-22: Agreed frequency detection width

⑥ **Frequency detection 2 (set value=5)**

- This contact is "closed" when output frequency is equal to or greater than Cn-33, as shown in the figure below.



Output Frequency ≥ Cn-33
Cn-33: Frequency detection 2 level.
Cn-22 Agreed frequency detection width.

⑦ **AC drive operation ready (set value=6)**

- This is "closed" when the AC drive is ready for operation.

⑧ **During undervoltage (UV) detection (set value=7)**

- This contact remains "closed" as long as the AC drive is detecting undervoltage.

⑨ **During baseblock (set value=8)**

- This contact is always "closed" when AC drive output is shut OFF.

⑩ **Frequency reference mode (set value=9)**

- This contact is "closed" when the frequency reference mode from the operator is selected.

⑪ **Control command (set value=A)**

- This contact is "closed" when the control command from the keyboard is selected.

⑫ **Overtorque detection (set value=B)**

- This contact remains "closed" as long as the AC drive is detecting overtorque. Set overtorque detection level in Cn-26 and set overtorque detection time in Cn-27.

⑬ **Frequency reference loss (set value=C)**

- This is "closed" when loss of frequency reference is detected.

⑭ **Not used (set value= D)**

⑮ **Fault (set value=E)**

- This contact is "closed" when the AC drive detects a major fault. However, in the event of a fault in the watchdog (OP Commu. Error 1 CPF00) or transmission between the mainframe and operator, the AC drive does not operate.

⑯ **Not used (set value=F)**

- Set F in multi-function contact when the output is not used.

18. AC drive station address (Sn-23)

19. RS-485 Communication protocol setting (Sn-24)

- The PA7300 AC drive has three RS-485 communication option card's: PA-C (METASYS/MODBUS protocol), PA-L (LONWORKS protocol), and PA-P (PROFIBUS protocol). These option cards can be used for monitoring AC drive status, reading the parameter setting, and changing the parameter setting to control the AC drive operation.
- Parameter definitions are as follows:

  Sn-23: AC drive station address, setting range 1~31.

  Sn-24= □□□□

  Communication parity setting

00:	No parity
01:	Even parity
10:	Odd parity
11:	Not used

  Communication baud rate setting

00:	2400 bps (bit/sec)
01:	4800 bps
10:	9600 bps
11:	19200 bps

- Every message has a data length of II bits: 1 start_bit, 8 data_bits , 1 parity_bit and 1 stop_bit. If communication parity is set to no parity (Sn-24=XX00), the parity_bit is 1.
- 3 different commands are used for communication between the AC drive and the host:
  a. Read Command; host to read the memory address of the AC drive.
  b. Write command; host external units to write the memory address of the inverter in order to control the inverter
  c. Circuit test command: To test the communication status between the AC drive and the host.
- Any change of setting Sn-23, Sn-24 will be effective after cycling power to the AC drive.
- Do not make any DRIVE/PRGM changes while writing through RS-485.
- For more details on RS-485 communication refer to PA7300 RS-485 METASYS/MODBUS Communication Application Manual, PA7300 RS-485 PROFIBUS Communication Application Manual, or PA7300 RS-485 LONWORKS Communication Application Manual, or the PA7300 RS-485 PROFIBUS Communication Application Manual. Also refer to Appendix C.

20. LCD Language displayed selection (Sn-25)

- Sn-25 = 0 : English

  Sn-25 = 1 : Chinese

21. Multi-Function Analog Output A01 Function Selection (Sn-26)

22. Multi-Function Analog Output A02 Function Selection (Sn-27)

- The multi-function analog output A01 and A02 can be set to monitor the following 11 status items as shown below:

SN-26, SN-27 SETTING	MONITORED CONTENTS (LCD DISPLAY)	DESCRIPTION	
		INPUT	OUTPUT
0	Frequency Command	0 ~ max. frequency	0 ~ 10V
1	Output Frequency	0 ~ max. frequency	
2	Output Current	0 ~ rated Current	
3	Output Voltage	0 ~ rated Voltage	
4	DC Voltage	230V: 0 ~ 400VDC 460V: 0 ~ 800VDC 600V: 0 ~ 1000VDC	
5	Output Power	0 ~ max. applicable motor capacity	
6	VIN Analog Command	0 ~ 10V	
7	AIN Analog Command	4 – 20mA	
8	AUX Analog Command	0 ~ 10V	
9	PID feedback (VIN + AIN)	0 ~ 10V	
10	Comm. Control	0 ~ 100%*1	

- The output gain Bn-11, Bn-12 will determine the output voltage at multi-function analog output at A01 and A02 terminal. The specified multiple of 10V will correspond to the 100% output monitored value.

*1: When Sn-26 ~ Sn-27=10, the multi-function output terminals A01, A02 are controlled by RS-485 commutations. Please ref. To "PA7300 MODBUS/PROFIBUS application manual".

23. Not Used (Sn-28)

24. Not Used (Sn-29)

25. Pump Operation Mode Selection (Sn-30)

- The 1-8 PID Relay option card application parameter. Set PA-PID card ineffective (Sn-30=0) when the 1-8 PID Relay card is not installed. Please refer to "PA-PID instruction manual".

  - Sn-30 = 0: 1-8 PID Relay card is ineffective.

    Sn-30 = 1: Fixed AC drive mode stops all the pumps by first-run-last-stop sequence. i.e. Only one of the pumps is driven by AC drive, the others are run with the ac power source. Take the first run pump last stop sequence to stop all the pumps. This operation mode is better when different motor HP/KW ratings are used.

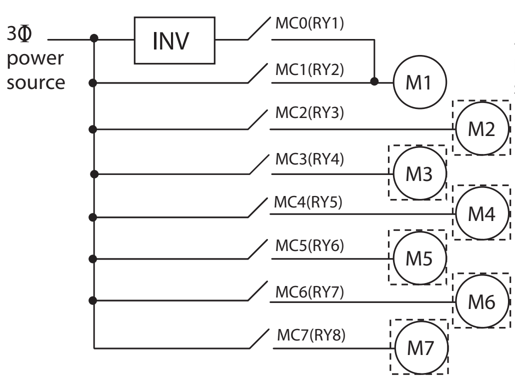
    Sn-30 = 2: Fixed AC drive mode stops the pump driven by the AC drive only. i.e. When the AC drive outputs the stop signal, only the inverter driven pump is stopped.

    Sn-30 = 3: Fixed AC mode, stops all the pumps by first-run-first-stop sequence. i.e. the first-run (the motor running for the longest time) -first-stop sequence is adapted to stop the motors and keeps the pumps at almost the same duty. This operation mode is better when using the same motor HP/KW ratings.

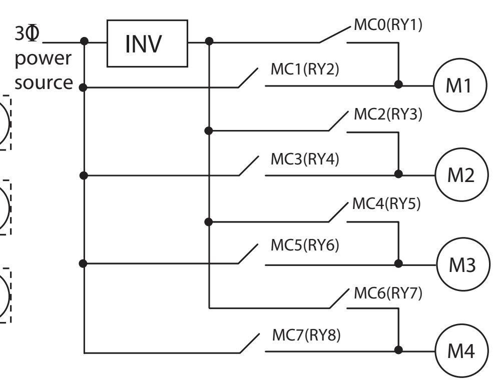
    Sn-30 = 4: Cycled AC drive mode, stops all the pumps by first-run-first-stop sequence. (i.e. Except for the auxiliary pumps, all the pumps are controlled by AC drive, and take the first-run-first-stop sequence to stop all the pumps).

    Sn-30 = 5: Cycled AC drive mode; stops the inverter-driven pumps only.

  - Fixed AC drive mode and Cycled AC drive mode connection examples:



(a) Fixed AC Drive mode



(b) Cycled AC Drive mode

Fig. 13 Pump Operation mode

26. 1-8 PID Card Relay 2 Control (Sn-31)

27. 1-8 PID Card Relay 3 Control (Sn-32)

28. 1-8 PID Card Relay 4 Control (Sn-33)

29. 1-8 PID Relay Card Relay 5 Control (Sn-34)

30. 1-8 PID Relay Card Relay 6 Control (Sn-35)

31. 1-8 PID Relay Card Relay 7 Control (Sn-36)

32. 1-8 PID Relay Card Relay 8 Control (Sn-37)

- The 1-8 PID Relay option card application parameters. Please refer to "1-8 PID Relay instruction manual".
- Used to control the pump ON/OFF.

  Sn-31 ~ 37 = 0: Relay output invalid.

  Sn-31 ~ 37 = 1: Relay output valid.

33. Parameter Copy (Sn-38)

- The JNEP-32 LCD digital operator can upload the parameter settings from the digital operator to the drive and download parameter settings from the AC Drive to the digital operator.
- The digital operator will check its EEPROM or the AC Drive's EEPROM under the following settings.

  Sn-38 = 0: NO action

  Sn-38 = 1: Upload data (digital operator → AC Drive). During this period, the LED on the digital operator will light sequentially in the CW sense.

  Sn-38 = 2: Download data (AC Drive → digital operator). During this period, the LED on the digital operator will light sequentially in the CCW sense.

  Sn-38 = 3: Verification check on digital operator's EEPROM; during this period the LED will be switched between 2 groups.

- Please follow the steps below to implement the action of parameter copy between different AC Drives (either upload or download).

  Step 1: Check the contents of digital operator EEPROM. (Sn-38='03'), then check the contents of AC Drive's EEPROM. Make sure that both EEPROM function properly.

  Step 2: Download and copy the AC Drive's parameter settings to digital operator EEPROM (Sn-38=2).

  Step 3: Upload and copy the parameter settings of digital operator to other AC Drive's EEPROM (Sn-38=1)

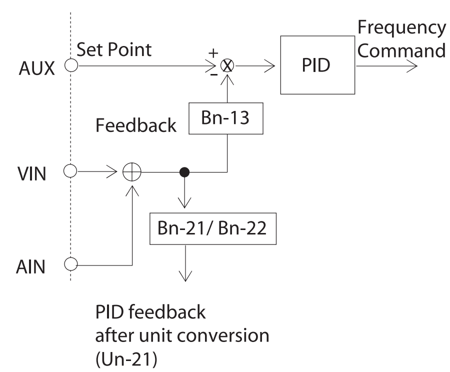
  Note: When transferring preameters from one drive to another, the following restrictions apply

  a) Parameter transfer is only allowed between identical model numbered units.

  b) Parameter transfer should be performed with units at the same software revision levels. Otherwise consult the factory for compatibility.

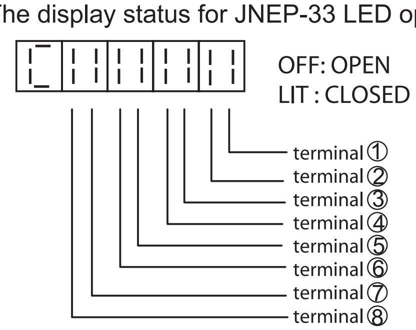
2.5 Monitoring Peramiters **UN-□□**

PARAMETER NO.	NAME	LCD DISPLAY (ENGLISH)	UNIT	DESCRIPTIONS
Un-01	Frequency Command	Un-01=60.00Hz Frequency Command	0.01Hz	Display frequency command, the displayed unit is determined by Cn-20
Un-02	Output Frequency	Un-02=60.00Hz Output Frequency	0.01Hz	Display output frequency, the displayed unit is determined by Cn-20
Un-03	Output Current	Un-03=12.5A Output Current	0.1A	Display AC Drive output current
Un-04	Output Voltage	Un-04=220.0V Output Voltage	0.1V	Display output voltage command of the AC Drive
Un-05	Main Circuit DC Voltage	Un-05=310.0V DC Voltage	0.1V	Display DC voltage of AC Drive main circuit
Un-06	Output Power	Un-06= KW Output Power	0.1KW	Display output power of AC Drive
Un-07	Output Power Factor	Un-07=0.90 Output P.F.	0.01	Display output power factor of AC Drive
Un-08	Input Terminal Status	*2 Un-08=00000000 I/P Term. Status	–	0 0 0 0 0 0 0 0 0: OPEN 1: CLOSE Input terminal ① Input terminal ② Input terminal ③ Input terminal ④ Input terminal ⑤ Input terminal ⑥ Input terminal ⑦ Input terminal ⑧
Un-09	Output Terminal Status	*3 Un-09=00000000 O/P Term. Status	–	0 0 0 0 0 0 0 0 0: OPEN 1: CLOSE Relay Contact R2A-R2C Opto-contact D01-DCOM Opto-contact R1A-R1C Reserved Reserved Reserved Reserved Reserved
Un-10	S/W Version	Un-10=00001 Software Version	–	– Manufacturing use–
Un-11	Motor Elapsed Run Hours	Un-11=00001Hr Elapsed Time	1Hr	Display total elapsed time after pressing RUN (display data is resetable)*1
Un-12	Motor Elapsed Energy KWHR	Un-12=00001Kwh Elapsed Energy	1Kwh	Display total motor output energy (display data is resetable)*1

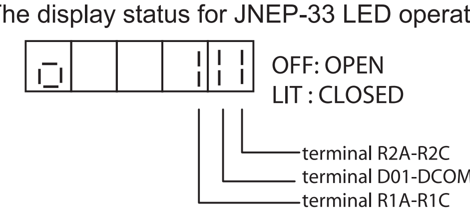
PARAMETER N●	NAME	LCD DISPLAY (ENGLISH)	UNIT	DESCRIPTIONS
Un-13	Option card code	Un-13=0 None Opt. Card	1	0: No option card is installed 1: PA-M, PA-L, PA-C card is installed in CN2. 2~5: Reserved 6: PA-P (PROFIBUS) card is installed in CN2. 7: Reserved 8: 1-8 PID Relay card is installed in CN2.
Un-14	U phase current (IU) conversion value	Un-14=1.00V IU current	0.01V	Range: 0.00V ~ 5.00V ● Un-14, Un-15 can be used to check DCCT function. ● Un-16, Un-17 can be used to check ADC function in the control board. ● Troubleshooting use
Un-15	W phase current (IW) conversion value	Un-15=1.00V IW current		
Un-16	3 phase rectify current (DIAC) conversion value	Un-16=1.00V DIAC current		
Un-17	ADC Reference Volt. conversion value	Un-17=2.50V ADCHK Voltage		
Un-18	External Analog Command VIN	Un-18=10.00V Voltage ~ Input	0.01V	Range: 0.00V ~ 10.00V
Un-19	External Analog Command AIN	Un-19=20.0mA Current ~ Input	0.1mA	Range: 0.0 ~ 20.0mA
Un-20	Multi-Function Analog Input Command AUX	Un-20=10.00V Multi-Fun ~ Input	0.01V	Range: 0.00V ~ 10.00V
Un-21	PID Feedback after display unit conversion	Un-21=1.000 PID Detect	0.001	Range: -9.999 ~ +9.999 The display conversion unit depends on Bn-21 and Bn-22. 

*1 The contents of Un-11 and Un-12 can be reset by Sn-03=1000 and 1001 Individually.

*2 The display status for JNEP-33 LED operator :



*3. The display status for JNEP-33 LED operator



2.6 Monitoring Parameters Hn-□□

- The AC Drive input/output interface status can be monitored under the PRGM mode by Hn-□□ parameters.
- Hn-□□ parameters will toggle display with low voltage protection alarm (UV) if the UV alarm occurred.

PARAMETER NO.	NAME	LCD DISPLAY (ENGLISH)	UNIT	DESCRIPTIONS
Hn-01	Main Circuit DC Voltage	Hn-01=622.0V DC Voltage	0.1V	Display DC voltage of inverter main circuit
Hn-02	Input Terminal Status	Hn-02=00000000 I/P Term. Status	–	0 0 0 0 0 0 0 0 0: OPEN 1: CLOSE Input terminal ① Input terminal ② Input terminal ③ Input terminal ④ Input terminal ⑤ Input terminal ⑥ Input terminal ⑦ Input terminal ⑧
Hn-03	Output Terminal Status	Hn-03=00000000 O/P Term. Status	–	0 0 0 0 0 0 0 0 0: OPEN 1: CLOSE Relay Contact R2A-R2C Opto-contact D01-DCOM Opto-contact R1A-R1C Reserved Reserved Reserved Reserved Reserved
Hn-04	Option card code	Hn-04=0 None Opt. Card	1	0: No option card is installed 1: PA-M, PA-L, PA-C card is installed. 2~5: Reserved 6: PA-P, PA-L, PA-C card is installed . 7: Reserved 8: PA-PID card is installed.
Hn-05	U phase current (IU) conversion value	Hn-05=2.50V IU current	0.01V	Range: 0.00V ~ 5.00V ● Hn-05, Hn-06 can be used to check the DCCT function. ● Hn-07, Hn-08 can be used to check the ADC function in the control board. ● Troubleshooting use.
Hn-06	W phase current (IW) conversion value	Hn-06=2.50V IW current		
Hn-07	3 phase rectify current (DIAC) conversion value	Hn-07=1.00V DIAC current		
Hn-08	ADC Reference Volt. conversion value	Hn-08=2.50V ADCHK Voltage		

PARAMETER NO.	NAME	LCD DISPLAY (ENGLISH)	UNIT	DESCRIPTIONS
Hn-09	External Analog Command VIN	Hn-09=10.00V Voltage ~ Input	0.01V	Range:0.00V ~ 10.00V
Hn-10	External Analog Command AIN	Hn-10=20.0mA Current ~ Input	0.1mA	Range:0.0 ~ 20.0mA
Hn-11	Multi-Function Analog Input Command AUX	Hn-11=10.00V Multi-Fct. ~ Input	0.01V	Range:0.00V ~ 10.00V
Hn-12	Motor Elapsed Run Hours	Hn-12=00001Hr Elapsed Time	1Hr	Display total time elapsed after pressing RUN (display data is resetable)
Hn-13	S/W	Version Hn-13=00001 Software Version	–	– Manufacturing use only

2.7 Order Parameters On-□□

- Order parameters are already set to their optimum value as initial values. Therefore, adjustment is not normally needed.

FUNCTION	PARAMETER NO.	NAME	LCD DISPLAY (ENGLISH)	DESCRIPTION	FACTORY SETTING
Control Status	On-01	Control Status 1	On-01=0000 Control Status 1	XX0X: stores the frequency reference in the HOLD status (for up/down operation) XX1X: Do not store the frequency reference in the HOLD status	0000
	On-02	Control Status 2	On-02=0000 Control Status 2	XXX0: Inverter overload protection (OL2) valid XXX1: Inverter overload protection (OL2) invalid XX0X: AVR function valid XX1X: AVR function invalid	0000
	On-03	Control Status 3	On-03=0000 Control Status 3	XXX0: Anti-hunting gain change depending on inverter output voltage XXX1: Anti-hunting gain depending on On-07 setting XX0X: Two-phase PWM modulation XX1X: Three-phase PWM modulation X0XX: Power angle compensation bias change depending on inverter output frequency X1XX: Power angle compensation bias fixed	0000
–	On-04	Not used	On-04=0000 Reserved	XXX0: Error is D controlled XXX1: Feedback is D controlled XX0X: PID normal output XX1X: PID inverse output X0XX: PID output only X1XX: Frequency command plus PID output 0XXX: Normal feedback Mode 1XXX: Inverse feedback Mode	0000
	On-05	Not used	On-05=0 Reserved	–	0.00
	On-06	Not used	On-06=0 Reserved	–	0

2.7 Order Parameters On-□□

- Order parameters are already set to their optimum value as initial values. Therefore, adjustment is not normally needed.

FUNCTION	PARAMETER NO.	NAME	LCD DISPLAY (ENGLISH)	DESCRIPTION	FACTORY SETTING
Hunting Prevention control	On-07	Hunting Prevention gain	On-07=0.10 Hunt_Prev. Gain	Setting range: 0.01 ~ 2.55	0.10
	On-08	Hunting Prevention limit	On-08=030% Hunt_Prev. Limit	Setting range: 0 ~ 100%	30%*1
Effective current detection control	On-09	Effective current detection filter time constant	On-09=005 I_Det. Time const	Setting range: 1 (3.5ms) ~ 100 (350ms)	5*1 (17.5ms)
	On-10	Not used	On-10=0 Reserved	–	0
On-delay control	On-11	ON-DELAY TIME	On-11=011 ON-Delay Time	Setting range: 11 (2.75μs) ~ 160 (40μs), △=0.25μs	11 (2.75μs)
	On-12	ON-DELAY Compensated value	On-12=014 ON-Delay Compen.	Setting range: 0 ~ 160 (40μs), △=0.25μs	14 (3.5μs)
–	On-13	Not used	On-13=0 Reserved	–	0
	On-14	Not used	On-14=0 Reserved	–	0
Energy Saving power detection	On-15	Power detection filter changing width	On-15=010% Power_Det. Dead Zone	Setting range: 0 ~100% Setting unit : 1%	10%
	On-16	Power detection filter time constant	On-16=020 Power_Det. Time Const.	Setting range: 1 ~255 Setting unit : 1 (=7ms)	20 (140ms)

FUNCTION	PARAMETER NO.	NAME	LCD DISPLAY (ENGLISH)	DESCRIPTION	FACTORY SETTING
Torque Boost Control	On-17	Motor phase to phase resistance	On-17=00.308Ω Motor Line R	Setting range 0 ~ 65.535Ω Setting unit 0.001Ω	0.308Ω*1
	On-18	Torque Compensation of core losses	On-18=425W Tq. Compens. Core Loss	Setting range 0 ~ 65535W Setting unit 1W	425W*1
	On-19	Torque Compensation limit	On-19=100V Tq. Compens. Limit	Setting range 0 ~ 50V*2 Setting unit 1V	100V*1
Energy-saving Motor Constant *3	On-20	Motor Constant R1	On-20=00.000Ω Motor Prim R	Setting range 0.000 ~ 65.535Ω Setting unit 0.001Ω	0.000Ω
	On-21	Motor Constant R2	On-21=00.000Ω Motor 2nd R	Setting range 0.000 ~ 65.535Ω Setting unit 0.001Ω	0.000Ω
	On-22	Motor Constant L	On-22=00.000mH Equivalent Leakage	Setting range 0.000 ~ 65.535mH Setting unit 0.001mH	0.000mH
	On-23	Motor Constant Rm	On-23=00.000mΩ/w Core Loss Impedance	Setting range 0.000 ~ 65.535mΩ/w Setting unit 0.001mΩ/w	0.000mΩ/w
	On-24	Motor Constant Lm	On-24=00.00mH Excitation Inductor	Setting range 0.00 ~ 655.35mH Setting unit 0.01mH	0.00mH

*1. Factory settings differ depending on AC Drive capacity (Sn-01 set value). This example shows a TECO standard motor 460V, 60Hz, 25HP (18.5KW).

*2. 2 For 230V Class, x2 for 460V, x2.5 for 600V.

*3.
- Setting can be made only when Cn-60=FFH. When the value is changed, K2 (Energy-savings Coefficient K2) is calculated and the calculated value is set to Cn-58.
- Motor constants (On-20 ~On-24) are not stored in NVRAM and become 0 at power startup.
- The unit and setting range changes depending on the AC Drive capacity:
  1/10 for 230V class 25HP ~ 125HP, 460V class 75HP ~ 500HP.

3. FAULT DISPLAY AND TROUBLESHOOTING

The PA7300 has protection function and warning self-diagnosis function. If a fault a occurs, the protection functions operate to shut off the AC Drive output and the motor coasts to a stop. At the same time, the fault contact signal (terminal R3A-R3C, R3B-R3C).

A). PROTECTION FUNCTION AND TROUBLESHOOTING

<table>
<tr><th colspan="2">PROTECTION FUNCTION</th><th>EXPLANATION</th><th>LCD DISPLAY (ENGLISH</th></tr>
<tr><td rowspan="4">Low voltage protection</td><td>Main circuit low voltage</td><td colspan="2">When the AC Drive power voltage drops, torque becomes insufficient and the motor is overheated.</td></tr>
<tr><td>Momentary*2 power loss protection</td><td>AC Drive output is stopped when the main circuit DC voltage becomes lower than the low voltage detection level for 15 ms or longer, or about 2 seconds or longer if the momentary power loss ride-thru function is used.
Detection level: Approximately 210V or less for 200V class and 420V or less for 400V class</td><td>Fault (UV1)*1
DC Volt. Low</td></tr>
<tr><td>Control circuit low voltage</td><td>The AC Drive output is shut-off when the control circuit voltage drops below the low voltage level.</td><td>Fault (UV2)*1
C/B DC Volt. Low</td></tr>
<tr><td>Man circuit soft charge contactor defective</td><td>The AC Drive output is shut-off when no answer back is received from the main circuit soft-start contactor.</td><td>Fault (UV3)*1
MC Ans. Fault</td></tr>
<tr><td colspan="2">Overcurrent protection*2</td><td>The AC Drive output is shut off when the AC Drive output current exceeds approx. 200% of AC Drive rated current.</td><td>Fault (OC)*1
Over Current</td></tr>
<tr><td colspan="2">Ground-fault protection*2</td><td>The AC Drive output is shut off when a ground-fault occurs at the AC Drive output side and the ground-fault current exceeds approximately 50% of the AC Drive rated current.</td><td>Fault (GF)*1
Ground Short</td></tr>
<tr><td colspan="2">Overvoltage protection*2</td><td>The AC Drive output is shut off when the main circuit DC voltage exceeds excessive because of regeneration energy caused by motor deceleration and negative load.
Detection. Approx. 800V for input voltage set 400V and above
Level : Approx. 700V for input voltage set 400V or less and approx. 400V for 200V class</td><td>Fault (OV)*1
Over Voltage</td></tr>
<tr><td colspan="2">Cooling fin overheat*2</td><td>The AC Drive output is shut off when the ambient temperature rises and the heat sink fin reaches 90 °C . Please check for a detective cooling fan or clogged filter.</td><td>Fault (OH)*1
Over Heat</td></tr>
<tr><td rowspan="3">Overload protection</td><td>Motor*2</td><td>AC Drive output is stopped when motor overload is detected by the electronic thermal overload in the AC Drive. Either an AC Drive duty constant torque specialized motor or general-purpose motor can be selected. If more than one motor is driven. overload protection should be disabled. Use a thermal relay or thermal protector for each motor.</td><td>Fault (OL1)*1
Motor Over Load</td></tr>
<tr><td>AC Drive*2</td><td>The AC Drive output is shut off when the electronic thermal overload reaches or exceeds the inverse time limit of 103% of the AC Drive's rated current occurs. Maximum rated overload: 110%. 1 min.</td><td>Fault (OL2)*1
AC Drive Over Load</td></tr>
<tr><td>Over torque*2 detection</td><td>The motor operates according to a preset mode when the AC Drive output current exceeds the overtorque detection level. This function is used to protect the machine or to monitor the output torque.</td><td>Fault (OL3)*1
Over Torque</td></tr>
<tr><td rowspan="5">External fault signal input</td><td>Terminal③</td><td rowspan="5">When an external alarm signal is asserted. the AC Drive operates according to a preset stop method (coasting to a stop, continuous operation or ramp to stop)</td><td>Fault (EF3)*1
External Fault 3</td></tr>
<tr><td>Terminal⑤</td><td>Fault (EF5)*1
External Fault 5</td></tr>
<tr><td>Terminal⑥</td><td>Fault (EF6)*1
External Fault 6</td></tr>
<tr><td>Terminal⑦</td><td>Fault (EF7)*1
External Fault 7</td></tr>
<tr><td>Terminal⑧</td><td>Fault (EF8)*1
External Fault 8</td></tr>
<tr><td rowspan="5">Control Circuit Fault</td><td>Control Circuit Fault</td><td rowspan="5">The AC Drive output is shut off when a transmission error occurs in the control circuit or a component fails. The AC Drive output is also shut off when a specialized option such as the digital operator is not properly connected.</td><td>Fault (CPF02)*1
Logic board Fault</td></tr>
<tr><td>EEPROM fault</td><td>Fault (CPF03)*1
EEPROM Fault</td></tr>
<tr><td>EEPROM BCC CODE Error</td><td>Fault (CPF04)*1
EEPROM CODE Err.</td></tr>
<tr><td>CPU ADC Fault</td><td>Fault (CPF05)*1
A/D Fault</td></tr>
<tr><td>Option Card Fault</td><td>Fault (CPF06)*1
Opt. Card A/D Fault</td></tr>
</table>

The warning and self-diagnosis functions do not operate fault contact outputs (except OH1 warning function) and return to the former operation status automatically when the condition is removed. The fault display and troubleshooting are provided as shown in the table below.

FAULT CONTACT OUTPUT	ERROR CAUSES	ACTION TO BE TAKEN
Operation	• AC Drive capacity is too small. • Voltage drop due to wiring. • AC Drive power voltage selection is wrong • A motor of large capacity (11 kW or greater) connected to the same power system has been started. • Rapid acceleration with generator power supply • Operation sequence when power is off • Defective electromagnetic contactor	• Check the power capacity and power system. • UV display appears when the AC Drive power is turned off while operation signal is inputed. Remove the power after stopping the AC Drive. • (Set the third and fourth bits of Sn-04 to 01.)
Operation	• Extremely rapid accel/decel • Motor on/off switching at the AC Drive output side • Short-circuit or ground-fault at the AC Drive output side • Motor of a capacity greater than the AC Drive rating has been started • High-speed motor or pulse motor has been started.	Transistor error may occur. Investigate the error cause, correct it, then restart.
Operation	• Motor dielectric strength is insufficient. • Load wiring is not proper.	Check for ground-fault in motor or load wiring.
Operation	• Over voltage • Insufficient deceleration time • Regenerative load (Motor is turned by the load.) • High input voltage compared to motor rated voltage	If required braking torque is excessive, extend the decel time or use a braking resistor. (If braking resistor is already installed, verify that Sn-10. 2nd digit to 1.)
Operation	• Defective cooling fan. • Ambient temperature rise • Clogged filter	Replace the cooling fan and clean the filter. Ambient temperature: 104 °F (40 °C) or less for enclosed type 122 °F (45 °C) or less for open chassis
Operation	Overload, low speed operation, or extended acceleration time, improper V/f characteristic setting	Investigate the cause of overload and review the operation pattern, V/f characteristic, and motor/AC Drive capacities. (If AC Drive is repeatedly reset after an overload occurs, the AC Drive may fault. Investigate and correct the cause of overload.)
Operation	Motor current exceeds the preset value because of machine error or overload.	Check the use of the machine. Correct the overload cause or set a higher detection level which is within the allowable range.
Operation	External fault condition occurred	Correct the source of the fault input.
Operation	• External noise • Excess vibration or shock • CPF 02: Control circuit fault • CPF 03: NVRAM (SRAM) fault • CPF 04: NVRAM BCC Code error • CPF 05: AD converter fault in CPU	Check data in Sn-01 and Sn-02. Record all data, then use Sn-03 for initializing. Cycle power. If error is persistant, contact your TECO representative

PROTECTION FUNCTION		EXPLANATION (ENGLISH)	LCD DISPLAY
Parameter Setting		Error Parameter Setting Error	Fault (Err)*1 Parameter
Input Phase Loss Fault		DC bus voltage ripple ΔV ≥input phase loss detection level (Cn - 61), the motor coasts to stop	Fault (IPL)*1 Input phase loss
Output Phase Loss Fault		One of the AC Drive output phases are lost, the motor coasts to stop.	Fault (oPL)*1 Output phase loss
Motor overheat		The motor temperature detected sensor PTC thermistor RT ≥ 1330Ω	Fault (OH3)*1 Motor Overheat
RS-485 communication Fault	Fault 1	RS-485 communication error or transmission fault during communicating and the RS-485 stopping method after communication error of Sn-08 is to stop the motor.	(CPF21)*1 RS-485 comm. Fault 1
	Fault 2	RS-485 communication protocol error and the RS-485 stopping method after communication error of Sn-08 is to stop the motor	(CPF22)*1 RS-485 comm. Fault 2
	Fault 3	PROFIBUS communication option card PA-P Dual port RAM fault.	(CPF23)*1 RS-485 comm. Fault 3
	Fault 4	PROFIBUS communication option card PA-P EEPROM checksum error.	(CPF24)*1 RS-485 comm. Fault 4
	Fault 5	PROFIBUS communication option card PA-P RAM fault	(CPF25)*1 RS-485 comm. Fault 5
	Fault 6	PROFIBUS communication option card PA-P communication IC fault.	(CPF26)*1 RS-485 comm. Fault 6
	Fault 7	PROFIBUS communication option card PA-P Watch dog timer active.	(CPF27)*1 RS-485 comm. Fault 7

*1. The display contents of LED digital operator.

*2. Auto-reset is available for these fault conditions.

FAULT CONTACT OUTPUT	ERROR CAUSES	ACTION TO BE TAKEN
Operation	Parameter setting error	
Operation	• One of the AC Drive input phases are lost • 3 phase power source is unbalanced. • The main circuit smoothing capacitors have deteriorated. • Improper input phase loss detection level (Cn-61) setting	• Check the AC Drive input power supply wiring. • Check the capacitors. • Check the setting of Cn-61.
Operation	• One of the AC Drive output phases are lost • DCCT fault.	• Check the wiring between AC Drive and motor. • Replace the DCCT.
Operation	• Motor load current is too large. • The effective cooling of motor is not sufficient.	• Check the motor load current. • Check the motor effective cooling.
Operation	• RS-485 communication option card fault • Excess vibration or shock • External noise	• Turn off power, then turn on again. If error is persistent, replace the option card.
Operation	• The RS-485 communication protocols setting AC Drive (Sn-24) and option card are inconsistent.	• Check the setting in Sn-24 and option card.
Operation	• PA-P card fault	• Turn off power, then turn on again. If error is persistent, replace the option card
Operation		
Operation		
Operation		
Operation		

B.) Warning and Self-Diagnosis Functions

PROTECTION FUNCTION		EXPLANATION	LCD DISPLAY (ENGLISH
Low-voltage protection [main circuit voltage insufficient]		Monitor display appears if low voltage protection conditions such as a drop in main circuit voltage or momentary power loss occur while the AC Drive output is off.	(blinking) Alarm (UV)[*1] DC Volt. Low
High voltage protection[*2]		Monitor display appears when the main circuit DC voltage rises above the detection level while the AC Drive output is off.	(blinking) Alarm (OV)[*1] Over Voltage
Cooling fin overheat warning		Monitor display appears when a separate thermal protector contact is input to the external terminal. (Sn-15 ~ 18 = OB)	(blinking) Alarm (OH2)[*1] Over Heat
Overtorque detection[*2]		This function is used to protect the machine and to monitor the AC Drive output torque. The AC Drive output reacts in a preset manner when the AC Drive output current exceeds the over torque detection level. The monitor display blinks when "operation continue" is preset.	(blinking) Alarm (OL3)[*1] Over Torque
Stall prevention Accel/decel is accomplished with maximum capacity of the AC Drive without tripping on over current or overvoltage	During acceleration	AC Drive acceleration is stopped when 150% of or more of the AC Drive rated current is required by the load. This prevents overload protection (OL2) or overcurrent (OC) from occurring. When current is reduced to less than 170%, acceleration is enabled.	–
	During normal operation	Output frequency is decreased when 130% of the AC Drive rated current or greater is required by the load. This prevents motor and AC Drive overload (OL1, OL2). When current is reduced below 130%, AC Drive acceleration is than enabled.	–
	During deceleration	Deceleration is stopped when the DC voltage is caused to rise by motor regenerative energy. This prevents overvoltage trips (OV). When DC voltage decreases, deceleration to the set value then resumes	–
Simultaneous normal and reverse rotation commands		When forward and reverse rotation commands are simultaneously detected for a period of time exceeding 500 ms, the AC Drive is stopped according to the preset stop method.	(blinking) Alarm (EF)[*1] Input Error
External Fault Signal Input (Minor fault)	Terminal③	It is indicated on the monitor when the mode after external signal input is set to "Operation continue." • Ref. to the external faults 5 ~ 8 setting on page 87 • Minor fault setting - terminal 3 (Sn-12=11XX) terminal 5 (Sn-15=2C) terminal 6 (Sn-16=3C) terminal 7 (Sn-17=4C) terminal 8 (Sn-18=5C)	(blinking) Alarm (EF3)[*1] External Fault 3
	Terminal⑤		(blinking) Alarm (EF5)[*1] External Fault 5
	Terminal⑥		(blinking) Alarm (EF6)[*1] External Fault 6
	Terminal⑦		(blinking) Alarm (EF7)[*1] External Fault 7
	Terminal⑧		(blinking) Alarm (EF8)[*1] External Fault 8
Digital Operator communication error		Operator transmission fault 1 (Initial fault)	Alarm (CPF00)[*1] OP comm. Error 1
		Operator transmission fault 2 (on time fault)	Alarm (CPF01)[*1] OP comm. Error 2

FAULT CONTACT OUTPUT	ERROR CAUSES	ACTION TO BE TAKEN
Non Operation	• Input voltage drop	Check the main circuit DC voltage in Un-xx. If the voltage is low, adjust the input voltage.
Non Operation	• Input voltage rise	Check the main circuit DC voltage in Un-xx. If the voltage is high, adjust the input voltage.
Non Operation	• Overload • Cooling fan fault • Ambient temperature rise • Clogged filter	Replace the cooling fan and clean the filter. Ambient temperature: 104 of (40 °C) or less for enclosed type 122 of (45 °C) or less for open chassis
Non Operation	• Motor current exceeded the set value because of machine fault or overload.	Check the driven machine and correct the cause of the fault or set to a higher value.
Non Operation	• Insufficient power for accel/decel • Overload • Phase loss	• Set proper accel/decel time for smooth operation. • For stall prevention during normal operation lighten the load or increase AC Drive capacity.
Non Operation	Operation sequence error • 3-wire/2-wire selection error	• Recheck the control sequence. • Recheck system constant (Sn-15 to -18)
Non Operation	• External fault conditions set-up	• Take appropriate measures for the cause of external fault input.
Non Operation	• Transmission between the AC Drive and digital operator cannot be established 5 seconds after supplying power. • Transmission between the AC Drive and digital operator is established once after supplying power, but later transmission faults continue for more than 2 seconds.	• Insert the operator connector again. • Check the wiring of control circuit. • Replace the control board or operator

PROTECTION FUNCTION		EXPLANATION	LCD DISPLAY (ENGLISH)
External baseblock signal input (Minor failure) main circuit transistor instantanous shut-off		When an external base block signal is inputed, the motor coasts to a stop. When the external base block signal is removed, the AC Drive output is immediately turned on at the previously set frequency.	(blinking) Alarm (bb)[*1] B.B.
Invalid parameter setting		When an invalid parameter is set, it is indicated on the monitor at power up or when the AC Drive is changed from the PRGM mode to the DRIVE Mode I/P Term. Incorrect	Alarm (OPE01)[*1] Set Cap. Error
			Alarm (OPE02)[*1] Parameter Incorrect Alarm (OPE03)[*1]
			Alarm (OPE10)[*1] V/F curve Incorrect
			Alarm (OPE11)[*1] Carry-Freq Incorrect
Parameter read error		Parameter read error Read Error	Alarm (Err)[*1]
RS-485 Communication Fault	Fault 1	RS-485 Communication error or transmission fault during communications and the Rs-485 stopping method after communication error of Sn-08 is to continue to run (Sn-08=11xx)	(blinking) (CPF21)[*1] RS-485 comm Fault 1
	Fault 2	RS-485 Communication protocol error and the RS-485 stopping method after communication error of Sn-08 is to continue to run (Sn-08=11xx)	(blinking) (CPF22)[*1] RS-485 comm Fault 2
RS-485 Communication Ready		When the AC Drive with communication option card (PA-L, PA-P or PA-C) does not receive correct data from master controller.	(CALL)[*1] RS-485 comm Ready

FAULT CONTACT OUTPUT	ERROR CAUSES	ACTION TO BE TAKEN
Non Operation	–	–
Non Operation	• AC Drive KVA setting (Sn-01) error • Parameter setting range error • Multi-function contact input setting error (Sn-15 ~ Sn-18) • Improper setting of V/F characteristic (Cn-02 ~ Cn-08) • Improper setting of carrier frequency (Cn-23 ~ Cn-25)	• Review the parameter setting range and and conditions
Non Operation	• EEPROM internal data did not match when initializing the constant	• Turn off power, then turn on again. If error is persistent, replace the control board.
Non Operation	• RS-485 communication option card fault. • Excess vibration or shock. • External noise	• Turn off power, then turn on again. If error is persistent, replace the option card.
Non Operation	• The RS-485 communication protocols setting in AC Drive (Sn-24) and option card are in consistent.	• Check the setting in Sn-24 and option card
Non Operation	• Poor connection • Defective communication software (in master controller)	• Check for communication cable between • communication option card and master controller (PLC) • Check for communication software.

APPENDIX

A. Energy-savings CONTROL

a. Constants related to Energy-savings Mode The table below shows the constants used in the Energy-savings mode.

FUNCTION	PARAMETER NO	NAME AND DESCRIPTION	LCD DISPLAY (ENGLISH)	UNIT	SETTING RANGE	FACTORY SETTING
Operation Mode Select	Sn-09	-0- -: Energy Saving function ineffective (V/F) -1- -: Energy Saving function effective	Sn-09=0000 Term. A01&Eng. Saving	–	–	0000
Energy Saving Voltage Limit	Cn-45	Energy Saving Voltage upper limit (60Hz)	Cn-45=120% Hi_spd. Sav. V_Upper	1%	0~120%	120%
	Cn-46	Energy Saving Voltage upper limit (6Hz)	Cn-46=16% Lo_spd. Sav. V_Upper	1%	0~25%	16%
	Cn-47	Energy Saving Voltage lower limit (60Hz)	Cn-47=050% Hi_spd. Sav. V_Lower	1%	0~100%	50%
	Cn-48	Energy Saving Voltage lower limit (6Hz)	Cn-48=12% Lo_spd. Sav. V_Lower	1%	0~25%	12%
Energy saving tuning operation	Cn-49	Tuning operation voltage limit	Cn-49=00% Sav. Tuning	1%	0~20%	0%
	Cn-50	Tuning operation control cycle	Cn-50=01.0s Sav. Tuning period	0.1s	0.1~10.0s	1.0s
	Cn-51	Tuning operation voltage step (100% output voltage)	Cn-51=00.5% Sav. Tuning Gain 1	0.1%	0.1~10.0%	0.5%
	Cn-52	Tuning operation voltage step (5% output voltage)	Cn-52=00.2% Sav. Tuning Gain 2	0.1%	0.1~10.0%	0.2%
Energy saving coefficient K2	Cn-58	Energy-saving coefficient K2 (60Hz)	Cn-58=115.74*1 Eng. Saving coeff.	0.01	0.00~655.35	115.74*1
	Cn-59	Energy-saving coefficient reduction ratio (6Hz)	Cn-59=100% K2 Reduce Ratio	1%	50~100%	100%
	Cn-60	Motor code	Cn-60=29*2 Motor Select	–	00~FF	29*2
*3 Energy saving power detection	On-15	Power detection filter changing width	On-15=10% Power-Det. Dead Zone	1%	0~100%	10%
	On-16	Power detection filter time constant	On-16=20 Power-Det. Time Control	1 (7ms)	1~255	20 (140ms)

* 1. Differences depending on the setting of Cn-60.

* 2. The same value as Sn-01 is set by initialization.

* 3. To change any of the On-☐☐ parameters, it is necessary to set Sn-03 to 1010. Please set Sn-03 to 0000 after the On-☐☐ parameters changed.

b. Energy-Savings operation procedures

(1) Enter the Energy-savings mode by setting the third digit of the operation mode selection 5 (Sn-09) to 1. (The Energy-savings mode is already set prior to shipping.)

(2) Set Cn-60 to the motor code (refer to page App-1) which is determined by the motor capacity and voltage.

(3) Set operation frequency.

(4) Input the run command. The motor accelerates up to the set frequency (bn-01). When it reaches the set value, the Energy-savings mode is enabled and operations perform at voltages according to the load.

c. Verification of Energy-savings Power

Energy-savings power can vary by comparing power in the V/f control mode operation (Sn-09 third digit to 0) with power in the Energy-savings mode operation (Sn-08 third digit to 1). Power can be monitored by Un-06.

Energy savings values vary according to the load ratio. Little energy-savings effect is realized with load ratios exceeding 70%. As the load becomes lighter, the effect becomes greater.

d. Adjustment

Since the constants used in the Energy-savings mode are already set initially to the optimum values, adjustments are not normally needed. However, when the motor characteristics are much different from those of the TECO standard motors, or if a fault occurs because of improper constant setting, then perform the following adjustment.

Adjustment at fault Occurrence

FAULT	CORRECTIVE ACTION
Power does not change in the Energy-savings mode.	Does setting frequency exceed 100Hz? If it does, the Energy-savings mode is released.
Power variation is very small in the Energy-savings mode.	Is the load ratio excessively large? When the load ratio is excessively large, energy saved value becomes larger as the load becomes lighter.
Hunting at a light load	Increase the time constant (On-16) of power detecting filter
Current increases to cause OL1 or OL2 although within rated load torque (Especially at low frequency)	Decrease the value (Cn-46) of Energy-savings voltage upper limit at 6Hz. Or decrease the energysaving coefficient reduction ratio (Cn-59)
When the Energy-savings mode is entered after completion of acceleration, the motor stalls to a stop (especially at a light load).	Increase the lower (Cn-47 or Cn-48)
Revolutions change periodically and its cycle is almost equal to Cn-50 set value.	Decrease search operation voltage stop (Cn-51 or Cn-52)

B. PID CONTROL

a. Constants related to PID Control Mode
The table below shows the constants used in the PID control mode.

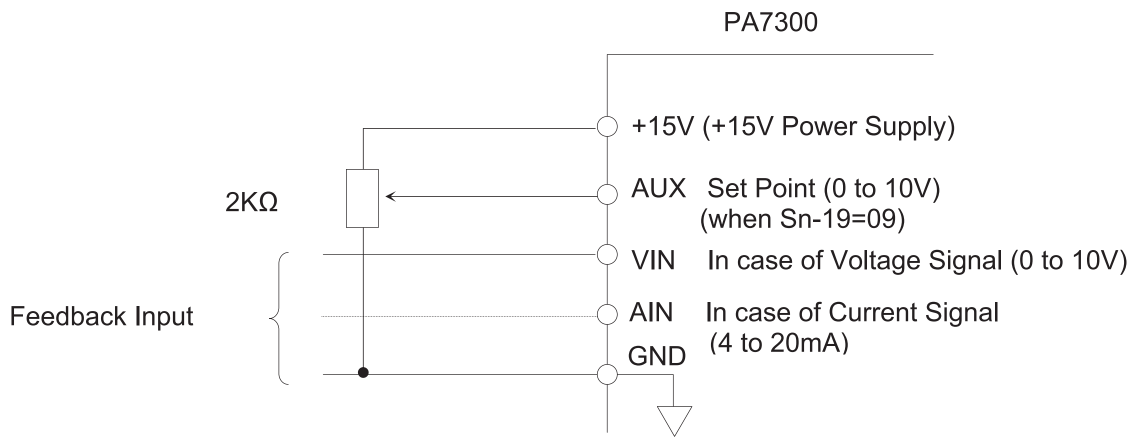
CONSTANTS USED IN PID CONTROL MODE

FUNCTION	PARAMETER NO	NAME AND DESCRIPTION	LCD DISPLAY (ENGLISH)	UNIT	SETTING RANGE	FACTORY SETTING
Setting of PID Control set points (Note 1)	An-01	Setting of set point 1 (Frequency command 1)	An-01=060.00Hz Frequency command 1	0.01Hz	0.00~180.00Hz	60.00Hz
	An-02	Setting of set point 2 (Frequency command 2)	An-02=000.00Hz Frequency command 2	0.01Hz	0.00~180.00Hz	0.00Hz
	An-03	Setting of set point 3 (Frequency command 3)	An-03=000.00Hz Frequency command 3	0.01Hz	0.00~180.00Hz	0.00Hz
	An-04	Setting of set point 4 (Frequency command 4)	An-04=000.00Hz Frequency command 4	0.01Hz	0.00~180.00Hz	0.00Hz
	An-05	Setting of set point 5 (Frequency command 5)	An-05=000.00Hz Frequency command 5	0.01Hz	0.00~180.00Hz	0.00Hz
	An-06	Setting of set point 6 (Frequency command 6)	An-06=000.00Hz Frequency command 6	0.01Hz	0.00~180.00Hz	0.00Hz
	An-07	Setting of set point 7 (Frequency command 7)	An-07=000.00Hz Frequency command 7	0.01Hz	0.00~180.00Hz	0.00Hz
	An-08	Setting of set point 8 (Frequency command 8)	An-08=000.00Hz Frequency command 8	0.01Hz	0.00~180.00Hz	0.00Hz
	An-09	Setting of set point 9 (Frequency command 9)	An-09=006.00Hz Jog command	0.01Hz	0.00~180.00Hz	6.00Hz
Setting of PID Control Constant	Bn-13	Setting of feedback adjustment (PID Detection Gain)	Bn-13=01.00 PID Gain	0.01	0.01~10.00	1.00
	Bn-14	Setting of proportional Gain (P)	Bn-14=01.0 PID P-Gain	0.1	0.0~10.0	1.0
	Bn-15	Setting of integral time (I)	Bn-15=010.0S PID I-Time	0.1S	0.0~100.0S	10.0S
	Bn-16	Setting of differential time (D)	Bn-16=0.00S PID D-Time	0.01S	0.00~1.00S	0.00S
	Bn-17	PID offset adjustment (PID Bias)	Bn-17=000% PID Bias	1%	0~109%	0%
	Cn-43	PID integral upper Bound Cn-43=100%	PID I-Upper	1%	0~109%	100%
	Cn-44 PID	primary delay time constant	Cn-44=0.0S PID Filter	0.1S	0.0~2.5S	0.0S
Integral value reset	Sn-15- Sn-18-	Integral value reset by external contact signal	–	–	–	–-
PID Control Cancel	Sn-15- Sn-18	PID Control Canceled by external contact signal	–	–	–	–
PID Control selection	Sn-19	Sn-19 PID Control mode is entered by setting Sn-19=09	–	–	–	–
Control status 4	On-04	Selection of PID Control Mode	On-04=0000 Control status 4	1	0000~1111	0000

(Note 1) The unit and setting range of An-□□ can be changed according to the setting of the operator display mode (Cn-20) as shown in the table above.

b. How to input PID control signals

For the set points, the multi-function analog input (control terminal AUX) or the Constant An-01 ~ 04 can be selected. The feedback value can be inputed from control terminal VIN (0 ~ 10V voltage signal) or the control terminal AIN. (4 ~ 20mA current signal), as shown below.



(1) When only the control terminal AUX is used: set Sn-04 = XXX0.

(2) When constant an for frequency reference is used:
Adjust the set points to An-01 to 08 and 09 The set point to be used can be selected by combination of multi-step speed reference 1, 2, 3 and jog command (setting by constant Sn-15 ~ 18), as the table below shows.

Selection of Set Points

Jog Command	Multi-step Speed 3	Multi-step Speed 2	Multi-step Speed 1	Value to be Selected
OFF	OFF	OFF	OFF	An-01
OFF	OFF	OFF	ON	An-02
OFF	OFF	ON	OFF	An-03
OFF	OFF	ON	ON	An-04
OFF	ON	OFF	OFF	An-05
OFF	ON	OFF	ON	An-06
OFF	ON	ON	OFF	An-07
OFF	ON	ON	ON	An-08
ON	–	–	–	An-09

* When Sn-04 = XXX0 is set, AUX terminal signal is used instead of An-01. An-01 is used When Sn-04 = XXX1

c. How to adjust

The PID control function is a control system that matches a feedback value to the set point. Combining P (Proportional, Bn-14), I (Integral, Bn-15), and D (Derivative, Bn-16) makes control possible even for a mechanical system with dead time. The PID control function, using different detected sensors, can be used for speed, pressure, flow, or temperature etc. applications.

(1) PID control operations.

In order to distinguish the separate PID control operations. The figure below shown the changes in the control input when the deviation between the target set point and the feed back is held constant.

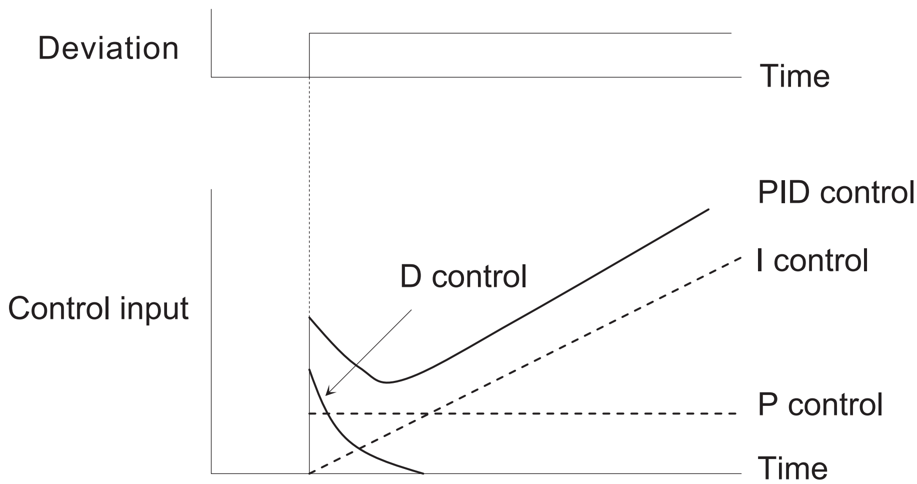


Fig. 14 PID Control Operations

- P Control: A control input proportional to the deviation is asserted. The deviation cannot be zeroed by P control alone.
- I Control: A control input which is an integral of the deviation is asserted. This is effective for matching the feedback to the target value. Sudden changes, however, cannot be followed.
- D Control: A control input which is an integral of the deviation is asserted. Quick response to sudded changes is possible.
- PID Control: Optimum control is achieved by combining the best features of P, I, and D control.

(2) Adjusting PID content

Refer to page 2-6, the block diagram of PID control selection, using the following procedure to activate the PID control and then adjust it while monitoring the response.

(I) Enable the PID control function (Setting Sn-19 = 09, and if any constant Sn-15 ~ 18 setting value is 66, then none of control terminals⑤~⑧ can be closed).

(II) Increase the proportional gain P (Bn-14) as far as possible without creating oscillation.

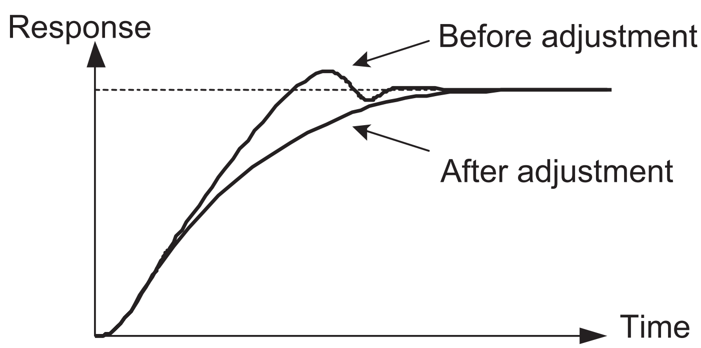
(III) Reduce in integral time I (Bn-15) as far as possible without creating oscillation.

(IV) Increase the differential time D (Bn-16) as far as possible without creating oscillation.

First set the individual PID control constants, and then make fine adjustments.

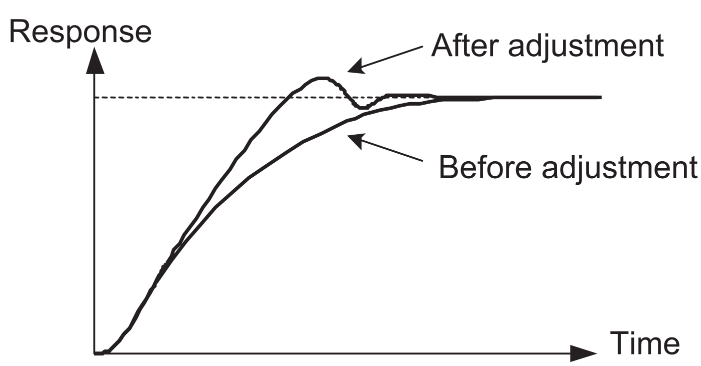
- **Reducing Overshooting**

If overshooting occurs, shorten the derivative time D (Bn-16) and lengthen the integral time I (Bn-15)



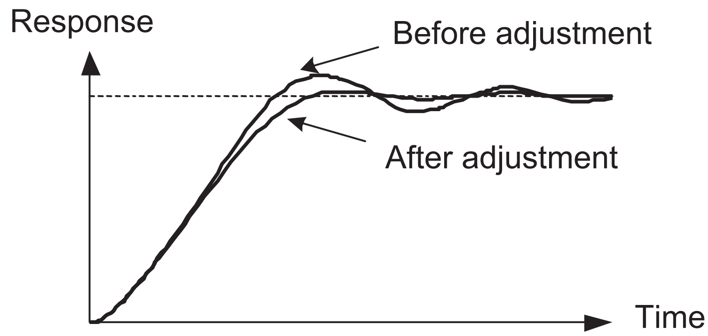
- **Rapidly Stabilizing Control Status**

To rapidly stabilize the control conditions even when overshooting occurs, shorten the integral time I (Bn-15) and lengthen the derivative time D (Bn-16)



- **Reducing Long-cycle Oscillation**

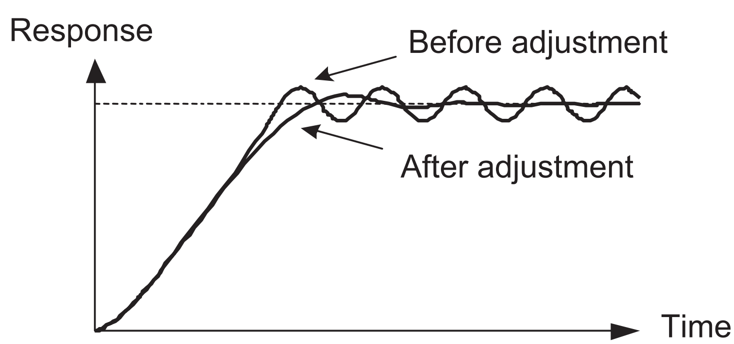
  If oscillation occurs with a longer cycle than the integral time I (Bn-15) setting, thus means that integral operation is dominant. The oscillation will be reduced as the integral time I is lengthened.



- **Reducing Short-cycle Oscillation**

  It the oscillation cycle is short and oscillation occurs with a cycle approximately the same as the derivative time D (Bn-16) setting, it means that the derivative operation is dominant. The oscillation will be reduced as the derivative time (D) is shortened.

  If oscillation cannot be reduced even by setting the derivative time (D) to "0.00" no derivative control), then either lower the proportional gain P (Bn-14) or raise the PID's primary delay time constant (Cn-44).



C. RS-485 COMMUNICATION CONNECTION DIAGRAM

The PA7300 provide PA-C (METASYS/MODBUS protocol) and PA-P (PROFIBUS-DP protocol) option card for RS-485 communication interface. The wiring diagrams of PA-C and PA-P are as below.

(a) PA-C METASYS/MODBUS protocol communication

The PA-C option card supports the METASYS/MODBUS protocol can be placed at the upper side of the control board.

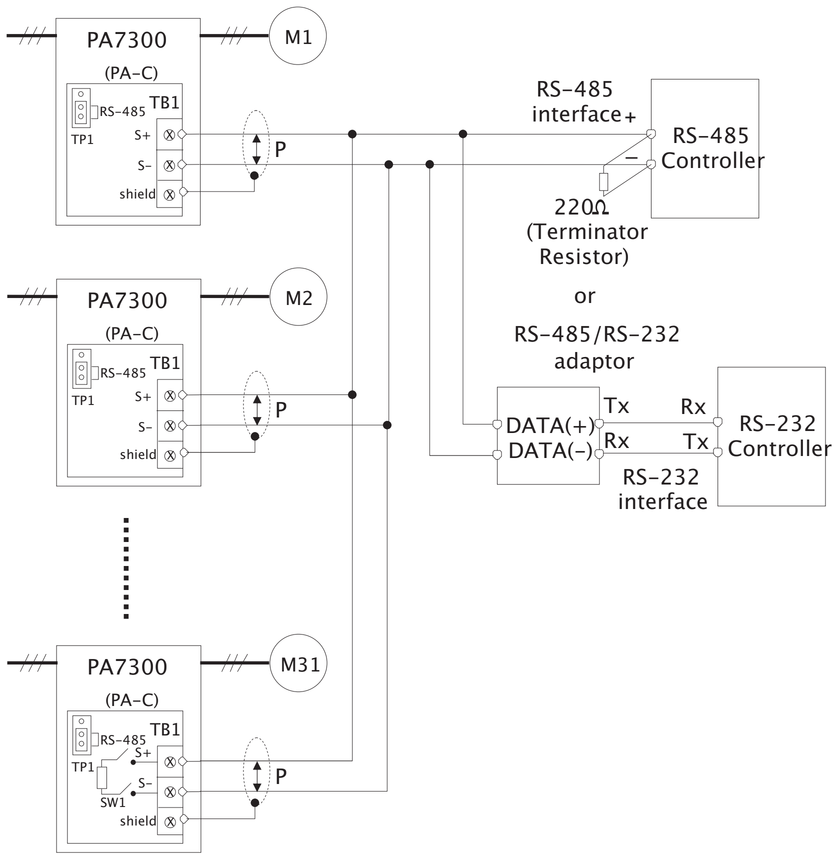


Fig. 15 Wiring for PA-C METASYS/MODBUS Protocol communication

Note:

1. A Host Controller with RS-485 interface can communicate with the PA7300 unit through the PA-C option card. If the Host Controller does not provide the RS-485 port and its RS-232 port is available, an RS-485/RS-232 conversion card should be used to connect between this Host Controller and PA-C option card of PA7300.
2. A METASYS/MODBUS Host Controller can drive the network with no more than 31 drivers connected, using MODBUS communication standard. If the driver (e.g., PA7300 drive) is at the end of the network it must have the terminating resistors 220Ω at both terminals (By SW1 dip Switch). All other drives in the system should not have their terminating resistor active.
3. The PA-C cards with RS-485 and RS-422 interface can be selected by TP1 jumper.
4. Please refer to the "PA7300 PA-C RS-485 METASYS/MODBUS Communication Application Manual".

(b) PA-P PROFIBUS protocol communication

The PA-P PROFIBUS option supports the PROFIBUS protocol. The PA-P option card can be mounted at the control board directly.

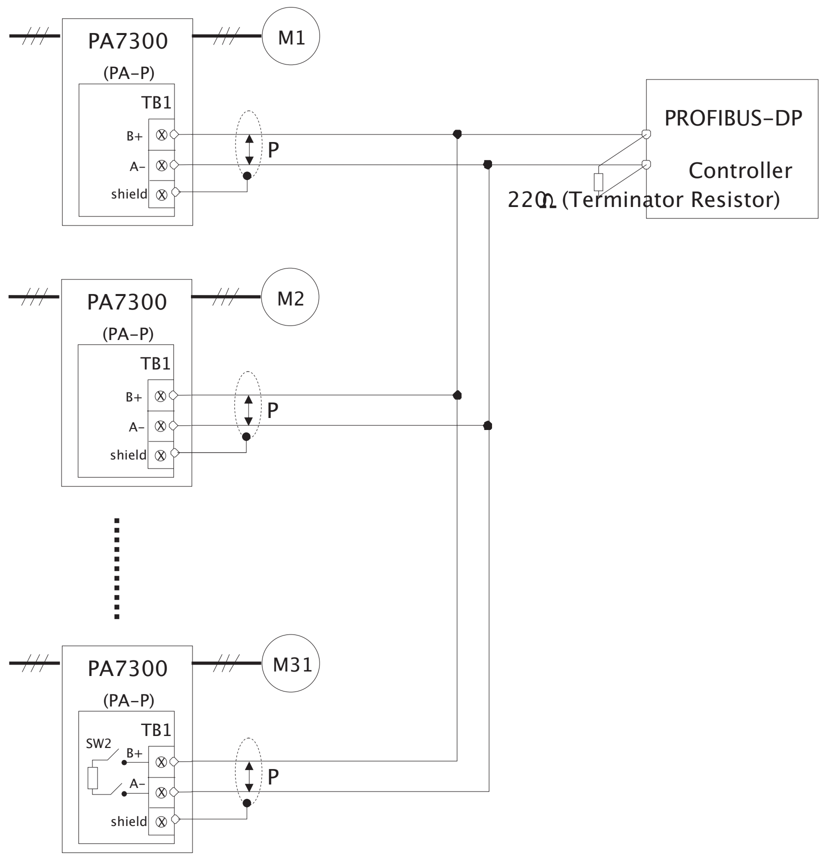


Fig. 16 Wiring for PROFIBUS protocol communication

Note: 1. A maximum of 31 PROFIBUS-DP stations (nodes) may be contained within a single network segment. If the drive is at the end of the network it must have 220Ω between terminals B+ and A- of PA-P card by SW2 dip switch.

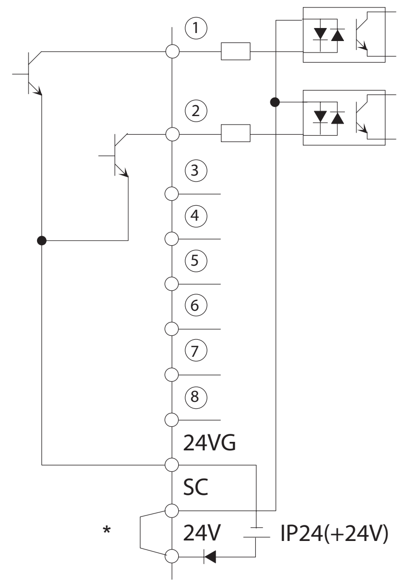
2. For more details, please refer to the manual "PA7300 PA-P PROFIBUS-DP Communication Application manual".

D. SINK/SOURCE TYPICAL CONNECTION DIAGRAM

- The terminals①~⑧ can be connected as SINK or SOURCE type input interface by changing connections of terminals 24VG, SC and 24V.

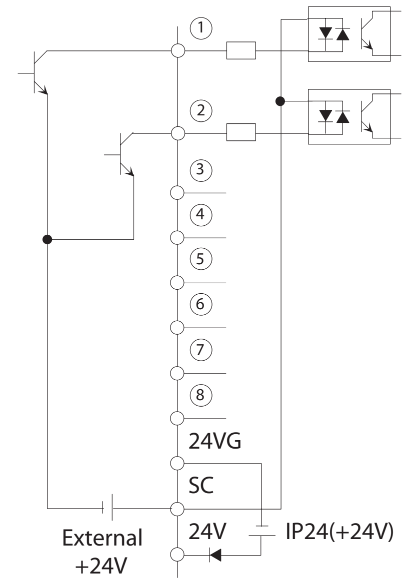
a. SINK MODE

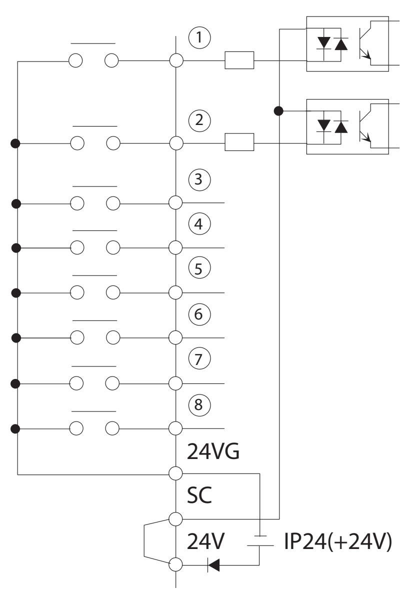
① Internal power supply (Sinking Mode)



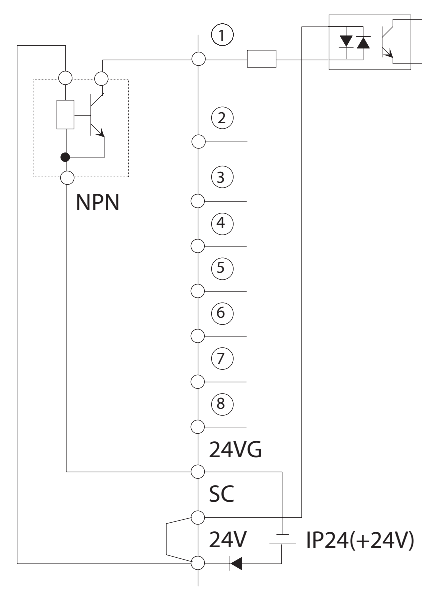
* shorted at factory setting

② External power supply (Sinking Mode)





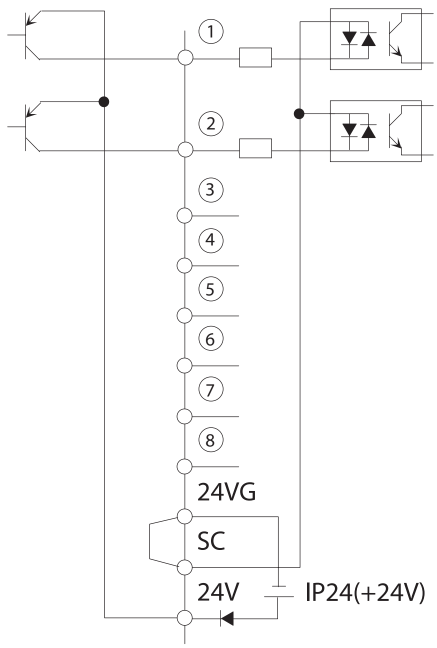
<Note 1> Contact signal used for operation signal



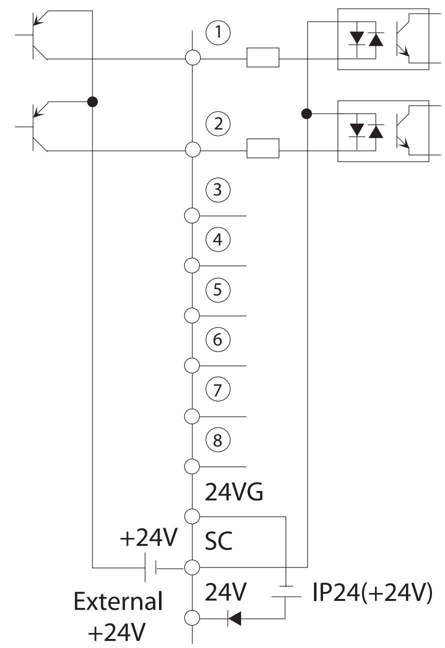
<Note 2> NPN sensor (Sink) used for operation signal.

b. SOURCE MODE

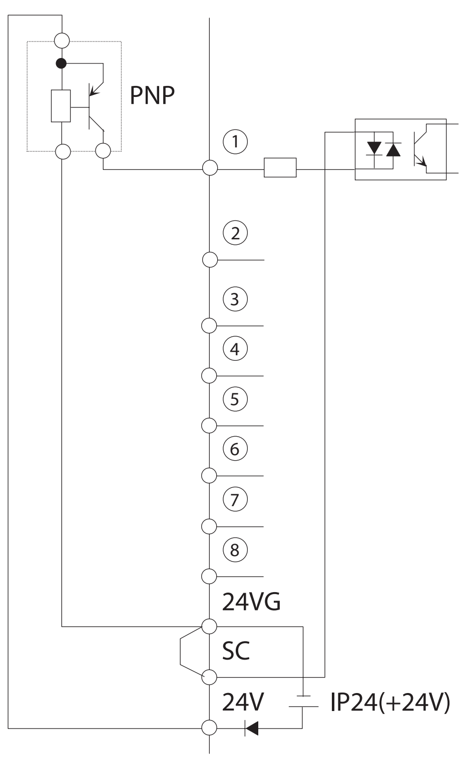
- ① Internal power supply (Sourcing Mode)



② External power supply (Sourcing Mode)



<Note 2> PNP sensor (Source) used for operation signal



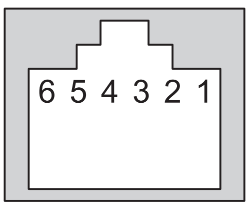
E. RS-232C SERIAL COMMUNICATIONS CONNECTION DIAGRAM

The Digital operator uses the RS-232C serial communication through connector CN1 to communicate with the control board. Using the CN1 port on the control board, parameters can be monitored and updated by a suitable PC programming tool.

The CN1 port is an un-isolated RS-232C with a bad rate of 2400 bps. Contact TECO for further information.

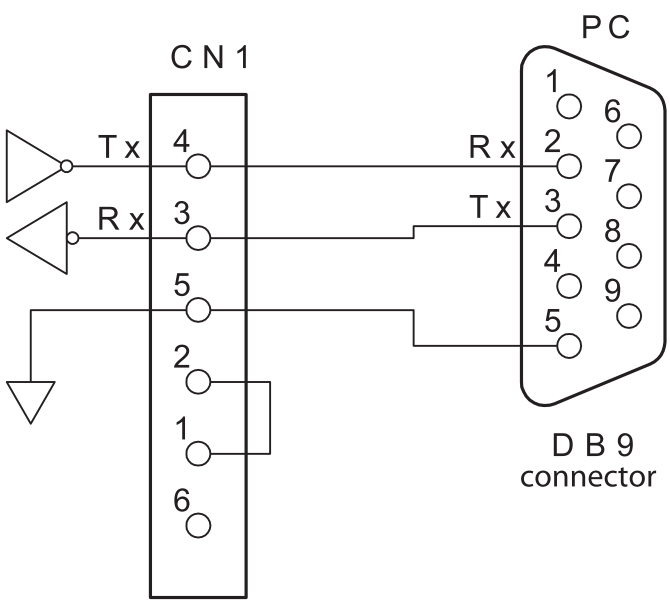
- The pin definitions of CN1

  - 6 pin telephone jack



Pin	Signal Definition
1	LCD/PC selection
2	5V
3	Rx
4	Tx
5	0V
6	Reserved (negative voltage, for LCD display)

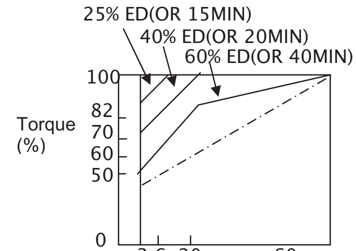
- Typical connection diagram



F. NOTES ON APPLICATION OF MOTORS

Motor Application Notes for Standard Motors

A standard motor driven by the AC Drive generates slightly less power than it does when it is driven with commercial power supply. Also, the cooling effect deteriorates in low speed range so that the motor temperature rise increases. Reduce load torque in the low speed range. Allowable load characteristics of the standard motor are shown in the figure. If 100% continuous torque is required in the low speed range, use an AC Drive duty motor.



Allowable Load Characteristics of the Standard Motor

- High speed operation
  When the motor is used above 60Hz, motor mechanical design should be verified. Contact your motor manufacturer.

• Torque characteristics
Motor torque characteristics vary when the motor is driven by an AC Drive instead of commercial power supply. Check the load torque characteristics of the machine to be connected.

• Vibrations
Because of the high carrier modulation technique for PWM control, the PA7300 series reduces motor vibration to a level equal to running with a commercial power supply. Larger vibrations may occur off of the following conditions:

(1) Response at resonant frequency of the mechanical system. Special care is required if a machine which has previously been driven at a constant speed, is to be driven at varying speeds. Installation of anti-vibration rubber padding under the motor base and frequency jump control are recommended.

(2) Rotator residual imbalance special care is required for operation at 60Hz or higher frequencies.

• Noise
AC Drive operation is as quiet as operation with a commercial power supply. At above rated speed(60Hz), noise may increase by motor cooling fan.

Application to Special Purpose Motors

Motors with Brakes	Use brake-equipped motors with an independent power supply. Connect the brake power supply to the AC Drive primary side. When the brake Operates (the motor stops) it turns the AC Drive output OFF. Some types of brakes may make abnormal sounds in low speed range.
Pole Change Motors	Select the AC Drive with a capacity exceeding the rated current of each pole. Pole change should be made only after the motor stops. If a pole is changed while the motor is rotating, the regenerative overvoltage or overcurrent protection circuit is activated and the motor coasts to a stop.
Submersible Motors	Since the rated current of underwater motors is large compared with general purpose motors, select an AC Drive with a larger capacity. If the wire length between the AC Drive and the motor is large, use cables with sufficiently large diameter.
Explosion-proof Motors	Explosion-proof motors which are applied to AC Drives must be currently approved as explosion-proof equipment. The AC Drive is not explosion-proof and should not be located where explosive gases exist.
Geared Motors	Lubrication method and continuous rotation limit differ with manufacturers. When oil lubrication is employed, continuous operation only in low speed range may cause burnout. Before operating the motor at more than 60Hz, you should consult the motor manufacturer.
Single-phase Motors	Single-phase motors are not suitable for variable speed operation with an AC Drive. If the AC Drive is applied to a motor using a capacitor stack, a high harmonic current flows and the capacitor may be damaged. For split-phase start motors and repulsion start motors, the internal centrifugal switch will not be actuated and the starting coil may be burned out. Therefore, only use 3-phase motors.

• Power Transmission Mechanism (Gear Reduction, Belt, Chain, etc.)
When gear boxes and change/reduction gears lubricated with oil are used in power transmission systems, (Continuous low speed operation decreases the oil lubrication function). Also, operation at more than 60Hz may result in noise, reduced life, etc.

G. PERIPHERAL UNIT NOTES

• Installation and selection of molded-case circuit breaker

On the input power side, a molded case circuit breaker (MCCB) to protect the AC Drive's primary wiring should be installed. The drive's power factor (depending on power voltage, output frequency, and load) must be taken into account for selecting the MCCB. For standard selection, see part page 4 I -5. If a full electromagnetic MCCB is to be used, select a larger capacity because the operating characteristics are altered by harmonic current. A leakage current breaker of AC Drive use is recommended.

• Use of input side magnetic contactor

The AC Drive can be used without an input side magnetic contactor (MC). An input MC can be used to prevent an automatic restart after recovery from an external power loss during remote control operation. However, do not use the MC frequently for start/stop operation, or it will lead to a reduced reliability. When the digital operator is used, automatic restart after power failure is disabled so that MC starting is impossible. Although the MC can stop the AC Drive, regeneration braking is disabled and the motor coasts to stop.

• Use of secondary magnetic contactor

In general, magnetic contactors on the output of the AC Drive for motor control should not be used. Starting a motor with the AC Drive at set frequency running will cause large surge currents and the AC Drive over-current protection to be triggered. If an MC is used for switching to commercial power supply, switch MC only after the AC Drive and the motor stop. To switch during motor rotation, use the speed search function.

• Use of overload relay

The AC Drive includes an electronic thermal protective function to protect the motor from overheating. If more than one motor is driven with a single AC Drive or when a multi-pole motor is used, place an overload relay between the AC Drive and the motor. Set 1 to the first position of Sn-14 (xxx1), and set the overload relay to the current nameplate value at 50Hz, or 1.1 times of that at 60 Hz.

• Power-factor improvement (elimination of phase advance capacitor)

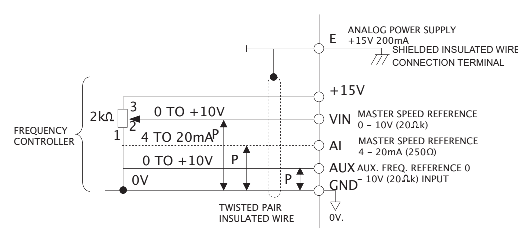
To improve the power-factor, install an AC reactor on the AC Drive's primary side. Power-factor improvement capacitors or surge suppressors on the AC Drive's output side will be damaged by the harmonic component in the AC Drive's output. Also, the over current caused in the AC Drive output will trigger the over current protection. To avoid this, do not use capacitors or surge suppressors in the AC Drive's output. To improve the power-factor, install an AC reactor on the AC Drive's primary side.

• Radio frequency interference

Because the AC Drive's I/O (main circuit) contains a higher harmonics component, it may emit RFI noise to communication equipment (AM radio, etc.) near the AC Drive. Use a noise filter to decrease the noise. Use of a metallic conduit between the AC Drive and motor and grounding the conduit is also effective. Proper routing of input and output leads is also recommended.

• Wire thickness and cable length

If the AC Drive is connected to a distant motor, (especially when low frequency is asserted,) motor torque decreases because of the voltage drop in the cable. Use sufficiently heavy wire. When a digital operator is to be installed separately from the AC Drive, use the TECO connection cable (option). For remote control with analog signals, connect the operating pot or operating signal terminal and the AC Drive within 30m of the AC Drive. The cable must be routed separately from power circuits (main circuit and relay sequence circuit) so that it is not subjected to inductive interference by other equipment. If frequencies are set not only from the digital operator but also with external frequency controller, use twisted pair shielded wire as shown in the following figure and connect the shielding to terminal E, not to the ground.



H. CIRCUIT PROTECTION AND ENVIRONMENTAL RATINGS NOTES

- Circuit Protection

  The maximum rms symmetrical amperes and voltage of the PA7300 series are listed as follows

DEVICE RATING		SHORT CIRCUIT RATING(A)	MAXIMUM VOLTAGE (V)
VOLTAGE	HP		
230V	1.5 ~ 50	5,000	240V
	51 ~ 100	10,000	
460V	1.5 ~ 50	5,000	480V
	51 ~ 200	10,000	
	201 ~ 500	18,000	
600V	1.5 ~ 60	5,000	600V
	75 ~ 100	10,000	

- Environmental Ratings
  The PA7300 is suitable for use in pollution degree 2 environments.

- Field Wiring Terminals and Tightening Torque

  The wiring terminals and tightening torque as follows.

  (The main circuit terminal specifications – use 60/75°C copper wire only)

(a) 230V class

CIRCUIT	INVERTER RATING (HP)	TERMINALS MARK CABLE SIZE	(AWG)	TERMINALS	TIGHTENING TORQUE (IN.-LBS.)
Main Circuit	5~10	⏚ L1, L2, L3, T1, T2, T3, B2, R, P, ⊖	8	M4	15.6
		–	–	–	–
	15~25	L1, L2, L3, T1, T2, T3, B2, P, ⊖	4	M5	30
		⏚	6	M6	35
	30	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4	M8	78
		⏚	6	M10	156
	40	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0	M8	78
		⏚	4	M10	156
	50	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0	M8	78
		⏚	4	M10	156
	60	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M8	78
		⏚	4	M10	156
	75	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M8	78
		⏚	2	M10	156
	100, 125	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4/0 x 2P	M10	156
		⏚	1/0	M10	156
Control Circuit	All series	1 ~ 33	24 - 14	M3	5

(b) 460V class

CIRCUIT	AC DRIVE RATING (HP)	TERMINALS MARK CABLE SIZE	CABLE SIZE (AWG)	TERMINALS	TIGHTENING TORQUE (IN.-LBS.)
Main Circuit	5~20	⏚, L1, L2, L3, T1, T2, T3, B2, R, P, ⊖	10	M4	15.6
			–	–	–
	25	L1, L2, L3, T1, T2, T3, B2, ⊕, ⊖	8	M4	15
		⏚	8	M6	35
	30	L1, L2, L3, T1, T2, T3, B2, ⊕, ⊖	8	M4	15
		⏚	8	M6	35
	40	L1, L2, L3, T1, T2, T3, ⊕, ⊖	6	M6	35
		⏚	8	M10	156
	50	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4	M6	35
		⏚	6	M10	156
	60	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4	M8	78
		⏚	6	M10	156
	75	L1, L2, L3, T1, T2, T3, ⊕, ⊖	1	M8	78
		⏚	4	M10	156
	100	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0	M8	78
		⏚	4	M10	156
	125	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M10	156
		⏚	4	M10	156
	150	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M10	156
		⏚	2	M10	156
	175	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M10	156
		⏚	2	M10	156
	215	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4/0 x 2P	M10	156
		⏚	1/0	M10	156
	250	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4/0 x 2P	M10	156
		⏚	1/0	M10	156
	300	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4/0x 2P	M10	156
		⏚	2/0	M10	156
	350, 400	L1, L2, L3, T1, T2, T3, ⊕, ⊖	650 x 2P	M12	277
		⏚	2/0	M10	156
	400, 500	L1, L2, L3, T1, T2, T3, ⊕, ⊖	650 x 2P	M12	277
		⏚	2/0	M10	156
Control Circuit	All series	1 ~ 33	20 - 14	M3	5

(c) 600V class

CIRCUIT	AC DRIVE RATING (HP)	TERMINALS MARK CABLE SIZE	CABLE SIZE (AWG)	TERMINALS	TIGHTENING TORQUE (IN.-LBS.)
Main Circuit	5~10	⏚, L1, L2, L3, T1, T2, T3, B2, ⊖, ⊕	8	M4	15.6
			–	–	–
	15~25	L1, L2, L3, T1, T2, T3, B2, ⊕, ⊖	4	M6	35
		⏚	6	M6	35
	30	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4	M6	35
		⏚	6	M10	156
	40	L1, L2, L3, T1, T2, T3, ⊕, ⊖	4	M6	35
		⏚	6	M10	156
	50	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0	M6	35
		⏚	4	M10	156
	60	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M6	35
		⏚	4	M10	156
	75	L1, L2, L3, T1, T2, T3, ⊕, ⊖	2/0 x 2P	M8	78
		⏚	2	M10	156
	100	L1, L2, L3, T1, T2, T3, ⊕, ⊖	20 x 2P	M8	78
		⏚	2	M10	156
Control Circuit	All Series	1 ~ 33	24 - 14	M3	5

I. AC Drive HEAT DISSIPATION

• 230V CLASS

AC DRIVE (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100	125
AC DRIVE CAPACITY (KVA)	6.2	9.3	12.4	18.6	24.8	27.4	33	44	55	63	81	110	125
RATED OUTPUT CURRENT (A)	16	24	32	48	64	72	88	117	144	167	212	288	327
SWITCHING FREQUENCY (KHZ)	10	10	10	10	10	6	6	6	6	3	3	3	3
FIN COOLINg	Fan cooled												
TOTAL POWER LOSS (W)	125	182	238	350	470	681	705	944	1086	1468	1924	2151	2452

• 460V CLASS

AC DRIVE (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	175	215	250	300	350	400	500
AC DRIVE CAPACITY (KVA)	6.2	9.3	12.4	18.6	24.8	29	34	45	57	66	85	115	144	176	203	232	259	290	393	446	558
RATED OUTPUT CURRENT (A)	8	12	16	25	32	38	44	59	75	86	111	151	189	231	267	304	340	380	516	585	732
SWITCHING FREQUENCY (KHZ)	10	10	10	10	10	6	6	6	6	6	6	3	3	3	3	3	3	2	2	2	2
FIN COOLING	Fan cooled																				
TOTAL POWER LOSS (W)	101	178	198	343	387	573	676	764	1010	1088	1254	1507	1882	2240	2614	3016	3487	3500	6205	7270	8808

• 600V CLASS

AC DRIVE (HP)	5	7.5	10	15	20	25	30	40	50	60	75	100
AC DRIVE CAPACITY (KVA)	6.0	8.9	10.9	16.9	22	27	32	41	52	62	77	99
RATED OUTPUT CURRENT (A)	6.1	9.0	11	17	22	27	32	41	52	62	77	99
SWITCHING FREQUENCY (KHZ)	10	10	10	10	10	10	10	10	10	10	10	4
FIN COOLING	Fan cooled											
TOTAL POWER LOSS (W)	98	170	186	325	388	520	653	744	960	1043	1227	1490

J. DRIVE INPUT FUSES

- Drive input fuses are provided to disconnect the drive from power in the event that a component fails in the drive's power circuitry. The drive's electronic protection circuitry is designed to clear drive output short circuits and ground faults without blowing the drive input fuses. The table below shows the PA7300 input fuse ratings.

AC DRIVE		DRIVE INPUT FUSE RATINGS (SEMICONDUCTOR PROTECTION)		
VOLTAGE	HP	RATED VOLTAGE	AMPS	FUSE TYPE (FERRAZ)
230V	5	300VAC	35	A30QS35-4
	7.5		40	A30QS40-4
	10		50	A30QS50-4
	15		80	A30QS80-4
	20		100	A30QS100-4
	25		125	A30QS125-4
	30		150	A30QS150-4
	40		175	A30QS175-4
	50		250	A30QS250-4
	60		250	A30QS250-4
	75		350	A30QS350-4
	100		450	A30QS450-4
	125		500	A30QS500-4
460V	5	500VAC	15	-
	7.5		20	-
	10		35	A50QS35-4
	15		40	A50QS40-4
	20		50	A50QS50-4
	25		60	A50QS60-4
	30		70	A50QS70-4
	40		90	A50QS90-4
	50		125	A50QS125-4
	60		125	A50QS125-4
	75		175	A50QS175-4
	100		225	A50QS225-4
	125		300	A50QS300-4
	150		350	A50QS350-4
	175		400	A50QS400-4
	215		450	A50QS450-4
	250		500	A50QS500-4
	300		600	A50QS600-4
	350		800	A50QS800-4
	400		900	A50QS900-4
	500		1200	A50QS1200-4
600V	5	600VAC	15	A60X15-1
	7.5		20	A60X20-1
	10		30	A60X30-1
	15		40	A60X40-1
	20		60	A60X60-1
	25		60	A60X60-1
	30		70	A60X70-1
	40		100	A60X100-1
	50		125	A60X125-1
	60		150	A60X150-1
	75		200	A60X200-1
	100		250	A60X250-1

K. CERTIFICATIONS FOR THE AC DRIVE

• CE Mark

- The PA7300 drives conform to the European Union Electromagnetic Compatibility Directive, when installed according to the recommendations described in the "EMC Installation Guideline" manual.
- The tests were made in accordance with the following basic standards:

EN55011	(2000-05) :	Conducted Emission and Radiated Emission.
EN61000-4-2	(1995-03) :	ESD
EN61000-4-3	(1998) :	RFI Immunity
EN61000-4-4	(1995-03) :	Fast Transient (Burst)
EN61000-4-5	(1995-03) :	Slow Transient (Surge)
EN61000-4-6	(1996-07) :	RF Common Mode Immunity
EN61000-4-11	(1994) :	Voltage Dips, Short Interruptions and Voltage Variations Immunity

• CSA Mark

- CSA Certificate Number : 219607
- Applicable Requirements :

C22.2 NO. 0-92 :	General Requirements
CAN/CAS – C22.2 NO. 14-95 :	Industrial Control Equipment–Industrial Products.
UL std. NO.508C :	Power Conversion Equipment

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