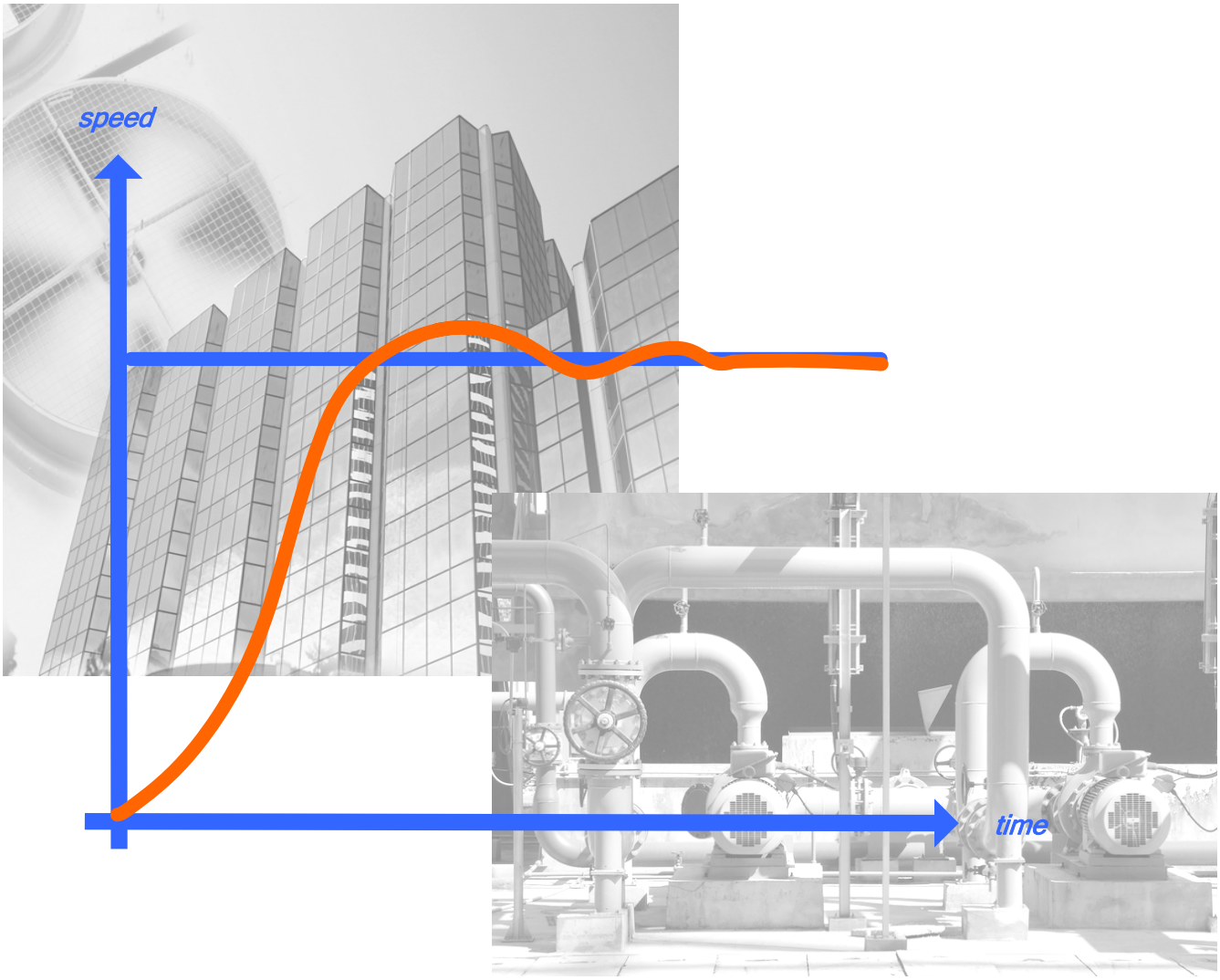
PA7300 INVERTER SERIES

PID Quick Start Manual
For Fan and Pump Applications



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PID Quick Start Guide for Fan and Pump Applications

PID is a control method that can be used for the purpose of automatically regulating flow or pressure in fan and pump applications. This guide is to simplify the start up of the PA7300 Inverter series for Fan and Pump applications using PID control. The Guide is not intended to replace the PA7300 Installation and Operation Manual 4H358D0250007, and the user is urged review this manual.

The PID method of control covered by this guide will consist basically of a ***set-point*** (operating Point, e.g. Flow, Pressure etc.) entered through the keypad and an analog **feedback** signal (0 – 10 VDC or 4 - 20 mA). These two signals are then compared, and through PID processing, correct for any load or environmental changes to maintain the ***set-point***. Only the **(P)** *proportional* and **(I)** *integral* parameters will be set and adjusted through the keypad to optimize performance. The parameter **(D)** *derivative* will not be discussed or used in this guide as the factory setting is usually sufficient for Fan and Pump applications. Although the inverter can be controlled via *Serial Communication* It is beyond the scope of this guide. For Serial Communication control or special external control, the user is referred to the PA7300 Installation and Operating Manual.

SAFETY FIRST!

Step 1 - Before Starting the Inverter

- Referring to the PA7300 Instruction Manual, please review and verify that the correct inverter size for the motor was received free of damage. To ensure personnel safety and to avoid equipment damage, follow the precautions and the installation procedures for mounting, wiring, and operating environment.

  CAUTION - ***To avoid damage to the inverter when removing the inverter cover and/or LCD Operator, refer to Appendix B for the proper procedure.***

- In accordance applicable codes make electrical connections to the motor and input power terminals. (Refer to the block diagram, Fig. 4). *No other external connections should be made at this time, as the initial control will be from the Keypad.*

Step 2 - Apply Power to the Drive

- Apply AC power to the Inverter and observe the LCD Display Line 1; it should read "**Freq. Cmd 0.00Hz**". Line 2 should read "**TECO**". The red LED on the ***STOP*** key should be *ON*. The ***DRIVE*** and ***FWD*** LED's should be *ON*. (See Fig. 1 below)

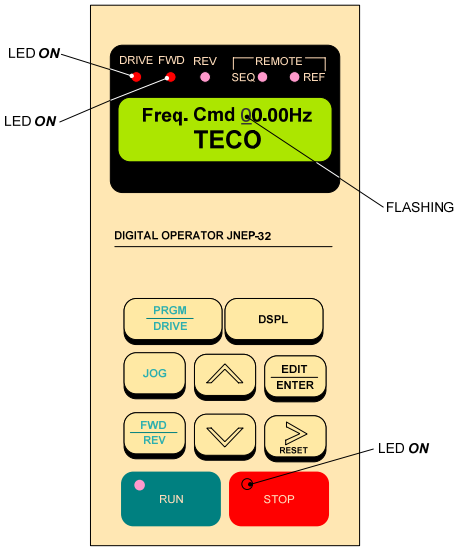


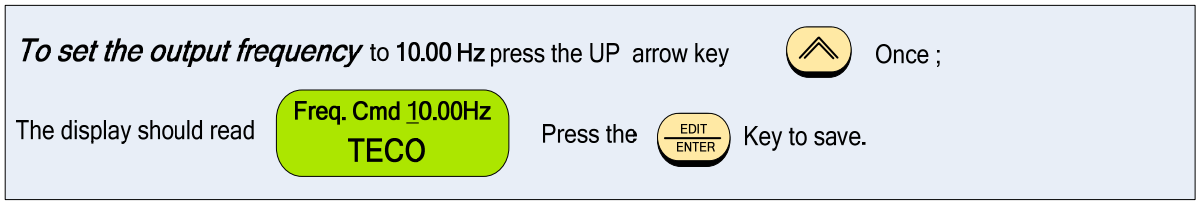
Fig. 1 PA7300 KEYPAD

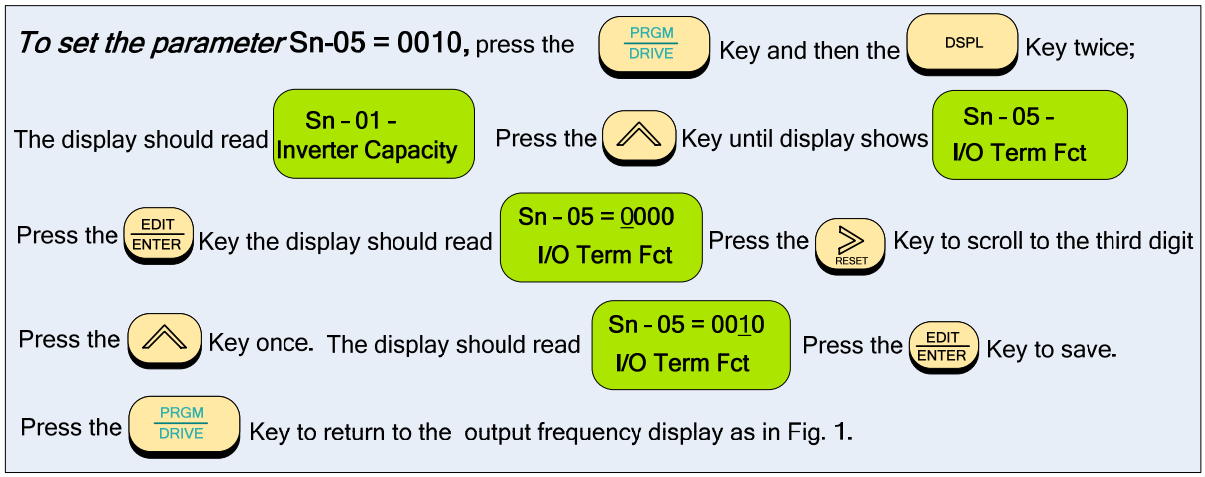
Step 3 - Set Drive to Run Mode

- If the red ***DRIVE*** LED is not ON with AC power up, press the ***PGRM / DRIVE*** key until the red ***Drive*** LED is *ON*. The Inverter is now in the **RUN** mode.

Step 4 - Check Fan or Pump Motor Operation

- Enter **10.00Hz** for the frequency reference and set parameter ***Sn-05 = 0010*** to disable Reverse Direction operation. ***Note***: *The output from the inverter is displayed in* ***Hz*** *as factory default. If desired, the output may be displayed in per cent* ***(%)*** *of full speed.* ***(see appendix)***





- Press the ***RUN*** key, and check the fan or pump direction of rotation. If the direction is not correct, press the ***STOP*** key and wait until the fan or pump has come to a complete *STOP.* Next, ***Power Down the inverter.***

  Danger

  After the power has been turned OFF, wait at least 5 minutes until the charge indicator extinguishes completely before touching any wiring, circuit boards or components.

- Reverse any ***two*** of the fan or pump motor connections at the inverter (U(T1),V(T2), or W(T3)). Next, following ***STEP 2,*** Power-up the inverter; the motor direction should now be correct.

Step 5 **– Select Method of Control (*Sn-04*) and PID Command (*Sn-19*)**

- Before selecting these parameters, **ensure the inverter is in the *STOP* mode.**
- The ***set-point*** is selected by the keypad, and the ***start / stop*** method can be from the keypad or external contact (***see Fig. 2A***). NOTE: The set-point can also be set from an external source but commonly it is set from the keypad.
- Parameter **Sn – 04** is used to select the method or control and the values are shown in the following Table.

Parameter Sn – 04 =		
Function	*Start / Stop*	*Set - Point*
0011	Keypad	Keypad
0001	External Contact	Keypad

- Parameter **Sn – 19** is used to select the PID operation mode and is to be set **= 09.**
- To set parameters **Sn – 04** and **Sn-19** follow the navigation procedure below.

To set parameter Sn-04 press the PRGM/DRIVE Key, and then the DSPL Key twice;

The display should read; Sn - 01 - Inverter Capacity Press the ∧ Key until display shows Sn - 04 - Stopping Method

Press the EDIT/ENTER Key; the display should read Sn - 04 = 0000 Stopping Method To select the desired combination in

accordance with the Table value, Press the RESET Key to scroll to the digit position and the ∧ Key

to select the digit value (0 or 1). After the selection press the EDIT/ENTER Key to save.

To set parameter Sn-19 press the DSPL Key; the display should read Sn - 04 - Stopping Method

Press the ∧ Key until the display shows Sn - 19 - Multi_ Fct Input Press the EDIT/ENTER Key; the display

should read Sn - 19 - 00 Auxilary Freq Cmd Press the ∧ Key until display shows Sn - 19 - 09 PID Command

Press the EDIT/ENTER Key to save. Press the PRGM/DRIVE to return to the output frequency display as in Fig. 1.

Step 6 – Making External Control Connections

- ***Before removing any covers or making any external control connections, power down the inverter.***

Danger

After the power has been turned OFF, wait at least 5 minutes until the charge indicator extinguishes completely before touching any wiring, circuit boards, or components.

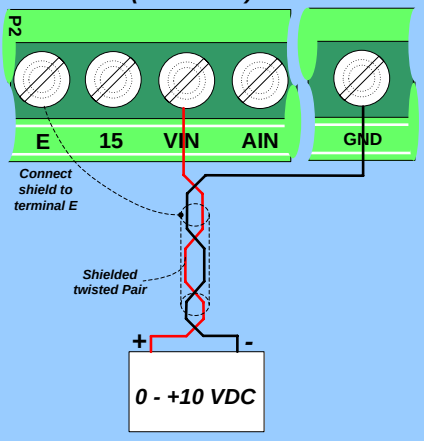
- In the following pages are wiring examples for (analog) feedback, (digital input) Start / Stop, E-Stop, (digital output) Restart, and Fault indication connections.

ANALOG FEEDBACK terminal connections

Fig's 2a,2b,and 2c, show the analog feedback schemes for ***0-10VDC or 4-20mA*** devices to control flow, level, pressure, etc.

Fig. 2a 0 - +10 VDC Analog Feedback

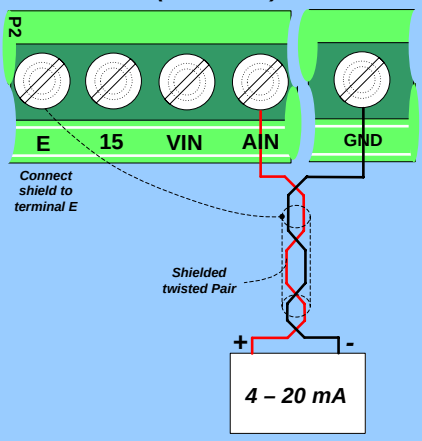
(Notes 1&2)



0 - +10 VDC FEEDSBACK VOLTAGE SOURCE

Fig. 2b 4 – 20 mA Analog Feedback

(Notes 1&2)



4 – 20 mA FEEDBACK CURRENT SOURCE

NOTES:

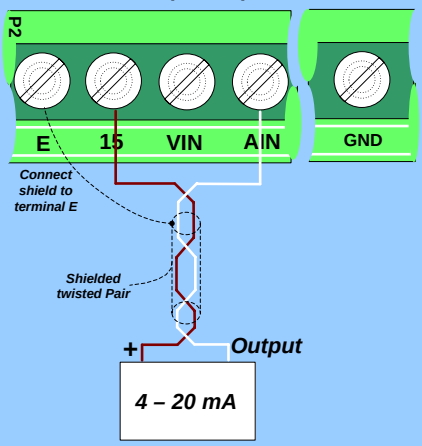
1 - Before connecting any feedback device, be sure to read the manufacturers instructions thoroughly as wiring color codes and connections may vary.

2 - Fig's 2a and 2b show typical connections for 0 - +10VDC and 4 – 20 mA feedback devices. The wiring color codes red and black and the connections shown are for illustrative purposes and may be different for a particular feedback device.

3 - As an example Fig. 2c shows the connections for a 4-20 mA pressure transducer used in water pump applications. Note that the color code is brown and white and the connections are to +15 and AIN .

Fig. 2c 4 – 20 mA Analog Feedback

(Note 3)



4 – 20 mA Pressure Tranasducer

DIGITAL INPUT / OUTPUT terminal connections

Fig's 3a, 3b, and 3c below show the terminal connections for input control functions. The connections shown are typical and the user is referred to the **PA7300 Manual** if additional information is required. Fig.3d shows an example for the use of the ***Fault Output Relay***.

Fig. 3a Start / Stop switch connection

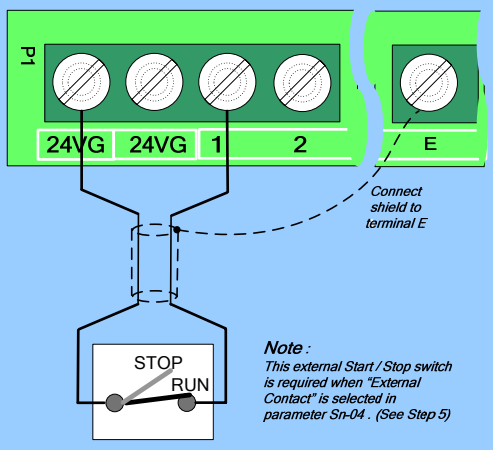


Fig. 3b External Fault contact connection

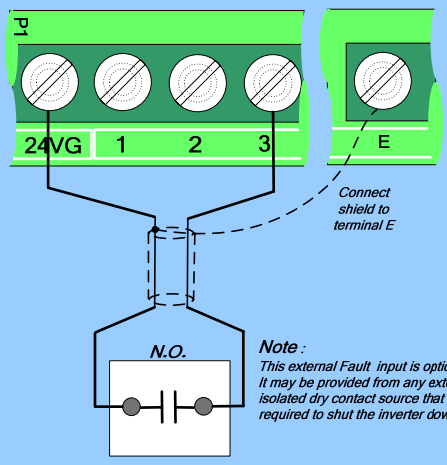


Fig. 3c Fault Reset switch connection

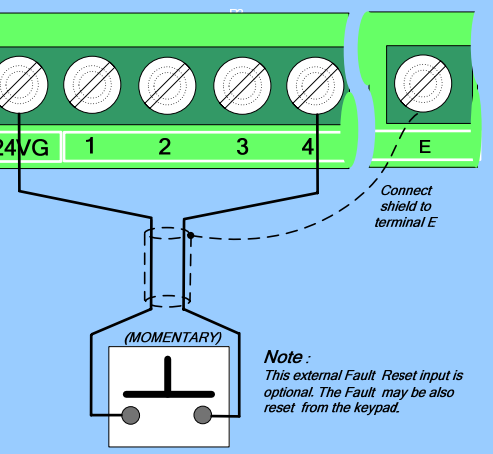
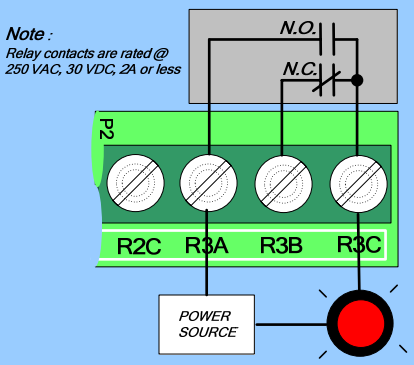


Fig. 3d Fault output contacts

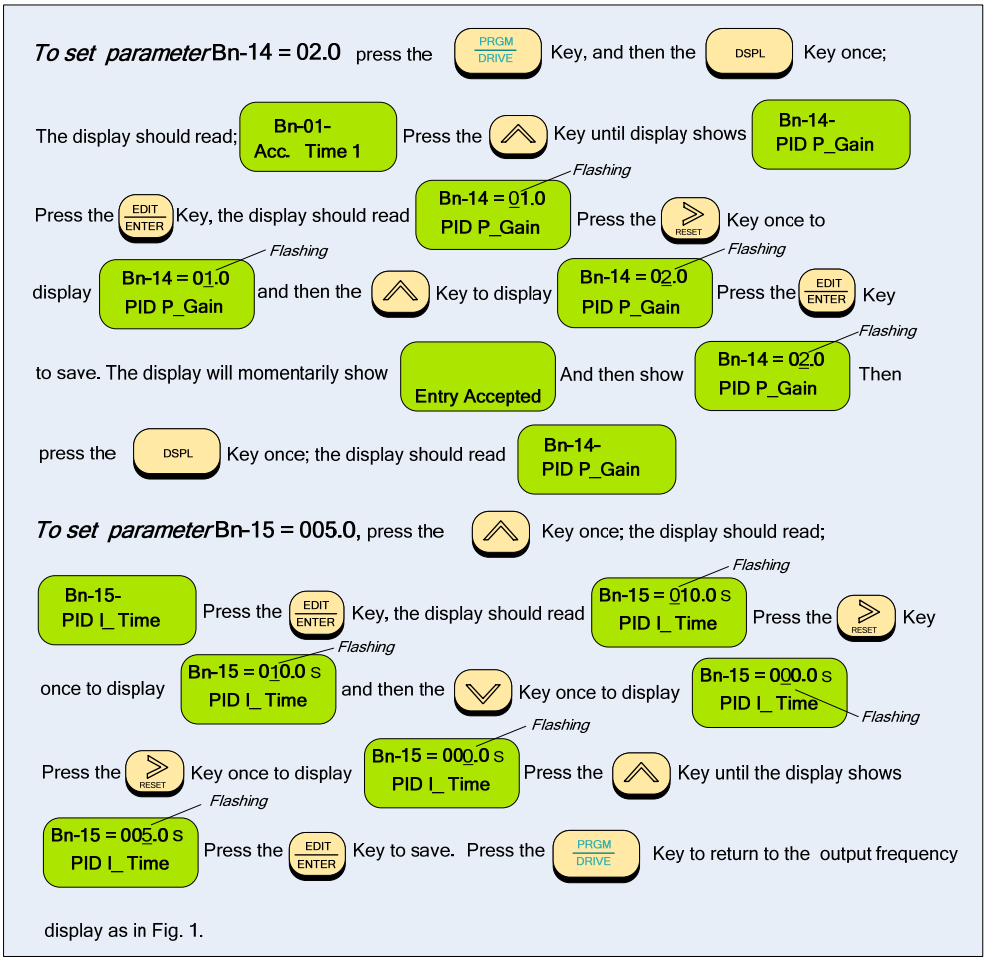


Step 7 – Setting PID Parameters; Proportional Gain (Bn-14) and Integral Time (Bn-15)

A Word About PID Control-

The PID control serves to maintain a given process within certain limits whether it be pressure, flow etc. To do this the ***feedback*** signal is compared to the ***set-point*** and the difference becomes the error signal for the PID control. The PID control then responds by trying to minimize this error. How small the difference becomes is dependent upon the value of the ***Proportional Gain*** set by parameter ***Bn-14***. The greater the gain the lower the difference. However, in any system as the gain is increased there is a point that the system will become unstable (oscillate). To correct this instability, the response time of the system may be ***slowed*** down by increasing the ***Integral Time*** set by parameter ***Bn-15***. However slowing the system down too much may be unsatisfactory for the process. The end result is that these two parameters in conjunction with the acceleration (***Bn-01***) and deceleration (***Bn-02***) times (see ***STEP 8***) are adjusted to achieve optimum performance for a particular application.

- After all external connections have been made and the protective covers have been replaced, ***POWER UP*** the inverter ***but do not RUN at this point***.
- Parameters ***Bn-14 = 1.0*** (*Proportional Gain*) and ***Bn-15 = 10.0s*** (*Integral Time*) are factory set to the values shown. However, a good starting point for these values is setting the ***Proportional Gain Bn-14 = 2.0*** and the ***Integral Time Bn-15 = 5.0s***. To change these parameters, follow the keypad navigation procedure below.



Step 8– Setting Parameters, Acceleration (Bn-01) and Deceleration (Bn-02) Times

- *Acceleration* and *Deceleration* times as well as the PID control [(*P) Proportional Gain* and/or the *(I) Integral Time (see STEP 7)*] directly control the system dynamic response. In general, the longer the acceleration and deceleration time, the slower the system response, and the shorter time, the faster the response. An excessive amount of time can result in sluggish system performance while too short of a time may result in system instability.

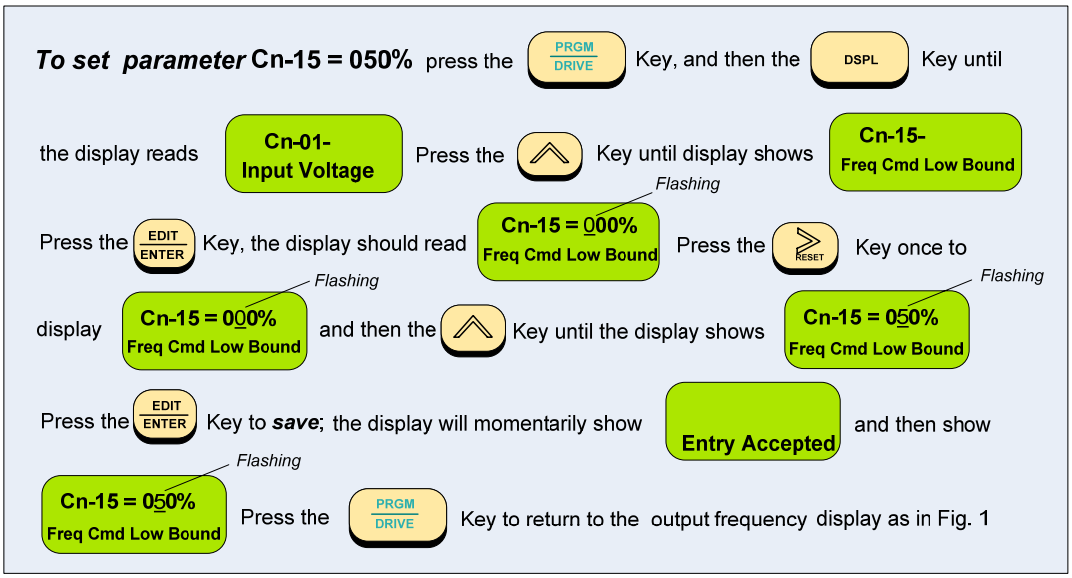
  The starting values suggested by this guide normally result in good system performance for the majority of Fan and Pump applications. If the values need to be adjusted, caution should be exercised, and the changes should be in small increments to avoid system instability.

- Parameters ***Bn-01*** *(Acceleration)* and ***Bn-02*** *(Deceleration)* are ***both*** set at the factory for ***10.0 seconds.*** For Fan and Pump applications, the recommended starting values are ***30 seconds.*** To change these parameters, follow the keypad navigation procedure below.

Step 9 – Setting Minimum Speed in Pump Applications

(NOTE: In the case of a Fan application skip this step and go to Step 10)

- In the case of pump applications it is normally required to limit the minimum speed that the pump will operate regardless of the input speed command. The pump minimum speed is usually specified either by the pump manufacturer or the application. Once this value has been established, the minimum output frequency of the inverter and thus the minimum motor (pump) speed can be set by parameter ***Cn-15.*** This parameter sets the minimum inverter frequency output, and thus a minimum motor (pump) speed to a ***percentage*** of the maximum output command frequency.
- The following is an example of setting the minimum motor (pump) speed to ***900 RPM,*** which is ***50%*** of the maximum pump speed, ***1800 RPM***.



Step 10 – Testing The System

- The system can now be tested for performance. To do this, set the ***set-point*** through the keypad and run the drive at some low level. Check that the motor is operating properly and that the ***feedback*** signal level and polarity are correct.
- Check the system for dynamic operation and make any adjustments necessary for optimum performance. This may require making adjustments to parameters ***Bn-14 proportional gain*** and ***Bn-15 Integral Time. (Refer to Step 7)***

NOTE: Parameters Bn-14 and Bn-15 may be changed through the keypad while the system is operating.

A word of CAUTION ! - the parameter changes should be made in small increments and the results checked to avoid highly unstable and possibly damaging conditions.

- This should complete the installation.

PA7300 BLOCK DIAGRAM

Fig. 4 is an overall basic electrical connection diagram for the **PA7300**. It is used in conjunction with the other sections of this guide to give the user the ability to successfully start up a Fan or Pump application. More detailed information is available in the **PA7300 Manua**l to which the user Is referred, if further information is required.

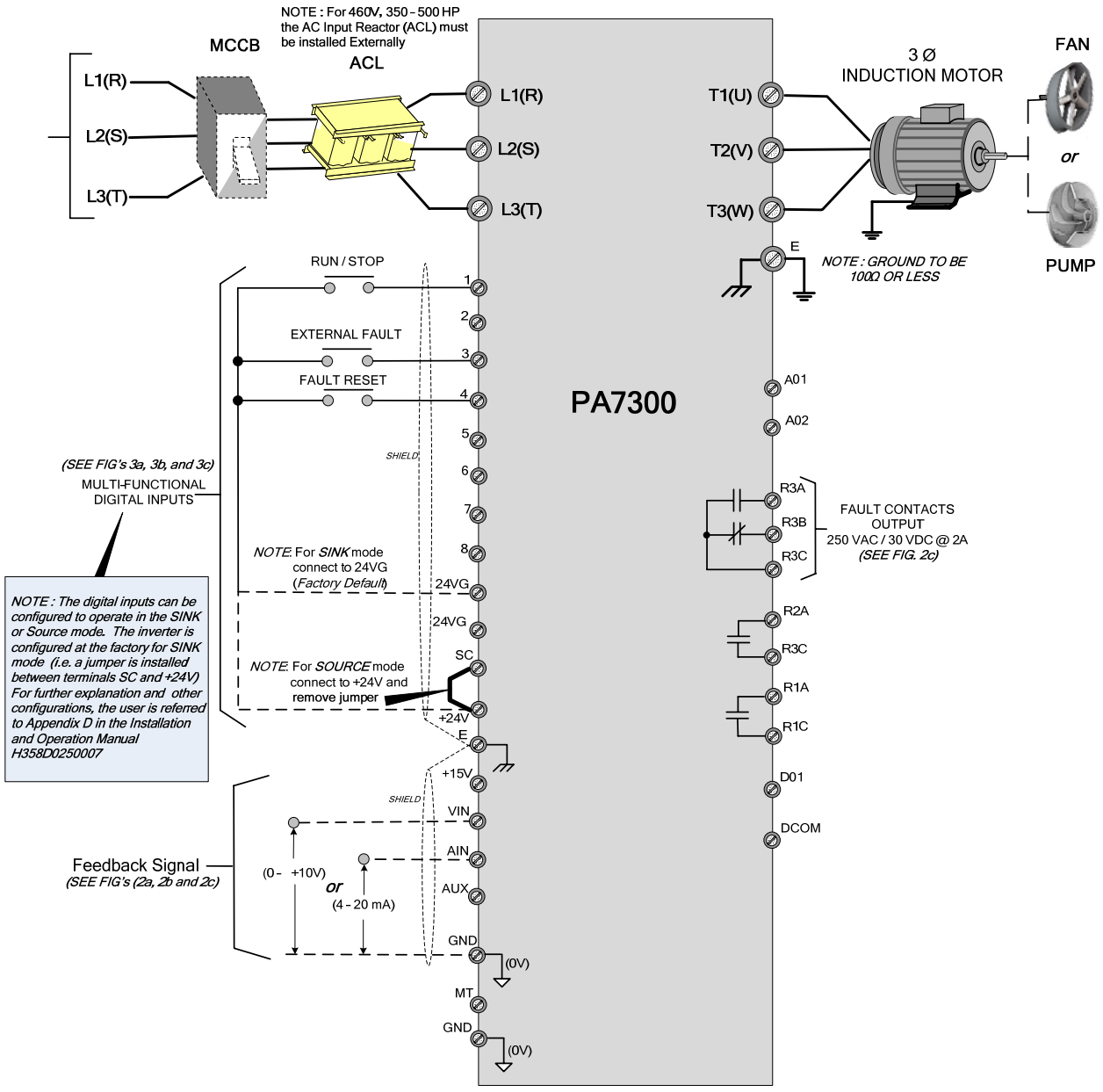


Fig. 4 PA7300 Fan or Pump APPLICATION DIAGRAM

Appendix A-

Changing display to read output speed in percent (%) of full speed.

The display is factory defaulted to show the inverter output frequency in **Hz**. If desired, the display can be changed to show the output frequency as a ***percentage*** of full speed. To do this parameter **Cn-20** must be changed from (00000) to (00001) as follows:

To set parameter Cn-20 press the PRGM/DRIVE Key, and then the DSPL Key 4 times;

The display should read Cn - 01 - Input Voltage Press the ^ Key until display shows Cn - 20 - Operator DSPL Unit

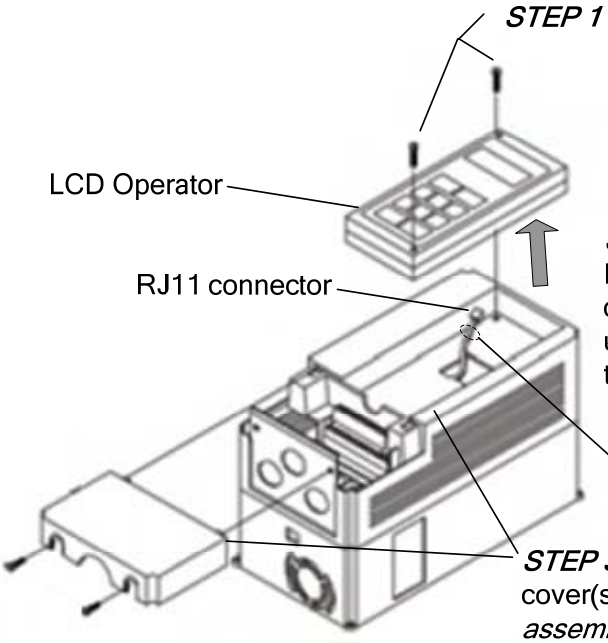
Press the EDIT/ENTER Key; the display should read Cn - 20 = 00000 DSPL Unit .1 Hz Press the RESET Key and scroll to the

last digit position and then press the ^ Key; The display should read Cn - 20 = 00001 DSPL Unit .1 %

Press the EDIT/ENTER Key to save. Press the PRGM/DRIVE to return to the main display.

Appendix B -

Removing the LCD Digital Operator and Inverter Cover(s)



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