GPD 503

HVAC Software

Effective 01/18/95

CONTENTS

INTRODUCTION

The HVAC software option provides a number of unique features that can provide superior operation of HVAC systems. These functions are contained in an EPROM set that can be installed into existing GPD 503 drives or ordered on new drives directly from the factory. This EPROM applies to GPD 503 460VAC from 1 thru 75 hp and 230VAC models 1 thru 40hp variable torque.

Additional Functions

Elapsed Time Meter
Kilowatt Hour Meter
Energy Cost Totalizer
Air Proving Function
Analog Output proportional to the output power and the PID function's error
Sleep function
PID function

NOTE: Option cards will not operate after this software has been installed.

(Continued)

EPROM INSTALLATION

☐ **IF your HVAC EPROMs WERE NOT factory installed, complete steps 1 thru 6 below.**

☐ **IF your HVAC EPROMs were factory installed, proceed to step 7.**

WARNING

Hazardous voltage can cause severe injury or death. Lock all drive power sources in the "OFF" position before servicing drive.

CAUTION

The supplied EPROMs are electrostatic-sensitive devices. Personnel must be properly grounded before removing and installing carton contents.

1. Turn off all electrical power to the drive.
2. Remove the front cover of the drive. Verify that the "CHARGE" indicator lamp inside the drive is off (allow time for the drive to discharge).
3. Use a voltmeter to verify power has been disconnected at incoming power terminals (L1, L2 & L3).
4. The HVAC software kit contains two EPROMs. See Figure 1. Remove the standard EPROM set from your GPD 503 drive, and install the HVAC EPROM set as shown. Be sure to locate U5 and U6 in their proper place, with the notches facing left! Failure to do this will ruin the EPROMs.
5. Replace the front cover.
6. Apply power to the drive.

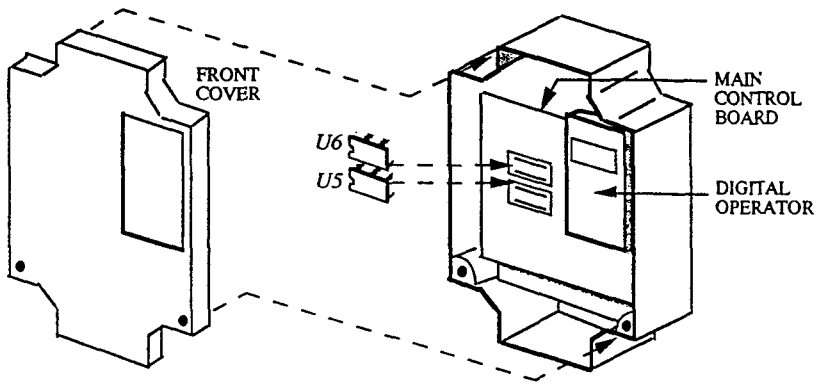


Figure 1. Installation of HVAC EPROM Set in GPD 503

(Continued)

7. After changing EPROMs, the drive must be reset (see Section 3 in the GPD 503 technical manual for details on programming the drive):

   - ☐ Press PRGM/DRIVE key. DRIVE lamp is now off.
   - ☐ Press DSPL key until display reads " Sn-01 ".
   - ☐ Press "up arrow" key until display reads " Sn-03 ".
   - ☐ Press DATA/ENTER key. Display reads " 0000 ".
   - ☐ The far left digit is blinking. Press the "up arrow" key, "down arrow" key, or "right arrow" key to enter the following in Sn-03:

     " 1110 " — 2-Wire Control (maintained contact start/stop)
     " 1111 " — 3-Wire Control (momentary contact start/stop)

   - ☐ Press DATA/ENTER key. Display flashes " End ", then displays " 0000 ". The drive is now reset.

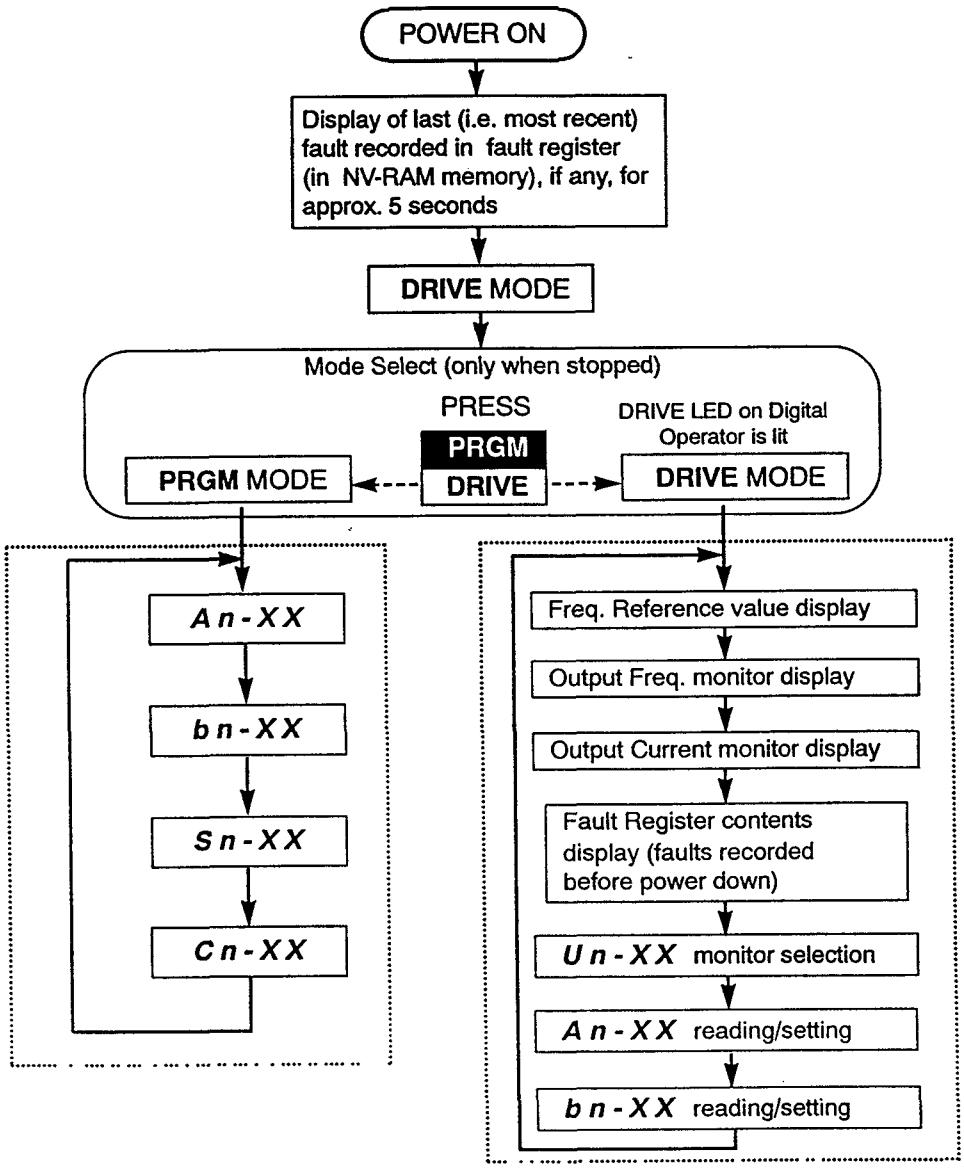
8. Proceed to next page for "HVAC PROGRAMMING INSTRUCTIONS".

HVAC PROGRAMMING INSTRUCTIONS

1. If your HVAC EPROMs were factory-installed, go to step 2.

   If your HVAC EPROMs WERE NOT factory-installed, and have yet to be installed, return to "EPROM INSTALLATION" on page 2 and install the HVAC EPROMs before proceeding.

2. Familiarize yourself with the drive's Digital Operator. See TM 4231, page 3-1, for complete description.



HVAC EPROM SOFTWARE FUNCTIONS

— Elapsed Time Meter (Hours)

Monitor constant **Un-13** indicates the amount of time that the drive has been running. This timer starts to count when the drive starts running. The time is written into the NV-RAM in one hour increments. The range of the timer is 0 to 65,535 hours. After 65,535 hours of continuous operating time (approximately 7.5 years), the timer resets itself and restarts from 0.

Setting Sn-03 to " 0011 " will also reset this timer.

— Kilowatt Hour Meter

Monitor constants **Un-14** and **Un-15** indicate the kilowatt hours (KWH) of energy that the drive is consuming. This meter starts when the drive starts running. Every one second, the meter is incremented and the data is written into the NV-RAM. The range of the meter is 0 to 655,359,999 watt hours (WH). Un-14 indicates from 0 to 9999 watt hours. Un-15 indicates from 1*E04 to 65534*E04 watt hours. After 655,359,999 watt hours of continuous energy consumption, the meter resets and restarts from 0. As an example, a 50HP fully loaded Drive will run continuously for approximately 2 years before this meter resets.

Setting Sn-03 to " 1100 " will also reset this meter.

— Energy Cost Totalizer

Monitor Constant **Un-16** indicates the total cost of energy in dollars the drive has been consuming.

NOTE: Cn-47 must be set to energy cost in cents/KWH.

The calculation is performed by the following formula:

Total Cost ($) = ((Un-14 + Un-15 value) / 1000) * Cn-47 (cents/KWH)

The unit is dollars ($). The range is from 0 to 65,535.

— Air Proving Function

The air proving function is designed to indicate belt break or other problem associated with the rotation of a fan. When the belt between the motor and the fan breaks, the motor operates under an unloaded condition. This function detects a belt failure by sensing the rapid decline in torque at the motor.

Setting Sn-07 to 1011 will enable the undertorque detection during operation.
Setting Sn-07 to 0011 will enable the overtorque detection during operation.
Setting Sn-07 to 1111 will enable the undertorque detection during operation and will allow the motor to coast to a stop after an undertorque situation is detected.

Setting Sn-20 to 0E will provide a fault indication at terminals 9 and 10.

Cn-26 must be set to the percent of drive rated amps that represents the amp draw of the motor in an unloaded condition. Unloaded amps are typically in the range of 25% to 35% of full load amps. Divide that number by the rated amps to determine the percentage to input to Cn-26.

Cn-27 is the detection time for the undertorque condition, in seconds.

— Analog Monitor Output (0 to 10 Vdc, between terminals 21 and 22) Proportional to the Output Power and the PID Error

The setting of Sn-08 selects the parameter output throughout the analog output.

XX00 : Output frequency
XX01 : Output current
XX10 : Output power
XX11 : PID error

- **Analog output proportional to the output power**

  Output voltage = (Output Power (KW) / Drive rated power [Sn-01]) * analog monitor gain [bn-11] * 10 Volts

- **Analog output proportional to the PID error**

  Output voltage = (PID Error / 100% (= maximum frequency)) * analog monitor gain [bn-11] * 10 Volts

NOTE: This function only performs when the PID function is selected (Sn-19 set to 09). If not, the analog output is always 0 V.

– Sleep Function

This function provides a deadband in drive operation that increases control flexibility, and a scheme to reduce unnecessary operation of the equipment. It is useful for applications which require a minimum operating speed. For example, a pump may have to move ar 25% rated speed in order to move liquid. When using the sleep function, a sensed variable like temperature or pressure must deviate by a large enough amount before the drive is allowed to run. For example, the temperature in a space may be allowed to drift past a set point by so many degrees before a fan is started. When the signal from the sensed variable is below a certain point (Fbase), the drive and motor are off.

This function operates when Fbase [Cn-46] is set to some value other than zero (in %) and Sn-04 is set to " XXX1 ". The drive starts to run when the analog frequency reference is above the Fbase setting and external Run (terminal 1 to 11) is closed It stops when the analog frequency reference goes below the Fbase setting or terminals 1 and 11 are opened

(Continued)

See timing chart:

1. The drive is stopped.
2. External Run is closed but the analog frequency reference is still below Fbase. The drive remains stopped.
3. The drive starts to accelerate after the analog frequency reference goes above the Fbase.
4. The drive is running at set frequency.
5. The external Run is opened. The drive begins decelerating.
6. The external Run is closed and the analog frequency reference remains above Fbase. The drive accelerates to set frequency.
7. The analog frequency reference is reduced below Fbase. The drive will stop even if the external Run is closed.
8. The drive is decelerating to stop.

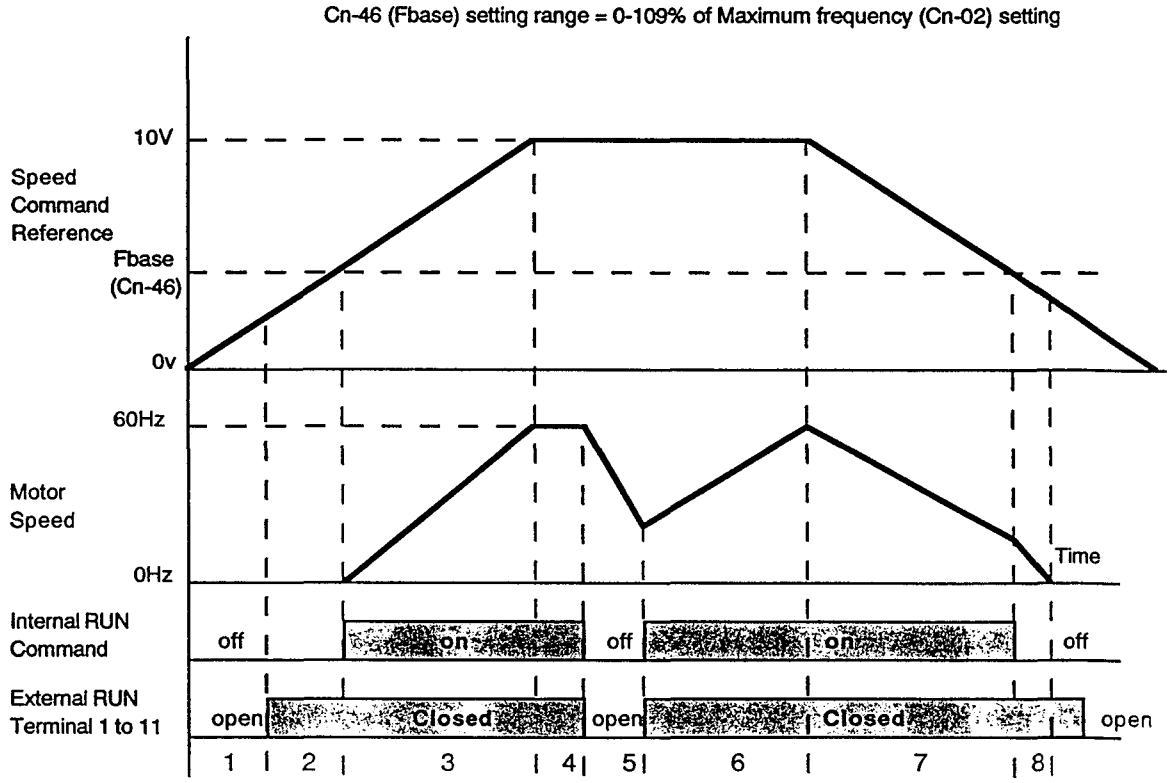


Figure 2. Sleep Function Time Chart

— PID Control

The PID Control increases, decreases, or holds drive speed by comparing setpoint signal to feedback (transducer) signal. There are three possible conditions:

Setpoint Value	<	Feedback Value	Drive speed decreases
	=		Drive speed holds
	>		Drive speed increases

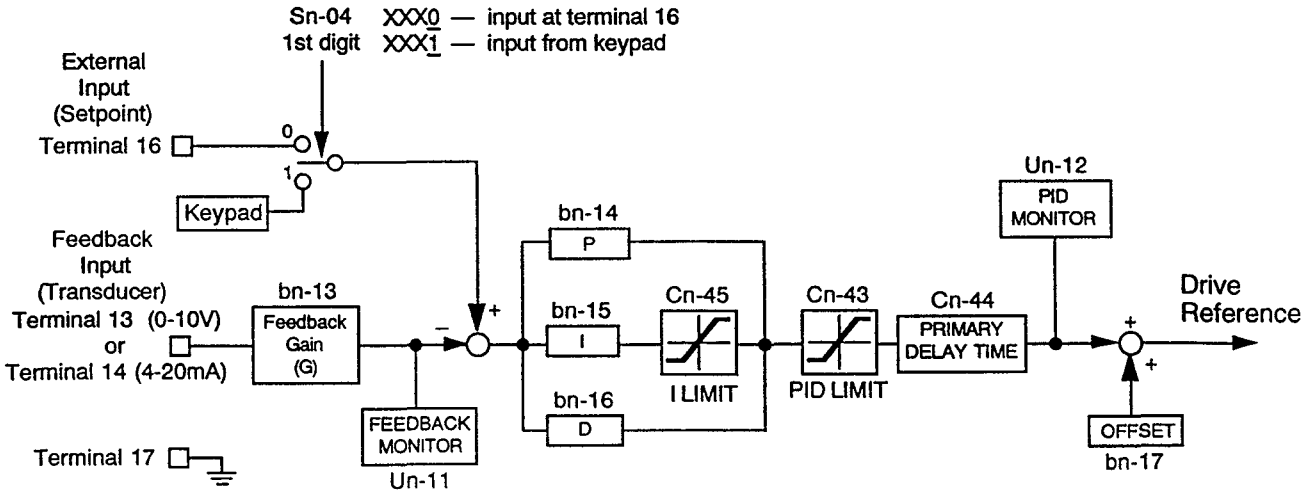


Figure 3. HVAC Software – PID Control Block Diagram

In case of difficulty, check the following:

1. PID is enabled — Sn-19 = 09.
2. Proportional Gain (bn-14) ≠ 0. (Default is 1.0.)
3. A feedback signal is present.
   a. Run drive from keypad (Sn-04 = 0011; Reference FXX.XX ≠ 0, RUN LED on).
   b If fan is running, verify Un-11 ≠ 0 If Un-11 = 0 :
      (1) Verify bn-13 ≠ 0
      (2) Transducer is powered and properly wired to drive.

   NOTE: Transducer output will be zero when fan is not running.

(Continued)

— PID (SETPOINT) PROGRAMMING INSTRUCTION

1. If your HVAC EPROMs were factory-installed, go to step 2.

   If your HVAC EPROMs were shipped separately, and have yet to be installed, return to "EPROM INSTALLATION" on page 2 and install the HVAC EPROMs before going to step 2.

2. Check for proper connections to the drive, per TM 4231, page 1-2.

3. Determine the output range of the transducer being used. For example, let's say the range is 0 to 10 Vdc. In this case, connect the positive output lead of the transducer to Terminal 13, and the COMMON output lead to Terminal 17 of the drive. See Figure 4.

4. Connect a power supply, as required, to the transducer. Connect the input of the transducer to the Supply Duct of your system.
   This completes the control loop.

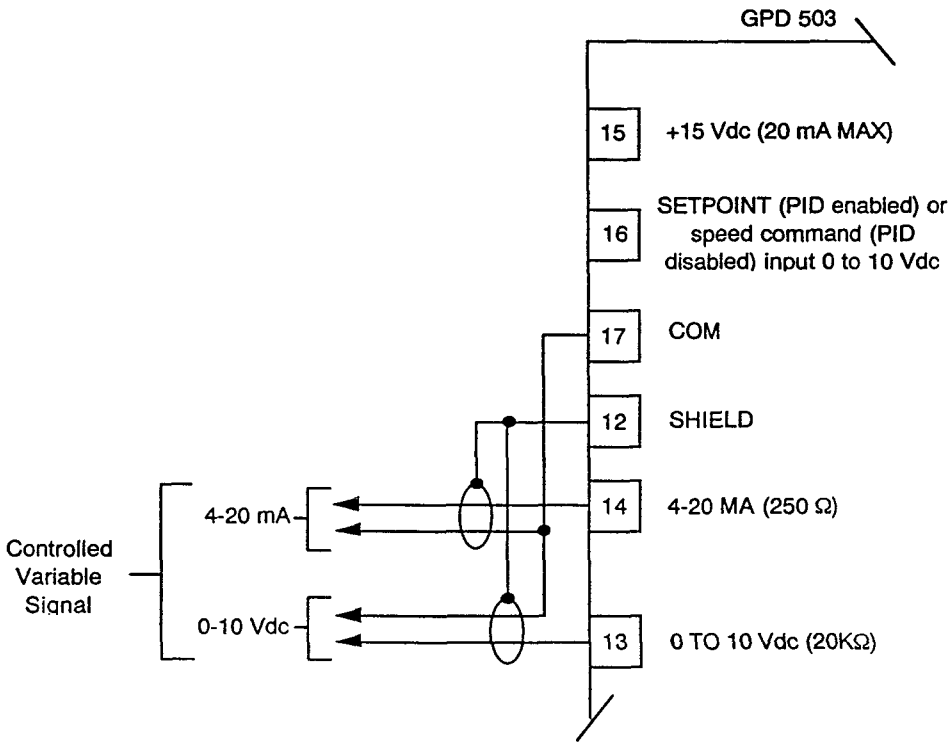


Figure 4. Transducer Wiring For PID Function

(Continued)

5. Familiarize yourself with the Digital Operator of the drive.
See TM 4231, page 3-1, for Digital Operator description and operation.

6. Apply power to the drive.

7. Perform a standard "STARTUP PROCEDURE" on the drive, per TD 4050, in order to insure that everything is working properly, before attempting to set up the PID control loop function.

8. Press the PRGM/DRIVE key to turn the DRIVE lamp off (thereby going into the PROGRAM mode). Press the DSPL key until the display reads Sn-XX. Press the ↑ key until the display reads Sn-19. Press the DATA/ENTER key. Display reads 00. Enter 09 at the constant Sn-19 and press the DATA/ENTER key. Display will momentarily flash END. This enables the PID software control of the drive.

9. Determine the input range of the transducer being used in your control loop. For this example, assume the range is 0.000 to 4.000 inches of water pressure.

10. We will now enter 11000 at the constant Cn-20, which will make a reading of 100% on the SETPOINT display equivalent to 4.000 inches of water pressure.

11. Press the DSPL key until the display reads Cn-01. Press the ↑ key until the display reads Cn-20.

12. Press the DATA/ENTER key. Display reads 00000. The left-hand digit is flashing.

13. Press the ↑ key. Display reads 10000. Press the > key. The second left-hand digit is now flashing. Press the ↑ key. Display now reads 11000.

14. Press the DATA/ENTER key. Display flashes END. Press the DSPL key. Display reads Cn-20. Now the value 11000 has been programmed into the constant Cn-20.

15. Now program a SETPOINT into the drive. For this example, 50% or 2.000 inches of water pressure (the midpoint between 0.000 and 4.000 inches of water pressure) will be used.

    Note: As an alternative, the drive will also accept an external SETPOINT signal (0 to 10 Vdc) at terminal 16. See Figure 4 on page 9. To enable this function, the value in constant Sn-04 must be changed from 0011 to 0010.)

16. Press the PRGM/DRIVE key. DRIVE lamp is on. Now you are in the DRIVE mode. Display reads F000.0, with the second left-hand digit flashing. Press the > key. Press the ↑ key five times Display reads F050.0.

17. Press the DATA/ENTER key. The 5 stops flashing momentarily Now a SETPOINT of 50%, or 2.000 inches of water pressure, has been programmed into the drive

(Continued)

18. We will now disable the integral (I) control function of the drive, which will allow a checkout of your system using proportional (P) control only.

19. Press the PRGM/DRIVE key. DRIVE lamp is off. Now you are in the PROGRAM MODE.

20. Press the DSPL key until display reads bn-XX. Use the ↑ key or the ↓ key to make the display read bn-15.

21. Enter 00 in bn-15. This disables the integral (I) function.

22. Press the DSPL key until display reads Un-XX. Press the ↑ key until display reads Un-11. This constant monitors the controlled variable. Press the DATA/ENTER key. Display reads 000.0.

23. Press the RUN key. Allow time for the motor speed to settle. Assume the speed stabilizes with the display reading approximately 040.0. This means the Controlled Variable has stabilized at approximately 40% of the transducer range, or 1.600 inches of water pressure (in this example), which is 0.400 inches below the desired SETPOINT of 2.00 inches of water pressure.

24. Press the DSPL key until display reads bn-01. Press and hold the ↑ key until display reads bn-14. This constant sets the proportional gain. Press the DATA/ENTER key. Display reads 001.0. The far left-hand digit is flashing.

25. Press the > key until the 1 is flashing. Press the ↑ key once. Display now reads 002.0. Press the DATA/ENTER key. Display flashes END. Now you have increased the proportional gain to 2.

26. Allow time for the motor speed to settle. Continue to increase the proportional gain until the oscillations of the Controlled Variable become continuous.

27. Once the oscillations become continuous, reduce the proportional gain (as in steps 32 and 33) in small increments. Allow time for the motor to settle with each adjustment (this time may be several minutes) until the oscillations stop.

    Note: Oscillations caused by load changes will settle out. Those caused by high proportional gain will not. Experience and practice with PID control will help you distinguish between the two.

28. Now press the DSPL key until display reads Un-11. Press the DATA/ENTER key. The Controlled Variable should now be closer to the 50% SETPOINT.

29. Allow time for the motor speed to settle (this time may be several minutes). If the reading on the display stabilizes near 50%, the control loop may now be properly tuned for your system. If the reading stabilizes with the speed not close enough to 50%, continue with step 30.

30. The integral time function (bn-15) can now be used to correct this steady-state error. Press the DSPL key until the display reads bn-14. Press the ↑ key once. Display reads bn-15.

31. Press the DATA/ENTER key. Display reads 000.0. Enter 010.0 in bn-15. Now you have programmed the integral time for 10 seconds.

32. Allow time for the motor speed to settle. Press the DSPL key until display reads Un-11. Press the DATA/ENTER key. The Controlled Variable should now be closer to the desired SETPOINT. After each setting change, go to Un-11 (the Controlled Variable) on the display (as in the above steps), and then back to bn-15.

33. Introducing integral gain can actually cause instability. If it does, increase the integral time until the oscillations die out. The fastest response will be obtained with a small integral time.

Note: Some of the functions from the standard EPROM set described in TM 4231 are no longer available when the HVAC option is included in your drive. Certain constants (memory locations) are redefined, or given new factory settings.

For additional information on the PID function as well as a complete listing of all constants (memory locations) for the HVAC EPROMs refer to page 13.

HVAC SOFTWARE – An-XX CONSTANTS

An-	HVAC or PID RELATED	DATA NAME	UNIT	SETTING	FACTORY SETTING
01	PID	Frequency reference (speed command) 1, or SETPOINT		According to Cn-22 setting	0.00 Hz
02		Frequency reference (speed command) 2		According to Cn-22 setting	0 00 Hz
03		Frequency reference (speed command) 3		According to Cn-22 setting	0 00 Hz
04		Not Used			
05		Not Used			
06		Not Used			
07		Not Used			
08		Not Used			
09		JOG frequency reference	0 01 Hz	0 00 - 400 00 Hz	6 00 Hz

HVAC SOFTWARE – bn-XX CONSTANTS

bn-	HVAC or PID RELATED	Data Name	Unit	Setting Range	Factory Setting
01		Acceleration time 1	0.1 sec	0.0 - 6000.0	10.0
02		Deceleration time 1	0.1 sec	0.0 - 6000.0	10.0
03		Not Used			
04		Not Used			
05		Frequency reference (speed command) gain	0.1 %	0.0 - 1000.0	100.0
06		Frequency reference (speed command) bias	1 %	-100 - +100	0
07		Torque compensation gain	0 1	0.0 - 9.9	0 0
08		Not Used			
09		Energy saving level gain	1 %	0 - 200	80
10		Not Used			
11		Analog monitor gain	0 01	0.00 - 2.55	1.00
12		Not Used			
13	PID	Feedback signal calibration gain	0 01	0 00 - 10 00	1 00
14	PID	Proportional gain	0 1	0 0 - 25 5	1 0
15	PID	Integral time	0 1 sec	0 0 - 999 9	0 0
16	PID	Derivative time	0.01 sec	0 00 - 1 00	0 00
17	PID	Offset compensation	1%	0 - 100	0

HVAC SOFTWARE – Sn-XX CONSTANTS

Sn-	DATA NAME	HVAC or PID RELATED	DIGIT	FUNCTION	FACTORY SETTING
01	GPD 503 Capacity			GPD 503 capacity selection	See TM 4231 Table A3-1
02	V/f (Volts/Hertz)			V/f pattern selection	01
03	Operator Status		0000 0101	Setting and reading of An-XX, bn-XX, Sn-XX, Cn-XX enabled Setting and reading of An-XX, bn-XX; reading of Sn-XX, Cn-XX enabled	0000
	Initialization		1110 1111	NV-RAM Initialization (2 WIRE reset) NV-RAM initialization (3 WIRE reset)	
	Meter Reset	HVAC	0011	Elapsed time meter reset	
		HVAC	1100	KWH meter reset	
04	Operation Method Select	PID	XXX0 XXX1	SETPOINT (PID enabled) or speed command (PID disabled) by analog input to terminal 16 SETPOINT (PID enabled) or speed command (PID disabled) from keypad (An-01)	0011
			XX0X XX1X	External terminal Run/stop command effective Keypad run/stop command effective	
	Stopping Method Select		00XX 01XX 10XX 11XX	RAMP to stop Coasting to stop Full-Range DC injection braking stop Coasting to stop (Timer function provided) bn-02 provides time delay before accepting run command	
05	Priority of stopping		XXX0 XXX1	Stop command from either keypad or external terminal Stop command from external terminal only	0010
	Prohibition of REV run		XX0X XX1X	REV run enabled REV run disabled	
	Control input scan		X0XX X1XX	Control inputs are scanned twice before being accepted by MPU Control inputs are scanned once before being accepted by MPU	
			XXXX	Not Used	

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-	DATA NAME	HVAC or PID RELATED	DIGIT	FUNCTION	FACTORY SETTING
06	S-Curve at ACCEL/DECEL time		XX00 XX01 XX10 XX11	0.2 sec S-Curve during accel/decel No S-Curve 0.5 sec S-Curve during accel/decel 1.0 sec S-Curve during accel/decel	0000
	SETPOINT (PID enabled) or speed command (PID disabled) - terminal 16	PID	X0XX X1XX	Response to input signal 1 - 100% for 0 - 10V (4 to 20mA) Response to input signal 1 - 100% for 10 - 0V (20 to 4mA)	
	Processing when feedback input (PID enabled) is lost	PID	0XXX 1XXX	Stop when input is lost Operation to continue with 80% of last input	
07	Over or Undertorque Detection	HVAC	XXX0 XXX1	Detection disabled Detection enabled	0000
		HVAC	XX0X XX1X	Enabled only if at set speed Enabled during operation (except during DC injection braking)	
		HVAC	X0XX X1XX	Operation continued after detection Coasts to stop after detection	
		HVAC	0XXX 1XXX	Overtorque detection enabled Undertorque detection enabled	
08	Analog output proportional to:	HVAC HVAC HVAC PID	XX00 XX01 XX10 XX11	Output frequency, Hz Output current, Amps Output power, KW PID function error signal (when PID function is enabled)	0000
	Feedback Loss Detection	PID PID PID PID	X0XX X1XX 0XXX 1XXX	Feedback signal loss detection enabled Feedback signal loss detection disabled Drive will stop when feedback loss is detected Drive will continue to run at set frequency	
09	Not Used		XXXX	Not Used	—
10	Stall Prevention		XXX0 XXX1	Stall prevention during acceleration enabled Stall prevention during acceleration disabled	0000
			XX0X XX1X	Stall prevention during deceleration enabled Stall prevention during deceleration disabled	
			X0XX X1XX	Stall prevention during running enabled Stall prevention during running disabled	
			XXXX	Not Used	

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-	DATA NAME	HVAC or PID RELATED	DIGIT	FUNCTION	FACTORY SETTING
11	DB Resistor Protection		XXX0 XXX1	No DB resistor protection calculated or provided Protection provided for drive internal DB resistor, if installed	0100
	Fault contact during auto reset/restart operation		XX0X XX1X	Fault contact is not energized during auto reset/restart opeartion Fault contact is energized during auto reset/restart operation	
	Momentary power loss protection		X0XX X1XX	Operation stopped by momentary power loss detection Operation continues during momentary power loss of less than 2 seconds	
			X̲XXX	Not Used	
12	External fault signal terminal 3		XXX0 XXX1	External fault signal: Normally open contact input External fault signal: Normally closed contact input	0000
	Receiving external fault signal		XX0X XX1X	External fault signal: Always detected External fault signal: Detected only while running	
	Processing at external fault detection		00XX 01XX 10XX 11XX	Ramp to stop (major fault) Coasting to stop (major fault) Not Used Operation to continue (minor fault)	
13	PID function selection	PID	XXX0 XXX1	Frequency output = PID output Frequency output = PID output + SETPOINT	0110
		PID	XX0X XX1X	"P" value is calculated after PID function is turned off by the multi-function input "P" value is set to zero after PID function is turned off by the multi-function input	
		PID	X0XX X1XX	"I" value is calculated after PID function is turned off by the multi-function input "I" value is set to zero after PID functino is turned off by the multi-function input	
			X̲XXX	Not Used	
14	Motor protection (Electronic Thermal)		XXX0 XXX1	Electronic thermal motor protection enabled Electronic thermal motor protection disabled	0000
			XX0X XX1X	Electronic thermal characteristics are in accordance with the variable torque motor Electronic thermal characteristics are in accordance with the constant torque motor	
			X0XX X1XX	Electronic thermal characteristics are standard Electric thermal characteristics are short-time rating	
			X̲XXX	Not Used	

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-	DATA NAME	HVAC or PID RELATED	DIGIT	FUNCTION	FACTORY SETTING
15	Terminal 5 function		00-0F	Selects terminal 5 function (factory set for multi-step reference 1)	03
16	Terminal 6 function		00-0F	Selects terminal 6 function (factory set for multi-step reference 2)	04
17	Terminal 7 function		00-0F	Selects terminal 7 function (factory set for JOG frequency reference)	06
18	Terminal 8 function		00-0F	Selects terminal 8 function (factory set for external base block by N.O. contacts)	08
19	Multi-function analog input (terminal 16)	PID	00-0F	Selects the function of terminal 16 (Setting 09 enables PID function; with any other setting, PID is disabled)	00
20	Multi-function output 1		00-0F	Selects multi-function contact output (terminal 9, 10) function	00
21	Multi-function output 2		00-0F	Selects multi-function open collector (terminal 25, 27) function	01
22	Multi-function output 3		00-0F	Selects multi-function open collector (terminal 26, 27) function	02

Setting error (OPE3) occurs when Sn-15 to Sn-18 are not set in ascending order.

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-15 thru -18 Settings — Ref. TM 4231, pages 2-25 – 2-27

SET VALUE	HVAC or PID RELATED	FUNCTION	DESCRIPTION
00		FWD/REV RUN Select	Open: FWD run (3 WIRE sequence mode (00 set in Sn-15)) Closed: REV run (terminal 1-run, 2-stop, 5 FWD/REV)
01		Operation signal select Local/Remote	Open: Operation according to setting of Sn-04 1st and 2nd digit Closed: Operation by run/stop signal from keypad
02		Not Used	Not Used
03		Multi-step speed command1	Combination of multi-step speed commands 1 and 2 correspond to speed command (master speed An-01) and speed commands 2, 3, 4 and 9 (An-02, 03, 09)
04		Multi-step speed command 2	
05		Not Used	Not Used
06		Jog Frequency Reference Selection	Closed: Jog frequency reference is selected
07		Not Used	Not Used
08		External base block at NO contact	Closed: Shut off the output of the inverter, set the output frequency to 0
09		External base block at NC contact	Open: Shut off the output of the inverter, set the output frequency to 0
0A		Frequency Hold Command	Closed: hold the output frequency
0b		Inverter overheat alarm	Closed: OH2 flashes on the digital operator and the inverter continues to run (Minor fault)
0C		Not Used	Not Used

Setting error (OPE3) occurs when Sn-15 to Sn-18 are not set in ascending order.

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-15 thru -18 Settings — Ref. TM 4231, pages 2-25 – 2-27 (Continued)

SET VALUE	HVAC or PID RELATED	FUNCTION	DESCRIPTION
10		UP function	Open: Output frequency hold Closed: Output frequency accels to the frequency upper limit
11		DOWN function	Open: Output frequency hold Closed: Output frequency decels to minimum frequency or frequency lower limit
12		FWD JOG	Closed: Forward jogging is performed at the frequency set in An-09
13		REV JOG	Closed: Reverse jogging is performed at the frequency set in An-09
20 - 2F		External fault 1	External fault signal input
30 - 3F		External fault 2	External fault signal input
40 - 4F		External fault 3	External fault signal input
50 - 5F		External fault 4	External fault signal input
60		DC injection braking command	Closed: DC injection braking applied when the frequency output is less than the DC injection start frequency (Cn-10)
61		Search 1	Closed: Search from maximum frequency
62		Search 2	Closed: Search from setting frequency
63		Energy-saving Operation	Closed: Energy-saving function enabled and reduced to level set in bn-09
64	PID	Integral value reset command	Closed: The calculated Integral value is set to zero
65	PID	PID loop off command	Closed: The PID loop is turned off (PID disabled)

Setting error (OPE3) occurs when Sn-15 to Sn-18 are not set in ascending order.

(Continued)

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-19 Settings — Ref. TM 4231, page 2-22

SET VALUE	HVAC or PID RELATED	FUNCTION	DESCRIPTION
00		Auto frequency reference	Used for auto/manual frequency reference selection
01		Frequency reference gain (FGAINE)	Total gain: Internal gain (bn-05) * FGAINE
02		Frquency reference bias 1 (FBIAS1)	Total bias: Internal bias (bn-06) + FBIAS1
03		Frequency reference bias 2 (FBIAS2)	Total bias: Internal bias (bn-06) + FBIAS2
04		Not Used	
05		VBIAS	VBIAS addition after V/F conversation
06		Acce/Decel time reduction coefficient	Acce/Decel time varied by analog input
07		DC injection braking current adjust	DC injection braking current varied by analog input
08		Stall prevention level during running	Stall prevention level adjusted by analog input
09	PID	PID reference signal input (SETPOINT) and PID enable	Multi-function analog input (terminal 16) used for PID SETPOINT; Analog input signal (terminal 13 or 14) used for PID feedback signal

HVAC SOFTWARE – Sn-XX CONSTANTS (Continued)

Sn-20 thru -22 Settings — Ref. TM 4231, page 2-30

SET VALUE	HVAC or PID RELATED	FUNCTION	DESCRIPTION
00		During running	Closed: During running
01		Zero speed	Closed: Zero speed
02		Up-to frequency setting	Closed: (Frequency ref.– 3% max freq)<=output freq <=(freq. ref. + 3% max freq.)
03		Not Used	Not Used
04		Not Used	Not Used
05		Not Used	Not Used
06		Drive operation ready	Closed: Drive operation ready
07		During undervoltage detection	Closed: During undervoltage
08		During base block	Closed: During drive output baseblock; motor is coasting
09		Frequency reference mode	Open: From terminal Closed: From keypad
0A		Control Command	Open: From terminal Closed: From keypad
0b		Over or undertorque detection	Closed: Detected (Detection depends upon Sn-07 4th bit setting)
0C		Frequency reference missing	Closed: Frequency reference missing
0d		Braking resistor fault	Closed: Braking resistor overheating or braking transistor fault
0E	HVAC	Fault indication	Fault condition (except CPF00, CPF01)

HVAC SOFTWARE – Cn-XX CONSTANTS

FUNCTION	Cn-	HVAC or PID RELATED	DATA NAME	SET UNIT	SETTING	FACTORY SETTING
Custom V/f pattern setting	01		Input voltage	0.1 V	0 - 255 (230V) 0 - 510 (460V) (NOTE 1)	230, 460
	02		Max. frequency	0.1 Hz	50.0 - 400.0	60 0
	03		Max. voltage	0 1 V	0 - 255 (230V) 0 - 510 (460V) (NOTE 1)	230, 460
	04		Max. voltage frequency	0 1 Hz	0.0 - 400.0	60.0
	05		Mid. output frequency 1	0 1 Hz	0.0 - 400 0	3 0
	06		Mid output frequency voltage 1	0 1 V	0 - 255 (230V) 0 - 510 (460V) (NOTE 1)	17 2 (230V) 34 4 (460V)
	07		Min output frequency	0 1 Hz	0.0 - 400 0	1 5
	08		Min. output frequency voltage	0 1 V	0 - 255 (230V) 0 - 510 (460V) (NOTE 1)	11 5 (230V) 23 (460V)
Electric thermal reference current	09		Motor rated current	0 1 A	10% - 200% of drive rated current	(NOTE 2)
DC injection braking	10		DC injection braking start frequency	0 1 Hz	0 - 10 0	1 5
	11		DC injection braking current	1 %	0 - 100	50
	12		DC injection braking time at stopping	0 1 sec	0 0 - 25 5	0 0
	13		DC injection braking time at starting	0 1 sec	0 0 - 25.5	0 0
Freq limit control	14		Frequency reference (speed command) upper limit	1 %	0 - 109	100
	15		Frequency reference (speed command) lower limit	1 %	0 - 109	0

Notes for Cn-XX constants are on page 25

HVAC SOFTWARE – Cn-XX CONSTANTS (Continued)

FUNCTION	Cn-	HVAC or PID RELATED	DATA NAME	SET UNIT	SETTING	FACTORY SETTING
Critical frequency rejection	16		Setting prohibited frequency 1	0.1 Hz	0.0 - 400 0	0 0
	17		Setting prohibited frequency 2	0.1 Hz	0.0 - 400.0	0 0
	18		Setting prohibited frequency 3	0.1 Hz	0 0 - 400.0	0.0
	19	HVAC	Setting prohibited frequency 1 deadband	0.1 Hz	0.0 - 25 5	0 0
	20	HVAC	Setting prohibited frequency 2 deadband	0.1 Hz	0.0 - 25 5	0 0
	21	HVAC	Setting prohibited frequency 3 deadband	0 1 Hz	0.0 - 25 5	0.0
Operator display change	22		Operator display mode	1	0 - 39999	0 0
Carrier freq adjustment	23		Carrier frequency upper limit	0.1 kHz	0 4 - 15 0	15 0
	24		Carrier frequency lower limit	0 1 kHz	0.4 - 15.0	15 0
	25		Carrier frequency proportional gain	1	0 - 99	0
Undertorque detection	26	HVAC	Over or undertorque detection level	1 %	0 - 200	0
	27	HVAC	Over or undertorque detection time	0 1 sec	0 0 - 25 5	0 1
Stall prevention	28		Stall prevention level during acceleration - below 60 Hz	1 %	30-200	170
	29		Stall prevention level during acceleration - above 60 Hz	1 %	30 - 200	50
	30		Stall prevention level during running at set frequency	1 %	30 - 200	160
Torque boost control	31		Motor terminal resistance (phase to phase)	0 001 ohm	0 00 - 65 535	(NOTE 2)
	32		Motor iron loss	1 W	0 - 65535	
	33		Not Used			

Notes for Cn-XX constants are on page 25

HVAC SOFTWARE – Cn-XX CONSTANTS (Continued)

FUNCTION	Cn-	HVAC or PID RELATED	DATA NAME	SET UNIT	SETTING	FACTORY SETTING
V/f pattern setting	34	HVAC	Mid output frequency voltage 2	0.1 V	0 - 255.5 (NOTE 1)	0 0
	35	HVAC	Mid. output frequency 2	0.1 Hz	0.0 - 400.0	0.0
Auto reset/restart operation	36		Number of auto restart attempts	1	0 - 10	0
Momentary power loss ride through	37		Momentary power loss ride-thru time	0.1 sec	0 0 - 2.0	2
Speed search control	38		Speed search deactivation current level	1 %	0 - 200	20
	39		Speed search decel time	0 1 sec	0 0 - 25 5	2 0
	40		Minimum base block time	0 1 sec	0 0 - 2 0	2 0
	41		V/f during speed search	1 %	0 - 100	25
	42		Voltage recovery time	0 1 sec	0 1 - 2 0	0 3
PID control	43	PID	PID values limit level	1 %	0 - 109	100
	44	PID	PID values output primary delay time	0 1 sec	0 0 - 2 5	1 0
	45	PID	Integration value limit level	1 %	0 - 109	100
Integrated run/stop and speed command (sleep function)	46	HVAC	Base frequency (Fbase)	1 %	0-109	0
Energy cost totalizer	47	HVAC	Energy cost in cents / KWH	0 1 cent	0 0 - 25 5	0 0

NOTES.

1 Initial setting is related to constant Sn-02 setting

2. Initial setting is related to constant Sn-01 setting

(Continued)

HVAC SOFTWARE – Un-XX CONSTANTS

Un-	HVAC or PID RELATED	MONITOR NAME	LED INDICATION EXAMPLE
01		Frequency reference (%)	*F100.0*
02		Output frequency (%)	*100*
03		Output current (Amps)	*12.5A*
04		Output voltage command (V)	*200u*
05		DC Voltage (Vpn)	*Pn270*
06		Output Power (KW) (no sign = positive value)	*-2.5*
07		Status of input terminals	*C IIIIIII*
08		Status of output terminals	*o III*
09		Check of LEDs	*8 8.8.8 8*
10		EPROM number	*17045*
11	PID	PID feed back signal (%)	*100 00*
12	PID	PID output (%) (no sign = positive value)	*- 100 0*
13	HVAC	Elapsed time meter (hours)	*65535*
14	HVAC	Watt hour meter 1 (WH)	*9999*
15	HVAC	Watt hour meter 2 (WH X 10,000)	*65535*
16	HVAC	Energy cost totalizer (dollars)	*65535*