



GPD 506/P5 Technical Manual

*This Manual
also available on
www.drives.com*



GPD506/P5 Simplified Startup Procedure

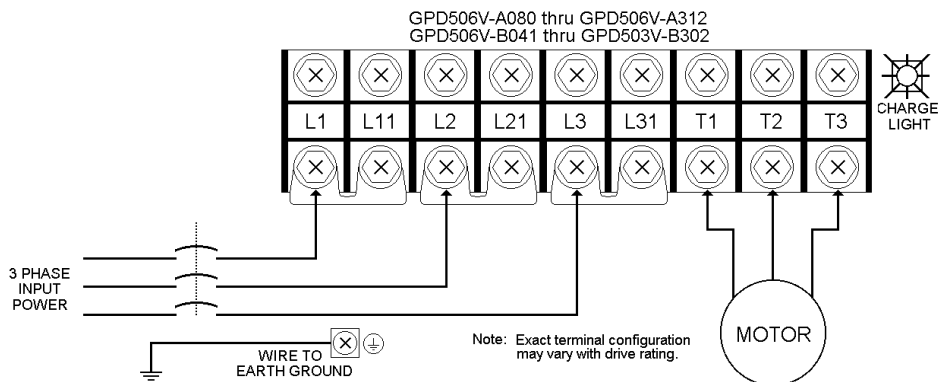
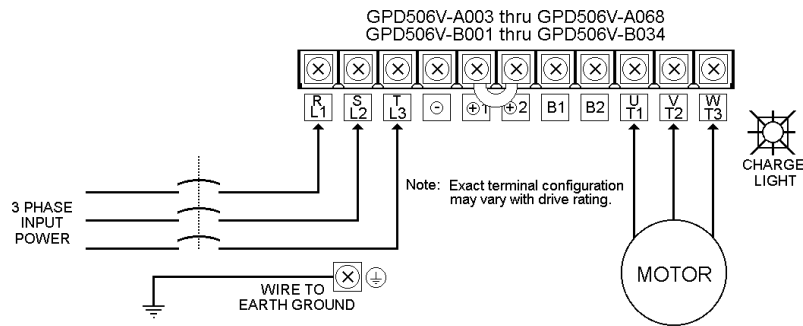
This procedure is a simplified step by step guide to installing, programming, and using a GPD506/P5 drive. It highlights several common installation configurations.

INSTALLATION

1. Be certain your input voltage source, motor and drive nameplates are all marked either 230V or 460V. Other voltages can be used, but require additional programming.
CAUTION: Verify that the input voltage matches the drive's nameplate BEFORE applying power or severe damage will result.
2. Mount drive on a vertical surface with adequate space for air circulation (4.7" above and below, 1.2" on each side).
3. Remove front cover, fit conduit to bottom plate, and connect power and ground wires as shown.

CAUTION: BE CERTAIN YOU CONNECT INPUT POWER TO TERMINALS L1, L2, AND L3 ONLY, OR SERIOUS DAMAGE WILL RESULT. CONNECT MOTOR TO TERMINALS T1, T2, AND T3 ONLY.

POWER WIRING SCHEMATIC



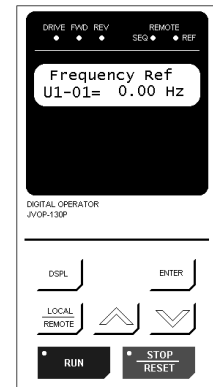
4. **Replace cover and apply input power** – digital operator shows “Frequency Ref 00.0 Hz”; DRIVE, SEQ, REF & STOP LEDs are on. Press the **LOCAL / REMOTE** button. The SEQ & REF LEDs should go off. Press and hold the **UP ARROW** button until the display shows “6.0 Hz, then press the **ENTER** button. Press the **RUN** button and note the direction of motor rotation. If rotation is incorrect, remove power, wait for charge light to go out, then switch wires between terminals T1 and T2. Replace the front cover and apply input power.

5. Digital Operator

To access a “Quick Start” display, press the **DSPL** button until the desired display is on the screen. Use the **UP** and **DOWN** keys to adjust the value then press the **ENTER** key.

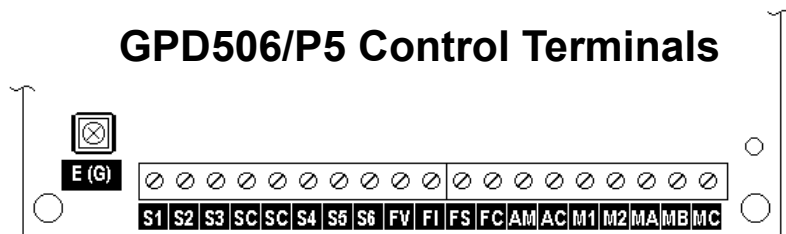
To access a parameter, press the **DSPL** button until the word “Parameter” is on the upper left side of the screen. Use the **UP** and **DOWN** keys until the desired parameter number is on the right side of the screen, then press **ENTER**. Use the **UP** and **DOWN** keys to adjust the value then press **ENTER** then **DSPL**.

Before the drive will accept a RUN command, the DRIVE LED must be on. Press the **DISPL** key until the DRIVE LED comes on. For more specific information on the digital operator, Section 4.



6. **Control Terminal Wiring** – Remove power and wait for the charge light to go out before making control terminal connections. Control wiring should be sized 16 to 20 AWG.

Control wiring should be shielded, with the shield connected to terminal E(G) and the other end of the shield left open. As shown at right there are two SC terminals provided for wiring convenience.



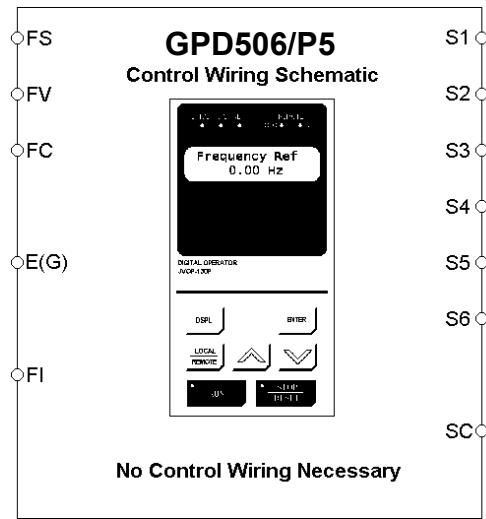
7. **Choose a configuration from Table 1 below.** Each example listed below contains a control wiring diagram, operation explanation, and all necessary programming.

Table 1: Drive Configuration Examples

Sequence* Source (Run / Stop)	Reference* Source (Motor Speed)	Description	Example Page
Digital Operator	Digital Operator	This method requires no control wiring connections to the drive. It is most often used during startup of the drive.	Example 1 (Page iii)
2-wire	4-20 mA	This method is the same as Example 2 but the reference comes from a remote 4 – 20 mA source such as a PLC.	Example 2 (Page iv)
3-wire	Speed Potentiometer	This method is similar to Example 3, but utilizes a remote mounted speed control (potentiometer).	Example 3 (Page v)

* For a more detailed explanation of sequence and reference, consult Page vi of this document.

Example 1: Sequence & Reference From The Digital Operator



When the drive is set up with the sequence and the reference coming from the digital operator, it is in “Local” control. Local control is often used during startup to verify motor operation, rotation, etc. The drive can be temporarily placed in “Local” control simply by pressing the **LOCAL / REMOTE** key. When the drive is in “Local” control, the SEQ and REF LEDs are off. If power is removed and then restored, the drive will come up in the “Remote” mode (SEQ and REF LEDs are on).

The drive can be programmed so that even if power is lost, the drive will come up in the local mode (see Table 2 below).

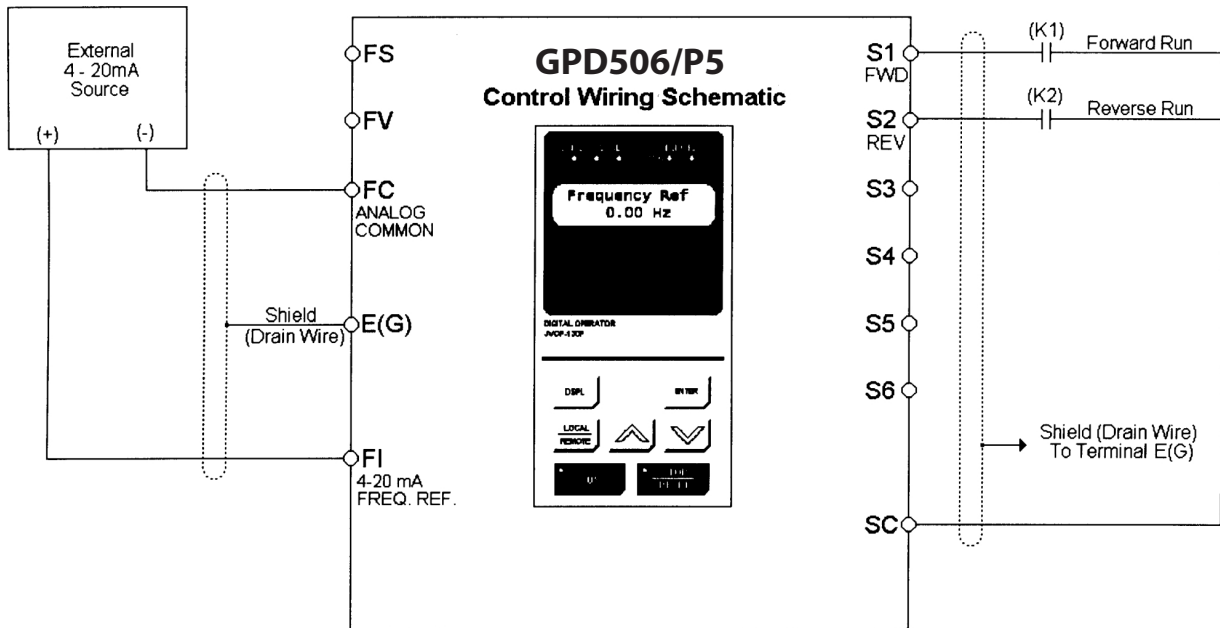
OPERATION:

- The frequency reference is programmed into the “Frequency Reference” quick start display.
- The drive can be started by pressing the **RUN** key on the digital operator.
- The drive can be stopped by pressing the **STOP** key on the digital operator.
- The direction of the motor can be changed regardless of motor speed by changing the “Forward/Reverse” quick start display.

Table 2: Programming required for “Local” mode

Parameter	Display	Description
n001	Password 3	Allows access to all parameters in the drive.
n002	Oper Mode Select SEQ=OPR REF=OPR	This parameter sets the drives sequence (start/stop) and reference (motor speed) to come from the digital operator (local).
Quick Start Display	Motor Rated FLA X.X A	Enter the motor's full load amps (as shown on the motor nameplate).
Quick Start Display	Frequency Ref X.X Hz	Enter into this parameter how fast you want the motor to go.
Quick Start Display	Forward / Reverse For	With this display, the motor direction can be changed regardless of motor speed.

Example 2: Remote Sequence (2-Wire) & Remote Reference (4 – 20 mA)



This configuration is used when the start & stop signals and the frequency reference come from a remote source, such as a PLC. It can also be used with a maintained switch when it is desirable to have the drive restart on restoration of power. It should not be used where safety of attending personnel might be threatened by a restart.

OPERATION:

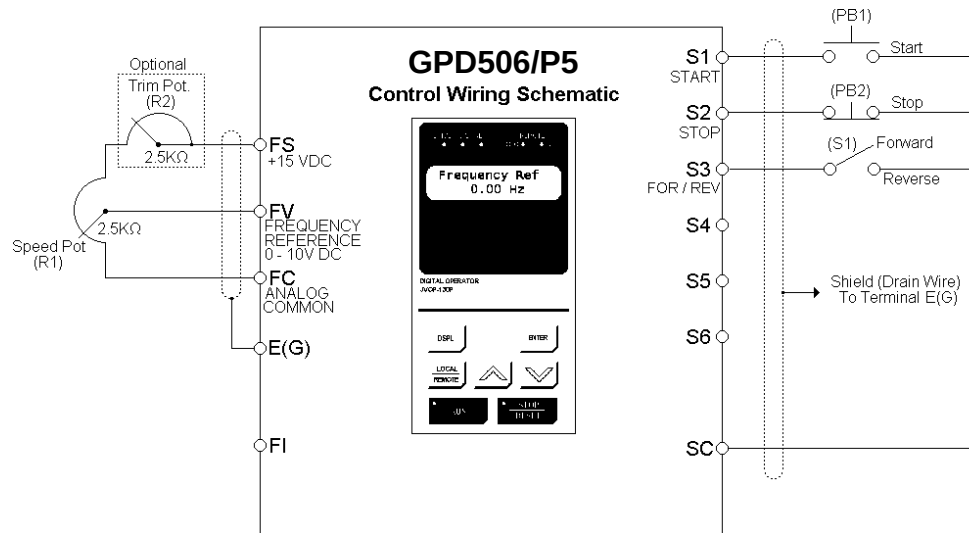
- Close (K1) to Run Forward.
- Close (K2) to Run Reverse.
- If both (K1) & (K2) are closed, the drive stops and displays the error message: "EF Ext Fault".
- Frequency reference is proportional to the signal level at Terminal FI. 4mA = 0 Hz, 12mA = 30 Hz, & 20mA = 60 Hz.
- If the **LOCAL / REMOTE** key is pressed, the drive will behave the same as illustrated in Example 1.

Table 3: Programming Required For Remote 2-wire Sequence & Remote (4-20 mA) Reference

Parameter	Display	Description
n001	Password 8	The drive will perform a 2-wire reset. CAUTION: Setting this value will reset all parameters to their original factory settings (all previous adjustments will be lost) <i>When the drive completes the reset, this parameter returns to a value of 1.</i>
n001	Password 3	After doing the reset above, the password parameter returned to a 1. Change it to a 3 to get access to all parameters in the drive.
n043	Analog Input Sel FV=AUX FI=MSTR	This parameter sets terminal FI to be the frequency reference.
Quick Start Display	Motor Rated FLA X.X A	Enter the motor's full load amps (as shown on the motor nameplate).

NOTE: After the above adjustments have been made, the DRIVE, SEQ, REF and STOP LEDs will be illuminated.

Example 3: Remote Sequence (3-Wire) & Speed Potentiometer



This configuration is best when a person rather than an external controller (PLC, relay, etc.) controls the drive. Both potentiometers ((R1) & (R2)) should have a resistance value between 2000Ω and 3000Ω and be rated for at least 1 Watt. The trim pot is optional, but without it the manual speed pot will output 10V (60 Hz) at just two-thirds of its rotation.

OPERATION:

- Close pushbutton (PB1) momentarily while pushbutton (PB2) is closed and the drive will start. Pushbutton (PB1) does *NOT* need to be maintained.
- Open pushbutton (PB2) at any time and the drive will stop.
- If switch (S1) is open the drive will run in the forward direction. If switch (S1) is closed, the drive will run in the reverse direction. Switch (S1) can be operated with the drive running at any speed.
- Frequency reference is proportional to the signal level at Terminal FV.
0V = 0 Hz, 5V = 30 Hz, & 10V = 60 Hz.
- If the **LOCAL / REMOTE** key is pressed, the drive will behave the same as illustrated in Example 1.

Table 4: Programming Required For Remote 3-wire Sequence & Speed Pot Reference

Parameter	Display	Description
n001	Password 9	The drive will perform a 3-wire reset. CAUTION: Setting this value will reset all parameters to their original factory settings (all previous adjustments will be lost) <i>When the drive completes the reset, this parameter returns to a value of 1.</i>
n001	Password 3	After doing the reset above, the password parameter returned to a 1. Change it to a 3 to get access to all parameters in the drive.
Quick Start Display	Motor Rated FLA X.X A	Enter the motor's full load amps (as shown on the motor nameplate).

NOTE: After the above adjustments have been made, the DRIVE, SEQ, REF and STOP LEDs will be illuminated.

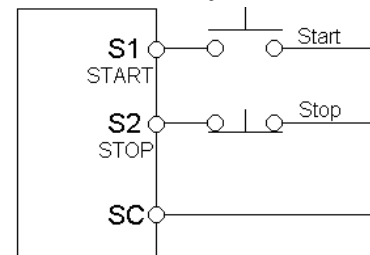
After the programming is complete, the trim pot needs to be calibrated. Press **DSPL** until the "Frequency Reference" quick start display is on the screen. Verify that the SEQ and REF LEDs are illuminated. Turn the Speed Pot (R1) all the way up. Adjust the trim pot (R2) so that the "Frequency Reference" display is just flickering between 59.99 Hz and 60.00 Hz. This completes the trim pot calibration.

Definitions

Sequence – refers to how the drive is started, stopped, and told which direction to run. When the sequence comes from the digital operator (local), the drive is started and stopped using the “RUN” and “STOP” keys on the digital operator, and direction is given via the “FWD/REV” key. Sequence can also come from the drive’s control terminals (remote) using either two-wire or three-wire control. **The sequence inputs to the drive do NOT require any outside voltages to activate them.** Instead, contact closures (either from switches, relay contacts or open collector circuits) activate the sequence inputs. Other sequence sources are available.

Two-wire sequence – utilizes a “maintained” switch or relay contact. It is used on applications where it is desirable to have the drive restart on restoration of power. It should not be used where safety of attending personnel might be threatened by a restart. This method is generally restricted to unattended fans & pumps, or where another controller is entrusted with the decision to restart. Direction is controlled by maintaining either a forward run or a reverse run command.

Three-wire sequence – utilizes “momentary” buttons or switches. This control scheme emulates the traditional 3-wire motor starter control. A momentary closure of a normally open run switch latches the drive in the RUN mode (STOP switch must be closed or the drive will not accept the momentary RUN command). A momentary opening of the normally closed STOP switch unlatches RUN mode bringing the drive to a stop. The three-wire sequence is used where it would be dangerous for the drive to restart after a power outage. This method requires an intentional restart, as the RUN command is unlatched immediately on loss of power. Direction is determined by another maintained contact closure (closed = reverse).



3-Wire Sequence

Reference - The frequency reference tells the drive how fast to run the motor. There are several source options for the frequency reference. First, the frequency reference can come from the digital operator (local). Simply put, the motor speed can be entered into the keypad. Second, the frequency reference can come from an analog signal (remote), such as 0 to 10 Volts DC. When 0 Volts is applied to the drive, the drive will run at zero speed. When 10V is applied to the drive, it will run at full speed. Apply anything in between and the drive will run at that corresponding frequency (2.5VDC = 25% speed = 15 Hz). Other reference sources are available.

Local Control – is when the sequence and/or reference comes from the digital operator. If the reference is supposed to come from the digital operator, the REF LED will be off. If the start/stop (sequence) is supposed to come from the digital operator, the SEQ LED will be off.

Remote Control – is when the sequence and/or reference comes from the control terminals. If the reference source is supposed to come from terminals FV or FI, the REF LED will be on. If the start/stop (sequence) is supposed to come from the terminals (2-wire or 3-wire control) the SEQ LED will be on.

QUICK REFERENCE FOR GPD 506/P5 PARAMETERS (FACTORY SET)

PARAMETER NUMBER	FACTORY SETTING ⁽⁵⁾	USER SETTING	PARA. REF.	PARAMETER NUMBER	FACTORY SETTING ⁽⁵⁾	USER SETTING	PARA. REF.	PARAMETER NUMBER	FACTORY SETTING ⁽⁵⁾	USER SETTING	PARA. REF.
n001	1		5.23	n034	STD Motor / 8 Min (1)		5.26	n076	2.0		5.20
n002	SEQ = TRM REF = TRM (3)		p. A1-1	n035	Continue Oper (3)		p. A1-5	n077	Disabled (0)		5.21
n003	230.0 (230V)		5.28 B	n036	Reverse RUN (2W) (0)		5.19	n078	160		5.21
	or 460.0 (460V)			n037	Ext Fault (2)		5.19	n079	0.1		5.21
n004	Ramp to STOP (0)		5.25	n038	Fault Reset (4)		5.19	n080	0.0		5.19 F
n005	Rotate C.C.W. (0)		p. A1-1	n039	Multi-Step Spd 1 (10)		5.19	n081	0.0		5.19 F
n006	REV Allowed (0)		p. A1-2	n040	Multi-Step Spd 2 (11)		5.19	n082	Disabled (0)		(Note 4)
n007	Enabled (1)		p. A1-2	n041	Fault (0)		5.20	n083	7		5.29
n008	Enabled (1)		p. A1-2	n042	During Running (1)		5.20	n084	Disabled (0)		5.22 A
n009	Enter Key Used (1)		p. A1-2	n043	FV=MSTR FI=AUX (0)		5.11	n085	1.00		5.22 E
n010	1		5.28 A	n044	4-20 mA (1)		5.11	n086	1.0		5.22 F
n011	60.0 (Note 2)		5.28	n045	Memorize FREF (0)		5.14	n087	10.0		5.22 F
n012	230.0 (230V)		p. A1-2	n046	Not Detected (0)		5.13	n088	0.00		5.22 F
	or 460.0 (Note 2) (460V)			n047	80		5.13	n089	100		5.22 G
n013	60.0 (Note 2)		p. A1-2	n048	100		5.10	n090	Disabled (0)		5.22 F
n014	3.0 (Note 2)		p. A1-3	n049	0		5.10	n091	0		5.22 F
n015	17.2 (Note 2)		p. A1-3	n050	100		5.10	n092	1.0		5.22 F
n016	1.5 (Note 2)		p. A1-3	n051	0		5.10	n093	Not Inverted (0)		p. A1-12
n017	11.5 (Note 2)		p. A1-3	n052	Output Freq (0)		5.18	n094	0.0		5.22 I
n018	10.0		5.2	n053	1.00		5.18	n095	0.0		5.22 I
n019	10.0		5.2	n054	(Note 1)		5.5	n096	Disabled (0)		5.9
n020	10		5.2	n055	Not Provided (0)		5.17	n097	(Note 1)		5.9
n021	10		5.2	n056	110		5.19 E	n098	75		5.9
n022	0.2 Sec (1)		5.3	n057	(Note 1)		5.19 E	n099	12		5.9
n023	0		5.8	n058	(Note 1)		5.19 E	n100	1		5.9
n024	0.0		5.19 B	n059	(Note 1)		5.17	n101	Enabled (1)		5.16
n025	0.0		5.19 B	n060	0		5.4	n102	Coast to STOP (1)		5.16
n026	0.0		5.19 B	n061	Activate Flt Relay (0)		5.4	n103	1 = 0.1Hz (0)		5.16
n027	0.0		5.19 B	n062	0.0		5.6	n104	1		5.16
n028	0.0		5.19 B	n063	0.0		5.6	n105	9600 Baud (2)		5.16
n029	0.0		5.19 B	n064	1.0		5.6	n106	No Parity (0)		5.16
n030	6.0		5.15	n065	Time Running Mtr (1)		p. A1-9	n107	0.0		5.23.1
n031	100		5.12	n066	0		p. A1-9	n108	30		5.23.1
n032	0		5.12	n067	0		p. A1-9	n109	2.0		5.23.1
n033	(Note 1) (3)		5.26	n068	50		5.7	n110	Disabled (0)		5.16.1
				n069	0.0		5.7	n111	Cycle Extern RUN (0)		5.15.1
				n070	0.0		5.7	n112	6.0		
				n071	1.0		5.27	n113	50		
				n072	Enabled (1)		5.24	n114	0		
				n073	170 (Note 1)		5.24	n115	(Note 1)		A3-1
				n074	160 (Note 1)		5.24	n116	(Note 1)		A1-11
				n075	0.0		5.20				

(Note 1) Factory setting depends on GPD 506/P5 rating. See Table A3-1.

(Note 2) Initial value is related to V/f curve selected by n010 setting.

(Note 3) Motor rated current (n033) is factory set at a value related to the drive rating (see Table A3-1). User must program this parameter to the actual FLA of the motor being used. See "Thermal Overload Protection", on page 5-57.

(Note 4) Only effective when Dynamic Braking components are wired to drive terminals; see Appendix 6.

(Note 5) Factory setting shows display for both LCD and LED digital operators. If only one value is shown, it will appear on either display. If text is shown followed by a value in parentheses, the text will be displayed on the LCD digital operator, and the value in parentheses will be displayed on the LED digital operator.

Current Ratings & Horsepower Range

RATED INPUT	CURRENT RATING (AMPS)	NOMINAL HORSEPOWER (120% OL)	MODEL NO. GPD506V-
2 3 0 V	3.2	0.75	A003
	6	1 & 1.5	A006
	8	2	A008
	11	3	A011
	17.5	5	A017
	27	7.5 & 10	A027
	36	15	A036
	54	20	A054
	68	25	A068
	80	30	A080
	104	40	A104
	130	50	A130
	160	60	A160
	192	75	A192
	248	100	A248
	312	125	A312
4 6 0 V	1.8	0.75	B001
	3.4	1 & 2	B003
	4.8	3	B004
	8	5	B008
	11	7.5	B011
	14	10	B014
	21	15	B021
	27	20	B027
	34	25	B034
	41	30	B041
	52	40	B052
	65	50	B065
	80	60	B080
	96	75	B096
	128	100	B128
	180	125 & 150	B180
	240	200	B240
	302	250	B302
	380	300	B380
	506	350 & 400	B506
	675	500	B675



WARNING

Do not touch circuit components until main input power has been turned off and “CHARGE” lamp is extinguished. The capacitors are still charged and can be quite dangerous.

Do not connect or disconnect wires and connectors while power is applied to the circuit.



CAUTION

Know your application before using either Initialization function of *n001* . This parameter must be set to " 0 ", " 1 ", " 2 ", or " 3 " to operate the drive. (See paragraph 5.23 for additional information.)

8 = Factory 2-Wire Control Initialization (Maintained RUN Contact)

9 = Factory 3-Wire Control Initialization (Momentary START/STOP Contact)

Entering either Initialization code resets all parameters, and automatically returns *n001* setting to " 1 ". If the GPD 506 is connected for 3-Wire control and this constant is set to " 8 " (2-Wire Control Initialization), the motor may run in reverse direction WITHOUT A RUN COMMAND APPLIED. Equipment damage or personal injury may result.



CAUTION

When drive is programmed for auto-restart (*n060* = " 1 " – " 10 "), the motor may restart unexpectedly — personal injury may result.

IMPORTANT

Wiring should be performed only by qualified personnel.

Always ground the GPD 506/P5 using ground terminal ($\perp$). See paragraph 1.4.3, "Grounding".

Verify that the rated voltage of the drive matches the voltage of the incoming power.

Never connect main circuit output terminals T1, T2, and T3 to AC main circuit power supply.

All parameters have been factory set. Do not change their settings unnecessarily.

Do not perform a “HIPOT” or withstand voltage test on any part of the GPD 506/P5. Equipment uses semi-conductors and is vulnerable to high voltage.

The Control PCB employs CMOS ICs which are easily damaged by static electricity. Use proper electrostatic discharge (ESD) procedures when handling the Control PCB.

Any modification of the product by the user is not the responsibility of Yaskawa, and will void the warranty.

Data subject to change without notice.

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Section 1. RECEIVING AND INSTALLATION

1.1 GENERAL

The GPD 506/P5, hereafter referred to as "the drive," is a high performance sine-coded pulse width modulated special purpose AC motor drive which generates an adjustable voltage/frequency three phase output for complete speed control of most conventional squirrel cage induction motors. Automatic stall prevention and voltage boost prevents nuisance tripping during load or line side transient conditions. The drive will not induce any voltage line notching distortion back to the utility line and maintains a displacement power factor of not less than 0.98 throughout its speed range.

When properly installed, operated and maintained, the drive will provide a lifetime of service. It is mandatory that the person who operates, inspects, or maintains this equipment thoroughly read and understand this manual before proceeding.

This manual primarily describes the GPD 506/P5, but contains basic information for the operator control station as well. For details of the operation of other units in the drive system, refer to their respective manuals.

1.2 RECEIVING

The drive is thoroughly tested at the factory. After unpacking, verify the part numbers with the purchase order (invoice). Any damages or shortages evident when the equipment is received must be reported immediately to the commercial carrier who transported the equipment. Assistance, if required, is available from your sales representative.

If the drive will be stored after receiving, keep it in its original packaging and store according to storage temperature specifications in Appendix 2.

1.3 PHYSICAL INSTALLATION

Location of the drive is important to achieve proper performance and normal operating life. The unit should be installed in an area where it will be protected from:

- Direct sunlight, rain or moisture.
- Corrosive gases or liquids.
- Vibration, airborne dust or metallic particles.

When preparing to mount the drive, lift it by its base, **never** by the front cover. For effective cooling as well as proper maintenance, the drive must be installed on a flat, non-flammable vertical surface (wall or panel) using four mounting screws. There **MUST** be a MINIMUM 4.7 in. clearance above and below the drive to allow air flow over the heat sink fins. A minimum 1.2 in. clearance is required on each side of the drive.

A GPD 506/P5 in a free-standing floor-mount cabinet must be positioned with enough clearance for opening the door of the cabinet; this will ensure sufficient air space for cooling. Make sure air entering the drive is below 113°F (45°C) (for protected chassis drives), or below 104°F (40°C) (for NEMA 1 drives), by adding a fan or other cooling device, if needed. See environmental specifications in Appendix 2.

1.4 ELECTRICAL INSTALLATION

All basic interconnections (using the Digital Operator) are shown in Figures 1-3 and 1-4.

1.4.1 Main Circuit Input/Output

Complete wire interconnections according to Table 1-2, Figure 1-3 and Figure 1-4. Be sure to observe the following:

- Use 600V vinyl-sheathed wire or equivalent. Wire size and type should be determined by local electrical codes.
- Avoid routing power wiring near equipment sensitive to electrical noise.
- Avoid running input and output wiring in the same conduit.
- NEVER connect AC main power to output terminals T1(U), T2(V), and T3(W).
- NEVER allow wire leads to contact metal surfaces. Short-circuit may result.
- NEVER connect power factor correction capacitors to the drive output. Consult Yaskawa when connecting noise filters to the drive output.
- WIRE SIZING MUST BE SUITABLE FOR CLASS I CIRCUITS.
- When connecting motor to drive's output terminals, include a separate ground wire. Attach ground wire solidly to motor frame and to drive's ground terminal. $\perp$
- When using armored or shielded cable for connection between drive and motor, solidly connect armor or shield to motor frame, and to drive's ground terminal. $\perp$
- Motor lead length should NOT EXCEED 164 feet (50 meters), and motor wiring should be run in a separate conduit from the power wiring. If lead length must exceed this distance, reduce carrier frequency (see paragraph 5.8) and consult factory for proper installation procedures.
- Use UL listed closed loop connectors or CSA certified ring connectors sized for the selected wire gauge. Install connectors using the correct crimp tool recommended by the connector manufacturer.

WIRE SIZE		TERMINAL SCREW	CLOSED-LOOP CONNECTOR	CLAMPING TORQUE			
AWG	mm ²			STEEL		COPPER	
				lb-in	N-m	lb-in	N-m
20	0.5	M3.5	1.25 - 3.5	7.8	0.9	7.0	0.8
18	0.75	M4	1.25 - 4	13.0	1.5	10.4	1.2
16	1.25	M4	1.25 - 4	13.0	1.5	10.4	1.2
14	2	M4	2 - 4	13.0	1.5	10.4	1.2
		M5	2 - 5	26.1	2.9	3.1	0.4
12	3.5	M4	3.5 - 4	13.0	1.5	10.4	1.2
		M5	3.5 - 5	26.1	2.9	3.1	0.4
10	5.5	M4	5.5 - 4	13.0	1.5	10.4	1.2
		M5	5.5 - 5	26.1	2.9	3.1	0.4
8	8	M5	8 - 5	26.1	2.9	3.1	0.4
		M6	8 - 6	40.9	4.6	4.8	0.5
6	14	M6	14 - 6	40.9	4.6	4.8	0.5
4	22	M8	22 - 8	100.0	11.3	11.7	1.3
2	38	M8	38 - 8	100.0	11.3	11.7	1.3
		M10	38 - 10	182.6	20.6	21.4	2.4
1/0	60	M10	60 - 10	182.6	20.6	21.4	2.4
3/0	80	M10	80 - 10	182.6	20.6	21.4	2.4
4/0	100	M10	100 - 10	182.6	20.6	21.4	2.4
		M12	100 - 12	313.0	35.4	36.7	4.2
MCM300	150	M12	150 - 12	313.0	35.4	36.7	4.2
MCM400	200	M12	200 - 12	313.0	35.4	36.7	4.2
MCM650	325	M12	325 - 12	313.0	35.4	36.7	4.2

Table 1-1. Typical Wire Sizing For Main Circuit*

SECTION A. 230V				
DRIVE MODEL NO. GPD506V-	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE	
			AWG	mm ²
A003, A006	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), $\frac{\perp}{\equiv}$	M4	14 - 10	2 - 5.5
A008	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14 - 10	2 - 5.5
	$\frac{\perp}{\equiv}$	M4	12 - 10	3.5 - 5.5
A011	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), $\frac{\perp}{\equiv}$	M4	12 - 10	3.5 - 5.5
A017	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), $\frac{\perp}{\equiv}$	M4	10	5.5
A027, A036	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	8	8
	$\frac{\perp}{\equiv}$	M5	10 - 8	5.5 - 8
A054	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M6	4	22
	$\frac{\perp}{\equiv}$	M6	8	8
A068	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, ⊕3, T1 (U), T2 (V), T3 (W)	M8	3	30
	$\frac{\perp}{\equiv}$	M6	8	8
A080	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M8	3	30
	$\frac{\perp}{\equiv}$	M8	6	14
A104	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M8	2	38
	$\frac{\perp}{\equiv}$	M8	6	14
A130	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	4/0	100
	$\frac{\perp}{\equiv}$	M8	4	22
A160	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
	$\frac{\perp}{\equiv}$	M8	4	22
A192	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
	$\frac{\perp}{\equiv}$	M8	4	22
A248	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
	$\frac{\perp}{\equiv}$	M8	3	30
A312	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M12	4/0 x 2P	100 x 2P
	$\frac{\perp}{\equiv}$	M8	1	50
Section B. 460V				
DRIVE MODEL NO. GPD506V-	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE	
			AWG	mm ²
B001	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W), $\frac{\perp}{\equiv}$	M4	14 - 10	2 - 5.5
B003, B004, B008	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14 - 10	2 - 5.5
	$\frac{\perp}{\equiv}$	M4	12 - 10	3.5 - 5.5
B011	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	14 - 10	2 - 5.5
	$\frac{\perp}{\equiv}$	M4	12 - 10	3.5 - 5.5

* Consult local electrical codes for wire sizing requirements.

Table 1-1. Typical Wire Sizing For Main Circuit - Continued*

Section B. 460V - Continued				
DRIVE MODEL NO. GPD506V-	TERMINAL SYMBOL	TERMINAL SCREW	WIRE SIZE	
			AWG	mm ²
B014	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	12 - 10	3.5 - 5.5
	⊕	M4	12 - 10	3.5 - 5.5
B021	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M4	8 - 6	8 - 14
	⊕	M4	8 - 6	8 - 14
B027	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	8 - 6	8 - 14
	⊕	M6	8	8
B034	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕2, B1, B2, T1 (U), T2 (V), T3 (W)	M5	8 - 6	8 - 14
	⊕	M6	8	8
B041	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M6	6	14
	⊕	M8	8	8
B052	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M6	4	22
	⊕	M8	8	8
B065	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M8	4	22
	⊕	M8	8	8
B080	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M8	3	30
	⊕	M8	6	14
B096	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M8	1	50
	⊕	M8	6	14
B128	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	4/0	100
	⊕	M8	4	22
B180	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
	⊕	M8	4	22
B240	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M10	1/0 x 2P	60 x 2P
	⊕	M8	3	30
B302	L1 (R), L2 (S), L3 (T), L11, L21, L31, T1 (U), T2 (V), T3 (W)	M12	4/0 x 2P	100 x 2P
	⊕	M8	1	50
B380	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕3, T1 (U), T2 (V), T3 (W)	M16	MCM650 x 2P	325 x 2P
	⊕	M8	1	50
	ℓ1 (r), ℓ2 200 (±200), ℓ2 400 (±400)	M4	20 - 10	0.5 - 5.5
B506	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕3, T1 (U), T2 (V), T3 (W)	M16	MCM650 x 2P	325 x 2P
	⊕	M8	1/0	60
	ℓ1 (r), ℓ2 200 (±200), ℓ2 400 (±400)	M4	20 - 10	0.5 - 5.5
B675	L1 (R), L2 (S), L3 (T), ⊖, ⊕1, ⊕3, T1 (U), T2 (V), T3 (W)	M16	MCM650 x 2P	325 x 2P
	⊕	M8	1/0	60
	ℓ1 (r), ℓ2 200 (±200), ℓ2 400 (±400)	M4	20 - 10	0.5 - 5.5

* Consult local electrical codes for wire sizing requirements.

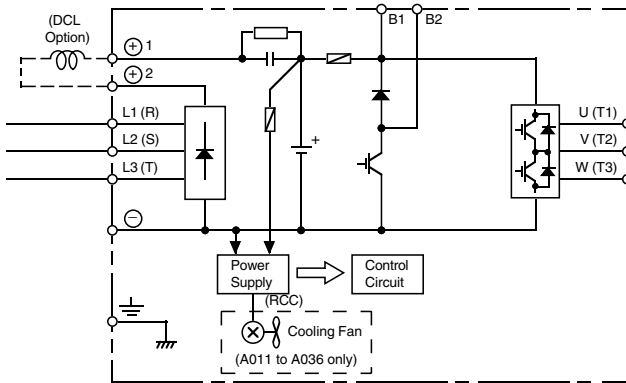
Table 1-2. Typical Terminal Functions and Voltages of Main Circuit

SECTION A. 230V			
TERMINAL	FUNCTION		
	A003 - A036	A054 - A068	A080 - A312
L1 (R) L2 (S) L3 (T)	Three phase Main circuit input power supply 200 / 208 / 220V at 50 Hz; 200 / 208 / 220 / 230V at 60 Hz		
L11 L21 L31	-----		Three phase Main circuit input power supply (same as at L1, L2 & L3)
T1 (U) T2 (V) T3 (W)	Three phase AC output to motor 0V to max. input voltage level		
B1 B2	DB Unit terminals (B1 & B2)	-----	
⊖ ⊕1 ⊕2	DC Reactor terminals (⊕1 & ⊕2) DC Bus terminals (⊕1 & ⊖)		-----
⊕3	-----	DB Unit terminals (⊕3 & ⊖)	-----
⏏	Ground terminal (100 ohms or less)		
SECTION B. 460V			
TERMINAL	FUNCTION		
	B001 - B034	B041 - B302	B380 - B675
L1 (R) L2 (S) L3 (T)	Three phase Main circuit input power supply 380 / 400 / 415 / 460V at 50/60 Hz		
L11 L21 L31	-----	Three phase Main circuit input power supply (same as at L1, L2 & L3)	-----
T1 (U) T2 (V) T3 (W)	Three phase AC output to motor 0V to max. input voltage level		
B1 B2	DB Unit terminals (B1 & B2)	-----	
⊖ ⊕1 ⊕2	DC Reactor terminals (⊕1 & ⊕2) DC Bus terminals (⊕1 & ⊖)	-----	
⊕3	-----		DB Unit terminals (⊕3 & ⊖)
ℓ ₁ (r) ℓ ₂ 200 (±200) ℓ ₂ 400 (±400)	-----		Power for heat sink fan: ℓ ₁ to ℓ ₂ 200: 230 Vac ℓ ₁ to ℓ ₂ 400: 460 Vac
⏏	Ground terminal (10 ohms or less)		

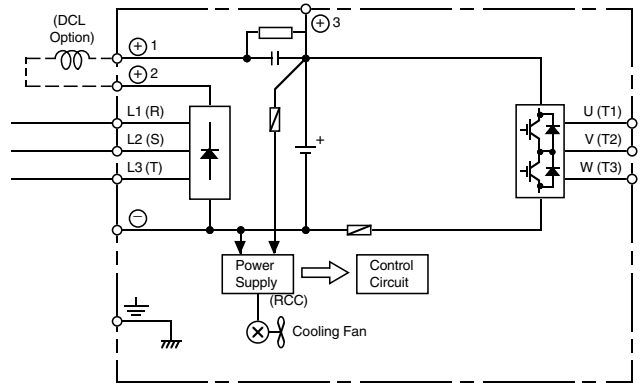
----- indicates that terminals are not present.

Main Circuit Configuration Block Diagrams 230V

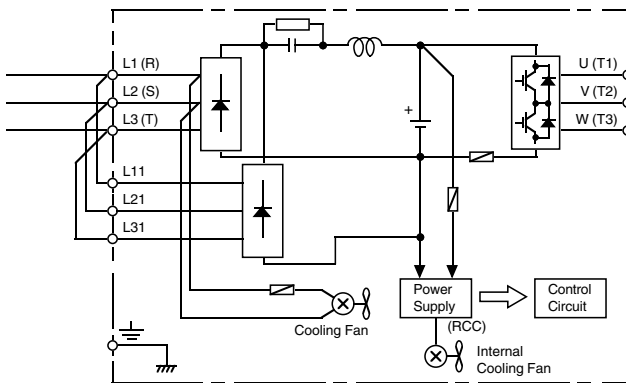
GPD506V-A003 to -A036



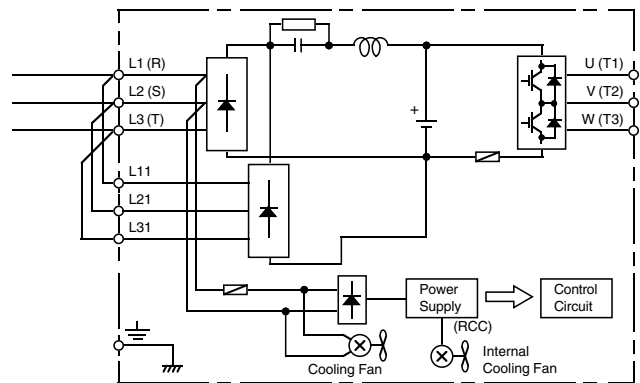
GPD506V-A054 to -A068



GPD506V-A080 to -A104

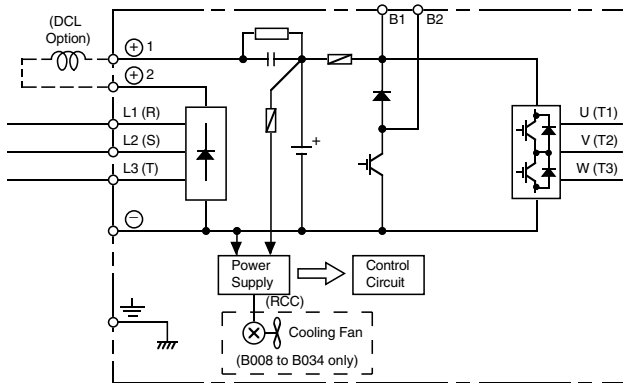


GPD506V-A130 to -A312

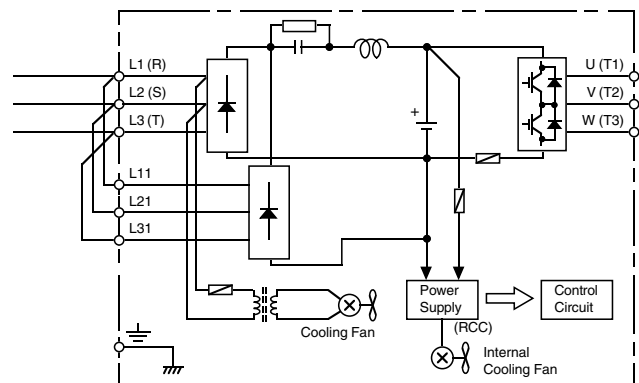


Main Circuit Configuration Block Diagrams 460V

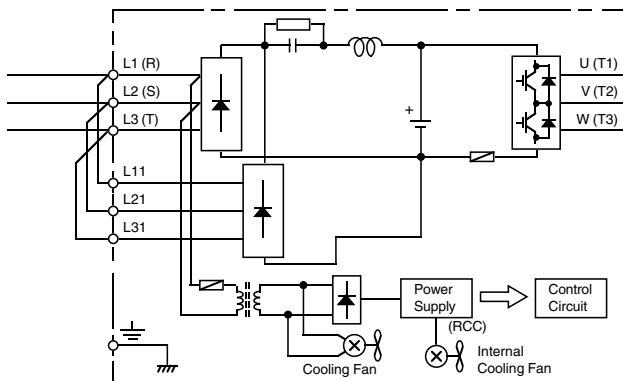
GPD506V-B001 to -B034



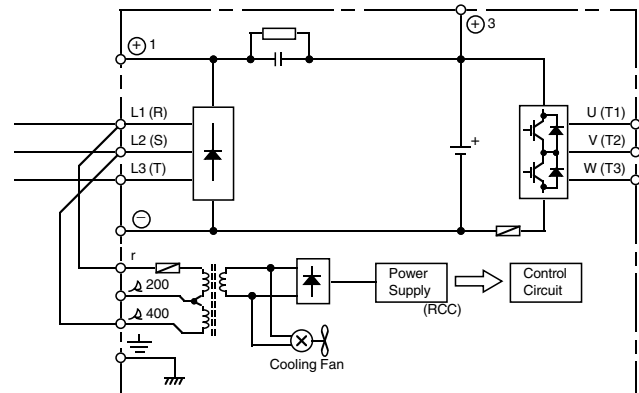
GPD506V-B041 to -B096



GPD506V-B128 to -B302



GPD506V-B380 to -B675



When using DC input as main circuit power, connect 460Vac to control power transformer terminals r and s400.

Table 1-3. Terminal Functions and Signals of Control Circuit

TERMINAL	FUNCTIONS		DESCRIPTION / SIGNAL LEVELS
S1	2-WIRE CONTROL: Forward Run / Stop signal (See NOTE 1)		Run at closed, stop at open (See NOTE 2)
	3-WIRE CONTROL: Run signal		Run at closed (See NOTE 2)
S2	2-WIRE CONTROL: Reverse Run / Stop signal (See NOTE 1)		Run at closed, stop at open (See NOTES 2 & 3)
	3-WIRE CONTROL: Stop signal		Stop at open (See NOTES 2 & 3)
S3	External fault input		Fault at closed (see NOTES 2 & 3). When the External Fault input is applied, the drive's Fault relay trips (shutdown) and the motor coasts to a stop. The Digital Operator displays " EF3 Ext Fault 3 " failure.
S4	Fault Reset input (external)		Fault Reset at closed (see NOTES 2 & 3). The Fault Reset input will reset the Fault relay, if the drive is in "stopped" condition. Both Forward Run/Stop signal and Reverse Run/Stop signal must be OPEN.
S5	Multi-step Speed Reference 1		Effective when closed (See NOTES 2 & 3)
S6	Multi-step Speed Reference 2		Effective when closed (See NOTES 2 & 3)
SC	Sequence control input common for terminals S1-S6.		Sequence control input 0 V
M1 M2	Multi-function contact output (N.O.). One of 18 functions are available, by setting of parameter n042 .		Contact capacity: 250 Vac at 1A or below 30 Vdc at 1A or below
G	Connection for shield sheath of signal leads		— — — —
FS	Frequency reference power supply		+15V (Control power supply for frequency setting: max 20 mA)
FV	Frequency reference analog input (voltage); auto input – can be changed to manual by setting of parameter n043 .		0 to +10V/100% (20K ohms) See paragraph 5.11.
FI	Frequency reference analog input (current); can be changed to voltage input by setting of parameter n044 , and status of jumper J1.		4-20mA/100% (250 ohms) See paragraph 5.11.
FC	Frequency reference analog input common		0 V
MA	Multi-function contact output (N.O./N.C.). One of 18 functions are available, by setting of parameter n041 .	Closed at fault	Contact capacity: 250 Vac at 1A or below 30 Vdc at 1A or below
MB		Open at fault	
MC		Common	
AM	Multi-function analog monitor (+)	Output current or output frequency is selectable	Type of analog signal (operating parameter) to be output is selected by setting of parameter n052 . Monitor output: 0 to +11V; 2 mA maximum
AC	Multi-function analog monitor (-)		

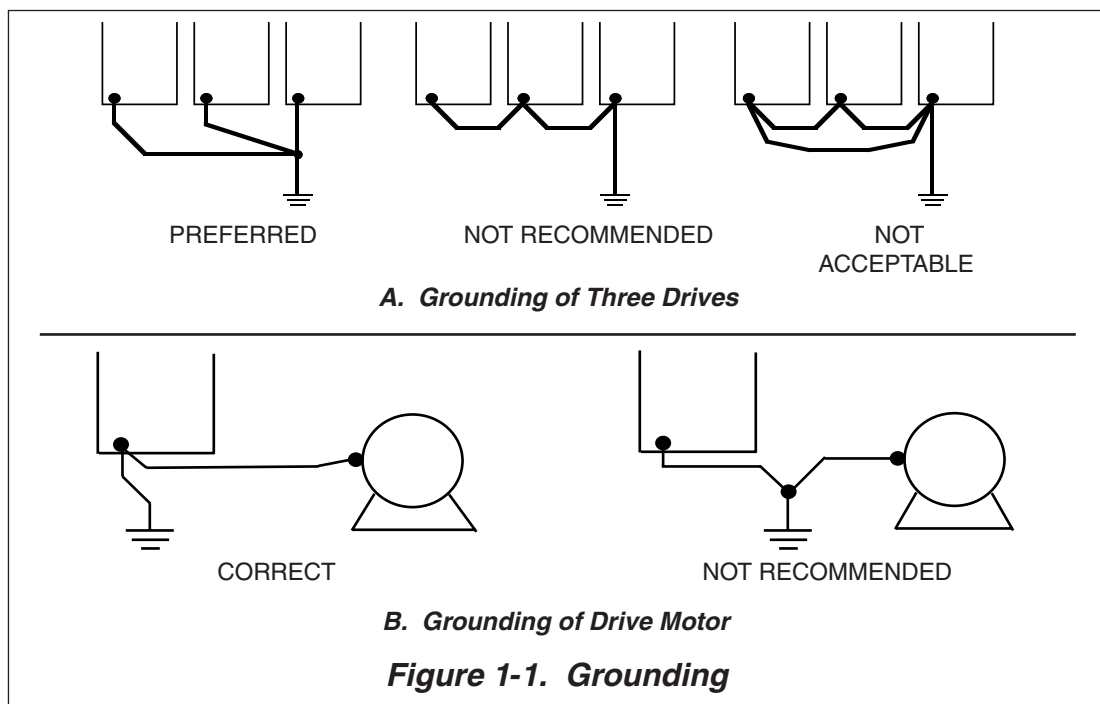
NOTES:

1. When Forward Run and Reverse Run inputs are both closed for more than 500 ms, the Digital Operator displays a blinking “ **EF Ext Fault** ” alarm code and the motor (if rotating) is decelerated by the drive to a stop. This stop condition is not stored by the drive (on Digital Operator, red LED at **STOP** key does not light); **IF ONE OF THE INPUTS IS OPENED, THE MOTOR WILL IMMEDIATELY START UP AGAIN.**
2. Terminals S1-S6 source +24 Vdc (8mA max.) and operate in a Low = True (ON) configuration when connected to terminal SC.

When using relays for input to terminals S1-S6, use relays with highly reliable contacts (for very small current) with a capacity of 30 Vdc or more and rated current of 100mA or higher. When using transistor (open collector) input, use transistors with rated voltage of 35 Vdc or more and rated current of 100mA or more.
3. These terminals are multi-function inputs. The indicated functions are their settings, based on a 2-Wire reset. For 3-Wire reset definitions, and other settings, see descriptions for “Multi-Function Input Terminals”, parameters **n036** thru **n040**, in paragraph 5.19.

1.4.2 Grounding

- The drive must be solidly grounded using the main circuit ground terminal. ≡
- If Drive is installed in a cabinet with other equipment, ground leads for all equipment should be connected to a common low-impedance ground point within the cabinet.
- The supply neutral should be connected to the ground point within the cabinet.
- Select appropriate ground wire size from Table 1-1.
- Make all ground wires as short as practical.
- NEVER ground the drive in common with welding machines or other high power electrical equipment.
- Where several drives are used, ground each directly to the ground point (see Figure 1-1). **DO NOT FORM A LOOP WITH THE GROUND LEADS.**
- When connecting a motor to the drive’s output terminals, include a separate ground wire. Attach ground wire solidly to motor frame and to drive’s ground terminal. ≡
- When using armored or shielded cable for connection between drive and motor, solidly connect armor or shield to motor frame, and to the drive’s ground terminal. ≡



1.4.3 Auxiliary Input and Output Power Option Devices

A disconnect device (circuit breaker, contactor, disconnect switch, etc.) should NOT be used as a means of starting and stopping the drive or motor.

A disconnect device can be installed for emergency stop purposes, but when that disconnect device is opened, there may be loss of electrical braking.

Figure 1-2 is a factory guideline for proper wiring practices and relative locations within the electrical path from the line to the load. It does not imply what devices are needed for a particular application, nor does it show what devices were shipped with a particular order. Therefore, disregard those items in the diagram which are not being used in your installation. However, it **is** recommended that an input or DC reactor be used with models GPD515C-A003 thru -A064 and -B001 thru -B034 when wired to a source of 600 kVA or greater. Mount all optional power devices close to the drive, and keep electrical connections as short as possible.

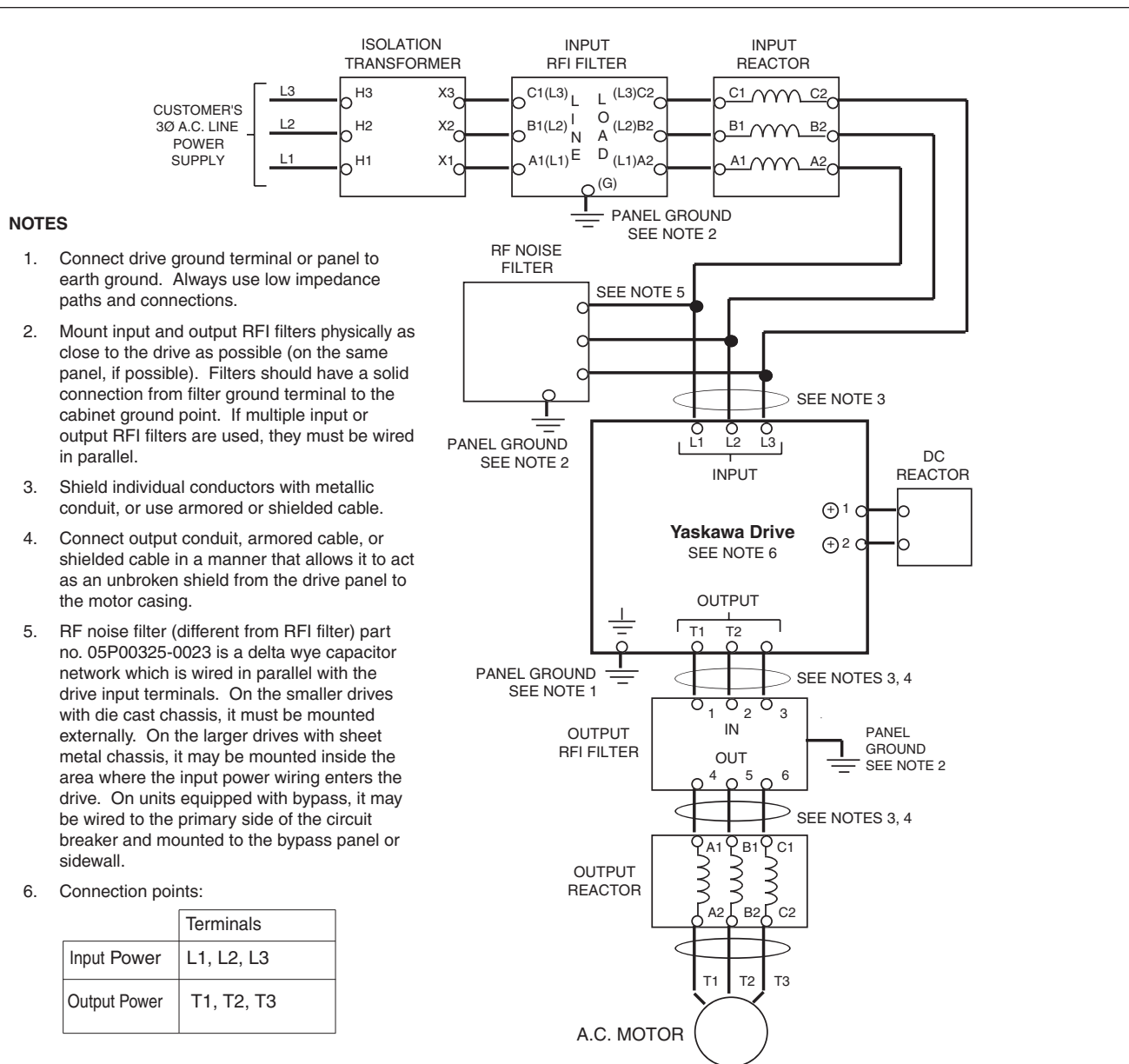


Figure 1-2. Customer Connection Diagram For Isolation Transformers, Input Reactors, Input RFI Filters, DC Reactors, Output Reactors and Output RFI Filters

1.4.3a Conformance to European EMC

In order to conform to EMC standards, the exclusive-use methods are required for line filter application, cable shielding and drive installation. The following explains the outline of the methods.

The line filter and drive must be mounted on the same metal plate. The filter should be mounted as close to the drive as practical. Keep cable as short as possible. The metal plate should be securely grounded. The ground of line filter and drive must be bonded to the metal plate with as much area as possible.

For mains input cables, screened cable is recommended at least within the panel. The screen of the cable should be connected to solid ground. For motor cable, screened cable (max. 20 m) must be used and the screen of the motor cable should be connected to ground at both ends by a short connection, using as large an area as practical.

For more detailed explanation, refer to Yaskawa document TD 4077, "Installation Guidelines For EMC Directive using Yaskawa AC Drive Products."

Table 1-4 and Figure 1-2A show the line filter list for EMC standards and the installation/wiring of drive and line filter.

Table 1-4. Line Filters for GPD 506/P5

Drive Model Number GPD506V-	Line Filter			
	Part Number	Rated Current (A)	Mass (kg)	Dimensions in mm ⁽¹⁾ L x W x D ⁽²⁾
B001	5P325-0106	8	1.8	320 x 143 x 46
B003				
B004	5P325-0103	20	1.8	320 x 143 x 46
B008				
B011	5P325-0104	30	3.0	350 x 213 x 51
B014				
B021	5P325-0105	60	5.3	435 x 268 x 56
B027				
B034	5P325-0107	80	7.5	350 x 180 x 90
B041				
B052	5P325-0108	100	13.8	420 x 200 x 130
B065				
B080	5P325-0109	150	13.8	480 x 200 x 160
B096	5P325-0110	160	25	480 x 200 x 160
B128	5P325-0111	180	25	480 x 200 x 160
B180	5P325-0112	300	25	480 x 200 x 160
B240				
B302	5P325-0113	400	45	588 x 250 x 200
B380	5P325-0119	500	Consult Factory	
B506	5P325-0120	600		
B675	5P325-0121	900		

(1) 1mm = 0.0394 inches

(2) D is the distance the filter will extend outward from the surface of the metal plate.

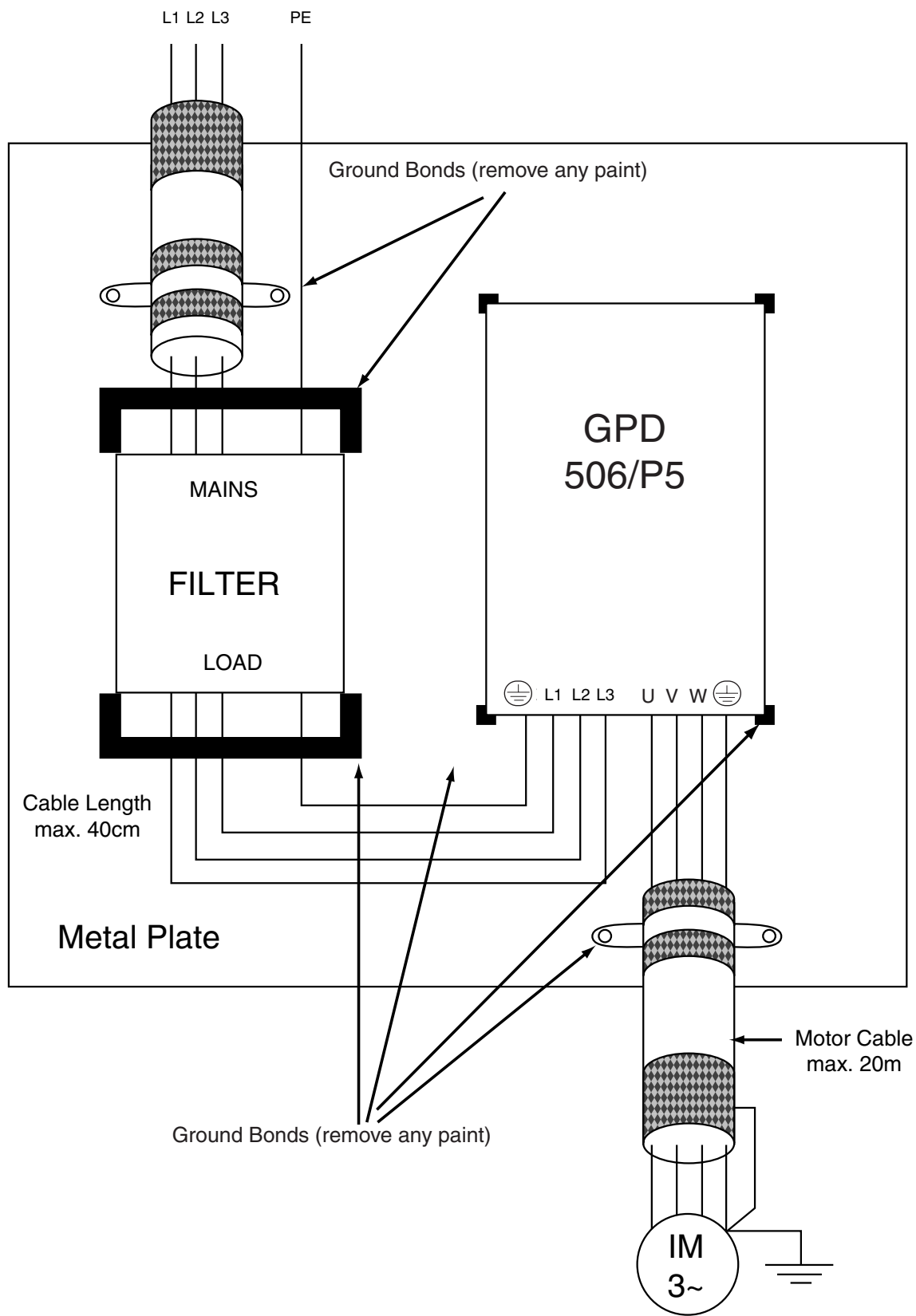


Figure 1-2A. Installation of Line Filter and GPD 506/P5 Drive

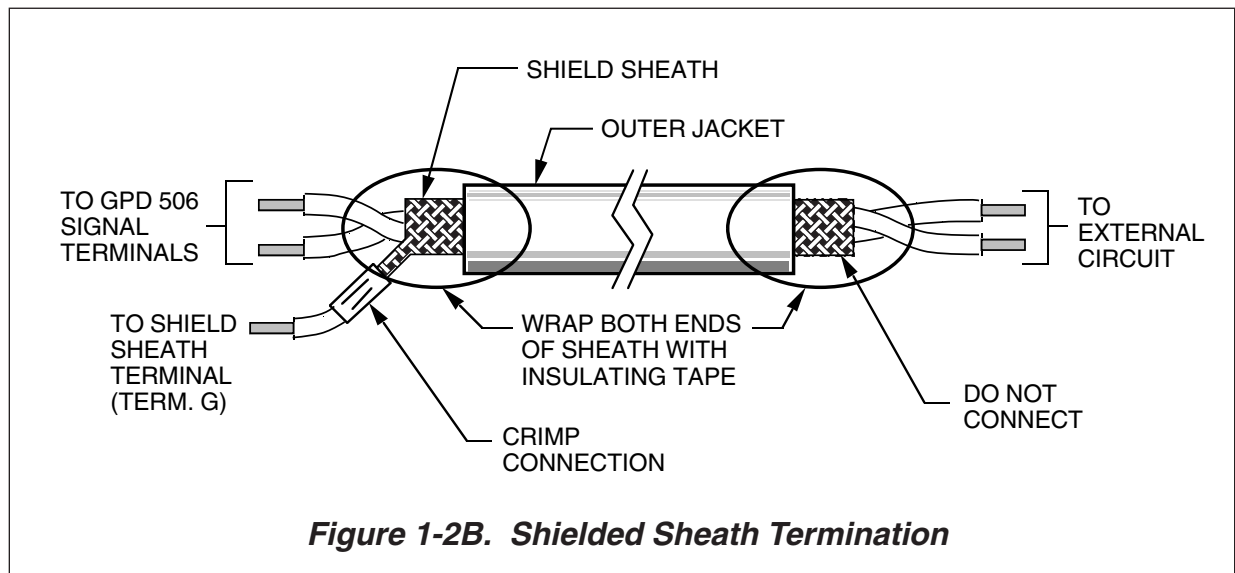
1.4.4 Control Circuit

All basic control circuit (signal) interconnections are shown in the appropriate diagram:

- Interconnections for external two-wire control in combination with the Digital Operator are shown in Figure 1-3.
- Interconnections for external three-wire control in combination with the Digital Operator are shown in Figure 1-4.

Make wire connections according to Figures 1-3, 1-4 and Table 1-3; observe the following:

- Signal Leads: Terminals 1-8 & 11; 12-17 & 33; and 21-27.
- Control Leads: Terminals 9 & 10 and 18-20.
- Use twisted shielded or twisted-pair shielded wire (20-16 AWG [0.5 – 1.25mm²]) for control and signal circuit leads. The shield sheath **MUST** be connected at the drive end **ONLY** (terminal 12). The other end should be dressed neatly and left unconnected (floating). See Figure 1-2B.
- Signal leads and feedback leads (PG) must be separated from control leads, main circuit leads and any other power cables to prevent erroneous operation caused by electrical noise.
- Lead length should **NOT EXCEED** 164 feet (50 meters). Wire sizes should be determined considering the voltage drop.
- All AC relays, contactors and solenoids should have RC surge suppressors installed across their coils.
- All DC relays, contactors and solenoids should have diodes installed across their coils.



NOTES FOR FIGURE 1-3

- * – Indicates components not supplied.
 - ** – Branch circuit protection (Circuit breaker or input fuses) must be supplied by customer.
 - ⊙ – Indicates customer connection terminal. Wire only to terminals shown. Note that not all terminals shown are available in all ratings – see pages 1-3 thru 1-5.
 - () – Indicates alternate terminal marking, i.e., (R) and L1.
 - ▲ – Function labels shown for these terminals are determined by factory settings of **n036** through **n040** (see paragraph 5.19).
 - – Function labels shown for these terminals are determined by factory settings of **n041** & **n042** (see paragraph 5.20).
 - ◆ – Function label shown for this terminal is determined by factory setting of **n043** & **n044** (see paragraph 5.11).
 - – Function labels shown for these terminals are determined by factory setting of **n052** (see paragraph 5.18).
1. Multiple combinations of frequency references are possible – see paragraph 5.11.
 2. The Drive Electronic Thermal Overload function (**n033**, **n034**) meets standards set by UL and CSA for motor thermal overload protection. If local code requires separate mechanical overload protection, an overload relay should be installed, interlocked with the drive as shown. It should be the manual reset type to prevent automatic restart following a motor fault and subsequent contact reclosure after cool down.
 3. Insulated twisted shielded wire is required.
 - 2-conductor #18 GA. (Belden #8760 or equivalent).
 - 3-conductor #18 GA. (Belden #8770 or equivalent).
 - Connect shield ONLY AT drive END. Stub and isolate other end.
 4. The Digital Operator is standard on every drive. Remote operators, as shown, may not be required.
 5. Customer to connect terminal $\perp$ to earth ground (100 Ω or less, 230V; 10 Ω or less, 460V).
 6. An optional DC reactor may be added for harmonic attenuation, if needed; see separate instruction sheet for wiring.
 7. If application does not allow reverse operation, **n006**, Reverse Run Prohibit Selection, should be set to "REV prohibited" ("1"), and the Reverse Run/Stop input can be eliminated.
 8. These terminals are not present on all drive ratings – refer to Table 1-1.

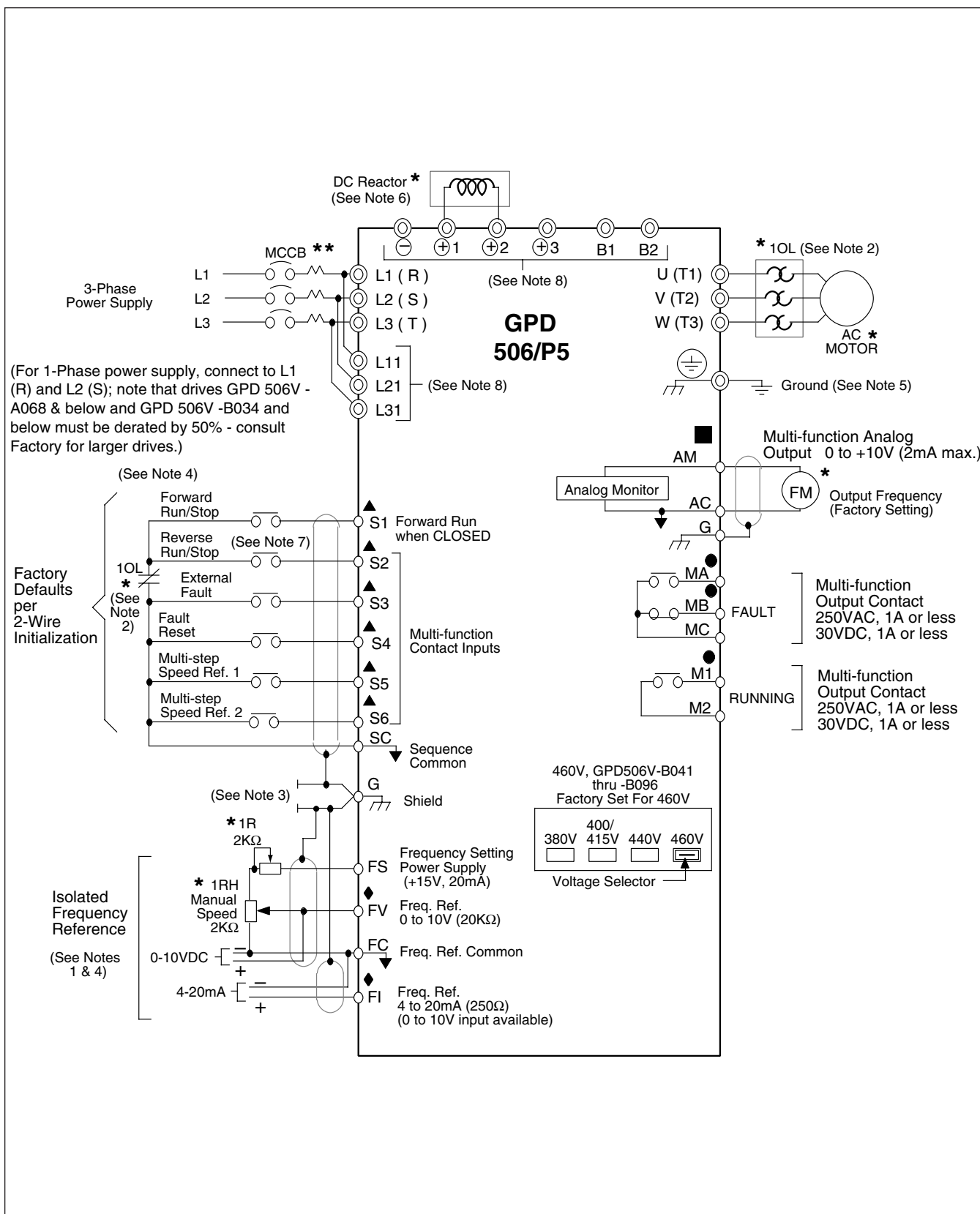


**Figure 1-3. 230V or 460V Interconnections - 2-Wire Control (n001 = 8)
(with parameters n036 = 0, n037 = 2,
n038 = 4, n039 = 10, and n040 = 11)**

NOTES FOR FIGURE 1-4

* – Indicates components not supplied.

** – Branch circuit protection (circuit breaker or input fuses) must be supplied by customer.

⊙ – Indicates customer connection terminal. Wire only to terminals shown. Note that not all terminals shown are available in all ratings – see pages 1-3 thru 1-5.

() – Indicates alternate terminal marking, i.e., (R) and L1.

▲ – Function labels shown for these terminals are determined by 3-Wire control factory settings of **n036** through **n040** (see paragraph 5.19).

● – Function labels shown for these terminals are determined by factory settings of **n041** & **n042** (see paragraph 5.20).

◆ – Function label shown for this terminal is determined by factory setting of **n043** & **n044** (see paragraph 5.11).

■ – Function labels shown for these terminals are determined by factory setting of **n052** (see paragraph 5.18).

1. Multiple combinations of frequency references are possible – see paragraph 5.11.
2. The Drive Electronic Thermal Overload function (**n033**, **n034**) meets standards set by UL and CSA for motor thermal overload protection. If local code requires separate mechanical overload protection, an overload relay should be installed, interlocked with the drive as shown. It should be the manual reset type to prevent automatic restart following a motor fault and subsequent contact reclosure after cool down.
3. Insulated twisted shielded wire is required.
 - 2-conductor #18 GA. (Belden #8760 or equivalent).
 - 3-conductor #18 GA. (Belden #8770 or equivalent).Connect shield ONLY AT DRIVE END. Stub and isolate other end.
4. The Digital Operator is standard on every drive. Remote operators, as shown, may not be required.
5. Customer to connect terminal $\perp$ to earth ground (10Ω or less, 230V; 10V or less, 460V).
6. An optional DC reactor may be added for harmonic attenuation, if needed; see separate instruction sheet for wiring.
7. If application does not allow reverse operation, **n006**, Reverse Run Prohibit Selection, should be set to "REV prohibited" ("1"), and the Forward/Reverse input can be eliminated.
8. These terminals are not present on all drive ratings – refer to Table 1-1.



CAUTION

Before running, *n001* must be set to " 0 ", " 1 ", " 2 ", or " 3 ". Resetting drive constant *n001* to " 8 " may cause the motor to run in the reverse direction WITHOUT A RUN COMMAND, and possibly result in damage to the equipment or personal injury.

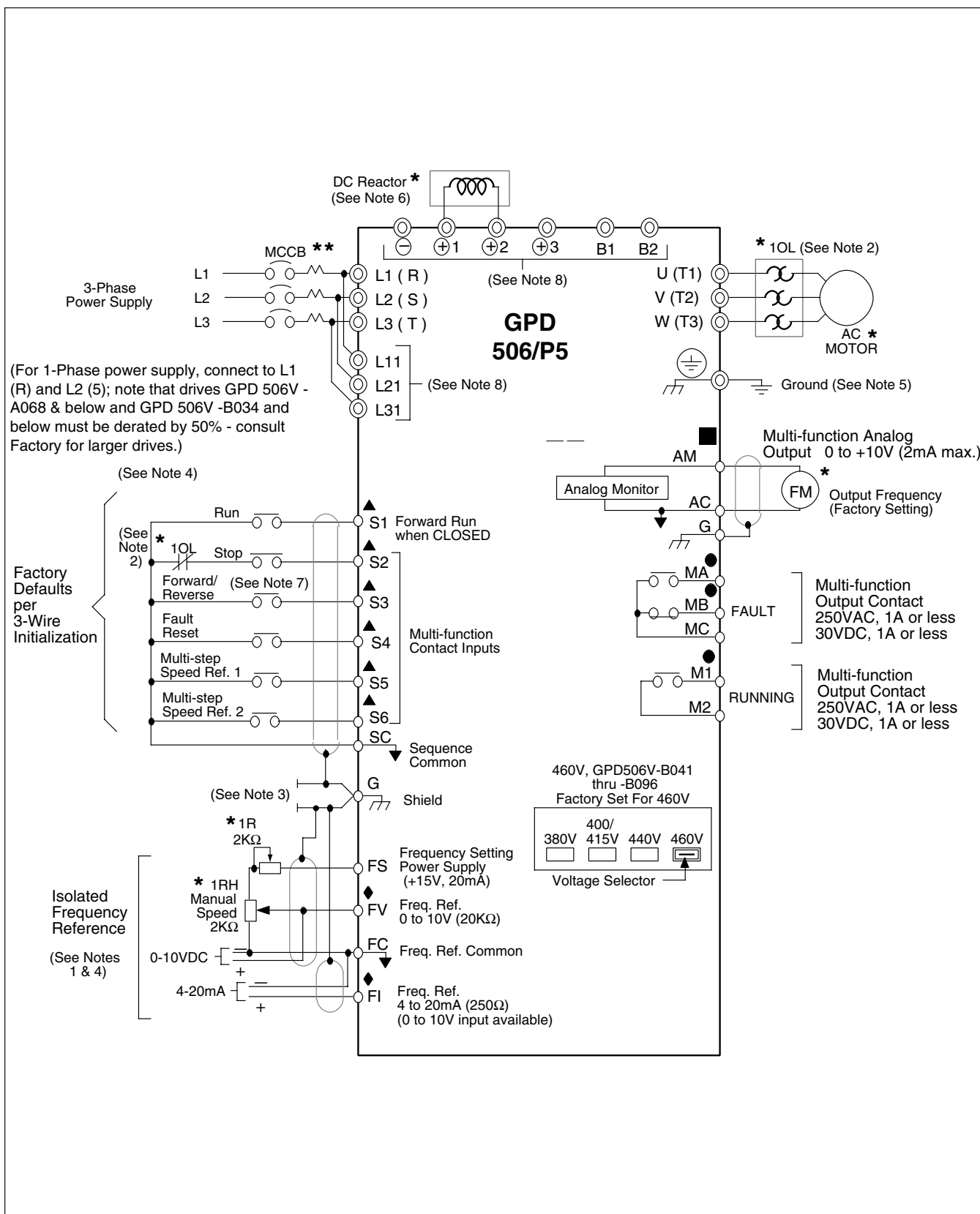
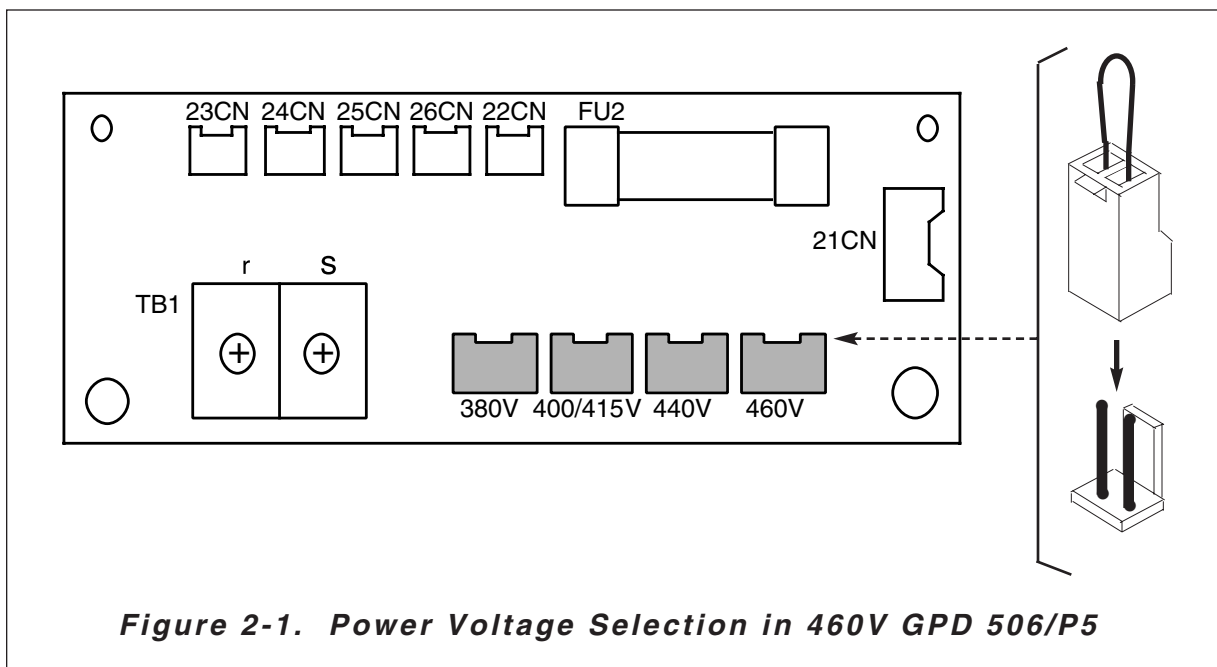


**Figure 1-4. 230V or 460V Interconnections - 3-Wire Control (n001 = 9)
(with parameters n036 = 1, n037 = --, n038 = 4,
n039 = 10, and n040 = 11)**

Section 2. INITIAL START-UP ("LOCAL" CONTROL)

2.1 PRE-POWER CHECKS

- Verify wires are properly connected and no erroneous grounds exist.
- Remove all debris from the drive enclosure. Check for loose wire clippings, metal shavings, etc.
- Verify all mechanical connections inside the drive are tight.
- Verify motor is not connected to load.
- Apply input power only after the front cover is in place. DO NOT remove the front cover or Digital Operator while input power is on.
- *For 460V, GPD506V-B041 thru -B096:* Verify that the drive power voltage select connector, located at lower left corner inside drive chassis (see Figure 2-1), is positioned correctly for the input power line voltage. Voltage is preset to 460V at the factory. Reposition, if required, to match nominal line voltage.



2.2 TEST RUN USING DIGITAL OPERATOR ("LOCAL" CONTROL)

The operation described in Table 2-1 and shown in Figure 2-2 is for a standard 60 Hz motor.

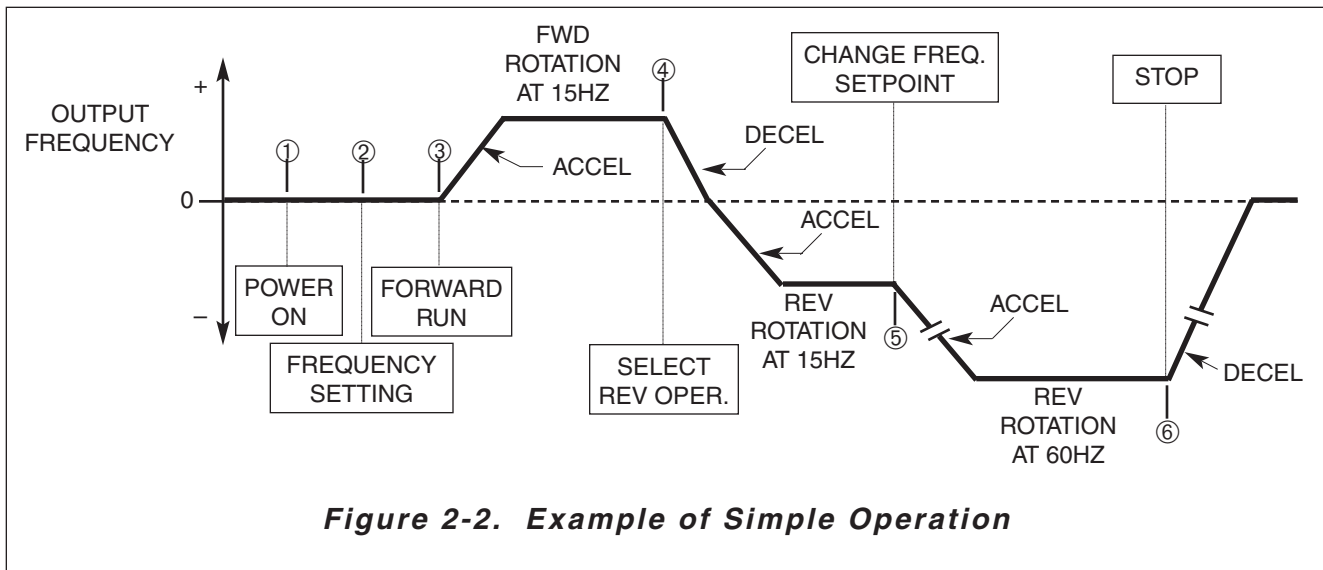


Figure 2-2. Example of Simple Operation

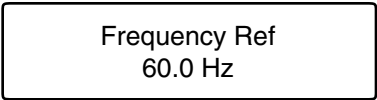
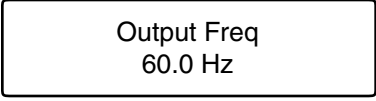
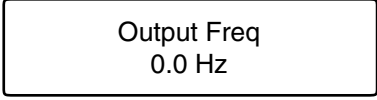
Table 2-1. Test Run With Digital Operator

DESCRIPTION	KEY SEQUENCE	DIGITAL OPERATOR DISPLAY
① Power ON Displays frequency reference setting.		SEQ & REF LEDs "ON", Frequency Ref 0.0 Hz Drive LED "ON"
Operation Condition Setting Select LOCAL mode.	Press	SEQ & REF LEDs "OFF" Frequency Ref 0.0 Hz Drive LED "ON"
② Frequency Setting Change reference value.	Change value by pressing either 	Frequency Ref 15.0 Hz
Write-in set value.	Press	Frequency Ref 15.0 Hz
Select output frequency monitor display.	Press	Output Freq 0.0 Hz

Table 2-1. Test Run With Digital Operator - Continued

DESCRIPTION	KEY SEQUENCE	DIGITAL OPERATOR DISPLAY
③ Forward Run Forward run (15 Hz)	Press 	RUN LED turns "ON" Output Freq 15.0 Hz (after motor reaches set frequency)
④ Reverse Run Select reverse run.	Press  3 times	Forward/Reverse F o r
	Switch to "rev" by pressing either  	Forward/Reverse r E v
	Write-in set value. Press 	Forward/Reverse r E v
	Select output frequency monitor display. Press  13 times	Output Freq 15.0 Hz
⑤ Frequency Reference Value Change (15 Hz to 60 Hz) Select frequency reference value display	Press  15 times	Frequency Ref 15.0 Hz
	Change set value. Change value by pressing either  	Frequency Ref 60.0 Hz

Table 2-1. Test Run With Digital Operator - Continued

DESCRIPTION	KEY SEQUENCE	DIGITAL OPERATOR DISPLAY
⑤ (Continued) Write-in set value	Press 	
Select output frequency monitor display.	Press 	
⑥ Stop Decelerates to a stop.	Press 	RUN LED blinks while motor is being decelerated and STOP/RESET LED turns "ON"; then RUN LED  turns "OFF"

2.3 PRE-OPERATION CONSIDERATIONS

- After completing the start-up, connect the motor to the load.
- Additional control circuit wiring can be added, and parameters in the drive can be programmed to configure the drive system to your specific application, including "Remote" (2-wire or 3-wire) Control. (See Table 5-1 for listing of Programmable Features descriptions.)

2.4 STORAGE FUNCTION

The drive uses internal NV-RAM to store information when power is removed or in the event of a power failure. Therefore, when power is reapplied, operation will begin at the same state as when power was removed.

The following information is stored:

- Last frequency command setting from Digital Operator.
- The sequence of failure conditions that occurred before power was removed.

Section 3. OPERATION AT LOAD

After completing the start-up, and programming of constants, turn off the AC main circuit power. Make additional wiring connections required for the external control functions selected by the constant programming. Connect the driven machine to the motor. Verify that the driven machine is in running condition, and that no dangerous conditions exist around the drive system.

OPERATING PRECAUTIONS

- Before applying a RUN command to the drive, verify that the motor is stopped. If the application requires the capability of restarting a coasting motor, parameter **n070** must be set to give DC Braking Time at Start.
- The motor cooling effect is reduced during low-speed running. The torque needs to be reduced in accordance with the frequency. For the reduction ratio, refer to the motor catalog or technical sheet.
- **NEVER** use a motor whose full-load amps exceeds the drive rating.
- When two or more motors are operated by one drive, verify that the total motor current **DOES NOT EXCEED** the drive rating.
- When starting and stopping the motor, use the operation signals (RUN/STOP, FWD/REV), NOT the magnetic contactor on the power supply side.

Run the motor under load with control by the Digital Operator using the same procedure as for the Test Run (Table 2-1). If the Digital Operator is used in combination with external commands or external commands only are used, the procedure must be altered accordingly.

For preset starting (one-touch operation after setting the frequency), perform the following:

1. Set the frequency and press **RUN**. Motor accelerates, at the rate corresponding to the preset accel time, to the preset frequency. The accel time is set too short relative to the load if the RPM of the accelerating motor does not increase smoothly (stall prevention during acceleration is functioning) or if a fault indication is displayed on the Digital Operator.
2. Press **STOP**. Motor decelerates, at the rate corresponding to the preset decel time, to a stop. The decel time is set too short relative to the load if the RPM of the decelerating motor does not decrease smoothly (stall prevention during deceleration is functioning) or if a fault indication is displayed on the Digital Operator.

Section 4. DIGITAL OPERATOR

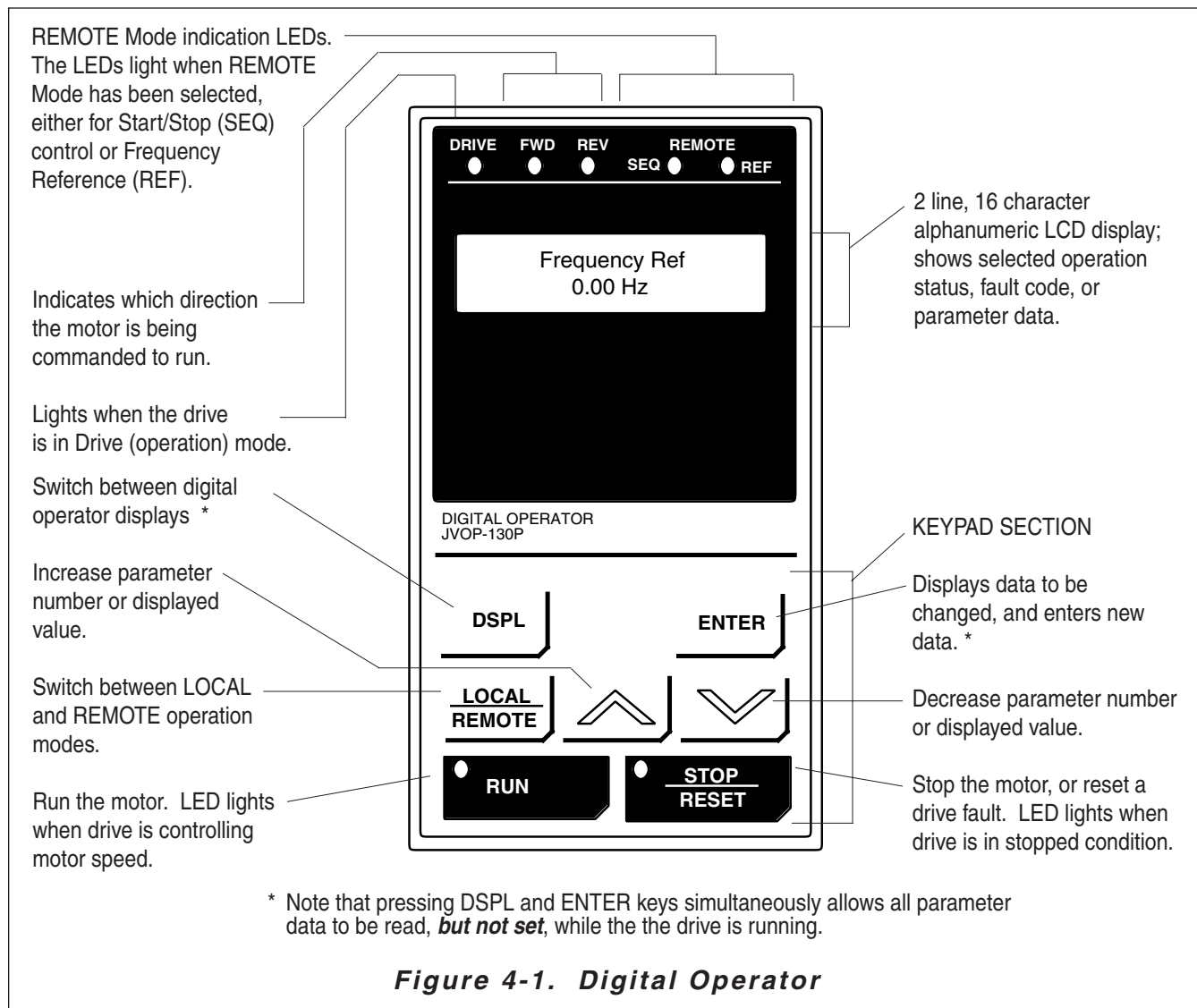
4.1 GENERAL

All functions of the GPD 506/P5 are accessed using the Digital Operator. In addition to controlling motor operation, the operator can enter information into the drive memory to configure the drive to the application, either by using the Quick-Start Displays or by entering the Program mode.

4.2 DISPLAY AND KEYPAD

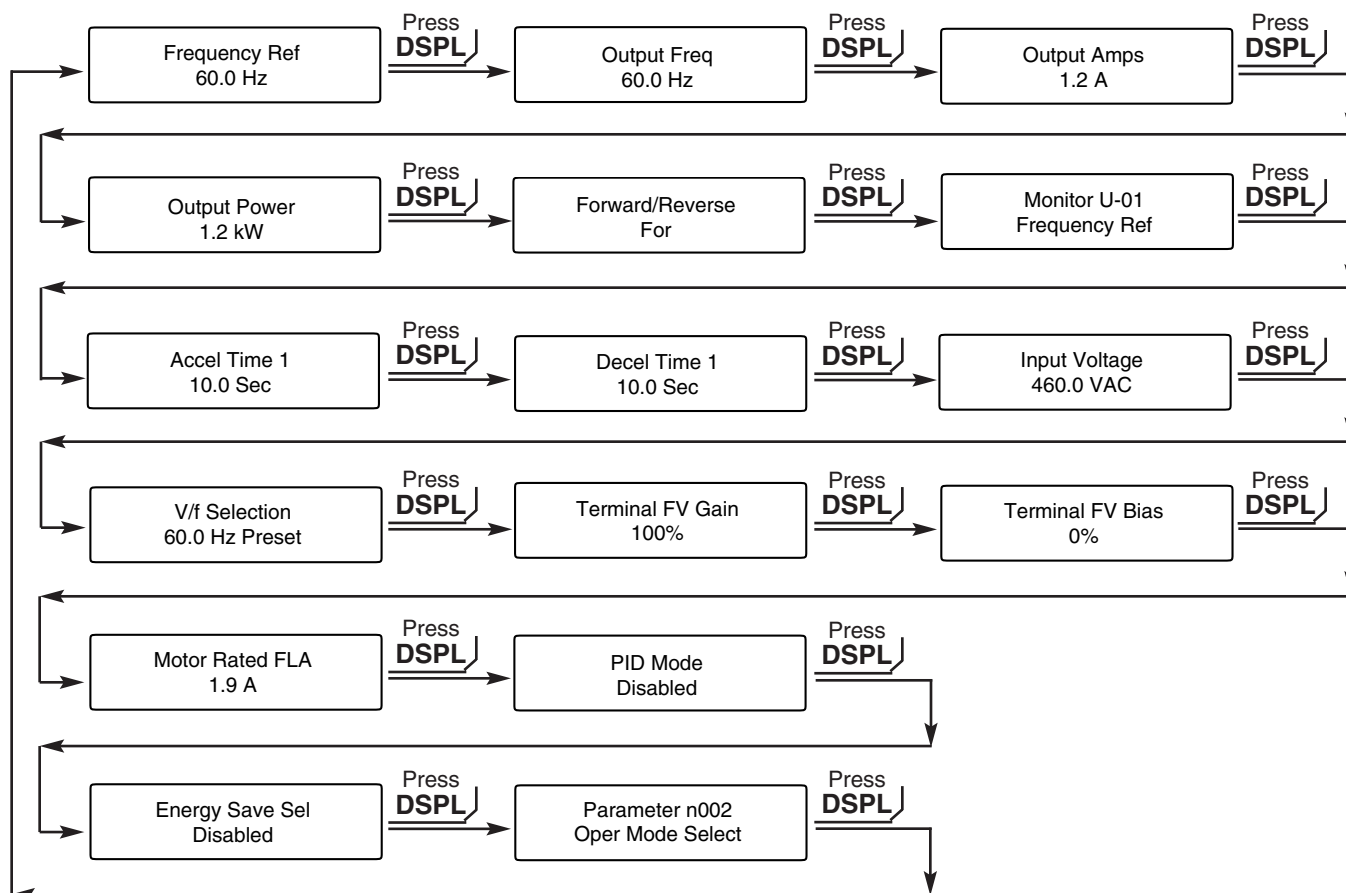
The Digital Operator has a 2-line by 16 character LED display. Both numeric and alphanumeric data can appear on the display.

Indicator lamps and keys on the Digital Operator are described in Figure 4-1.

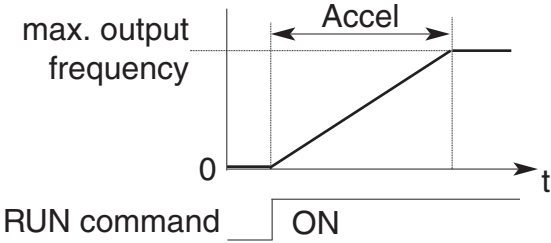
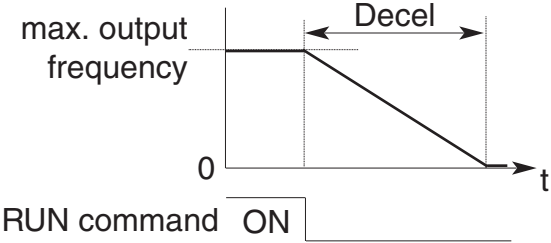


4.2.1 Description of Quick-Start Displays

By pressing the **DSPL** key on the Digital Operator while the drive is stopped or running, the operator can step to each of the sixteen Quick-Start Displays and its associated display/setting function:



- | | | |
|----------------------|---|---|
| Frequency Ref | — | Frequency Reference Setting [n024]
Sets the drive operation speed (Hz), unless the drive has been programmed for REMOTE Mode operation with run from external analog speed reference signal. Programmable during run. |
| Output Freq | — | Output Frequency Monitor
Displays the output frequency (Hz) at which the drive is currently operating. This is a monitor only function; the operator cannot change the displayed value by use of the keypad. |
| Output Amps | — | Output Current Monitor
Displays the level of output current (Amps) that the drive is currently producing. This is a monitor only function; the operator cannot change the displayed value by use of the keypad. |
| Output Power | — | Output Kilowatt Monitor
Displays the output power (kW) that the drive is currently producing. This is a monitor only function; the operator cannot change the displayed value by use of the keypad. |

Forward/Reverse —	FWD/REV Run Selection Sets the rotation direction of the motor when a Run command is given by the Digital Operator keypad. Display of For = forward run, rEv = reverse run. Use of this Quick-Start Display toggles between these two presets; the operator cannot enter a value.
Monitor U-xx —	Monitor Selection Pressing ENTER allows access to the various Monitor parameters, U-01 through U-13. These are monitor only functions; the operator cannot change the displayed value. See paragraph 4.4 for list of Monitor parameters. Programmable during run.
Accel Time 1 —	Acceleration Time 1 [n018] Sets the time (in seconds) it will take the drive to accelerate the motor from a stopped condition to maximum output frequency (i.e. sets the slope of the accel ramp). Programmable during run. 
Decel Time 1 —	Deceleration Time 1 [n019] Sets the time (in seconds) it will take the drive to decelerate the motor from maximum output frequency to a stopped condition (i.e. sets the slope of the decel ramp). Programmable during run. 
Input Voltage —	Motor Rated Voltage [n013] Sets the rated voltage (V) of the motor. (Part of V/f pattern setup; see paragraph 5.29.)
V/f Selection —	V/f Pattern Selection [n010] Sets a preset V/f pattern or allows a custom V/f pattern to be set for the application. (Part of V/f pattern set-up; see paragraph 5.28.)
Terminal FV Gain —	Frequency Reference Gain [n048] Sets the gain (%) for the analog frequency reference, input at terminal FV; see paragraph 5.10. Programmable during run.
Terminal FV Bias —	Frequency Reference Bias [n049] Sets the bias (%) for the analog frequency reference, input at terminal FV; see paragraph 5.10. Programmable during run.

Motor Rated FLA	—	Motor Rated Current [<i>n033</i>] Sets the Amps used for detecting motor overload. This is normally set to the motor rated current value (nameplate full-load amps). When set to " 0.0 ", motor overload protection is disabled. The factory settings are listed in Appendix 1.
PID Mode	—	PID Selection [<i>n084</i>] Setting data to "Disabled" (" 0 ") (factory setting) disables the PID function. Setting to "Enabled D = Fdbk" (" 1 ") enables PID; setting to "Enabled D = Fdfwd" (" 2 ") enables the "Feed Forward" function; setting to "Enabled RevFdbk" (" 3 ") enables the "Inverted PID" function. See "PID Control", paragraph 5.22.
Energy Save Sel	—	Energy Saving Selection [<i>n096</i>] Setting data to "Disabled" (" 0 ") (factory setting) disables the energy saving function; and setting to "Enabled" (" 1 ") enables this function. See "Energy Saving Control", paragraph 5.9.
Parameter nxxx	—	Parameter Programming Selects or reads data using parameter number (<i>nXXX</i>). Data is displayed by pressing the ENTER key, and can be changed by pressing the "up arrow" or "down arrow" keys. Any changes can be saved by again pressing the ENTER key. Pressing the DSPL key exits the Programming mode.

4.3 BASIC PROGRAMMING

By using the Quick-Start Displays on the Digital Operator, simple programming of the drive is possible. Following are examples of two methods for setting the acceleration time (**n018**). The first example shows how to utilize the **Accel** Quick-Start Display, and the second example shows how to access parameter **n018** through the **Program Mode**.

EXAMPLE 1: Using Accel Quick-Start Display

	Display
Press the DSPL key repeatedly until the " Accel Time 1 " appears.	Accel Time 1 10.0 sec
To set the acceleration time to 5 seconds, press the "down arrow" key until the Digital Operator display reads " 5.0 ".	Accel Time 1 5.0 sec
Press the ENTER key.	Accel Time 1 5.0 sec

EXAMPLE 2: Using PRGM LED

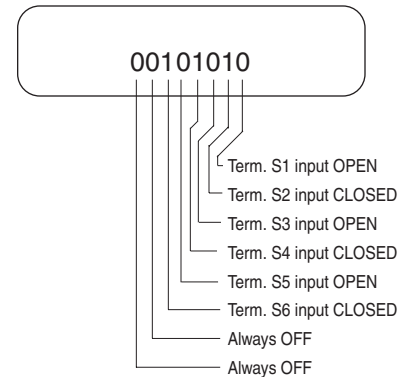
Press the DSPL key repeatedly until " Parameter n001 " appears.	Parameter n001 Password
Press the "up arrow" key to access n018.	Parameter n018 Accel Time 1
Press the ENTER key. The current set value is displayed.	Accel Time 1 10.0 sec
To set the acceleration time to 15 seconds, press the "up arrow" key until the Digital Operator display reads " 15.0 ".	Accel Time 1 15.0 sec
Press the ENTER key. Note: Once changed, data will blink until the ENTER key is pressed.	Accel Time 1 15.0 sec
Press the DSPL key until " Frequency Ref " appears and DRIVE LED turns on.	Frequency Ref 0.0 Hz

4.4 MONITOR DISPLAYS

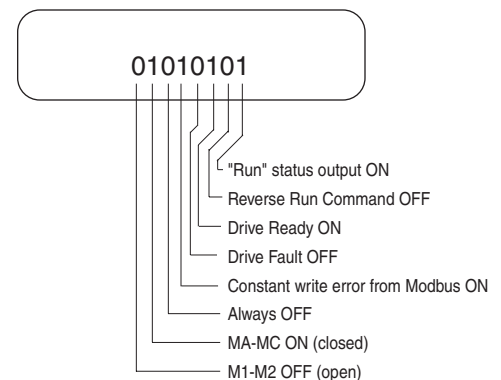
When using the **Monitor** Function, a variety of information will appear on the Digital Operator display when each of the U-XX (display only) parameters is selected.

CONSTANT U-	MONITORED ITEM	DISPLAY EXAMPLE
01	Frequency reference (Hz)	Frequency Ref. 60.0 Hz
02	Output frequency (Hz)	Output Freq. 60.0 Hz
03	Output current (A)	Output Amps 12.5 A
04	AC output voltage (V)	Output Voltage 230 VAC
05	DC Bus voltage (VPN)	DC Bus Voltage 325 VDC
06	Output power (kW)	Output Power (-) 0.7 kW
07	Input terminal status	00101010 ⁽¹⁾
08	Drive status	01010101 ⁽²⁾
09	Fault log (last 4 faults) ⁽³⁾	Fault History oC
10	Software number (last 4 digits) : 10XXXX	PROM Number 5110
11	Elapsed time meter (Hrs) (lower 4 digits, can be preset in parameter n066)	Elapsed Time 1 3456 H
12	Elapsed time meter (Hrs) (upper 2 digits, can be preset in parameter n062)	Elapsed Time 2 12 H
13	PID feedback (Hz)	45.0
14	Square root function	Square Root N 7557
15	Kilowatt-hour meter (lower 4 digits)	KwH Monitor 1 0.1 KwH
16	Kilowatt-hour monitor (upper 2 digits)	KwH Monitor 2 0

(1) Actual display appearance:



(2) Actual display appearance:



(3) See paragraph 6.2 for viewing of fault log contents.

Section 5. PROGRAMMABLE FEATURES

5.1 GENERAL

This section describes features of the drive which are defined by programmed settings in the various parameters in memory. Since most features use more than one parameter, the descriptions appear in alphabetical order by the function name. In Table 5-1, the functions are grouped into operational categories. To cross reference a particular parameter to the features to which it applies, see the listings in Appendix 1, or the Index.

Table 5-1. List of Features Defined By Parameters

FUNCTION	PARAGRAPH REFERENCE	PARAMETER(S)
SET-UP		
Initialization (Reset), 2-Wire or 3-Wire	5.23	<i>n001</i>
Drive Capacity, Parameters Affected By	Table A3-1	—
Volts/Hertz Patterns, Standard	5.28 A	<i>n010</i>
Volts/Hertz Pattern, Custom	5.28	<i>n011 - n017</i>
Input & Output Voltage Setting	5.28 B	<i>n003</i>
Thermal Motor Overload Protection	5.26	<i>n033, n034</i>
Digital Operator Display, Re-scaling	5.8	<i>n023</i>
Input Phase Loss Detection	5.29	<i>n083</i>
STARTING		
Accel Time	5.2	<i>n018, n020</i>
S-Curve Characteristics	5.3	<i>n022</i>
DC Injection Braking at Start	5.7	<i>n016, n068, n070</i>
STOPPING		
Stopping Method	5.25	<i>n004</i>
Decel Time	5.2	<i>n019, n021</i>
DC Injection Braking at Stop	5.7	<i>n016, n068, n069, n070</i>
Local/Remote Changeover	5.15.1	<i>n111</i>
SPEED CONTROL		
Frequency Reference, Upper & Lower Limits	5.12	<i>n031, n032</i>
Jog Reference	5.15	<i>n030, n036 - n040</i>
Speed Reference Selection (Remote/Local)	5.19A	<i>n002</i>
Multi-step Speed Setting	5.19B	<i>n024 - n030, n037 - n040</i>
Sample/Hold	5.19G	<i>n036 - n040</i>
Accel/Decel/Hold	5.19H	<i>n036 - n040</i>
Up/Down Frequency Setting	5.19H	<i>n040</i>

Table 5-1. List of Features Defined By Parameters - Continued

FUNCTION	PARAGRAPH REFERENCE	PARAMETER(S)
SPEED CONTROL (continued)		
Modbus Control	5.16	<i>n002, n036 - n040, n101- n106</i>
PID Control	5.22	<i>n002, n024 - n030, n043, n044, n084 - n093, n094, n095</i>
REVERSE		
Reverse Run Disabled	Table A1-1	<i>n006</i>
RUNNING		
Critical Frequency Rejection	5.6	<i>n062, n063, n064</i>
Carrier Frequency	5.5	<i>n054</i>
Speed Search	5.19E	<i>n036 - n040, n056 - n058</i>
Speed Coincidence	5.20B	<i>n075, n076</i>
Energy Saving	5.9	<i>n096 - n100</i>
Slip Compensation	5.23.1	<i>n107 - n109</i>
RUNNING IMPROVEMENTS		
Torque Compensation	5.27	<i>n071</i>
Stall Prevention	5.24	<i>n072, n073, n074</i>
PROTECTIVE FEATURES		
Momentary Power Loss Ride-thru	5.17	<i>n055, n059</i>
Auto Restart	5.4	<i>n060, n061</i>
Frequency Reference Loss Detection	5.13	<i>n046, n047</i>
Frequency Reference Retention	5.14	<i>n045</i>
Overtorque/Undertorque Detection	5.21	<i>n041, n042, n077, n078, n079</i>
Miscellaneous Protective Functions	5.16.1	<i>n110</i>
Timer Function	5.19 F	<i>n041, n042, n080, n081</i>
DRIVE CONTROLS, INPUT		
Multi-function Analog Input (Auto/Manual)	5.11	<i>n043, n044</i>
Frequency Reference Bias and Gain	5.10	<i>n048 - n051</i>
Multi-function Input Terminals	5.19	<i>n036 - n040</i>
External Fault Terminals	5.19	<i>n036 - n040</i>
DRIVE OUTPUT		
Multi-function Output Terminals	5.20	<i>n041, n042, n075, n076</i>
Analog Monitor Output (Multi-function)	5.18	<i>n052, n053</i>
MONITOR DISPLAY		
Digital Operator Display Selection	5.8	<i>n023</i>

5.2 ACCEL/DECEL TIME

- A. **n018**: Accel Time 1
n019: Decel Time 1

Factory setting (each): 10.0 seconds
Range (each): 0.0 to 3600 seconds

- n020**: Accel Time 2
n021: Decel Time 2

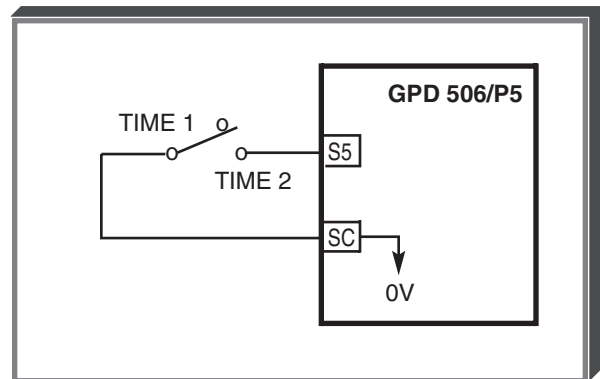
Factory setting (each): 10 seconds
Range (each): 0 to 255 seconds

The Drive incorporates two sets of individually programmable acceleration and deceleration times.

- B. **n036 thru n040**: Multi-function Inputs (Term. S2 thru S6)

Data 14 : Accel/Decel Time Selection

By programming data "Acc/Dec Switch" (" 14 ") into one of the multi-function parameters (**n036** thru **n040**), one of the multi-function input terminals (S2 thru S6) becomes a time selection input. When the input terminal (i.e. external contact) is open, Time 1 (**n018/n019**) is selected. When the input terminal is closed, Time 2 (**n020/n021**) is selected.

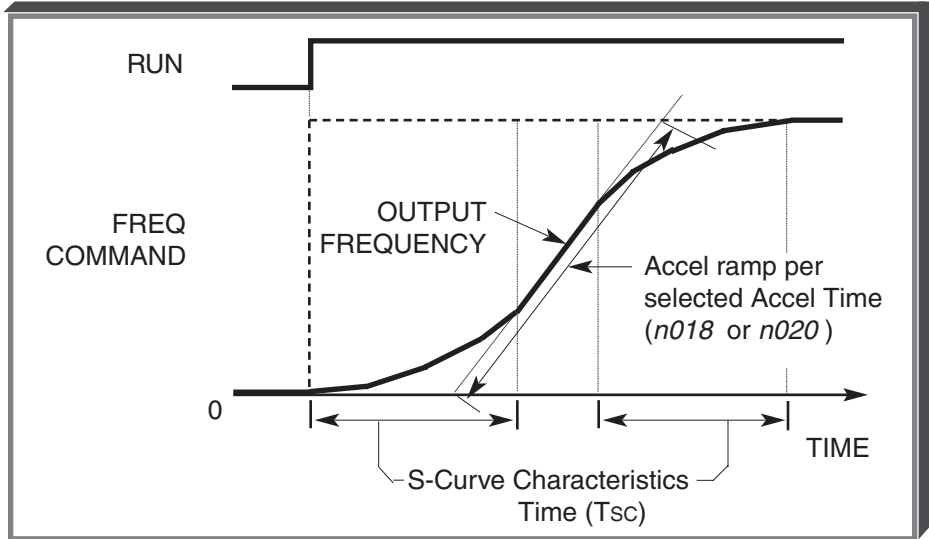


Note: All tables for parameters with "selectable" data (**n002**, **n004**, etc.) show the factory setting indicated in **bold**, followed by an asterisk (*).

5.3 ACCEL/DECEL: S-CURVE CHARACTERISTICS

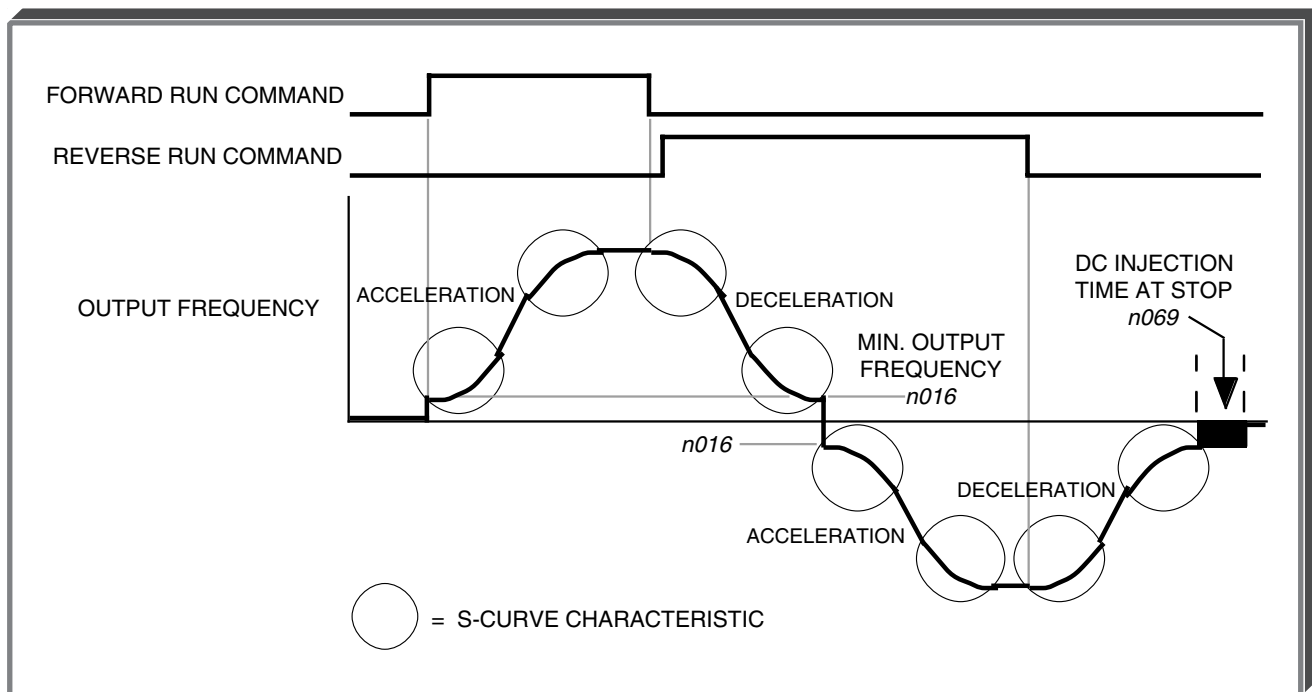
n022 : S-Curve Selection (S-Curve Select)

Setting of this parameter determines the S-curve (starting) characteristics of the acceleration ramp.



LED Setting	LCD Setting	Description
0	No S-Curve *	S-Curve disabled
1	0.2 Sec	S-Curve of 0.2 seconds
2	0.5 Sec	S-Curve of 0.5 seconds
3	1.0 Sec	S-Curve of 1.0 seconds

The following figure shows FWD/REV switching and acceleration & deceleration to a stop with S-curve active.



5.4 AUTO-RESTART

A. **n060** : Number of Auto-Restart Attempts (Num of Restarts)

Factory setting: **0**

Range: 0 - 10

When a fault occurs during operation, the drive can be programmed for an auto-restart operation to automatically reset the fault. Auto-restart operation will use the number of reset attempts set in this parameter, up to the maximum of 10. When set to "0", no auto-restarts will be attempted.

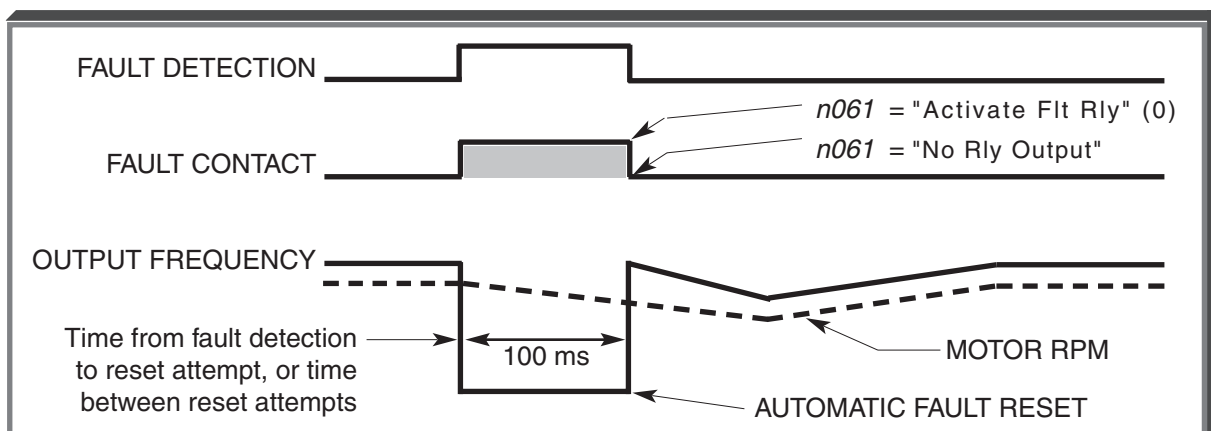
- The following faults can be automatically reset:

oC: Overcurrent	GF: Ground fault
ou: Overvoltage (OV)	Uu1: Undervoltage (Power UV)
- The following conditions WILL NOT initiate auto-restart:
 1. oL, EF_, PUF or CPF_ fault.
 2. When OC or UV occurs during deceleration.
 3. When **n055** is programmed to stop during momentary power failure (data = "0"). (See paragraph 5.17, **MOMENTARY POWER LOSS RIDE-THRU**.)
- The number of restart attempts available will be reset to the **n060** setting when:
 1. 10 minutes has elapsed without a fault occurring.
 2. The **RESET** key, or external Fault Reset push button, is pressed.
 3. Power is removed from the Drive.

B. **n061** : Fault Contact Status During Auto-Restart (Restart Sel)

This digit controls how the fault contact responds to a drive fault during the auto-restart operation.

LED Setting	LCD Setting	Description
0 *	Activate Flt Fly *	Fault contract actuates during auto-restart attempts
1	No Rly Output	Fault contract will not actuate during auto-restart attempts



Auto-Restart Operation Timing

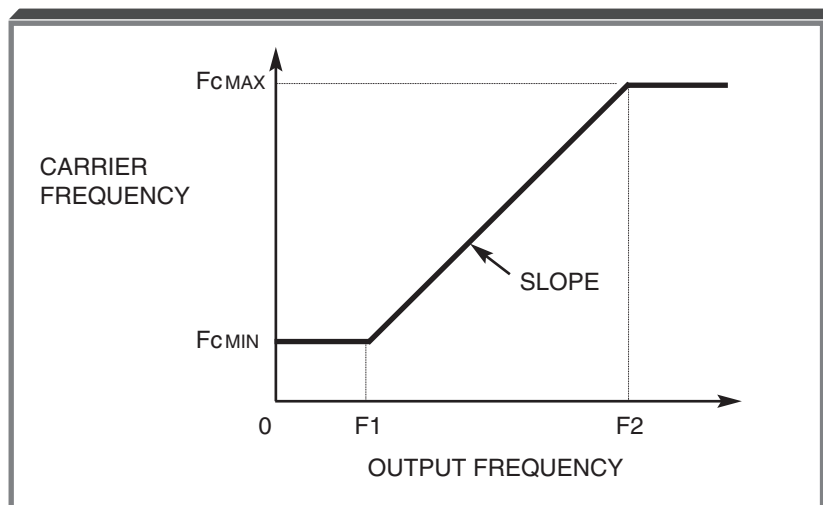
5.5 CARRIER FREQUENCY

n054 : Carrier Frequency Upper Limit (Carrier Freq Sel)

The relationship between output frequency and carrier frequency is determined from the set value of **n054**.

- (a) For constant carrier frequency, set to "2.5 kHz" through "15.0 kHz."
 (b) For synchronous mode, set **n054** to "synchronous 1, 2, or 3" (7 ", " 8 ", or " 9 "). These setting values establish carrier frequencies of 12f, 24f, or 36f, respectively.

LED SETTING	LCD SETTING	CARRIER FREQUENCY (kHz)		SLOPE (= $\frac{F_c}{F_o}$)	OUTPUT FREQUENCY (Hz)		MODE
		Maximum (FcMAX)	Minimum (FcMIN)		F1	F2	
1	2.5 kHz	2.5	2.5	0	NA	NA	CONSTANT
2	5.0 kHz	5.0	5.0	0	NA	NA	
3	7.5 kHz	7.5	7.5	0	NA	NA	
4	10.0 kHz	10.0	10.0	0	NA	NA	
5	12.5 kHz	12.5	12.5	0	NA	NA	
6	15.0 kHz	15.0	15.0	0	NA	NA	
7	Synchronous 1	2.5	1.0	12	83.3	208.3	SYNCHRONOUS
8	Synchronous 2	2.5	1.0	24	41.6	104.1	
9	Synchronous 3	2.5	1.0	36	27.7	69.4	
10†		7.0	7.0	0	NA	NA	CONSTANT



† Setting of " 10 " is available only on GPD 506V - B096.

Maximum carrier frequency is dependent upon drive rating; see Appendix 3.

Carrier frequency should be decreased as the distance between the drive and the motor increases, to reduce capacitive coupling in the motor leads.

- For wiring distances up to 50m (164 ft.), **n054** should be set to "15.0 kHz" (data " 6 ") or less.
- For wiring distances from 50m (164 ft.) to 100m (328 ft.), **n054** should be set to "10.0 kHz" (data " 4 ") or less.
- For wiring distances greater than 100m (328 ft.), **n054** should be set to "5.0 kHz" (data " 2 ") or less.

5.6 CRITICAL FREQUENCY REJECTION

- A. **n062** : Prohibited Frequency 1 (Jump Freq 1)
n063 : Prohibited Frequency 2 (Jump Freq 2)

Factory setting (each): **0.0**

Range (each): 0.0 to 400.0 Hz

These parameters allow programming of up to two prohibited frequency points for eliminating problems with resonant vibration of the motor/machine. This feature does not actually eliminate the selected frequency values, but will accelerate and decelerate the motor through the prohibited bandwidth.

- B. **n064** : Prohibited Frequency Deadband
(Jump Bandwidth)

Factory setting: **1.0**

Range: 0.0 to 25.5 Hz

This parameter determines the width of the deadband around each selected prohibited frequency point. The factory setting is "1.0", which establishes a deadband of ± 1.0 Hz.

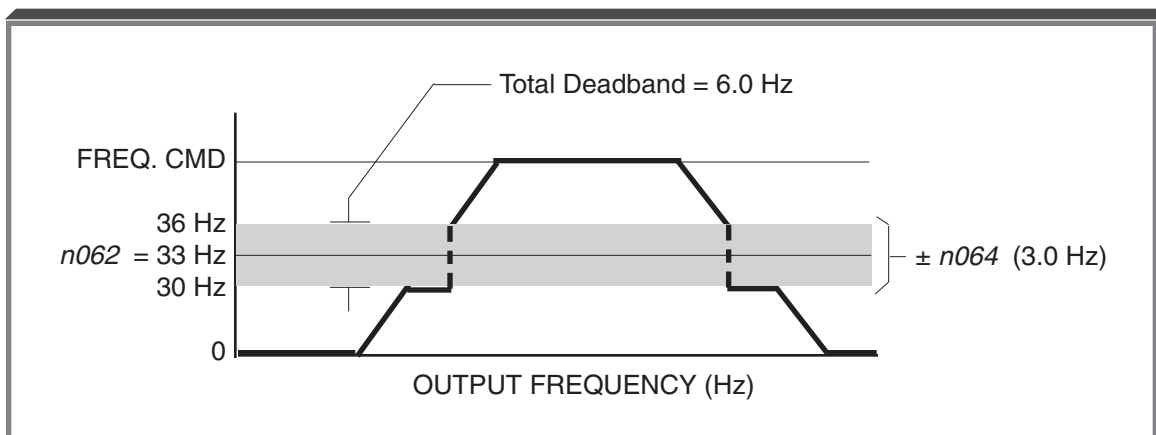
EXAMPLE:

Vibration encountered between 30.0 and 36.0 Hz.

SOLUTION: Set **n062** to "33.0". This is the center of the problem frequency band.

Set **n064** to "3.0". This will cause the drive to reject all frequency command values between 30.0 and 36.0 Hz.

A frequency command in the deadband will be converted to the bottom value of the deadband, e.g. a command of 33 Hz would result in a run frequency of 30 Hz.



Note that if **n062** $\leq$ **n063** is not satisfied, the Digital Operator displays the parameter setting error code " **OPE6** Parameter Error", except when **n063** equals zero.

5.7 DC INJECTION BRAKING

n016 : Minimum Frequency (Min Frequency)

Range: 0.1 to 10.0 Hz

n068 : DC Injection Braking Current (DC Inj Current)
(% of Drive Rated Current)

Factory setting: **50** %

Range: 0 to 100 %

n069 : DC Injection Time at Stop (DC Inj Time@Stop)

Factory setting: **0.0** sec

Range: 0.0 to 10.0 sec

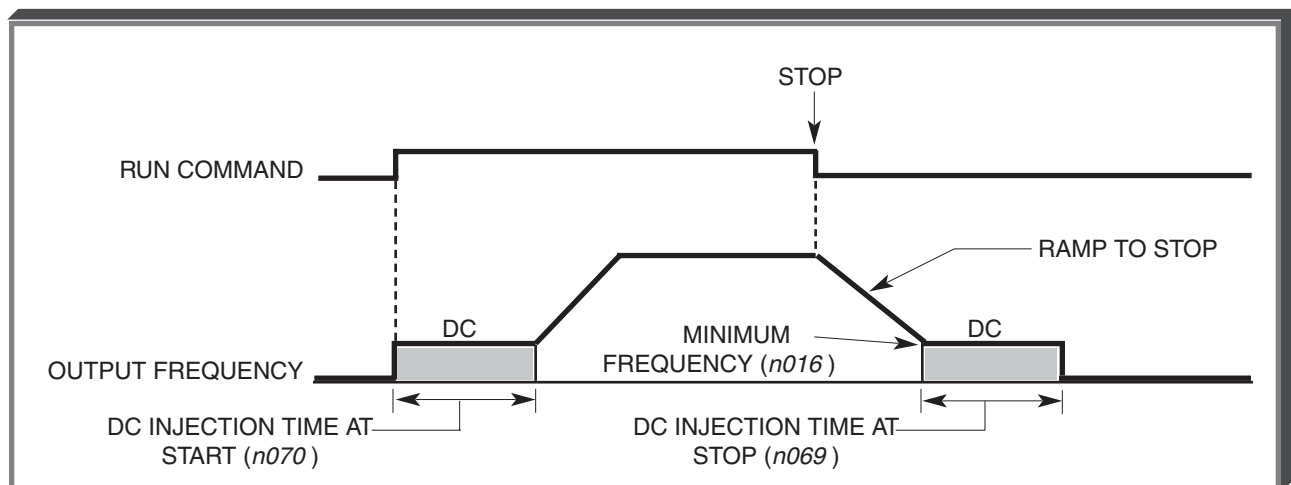
n070 : DC Injection Time at Start (DC Inj Time@Start)

Factory setting: **0.0** sec

Range: 0.0 to 10.0 sec

DC injection can be used to stop a motor whose rotational direction is uncertain at start-up, or to help stop a coasting motor.

With ramp to stop enabled (**n004** = "Ramp to Stop" ("0")), after a STOP command is received the drive controls motor deceleration according to the Decel Time setting, until output frequency reaches the DC injection braking start frequency (or Minimum Frequency, **n016**). Then the drive output is turned off and DC injection current is applied to the motor. The effective DC injection time and current should be set to provide adequate stopping without excessive motor heating. The DC injection voltage is determined by the DC injection braking current and motor impedance.



DC Braking Sequence

5.8 DIGITAL OPERATOR DISPLAY SELECTION

n023 : Operator Display Mode
Reference and Indication (Display Units)

Factory setting: **0**

Range: 0 to 4999

This parameter determines the scaling of the Digital Operator display, for both Output Frequency and all Frequency References.

DATA	DISPLAY
0* (factory setting)	Output frequency, in increments of 0.1 Hz.
1	Output frequency, in increments of 0.1 %.
2 to 39 (no. of motor poles)	Motor synchronous speed ($P = \frac{120 \times F}{N_s}$) in increments of 1 RPM (3999 max). P = no. of motor poles F = Frequency N_s = motor synchronous speed NOTE: If motor synchronous speed exceeds 3999 RPM, display holds at 3999.
40 to 4999	Line speed or other parameter. <u>X X X X</u> Parameter value at maximum frequency (n011) (include leading zeroes if necessary) Location of decimal point: _ = _ X X X 1 = X X X. X 2 = X X. X X 3 = X. X X X 4 = X. X X O (X X X *10) (See CAUTION on next page) EXAMPLE: To display Line Speed, based on 54.3 FPM at 60 Hz: n023 setting = " 1543 "

Exceptions to the general format are as follows:

<u><i>n 0 2 3</i></u>		<u>DISPLAY</u>
" <i>1 0 0 0</i> "	=	<i>1 0 0 . 0</i>
" <i>2 0 0 0</i> "	=	<i>1 0 . 0 0</i>
" <i>3 0 0 0</i> "	=	<i>1 . 0 0 0</i>

CAUTION

When setting a value in *n023*, the decimal point position selected will also automatically affect all of the Frequency Reference Memory Settings (*n024 thru n030* ; see Table A1-1).

EXAMPLE:

n023 factory setting: *0 0 0 0*

n030 (Jog) factory setting: *0 0 6 . 0* (6 Hz)

n023 changed to *2 0 6 0*

└─ Decimal point at X X.X X

n030 setting becomes *0 . 0 6*

Therefore, for 10.00 Hz Jog frequency, *n030* must be reprogrammed to *0 . 1 0*

5.9 ENERGY SAVING CONTROL

n096 : Energy Saving Selection (Energy Save Sel)

LED Setting	LCD Setting
0*	Disabled*
1	Enabled

To enable energy saving control, **n096** must be set to "Enabled" (" 1 ").

Since the parameters used in the energy saving control mode have been preset to the optimum values, it is not necessary to adjust them under normal operation. If your motor characteristics differ greatly from those of a standard motor, refer to the following description to change the parameters.

A. Energy Saving Control Mode

n097 : Energy Saving Gain K2
(Energy Save Gain)

Factory setting: *See Table A3-1*

Range: 0.00 to 655.0

The drive uses this gain when running in the energy saving control mode to calculate the voltage at which motor efficiency will be greatest, and sets it as the output voltage reference. This value is preset to a typical standard motor value. As energy saving gain increases, output voltage also increases.

n098 : Energy Saving Voltage Lower Limit
at 60Hz (EngSavVlmt@60Hz)

Factory setting: **75 %**

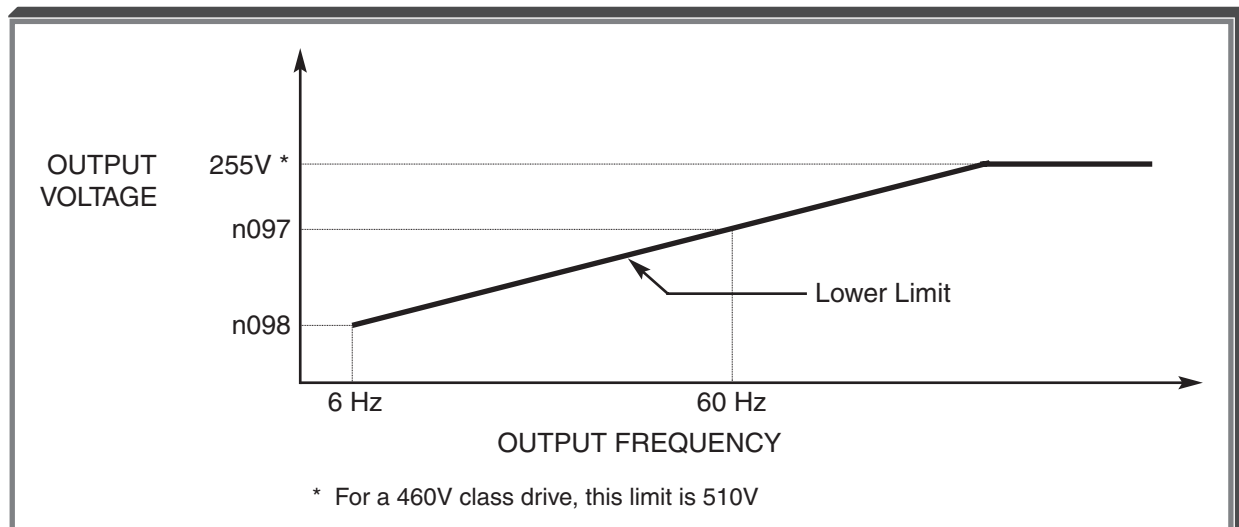
Range: 0 to 120 %

n099 : Energy Saving Voltage Lower Limit
at 6Hz (EngSavVlmt@6Hz)

Factory setting: **12 %**

Range: 0 to 25 %

Sets the output voltage lower limit. If the voltage reference value calculated in the energy saving mode is below the specified lower limit, this lower limit value is used as the voltage reference value. The lower limit value is set to prevent stalling at light loads. Set voltage limits at 6Hz and 60Hz; a value obtained by linear interpolation should be set to any limit values other than at 6Hz or 60Hz. Setting is made as a percentage of motor rated voltage.



5.9 ENERGY SAVING CONTROL

Continued

B. Energy Saving Tuning

In the energy saving control mode, the optimum voltage is calculated according to load power, and this voltage is supplied to the load. However, since the set parameter may change due to temperature variations or using other manufacturers' motors, the optimum voltage may not necessarily be supplied. Automatic tuning controls the voltage so that highly efficient operation is maintained.

n100 : Time of Average kW
(EngSavTime/Avg/kW)

Factory setting: 1
Range: 1 to 200 (x 25 ms)

Sets adjustment time of kW saving. By increasing this value, the response time to a change in load is increased, which may prevent the system from oscillating. However, too long of a response time may starve the motor of voltage.

5.10 FREQUENCY REFERENCE BIAS/GAIN

n048 : Terminal FV Gain

Sets the auto-speed frequency command gain, in increments of 1%.

Factory setting: **100** %

Range: 0 to 200 %

n049 : Terminal FV Bias

Sets the auto-speed frequency command bias, in increments of 1%.

Factory setting: **0** %

Range: -100 to 100 %

n050 : Terminal FI Gain

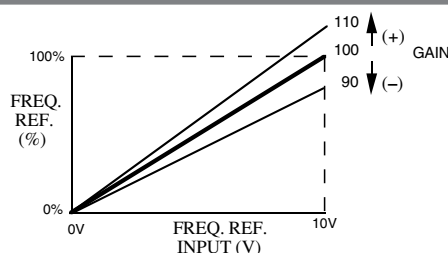
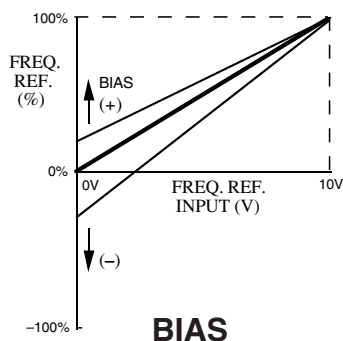
Factory setting: **100** %

Range: 0 to 200 %

n051 : Terminal FI Bias

Factory setting: **0** %

Range: -100 to 100 %



ADJUSTMENT PROCEDURE:

- A. For 0-10 Vdc input (term. FV)
 1. With no input, adjust Bias (**n049** setting) until an output of 0.0 Hz is obtained.
 2. With full scale input, adjust Gain (**n048** setting) until an output of 60.0 Hz (or other desired max. output frequency) is obtained.
- B. For 4-20mA input (term. FI)
 1. With 4mA input, adjust Bias (**n050** setting) until an output of 0.0 Hz is obtained.
 2. With 20mA input, adjust Gain (**n051** setting) until an output of 60.0 Hz (or other desired max. output frequency) is obtained.

NOTE

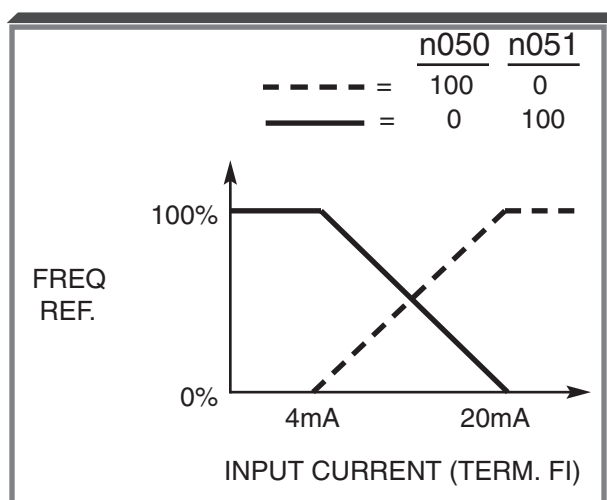
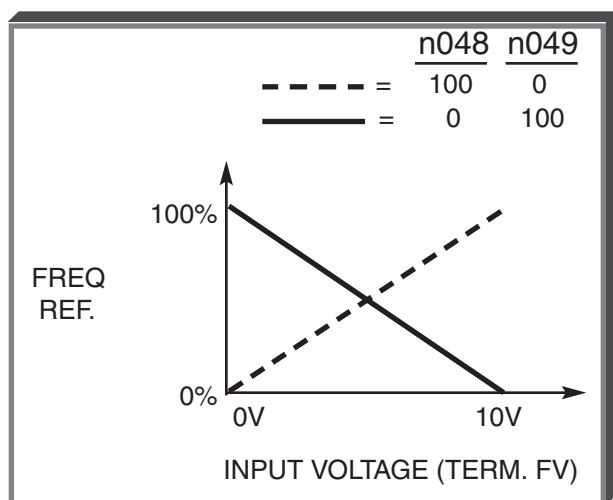
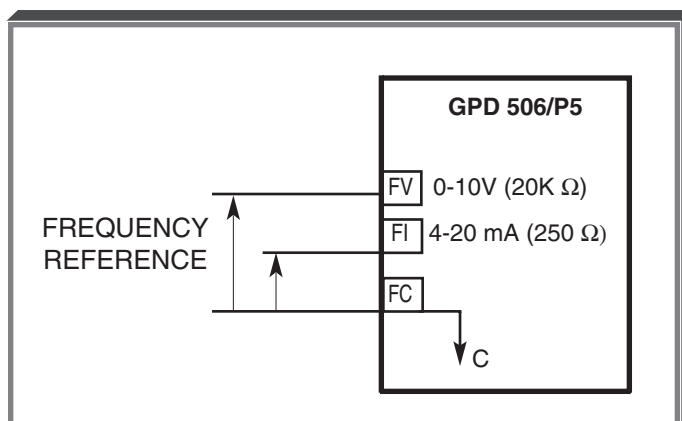
Follow the same adjustment procedure for other desired frequency setpoints.

5.10 FREQUENCY REFERENCE BIAS/GAIN

Continued

- C. For inverse-acting frequency reference
1. Begin with **n048** & **n049** settings as shown below.
 2. Fine tune as indicated in A or B above.

Frequency reference inputs:
 terminals FV & FC — 0-10 VDC
 terminals FI & FC — 4-20 mA



5.11 FREQUENCY REFERENCE INPUT SIGNALS (AUTO/MANUAL)

n043 : Analog Input Selection (Analoginput Sel)

To input an auto frequency reference from external terminals, program **n043** to "FV=MSTR FI=AUX" ("0") for a voltage reference (0 to 10V) or to " FV=AUX FI=MSTR " for ("1") for a current reference (4 to 20mA).

LED Setting	LCD Setting	Terminal FV Function	Terminal FI Function	FV/FI Switching Allowed ⁽¹⁾
0*	FV=MSTR FI=AUX*	Auto Speed Reference	Manual Speed Reference	Yes
1	FV=AUX FI=MSTR	Manual Speed Reference	Auto Speed Reference	Yes
2	FV=RST FI=MSTR ⁽³⁾	Fault Reset ⁽²⁾	Auto Speed	No
3	FV=MSTR FI=SQRT	Auto Speed Reference	$\sqrt{N}$	No
4	FV=RST FI=SQRT	Fault Reset**	$\sqrt{N}$	No

- (1) A Multi-function input can be programmed to switch the analog terminal function. This is accomplished by programming a multi-function input parameter (**n036** thru **n040**) to = "Master Fref Sel"("9"). Note that if **n043** is then set to "FV=RST FI=MSTR" ("2"), an OPE6 fault will occur.
- (2) A fault reset will occur when the voltage on this terminal exceeds 6.0V.
- (3) When **n043** is set to "FV=RST FI=MSTR" ("2") and PID selection **n084** is NOT disabled (set to anything other than "Disabled"("0")) an OPE6 fault will occur.

n044 : Terminal FI Signal Level Selection (Terminal FI Sel)

To change the control circuit terminal FI input level, program **n044** .

LED Setting	LCD Setting	Terminal FI Signal Level
0	0-10VDC	0 to 10 V input
1*	4-20mA*	4 to 20 mA input

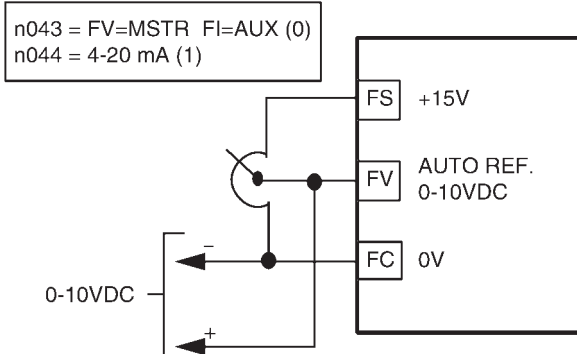
NOTE: In addition to setting parameter **n044** to "0-10VDC" (" 0 ") for a voltage input, jumper J1 on the drive Control PCB must be cut.

Examples of wiring the drive for frequency references from various sources are shown on the next page.

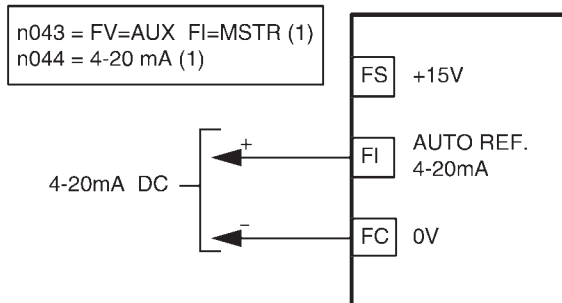
5.11 FREQUENCY REFERENCE INPUT SIGNALS (AUTO/MANUAL)

Continued

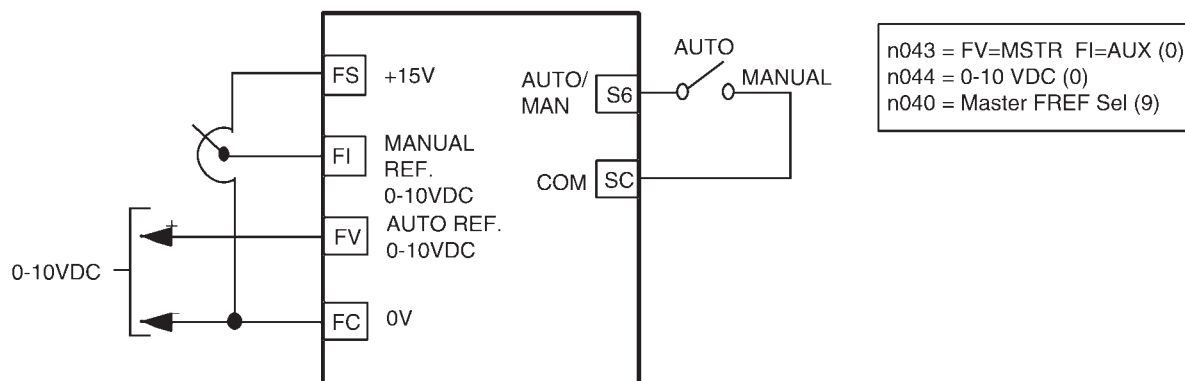
A. Speed pot or 0-10VDC signal only:



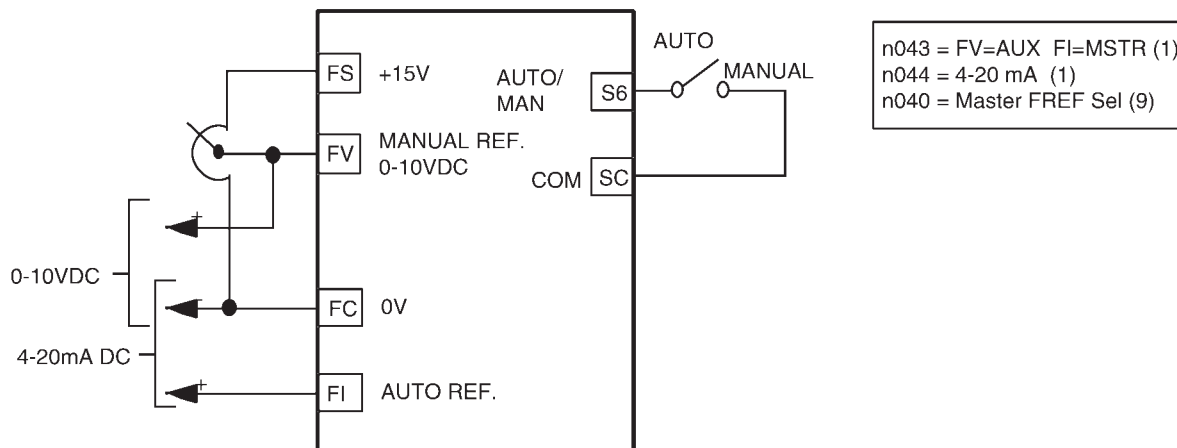
B. 4-20mA signal only:



C. 0-10VDC signal (auto) and speed pot (manual):



D. 4-20mA DC signal (auto) and 0-10VDC signal or speed pot (manual):



5.12 FREQUENCY REFERENCE UPPER & LOWER LIMITS

n031 : Frequency Reference Upper Limit
(Ref Upper Limit)

Factory setting: **100** %

Range: 0 to 109 %

n032 : Frequency Reference Lower Limit
(Ref Lower Limit)

Factory setting: **0** %

Range: 0 to 100 %

These two parameters set the range for the frequency command signal. Each is set, in increments of 1%, as a percentage of maximum frequency (Fmax; **n011**) as established by either the selected standard V/f pattern or custom V/f pattern.

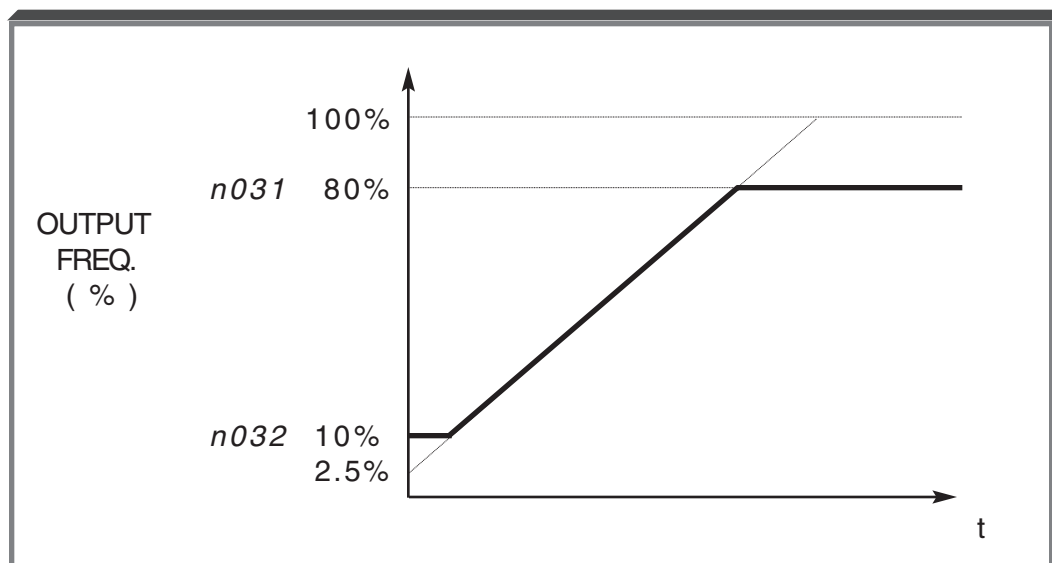
NOTE: All references are affected by the upper and lower limit points.

EXAMPLE:

n011 = " 60 " Hz (100%)

n031 = " 80 " % = 48Hz – Max. speed

n032 = " 10 " % = 6Hz – Min. speed



5.13 FREQUENCY REFERENCE - LOSS DETECTION

n046 : Frequency Reference Loss Detection
(Ref Loss Detect)

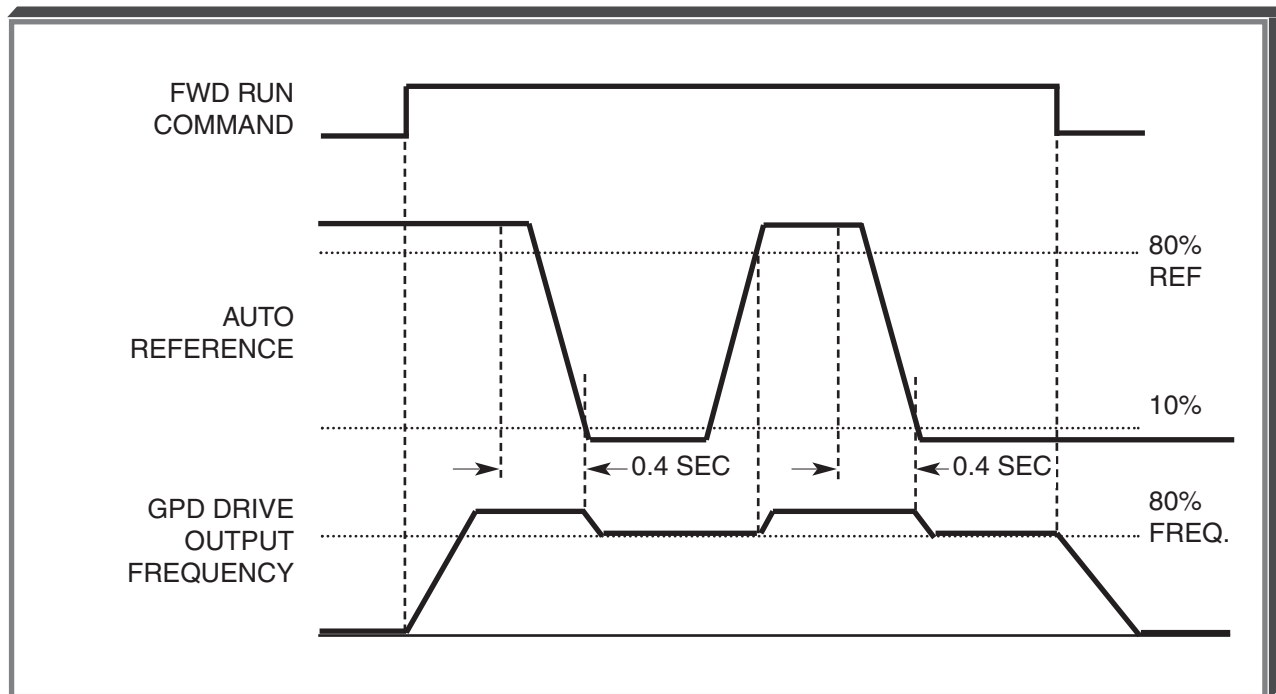
n047 : Frequency Reference Level at Loss
of Frequency Detection
(Fref Lvl@FLoss)

Factory setting: **80%**

Range: 0 - 100%

LED Setting	LDC Setting	Terminal FI Signal Level
0 *	0-10 VDC*	0 to 10 V input
1	4-20mA	4 to 20 mA input

The reference loss detection function is either enabled or disabled, based on the setting of **n046**. When enabled (**n046** = "RUN @ **n047** Freq" (" 1 ")), the reference loss detection compares the change in reference with respect to time. If the reference decreases by 90% in more than 0.4 seconds, the drive will decelerate to the set reference; if the reference decreases by 90% in less than 0.4 seconds, the drive will continue to operate at a percentage of the output frequency. This percentage can be set in parameter **n047**. To regain control of output frequency, either exceed the set reference (**n047** * original frequency reference) or initiate a STOP command. If Auto Reference is less than $F_{max} (n011) \times .05$, this function is not performed.



Time Chart

5.14 FREQUENCY REFERENCE RETENTION

n045 : Frequency Reference Retention
(MOP Ref Memory)

Useable with the Up/Down or Sample/Hold commands when either is used as a multi-function contact input. To retain the held frequency reference in **n024** when power is removed, set **n045** to "Memorize FREF" (" 1 ").

LED Setting	LCD Setting	Description
0*	Memorize FREF*	Held reference in Frequency Reference 1 (n024)
1	Not Memorized	Not Retained

5.15 JOG REFERENCE

n030 : Jog Reference

Factory setting: **6.0** Hz

Range: 0.0 to 400.0 Hz

n036 thru **n040** : Multi-function Inputs
(Term. S2 - S6 Sel)

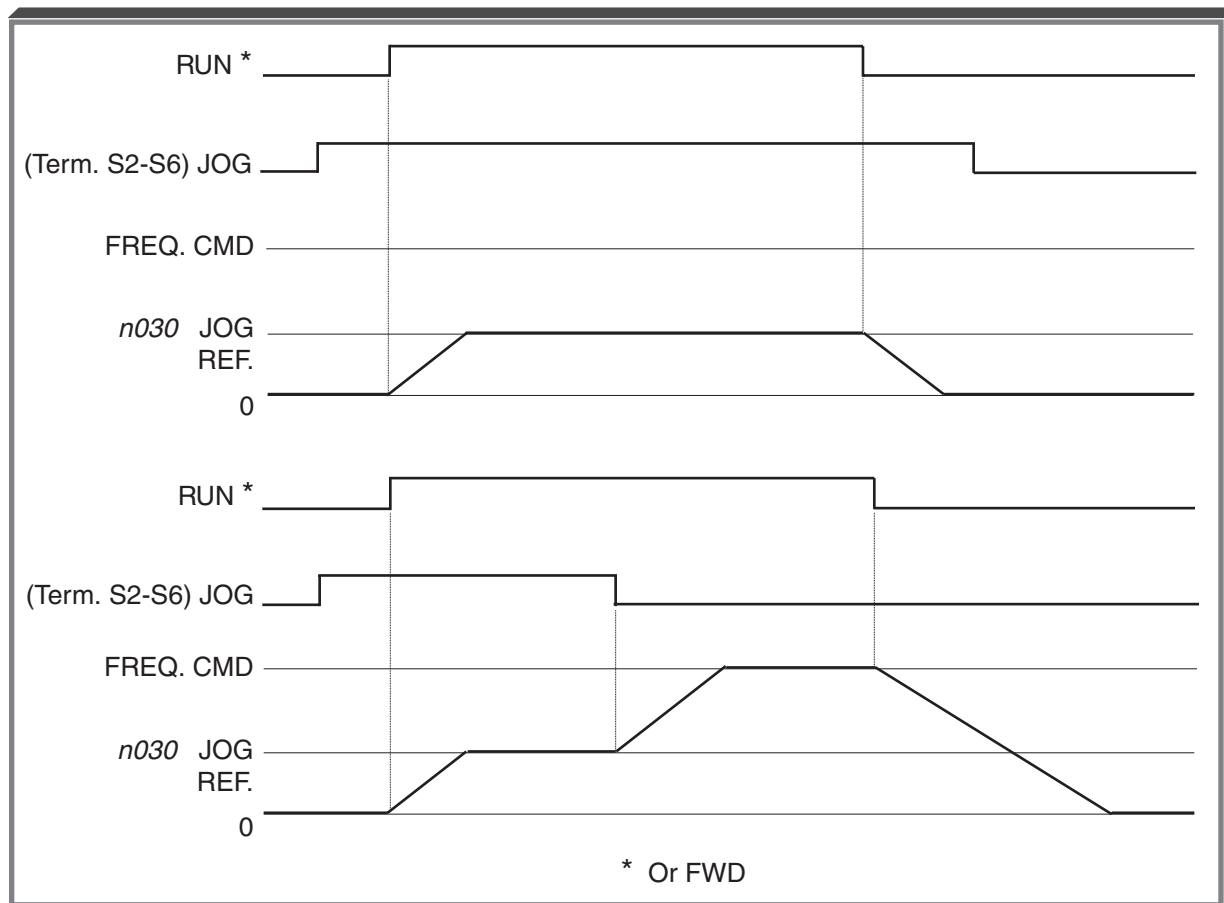
Data : Jog Command (13)

When jog operation is selected (by external Jog and Run signals), the drive output will ramp to the output level set by this parameter.

When an external Jog signal is present, it will override the existing operation mode and the drive will ramp to the level set by this parameter.

EXAMPLE:

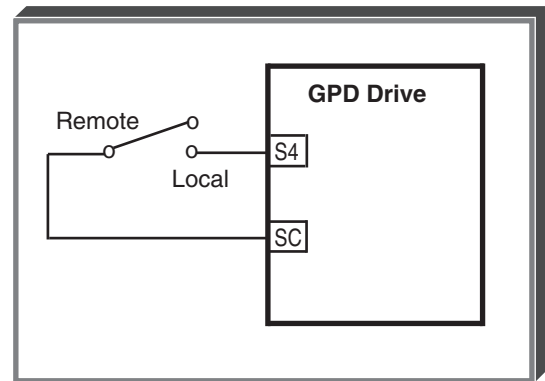
OPERATION BY REMOTE SIGNAL INPUT (RUN & JOG)



Also see descriptions of **MULTI-FUNCTION INPUT TERMINALS**, paragraph 5.19.

5.15.1 LOCAL/REMOTE CHANGEOVER

n111 : Local/Remote Changeover



LED Setting	LCD Setting	Description
0 *	Cycle Extern RUN*	Must open and re-apply RUN command
1	Accept Extern RUN	Will accept external RUN command

The Local/Remote function is used to switch the Drive's Sequence and Reference commands from Remote (as defined by the setting of **n002**) to Local (i.e. from the Digital Operator). This function is enabled by programming a Multi-function input terminal (setting **n036** thru **n040**) to "LOC/REM Sel" ("5").

If the Drive is running from a Local RUN command (Digital Operator) (which assumes the Local/Remote Multi-function input is closed to terminal SC), the Drive will stop if the STOP key of the Digital Operator is pressed, as usual.

If the Local/Remote input is then opened, the reference will immediately switch over to the Remote reference, and :

if **n111** = "Cycle Extern RUN" ("0"), the external RUN command must then be removed and re-applied in order for the Drive to run.

if **n111** = "Accept Extern RUN" ("1"), the Drive will run immediately if the external RUN command is still applied.

Note: if **n002** is set to "SEQ=OPR REF=OPR" ("0"), the Local/Remote function will have no effect.

5.16 MODBUS CONTROL

The drive can perform serial communication by using a programmable controller (PLC) and MODBUS™ protocol. MODBUS is composed of one master PLC and 1 to 31 (maximum) slave units (GPD 506/P5 drives). In serial communication between the master and slaves, the master always starts transmission and the slaves respond to it.

The master communicates with one slave at a time. Address numbers are assigned to each slave in advance, and the master specifies an address to communicate with. The slave which receives the command from the master executes the function, and then responds to the master.

A. Communication Specifications

- Interface : RS-232C (standard); RS-485, RS-422 (option - requires communication interface card CM086)
- Synchronization : Asynchronous
- Transmission parameters :
 - Baud rate* — Selectable from 2400, 4800, 9600 BPS (**n105**)
 - Data length* — Fixed to 8 bits
 - Parity* — Parity / no parity, even / odd selectable (**n106**)
 - Stop bit* — Fixed to 1 bit
- Protocol : MODBUS
- Maximum number to units to be connected : 31 units (when RS-485 is used)

B. Sending/Receiving Data

Data that can be sent and received are run/stop commands, frequency reference, fault reset, drive status, and setting and reading of parameters.

n002 : Operation Mode Selection (Oper Mode Select)

LED Setting	LCD Setting	Description	
		Sequence	Reference
0	SEQ=OPR REF=OPR	Digital Operator	Digital Operator
1	SEQ=TRM REF=OPR	External Terminals	Digital Operator
2	SEQ=OPR REF=TRM	Digital Operator	External Terminals
3	SEQ=TRM REF=TRM**	External Terminals	External Terminals
4	SEQ=OPR REF=COM	Digital Operator	Serial Communications
5	SEQ=TRM REF=COM	External Terminals	Serial Communications
6	SEQ=COM REF=COM	Serial Communications	Serial Communications
7	SEQ=COM REF=OPR	Serial Communications	Digital Operator
8	SEQ=COM REF=TRM	Serial Communications	External Terminals

Select the run command and frequency reference input method in **n002**. To provide a run command and/or frequency reference by communication, set this parameter to one of the last five settings. Monitoring of run status, parameter setting/reading, fault reset and multi-function input command from the PLC are enabled. The multi-function input command is OR'ed with the command input from control circuit terminals S2-S6.

n 036 thru ***n 040*** : Multi-function Inputs
(Term. S2-S6 Sel)

Data COM/Inv Sel (**6**) : Serial Communication /
Digital Operator

Selects operation by serial communication or by external terminal. If the status of this command input is changed while the drive is running, the selection is ignored until the next time the drive is stopped.

Open : Run according to the setting of Operation Mode Selection (***n 002***)
Closed : Run by frequency reference and run command from serial communication

EXAMPLE: ***n 002*** setting is SEQ=TRM REF=TRM (" 3 ").

Open : Run by frequency reference from control circuit terminals FV, FI
and run command from control circuit terminals S1, S2.
Closed : Run by frequency reference and run command from serial communication.

n 103 : Modbus Frequency Resolution
(MODBUS Fref Unit)

LED Setting	LCD Setting
0*	1 = 0.1 Hz *
1	1 = 0.01 Hz
2	30000 = 100%
3	1 = 0.1 %

The frequency resolution from the PLC and in the frequency reference and output frequency monitor (by communication) are selected with this parameter. The output frequency resolution of the drive is 0.1 Hz. Even if the Modbus resolution is changed to 0.01 Hz in ***n 103***, the

value in the hundredths digit of 0.01 Hz of the received frequency reference is rounded off internally. When 30,000/100% in units of 0.1% is selected, the value is also rounded off.

n 104 : Modbus Slave Address
(MODBUS Address)

Factory setting: **1**

Range: 0 to 31

Each slave drive on the same transmission line must be given a unique address.

n 105 : Modbus Baud Rate
(MODBUS Baud Rate)

Selects the baud rate, as indicated by the following table:

LED Setting	LCD Setting (BPS)
0	2400 Baud
1	4800 Baud
2*	9600 Baud*

5.16 MODBUS CONTROL

n 106 : Modbus Parity Selection (MODBUS Parity)

Selects the parity, as indicated by the following table:

LED Setting	LCD Setting (BPS)
0*	No Parity *
1	Even Parity
2	Odd Parity

NOTE: To change the values set in ***n 104*** thru ***n 106*** and enable the new settings, it is necessary to turn OFF power to the Drive, then turn it ON again.

n 101 : Modbus Time Out Detection (MODBUS Timeout)

LED Setting	LCD Setting
0	Disabled
1*	Enabled*

If time between Modbus messages exceeds 2.0 seconds, the drive will respond according to the setting of ***n 102***.

n 102 : Stop Method on Modbus Communication Error (CE) (MODBUS Fault Stop)

If communications error exists, drive will respond according to the following table:

LED Setting	LCD Setting	Description
0	Ramp STOP / Decel 1	Ramp to Stop - Decel 1 (fault)
1*	Coast to STOP *	Coast to Stop (fault)
2	Ramp STOP / Decel 2	Ramp to Stop - Decel 2 (fault)
3	Continue Oper	Continue Operation (alarm)

5.16.1 MISCELLANEOUS PROTECTIVE FUNCTIONS

n 1 1 0 : Operator Connection Fault Detection
Selection (Oper Detect Flt)

LED Setting	LCD Setting
0*	Disabled*
1	Enabled

Set this parameter to "Enabled" ("1") only if the drive should shut down immediately if the Digital Operator is disconnected while the drive is running. When set to Disabled ("2") the fault will not occur until after the drive has been stopped.

5.17 MOMENTARY POWER LOSS RIDE-THRU

n055 : Momentary Power Loss Ride-thru Protection

LED Setting	LCD Setting	Description
0*	Not Provided*	Disabled (Factory setting)
1	2 Seconds Max	Enabled – 2 sec. power loss ride-thru
2	CPU Power Active	Enabled – indefinite power loss ride-thru, provided control power is maintained

The setting of this parameter either enables or disables the ride-thru feature of the drive. If disabled, the unit will stop immediately whenever a power loss occurs. If enabled, the drive will continue to operate during a momentary power loss of up to 80%, but if the loss exceeds the identified time period, the drive will stop.

n059 : Power Loss Ride-Thru Deactivation Time (PwrL Ridethru t)

Factory setting: *See Table A3-1*

Range: 0.0 to 2.0 seconds

If the loss exceeds the length of time identified by **n059**, the drive will stop. The factory setting of this parameter, in 0.1 second increments, is related to the drive's rating.

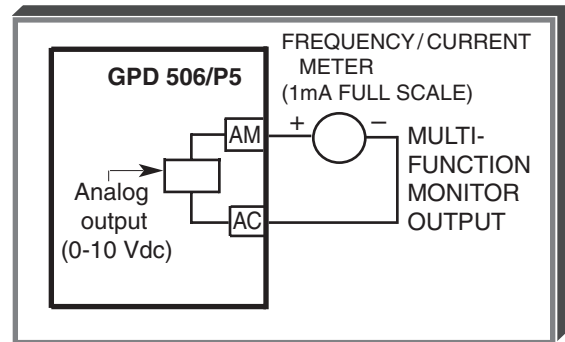
Note that the RUN command must be maintained throughout the ride-thru period. If **n055** is set to "CPU Power Active" (" 2 "), a " **Uv** Undervoltage " alarm is displayed during power loss, and no fault signal is output at terminals M1 & M2 or MA, MB & MC.

5.18 MULTI-FUNCTION ANALOG MONITOR OUTPUT (Term. AM & AC)

n052 : Multi-function Analog Output (Terminal AM Sel)

The monitor output provides a 0-10 Vdc signal proportional to either output frequency, output current, output voltage reference, or output power between terminals AM & AC:

LED Setting	LCD Setting	Description
0*	Output Freq *	0-10 VDC proportional to output frequency
1	Output Amps	0-10 VDC proportional to output current
2	Output KWatts	0-10 VDC proportional to output power
3	DC Bus Voltage	0-10 VDC proportional to DC bus voltage

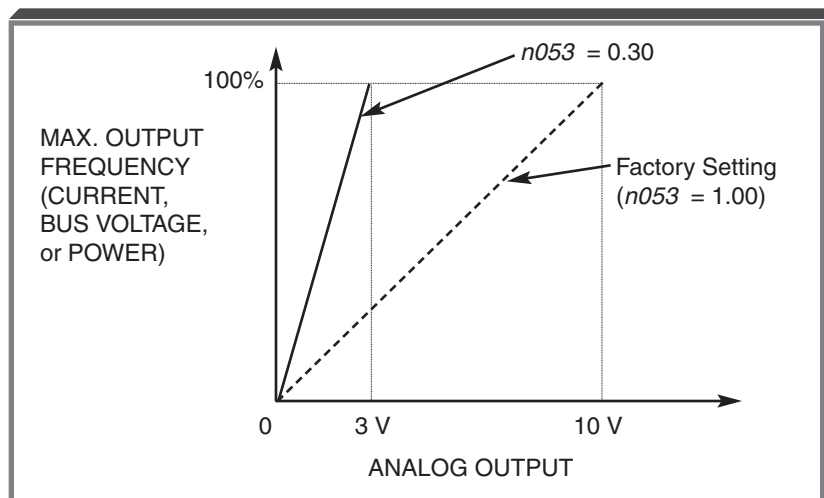


n053 : Analog Monitor Gain (Terminal AM Gain)

Factory Setting: **1.00**

Range: 0.01 to 2.00

This constant is used to calibrate, in increments of 0.01, either the frequency, current or volt meter connected to terminals AM & AC.



5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

n036 : Terminal S2 Sel
n037 : Terminal S3 Sel
n038 : Terminal S4 Sel
n039 : Terminal S5 Sel
n040 : Terminal S6 Sel

Factory Settings:	2-Wire Control	
	LED	LCD
n036	0	Reverse RUN (2W)
n037	2	Ext Fault (NO)
n038	4	Fault Reset
n039	10	Multi-Step Spd 1
n040	11	Multi-Step Spd 2

Factory Settings:	3-Wire Control	
	LED	LCD
n036	1	FWD/REV Cmd (3W)
n037	--	--
n038	4	Fault Reset
n039	10	Multi-Step Spd 1
n040	11	Multi-Step Spd 2

These five parameters select the input signal functions for terminals S2 thru S6, and can be independently set.

Parameter settings are checked whenever power is applied to the drive, or upon exiting Program mode. A parameter set value failure (" **oPE3** MF Input Error") will occur if any of the following conditions are detected among these five parameters:

- (1) Two or more of the parameters contain the same value.
- (2) Both Speed Search functions "Sel Srch (MAXFRQ)" ("17") and "Spd Srch (SETFRQ)" ("8") have been selected.
- (3) Both the "Ref Sample/Hold" ("24") and "Up/Down Control" ("29") functions have been selected.

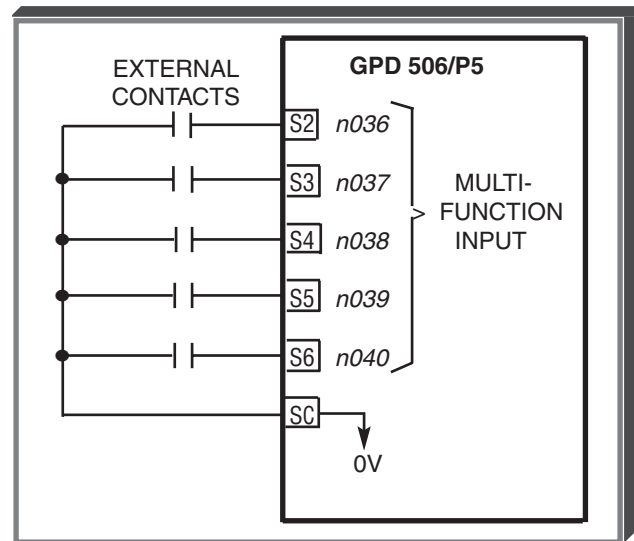


Table 5-2 lists the possible data setting values for these parameters, with the function and a brief description for each one.

For a few of the data settings, a more detailed description is given on the following pages; for others, the description is given in other PROGRAMMABLE FEATURES paragraphs.

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6) Continued

Table 5-2. *n036* thru *n040* Data Settings

LED SETTING	LCD SETTING	FUNCTION	DESCRIPTION **
0	Reverse RUN (2W)	Reverse Run/Stop command (for 2-wire control)	MUST BE SET ONLY IN <i>n036</i> . Redefines terminals: S1 = Run/Stop Forward; S2 = Run/Stop Reverse
1	FWD/REV Cmd (3W)	FWD/REV selection (for 3-wire control)	MUST BE SET ONLY IN <i>n036</i> . Redefines terminals: S1 = Run; S2 = Stop; S3 = FWD/REV select
2	Ext Fault (NO)	External fault (N.O. contact input)	Drive trips; Digital Operator displays " EFX ", where X is 2-6, corresponding to the terminal S2-S6, which is receiving the fault input signal
3	Ext Fault (NC)	External fault (N.C. contact input)	
4	Fault Reset	Fault Reset	Resets fault, only if RUN command is not present
5	LOC/REM Sel	Remote/Local selection	Open = Operates according to setting of <i>n002</i> Closed = Operates from keys of the Digital Operator See paragraph 5.19A
6	COM/INV Sel	GPD Drive operation & reference/serial communication selection	Open = Operates according to setting of <i>n002</i> Closed = Operates from serial communication See paragraph 5.16
7	STOP Cmd/Dec 2 NO	Quick Stop (N.O. Contact Input)	Open = Stop according to setting of <i>n004</i> Closed = Ramp to stop by Decel Time 2 (<i>n021</i>)
8	STOP Cmd/Dec 2 NC	Quick Stop (N.C. contact input)	Open = Ramp to stop by Decel Time 2 (<i>n021</i>) Closed = Stop according to setting of <i>n004</i>
9	Master FREF Sel	Auto/Manual frequency reference selection	If <i>n043</i> = "FV=MSTR FI=Aux" ("0") Open = Frequency reference from terminal FV Closed = Frequency reference from terminal FI If <i>n043</i> = "FV=Aux FI=MSTR" ("1") Open = Frequency reference from terminal FI Closed = Frequency reference from terminal FV
10	Multi-Step Spd 1	Multi-step frequency ref. select 1	See paragraph 5.19B
11	Multi-Step Spd 2	Multi-step frequency ref. select 2	
12	Multi-Step Spd 3	Multi-step frequency ref. select 3	
13	JOG Command	Jog selection	Closed = Jog selected See paragraph 5.15

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6) Continued

Table 5-2. n036 thru n040 Data Settings - Continued

LED SETTING	LCD SETTING	FUNCTION	DESCRIPTION **
14	ACC/DEC Switch	Accel/decel time selection	Open = Accel/decel by n018 / n019 Closed = Accel/decel by n020 / n021 See paragraph 5.2
15	Ext Baseblk (NO)	External base block (N.O. contact input)	Closed = Shuts off drive output (frequency command is held)
16	Ext Baseblk (NC)	External base block (N.C. contact input)	See paragraphs 5.19C, 5.19D
17	Spd Srch (MAXFRQ)	Speed Search 1	Closed * = Speed Search operation from maximum frequency See paragraph 5.19E
18	Spd Srch (SETFRQ)	Speed Search 2	Closed * = Speed Search operation from set frequency See paragraph 5.19E
19	Param Lockout	Programming enable	Open = Programming from Digital Operator or serial communication is enabled Closed = All programming is disabled
20	PID I Reset	PID integral value reset	Closed = Value of I (n087) is reset to " 0 " See paragraph 5.22I
21	PID Disable	PID control disable	Closed = PID control is disabled – setpoint becomes frequency reference See paragraph 5.22I
22	Timer Start Cmd	Timer function	See paragraph 5.19F
23	oH3 Input	External overheat	Closed = oH3 blinks on the Digital Operator, and operation continues (minor fault)
24	Ref Sample Hold	Analog reference sample/hold	Open = Hold frequency reference Closed = Sample frequency reference See paragraph 5.19G
25	KEB Cmd (NO)	Inertia ride-thru command (N.O. contact input)	Closed = Inertia ride-thru is enabled
26	KEB Cmd (NC)	Inertia ride-thru command (N.C. contact input)	Closed = Inertia ride-thru is disabled
27	Hold Command	Accel/Decel Hold	See paragraph 5.19 H
28	PID Polarity Sel	PID Changeover	See paragraph 5.19 I
29	Up/Down Control	Up/Down function	See paragraph 5.19 J (can only be set in n040)

** All contact closures must be maintained, except for speed search, which may be momentary (see paragraph 5.19E).

A. Local/Remote Sel (5) : Remote/Local Selection

Set parameter **n002** to "SEQ=TRM REF=TRM" (" 3 ") to select external inputs as the source for frequency reference and operation commands. The use of a Remote/Local command input allows switching between the Digital Operator control and the external terminal input signals, without the need to re-program **n002**. If the status of the Remote/Local command input is changed while the drive is running, the Remote/Local operation selection is not completed until the next time the drive is stopped.

Closed = Controlled locally (Digital Operator)

Open = Controlled remotely (external terminal inputs, for Start/Stop and frequency reference)

- B. Multi-Step Spd 1 (10): Multi-step Frequency Ref. Select 1**
 Multi-Step Spd 2 (11): Multi-step Frequency Ref. Select 2
 Multi-Step Spd 3 (12): Multi-step Frequency Ref. Select 3

n024 thru **n030**: Frequency Reference 1-6
 and Jog Reference

Factory settings: n030 = 6.0 all others = 0.0
Range (ea): 0.0 to 9999

In order to use multi-step frequency presets, parameters **n037**, **n038**, **n039** & **n040** must be programmed accordingly for 2-Wire or 3-Wire control. (Parameter **n002** must be set for frequency reference from Digital Operator.)

To use the maximum of 7 preset frequencies, **n037** must be set to "Multi-step Spd Sel 1" (" 10 "), **n038** must be set to "Multi-step Spd Sel 2" (" 11 "), and **n039** must be set to "Multi-step Spd Sel 3" (" 12 "), and **n040** must be set to "Jog Command" (" 13 ")

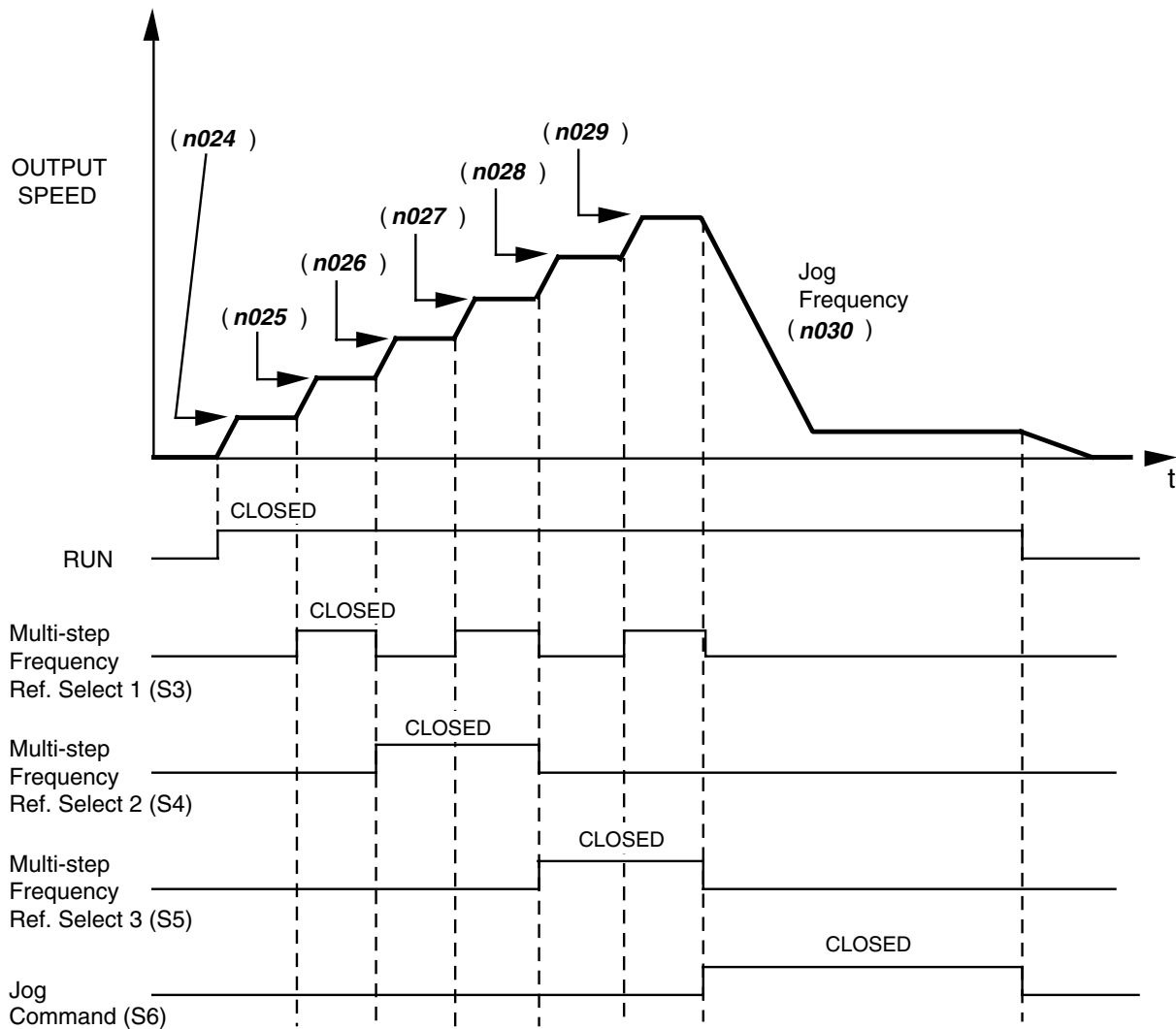
Note that the remote frequency reference (terminal FV) can be substituted for Freq. Ref. 1 by selecting the Remote mode, either with the **LOCAL/REMOTE** key on the Digital Operator, or programming one of the Multi-function inputs for "Local/Remote Sel" ("5").

See next page for timing chart of multi-step speed operation.

Multi-step (7 preset frequencies) in 2-Wire control

PARAMETER and NAME	EXTERNAL TERMINAL			
	S6	S5	S4	S3
n024 Frequency Ref 1	0	0	0	0
n025 Frequency Ref 2	0	0	0	1
n026 Frequency Ref 3	0	0	1	0
n027 Frequency Ref 4	0	0	1	1
n028 Frequency Ref 5	0	1	0	0
n029 Frequency Ref 6	0	1	0	1
n030 Jog Reference	1	X	X	X

1 = Closed (ref terminal SC)
 0 = Open (ref terminal SC)
 X = Doesn't matter



NOTE: The Jog command takes priority over multi-step frequency select inputs.

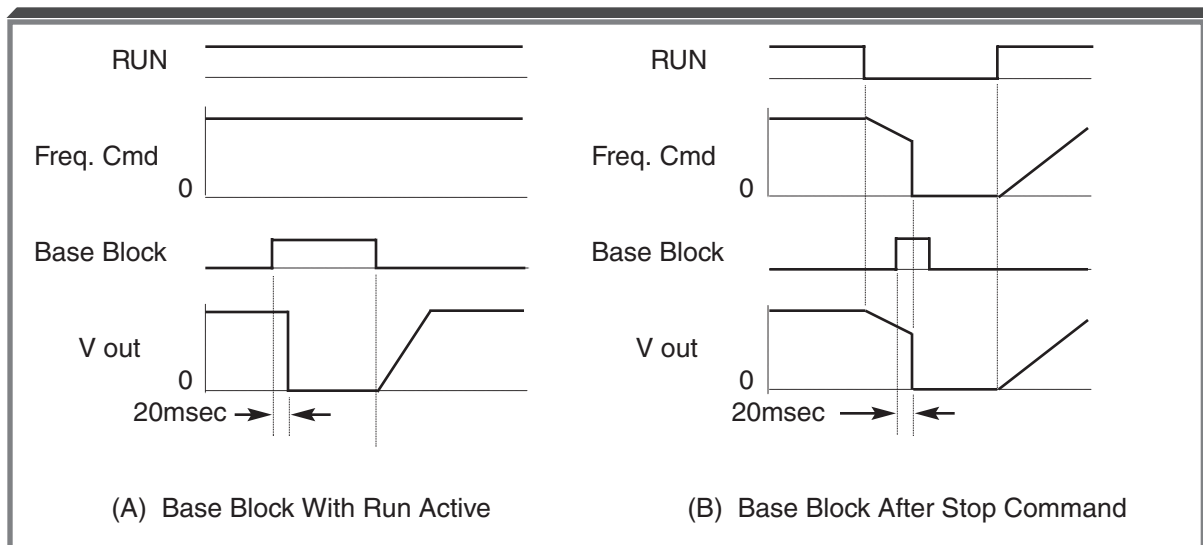
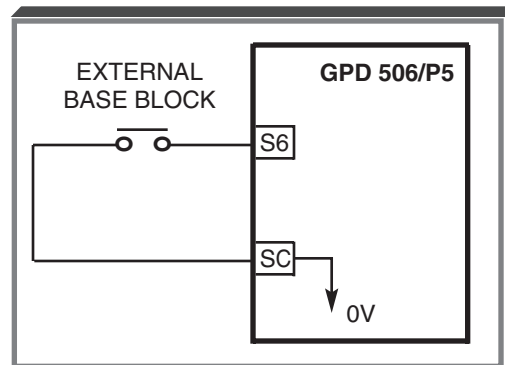
Typical Multi-step Speed Operation

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

Continued

C. Ext Baseblk (NO) (15): External Base Block by N.O. Contact

- When either the Forward Run command or Reverse Run command is present, and the external Base Block command is applied (i.e. contact closed), coast stop is accomplished (after a 20 msec delay), while the frequency command is maintained. When the Base Block command is removed, the drive will recover in a manner similar to that of Speed Search operation.
- When both the Forward Run command and Reverse Run command are open, and the external Base Block command is applied (i.e. contact closed), coast stop is accomplished and after a 20 msec delay the frequency command is changed to 0Hz. When the Base Block command is removed, the drive will remain in stopped condition until Forward Run command or Reverse Run command is again applied.
- When external Base Block command is active, a blinking "**bb** Base Block" will be displayed on the Digital Operator.



D. Ext Basedblk (NC) (16): External Base Block by N.C. Contact

Base block operation is the same as described above, except that the Base Block contact must be *open* to be recognized.

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

Continued

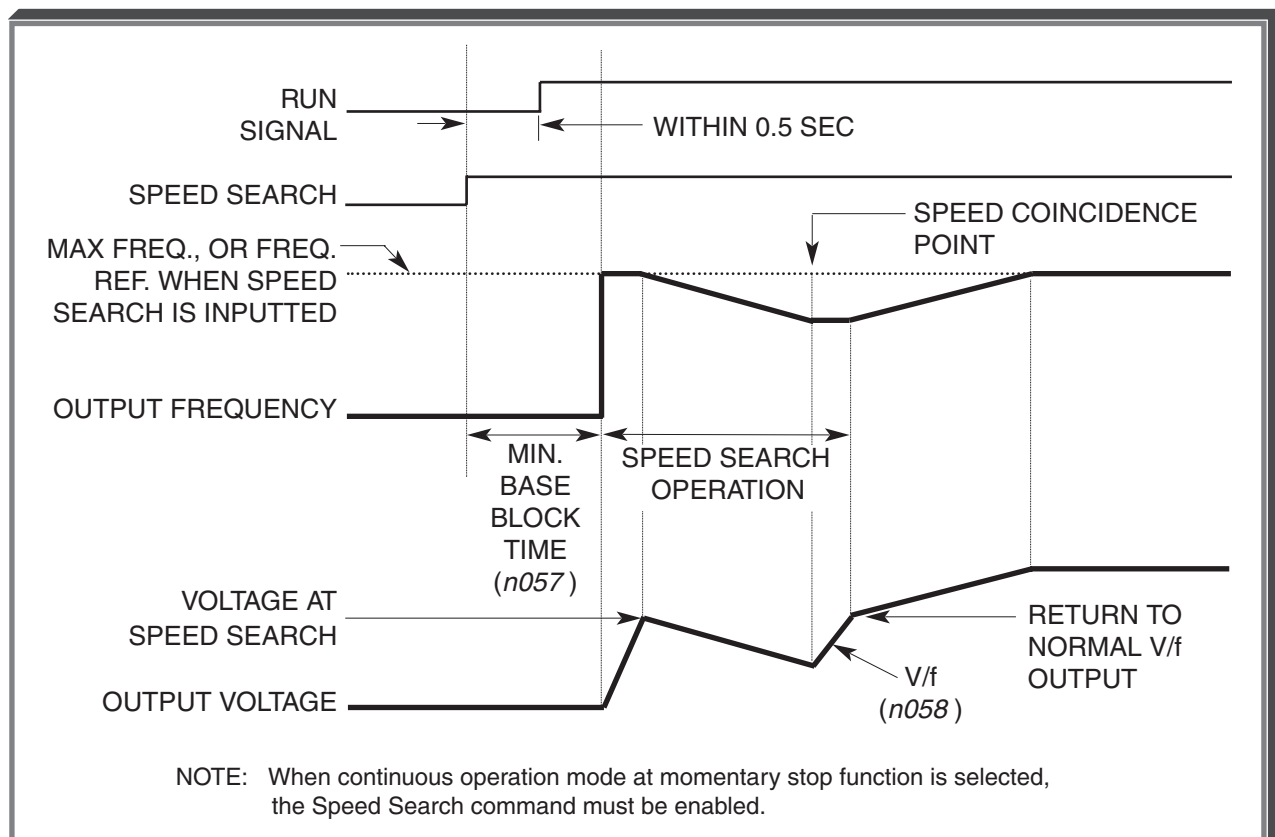
- E. Spd Srch (MAX FRQ) (17): Speed Search From Max Frequency
Spd Srch (SET FRQ) (18) : Speed Search From Set Frequency

A multi-function input terminal is utilized to activate speed search. When the external speed search command is closed, the base is blocked for the min. base block time, **n057**, then the speed search is made. The operation depends on the set value.

IMPORTANT

Spd Srch (MAX FRQ) (17) and "Spd Srch (SET FRQ)" ("18") CANNOT be selected in combination.

- When "Spd Srch (MAX FRQ)" ("17") is set, the speed search begins with the maximum frequency.
- When "Spd Srch (SET FRQ)" ("18") is set, the speed search begins with the frequency command that has been set after the search command was received.



Speed Search Operation Timing

n056 : Speed Search Deactivation Current Level
(SpdSrch Current)

Factory setting: **110** %

Range: 0 to 200 %

After power recovery, if the drive output current is larger than the set value of **n056**, speed search is started, using a decel rate of 2.0 sec. When drive output current is lower than the set value of **n056**, speed search is complete and acceleration or deceleration is continued at the normal rate (**n018** - **n021**) to set frequency.

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

Continued

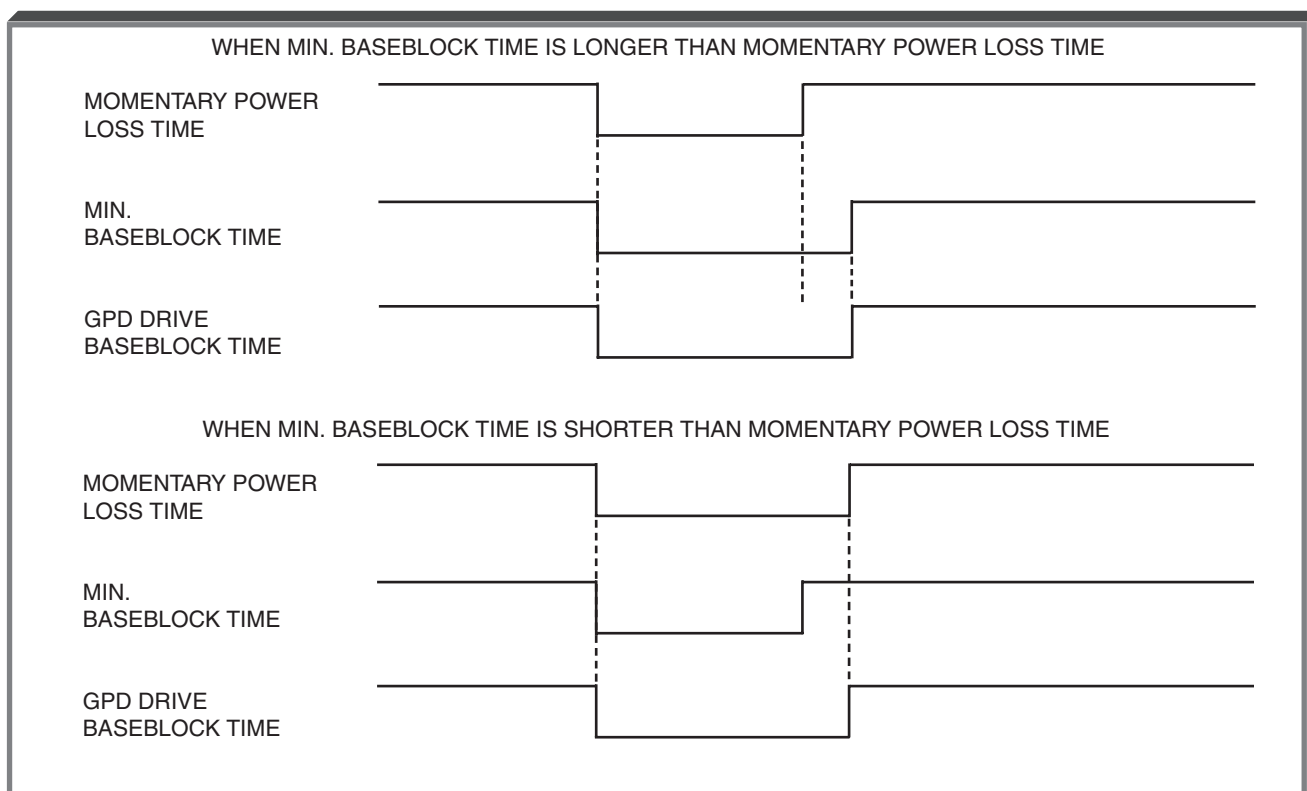
n057 : Minimum Baseblock Time
(Min Baseblock t)

Factory setting: *See Table A3-1*

Range: 0.0 to 25.5 sec.

When a momentary power loss is detected, the drive output transistors are disabled for a period of time determined by the setting of **n057**. The **n057** setting should represent the time required for the motor residual voltage to go to zero.

When the momentary power loss time exceeds the minimum base block time, the speed search operation is started immediately after power recovery.



n058 : V/f During Speed Search
(SpdSrch V/F)

Factory setting: *See Table A3-1*

Range: 0 to 100 %

To prevent a fault such as OC from occurring during the speed search operation, V/f must be set to a value lower than that required during normal operation.

$$\text{V/f during speed search} = \text{V/f at normal operation} \times \mathbf{n058}$$

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

Continued

F. Timer Start Cmd (22): Timer Function

n041 or **n042** : Multi-function Output Terminals

Timer Output **1 1** : Timer Function

(Terminal MA Sel) or (Terminal M1 Sel)

n080 : On-Delay Timer

Factory setting: **0.0** sec.

Range: 0.0 to 25.5 sec.

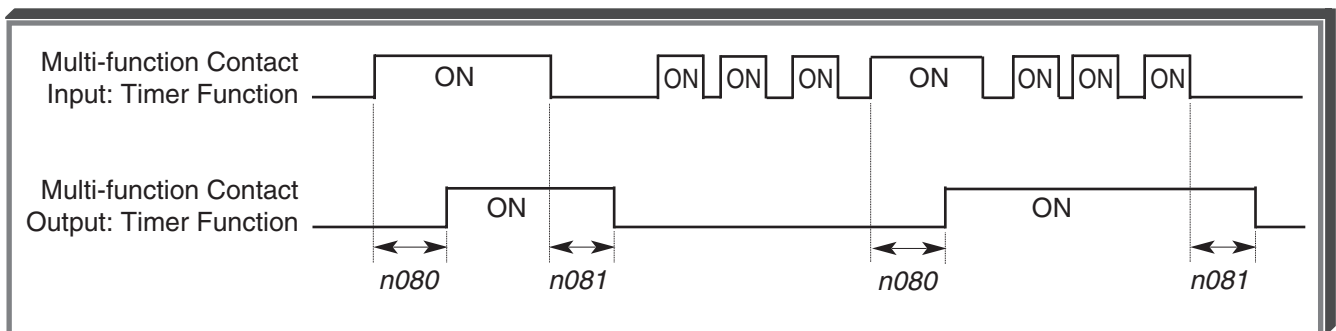
n081 : Off-Delay Timer

Factory setting: **0.0** sec.

Range: 0.0 to 25.5 sec.

When the timer function input is “closed” for longer than On-delay Timer (**n080**), the timer function output closes.

When the timer input is “open” for longer than Off-delay Timer (**n081**), the timer function output opens.



As can be seen, the timer function must be programmed as both a multi-function input **and** an output to be effective.

5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

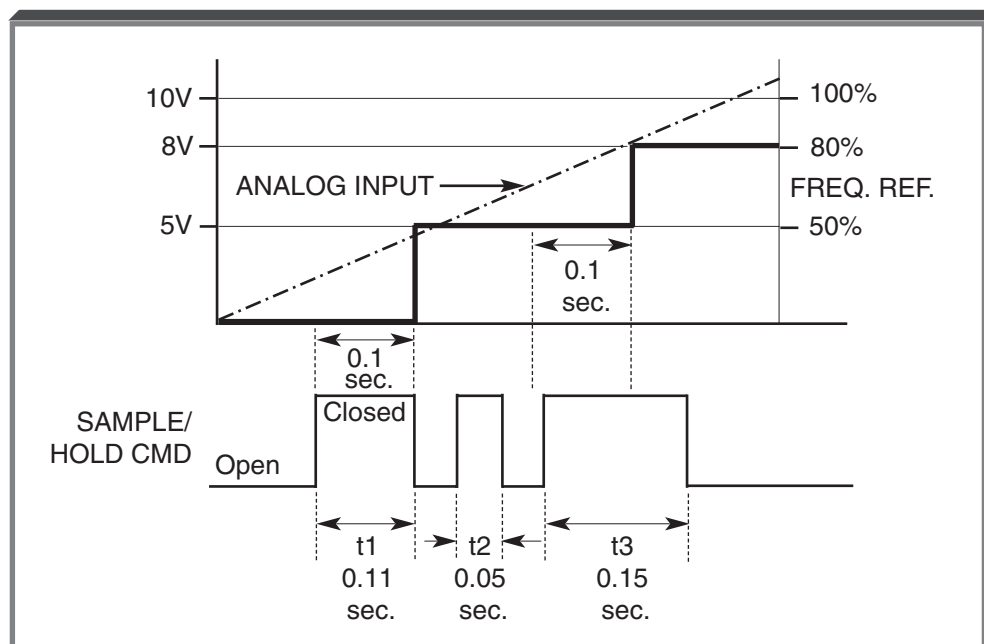
Continued

G. Ref Sample Hold (24) : Sample/Hold Command

This function applies only to an analog voltage or current input used as a frequency reference at terminals FV or FI.

If the Sample/Hold command is present (contact is closed) for more than 0.1 sec., the frequency reference will follow (sample) the analog signal, e.g. if 5V corresponds to 50% frequency, a 5V analog signal will produce 50% frequency reference if the Sample/Hold command is present.

If the Sample/Hold command is removed (contact is opened) while the Drive is still in Run condition, the frequency reference is held at the level it was at the time the Sample/Hold command was removed, e.g. the frequency reference would remain at 50%, even though the analog signal increased to 8V.



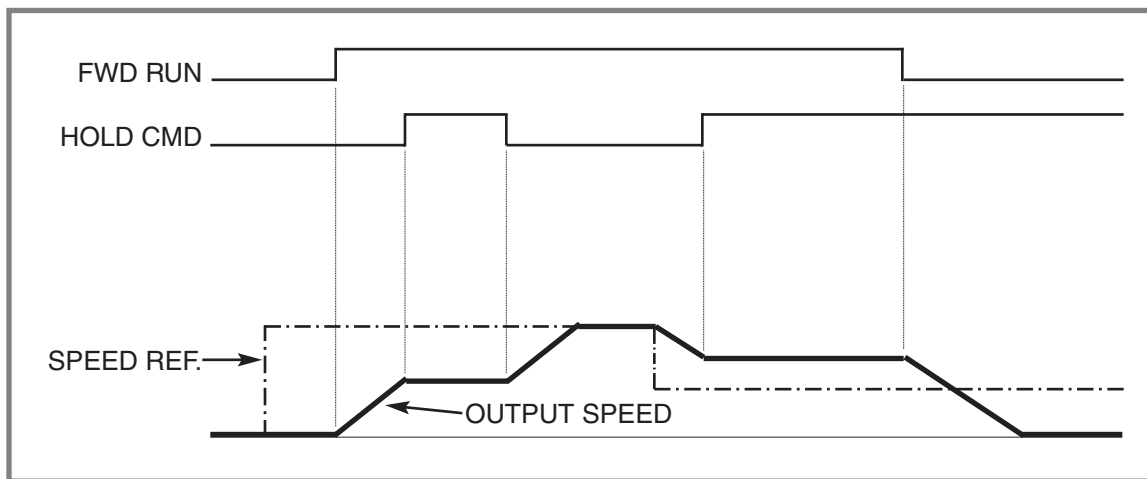
Sample/Hold Function Timing

Continued



H. Hold Command (27): Accel/Decel Hold

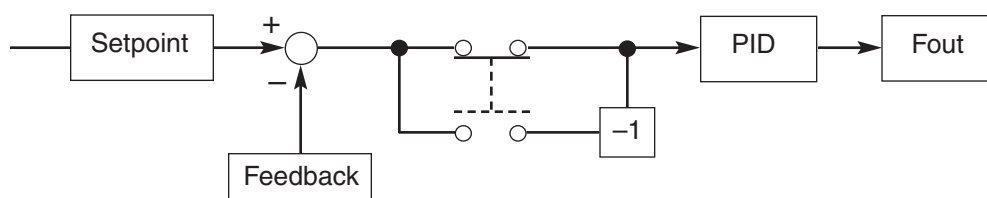
By programming data "Hold Command" (" 27 ") into one of the multifunction input parameters (**n036** thru **n040**), one of the multi-function input terminals (S2 thru S6) becomes a HOLD command input. As long as the HOLD command is present, accel and decel are in a prohibit state, and the output speed is held at the level it was at the time the HOLD command was input. When the HOLD command is removed while the system is still in Run condition, accel or decel will again become active to allow output to reach set speed. If Stop is initiated while the HOLD command is present, the prohibit state is cancelled and the system enters stop operation.



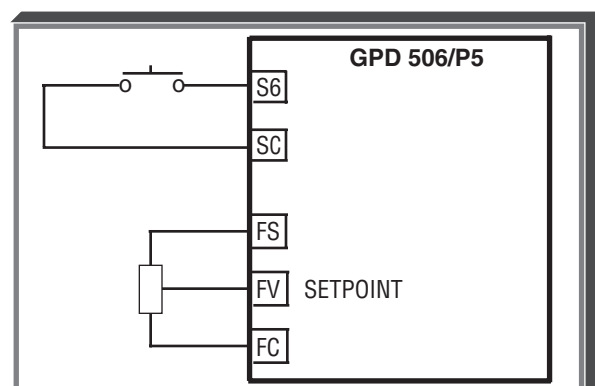
HOLD Function Timing

I. PID Polarity Sel (28) : PID Changeover

Programming data "PID Polarity Sel" (" 28 ") for **n040** allows the PID input characteristic changeover to function as follows:



Multi-function input: Open = As usual
Closed = Polarity of Deviation is changed over



5.19 MULTI-FUNCTION INPUT TERMINALS (Term. S2-S6)

Continued

J. Up/Down Control (29): Up/Down Function

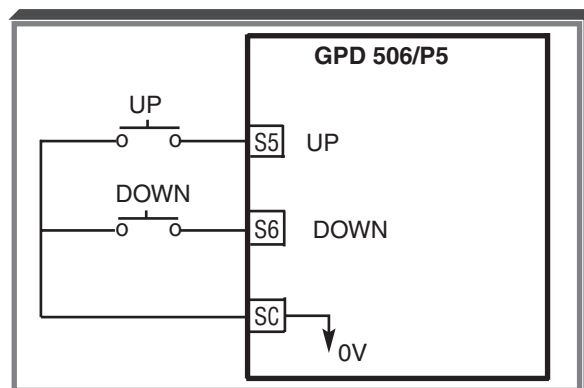
Programming data "Up/Down Control" (" 29 ") for **n040** (multi-function input terminal) allows the inputs to be used for Up/Down frequency setting.

NOTES:

1. Parameter **n039** will display " -- " when **n040** is set to "Up/Down Control" (" 29 ").
2. Jog has priority over Up/Down.
3. Up/Down has priority over Multi-step Frequency inputs.
4. Up/Down is ineffective when operation is from the Digital Operator.
5. Upper limit speed is set by the formula:
$$\mathbf{n011} (\text{Fmax}) \times \frac{\mathbf{n031} (\text{Freq. Ref. Upper Limit})}{100}$$
6. Lower limit speed is either the reference from external terminals FV or FI, or from **n032** , Frequency Reference Lower Limit, whichever is higher.
7. Upon a Forward (or Reverse) Run command, the drive will operate at the lower limit speed, until an UP command is given.

EXAMPLE:

n040 "Up/Down Control" (**29**):
Up/Down function



INPUT SIGNAL		FUNCTION
Term. S5	Term. S6	
UP	DOWN	
Open	Open	HOLD
Closed	Open	UP (Frequency command approaches frequency command upper limit)
Open	Closed	DOWN (Frequency command approaches minimum output frequency or frequency command lower limit, whichever is larger)
Closed	Closed	HOLD

5.20 MULTI-FUNCTION OUTPUT TERMINALS (Term. MA, MB & MC; M1 & M2)

n041 : Contact Output (external terminals MA, MB & MC)
(Terminal MA Sel)

n042 : Contact Output (external terminals M1 & M2)
(Terminal M1 Sel)

A Form-C contact, or an N.O. contact, can be programmed to change states during any of the conditions indicated in Table 5-3.

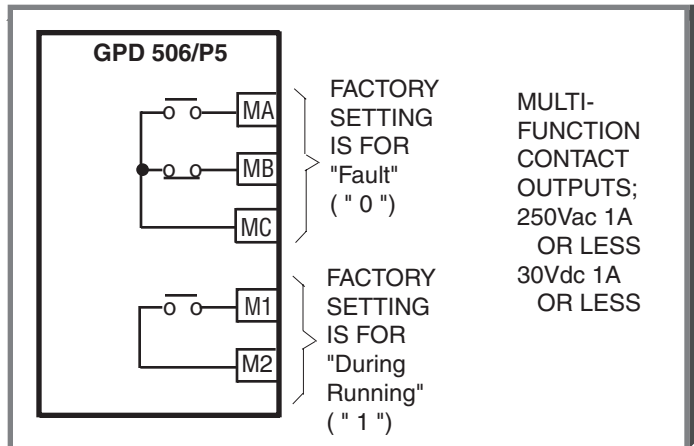


Table 5-3. Multi-function Output Terminals

LED SETTING	LCD SETTING	CONDITION	SIGNAL LEVEL
0*	Fault*	Fault	Closed = Drive fault has occurred (except CPF0, CPF1)
1 *	During Running *	During operation	Closed = Drive is operating
2	At Speed	Speed at set frequency	Closed = Frequency Reference = output frequency See description on next page
3	At Desired Speed	Speed coincidence	Closed = Speed at set frequency and output frequency = n075 See description on next page
4	Freq Detection 1	Frequency detection - low	Closed = Output frequency ≤ n075 . See description on next page
5	Freq Detection 2	Frequency detection - high	Closed = Output frequency ≥ n075 . See description on next page
6	Overtrq Det (NO)	Overtorque / Undertorque detection (N.O. contact)	Closed = Overtorque / Undertorque detected
7	Overtrq Det (NC)	Overtorque / Undertorque detection (N.C. contact)	Open = Overtorque / Undertorque detected
8	Base Blocked	During coast to stop	Closed = Drive output base block is active; motor is coasting
9	Operation Mode	Frequency or Run reference mode	Open = Frequency or Run Command by ext. input; Closed = Frequency or Run Command by Digital Operator
10	Ready	Operation ready	Closed = Drive is ready for operation (not faulted)
11	Timer Output	Timer function	See paragraph 5.19F
12	Auto-Restarting	Auto-restart	Closed = During auto-restart operation
13	OL Pre-Alarm	OL warning	Closed = 150% current for 48 sec. (OL1) or 80% time (OL2)
14	Freq Ref Loss	Frequency reference missing	Closed = Frequency reference is missing. See paragraph 5.13
15	Set by Com Cntl	Serial communication	Closed = Command from serial communication
16	PID Fdbk Loss	PID feedback loss	Closed = Feedback value < detection level (n091) for longer than detection delay time (n092)
17	OH1 Alarm	OH1 warning	Closed = Heatsink temperature ≥ 90°C (194°F) (if n035 = 3)

5.20 MULTI-FUNCTION OUTPUT TERMINALS

Continued

n075 : Speed Coincidence Frequency / Frequency
Detection Level
(Freq Det Level)

Factory setting: **0.0** Hz

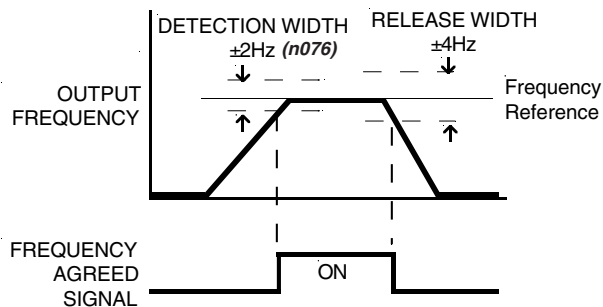
Range: 0.0 to 400.0 Hz

Speed coincidence is used to control an output contact at terminals MA or MB (with respect to terminal MC), or terminals M1 & M2, when selected by **n041** and **n042**.

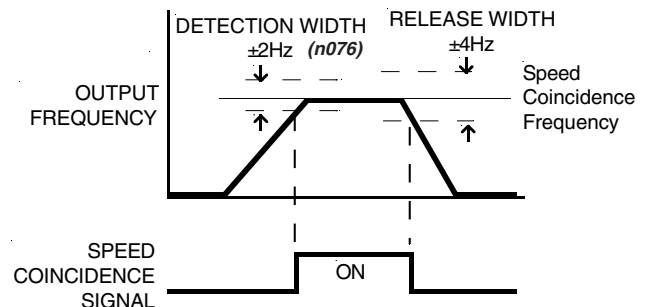
n041 or **n042** : Multi-Fuction Output Terminals
(Terminal MA Sel) or (Terminal M1 Sel)

The output contact will close, dependent upon the data programmed into **n041** or **n042**. See the appropriate figure below for operation.

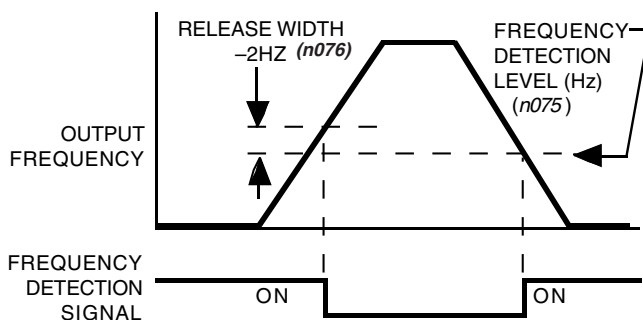
A. Speed at Set Frequency
(setting: **n041** or **n042** =
"At Speed" (" 2 "))



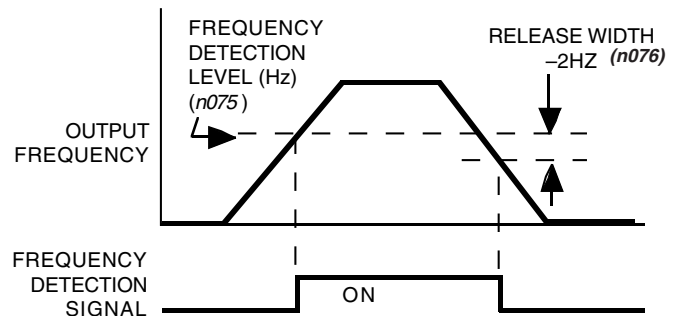
B. Speed Coincidence
(setting: **n041** or **n042** =
"At Desired Speed" (" 3 "))



C. Frequency Detection – Low
(setting: **n041** or **n042** =
"Freq Detection 1) (" 4 "))



D. Frequency Detection – High
(setting: **n041** or **n042** =
"Freq Detection 2) (" 5 "))



n076 : Frequency Agreed Detection Width
(Freq Det Width)

Factory Setting: **2.0** Hz

Range: 0.0 to 25.50 Hz

This Detection Width setting is used to establish the frequency level at which the output contact activates, when **n041** or **n042** is set to "At Speed" (" 2 ") or "At Desired Speed" (" 3 ").

5.21 OVERTORQUE / UNDERTORQUE DETECTION

Overtorque detection is used to compare drive rated output current with the overtorque detection level. When the output current is equal to or greater than the defined level, an overtorque condition exists. This will be indicated as an "**oL3 Overload 3**" fault on the Digital Operator. This feature can be selected to operate over a wide range of conditions.

A. **n077** : Overtorque / Undertorque Detection (Torq Det Sel)

Factory setting: **0**

This constant determines whether the overtorque detection function of the drive is enabled, under what conditions it will detect for overtorque, and what operation it will perform after detecting an overtorque.

LED Setting	LCD Setting	Overtorque / Undertorque Disabled	Operation After Detection	Detection Condition
0*	Disabled*	Disabled	—	—
1	OT/SpdAgree/Alm	Overtorque	Continues	Only at set frequency
2	OT/RUN/Alm	Overtorque	Continues	At all times except during stopping or DC injection braking
3	OT/SpdAgree/Flt	Overtorque	Coast to stop	Only at set frequency
4	OT/RUN/Flt	Overtorque	Coast to stop	At all times except during stopping or DC injection braking
5	UT/SpdAgree/Alm	Undertorque	Continues	Only at set frequency
6	UT/RUN/Alm	Undertorque	Continues	At all times except during stopping or DC injection braking
7	UT/SpdAgree/Flt	Undertorque	Coast to stop	Only at set frequency
8	UT/RUN/Flt	Undertorque	Coast to stop	At all times except during stopping or DC injection braking

- For overtorque detection during accel or decel, set to "OT/RUN Alm" (" 2 ") or "OT/RUN/Flt" (" 4 ").
- For continuous operation after overtorque detection, set to "OT/Spd Agree/Alm" (" 1 ") or "OT/RUN/Alm" (" 2 "). During detection, the Digital Operator displays and "**oL3 Overload 3**" alarm (blinking).
- To stop the drive at an overtorque detection fault, set to "OT/Spd Agree/Flt" (" 3 ") or "OT/RUN/Flt" (" 4 "). At detection, the Digital Operator displays an "**oL3 Overload 3**" fault.
- To output an overtorque detection signal, set output terminal function selection (**n41** or **n42**) to "OverTrq Det (NO)" (" 6 ") or "OverTrq Det (NC)" (" 7 ").

B. **n078** : Overtorque / Undertorque Detection Level (Torq Det Level)

Factory setting: **160** %

Range: 30 to 200 %

This is the reference point for determining that an overtorque condition exists. Set as a percent of drive rated current (see Appendix 2).

C. **n079** : Overtorque / Undertorque Detection Time (Torq Det Time)

Factory setting: **0.1** sec.

Range: 0.0 to 10.0 seconds

Determines how long an overtorque condition must exist before another event will occur, e.g. coast to stop, multi-function output change of state, or "**oL3 Overload 3**" warning or fault display.

5.21 OVERTORQUE / UNDERTORQUE DETECTION

Continued

D. **n041** : Multi-function Output 1 – Contact
(Terminal MA Sel)

n042 : Multi-function Output 2 – Contact
(Terminal M1 Sel)

OverTrq Det (NO) (6) or OverTrq
Det (NC) (7): Overtorque
/ Undertorque Detection

A Form-C contact, or an N.O. contact, can be programmed to change states during an overtorque detection condition.

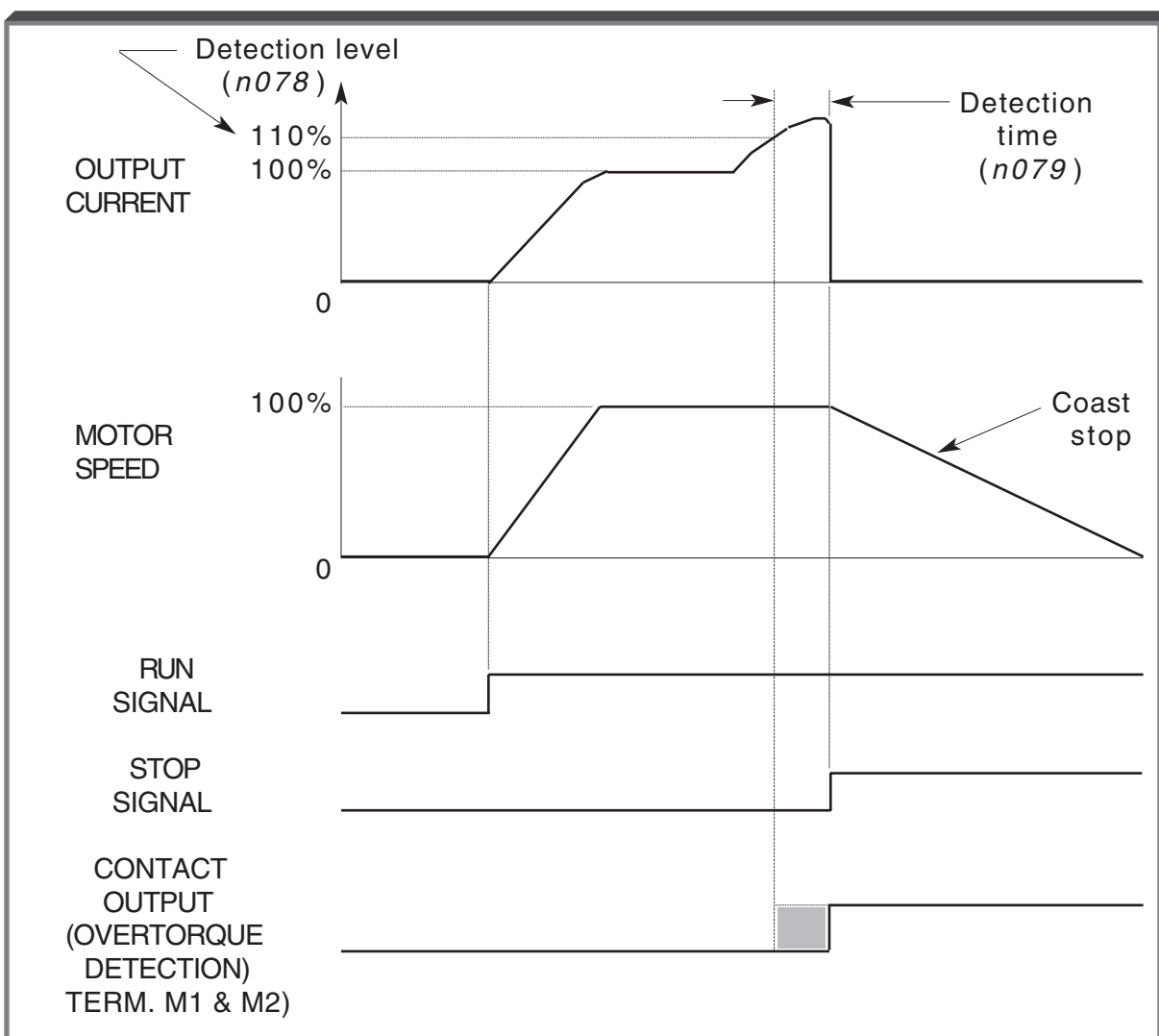
EXAMPLE OF OVERTORQUE DETECTION

n077 setting: "OT/Spd/Flt" (3) — Overtorque enabled, only at set frequency, coast to stop

n042 setting: "OverTrqDet1" (6) — Output contact programmed for overtorque detection

n078 setting: **110%** — Level at which overtorque is sensed

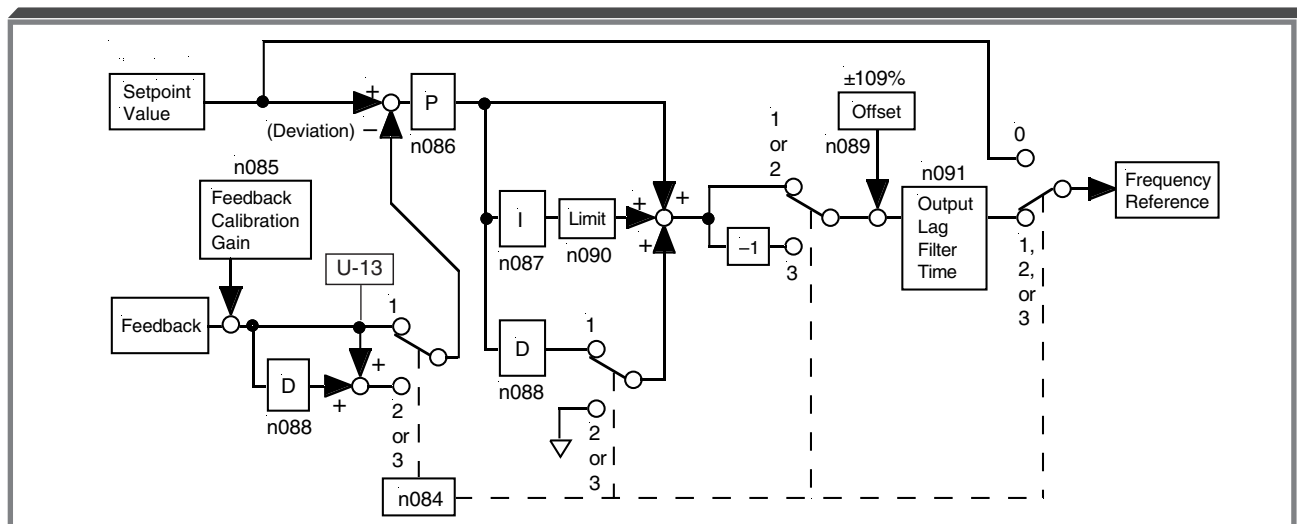
n079 setting: **1.0 s** — Time delay before overtorque event occurs



Overtorque Detection Timing Diagram

5.22 PID CONTROL

The Proportional, Integral and Derivative control function provides closed-loop control, or regulation, of a system process variable (pressure, temperature, etc.). This regulation is accomplished by comparing a feedback signal to a setpoint reference, which results in an error signal. The PID control algorithm then performs calculations, based upon the PID parameter settings (**n084** thru **n092**), on this error signal. The result of the PID algorithm is then used as the new speed reference.



A. **n084** : PID Selection (PID Mode)

Using this parameter, PID control can be enabled, feed forward function can be activated, or the PID Feedback can be inverted.

LED Setting	LCD Setting	Description
0 *	Disabled*	PID disabled
1	Enabled D=Fdbk	PID enabled (Deviation is D-controlled)
2	Enabled D=Fwd	PID with feed forward (Feedback value is D-controlled)
3	Enabled Rev Fdbk	Inverted PID Feedback signal

5.22 PID CONTROL

Continued

B. Setpoint Reference Selection

n002 : Operation Mode Selection
(Oper Mode Sel)

n043 : Analog Input Selection
(AnalogInput Sel)

n024 thru **n030** : Multi-step Frequency Presets
(Reference 1-6, Jog Frequency)

Factory settings: n030 = 6.0 all others = 0.0

Range (ea): 0.0 to 9999

Select the PID control Setpoint Reference from either the external terminal FV (for 0-10 VDC), or from multi-step speed parameters, **n024** thru **n030**.

- External terminal FV: Set **n002** to "SEQ=OPR REF=TRM" (" 2 ") or "SEQ=TRM REF=TRM" (" 3 ").
- Multi-step speed parameters: Set **n002** to "SEQ=OPR REF=OPR" (" 0 ") or "SEQ=TRM REF=OPR" (" 1 "). (See Operation Mode Selection, page A1-1, and Multi-step Speed Setting, paragraph 5.19B.)

C. Feedback Signal Selection

n044 : Terminal FI Signal Level Selection
(Terminal FI Sel)

Factory setting: 1

Range: 0 or 1

Select the PID control Feedback Signal from external terminal FI for either a current signal (4-20mA DC) or a voltage (0-10 VDC).

- Current signal: Set **n044** to "4-20 mA" (" 1 ").
- Voltage signal: Set **n044** to "0-10 VDC" (" 0 ").
(**Must also cut jumper J1 on Control PCB.**)

D. Inverse PID

NOTE: The following applies only when **n084** = "Enable Rev Fdbk" (" 3 ").

If using inverse PID control, the following adjustments need to be made:

- If a 0-10 VDC reference is used to determine the setpoint, exchange the values in **n048** and **n049**.

EXAMPLE: If the Frequency Reference Gain (**n048**) = " 100 " % and the Frequency Reference Bias (**n049**) = " 0 " %, these parameters will now need to be set as follows:

n048 = " 0 " %

n049 = " 100 " %

5.22 PID CONTROL

Continued

- If the setpoint is entered via the keypad, the entered setpoint needs to be recalculated as follows:

$$\text{Entered Setpoint} = \text{Max Value (n023)} - \text{Desired Setpoint}$$

This effectively inverts the reference input.

EXAMPLE: Desired Setpoint is 43.0 Hz, Max. Value (**n023**) = " 60.0 " Hz.
Therefore, the entered setpoint is:

$$\text{Entered Setpoint} = 60.0 \text{ Hz} - 43.0 \text{ Hz} = " 17.0 " \text{ Hz.}$$

This setpoint should be entered as " 17.0 " Hz.

- If PID feedback loss detection is used, the *inverse* of the desired feedback loss detection level should be entered in **n091**.

EXAMPLE: Desired Feedback Loss Level = 7%.

$$\text{Desired Fdbk Loss Det. Level} = 100\% - 7\% = " 93 " \%$$

E. **n085** : Feedback Calibration Gain
(PID Fdbk Gain)

Factory setting: **1.00**

Range: 0.00 to 10.00

This parameter is used to adjust the Feedback Signal level.

F. Feedback Loss Detection

n090 : Feedback Loss Detection Selection
(PID Fdbk Loss Sel)

LED Setting	LCD Setting
0*	Disabled*
1	MF Output Only

n091 : Feedback Loss Detection Level
(PID Fdbk Loss Lvl)

Factory setting: **0** %

Range: 0 to 100 %

n092 : Feedback Loss Detection Delay Time
(PID Fdbk Loss Time)

Factory setting: **1.0** seconds

Range: 0.0 to 25.5 seconds

When enabled (**n090** = "MF Output Only" (" 1 ")), the drive will sense if the Feedback Signal falls below the **n091** level for more than the **n092** delay time.

G. PID Settings

n086 : Proportional Gain
(PID P Gain)

Factory setting: **1.0**

Range: 0.0 to 10.0

Proportional gain is the value by which the error signal is multiplied to generate the new speed reference.

(continued on next page)

5.22 PID CONTROL

Continued

n087 : Integral Time
(PID I Time)

Factory setting: **10.0** seconds

Range: 0.0 to 100.0 seconds

This parameter determines how fast the integral gain increase is added to the control loop.

n088 : Derivative Time
(PID D Time)

Factory setting: **0.0** seconds

Range: 0.00 to 1.00 seconds

Derivative time can be adjusted to dampen initial oscillations and reduce overshoot, which serves to improve stability.

These parameters are all interactive, and will need to be adjusted until the control loop is properly tuned, i.e. stable with minimal steady-state error. A general procedure for tuning these parameters is as follows:

1. Adjust Proportional Gain until continuous oscillations in the Controlled Variable are at a minimum.
2. The addition of Integral Time will cause the steady-state error to approach zero. The time should be adjusted so that this minimal error is attained as fast as possible, without making the system oscillate.
3. If necessary, adjust derivative time to reduce overshoot during startup. The drive's accel and decel rate times can also be used for this purpose.

H. n089 : Integral Value Limit
(PID I Limit)

Factory setting: **100** %

Range: 0 to 109 %

Parameter **n089** is factory set for optimum results for most applications, and generally doesn't need to be changed.

I. n036 thru n040 : Multi-function Input Terminals
(Terminal S2-S6 Sel)

PID I Reset (**20**): Integral Value Reset

A Multi-function Input Terminal can be used to reset the value of **n087** to data " 0 ". Note that this value is also reset to " 0 " if the drive is given a STOP command.

PID Disable (**21**): PID Disable

A Multi-function Input Terminal can be used to disable PID control. When this terminal is closed, PID control is disabled, and the Setpoint Reference is used as the frequency reference.

5.22 PID CONTROL

Continued

n094 : Sleep Function Start Level
(Sleep Start Lvl)

Factory setting: **0.0** Hz

Range: 0.0 to 400.0 Hz

n095 : Sleep Function Delay Time
(Sleep Delay Time)

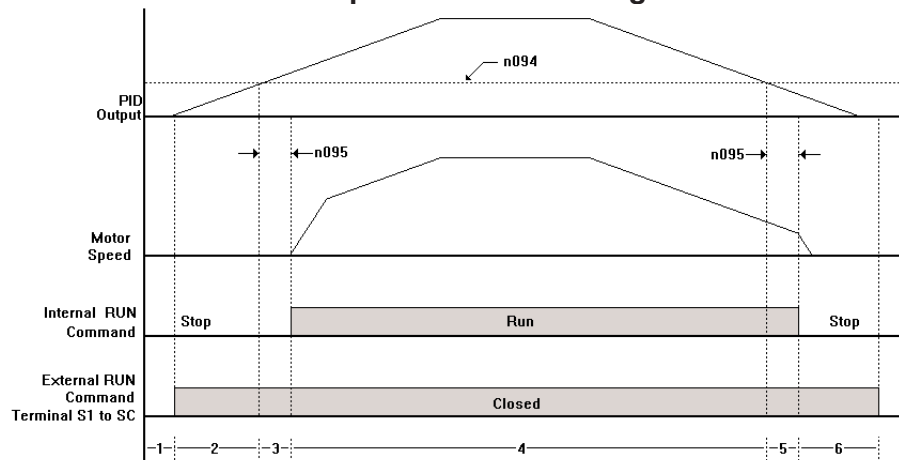
Factory setting: **0.0** seconds

Range: 0.00 to 25.5 seconds

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 at 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, the drive and motor are off.

This function operates when parameter **n094** (Sleep function start level) is set to some value other than zero and one of the PID modes is selected (**n084** is "Enabled"). The drive starts to run when the PID output (frequency reference) is higher than the setting specified in parameter **n094** for longer than the time entered into parameter **n095** (Sleep function delay time) has elapsed. The drive stops running when the PID output drops below the value in parameter **n094** for longer than the time entered into parameter **n095**.

Sleep Function Timing Chart



See timing chart:

1. The drive is stopped.
2. External Run is closed, but the PID output is below the sleep function start level (**n094**). The drive remains stopped.
3. The PID output exceeds the sleep function start level (**n094**), and the sleep function time delay timer (**n095**) starts timing.
4. The sleep function delay timer (**n095**) expires and the drive accelerates on the acceleration ramp to "catch up" with PID output. The drive then follows the PID output.
5. The PID output level falls below the sleep function start level (**n094**). The sleep function time delay timer (**n095**) starts timing. The drive still follows PID output.
6. The sleep function delay timer (**n095**) expires and the drive decelerates on the deceleration ramp.

5.23 RESET CODES: 2-WIRE, 3-WIRE INITIALIZATION

n001 : Parameter Selection / Initialization
(Password)

Factory setting: **1**

Range: 0 to 9

The following table shows which parameters can be programmed (displayed & changed) or only displayed when **n001** is selected.

LED & LCD Setting	Programmable Parameters	Display Only Parameters
0	n001	n002 to n116
1	n001 to n035	n036 to n116
2	n001 to n053	n054 to n116
3	n001 to n116	—
4 - 7	Not Used	
8	Initialization: 2-Wire control	
9	Initialization: 3-Wire control	

By entering either initialization code into **n001**, a reset to factory configuration (parameter initialization) is accomplished. The parameters which are NOT affected are: **n005** (Motor Rotation), **n010** (V/f selection), and **n115** (Inverter kVA Sel).

Factory Settings	2-Wire Control		3-Wire Control	
	LED	LCD	LED	LCD
n036	0	Reverse RUN	1	STOP Command
n037	2	Ext Fault (NO)	--	FWD / REV Cmd (3W)
n038	4	Fault Reset	4	Fault Reset
n039	10	Multi-step Spd 1	10	Multi-step Spd 1
n040	11	Multi-step Spd 2	11	Multi-step Spd 2

CAUTION

Know your application before using either Initialization function of **n001**. This parameter must be set to " 0 " to " 3 " for operation.

" 8 " = Factory 2-Wire Control Initialization (Maintained RUN Contact)

" 9 " = Factory 3-Wire Control Initialization (Momentary START/STOP Contact)

Entering either Initialization code resets all parameters to factory settings, and automatically returns **n001** setting to " 1 ". If the drive is connected for 3-Wire control and this parameter is set to " 8 " (2-Wire Control Initialization), the motor may run in reverse direction WITHOUT A RUN COMMAND APPLIED. Equipment damage or personal injury may result.

IMPORTANT

After " 8 " or " 9 " has been entered in **n001**, the Motor Rated Current (**n033**) MUST BE REPROGRAMMED to the correct setting for the application. See paragraph 5.26.

5.23.1 SLIP COMPENSATION

Continued

n 108 : Motor No-Load Current
(Mtr No-Load Amp)

Factory setting: <i>2.0</i> sec.

Range: 0.0 to 25.5 sec.

Motor no-load current (***n 108***) is set as a percentage of motor full-load current (***n 033***). It is used as shown in the slip compensation block diagram. The factory setting of 30% should be sufficient for most motors.

n 109 : Slip Compensation Primary Delay
Time Constant
(Slip Comp Delay)

Factory setting: <i>2.0</i> sec.

Range: 0.0 to 25.5 sec.

Parameter (***n 109***) can be increased to improve stability or decreased to improve response to load changes.

5.24 STALL PREVENTION

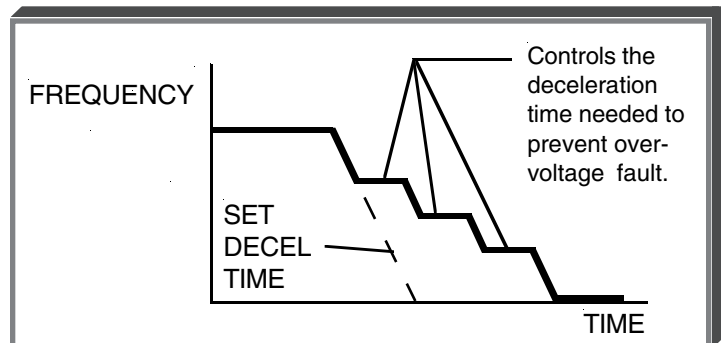
A. **n072** : Stall Prevention During Deceleration (StallP Decel Sel)

Factory setting: **1**

LED Setting	LCD Setting	Description
0	Disabled	Stall Prevention during deceleration disabled
1 *	Enabled *	Stall Prevention during deceleration enabled

Stall prevention during deceleration automatically adjusts the deceleration rate while monitoring the DC bus voltage to prevent overvoltage during deceleration.

When the motor load is large or decel time is short, actual decel time may be longer than the set value because of stall prevention.



B. **n073** : Stall Prevention Level During Acceleration (StallP Accel Lvl)

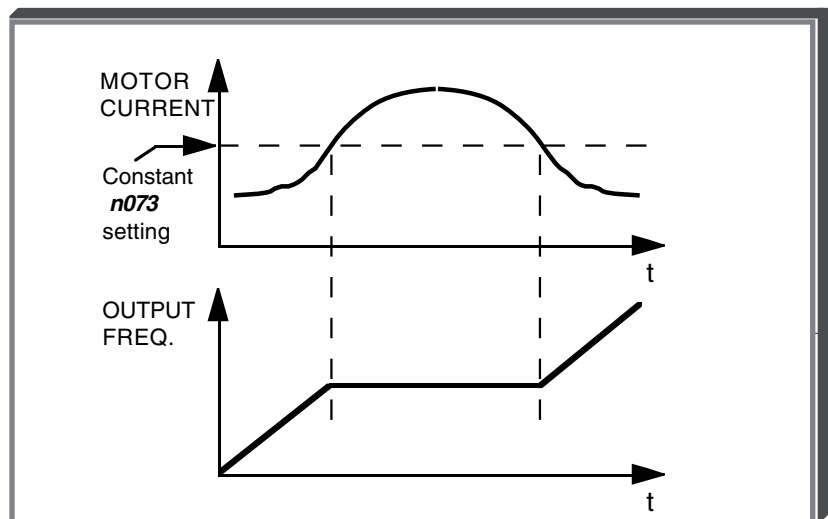
Factory setting: See Table A3-1

Range: 30 - 200 %

This parameter determines the actual drive output current level during an acceleration condition. Set in percent of drive rated output current (see Appendix 2).

A setting of " 200 " disables stall prevention during acceleration. During acceleration, if the output current exceeds the value in **n073**, acceleration stops and frequency is maintained. When the output current goes below the value set in **n073**, acceleration resumes.

In the constant horsepower region [actual output frequency * max. voltage frequency (**n013**)], the stall prevention level during acceleration is changed by the following formula:



$$\text{Stall prevention level during accel (constant horsepower)} = \text{Stall prevention level during accel} \times \frac{\text{Max. voltage frequency}}{\text{Actual output frequency}}$$

5.24 STALL PREVENTION

Continued

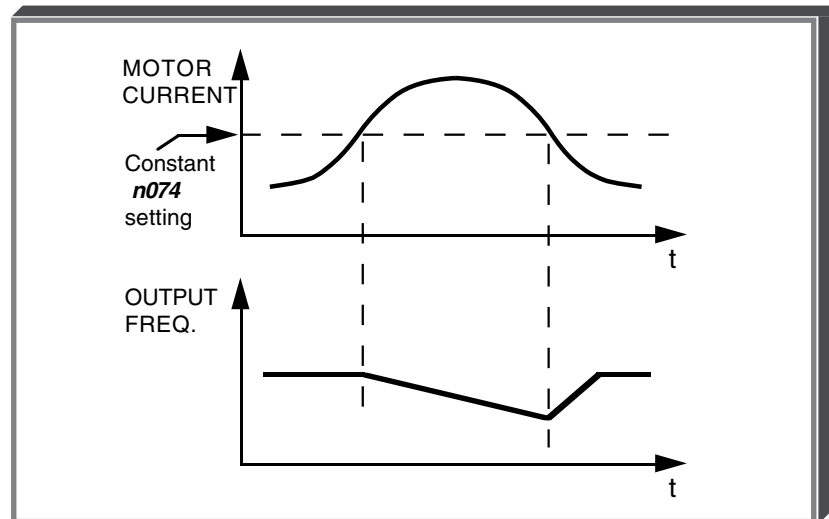
C. **n074** : Stall Prevention Level At Set Speed (StallP Run Lvl)

Factory setting: See Table A3-1

Range: 30 - 200 %

This parameter determines the actual drive output current level while operating at set speed (frequency). Set in percent of drive rated output current (see Appendix 2).

A setting of " 200 " disables stall prevention at set speed. During running at set speed, if the output current exceeds the value set in **n074**, the drive will begin to decelerate. When the output current goes below the value set in **n074**, acceleration begins, up to the set frequency.



5.25 STOPPING METHOD

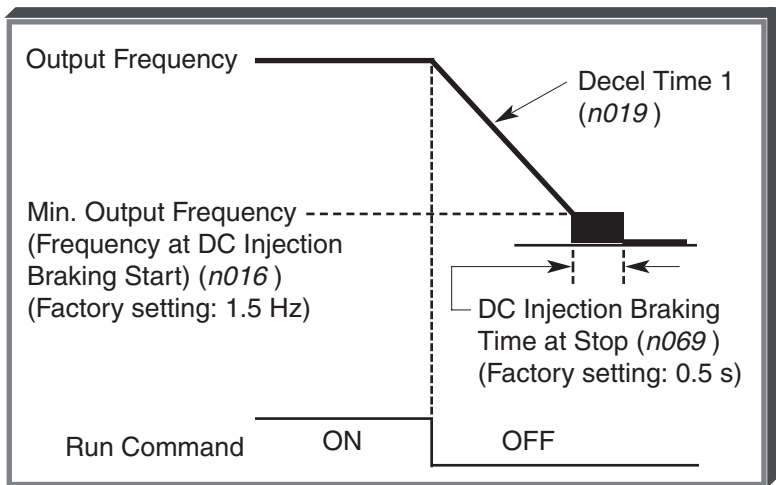
n004 : Stopping Method

Selects the stopping method suitable for the application.

LED Setting	LCD Setting	Description
0*	Ramp to STOP*	Deceleration (ramp) to stop
1	Coast to STOP	Coast to stop
2	Coast w/Timer 1	Coast to stop with Timer 1
3	Coast w/Timer 2	Coast to stop with Timer 2

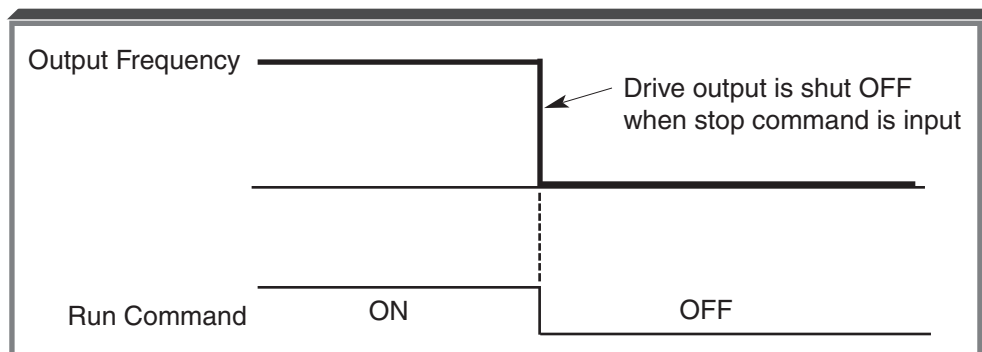
A. Ramp to STOP (0) : Deceleration to Stop

Upon removal of the FWD (or REV) Run command, the motor decelerates at the deceleration rate determined by the time set in Decel Time 1 (*n019*), and DC injection braking is applied immediately before stop. If the decel time is too short or the load inertia is too large, an overvoltage (OV) fault may occur on a stop command — the decel time must be increased.



B. Coast to STOP (1) : Coast to Stop

Upon removal of the FWD (or REV) Run command, the motor coasts to rest.

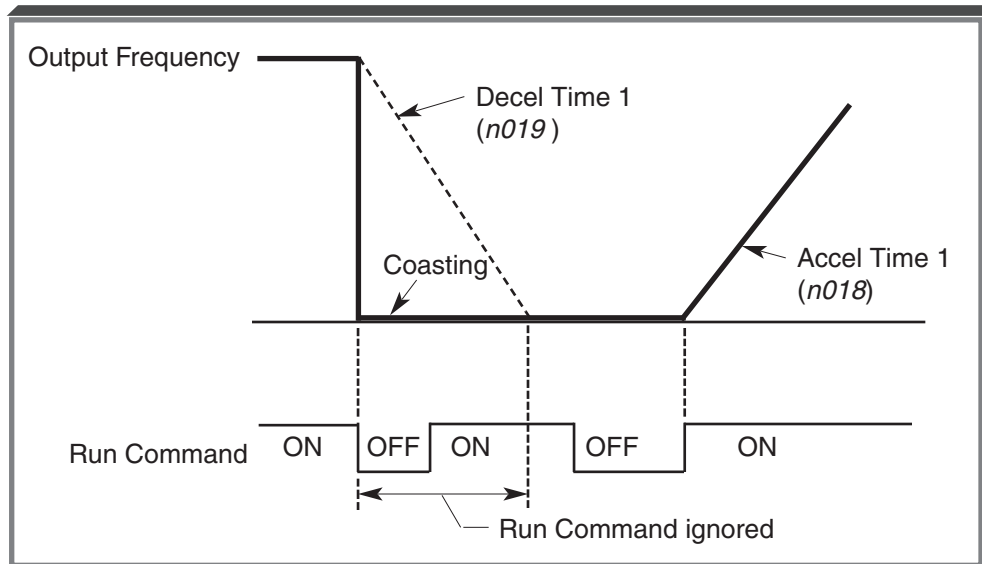


5.25 STOPPING METHOD

Continued

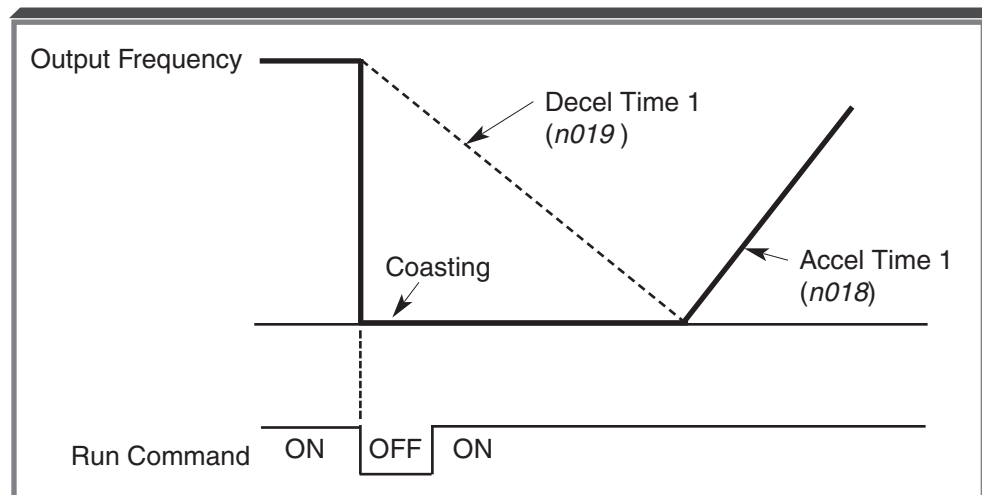
C. Coast w/Timer 1 (2) : Coast to Stop With Timer 1

When programmed for coast to stop with timer 1, a Run command is ignored if issued during the time the motor would normally be decelerating (**n019** or **n021**), or for the minimum base block time (**n057**), whichever is longer.



D. Coast w/Timer 2 (3) : Coast to Stop With Timer 2

When programmed for coast to stop with timer 2, a Run command is retained, but is not responded to, until after the time the motor would normally have decelerated to a stop (**n019** or **n021**), or for the minimum base block time (**n057**), whichever is longer.



5.26 THERMAL OVERLOAD PROTECTION

n033 : Motor Rated Current
(Motor Rated FLA)

Factory setting: See Table A3-1

Range: see description

This parameter should be set, in increments of 0.1 A, to the rated current (FLA) value shown on the motor nameplate; this value **MUST BE** between 10% and 120% of the *drive rated current* (refer to Specifications in Appendices 2 & 3 of this manual). If the motor FLA does not fall within this range, a different Model No. drive must be used.

NOTE: Setting **n033** to " 0.0 " disables the motor overload protection function, regardless of the setting of **n034**.

n034 : Electronic Thermal Motor Protection
(Motor OL Sel)

LED Setting	LCD Setting	Description
0	Disabled	Electronic thermal overload protection disabled
1*	STD Motor/8 Min *	General-purpose motor, standing rating (8 min.)
2	STD Motor/5 Min	General-purpose motor, short-term rating (5 min.)
3	INVMotor/8 Min.	Blower-cooled motor, standard rating (8 min.)
4	INVMotor/5 Min.	Blower-cooled motor, short-term rating (5 min.)

The drive protects against motor overload with a UL-recognized, built-in electronic thermal overload relay.

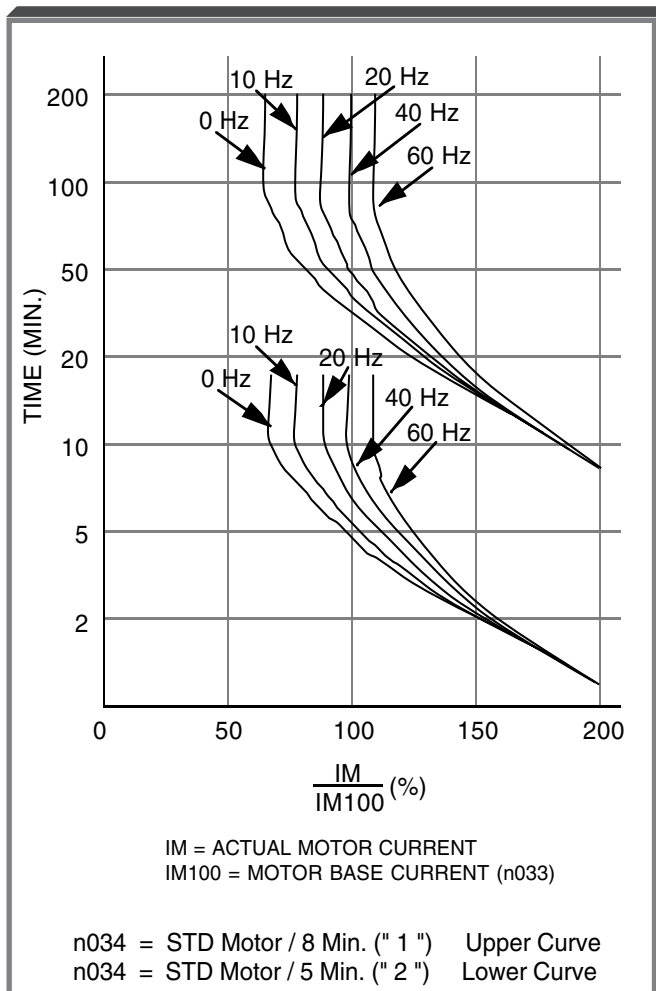
The electronic thermal overload function monitors motor temperature, based on drive output current and time, to protect the motor from overheating. When the electronic thermal overload trips, an " **oL1 Overload 1**" error occurs, shutting OFF the drive output and preventing excessive overheating of the motor.

When operating with one drive connected to only one motor, an external thermal relay is not needed. When operating several motors with one drive, install a thermal overload relay on each motor.

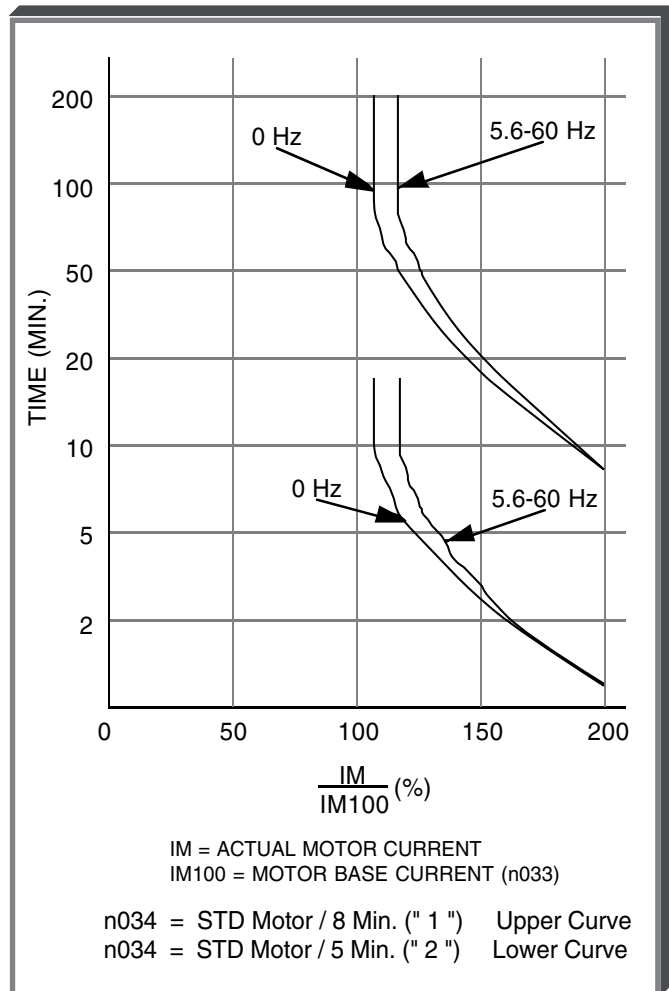
- General-purpose and blower-cooled motors**

Induction motors are classified as general-purpose or blower-cooled motors, based on their cooling capabilities; the motor overload detection function operates differently, as shown, for each of these two motor types.

NOTE: If a TEFC motor is going to be run at or near 100% of rated current at frequencies below 30 Hz for an extended period of time, select the blower cooled curve (**n034** = "INV Motor/8 Min" (" 3 ")).



**Electronic Motor Thermal
Protection Characteristics
For General-Purpose Motor**



**Electronic Motor Thermal
Protection Characteristics
For Blower-Cooled Motor**

5.27 TORQUE COMPENSATION

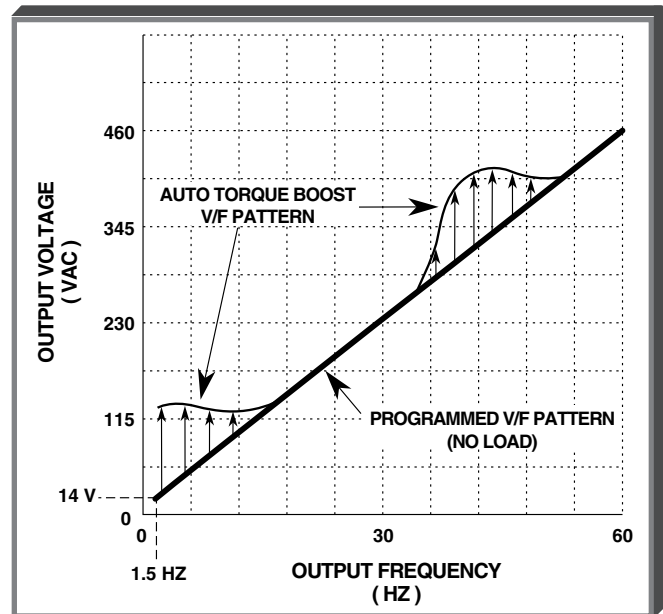
n071 : Torque Compensation Gain (K_T)
(Torq Comp Gain)

Factory setting: **1.0**

Range: 0.0 to 3.0

Sets the torque compensation, in increments of 0.1. When the motor has the same capacity as that of the drive, the gain is 1.0. When a smaller motor is used, the gain should be set to 1.5 (typical).

This parameter is used by the drive's automatic torque boost function to match the drive's output voltage boost to the motor load. Except for the most demanding of high starting torque applications, the factory settings of these parameters will be adequate. The factory settings are programmed to match the performance characteristics of typical AC motors.



Example of Torque Compensation Operation

The calculation of compensated torque uses the following formula:

$$\text{Compensated Value} = \left[\frac{(\sqrt{3} \cdot V_{ac} \cdot I_{ac} \cdot \cos \Phi)}{\text{Frequency}} \right] \times K_T$$

Where

K_T = **n071**

Φ = Power Factor (calculated by the drive)

5.28 V/f PATTERN

A. n010 : V/f Pattern

LED Setting	LCD Setting	Description
0	User Defined V/f	"Custom" pattern
1*	60 Hz Preset *	"Preset" pattern

When parameter **n010** is set to "User Defined V/f" ("0"), the V/f pattern can be tailored to suit a specific application and load characteristics by adjusting parameters **n011** to **n017** (see the V/f characteristics figure on the following page). The values set into **n011** to **n017** from the factory should be adequate for most variable torque applications (60 Hz rated motors only).

When parameter **n010** is set to "60 Hz Preset" ("1"), the V/f pattern is fixed. This fixed pattern is good for most constant torque applications (60 Hz rated motor only).

If motor rated voltage is other than 230Vac (e.g. 208Vac, 380Vac, or 460Vac), set parameter **n010** = 0 and adjust **n012**, **n015**, and **n017** according to footnote 5 below.

Table 5-4. Recommended V/f Patterns

Max. Freq.	Starting Torque	Load Type ¹	n010	n011 (Hz)	n012 (V) ⁵	n013 (Hz)	n014 (Hz)	n015 (V) ⁵	n016 (Hz)	n017 (V) ⁵
50	Normal	VT	0	50	230	50	25.0	40.2	1.3	9.2
50	High ²	VT	0	50	230	50	25.0	57.5	1.3	11.5
60	Normal	VT	0	60	230	60	30.0	40.2	1.5	9.2
60	High ²	VT	0	60 ³	230 ³	60 ³	30.0 ³	57.5 ³	1.5 ³	11.5 ³
50	Normal	CT	0	50	230	50	3.0	17.2	1.5	11.5
50	Medium	CT	0	50	230	50	2.5	23.0	1.3	13.8
50	High ²	CT	0	50	230	50	2.5	28.7	1.3	16.1
60	Normal	CT	1 ⁴	60 ⁴	230 ⁴	60 ⁴	3.0 ⁴	17.2 ⁴	1.5 ⁴	11.5 ⁴
60	Medium	CT	0	60	230	60	3.0	20.7	1.5	13.8
60	High ²	CT	0	60	230	60	3.0	28.7	1.5	23.0
72	Normal	CT	0	72	230	60	3.0	17.2	1.5	11.5
90	Normal	CT	0	90	230	60	3.0	17.2	1.5	11.5
120	Normal	CT	0	120	230	60	3.0	17.2	1.5	11.5
180	Normal	CT	0	180	230	60	3.0	17.2	1.5	11.5

NOTES:

¹ VT = Variable Torque, typically used for blowers, centrifugal pumps, and fans.

CT = Constant Torque, most other applications. Consult Yaskawa for further assistance.

The following conditions must be considered when selecting a V/f pattern:

- Pattern matches the voltage-frequency characteristics of the motor.
- Maximum motor speed.

² V/f pattern for high starting torque should be selected for:

- Long wiring distance.
- Large voltage drop at start
- AC reactor connected to drive input or output.
- Use of motor rated below drive max. output.

³ These are the factory settings when n010 = "User defined V/f" ("0").

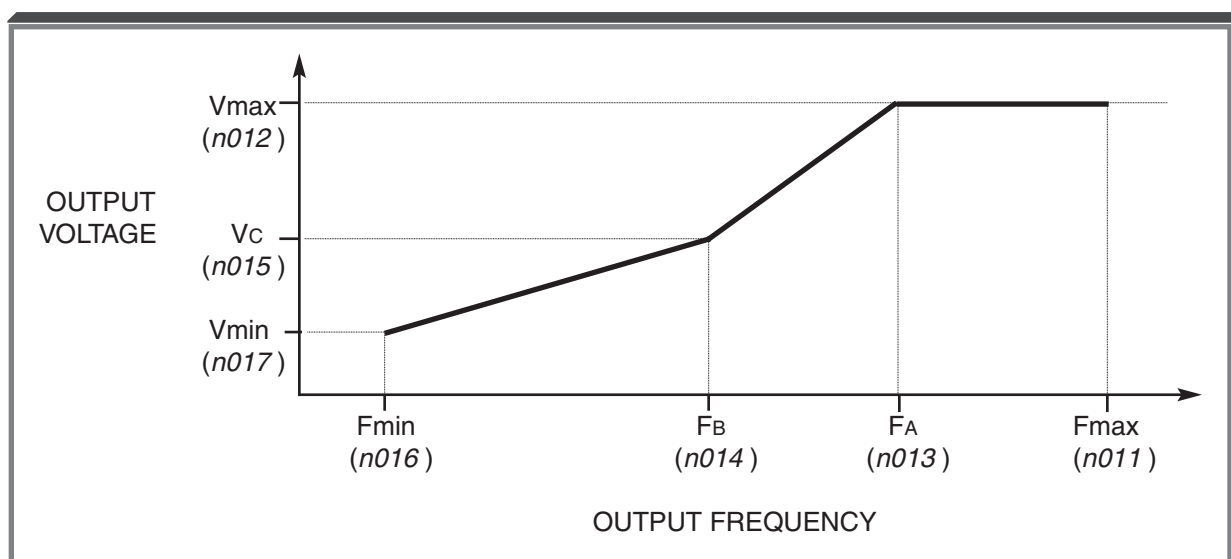
⁴ These settings cannot be changed when n010 = "60 Hz Preset" ("1").

⁵ Voltages shown are for 230V motors; for other motor voltages, multiply all voltage (V) values by (Vmtr/230); i.e., for 460V input, multiply by 460/230 = 2.

5.28 V/f PATTERN Continued

- n011** : Frequency – Max. (Fmax)
- n012** : Voltage – Max. (Vmax)
- n013** : Frequency – Max. Voltage point (FA)
- n014** : Frequency – Midpoint (FB)
- n015** : Voltage – Midpoint (Vc)
- n016** : Frequency – Min. (Fmin)
- n017** : Voltage – Min. (Vmin)

These seven parameters define the custom V/f pattern, **only if n010 is set to "User Defined V/f" ("0")**. The illustration below shows how these constants relate to each other in establishing the custom V/f pattern.



V/f Characteristics Set by n011 thru n017

- B. n003** : Motor Rated Voltage
(Input Voltage)

Factory Setting: 230.0 or 460.0 V
Range: 150.0 to 255.0 V (230V) 150.0 to 510.0 V (460V)

This parameter should be set to match the motor rated voltage when using the preset V/f pattern (**n010** = "60 Hz Preset" ("1")). The voltages (**n012**, **n015**, and **n017**) will automatically be multiplied by **n003** / 230V. If parameter **n010** = "User defined V/f" ("0"), parameter **n003** will have no effect.

NOTES:

- ⁶ Parameter **n003** is also represented by the Vmtr Quick-Start display - see paragraph 4.2.1, "Input Voltage".

5.28 V/f PATTERN

Continued

NOTE: To establish a V/f pattern with a straight line from Fmin to FA, set FB = Fmin. The setting of Vc is then disregarded and does not affect the V/f pattern.

IMPORTANT

The parameter settings are checked whenever power is applied to the drive, or each time the **ENTER** key is pressed while in the Program (PRGM) mode. A parameter set value failure ("**oPE5 V/f Error**") will occur if any part of the following relationships among **n011** thru **n017** is not TRUE:

- (a) $F_{max} \geq F_A \geq F_B \geq F_{min}$
- (b) $V_{max} \geq V_c \geq V_{min}$

5.29 INPUT PHASE LOSS DETECTION

n083 : Input Phase Loss Detection Level
(In Ph Loss Lvl)

Factory setting: 7 %

Range: 1 to 100 %

The input phase loss detection circuit monitors the DC bus current ripple and activates when one of the input phases is lost. The detection circuit calculates the maximum and minimum values of the DC bus voltage in 1.28 second intervals, and compares the difference (ΔV) between these values with the input phase loss detection level (**n083**). If $\Delta V \geq \text{n083}$, then an input phase loss is detected, and after the 10.24s, an SPI fault occurs, the display shows "SPi Input PhaLoss" and the motor coasts to stop.

Input phase loss detection is disabled in the following cases:

- Parameter **n083** is set to data " 100 ".
- A Stop command is input.
- Magnetic Contactor (MC) shuts OFF.
- CPU A/D converter fault (CPF5).
- During acceleration.
- Output current $\leq 30\%$ of drive rated current.

Section 6. FAULT INDICATION AND TROUBLESHOOTING

6.1 GENERAL

A failure in the GPD 506/P5 can fall into one of two categories, Alarm or Fault.

A blinking "Alarm" indication is a warning that a drive trouble condition will soon occur, or that a problem exists in the external circuitry. The drive will continue to operate during an "Alarm" indication. "Alarm" indications are not entered into the fault register.

A steady "Fault" indication is displayed when the drive's Fault relay has tripped (drive shutdown). The motor coasts to a stop, and a fault signal output is present at control circuit terminals MA, MB, & MC, if parameter **n041** is programmed for fault output "Fault" ("0").

Table 6-1. Alarm Indication and Details

INDICATION (DISPLAY)	PROBLEM	DESCRIPTION
bb Base Block (blinking)	External Base Block command	Base Block command at multi-function terminal is active, shutting off drive output (motor coasting). Temporary condition, cleared when input command is removed.
CALL Waiting Message (blinking)	Communication ready	Drive is waiting for the PLC to establish communication (only when n002 is set for Sequence or Reference from Serial Communications).
CE Modbus Com Err (blinking)	Modbus transmission fault	Control data cannot be received normally – condition has lasted longer than 2 seconds.
EF Ext Fault (blinking)	Simultaneous forward and reverse operation commands	Fwd Run and Rev Run commands are both closed for more than 0.5 sec. Removing one of the commands will allow drive operation.
oH1 Overheat 1 (blinking)	Heat sink overheated	Fin temperature exceeds 90° C (194° F); drive is programmed for operation to continue.
oH3 Overheat 3 (blinking)	External overheat	External temperature monitoring circuit(s) detected an overtemperature condition and produced an input signal. See paragraph 5.19, Data 23.
oL3 Overload 3 (blinking)	Overload	Drive output torque exceeds the set Overtorque Detection level (n078); Drive is programmed to continue operation at overtorque.
oPE1 (1) KVA Setting Err	kVA parameter setting fault	kVA setting (n115) is incorrect.
oPE3 (1) MF Input Error	Parameter set value fault	n036 to n040 (multi-function input) set value fault. See paragraph 5.19 for description.
oPE5 (1) V/f Error	Parameter set value fault	n011 to n017 (V/f data) set incorrectly.
oPE6 (1) Parameter Error	Parameter set value fault	One of the following conditions was detected: • n062 > n063 (prohibit frequencies) • n031 < n032 (frequency reference limits) • n043 = "FV = RST FI MSTR" ("2") and n036 thru n040 = "Master Fref Sel" ("9") • n043 = "FV = RST FI MSTR" ("2") and n084 ≠ "Disabled" ("0")
ov Overvoltage (blinking)	Overvoltage	Internal monitor of DC Bus voltage indicates that input AC power is excessively high, while drive is in stopped condition.
Uv Undervoltage (blinking)	Low voltage (Power UV)	Internal monitor of DC Bus voltage indicates that input AC power is below Undervoltage detection level, while the drive is stopped.

NOTES:

- (1) These displays occur only when in the Program mode, when exiting from Program mode, or when applying power to the drive.

Table 6-2. Fault Indication and Details

INDICATION (DISPLAY)	FAULT	DESCRIPTION
CE Modbus Com Err	Modbus transmission error	Control data cannot be received normally — condition has lasted longer than 2 seconds.
CPF0 (1) Com-Err (Op + Inv)	Transmission error or control function hardware fault (including internal RAM, external RAM or PROM)	Transmission between drive and remote operator is not established within 5 seconds after the power supply is turned on. (Displayed on the remote operator.)
CPF1 (1) Com-Err (Op + Inv)	Transmission error	Transmission error occurs 2 seconds or more <u>after</u> transmission has first been established.
CPF4 (1) EPROM Error	EPROM fault	Drive failure.
CPF5 (1) External A/O Err	A/D converter failure in CPU	Drive failure.
EF0 Opt External Flt	External fault – serial communication	Fault condition occurred in the external communication circuit(s).
EF_ External Fault _	Ext. fault signal at term. S_ (" _ " represents a digit 2-6)	A fault condition has occurred in the external circuit(s) monitored by the contact providing input to the indicated terminal.
Err EPROM R/W Err	Parameter write-in fault	Temporary display, in Program mode, indicating that parameter setting was not written into EPROM memory.
GF Ground Fault	Ground fault protection	Ground current exceeded approx. 50% of the drive rated current.
oC (2) Overcurrent	Overcurrent	Drive output current exceeds 200% (for GPD 506V-A107 thru -A068, and -B008 thru -B034), or 180% for all other ratings, of drive rated current.
oH1 Overheat 1	Heat sink overheated	Fin temperature exceeds 95°C (203°F), or internal cooling fan has failed.
oH2 Overheat 2	Heat sink overheated	Fin temperature exceeds 105°C (221°F)
oL1 Overload 1	Motor overload	Thermal motor overload protection has tripped.
oL2 (2) Overload 2	Drive overload	Drive overload protection has tripped.
oL3 Overload 3	Overtorque	Drive output torque exceeds the set Overtorque Detection level (n078), and drive is programmed for coast to stop at overtorque detection.
oPr Operator Failure	Operator disconnect	Digital Operator has been disconnected. Check n110 .
ov Overvoltage	Overvoltage (OV)	Detection level: Approx. 400VDC for 230V GPD 506/P5; Approx. 800VDC for 460V GPD 506/P5. Reset level: 385VDC.
PUF DC Bus Fuse	Fuse blown	DC Bus fuse has cleared. Check for short circuit in output, and check main circuit transistors.
rr Dyn Brk Trans	Regenerative transistor failure	Dynamic Braking resistor has failed.
rH Dyn Brk Res	Braking resistor unit overheated	Dynamic Braking resistor has overheated.

Table 6-2. Fault Indication and Details - Continued

INDICATION (DISPLAY)	FAULT	DESCRIPTION
SC Short Circuit	Load short-circuit	Drive output has been short-circuited.
SP i Input Pha Loss	Input open-circuit	Drive input has an open-circuit in one or more phase.
SPo Output Pha Loss	Output open-circuit	Drive output has an open-circuit in one or more phase. Lasted longer than 2 seconds.
Uv1 Undervoltage 1	Low voltage (Power UV)	Occurs two seconds after detection of low voltage. Detection level: 230V drive = 190 VDC or less; 460V drive = 380 VDC or less.
Uv2 Undervoltage 2	Low voltage (Control UV)	Control circuit voltage levels below acceptable levels during operation.
Uv3 Undervoltage 3	Low voltage (MC fault)	Main circuit (precharge) magnetic contactor not operating correctly.

NOTES:

- (1) These are all Control PCB hardware faults – see Troubleshooting Chart 6.9.
- (2) Note that circumstances leading to these faults stress the drive's output devices - do not simply reset the fault without following procedure in Troubleshooting Chart 6.5 or 6.6.

6.2 DISPLAYING FAULT SEQUENCE

A. If a fault is reset either from the digital operator or a multi-function input, **ALL FAULT INFORMATION WILL BE LOST.**

B. If one or more faults occur simultaneously and are NOT reset (by digital operator, multi-function input, or cycling power), up to four faults can be displayed by pressing the “up arrow” key.

C. Whenever the Fault relay trips and power is removed from the drive without the fault being reset, the display code of the fault that caused the trip (except for Illegal Constant [**oPE _**] or Control Function Error [**CPF _**]) is entered into a register in NV-RAM memory. This register retains, in sequence, that fault code and those of up to three immediately following the shutdown.

A newly occurring fault code will not change the fault register if it is a recurrence of the most recently entered fault.

The contents of this register can be displayed by following the steps in Table 6-3.

Table 6-3. Displaying Fault Sequence After Power Cycle

STEP	OPERATION PROCEDURE	DIGITAL OPERATOR DISPLAY
1	Press  until the Keypad display shows " Monitor U-01 Frequency Ref ".	Monitor U-01 Frequency Ref
2	Press  until " Monitor U-09 Fault History " appears on the display.	Monitor U-09 Fault History
3	Press  .	Fault History U1 Overcurrent
4	Press  . The display indicates that this is currently the next code in the memory register.	Fault History U2 Overvoltage
5	Continue pressing  to display the other codes in the memory register. After the last register code is displayed, the sequence will return to the first code.	Fault History U3 Short Circuit Fault History U1 Overheat 2 Fault History U1 Overcurrent

After the fault sequence has been examined, troubleshoot the most recent fault before entering a Fault Reset command (by Digital Operator **STOP/RESET** key or external signal at term. S4) to prepare the drive for restart of operation.

6.3 TROUBLESHOOTING FLOWCHARTS

If the GPD 506/P5 Drive malfunctions, locate the cause and take corrective action by following the flowcharts given in this section.

A. TROUBLESHOOTING MOTOR SYMPTOMS

Motor Does Not Rotate	Chart 6.1
Motor Stalls During Acceleration	Chart 6.2

B. TROUBLESHOOTING FOR FAULT CONDITIONS

Overvoltage (ou) Fault Indication.....	Chart 6.3
Blown Fuse (PUF) Fault Indication	Chart 6.4
Overcurrent (oC) Fault Indication.....	Chart 6.5
Overload (oL) Fault Indication	Chart 6.6
Undervoltage (Uu) Fault Indication.....	Chart 6.7
Control Function Error (CPF_) Fault Indication.....	Chart 6.8
External Fault (EF_) Indication	Chart 6.9
No Digital Operator Display	Chart 6.10

WARNING

Oscilloscope chassis may be at voltages potentially hazardous to life if not properly grounded. If oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X100 probes. Always connect oscilloscope chassis to earth ground.

WARNING

Voltages dangerous to life exist when equipment is open and energized. Do not work alone.

CAUTION

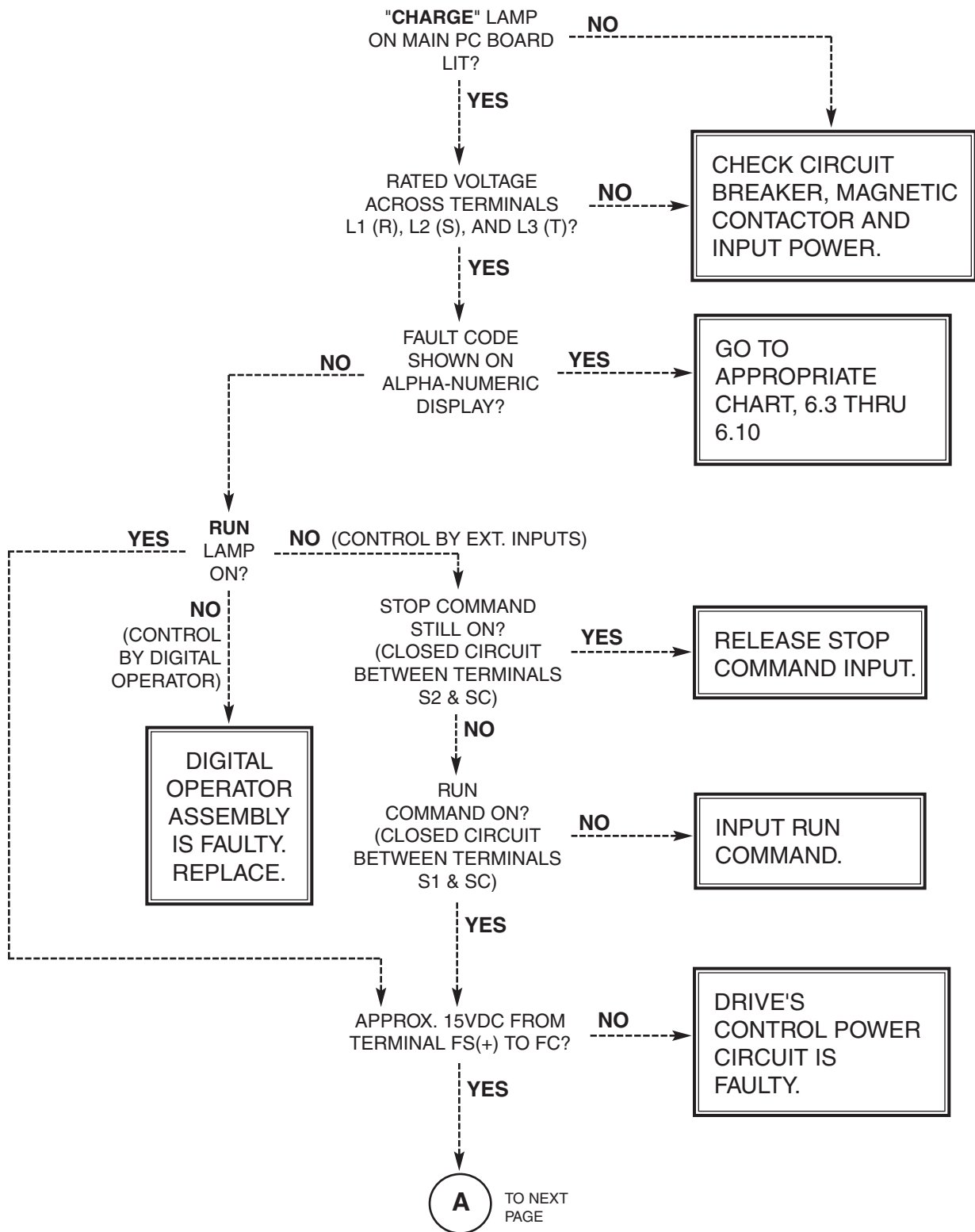
To prevent equipment damage always remove incoming three-phase power before test equipment is connected or removed.

CAUTION

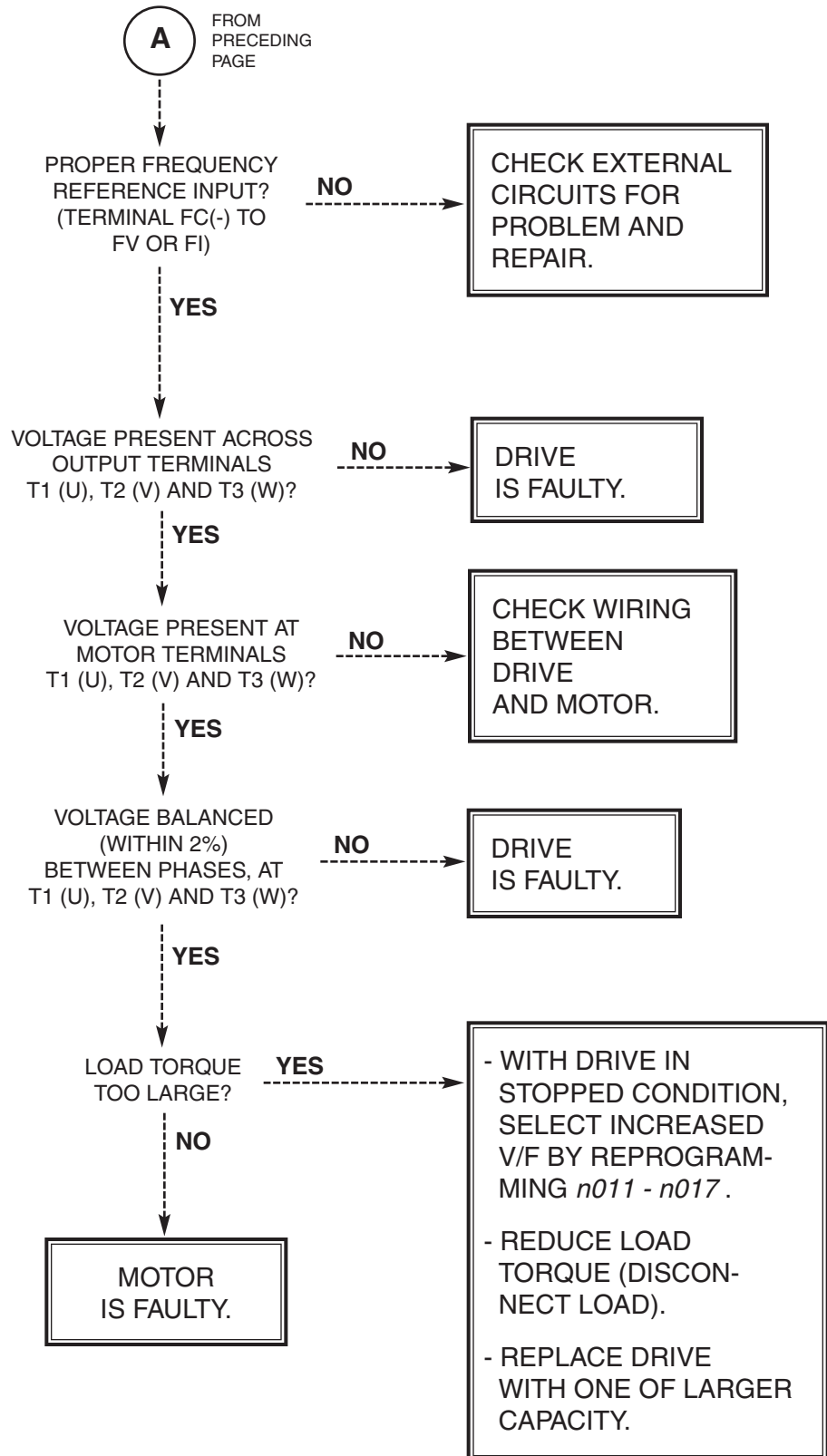
If the Drive Control PCB is replaced, ALL Drive CONSTANTS MUST BE REPROGRAMMED for your application.

TROUBLESHOOTING CHART 6.1

MOTOR DOES NOT ROTATE

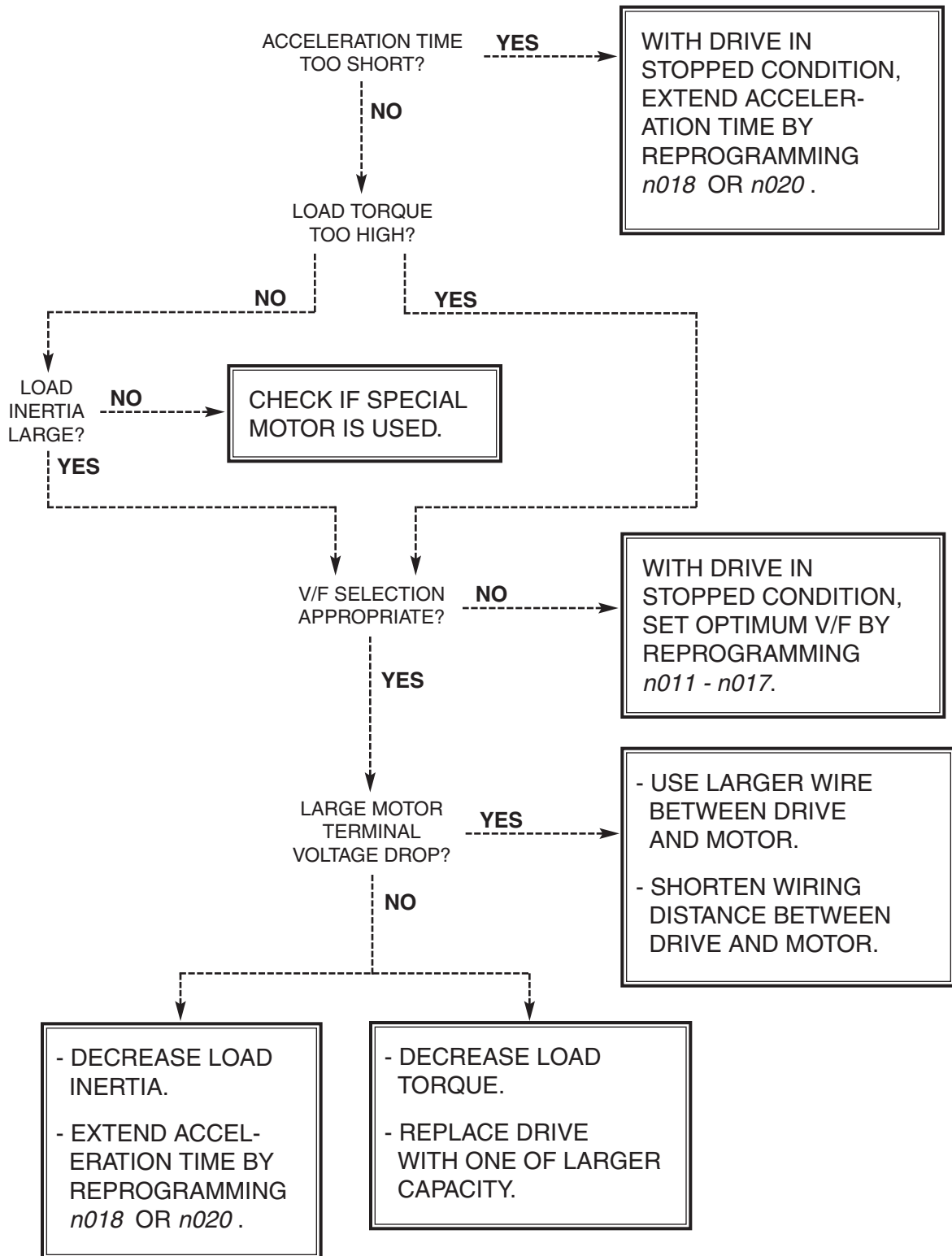


TROUBLESHOOTING CHART 6.1 - Continued



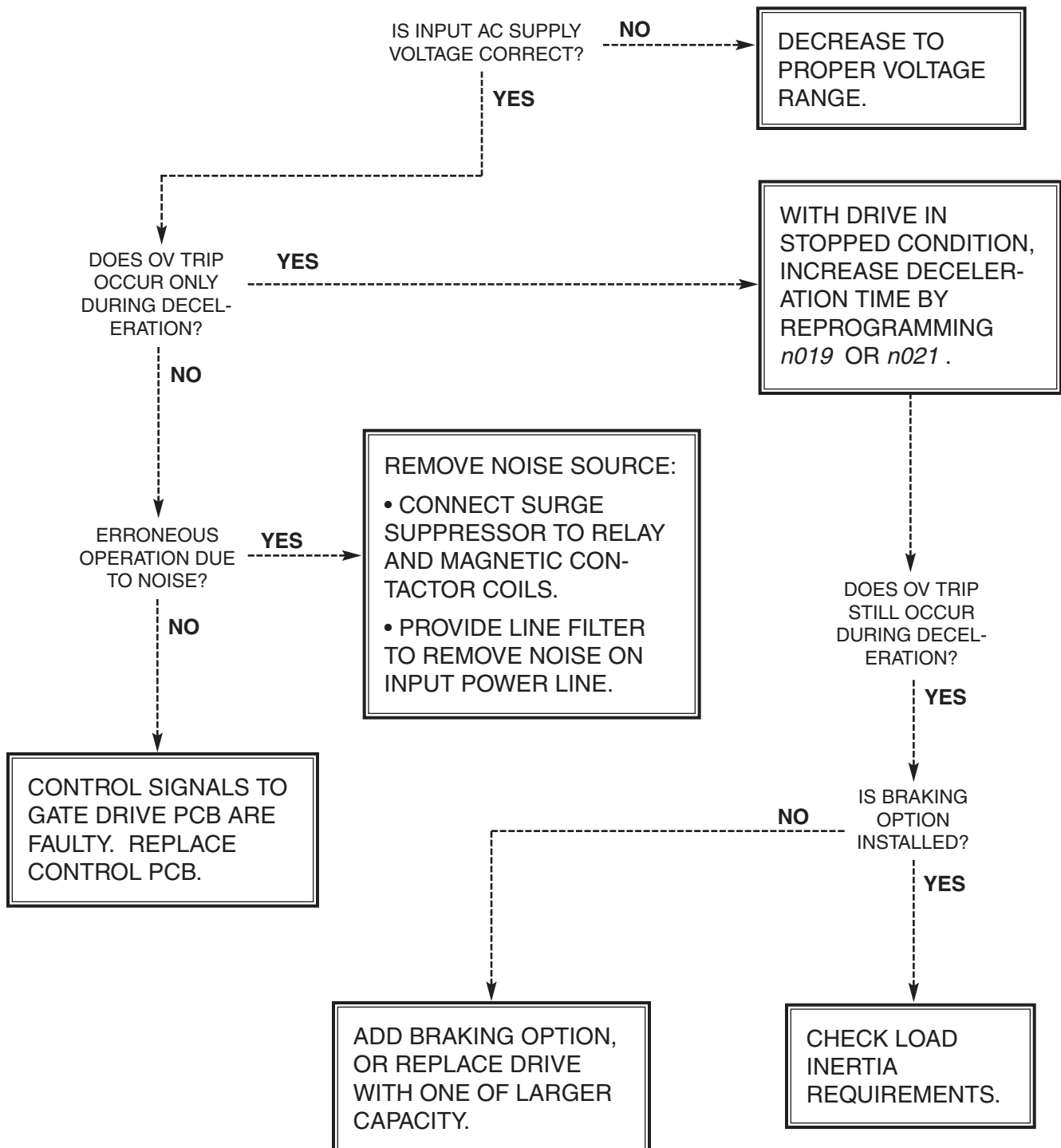
TROUBLESHOOTING CHART 6.2

MOTOR STALLS DURING ACCELERATION



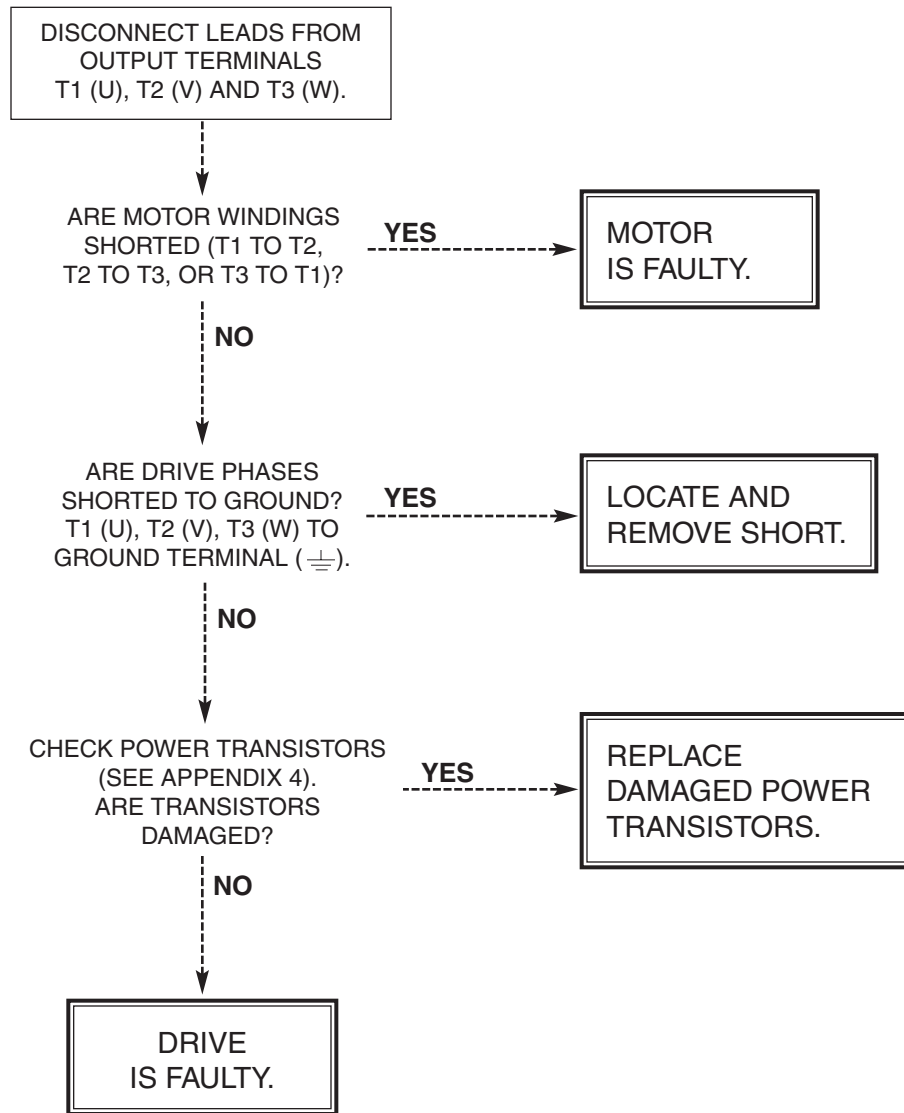
TROUBLESHOOTING CHART 6.3

OVERVOLTAGE (*ou*) FAULT INDICATION



TROUBLESHOOTING CHART 6.4

BLOWN FUSE (*PUF*) FAULT INDICATION

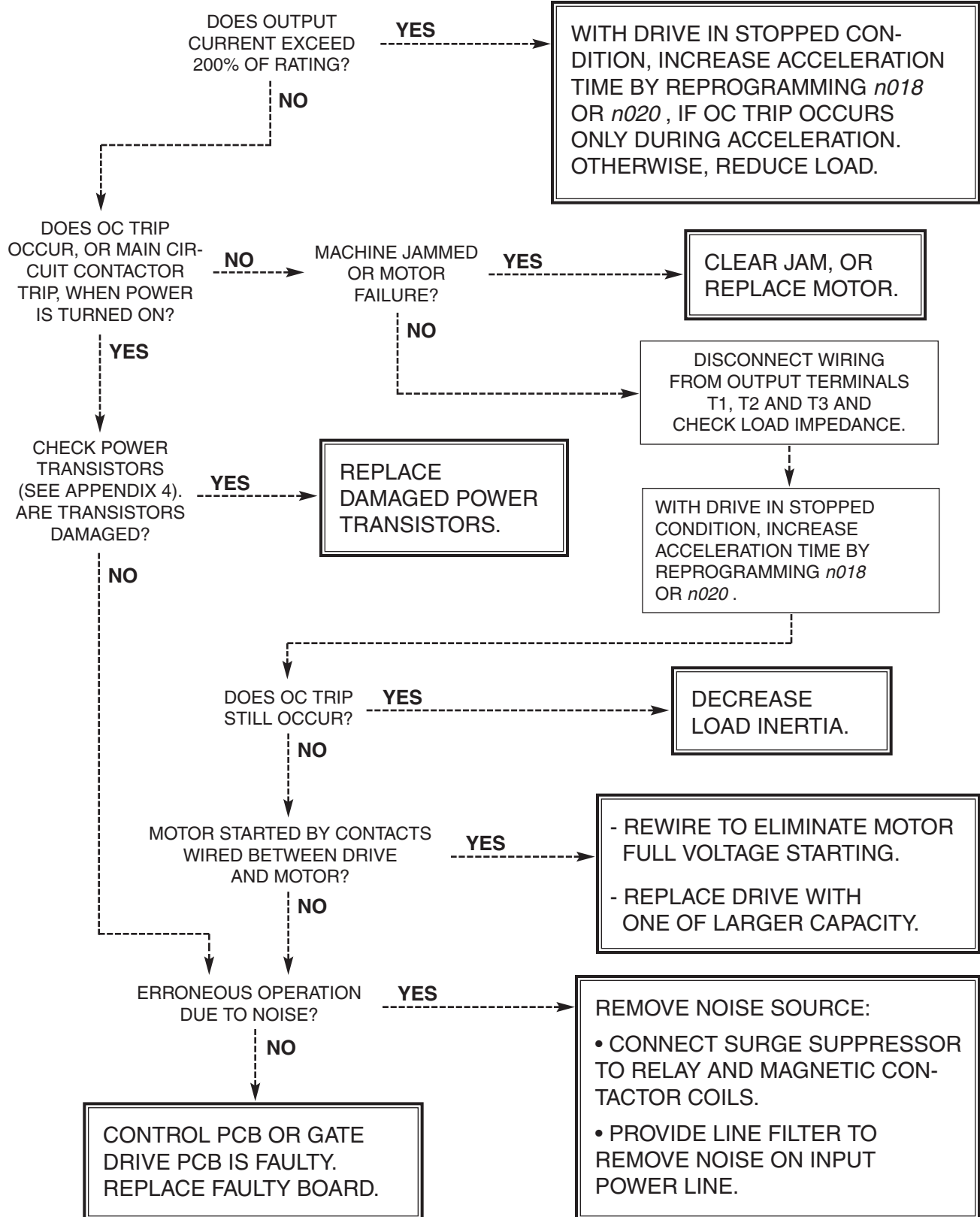


CAUTION

Do not replace DC Bus fuse without first checking output transistors.

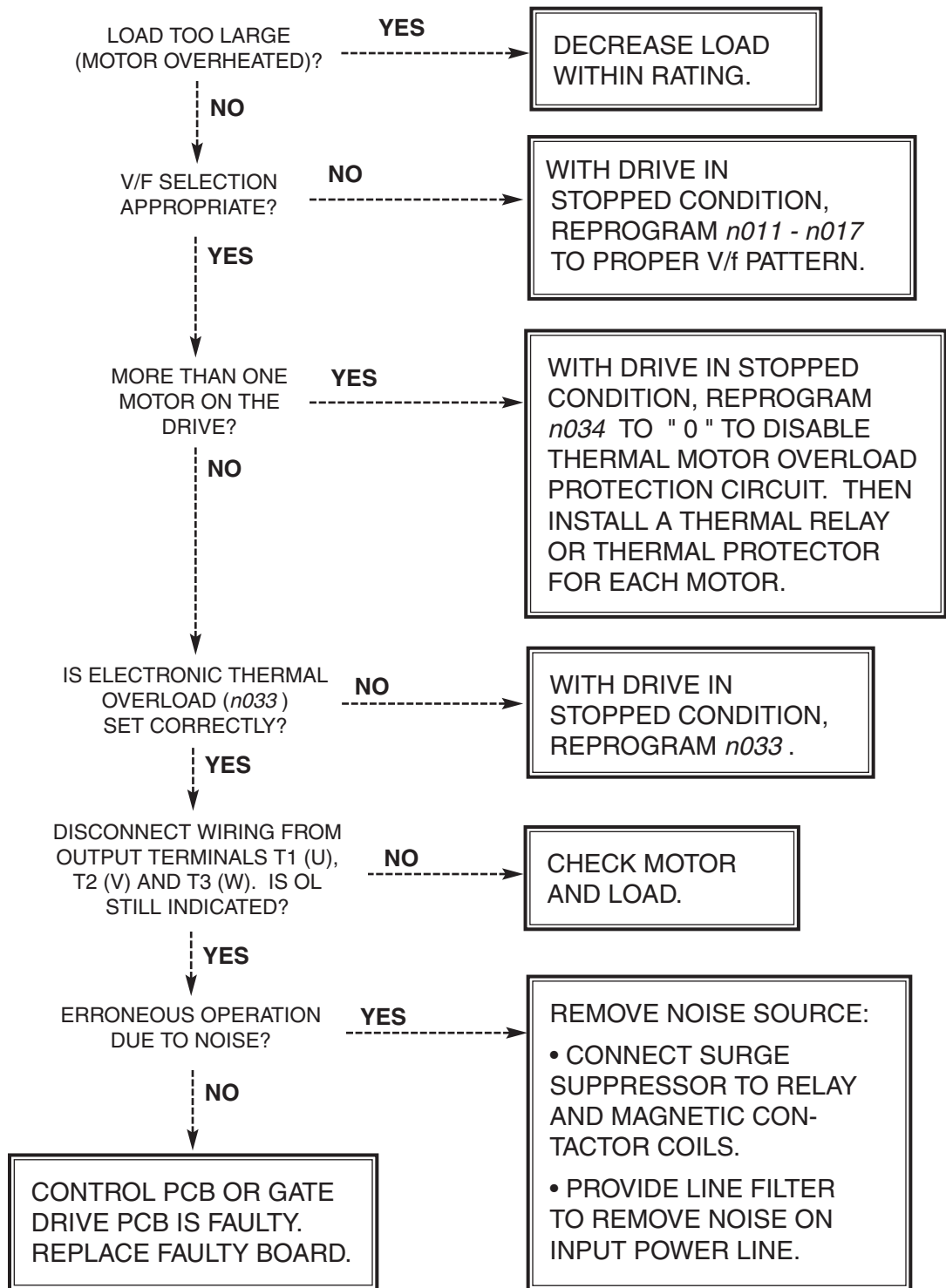
TROUBLESHOOTING CHART 6.5

OVERCURRENT (oC) FAULT INDICATION



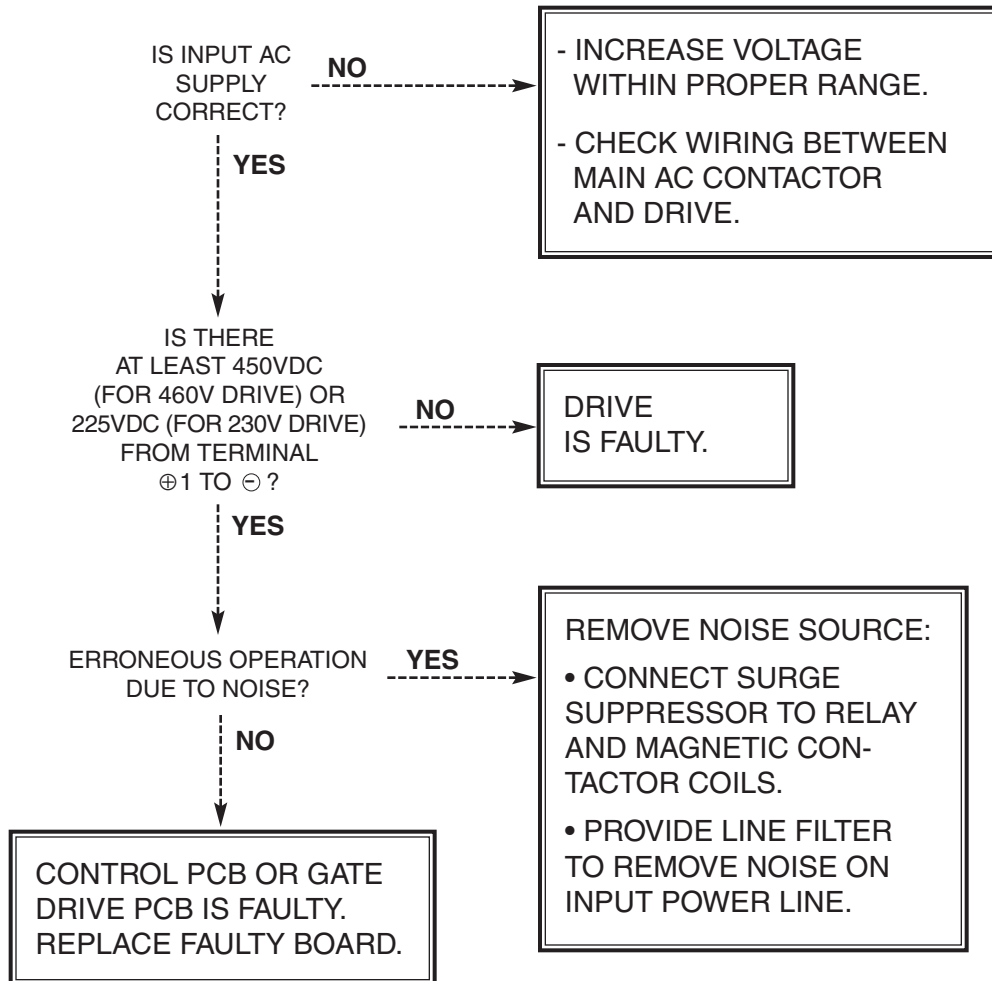
TROUBLESHOOTING CHART 6.6

OVERLOAD (oL) FAULT INDICATION



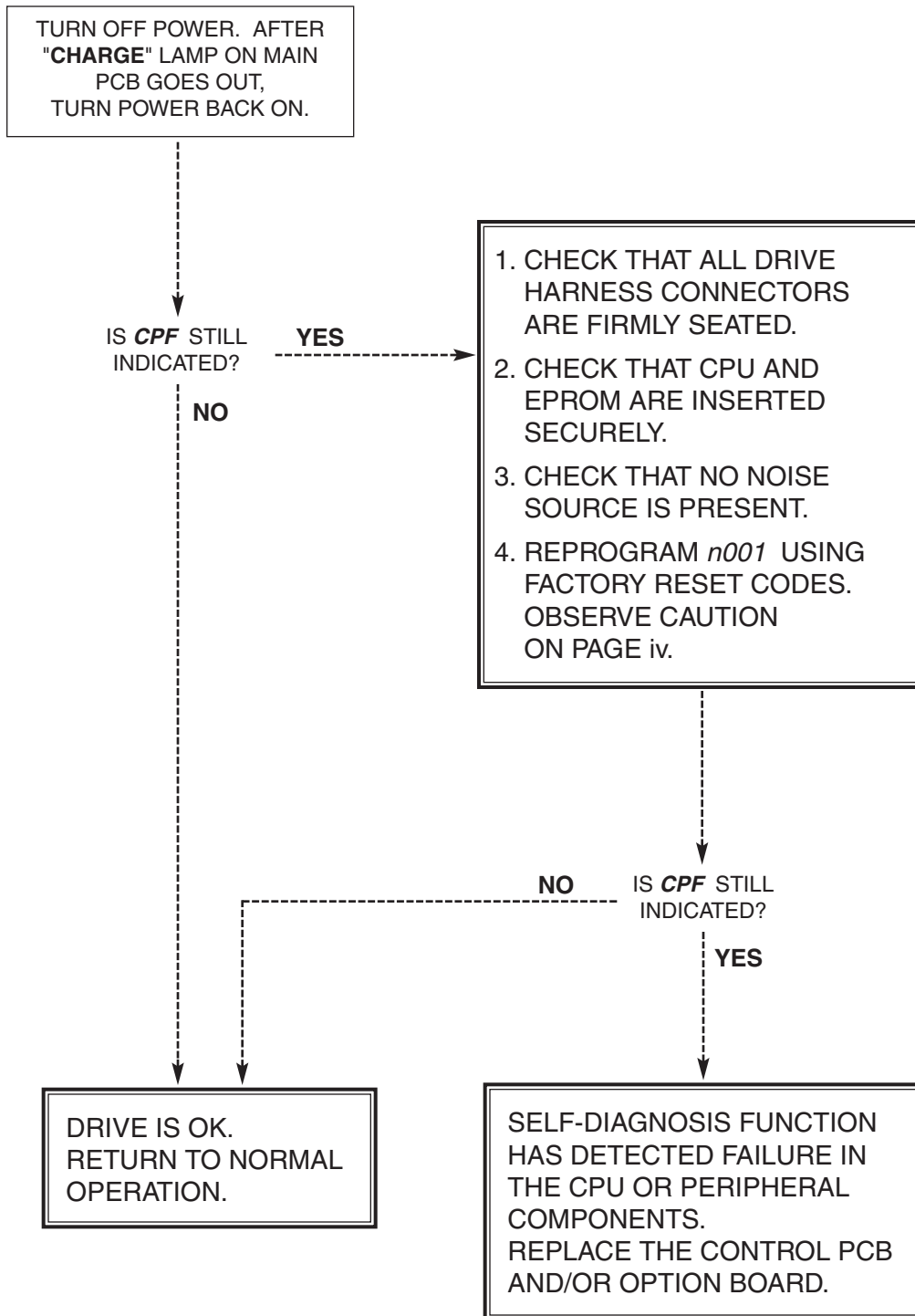
TROUBLESHOOTING CHART 6.7

UNDERVOLTAGE (U_u) FAULT INDICATION



TROUBLESHOOTING CHART 6.8

CONTROL FUNCTION ERROR (*CPF*_) FAULT INDICATION



TROUBLESHOOTING CHART 6.9

EXTERNAL FAULT (*EF_*) INDICATION

*

IS AN EXTERNAL FAULT SIGNAL
PRESENT (OPEN OR CLOSED **
CIRCUIT BETWEEN TERMINAL
SC AND WHICHEVER TERMINAL
(S2-S6) HAS BEEN PROGRAMMED
FOR EXT. FAULT INPUT)?

YES

FAULT HAS OCCURRED
IN CIRCUITS OUTSIDE
THE DRIVE.
TROUBLESHOOT AND
CORRECT.

NO

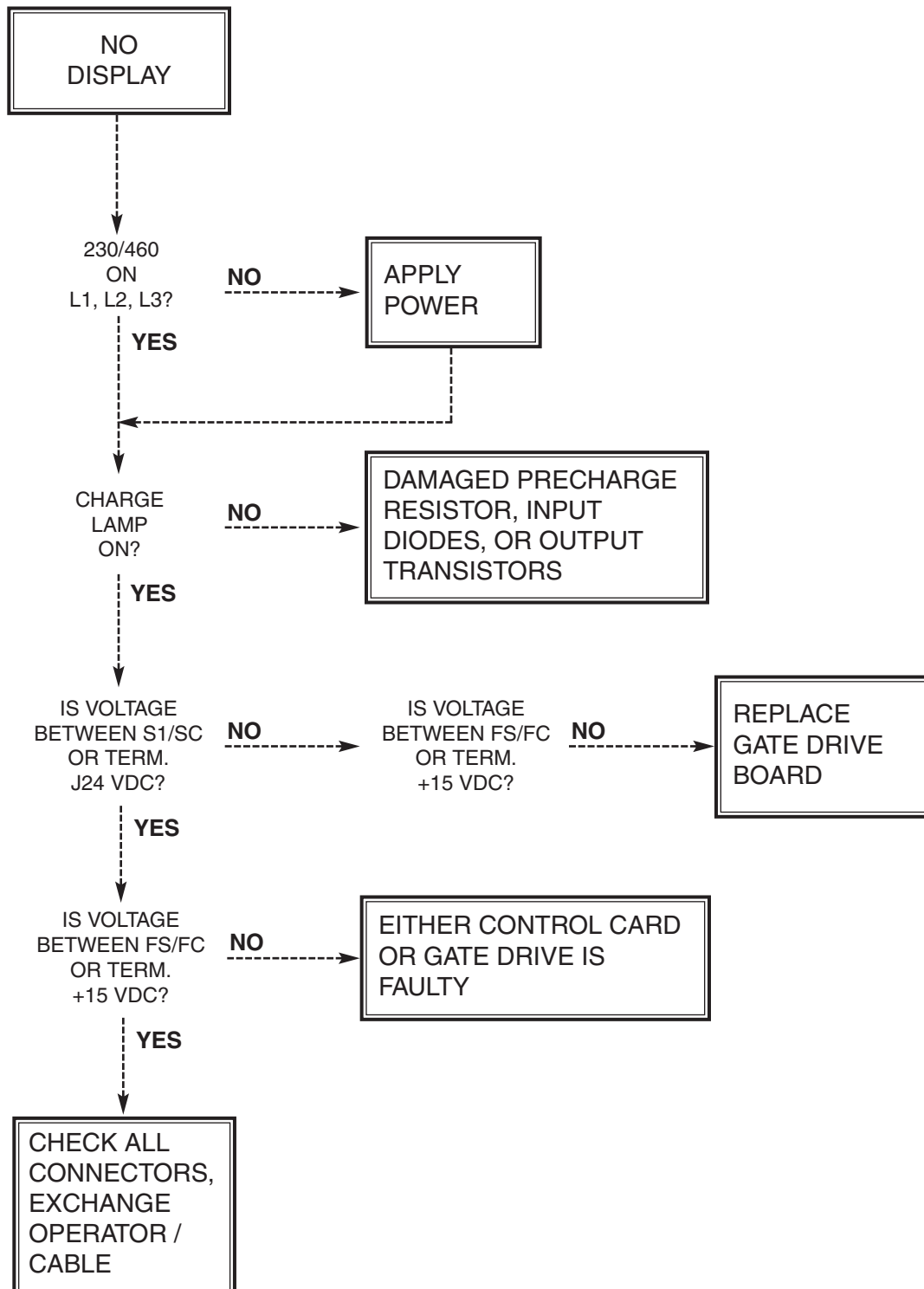
CONTROL PCB IS
FAULTY. REPLACE.

* THIRD DIGIT OF FAULT DISPLAY
INDICATES WHICH TERMINAL IS
INVOLVED.

** DEPENDING ON WHETHER THE
TERMINAL HAS BEEN PROGRAMMED
TO MONITOR A N.O. OR N.C.
CONTACT.

TROUBLESHOOTING CHART 6.10

NO DIGITAL OPERATOR DISPLAY



6.4 DIODE AND IGBT (TRANSISTOR) MODULE RESISTANCE TEST

A. DIODE MODULE

Measure the resistance across the module terminals with a volt-ohm meter. Set the meter at the X1 range. The measured resistance should be within the values listed in Table 6-4.

NOTE: If the DC bus fuse is blown (PUF), the values shown below may not be accurate.

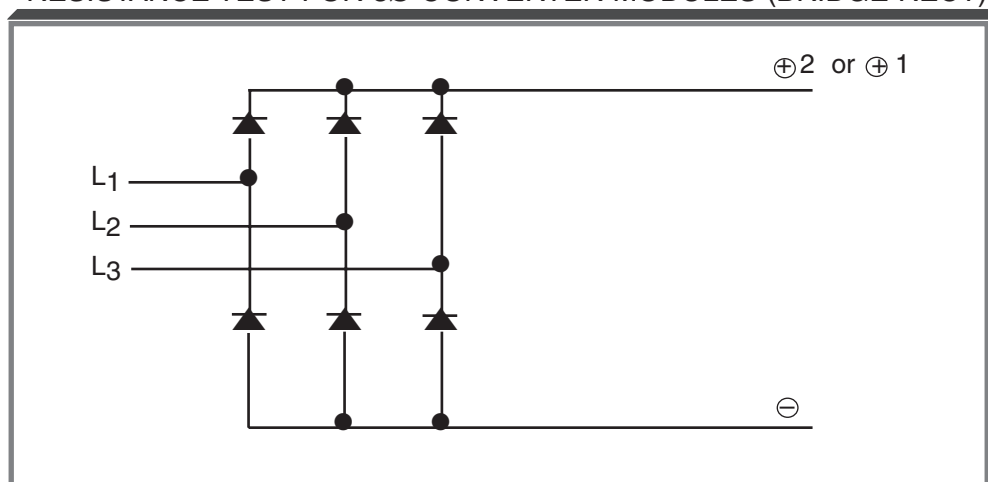
WARNING

Power should be removed from L1, L2, & L3 and the CHARGE light should be out prior to conducting these tests.

Table 6-4. Diode Module Resistances

+	-	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)	+	-	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)
ON	ON			ON	ON		
L1	⊕1	2.5 to 50 Ω or 0.25 to 0.7 if using → scale	0 Ω or INFINITE	L1	⊖	INFINITE	LESS THAN 1M Ω
L2	⊕1			L2	⊖		
L3	⊕1			L3	⊖		
⊖	L1			⊕2	L1		
⊖	L2			⊕2	L2		
⊖	L3			⊕2	L3		
				⊕2	⊖	MAGNITUDE OF CAP CHARGE TO INFINITE	0 Ω or INFINITE

RESISTANCE TEST FOR 3Ø CONVERTER MODULES (BRIDGE RECT)



VOM RESISTANCE SCALE R x 1
+ IS THE POSITIVE POLARITY LEAD *
- IS THE NEGATIVE POLARITY LEAD

* The VOM red lead is not necessarily the positive potential in the resistance mode. For these tests the + lead refers to the positive potential. Make sure you know which polarity you have on your VOM.

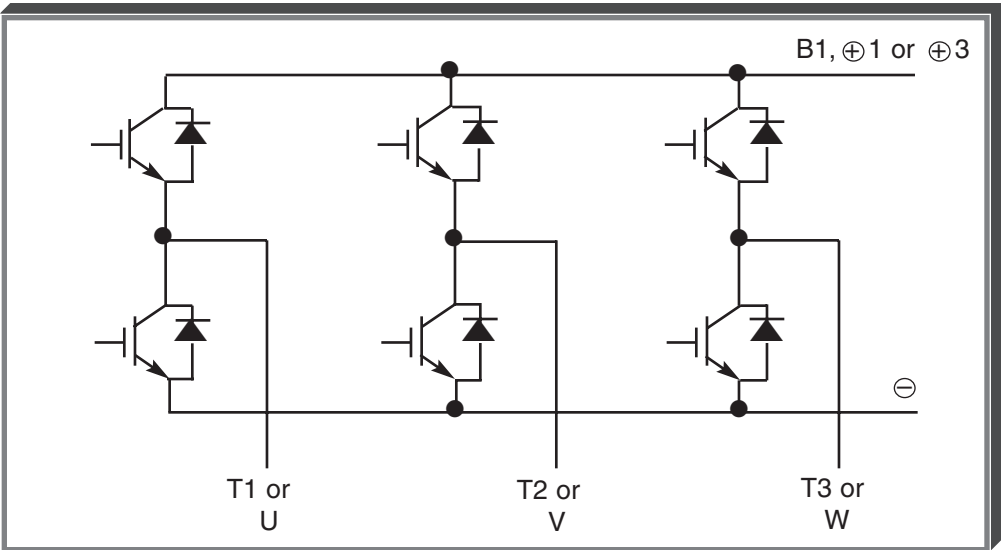
B. TRANSISTOR MODULE

Measure the resistance across the module terminals with a volt-ohm meter. Set the meter to the X1 range. The measured resistance should be within the values listed in Table 6-5.

NOTE: If the DC bus fuse is blown (PUF), the values shown below may not be accurate.

Table 6-5. Transistor Module Resistances			
+	-	NORMAL READING (OHMS)	ABNORMAL READING (OHMS)
ON	ON		
B1/⊕3/⊕1 B1/⊕3/⊕1 B1/⊕3/⊕1 T1/U T2/V T3/W	T1/U T2/V T3/W ⊖ ⊖ ⊖	INFINITE	0 Ω
T1/U T2/V T3/W ⊖ ⊖ ⊖	B1/⊕3/⊕1 B1/⊕3/⊕1 B1/⊕3/⊕1 T1 T2 T3	2.5 to 50 Ω or 0.3 to 0.7 if using scale 	0 Ω or INFINITE

RESISTANCE TEST FOR 3Ø TRANSISTOR MODULES



VOM RESISTANCE SCALE R x 1
+ IS THE POSITIVE POLARITY LEAD *
- IS THE NEGATIVE POLARITY LEAD

* The VOM red lead is not necessarily the positive potential in the resistance mode. For these tests the + lead refers to the positive potential. Make sure you know which polarity you have on your VOM.

Appendix 1. LISTING OF PARAMETERS

The GPD 506/P5 control circuits use various parameters to select functions and characteristics of the drive. Changing of parameter settings must be done in the Program mode, or by use of the Quick-Start Displays (see Section 4).

The following table lists all parameters in numerical order. For each parameter, reference paragraph(s) in Section 5 are listed (if applicable) where the features of the drive affected by that parameter are described.

Table A1-1. Drive Parameters (nXXX)

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION	SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n001	Parameter Selection / Initialization (Password)	0 : n001 can be read and set; n002 -n116 read only 1 : n001 -n035 read and set; n036 -n116 read only 2 : n001 -n053 read and set; n054 -n116 read only 3 : n001 -n116 read and set 4, 5, 6, 7 : Not Used 8 : 2-Wire initialization 9 : 3-Wire initialization	0 to 9	1		5.23
n002	Operation Mode Selection (Oper Mode Select)	LED Setting LCD Setting Sequence Reference 0 SEQ=OPR REF=OPR Dig. Oper. Dig. Oper. 1 SEQ=TRM REF=OPR Ext. Term. Dig. Oper. 2 SEQ=OPR REF=TRM Dig. Oper. Ext. Term. 3 SEQ=TRM REF=TRM** Ext. Term. Ext. Term. 4 SEQ=OPR REF=COM Dig. Oper. Dig. Oper. 5 SEQ=TRM REF=COM Ext. Term. Ser. Comm. 6 SEQ=COM REF=COM Ser. Comm. Ser. Comm. 7 SEQ=COM REF=OPR Ser. Comm. Dig. Oper. 8 SEQ=COM REF=TRM Ser. Comm. Ext. Term.	0 to 8	3		5.16B, 5.22B
n003	Motor Rated Voltage (Input Voltage)	Nominal value of input power applied to drive	150.0 to 255.0 (230V drive) 150.0 to 510.0 (460V drive)	230.0 (VAC) 460.0 (VAC)		5.28B
n004	Stop Method (Stopping Method)	LED Setting LCD Setting 0 Ramp to STOP ** 1 Coast to STOP 2 Coast w/Timer 1 3 Coast w/Timer 2	0 to 3	0		5.25
n005	Phase Rotation (Motor Rotation)	LED Setting LCD Setting 0 Rotate C.C.W ** 1 Rotate C.W. (or opposite direction)	0 or 1	0		

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION		SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n006	Reverse Prohibit (Reverse Oper)	LED Setting 0 1	LCD Setting REV Allowed ** REVProhibited	0 or 1	0		
n007	LOCAL/REMOTE Key Function (Local/Remote Key)	LED Setting 0 1	LCD Setting Disabled Enabled **	0 or 1	1		
n008	STOP KEY Function (Oper STOP Key)	LED Setting 0 1	LCD Setting Disabled Enabled **	0 or 1	1		
			<u>Description</u> STOP key is effective only when sequence command (per n002) is to be from Digital Operator STOP key is effective-regardless of programming of n002				
n009	Frequency Reference Setting Method From Digital Operator (Operator M.O.P.)	LED Setting 0 1	LCD Setting Enter Not Used Enter Key Used **	0 or 1	1		
			<u>Description</u> ENTER key does not have to be pressed to write-in new value ENTER key must be pressed to write-in new value				
n010	V/f Pattern Selection (V/f Selection) See Note 5	LED Setting 0 1	LCD Setting User Defined V/f 60 Hz Preset **	0 or 1	1		5.28
			<u>Description</u> Custom V/f pattern (60 Hz VT default) Preset V/f pattern				
n011	Frequency – Max. (Max Frequency)	Maximum level for drive output frequency		50.0 to 400.0	60.0 (Hz) See Note 1		5.28
n012	Voltage – Max. (Max Voltage)	Maximum level of drive output voltage		0.1 to 255.0 (230V drive) 0.1 to 510.0 (460V drive)	230.0 (VAC) 460.0 (VAC) See Note 1		5.28
n013	Frequency – Max. Voltage Point (Base Frequency)	Level of frequency at which drive output voltage will reach n012 value		0.2 to 400.0	60.0 (Hz) See Note 1		5.28

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION	SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n014	Frequency – Midpoint (Mid Frequency)	Level of frequency at which drive output voltage will reach n015 value	0.1 to 399.9	3.0 (Hz) See Note 1		5.28
n015	Voltage – Midpoint (Mid Voltage)	Level of drive output voltage when output frequency is at n014 value	0.1 to 255.0 (230V drive)	17.2 (VAC)		5.28
			0.1 to 510.0 (460V drive)	34.5 (VAC) See Note 1		
n016	Frequency – Min. (Min Frequency)	Lowest level of output frequency drive will produce	0.1 to 10.0	1.5 (Hz) See Note 1		5.28
n017	Voltage – Min. (Min Voltage)	Level of drive output voltage output frequency is at n016 value	0.1 to 50.0 (230V drive)	11.5 (VAC)		5.28
			0.1 to 100.0 (460V drive)	23.0 (VAC) See Note 1		
n018	Acceleration Time 1 (Accel Time 1) See Note 5	Time for drive output to ramp from Fmin. to Fmax. Setting increment is 0.1 sec. from 0.0 to 999.9 sec, and 1 sec. from 1000 to 3600 sec.	0.0 to 3600	10.0 (sec)		5.2
n019	Deceleration Time 1 (Decel Time 1) See Note 5	Time for drive output to ramp from Fmax. to Fmin. Setting increment is 0.1 sec. from 0.0 to 999.9 sec, and 1 sec. from 1000 to 3600 sec.	0.0 to 3600	10.0 (sec)		5.2
n020	Acceleration Time 2 (Accel Time 2)	Alternate time for drive output to ramp from Fmin. to Fmax.	0 to 255	10 (sec)		5.2
n021	Deceleration Time 2 (Decel Time 2)	Alternate time for drive output to ramp from Fmax. to Fmin.	0 to 255	10 (sec)		5.2
n022	S-curve Selection (S-Curve Select)	LED Setting LCD Setting 0 No S-Curve 1 0.2 Sec ** 2 0.5 Sec 3 1.0 Sec	0 to 3	1		5.3
n023	Digital Operator Display Mode (Display Units)	LED Setting LCD Setting 0 0 ** 1 1 2-39 2-39 40-4999 40-4999 <u>Display Units</u> 0.1 Hz 0.1 % rpm custom	0 to 4999	0		5.8

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION	SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n024	Frequency Reference 1 (Reference 1) See Note 5	Frequency set by Digital Operator (or value retained by Up/Down or Sample/Hold function)	0 to 400.0 See Note 4	0.0 (Hz)		5.19B
n025	Frequency Reference 2 (Reference 2)	Additional frequency setpoint for multi-step speed	0 to 400.0 See Note 4	0.0 (Hz)		5.19B
n026	Frequency Reference 3 (Reference 3)	Additional frequency setpoint for multi-step speed	0 to 400.0 See Note 4	0.0 (Hz)		5.19B
n027	Frequency Reference 4 (Reference 4)	Additional frequency setpoint for multi-step speed	0 to 400.0 See Note 4	0.0 (Hz)		5.19B
n028	Frequency Reference 5 (Reference 5)	Additional frequency setpoint for multi-step speed	0 to 400.0 See Note 4	0.0 (Hz)		5.19B
n029	Frequency Reference 6 (Reference 6)	Additional frequency setpoint for multi-step speed	0 to 400.0 See Note 4	0.0 (Hz)		5.19B
n030	Jog Reference (Jog Reference)	Operating frequency when a Jog command is input	0 to 400.0 See Note 4	6.0 (Hz)		5.15, 5.19B
n031	Frequency Reference Upper Limit (Ref Upper Limit)		0 to 109	100 (%)		5.12
n032	Frequency Reference Lower Limit (Ref Lower Limit)		0 to 100	0 (%)		5.12
n033	Motor Rated Current (Motor Rated FLA) See Note 5	FLA rating of motor	See Note 2	(A) See Note 3		5.26
n034	Electronic Thermal Overload Protection (Motor OL Sel)	LED Setting LCD Setting Characteristics 0 Disabled No protection 1 STD Motor/8 min** Standard motor (8 min.) 2 STD Motor/5 min Standard motor (5 min.) 3 INV Motor/8 min Blower-cooled motor (8 min.) 4 INV Motor/5 min Blower-cooled motor (5 min.)	0 to 4	1		5.26

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n035	Overheat Stop Method (OH1 Stop Method)	LED Setting 0 1 2 3	LCD Setting Ramp STOP/Decel1 Coast to STOP Ramp STOP/Decel1 Continue Oper**	<u>Stop method</u> Ramp to stop – Decel 1 (fault) Coast to stop (fault) Ramp to stop – Decel 2 (fault) Continue operation (alarm) at 80% & Freq. Ref.	0 to 3	3		
n036	Multi-function Input Selection (Terminal S2 Sel)	LED Setting 0	LCD Setting Reverse RUN (2W)**	<u>Description</u> Reverse run (2-Wire sequence) [can only be set in n036]	0 to 28	0 (1)*		5.19
n037	Multi-function Input Selection [When n036 has been set to " 1 ", this parameter will display "In Use by Other", and no value can be entered] (Terminal S3 Sel)	1 2 3 4 5 6 7 8 9	FWD/REV Cmd (3W) Ext Fault (NO) ** Ext Fault (NC) Fault Reset ** LOCAL/REMOTE Sel COM/INV Sel STOP Cmd/Dec2 NO STOP Cmd/Dec2 NC Master FREF Sel	Fwd / Rev command (3-Wire sequence) [can only be set in n036] External fault (N.O.) External fault (N.C.) Fault reset Remote / Local selection Serial communication/Dig.Op. (Freq. Ref. & Run command) Stop command using Decel. Time 2 (Normally Open) Stop command using Decel. Time 2 (Normally Closed) Auto frequency reference selection	2 to 28	2 (--)*		5.19
n038	Multi-function Input Selection (Terminal S4 Sel)	10 11 12	Multi-Step Spd1** Multi-Step Spd2** Multi-Step Spd3	Multi-step speed reference Command 1 Multi-step speed reference Command 2 Multi-step speed reference Command 3	2 to 28	4		5.19
n039	Multi-function Input Selection [When n040 has been set to " 29 ", this parameter will display " In Use by Other" and no value can be entered] (Terminal S5 Sel)	13 14 15 16 17 18 19 20 21	JOG Command ACC/DEC Switch Ext Baseblk (NO) Ext Baseblk (NC) SpdSrch (MAXFRQ) SpdSrch (SETFRQ) Param Lockout PID I Reset PID Disable	Jog command Accel/Decel time change command External base block (N.O.) External base block (N.C.) Speed search from maximum frequency Speed search from set frequency Parameter change enable I value reset (PID) PID control of	2 to 28	10		5.19

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION				SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n040	Multi-function Input Selection (Terminal S6 Sel) (Terminal S6 Sel)	22	Timer Start Cmd	Timer function		2 to 29	11		5.19
		23	OH3 Input	OH3 (pre-alarm input)					
		24	Ref Sample Hold	Analog reference Sample/Hold command					
		25	KEB Cmd (NO)	Inertia ridethrough command (N.O.)					
		26	KEB Cmd (NC)	Inertia ridethrough command (N.C.)					
		27	Hold Command	Accel / Decel Ramp Hold					
		28	PID Polarity Sel	PID changeover					
		29	Up/Down Control	Up/Down Command [can only be set in n040]					
n041	Multi-function Output (Terminals MA-MB-MC) (Terminal MA Sel)	LED Setting	LCD Setting	Description		0 to 17	0		5.20
		0	Fault **	Fault					
		1	During Running	During running					
		2	At Speed	Speed agree					
		3	At Desired Speed	Desired speed agree					
		4	Freq Detection 1	Frequency detection 1					
		5	Freq Detection 2	Frequency detection 2					
		6	OverTrq De (NO)	Overtorque / undertorque detection (N.O.)					
n042	Multi-function Output (Terminals M1-M2) (Terminal M1 Sel)	7	OverTrq Det (NC)	Overtorque / undertorque detection (N.C.)		0 to 17	1		5.20
		8	BaseBlocked	During base block					
		9	Operation mode	Operation mode					
		10	Ready	Ready					
		11	Timer Output	Timer function					
		12	Auto Restarting	During auto restart					
		13	OL Pre-Alarm	OL pre-alarm (80% of OL1 or OL2)					
		14	Freq Ref Loss	Frequency reference loss					
n043	Analog Input Selection (Analog Input Sel)	15	Set By COM Cntl	Closed by serial comm.		0 to 4	0		5.11, 5.22B
		16	PID Fdbk Loss	PID feedback loss					
		17	OH1 Alarm	OH1 alarm (functions only if n035 has been set to " 3 ")					
		LED Setting	LCD Setting	FV	FI	Auto/Man Switch			
		0	FV=MSTR FI=AUX**	Auto	Man	Yes			
		1	FV=AUX FI=MSTR	Man	Auto	Yes			
		2	FV=RST FI=MSTR	Flt Rst	Auto	No			
		3	FV=MSTR FI=SQRT	Auto	$\sqrt{N}$	No			
n044	Terminal FI Signal Level Selection (Terminal FI Sel)	4	FV=RST FI=SQRT	Flt Rst	$\sqrt{N}$	No	0 or 1	1	5.11, 5.22B
		LED Setting	LCD Setting	Description					
		0	0-10 VDC	0-10V input (jumper J1 on Control PCB must be cut)					
		1	4-20 mA**	4-20mA input					

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n045	Frequency Reference Retention (MOP Ref Memory)	LED Setting 0	LCD Setting Memorize FREF**	<u>Description</u> Retained in Frequency Reference 1 (n024) (for Up/Down, Sample/Hold functions)	0 or 1	0		5.14
		1	Not Memorized	Not retained				
n046	Frequency Reference Loss Detection (Ref Loss Detect)	LED Setting 0	LCD Setting Not Detected **	<u>Description</u> No detection	0 or 1	0		5.13
		1	RUN @ no47 Fref	Continue to run at value set in n047				
n047	Freq. Ref. Level at loss of Freq. detection (Fref Lvl@F Loss)				0 to 100	80 (%)		5.13
n048	Terminal FV Gain (Terminal FV Gain) See Note 5				0 to 200	100 (%)		5.10
n049	Terminal FV Bias (Terminal FV Bias) See Note 5				-100 to 100	0 (%)		5.10
n050	Terminal FI Gain (Terminal FI Gain)				0 to 200	100 (%)		5.10
n051	Terminal FI Bias (Terminal FI Bias)				-100 to 100	0 (%)		5.10
n052	Multi-function Analog Output (Terminal AM Sel)	LED Setting 0	LCD Setting Output Freq **	<u>Monitor</u> Output frequency (Hz)	0 to 3	0		5.18
		1	Output Amps	Output current (A)				
		2	Output kWatts	Output power (kW)				
		3	DC Bus Voltage	DC bus voltage (VDC)				
n053	Analog Monitor Gain (Terminal AM Gain)				0.01 to 2.00	1.00		5.18

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n054	Carrier Frequency (Carrier Freq Sel)	LED Setting 2 (x2.5 khz) 3 (x2.5 khz) 4 (x2.5 khz) 5 (x2.5 khz) 6 (x2.5 khz) 7 8 9	LCD Setting 5.0 kHz 7.5 kHz 10.0 kHz 12.5 kHz 15.0 kHz Synchronous 1 Synchronous 2 Synchronous 3		1 to 9	See Note 3 1 (x2.5 khz)		5.5 2.5 kHz
n055	Momentary Power Loss Ride-through Method (PwrL Selection)	LED Setting 0 1 2	LCD Setting Not Provided ** 2 Seconds Max CPU Power Active	Description Not provided Continuous operation after power recovery within 2 sec. Continuous operation after power recovery within control logic time (no fault output)	0 to 2	0		5.17
n056	Speed Search Operation Level (SpdSrch Current)				0 to 200	110 (%)		5.19E
n057	Minimum Base Block Time (Min Baseblock t)				0.5 to 5.0	(Sec) See Note 3		5.19E
n058	V/f Reduction Level During Speed Search (SpdSrch V/F)				0 to 100	(%) See Note 3		5.19E
n059	Momentary Power Loss Ride-through Time (PwrL Ridethru t)				0.0 to 2.0	(Sec) See Note 3		5.17
n060	Number of Automatic Restart Attempts (Num of Restarts)				0 to 10	0		5.4

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n061	Fault Contact Selection at Automatic Restart (Restart Sel)	LED Setting 0 1	LCD Setting Activate Flt Rly** No Rly Output	Description Closed during auto restart Open during auto restart	0 or 1	0		5.4
n062	Prohibit Frequency 1 (Jump Freq 1)				0.0 to 400.0	0.0 (Hz)		5.6
n063	Prohibit Frequency 2 (Jump Freq 2)				0.0 to 400.0	0.0 (Hz)		5.6
n064	Prohibit Frequency Deadband (Jump Bandwidth)				0.0 to 25.5	1.0 (Hz)		5.6
n065	Elapsed Timer Selection (Elapsed Timer)	LED Setting 0 1	LCD Setting Time Power is ON Time Running Mtr**	Description Accumulated time during power on Accumulated time during running	0 or 1	1		
n066	Elapsed Timer 1 (Elapsed Time 1)		Used to set an initial value into the elapsed time meter.		0 to 9999	0 (Hours)		
n067	Elapsed Timer 2 (Elapsed Time 2)		Used to set an initial value into the elapsed time meter. hours)		0 to 27 (x 10,000)	0		
n068	DC Injection Current (DCInj Current)				0 to 100 [100% = drive rated current]	50 (%)		5.7
n069	DC Injection Time at Stop (DCInj Time@ Stop)				0.0 to 10.0	0.0 (Sec)		5.7
n070	DC Injection Time at Start (DCInj Time@ Start)				0.0 to 10.0	0.0 (Sec)		5.7

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION	SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n071	Torque Compensation Gain (Torq Comp Gain)		0.0 to 3.0	1.0		5.27
n072	Stall Prevention During Deceleration (StallP Decel Sel)	LED Setting 0 Disabled 1 Enabled **	0 or 1	1		5.24
n073	Stall Prevention Level During Acceleration (StallP Decel Sel)	[When level is set to 200%, stall prevention during deceleration is disabled]	30 to 200	(%) See Note 3		5.24
n074	Stall Prevention Level at Set Frequency (StallP Accel Lvl)	[When level is set to 200%, stall prevention during deceleration is disabled]	30 to 200	(%) See Note 3		5.24
n075	Speed Coincidence Frequency (Freq Det Level)		0.0 to 400.0	0.0 (Hz)		5.20
n076	Frequency Agreed Detection Width (Freq Det Width)		0.0 to 25.5	2.0 (Hz)		5.20

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n077	Overtorque / Undertorque Detection (OL3) (Torq Det Sel)	LED	LCD		0 to 8	0		5.21
		<u>Setting</u>	<u>Setting</u>	<u>Method</u>				
		0	Disabled **	Detection disabled				
		1	OT/SpdAgree/Alm	Overtorque detect only at set frequency; operation continues				
		2	OT/RUN/Alm	Overtorque detect during all frequency conditions; operation continues				
		3	OT/SpdAgree/Flt	Overtorque detect only at set frequency; coast to stop				
		4	OT/RUN/Flt	Overtorque detect during all frequency conditions; coast to stop				
		5	UT/SpdAgree/Alm	Undertorque detect only at set frequency; operation continues				
		6	UT/RUN/Alm	Undertorque detect during all frequency conditions; operation continues				
		7	UT/SpdAgree/Flt	Undertorque detect only at set frequency; coast to stop				
		8	UT/RUN/Flt	Undertorque detect during all frequency conditions; coast to stop				
n078	Overtorque / Undertorque Detection Level (Torq Det Level)				30 to 200 [100% = drive rated current]	160 (%)		5.21
n079	Overtorque / Undertorque Detection Delay Time (Torq Det Time)				0.0 to 10.0	0.1 (Sec)		5.21
n080	On-delay Timer (On-Delay Timer)				0.0 to 25.5	0.0 (Sec)		5.19F
n081	Off-delay Timer (Off-Delay Timer)				0.0 to 25.5	0.0 (Sec)		5.19F

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n082	DB Resistor Overheat Function (rH)	LED Setting 0	LCD Setting Disabled **	Description No DB protection calculated or provided	0 or 1	0		
	(DB Resistor Prot)	1	Enabled	Protection provided for installed factory option DB resistor				
n083	Input Phase Loss Detection Level (SPi) (In Ph Loss Lvl)	When set to 100%, input phase loss detection is disabled			1 to 100	7 (%)		5.29
n084	PID Selection	LED Setting 0	LCD Setting Disabled **	Description PID disabled	0 to 3	0		5.22A
	(PID Mode)	1	Enabled D=Fdbk	PID enabled				
	See Note 5	2	Enabled D=Fdfwd	PI with Feed Forward				
		3	Enabled RevFdbk	Inverted PID				
n085	Feedback Calibration Gain (PID Fdbk Gain)				0.00 to 10.00	1.00		5.22E
n086	Proportional Gain (PID P Gain)				0.0 to 10.0	1.0		5.22G
n087	Integral Gain (PID I Time)				0.0 to 100.0	10.0 (Sec)		5.22G
n088	Derivative Time (PID D Time)				0.00 to 1.00	0.00 (Sec)		5.22G
n089	Limit of Integral Value (PID I Limit)				0 to 109	100 (%)		5.22H
n090	Feedback Loss Detection	LED Setting 0	LCD Setting Disabled **	Description Detection is disabled	0 or 1	0		5.22F
	(PID FdbkLoss Sel)	1	MF Output Only	Detection is enabled - alarm only				
		2	Fault output	Detection is enabled - fault				
n091	Feedback Loss Det. Level (PID FdbkLoss Lvl)				0 to 100	0 (%)		5.22F

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION		SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n092	Feedback Loss Det. Delay Time (PID FdbkLoss Time)			0.0 to 25.5	1.0 (Sec)		5.22F
n093	PID Output Selection (PID Output Sel)	LED <u>Setting</u> 0: 1:	LCD <u>Setting</u> Not Inverted ** Inverted	0 or 1	0		
n094	Sleep function Start Level (Sleep Start Lvl)			0.00 to 400.0	0.0 (Hz)		5.22I
n095	Sleep function Delay Function (Sleep Delay Time)			0.0 to 25.5	0.0 (Sec)		5.22I
n096	Energy Saving Selection (Energy Save Sel) See Note 5	LED <u>Setting</u> 0 1	LCD <u>Setting</u> Disabled ** Enabled	0 or 1	0		5.9
n097	Energy Saving Gain K2 (Energy Save Gain)			0.00 to 655.0	See Note 3		5.9
n098	Energy Saving Voltage Lower Limit at 60 Hz (EngSavVLLmt @60Hz)			0 to 120	75 (%)		5.9
n099	Energy Saving Voltage Lower Limit at 6 Hz (EngSavVLLmt @ 6Hz)			0 to 25	12 (%)		5.9
n100	Time of Average kW (EngSavTime/ AvgkW)			1 to 200 (x 25ms)	1 (= 25ms)		5.9
n101	Modbus Time Out Detection (MODBUS Timeout)	LED <u>Setting</u> 0 1	LCD <u>Setting</u> Disabled Enabled **	0 or 1	1		5.16

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION		SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n102	Stop Method on Modbus Communication Error (CE) (MODBUS FaultStop)	LED <u>Setting</u> 0 1 2 3	LCD <u>Setting</u> Ramp STOP/Decel1 (fault) Coast to STOP** Ramp STOP/Decel2 (fault) Continue Oper Continue operation (alarm)	0 to 3	1		5.16
n103	Modbus Setting Frequency Reference Unit (MODBUS Fref Unit)	LED <u>Setting</u> 0 1 2 3	LCD <u>Setting</u> 1 = 0.1Hz ** 0.1 Hz / 1 0.01 Hz / 1 100% / 30000 0.01 % / 1	0 to 3	0		5.16
n104	Modbus Slave Address (MODBUS Address)			0 to 31	1		5.16
n105	Modbus BPS Selection (MODBUS Baud Rate)	LED <u>Setting</u> 0 1 2	LCD <u>Setting</u> 2400 Baud 4800 Baud 9600 Baud **	0 to 2	2		5.16
n106	Modbus Parity Selection (MODBUS Parity)	LED <u>Setting</u> 0 1 2	LCD <u>Setting</u> No parity ** Even parity Odd parity	0 to 2	0		5.16
n107	Slip Compensation Gain (Slip Comp Gain)			0.0 to 9.9	0.0 (%)		5.23.1
n108	Motor No-load Current (Mtr No-Load Amp)			0 to 99	30 (%)		5.23.1
n109	Slip Comp. Primary Delay Time Constant (Slip Comp Delay)			0.0 to 25.5	2.0 (Sec)		5.23.1

Table A1-1. Drive Parameters (nXXX) – Continued

PARAM. NO.	FUNCTION NAME (ACTUAL DISPLAY)	DESCRIPTION			SETTING RANGE	FACTORY SETTING **	USER SETTING	PARA. REF.
n110	Operator Connection Fault Detection Selection (Oper Detect Flt)	LED Setting 0 1	LCD Setting Disabled ** Enabled	Description Operation continues Operation stops	0 or 1	0		5.16.1
n111	Local/Remote Changeover Fault Detection Selection (LOC/REM Change)	LED Setting 0 1	LCD Setting Cycle Extern RUN** Accept Extern RUN	Description Must open and re-apply external RUN command Will accept external RUN command	0 or 1	0		5.15.1
n112	Starting Point For OL at Low Frequency (Low Frq OL2 Start)				0.0 to 6.0	6.0 (Hz)		
n113	Continuous Operation Level at 0 Hz (OL2 Level @ 0 Hz)				25 to 100	50 (%)		
n114	Square Root N Monitor Gain (Sqr Root N Gain)	$U1-14 = \sqrt{\frac{FI \text{ level}}{10}} \times n114 \times 100$			0 to 99	0		
n115	kVA Selection (Inverter kVA Sel)				00 to 35	See Note 3		Table A3-1
n116	CT/VT Selection (CT/VT Selection)	LED Setting 0 1	LCD Setting CT Operation ** VT Operation		0 or 1	0		

NOTES:

* () values are parameter settings after a 3-Wire reset code has been entered.

** Factory setting for parameters with non-numerical data (**n002**, **n004**, etc.) is shown as **bold** followed by ** in "Description" column. Units shown in () only appear with LCD display.

- Initial value differs depending on V/f curve selected (**n010** setting). Values shown are initial values when **n010** is set to " 1 ".
- To be accepted, the user setting must be between 10% and 120% of the drive's output current rating. See Table A3-1 and paragraph 5.26.
- Initial value depends on drive capacity – see Table A3-1.
- Range and increment may change due to a "custom" setting of **n023** — see paragraph 5.8.
- When a parameter number is enclosed in a shaded box that parameter can also be examined and set by means of a Quick-Start Display.

Appendix 2. SPECIFICATIONS

Table A2-1. Standard Specifications

SECTION A. Input Voltage Related Specifications						
230V Class						
Input Power		Voltage : 3 Phase 200 / 208 / 220 / 230 VAC + 10%, – 15% Frequency : 50 / 60 Hz +/- 5%				
Output Power		Voltage : 0 - 230V (Output cannot be greater than input) Frequency: 0 - 400 Hz (V/Hz pattern selectable)				
MODEL NO. GPD506V-	RATED kVA	NOMINAL HP	100% CONT. OUTPUT AMPS ¹	RATED INPUT AMPS	RECOMMENDED MCCB RATING ⁽¹⁾ (AMPS)	RECOMMENDED INPUT FUSING (AMPS) ⁽²⁾
A003	1.2	0.75	3.2	3.9	7	5.6
A006	2.3	1 & 1.5	6	7.2	15	10
A008	3.0	2	8	9.6	15	12
A011	4.2	3	11	13.2	15	17.5
A017	6.7	5	17.5	21	25	30
A027	9.5	7.5 & 10	27	33	40	45
A036	13.0	15	36	44	55	60
A054	19.0	20	54	65	75	90
A068	24	25	68	82	100	100
A080	30	30	80	88	105	125
A104	37	40	104	115	135	175
A130	50	50	130	143	165	200
A160	61	60	160	176	205	250
A192	70	75	192	212	245	300
A248	85	100	248	270	315	400
A312	110	125	312	344	400	400
460V Class						
Input Power		Voltage : 3 Phase 380 / 400 / 415 / 440 / 460 VAC + 10%, – 15% Frequency : 50 / 60 Hz +/- 5%				
Output Power		Voltage : 0 - 460V (Output cannot be greater than input) Frequency: 0 - 400 Hz (V/Hz pattern selectable)				
MODEL NO. GPD506V-	RATED kVA	NOMINAL HP	100% CONT. OUTPUT AMPS ¹	RATED INPUT AMPS	RECOMMENDED MCCB RATING ⁽¹⁾ (AMPS)	RECOMMENDED INPUT FUSING (AMPS) ⁽²⁾
B001	1.4	0.75	1.8	2.2	3	3
B003	2.6	1 & 2	3.4	4.1	7	6
B004	3.7	3	4.8	5.8	7	8
B008	6.1	5	8	9.6	15	12
B011	8.6	7.5	11	13.2	20	17.5
B014	11	10	14	16.8	20	20
B021	14	15	21	26	30	30
B027	21	20	27	33	40	45
B034	26	25	34	40	50	50
B041	31	30	41	46	55	70
B052	40	40	52	58	70	90
B065	50	50	65	72	85	100
B080	61	60	80	88	105	125
B096	73	75	96	106	125	150
B128	98	100	128	141	165	200
B180	130	125 & 150	180	198	230	300
B240	170	200	240	264	305	400
B302	230	250	302	330	380	400
B380	260	300	380	456	525	600
B506	340	350 & 400	506	608	700	400 ⁽³⁾
B675	460	500	675	810	935	450 ⁽³⁾

(1) Molded-case circuit breaker must be rated for at least 18,000 RMS symmetrical amperes interrupting capacity.

(2) Fuses should be of the current-limiting, time-delay type offering protection for semiconductor devices.

(3) Two fuses of this rating are required for each phase.

(table continued on next page)

Table A2-1. Standard Specifications (Continued)

SECTION B. ALL GPD 506s		
Control Characteristics	Control Method	Sine Wave PWM
	Frequency Regulation	Digital command: 0.01% (-10 to 40°C) (+14 to 104°F)
		Analog command: 0.1% (15 to 35°C) (59 to 95°F)
	Frequency Resolution	Digital Operator reference: 0.1 Hz Analog reference: 0.06 Hz/60Hz
	Output Frequency Resolution	0.01 Hz
	Frequency Setting Signal	0 to 10 VDC (20K Ohms), 4-20mA (250 Ohms)
	Accel / Decel Time	0.1 to 3600 sec (Accel / Decel time setting independently)
	Braking Torque	Approximately 20%
	V/F Pattern Selection	1 Preset Pattern: 1 Custom Pattern: defined by parameter settings.
Protective Functions	Motor Overload Protection	Electronic thermal overload relay
	Instantaneous Overcurrent	Motor coasts to a stop at approximately 180% rated current. (200% for Model -A068 & below, -B034 & below)
	Fuse Blown Protection	Motor coasts to a stop by blown fuse.
	Overload	Motor coasts to a stop after 60 sec. of a 120% overload condition.
	Overvoltage	Motor coasts to a stop if drive DC bus voltage exceeds 410 VDC (230V unit), 820VDC (460V unit).
	Undervoltage	Motor coasts to a stop if drive DC bus voltage drops to 190 VDC or below (230V unit), 350 VDC or below (460V unit).
	Momentary Power Failure	Factory setting provides for motor to coast to a stop after momentary power failure of more than 15 ms. Can be reprogrammed to allow continuous operation (ride-through) during power failure of up to 2 seconds or longer (see Note 2).
	Heatsink Overheat	Thermoswitch
	Stall Prevention	Stall prevention at acceleration/deceleration and constant speed operation.
	Ground Fault	Provided by electronic circuit.
	Power Charge Indication	"CHARGE" lamp remains lit until bus voltage drops below 50 V.

Table A2-1. Standard Specifications (Continued)

SECTION B. ALL GPD 506s (Continued)		
Environmental Conditions	Location	Indoor (protected from corrosive gases and dust).
	Ambient Temperature	–10 to 40°C (+14 to 104°F) for NEMA 1; –10 to 45°C (+14 to 113°F) for protected chassis
	Storage Temperature (Note 3)	–20 to 60°C (–4 to 140°F)
	Humidity	95% RH (no condensation)
	Vibration	1 G at less than 20 Hz, up to 0.2 G at 20 to 50 Hz.

NOTES:

1. Overload capacity: 120% of rated for 60 sec.
2. See paragraph 5.17 for detailed information.
3. Temperature during shipping. Storing in this temperature for a long period may deteriorate main circuit capacitor.

Appendix 3. CAPACITY RELATED PARAMETERS

If a Control PCB is changed, the next time the drive is powered up parameter **n115** must be set to the appropriate value listed in Table A3-1 for the drive Model No. This will automatically program the values of all other parameters listed in the table to the factory settings for that particular drive rating.

Table A3-1. Parameters Related to GPD 506/P5 Capacity

MODEL NO. GPD 506V-	NOMINAL HP	OUTPUT AMPS	PARAMETER									
			<i>n115</i> (H)	<i>n033</i> (Amps)	<i>n054</i>	<i>n057</i> (sec.)	<i>n058</i> (%)	<i>n059</i> (sec.)	<i>n073</i> (%)	<i>n074</i> (%)	<i>n097</i>	<i>n116</i>
2 3 0 V												
A003	0.75	3.2	0	1.9	15.0 kHz (6)	0.5	100	0.7	170	160	288.2	CT (0)
A006	1 & 1.5	6	1	3.3	15.0 kHz (6)	0.5	100	1.0	170	160	223.7	CT (0)
A008	2	8	2	6.2	15.0 kHz (6)	0.5	100	1.0	170	160	169.4	CT (0)
A011	3	11	3	8.5	15.0 kHz (6)	0.5	100	1.0	170	160	156.8	CT (0)
A017	5	17.5	4	14.0	15.0 kHz (6)	0.5	100	2.0	170	160	122.9	CT (0)
A027	7.5 & 10	27	5	19.6	10.0 kHz (4)	0.7	100	2.0	170	160	94.75	VT (1)
A036	15	36	6	26.6	10.0 kHz (4)	0.7	100	2.0	170	160	72.69	VT (1)
A054	20	54	7	39.7	10.0 kHz (4)	0.7	100	2.0	170	160	70.44	VT (1)
A068	25	68	8	53.0	10.0 kHz (4)	0.7	100	2.0	170	160	63.13	VT (1)
A080	30	80	9	65.8	15.0 kHz (6)	1.0	100	2.0	120	120	57.87	VT (1)
A104	40	104	A	77.2	15.0 kHz (6)	1.0	100	2.0	120	120	51.79	VT (1)
A130	50	130	b	105.0	10.0 kHz (4)	1.0	80	2.0	120	120	46.27	VT (1)
A160	60	160	C	131.0	10.0 kHz (4)	1.0	80	2.0	120	120	38.16	VT (1)
A192	75	192	d	156.0	10.0 kHz (4)	1.0	80	2.0	120	120	35.78	VT (1)
A248	100	248	E	190.0	8.0 kHz (3)	1.0	80	2.0	120	120	31.35	VT (1)
A312	125	312	F	224.0	8.0 kHz (3)	1.0	80	2.0	120	120	23.10	VT (1)
4 6 0 V												
B001	0.75	1.8	20	1.0	10.0 kHz (4)	0.5	100	1.0	170	160	576.4	CT (0)
B003	1 & 2	3.4	21	1.6	10.0 kHz (4)	0.5	100	1.0	170	160	447.4	CT (0)
B004	3	4.8	22	3.1	10.0 kHz (4)	0.5	100	1.0	170	160	338.8	CT (0)
B008	5	8	24	7.0	10.0 kHz (4)	0.5	100	2.0	170	160	313.6	CT (0)
B011	7.5	11	25	7.0	10.0 kHz (4)	0.7	100	2.0	170	160	245.8	CT (0)
B014	10	14	26	9.8	10.0 kHz (4)	0.7	100	2.0	170	160	189.5	CT (0)
B021	15	21	27	13.3	10.0 kHz (4)	0.7	100	2.0	170	160	145.4	CT (0)
B027	20	27	28	19.9	10.0 kHz (4)	0.7	100	2.0	170	160	140.9	CT (0)
B034	25	34	29	26.5	10.0 kHz (4)	0.7	100	2.0	170	160	126.3	CT (0)
B041	30	41	2A	32.9	10.0 kHz (4)	1.0	100	2.0	120	120	115.7	VT (1)
B052	40	52	2b	38.6	8.0 kHz (3)	1.0	100	2.0	120	120	103.6	VT (1)
B065	50	65	2C	52.3	8.0 kHz (3)	1.0	100	2.0	120	120	92.54	VT (1)
B080	60	80	2d	65.6	5.0 kHz (2)	1.0	100	2.0	120	120	76.32	VT (1)
B096	75	96	2E	79.7	5.0 kHz (2)	1.0	100	2.0	120	120	71.56	VT (1)

(table continued on next page)

Table A3-1. Parameters Related to GPD 506/P5 Capacity - Continued

MODEL NO. GPD 506V-	NOMINAL HP	OUTPUT AMPS	PARAMETER									
			<i>n115</i> (H)	<i>n033</i> (Amps)	<i>n054</i>	<i>n057</i> (sec.)	<i>n058</i> (%)	<i>n059</i> (sec.)	<i>n073</i> (%)	<i>n074</i> (%)	<i>n097</i>	<i>n116</i>
4 6 0 V (Continued)												
B128	100	128	2F	98.0	5.0 kHz (2)	1.0	80	2.0	120	120	67.20	VT (1)
B180	125 & 150	180	30	120.0	5.0 kHz (2)	1.0	80	2.0	120	120	46.20	VT (1)
B240	200	240	31	175.0	5.0 kHz (2)	2.0	80	2.0	120	120	36.23	VT (1)
B302	250	302	32	245.0	5.0 kHz (2)	2.0	80	2.0	120	120	30.13	VT (1)
B380	300	380	33	302.0	2.5 kHz (9) *	2.0	80	2.0	120	120	30.57	VT (1)
B506	350 & 400	506	34	368.0	2.5 kHz (9) *	2.0	80	2.0	120	120	27.13	VT (1)
B675	500	675	35	490.0	2.5 kHz (9) *	2.0	80	2.0	120	120	21.76	VT (1)

NOTES:

- * 2.5 kHz is maximum carrier frequency — see paragraph 5.5 for detailed information.

Appendix 4. GPD 506/P5 SPARE PARTS

Drive Model No. GPD506V-	Power Module Part No. 5P30-					Transistor Module Part No. 5P30-								Diode Module Part No. 5P50-					
	0174	0175	0178	0154	0155	0156	0157	0158	0159	0160	0161	0182	0477	0478	0479	0480	0481	0482	
A003	1												No Diode Module in these Drive Model No's; diodes are contained in Power Module.						
A006		1																	
A008		1																	
A011			1																
A017				1															
A027				1															
A036					1								1						
A054						3								1					
A068							3								1				
A080								3					2						
A104								3					2						
A130									6							6			
A160										6							6		
A192										6							6		
A248											6						6		
A312												12						6	

Drive Model No. GPD506V-	Power PCB Part No. 5P90-									Gate Drive PCB Part No. 5P90-					Control PCB Part No. 5P90-	
	0422	0423	0424	0425	0426	0427	0428	0429	0430	0410	0414	0415	0416	0417	0528	0529
A003	1														1	
A006		1													1	
A008			1												1	
A011				1											1	
A017					1										1	
A027						1									1	
A036							1								1	
A054								1							1	
A068								1							1	
A080										1						1
A104										1						1
A130											1					1
A160												1				1
A192													1			1
A248													1			1
A312														1		1

Drive Model No. GPD506V-	Cooling Fan Part No. 5P16-							DC Bus Fuse Part No. 5P17-											Control Fuse Part No. 5P17-	
	0057	0058	0059	0061	0050	0062	0051	0504	0506	0488	0480	0481	0482	0483	0484	0485	0486	0487	0500	0502
A003								1											1	
A006								1											1	
A008									1										1	
A011	1									1									1	
A017	1										1								1	
A027	1											1							1	
A036	2											1							1	
A054		2											1						1	
A068		2												1					1	
A080			1	1											1				1	
A104			1	1											1				1	
A130					3	1										3				1
A160					3	1										3				1
A192					3	1										3				1
A248					3	1											3			1
A312						1	3											3		1

IMPORTANT

Numbers represent total quantity used in one Drive. To determine adequate inventory of spare parts, Yaskawa suggests using listed value for quantities 2 and below. If listed value is greater than 2, factory suggests 1/3 of total listed.

Drive Model No. GPD506V–	Power Module Part No. 5P30–				Transistor Module Part No. 5P30–							Xstr/Heatsink Assy Part No. 5P30–			Diode Module Part No. 5P50–							
	0171	0162	0163	0164	0165	0166	0167	0168	0150	0169	0152	0288	0289	0290	0483	0484	0485	0486	0487	0488	0496	
B001	1														No Diode Module in these Drive Model No's; diodes are contained in Power Module.							
B003	1																					
B004	1																					
B008		1																				
B011		1																				
B014			1												1							
B021				1											1							
B027					3											1						
B034					3											1						
B041					3											2						
B052						3										2						
B065						3										2						
B080							3										2					
B096							3											2				
B128								6											6			
B180									6										6			
B240										12										6		
B302											12									6		
B380												3									6	
B506													3								6	
B675														3							9	

Drive Model No. GPD506V-	Power PCB Part No. 5P90–								Gate Drive PCB Part No. 5P90–									Control PCB Part No. 5P90–		
	0431	0432	0433	0435	0436	0437	0438	0439	0411	0412	0413	0418	0419	0420	0421	0465	0468	0471	0528	0529
B001	1																		1	
B003		1																	1	
B004			1																1	
B008				1															1	
B011					1														1	
B014						1													1	
B021							1												1	
B027								1											1	
B034								1											1	
B041									1											1
B052										1										1
B065											1									1
B080											1									1
B096											1									1
B128												1								1
B180													1							1
B240														1						1
B302															1					1
B380																1				1
B506																	1			1
B675																		1		1

IMPORTANT

Numbers represent total quantity used in one Drive. To determine adequate inventory of spare parts, Yaskawa suggests using listed value for quantities 2 and below. If listed value is greater than 2, factory suggests 1/3 of total listed.

Drive Model No. GPD506V-	Cooling Fan Part No. 5P16–									DC Bus Fuse Part No. 5P17–										Control Fuse Part No. 5P17–		
	0057	0058	0059	0061	0060	0050	0062	0051	0064	0504	0488	0480	0489	0490	0491	0492	0477	0478	0479	0500	0502	0503
B001										1										1		
B003										1										1		
B004										1										1		
B008	1										1									1		
B011	1										1									1		
B014	1											1								1		
B021	2												1							1		
B027		2												1						1		
B034		2												1						1		
B041			1	1										1						1		
B052			1	1											1					1		
B065				1	2											1				1		
B080				1	2											1				1		
B096				1	2											1				1		
B128						3	1										3			1		
B180						3	1										3			1		
B240						3	1											3		1		
B302							1	3											3		1	
B380									3	No DC Bus Fuse in these Drive Model No's; fuses are contained in Transistor/Heatsink Assembly.											1	
B506									3													1
B675									3													1

IMPORTANT

Numbers represent total quantity used in one Drive. To determine adequate inventory of spare parts, Yaskawa suggests using listed value for quantities 2 and below. If listed value is greater than 2, factory suggests 1/3 of total listed.

Appendix 5. GPD 506/P5 DIMENSIONS

Table A6-1 lists dimensions for the drive in its standard enclosure. For information on other types of enclosures available, consult your Yaskawa representative.

Table A6-1. Drive Size and Weight

VOLTS		MODEL NO.	NOMINAL HP	ENCLOSURE TYPE	PHYSICAL DIMENSIONS (IN.)			MOUNTING DIM. (IN.)		WEIGHT (LB)	HEAT LOSS (WATTS)			
		GPD506V-			H	W	D	H1	W1		Heatsink	Internal	Total	
2 3 0	A003 A006 A008	0.75 1 & 1.5 2	NEMA 1	11.02 11.02 11.02	5.51 5.51 5.51	6.30 6.30 6.30	10.47 10.47 10.47	4.96 4.96 4.96	7 7 7	15 25 40	50 65 80	65 90 120		
	A011 A017	3 5		NEMA 1	11.02 11.02	5.51 5.51	7.09 7.09	10.47 10.47	4.96 4.96	10 10	80 135	60 80	140 215	
	A027 A036	7.5 & 10 15			NEMA 1	11.81 11.81	7.87 7.87	8.07 8.07	11.22 11.22	7.32 7.32	12 13	210 235	90 110	300 345
	A054 A068 A080 A104	20 25 30 40	NEMA 1	14.96 15.75 24.02 26.57		9.84 9.84 12.99 12.99	8.86 8.86 11.22 11.22	14.37 14.37 17.13 17.13	9.29 9.29 10.83 10.83	24 24 71 71	425 525 655 830	160 200 230 280	585 725 885 1110	
	A130 A160	50 60		Protected Chassis	26.57 26.57	16.73 16.73	13.78 13.78	25.59 25.59	12.60 12.60	134 137	1050 1250	500 700	1550 1950	
	A192 A248 A312	75 100 125			Protected Chassis	31.50 31.50 36.42	18.70 18.70 22.64	13.78 13.78 15.75	30.51 30.51 35.24	14.57 14.57 17.52	176 176 298	1550 1950 2300	750 1000 1300	1950 2950 3600
	4 6 0	B001 B003		0.75 1 & 2		NEMA 1	11.02 11.02	5.51 5.51	6.30 6.30	10.47 10.47	4.96 4.96	7 7	10 20	50 65
		B004 B008 B011	3 5 7.5	NEMA 1			11.02 11.02 11.02	5.51 5.51 5.51	7.09 7.09 7.09	10.47 10.47 10.47	4.96 4.96 4.96	9 10 10	30 80 120	80 65 80
		B014 B021	10 15		NEMA 1	11.81 11.81	7.87 7.87	8.07 8.07	11.22 11.22	7.32 7.32	13 13	135 240	85 120	220 360
		B027 B034	20 25			NEMA 1	14.96 14.96	9.84 9.84	8.86 8.86	14.37 14.37	9.29 9.29	24 24	305 390	150 180
		B041 B052 B065	30 40 50	NEMA 1	24.02 24.02 30.91		12.99 12.99 12.99	11.22 11.22 11.22	17.13 17.13 24.02	10.83 10.83 10.83	68 68 106	465 620 705	195 260 315	660 880 1020
		B080 B096	60 75		NEMA 1	30.91 33.46	12.99 12.99	11.22 11.22	24.02 24.02	10.83 10.83	106 106	875 970	370 415	1245 1385
		B128 B180 B240 B302	100 125 & 150 200 250			Protected Chassis	32.28 32.28 36.42 36.42	17.91 17.91 22.64 22.64	13.78 13.78 14.76 15.75	31.30 31.30 35.24 35.24	13.78 13.78 17.52 17.52	174 176 298 320	1110 1430 1870 2670	710 890 1160 1520
		B380 B506 B675	300 300 & 400 500	Protected Chassis	57.09 57.09 62.99		37.40 37.40 37.80	17.13 17.13 17.91	55.12 55.12 61.02	(1) (1) (1)	794 794 926	3400 4740 6820	1510 2110 2910	4910 6850 9730

(1) 3 mounting holes top, 3 mounting holes bottom; consult Yaskawa for horizontal hole spacing.

Appendix 6. DYNAMIC BRAKING CONNECTIONS

GENERAL. Dynamic braking (DB) enables the motor to be brought to a smooth and rapid stop. This is achieved by dissipating the regenerative energy of the AC motor across the resistive components of the Dynamic Braking option. For further details on dynamic braking operation, see the instruction sheet shipped with dynamic braking components.

The GPD506-A003 thru -A033 and -B001 thru -B034 have an integral braking transistor and only require the addition of a Remote Mount Resistor Unit or a Heat Sink Mount Resistor. All higher rated drives require the use of a Braking Transistor Unit *and* a Remote Mount Resistor Unit.

Remote Mount Resistor Units typically mount outside of an electrical enclosure. Braking Transistor Units mount inside of an electrical enclosure. Heat Sink Mount Resistors mount to the back of the drive, attaching directly to the heat sink.

Available dynamic braking components are listed in Table A6-1 through A6-5.

Table A6-1. Dynamic Braking - 3% Duty Cycle - 230V

Drive		Heat Sink Mount Resistor							
Rated Input	Model No. GPD506V-	Part No.	Qty Req'd	Resistance (Ohms) (Each)	Power (Watts) (Each)	Approx. Braking Torque (%)	Dimensions (Inches)		
							Height	Width	Depth
230 V	A003	50185430	1	200	150	220	7.16	1.73	0.51
	A006	50185430	1	200	150	220	7.16	1.73	0.51
	A008	50185431	1	100	150	125	7.16	1.73	0.51
	A011	50185432	1	70	150	120	7.16	1.73	0.51
	A017	50185433	1	62	150	100	7.16	1.73	0.51
460 V	B001	50185530	1	750	150	165	7.16	1.73	0.51
	B003	50185531	1	400	150	120	7.16	1.73	0.51
	B004	50185531	1	200	150	150	7.16	1.73	0.51

Table A6-2. Dynamic Braking - 10% Duty Cycle - 230V

Table A0-2: Dynamic Braking - 10% Duty Cycle - 230V															
Drive		Braking Transistor Unit						Remote Mount Resistor Unit							
Rated Input	Model No. GPD506V-	Part No. 46S03331-	Qty Req'd	Minimum Connectable Resistance Each (Ohms)	Dimensions (Inches)			Part No. 5P41-	Qty Req'd	Resistance (Ohms) (Each)	Power (Watts) (Each)	Approx Braking Torque (%)	Dimensions (Inches)		
					Height	Width	Depth						Height	Width	Depth
230V	A003	--	--	48	--	--	--	0825	1	200	250	150	5.00	14.00	4.00
	A006	--	--	48	--	--	--	0826	1	100	250	150	5.00	14.00	4.00
	A008	--	--	16	--	--	--	0826	1	100	250	115	5.00	14.00	4.00
	A011	--	--	16	--	--	--	0827	1	70	250	110	5.00	14.00	4.00
	A017	--	--	16	--	--	--	0828	1	40	846	115	5.00	14.00	7.00
	A025	--	--	9.6	--	--	--	0829	1	30	824	105	5.00	14.00	7.00
	A027	--	--	9.6	--	--	--	0829	1	30	824	105	5.00	14.00	7.00
	A033	--	--	9.6	--	--	--	0830	1	20	1260	115	5.00	14.00	10.00
	A036	--	--	9.6	--	--	--	0830	1	20	1260	115	5.00	14.00	10.00
	A049	0010	1	9.6	11.00	5.53	5.91	0831	1	13.6	1500	115	5.00	14.00	13.00
	A054	0010	1	9.6	11.00	5.53	5.91	0831	1	13.6	1500	115	5.00	14.00	13.00
	A064	0020	1	6.3	11.00	5.53	5.91	0832	1	10	1920	115	5.00	14.00	13.00
	A068	0020	1	6.3	11.00	5.53	5.91	0832	1	10	1920	115	5.00	14.00	13.00
	A080	0020	1	6.3	11.00	5.53	5.91	0833	1	8	2592	100	5.00	21.00	10.00
	A096	0020	2	6.3	11.00	5.53	5.91	0834	2	6.8	2760	150	5.00	21.00	10.00
	A130	0020	2	6.3	11.00	5.53	5.91	0834	2	6.8	2760	135	5.00	21.00	10.00
	A160	0020	2	6.3	11.00	5.53	5.91	0834	2	6.8	2760	115	5.00	21.00	10.00
	A224	0020	3	6.3	11.00	5.53	5.91	0834	3	6.8	2760	135	5.00	21.00	10.00
	A300	0020	3	6.3	11.00	5.53	5.91	0834	3	6.8	2760	105	5.00	21.00	10.00

Table A6-3. Dynamic Braking - 3% Duty Cycle - 460V

Drive		Heat Sink Mount Resistor							
Rated Input	Model No. GPD506V-	Part No	Qty. Reqd.	Resistance (Ohms) (Each)	Power (Watts) (Each)	Approx Braking Torque (%)	Dimensions (Inches)		
							Height	Width	Depth
460 V	B001	50185530	1	750	150	165	7.16	1.73	0.51
	B003	50185531	1	400	150	120	7.16	1.73	0.51
	B004	50185531	1	200	150	150	7.16	1.73	0.51

Table A6-4. Dynamic Braking - 10% Duty Cycle - 460V

Drive		Braking Transistor Module						Remote Mount Resistor Unit							
Rated Input	Model No. GPD506V-	Part No. 46S03331-	Qty Req'd	Minimum Connectable Resistance Each (Ohms)	Dimensions (Inches)			Part No. 5P41-	Qty Req'd	Resistance (Ohms) (Each)	Power (Watts) (Each)	Approx Braking Torque (%)	Dimensions (Inches)		
					Height	Length	Depth						Height	Length	Depth
460 V	B001	--	--	96	--	--	--	0835	1	750	600	150	5.00	14.00	7.00
	B003	--	--	96	--	--	--	0836	1	400	500	115	5.00	14.00	4.00
	B004	--	--	64	--	--	--	0837	1	250	500	125	5.00	14.00	4.00
	B008	--	--	32	--	--	--	0838	1	150	500	125	5.00	14.00	4.00
	B011	--	--	32	--	--	--	0839	1	100	975	125	5.00	14.00	7.00
	B014	--	--	32	--	--	--	0840	1	75	1050	125	5.00	14.00	10.00
	B021	--	--	32	--	--	--	0841	1	50	1600	125	5.00	14.00	13.00
	B027	--	--	20	--	--	--	0842	1	40	2050	120	5.00	21.00	10.00
	B034	--	--	20	--	--	--	0843	1	32	2340	120	5.00	21.00	10.00
	B041	0050	1	20	11.00	5.53	5.91	0844	1	27	3000	115	5.00	21.00	13.00
	B052	0060	1	12.7	11.00	5.53	5.91	0845	1	20	3850	120	5.00	21.00	13.00
	B065	0060	1	12.7	11.00	5.53	5.91	0846	1	16	5440	120	5.00	28.00	13.00
	B080	0060	1	12.7	11.00	5.53	5.91	0847	1	13.6	5715	115	5.00	28.00	13.00
	B096	0060	2	12.7	11.00	5.53	5.91	0845	2	20	3850	125	5.00	21.00	13.00
	B128	0060	2	12.7	11.00	5.53	5.91	0847	2	13.6	5715	135	5.00	28.00	13.00
	B165	0060	2	12.7	11.00	5.53	5.91	0847	2	13.6	5715	110	5.00	28.00	13.00
	B224	0090	1	3	14.50	10.63	7.25	0848	1	5.2	17,280	120	14.00	29.00	18.00
	B302	0090	1	3	14.50	10.63	7.25	0849	1	4	19,600	95	14.00	29.00	18.00
	B380	0090	1	3	14.50	10.63	7.25	0849	1	4	19,600	80	14.00	29.00	18.00
	B450	0090	1	3	14.50	10.63	7.25	0849	1	4	19,600	70	14.00	29.00	18.00
	B605	0090	2	3	14.50	10.63	7.25	0849	2	4	19,600	95	14.00	29.00	18.00
GPD506V-B041 thru GPD506V-B302 cannot be connected for Dynamic Braking.															
460 V	B380	0090	1	3	14.50	10.63	7.25	0849	1	4	19,600	80	14.00	29.00	18.00
	B506	0090	1	3	14.50	10.63	7.25	0849	1	4	19,600	70	14.00	29.00	18.00
	B675	0090	2	3	14.50	10.63	7.25	0849	2	4	19,600	95	14.00	29.00	18.00

INSTALLATION

This option should only be installed by a **TECHNICALLY QUALIFIED INDIVIDUAL** who is familiar with this type of equipment and the hazards involved.

WARNING

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

CAUTION

Failure to follow these installation steps may cause equipment damage or personnel injury.

Preliminary Procedures

1. Disconnect all electrical power to the drive.
2. Remove drive front cover.
3. Use a voltmeter to verify that voltage is disconnected from incoming power terminals.

Heat Sink Mount Resistor Installation

1. Remove the drive from its mounting for access to the rear of the heat sink.
2. Attach the Heat Sink Mount Resistor on the back of the drive's heat sink, as shown in Figure A6-1.
3. Reinstall the drive in its mounting position.
4. Connect the leads from the Heat Sink Mount Resistor to drive terminals according to Figure A6-2.
5. Proceed to "ADJUSTMENTS" on page A6-7.

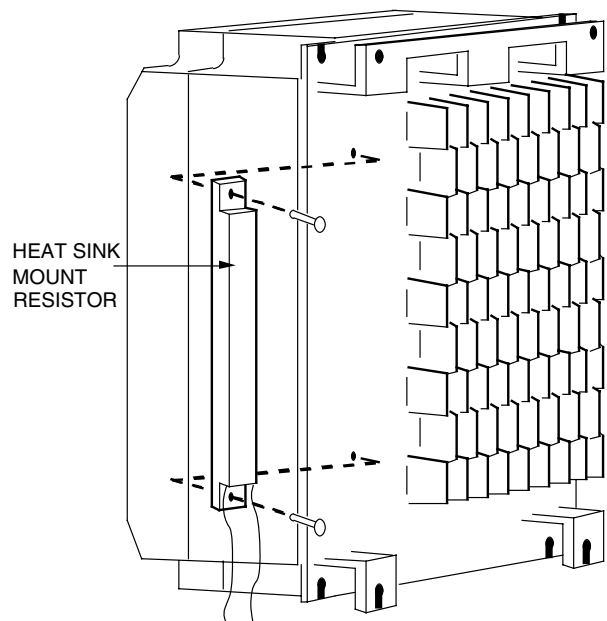


Figure A6-1. Attaching Heat Sink Mount Resistor on Heat Sink

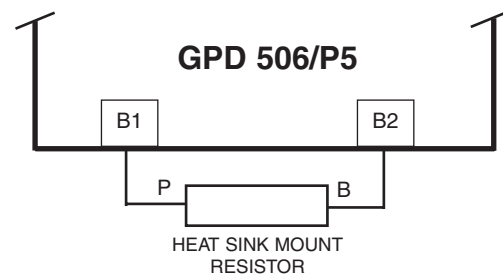


Figure A6-2. Lead Connections For Heat Sink Mount Resistor

Remote Mount Resistor Unit Installation (for GPD506V-A003 thru -A033, -B001 thru -B034)

IMPORTANT

Since the Remote Mount Resistor Unit, generates heat during dynamic braking operation, install it in a location away from other equipment.

1. Attach the Remote Mount Resistor Unit, maintaining a minimum 1.18 inch (30 mm) clearance on each side and a minimum 5.91 inch (150 mm) clearance top and bottom.

2. Remove the Remote Mount Resistor Unit cover to access its terminal block. Connect the Remote Mount Resistor Unit to the drive and to external control circuitry according to the chart at right and Figure A6-3.
- | Terminals | B, P | 1, 2 * |
|-----------------|---|---------|
| Lead Size (AWG) | 12-10 | 18-14 * |
| Lead Type | 600V ethylene propylene rubber insulated, or equivalent | |
| Terminal Screw | M4 | |
- * Power leads for the Remote Mount Resistor Unit generate high levels of electrical noise; these signal leads must be grouped separately.

3. Reinstall and secure Remote Mount Resistor Unit cover and drive front cover.
4. Proceed to "ADJUSTMENTS" on page A6-8.

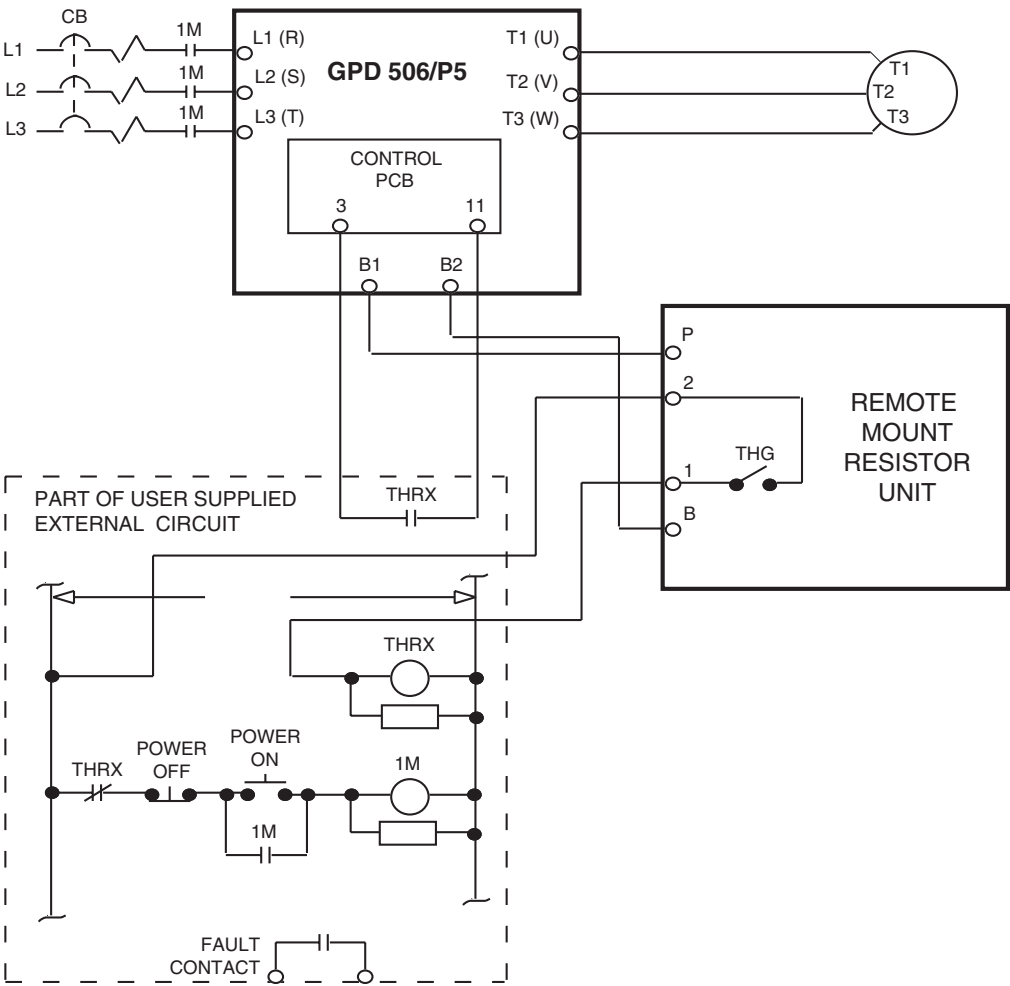


Figure A6-3. Wiring Remote Mount Resistor Unit to Drive (GPD506V-A003 thru -A033, -B001 thru -B034)

Braking Transistor Unit(s) and Remote Mount Resistor Unit(s) Installation (for GPD506V-A049 and above, -B041 and above)

IMPORTANT

Since the Remote Mount Resistor Unit generates heat during dynamic braking operation, install it in a location away from other equipment.

Select mounting locations for the Braking Transistor Unit(s) and Remote Mount Resistor Unit(s) so that wiring between the drive and the (Master) Braking Transistor Unit, and between each Braking Transistor Unit and its associated Remote Mount Resistor Unit, is less than 33 feet (10 m).

1. Mount the Braking Transistor Unit(s) on a vertical surface. A Braking Transistor Unit requires a minimum 1.18 inches (30 mm) clearance on each side and a minimum 3.94 inches (100 mm) clearance top and bottom. Attach the Remote Mount Resistor Unit maintaining a minimum 1.97 inches (50 mm) clearance on each side and a minimum 7.87 inches (200 mm) clearance on top.
2. In each Braking Transistor Unit, set the nominal line voltage jumper plug to the correct setting for the installation; this is factory set at the "230V/460V/575V" position. To access jumper plugs, remove plexiglass cover.
3. If multiple Braking Transistor Units are being installed, the unit closest to the drive should have the "SLAVE/MASTER" jumper plug on its PCB set to the "MASTER" position (factory setting); all others must have this jumper plug moved to the "SLAVE" position.
4. If a single Braking Transistor Unit and Remote Mount Resistor Unit are being installed, connect them to the drive and external control circuitry according to the chart below and Figure A6-4.

If two or more Braking Transistor Units and Remote Mount Resistor Units are being installed, connect them to the drive and to external circuitry according to the chart below and Figure A6-5.

UNIT	TERMINALS	LEAD SIZE (AWG)	LEAD TYPE	TERMINAL SCREWS
Remote Resistor Unit	B, P	12-10	600V ethylene propylene rubber insulated or equivalent	M5
	1, 2 *	18-14 *		M4
Braking Transistor Unit	P, Po, N, B	12-10	600V ethylene propylene rubber insulated, or equivalent	M4
	1, 2 *	18-14 *		

* Power leads for the Remote Mount Resistor Unit generate high levels of electrical noise; these signal leads must be grouped separately.

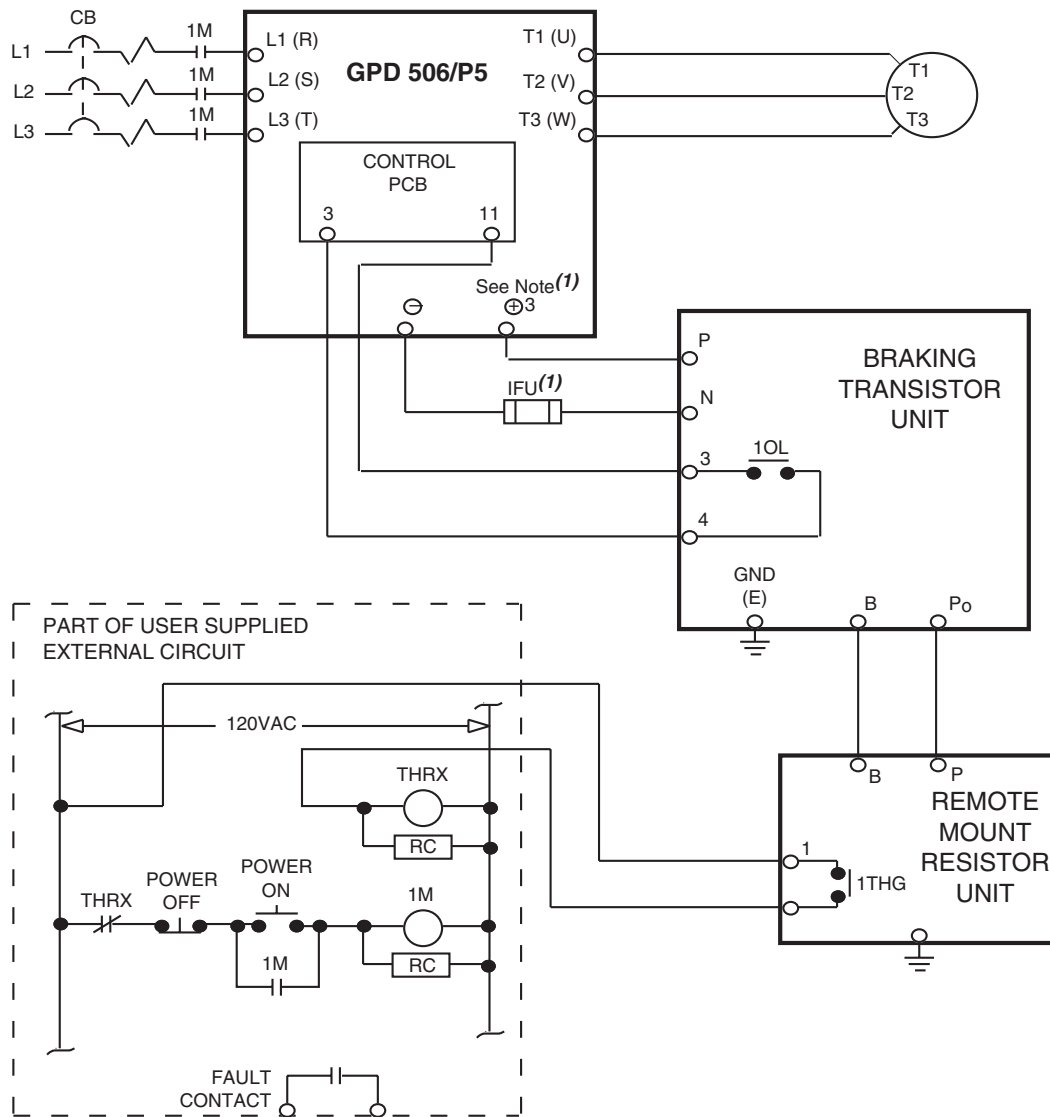


Figure A6-4. Wiring Single Braking Transistor Unit and Remote Mount Resistor Unit to Drive (GPD506V-A049 thru -A080, -B041 thru -B080)

5. The Braking Transistor Unit and Remote Mount Resistor Unit **MUST BE GROUNDED**. Observe the following precautions:

- Use grounding leads conforming to National Electrical Code.
- If the installation requires the Remote Mount Resistor Unit to be used without its enclosure (with grounding terminal), ground it by attaching a ground lead at one of the mounting screws.
- Grounding resistance of the Braking Transistor Unit should be 100 ohms or less.

⁽¹⁾ Fuse required only if UL/CUL certification is needed. See separate instruction sheet 02Y00025-0393 for details.

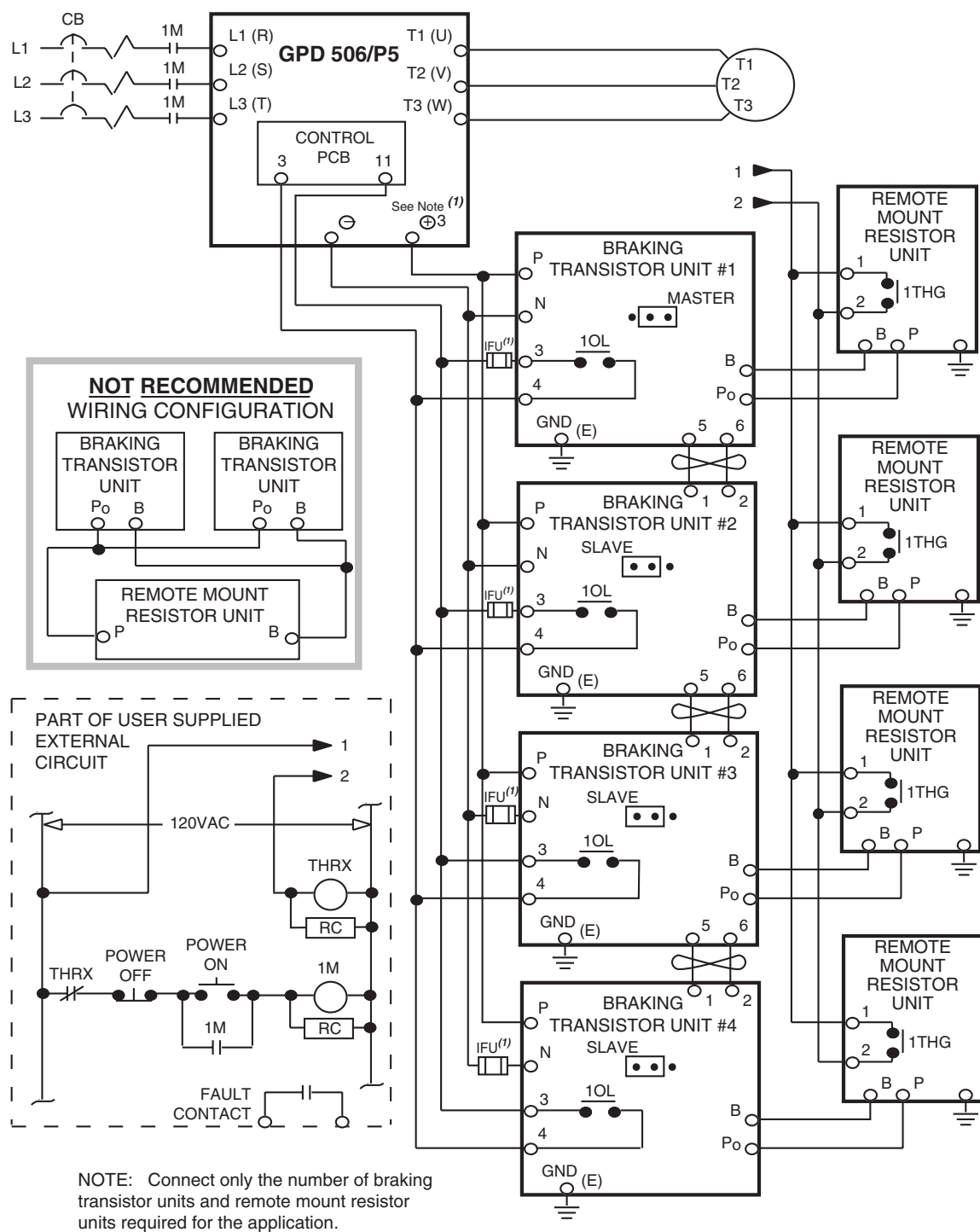


Figure A6-5. Wiring Multiple Braking Transistor Units and Remote Mount Resistor Units to Drive (GPD506V-A130 thru -A300, -B096 thru -B605)

⁽¹⁾ Fuse required only if UL/CUL certification is needed. See separate instruction sheet 02Y00025-0393 for details.

6. **IMPORTANT:** After wiring, test insulation resistance of each Braking Transistor Unit/Remote Mount Resistor Unit with a 900V megger as follows:
- Disconnect leads between the Braking Transistor Unit and the drive. If equipment with semiconductors is connected across terminals 1 & 2 of the Braking Transistor Unit, remove the wiring.
 - Connect common leads (jumpers) across Braking Transistor Unit terminals N, P, Po, and B, and across 3 & 4, as shown in Figure A6-6.
 - Measure the insulation resistance at points a, b, and c in Figure A6-6 with the megger.

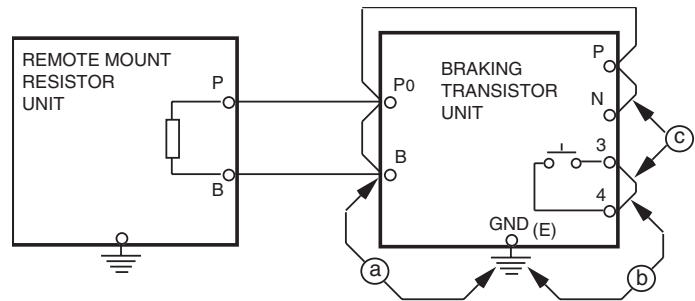


Figure A6-6. Megger Testing Set-up

ADJUSTMENTS

- ALL drives: Program **L3-04** to " 0 ", to disable stall prevention during deceleration.
- Only with Heat Sink Mount Resistor: Program **L8-01** to " 1 ", to enable overheat protection for the braking resistor.

OPERATION CHECK

- During dynamic braking operation, verify that the "BRAKE" lamp inside the Braking Unit is lit.
- During dynamic braking operations, ensure that the required deceleration characteristic is obtained. If not, contact MagneTek for assistance.
- Reinstall and secure covers on the Braking Transistor Units, Remote Mount Resistor Units, and the drive.



During normal operation, the Braking Transistor Unit and the Remote Mount Resistor Unit enclosures must be kept closed, since high voltage is applied to the dynamic braking circuit.

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- Drive model and all nameplate data.
- Motor type, brand, and all nameplate data.

For Troubleshooting, additional information may be required.

- Power distribution information (type – delta, wye; power factor correction; other major switching devices used; voltage fluctuations)
- Installation Wiring (separation of power & control wire; wire type/class used; distance between drive and motor, grounding.
- Use of any devices between the Drive & motor (output chokes, etc.).

Please phone us at 1-800-541-0939 for technical support.

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