GV3000 A-C Power Modules
Hardware Reference, Installation, and Troubleshooting
Version 5.0

Instruction Manual D2-3340

RELIANCE ELECTRIC

The information in the user's manual is subject to change without notice.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL AND OTHER APPLICABLE MANUALS IN THEIR ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING WITH ALL APPLICABLE LOCAL, NATIONAL, AND INTERNATIONAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

D-C BUS CAPACITORS RETAIN HAZARDOUS VOLTAGES AFTER INPUT POWER HAS BEEN DISCONNECTED. AFTER DISCONNECTING INPUT POWER, WAIT FIVE (5) MINUTES FOR THE D-C BUS CAPACITORS TO DISCHARGE AND THEN CHECK THE VOLTAGE WITH A VOLTMETER TO ENSURE THE D-C BUS CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE DRIVE IS CAPABLE OF OPERATING AT AND MAINTAINING ZERO SPEED. THE USER IS RESPONSIBLE FOR ASSURING SAFE CONDITIONS FOR OPERATING PERSONNEL BY PROVIDING SUITABLE GUARDS, AUDIBLE OR VISUAL ALARMS, OR OTHER DEVICES TO INDICATE THAT THE DRIVE IS OPERATING OR MAY OPERATE AT OR NEAR ZERO SPEED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING

THE USER MUST PROVIDE AN EXTERNAL, HARDWIRED EMERGENCY STOP CIRCUIT OUTSIDE OF THE DRIVE CIRCUITRY. THIS CIRCUIT MUST DISABLE THE SYSTEM IN CASE OF IMPROPER OPERATION. UNCONTROLLED MACHINE OPERATION MAY RESULT IF THIS PROCEDURE IS NOT FOLLOWED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Manufacturer's Declaration

Manufacturer:

Reliance Electric Industrial Co.
24701 Euclid Avenue
Cleveland, Ohio 44117 – USA

declares that the product:

GV3000, A-C Speed Controller for Electric Motors

- *is intended to be incorporated into machinery or to be assembled with other machinery to constitute machinery covered by Directive 89/392/EEC, as amended;*

and that

- *the following harmonized standards have been applied:*

EN 60204-1: Electrical equipment of industrial machines – Part 1: General Requirements

and furthermore declares that the product covered by this Declaration must not be put into service until the machinery into which it is to be incorporated or of which it is a component has been found and declared to be in conformity with the provisions of Directive 89/392/EEC and with national implementing legislation, i.e., as a whole, including the product refered to in this Declaration.

Authorized Representative of the Company:

Place: ***Reliance Electric Industrial Co., Cleveland, Ohio 44117, USA***

Date: ***December 1, 1995***

Signature: Charles Jankl

Name: ***Charles Jankl***

Position: ***Product Development Safety Engineer***

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1.0 BECOMING FAMILIAR WITH THE MANUAL

This chapter provides help in finding information in the manual and describes the intended audience. Also included are references to other related publications and instructions on receiving assistance from Reliance Electric.

1.1 Finding Information

This instruction manual describes the GV3000 drive's Power Module and regulator hardware. It does not cover the GV3000 software. For additional software information, refer to the GV3000 A-C General Purpose (V/Hz) and Vector Duty Drive Software Start-Up and Reference Manual (D2-3339).

As an aid in finding information in this manual, each chapter is briefly described below:

- Chapter 1 - Becoming Familiar with the Manual

  Provides information on how the manual is organized and where to find additional information.

- Chapter 2 - About the Drive

  Identifies drive components and shows their locations.

- Chapter 3 - Planning Before Installing

  Presents information that must be considered when planning a drive installation.

- Chapter 4 - Mounting the Drive, Grounding, and Finding Wire Routing Locations

  Describes how to mount the drive and properly ground it.

- Chapter 5 - Installing Input Power Wiring

  Describes incoming A-C and D-C line components and how to properly connect them.

- Chapter 6 - Installing A-C Output Power Wiring

  Describes output A-C line components and how to properly connect them to the motor.

- Chapter 7 - Wiring the Regulator Board Terminal Strip

  Provides information on the I/O wiring that connects to the terminal strip on the Regulator board.

- Chapter 8 - Completing the Installation

  Provides instructions on how to perform a final check of the installation before power is applied.

- Chapter 9 - Troubleshooting the Drive

  Describes the equipment that is needed to troubleshoot the drive and how to measure D-C bus voltage. Replacement part lists are also provided.

- Appendix A - Technical Specifications

  Lists drive specifications in table form.

- Appendix B - Drive Regulation Overview

  Briefly describes volts/hertz and vector regulation.

- Appendix C - Compliance with EN 60204-1: 1992

  Lists the sections of standard EN 60204-1: 1992 that the GV3000 drive complies with.

1.2 Assumptions About the Audience

This manual is intended for qualified electrical personnel. It is task-oriented and is organized according to a logical progression of steps to be followed to install and troubleshoot the drive.

1.3 Taking Safety Precautions

Dangers, warnings, and cautions are used in this manual to point out potential problem areas. All three types of precautions are enclosed in a box to call attention to them.

DANGER
A DANGER ALERTS A PERSON OF A CONDITION WHICH COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

WARNING
A WARNING ALERTS A PERSON OF A CONDITION WHICH COULD RESULT IN POTENTIAL BODILY INJURY IF PROCEDURES ARE NOT FOLLOWED.

CAUTION: A caution alerts a person of a condition which could result in damage to, or destruction of, the equipment.

1.4 Understanding Terms Used in this Manual

The following terms are defined according to the way they are used in this manual:

- GV3000 drives will typically be referenced by horsepower. If additional clarity is required, drive model numbers will also be included.
- Parameters will be referenced either as parameter (P.030) or Elapsed Time Meter Reset (P.030).

1.5 If You Want to Know More

Refer to the following related publications as necessary for more information:

- D2-3339 GV3000 A-C General Purpose (V/Hz) and Vector Duty Drive Software Start-Up and Reference Manual
- D2-3291 Snubber Resistor Braking Kit
- D2-3305 Motor Encoder Cable Kit
- D2-3308 AutoMax Network Communication Board
- D2-3348 Control and Configuration Software (CS3000)
- D2-3341 Remote Meter Interface
- D2-3342 Operator Interface Module

1.6 Getting Assistance from Reliance Electric

If you have any questions or problems with the products described in this instruction manual, contact your local Reliance Electric sales office. For technical assistance, call 1-800-RELIANCE.

2.0 ABOUT THE DRIVE

This chapter describes how to identify the drive using the model number matrix and illustrates the differences between the NEMA enclosures. Major components of each drive group are also shown.

The GV3000 A-C drive is a PWM drive that provides vector and general purpose (volts/hertz or V/Hz) regulation for a wide range of applications.

Using vector regulation, the drive can provide high dynamic response, maintain full rated motor torque to zero speed, and precisely control motor speed in both directions using pulse tachometer feedback.

Using general purpose (volts/hertz) regulation, the drive is suited for a broad range of applications requiring adjustable speed control of motors.

2.1 Identifying the Drive by Model Number

Each GV3000 A-C drive can be identified by its model number. See figure 2.1. This number appears on the shipping label and on the drive's nameplate. The drive's model number includes the Power Module and the regulator. Drive power ratings are provided in table 2.1.

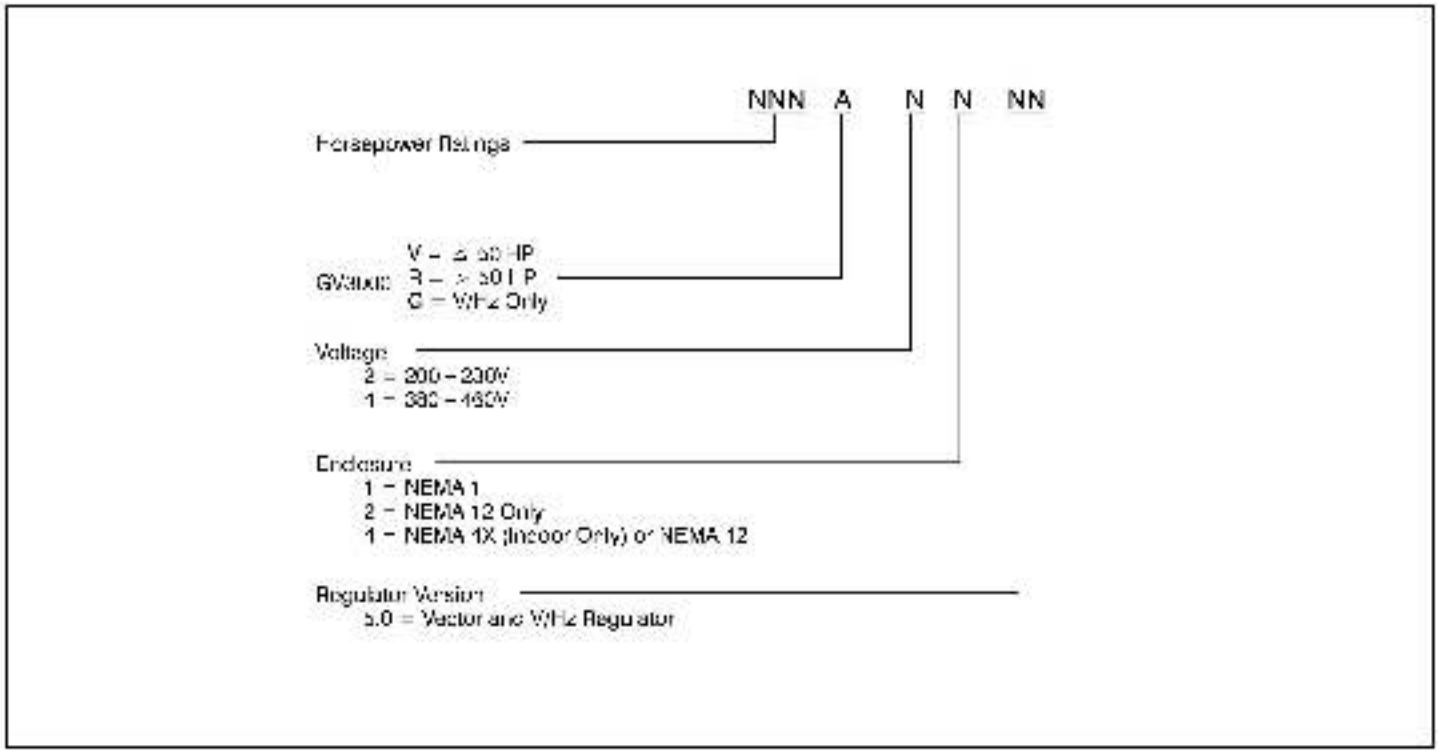


Figure 2.1 - Identifying the Drive Model Number

Taole 2.1 - Power and NEMA Enclosure Ratings

Model Number	Selected Regulation* and Horsepower Rating	Input Voltage (+/– 10%)	NEMA Rating	Input KVA	Input Amps	Output Amps at 8 kHz	Power Loss Watts (Full Load)
1V4150 1V4250	V/Hz or Vector (1 HP)	380–460 VAC	1 4X/12	2.0	2.5	2.1	60
2V4150 2V4250	V/Hz or Vector (2 HP)	380–460 VAC	1 4X/12	3.3	4.2	3.4	100
3V4150 3V4250	V/Hz or Vector (3 HP)	380–460 VAC	1 4X/12	5.1	6.4	5.3	140
5V4150 5V4250	V/Hz or Vector (5 HP)	380–460 VAC	1 4X/12	7.9	9.9	8.2	180
7V4150 7V4250	V/Hz or Vector (7.5 HP)	380–460 VAC	1 12	10.7	13.4	11.1	210
10V4150 10V4250	V/Hz or Vector (10 HP)	380–460 VAC	1 12	13.4	16.8	14.2	250
15V4150 15V4250	V/Hz or Vector (15 HP)	380–460 VAC	1 12	20.2	25.4	21.0	375
20V4150 20V4250	V/Hz or Vector (20 HP)	380–460 VAC	1 12	26.1	32.7	27.0	600
25G4150 25G4250	V/Hz (25 HP)	380–460 VAC	1 12	29.5	37.0	30.4	600
25V4150 25V4250	V/Hz or Vector (25 HP)	380–460 VAC	1 12	30.2	38.0	34.5	750
30V4150 30V4250	V/Hz or Vector (30 HP)	380–460 VAC	1 12	35.0	44.0	39.0	800
40V4150 40V4250	V/Hz or Vector (40 HP)	380–460 VAC	1 12	46.2	58.0	54.0	960
50V4150 50V4250	V/Hz or Vector (50 HP)	380–460 VAC	1 12	57.3	72.0	67.0	1200
50R4150	Vector (50 HP) V/Hz (75 HP)	380–460 VAC	1	65.0 81.0	81.0 102	70.0** 90.0**	1420
60G4150 60G4250	V/Hz (60 HP)	380–460 VAC	1 12	71.7	90.0	78.0	1200
75R4150	Vector (60–75 HP) V/Hz (100 HP)	380–460 VAC	1	80.0 100	101 126	89.0** 116**	1400 1780
125R4150	Vector (100–125 HP) V/Hz (125–150 HP)	380–460 VAC	1	127 170	159 213	152** 210**	2410 3200

*With V/Hz regulation, 110% continuous output current capability. With vector regulation, 150% output current capability for one minute.

**At 2 kHz. For 4 kHz operation, derate by 20%. For 8 kHz operation, derate by 40%.

2.2 NEMA Enclosures

Each of the GV3000 Power Modules have one of following NEMA ratings:

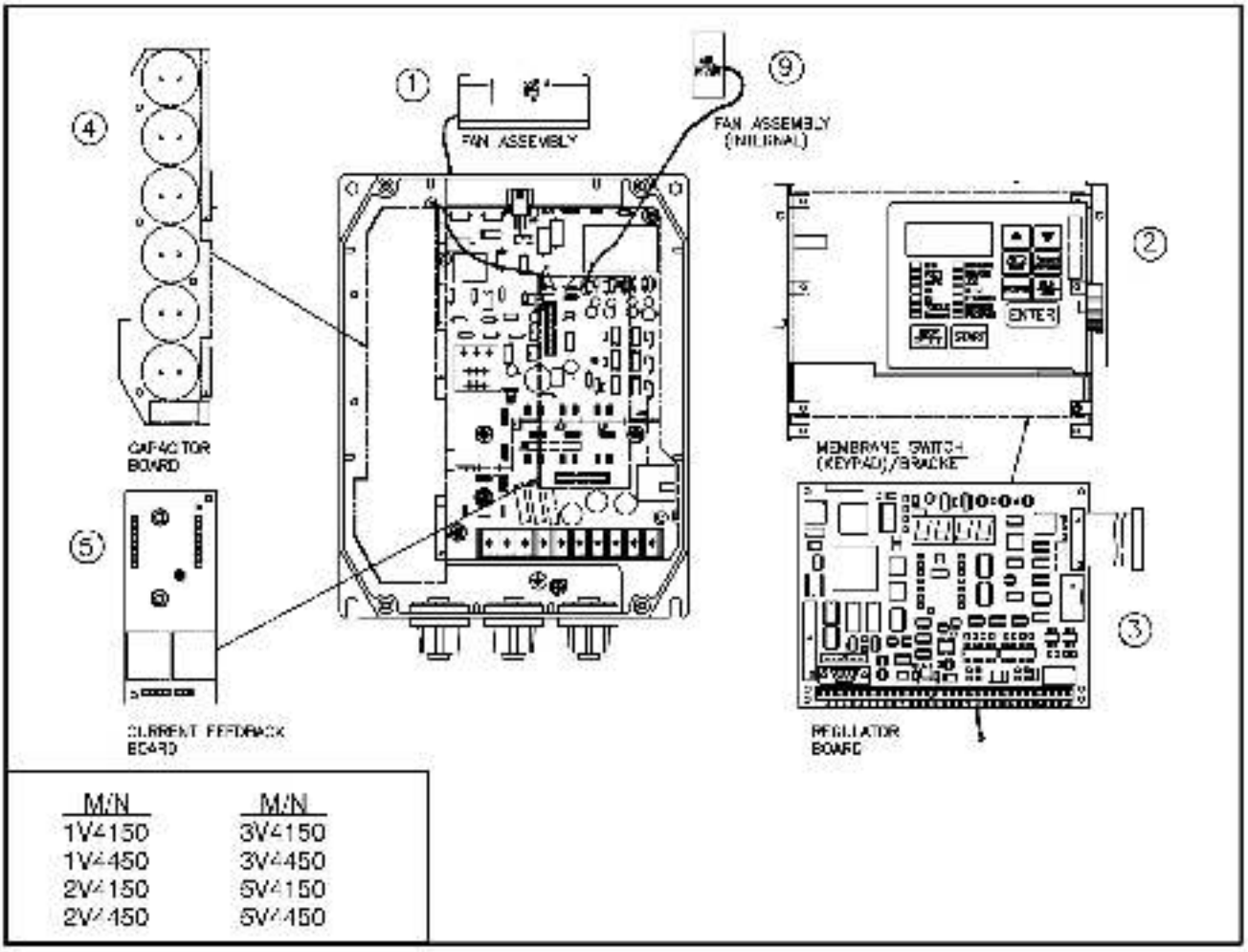
- NEMA 1: Vented. Contains a communication access door that allows access to the communication port without removing the cover. Intended for general-purpose indoor applications.
- NEMA 4X/12: Not vented. Supplied with base and keypad gaskets. Intended for use in indoor environments that require a water-tight/dust-tight enclosure. An enclosure with this NEMA rating encompasses both ratings (4X and 12).
- NEMA 12: Intended for use in indoor environments that require a dust-tight/drip-tight enclosure.

See table 2.1 for a listing of the Power Modules and their individual NEMA ratings.

2.3 1-25 HP GV3000 Drive Components and Locations

The 1-25 HP GV3000 drives have the following main components. The identification numbers provided correspond to the numbers used in figures 2.2 to 2.4. Replacement parts are listed in chapter 9.

1. Fan/Fan Assembly
2. Membrane Switch (Keypad/Bracket)
3. Regulator Printed Circuit Board (PCB)
4. Capacitor PCB/Input Capacitors
5. Current Feedback PCB
6. Power PCB (15-25 HP drives only)
7. Power Supply PCB (15-25 HP drives only)
8. Gate Driver PCB (15-25 HP drives only)
9. Internal Fan Assembly
10. IGBT Module
11. Diode Bridge
12. Fan Wire Harness



M/N	M/N
1V4150	3V4150
1V4450	3V4450
2V4150	5V4150
2V4450	5V4450

Figure 2.2 - 1-5 HP Drive Components and Locations

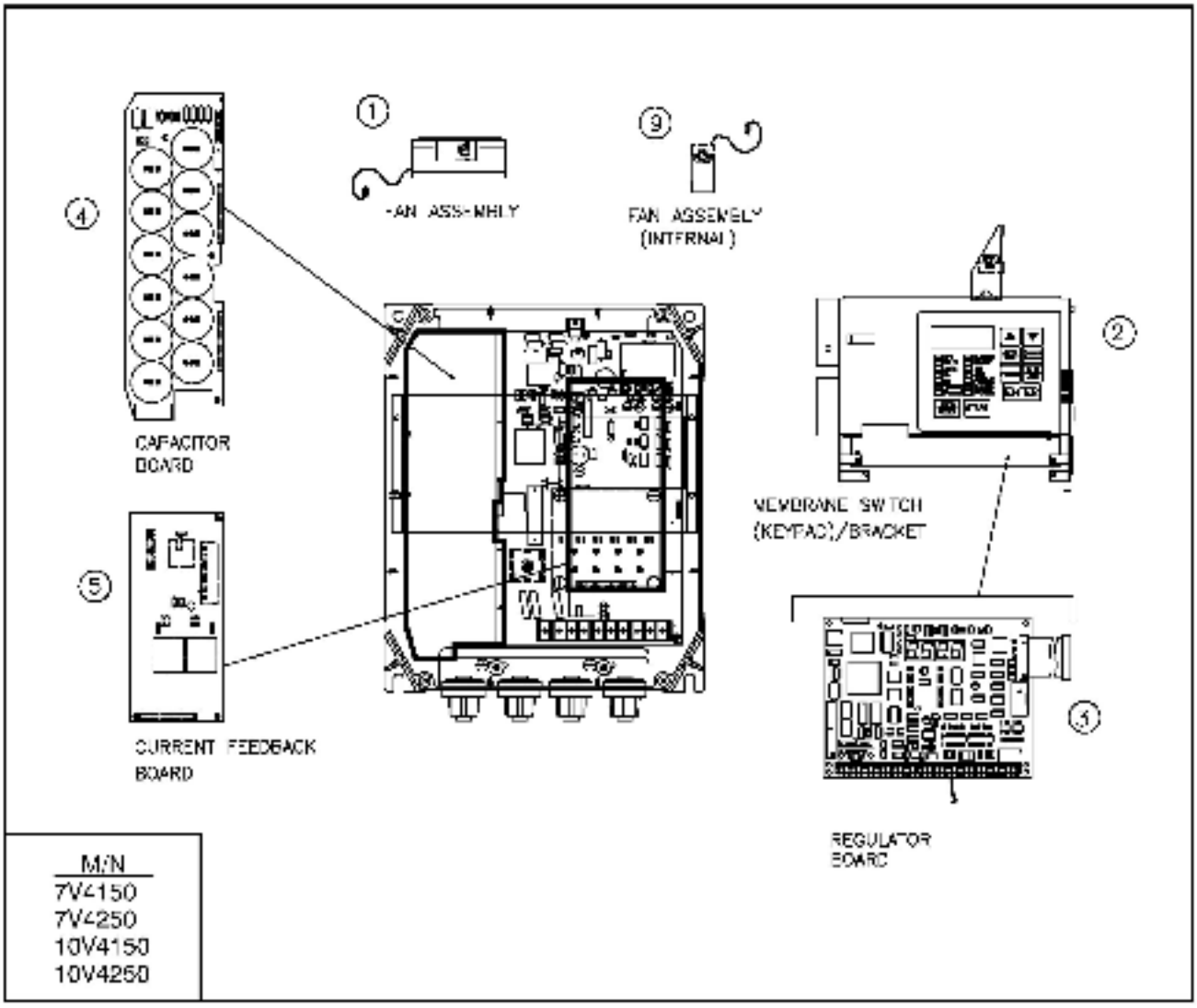


Figure 2.3 - 7.5-10 HP Drive Components and Locations

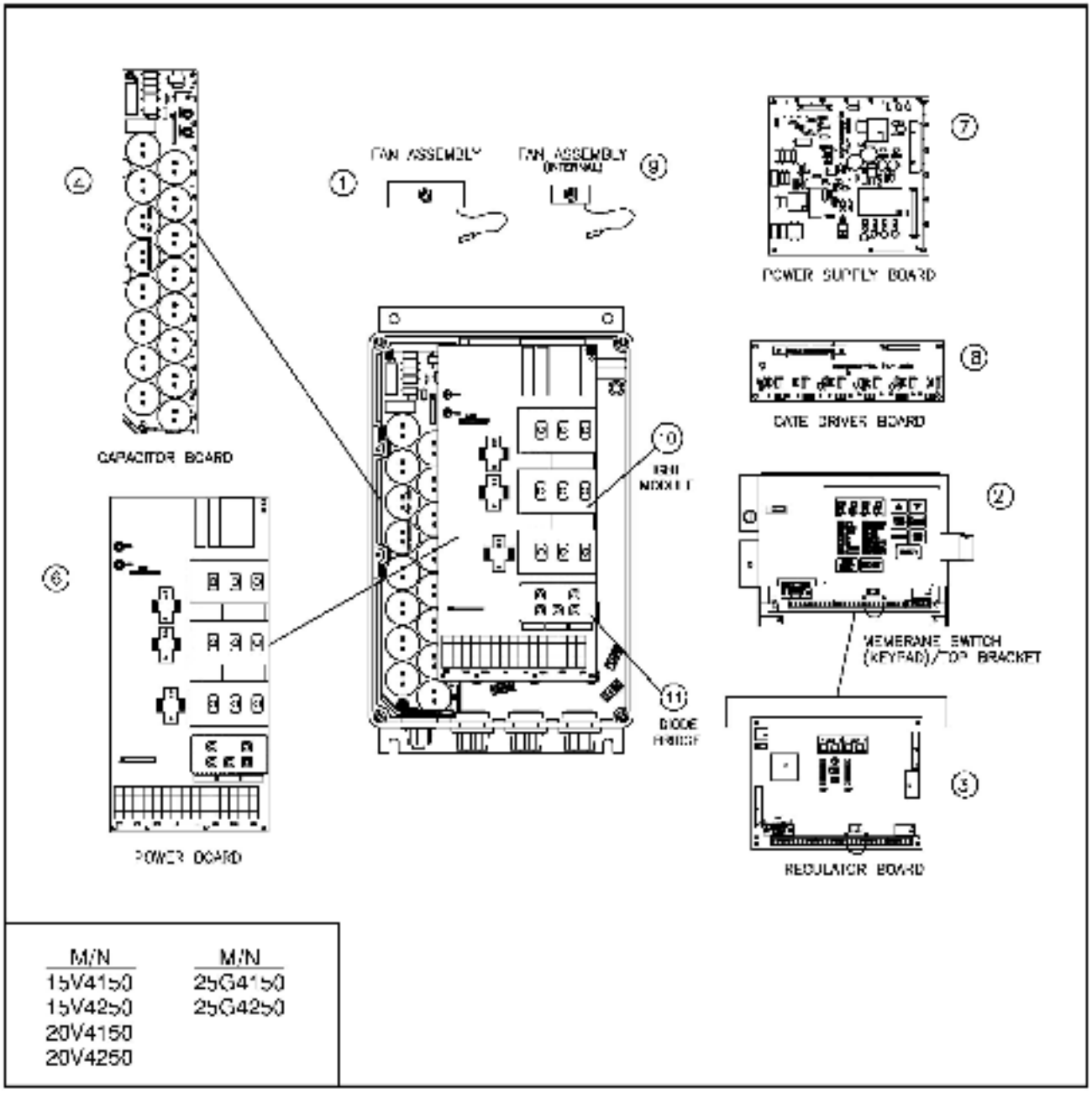
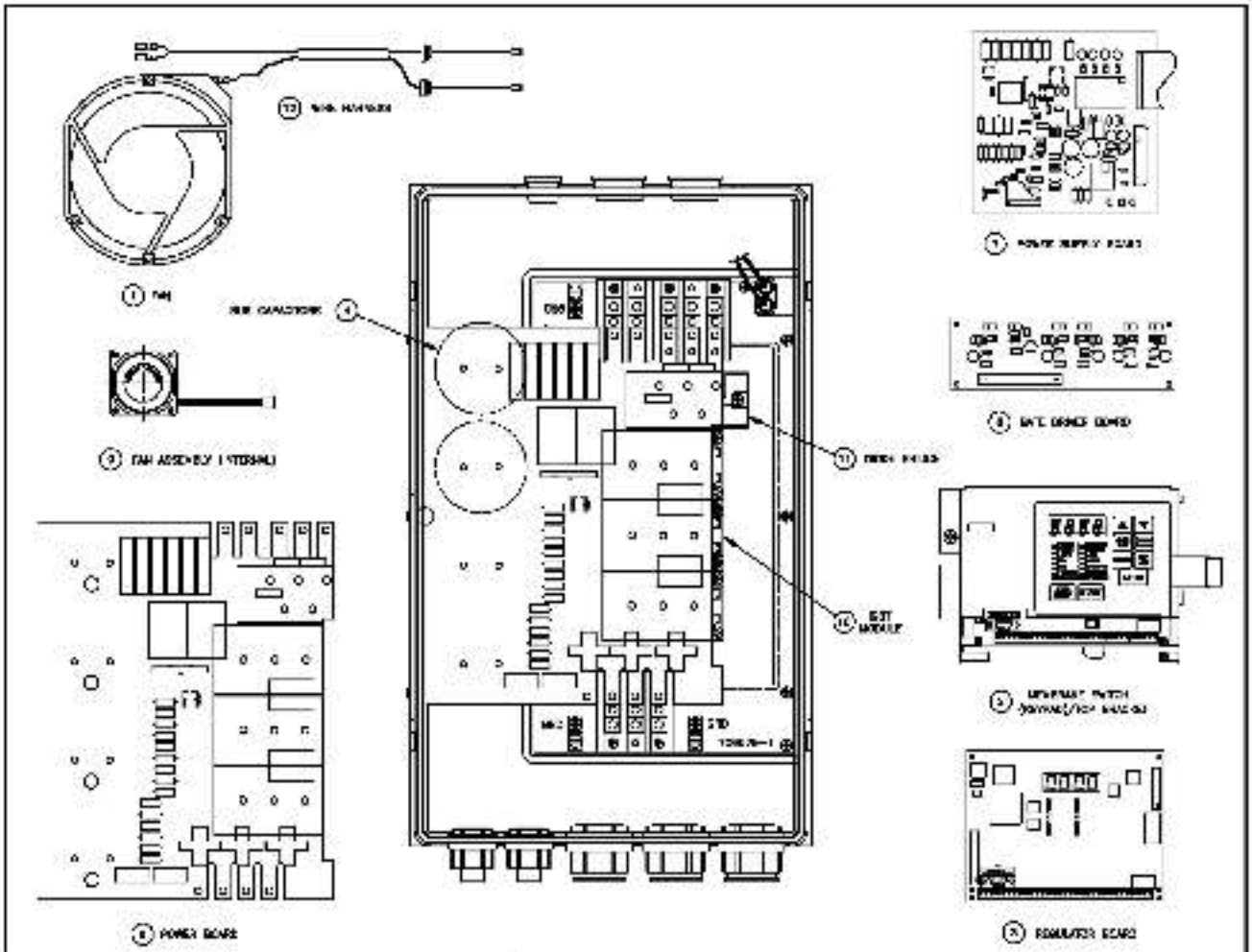


Figure 2.4 - 15-25 HP Drive Components and Locations

2.4 25-60 HP GV3000 Drive Components and Locations

The 25-60 HP drives have the following main components. The identification numbers provided correspond to the numbers used in figure 2.5. Replacement parts are listed in chapter 9.

1. Fan
2. Membrane Switch (Keypad/Bracket)
3. Regulator Board
4. Bus Capacitors
5. Not Used
6. Power Board
7. Power Supply Board
8. Gate Driver Board
9. Internal Fan Assembly
10. IGBT Module
11. Diode Bridge
12. Wire Harness



M/N	M/N	M/N
25V4150	40V4150	60G4150
25V4250	40V4250	60G4250
30V4150	50V4150	
30V4250	50V4250	

Figure 2.5 - 25-60 HP Drive Components and Locations

2.5 60-100 HP GV3000 Drive Components and Locations

The 60-100 HP drives have the following main components. The identification numbers provided correspond to the numbers used in figure 2.6. Replacement parts are listed in chapter 9.

1. Regulator Printed Circuit Board (PCB)
2. Power Module Interface PCB
3. Gate Driver PCB
4. Bus Clamp PCB - Right
5. Bus Clamp PCB - Left
6. Intelligent Power Module PCB
7. Diode Bridge
8. D-C Bus Fuse
9. Precharge Contactor
10. Current Transformer
11. Ground Fault Transformer
12. Output Reactor
13. Precharge Resistor
14. Bus Discharge Resistor
15. 24 VDC Fan
16. Keypad

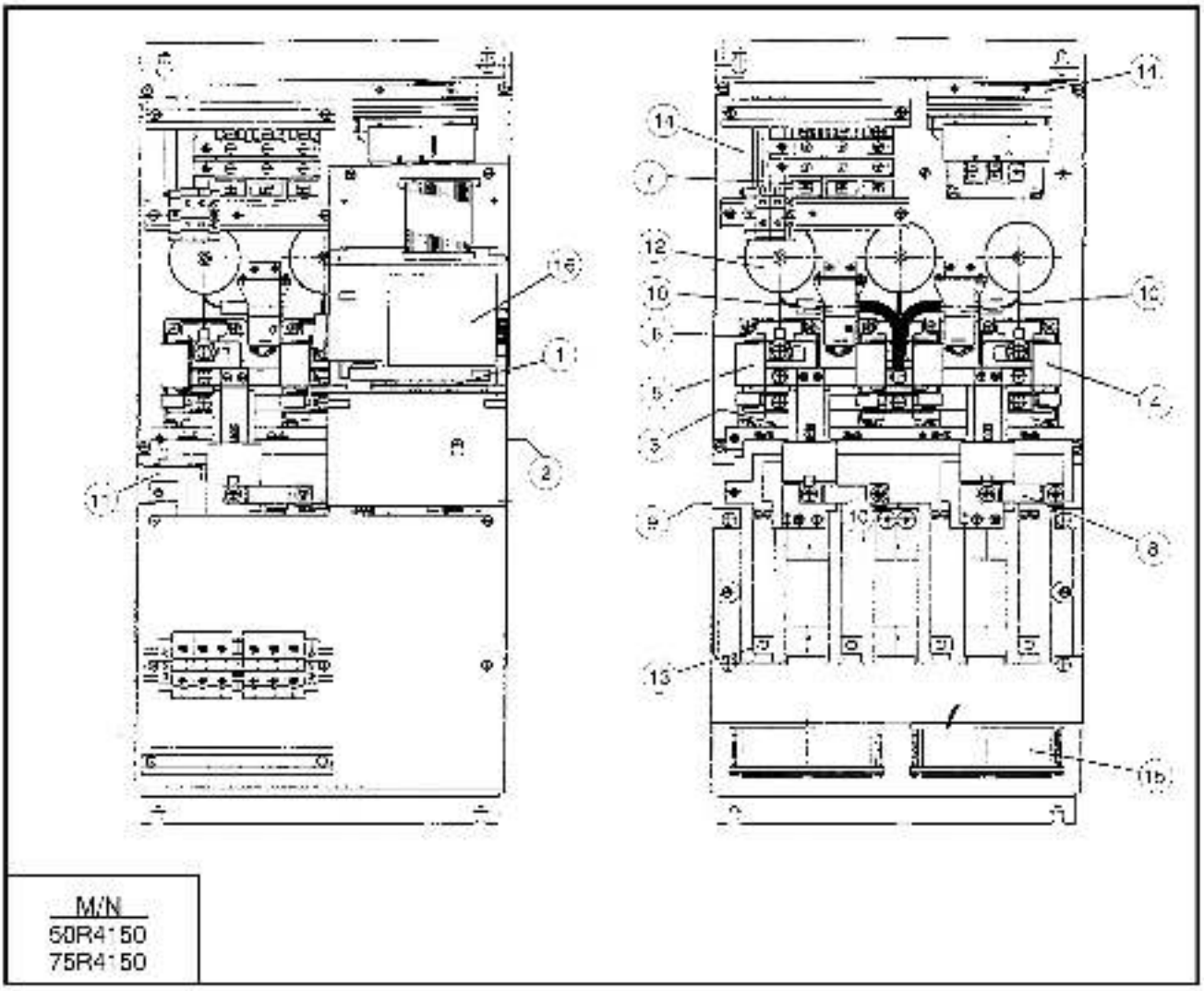


Figure 2.6 - 60-100 HP Drive Components and Locations

2.6 100-150 HP GV3000 Drive Components and Locations

The 100-150 HP drive has the following main components. The identification numbers provided correspond to the numbers used in figure 2.7. Replacement parts are listed in chapter 9.

1. Regulator Printed Circuit Board (PCB)
2. Power Module Interface PCB
3. Gate Driver PCB
4. Bus Clamp PCB - Right
5. Bus Clamp PCB - Left
6. Intelligent Power Module PCB
7. Thyristor Precharge Module
8. D-C Bus Fuse
9. Not Used
10. Current Transformer
11. Ground Fault Transformer
12. Output Reactor
13. Not Used
14. Bus Discharge Resistor
15. 24 VDC Fan
16. Keypad
17. Thyristor Firing Pulse PCB

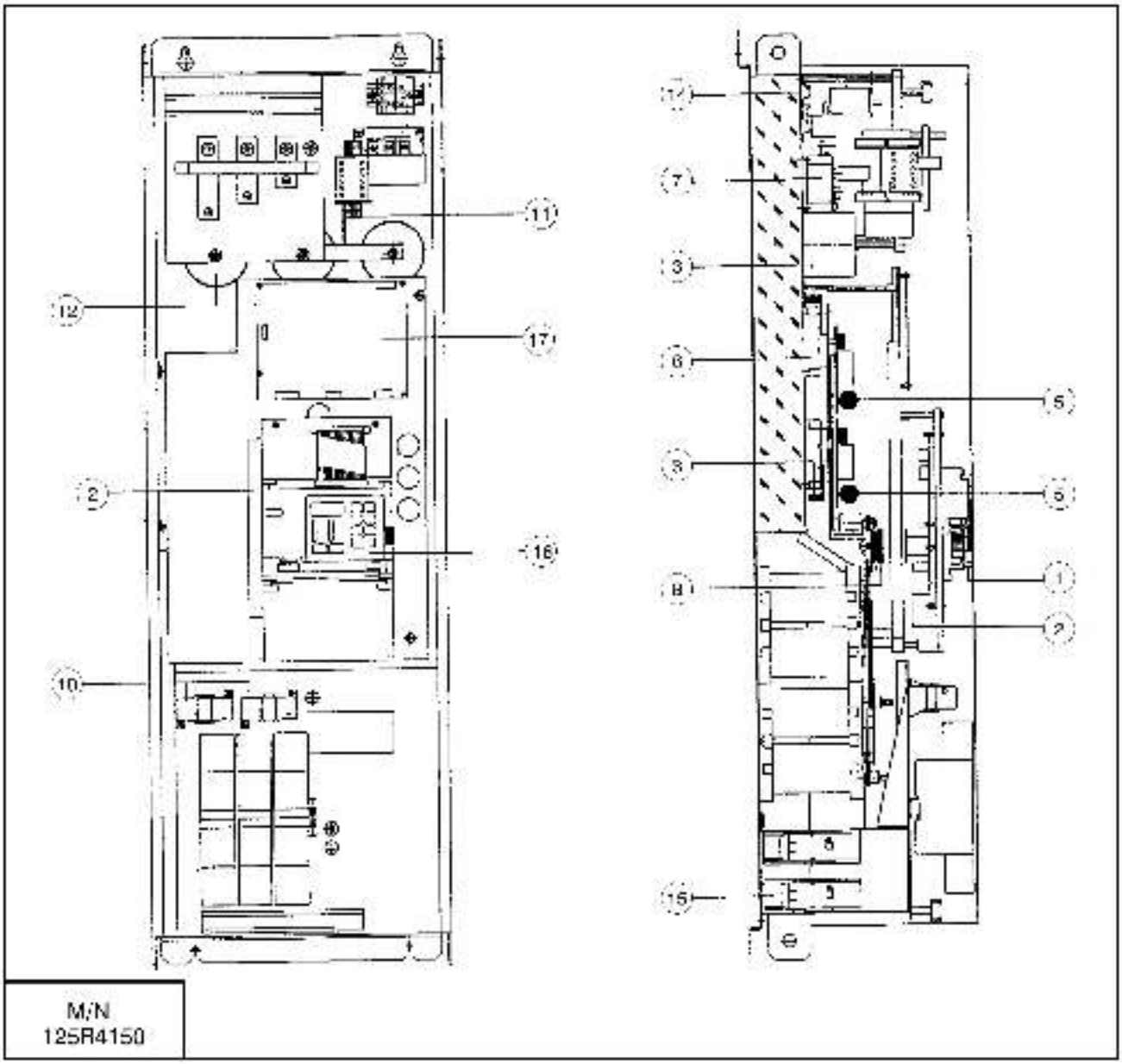


Figure 2.7 - 100-150 HP Drive Components and Locations

2.7 Regulator Board Description

GV3000 drive regulation is performed by a microprocessor on the Regulator board. See figures 2.8 and 2.9. Drive operation is adjusted by the parameters entered through the keypad. The Regulator board accepts power circuit feedback signals, an external speed reference signal, and internal heat sensor feedback, as well as data from a pulse tachometer that is attached to the motor when set up for vector regulation. The Regulator board provides:

- PWM gating signals to the IGBT power devices

  Based on the output of the control loop, the regulator sends PWM gating signals through the Current Feedback board to isolated drivers on the Gate Driver board. These drivers switch the Insulated Gate Bi-polar Transistors (IGBTs), producing a Pulse Width Modulated (PWM) waveform that corresponds to the speed (vector regulation) or frequency (volts/hertz regulation) reference. The IGBTs can be switched at either a 2, 4 or 8 kHz carrier frequency.

- Form A and B contacts for drive status indicators

  The Form A and B contacts are under control of the user via programmable parameters. A Form A or B transition can indicate drive status. The contacts are rated for 5 Amps resistive load at 250 VAC/ 30 VDC and are made available through the terminal strip.

- Display data for a four-character display and fourteen indicator LEDs

  The four-character display is used to indicate drive parameters, parameter values, and fault codes. The fourteen single LEDs indicate drive status and mode, as well as identifying drive outputs whose values are displayed on the four-character display.

- An analog output

  The analog output is a scaled voltage (0-10 VDC) or current (4-20 mA) signal proportional to either motor speed (RPM) or motor torque or current (%TORQUE). The current selection (via jumper J17) requires a power supply for operation. The power can be sourced from the pulse tachometer terminals (4 and 9) or from an external 15V power supply. See table 7.1, terminals 10 and 11, for more information. The analog output signal is available through the terminal strip.

- A snubber resistor braking signal

  The 1-60 HP regulator provides a signal for use by an optional snubber resistor braking kit. The signal goes through an isolating driver, made available through the terminal strip.

Two Regulator boards are used on the GV3000 drives: 1-60 HP Regulator boards are used with 1-60 HP drives; 60-150 HP Regulator boards are used with 60-150 HP drives. As shown in figures 2.8 and 2.9, the Regulator boards are similar but have different Power Module interface connectors.

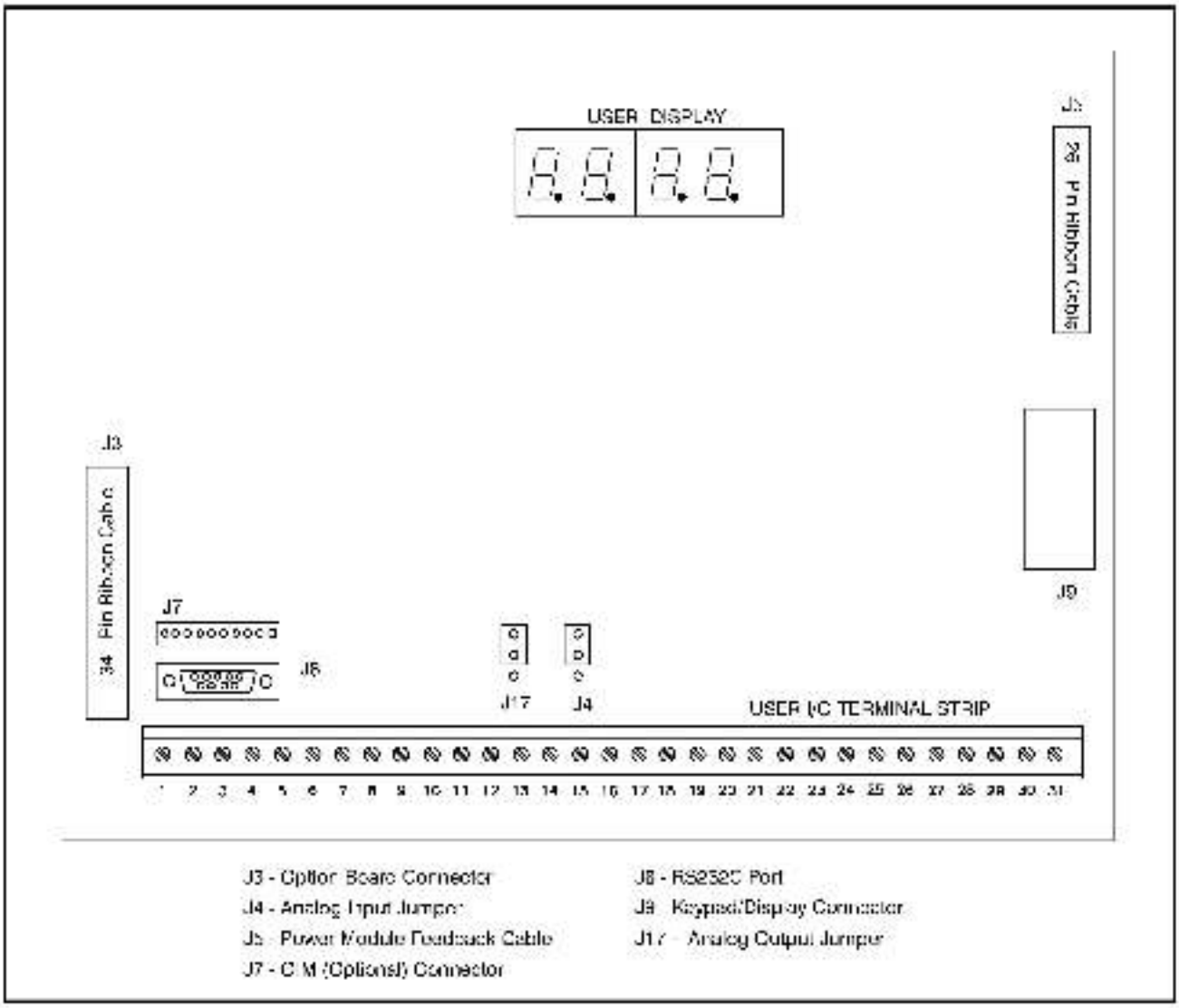


Figure 2.8 - 1-60 HP Regulator Board Components and Locations

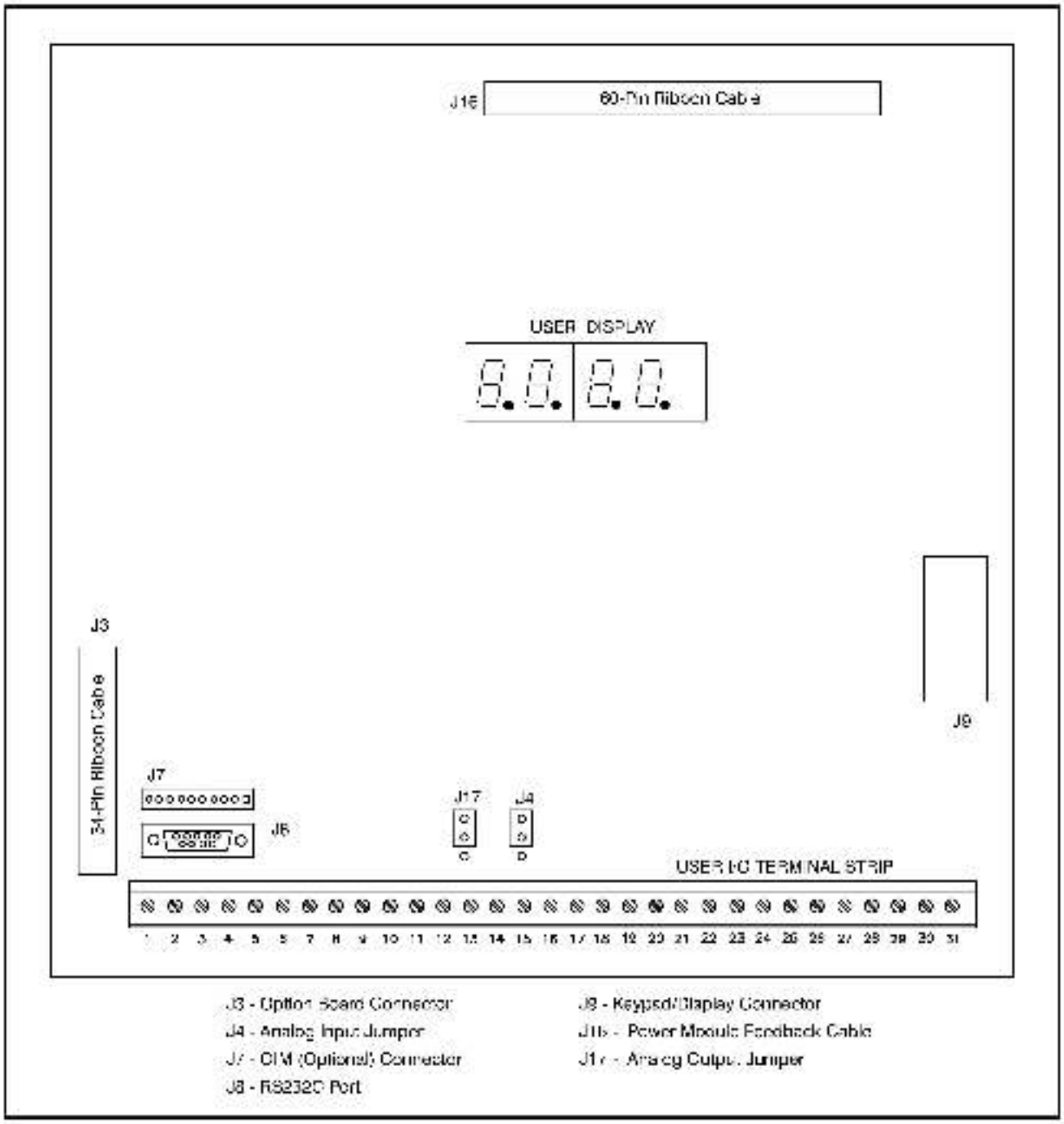


Figure 2.9 - 60-150 HP Regulator Board Components and Locations

2.7.1 Jumper Locations and Settings

Jumpers J4 and J17 on the Regulator board are factory-set for voltage in and voltage out signals. Refer to figures 2.8 and 2.9 for their locations on the Regulator boards. If you need to change the jumpers' settings, use the following procedures.

CAUTION: Do not alter the setting of any jumper not described in this instruction manual. Failure to observe this precaution could result in damage to or destruction of the equipment.

2.7.1.1 Analog Input Speed Reference Jumper

Jumper J4 is the analog speed/torque (U.000) reference jumper. This jumper selects either +/– 10 VDC or 0-20 mA input. Parameters P.009, P.010, and P.011 are used in conjunction with the jumper. Note that if the position of jumper J4 is changed after the parameters are programmed, the software will not recognize that the input reference or polarity has been changed. Be sure to verify that parameters P.009, P.010, and P.011 are correct before starting the drive. Refer to instruction manual D2-3339 for more information.

Use the following procedure to set jumper J4:

DANGER

D-C BUS CAPACITORS RETAIN HAZARDOUS VOLTAGES AFTER INPUT POWER HAS BEEN DISCONNECTED. AFTER DISCONNECTING INPUT POWER, WAIT FIVE (5) MINUTES FOR THE D-C BUS CAPACITORS TO DISCHARGE AND THEN CHECK THE VOLTAGE WITH A VOLTMETER TO ENSURE THE D-C BUS CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 1. Turn off input power to the drive and wait five minutes.

Step 2. Remove the cover from the drive by unscrewing the four attaching screws.

Step 3. Verify that the D-C bus voltage is zero by following the procedure in section 9.3.

Step 4. Locate jumper J4 on the Regulator board. Refer to figures 2.8 and 2.9.

Step 5. Locate pin 1 on jumper J4. Move the jumper to the desired setting as shown in figure 2.10.

Step 6. Re-attach the cover.

Step 7. Re-apply input power.

Step 8. Verify that Terminal Strip Analog Input Offset (P.009), Terminal Strip Analog Input Gain (P.010), and Terminal Strip Analog Input Invert (P.011) are correctly set. Refer to instruction manual D2-3339 for more information.

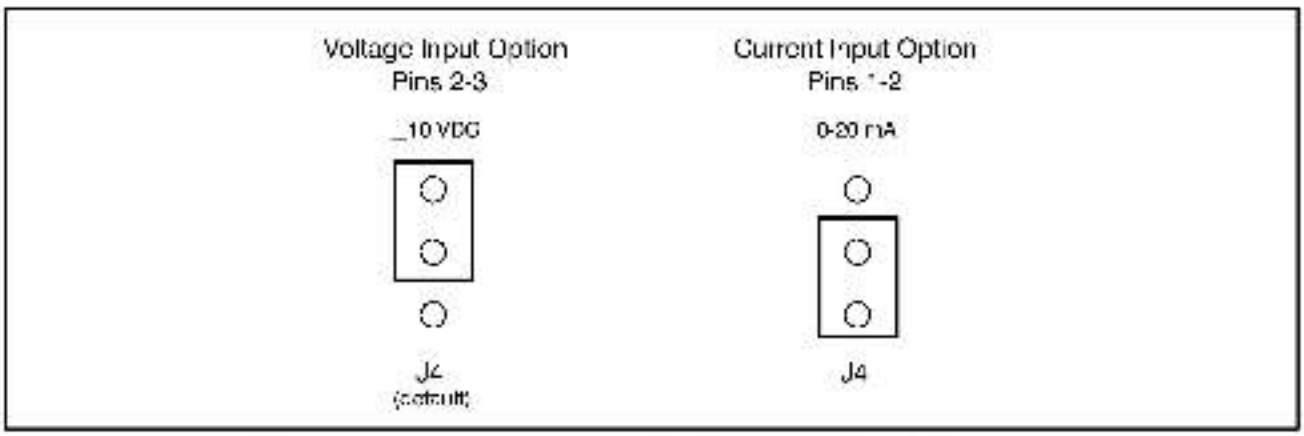


Figure 2.10 - Jumper J4 Settings for Analog Input Speed Reference

2.7.1.2 Analog Output Jumper

Jumper J17 is the analog output jumper. This jumper selects either a 0-10 VDC or 4-20 mA scaled signal output that is programmable for either speed or torque, parameter P012. The jumper only selects a 0-10 VDC source voltage or 4-20 mA sink current to represent speed or torque. Note that the 4-20 mA current selection requires a power supply for operation as shown in table 7.1, terminals 10 and 11.

Use the following procedure to set jumper J17:

DANGER

D-C BUS CAPACITORS RETAIN HAZARDOUS VOLTAGES AFTER INPUT POWER HAS BEEN DISCONNECTED. AFTER DISCONNECTING INPUT POWER, WAIT FIVE (5) MINUTES FOR THE D-C BUS CAPACITORS TO DISCHARGE AND THEN CHECK THE VOLTAGE WITH A VOLTMETER TO ENSURE THE D-C BUS CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 1. Turn off input power to the drive and wait five minutes.

Step 2. Remove the cover from the drive by unscrewing the four attaching screws.

Step 3. Verify that the D-C bus voltage is zero by following the procedure in section 9.3.

Step 4. Locate jumper J17 on the Regulator board. Refer to figures 2.8 and 2.9.

Step 5. Locate pin 1 on jumper J17. Move the jumper to the desired setting as shown in figure 2.11.

Step 6. Re-attach the cover.

Step 7. Re-apply input power.

Step 8. Verify that parameter P012 is set correctly for either speed or current.

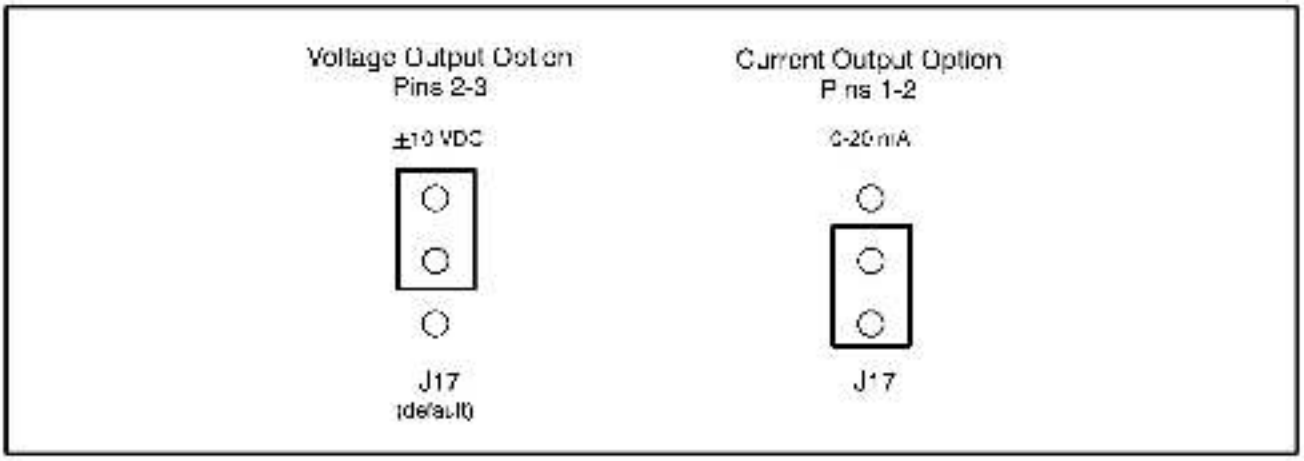


Figure 2.11 - Jumper J17 Settings for Analog Outputs

2.7.2 Wiring the Terminal Strip

The terminal strip on the Regulator board provides terminals for connecting customer I/O devices. See figures 2.8, 2.9, and 2.12. The following terminals are provided:

- Terminals 1-3: RS-232 connections
- Terminals 4-9: pulse tachometer connections
- Terminals 10-11: analog output connections
- Terminals 12-15: analog speed/torque reference connections
- Terminals 16-25: 24V D-C digital input connections (1-60 HP Regulator boards only)
- Terminals 26-27: snubber resistor braking control connections (1-60 HP Regulator boards only)
- Terminals 28-31: status relay connections

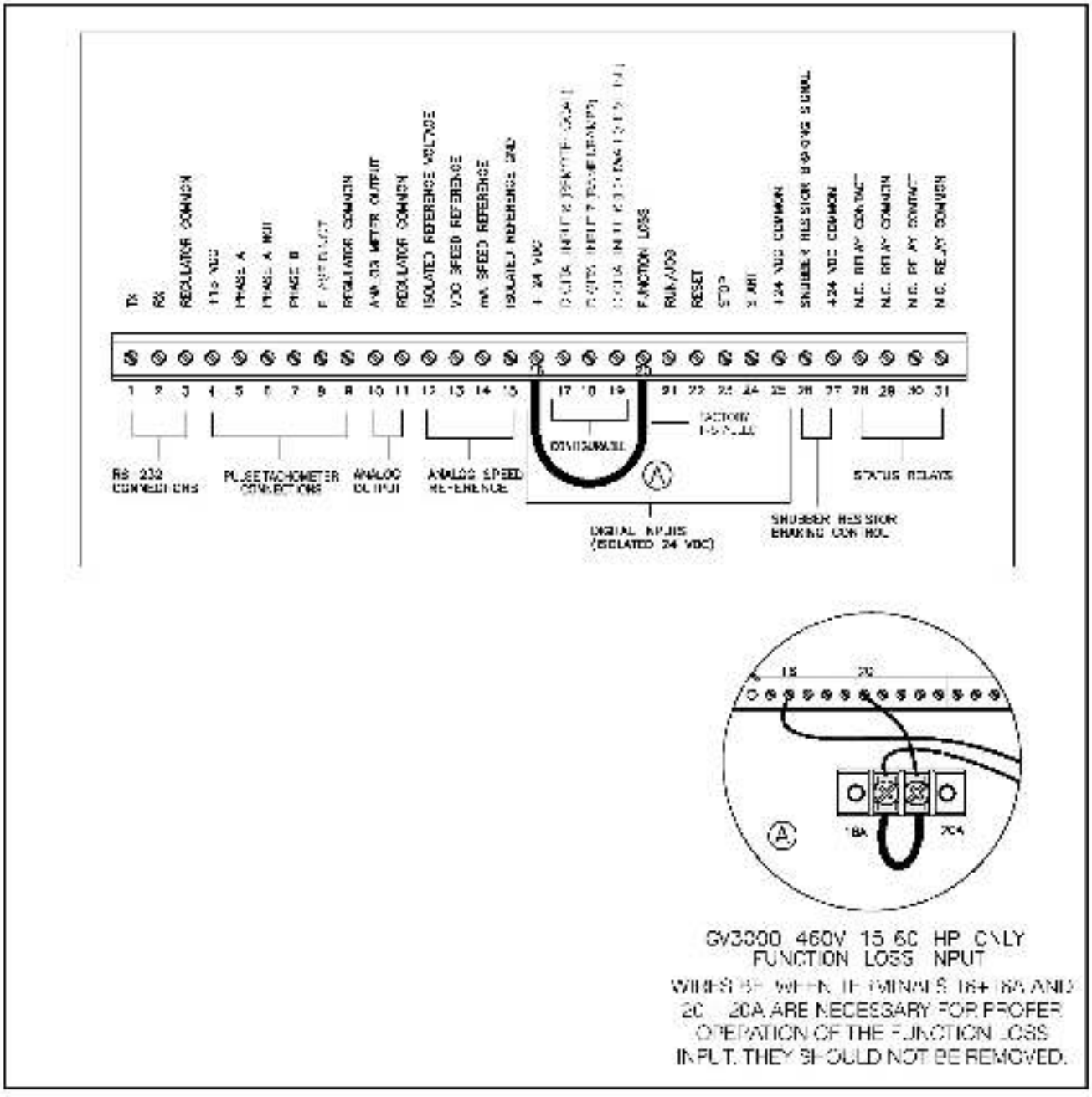


Figure 2.12 - Typical Terminal Strip Connections

2.7.3 RS-232 Communication Port

The Regulator board contains a 9-pin D-shell RS-232 communication port (J8). This port provides RS-232 communication between the GV3000 drive and a personal computer running the Control and Configuration (CS3000) software. See figures 2.8 and 2.9. Refer to instruction manual D2-3348, for more information.

2.7.4 Option Board Connector

The flat-ribbon cable connector (J3) on the left side of the Regulator board is a parallel bus connection port that provides a means of attaching optional boards such as the DeviceNet board, the RMI board, or the AutoMax Network Communication board to the GV3000 drive. See figures 2.8 and 2.9. The option board is mounted below the Regulator board inside the drive. Refer to the appropriate board instruction manual for more information. Refer to section 2.7 of this manual for more information on optional drive kits.

2.7.5 Operator Interface Module Connector

Flat-ribbon connector J7 provides a means of attaching the optional Operator Interface module (OIM). The OIM is available for use as a remote keypad for the GV3000.

2.7.6 Keypad/Display

The front panel keypad/display is used to program and operate the GV3000 drive. See figure 2.13. Refer to instruction manual D2-3339 for more information.

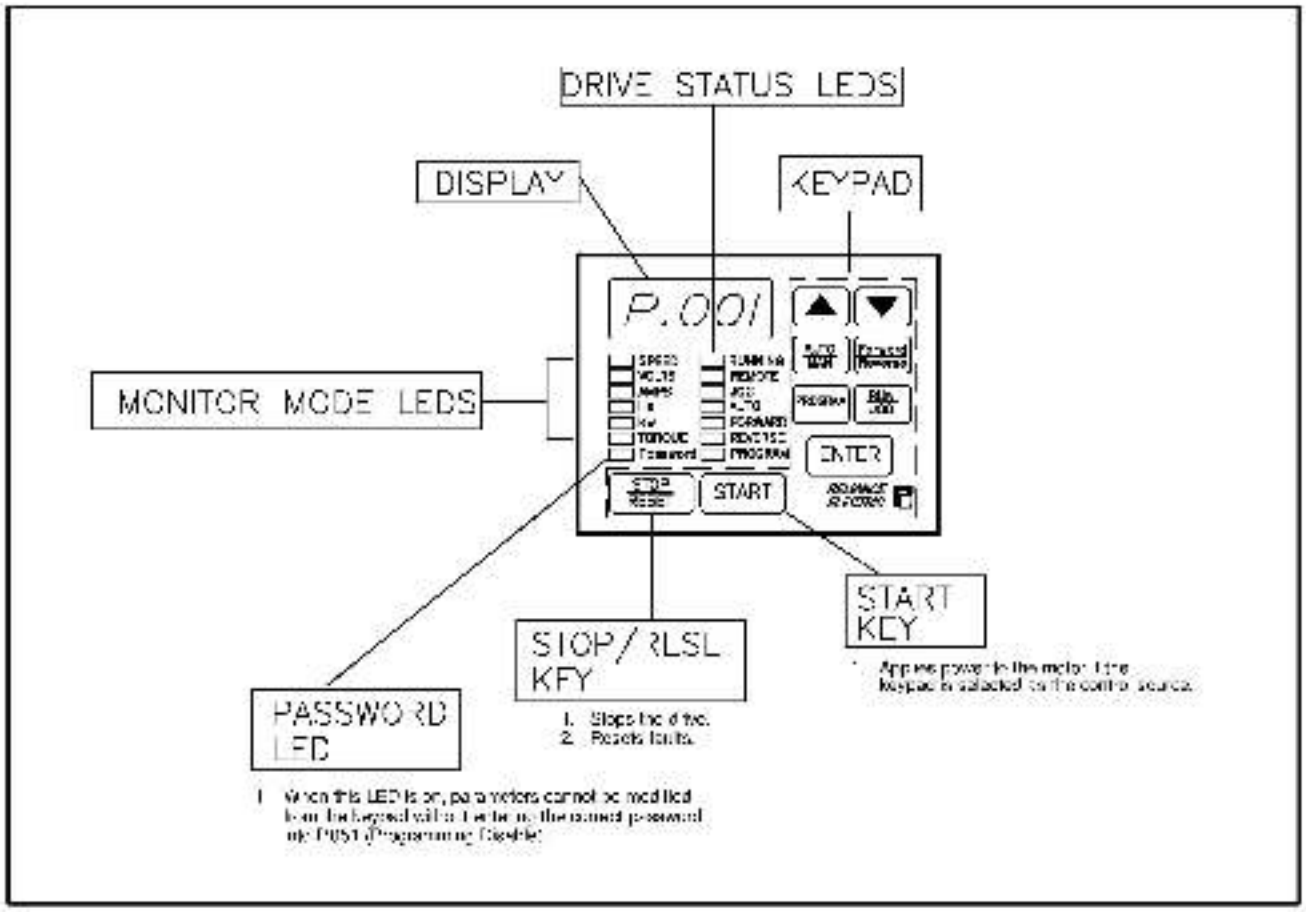


Figure 2.13 - Keypad/Display

2.8 Drive Kit Options

Table 2.2 provides a listing of the available GV3000 kit options.

Table 2.2 - Available Kits and Options

Kit Description	Option Kit Model Number	Instruction Manual
Snubber Resistor Braking	2SR40400[1] 2SR40600[2] 2SR41200[2] 2SR41800[3]	D2-3291
Low Energy Snubber Braking Resistor[1][2]	2DB4010 2DB4020	D2-3179
Snubber Transistor Only[1][2][3]	2ST40027	D2-3291
Line Regeneration Unit[1][2][3]	1RG42008 1RG42015 1RG42045	N/A
Motor Encoder Cable[1][2][3][4]	2TC3025[5] 2TC3075[5] 2TC4025[5] 2TC4075[5] 2TC4100[6] 2TC4300[6]	D2-3305
AutoMax Network Communication Board w/10 Foot of Cable[1][2][3][4]	2AX3000	D2-3308
Remote Meter Interface (RMI)	2SI3000	D2-3341
DeviceNet Board	2DV3000	HE-HGV3DN
Operator Interface Module (OIM)	2RK3000	D2-3342
Control and Configuration Software (CS3000)	2CS3000	D2-3348

(1) 1-5 HP GV3000 Drives

(2) 7.5-10 HP GV3000 Drives

(3) 15-60 HP GV3000 Drives

(4) 60-150 HP GV3000 Drives

(5) For use with Reliance NEMA Vector Inverter Duty Motors (tachometer connector and exposed wire pairs).

(6) For use with Reliance NEMA Vector Inverter Duty Motors (exposed wire pairs on both ends).

3.0 PLANNING BEFORE INSTALLING

This chapter provides information that must be considered when planning a GV3000 drive installation. Installation site requirements, drive requirements, and wiring requirements are presented.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD INSTALL, ADJUST, OPERATE, OR SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THIS MANUAL AND OTHER APPLICABLE MANUALS IN THEIR ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

DANGER

THE USER IS RESPONSIBLE FOR CONFORMING WITH ALL APPLICABLE LOCAL, NATIONAL, AND INTERNATIONAL CODES. WIRING PRACTICES, GROUNDING, DISCONNECTS, AND OVERCURRENT PROTECTION ARE OF PARTICULAR IMPORTANCE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

CAUTION: Use of power correction capacitors on the output of the drive can result in erratic operation of the motor, nuisance tripping, and/or permanent damage to the drive. Remove power correction capacitors before proceeding. Failure to observe this precaution could result in damage to or destruction of the equipment.

3.1 Requirements for the Installation Site

It is important to properly plan before installing a GV3000 drive to ensure that the drive's environment and operating conditions are satisfactory. Note that no devices are to be mounted behind the drive. This area must be kept clear of all control and power wiring. Read the following recommendations before continuing with drive installation.

3.1.1 Making Sure Environmental Conditions are Met

Before deciding on an installation site, consider the following guidelines:

Verify that NEMA 1 drives can be kept clean, cool, and dry.

The area chosen should allow the space required for proper air flow as defined in section 3.1.2.

Be sure that NEMA 1 drives are away from oil, coolants, or other airborne contaminants.

Do not install the drive above 1000 meters (3300 feet) without derating output power. For every 91.4 meters (300 feet) above 3300 feet, derate the output current 1%.

Verify that the drive location will meet the environmental conditions specified in table 3.1.

Table 3.1 - Ambient Conditions

Condition	Specification
Operating Temperature (Ambient)	0° to +40° C (32° to 104°F)
Storage Temperature (Ambient)	−40° to +65°C (−40° to +149°F)
Humidity	5 to 95% (non-condensing)

3.1.2 Determining Total Area Required Based on Drive Dimensions

Drive dimensions and weights are listed in table 3.2. Overall drive dimensions are illustrated in figure 3.1 as an aid in calculating the total area required by the GV3000 drives.

Table 3.2 - Drive Dimensions and Weights

GV3000 Drive	Dim. A	Dim. B	Dim. C	Dim D.	Dim. E	Weight
1V4150 1V4450 2V4150 2V4450 3V4150 3V4450 5V4150 5V4450	222.3 mm 8.75"	280.7 mm 11.05"	198.1 mm 7.80"	254.3 mm 10.01"	200.0 mm 7.87"	6.3 kg 14 lbs
7V4150 7V4250 10V4150 10V4250	280.6 mm 11.05"	338.4 mm 13.32"	248.0 mm 9.76"	309.1 mm 12.17"	200.0 mm 7.87"	9 kg 20 lbs
15V4150 15V4250 20V4150 20V4250 25G4150 25G4250	288.0 mm 11.34"	463.0 mm 18.23"	223.0 mm 8.78"	442.0 mm 17.40"	238.1 mm 9.37"	15.75 kg 35 lbs
25V4150 25V4250 30V4150 30V4250 40V4150 40V4250	376.0 mm 14.80"	605.0 mm 23.82"	308.0 mm 12.13"	565.2 mm 22.25"	350.0 mm 13.78"	23.6 kg 52 lbs
50V4150 50V4250 60G4150 60G4250	376.0 mm 14.80"	605.0 mm 23.82"	308.0 mm 12.13"	565.2 mm 22.25"	350.0 mm 13.78"	25.8 kg 57 lbs
50R4150 75R4150	421.0 mm 16.60"	880.0 mm 34.65"	360.0 mm 14.17"	850.0 mm 33.46"	322.0 mm 12.68"	70 kg 154 lbs
125R4150	765.0 mm 28.30"	1457 mm 57.36"	330.0 mm 12.99"	1414 mm 55.66"	355.0 mm 13.97"	96 kg 211 lbs

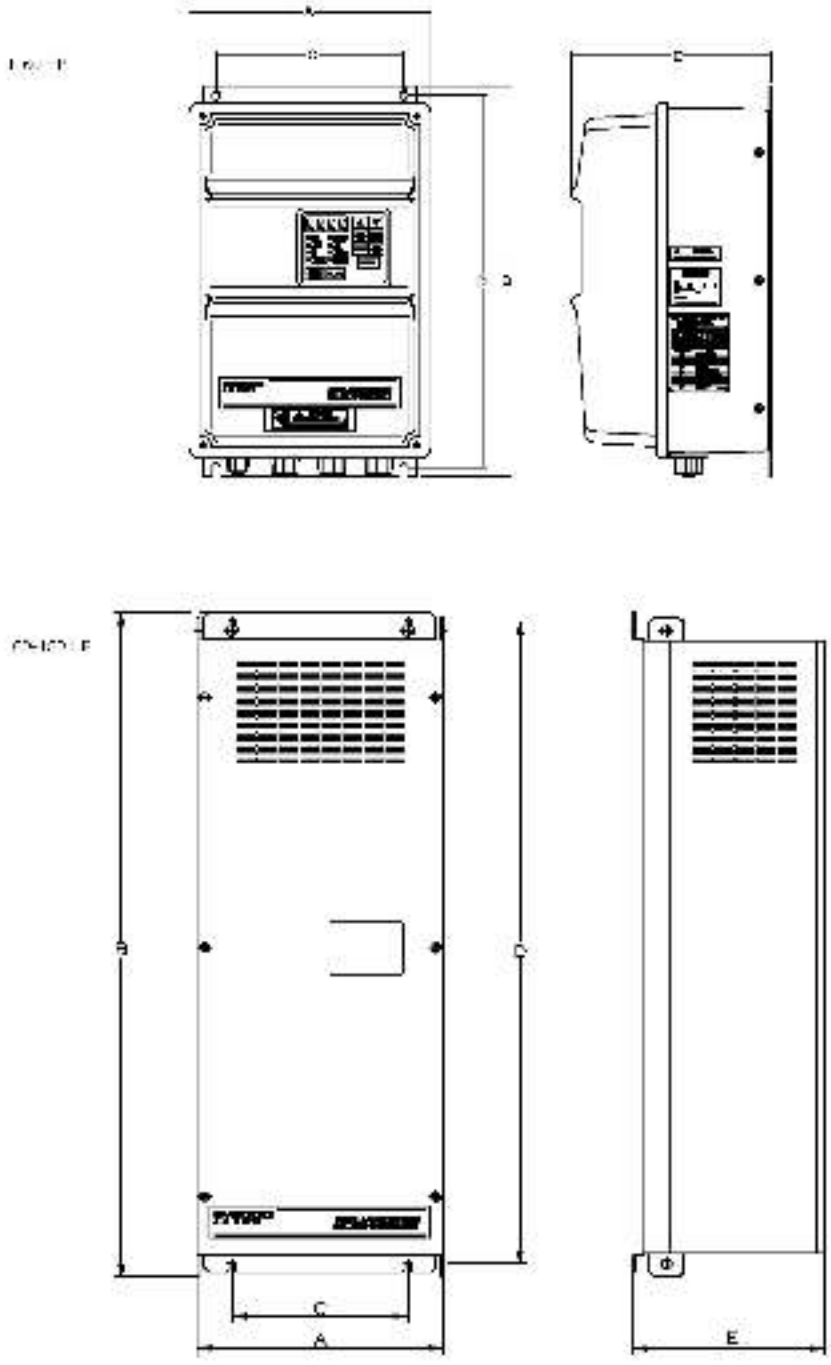


Figure 3.1 - Drive Dimensions

3.1.3 Verifying the Site Provides for Recommended Air Flow Clearances

Be sure there is adequate clearance for air ventilation around the drive. For best air movement, do not mount CV3000 drives directly above each other. Note that no devices are to be mounted behind the drive. This area must be kept clear of all control and power wiring. Refer to figure 3.2 for recommended air flow clearances.

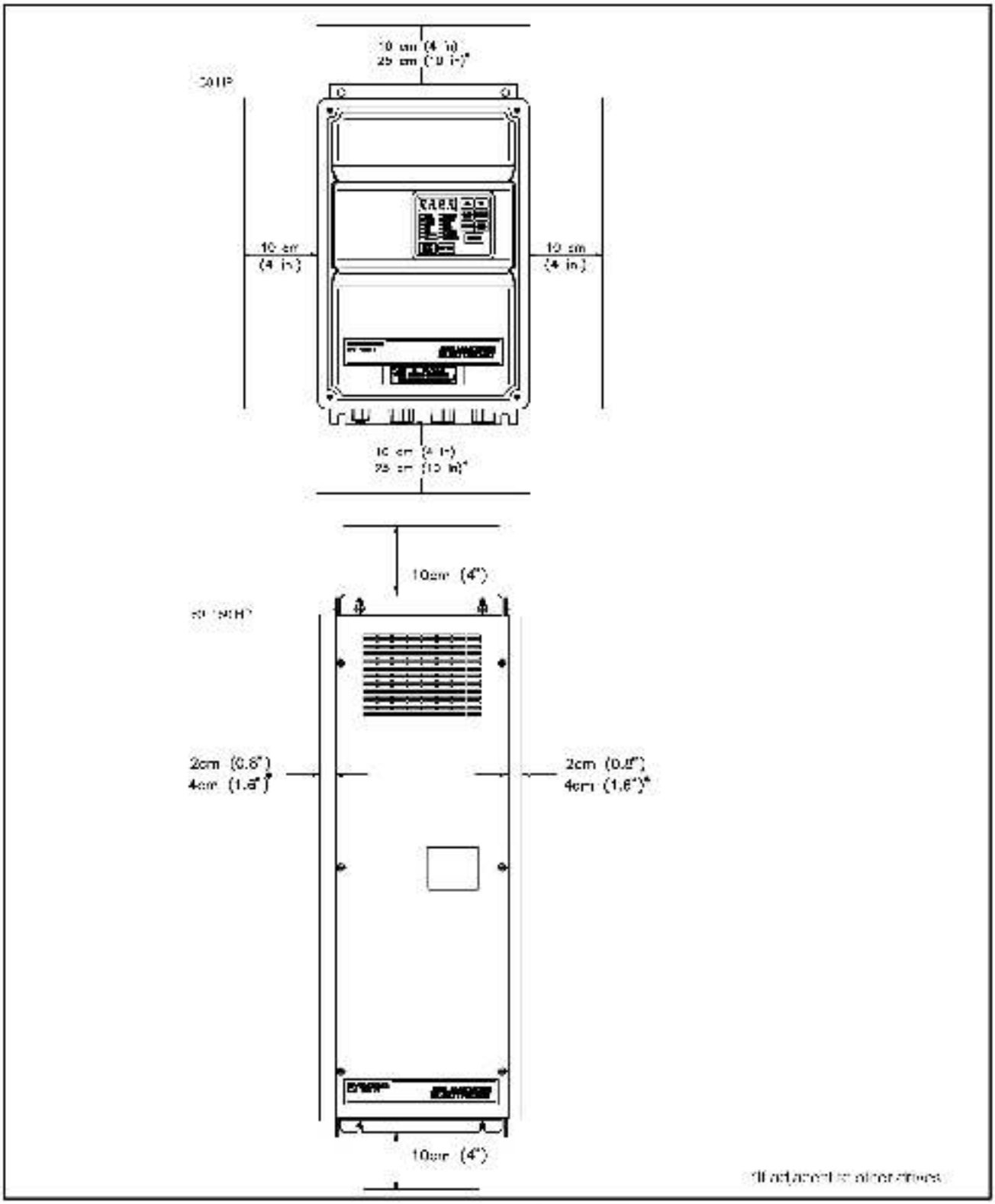


Figure 3.2 - Recommended Air Flow Clearances

3.1.4 Verifying Power Module Input Ratings Match Supplied Power

It is important to verify that plant power will meet the input power requirements of the GV3000 drive's Power Module circuitry. Refer to table 2.1 for input power rating specifications. Be sure input power to the drive corresponds to the drive nameplate voltage and frequency.

3.2 Wiring Requirements for the Drive

Certain drive requirements should be checked before continuing with the drive installation. Wire sizes, branch circuit protection, speed feedback (for vector regulation), and E-stop wiring (see chapter 7), are all areas that need to be evaluated.

3.2.1 Meeting Terminal Strip Input and Output Specifications

The terminal strip on the Regulator board provides terminals for 24 VDC power for the eight remote control inputs. Refer to tables A.3 and A.4 for control input and output specifications.

3.2.2 Determining Wire Size Requirements

Wire size should be determined based on the size of conduit openings, NEC/CEC regulations, and applicable local codes.

DANGER

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3.2.2.1 Conduit Entry Opening Sizes

It is important to accurately determine the size of the conduit openings so that the wire planned for a specific entry point will fit through the opening. Conduit opening sizes are shown in figures 4.1 through 4.6.

3.2.2.2 Recommended Power Wire Sizes

Input power wiring should be sized according to applicable codes to handle the drive's continuous-rated input current. Output wiring should be sized according to applicable codes to handle the drive's continuous-rated output current. See tables 3.3 through 3.7 for recommended power wire sizes.

Table 3.3 - Recommended Power Wire Sizes for 1-10 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)
A-C Input Power	R/L1, S/L2, T/L3	12 AWG, 3 (mm^2)
Output Power	U/T1, V/T2, W/T3	
D-C Input Power	+, –	

Table 3.4 - Recommended Power Wire Sizes for 15-25 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)
A-C Input Power	R/L1, S/L2, T/L3	6 AWG, 13 (mm^2)
Output Power	U/T1, V/T2, W/T3	
D-C Input Power	+, –	

Table 3.5 - Recommended Power Wire Sizes for 25-60 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)
A-C Input Power	R/L1, S/L2, T/L3	2/0 AWG (2X), 185 (mm^2)
Output Power	U/T1, V/T2, W/T3	
D-C Input Power	+, –	

Table 3.6 - Recommended Power Wire Sizes for 60-100 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)
A-C Input Power	1L1, 1L2, 1L3 2L1, 2L2	4/0 AWG, 95 (mm^2)
Output Power	U, V, W	
A-C Ground	PE	2 AWG, 35 (mm^2)
D-C Input Power	45, 47	4/0 AWG, 95 (mm^2)
D-C Ground	⏚	6 AWG, 16 (mm^2)

Table 3.7 - Recommended Power Wire Sizes for 100-150 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)
A-C Input Power	1L1, 1L2, 1L3 2L1, 2L2	2/0 AWG (2X), 185 (mm^2)
Output Power	U, V, W	
A-C Ground	PE	4/0 AWG, 95 (mm^2)
D-C Input Power	45, 47	2 AWG, 35 (mm^2)
D-C Ground	⏚	6 AWG, 16 (mm^2)

3.2.2.3 Recommended Control and Signal Wire Sizes

The recommended wire sizes to connect I/O signals to the terminal strip on the Regulator board are shown in table 3.8. Recommend terminal tightening torque is 0.5 Newton-meters (4.5 in-lbs).

Table 3.8 - Recommended Terminal Strip Wire Sizes

Terminals	Wire Size
1 to 31	20 to 14 AWG, 2 to 0.5 (mm^2)

3.2.2.4 Recommended Motor Lead Lengths

The following motor lead lengths are recommended to reduce line disturbances and noise. See figure 3.3.

For applications using one motor, motor lead length should not exceed 76 meters (250 feet).

For applications with multiple motors, total motor lead length should not exceed 76 meters (250 feet).

When total lead length exceeds 76 meters (250 feet), nuisance trips can occur. These trips are caused by capacitive current flow to ground. Note that these capacitively-coupled currents should be taken into consideration when working in areas where drives are running. If the motor lead length must exceed these limits, output line reactors or other steps must be taken to correct the problem. Note that drives set up for vector regulation can only be connected to one motor at a time.

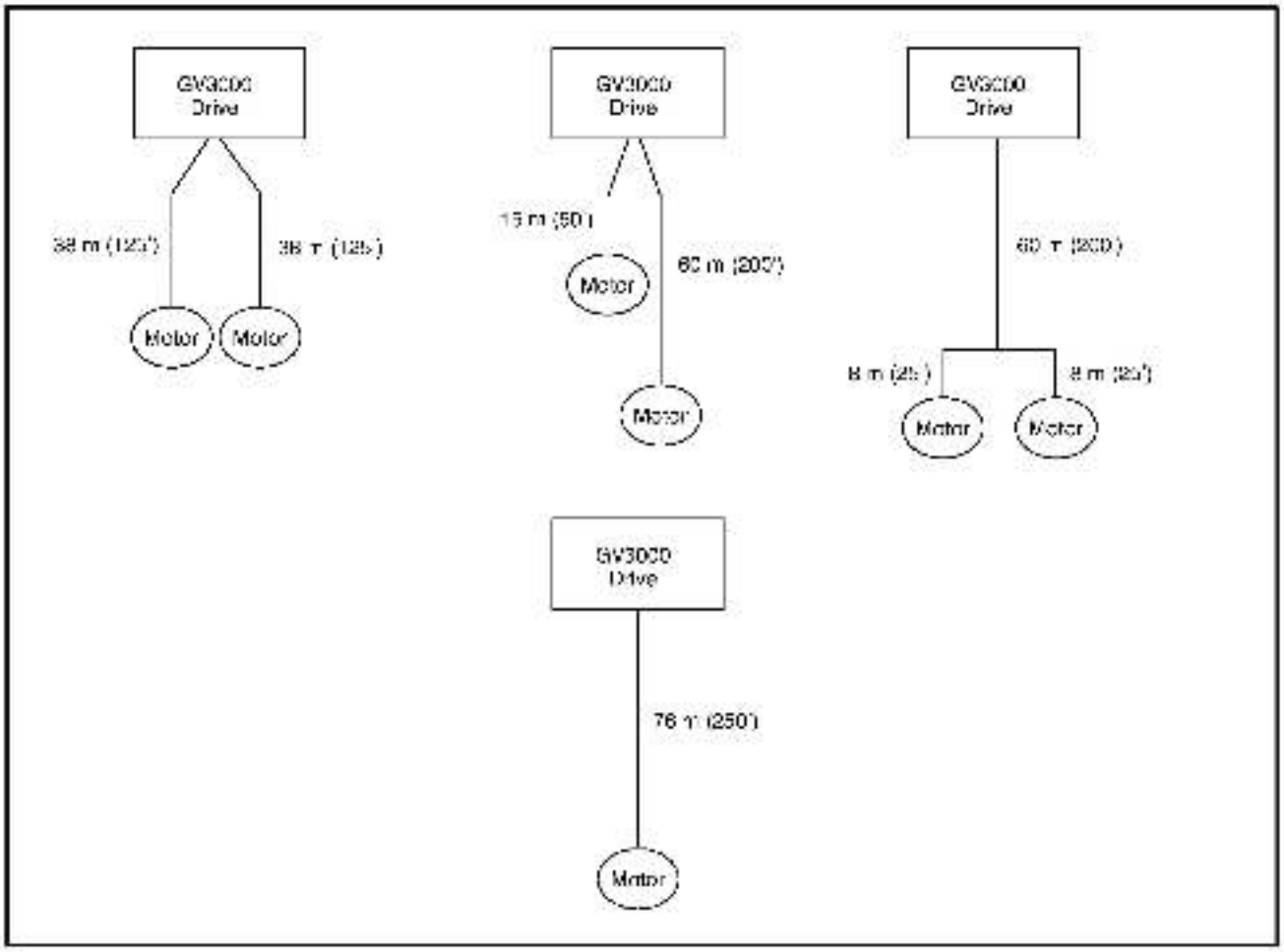


Figure 3.3 - Single and Multiple Motor Lead Lengths

3.2.2.5 Recommended Serial Communication Cable Lengths

Connector J8 on the Regulator boards is an RS-232 serial communication port. This connector allows the GV3000 drive to communicate with external devices such as a personal computer using RS-232 protocol. See table A.5. Two RS-232 cables are available from Reliance: a 3.5 meter (12 feet) D-shell 9-pin to 9-pin cable (M/N 615184-1A) and a 0.3 meter (1 foot) D-shell 9-pin to 25-pin adaptor cable (M/N 615184-2A). User-constructed cables can be up to 15 meters (50 feet) in length. Note that for communication between a GV3000 drive and a personal computer, the Control and Configuration software must also be used. Refer to instruction manual D2-3348 for more information.

The Regulator boards have one set of RS-232 transmit/receive lines. These lines can be accessed by only one device at a time: connector J8, the RS-232 terminals (1-3) on the terminal strip, or an Operator Interface module (OIM).

3.2.3 Selecting Input Line Branch Circuit Fuses

CAUTION: The NEC/CEC requires that upstream branch circuit protection be provided to protect input power wiring. Install the fuses recommended in table 3.9. Do not exceed the fuse ratings. Failure to observe this precaution could result in damage to or destruction of the equipment.

Input line branch circuit protection fuses must be used to protect the input power lines. See figures 5.1 and 5.2. Recommended fuse values are shown in table 3.9. The input fuse ratings listed in table 3.9 are applicable for one drive per branch circuit. No other load may be applied to that fused circuit.

Table 3.9 - A-C Input Line Fuse Selection Values

Model Number	Horsepower Rating	Input Voltage	Fuse Rating*
1V4150 1V4450	1	380-460 VAC	6A
2V4150 2V4450	2	380-460 VAC	6A
3V4150 3V4450	3	380-460 VAC	12A
5V4150 5V4450	5	380-460 VAC	20A
7V4150 7V4250	7.5	380-460 VAC	25A
10V4150 10V4250	10	380-460 VAC	35A
15V4150 15V4250	15	380-460 VAC	45A
20V4150 20V4250	20	380-460 VAC	60A
25G4150 25G4250	25	380-460 VAC	70A
25V4150 25V4250	25	380-460 VAC	70A
30V4150 30V4250	30	380-460 VAC	100A
40V4150 40V4250	40	380-460 VAC	100A
50V4150 50V4250	50	380-460 VAC	125A
50R4150	Vector 50 V/Hz 75	380-460 VAC	125A
60G4150 60G4250	60	380-460 VAC	150A
75R4150	Vector 60-75 V/Hz 100	380-460 VAC	125A 150A
125R4150	Vector 100-125 V/Hz 125-150	380-460 VAC	250A

*Recommended fuse type: UL Class J 600V, time delay, or equivalent.

3.2.4 Meeting Pulse Tachometer Specifications (Vector Regulation Only)

GV3000 drives set up for vector regulation require a pulse tachometer for closed loop operation. Pulse tachometer specifications are provided in table A.6. Drives set up for volts/hertz regulation do not require a pulse tachometer for feedback because they operate in the open loop mode.

3.2.5 Verifying Power Module Output Current Rating is Greater Than Motor Full Load Amps

Verify that the GV3000 output current rating is greater than the motor's full load current (amps). Table 2.1 lists the output current values.

4.0 MOUNTING THE DRIVE, GROUNDING, AND FINDING WIRE ROUTING LOCATIONS

This chapter shows how to mount the drive and properly ground it. Also shown are the conduit entry areas where wiring is to be routed in and out of the drive.

4.1 Mounting the Drive

Attach the drive to the vertical surface selected using the four (4) mounting holes provided. In order to maintain a flat mounting surface and to ensure that bolt tightness is maintained, use washers under the bolt heads. Refer to figure 3.2 and table 3.2 for drive mounting dimensions. Use the following user-supplied mounting bolts and washers:

- 1-5HP drives: M6 (1/4"-20)
- 7.5-10HP drives: M8 (5/16"-18)
- 15-60HP drives: M8 or M10 (3/8"-16)
- 60-150HP drives: M8 (3/8" -16)

4.1.1 Verifying the Drive's Watts Loss Rating

When mounting the drive inside of another enclosure, you should examine the watts loss rating of the drive as shown in table 2.1. This table lists the typical full load power loss watts value under all operating carrier frequencies. Ensure adequate ventilation is provided based on the drive's watts loss rating.

4.2 Routing Input, Motor Output, Ground, and Control Wiring for the Drive

All wiring should be installed in conformance with the NEC/CEC and applicable local codes. Signal wiring, control wiring, and power wiring must be routed in separate conduits to prevent interference with drive operation. Note that no wires are to be routed behind the drive. Use grommets, when hubs are not provided, to guard against wire chafing. Figures 4.1 through 4.6 show the wire routing, grounding terminal, and power terminal strips of the GV3000 drives.

CAUTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to or destruction of the equipment.

Note that in applications using GV3000 drives (75 HP and above), induced electrical noise may result when the motor output leads from two or more drives are run together in the same conduit. It is recommended that separate conduit be run from each drive to the motor it is operating.

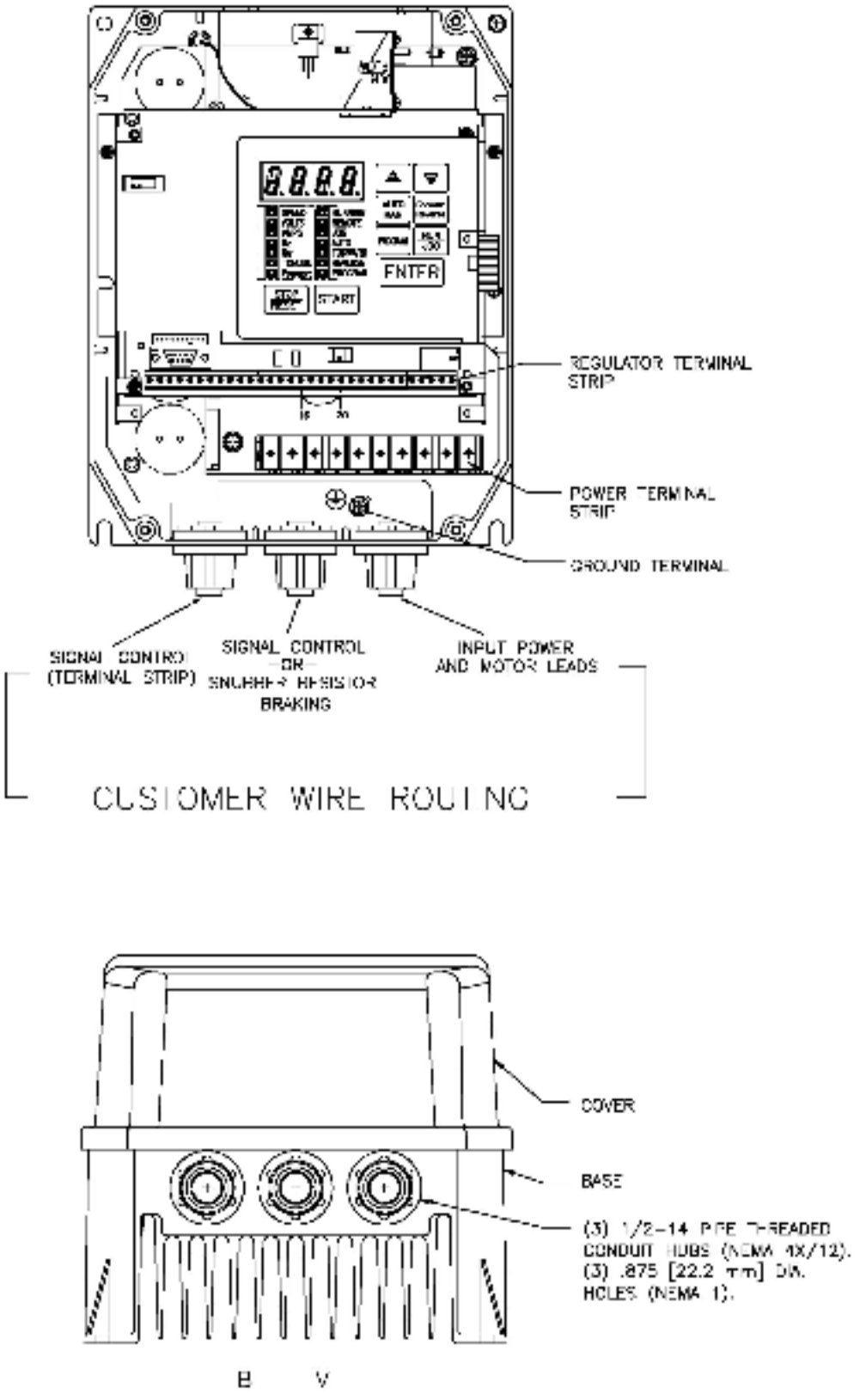


Figure 4.1 - Wire Routing Locations for 1-5 HP Drives

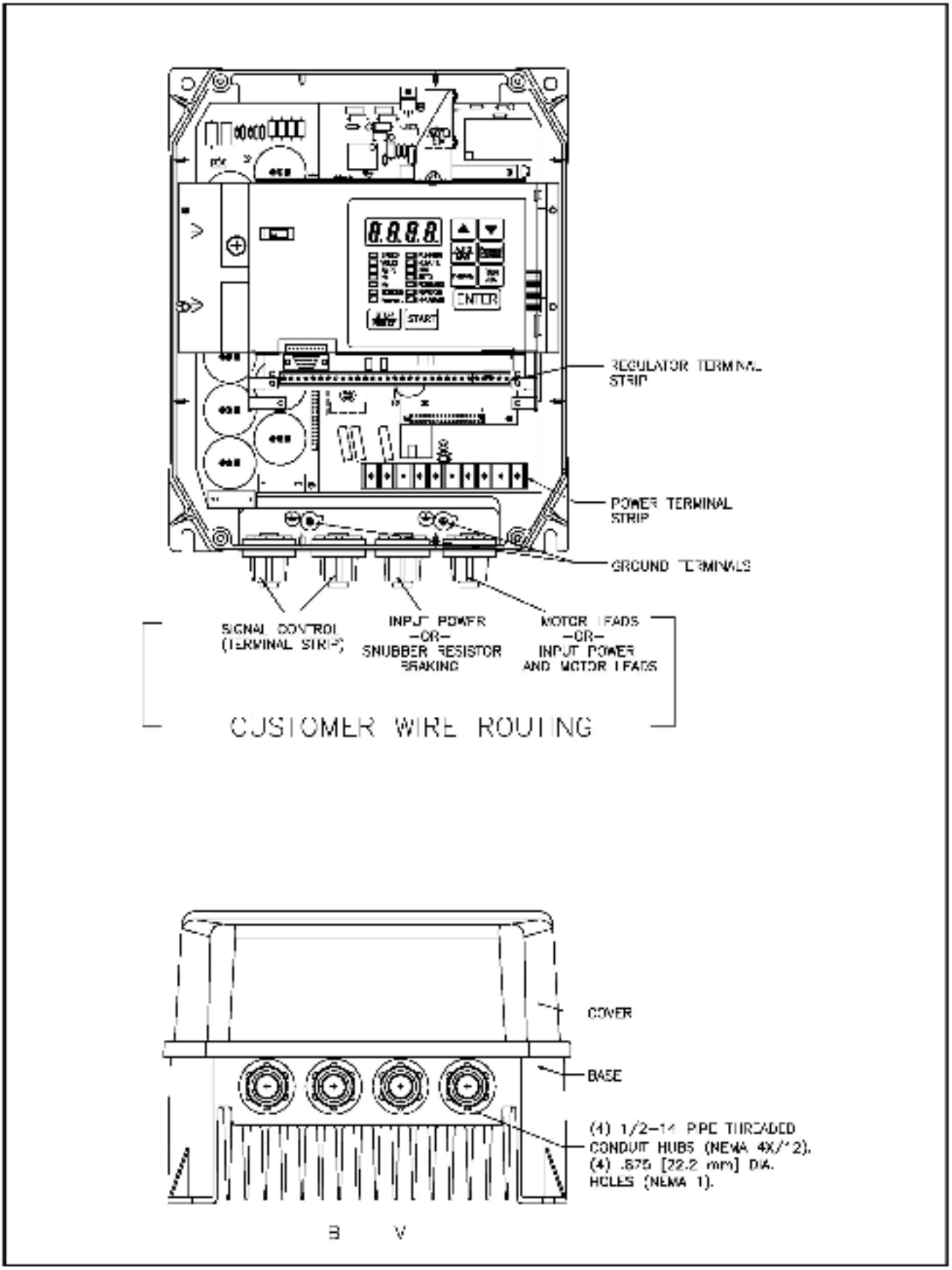
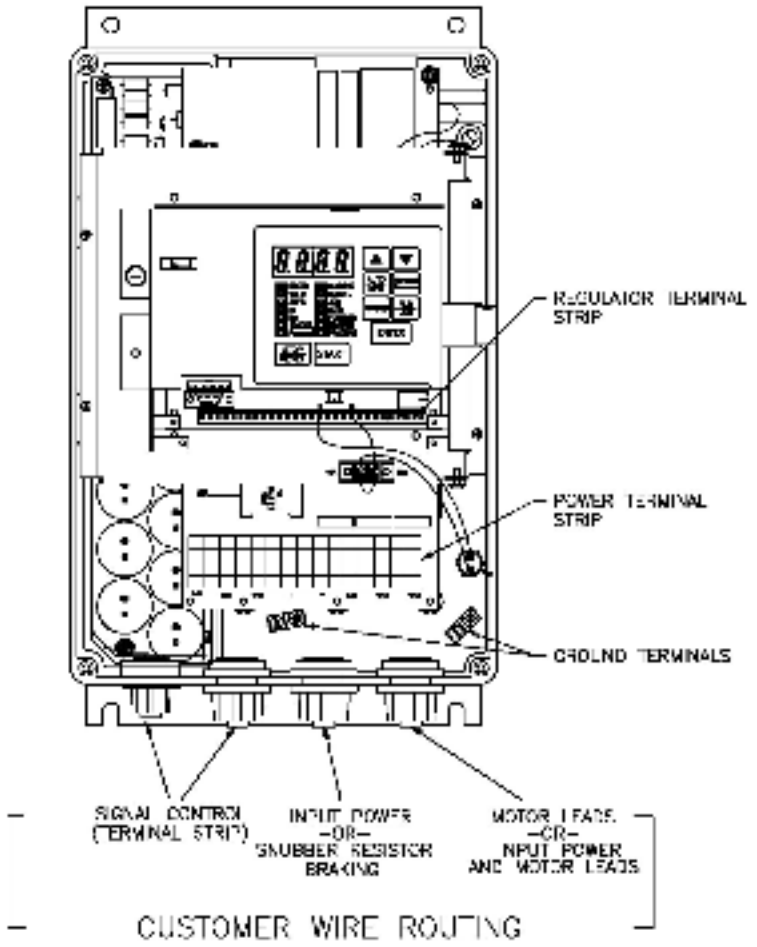


Figure 4.2 - Wire Routing Locations for 7.5-10 HP Drives



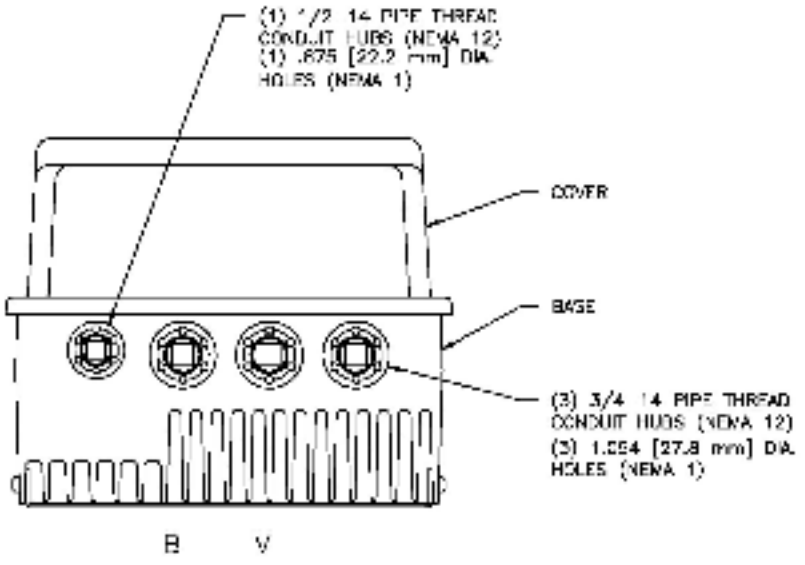


Figure 4.3 - Wire Routing Locations for 15-25 HP Drives

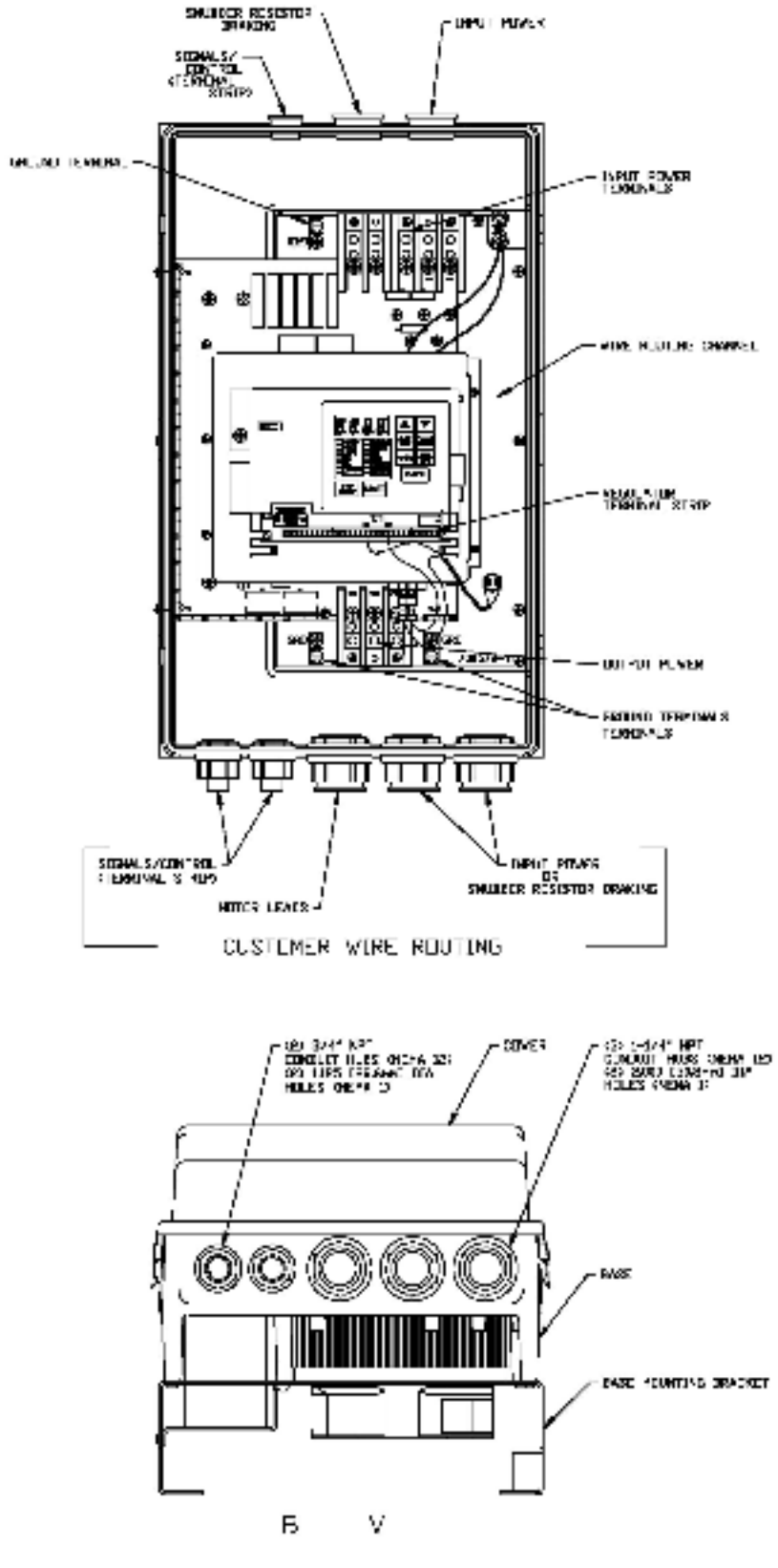


Figure 4.4 - Wire Routing Locations for 25-60 HP Drives

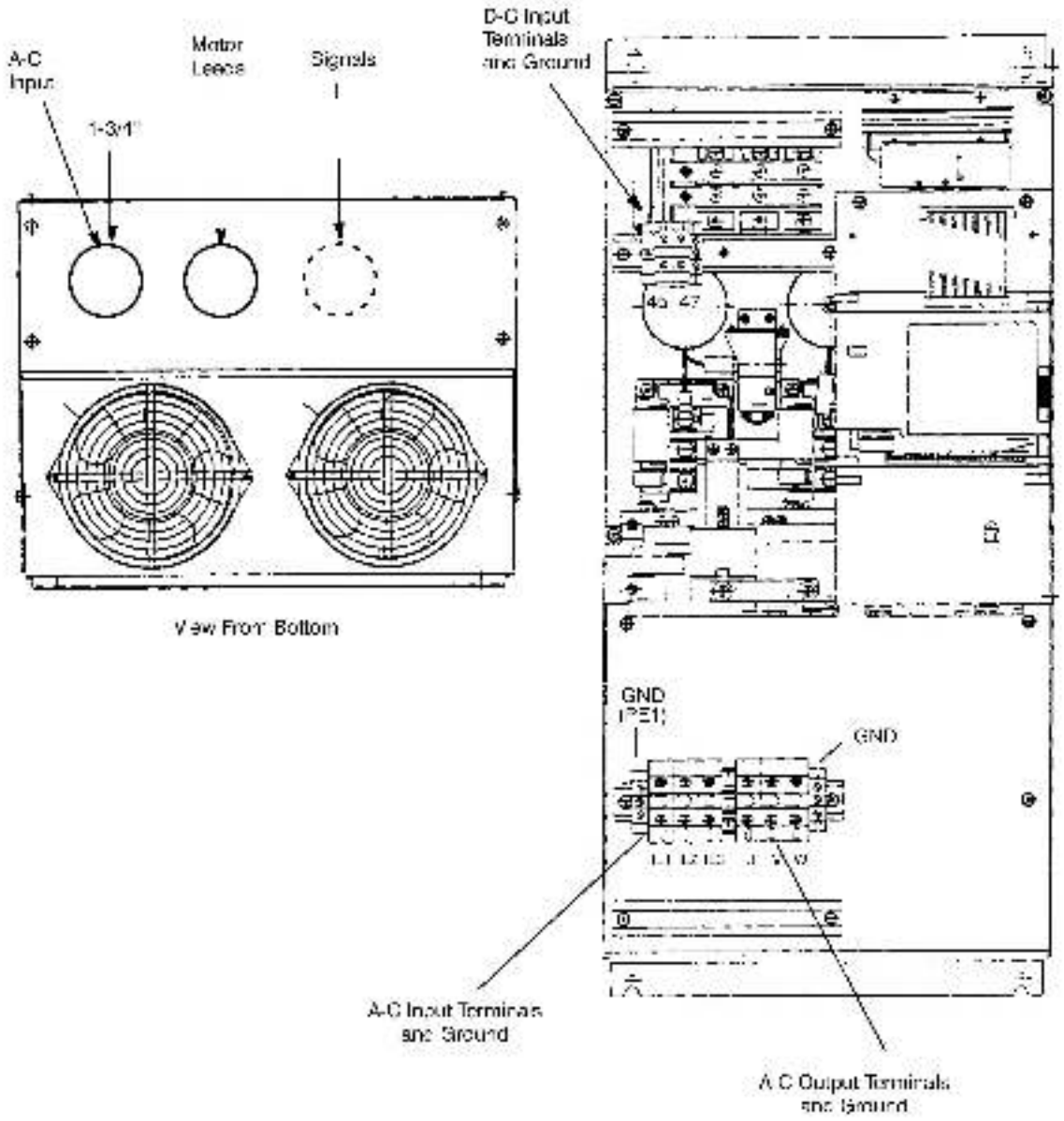


Figure 4.5 - Wire Routing Locations for 60-100 HP Drives

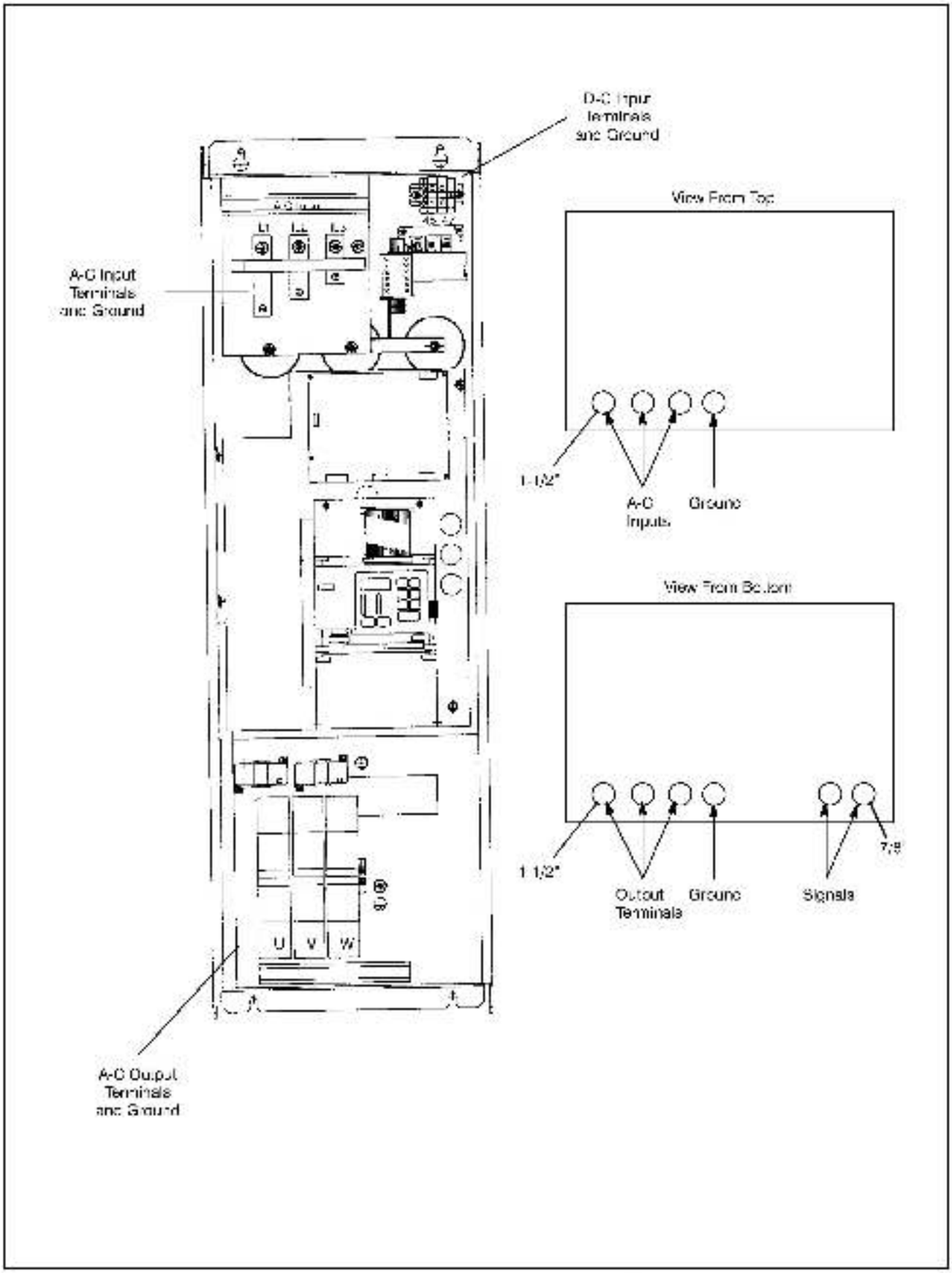


Figure 4.6 - Wire Routing Locations for 100-150 HP Drives

4.3 Grounding the Drive

DANGER

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Use the following steps to ground the drive:

Step 1. Remove the drive's cover.

Step 2. Run a suitable equipment grounding conductor unbroken from the drive's ground terminal to the motor's ground terminal and then to earth ground. See figures 4.1 to 4.6, 5.1, and 5.2.

Step 3. Connect a suitable grounding conductor to the motor frame, the remote control station (if used), and the transformer. Run each conductor **unbroken** to earth ground.

Note that to conform with CSA requirements, when adding more than one grounding conductor wire to a single chassis ground, twist the conductors together.

Step 4. Re-attach the drive's cover.

5.0 INSTALLING INPUT POWER WIRING

This chapter describes incoming line components and how to install them.

5.1 Installing Transformers and Reactors (Optional)

Input isolation transformers might be needed to help eliminate the following:

- Damaging line voltage transients from reaching the drive.
- Line noise from the drive back to the incoming power source.
- Damaging currents that could develop if a point inside the drive becomes grounded.

Observe the following guidelines when installing an isolation transformer:

- A power disconnecting device must be installed between the power line and the primary of the transformer.
- If the power disconnecting device is a circuit breaker, the circuit breaker trip rating must be coordinated with the in-rush current (10 to 12 times full load current) of the transformer.
- An input isolation transformer rated more than 1000 KVA for 460 VAC with less than 5% impedance should NOT be used directly ahead of the drive without additional impedance between the drive and the transformer.

CAUTION: Distribution system capacity above the maximum recommended system KVA (1000 KVA for 460 VAC) requires the use of an isolation transformer, a line reactor, or other means of adding similar impedance to the drive power input. Failure to observe these precautions could result in damage to or destruction of the equipment.

CAUTION: When the A-C line is shared directly with other SCR-rectified drives, an optional snubber resistor braking kit might be required to alleviate excess D-C bus voltage. Failure to observe these precautions could result in damage to or destruction of the equipment.

5.2 Installing Fuses for Branch Circuit Protection

Install the required, user-supplied branch circuit protection fuses according to NEC/CEC guidelines. The fuses must be installed in the line before the drive input terminals. See figures 5.1 and 5.2. Fuse value selections are provided in table 3.9.

WARNING

THE NEC/CEC REQUIRES THAT UPSTREAM BRANCH PROTECTION BE PROVIDED TO PROTECT INPUT POWER WIRING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

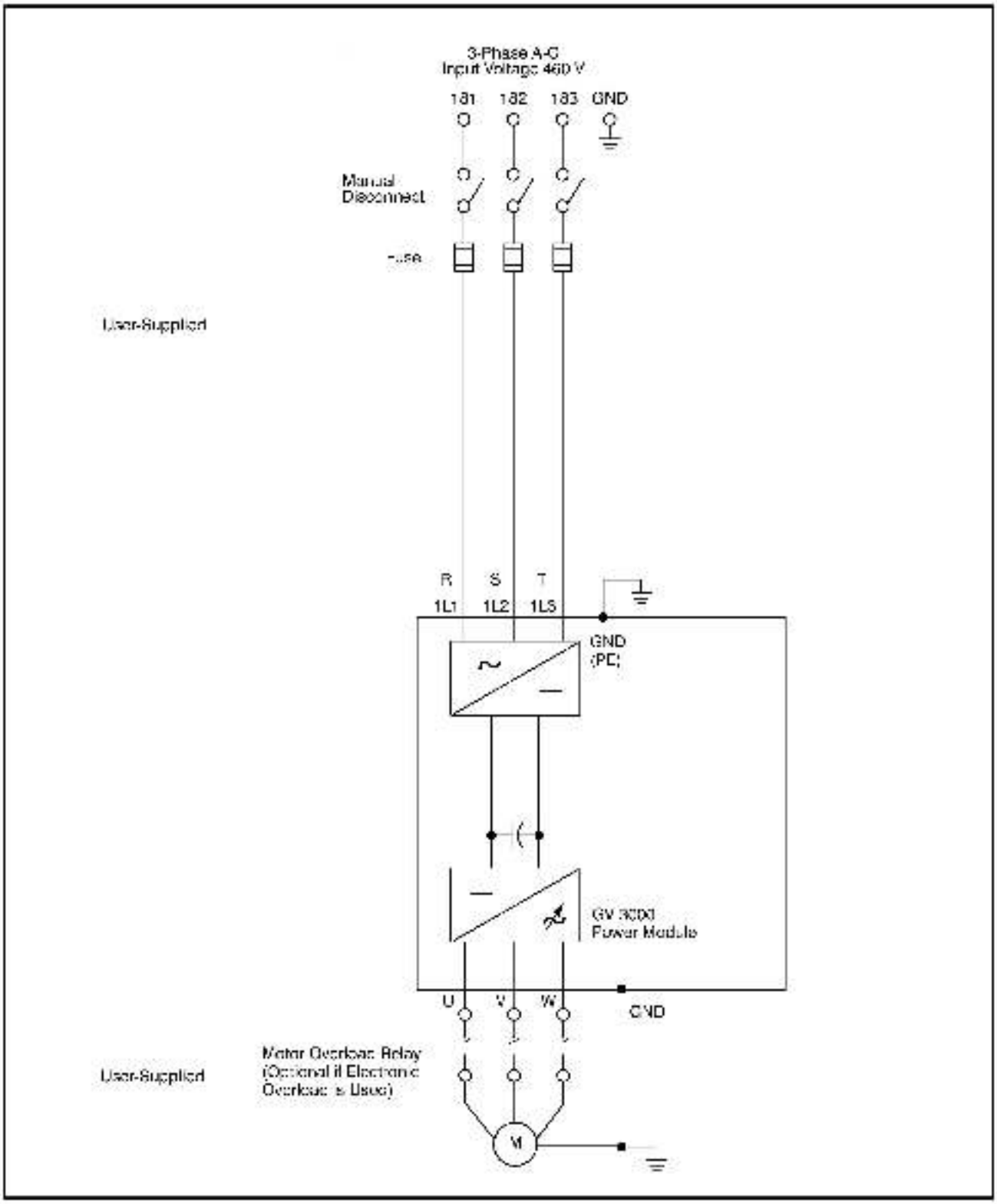


Figure 5.1 - Typical A-C Input Electrical Connections

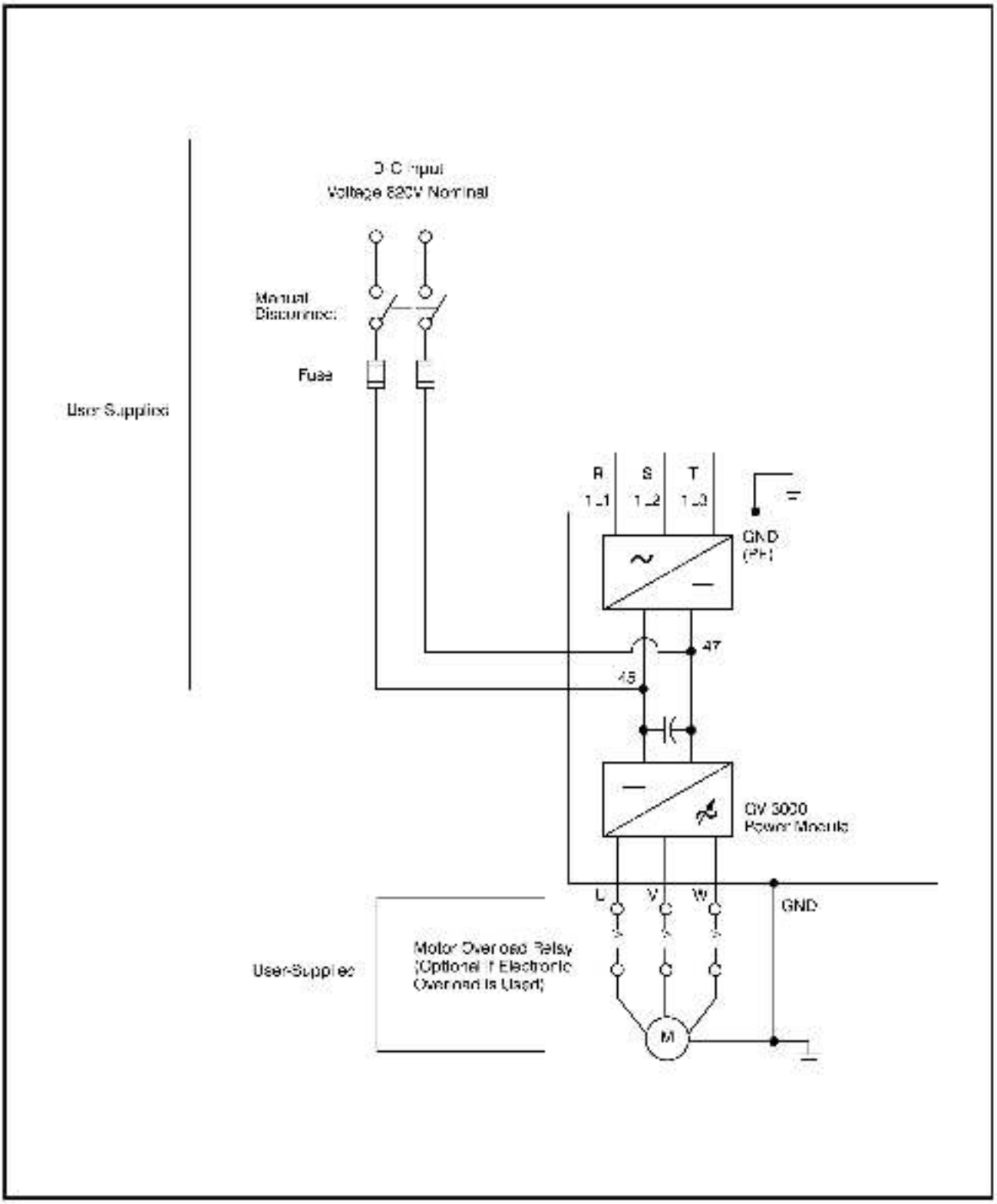


Figure 5.2 - Typical D-C Bus Electrical Connections

5.3 Installing a Required External/Separate Input Disconnect

An input disconnect must be installed in the line before the drive input terminals in accordance with NEC/CEC guidelines. The disconnect should be sized according to the in-rush current as well as any additional loads the disconnect might supply. Note that the trip rating for the inrush current (10-12 times full load current) should be coordinated with that of the input isolation transformer, if used. Refer to section 5.1 for additional information.

5.4 Installing Power Wiring from the A-C Input Line to the Drive's Power Terminals

Use the following steps to connect A-C input power to the drive:

Step 1. Wire the A-C input power leads by routing them according to drive type. Refer to figures 4.1 through 4.6. Tables 3.3 through 3.7 contain the recommended power wiring sizes.

On 1-5 HP drives, route the power leads through the bottom right opening of the drive base.

On 7.5-25 HP drives, route the power leads through the bottom middle-right opening of the drive base. If the snubber resistor braking option is used, route the power leads through the bottom right opening.

On 25-60 HP drives, route the power leads through top right or bottom right openings of the drive base.

On 60-100 HP drives, route the power leads through the bottom left opening of the cover.

On 100-150 HP drives, route the power leads through the top left opening of the cover.

CAUTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to or destruction of the equipment.

Step 2. Connect the three-phase A-C input power leads (three-wire 380-460 VAC) to the proper terminals according to drive type.

On 1-60 HP drives, connect the A-C input power leads to terminals R/L1, S/L2, T/L3 on the power terminal strip.

On 60-150 HP drives, connect the A-C input power leads to terminals 1L1, 1L2, and 1L3.

Step 3. Tighten the A-C input power terminals to the proper torque as shown in table 5.1.

Table 5.1 - Terminal Tightening Torques

Drive	Terminals	Maximum Tightening Torque
1-25HP	All	1.08 Newton-meters (9.5 in-lbs)
25-60HP	All	13.5 Newton-meters (120 in-lbs)
60-100HP	1L1, 1L2, 1L3 U, V, W 45,47	10 Newton-meters (88.5 in-lbs)
	PE, ⏚	2.5 Newton-meters (22.1 in-lbs)
100-150HP	1L1, 1L2, 1L3, PE	10 Newton-meters (88.5 in-lbs)
	U, V, W ⏚ , 45, 47	2.5 Newton-meters (22.1 in-lbs)

5.5 Installing Power Wiring from an External D-C Bus to the Drive's Internal D-C Bus Terminals

Use the following steps to connect D-C input power to the drive:

Step 1. Wire the D-C input power leads by routing them according to drive type. Refer to figures 4.1 through 4.6. Tables 3.3 through 3.7 contain the recommended power wiring sizes.

On 1-5 HP drives, route the power leads through the bottom right opening of the drive base.

On 7.5-25 HP drives, route the power leads through the bottom middle-right opening of the drive base. If the snubber-resistor braking option is used, route the power leads through the bottom right opening.

On 25-60 HP drives, route the power leads through the top right or bottom right openings of the drive base.

On 60-100 HP drives, route the power leads through the bottom left opening of the cover.

On 100-150 HP drives, route the power leads through the top left opening of the cover.

CAUTION: Do not route signal and control wiring in the same conduit with power wiring. This can cause interference with drive operation. Failure to observe this precaution could result in damage to or destruction of the equipment.

CAUTION: If the GV3000 drive is connected to an external D-C bus, the user is responsible for D-C bus short-circuit protection. Failure to observe this precaution could result in damage to or destruction of the equipment.

Step 2. Connect the D-C input power leads (two-wire 620 VDC nominal) to the proper terminals according to drive type.

On 1-60 HP drives, connect the D-C input power leads to terminals + and − on the power terminal strip.

On 60-150 HP drives, connect the D-C input power leads to terminals 45 and 47.

Note that the maximum discharge rate of the D-C bus supply should be 200V/second.

Step 3. Tighten the D-C input power terminals to the proper torque as shown in table 5.1.

Step 4. On 60-150 HP drives using volts/hertz regulation, set parameter H.017 to a value greater than one to enable D-C bus operation. Refer to the GV3000 Programming instruction manual (D2-3339) for additional information.

6.0 INSTALLING OUTPUT POWER WIRING

This chapter provides instructions on wiring output contactors, motor overload protection, and output wiring to the motor.

6.1 Installing Output Contactors (Optional)

Output contactors provide a positive means of disconnecting the motor from the drive. If the application requires the use of output contactors, contact Reliance Electric for assistance.

6.2 Installing Mechanical Motor Overload Protection (Optional)

To provide the motor with overload protection, the NEC requires that a motor thermostat, internal to the motor, be installed or an electronic thermal motor overload relay, sized to protect the motor, be installed between the motor and the drive's output terminals.

The Motor Overload Enable parameter (P040) can be used in place of the electronic thermal motor overload relays in single motor applications. Note, however, that temperature measuring devices integral to the motor are the best way to thermally protect A-C motors under all conditions. Parameter P040 must be enabled to provide overload protection. Refer to the GV3000 Programming Manual (D2-3339) for more information.

In multiple motor applications (volts/hertz regulation only), each motor must have its own user-supplied overload protection.

6.3 Installing Output Wiring from the Drive Output Terminals to the Motor

Use the following steps to connect the A-C output power wiring from the drive to the motor:

Step 1. Wire the three-phase A-C output power motor leads by routing them according to drive type. Refer to figures 4.1 to 4.6. Tables 3.3 to 3.7 contain the recommended power wiring sizes.

On 1-5 HP drives, route the motor leads through the bottom right opening of the drive base.

On 7.5-25 HP drives, route the motor leads through the bottom right opening of the drive base.

On 25-60 HP drives, route the motor leads through the middle bottom opening of the drive base.

On 60-100 HP drives, route the motor leads through the bottom right opening of the cover.

On 100-150 HP drives, route the motor leads through the three left-most bottom openings of the cover. Route the ground wire through the opening to the right of the motor leads.

CAUTION: Do not route signal and control wiring with power wiring in the same conduit. This can cause interference with drive operation. Failure to observe this precaution could result in damage to or destruction of the equipment.

Note that in applications using GV3000 drives (75 HP and above), induced electrical noise may result when the motor output leads from two or more drives are run together in the same conduit. It is recommended that separate conduit be run from each drive to the motor it is operating.

Step 2. Connect the three-phase A-C output power motor leads to the proper output terminals according to drive type.

On 1-60 HP drives, connect the motor leads to terminals U/T1, V/T2, W/T3 on the power terminal strip.

On 60-150 HP drives, connect the motor leads to terminals U, V, and W.

Step 3. Tighten the three-phase A-C output power terminals to the proper torque according to drive type as shown in table 5.1.

7.0 WIRING THE REGULATOR BOARD TERMINAL STRIP

This chapter describes how to wire the Regulator board terminal strip for stop, speed feedback, and remote control signals.

The terminal strip has the following signals available, as shown in figures 7.1 and 7.2. Table 7.1 provides additional information. Note that when the Control Source parameter (P.000) is set to remote (rE), the drive will be controlled by the signals connected to the terminal strip. Refer to instruction manual D2-3339 for more information on how parameter P.000 is used to specify where the drive is controlled from.

RS-232 Connections (Terminals 1-3)

- Terminal 1: Transmit (Tx)
- Terminal 2: Receive (Rx)
- Terminal 3: Regulator Common

The RS-232 terminals should only be used when the RS-232 communication port (J8) or an Operator Interface module (OIM) is not being used, as all three devices use the same transmit/receive lines.

Pulse Tachometer Connections (Terminals 4-9)

- Terminal 4: +15 VDC
- Terminal 5: Phase A
- Terminal 6: Phase A Not
- Terminal 7: Phase B
- Terminal 8: Phase B Not
- Terminal 9: Regulator Common

A speed feedback device (pulse tachometer) must be installed if vector regulation (P.048=1) is used.

Analog Output Connections (Terminals 10 and 11)

- Terminal 10: Analog Meter Output
- Terminal 11: Regulator Common

The output of this terminal is either 0-10 VDC or 4-20 mA as determined by the setting of jumper J17 on the Regulator board. The analog output must also be programmed via parameter P.012 for an indication of speed and direction or percent of torque.

Analog Speed/Torque Reference Connections (Terminals 12-15)

- Terminal 12: Isolated Reference Voltage
- Terminal 13: VDC Speed/Torque Reference
- Terminal 14: mA Speed/Torque Reference
- Terminal 15: Isolated Reference Ground

The analog speed/torque (P.008/U.000) reference is either +/−10 VDC or +/−20 mA, as determined by the setting of jumper J4 on the Regulator board. The analog reference must also be programmed via parameters P.009, P.010, and P.011.

Digital Input Connections (Terminals 16-25)

- Terminal 16: +24 VDC (Current Limited) (For remote control digital inputs only)
- Terminal 17: Digital Input 8 (Remote/Local) - Programmable
- Terminal 18: Digital Input 7 (Ramp1/Ramp2) - Programmable
- Terminal 19: Digital Input 6 (Forward/Reverse) - Programmable
- Terminal 20: Function Loss
- Terminal 21: Run/Jog
- Terminal 22: Reset
- Terminal 23: Stop
- Terminal 24: Start
- Terminal 25: +24 VDC Common

When a user-installed function loss input, a coast-to-stop pushbutton, or another external interlock is installed, the factor-installed jumper connecting terminals 16 and 20 (or 16A and 20A) must be removed so that a contact will open to stop the drive.

Terminals 17, 18, and 19 (remote control inputs 8, 7, and 6) are programmed using parameters P007, P008, and P031 through P038. Factory default settings are shown here in parentheses. Refer to the GV3000 Programming Manual (D2-3339) for more information.

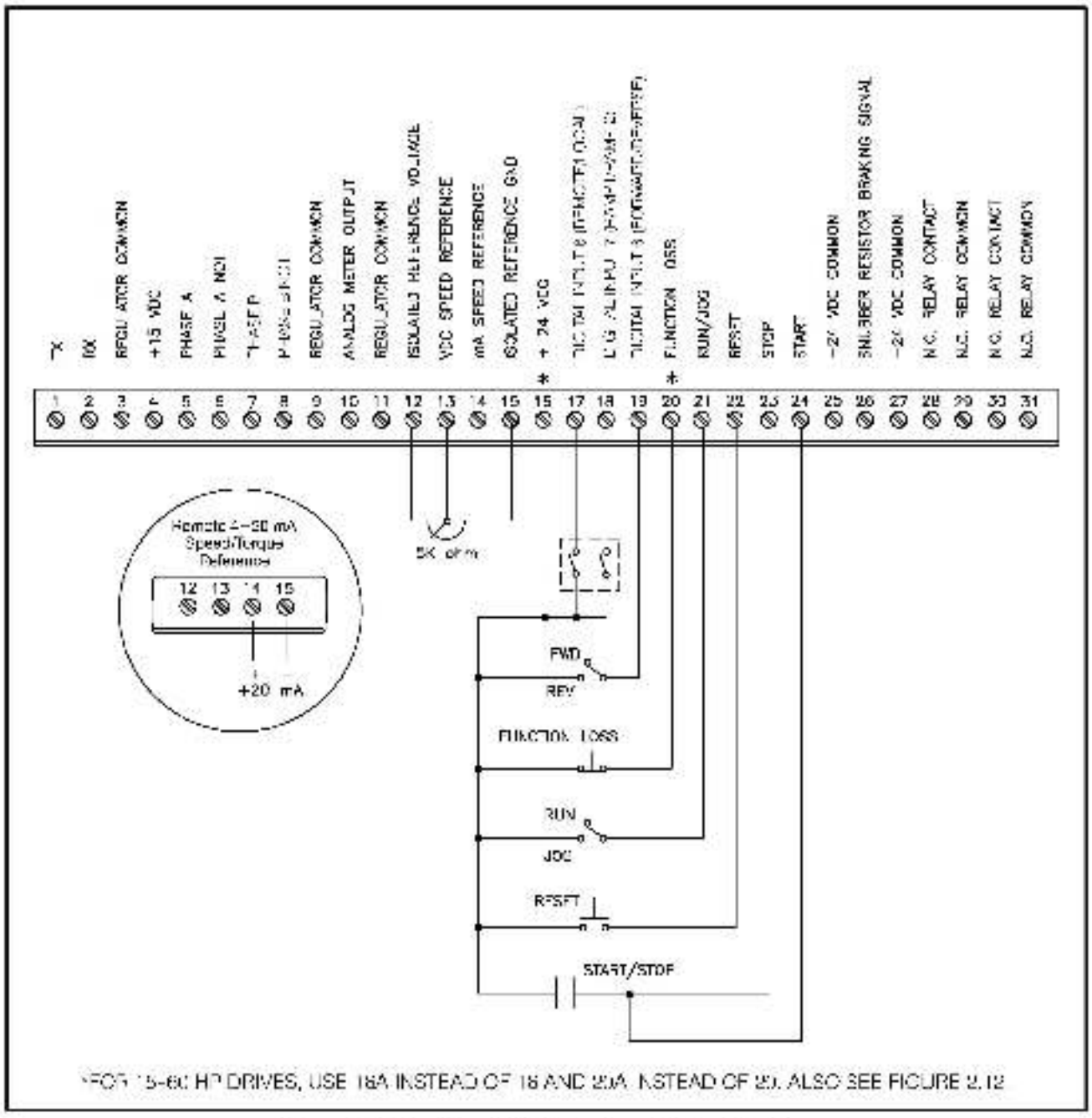
Snubber Resistor Braking Connections (Terminals 26 and 27)

- Terminal 26: Snubber Resistor Braking Signal (1-25HP Drives only)
- Terminal 27: +24 VDC Common

Status Relay Connections (Terminals 28-31)

- Terminal 28: N.C Relay Contact
- Terminal 29: N.C. Relay Common
- Terminal 30: N.O. Relay Contact
- Terminal 31: N.O. Relay Common

Relay contact closure is programmable through parameter P013. Refer to the GV3000 Programming Manual (D2-3339) for more information.



FOR 15-60 HP DRIVES, USE 18A INSTEAD OF 18 AND 20A INSTEAD OF 20. ALSO SEE FIGURE 2.12

Figure 7.1 - Two-Wire Start/Stop Sample Control Wiring

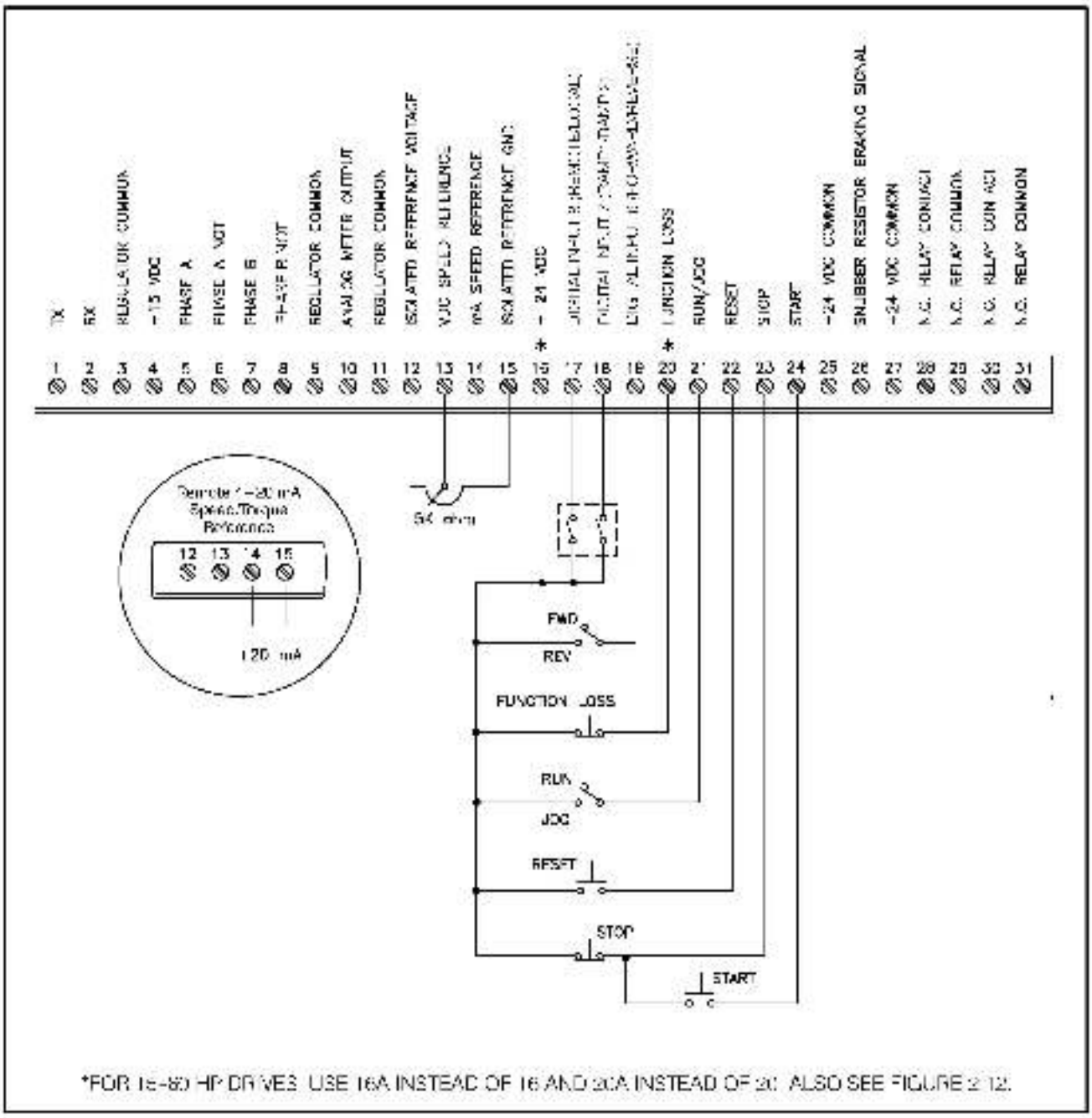


Figure 7.2 - Three-Wire Start/Stop Sample Control Wiring

7.1 Stopping the Drive

WARNING

THE USER MUST PROVIDE AN EXTERNAL, HARDWIRED EMERGENCY STOP CIRCUIT OUTSIDE OF THE DRIVE CIRCUITRY. THIS CIRCUIT MUST DISABLE THE SYSTEM IN CASE OF IMPROPER OPERATION. UNCONTROLLED MACHINE OPERATION MAY RESULT IF THIS PROCEDURE IS NOT FOLLOWED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Depending upon the requirements of the application, the GV3000 drive can be programmed to provide either a coast-to-rest or a ramp-to-rest operational stop without physical separation of the power source from the motor. A coast-to-rest stop turns off the transistor power device drivers. A ramp-to-rest stop fires the transistor power device drivers until the motor comes to a stop, and then turns off the power devices. The user can also program zero speed with power maintained to the motor, but in this condition, the drive is not actually stopped. See the description of terminals 23 and 24 or Stop Type (P025) for more information on how to program the operational stop.

In addition to the operational stop, the user must provide a hardwired emergency stop external to the drive. The emergency stop circuit must contain only hardwired electromechanical components. Operation of the emergency stop must not depend on electronic logic (hardware or software) or on the communication of commands over an electronic network or link.

7.1.1 Compliance with EN 60204-1: 1992

This section applies to users who must comply with EN 60204-1: 1992, part 9.2.5.4, Emergency Stop.

The GV3000 drive coast-to-rest stop is a category 0 operational stop. The ramp-to-rest stop is a category 1 operational stop. In addition, it is possible to implement a category 2 stop, with power maintained to the motor at zero speed.

The required external hardwired emergency stop must be either a category 0 or 1 stop, depending on the user's risk assessment of the associated machinery. In order to fully comply with EN60204-1: 1992, part 9.2.5.4, at least one of the two stop methods must be a category 0 stop. Refer to Appendix C for more information.

7.2 Wiring the Speed Feedback Device (Vector Regulation Only)

If the GV3000 drive is programmed to provide vector regulation, a speed feedback device (pulse tachometer) must be installed. Drives using volts/hertz regulation do not require the use of a speed feedback device. The pulse tachometer connects to terminals 4 to 9 of the terminal strip:

- Terminal 4: Pulse Tachometer Supply +15 VDC
- Terminal 5: Pulse Tachometer Phase A Differential Input
- Terminal 6: Pulse Tachometer Phase A Not Differential Input
- Terminal 7: Pulse Tachometer Phase B Differential Input
- Terminal 8: Pulse Tachometer Phase B Not Differential Input
- Terminal 9: Pulse Tachometer/Regulator Common

Use the following procedure to connect a pulse tachometer to the terminal strip:

Step 1. Connect the pulse tachometer's wires to terminals 4 through 9 of the terminal strip. See figure 7.3. See table A.6 for additional pulse tachometer specifications.

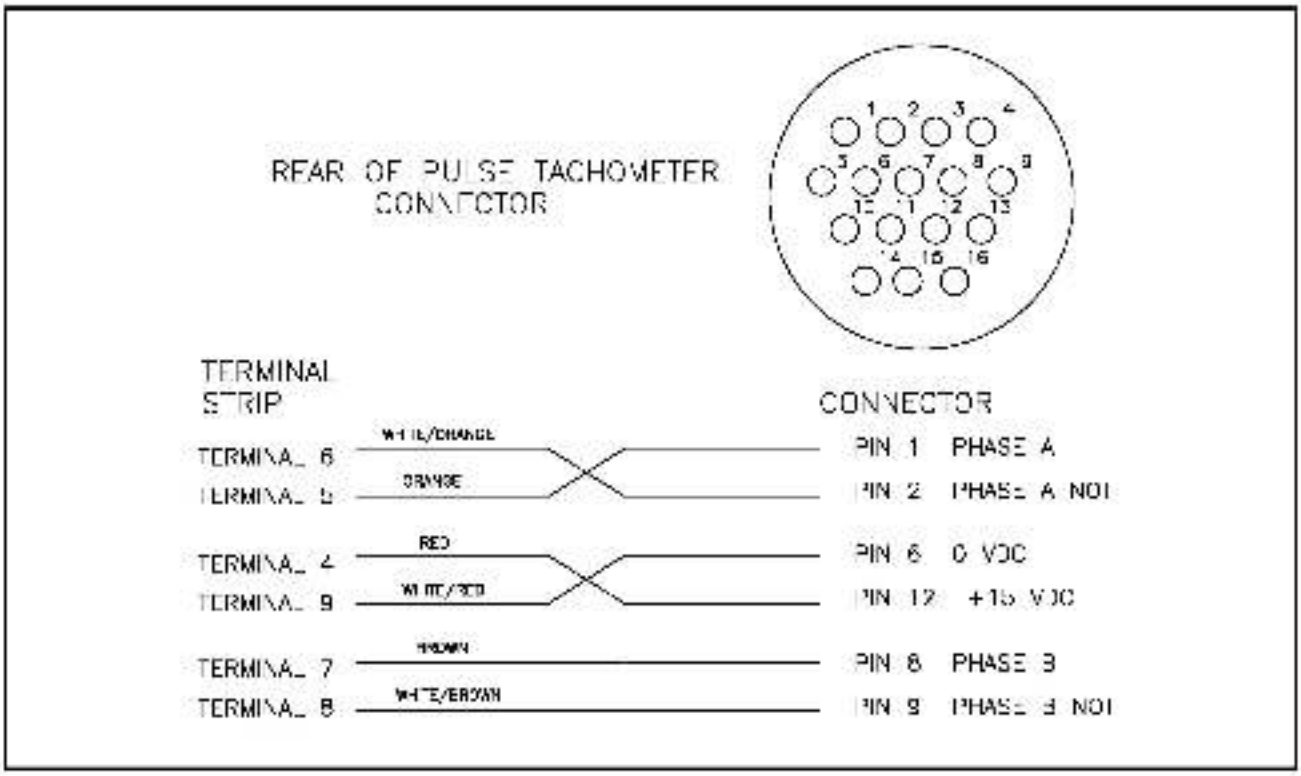


Figure 7.3 - Wiring Connections for the Speed Feedback Device

Step 2. Set the following parameters to establish the maximum motor speed:

- P.004: Maximum Speed
- U.001: Pulse Tach PPR
- U.002: Motor Poles
- U.003: Motor Nameplate Base Frequency
- U.005: Motor Nameplate RPM
- U.017: Motor Top Speed

Refer to the GV3000 Programming Manual (D2-3339) for more information.

7.3 Wiring the Signal and Control I/O

Wire the drive's signal and control I/O to the terminal strip as shown in table 7.1.

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip

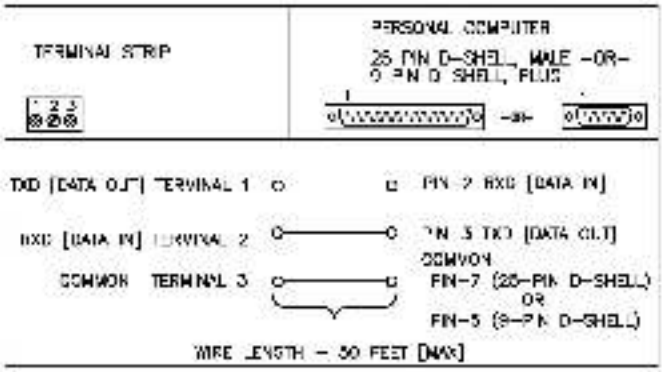
Terminal Number	Description	Parameters/Wiring Connections
		Wiring RS-232 Signals
1 2 3	RS-232 Transmit RS-232 Receive RS-232 Signal/Regulator Common	Note that RS-232 communication between the GV3000 drive and a personal computer requires the use of the Control and Configuration software. Refer to instruction manual D2-3348 for more information. These terminals should only be used when the RS-232 port (J8) or an Operator Interface module (OIM) are not being used, as all three devices use the same transmit/receive lines. 
		Wiring Pulse Tachometer Inputs
4-9	Pulse Tachometer Wiring	See section 7.2.

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

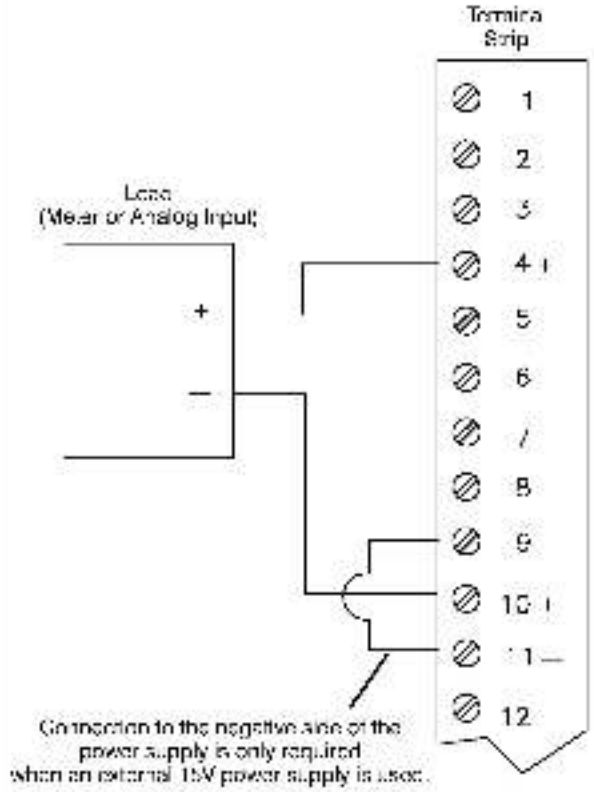
Wiring Analog Outputs		
10 11	0-10 VDC or 4-20 mA Analog Output Reference Regulator Common	The setting of parameter P012 selects the terminal strip analog output source (either speed or torque). Jumper J17 must also be set. See figure 2.11. The 4-20mA current selection requires a power supply for operation. The power can be sourced from the pulse tachometer supply, terminal 4 (15VDC), or from an external 15V power supply. Note that the maximum supply current from terminal 4 is 250mA (pulse tachometer and current source) at 15V. Terminals 9 and 11 are internally connected. 

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

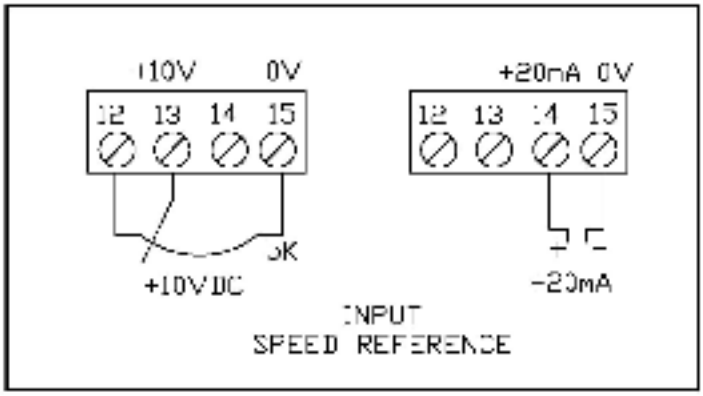
Terminal Number	Description	Parameters/Wiring Connections
Wiring Analog Speed Reference Inputs		
12 13 14 15	Isolated Reference Voltage (+15VDC) Analog Speed/Torque Reference Input Voltage (+/– 10 VDC) Analog Speed/Torque Reference Input Current (0-20mA) Isolated Speed/Torque Reference Common (Voltage/Current)	The following parameters must be set: P000: Control Source P009: Terminal Strip Analog Input Offset P010: Terminal Strip Analog Input Gain P011: Terminal Strip Analog Input Invert Refer to the GV3000 Programming instruction manual (D2-3339) for additional parameter information. Jumper J4 must also be set. See figure 2.10. 

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

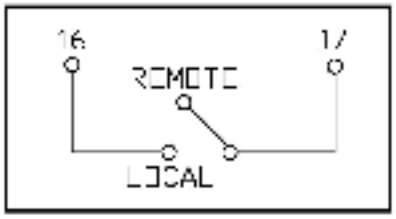
Terminal Number	Description	Parameters/Wiring Connections
	Wiring a Remote/Local Input	
16	+24 VDC Power Supply	Current limited for remote input logic use only.
17	Digital Input 8 (Default - Remote/Local)	Digital input 8 is control function programmable through parameter P.007.
	WARNING **IF A MAINTAINED START CONTACT IS USED WHEN THE CONTROL SOURCE = rE, SWITCHING FROM LOCAL TO REMOTE FROM THE TERMINAL STRIP WILL CAUSE POWER TO BE APPLIED TO THE MOTOR IF THE REMOTE START CONTACT IS CLOSED. STAY CLEAR OF ROTATING MACHINERY IN THIS CASE. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.**	
		The following parameters must be set: P.000: Control Source (Only active when P.000 = rE) P.006: Second Menu Password P.007: Terminal Strip Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8). P.008: Terminal Strip Speed Reference Source (Analog, Motor Operated Potentiometer (MOP), or Preset Speeds) Note that based on the settings of parameters P.000, P.007, P.008, and r.030 if an RMI board is used, the following parameters can affect digital input 8. P.023: MOP Accel/Decel Time P.024: MOP Reset Configuration P.031 to P.038: Preset Speeds 1-8 Refer to the GV3000 Programming instruction manual (D2-3339) for additional information.  Terminal 17 On = Local Control Diagram shows factory setting.

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

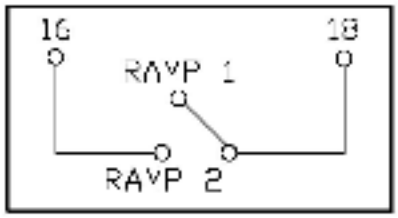
Terminal Number	Description	Parameters/Wiring Connections
Wiring an Additional Ramp Input		
18	Digital Input 7 (Default - Ramp1/Ramp2)	Digital input 7 is control function programmable through parameter P007. The following parameters must be set: P000: Control Source P001: Accel Time 1 (Ramp 1) P002: Decel Time 1 (Ramp 1) P006: Second Menu Password P007: Terminal Strip Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8). P008 Terminal Strip Speed Reference Source (Analog, Motor Operated Potentiometer (MOP), or Preset Speeds) P017: Accel Time 2 (Ramp 2) P018: Decel Time 2 (Ramp 2) Note that based on the settings of parameters P000, P007, P008, and r.030 if an RMI board is used, the following parameters can affect digital input 7. P023: MOP Accel/Decel Time P024: MOP Reset Configuration P031 to P038: Preset Speeds 1-8 Refer to the GV3000 Programming instruction manual (D2-3339) for additional information.  Terminal 18 On – Ramp 2 Diagram shows factory setting.

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

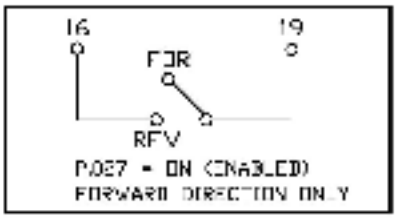
Terminal Number	Description	Parameters/Wiring Connections
Wiring a Forward/Reverse Input		
19	Digital Input 6 (Default - Forward/Reverse)	Digital input 6 is control function programmable through parameter P.007. The following parameters must be set: P.000: Control Source P.006: Second Menu Password P.007: Terminal Strip Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8). P.008: Terminal Strip Speed Reference Source (Analog, Motor Operated Potentiometer (MOP), or Preset Speeds) P.027: Reverse Disable Note that based on the settings of parameters P.000, P.007, P.008, and P.030 if an RMI board is used, the following parameters can affect digital input 6. P.023: MOP Accel/Decel Time P.024: MOP Reset Configuration P.031 to P.038: Preset Speeds 1-8 Refer to the GV3000 Programming instruction manual (D2-3339) for additional information.  Terminal 19 On = Reverse Direction Diagram shows factory setting. From the pulse tachometer end of the motor, clockwise rotation indicates forward motor movement.

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

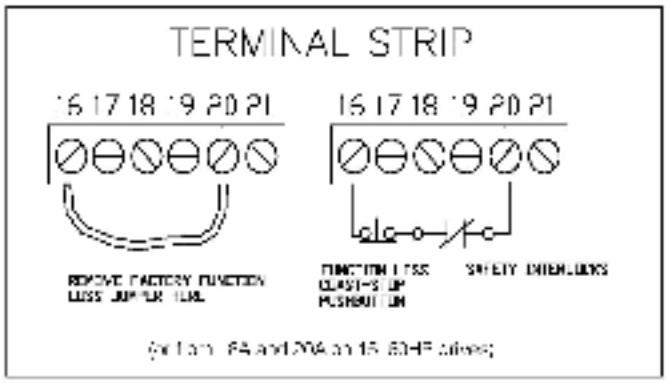
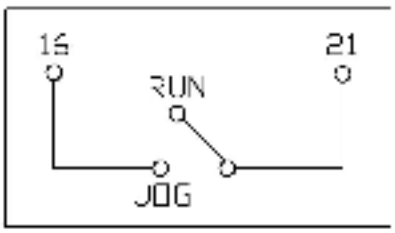
Terminal Number	Description	Parameters/Wiring Connections
		Wiring a Function Loss Input
20	Digital Input 5 (Function Loss)	The following parameters must be set: P026: Function Loss Response A signal must be present at terminal 20 for the drive to be able to start. See figures 7.1 and 7.2. The drive is shipped from the factory with a jumper between terminals 16 and 20 which provides the signal. The function loss input should be in series with the drive's external interlocks. In this case, the jumper must be removed before the connections are made. See figure 2.12.  Terminal 20 On = No Function Loss
		Wiring a Run/Jog Input
21	Digital Input 4 (Run/Jog)	The following parameters must be set: P000: Control Source P020: Jog Speed Reference P021: Jog Ramp Accel Time P022: Jog Ramp Decel Time  Terminal 21 On = Jog Operation

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

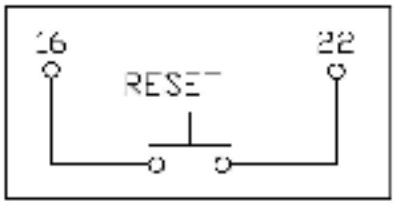
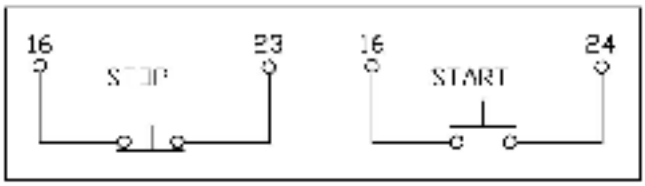
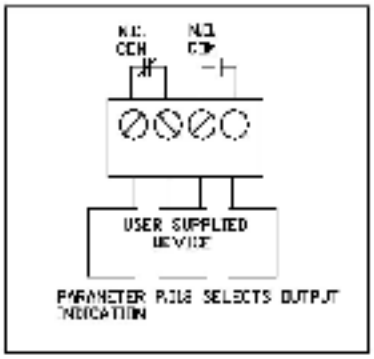
Terminal Number	Description	Parameters/Wiring Connections
	Wiring the Reset Input	
22	Digital Input 3 (Reset)	The following parameter must be set: P000: Control Source  Terminal 22 On = Reset
	Wiring the Stop/Start Inputs	
23	Digital Input 2 (Stop)	The following parameter must be set:
24	Digital Input 1 (Start)	P000: Control Source P025: Stop Type  Terminal 23 Off = Stop Terminal 24 On Transition = Start
25	24 VDC Isolated Common	
	Wiring the Snubber Resistor	
26	Snubber Resistor Braking Control Signal	Used with Snubber Resistor Braking Kit M/N 2DB4010. Refer to the kit's instruction manual for installation instructions.
27	–24 VDC Isolated Common	

Table 7.1 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

Terminal Number	Description	Parameters/Wiring Connections
Wiring the Output Status Relays		
28	Normally-Closed Contact (Form B)	Both Form A and Form B contacts are rated for 250 VAC/30 VDC at 5 amps resistive or 2 amps inductive load. The following parameter must be set: P013: Output Relay Configuration Note that depending on the setting of parameter P013, the relay coil will energize (the normally-open contact will close and the normally-closed contact will open). Refer to the GV3000 Programming instruction manual (D2-3339) for more information. 
29	Normally-Closed Contact Common (Form B)	
30	Normally-Open Contact (Form A)	
31	Normally-Open Contact Common (Form A)	

8.0 COMPLETING THE INSTALLATION

This chapter provides instructions on how to perform a final check of the installation before power is applied to the drive.

DANGER

ONLY QUALIFIED ELECTRICAL PERSONNEL FAMILIAR WITH THE CONSTRUCTION AND OPERATION OF THIS EQUIPMENT AND THE HAZARDS INVOLVED SHOULD START AND ADJUST IT. READ AND UNDERSTAND THIS MANUAL IN ITS ENTIRETY BEFORE PROCEEDING. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

8.1 Checking the Installation

Use the following procedure to verify the condition of the installation:

DANGER

D-C BUS CAPACITORS RETAIN HAZARDOUS VOLTAGES AFTER INPUT POWER HAS BEEN DISCONNECTED. AFTER DISCONNECTING INPUT POWER, WAIT FIVE (5) MINUTES FOR THE D-C BUS CAPACITORS TO DISCHARGE AND THEN CHECK THE VOLTAGE WITH A VOLTMETER TO ENSURE THE D-C BUS CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 1. Turn off, lock out, and tag the input power to the drive. Wait five minutes.

Step 2. Verify that the D-C bus voltage is zero. Refer to section 9.3.

Step 3. If a function loss coast-stop pushbutton has been installed, verify that it has been wired correctly. Be sure the factory-installed jumper at terminals 16 and 20 (or 16A and 20A) has been removed so that the coast-stop pushbutton will work.

WARNING

THE USER MUST PROVIDE AN EXTERNAL, HARDWIRED EMERGENCY STOP CIRCUIT OUTSIDE OF THE DRIVE CIRCUITRY. THIS CIRCUIT MUST DISABLE THE SYSTEM IN CASE OF IMPROPER OPERATION. UNCONTROLLED MACHINE OPERATION MAY RESULT IF THIS PROCEDURE IS NOT FOLLOWED. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN BODILY INJURY.

Step 4. Remove any debris, such as metal shavings, from around the drive.

Step 5. Check that there is adequate clearance around the drive.

Step 6. Verify that the wiring to the terminal strip and the power terminals is correct.

Step 7. Check that the wire size is within terminal specification and that the wires are tightened properly.

Step 8. Check that user-supplied branch circuit protection is installed and correctly rated.

Step 9. Check that the incoming power is rated correctly.

Step 10. Check the motor installation and length of motor leads.

Step 11. Disconnect any power correction capacitors connected between the drive and the motor.

Step 12. Check that the rating of the transformer (if used) matches the drive requirements and is connected properly.

Step 13. Verify that a properly-sized ground wire is installed and a suitable earth ground is used. Check for and eliminate any grounds between the motor frame and the motor power leads. Verify that all ground leads are unbroken.

Step 14. Uncouple the motor from any driven machinery to initially start the drive.

8.2 Installing the Cover for NEMA 4X/12 Drives

In order to maintain the integrity of the NEMA 4X/12 enclosures, care must be taken when re-installing the covers. Use the following steps to re-install the covers:

Step 1. Before installing the cover, check that the gaskets on the cover are flat and within the gasket channels.

Step 2. Position the cover and sequentially tighten the four (4) captive screws to ensure even compression of the gaskets. Do not exceed 2.2 Nm (20 in-lbs) of torque on these screws.

8.3 Powering Up After Installation is Complete

Use the following procedure to verify that the drive is installed correctly and is receiving the proper line voltage:

Step 1. Turn the drive's input power disconnect to the On position.

Step 2. Apply power to the drive.

Step 3. Follow the start-up procedure in instruction manual D2-3339.

9.0 TROUBLESHOOTING THE DRIVE

This chapter describes how to troubleshoot the drive and the equipment that is needed to do so. Also provided are replacement part lists and information on clearing faults.

9.1 Test Equipment Needed to Troubleshoot

An isolated multimeter will be needed to measure D-C bus voltage and to make resistance checks.

9.2 Drive Alarms and Faults

The drive will display alarm and fault codes to assist in troubleshooting when a problem develops during self-tuning or drive operation.

If an alarm condition occurs, the drive will continue to run and a 2- or 3-digit alarm code will flash on the display.

If a fault occurs, the drive will coast-to-stop and a 2- or 3-digit fault code will flash on the display.

Refer to the GV3000 Software Start-Up and Reference Manual (D2-3339) for more information on drive alarms and faults.

9.3 Verifying That D-C Bus Capacitors are Discharged

DANGER

D-C BUS CAPACITORS RETAIN HAZARDOUS VOLTAGES AFTER INPUT POWER HAS BEEN DISCONNECTED. AFTER DISCONNECTING INPUT POWER, WAIT FIVE (5) MINUTES FOR THE D-C BUS CAPACITORS TO DISCHARGE AND THEN CHECK THE VOLTAGE WITH A VOLTMETER TO ENSURE THE D-C BUS CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

The GV3000 drive's D-C bus capacitors retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components:

Step 1. Turn off and lock out input power. Wait five minutes.

Step 2. Remove the drive's cover.

Step 3. Verify that there is no voltage at the drive's input power terminals.

Step 4. Measure the D-C bus potential with a voltmeter.

For 1-60 HP drives, measure the D-C bus potential at the D-C bus power terminals. See figures 9.1 and 9.2.

For 60-100HP drives, while standing on a non-conductive surface and wearing insulated gloves (600V), remove the top two screws of the regulator panel and tilt the panel forward. See figure 9.3. Measure the D-C bus potential at the diode bridge as shown. Re-attach the regulator panel.

For 100-150HP drives, while standing on a non-conductive surface and wearing insulated gloves (600V), remove the top two screws of the regulator panel and tilt the panel forward. See figure 9.4. Measure the D-C bus potential at the bottom of the fuse holders on the Power Module Interface board on the back of the regulator panel. Take care not to touch any conductive traces. Re-attach the regulator panel.

Step 5. Once the drive has been serviced, re-attach the drive's cover.

Step 6. Re-apply input power.

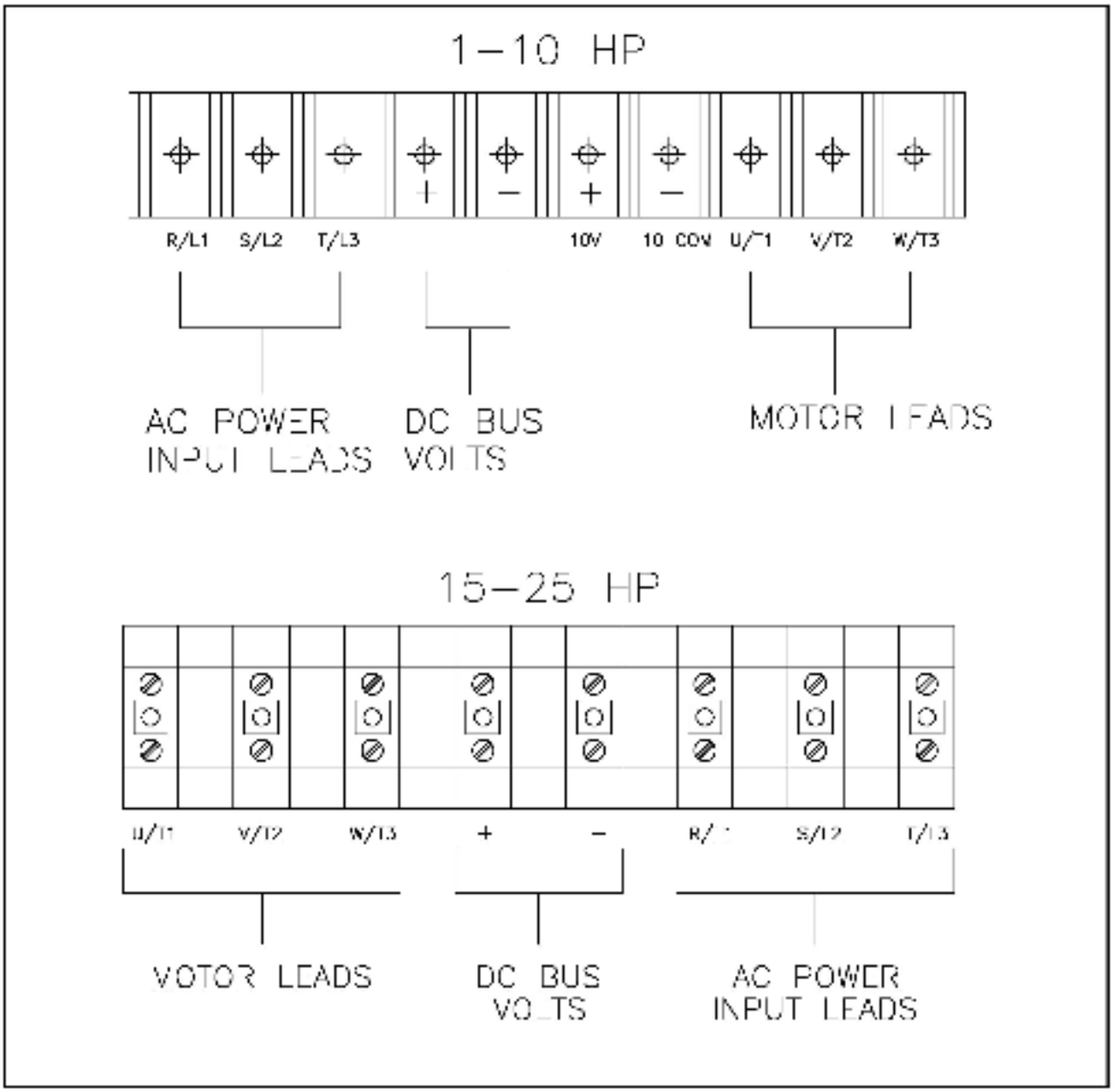


Figure 9.4 - D-C Bus Voltage Terminals (1-25 HP Drives)

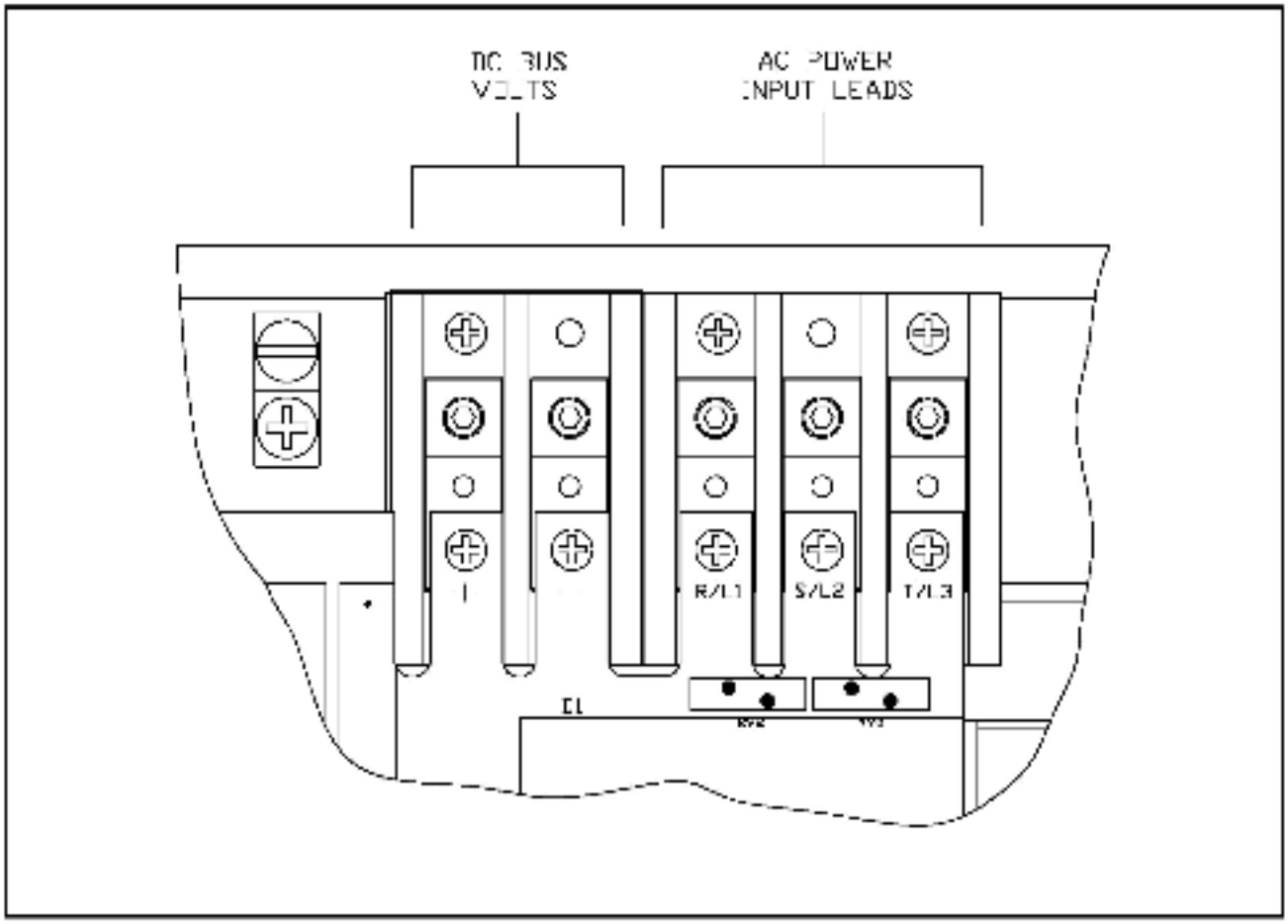


Figure 9.2 - D-C Bus Voltage Terminals (25-60 HP Drives)

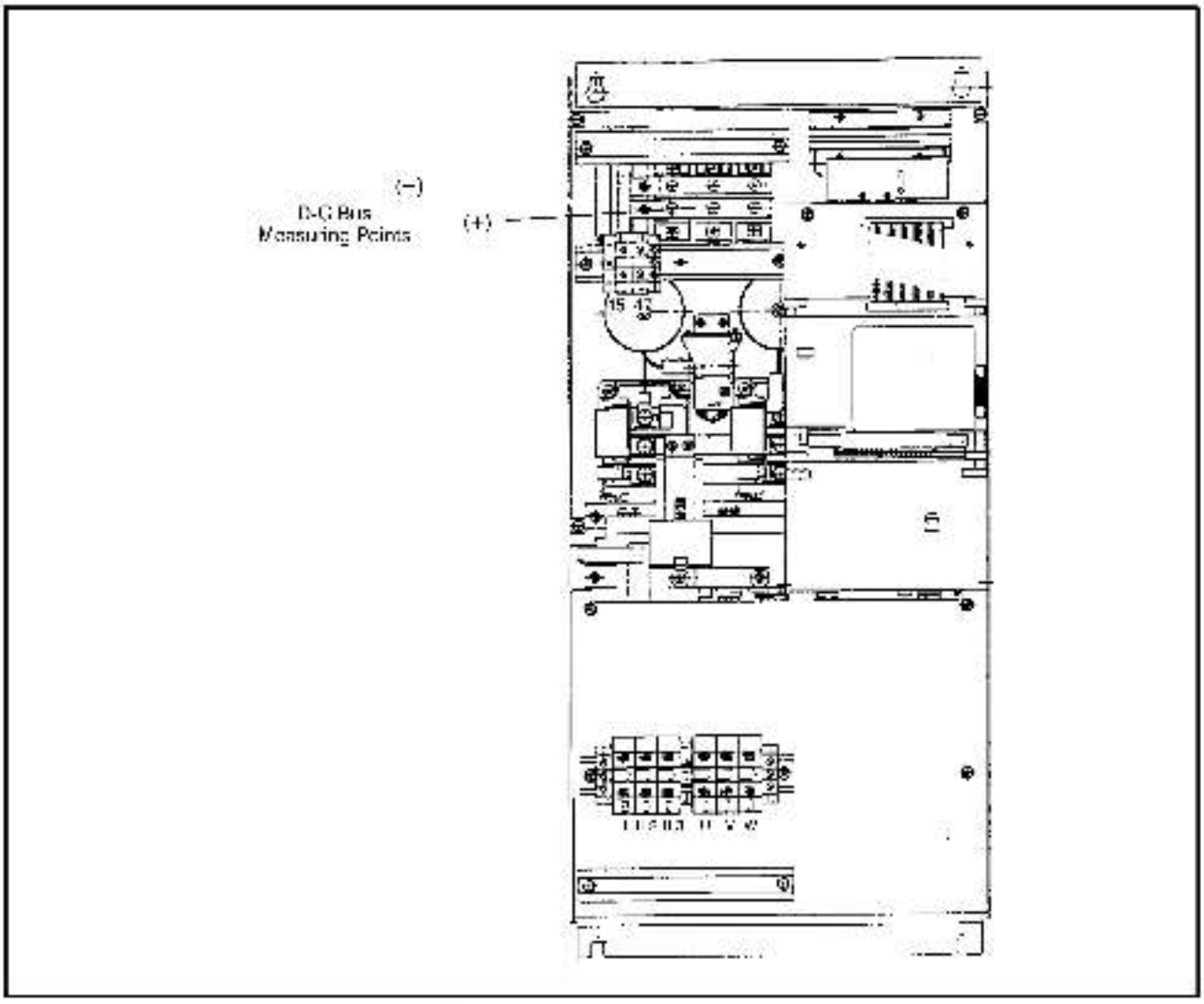


Figure 9.3 - D-C Bus Voltage Terminals (60-100 HP Drives)

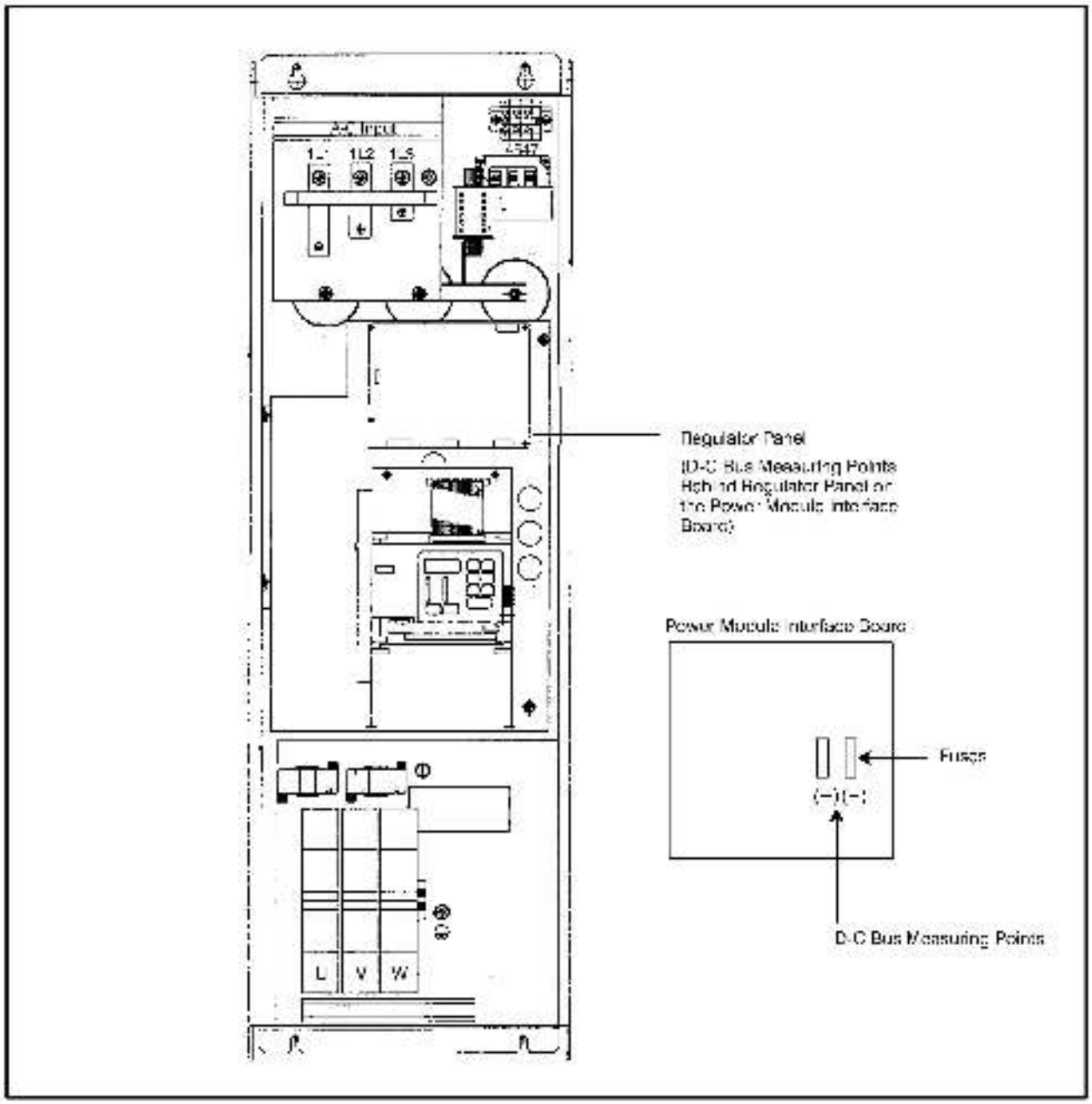


Figure 9.4 - D-C Bus Voltage Terminals (100-150 HP Drives)

9.4 Checking Out the Power Modules with Input Power Off

Use the following procedure to check the drive's Power Module circuitry with power off:

DANGER

D-C BUS CAPACITORS RETAIN HAZARDOUS VOLTAGES AFTER INPUT POWER HAS BEEN DISCONNECTED. AFTER DISCONNECTING INPUT POWER, WAIT FIVE (5) MINUTES FOR THE D-C BUS CAPACITORS TO DISCHARGE AND THEN CHECK THE VOLTAGE WITH A VOLTMETER TO ENSURE THE D-C BUS CAPACITORS ARE DISCHARGED BEFORE TOUCHING ANY INTERNAL COMPONENTS. FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN SEVERE BODILY INJURY OR LOSS OF LIFE.

Step 1. Turn off and lock out input power. Wait five minutes.

Step 2. Remove the drive's cover.

Step 3. Verify that there is no voltage at the drive's input power terminals.

Step 4. Check the D-C bus potential with a voltmeter as described in section 9.3 to ensure that the D-C bus capacitors are discharged.

Step 5. Disconnect the motor from the drive.

Step 6. Check all A-C line and D-C bus fuses.

Step 7. If a fuse is blown, use a multimeter to check the input diodes and output IGBTs. See table 9.1.

Note that 1-10HP drives do not have replaceable transistor modules: the entire drive must be replaced if a transistor malfunctions. Intelligent Power Modules (IPM) may be replaced if they fail in a 60-150HP drive.

Step 8. Re-connect the motor to the drive.

Step 9. Re-attach the drive's cover.

Step 10. Re-apply input power.

Table 9.1 - Resistance Checks

1-60HP Drives				
Input Diode No.	**Meter Connection** (+)	(−)	**Component is OK if resistance (R) is:**	**Component is defective if:**
1	*	R/L1	50 < R < 10 Megohm	Continuity (short circuit) or open when the meter is connected with reversed polarity
2	*	S/L2		
3	*	T/L3		
4	R/L1	**		
5	S/L2	**		
6	T/L3	**		
* (+) D-C Bus Volts power terminal ** (−) D-C Bus Volts power terminal				

Table 9.1 - Resistance Checks (Continued)

60-100HP Drives				
Input Diode No.	Meter Connection (+)	(−)	Component Is OK If resistance (R) is:	Component is defective if:
1	47	1L1	0.3 kohm <R< 8 kohm	Continuity (short circuit) or open when the meter is connected with reversed polarity
2	47	1L2		
3	47	1L3		
4	1L1	45		
5	1L2	45		
6	1L3	45		

100-150HP Drives				
Input Diode No.	Meter Connection (+)	(−)	Component is OK if resistance (R) is:	Component Is defective if:
1	47	1L1	R> 100 kohm	Continuity (short circuit)
2	47	1L2		
3	47	1L3		
4	1L1	45		
5	1L2	45		
6	1L3	45		

1-60HP Drives				
IGBT No.	Meter Connection (+)	(−)	Component Is OK If resistance (R) Is:	Component is defective if:
1	*	W/T3	50 <R< 10 Megohm	Continuity (short circuit) or open when the meter is connected with reversed polarity
2	*	V/T2		
3	*	U/T1		
4	W/T3	**		
5	V/T2	**		
6	U/T1	**		
* (+) D-C Bus Volts power terminal				
** (−) D-C Bus Volts power terminal				

60-150HP Drives				
IGBT No.	Meter Connection (+)	(−)	Component Is OK If resistance (R) Is:	Component is defective if:
1	47	W	0.3 kohm <R< 8 kohm	Continuity (short circuit) or open when the meter is connected with reversed polarity
2	47	V		
3	47	U		
4	W	45		
5	V	45		
6	U	45		

9.5 Replacement Parts

Tables 9.2 to 9.7 list the replacement parts that are available from Reliance Electric. See figures 2.3 to 2.8 for the location of the parts.

Table 9.2 - 1-5 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower			
		1	2	3	5
Fan Assembly	615161-S			1	1
NEMA 1 Cover	805531-1R	1	1	1	1
NEMA 4X/12 Cover/Gasket	805532-1R	1	1	1	1
Membrane Switch Keypad/Bracket	709576-1R	1	1	1	1
Regulator PCB	0-56921-5xx	1	1	1	1
Capacitor PCB	0-56928-30	1	1	1	
	0-56928-50				1
Current Feedback PCB	0-56926-20	1	1		
	0-56926-50			1	1
Internal Fan Assembly	615159-1R	1	1	1	1

* Components are identified in figure 2.3.

Table 9.3 - 7.5-10 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower	
		7.5	10
Fan Assembly	615161-S	2	2
NEMA 1 Cover	805538-1R	1	1
NEMA 12 Cover/Gasket	805539-1R	1	1
Membrane Switch Keypad/Bracket	805578-1R	1	1
Regulator PCB	0-56921-5xx	1	1
Capacitor PCB	0-56934-100	1	1
Current Feedback PCB	0-56935-100	1	1
Internal Fan Assembly	615159-1R	1	1

* Components are identified in figure 2.4.

Table 9.4 - 15-25 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower		
		15	20	25
Fan Assemoly	6*5*6*-S	2	2	2
NEMA 1 Cover	805547-1R	1	1	1
NEMA 12 Cover/Gasket	805547-2R	1	1	1
Membrane Switch Keypad/Top Bracket	805548-1R	1	1	1
Regulator PCB	0-56921-5xx	1	1	1
Capacitor PCB	0-56948-015	1		
	0-56948-020		1	1
Power Board	0-56949-020	1	1	1
Power Supply Board	0-56950-015	1		
	0-56950-020		1	1
Gate Driver Board	0-56947-020	1	1	1
Internal Fan Assemoly	615159-1S	1	1	1

* Components are identified in figure 2.5.

Table 9.5 - 25-60 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower				
		25	30	40	50	60
Fan	69739-48A	2	2	2	2	2
Fan Wire Harness	615195-2R	1	1	1	1	1
NEMA 1 Cover	805534-11R	1	1	1	1	1
NEMA 12 Cover/Gasket	805534-12R	1	1	1	1	1
Membrane Switch Keypad/ Top Bracket	805548-1R	1	1	1	1	1
Regulator PCB	0-56921-5xx	1	1	1	1	1
Input Capacitor	600442-32A	2			4	4
	600442-33A		2	2		
Power PCB	0-56949-040	1	1	1		
	0-56949-050				1	1
Power Supply PCB	0-56950-025	1				
	0-56950-030		1			
	0-56950-040			1		
	0-56950-050				1	1
Gate Driver PCB	0-56947-025	1				
	0-56947-040		1	1		
	0-56947-050				1	1
IGBT Module	602909-810AW	3				
	602909-811AW		3	3		
	602909-812AW				3	3
Diode Bridge	701819-113BA	1	1	1		
	701819-114BA				1	1
Internal Fan Assembly	615196-2R	1	1	1	1	1

* Components are identified in figure 2.5.

Table 9.6 - 60-100 HP Drive Replacement Parts

Description*	Part Number	Quantity
Regulator PCB	413338-5AU	1
Power Module Interface PCB	413338-5AW	1
Power Module Interface PCB Fuses	413338-5AB	2
Keypad	413338-5AX	1
Gate Driver PCB	413338-5D	1
Bus Clamp PCB (right)	413338-5E	2
Bus Clamp PCB (left)	413338-5F	2
Intelligent Power Module (IPM) PCB	413338-5J	3
Diode Bridge	413338-5K	3
MOV on Diode Bridge	413338-5L	3
D-C Bus Fuse	413338-5M	2
Precharge Contactor	413338-5N	4
Current Transformer	413338-5R	2
Ground Fault Transformer	413338-5Q	1
Output Reactor	413338-5S	3
Precharge Resistor (18 ohms)	413338-5T	4
Bus Discharge Resistor (1.5K ohms)	413338-5V	2
24V D-C Fan	413338-5W	2

* Components are identified in figure 2.7.

Table 9.7 - 100-150 HP Drive Replacement Parts

Description *	Part Number	Quantity
Regulator PCB	413338-5AU	1
Power Module Interface PCB	413338-5AV	1
Power Module Interface PCB Fuses	413338-5AB	2
Keypad	413338-5AX	1
Gate Driver PCB	413338-5AC	6
Bus Clamp PCB (right) Bus Clamp PCB (left)	413338-5AE 413338-5AF	2 2
Intelligent Power Module (IPM) PCB **	413338-5AH	6
Thyristor Precharge Module	413338-5AJ	3
D-C Bus Fuse	413338-5AK	4
Current Transformer	413338-5R	2
Ground Fault Transformer	413338-5Q	1
Output Reactor	413338-5AR	3
Bus Discharge Resistor (1.5K ohms)	413338-5V	1
24V D-C Fan	413338-5W	4
Thyristor Firing Pulse PCB	413338-5AG	1
Thyristor Firing Pulse PCB Fuses (15A)	413338-1JS	3

* Components are identified in figure 2.8.

**It is recommended that the Gate Driver PCB be replace at the same time as the IPM PCB.

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Appendix A

Technical Specifications

Table A.1 - Service Conditions

A-C Line Distribution System Capacity (maximum) for 460 VAC Units	1000KVA, three-phase with 25,000 amps symmetrical fault current capacity with a line impedance of less than 8%
Control Method	All-digital vector, sinusoidal pulse-width-modulated (PWM)
Displacement Power Factor	0.96
Line Frequency	50/60Hz (±2 Hz)
Line Voltage Variation	−10% to +10%
Line Dip Ride Through	Maximum 500 milliseconds - vector Adjustable up to 999.9 seconds (See P042) - V/Hz
Motor Lead Lengths	76 meters (250 feet) total
Analog Speed Reference Accuracy	0.5%
Acceleration Adjustment Range	0.1 to 999.9 seconds (within the ability of current)
Carrier Frequency	2 Hz, 4 Hz, or 8 Hz, software-selectable
Current Limit Adjustment	0.006 to 150% (based on drive nameplate rating) - vector 50% to 110% (based on drive nameplate rating) - V/Hz
Service Factor	1.0
Speed Adjustable Range	From 0 RPM to maximum speed
Speed Regulation	Vector - 0.01% long term steady state V/Hz - motor slip dependent
Speed Reference Resolution	1 RPM with local keypad, −4095 to +4095 counts with a network or serial reference
Torque Control Response	180 to 220 Hz
Torque Linearity	1.3% with optimal parameter setting (typical) (see parameter U.005)

Table A.2 - Ambient Conditions

Condition	Specification
Operating Temperature (Ambient)	0° to 140° C (32° to 104°F)
Storage Temperature (Ambient)	−40° to +65° C (−40° to +149°F)
Humidity	5 to 95% (non-condensing)

Table A.3 - Terminal Strip Input Specifications

Signal Type	Terminal(s)	Specification
Speed Reference Input	12-15	10 V (@ 50K ohm input impedance or 20 mA)
Digital Inputs (1 - 8)	16	+24 VDC Isolated Supply
	17	Remote/Local (Default)
	18	Ramp1/Ramp2 (Default)
	19	Forward/Reverse (Default)
	20	Function Loss
	21	Run/Jog
	22	Reset
	23	Stop
	24	Start

Table A.4 - Terminal Strip Output Specifications

Signal Type	Terminal(s)	Specification
Analog Output	10 -11 scaled signal	0-10 VDC or 4-20 mA
Snubber Resistor	26 - 27	Used with Snubber Resistor Braking Kits - Refer to Instruction Manual D2-3179.

Table A.5 - RS-232 Specifications

Signal Type	Terminal(s)	Specification
RS 232 Communications	1	XMIT
	2	RECV
	3	COMMON

Table A.6 - Speed Feedback Device Specifications (Vector Regulation Only)

Specification	Rating
Motor Poles	2, 4, 6, or 8 poles
Overcurrent IET	200% load (based on drive nameplate rating)
Overload Current Rating	150% for 1 minute (based on drive nameplate rating)
Speed Control Range	1:600 with 1024 PPR
Speed Control Response	15 Hz (typical)
Speed Feedback	15 V differential quadrature, pulse tachometer incremental (512 PPR, 1024 PPR, 2048 PPR, 4096 PPR)
Service Factor	1.0

Table A.7 - Input Signal Response Times (Worst Case)

These are the maximum times from transitioning the input to the drive reacting to the input.		
Signal Type and Source	**Volts/Hertz Regulation**	**Vector Regulation**
Keypad START	150 milliseconds	130 milliseconds
Terminal Strip:		
START	126 milliseconds	105 milliseconds
STOP, RESET, FL	75 milliseconds	75 milliseconds
Preset Speeds	75 milliseconds	75 milliseconds
Analog Speed/Trim Reference	16 milliseconds	5 milliseconds
Analog Torque Reference	N/A	0.5 milliseconds
Network:		
START	46 milliseconds + network transport time	25 milliseconds + network transport time
STOP, RESET, FL	26 milliseconds + network transport time	25 milliseconds + network transport time
Analog Speed/Trim Reference	5 milliseconds + network transport time	5 milliseconds + network transport time
Torque Reference	N/A	0.5 milliseconds + network transport time

Appendix B

Drive Regulation Overview

The GV3000 is a digital drive that provides closed loop vector or open loop volts/hertz regulation of A-C motors. The Volts/Hertz or Vector Regulation parameter (P048) is used to select the type of regulation for the application. See figures B.1 and B.2 for block diagrams of both regulators.

Volts/Hertz Regulation

Volts/hertz regulation provides general purpose open loop A-C drive control. It does not use a speed feedback device. In this type of control, the regulator maintains a programmed ratio of voltage to an output frequency, which provides constant or variable motor torque across a wide speed range. An internal function generator calculates the output motor voltage based on requested frequency and user-specified motor characteristics. The control loop output switches the power device gates, generating a pulse-width-modulated (PWM) waveform to the motor.

Vector Regulation

Vector regulation allows dynamic closed-loop performance in an A-C drive similar to that achieved with a D-C drive. Torque is constant across the motor's base speed range in both forward and reverse directions. The drive uses two digital control loops, speed and torque, to obtain vector performance.

The speed loop reference can be an internal or an external source. Speed loop feedback is provided by a pulse tachometer attached to the motor's shaft. A trim parameter is summed with the speed reference to provide a torque reference, or to adjust a user-specified Torque Reference Source parameter, for the torque control loop. An internally-generated flux reference is also fed to the torque loop. The torque will vary to maintain the motor at the requested speed. The torque control loop output switches the power device gates, generating a pulse-width-modulated (PWM) waveform to the motor.

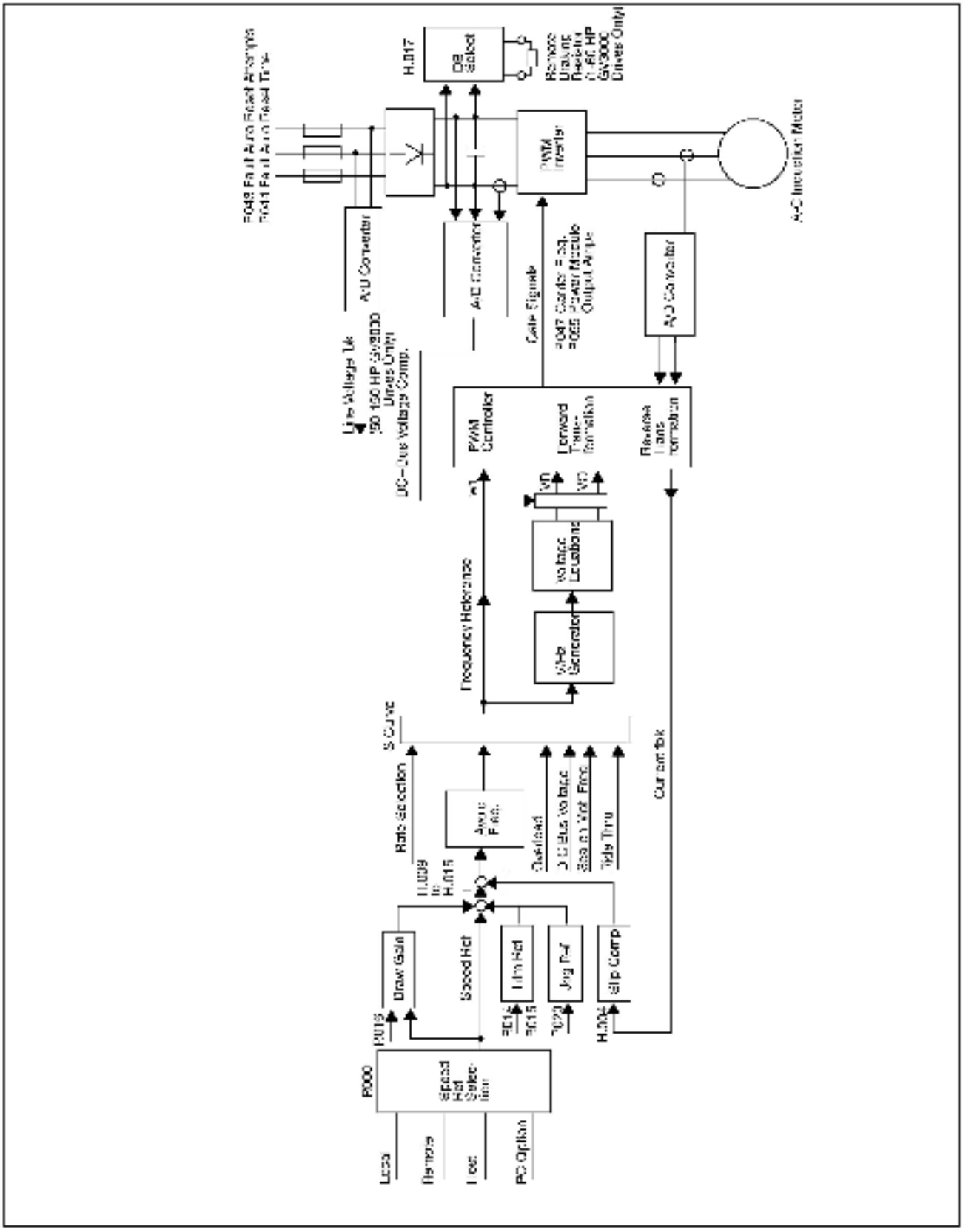

Figure B.1 - Volts/Hertz Regulation Block Diagram

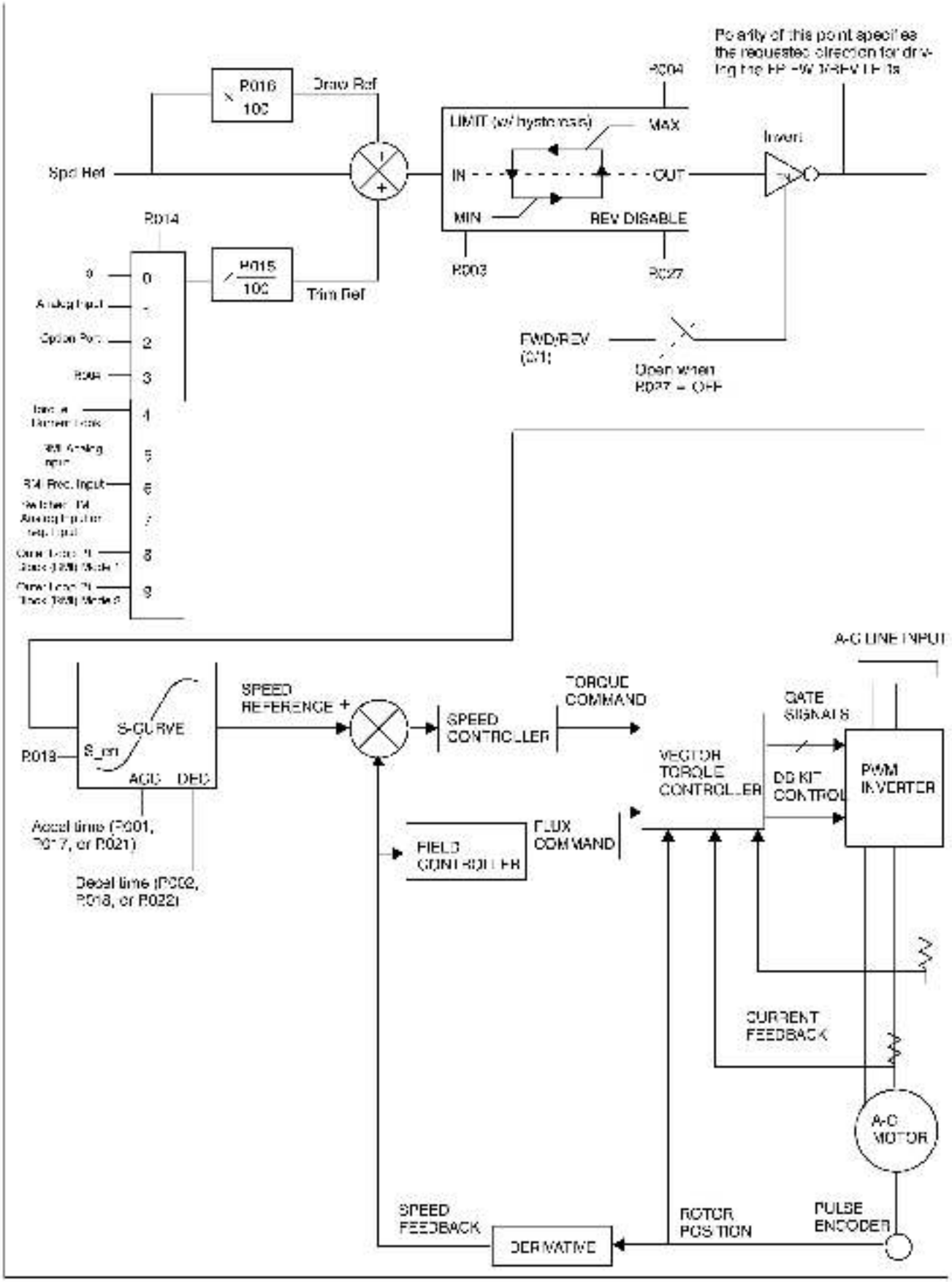

Figure B.2 - Vector Regulation Block Diagram

Appendix C

Compliance with EN 60204-1: 1992

The CV3000 complies with the following sections of standard EN 60204-1: 1992.

EN60204-1 Section	Title
6	Protection against electrical shock
6.2.1	- Protection by enclosure
6.2.3	- Protection against residual voltages
6.3.1	- Protection by automatic disconnect of supply
6.4	- Protection by the use of PELV (Protective Extra Low Voltage)
7	Protection of equipment
7.2	- Overcurrent protection
7.2.3	- Control circuits
7.2.6	- Transformers
7.5	- Protection against supply interruption or voltage reduction and subsequent restoration
8	Equipotential bonding
8.2.1	- General (the PE terminal)
8.2.2	- Protective conductors (connection points)
8.2.3	- Continuity of the protective bonding circuit
8.2.7	- Protective conductor connecting points
8.3	- Bonding to the protective bonding circuit for operational purposes
8.4	- Insulation failures
8.5	- Bonding to a common reference potential
8.6	- Electrical interferences
9	Control circuit and control functions
9.1.1	- Control circuit supply
9.1.3	- Protection
9.1.4	- Connection of control devices
9.2	- Control functions
9.2.1	- Start function
9.2.2	- Stop function
9.2.3	- Operating modes
9.2.5	- Operation
9.2.5.3	- Stop
9.2.5.6	- Hole-to-run controls
9.2.6	- Combined start and stop controls
9.3	- Protective interlocks
9.3.5	- Reverse current braking
9.4	- Control functions in case of failure
9.4.2.1	- Use of proven circuit techniques and components
9.4.3	- Provisions for redundancy
9.4.3.1	- Earth faults
9.4.3.2	- Voltage interruption

Appendix C

Compliance with EN 60204-1: 1992 (Continued)

EN60204-1 Section	Title
10	Operator interface and machine mounted control devices
10.2.1	- Pushbutton colors
10.8	- Displays
11	Control interfaces
11.2	- Digital input/output interfaces
11.2.1	- Inputs
11.2.2	- Outputs
11.3	- Drive interfaces with analog inputs
11.3.1	- Separation between control and electric drives
11.5	- Communications
12	Electronic equipment
12.2.2	- Electronic control equipment
12.2.3	- Equipotential bonding
12.3	- Programmable equipment
12.3.1	- Programmable controllers
12.3.2	- Memory retention and protection
12.3.3	- Programming equipment
12.3.4	- Software verification
12.3.5	- Use in safety-related functions
13	Controlgear: Location, mounting and enclosures
13.2.3	- Heating effects
13.4	- Enclosures, doors and openings
15	Wiring practices
15.1.1	- General requirements
15.1.3	- Conductors of different circuits
15.2.2	- Identification of the protective conductor
18	Warning signs and item identification
18.2	- Warning signs
18.4	- Marking of control equipment
19	Technical documentation
19.1	- General

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