GV3000 A-C Power Modules
Hardware Reference, Installation, and Troubleshooting
1-150 HP @ 380-460 VAC
Version 4.0

Instruction Manual D2-3324-1

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.

Table of Contents

Appendices

List of Figures

List of Tables

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 (D2-3323).

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

- 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 A-C Input Power Wiring

  Describes incoming A-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.

The thick black bar shown on the right-hand margin of this page will be used throughout this instruction manual to signify new or revised text or figures.

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:

- 1-25 HP drives: low horsepower GV3000 drives
- 25-150 HP drives: high horsepower GV3000 drives
- 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:

- D2-3323 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
- D2-3303 Configuration Executive 3000

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. If the product is still under the standard one-year warranty, you can also call the Customer Response Center (CRC) at 1-800-726-8112. This is a toll-free call.

If the product is no longer under warranty, you have two options. You can call 1-900-230-8600. This is a toll call for which you will be billed by the minute (first 2 minutes are free). Alternately, you can call 1-900-346-3400. Calls to this number will be billed at a flat rate per call. If you think your problem will take longer than 25 minutes to resolve, it will be more economical to contact Reliance at the second number.

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) regulation for a wide range of applications.

In vector mode, 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.

In general purpose (volts/hertz) mode, 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.

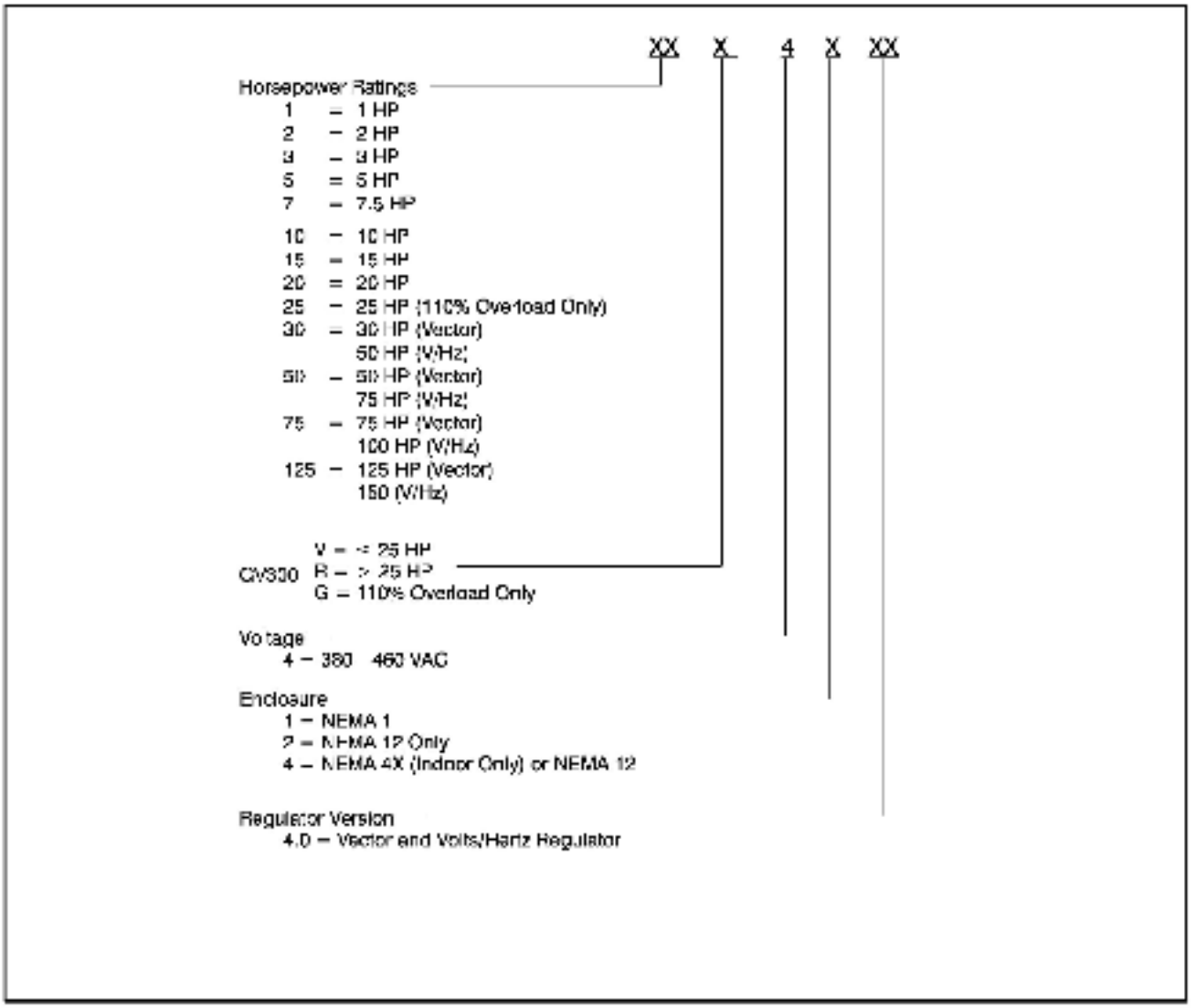


Figure 2.1 - Identifying the Drive Model Number

Table 2.1 - Power Ratings

1 to 25 HP – V/Hz or Vector Regulation					
Model Number	**Input Volts (A-C)**	**Input KVA**	**Input Amps**	**Output Amps[1][2]**	**Power Loss Watts (Full Load)**
1V4140 1V4440	380-460 VAC +/–10%	2.0	2.5	2.1	60
2V4140 2V4440	380-460 VAC +/–10%	3.3	4.2	3.4	100
3V4140 3V4440	380-460 VAC +/–10%	5.1	6.4	5.3	140
5V4140 5V4440	380-460 VAC +/–10%	7.9	9.9	8.2	180
7V4140 7V4240	380-460 VAC +/–10%	10.7	13.4	11.1	210
10V4140 10V4240	380-460 VAC +/–10%	13.4	16.8	14.2	250
15V4140 15V4240	380-460 VAC +/–10%	20.2	25.4	21.0	375
20V4140 20V4240	380-460 VAC +/–10%	26.1	32.7	27.0	600
25G4140 25G4240	380-460 VAC +/–10%	29.5	37.0	30.4	800

30 to 125 HP – V/Hz Regulation					
Model Number	**Input Volts (A-C)**	**Input KVA**	**Input Amps**	**Output Amps[1]**	**Power Loss Watts (Full Load)**
30R4140	380-460 VAC +/–10%	59	74	63	960
50R4140	380-460 VAC +/–10%	81	102	90	1420
75R4140	380-460 VAC +/–10%	100	126	116	1780
125R4140	380-460 VAC +/–10%	170	213	210	3200

NOTE: *The above ratings are at 2 kHz.*

30 to 125 HP – Vector Regulation					
Model Number	**Input Volts (A-C)**	**Input KVA**	**Input Amps**	**Output Amps[2]**	**Power Loss Watts (Full Load)**
30R4140	380-460 VAC +/–10%	44	55	45	720
50R4140	380-460 VAC +/–10%	65	81	70	1150
75R4140	380-460 VAC +/–10%	80	101	89	1400
125R4140	380-460 VAC +/–10%	127	159	152	2410

NOTE: *The above ratings are at 2 kHz.*

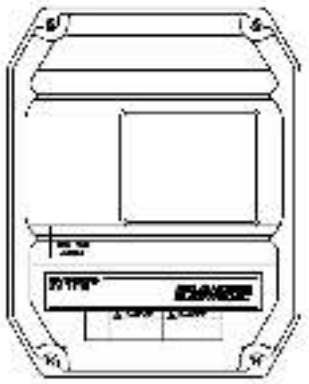
(1) With V/Hz regulation, 110% continuous output capability at 2 kHz.

(2) With vector regulation, 150% overload capability for one minute.

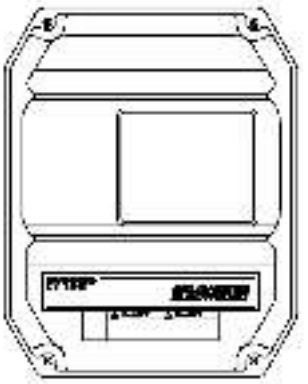
2.2 NEMA Enclosures

GV3000 enclosures have one of the following NEMA ratings. See figure 2.2.

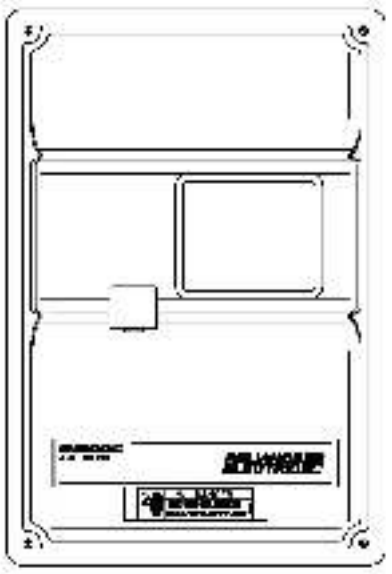
- NEMA 1: Vented. Intended for general-purpose indoor applications. Contains a communication access door that allows access to the communication port without removing the cover.
- NEMA 4X/12: Not vented. Intended for use in indoor environments that require a water-tight/dust-tight enclosure.
- NEMA 12: Intended for use in indoor environments that require a dust-tight/drip-tight enclosure.



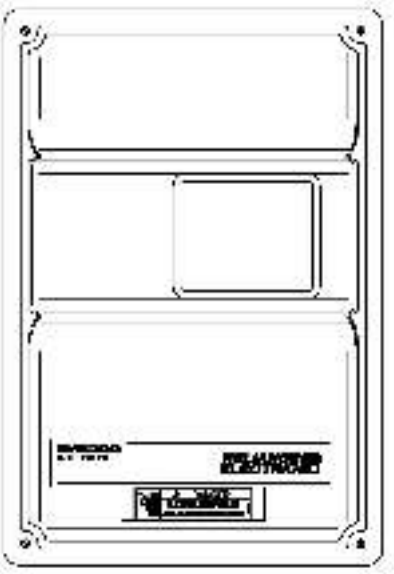
NEMA 1
(1-10 HP)



NEMA 1X/12
(1-5 HP)



NEMA 1
(15-25 HP)



NEMA 12
(7.5-25 HP)

1. NEMA 1 COVER IS VENTED AND CONTAINS COMMUNICATION ACCESS DOOR.
2. NEMA 4X/12 COVER IS NOT VENTED AND IS SUPPLIED WITH BASE AND KEYPAD GASKETS.
3. 25-150 HP ENCLOSURES ARE NEMA 1 RATED AND ARE NOT SHOWN.

Figure 2.2 - NEMA Enclosures

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 2.3 to 2.5. Replacement parts are listed in chapter 9.

1. Fan Assembly
2. Membrane Switch (Keypad/Bracket)
3. Regulator Printed Circuit Board (PCB)
4. Capacitor PCB
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

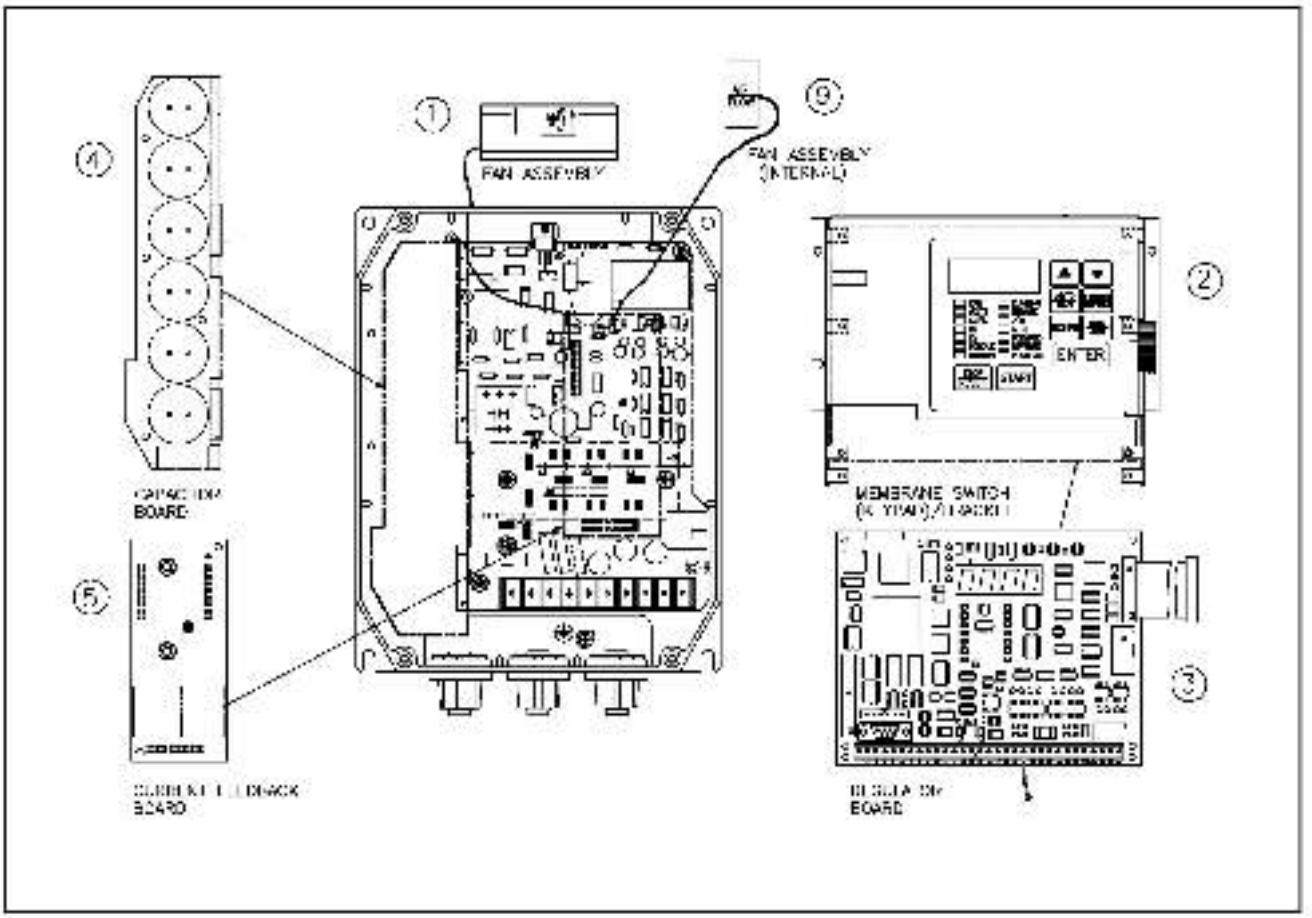


Figure 2.3 - 1-5 HP Drive Components and Locations

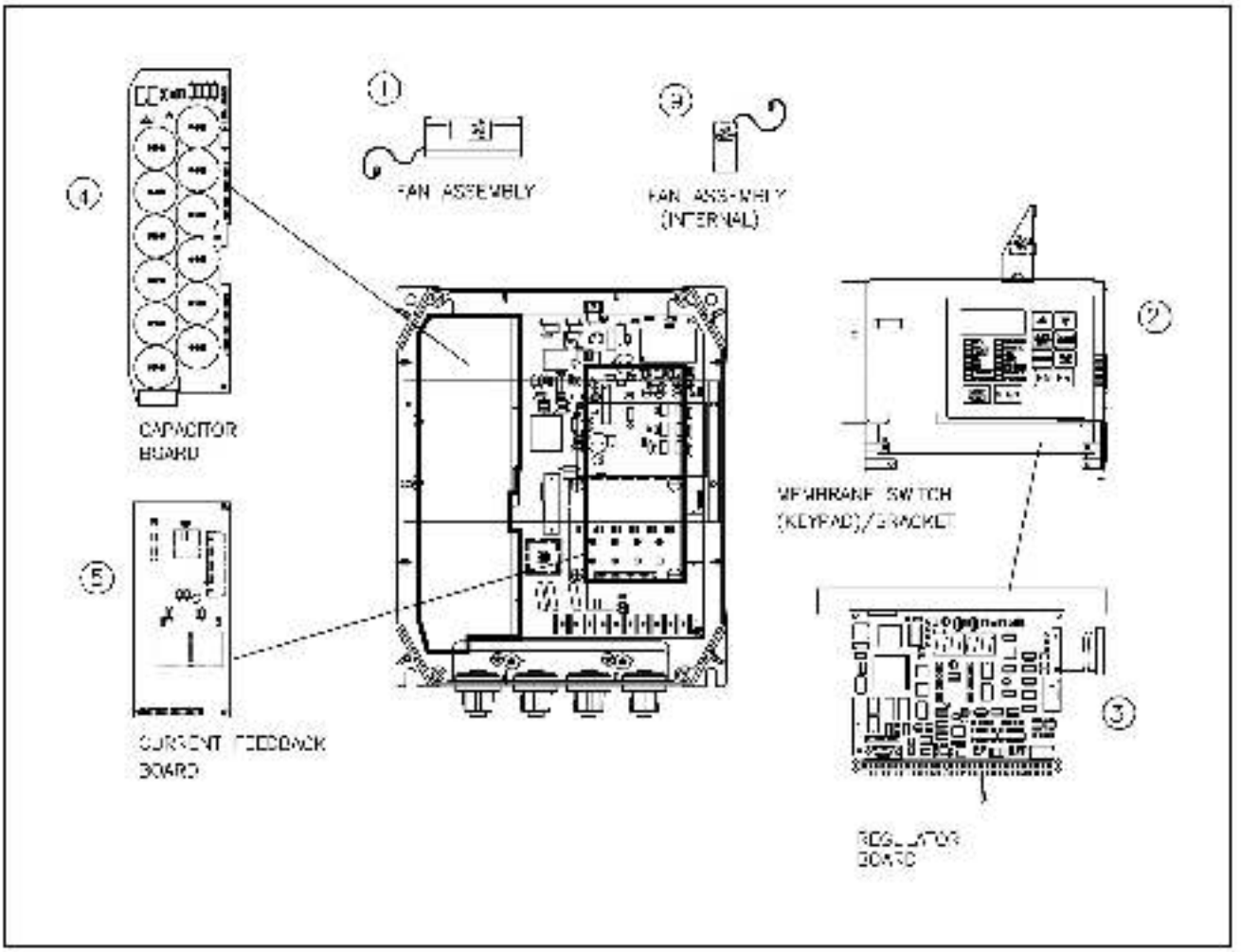


Figure 2.4 - 7.5-10 HP Drive Components and Locations

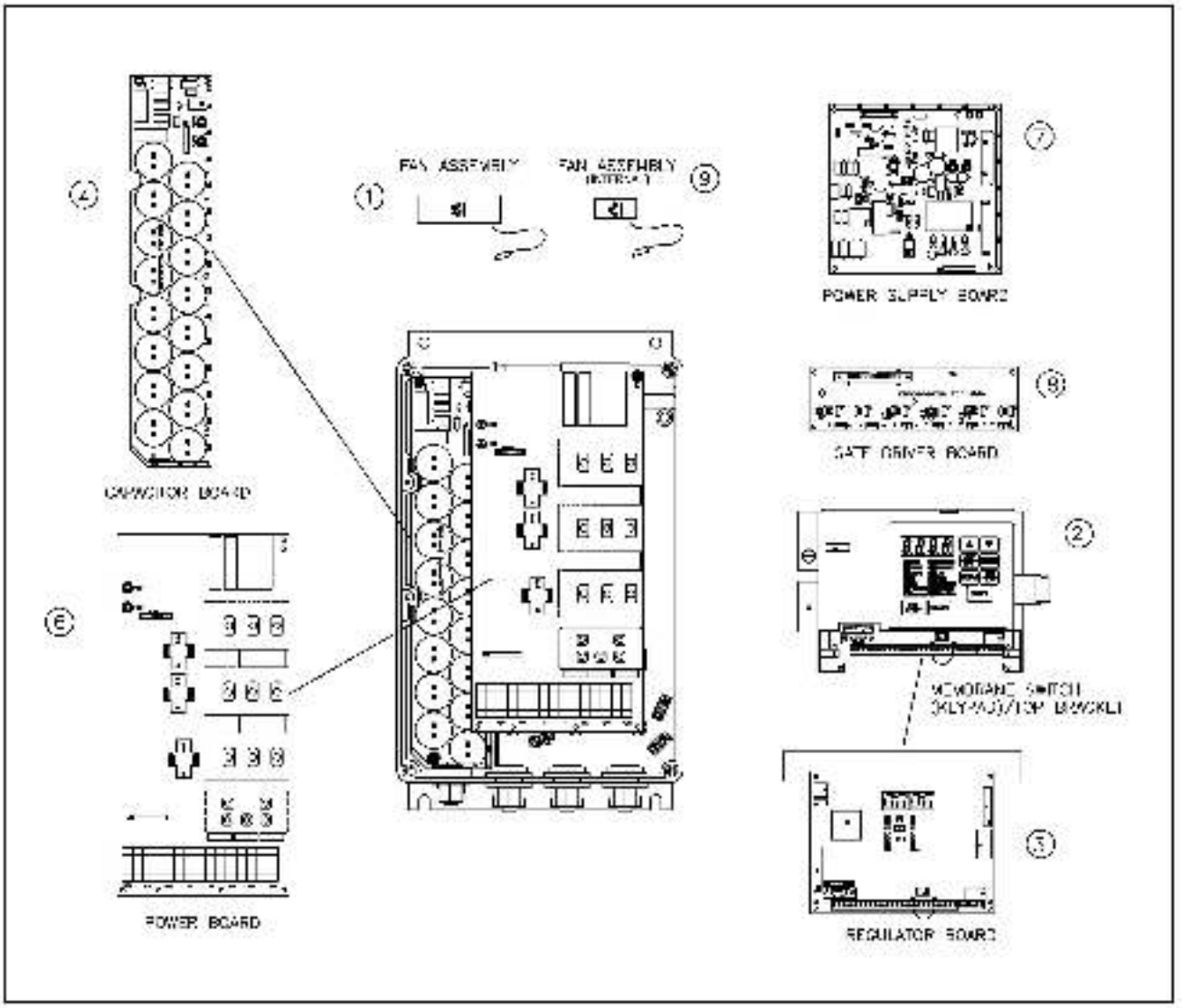


Figure 2.5 - 15-25 HP Drive Components and Locations

2.4 25-100 HP GV3000 Drive Components and Locations

The 25-100 HP drives have the following main components. The identification numbers provided correspond to the numbers used in figures 2.6 and 2.7. Replacement parts are listed in chapter 9.

1. Regulator Printed Circuit Board (PCB)
2. Power Unit 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. D-C Bus Current Sensor
17. Keypad

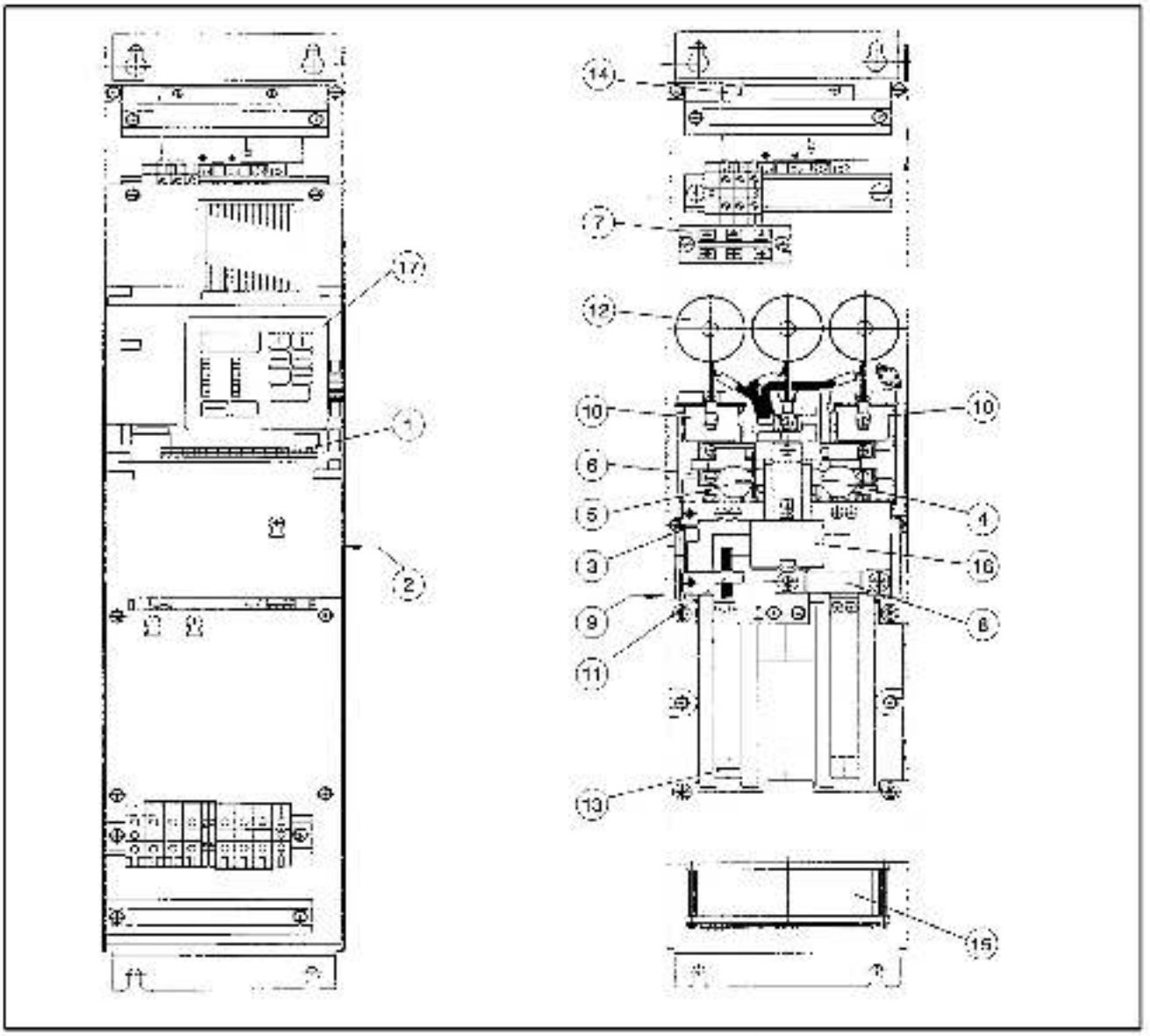


Figure 2.6 - 25-50 HP Drive Components and Locations

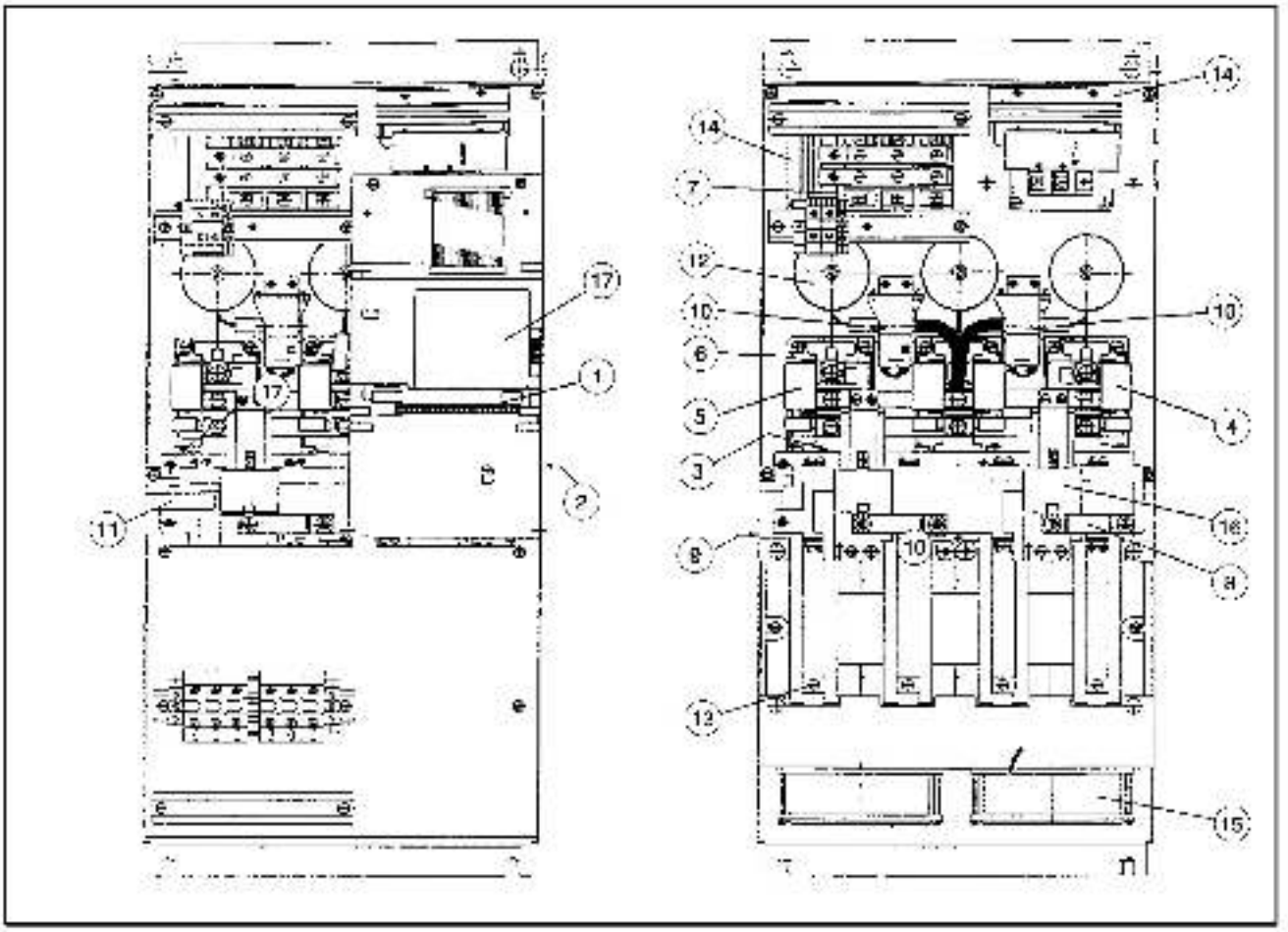


Figure 2.7 - 40-100 HP Drive Components and Locations

2.5 100-150 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 2.8. Replacement parts are listed in chapter 9.

1. Regulator Printed Circuit Board (PCB)
2. Power Unit Interface PCB
3. Gate Driver PCB
4. Bus Clamp PCB - Right
5. Bus Clamp PCB - Left
6. Intelligent Power Module PCB
7. Thyristor 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. D-C Bus Current Sensor
17. Keypad
18. Thyristor Firing Pulse PCB

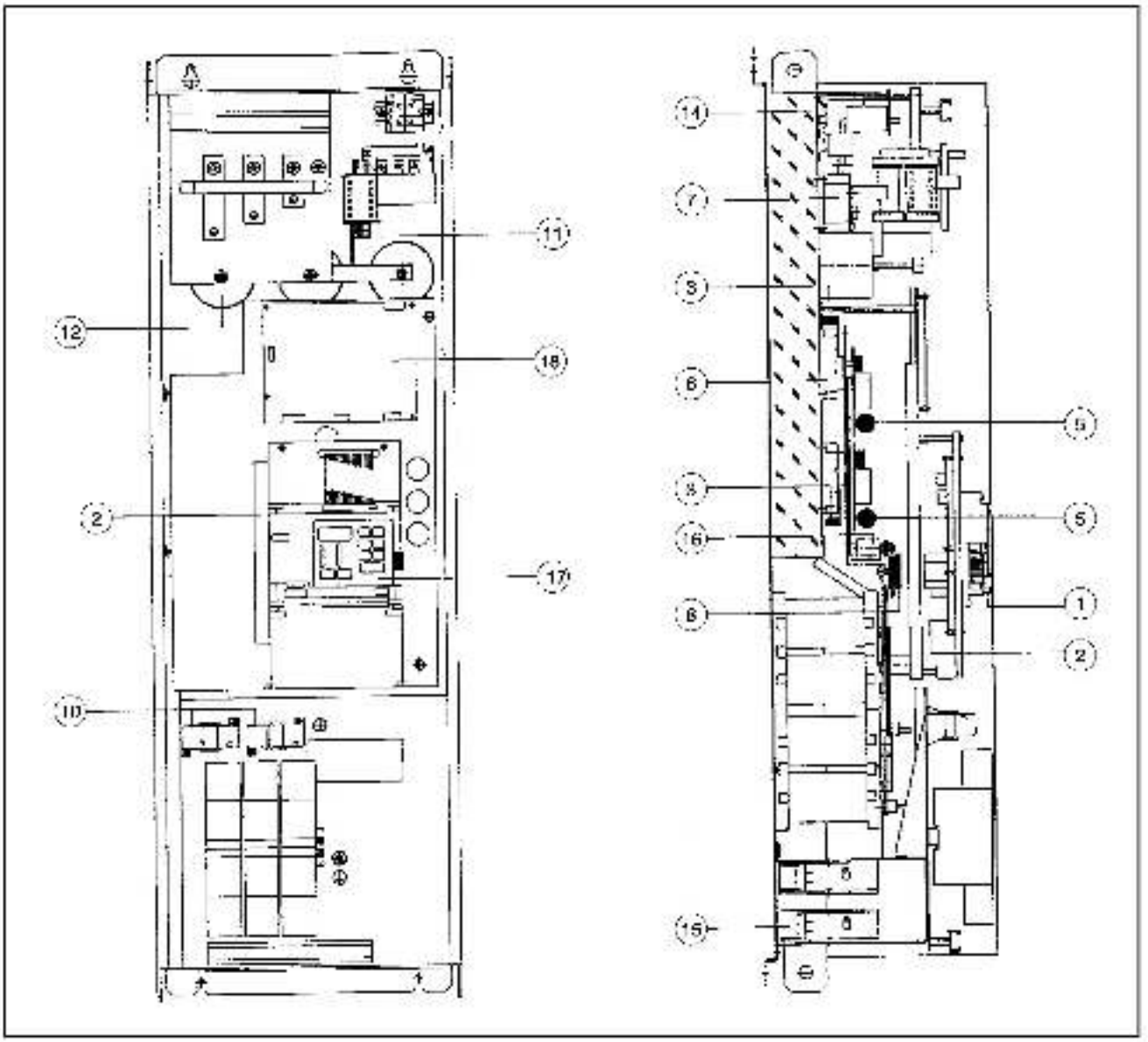


Figure 2.8 - 100-150 HP Drive Components and Locations

2.6 Regulator Board Description

GV3000 drive regulation is performed by a microprocessor on the Regulator board. See figures 2.9 and 2.10. Drive operation is adjusted by the parameters entered through the keypad. The Regulator board accepts power circuit feedback signals, an external speed reference signal, 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 user-supplied external power supply for operation. The analog output signal is available through the terminal strip.

- A snubber resistor braking signal

The low 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: low HP Regulator boards are used with 1-25 HP drives: high HP Regulator boards are used with 25-150HP drives. As shown in figures 2.9 and 2.10, the Regulator boards are similar but have different power unit interface connectors.

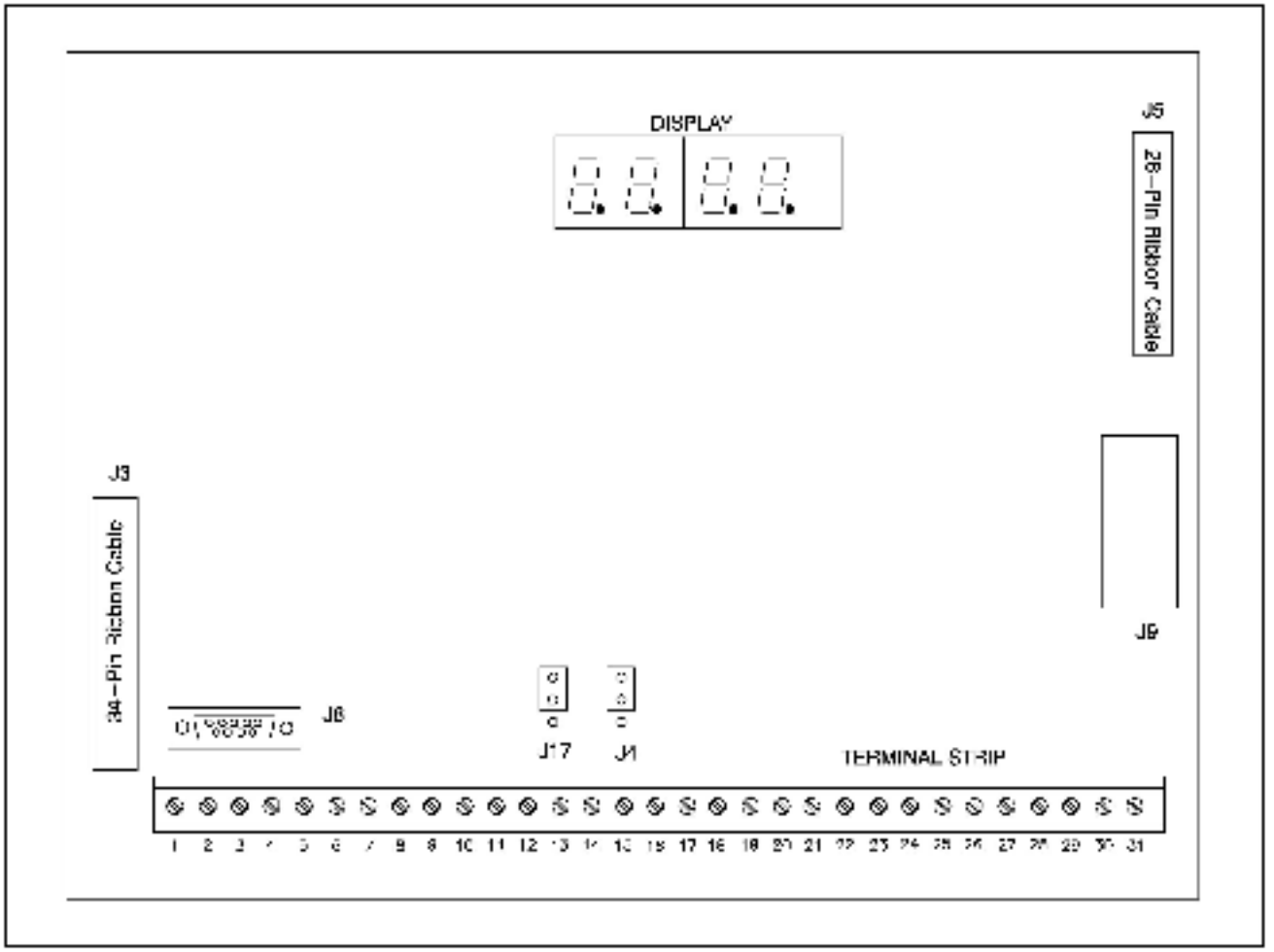


Figure 2.9 - Low HP Regulator Board Components and Locations

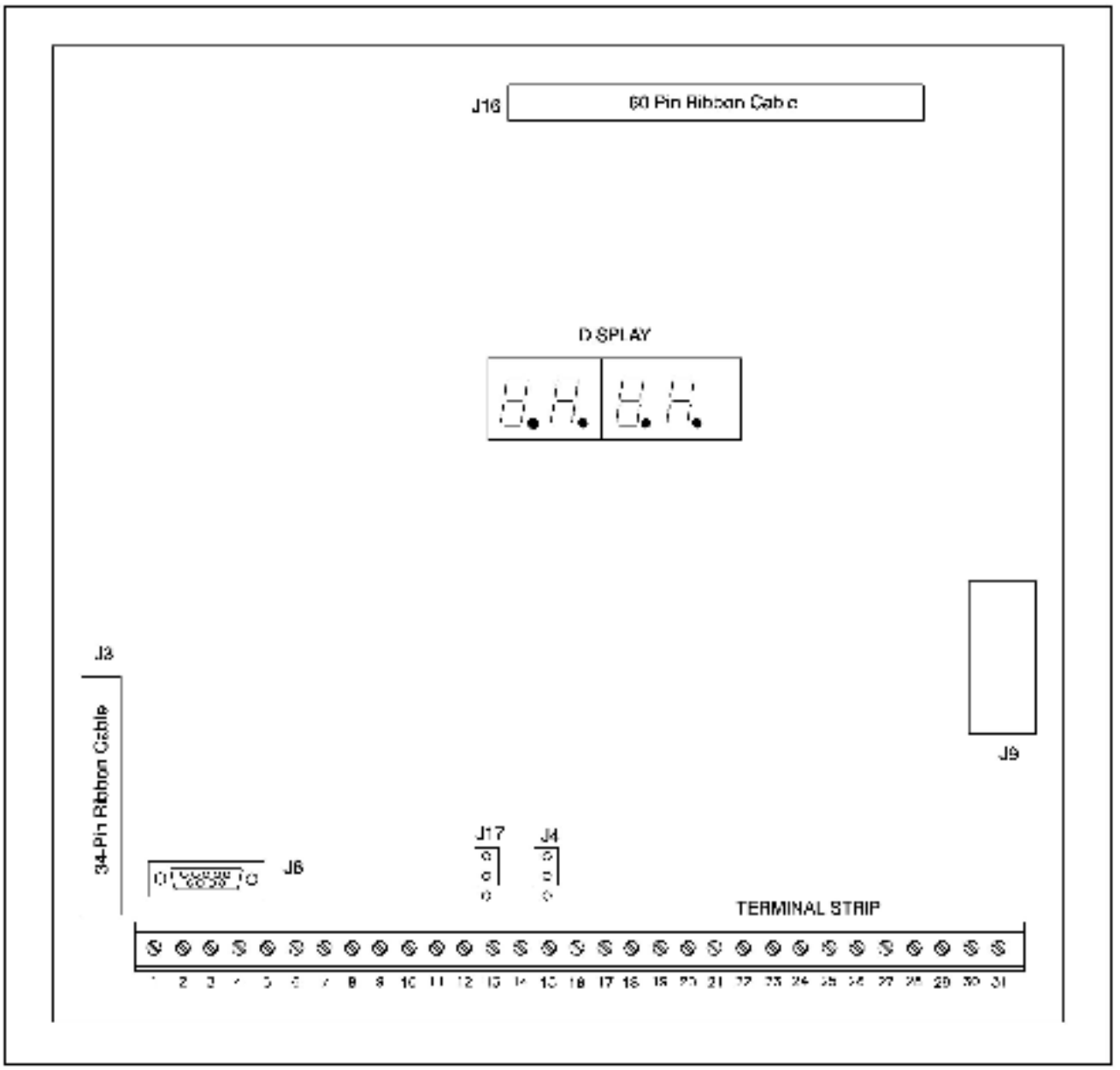


Figure 2.10 - High HP Regulator Board Components and Locations

2.6.1 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 2.9 and 2.10 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.

Jumper J4 is the analog speed/torque (U.000) reference jumper. This jumper selects either +/– 10 VDC or 0-20 mA speed input in conjunction with the following parameters: Terminal Block Analog Input Gain (P.010), Terminal Block Analog Input Offset (P.009), and Terminal Block Analog Input Invert (P.011). Note that if the position of jumper J4 is changed after the parameters are configured, the software will not recognize that the input reference or polarity has been changed. Verify that parameters P.009, P.010, and P.011 are correct before starting the drive. Refer to instruction manual D2-3323 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 A-C 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 2.9 and 2.10.

Step 5. Locate pin 1 on jumper J4. Move the jumper to the desired setting as shown in figure 2.11.

Step 6. Re-attach the cover.

Step 7. Re-apply A-C input power.

Step 8. Verify that Terminal Block Analog Input Offset (P.009), Terminal Block Analog Input Gain (P.010), and Terminal Block Analog Input Invert (P.011) are correctly set. Refer to instruction manual D2-3323 for more information.

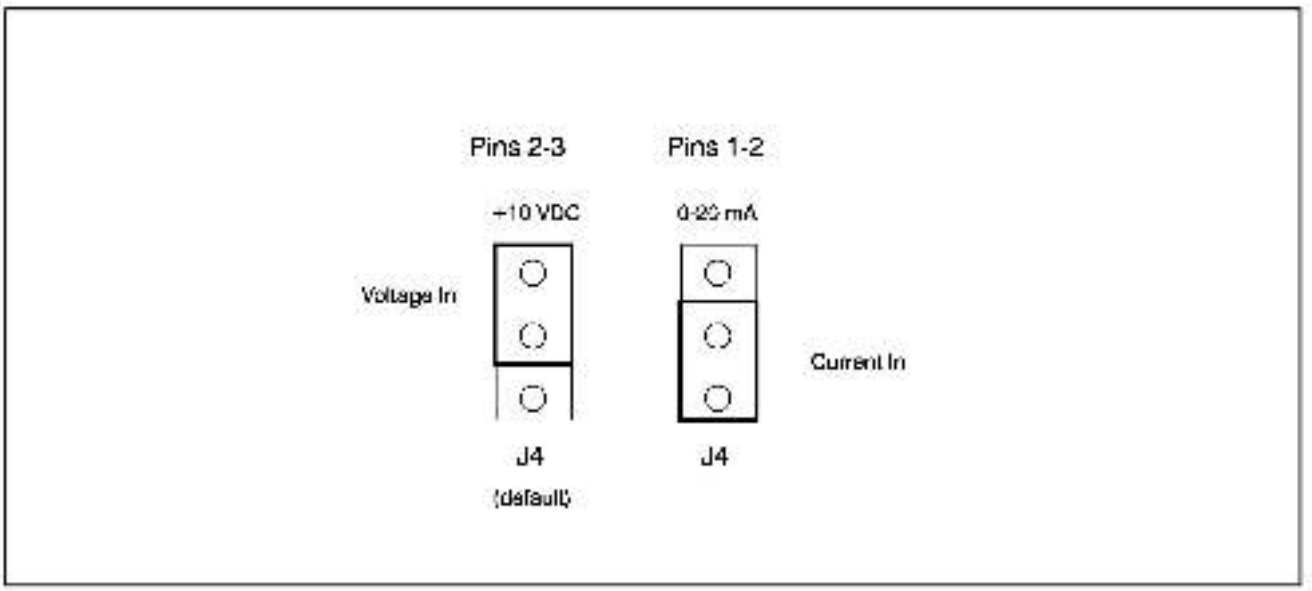


Figure 2.11 - Jumper J4 Settings for Analog Input Speed Reference

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 P.012. The jumper only selects a 0-10 VDC source voltage or 4-20 mA sink current to represent speed or torque.

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 A-C 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 2.9 and 2.10.

Step 5. Locate pin 1 on jumper J17. Move the jumper to the desired setting as shown in figure 2.12.

Step 6. Re-attach the cover.

Step 7. Re-apply A-C input power.

Step 8. Verify that parameter P.012 is set correctly for either speed or current.

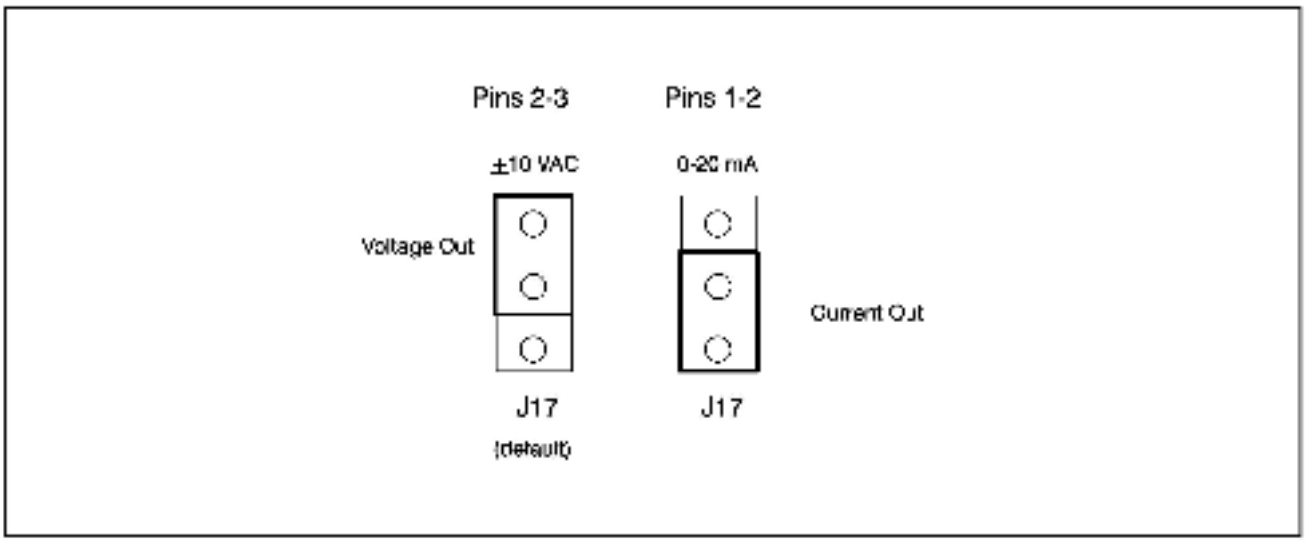


Figure 2.12 - Jumper J17 Settings for Analog Outputs

2.6.2 Wiring the Terminal Strip

The terminal strip on the Regulator board provides terminals for connecting customer I/O devices. See figures 2.9, 2.10, and 2.13. 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 (low HP Regulator boards only)
- Terminals 26-27: snubber resistor braking control connections (low HP Regulator boards only)
- Terminals 28-31: status relay connections

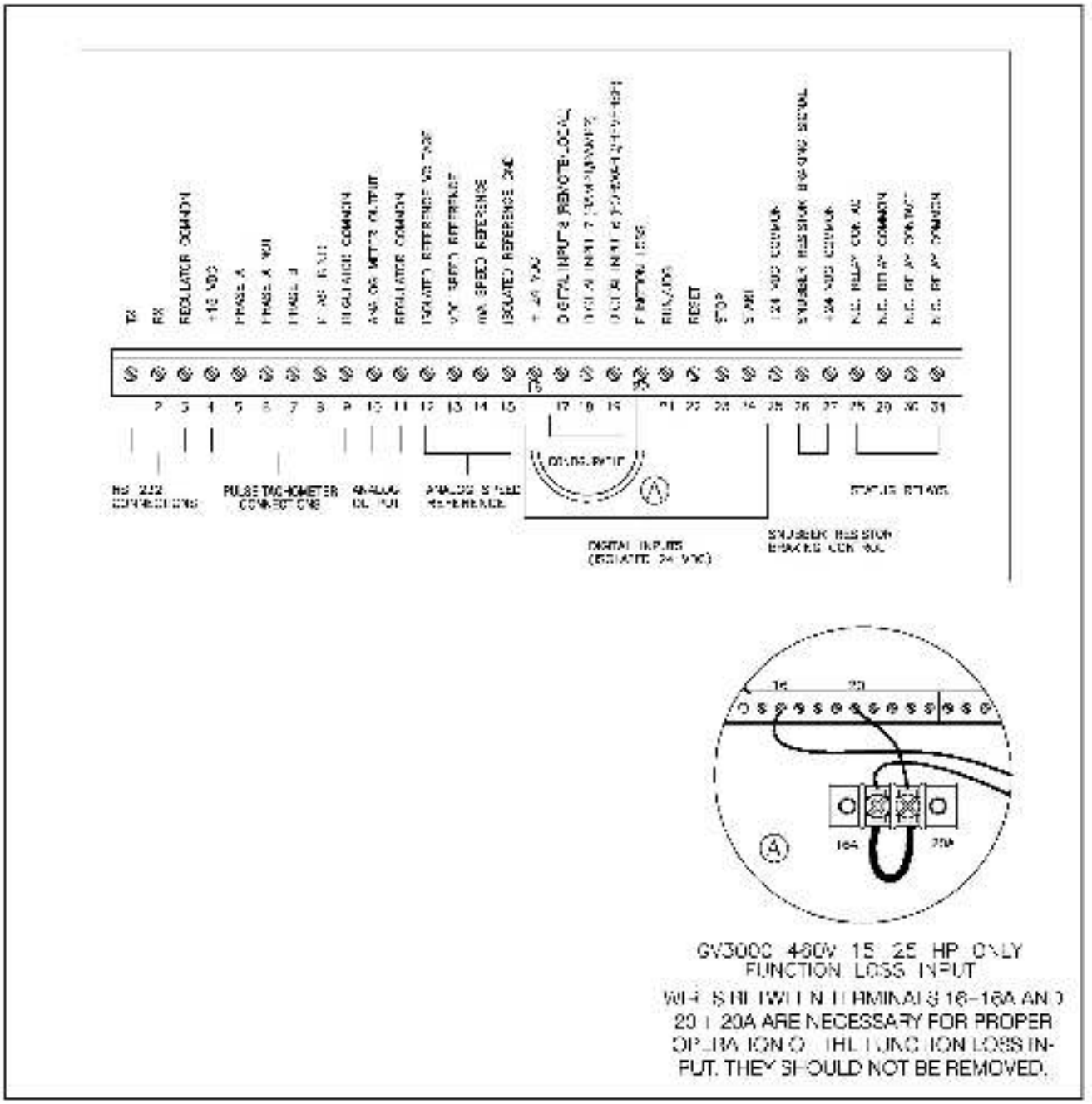


Figure 2.13 - Typical Terminal Strip Connections

2.6.3 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 Configuration Executive 3000 software. See figures 2.9 and 2.10. Refer to instruction manual D2-3303, Configuration Executive 3000, for more information.

2.6.4 Network Communication Board Ribbon Cable Assembly and Connectors

The flat-ribbon cable connector (J3) on the left side of the Regulator board provides a means of attaching optional communication boards such as the AutoMax Network Communication board to the GV3000 drive. See figures 2.9 and 2.10.

The Network board allows the drive to be operated and monitored via an AutoMax network. The Network board is mounted below the Regulator board inside the drive. Refer to instruction manual D2-3308 for more information. Refer to section 2.7 of this manual for more information on optional drive kits.

2.6.5 Keypad/Display

The front panel keypad/display is used to program and operate the GV3000 drive. See figure 2.14.

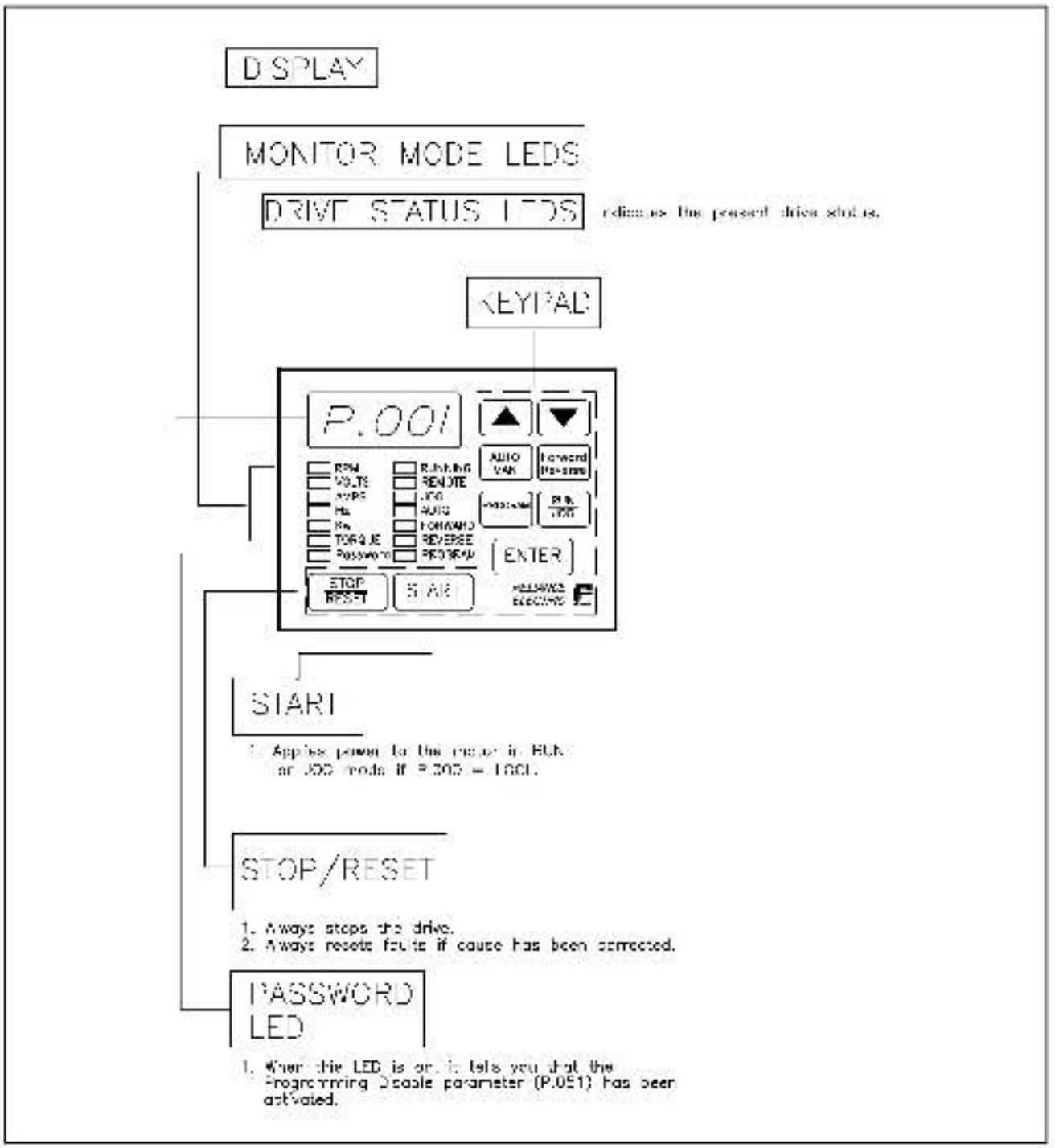


Figure 2.14 - Keypad/Display

2.7 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][3]	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]	2TC4025[5] 2TC4075[5] 2TC4100[6] 2TC4300[6]	D2-3305
AutoMax Network Communication Board w/10 Feet of Cable[1][2][3][4]	2AX3000	D2-3308

(1) 1-5 HP GV3000 Drives

(2) 7.5-10 HP GV3000 Drives

(3) 15-25 HP GV3000 Drives

(4) 25-150 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 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. 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 - Environmental 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	5-95% (non-condensing)

3.1.2 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 GV3000 drives directly above each other. Refer to figure 3.1 for recommended air flow clearances.

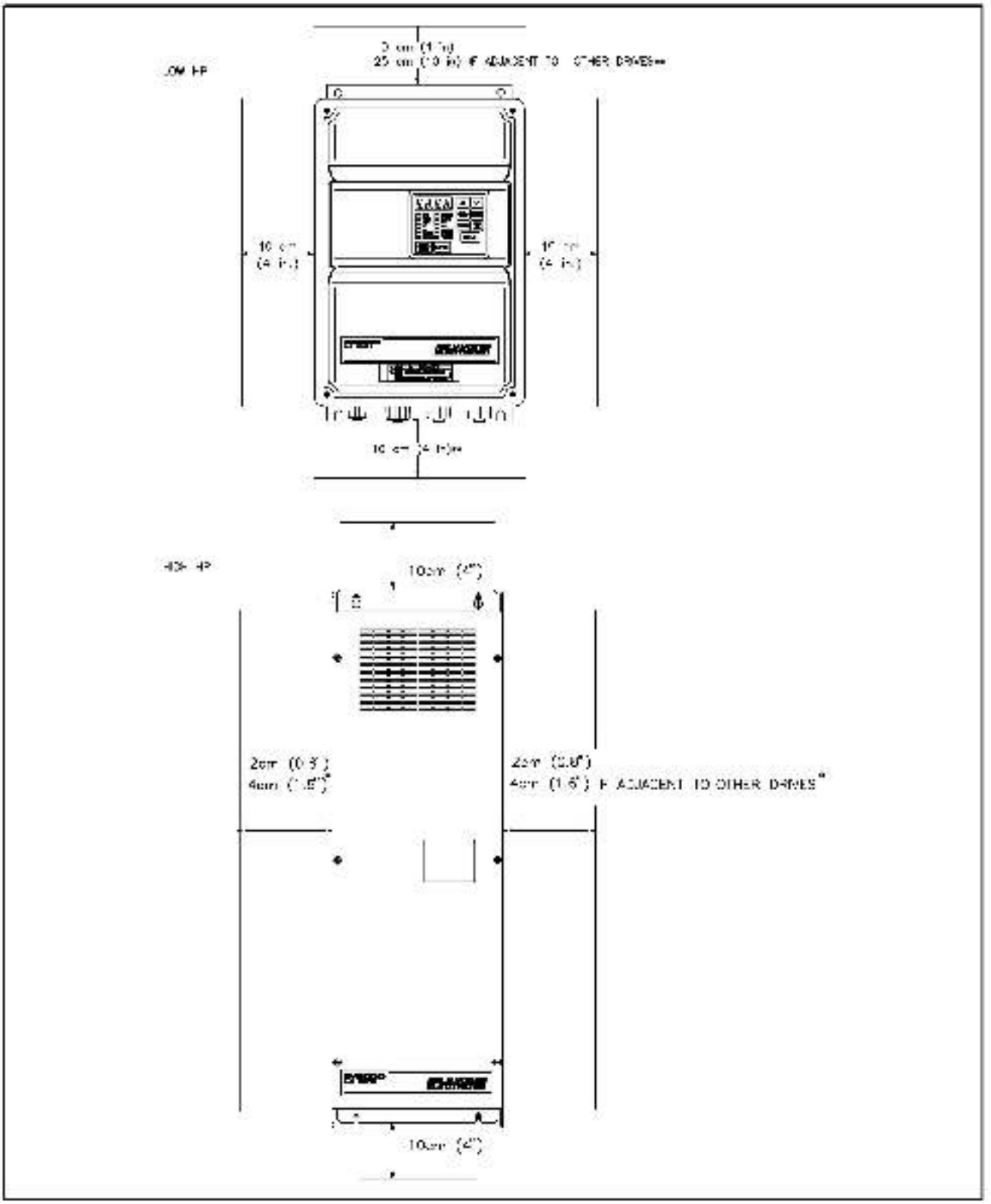


Figure 3.1 - Recommended Air Flow Clearances

3.1.3 Determining Total Area Required Based on Drive Dimensions

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

Table 3.2 - Drive Dimensions and Weights

GV3000 Drive	Dim. A	Dim. B	Dim. C	Dim D.	Dim. E	Weight
1V4140 1V4440 2V4140 2V4440 3V4140 3V4440 5V4140 5V4440	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
7V4140 7V4240 10V4140 10V4240	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
15V4140 15V4240 20V4140 20V4240 25Q4140 25Q4240	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
30R4140	212.0 mm 8.35"	880.0 mm 34.65"	150.0 mm 5.90"	850.0 mm 33.46"	322.0 mm 12.68"	39 kg 85.9 lbs
50R4140 75R4140	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
125R4140	465.0 mm 18.30"	1457 mm 57.36"	330.0 mm 12.99"	1414 mm 55.66"	355.0 mm 13.97"	96 kg 211 lbs

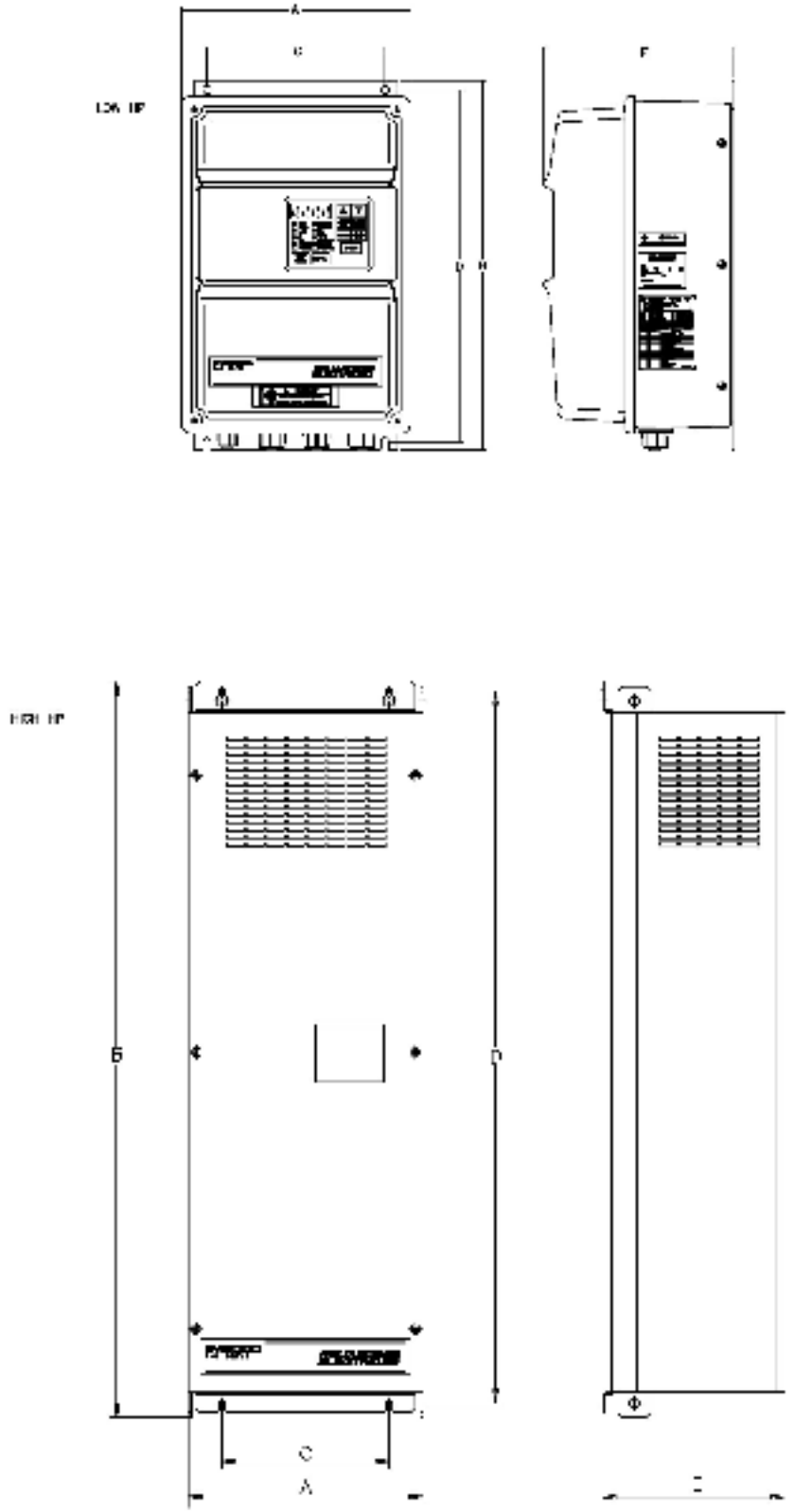


Figure 3.2 - Drive Dimensions

3.1.4 Verifying Power Module A-C Input Ratings Match Available 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.

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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
A-C Input Power	R/L1, S/L2, T/L3	12 to 18 AWG, 3 to 0.9 (mm^2)
Output Power	U/T1, V/T2, W/T3	

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

Type of Wiring	Terminals	Size of Wire
A-C Input Power	R/L1, S/L2, T/L3	6 to 14 AWG, 13 to 2 (mm^2)
Output Power	U/T1, V/T2, W/T3	

Table 3.5 - Recommended Power Wire Sizes for 25-50 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)
A-C Input Power	1L1, 1L2, 1L3 2L1, 2L2	2 AWG (2X), 35 (mm^2)
Output Power	U, V, W	
Grounds	PE1, PE2	2 AWG, 35 (mm^2)

Table 3.6 - Recommended Power Wire Sizes for 40-100 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	
Grounds	PE1, PE2	2 AWG, 35 (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	
Grounds	PE1, PE2	4/0 AWG, 95 (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.

Table 3.8 - Recommended Terminal Strip Wire Sizes

Terminals	Wire Size
1 to 31	14 to 20 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 connected to a 1-25 HP drive, individual motor lead lengths should not exceed 76 meters (250 feet) per phase.
- For applications using one motor connected to a 25-150 HP drive, individual motor lead lengths should not exceed 76 meters (250 feet) per phase. Note that drives set up for vector regulation can only be connected to one motor at a time.
- For applications where multiple motors are connected to a 1-25 HP drive, total motor lead length on each phase should not exceed 76 meters (250 feet). Also, each motor connection 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. If the motor lead length must exceed these limits, output line reactors or other steps must be taken to correct the problem.

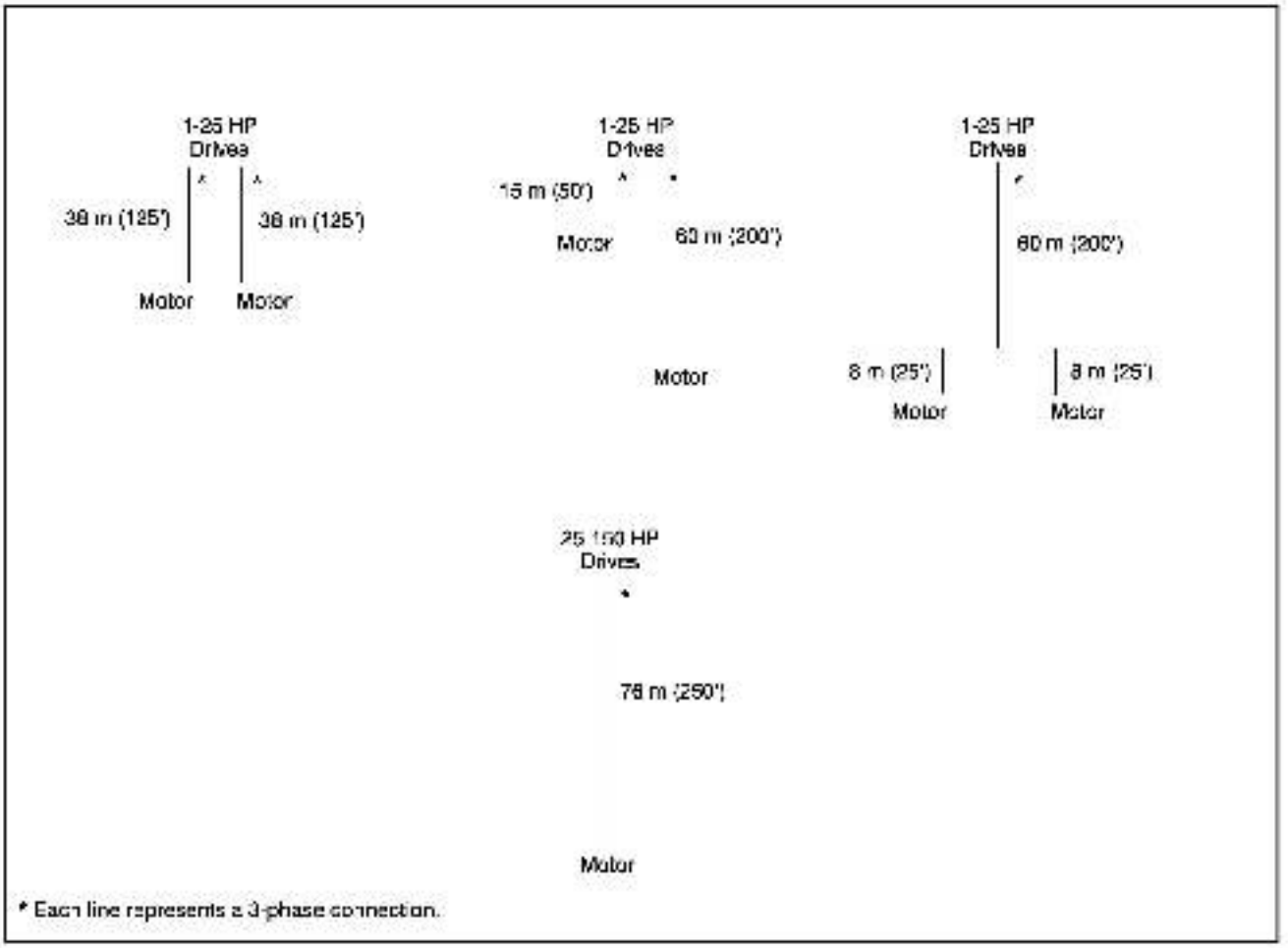


Figure 3.3 - Motor Lead Lengths

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 foot) 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 Configuration Executive 3000 software must also be used. Refer to instruction manual D2-3303 for more information.

The Regulator boards have one set of RS-232 transmit/receive lines. These lines can be accessed by only <u>one</u> 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 A-C 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.

A-C input line branch circuit protection fuses must be used to protect the input power lines. 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. Note that on 100-150 HP drives drives only, A-C input power and external fuses must be connected to terminals 2L1 and 2L2.

Table 3.9 - A-C Input Line Fuse Selection Values

Model Number	Horsepower Rating	380-460V A-C Input Line Fuse Rating[1][2]
1V4140 1V4440	1	6A
2V4140 2V4440	2	8A
3V4140 3V4440	3	12A
5V4140 5V4440	5	25A
7V4140 7V4240	7.5	25A
10V4140 10V4240	10	35A
15V4140 15V4240	15	45A
20V4140 20V4240	20	55A
25G4140 25G4240	25	55A
30R4140	25-50 V/Hz 25-30 Vector	100A (2A)[3] 70A (2A)[3]
50R4140	60-100 V/Hz 40-75 Vector	125A (2A)[3] 100A (2A)[3]
75R4140	60-100 V/Hz 40-75 Vector	150A (2A)[3] 125A (2A)[3]
125R4140	125-150 V/Hz 100-125 Vector	250A (2A)[3] 250A (2A)[3]

(1) Recommended fuse type for low HP drives: UL Class J, 600V, time delay, or equivalent.

(2) Recommended fuse type for high HP drives: UL Class J, 660V, time delay, or equivalent.

(3) Recommended fuse type for high HP drives (terminals 2L1, 2L2 only): 2A, class CC, time delay.

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 per 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. Refer to figure 3.2 and table 3.2 for drive mounting dimensions. Use the following user-supplied mounting screws:

- 1-5HP drives: 1/4-20
- 7.5-10HP drives: 5/16-18
- 15-25HP drives: 3/8-16
- 25-150HP drives: M8 (.315")

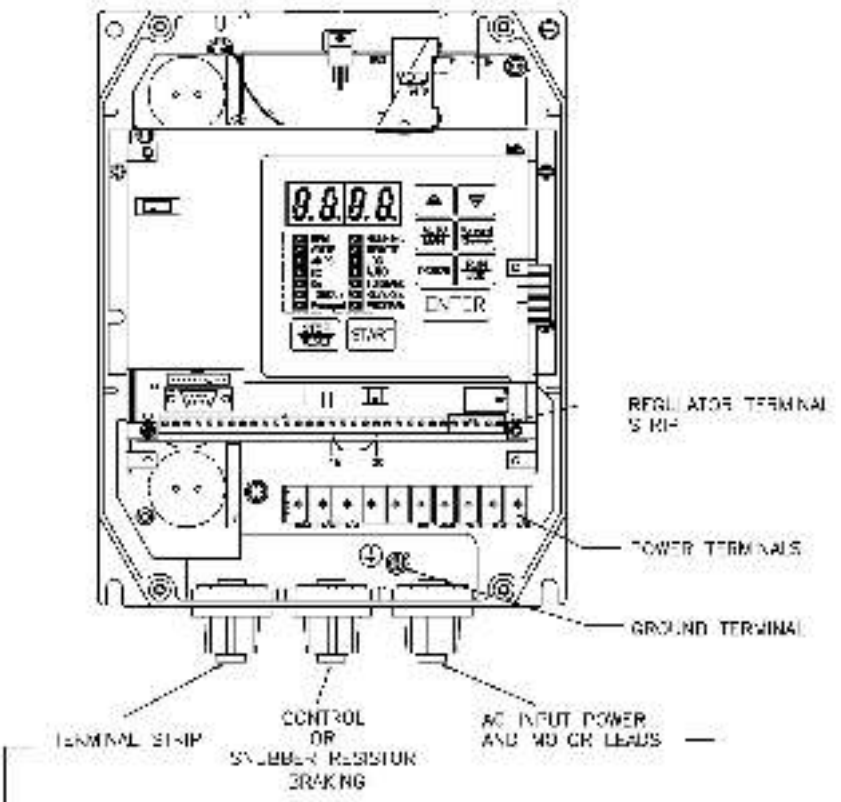
4.1.1 Verifying the Drive's Watts Loss Rating

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 A-C 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. 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.



CUSTOMER WIRE ROUTING

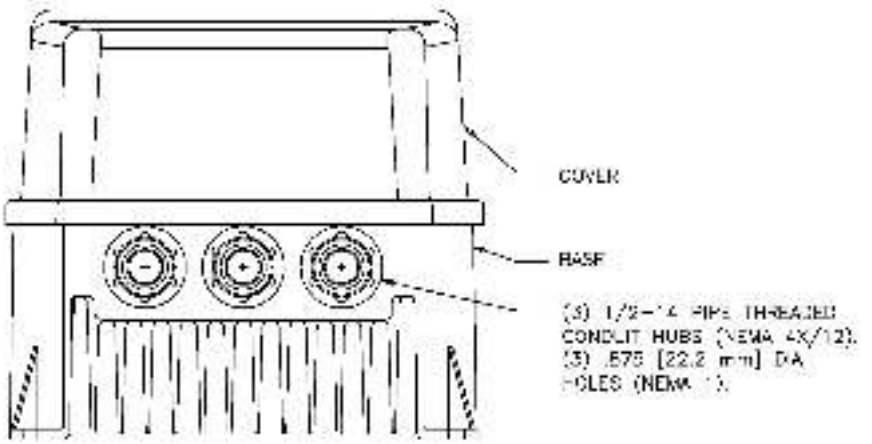
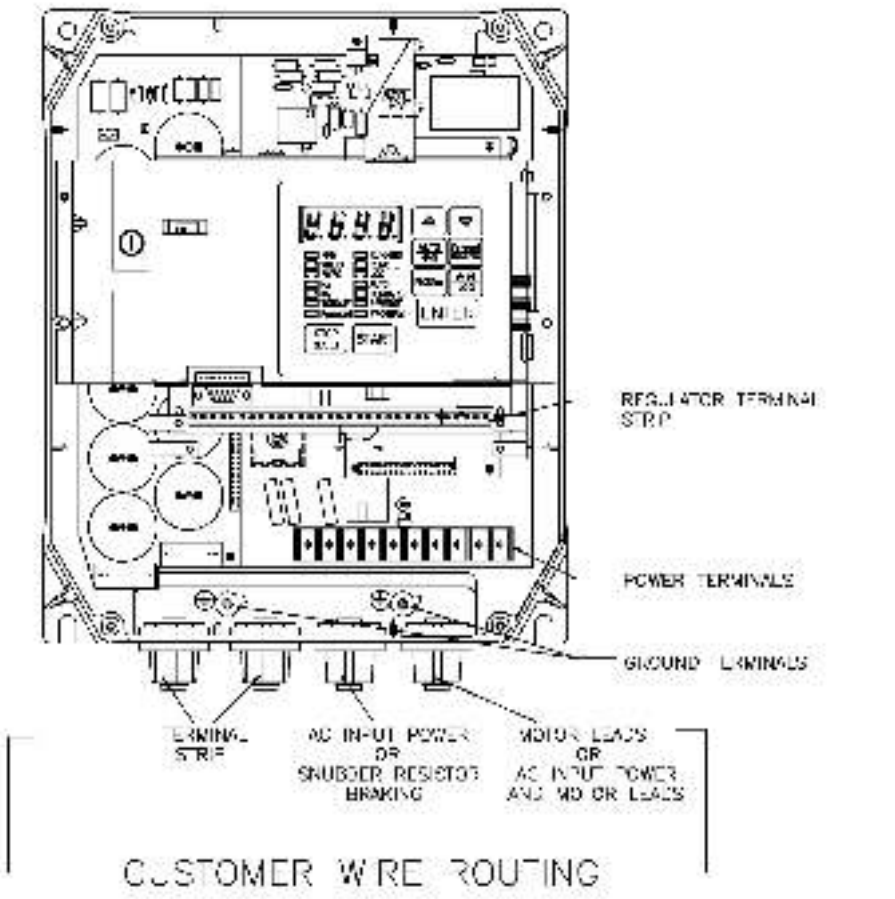


Figure 4.1 - Wire Routing Locations for 1-5HP Drives



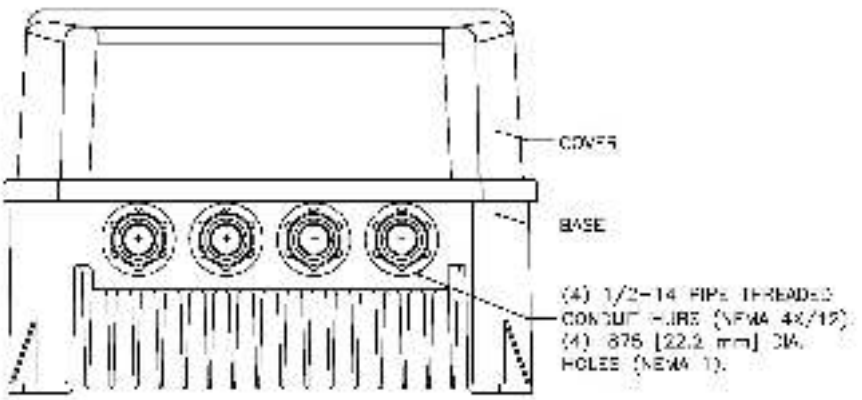


Figure 4.2 - Wire Routing Locations for 7.5-10HP Drives

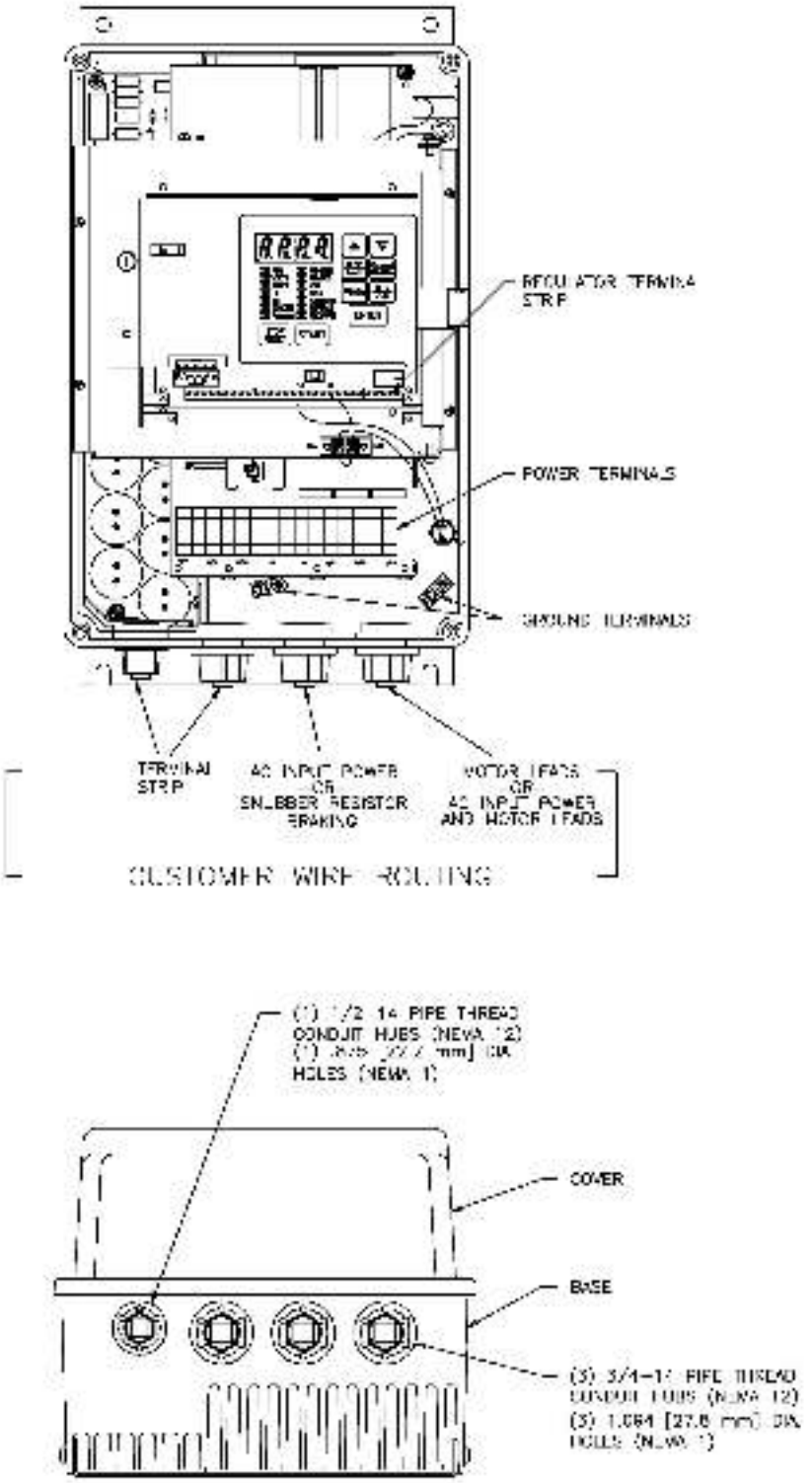


Figure 4.3 - Wire Routing Locations for 15-25HP Drives

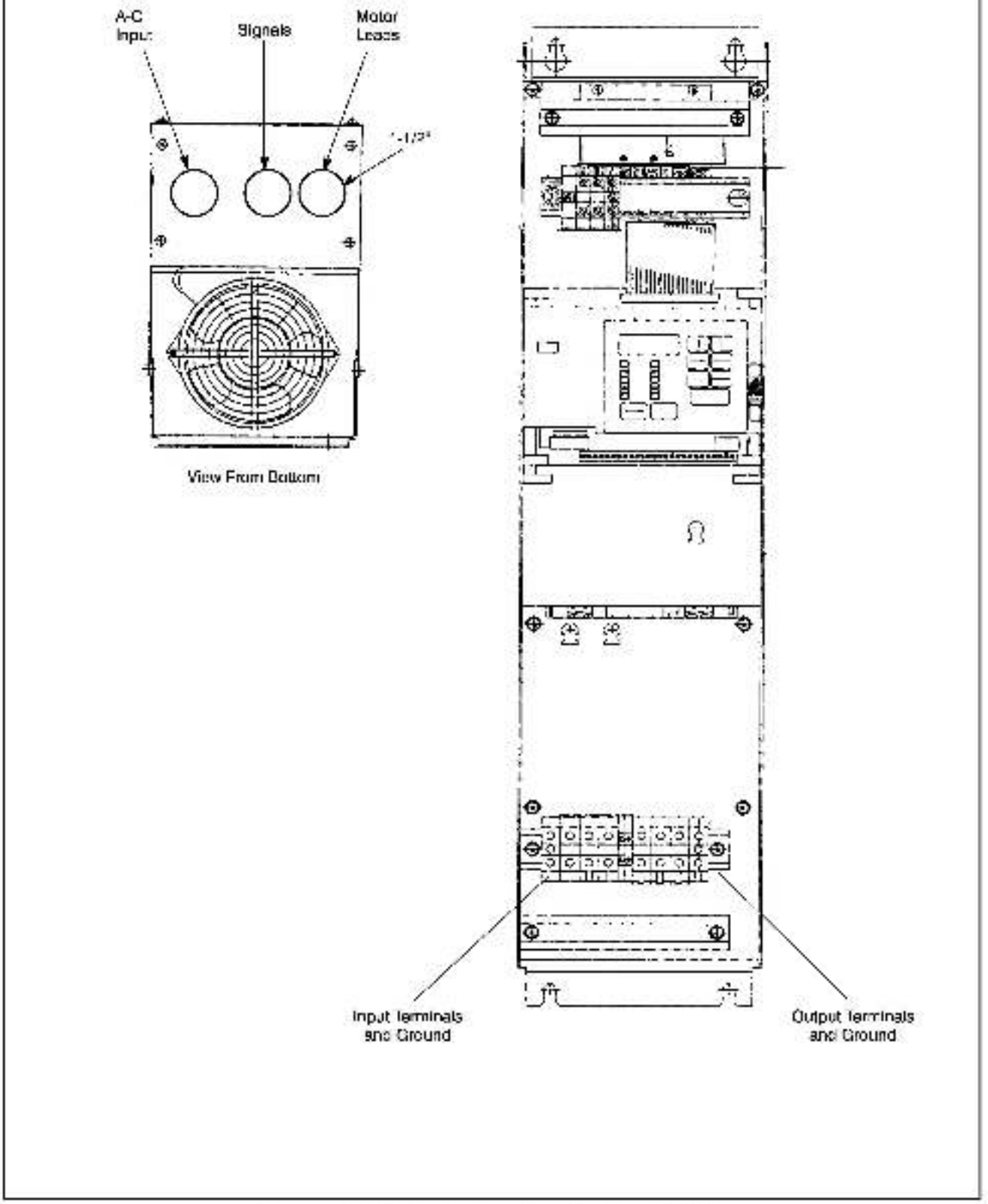


Figure 4.4 - Wire Routing Locations for 25-50HP Drives

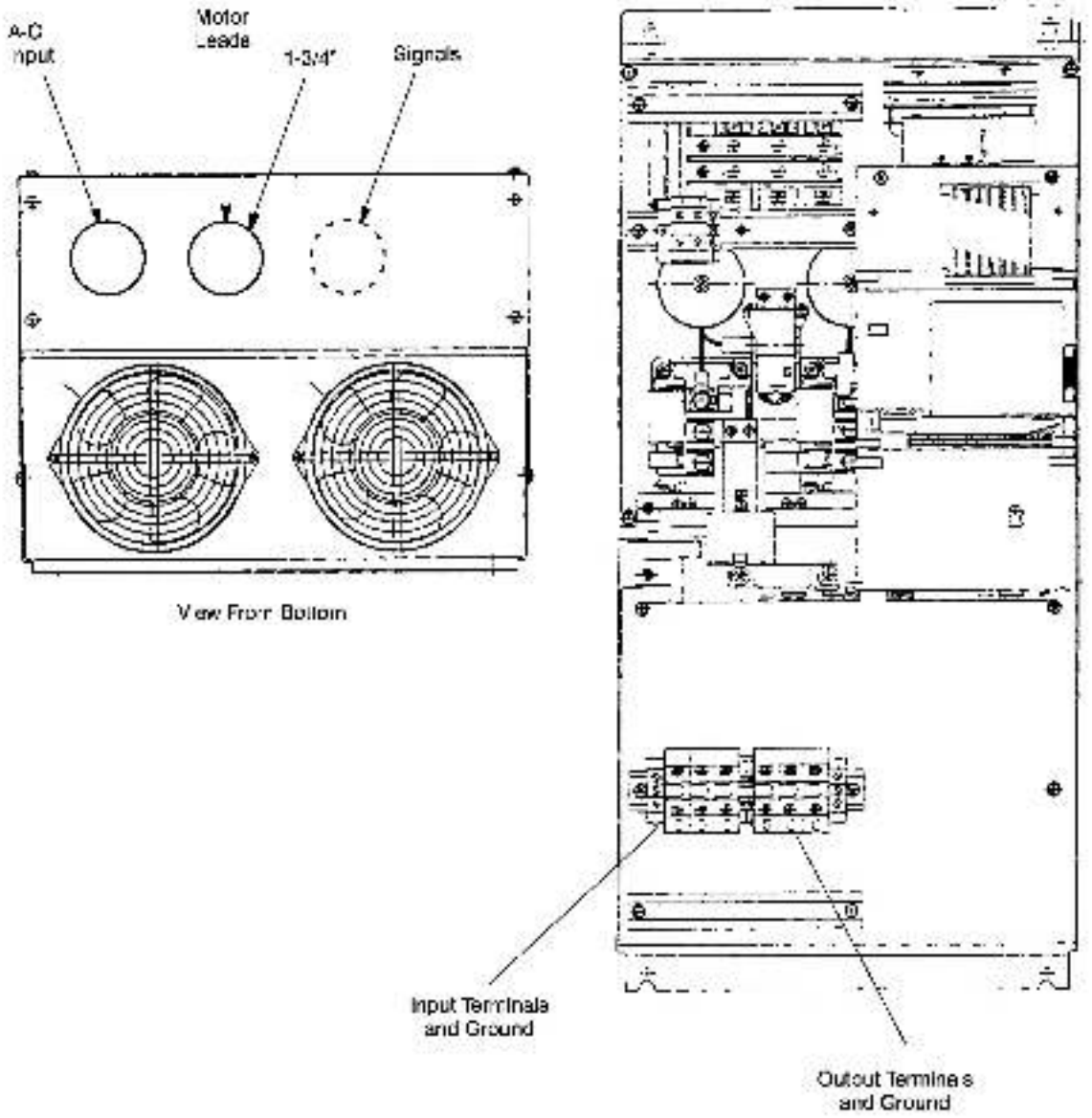


Figure 4.5 - Wire Routing Locations for 40-100HP Drives

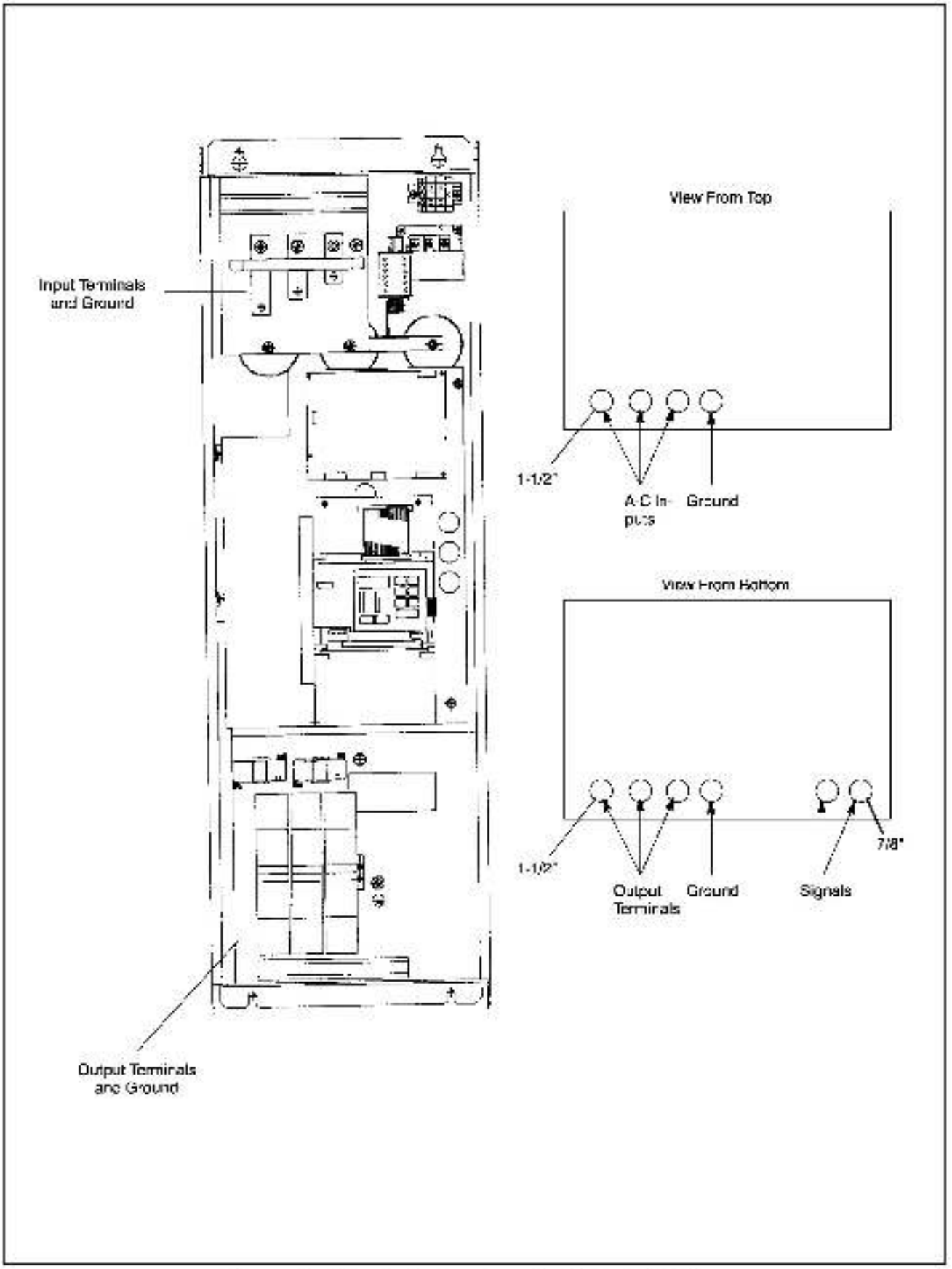


Figure 4.6 - Wire Routing Locations for 100-150HP Drives

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 ground terminal to the earth ground conductor. See figures 4.1 to 4.6.

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 A-C INPUT POWER WIRING

This chapter describes incoming A-C 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 A-C 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, a line reactor or optional snubber resistor braking kit (1-25HP drives only) 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.

In applications requiring the use of an output reactor, contact your Reliance Electric sales office for assistance.

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 A-C line before the drive input terminals. See figure 5.1. 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.

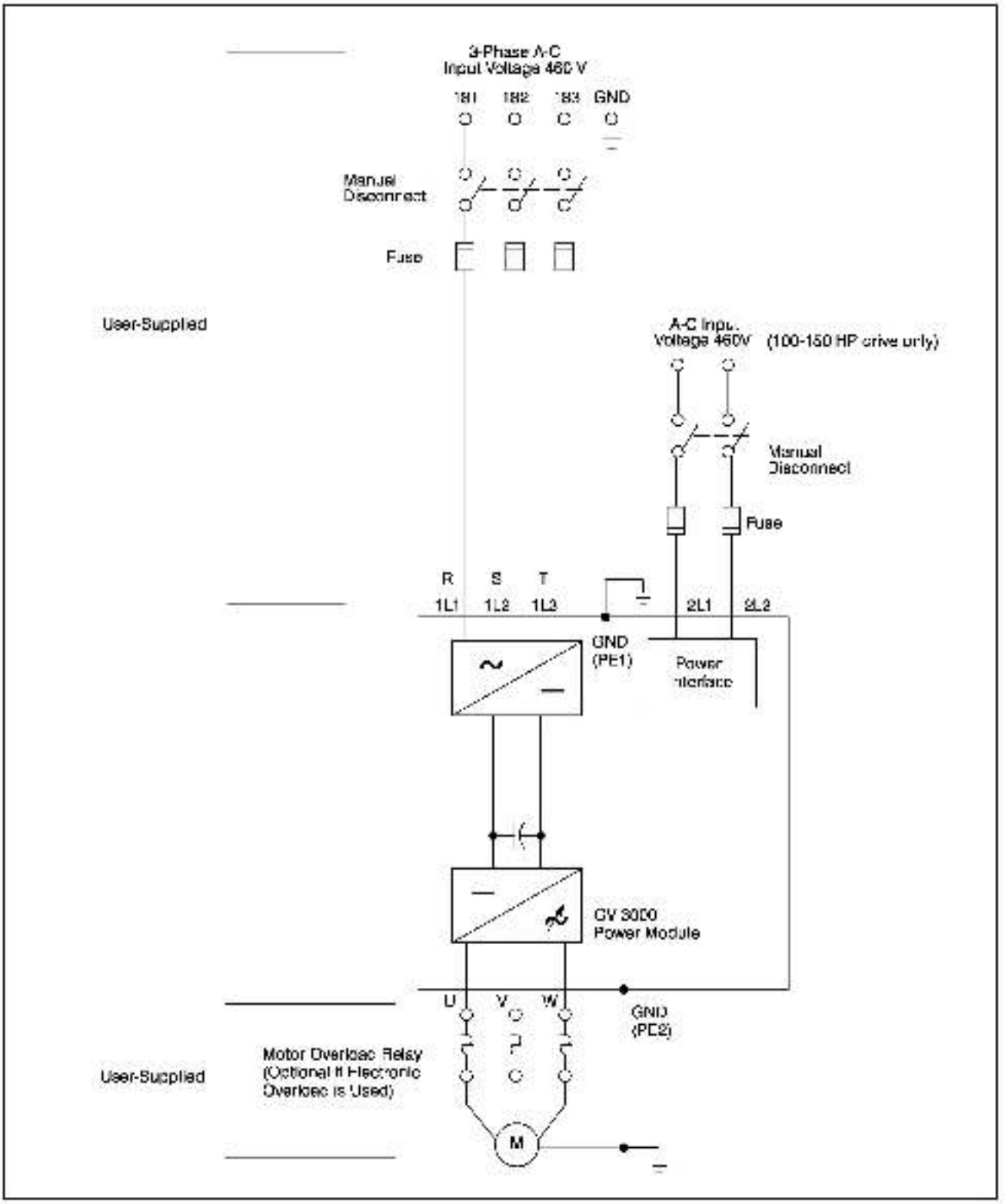


Figure 5.1 - Typical A-C Input Electrical Connections

5.3 Installing a Required External/Separate Input Disconnect

An A-C input disconnect must be installed in the A-C 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 1-5HP drives, route the power leads through the bottom right opening of the drive base.

On 7.5-25HP 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 25-100HP drives, route the power leads through the bottom left opening of the cover.

On 100-150HP drives, route the power leads through the top left opening of the cover. Note that 460 VAC input power to terminals 2L1/2L2 is required on 100-150HP 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.

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 1-25HP drives, connect the A-C input power leads to terminals R/L1, S/L2, T/L3 on the power terminal strip.

On 25-150HP drives, connect the A-C input power leads to terminals 1L1, 1L2, and 1L3. In addition, on 100-150HP drives only, connect the required A-C input power to terminals 2L1 and 2L2.

Step 3. Tighten the 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	1.35 newton-meters (12 lb-in)
25-50HP	1L1, 1L2, 1L3 U, V, W PE1, PE2	2.5 newton-meters (22.1 lb-in)
40-100HP	1L1, 1L2, 1L3 U, V, W	10 newton-meters (88.5 lb-in)
	PE1, PE2	2.5 newton-meters (22.1 lb-in)
100-150HP	1L1, 1L2, 1L3	10 newton-meters (88.5 lb-in)
	U, V, W	2.5 newton-meters (22.1 lb-in
	PE1, PE2	10 newton-meters (88.5 lb-in)

6.0 INSTALLING A-C 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 (P.040) 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 P.040 must be enabled to provide overload protection. Refer to the GV3000 Programming Manual (D2-3323) for more information.

In multiple motor applications (V/Hz regulation), each motor is to 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 1-5HP drives, route the motor leads through the bottom right opening of the drive base.

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

On 25-100HP drives, route the motor leads through the bottom right opening of the cover.

On 100-150HP 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.

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

On 1-25HP drives, connect the motor leads to terminals U/T1, V/T2, W/T3 on the power terminal strip.

On 25-150HP 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.

On 1-25HP drives, tighten all power terminal wire connections to 1.35 newton-meters (12 lb-in) maximum.

On 25-50HP drives, tighten all U, V, and W wire connections to 2.5 newton-meters (22.1 lb-in) maximum.

On 40-100HP drives, tighten all U, V, and W wire connections to 10 newton-meters (88.5 lb-in) maximum.

On 100-150HP drives, tighten all U, V, and W wire connections to 2.5 newton-meters (22.1 lb-in) maximum.

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 Select 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 D2-3323 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 (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 P.007, P.008, and P.031 through P.038. Factory default settings are shown here in parentheses. Refer to the GV3000 Programming Manual (D2-3323) 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 P.013. Refer to the GV3000 Programming Manual (D2-3323) for more information.

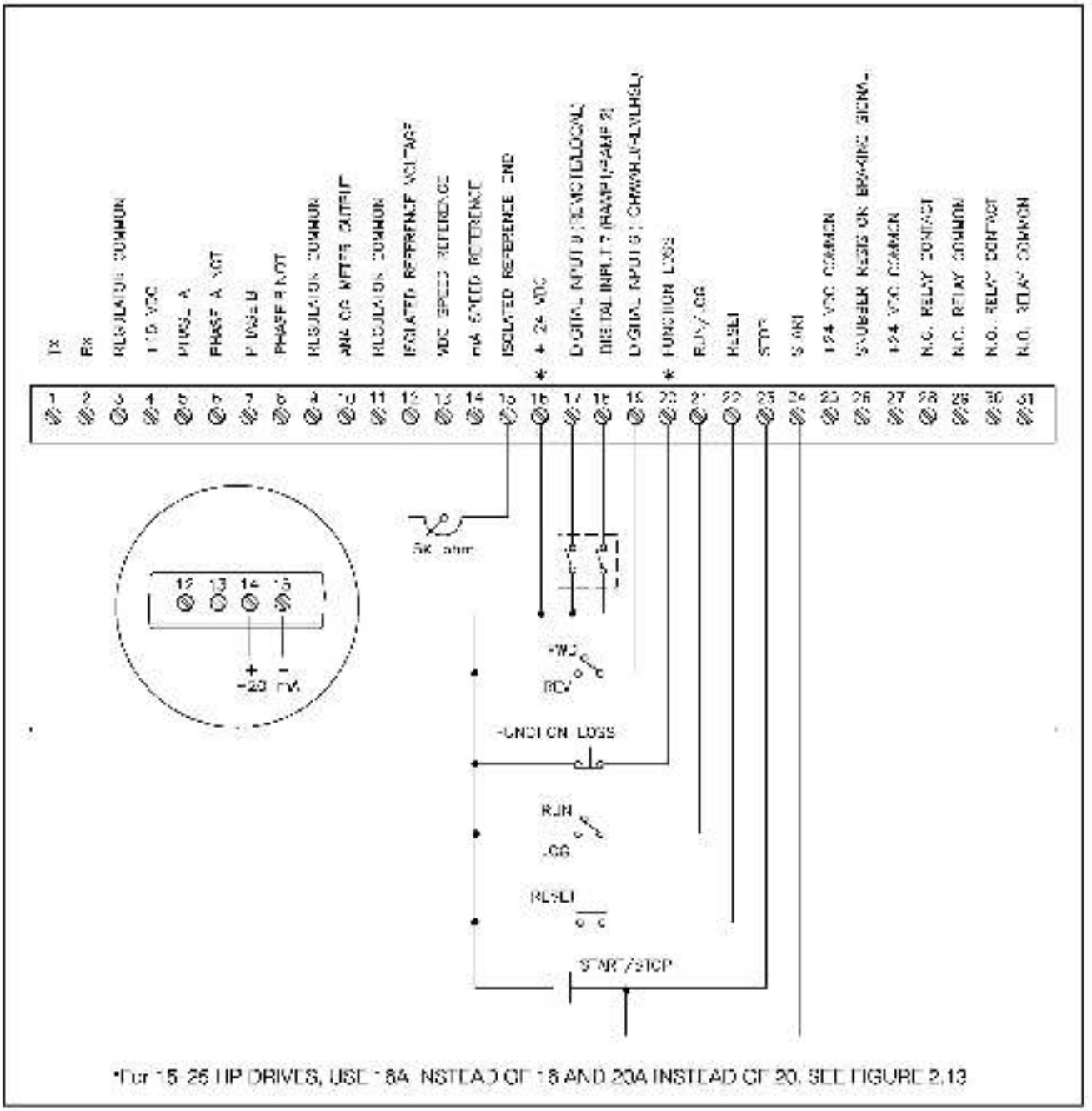


Figure 7.1 - Two-Wire Start/Stop Sample Control Wiring

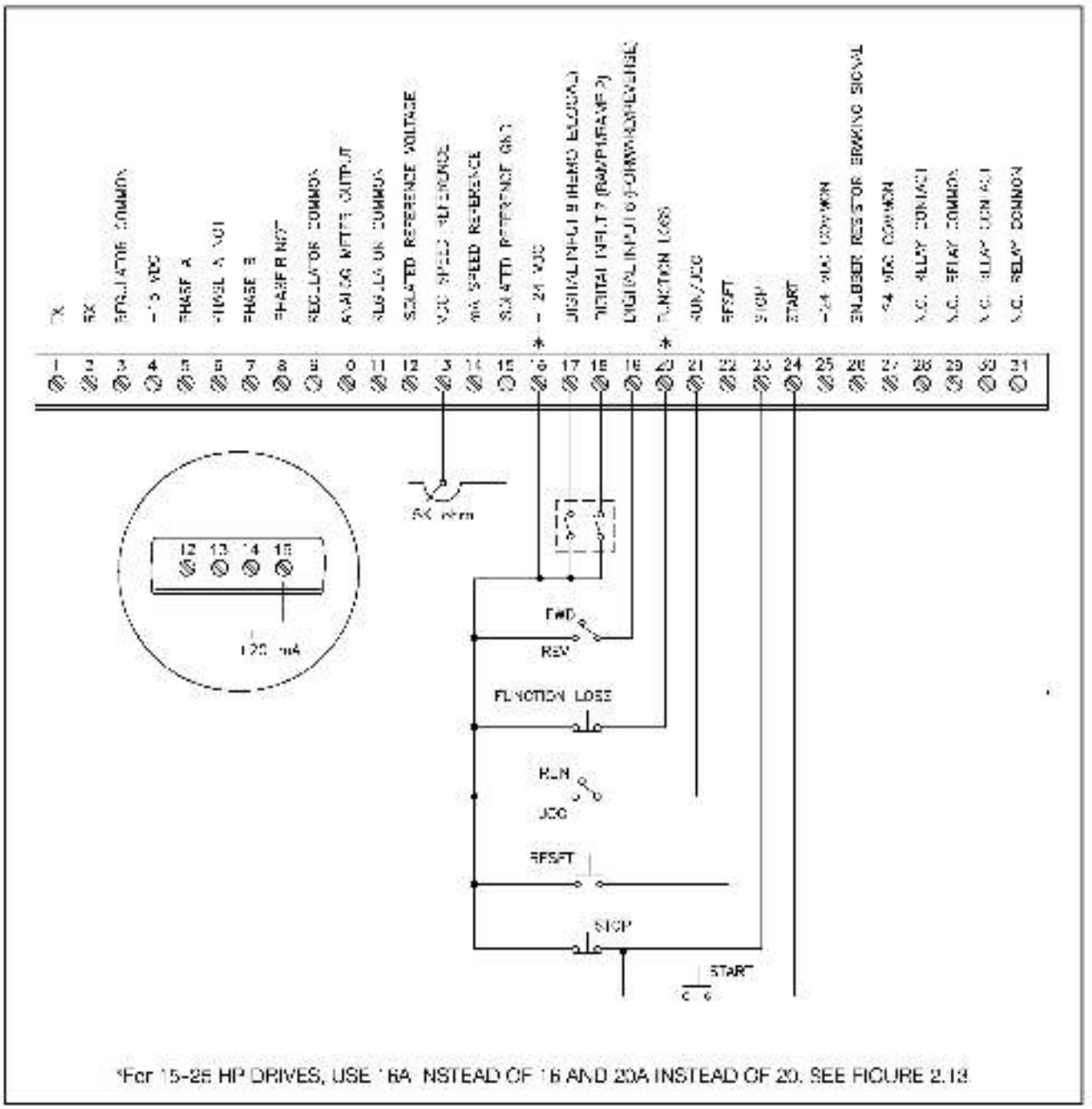


Figure 7.2 - Three-Wire Start/Stop Sample Control Wiring

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 configured 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 Mode (P.025) for more information on how to configure 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 uses 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.

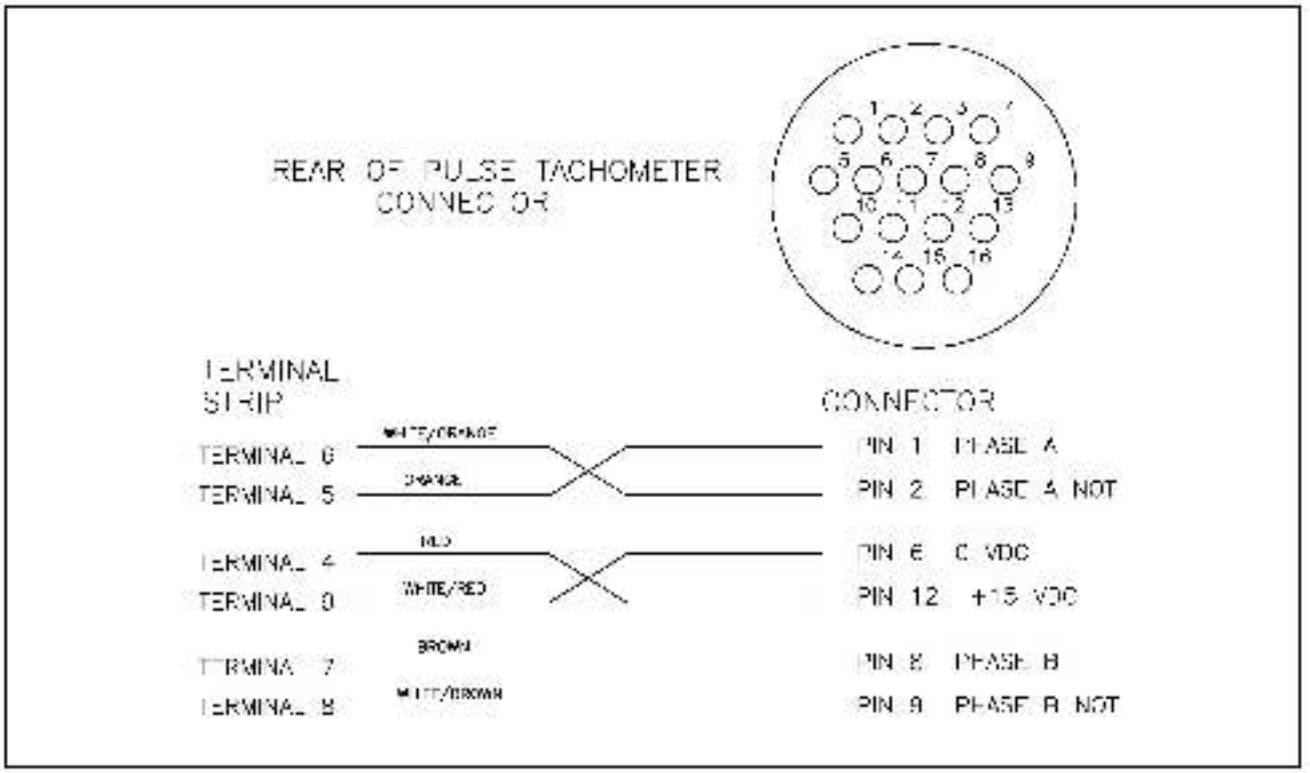


Figure 7.3 - Wiring Connections for the Speed Feedback Device

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

- P.004: Maximum Speed
- P.050: Restore Defaults
- 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 (D2-3323) 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

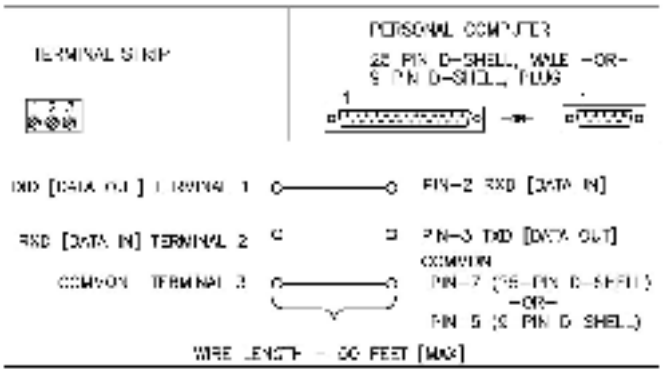
Terminal Number	Description	Parameters/Wiring Connections
	Wiring RS-232 Signals	
1 2 3	RS-232 Transmit RS-232 Receive RS-232 Signal/Regulator Common	Note that RS-232 communication between the GV3000 drive and a personal computer requires the use of the Configuration Executive 3000 software. Refer to instruction manual D2-3303, Configuration Executive 3000, 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.
	Wiring Analog Outputs	
10 11	0-10 VDC or 4-20 mA Analog Output Reference Regulator Common	The setting of parameter P.012 selects the terminal strip analog output source (either speed or torque). Jumper J17 must also be set. See figure 2.12.

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

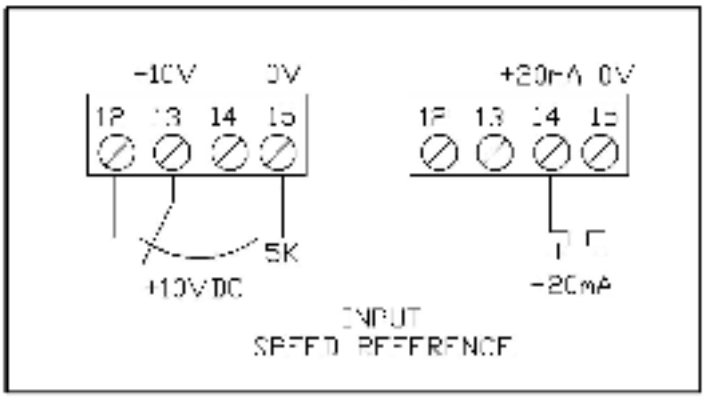
Terminal Number	Description	Parameters/Wiring Connections
Wiring Analog Speed Reference Inputs		
12 13 14 15	Isolated Reference Voltage (+15VDC) Analog Speed/Torque Reference Input Voltage (+/− 10 VDC) Analog Speed/Torque Reference Input Current (0-20mA) Isolated Speed/Torque Reference Common (Voltage/Current)	The following parameters must be set: P.000: Control Source Select P.009: Terminal Block Analog Input Offset P.010: Terminal Block Analog Input Gain P.011: Terminal Block Analog Input Invert Refer to the GV3000 Programming instruction manual (D2-3323) for additional parameter information. Jumper J4 must also be set. See figure 2.11. 

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

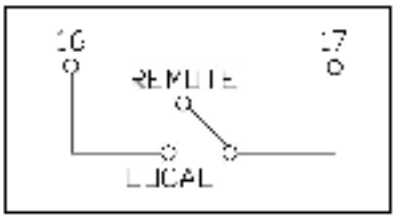
<table>
<tr><th>Terminal Number</th><th>Description</th><th>Parameters/Wiring Connections</th></tr>
<tr><td colspan="3">Wiring a Remote/Local Input</td></tr>
<tr><td>16</td><td>–24 VDC Power Supply</td><td>Current limited for remote input logic use only.</td></tr>
<tr><td>17</td><td>Digital Input 8
(Remote/Local)</td><td>Digital input 8 is control function programmable through parameter P.007.</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td></td><td></td><td>The following parameters must be set:

P.000: Control Source Select
(Only active when P.000 = rE)
P.006: Second Menu Password
P.007: Terminal Block Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8).
P.008: Terminal Block Speed Reference Select
(Analog, Motor Operated Potentiometer (MOP), or Multi-speed Presets)

Note that based on the settings of parameters P.000, P.007, and P.008, the following parameters can affect digital input 8.

P.023: MOP Accel/Decel
P.024: MOP Reset Configuration
P.031 to P.038: Presets 1-8

Refer to the GV3000 Programming instruction manual (D2-3323) for additional information.

Terminal 17 On = Local Control
Diagram shows factory setting.</td></tr>
</table>

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

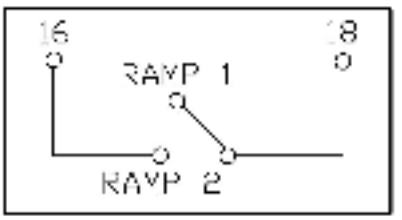
Terminal Number	Description	Parameters/Wiring Connections
Wiring an Additional Ramp Input		
18	Digital Input 7 (Ramp1/Ramp2)	Digital input 7 is control function programmable through parameter P.007. The following parameters must be set: P.000: Control Source Select P.001: Accel Time 1 (Ramp 1) P.002: Decel Time 1 (Ramp 1) P.006: Second Menu Password P.007: Terminal Block Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8). P.008 Terminal Block Speed Reference Select (Analog, Motor Operated Potentiometer (MOP), or Multi-Speed Presets) P.017: Accel Time 2 (Ramp 2) P.018: Decel Time 2 (Ramp 2) Note that based on the settings of parameters P.000, P.007, and P.008, the following parameters can affect digital input 7. P.023: MOP Accel/Decel P.024: MOP Reset Configuration P.031 to P.038: Presets 1-8 Refer to the GV3000 Programming instruction manual (D2-3323) 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)

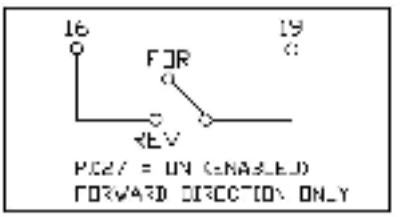
Terminal Number	Description	Parameters/Wiring Connections
	Wiring a Forward/Reverse Input	
19	Digital Input 6 (Forward/Reverse)	Digital input 6 is control function programmable through parameter P.007. The following parameters must be set: P.000: Control Source Select P.006: Second Menu Password P.007: Terminal Block Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8). P.008: Terminal Block Speed Reference Select (Analog, Motor Operated Potentiometer (MOP), or Multi-Speed Presets) P.027: Reverse Disable Note that based on the settings of parameters P.000, P.007, and P.008, the following parameters can affect digital input 6. P.023: MOP Accel/Decel P.024: MOP Reset Configuration P.031 to P.038: Presets 1-8 Refer to the GV3000 Programming instruction manual (D2-3323) 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)

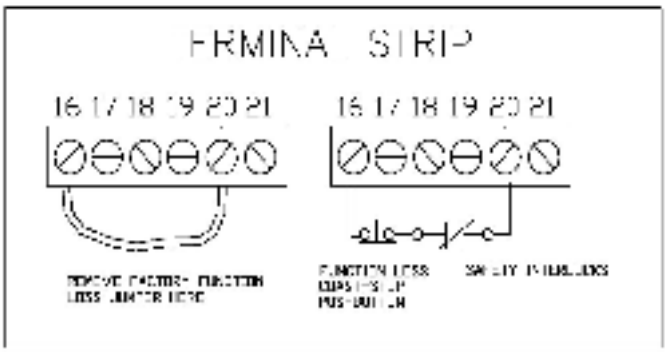
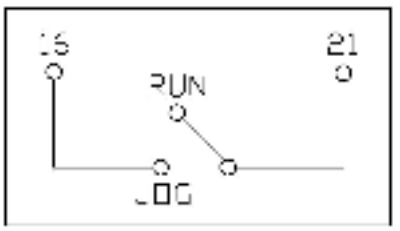
Terminal Number	Description	Parameters/Wiring Connections
		Wiring a Function Loss Input
20	Digital Input 5 (Function Loss)	The following parameters must be set: P.000: Control Source Select P.026: Function Loss Selection A signal must be present at terminal 20 for the drive to be able to start. See 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 2.13.  Terminal 20 Asserted = No Function Loss
		Wiring a Run/Jog Input
21	Digital Input 4 (Run/Jog)	The following parameters must be set: P.000: Control Source Select P.020: Jog Speed Reference P.021: Jog Ramp Accel Time P.022: Jog Ramp Decel Time 

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

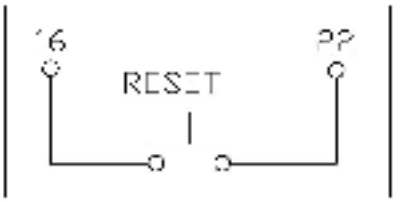
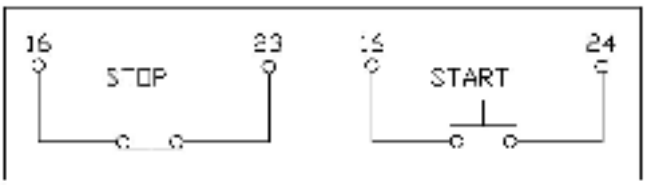
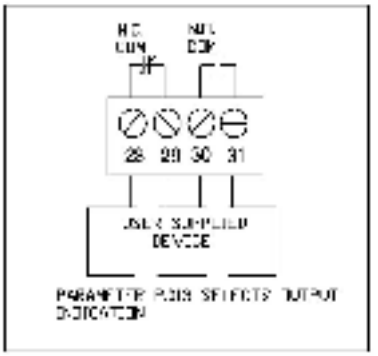
Terminal Number	Description	Parameters/Wiring Connections
	Wiring the Reset Input	
22	Digital Input 3 (Reset)	The following parameter must be set: P.000: Control Source Select  Terminal 22 On = Reset
	Wiring the Stop/Start Inputs	
23 24	Digital Input 2 (Stop) Digital Input 1 (Start)	The following parameter must be set: P.000: Control Source Select P.025: Stop Mode  Terminal 23 Off = Stop Terminal 24 On Transition = Start
25	24 VDC Isolated Common	
	Wiring the Snubber Resistor	
26 27	Snubber Resistor Braking Control Signal −24 VDC Isolated Common	Used with Snubber Resistor Braking Kit M/N 2DB4010. Refer to the kit's instruction manual for proper installation instructions.

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 29 30 31	Normally-Closed Contact (Form B) Normally-Closed Contact Common (Form B) Normally-Open Contact (Form A) Normally-Open Contact Common (Form A)	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: P.013: Output Relay Configuration Note that depending on the setting of parameter P.013, 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 (D2-3323) for more information. 

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 A-C 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 lb-in) 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 D2-3323.

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 the alarm code will flash on the display as a 2- or 3-digit code.

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

Refer to the GV3000 Software Start-Up and Reference Manual (D2-3323) 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 A-C input power. Wait five minutes.

Step 2. Remove the drive's cover.

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

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

For 1-25 HP drives, measure the D-C bus potential at the D-C bus power terminals. See figure 9.1.

For 25-50HP 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 9.2. Measure the D-C bus potential at the diode bridge as shown. Re-attach the regulator panel.

For 40-100HP 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 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 A-C input power.

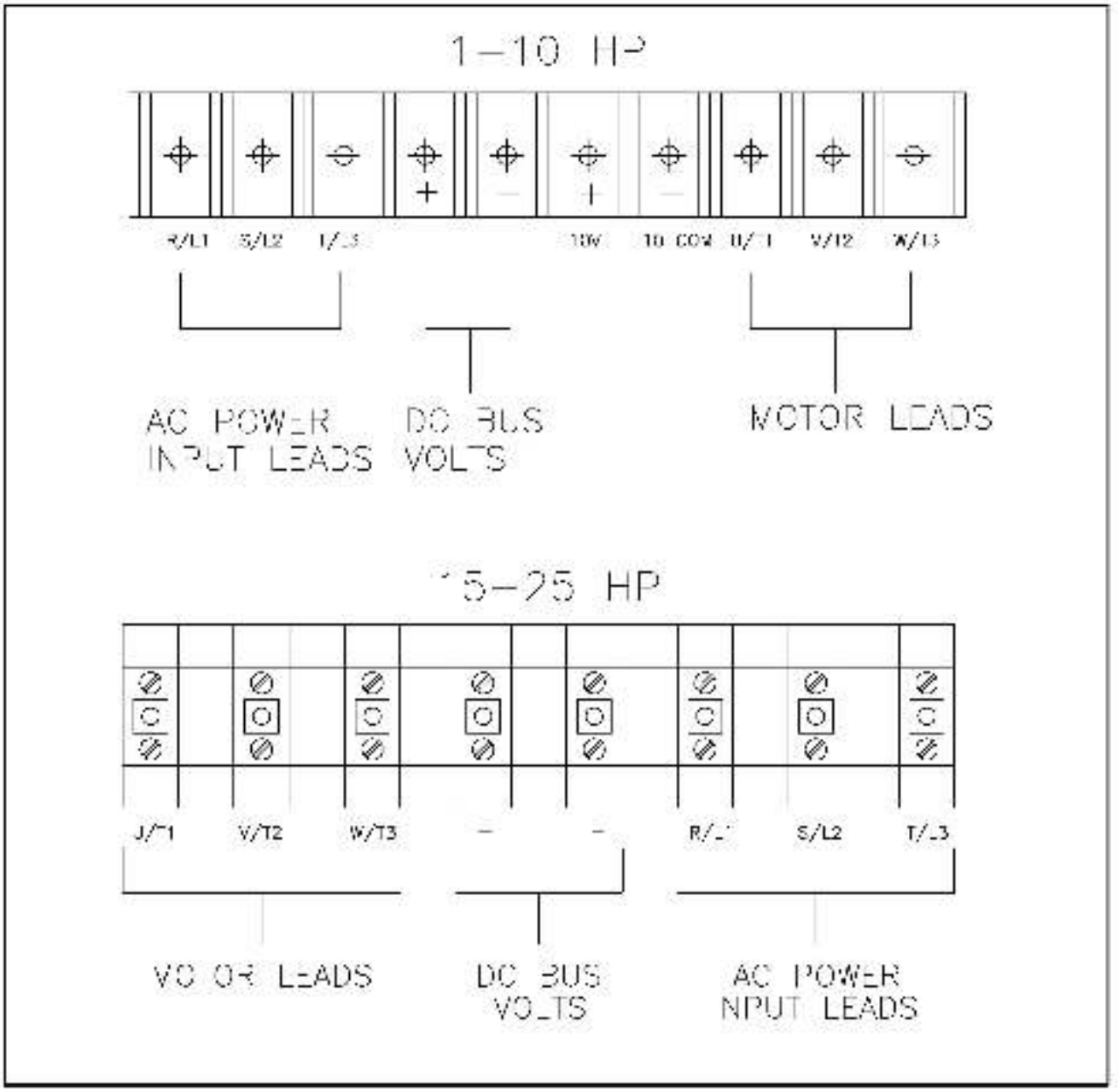


Figure 9.1 - D-C Bus Voltage Terminals (1-25HP Drives)

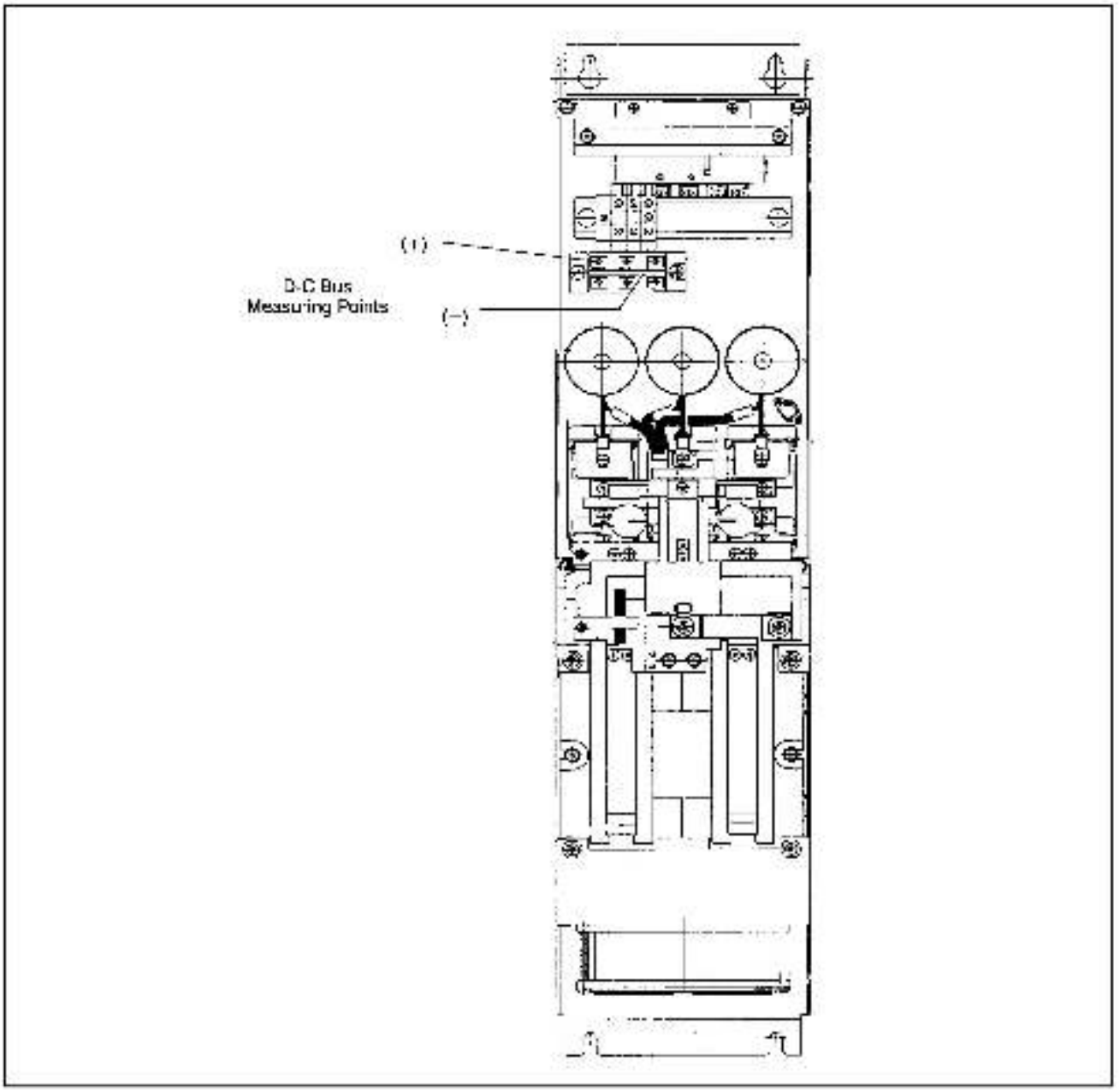


Figure 9.2 - D-C Bus Voltage Terminals (25-50HP Drives)

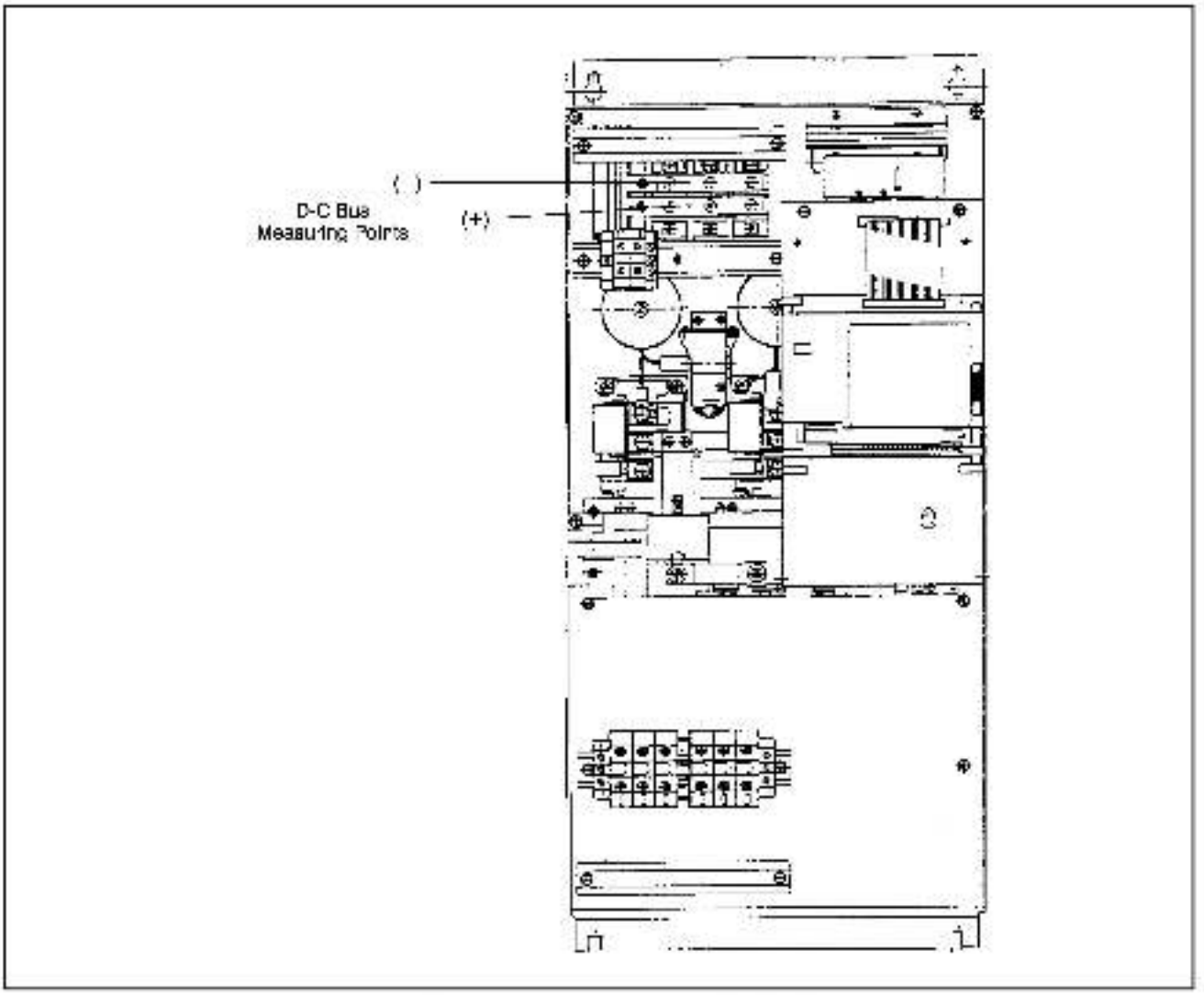


Figure 9.3 - D-C Bus Voltage Terminals (40-100HP Drives)

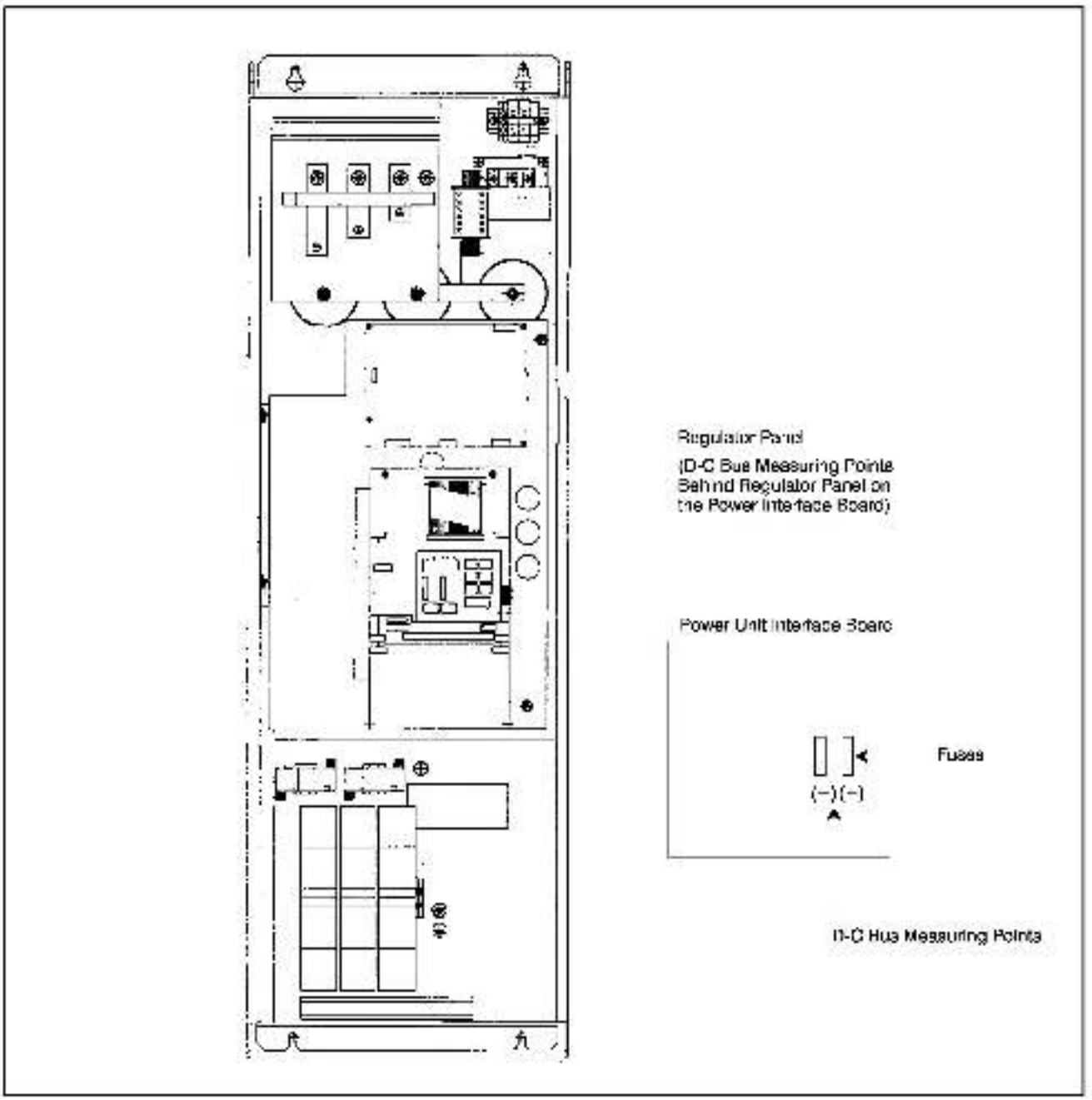


Figure 9.1 - D-C Bus Voltage Terminals (100-150HP Drives)

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 A-C input power. Wait five minutes.

Step 2. Remove the drive's cover.

Step 3. Verify that there is no voltage at the drive's A-C 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 1-25HP 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 25-150HP drive.

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

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

Step 10. Re-apply A-C input power.

Table 9.1 - Resistance Checks

1-25HP 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)

25-100HP 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		

1-25HP 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				

25-150HP 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 Replacing 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 - 1-5HP 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	0-56921-400	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 - 7.5-100HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower	
		7.5	10
Fan Assembly	615161-S	2	2
NEMA 1 Cover	805536-1R	1	1
NEMA 4X/12 Cover/Gasket	805539-1R	1	1
Membrane Switch Keypad/Bracket	709577-1R	1	1
Regulator PCB	0-56921-400	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 - 15-25HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower		
		15	20	25
Fan Assembly	615161-S	2	2	2
NEMA 1 Cover	805547-1R	1	1	1
NEMA 12 Cover/Gasket	805548-1R	1	1	1
Membrane Switch Keypad/Top Bracket	805548-R	1	1	1
Regulator PCB	0-56921-400	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 Assembly	615159-1S	1	1	1

* Components are identified in figure 2.5.

Table 9.5 - 25-50HP Drive Replacement Parts

Part Description *	Part Number	# Needed
Regulator PCB	413338-5AU	1
Power Unit Interface PCB	413338-5AW	1
Power Unit Interface PCB Fuses	413338-5AB	2
Keypad	413338-5AX	1
Gate Driver PCB	413338-4T	1
Bus Clamp PCB (right)	413338-4V	1
Bus Clamp PCB (left)	413338-4W	1
Intelligent Power Module (IPM) PCB	413338-4Y	3
Diode Bridge	413338-4Z	1
MOV on Diode Bridge	413338-5L	4
D-C Bus Fuse	413338-5M	1
Precharge Contactor	413338-5N	1
Current Transformer	413338-5P	3
Ground Fault Transformer	413338-5Q	1
Output Reactor	413338-5S	3
Precharge Resistor (18 ohms)	413338-5T	2
Bus Discharge Resistor (3.6K ohms)	413338-5A	1
24V D-C Fan	413338-5W	1

*Components are identified in figure 2.6.

Table 9.6 - 40-100HP Drive Replacement Parts

Part Description*	Part Number	# Needed
Regulator PCB	413338-5AU	1
Power Unit Interface PCB	413338-5AW	1
Power Unit 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
D-C Bus Current Sensor	413338-5P	2
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 - 100-150HP Drive Replacement Parts

Part Description *	Part Number	# Needed
Regulator PCB	413338-5AU	1
Power Unit Interface PCB	413338-5AV	1
Power Unit 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 Module	413338-5AJ	3
D-C Bus Fuse	413338-5AK	1
Current Transformer	413338-5R	2
Ground Fault Transformer	413338-5Q	1
D-C Bus Current Sensor	413338-5P	4
Output Reactor	413338-5AR	3
Bus Discharge Resistor (1.5K ohms)	413338-5V	4
24V D-C Fan	413338-5W	4
Thyristor Firing Pulse PCB	413338-5AG	1

* Components are identified in figure 2.8.

Appendix A

Technical Specifications

Table A.1 - Service Conditions

A-C Line Distribution System Capacity (maximum) for 460 VA-C Units	1000KVA, three-phase with 25,000 amps symmetrical fault current capacity with a line impedance of less than 8%
Control Method	All-digital flux 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 P.042) - volts/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) - volts/Hz
Service Factor	1.0
Speed Adjustable Range	From 0 RPM to maximum speed
Speed Regulation	0.05% long term steady state or 0.1% for a 20 millisecond period (typical) - vector motor slip dependent - volts/Hz
Speed Setpoint Resolution	±1 RPM with local keypad, ±4096 of rated RPM with personal computer
Torque Control Response	180 to 220 Hz
Torque Linearity	±3% with optimal parameter setting (typical) (see parameter 0.005)

Table A.2 - Operating Conditions

Temperature: Ambient Operating Ambient Storage	 0°C to 40°C (32°F to 104°F) -40°C to 65°C (-40°F to 149°F)
Humidity	5 to 95% non-condensing humidity
Altitude	To 1000 meters (3000 feet) above sea level without derating. For every 91.4 meters (300 feet) from 1001 to 3033 meters (3300 to 10,000 feet), derate the current by 1%. Contact your Reliance Electric sales office for operation above 3033 meters (10,000 feet).

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 VD-C Isolated Supply
	17	Remote/Local
	18	Ramp1/Ramp2
	19	Forward/Reverse
	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 VD-C or 4-20 mA
Snubber Resistor	26 - 27	Used with Snubber Resistor Braking Kits - Refer to Instruction Manual D2-3291.

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
Multispeed Select	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/Hz or Vector Mode Select parameter (P.048) 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 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.

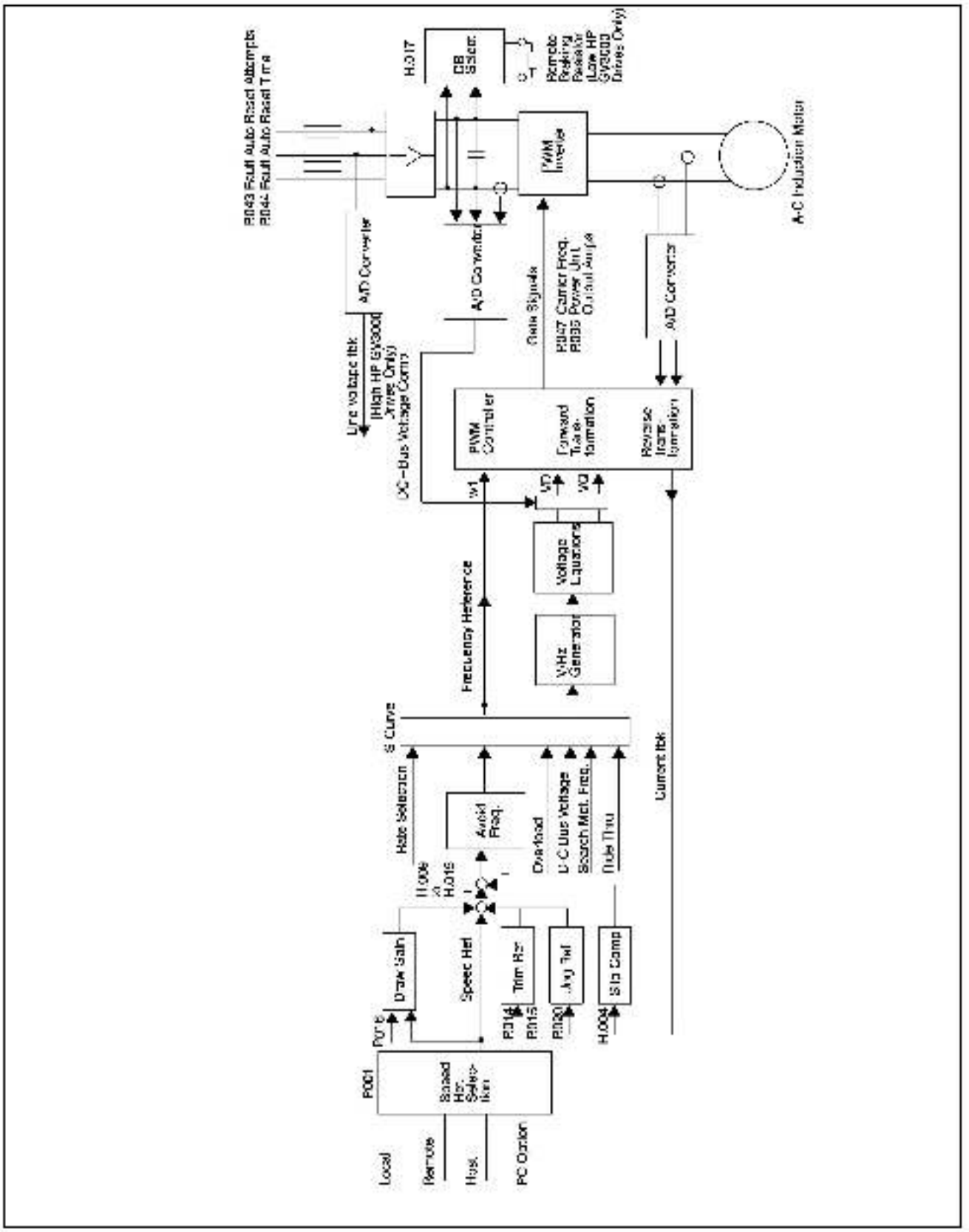


Figure B.1 - Volts/Hertz Regulation Block Diagram

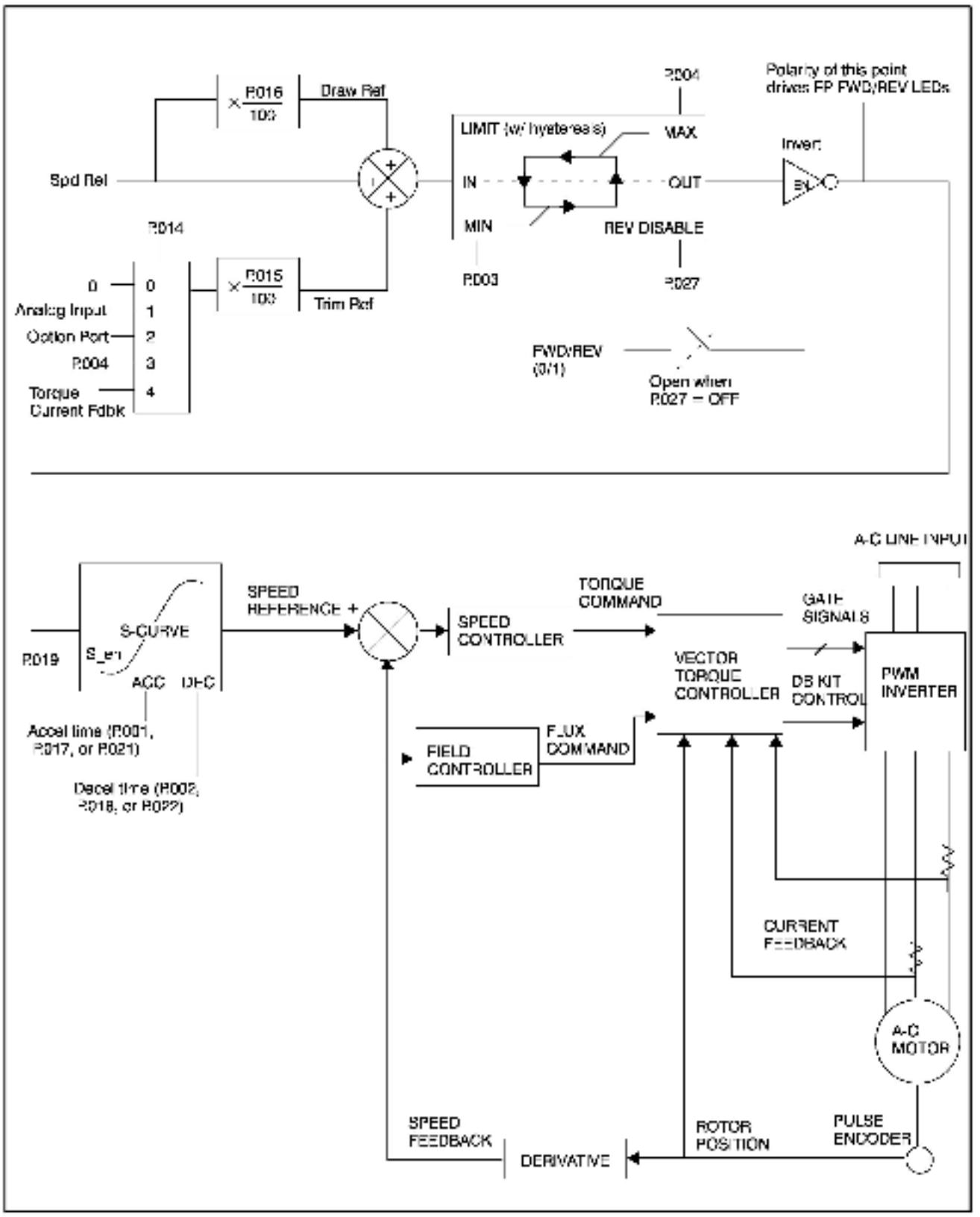


Figure B.2 - Vector Regulation Block Diagram

Appendix C

Compliance with EN 60204-1: 1992

The GV3000 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
16	Warning signs and item identification
16.2	- Warning signs
16.4	- Marking of control equipment
19	Technical documentation
19.1	- General

Index

A

B

C

D

N

O

P

R

S

T

V

W

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 referred to in this Declaration.

Authorized Representative of the Company:

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

Date: ***January 1, 1995***

Signature: 

Name: ***Thomas R. Lenk***

Position: ***Product Development Engineering Manager***

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TM2242	Troubleshooting the VVI Regulator	Videotape	985
TM2367	Troubleshooting the 6-Transistor Power Module	Videotape	725
	VIDEO TRAINING PROGRAMS		
VMBA001	Fundamentals of A-C Motors	Videotape	$495
VMBV001	Concepts of Digital Controls	Videotape	495
VWVS001	GP2000 Video Training	Videotape	495
VWVS002	HR2000 Video Training	Videotape	495
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