Hardware Reference, Installation, and Troubleshooting Manual D2-3360-6

RELIANCE ELECTRIC

GV3000/SE AC Drive

Version 6.06

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Document Update

Electronic Motor Overload Protection

This product does not offer speed-sensitive overload protection, thermal memory retention or provisions to act upon motor over-temperature sensing in motors. If such protection is needed in the end-use product, it needs to be provided by additional means.

Notes:

The information below summarizes the changes made to this manual since its last release (December 2000).

Description of Changes	Page
Added Document Update.	After manual front cover
Deleted the following statement: 'The Motor Overload Enable parameter (P.040) can be used in place of the electronic thermal overload relays in single motor applications'.	6-1

Notes:

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CHAPTER 1
Introduction

This instruction manual describes the GV3000/SE drive hardware. It does not cover the GV3000/SE drive software. For software information, refer to the GV3000/SE AC General Purpose (V/Hz) and Vector Duty Drive Software Start-Up and Reference Manual (D2-3359).

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

GV3000/SE drives will typically be referenced by horsepower in the manual. If additional clarity is required, drive model numbers will also be included.

1.1 Related Publications

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

- D2-3359 GV3000/SE AC General Purpose (V/Hz) and Vector Duty Drive Software Start-Up and Reference Manual
- D2-3391 Snubber Resistor Braking Kit
- D2-3305 Motor Encoder Cable Kit
- D2-3308 AutoMax Network Communication Option Board
- D2-3348 Control and Configuration Software (CS3000)
- D2-3341 Super Remote Meter Interface (RMI) Board
- D2-3342 Operator Interface Module (OIM)
- D2-3390 ControlNet Network Communication Option Board

1.2 Getting Assistance from Reliance Electric

If you have any questions or problems with the products described in this instruction manual, contact your local Reliance Electric sales office. For technical assistance, call 1-800-726-8112.

CHAPTER 2

About the Drive

This chapter provides an overview of the drive including how to identify the drive, a description of the Regulator board, and the identification of major components of the drive.

The GV3000/SE AC drive is a PWM (pulse-width-modulated) drive that provides vector and general purpose regulation for a wide range of applications.

Using vector regulation, the drive can provide high dynamic response, maintain full rated motor torque to zero speed, and precisely control motor speed in both directions. The drive can provide this functionality either with encoder feedback (flux vector control or FVC) or without (sensorless vector control or SVC).

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

2.1 Identifying the Drive by Model Number

Each GV3000/SE AC 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.

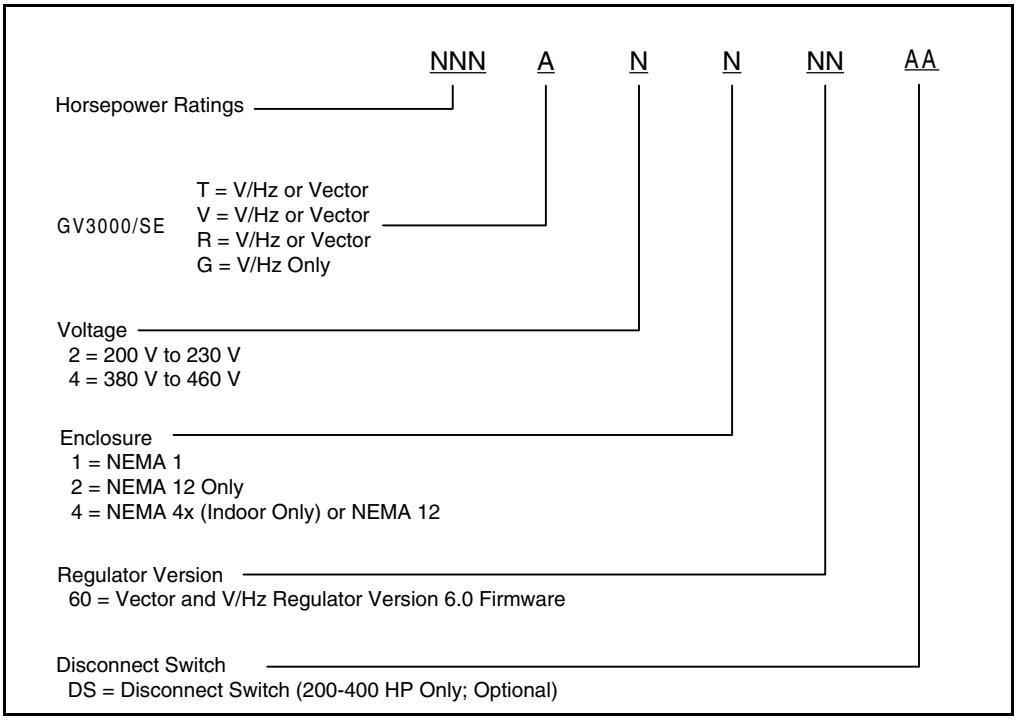


Figure 2.1 – Identifying the Drive Model Number

Table 2.1 – Power and NEMA Enclosure Ratings

Model Number	Selected Regulation[1] and Horsepower Rating	NEMA Rating	Input KVA	Input Amps[2]	Output Amps at 2 kHz	Output Amps at 4 kHz	Output Amps at 8 kHz	Power Loss Watts (Full Load)
1V4160 1V4460	V/Hz or Vector (1 HP)	1 4X/12	2.0	2.5	2.1	2.1	2.1	60
2V4160 2V4460	V/Hz or Vector (2 HP)	1 4X/12	3.3	4.2	3.4	3.4	3.4	100
3V4160 3V4460	V/Hz or Vector (3 HP)	1 4X/12	5.1	6.4	5.3	5.3	5.3	140
5V4160 5V4460	V/Hz or Vector (5 HP)	1 4X/12	7.9	9.9	8.2	8.2	8.2	180
7V4160 7V4260	V/Hz or Vector (7.5 HP)	1 12	10.7	13.4	11.1	11.1	11.1	210
10V4160 10V4260	V/Hz or Vector (10 HP)	1 12	13.4	16.8	14.2	14.2	14.2	250
15V4160 15V4260	V/Hz or Vector (15 HP)	1 12	20.2	25.4	21.0	21.0	21.0	375
20V4160 20V4260	V/Hz or Vector (20 HP)	1 12	26.1	32.7	27.0	27.0	27.0	600
25G4160 25G4260	V/Hz (25 HP)	1 12	29.5	37.0	30.4	30.4	30.4	600
25V4160 25V4260	V/Hz or Vector (25 HP)	1 12	30.2	38.0	34.5	34.5	34.5	750
30V4160 30V4260	V/Hz or Vector (30 HP)	1 12	35.0	44.0	39.0	39.0	39.0	800
40V4160 40V4260	V/Hz or Vector (40 HP)	1 12	46.2	58.0	54.0	54.0	54.0	960
50V4160 50V4260	V/Hz or Vector (50 HP)	1 12	57.3	72.0	67.0	67.0	67.0	1200
50R4160 50T4160	Vector (50 HP) or V/Hz (75 HP)	1	65.0 81.0	81.0 102	70.0 90.0	56.0 72.0	41.0 54.0	1420
60G4160 60G4260	V/Hz (60 HP)	1 12	71.7	90.0	78.0	78.0	78.0	1200
75R4160 75T4160	Vector (60-75 HP) or V/Hz (100 HP)	1	80.0 100	101 126	89.0 116	71.0 93.0	53.0 70.0	1400 1780
125R4160	Vector (100-125 HP) or V/Hz (125-150 HP)	1	127 170	159 213	152 210	122 168	91.0 126	2410 3200
200V4160 200V4160DS[3]	Vector (150-200 HP) or V/Hz (200 HP)	1A	224	281	240	240	-	3290
250V4160 250V1460DS[3]	V/Hz or Vector (250 HP)	1A	269	337	302	302	-	4160
300V4160 300V4160DS[3]	V/Hz or Vector (300 HP)	1A	310	389	361	361	-	5100
350V4160 350V4160DS[3]	V/Hz or Vector (350 HP)	1A	352	442	414	414	-	6150
400V4160 400V4160DS[3]	V/Hz or Vector (400 HP)	1A	394	494	477	477[4]	-	7350

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

[2]Input Voltage: 380-460 VAC (+/-10%)

[3]With optional input disconnect factory installed

[4]110% overload only at 4KHz in V/Hz and vector modes.

2.2 NEMA Enclosures

Each of the GV3000/SE drives have one of following NEMA ratings:

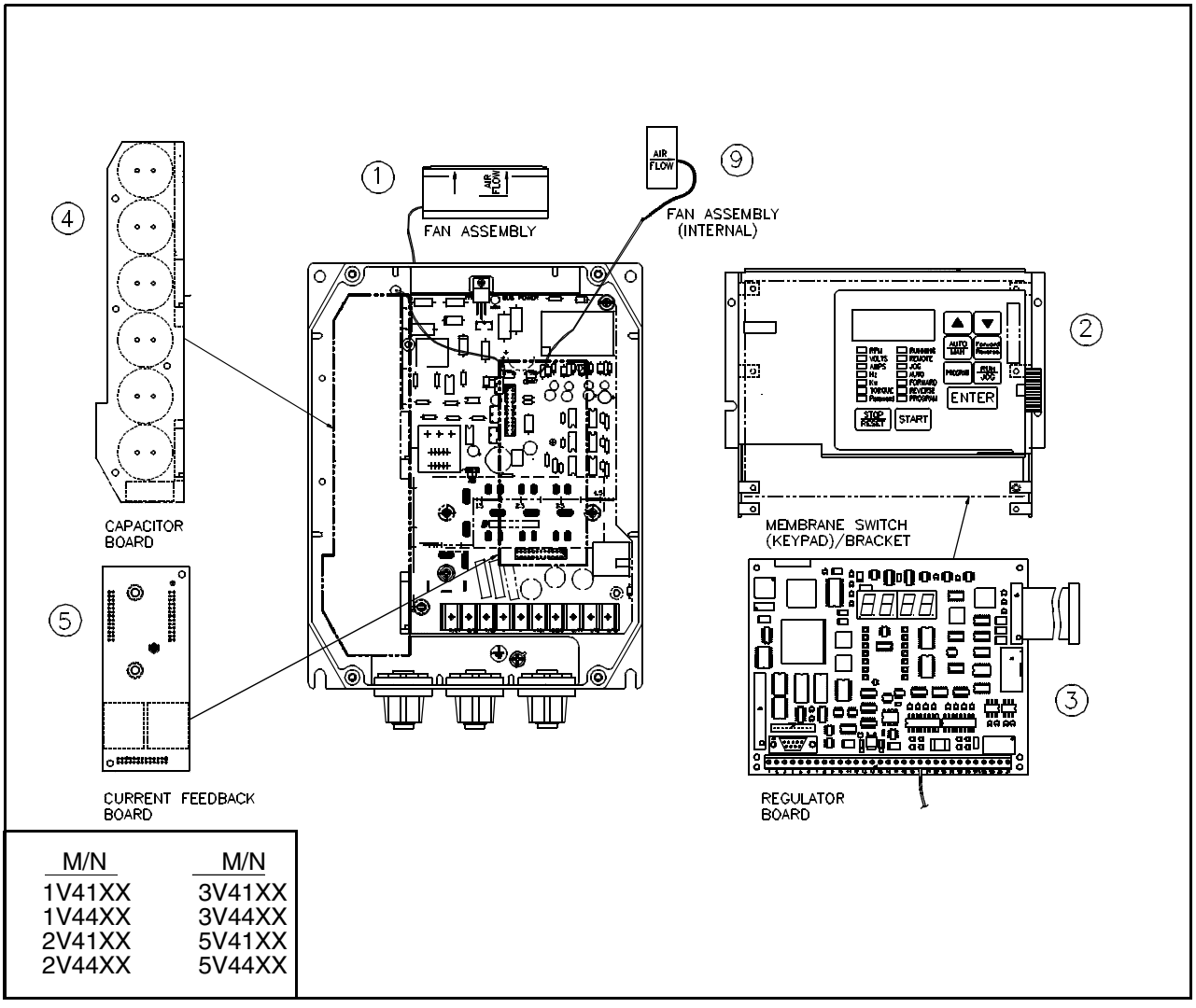
- NEMA 1: Vented. Contains a communication access door that allows access to the communication port without removing the cover. Intended for general-purpose indoor applications.
- NEMA 1A: Ventilated with fan and filter. Contains a communication access door that allows access to the communication port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

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

2.3 1-25 HP GV3000/SE Drive Component Locations

The 1-25 HP GV3000/SE drives have the following main components. The numbered items listed below correspond to the numbers used in figures 2.2 to 2.4. Replacement parts are listed in chapter 9.

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



M/N	M/N
1V41XX	3V41XX
1V44XX	3V44XX
2V41XX	5V41XX
2V44XX	5V44XX

Figure 2.2 – 1-5 HP Drive Component Locations

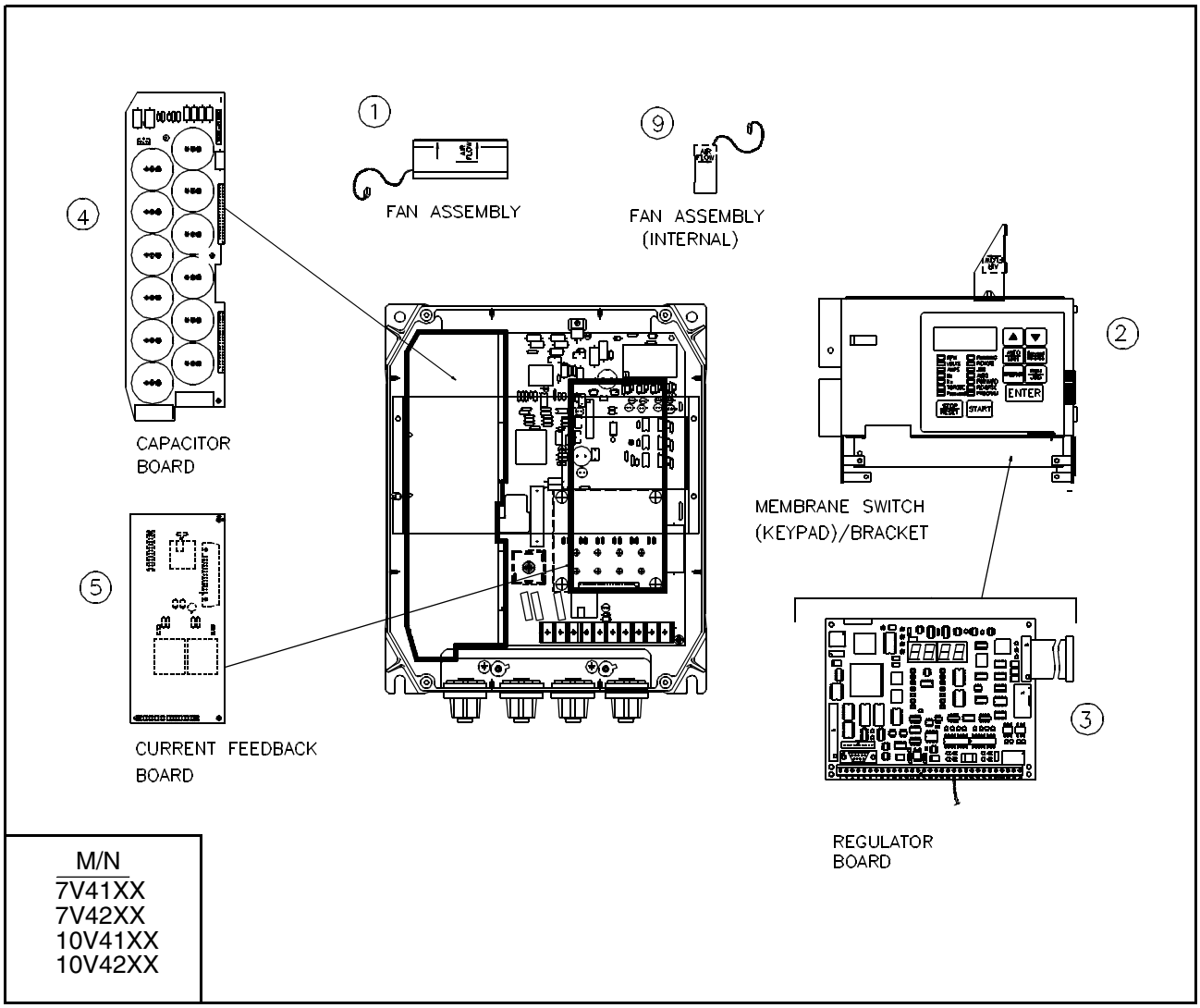


Figure 2.3 – 7.5-10 HP Drive Component Locations

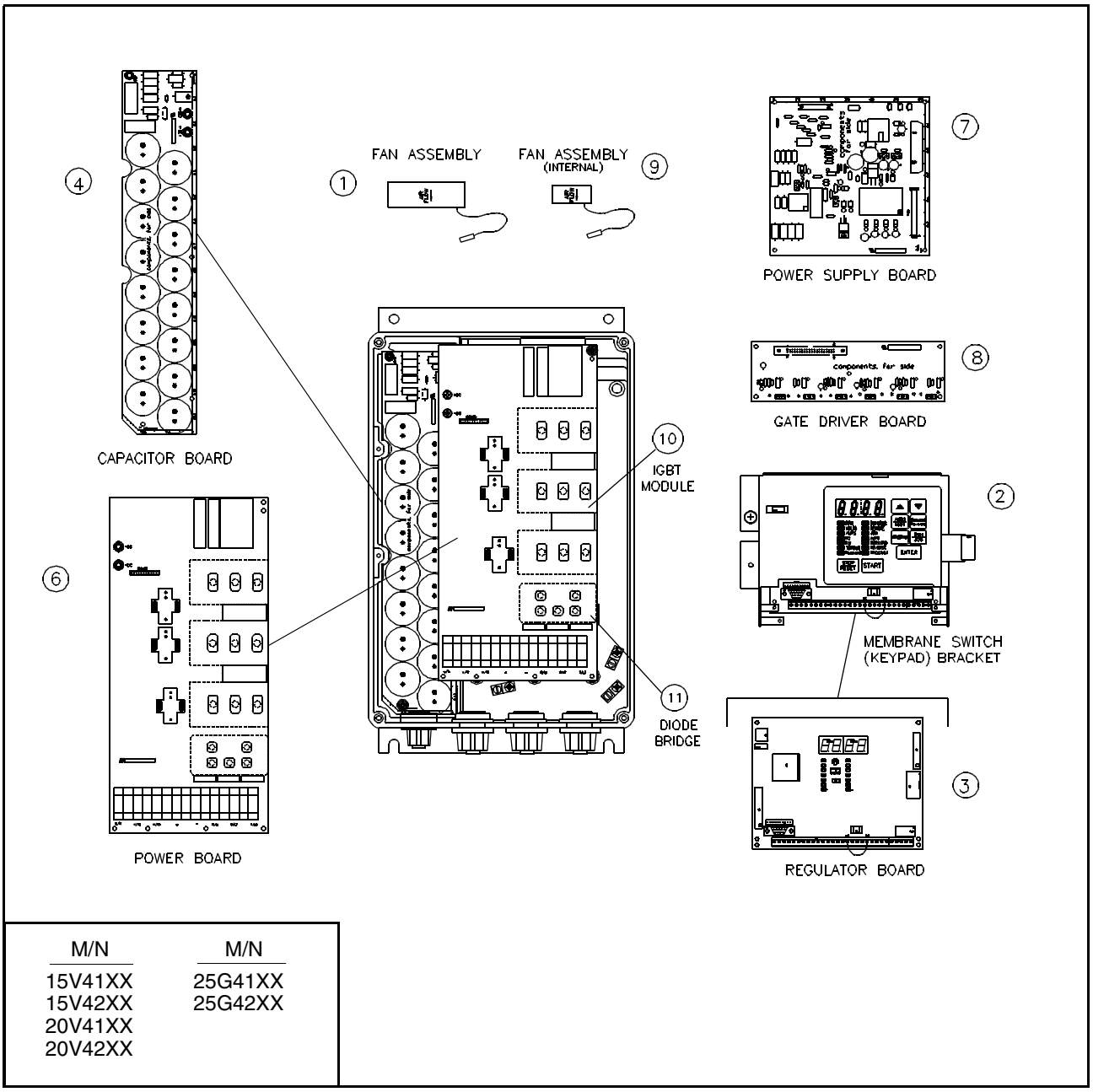
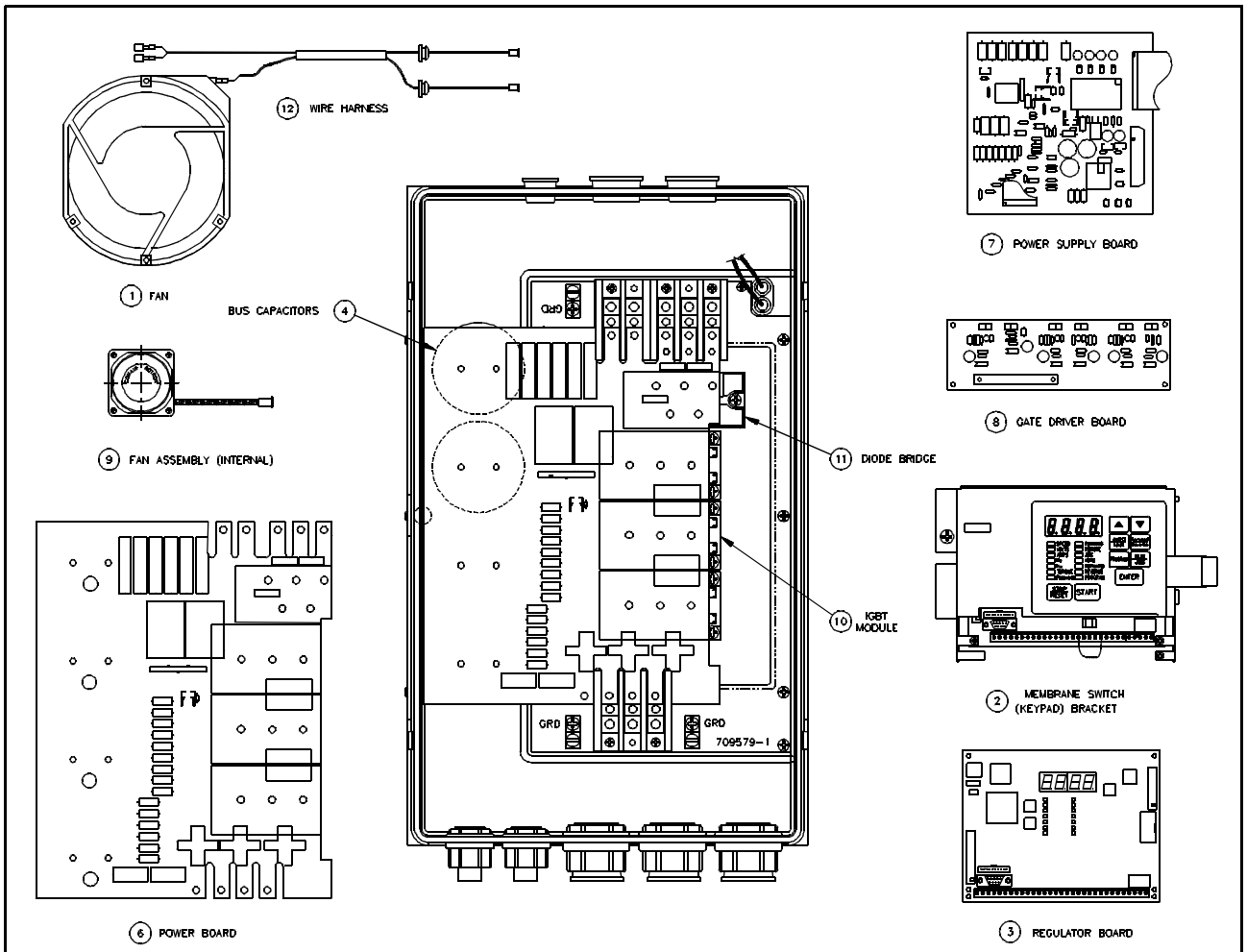


Figure 2.4 – 15-25 HP Drive Component Locations

2.4 25-60 HP GV3000/SE Drive Component Locations

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

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



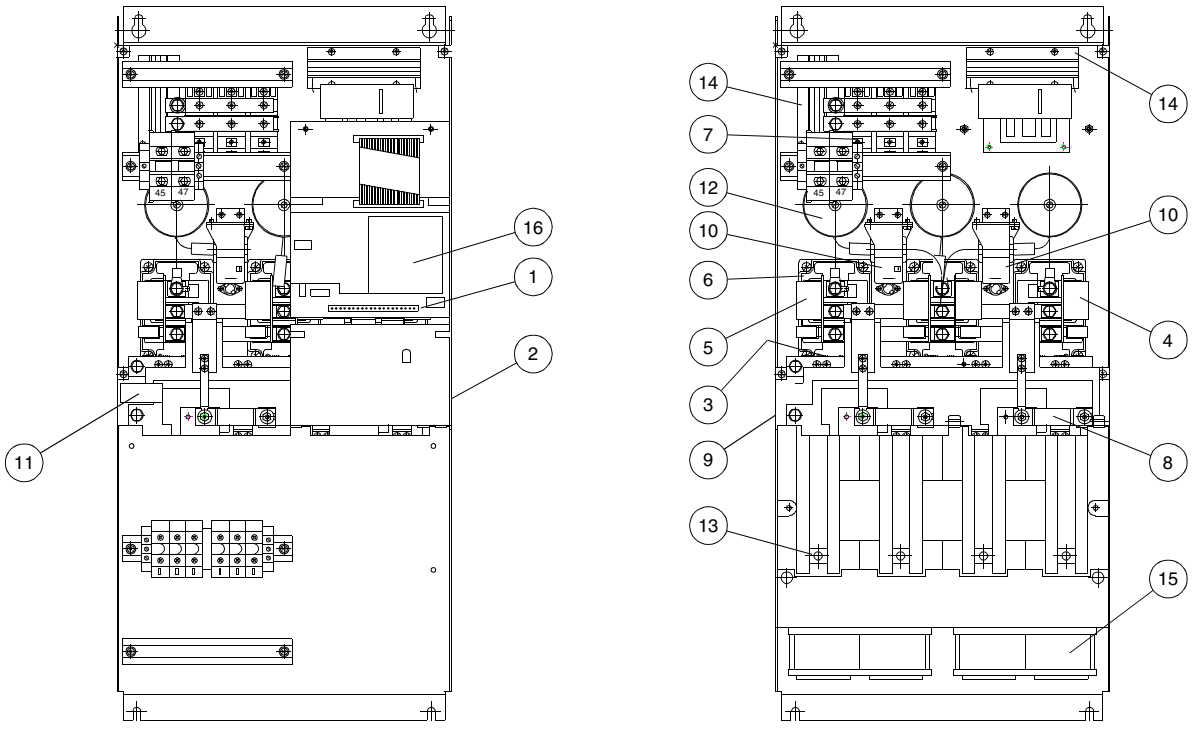
M/N	M/N	M/N
25V41XX	40V41XX	60G41XX
25V42XX	40V42XX	60G42XX
30V41XX	50V41XX	
30V42XX	50V42XX	

Figure 2.5 – 25-60 HP Drive Component Locations

2.5 60-100 HP GV3000/SE Drive Component Locations

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

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



M/N
50R41XX
50T41XX
75R41XX
75T41XX

Figure 2.6 – 60-100 HP Drive Component Locations

2.6 100-150 HP GV3000/SE Drive Component Locations

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

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

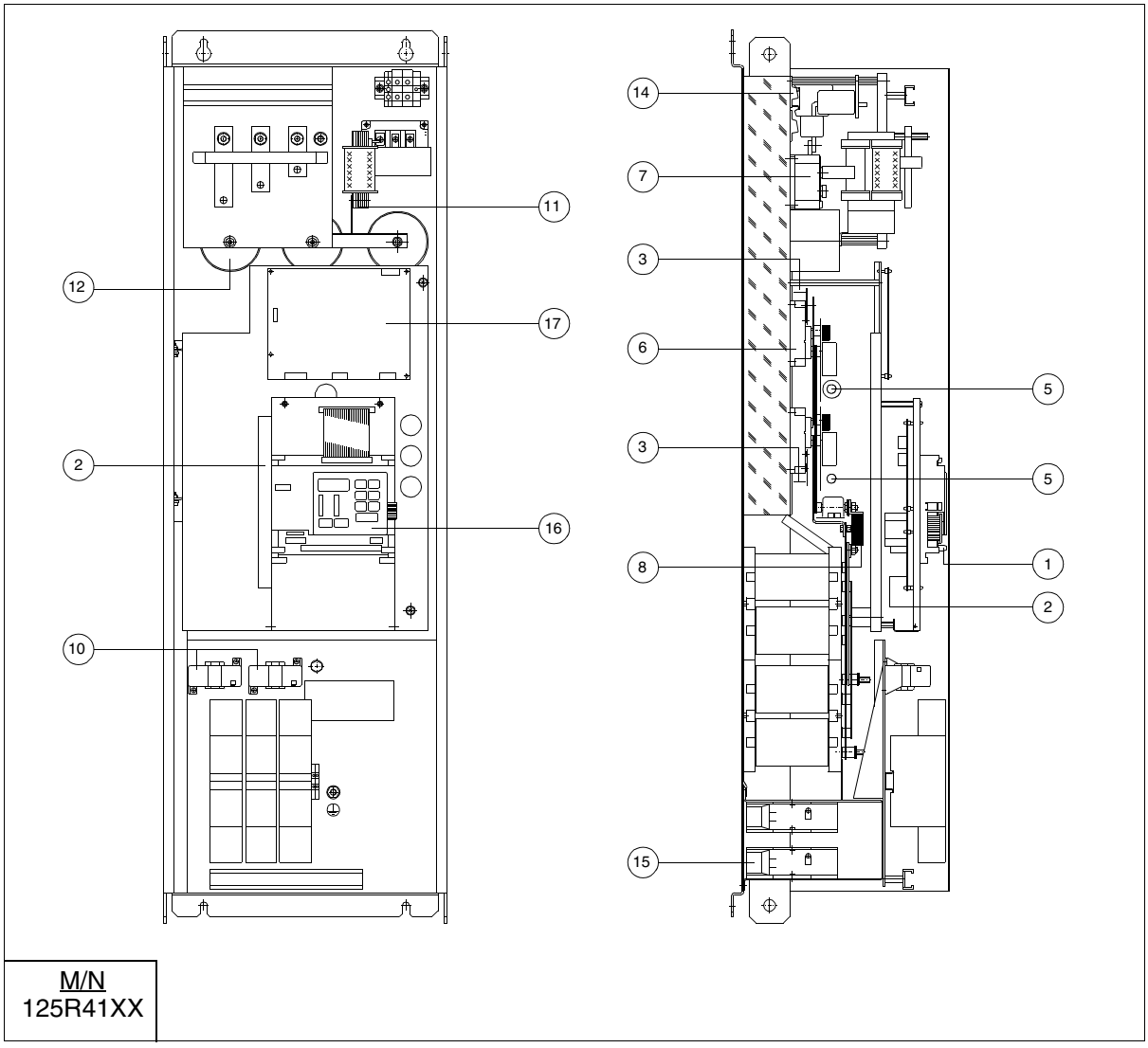
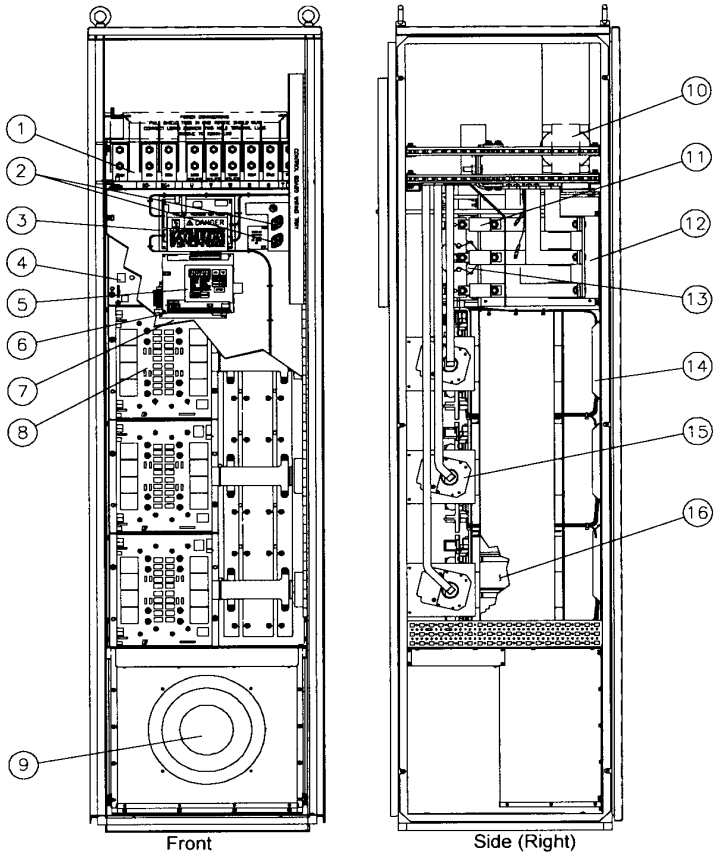


Figure 2.7 – 100-150 HP Drive Component Locations

2.7 200-400 HP GV3000/SE Drive Component Locations

The 200-400 HP drive has the following main components. The numbered items listed below correspond to the numbers used in figure 2.8. Replacement parts are listed in chapter 9.

1. Terminal Block Assembly
2. Blower Fuses
3. Power Module Power Interface PCB
4. SCR-Precharge Assembly
5. Keypad
6. Regulator Printed Circuit Board (PCB)
7. Option Board (Optional)
8. Phase Module Assembly
9. Blower Assembly
10. Blower Transformer Assembly
11. AC Input Fuse
12. AC Disconnect (Optional)
13. Ground Fault Current Transformer
14. DC Bus Discharge Resistor
15. Current Feedback Assembly
16. Capacitor Bank



Front door and sidewalls removed.
Control panel door is partially shown.

M/N
200V41XX
200V41XXDS
250V41XX
250V41XXDS
300V41XX
300V41XXDS
350V41XX
350V41XXDS
400V41XX
400V41XXDS

Figure 2.8 – 200-400 HP Drive Component Locations

2.8 Regulator Board Description

Drive regulation is performed by a microprocessor on the Regulator board. See figures 2.9, 2.10, and 2.11. Drive operation is adjusted by the parameters entered through the keypad. The Regulator board accepts power circuit feedback signals and an external speed reference signal, as well as data from an encoder that is attached to the motor when set up for FVC 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 PWM waveform that corresponds to the speed (FVC regulation) or frequency (V/Hz 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

  For a description of the keypad/display, refer to section 2.8.6. For operational instructions, see the GV3000/SE software reference manual (D2-3359).

- 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 signal selection (via jumper J17) requires a power supply for operation. The power can be sourced from the encoder terminals (4 and 9) or from an external 15V power supply. See tables 7.3 and 7.8, terminals 10 and 11, for more information. The analog output signal is available through the terminal strip.

- A snubber resistor braking signal

  The 1-60 HP Regulator board provides a signal for use by an optional snubber resistor braking kit for 1-10 HP drives. The signal is available through the terminal strip.

Three Regulator boards are used on the GV3000/SE drives:

- 1-60 HP Regulator boards are used with 1-60 HP drives (M/N 1V4XXX to 60G4XXX)
- 60-150 HP Regulator boards are used with 60-150 HP drives (M/N 75R4XXX to 125R4XXX)
- 200-400 HP Regulator boards are used with 200-400 HP drives (M/N 200V4XXX to 400V4XXX).

As shown in figures 2.9, 2.10, and 2.11, the Regulator boards are similar but have different Power Module interface connectors.

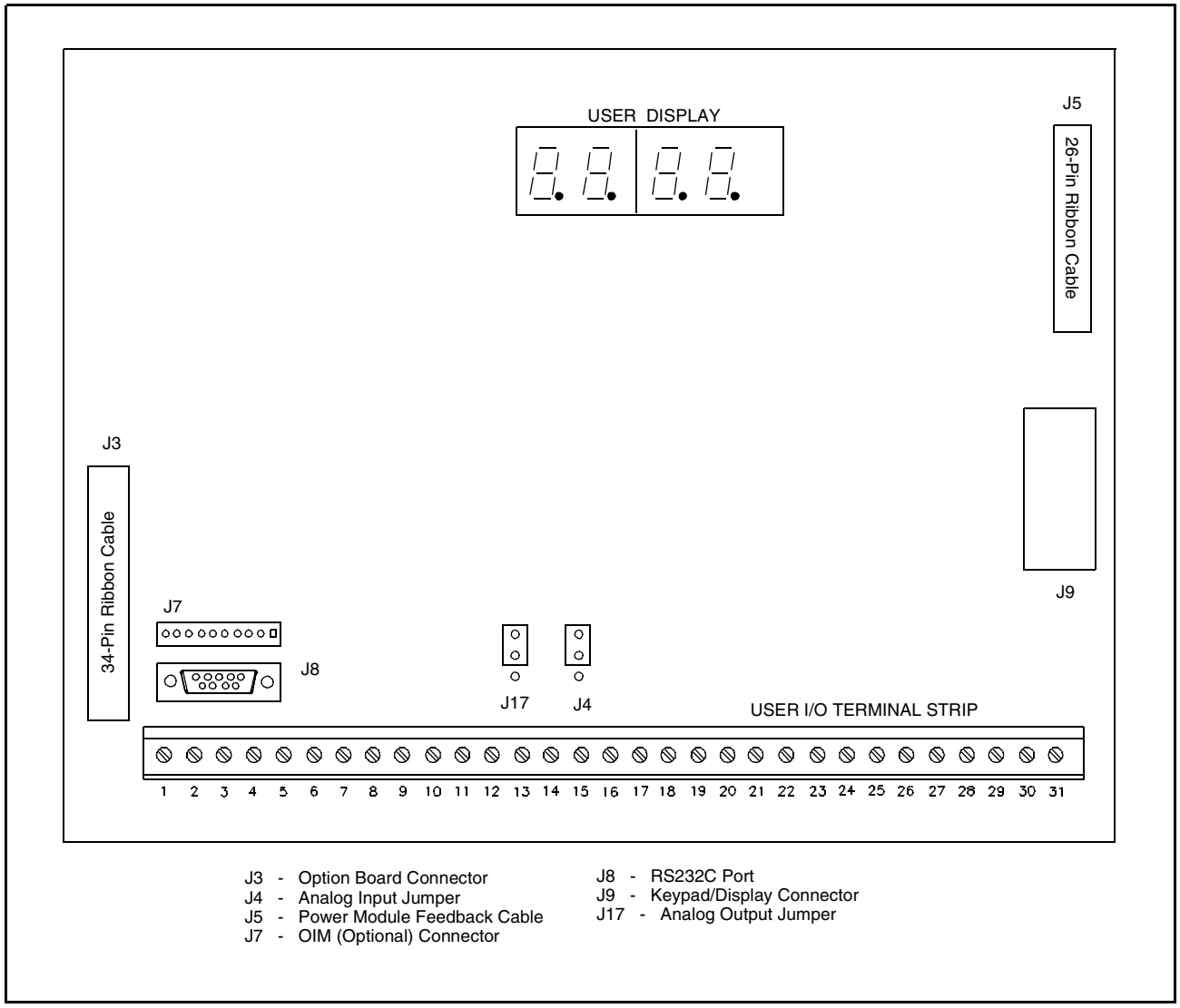


Figure 2.9 – 1-60 HP Regulator Board Component Locations

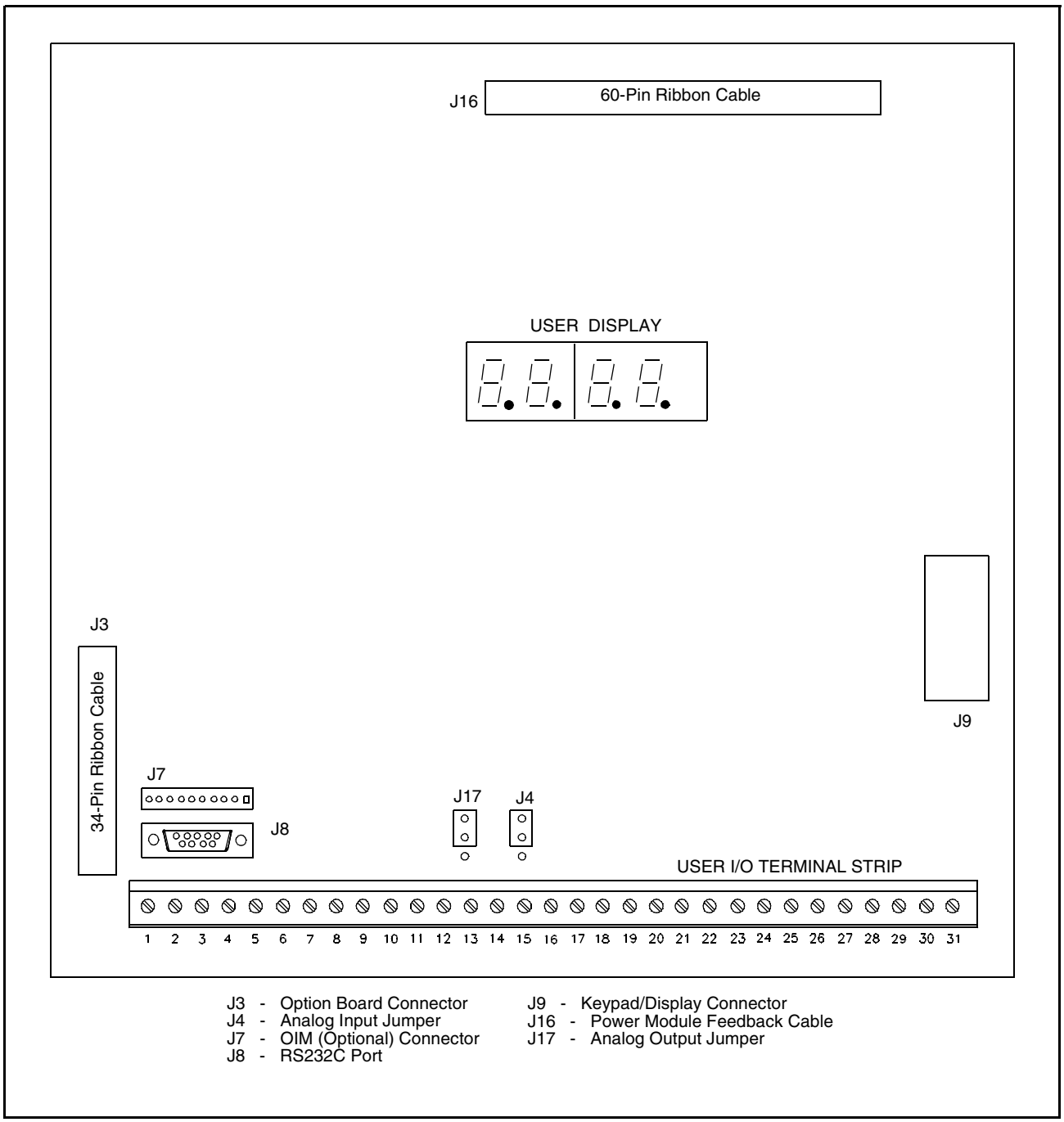


Figure 2.10 – 60-150 HP Regulator Board Component Locations

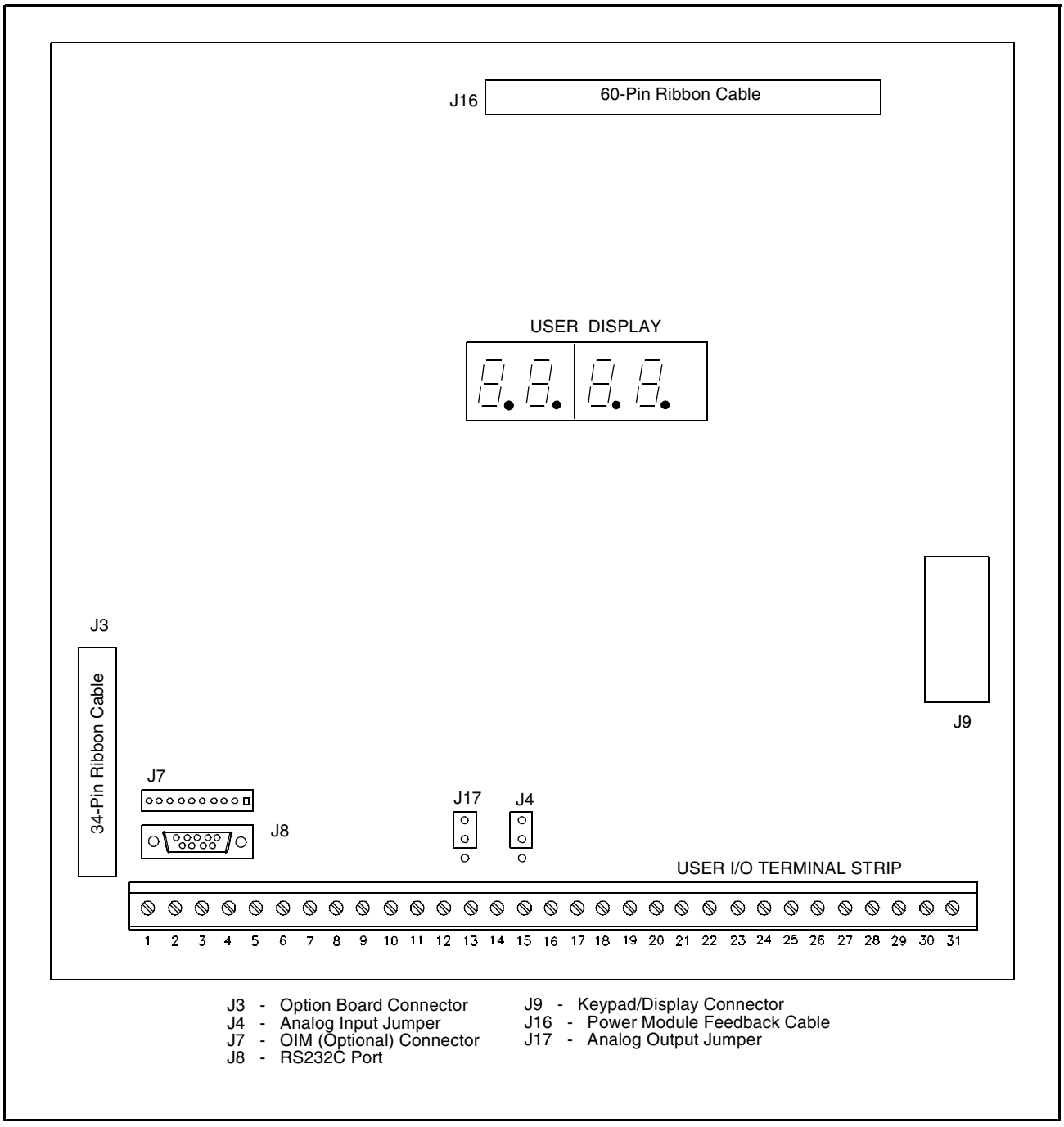


Figure 2.11 – 200-400 HP Regulator Board Component Locations

2.8.1 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, 2.10, and 2.11 for their locations on the Regulator boards. If you need to change the jumpers' settings, use the following procedures.

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

2.8.1.1 Setting the Analog Input Speed Reference Jumper (J4)

Jumper J4 is the analog speed/torque (U.000) reference jumper. This jumper selects either +/- 10 VDC or 0-20 mA input. Parameters P.009, P.010, and P.011 are used in conjunction with the jumper.

Note that if the position of jumper J4 is changed after the parameters are programmed, the software will not recognize that the input reference or polarity has been changed. Be sure to verify that parameters P.009, P.010, and P.011 are correct before starting the drive. Refer to the GV3000/SE Software Start-Up and Reference manual for more information.

Use the following procedure to set jumper J4:

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

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

Step 2. Remove the cover from the drive by unscrewing the four attaching screws. On 200-400 HP drives, open the outer cabinet door.

ATTENTION: Do not operate 200-400 HP drives with the outer and inner cabinet doors open due to possible exposure to high voltage. Close the outer and inner cabinet doors before putting the drive into run. Failure to observe this precaution could result in severe bodily injury or loss of life.

Step 3. Verify that the DC 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, 2.10, and 2.11.

Step 5. Locate pin 1 on jumper J4. Move the jumper to the desired setting as shown in figure 2.12.

Step 6. Reattach the cover. On 200-400 HP drives, close the outer cabinet door.

Step 7. Reapply input power.

Step 8. Verify that Terminal Strip Analog Input Offset (P.009), Terminal Strip Analog Input Gain (P.010), and Terminal Strip Analog Input Configure (P.011) are correctly set.

Note that the jumper settings must match the software settings otherwise the reference value may differ from what is expected. Refer to the GV3000/SE Software Start-Up and Reference manual for more information.

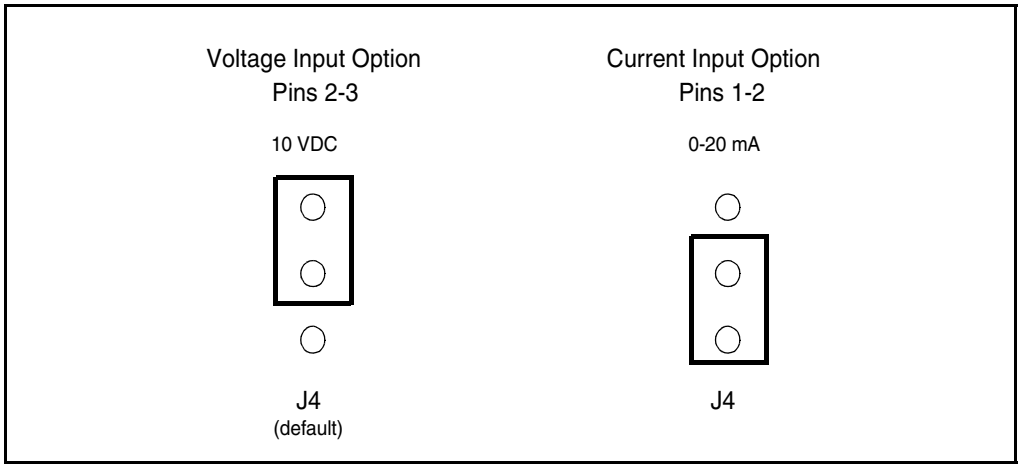


Figure 2.12 – Jumper J4 Settings for Analog Input Speed Reference

2.8.1.2 Setting the Analog Output Jumper (J17)

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 to be proportional to either speed or torque using parameter P.012. Refer to the GV3000/SE Software Start-Up and Reference manual for more information on this parameter.

The jumper only selects a 0-10 VDC source voltage or 4-20 mA sink current to represent speed or torque. Note that the 4-20 mA current selection requires a power supply for operation as shown in tables 7.3 and 7.8, terminals 10 and 11.

Use the following procedure to set jumper J17:

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

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

Step 2. Remove the cover from the drive by unscrewing the four attaching screws. On 200-400 HP drives, open the outer cabinet door.

ATTENTION: Do not operate 200-400 HP drives with the outer and inner cabinet doors open due to possible exposure to high voltage. Close the outer and inner cabinet doors before putting the drive into run. Failure to observe this precaution could result in severe bodily injury or loss of life.

Step 3. Verify that the DC 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, 2.10, and 2.11.

Step 5. Locate pin 1 on jumper J17. Move the jumper to the desired setting as shown in figure 2.13.

Step 6. Reattach the cover. On 200-400 HP drives, close the outer cabinet door.

Step 7. Reapply input power.

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

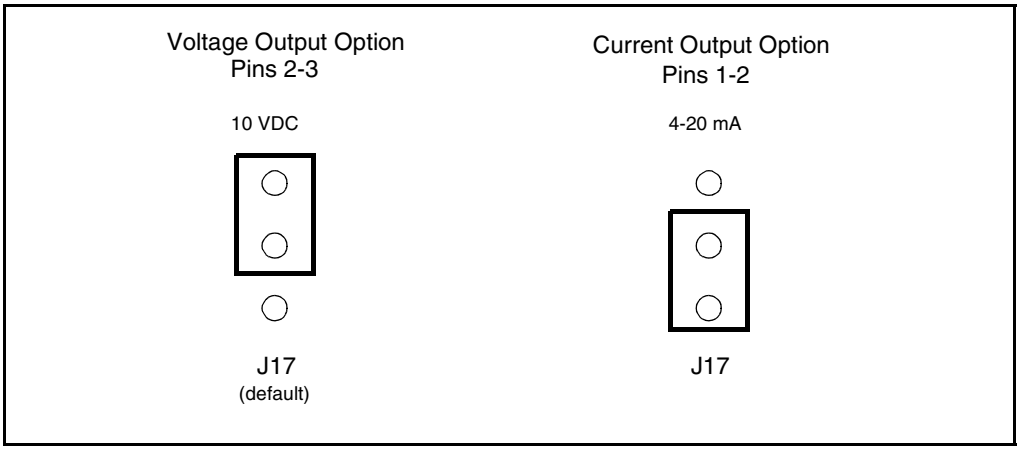


Figure 2.13 – Jumper J17 Settings for Analog Outputs

2.8.2 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, 2.11, and 2.14. The following terminals are provided:

- Terminals 1-3: RS-232 connections
- Terminals 4-9: encoder connections
- Terminals 10-11: analog output connections
- Terminals 12-15: analog speed/torque reference connections
- Terminals 16-25: 24V DC digital input connections
- Terminals 26-27: snubber resistor braking control connections (1-10 HP Regulator boards only) for older Snubber Resistor Braking Kits (for example, the M/N 2DB4010 series)
- Terminals 28-31: status relay connections

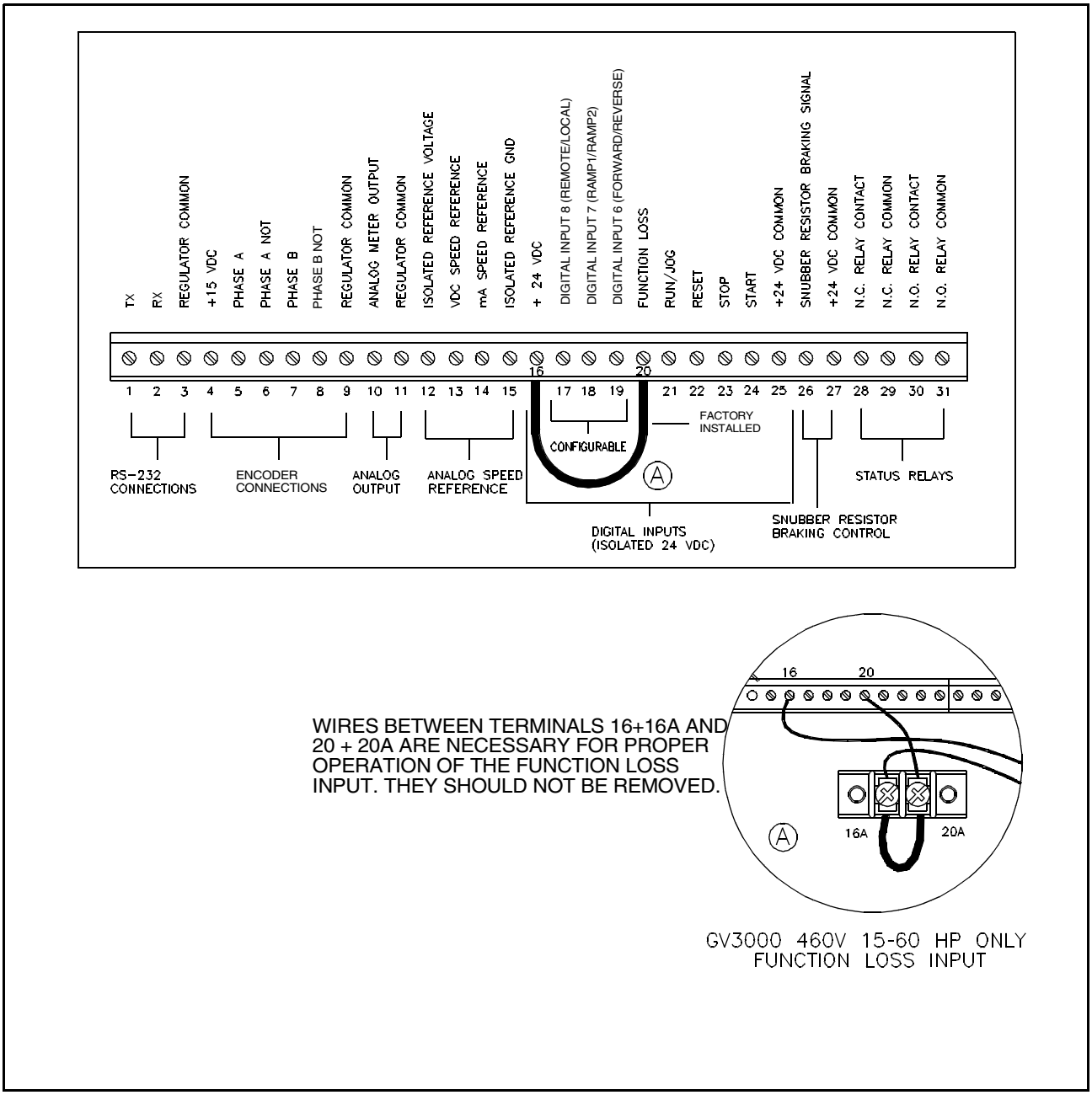


Figure 2.14 – Typical Terminal Strip Connections

2.8.3 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/SE drive and a personal computer running the Control and Configuration (CS3000) software. See figures 2.9, 2.10, and 2.11. Refer to instruction manual D2-3348 for more information about the CS3000 software.

2.8.4 Option Board Connector

The flat-ribbon cable connector (J3) on the left side of the Regulator board is a parallel bus connection port that provides a means of attaching optional boards such as the DeviceNet Option board, the RMI board, the AutoMax Network Option board, or similar boards to the GV3000/SE drive. See figures 2.9, 2.10, and 2.11. The option board is mounted below the Regulator board inside the drive. Refer to the appropriate board instruction manual for more information. Refer to section 2.9 of this manual for more information on optional drive kits.

2.8.5 Operator Interface Module Connector

Flat-ribbon connector J7 provides a means of attaching the optional Operator Interface Module (OIM). The OIM is available for use as a remote keypad for the drive. Refer to the Operator Interface Module manual (D2-3342) for more information.

2.8.6 Keypad/Display

The front panel keypad/display is used to program and operate the drive. See figure 2.15. The four-character display is used to indicate drive parameters, parameter values, and error codes. The fourteen single LEDs indicate drive status and operating mode, as well as identify drive outputs whose values are displayed on the four-character display.

Refer to the GV3000/SE Software Start-Up and Reference manual for more information about the keypad/display.

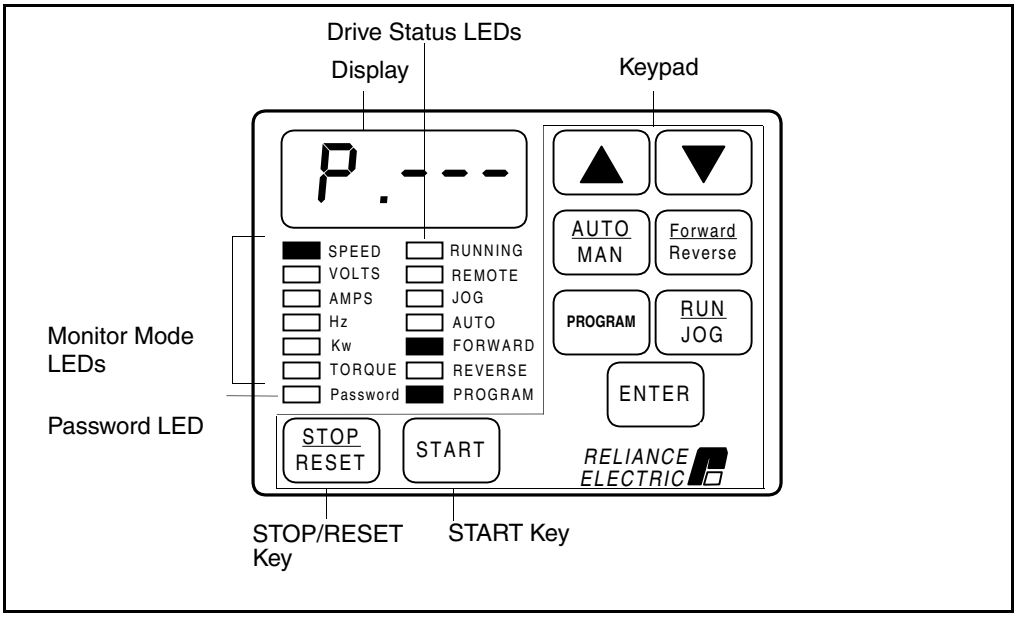


Figure 2.15 – Keypad/Display

2.9 Optional Equipment

Table 2.2 lists standard GV3000/SE kits and options.

Table 2.2 – Standard Kits and Options

Description	Model Number	Instruction Manual
Snubber Resistor Braking Kits (NEMA 1 Enclosed)	2SR20400 2SR20600 2SR21200 2SR21800 2SR40400 2SR40600 2SR41200 2SR41800	D2-3291
Snubber Transistor Braking Kits (Transistor Only, Open Frame Type)	2ST20019 2ST20054 2ST40009 2ST40027 2ST40075 2ST40125 2ST40150 2ST40200 2ST40300	D2-3291
Line Regeneration Modules	1RG22008 1RG22015 1RG22025 1RG22045 1RG42008 1RG42015 1RG42025 1RG42045 1RG42060 1RG42090	N/A
Motor Encoder Cable	2TC3025 2TC3075 2TC4025 2TC4075 2TC4100 2TC4300	D2-3305
CE-Compliant AC Mains Filters	2DF4283 2DF4284 2DF4285 2DF4286 2DF4125	D2-3360
Fan Kit for Line Regeneration Modules	1RG1000	N/A
ControlNet Network Option Board	2CN3000	D2-3390
Interbus-S Network Option Board	2NB3000	49’1333
AutoMax Network Option Board with 762 mm (30”) of Cable	2AX3000	D2-3308
AutoMax RS-232 Adapter Cable	2CA3001	D2-3348
Super Remote Meter Interface (RMI)	2SI3000	D2-3341

Table 2.2 – Standard Kits and Options (Continued)

Description	Model Number	Instruction Manual
DeviceNet Network Option Board	2DV3000	MAN0096-03
Operator Interface Module (OIM)	2RK3000	D2-3342
CS3000 Control and Configuration Software	2CS3000	D2-3348
CS3000 RS-232 Computer Cable	2CA3000	D2-3348
115 VAC Interface Option Board	2LB3000	D2-3376
PROFIBUS™ Interface Board	2PB3000	49.1355

CHAPTER 3
Planning Before Installing

This chapter describes how to plan a GV3000/SE drive installation.

ATTENTION: 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.

ATTENTION: When the level-sense start feature is enabled (P.054 = ON, the user must ensure that automatic start up of the driven equipment will not cause injury to operating personnel or damage to the driven equipment. In addition, the user is responsible for providing suitable audible or visual alarms or other devices to indicate that this function is enabled and the drive may start at any moment. Refer to the GV3000/SE Software Start-Up and Reference manual (D2-3359) for additional information. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: 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.

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

3.1 General Requirements for the Installation Site

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

3.1.1 Making Sure Environmental Conditions are Met

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

- Verify that NEMA 1 drives can be kept clean, cool, and dry.
- The area chosen should allow the space required for proper air flow as defined in section 3.1.3.
- 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 1000 meters (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 to 95% (non-condensing)

3.1.2 Determining Total Area Required Based on Drive Dimensions

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

Table 3.2 – Drive Dimensions and Weights

GV3000 Drive	Dim. A	Dim. B	Dim. C	Dim. D	Dim. E	Weight
1V4160 1V4460 2V4160 2V4460 3V4160 3V4460 5V4160 5V4460	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
7V4160 7V4260 10V4160 10V4260	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
15V4160 15V4260 20V4160 20V4260 25G4160 25G4260	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
25V4160 25V4260 30V4160 30V4260 40V4160 40V4260	376.0 mm 14.80"	605.0 mm 23.82"	308.0 mm 12.13"	565.2 mm 22.25"	350.0 mm 13.78"	23.6 kg 52 lbs
50V4160 50V4260 60G4160 60G4260	376.0 mm 14.80"	605.0 mm 23.82"	308.0 mm 12.13"	565.2 mm 22.25"	350.0 mm 13.78"	25.8 kg 57 lbs
50R4160 50T4160 75R4160 75T4160	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
125R4160	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
200V4160 250V4160 300V4160 350V4160 400V4160	600 mm 23.6"	2200 mm 86.6"	N/A	N/A	600 mm* 23.6"	382.5 kg 850 lbs

*Dimension E is 660 mm (26.0") with optional disconnect.

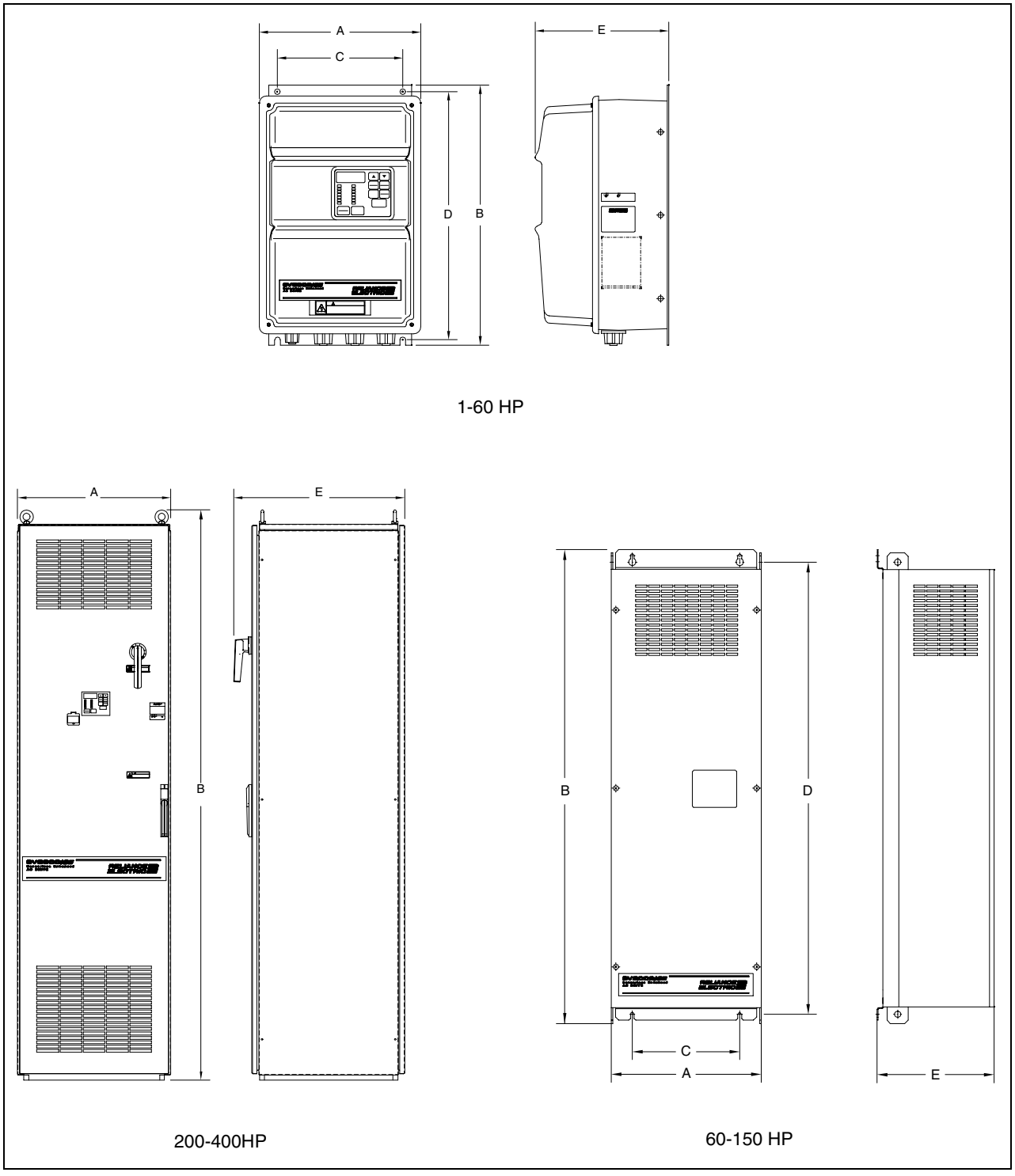


Figure 3.1 – Drive Dimensions

3.1.3 Verifying the Site Provides for Recommended Air Flow Clearances

Be sure there is adequate clearance for air circulation around the drive. For best air movement, do not mount GV3000/SE drives directly above each other. Note that no devices are to be mounted behind the drive. This area must be kept clear of all control and power wiring. Refer to figure 3.2 for recommended air flow clearances.

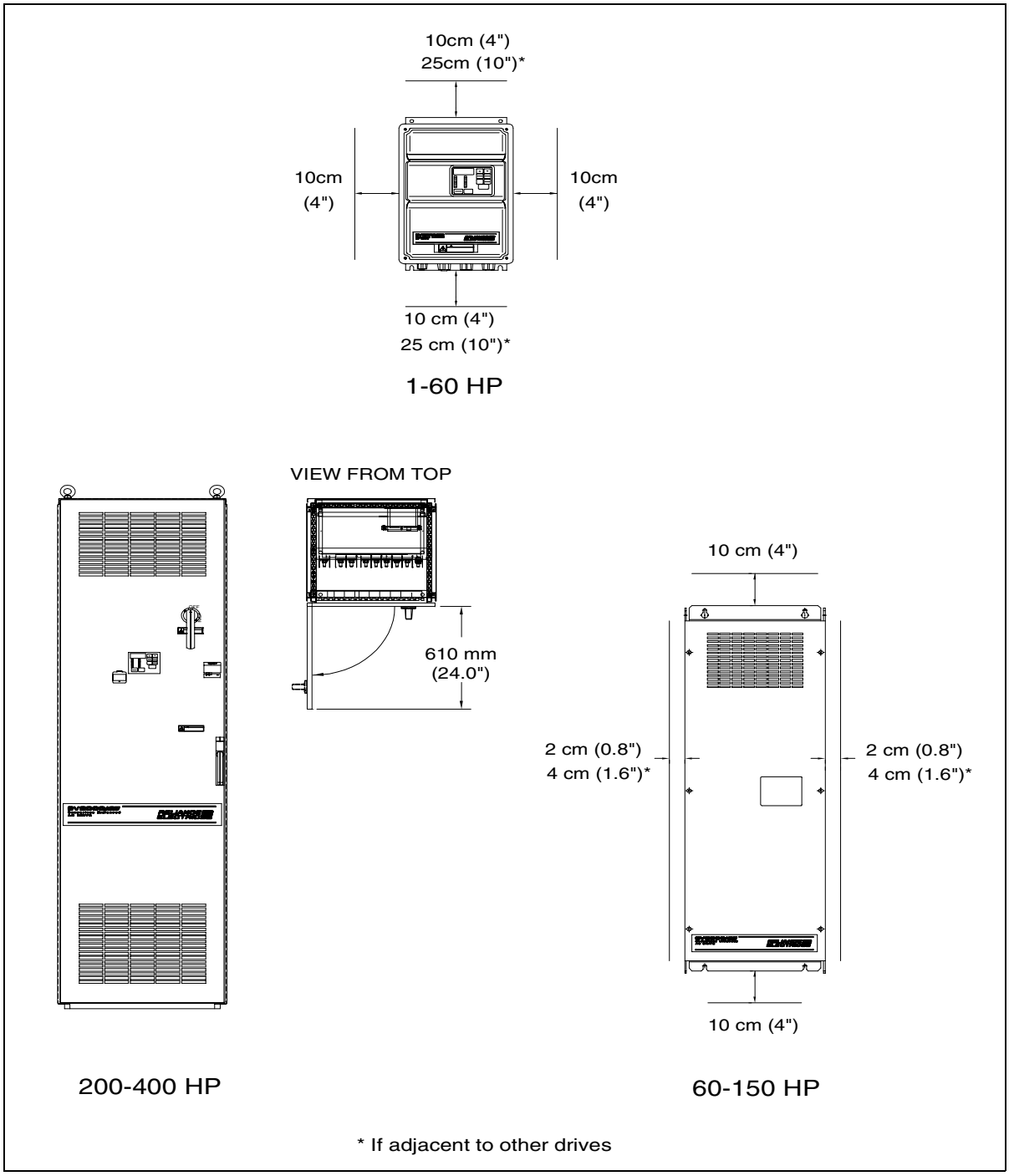


Figure 3.2 – Recommended Air Flow Clearances

3.1.4 Verifying Power Module Input Ratings Match Supplied Power

It is important to verify that plant power will meet the input power requirements of the 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, encoder feedback (for FVC 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, and applicable local, national, and international codes (e.g., NEC/CEC regulations).

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

3.2.2.1 Conduit Entry Opening Sizes

It is important to 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 4.7.

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 3.8 for recommended power wire sizes.

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

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

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

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

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

Type of Wiring	Terminals	Size of Wire (Maximum)
AC Input Power	R/L1, S/L2, TL3	4 AWG (2X), 28 mm^2
Output Power	U/T1, V/T2, W/T3	
DC Input Power	+, -	
Ground	⏚	

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

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

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

Type of Wiring	Terminals	Size of Wire (Maximum)
AC Input Power	1L1, 1L2, 1L3 2L1, 2L2	2/0 AWG (2X), 185 mm^2
Output Power	U, V, W	
AC Ground	PE	4/0 AWG, 95 mm^2

Table 3.8 – Recommended Power Wire Sizes for 200-400 HP Drives

Type of Wiring	Terminals	Size of Wire (Maximum)*
AC Input Power	R/L1, S/L2, T/L3	350 MCM (2X), 177 mm^2
Output Power	U/T1, V/T2, W/T3	
DC Bus Connections	DC-, DC+	
Ground	GND	

*Wires must be lugged. Lugs must be Burndy YA31-2N or equivalent.

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 3.9. Recommended terminal tightening torque is 0.5 Newton-meters (4.5 in-lb). Operator controls can be up to 303 meters (1000 feet) from the drive.

Table 3.9 – Recommended Terminal Strip Wire Sizes

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

3.2.2.4 Recommended Motor Lead Lengths

To reduce line disturbances and noise, motor lead length should not exceed 76 meters (250 feet) for any non-Reliance Electric motor or any non-inverter duty motor.

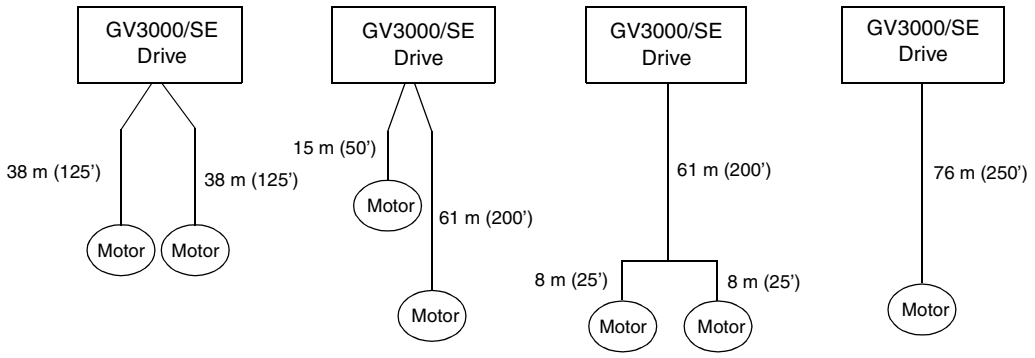
When total lead length exceeds 76 meters (250 feet), nuisance trips can occur caused by capacitive current flow to ground. Note that these capacitively-coupled currents should be taken into consideration when working in areas where drives are running. If the motor lead length must exceed these limits, the addition of output line reactors or other steps must be taken to correct the problem. Refer to table 3.11 for a list of compatible reactors.

For Reliance Electric inverter duty motors, use the recommended lead lengths shown in table 3.10 as a guideline.

Your application may be restricted to a shorter lead length due to:

- the type of wire
- the placement of wire (for example, in conduit or a cable tray)
- the type of line reactor
- the type of motor.

Figure 3.3 illustrates how to calculate motor lead lengths.



This example shows how to measure various motor configurations when the maximum motor lead length is 76 m (250 ft). Note that drives using vector regulation can be connected to only one motor at a time.

Figure 3.3 – How to Calculate Motor Lead Lengths

Table 3.10 – Recommended Motor Lead Lengths for Reliance Inverter Duty Motors

GV3000/SE HP Rating	Filter Type	Maximum Lead Length in Feet with 460 VAC Motor		
		Carrier Frequency		
		2 kHz	4 kHz	8 kHz
1 to 2	None	500	500	500
3 to 5		500	500	500
7.5 to 10		750	500	500
15 to 20		800	500	500
25 to 60		800	500	500
75 to 100		800	500	500
125 to 150		800	500	500
200 to 400		1000	1000	1000
1 to 2	A 5% reactor/filter at the drive.	1000	1000	1000
3 to 5		1000	1000	1000
7.5 to 10		1000	1000	1000
15 to 20		1000	1000	1000
25 to 60		1000	1000	1000
75 to 100		1000	1000	1000
125 to 150		1000	1000	1000
200 to 400		1000	1000	1000

Table 3.11 – Compatible Reactors

GV3000/SE HP Rating	480 Volt 5% Reactor		GV3000/SE HP Rating	480 Volt 5% Reactor
1	RL-00202		50	RL-08003
2	RL-00403		60	RL-08003
3	RL-00403		75	RL-10003
5	RL-00803		100	RL-13003
7.5	RL-01203		125	RL-16003
10	RL-01803		150	RL-20003
15	RL-02503		200	RL-25003
20	RL-03503		250	RL-32003
25	RL-03503		300	RL-40003
30	RL-04503		350	RL-50003
40	RL-05503		400	RL-50003

Standard reactors can be used on GV3000/SE drives with carrier frequency settings up to 8 kHz.
All reactors listed are UL-recognized (UL-506 File #E53094) and CSA certified (CSA File #LR29753).

3.2.2.5 Recommended Serial Communication Cable Lengths

Connector J8 on the Regulator board is an RS-232 serial communication port. This connector allows the 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:

- 3-meter (10-foot) D-shell 9-pin to 9-pin cable (M/N 2CA3000)
- 0.3-meter (1-foot) D-shell 9-pin to 25-pin adaptor cable (M/N 2CA3001).

User-constructed cables can be up to 15 meters (50 feet) in length.

Note that for communication between a GV3000/SE drive and a personal computer, the Control and Configuration Software (2CS3000) must also be used. Refer to instruction manual D2-3348 for more information about the CS3000 software.

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

3.2.3 Selecting Input Line Branch Circuit Fuses

ATTENTION: Most codes require that upstream branch circuit protection be provided to protect input power wiring. Install the fuses recommended in table 3.12. Do not exceed the fuse ratings. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Input line branch circuit protection fuses must be used to protect the input power lines. See figures 5.1 and 5.2. Recommended fuse values are shown in table 3.12. The input fuse ratings listed in table 3.12 are applicable for one drive per branch circuit. No other load may be applied to that fused circuit.

3.2.4 Meeting Encoder Specifications (FVC Regulation Only)

GV3000/SE drives set up for FVC regulation require an encoder for closed-loop operation. Refer to table A.6 for specifications. Drives set up for V/Hz or SVC regulation do not require an encoder for feedback.

3.2.4.1 Encoder Wiring Guidelines

Encoder connections are considered signal level wiring and, therefore, must be run separate from control and power wiring. Reliance Electric recommends 18 AWG unshielded twisted pair wires with 2-3 twists per inch for applications to a maximum distance of 303 meters (1000 feet). The recommended Reliance Electric part number is 417900-207CG, 18 AWG, 6 conductor (3 twisted pairs).

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

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

Table 3.12 – AC Input Line Fuse Selection Values

Drive Model Number	Selected Regulation and Horsepower Rating	Input Voltage (+/-10%)	Fuse Rating*
1V4160 1V4460	V/Hz or Vector (1 HP)	380-460 VAC	6 A
2V4160 2V4460	V/Hz or Vector (2 HP)	380-460 VAC	8 A
3V4160 3V4460	V/Hz or Vector (3 HP)	380-460 VAC	12 A
5V4160 5V4460	V/Hz or Vector (5 HP)	380-460 VAC	20 A
7V4160 7V4260	V/Hz or Vector (7.5 HP)	380-460 VAC	25 A
10V4160 10V4260	V/Hz or Vector (10 HP)	380-460 VAC	35 A
15V4160 15V4260	V/Hz or Vector (15 HP)	380-460 VAC	45 A
20V4160 20V4260	V/Hz or Vector (20 HP)	380-460 VAC	60 A
25G4160 25G4260	V/Hz (25 HP)	380-460 VAC	70 A
25V4160 25V4260	V/Hz or Vector (25 HP)	380-460 VAC	70 A
30V4160 30V4260	V/Hz or Vector (30 HP)	380-460 VAC	100 A
40V4160 40V4260	V/Hz or Vector (40 HP)	380-460 VAC	100 A
50V4160 50V4260	V/Hz or Vector (50 HP)	380-460 VAC	125 A
50R4160 50T4160	Vector (50 HP) or V/Hz (75 HP)	380-460 VAC	125 A
60G4160 60G4260	V/Hz (60 HP)	380-460 VAC	150 A
75R4160 75T4160	Vector (60-75 HP) or V/Hz (100 HP)	380-460 VAC	125 A 150 A
125R4160	Vector (100-125 HP) or V/Hz (125-150 HP)	380-460 VAC	250 A
200V4160	Vector (150-200 HP) or V/Hz (200 HP)	380-460 VAC	**
250V4160	V/Hz or Vector (250 HP)	380-460 VAC	**
300V4160	V/Hz or Vector (300 HP)	380-460 VAC	**
350V4160	V/Hz or Vector (350 HP)	380-460 VAC	**
400V4160	V/Hz or Vector (400 HP)	380-460 VAC	**

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

**The drive contains internal fusing sized to protect the drive. Install fuses to protect the input wiring in accordance with local codes.

CHAPTER 4

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 entry areas where wiring is to be routed in and out of the drive.

4.1 Mounting the Drive

Attach the drive (1-150 HP) to the vertical surface selected using the four (4) mounting holes provided. In order to maintain a flat mounting surface and to ensure that bolt tightness is maintained, use washers under the bolt heads. Refer to figure 3.1 and table 3.2 for drive mounting dimensions. Use the following user-supplied mounting bolts and washers:

- 1-5HP drives: M6 (1/4")
- 7.5-10HP drives: M8 (5/16")
- 15-60HP drives: M8 or M10 (5/16" or 3/8")
- 60-150HP drives: M8 (5/16")
- 200-400 HP drives are to be floor-mounted. Use the cabinet mounting brackets supplied with the drive.

4.1.1 Verifying the Drive's Watts Loss Rating

When mounting the drive inside of another enclosure, you should determine the watts loss rating of the drive from table 2.1. This table lists the typical full load power loss watts value under all operating carrier frequencies. Ensure that the enclosure is adequately ventilated with 0° to 40° C ambient air based on the drive's watts loss rating.

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

All wiring should be installed in conformance with the applicable local, national, and international codes (e.g., NEC/CEC). Signal wiring, control wiring, and power wiring must be routed in separate conduits to prevent interference with drive operation. Note that no wires are to be routed behind the drive. Use grommets, when hubs are not provided, to guard against wire chafing. Figures 4.1 through 4.7 show the wire routing, grounding terminal, and power terminal strips of the GV3000/SE drives.

ATTENTION: 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.

Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

4.2.1 Replacing Conduit Plugs

The plastic plugs installed in the conduit hub of all NEMA 4x/12 and NEMA 12 drives must be replaced with NPT connectors or hole plugs having a similar enclosure rating. Seal all threaded connections.

4.3 Grounding the Drive

ATTENTION: The user is responsible for conforming with all applicable local, national, and international codes. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Use the following steps to ground the drive:

Step 1. Remove the drive's cover. On 200-400 HP drives, open the outer cabinet door.

Step 2. Run a suitable equipment grounding conductor unbroken from the drive's ground terminal to the motor's ground terminal and then to earth ground. See figures 4.1 to 4.7, 5.1, and 5.2.

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

When adding more than one grounding conductor wire to a single chassis ground, twist the conductors together.

Step 4. Reattach the drive's cover. On 200-400 HP drives, close the outer cabinet door.

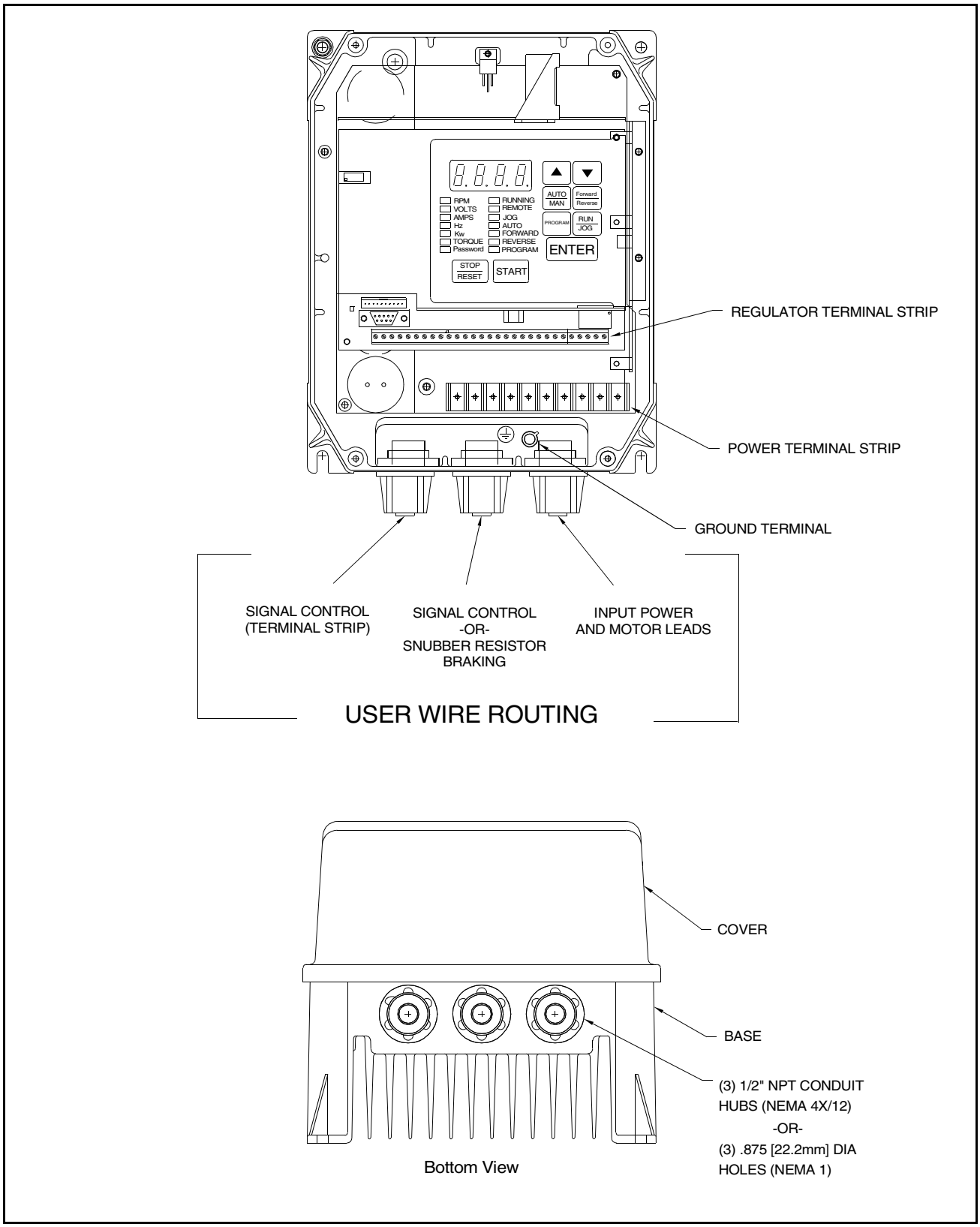
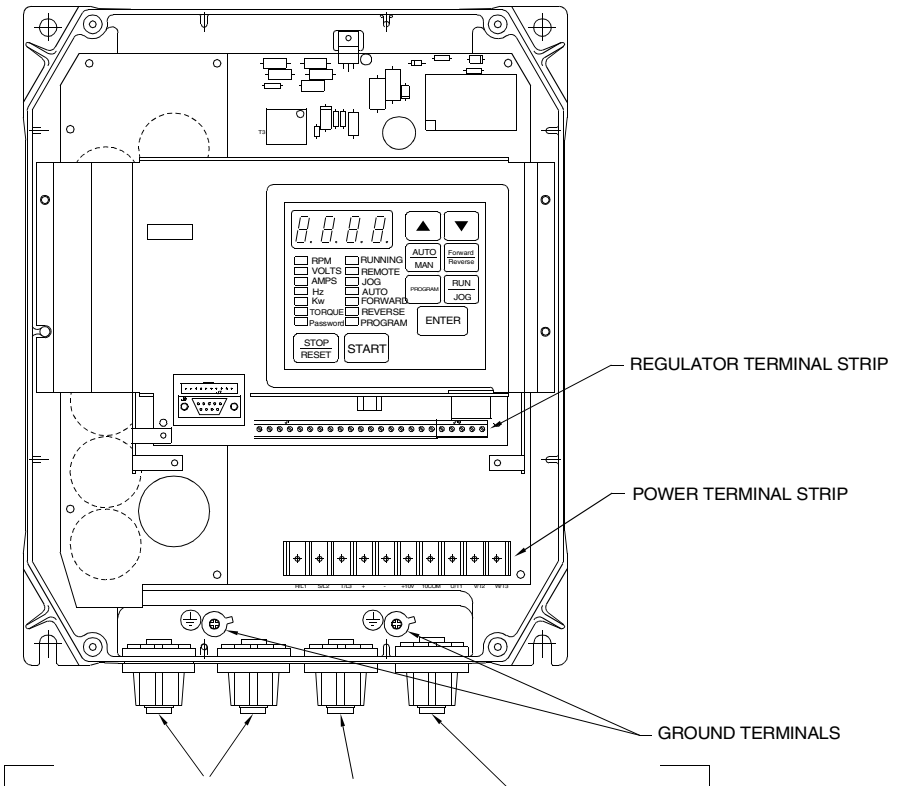


Figure 4.1 – Wire Routing Locations for 1-5 HP Drives



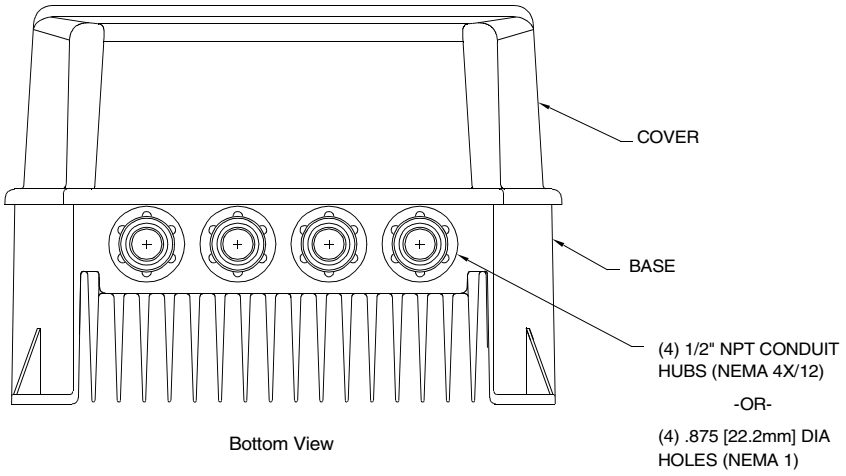


Figure 4.2 – Wire Routing Locations for 7.5-10 HP Drives

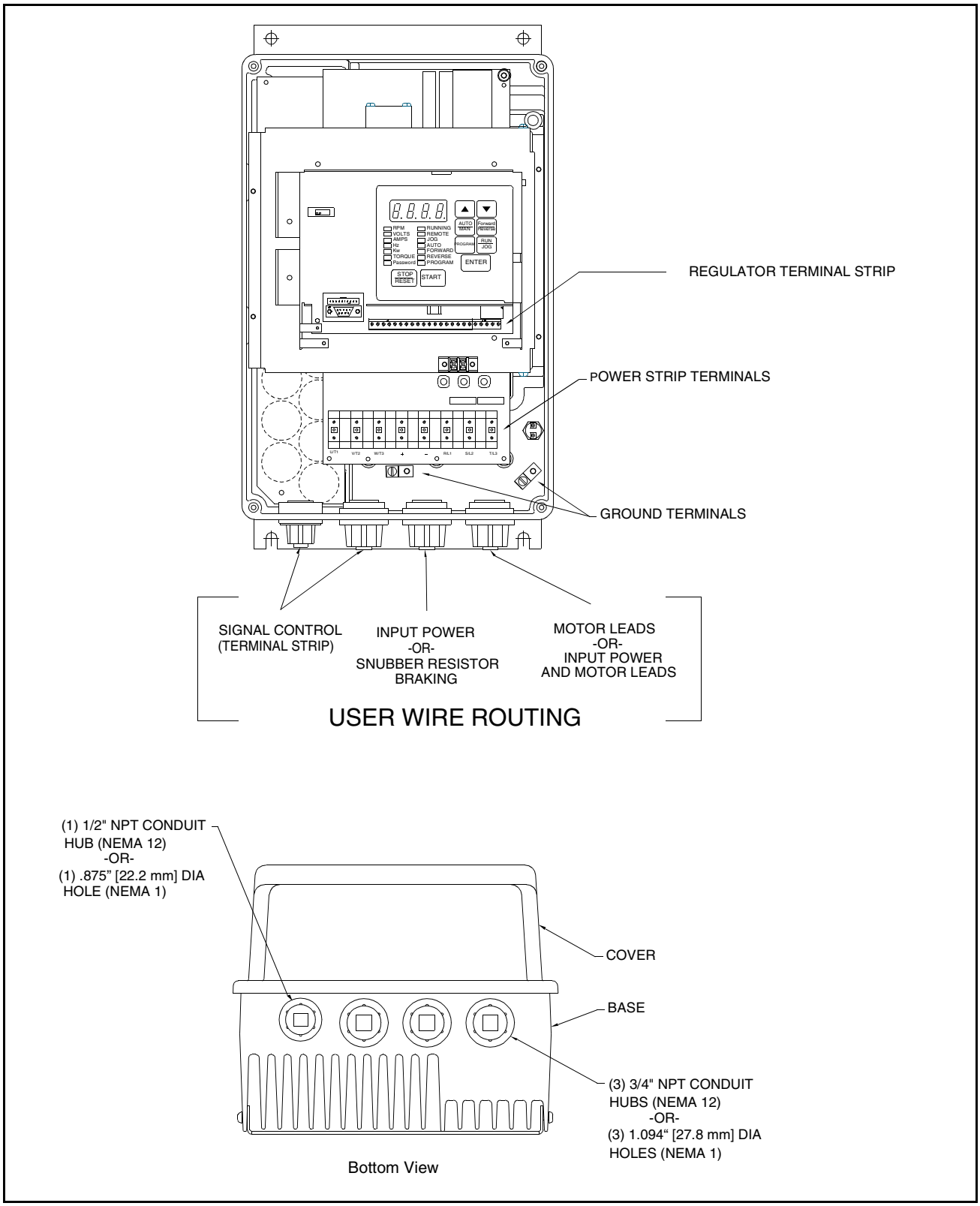


Figure 4.3 – Wire Routing Locations for 15-25 HP Drives

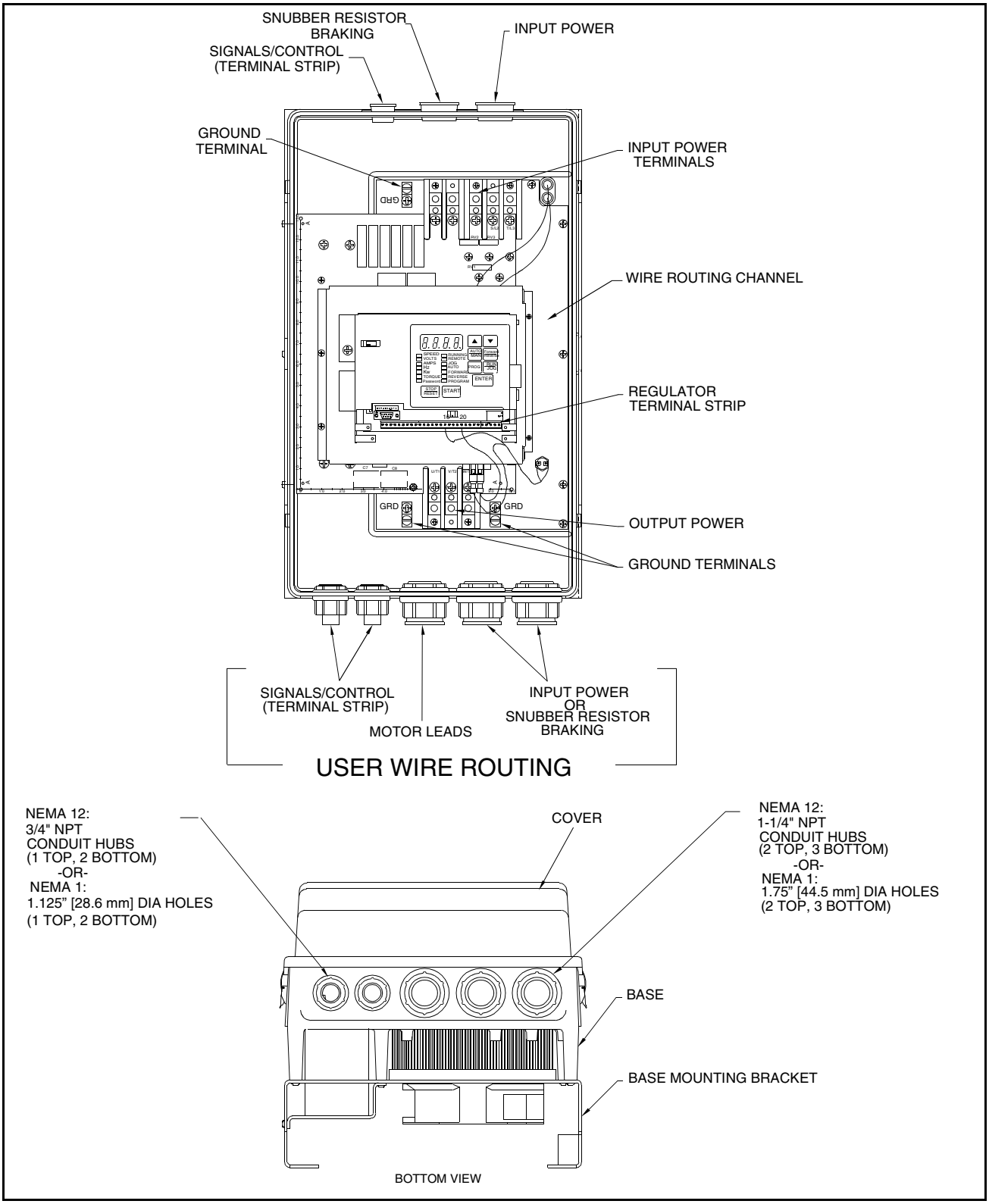


Figure 4.4 – Wire Routing Locations for 25-60 HP Drives

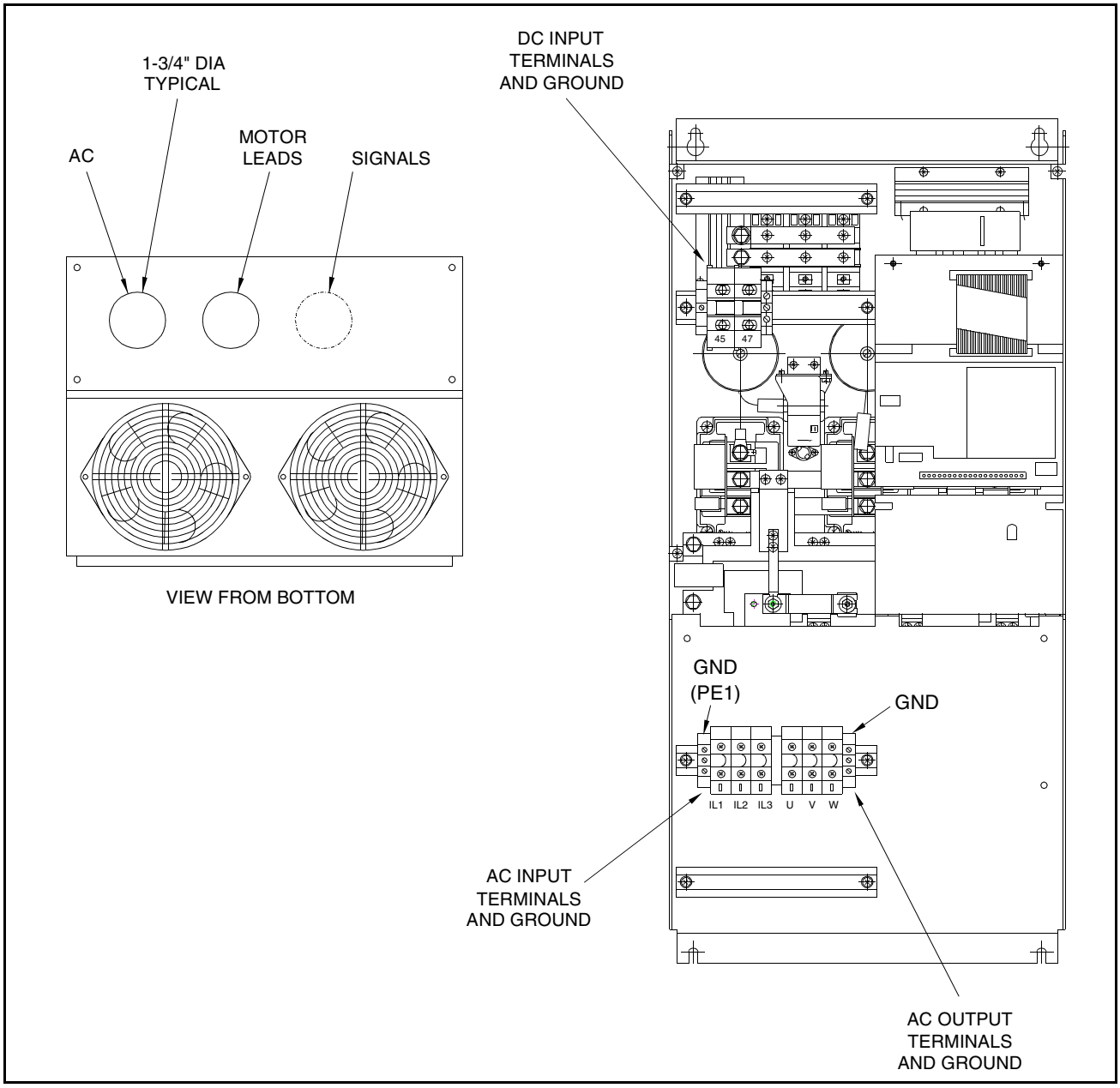


Figure 4.5 – Wire Routing Locations for 60-100 HP Drive

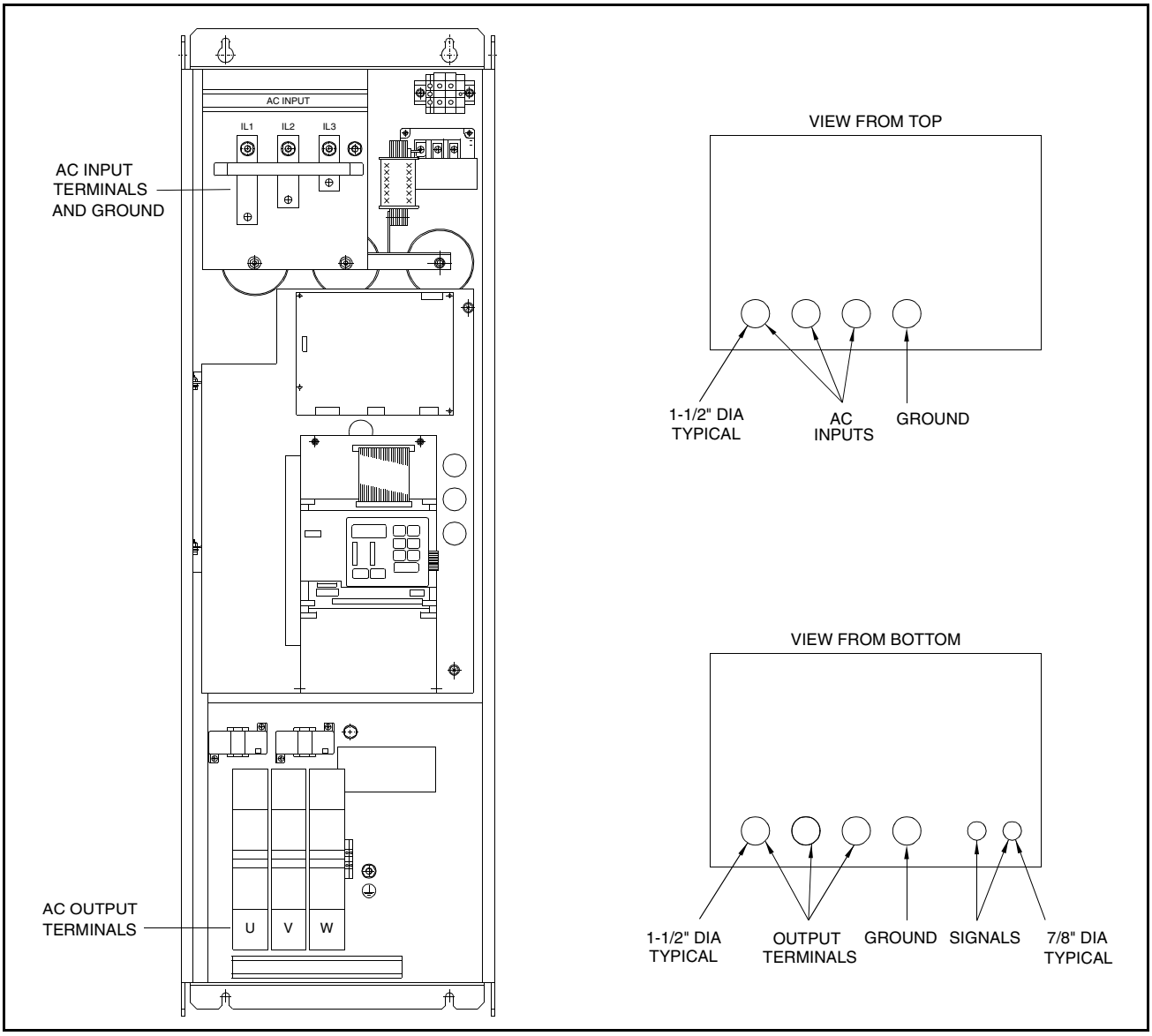


Figure 4.6 – Wire Routing Locations for 100-150 HP Drives

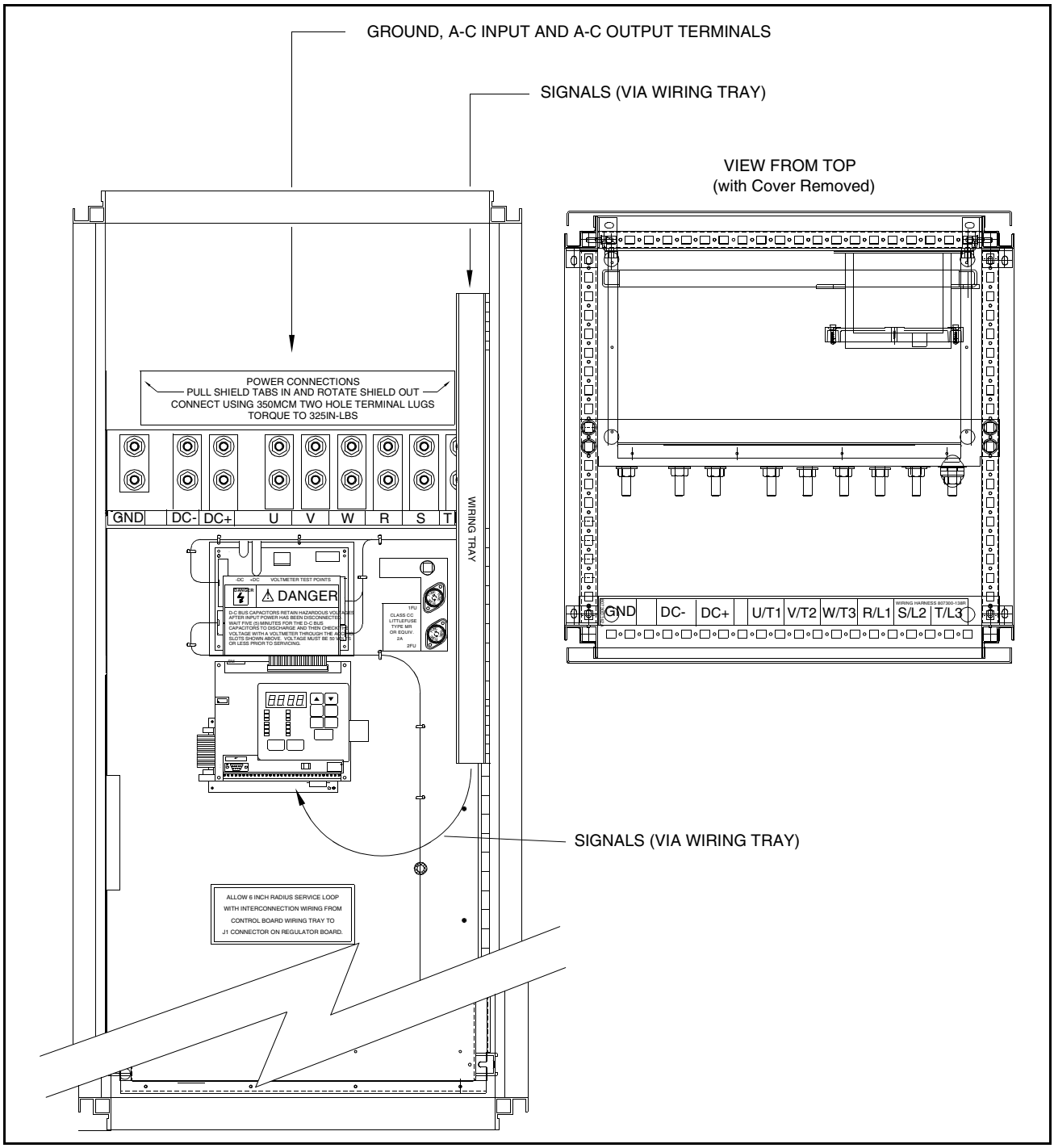


Figure 4.7 – Wire Routing Locations for 200-400 HP Drives

CHAPTER 5

Installing Input Power Wiring

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

5.1 Installing Transformers and Reactors (Optional)

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

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

Observe the following guidelines when installing an isolation transformer:

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

ATTENTION: 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

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

The GV3000/SE AC line distribution system capacity is 1000 KVA, three-phase with 30,000 amps symmetrical fault current capacity with a line impedance of less than 5%. The symmetrical fault current may be increased to 85,000 amps if the appropriate three-phase AC line reactor is used as shown in table 5.1.

Table 5.1 – AC Line Reactors

Drive	Line Reactor Inductance (+/-10%)
1 HP	12.0 mh
2 to 3 HP	6.5 mh
5 HP	3.0 mh
7.5 HP	2.5 mh
10 HP	1.5 mh
15 HP	1.2 mh
20 to 25 HP	0.8 mh
30 HP	0.7 mh
40 HP	0.5 mh
50 to 60 HP	0.4 mh
200 to 400 HP	30 µh

5.2 Installing Fuses for Branch Circuit Protection

Install the required, user-supplied branch circuit protection fuses according to the applicable local, national, and international codes (e.g., NEC/CEC). The fuses must be installed in the line before the drive input terminals. See figures 5.1 and 5.2. Fuse value selections are provided in table 3.12.

ATTENTION: Most codes require 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.

5.3 Installing a Required External/Separate Input Disconnect

An input disconnect must be installed in the line before the drive input terminals in accordance with local, national, and international codes (e.g., NEC/CEC). The disconnect should be sized according to the in-rush current as well as any additional loads the disconnect might supply. 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. Note that 200-400 HP drives may be supplied with an optional AC disconnect.

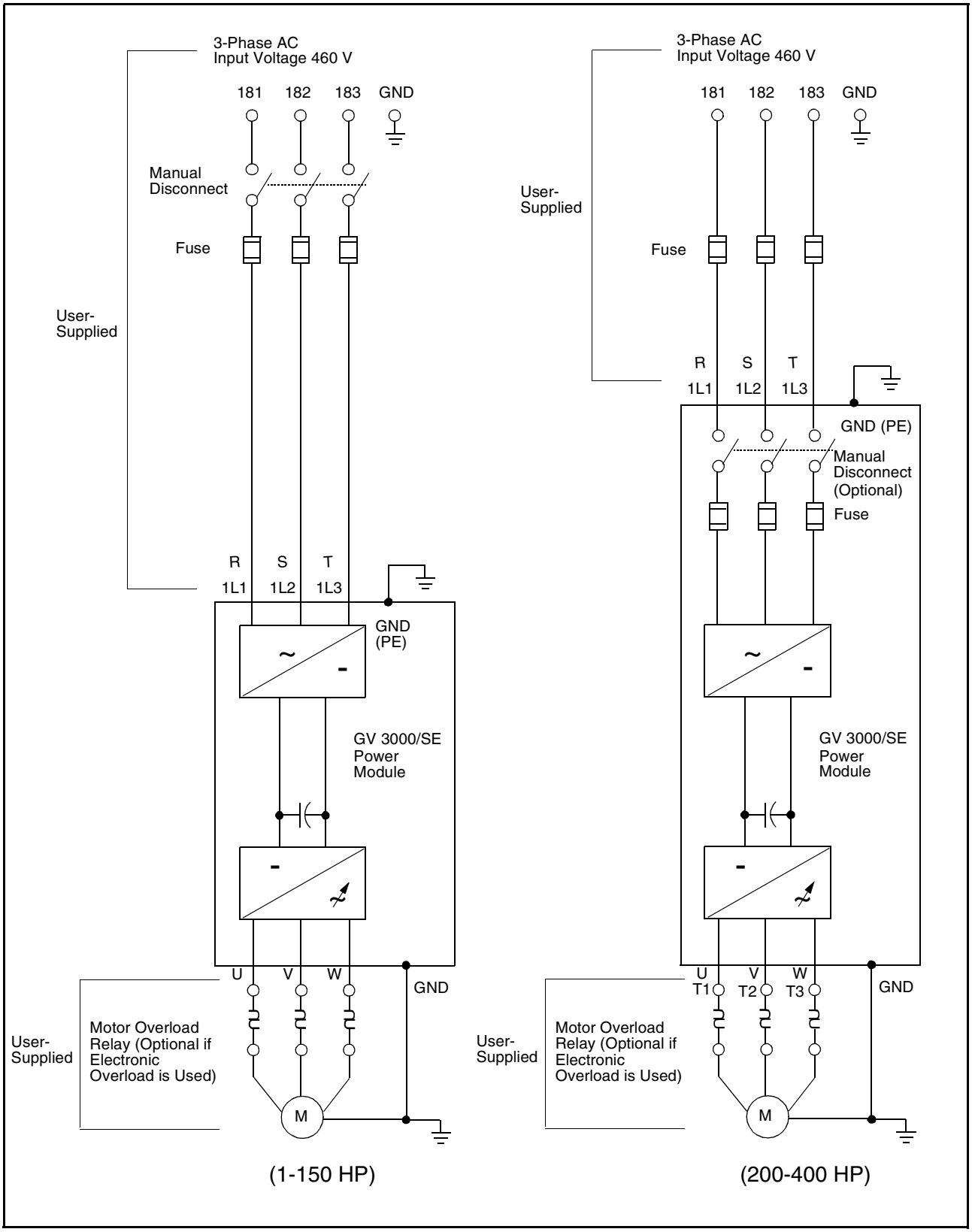
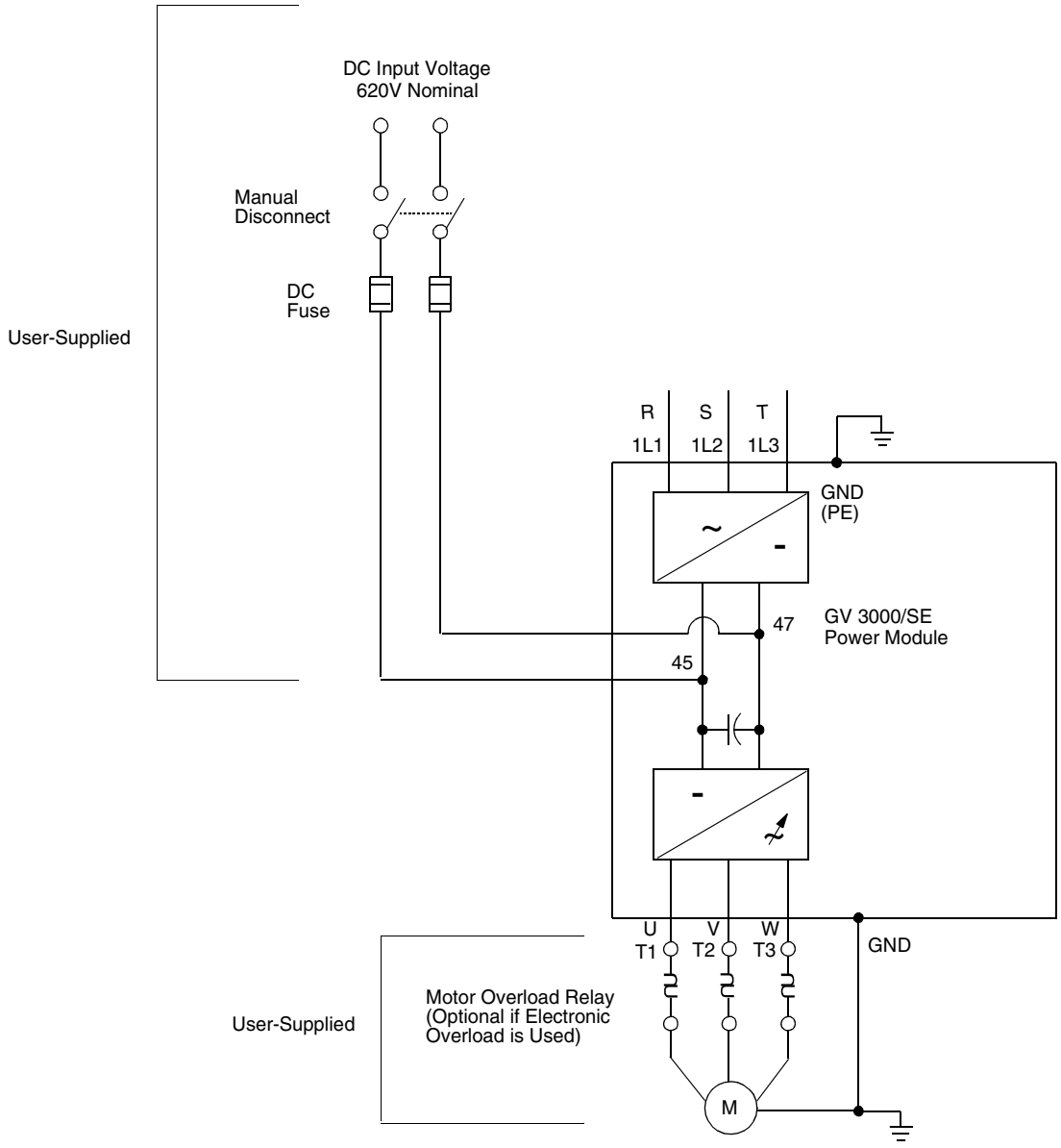


Figure 5.1 – Typical AC Input Electrical Connections



Note that the following GV3000/SE drives are not to be used on a common DC bus: M/N 125R4160, 200V4160, 250V4160, 300V4160, and 400V4160.

Figure 5.2 – Typical DC Bus Electrical Connections

5.4 Installing Power Wiring from the AC Input Line to the Drive's Power Terminals

Use the following steps to connect AC input power to the drive:

Step 1. Wire the AC input power leads by routing them according to drive type. Refer to figures 4.1 through 4.7. Tables 3.3 through 3.8 contain the recommended power wiring sizes.

Note that on 200-400 HP drives, knockouts for conduit installation are not provided. If incoming power is 380 or 415 VAC, the fan transformer taps must be changed before the power leads are connected. See section 5.6.

ATTENTION: 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 AC input power leads (three-wire 380-460 VAC) to the appropriate terminals.

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

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

On 200-400 HP drives, connect the AC input power leads to terminals R, S, and T.

Step 3. Tighten the AC input power terminals to the proper torque as shown in table 5.2.

Table 5.2 – Terminal Tightening Torques

Drive	Terminals	Maximum Tightening Torque
1-25HP	All	1.08 Newton-meters (9.5 in-lb)
25-60HP	All	13.5 Newton-meters (10 ft-lb)
60-100HP	1L1, 1L2, 1L3 U, V, W 45,47	10 Newton-meters (7.4 ft-lb)
	PE, ⏚	2.5 Newton-meters (1.8 ft-lb)
100-150HP	1L1, 1L2, 1L3, PE	34 Newton-meters (25 ft-lb)
	U, V, W ⏚, 45, 47	34 Newton-meters (25 ft-lb)
200-400HP	R/L1, S/L2, T/L3 U/T1, V/T2, W/T3 DC-, DC+ GND	34 Newton-meters (25 ft-lb)

5.5 Installing Power Wiring from an External DC Bus to the Drive's Internal DC Bus Terminals

Use the following steps to connect DC input power to the drive:

Step 1. Wire the DC input power leads by routing them according to drive type. Refer to figures 4.1 through 4.7. Tables 3.3 through 3.8 contain the recommended power wiring sizes.

Note that the following GV3000/SE drives are not to be used on a common DC bus: M/N 125R4160, 200V4160, 250V4160, 300V4160, 350V4160, and 400V4160.

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

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

Step 2. Connect the DC input power leads (two-wire 620 VDC nominal) to the proper terminals.

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

On 60-100 HP drives, connect the DC input power leads to terminals 45 and 47.

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

Step 3. Tighten the DC input power terminals to the proper torque as shown in table 5.2.

Step 4. On 60-100 HP drives using volts/hertz regulation, set parameter H.017 to a value greater than one to enable DC bus operation. Refer to the GV3000/SE Software Start-Up and Reference manual for additional information.

5.6 Changing Blower Transformer Taps

On 200-400 HP drives, the blower transformer is factory-wired for 460 VAC operation. If incoming power is 380 or 415 VAC, the blower transformer taps must be changed before the AC input power leads are connected as described in section 5.4. Use the following procedure to change the transformer taps:

Step 1. Locate the blower transformer as shown in figure 2.8. The transformer has three taps: 380V, 415V, and 460V. The transformer is factory-wired for 460V input power.

Step 2. Unplug the wire connected to the 460V tap and move it to the appropriate tap, either 380V or 415V.

Step 3. Continue with the AC input power wiring installation described in section 5.4.

CHAPTER 6

Installing Output Power Wiring

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

6.1 Installing Output Contactors (Optional)

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

6.2 Installing Mechanical Motor Overload Protection (Optional)

To provide the motor with overload protection, local, national, and international codes (e.g., NEC/CEC) require one of the following:

- A motor thermostat be installed internal to the motor.
- An electronic thermal motor overload relay, sized to protect the motor, be installed between the motor and the drive's output terminals.

Note, however, that temperature measuring devices integral to the motor are the best way to thermally protect AC motors under all conditions. Parameter P.040 must be enabled to provide overload protection. Refer to the GV3000/SE Software Start-Up and Reference manual for more information.

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

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

Use the following steps to connect the AC output power wiring from the drive to the motor:

Step 1. Wire the three-phase AC output power motor leads by routing them according to drive type. Refer to figures 4.1 to 4.7. Tables 3.3 to 3.8 contain the recommended power wiring sizes.

Do not route more than three sets of motor leads through a single conduit. This will minimize cross-talk that could reduce the effectiveness of noise reduction methods. If more than three drive/motor connections per conduit are required, shielded cable must be used. If possible, each conduit should contain only one set of motor leads.

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

ATTENTION: Unused wires in conduit must be grounded at both ends to avoid a possible shock hazard caused by induced voltages. Also, if a drive sharing a conduit is being serviced or installed, all drives using this conduit should be disabled to eliminate the possible shock hazard from cross-coupled motor leads. Failure to observe these precautions could result in bodily injury.

Step 2. Connect the three-phase AC output power motor leads to the appropriate output terminals.

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

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

On 200-400 HP drives, connect the motor leads to terminals U/T1, V/T2, and W/T3.

Step 3. Tighten the three-phase AC output power terminals to the proper torque according to drive type as shown in table 5.2.

CHAPTER 7

Wiring the Regulator Board Terminal Strip

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

The signals available through the terminal strip are shown in tables 7.1 to 7.7 and figures 7.1 and 7.2. Table 7.8 provides additional information.

Note that when the Control Source parameter (P.000) is set to remote (rE), the drive will be controlled by the signals connected to the terminal strip. Refer to the GV3000/SE Software Start-Up and Reference manual for more information on how parameter P.000 is used to specify where the drive is controlled from.

Table 7.1 – RS-232 Connections (Terminals 1-3)

Terminal #	Signal
1	Transmit (Tx)
2	Receive (Rx)
3	Regulator Common
Notes: 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.	

Table 7.2 – Encoder Connections (Terminals 4-9)

Terminal #	Signal
4	+15 VDC
5	Phase A
6	Phase A Not
7	Phase B
8	Phase B Not
9	Regulator Common
Notes: An encoder feedback device must be installed if FVC regulation is used.	

Table 7.3 – Analog Output Connections (Terminals 10 and 11)

Terminal #	Signal
10	Analog Meter Output
11	Regulator Common
Notes: 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.	

Table 7.4 – Analog Speed/Torque Reference Connections (Terminals 12-15)

Terminal #	Signal
12	Isolated Reference Voltage
13	VDC Speed/Torque Reference
14	mA Speed/Torque Reference
15	Isolated Reference Common
Notes: The analog speed/torque (P.008/U.000) reference is either +/-10 VDC or +/-20 mA, as determined by the setting of jumper J4 on the Regulator board. The analog reference can be adjusted using parameters P.009, P.010, and P.011. Refer to Appendix G in the GV3000/SE Software Start-Up and Reference manual for more information about the analog input.	

Table 7.5 – Digital Input Connections (Terminals 16-25)

Terminal #	Signal
16	+24 VDC (Current Limited) (For remote control digital inputs only)
17	Digital Input 8 (Remote/Local) - Programmable
18	Digital Input 7 (Ramp1/Ramp2) - Programmable
19	Digital Input 6 (Forward/Reverse) - Programmable
20	Function Loss
21	Run/Jog
22	Reset
23	Stop
24	Start
25	+24 VDC Common
Notes: When a user-installed function loss input, a coast-to-stop pushbutton, or another external interlock is installed, the factory-installed jumper connecting terminals 16 and 20 (or 16A and 20A) must be removed so that a contact, when open, will 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/SE Software Start-Up and Reference manual for more information.	

Table 7.6 – Snubber Resistor Braking Connections (Terminals 26 and 27)

Terminal #	Signal
26	Snubber Resistor Braking Signal (1-10 HP Drives only)
27	+24 VDC Common
Notes: These terminals are used with older Snubber Resistor Braking kits that require a gate turn-on signal from the drive (for example, the M/N 2DB4010 series).	

Table 7.7 – Status Relay Connections (Terminals 28-31)

Terminal #	Signal
28	N.C Relay Contact
29	N.C. Relay Common
30	N.O. Relay Contact
31	N.O. Relay Common
Notes: Relay contact closure is programmable through parameter P.013. Refer to the GV3000/SE Software Start-Up and Reference manual for more information.	

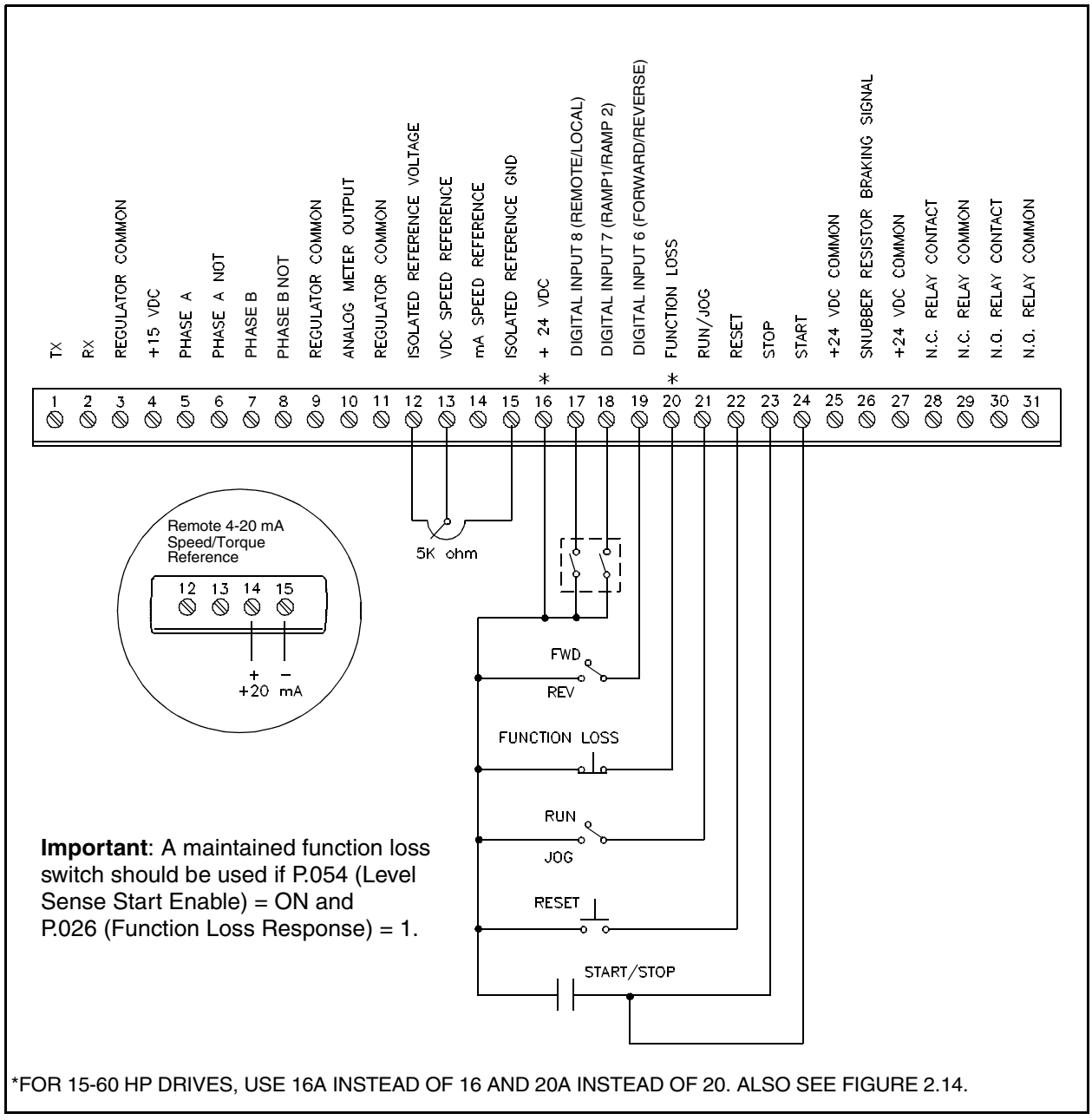


Figure 7.1 – Two-Wire Start/Stop Sample Control Wiring

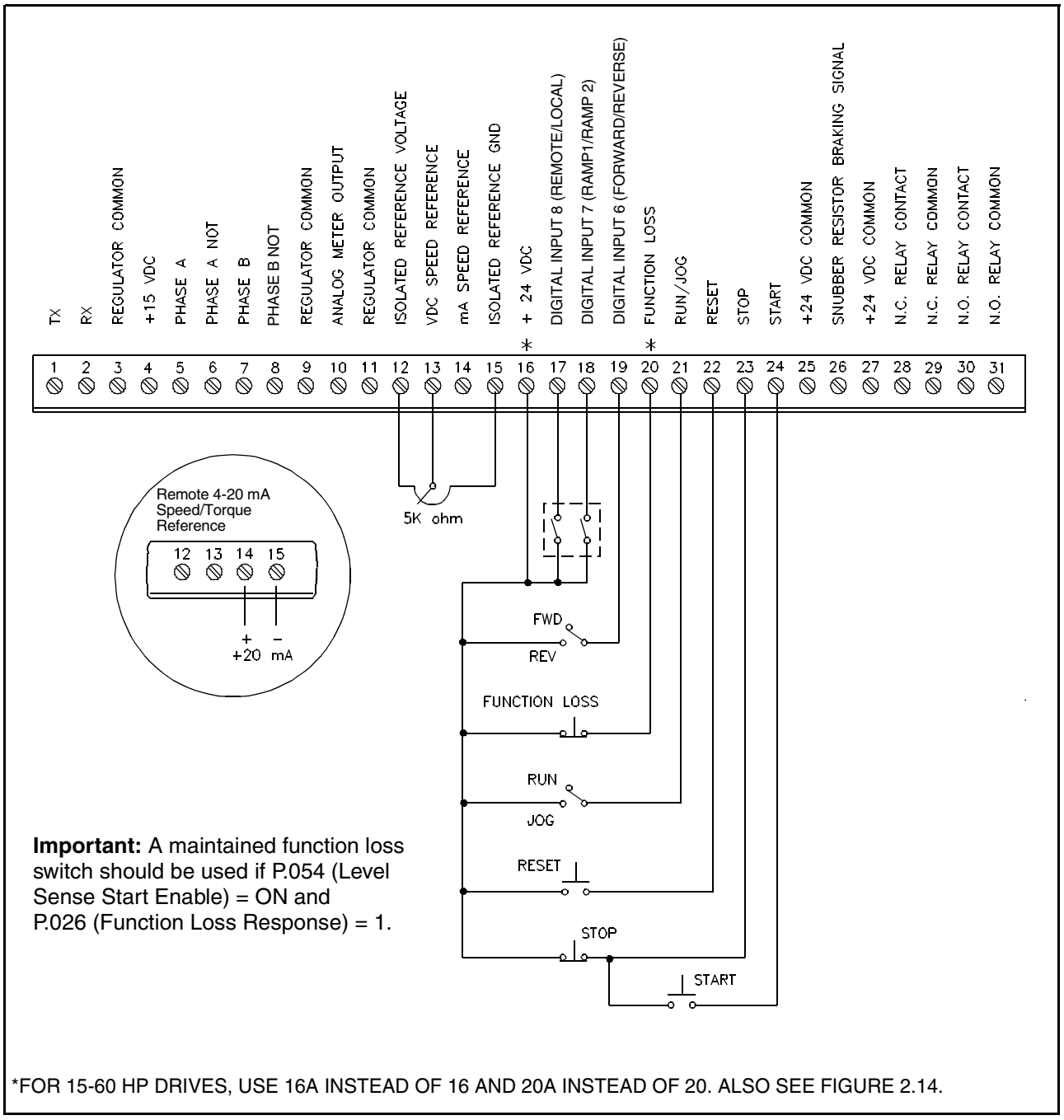


Figure 7.2 – Three-Wire Start/Stop Sample Control Wiring

7.1 Stopping the Drive

ATTENTION: When P.055 is set to ON, the STOP/RESET key is functional only from the selected control source. As a safety precaution, Reliance Electric recommends that an emergency stop push button be located near the drive in an easily accessible location. As a further safety precaution, the user should post a warning on the drive to alert personnel that the STOP/RESET key is not functional. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: 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/SE drive can be programmed to provide either a coast-to-rest or a ramp-to-rest operational stop without physical separation of the power source from the motor.

A coast-to-rest stop turns off the transistor power device drivers. A ramp-to-rest stop fires the transistor power device drivers until the motor comes to a stop, and then turns off the power devices.

The user can also program zero speed with power maintained to the motor, but in this condition, the drive is not actually stopped.

See the description of terminals 23 and 24 or Stop Type (P.025) for more information on how to program the operational stop.

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

Parameter P.055 (STOP/RESET Key Disable), can be used to change the operation of the STOP/RESET key. See the P.055 parameter description in the software manual for more information.

Note that the user-installed hardwired emergency stop may be used at any time to stop the drive.

7.1.1 Compliance with Machinery Safety Standard EN 60204-1:1992

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

The GV3000/SE 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 machinery safety standard 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 B for more information.

7.2 Wiring the Encoder Feedback Device (FVC Regulation Only)

If the GV3000/SE drive is programmed to provide FVC regulation, an encoder must be installed. Drives using V/Hz or SVC regulation do not require the use of an encoder feedback device. The encoder connects to terminals 4 through 9 of the Regulator board terminal strip as shown in table 7.8.

Table 7.8 – Encoder Connections

Terminal	Encoder Connection
4	Encoder Supply +15 VDC (250 mA capacity)
5	Encoder Phase A Differential Input
6	Encoder Phase A Not Differential Input
7	Encoder Phase B Differential Input
8	Encoder Phase B Not Differential Input
9	Encoder/Regulator Common

Use the following procedure to connect an encoder to the Regulator board's terminal strip:

Step 1. Connect the encoder's wires to terminals 4 through 9 of the terminal strip. See figure 7.3. See table A.6 for additional encoder specifications. Refer to section 3.2.4.1 for encoder wiring guidelines.

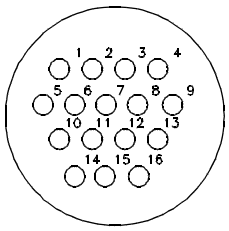
Step 2. Set the following parameters to establish the maximum motor speed:

- P.004: Maximum Speed
- U.001: Encoder 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/SE Software Start-Up and Reference manual for parameter descriptions.

Tamagawa-Style, 16-Pin MS Connector

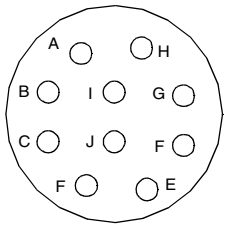
View of Encoder Cable MS Connector (Female)
(M/N 2TC4025 and 2TC4075)



Regulator Terminal Strip		Connector/Cable End	
Terminal 6	WHITE/ORANGE	Pin 1	Phase A
Terminal 5	ORANGE	Pin 2	Phase A Not
Terminal 4	RED	Pin 6	0 VDC
Terminal 9	WHITE/RED	Pin 12	+15 VDC
Terminal 7	BROWN	Pin 8	Phase B
Terminal 8	WHITE/BROWN	Pin 9	Phase B Not

Dynapar-Style, 10-Pin MS Connector

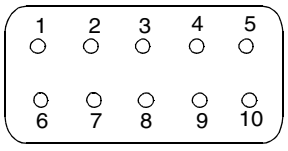
View of Encoder Cable MS Connector (Female)
(M/N 2TC3025 and 2TC3075)



Regulator Terminal Strip		Connector/Cable End	
Terminal 6	WHITE/ORANGE	Pin A	Phase A
Terminal 5	ORANGE	Pin H	Phase A Not
Terminal 4	RED	Pin F	0 VDC
Terminal 9	WHITE/RED	Pin D	+15 VDC
Terminal 7	BROWN	Pin B	Phase B
Terminal 8	WHITE/BROWN	Pin I	Phase B Not

Lakeshore-Style, 10-Pin MS Connector

View of Encoder Cable MS Connector (Female)
(Lakeshore M/N SL56 Slim-Tach Encoder)



Regulator Terminal Strip		Connector/Cable End	
Terminal 6	WHITE/ORANGE	Pin 3	Phase A
Terminal 5	ORANGE	Pin 8	Phase A Not
Terminal 4	RED	Pin 1	0 VDC
Terminal 9	WHITE/RED	Pin 6	+15 VDC
Terminal 7	BROWN	Pin 2	Phase B
Terminal 8	WHITE/BROWN	Pin 7	Phase B Not

Figure 7.3 – Encoder Wiring Connections

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 7.8.

Table 7.9 – Wiring Signal and Control I/O to the Terminal Strip

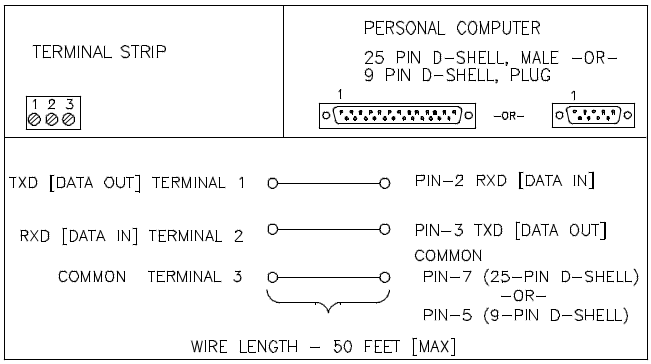
Terminal Number	Description	Parameters/Wiring Connections
Wiring RS-232 Signals		
1 2 3	RS-232 Transmit RS-232 Receive RS-232 Signal/Regulator Common	Note that RS-232 communication between the drive and a personal computer requires the use of the Control and Configuration software. Refer to instruction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

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

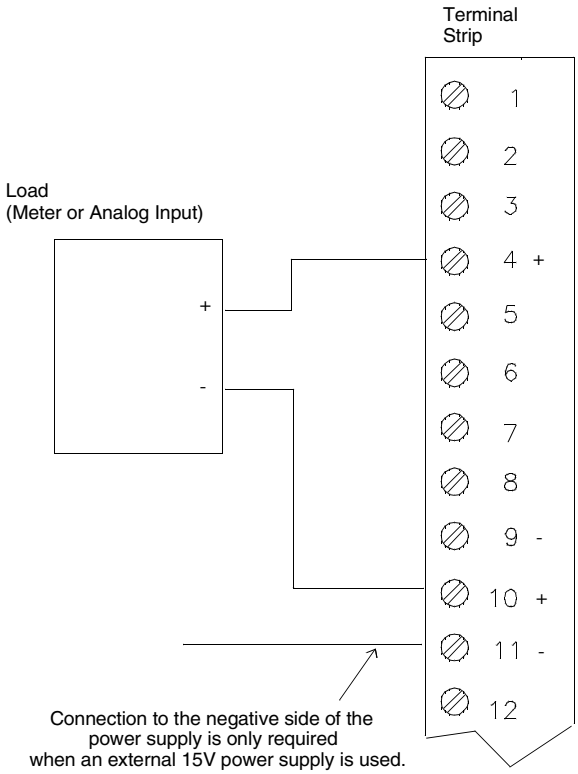
Terminal Number	Description	Parameters/Wiring Connections
	Wiring Analog Outputs	
10 11	0-10 VDC or 4-20 mA Analog Output Reference Regulator Common	The setting of parameter P.012 selects the terminal strip analog output source (either speed or torque). Jumper J17 must also be set. See figure 2.13. The 4-20mA current selection requires a power supply for operation. The power can be sourced from the encoder supply, terminal 4 (15VDC), or from an external 15V power supply. Note that the maximum supply current from terminal 4 is 250mA (encoder and current source) at 15V. On the 1-60 HP and 200-400 HP Regulator boards, terminals 9 and 11 are internally connected. 

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

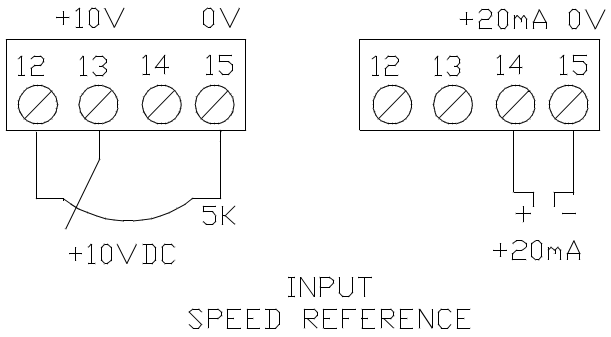
Terminal Number	Description	Parameters/Wiring Connections
Wiring Analog Speed Reference Inputs		
12 13 14 15	Isolated Reference Voltage (+10VDC) Analog Speed/Torque Reference Input Voltage (+/- 10VDC) Analog Speed/Torque Reference Input Current (0-20mA) Isolated Speed/Torque Reference Common (Voltage/Current)	Related parameters: • P.000: Control Source • P.009: Terminal Strip Analog Input Offset • P.010: Terminal Strip Analog Input Gain • P.011: Terminal Strip Analog Input Configure Refer to the GV3000/SE Software Start-Up and Reference manual for additional parameter information. Jumper J4 must also be set. See figure 2.12.  Refer to Appendix G in the GV3000/SE Software Start-Up and Reference manual (D2-3359) for more information about the analog input.

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

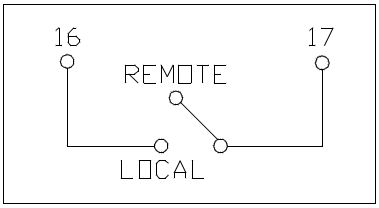
Terminal Number	Description	Parameters/Wiring Connections
Wiring a Remote/Local Input		
16	+24 VDC Power Supply	Current limited for remote input logic use only.
17	Digital Input 8 (Default - Remote/Local)	Digital input 8 is control function programmable through parameter P.007.
⚠	**ATTENTION:** If a maintained start contact is used when the control source = rE, switching from local to remote from the terminal strip will cause power to be applied to the motor if the remote start contact is closed. Stay clear of rotating machinery in this case. Failure to observe this precaution could result in bodily injury.	
		The following parameters must be set: • P.000: Control Source (Only active when P.000 = rE) • P.006: Second Menu Password • P.007: Terminal Strip Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8) • P.008: Terminal Strip Speed Reference Source (Analog, Motor Operated Potentiometer (MOP), or Preset Speeds) Note that based on the settings of parameters P.000, P.007, P.008, and r.030 if an RMI board is used, the following parameters can affect digital input 8: • P.023: MOP Accel/Decel Time • P.024: MOP Reset Configuration • P.031 to P.038: Preset Speeds 1-8 Refer to the GV3000/SE Software Start-Up and Reference manual for additional information.  Terminal 17 On = Local Control Diagram shows factory setting.

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

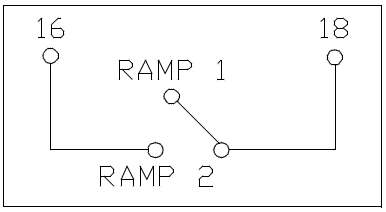
Terminal Number	Description	Parameters/Wiring Connections
Wiring an Additional Ramp Input		
18	Digital Input 7 (Default - Ramp1/Ramp2)	Digital input 7 is control function programmable through parameter P.007. The following parameters must be set: • P.000: Control Source • P.001: Accel Time 1 (Ramp 1) • P.002: Decel Time 1 (Ramp 1) • P.006: Second Menu Password • P.007: Terminal Strip Digital Inputs Configure (Selects and assigns a control function to digital inputs 6 to 8) • P.008: Terminal Strip Speed Reference Source (Analog Motor Operated Potentiometer (MOP), or Preset Speeds) • P.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, P.008, and r.030 if an RMI board is used, the following parameters can affect digital input 7: • P.023: MOP Accel/Decel Time • P.024: MOP Reset Configuration • P.031 to P.038: Preset Speeds 1-8 Refer to the GV3000/SE Software Start-Up and Reference manual for additional information.  Terminal 18 On = Ramp 2 Diagram shows factory setting.

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

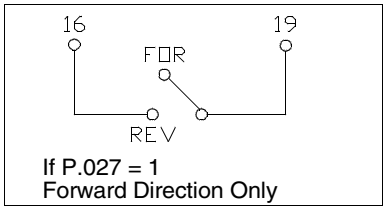
Terminal Number	Description	Parameters/Wiring Connections
Wiring a Forward/Reverse Input		
19	Digital Input 6 (Default - Forward/Reverse)	Digital input 6 is control function programmable through parameter P.007. The following parameters must be set: • P.000: Control Source • P.006: Second Menu Password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

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

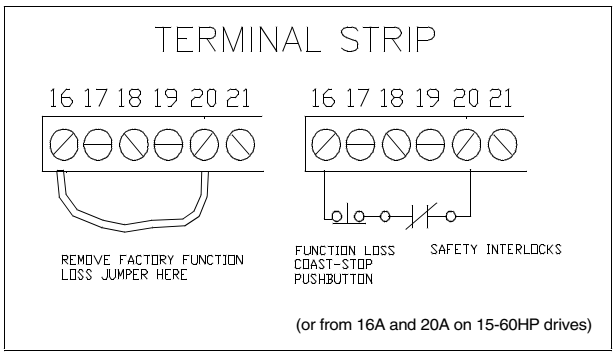
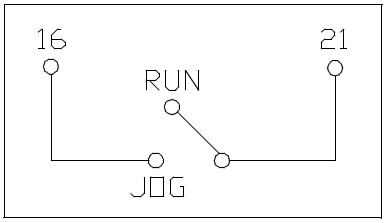
Terminal Number	Description	Parameters/Wiring Connections
Wiring a Function Loss Input		
20	Digital Input 5 (Function Loss)	The following parameter must be set: • P.026: Function Loss Response A signal must be present at terminal 20 for the drive to be able to start. See figures 7.1 and 7.2. The drive is shipped from the factory with a jumper between terminals 16 and 20 which provides the signal. The function loss input should be in series with the drive's external interlocks. In this case, the jumper must be removed before the connections are made. See figure 2.14.  Terminal 20 On = No Function Loss **Important:** A maintained function loss switch should be used if P.054 (Level Sense Start Enable) = ON and P.026 = 1.
Wiring a Run/Jog Input		
21	Digital Input 4 (Run/Jog)	The following parameters must be set: • P.000: Control Source • P.020: Jog Speed Reference • P.021: Jog Ramp Accel Time • P.022: Jog Ramp Decel Time  Terminal 21 On = Jog Operation

Table 7.8 - Wiring Signal and Control I/O to the Terminal Strip (Continued)

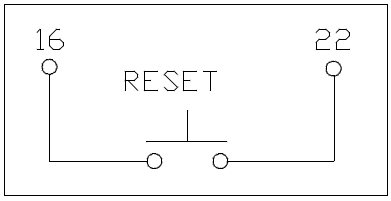
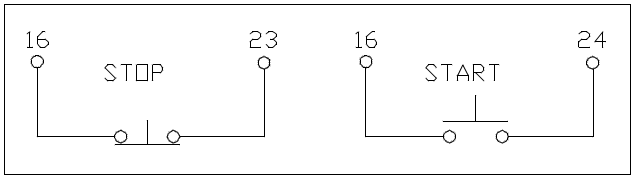
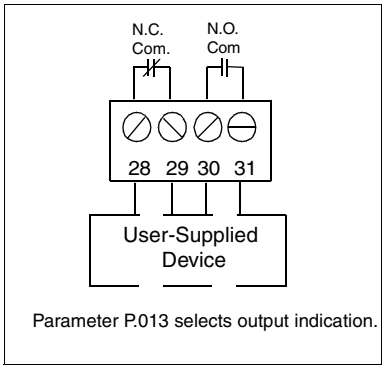
Terminal Number	Description	Parameters/Wiring Connections
Wiring the Reset Input		
22	Digital Input 3 (Reset)	The following parameter must be set: • P.000: Control Source  Terminal 22 On = Reset
Wiring the Stop/Start Inputs		
23 24	Digital Input 2 (Stop) Digital Input 1 (Start)	The following parameters must be set: • P.000: Control Source • P.025: Stop Type  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 older Snubber Resistor Braking Kits that require a gate turn-on signal from the drive (for example, the M/N 2DB4010 series). Note that terminals 26 and 27 are not to be used with Snubber Resistor Braking Kits M/N 2SR40400, 2SR40600, 2SR41200, and 2SR41800.

Table 7.8 - 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/SE Software Start-Up and Reference manual for more information.  Parameter P.013 selects output indication.

CHAPTER 8

Completing the Installation

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

> **ATTENTION:** 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:

> **ATTENTION:** DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC 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 DC 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.

> **ATTENTION:** 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 there is nothing mounted behind the drive.

Step 7. Verify that the wiring to the terminal strip and the power terminals is correct.

Step 8. Check that the wire size is within terminal specification and that the wires are tightened properly.

Step 9. Check that user-supplied branch circuit protection is installed and correctly rated.

Step 10. Check that the incoming power is rated correctly.

Step 11. Check the motor installation and length of motor leads.

Step 12. Disconnect any power correction capacitors connected between the drive and the motor.

Step 13. Check that the rating of the transformer (if used) matches the drive requirements and is connected properly.

Step 14. 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 15. 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 captive screws to ensure even compression of the gaskets. Do not exceed 2.2 Nm (20 in-lb) 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 the GV3000/SE Software Start-Up and Reference manual.

CHAPTER 9
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 DC bus voltage and to make resistance checks. Note that dedicated troubleshooting test points are not provided.

9.2 Drive Alarms and Faults

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

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

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

Refer to the GV3000/SE Software Start-Up and Reference manual for more information on drive alarms and faults.

9.3 Verifying That DC Bus Capacitors Are Discharged

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC 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/SE drive's DC bus capacitors retain hazardous voltages after input power has been disconnected. Perform the following steps before touching any internal components:

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

Step 2. Remove the drive's cover. On 200-400 HP drives, open the outer cabinet door.

ATTENTION: Do not operate 200-400 HP drives with the outer and inner cabinet doors open due to possible exposure to high voltage. Close the outer and inner cabinet doors before putting the drive into run. Failure to observe this precaution could result in severe bodily injury or loss of life.

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

Step 4. Measure the DC bus potential with a voltmeter while standing on a non-conductive surface and wearing insulated gloves (600V).

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

For 60-100 HP drives, remove the top two screws of the Regulator panel and tilt the panel forward. See figure 9.3. Measure the DC bus potential at the diode bridge as shown. Reattach the Regulator panel.

For 100-150 HP drives, remove the top two screws of the Regulator panel and tilt the panel forward. See figure 9.4. Measure the DC bus potential at the bottom of the fuse holders on the Power Module Interface board on the back of the Regulator panel. Take care not to touch any conductive traces. Reattach the Regulator panel.

For 200-400 HP drives, measure the DC bus potential at the test points on the Power Module Interface board. See figure 9.5. If it is necessary to open the inner cabinet door, wait until the bus voltage is 50 VDC or less and then measure the voltage on the DC bus bars as shown in figure 9.5. For additional wiring information, refer to Appendix D.

Step 5. Once the drive has been serviced, reattach the drive's cover. On 200-400 HP drives, close the inner and outer cabinet doors.

Step 6. Reapply input power.

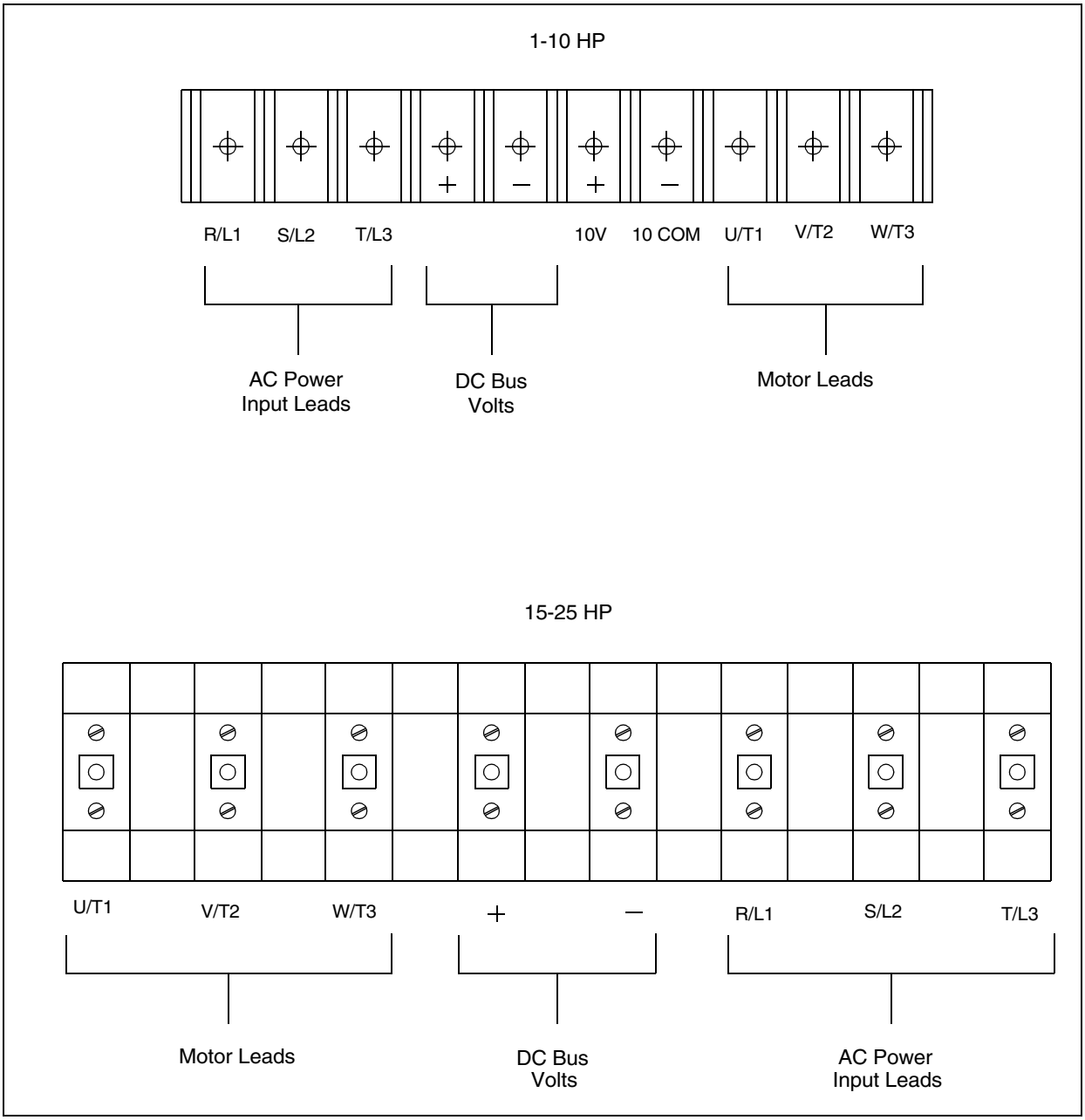


Figure 9.1 – DC Bus Voltage Terminals (1-25 HP Drives)

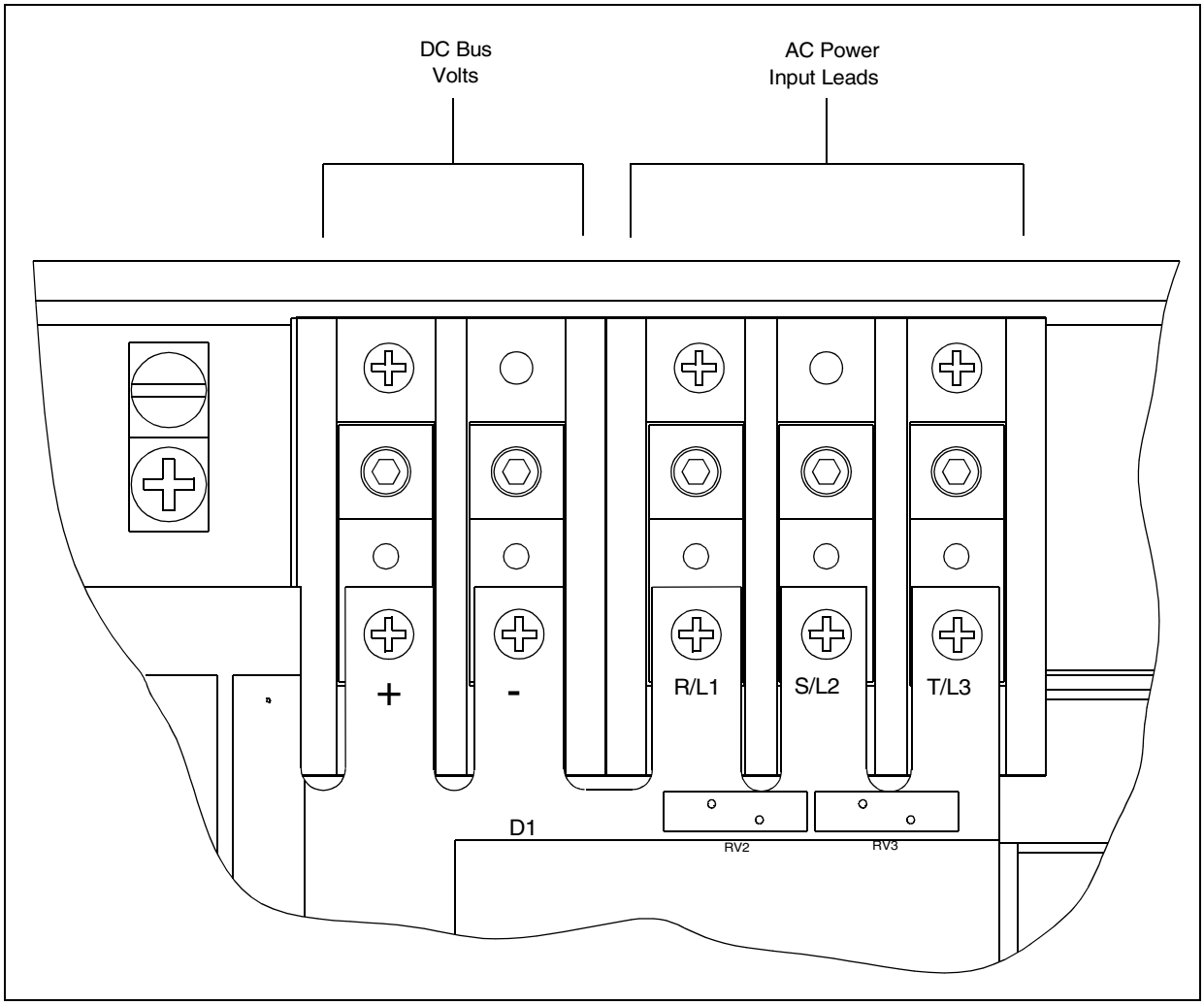


Figure 9.2 – DC Bus Voltage Terminals (25-60 HP Drives)

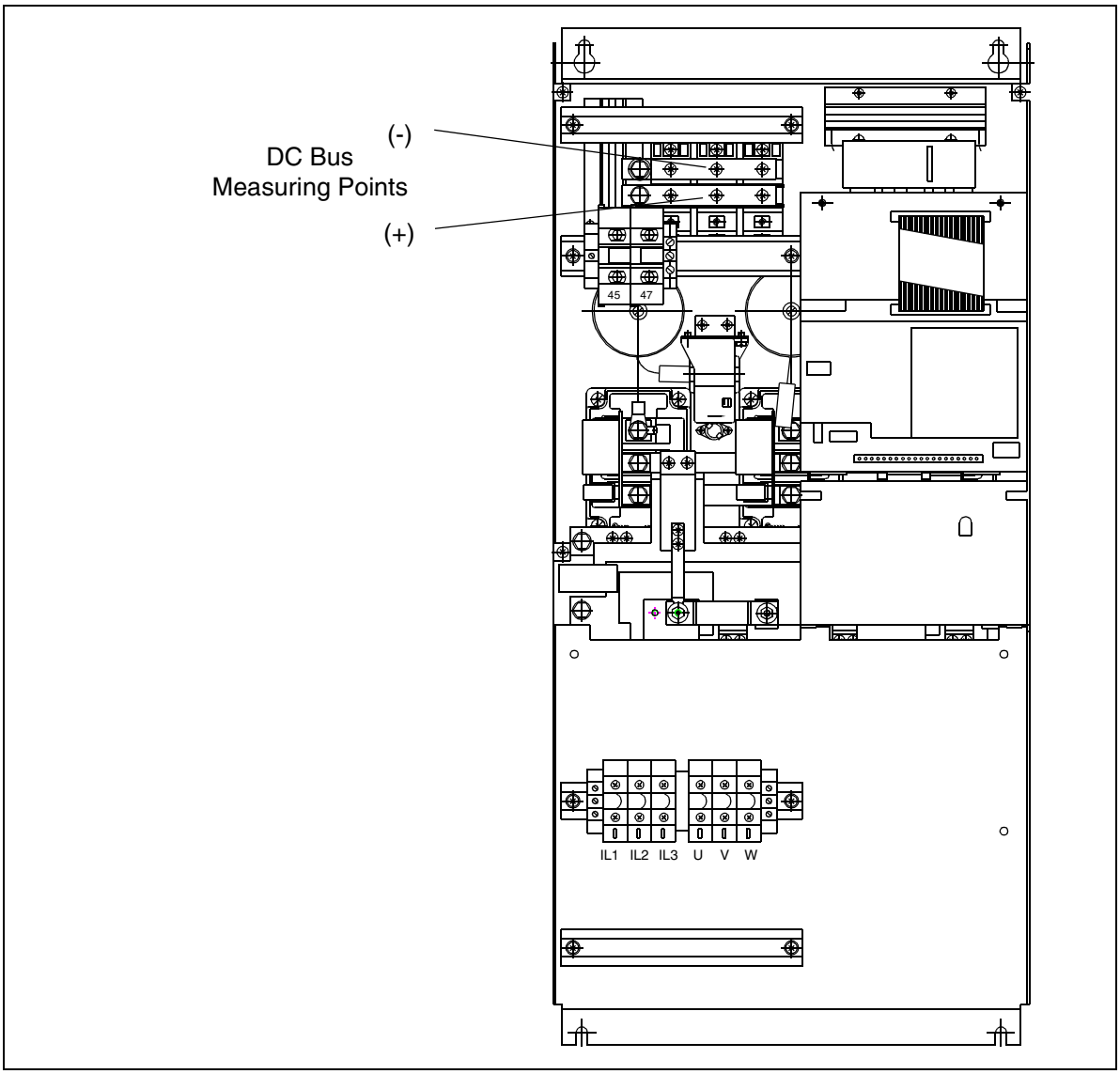


Figure 9.3 – DC Bus Voltage Terminals (60-100 HP Drives)

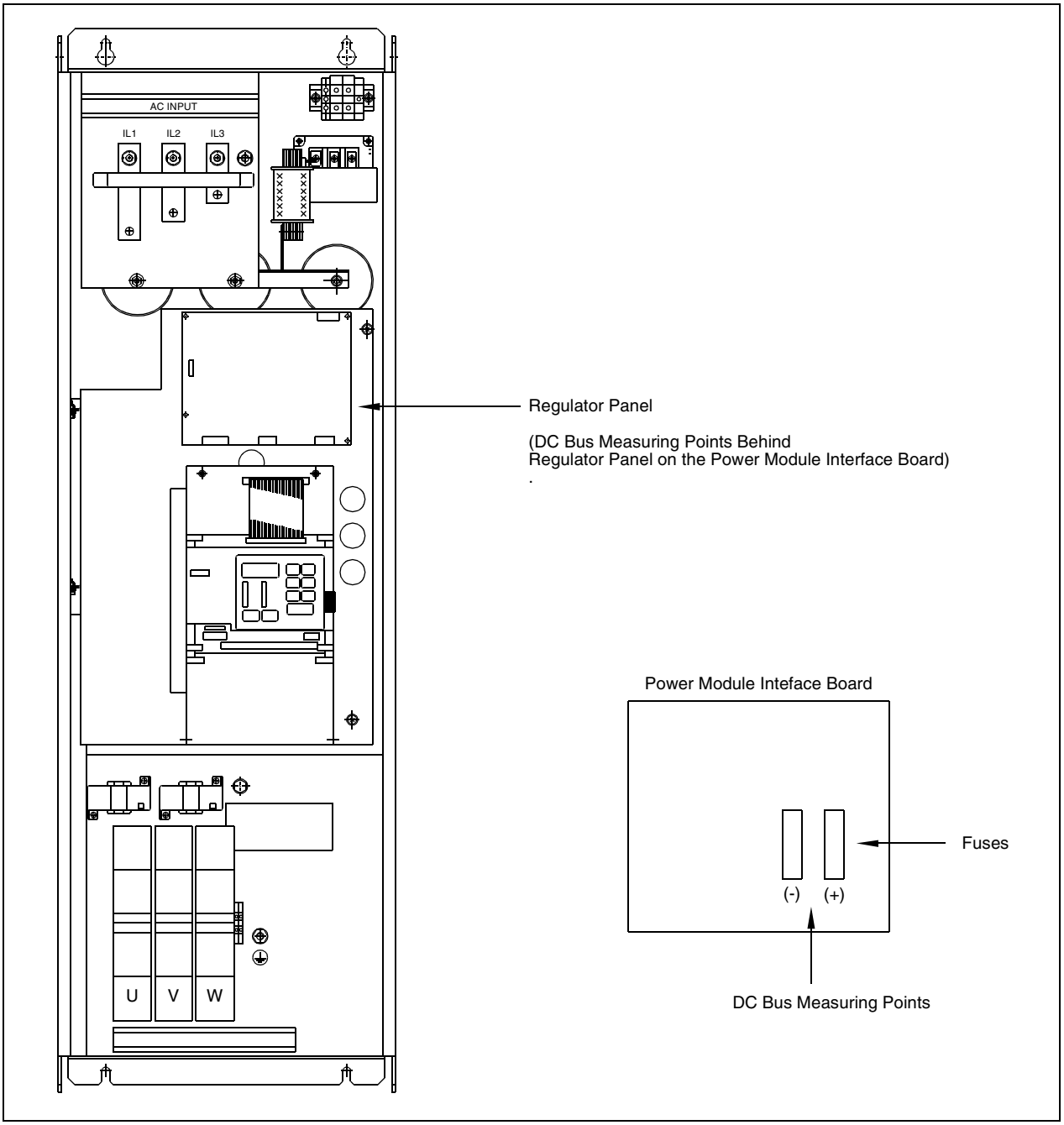


Figure 9.4 – DC Bus Voltage Terminals (100-150 HP Drives)

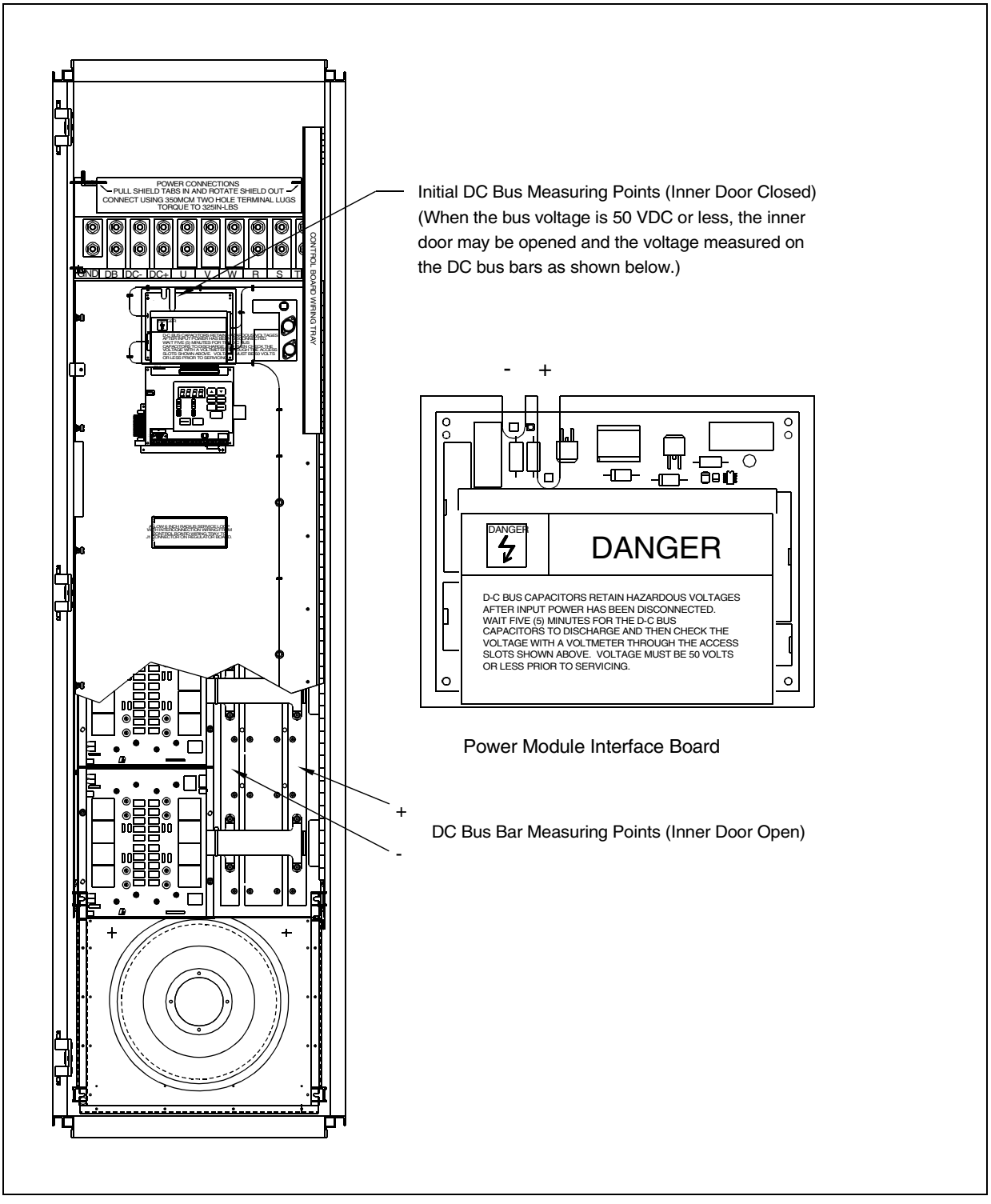


Figure 9.5 – DC Bus Voltage Terminals (200-400 HP Drives)

9.4 Checking Out the Drive with Input Power Off

Use the following procedure to check the drive circuitry with power off:

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five (5) minutes for the DC bus capacitors to discharge and then check the voltage with a voltmeter to ensure the DC bus capacitors are discharged before touching any internal components. Failure to observe this precaution could result in severe bodily injury or loss of life.

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

Step 2. Remove the drive's cover. On 200-400 HP drives, open the outer cabinet door.

ATTENTION: Do not operate 200-400 HP drives with the outer and inner cabinet doors open due to possible exposure to high voltage. Close the outer and inner cabinet doors before putting the drive into run. Failure to observe this precaution could result in severe bodily injury or loss of life.

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

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

Step 5. Disconnect the motor from the drive.

Step 6. Check all AC line and DC bus fuses.

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

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

Step 8. Reconnect the motor to the drive.

Step 9. Reattach the drive's cover. On 200–400 HP drives, close the inner and outer cabinet doors.

Step 10. Reapply input power.

Table 9.1 – Resistance Checks

1–60 HP Drives			
Input Diode No.	**Meter Connection (+) (-)**	**Component is OK if resistance (R) is:**	**Component is defective if:**
1	* R/L1	50K < R < 10 Megohms	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 **		
* (+) DC Bus Volts power terminal ** (-) DC Bus Volts power terminal			

60–100 HP 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		

100–150 HP 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		

Table 9.1 - Resistance Checks (Continued)

200–400 HP Drives			
Input Diode No.	**Meter Connection (+) (-)**	**Component is OK if resistance (R) is:**	**Component is defective if:**
1	* R/L1	R > 100 kohm	Continuity (short circuit)
2	* S/L2		
3	* T/L3		
4	R/L1 **		
5	S/L2 **		
6	T/L3 **		
* (+) DC Bus power terminal ** (-) DC Bus power terminal			

1–60 HP Drives			
IGBT No.	**Meter Connection (+) (-)**	**Component is OK if resistance (R) is:**	**Component is defective if:**
1	* W/T3	50K < 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 **		
* (+) DC Bus Volts power terminal ** (-) DC Bus Volts power terminal			

60–150 HP 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		

Table 9.1 - Resistance Checks (Continued)

200–400 HP Drives (with the motor connected)			
IGBT No.	**Meter Connection (+) (-)**	**Component is OK if resistance (R) is:**	**Component is defective if:**
All IGBTs tested in parallel	U/T3 *	10 < R < 1 Megohm	Continuity (short circuit) or open when the meter is connected with reversed polarity
	* U/T3		
	U/T3 **		
	* U/T3		
* (+) DC Bus power terminal ** (-) DC Bus power terminal			

200–400 HP Drives (with the motor disconnected)			
IGBT No.	**Meter Connection (+) (-)**	**Component is OK if resistance (R) is:**	**Component is defective if:**
1	* W/T1	10 < R < 1 Megohm	Continuity (short circuit) or open when the meter is connected with reversed polarity
2	* V/T2		
3	* U/T3		
4	W/T1 **		
5	V/T2 **		
6	U/T3 **		
* (+) DC Bus power terminal ** (-) DC Bus power terminal			

9.5 Replacement Parts

Tables 9.2 to 9.8 list the replacement parts that are available from Reliance Electric. See figures 2.2 to 2.8 for the location of the parts.

Table 9.2 – 1-5 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower			
		1	2	3	5
NEMA 1 Fan Assembly	615161–V			1	1
NEMA 4X/12 Fan Assembly	615161–S			1	1
NEMA 1 Cover	805531–1S	1	1	1	1
NEMA 4X/12 Cover/Gasket	805532–1S	1	1	1	1
Membrane Switch Keypad/Bracket	709576–1R	1	1	1	1
Regulator PCB	0–56921–6xx	1	1	1	1
Capacitor PCB	0–56928–30 0–56928–50	1	1	1	 1
Current Feedback PCB	0–56926–20 0–56926–50	1	1	 1	 1
Internal Fan Assembly	615159–1R	1	1	1	1

* Components are identified in figure 2.2.

Table 9.3 – 7.5-10 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower	
		7.5	10
NEMA 1 Fan Assembly	615161–V	2	2
NEMA 4X/12 Fan Assembly	615161–S	2	2
NEMA 1 Cover	805538–1S	1	1
NEMA 12 Cover/Gasket	805539–1S	1	1
Membrane Switch Keypad/Bracket	805548–1R	1	1
Regulator PCB	0–56921–6xx	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 2.3.

Table 9.4 – 15-25 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower		
		15	20	25**
NEMA 1 Fan Assembly	615161–V	2	2	2
NEMA 4X/12 Fan Assembly	615161–S	2	2	2
NEMA 1 Cover	805547–1S	1	1	1
NEMA 12 Cover/Gasket	805547–2S	1	1	1
Membrane Switch Keypad/Top Bracket	805548–1R	1	1	1
Regulator PCB	0–56921–6xx	1	1	1
IGBT Module	602909–813AW	3	3	3
Capacitor PCB	0–56961 0–56962	1	1	1
Power Board	0–56963	1	1	1
Power Supply Board	0–56950–15 0–56950–20	1	1	1
Gate Driver Board***	0–56960	1	1	1
Internal Fan Assembly	615159–1S	1	1	1

* Components are identified in figure 2.4.
** M/N 25G4160 and 25G4260
*** Replace the Gate Driver Board when the IGBT modules are replaced.

Table 9.5 – 25-60 HP Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower				
		25**	30	40	50	60***
Fan	69739–48A	2	2	2	2	2
Fan Wire Harness	615195–2R	1	1	1	1	1
NEMA 1 Cover	805534–11S	1	1	1	1	1
NEMA 12 Cover/Gasket	805534–12S	1	1	1	1	1
Membrane Switch Keypad/Top Bracket	805548–1R	1	1	1	1	1
Regulator PCB	0–56921–6xx	1	1	1	1	1
Input Capacitor	600442–32SS 600442–33SW	2	2	2	4	4
Power PCB	0–56949–40 0–56949–50	1	1	1	1	1
Power Supply PCB	0–56950–25 0–56950–30 0–56950–40 0–56950–50	1	1	1	1	1
Gate Driver PCB****	0–56947–25 0–56947–40 0–56947–50	1	1	1	1	1
IGBT Module	602909–810AW 602909–811AW 602909–812AW	3	3	3	3	3
Diode Bridge	701819–113BA 701819–114BA	1	1	1	1	1
Internal Fan Assembly	615196–2R	1	1	1	1	1

* Components are identified in figure 2.5.
** M/N 25V4160 and 25V4260.
*** M/N 60G4160 and 60G4260.
**** Replace the Gate Driver Board when the IGBT modules are replaced.

Table 9.6 – 60-100 HP Drive Replacement Parts

Description*	Part Number	Quantity
Regulator PCB	413338–6BU	1
Power Module Interface PCB	413338–5AW	1
Power Module Interface PCB Fuses	413338–5AB	2
Keypad	413338–5AX	1
Gate Driver PCB	413338–5D	1
Bus Clamp PCB (right) Bus Clamp PCB (left)	413338–5E 413338–5F	2 2
Intelligent Power Module (IPM) PCB	413338–5J	3
Diode Bridge	413338–5K	3
MOV on Diode Bridge	413338–5L	3
DC Bus Fuse	413338–5M	2
Precharge Contactor	413338–5N	4
Current Transformer	413338–5R	2
Ground Fault Transformer	413338–5Q	1
Output Reactor	252.84.21 (Left)	1
	252.84.22 (Center)	1
	252.84.23 (Right)	1
Precharge Resistor (18 ohms)	413338–5T	4
Bus Discharge Resistor (1.5K ohms)	413338–5V	2
24V DC Fan	413338–5W	2

* Components of the 60-100 HP drives (M/N 50R4160, 50T4160, 75R4160, 75T4160) are identified in figure 2.6.

Table 9.7 – 100-150 HP Drive Replacement Parts

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

* Components of the 100-150 HP drives (M/N 125R4160) are identified in figure 2.7.

**It is recommended that the Gate Driver PCB and the Bus Clamp PCBs be replaced at the same time as the IPM PCB.

Table 9.8 – 200-400 HP Drive Replacement Parts

Description*	Part Number	Quantity
Phase Module Assembly	807300–124R	3***
Phase Module Assembly	807300–158R	3**
SCR Module Assembly	807300–200R	1
Blower Motor	616300–100R	1
Blower Starter Capacitor	69932–24QK	1
Fault Thermostat	66012–16B	4
Gate Driver PCB	0–56956	3
DC Bus Capacitor	600442–34SU	10/18****
SCR Diode	701819–207BA	3
Bus Control PCB	0–56966	1
Bus Control PCB Fuse	64676–65B	6
Disconnect Switch	65242–11A	1
AC Input Fuse	64676–120BDX	3
Blower Fuse	64676–64G	2
Blower Transformer	411027–130A	1
Regulator PCB	0–56940–6xx	1
Power Module Interface PCB*****	0–56942	1
Current Feedback Sensor	600595–18A	3
Blower Filter	69470–10H	1
Ground Fault Current Transformer	64670–43A	1
DC Bus Discharge Resistor	616300–117R	3
Keypad	410483–15A	1
SCR Gate Wiring Harness	807300–141S	1
Gate Driver/Power Supply Wiring Harness	807300–139S	1
Raceway Wiring Harness	807300–156R	1
LPI/LEM Wiring Harness	807300–137R	1
Blower Fuses to Bus Bar Wiring Harness	616300–137R	1
Transformer/Fuses Wiring Harness	616300–136R	1
Transformer/Terminal Block Wiring Harness	616300–135R	1

* Components are identified in figure 2.8.

** Three sets of two IGBTs (P/N 602909–808AW) for a 200 HP drive.

*** Three sets of four IGBTs (P/N 602909–808AW) for 250–400 HP drives, inclusive.

**** Ten DC bus capacitors in a 200 HP drive. Eighteen DC bus capacitors in 250-400 HP drives, inclusive.

***** When replacing PMI boards, you must set rotary switches SW1, SW2, and SW3 based on the drive's horsepower rating as shown below. All three switches are set to the same position.

Drive HP Rating	Switch Position
200	0
250	1
300	3
350	7
400	F

APPENDIX A

Technical Specifications

Table A.1 – Service Conditions

AC Line Distribution System Capacity (maximum) for 460 VAC Units	1000KVA, three-phase with 30,000 amps symmetrical fault current capacity with a line impedance of less than 5%. (85,000 amps fault current capacity with optional AC line reactors. See table 5.1.)
Control Method	All-digital vector, sinusoidal pulse-width-modulated (PWM)
Displacement Power Factor	0.96
Line Frequency	50/60Hz (+2 Hz)
Line Voltage Variation	-10% to +10%
Line Dip Ride-Through	FVC: Maximum 500 milliseconds V/Hz, SVC: Adjustable up to 999.9 seconds (See P.042)
Maximum Motor Lead Lengths	76 meters (250 feet) typical (refer to section 3.2.2.4)
Remote Operator Control Wire Length	Up to 303 meters (1000 feet) from the drive
Analog Speed Reference Resolution	1/1024 (10 bits) 0.1%
Acceleration Adjustment Range	0.1 to 999.9 seconds (within the ability of current)
Carrier Frequency	2 kHz, 4 kHz, or 8 kHz, software-selectable
Current Limit Adjustment	Vector: U.006 to 150% (based on motor nameplate rating) V/Hz: 50% to 110% (based on drive nameplate rating)
Service Factor	1.0
Speed Adjustable Range	From 0 RPM to maximum speed (vector)
Speed Regulation	Vector: 0.01% FVC, 0.5% SVC (steady state) V/Hz: Motor slip dependent
Speed Reference Resolution	1 RPM with local keypad, -4095 to +4095 counts with a network or serial reference
Torque Control Response	180 to 220 Hz
Torque Linearity	+3% with optimal parameter setting (typical) (see parameter U.005)

Table A.2 – Environmental Condition

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

Table A.3 – Terminal Strip Input Specifications

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

Table A.4 – Terminal Strip Output Specifications

Signal Type	Terminal(s)	Specification
Analog Output	10 -11 scaled signal	0-10 VDC or 4-20 mA
Snubber Resistor	26 - 27	Used with older Snubber Resistor Braking Kits, such as the M/N 2DB4010 series, that require a gate turn-on signal from the drive.

Table A.5 – Terminal Strip RS-232 Specifications

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

Table A.6 – Encoder Feedback Device Specifications (FVC 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)
Encoder Feedback	15 V differential quadrature, encoder incremental (512 PPR, 1024 PPR, 2048 PPR, 4096 PPR)
Service Factor	1.0

Table A.7 – Input Signal Response Times (Maximum)

Signal Type and Source	Volts/Hertz Regulation*	Vector Regulation*
Keypad START	150 milliseconds	130 milliseconds
Terminal Strip:		
START	126 milliseconds	105 milliseconds
STOP, RESET, FL	75 milliseconds	75 milliseconds
Preset Speeds	75 milliseconds	75 milliseconds
Analog Speed/Trim Reference	16 milliseconds	5 milliseconds
Analog Torque Reference	N/A	0.5 milliseconds
Network:		
START	46 milliseconds + network transport time	25 milliseconds + network transport time
STOP, RESET, FL	26 milliseconds + network transport time	25 milliseconds + network transport time
Analog Speed/Trim Reference	5 milliseconds + network transport time	5 milliseconds + network transport time
Torque Reference	N/A	0.5 milliseconds +network transport time

*These are the maximum times from transitioning the input to the drive reacting to the input.

APPENDIX B

Compliance with Machinery Safety Standard EN 60204-1:1992

The GV3000/SE drive complies with the following sections of machinery safety 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	- Hold-to-run controls

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

Copies of this standard can be purchased from the American National Standards Institute at www.ansi.org.

APPENDIX C

Compliance with Electromagnetic Compatibility Standards

C.1 Introduction

This appendix provides information on the GV3000/SE drive's compliance with European community electromagnetic compatibility standards and covers the following:

- requirements for standards compliance
- guidelines on installing the AC Mains Filter
- instructions on how the drive must be wired.

The GV3000/SE drives listed on the Declaration of Conformity (DOC) and in table C.1 have been tested and are in compliance with the following standards when installed with the appropriate AC Mains Filter:

- EN50081-1 (1992)
  Electromagnetic compatibility - Generic emission standard
  Part 1: Residential, commercial, and light industrial
- EN50081-2 (1992)
  Electromagnetic compatibility - Generic emission standard
  Part 2: Industrial
- EN50082-1 (1992)
  Electromagnetic compatibility - Generic immunity standard
  Part 1: Residential, commercial, and light industrial
- EN50082-2 (1995)
  Electromagnetic compatibility - Generic immunity standard
  Part 2: Industrial

Note that the conformity of the GV3000/SE drive to the above standards does not guarantee that the entire installation will be in conformance.

Copies of the Declaration of Conformity (DOC) may be obtained by contacting the Rockwell AutoFax service at 440-646-7777.

C.2 Compliance Requirements

In order for the GV3000/SE drive to conform to the standards listed in section C.1, the drive must:

- be specified by model number on the DOC.
- have a CE mark. This mark is found on the drive's certification label.
- include an AC Mains Filter. See section C.3 for information on installing the filter.
- be installed according to the instructions in this appendix.

Note that when using 25-60HP GV3000/SE drives, a special cover is required. The model number of the GV3000 cover kit is M/N 2CK4160. Follow the instructions provided with the kit when replacing the cover. The instructions in this appendix assume that the drive has the correct cover on it.

Contact Reliance Electric for assistance if your application requires CE-certification when using 200-400HP GV3000/SE drives.

C.3 Installing the AC Mains Filters

The following sections describe how to identify and install the AC Mains Filters. These filters have been designed to limit the conducted electromagnetic emissions to the AC power mains from the GV3000/SE drives.

Table C.1 identifies the GV3000/SE drives that are in conformance with the standards listed in section C.0 and their corresponding AC Mains Filters. Verify that you have the correct AC Mains Filter for your application. The information provided in this appendix applies to all the AC Mains Filters listed in table C.1 unless otherwise noted.

Table C.1 – AC Mains Filters

HP	GV3000/SE Model Number	AC Mains Filter Model Number
1	1V41xx 1V44xx	2DF4283
2	2V41xx 2V44xx	2DF4283
3	3V41xx 3V44xx	2DF4283
5	5V41xx 5V44xx	2DF4283
7	7V41xx 7V42xx	2DF4284
10	10V41xx 10V42xx	2DF4284
15	15V41xx 15V42xx	2DF4285
20	20V41xx 20V42xx	2DF4285
25	25G41xx 25G42xx	2DF4285
25	25V41xx 25V42xx	2DF4286
30	30V41xx 30V42xx	2DF4286
40	40V41xx 40V42xx	2DF4286
50	50V41xx 50V42xx	2DF4286
50	50T41xx	*
60	60G41xx 60G42xx	2DF4286
75	75T41xx	*
125	125R41xx	2DF4125**
200	200V41xx	***
250	250V41xx	***
300	300V41xx	***
350	350V41xx	***
400	400V41xx	***

* Filter is internally mounted in the GV3000/SE drive at the factory.
** Does not comply with standard EN50081-1 (1992)
*** Contact Reliance Electric for assistance.

C.3.1 Installing AC Mains Filters M/N 2DF4283, 2DF4284, 2DF4285, and 2DF4286

Use the following guidelines to mount the GV3000SE drive to the AC Mains Filter and then mount the drive/filter assembly to a panel:

- Attach the GV3000/SE drive to the AC Mains Filter. See figure C.1. No other type of mounting is permitted. The required mounting hardware is supplied with the filter.
- Attach the GV3000/SE drive/AC Mains Filter assembly to a panel or wall. See figure C.1 and table C.2 for mounting dimensions. The panel/wall surface does not have to be conductive, although it is preferable. The hardware for mounting the drive/filter assembly to the panel/wall must be supplied by the user.
- For 25-60 HP drives, cover kit M/N 2CK4160 is required.

Continue with section C.4.

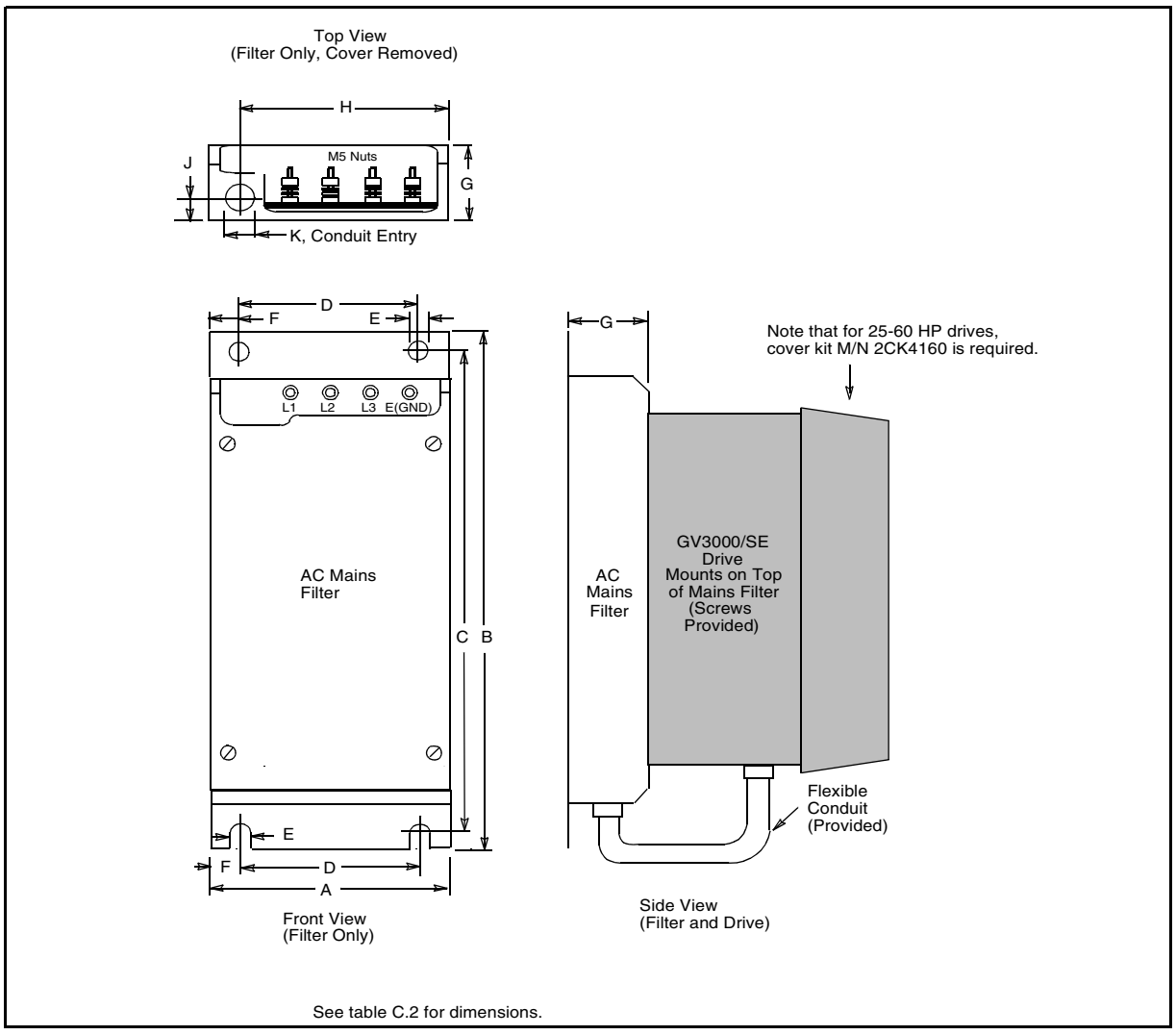


Figure C.1 – AC Mains Filter Dimensions

Table C.2 – AC Mains Filter Mounting Dimensions and Weight

Dimension	AC Mains Filter 2DF4283	AC Mains Filter 2DF4284	AC Mains Filter 2DF4285	AC Mains Filter 2DF4286	AC Mains Filter 2DF4125
A	217 mm 8.5"	272 mm 10.7"	272 mm 10.7"	365.5 mm 14.3"	*
B	387mm 5.25"	441 mm 17.4"	575 mm 22.6"	958 mm 37.7"	*
C	362 mm 14.25"	415 mm 16.3"	550 mm 21.7"	933 mm 36.7"	*
D	174 mm 6.9"	230 mm 9.1"	232 mm 9.1"	300 mm 11.8"	*
E	9 mm 0.35"	9 mm 0.35"	9 mm 0.35"	11 mm 0.43"	*
F	21.5 mm 0.85"	21 mm 0.83"	20 mm 0.79"	_	*
G	53 mm 2.1"	53 mm 2.1"	93 mm 3.7"	91.5 mm 3.6"	*
H	180 mm 7.1"	231 mm 9.1"	235 mm 9.25"	181 mm 7.1"	*
J	18 mm 0.71"	18 mm 0.71"	43 mm 1.7"	35 mm 1.4"	*
K	22 mm 0.87"	22 mm 0.87"	28 mm 1.1"	43 mm 1.7"	*
Filter Weight	3.2 kg 7 lbs	3.2 kg 7 lbs	5 kg 11 lbs	20 kg 44 lbs	48 kg 105 lbs

* See figure C.2 for mounting dimensions.

C.3.2 Installing AC Mains Filters in GV3000/SE Drives M/N 50T41xx and 75T41xx

In GV3000/SE drives M/N 50T41xx and 75T41xx, the AC Mains Filters are installed within the GV3000/SE chassis at the factory. No additional filter installation is required. Continue with section C.4.

C.3.3 Installing AC Mains Filter M/N 2DF4125

GV3000/SE drive M/N 125R41xx and AC Mains Filter M/N 2DF4125 are to be mounted separately. See figure C.2. They must be mounted on a steel surface with good conductivity between the two assemblies, for example, the mounting surfaces should not be painted.

When placing the drive and the AC Mains Filter in a cabinet or IP20 enclosure, a common ground bus bar is to be located in front of the terminals. This bus bar must be solidly connected to the back panel to ensure good conductivity. All cable screens must be connected to this bus bar. To ensure good conductivity, use galvanized cable brackets to connect the screens to the bus bar.

Continue with section C.4.

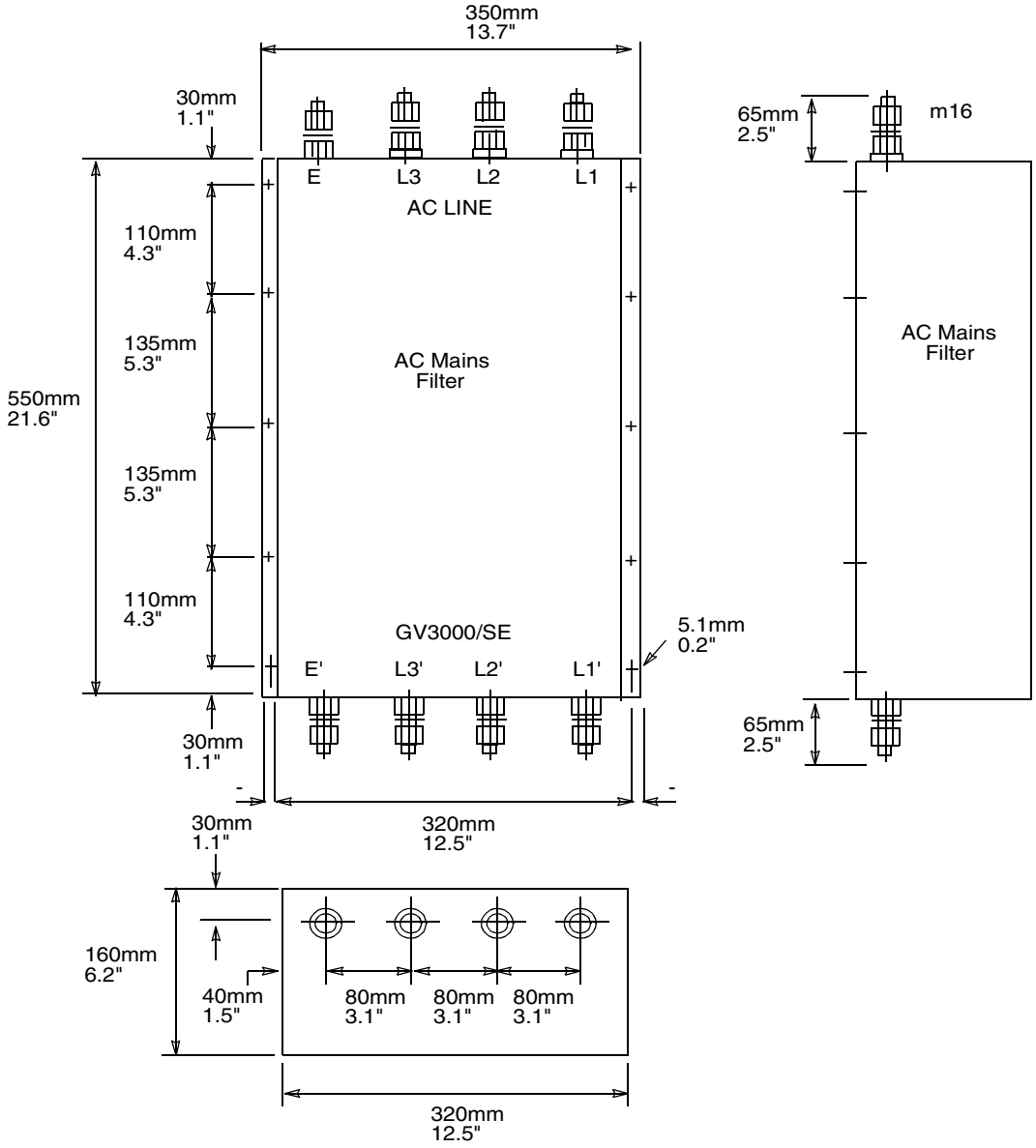


Figure C.2 – M/N 2DF4125 AC Mains Filter Dimensions

C.4 Wiring Practices

This section describes how the GV3000/SE drive must be wired to conform to the standards listed in section C.1. Figures C.3 and C.4 show GV3000/SE wiring configuration examples.

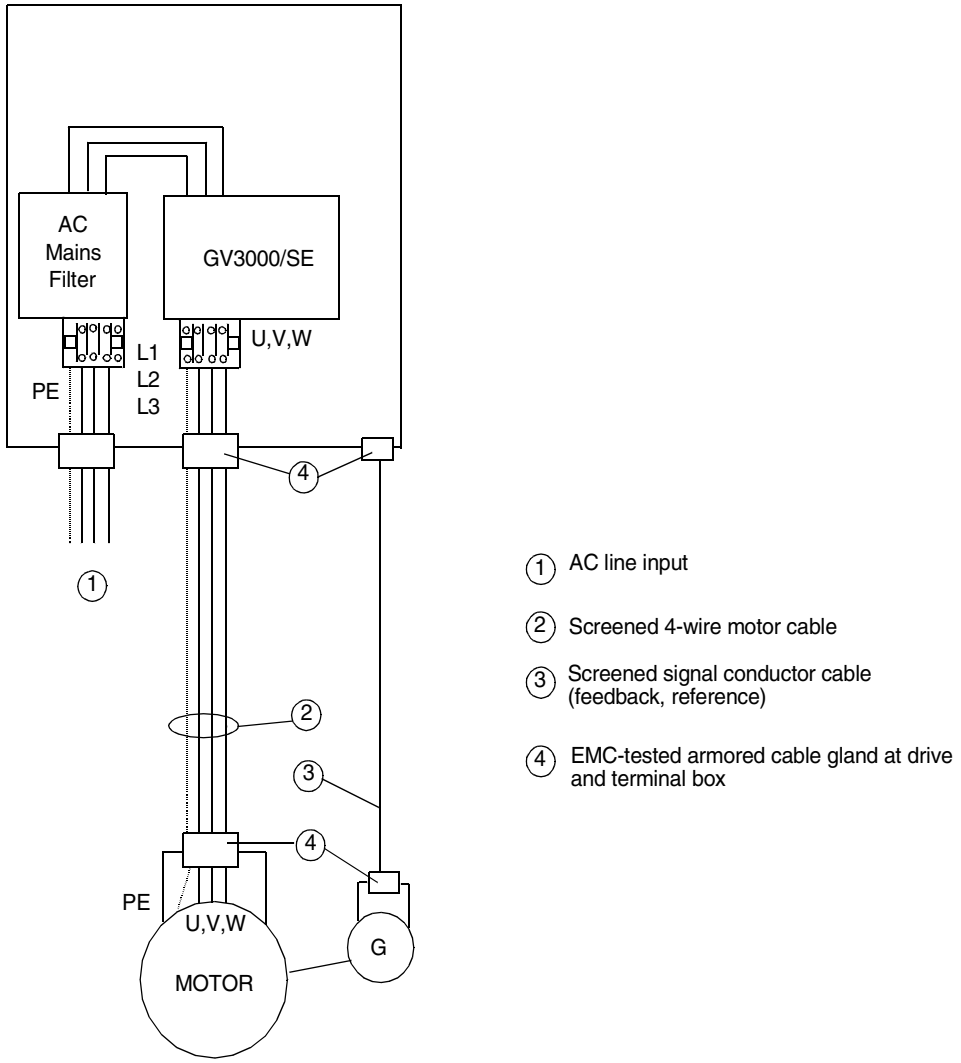


Figure C.3 – Stand-Alone GV3000/SE Wiring Example

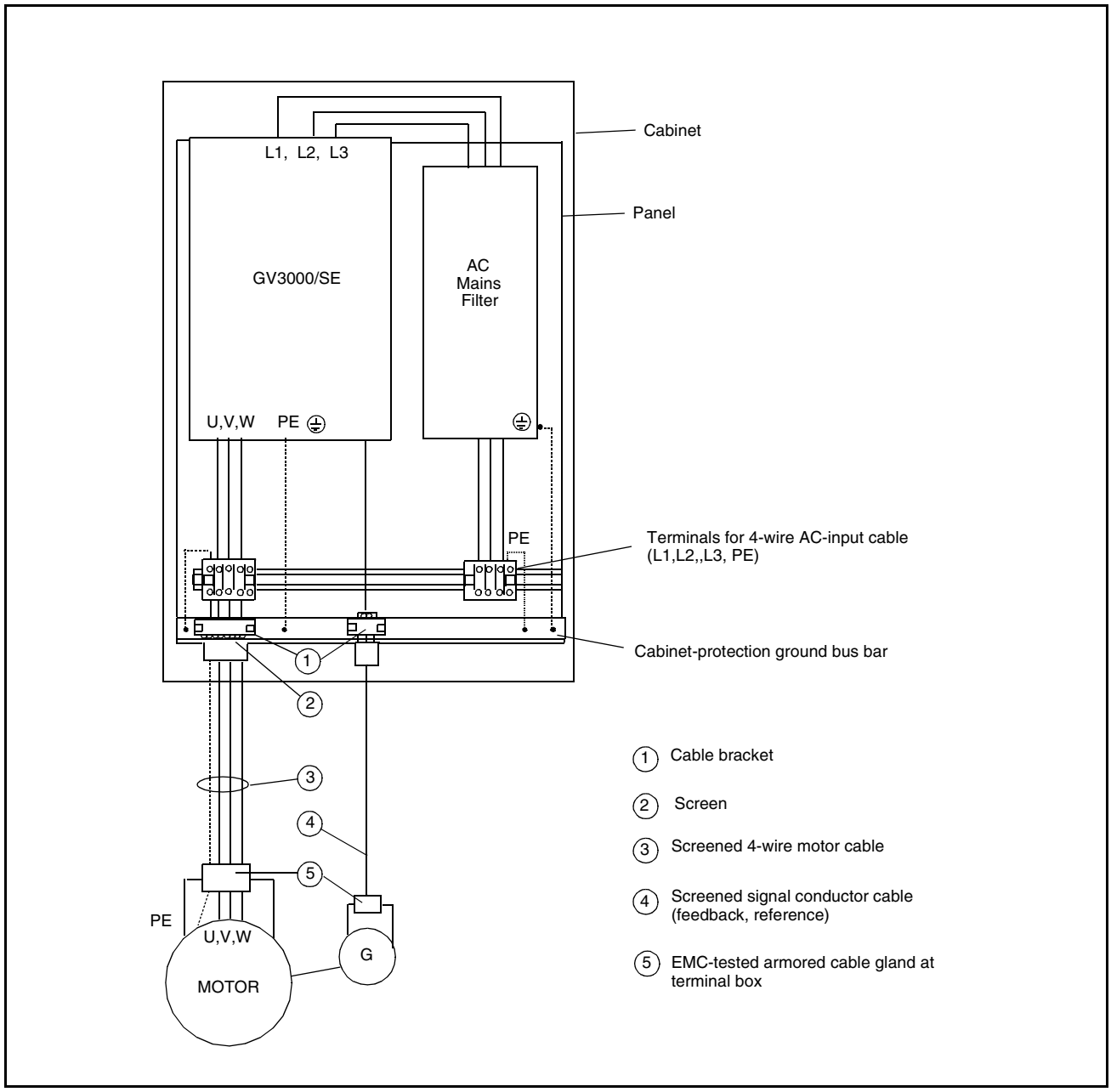


Figure C.4 – Cabinet-Mounted GV3000/SE Wiring Example

C.4.1 Connecting the AC Mains Filter Output to the GV3000/SE Drive Input

The following sections describe how to wire the AC Mains Filters to the GV3000/SE drives.

C.4.1.1 Connecting AC Mains Filters M/N 2DF4283, 2DF4284, 2DF4285, and 2DF4286

The power leads that connect the output terminals of the AC Mains Filter to the drive's AC input terminals are included with the filter. The flexible conduit to be used with these power leads is also provided. See figure C.5.

- Place the flexible conduit's hub in the drive's wire entry hole that is in-line with the filter's output wiring opening. Route the leads through the conduit. Secure both ends of the flexible conduit.
- Trim the power leads to the proper length and connect them to the drive's AC input power terminals (R,S,T). Connect the green/yellow ground lead to the drive's ground terminal.

  Note that the filter's output leads are red, yellow, and blue. This color coding is stenciled on the printed circuit board at the filter's input power terminals to help identify the filter's output wiring relative to the filter's input wiring.
- When the drive is connected to three-phase AC input power, the three output leads from the filter should be connected to the drive's AC input power terminals as shown in figure C.5.
- Connect the filter ground wire (green/yellow) to the drive ground.

Continue with section C.4.2.

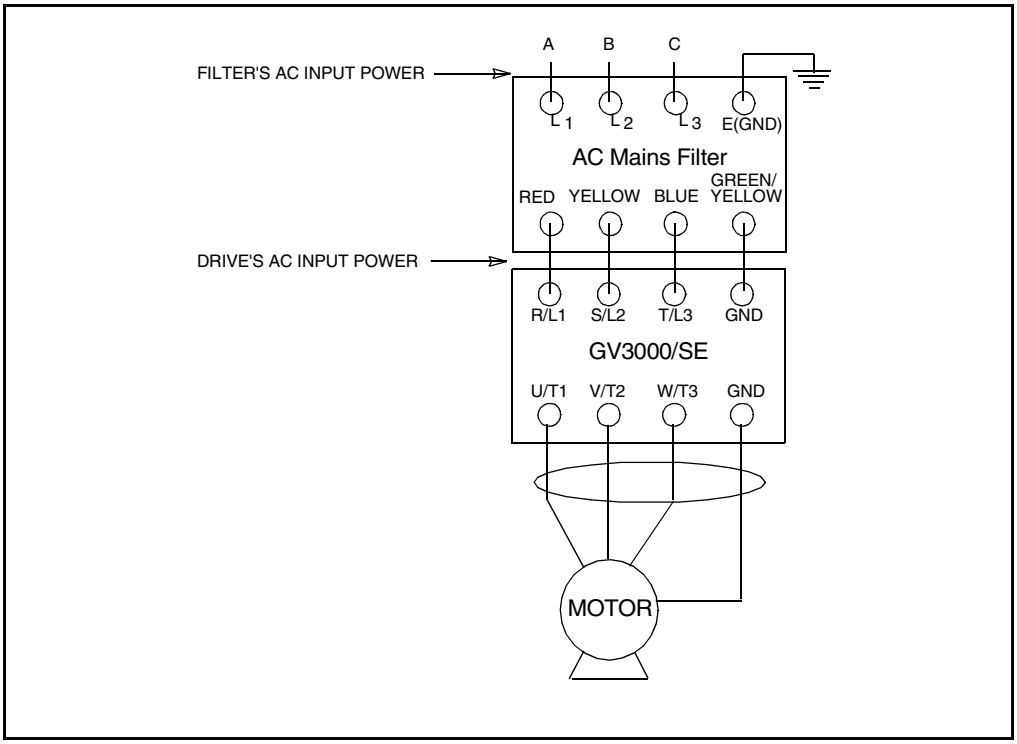


Figure C.5 – Typical Three-Phase Connections for AC Mains Filters M/N 2DF4283, 2DF4284, 2DF4285, and 2DF4286

C.4.1.2 Connecting Built-in AC Mains Filters in GV3000/SE Drives M/N 50T41xx and 75T41xx

The power leads that connect the output terminals of the AC Mains Filter to the drive's AC input terminals are prewired and installed at the factory. See figure C.6.

When the drive is connected to three-phase AC input power, the three output leads from the filter should be connected to the drive's AC input power terminals as shown in figure C.6.

Continue with section C.4.2.

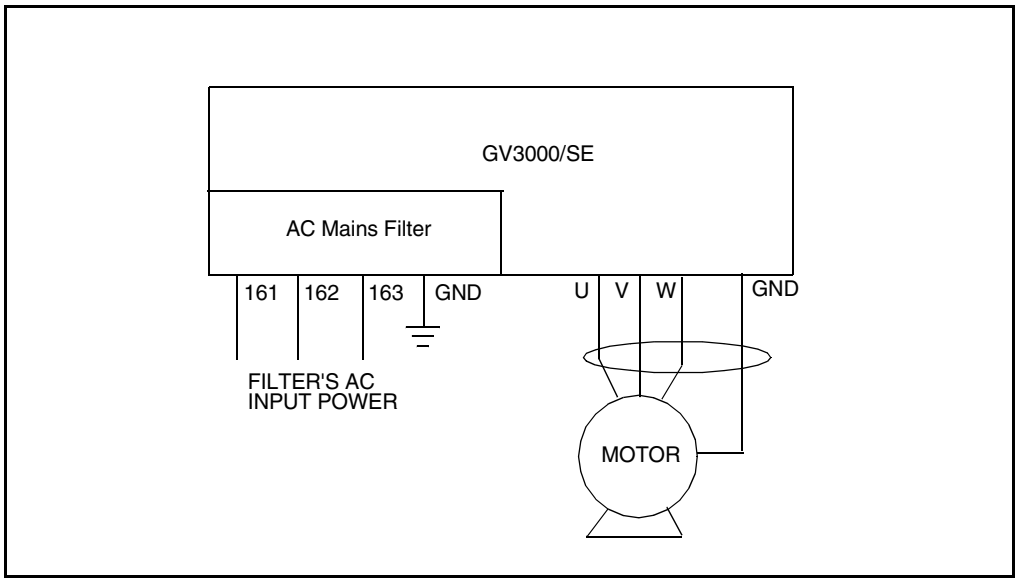


Figure C.6 – Typical Three-Phase Connections for Built-in AC Mains Filters in GV3000/SE Drives M/N 50T41xx and 75T41xx

C.4.1.3 Connecting AC Mains Filter M/N 2DF4125

The power leads that connect the output terminals of the AC Mains Filter to the drive's AC input terminals are user-supplied. See figure C.7.

- Cut the power leads to the proper length and connect them to the drive's AC input power terminals (1L1, 1L2, 1L3). Connect the green/yellow ground lead to the drive's ground terminal. The leads should be kept as short as possible and should be fastened together in a triangular shape using tie wraps.

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

- When the drive is connected to three-phase AC input power, the three output leads from the filter should be connected to the drive's AC input power terminals as shown in figure C.7.

Continue with section C.4.2.

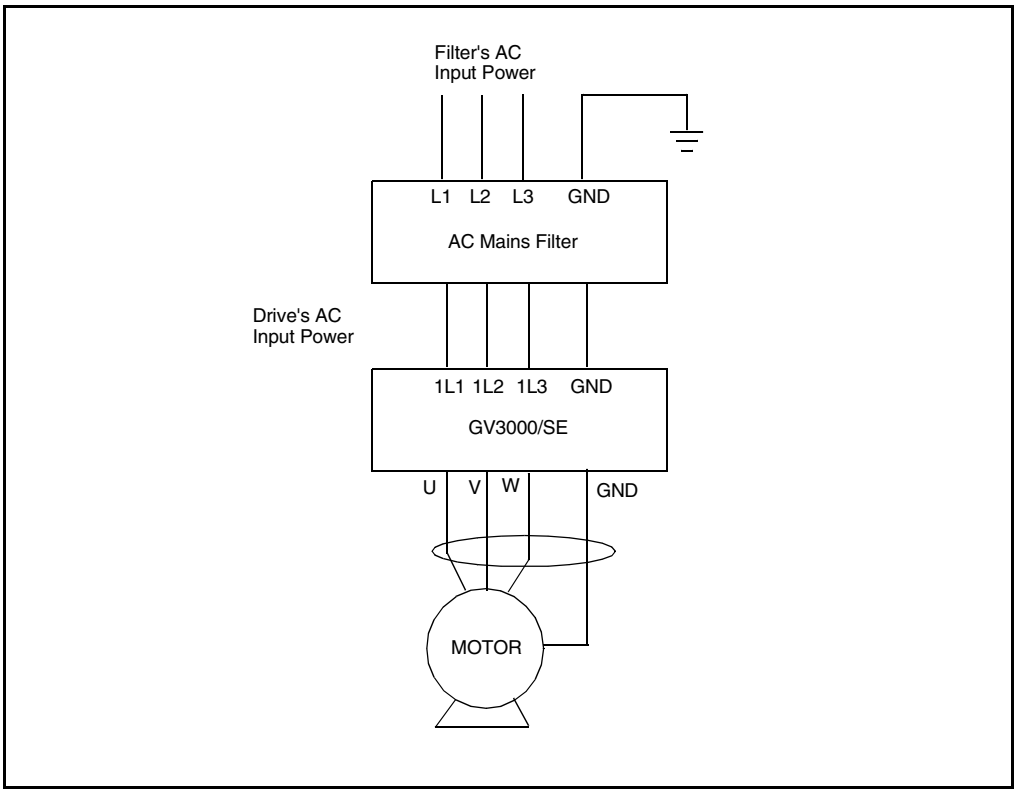


Figure C.7 – Typical Three-Phase Connections for AC Mains Filter M/N 2DF4125

C.4.2 Motor Leads

The motor leads must be run in continuous, rigid, conductive conduit, continuously-screened armored cable, or equivalent. Note that the use of flexible metal conduit, open wire, or wire in trays is not acceptable. Many flexible metal conduit products have not been designed for RF containment and are not adequate to maintain compliance.

All motor leads should have the same cross-sectional area. The maximum allowable motor lead length from the drive to the motor is 250’ (76m).

A ground (earth) lead, equivalent in size to the motor leads, must be run with the motor leads from the motor to the drive. Terminate this lead in the drive at the ground terminal.

Proper glands must be used to terminate the motor conduit/cable. The gland must secure the cable screen to the conductive surfaces of the drive and motor. A full 360° screen termination is preferred.

Follow all instructions supplied with the motor.

C.4.3 Connecting AC Input Power to the AC Mains Filter

Connect AC input power to the filter by first removing the filter’s cover and then connecting the AC input power leads to the terminals at the top of the filter. See figure C.1. The AC input power leads should have lugs attached. The filter-GV3000/SE cabinet has a conduit opening to secure the AC input power conduit.

C.4.4 Grounding the Drive/Filter Assembly

Connect the drive/filter assembly to earth ground at the terminal provided next to the filter's AC input power terminals. The ground wire should be sized per EN-60204-1, Part 5.2[1], for copper conductors and EN-60204-1, Part 8.2.2.2[2] , for non-copper conductors. European Union standards require that the ground wire must be green/yellow according to EN-60204-1, Part 15.2.2.[3]

[1]EN-60204-1, Part 5.2: Minimum Cross-Sectional Area of the External Protective Copper Conductor

Cross-Sectional Area of Phase Conductors Supplying the Equipment (S) (mm^2)	Minimum Cross-sectional Area of the External Protective Conductor (mm^2)
$S \geq 16$	S
$16 < S \leq 35$	16
$S \geq 35$	S/2

[2] EN-60204-1, Part 8.2.2.2: Protective Conductors

Copper conductor should be used. If a material other than copper is used, its electrical resistance per unit length should not exceed that of copper. Non-copper conductors should not be less than 16 mm^2 in cross-sectional area.

[3] EN-60204-1, Part 15.2.2: Identification of the Protective Conductor

For insulated conductors, the two-color combination of Green and Yellow should meet the following criteria for any given 15 mm length: one of the colors should cover at least 30% and no more than 70% of the surface, with the other color covering the remainder of the surface.

C.4.5 I/O Signals

Control (I/O) and signal wiring must be run in continuous, rigid, conductive conduit or continuously-screened cable as shown in figure C.8. Note that the use of flexible metal conduit, open wire, or wire in trays is not acceptable. Many flexible metal conduit products have not been designed for RF containment and are not adequate to maintain compliance.

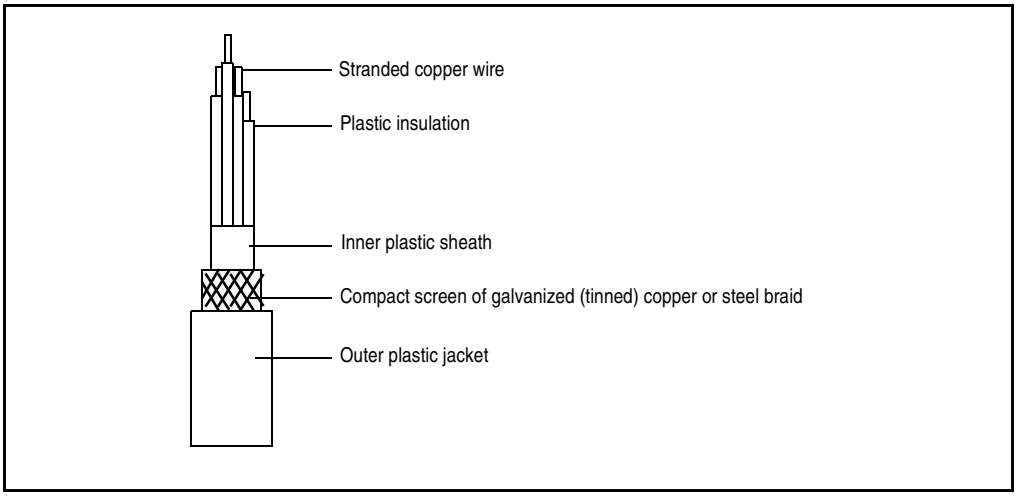


Figure C.8 – I/O Signal Cable

C.4.6 Operator Control Stations

The enclosure of an operator's control station must be constructed of a conductive metal. The cover of the enclosure should be bonded to the case and not rely on the hinge for bonding. Standard industrial operator devices, e.g., pushbuttons, switches, and meters, may be used.

The wiring connecting the operator's devices to the drive must be run in continuous, rigid, conductive conduit, continuously-screened armored cable, or equivalent. Note that the use of flexible metal conduit, open wire, or wire in trays is not acceptable. Many flexible metal conduit products have not been designed for RF containment and are not adequate to maintain compliance.

Proper glands must be used to terminate the operator's control station conduit/cable at the station and the drive. The gland must secure the cable screen to the conductive surfaces of the drive and station enclosure. A full 360° screen termination is preferred. Screen pigtails are not permitted.

C.4.7 Connecting to the AutoMax Network

GV3000/SE drive connections to an AutoMax network require the use of coaxial cable as described in instruction manuals J2-3001 and D2-3308. The coaxial cable must be run in continuous, rigid, conductive conduit.

Proper glands must be used to terminate the conduit at the AutoMax enclosure and the GV3000/SE drive. The gland must secure the cable screen to the conductive surfaces of the drive and AutoMax enclosure. A full 360° screen termination is preferred. Screen pigtails are not permitted.

C.4.8 Encoder Cabling

Use only the Reliance Electric encoder cables listed in table C.3.

Table C.3 – Encoder Cabling

Cable Type	Cable Length	Cable Model Number
MS connector on encoder end	25’	2TC4025/2TC3025
MS connector on encoder end	75’	2TC4075/2TC3075
Bare wire on both ends	100’	2TC4100
Bare wire on both ends	300’	2TC4300

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