The information in this manual is subject to change without notice.

Throughout this manual, the following notes are used to alert you to safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Important: Identifies information that is critical for successful application and understanding of the product.

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

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, operate, or service this equipment. 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.

ATTENTION: Do not install or remove modification kits with power applied to the drive. Disconnect and lock out incoming power before attempting such installation or removal. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.

ATTENTION: The drive can operate at and maintain zero speed. You are responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or might operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

ATTENTION: You 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 can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

ATTENTION: You are 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.

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New Features in Version 6.04

The VTAC 7 drive includes support for these features:

- Enhanced analog input configuration. See P.011 (Analog Input Configure).
- Enhanced output relay configuration. See P.013 (Output Relay Configuration).

CHAPTER 1

Becoming Familiar with the Manual

This manual is a software/hardware reference guide for the VTAC 7 drive (software version 6.04). It describes the VTAC 7 drive Power Module, regulator hardware, and software.

The hardware sections of this manual include drive installation instructions, wiring information, and hardware troubleshooting. Software sections include drive configuration instructions, a description of the keypad/display, descriptions of the drive's configurable and tunable parameters, and instructions on how to use the alarm fault log or troubleshooting.

This chapter describes the intended audience. It also has references to other related publications and has instructions on receiving assistance from Reliance Electric.

1.1 Assumptions About the Audience

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

1.2 Understanding Terms Used in this Manual

These are the common terms used in this manual:

- VTAC 7 drives are typically referenced by horsepower. If necessary, drive model numbers are also included.
- Parameters are referenced by number (example: (P.030)), or by name followed by its number (example: Elapsed Time Meter Reset (P.030)).

1.3 If You Want to Know More

Refer to these related publications for more information:

- D2-3305, Motor Encoder Cable Kit
- D2-3308, AutoMax Network Communication Board
- D2-3348, Control and Configuration Software (CS3000)
- D2-3341, Remote Meter Interface Board
- D2-3342, Operator Interface Module
- HEC-GV3-RTU-A, RTU/MODBUS Network Communication Board
- HE-HGV3DN, DeviceNet Communication Board
- HE-HGV3MT, Metasys Communication Board

1.4 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 authorized HVAC representative. For technical assistance, call 1-800-726-8112.

CHAPTER 2

About the Drive

The VTAC 7 drive is a pulse-width-modulated (PWM) drive that provides general purpose (volts/hertz) regulation for a broad range of applications requiring adjustable speed control of motors.

This chapter provides information about the VTAC 7 drive, including:

- Information on identifying the drive
- Descriptions of NEMA ratings
- A description of the Regulator board
- Instructions on making jumper settings

2.1 Identifying the Drive by Model Number

Each VTAC 7 drive can be identified by its model number, as shown in figure 2.1. The model number is on the shipping label and the drive nameplate. The model number includes the Power Module, regulator, and any options. Model numbers and drive power ratings are provided in table 2.1.

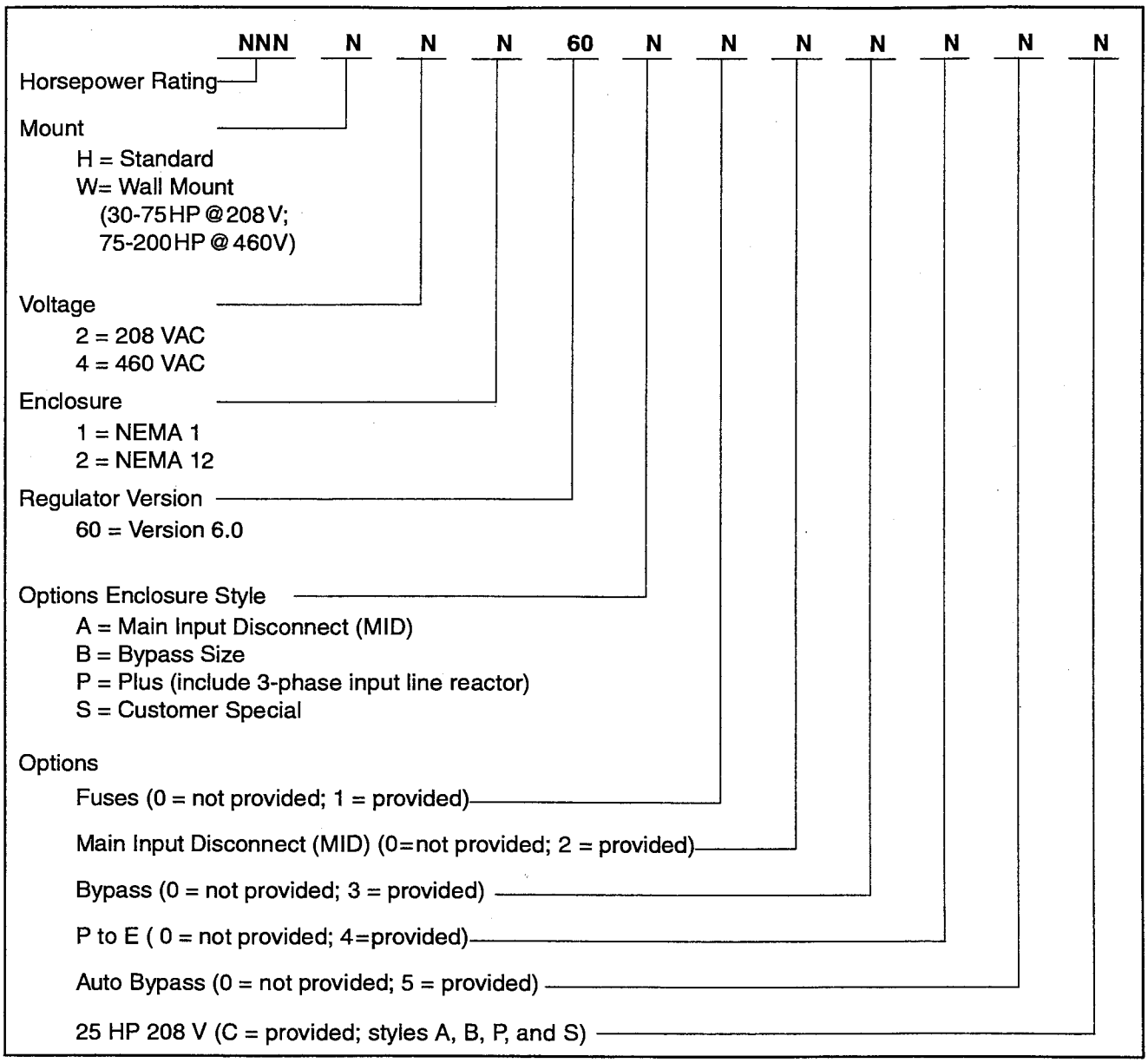


Figure 2.1 – Identifying the Drive by Model Number

2.2 Power and NEMA Enclosure Ratings

Each of the VTAC 7 drive Power Modules has one of these NEMA ratings:

- NEMA 1: Vented. Includes a communication access door that allows access to the communication port without removing the cover. Intended for general-purpose indoor applications.
- NEMA 12: Intended for use in indoor environments that require a dust-tight and drip-tight enclosure.

Table 2.1 is a listing of the Power Modules and their NEMA ratings.

Table 2.1 – Power and NEMA Enclosure Ratings

Model Number	HP	Input Voltage (VAC) ±10%	NEMA Rating	Input KVA	Input Amps	Output Amps @ Carrier Frequency	Power Loss Watts (Full Load)
1H2160 1H2260	1	208	1 12	2.4	5.3	4.6 @ 8kHz	60
2H2160 2H2260	2	208	1 12	3.7	8.6	7.5 @ 8kHz	100
3H2160 3H2260	3	208	1 12	5.5	12.1	10.6 @ 8kHz	140
5H2160 5H2260	5	208	1 12	9.6	19.3	16.7 @ 8kHz	180
7H2160 7H2260	7.5	208	1 12	12.7	27.8	24.2 @ 8kHz	210
10H2160 10H2260	10	208	1 12	15.5	35.9	30.8 @ 8kHz	250
15H2160 15H2260	15	208	1 12	24.1	53.2	46.2 @ 8kHz	375
20H2160 20H2260	20	208	1 12	29.8	66.5	59.4 @ 8kHz	600
25W2160	25	208	1	32.3	81	81 @ 8 kHz	630
30W2160	30	208	1	41.8	105	105 @ 4kHz	660
40W2160	40	208	1	53.8	135	135 @ 4kHz	900
50W2160	50	208	1	59.8	150	150 @ 4kHz	1100
60W2160	60	208	1	77.7	195	195 @ 4kHz	1350
75W2160	75	208	1	97.6	245	245 @ 4kHz	1650
100W2160	100	208	1	109.6	275	275 @ 4kHz	2250
1H4160 1H4260	1	460	1 12	2.0	2.5	2.1 @ 8kHz	60
2H4160 2H4260	2	460	1 12	3.3	4.2	3.4 @ 8kHz	100
3H4160 3H4260	3	460	1 12	5.1	6.4	5.3 @ 8kHz	140
5H4160 5H4260	5	460	1 12	7.9	9.9	8.2 @ 8kHz	180
7H4160 7H4260	7.5	460	1 12	10.7	13.4	11.1 @ 8kHz	210
10H4160 10H4260	10	460	1 12	13.4	16.8	14.2 @ 8kHz	250

Table 2.1 – Power and NEMA Enclosure Ratings (Continued)

Model Number	HP	Input Voltage (VAC) ±10%	NEMA Rating	Input KVA	Input Amps	Output Amps @ Carrier Frequency	Power Loss Watts (Full Load)
15H4160 15H4260	15	460	1 12	20.2	25.4	21.0 @ 8kHz	375
20H4160 20H4260	20	460	1 12	26.1	32.7	27.0 @ 8kHz	600
25H4160 25H4260	25	460	1 12	29.5	39.0	34.0 @ 8kHz	680
30H4160 30H4260	30	460	1 12	35.0	44.0	40.0 @ 8kHz	800
40H4160 40H4260	40	460	1 12	46.2	58.0	54.0 @ 8kHz	960
50H4160 50H4260	50	460	1 12	57.3	72.0	67.0 @ 8kHz	1200
60H4160 60H4260	60	460	1 12	71.7	90.0	78.0 @ 8kHz	1200
75H4160 75W4160	75	460	1	97	122	100.0 @ 8kHz 100.0 @ 4kHz	1350
100H4160 100W4160	100	460	1	103	150	130.0 @ 8kHz 130.0 @ 4kHz	1650
125H4160 125W4160	125	460	1	160	201	160.0 @ 8kHz 160.0 @ 4kHz	2250
150H4160 150W4160	150	460	1	190	238	190.0 @ 8kHz 190.0 @ 4kHz	2700
200H4160 200W4160	200	460	1	207	260	240.0 @ 8kHz 240.0 @ 4kHz	3300
250H4160	250	460	1	268	337	302.0 @ 4kHz	4160
300H4160	300	460	1	307	386	361.0 @ 4kHz	5100
350H4160	350	460	1	351	442	414.0 @ 4kHz	6150
400H4160	400	460	1	406	510	477.0 @ 2kHz	7000

2.3 Regulator Board Description

VTAC 7 drive regulation is performed by a microprocessor on the Regulator board. The Regulator board accepts power circuit feedback signals and an external speed reference signal. Drive operation is adjusted by the parameters entered through the keypad.

The Regulator board provides:

- PWM gating signals to the insulated gate bi-polar transistor (IGBT) power devices

  Based on the control loop output, the regulator sends PWM gating signals through the Current Feedback board to isolated drivers on the Gate Driver board. These drivers switch the IGBTs, producing a PWM waveform that corresponds to the frequency reference. The IGBTs can be switched at a 2, 4, or 8 kHz carrier frequency.

- Form A and B contacts for drive status indicators

  The Form A and B contacts are controlled by programmable parameters. The Form A or B transition can indicate drive status. The contacts are available through the terminal strip and are rated for 5 amps resistive load at 250VAC / 30VDC.

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

  The four-character display indicates drive parameters, parameter values, and fault codes. The indicator LEDs indicate drive status and mode, as well as identifying drive outputs whose values are displayed on the four-character display.

- An analog output

  The analog output is a scaled voltage (0-10VDC) or current (4-20mA) signal proportional to either motor speed (RPM), motor torque, or current (%TORQUE). The current 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 table 6.2, terminals 10 and 11, for more information. The analog output signal is available through the terminal strip.

- A snubber resistor braking signal

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

Two Regulator boards are used on the VTAC 7 drives:

- 1-200 HP Regulator boards are used with model numbers 1H4XXX to 200H4XXX and 75WXXX to 200WXXX drives
- 200-400HP Regulator boards are used with model numbers 250H4XXX to 400H4XXX drives.

The Regulator boards are similar but have different Power Module interface connectors.

For Regulator board components, see figures 2.2 and 2.3.

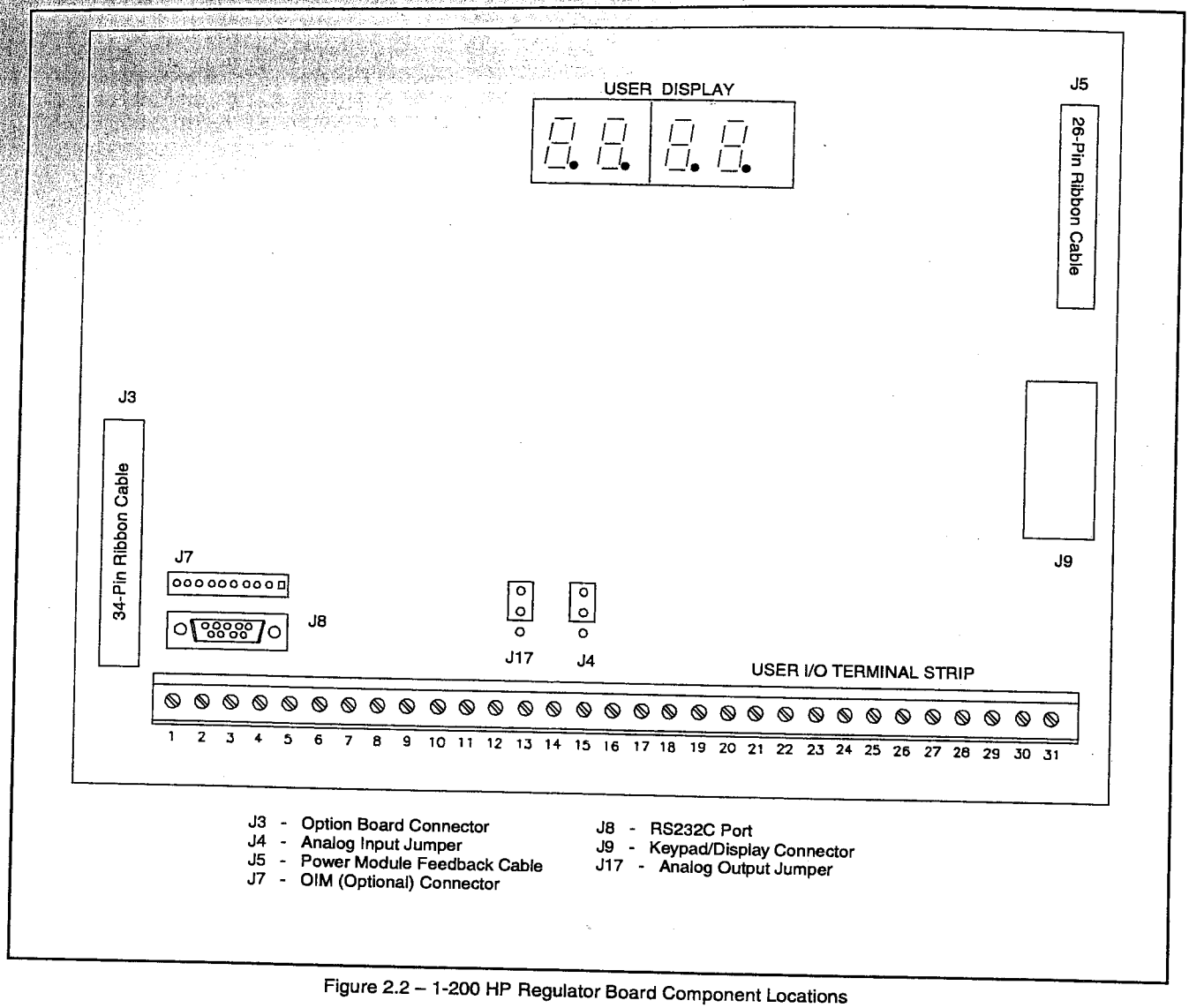


Figure 2.2 – 1-200 HP Regulator Board Component Locations

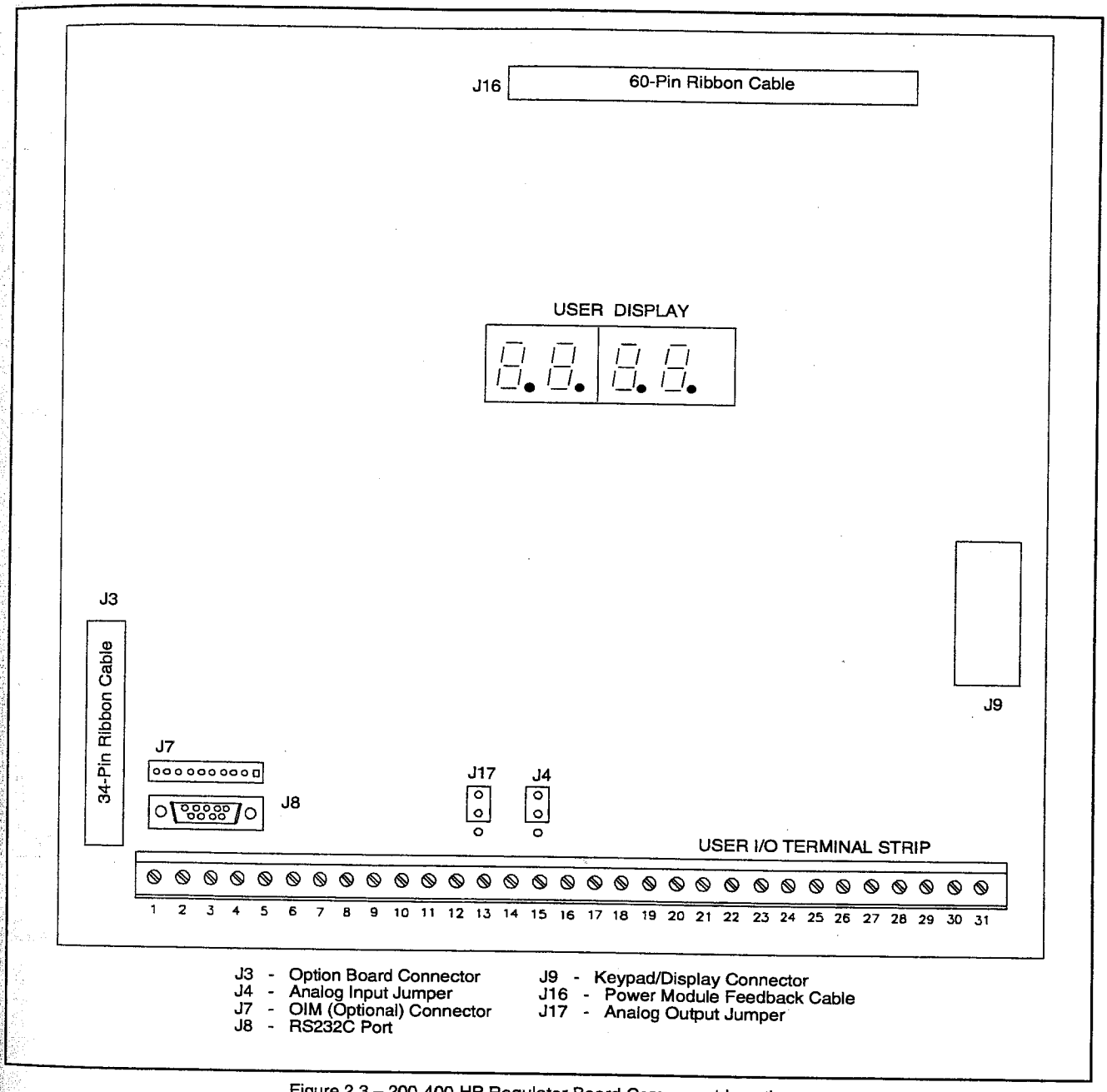


Figure 2.3 – 200-400 HP Regulator Board Component Locations

2.3.1 Jumper Locations and Settings

Jumpers J4 and J17 on the Regulator board are factory-set for voltage in and voltage out signals. See figure 2.2 and figure 2.3 for their locations on the Regulator board. If you need to change the jumpers' settings, use these procedures.

> **ATTENTION:** Do not change 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.

2.3.1.1 Setting the Analog Input Speed Reference Jumper (J4)

Jumper J4 is the analog speed reference jumper. This jumper selects either ±10VDC or 0-20mA input. This jumper is used in conjunction with parameters P.009, P.010, and P.011. Note that if the position of jumper J4 is changed after the parameters are programmed, the software will not recognize the change to the input reference or polarity. Be sure to verify that parameters P.009, P.010, and P.011 are correct before starting the drive. See chapter 9 for more information.

To set jumper J4:

> **ATTENTION:** DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.
>
> **ATTENTION:** Do not operate 200 to 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 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 to 400 HP drives, open the outer cabinet door.

Step 3. Verify that the DC bus voltage is zero by following the procedure in section 11.3.

Step 4. Locate jumper J4 on the Regulator board. See figures 2.2 and 2.3.

Step 5. Locate pin 1 on jumper J4. Move the jumper to the desired setting as shown in figure 2.4.

Step 6. 1 to 200 HP drives: Reattach the cover.
200 to 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. The jumper settings must match the software settings. If not, the reference value might differ from what is expected. See chapter 9 for more information.

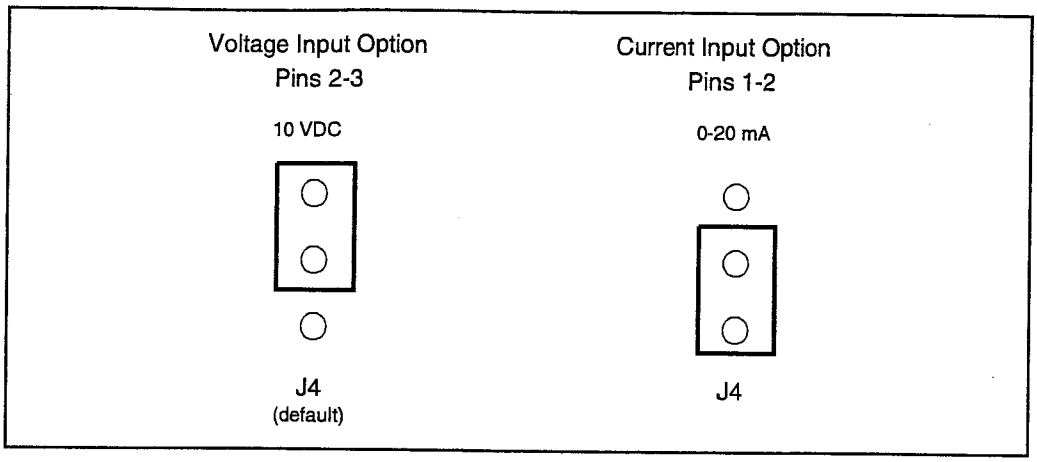


Figure 2.4 – Jumper J4 Settings for Analog Input Speed Reference

2.3.1.2 Setting the Analog Output Jumper (J17)

Jumper J17 is the analog output jumper. This jumper selects either a 0-10VDC or 4-20mA scaled signal output that is programmable for either speed or torque, parameter P.012. The jumper only selects a 0-10VDC source voltage or 4-20mA sink current to represent speed or torque. Note that the 4-20mA current selection requires a power supply for operation as shown in table 6.2, terminals 10 and 11. Terminal 4 can be used for this power supply if a minimum load of 600Ω is connected.

To set jumper J17:

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.

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 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.

Step 3. Verify that the DC bus voltage is zero by following the procedure in section 11.3.

Step 4. Locate jumper J17 on the Regulator board. See figure 2.2 and figure 2.3.

Step 5. Locate pin 1 on jumper J17. Move the jumper to the desired setting as shown in figure 2.5.

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.

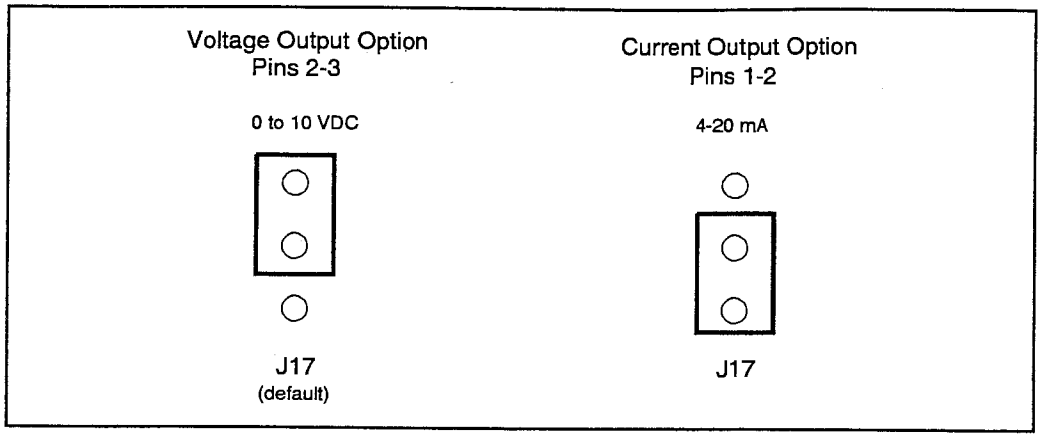


Figure 2.5 – Jumper J17 Settings for Analog Outputs

2.3.2 Wiring the Regulator Board Terminal Strip (Drive Only)

If your VTAC 7 drive does not inclue an options cabinet, the terminal strip on the Regulator board provides terminals for connecting customer I/O devices. See figures 2.2 or 2.3 for terminal strip location. See figure 6.1 for a sample wiring diagram. The terminals are:

- Terminals 1 to 3: RS-232 connections
- Terminals 4: +15VDC connection (minimum 600Ω load)
- Terminals 5 to 9: Not used
- Terminals 10 to 11: Analog output connections
- Terminals 12 to 15: Analog speed/torque reference connections
- Terminals 16 to 25: 24VDC digital input connections
- Terminals 26 to 27: Not used
- Terminals 28 to 31: Status relay connections

2.3.3 Wiring the Options Cabinet Terminal Strip (Drive with Options)

If your VTAC 7 drive uses an options cabinet, the control terminal strip inside the options cabinet is used for customer-specific I/O devices located in that cabinet. See figures 6.2 to 6.7 for sample wiring diagrams. The terminals are:

- Terminals 2 to 3: Analog output connections
- Terminals 4 to 6: Analog speed reference connections
- Terminals 7 to 8 and 13 to 14: 24VDC digital input connections
- Terminals 9 to 12: Status relay connections

RS-232 connections are still made at the VTAC 7 drive Regulator board. Control terminal strips for option enclosures A, B, and B+ are shown in figures 6.2 to 6.4.

2.3.4 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 VTAC 7 drive and a personal computer running the CS3000 software. See figures 2.2 and 2.3. Refer to instruction manual D2-3348 for more information.

2.3.5 Option Board Connector and Drive Kit Options

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 Network Communication kit, the Remote Meter Interface kit, or the Metasys Interface board to the VTAC 7 drive.

The option board is mounted below the Regulator board inside the drive. Refer to the appropriate board instruction manual for more information. See table 2.2 for a list of available kits and options.

Table 2.2 – Available Kits and Options

Kit Description*	Option Kit Model Number	Instruction Manual
DeviceNet Network Communication	2DV3000	HE-HGV3DN
Remote Meter Interface (RMI)	2SI3000	D2-3341
Operator Interface Module (OIM)	2RK3000	D2-3342
CS3000 Control and Configuration Software	2CS3000	D2-3348
Johnson Metasys Interface	2MT3000	HE-HGV3MT
UTP/MODBUS Network Communication board	2MB3000	HEC-GV3-RTU-A

* Contact Reliance Electric if you need an option kit that is not shown here. Option kits are subject to change for feature or performance enhancements.

2.3.6 Operator Interface Module (OIM) Connector

Flat-ribbon connector J7 allows you to attach the optional Operator Interface Module. You can use the OIM as a remote keypad for the VTAC 7 drive.

2.3.7 Keypad/Display

You use the front panel keypad/display to program and operate the VTAC 7 drive. See chapter 8 for information on using the keypad/display.

CHAPTER 3
Mounting the Drive

This chapter provides information that must be considered when planning a VTAC 7 drive installation and provides drive mounting information. Installation site requirements, drive requirements, and wiring requirements are presented.

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), you 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, you are 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 chapters 9 and 10 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: You are 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 Requirements for the Installation Site

It is important to properly plan before installing a VTAC 7 drive to ensure that the drive's environment and operating conditions are satisfactory. Note that no devices are to be mounted behind the drive. The area behind the drive must be kept clear of all control and power wiring. Read the following recommendations before continuing with drive installation.

3.1.1 Verifying Power Module AC Input Ratings Match Available Power

Plant power must meet the input power requirements of the VTAC 7 drive's Power Module circuitry. See table 2.1 for input power rating specifications. Be sure input power to the drive corresponds to the drive nameplate voltage and frequency.

3.1.2 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 more than 3300 feet above sea level without derating output power. For every 300feet above 3300feet, derate the output current 1%.
- Verify that the drive location will meet the environmental conditions in table 3.1.

Table 3.1 – Environmental Conditions

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

3.1.3 Verifying the Site Provides for Recommended Air Flow Clearances

Be sure there is adequate clearance for air ventilation around the drive. For best air movement, do not mount VTAC 7 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. See figure 3.1 for recommended air flow clearances.

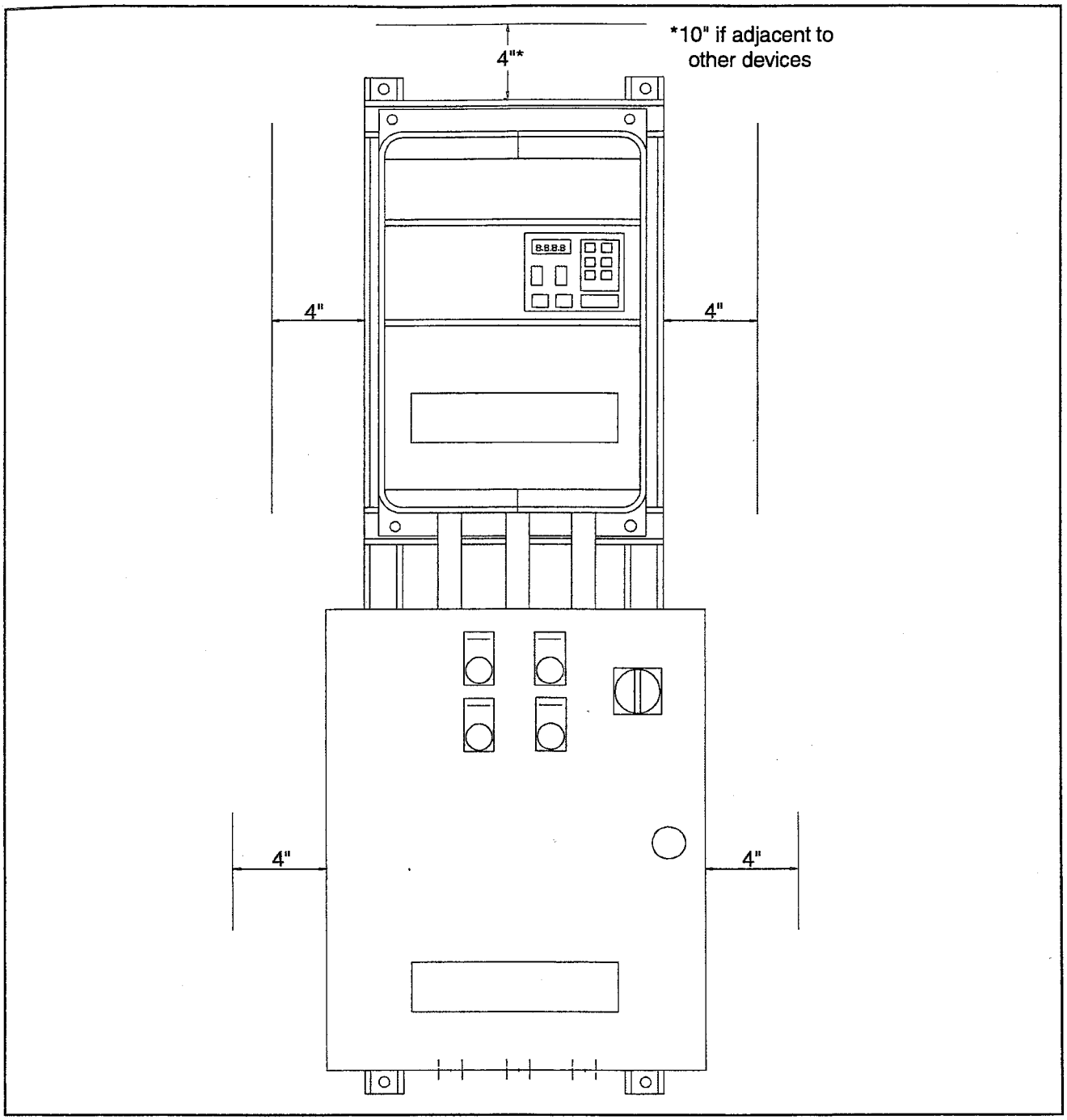


Figure 3.1 – Recommended Air Flow Clearances

3.1.4 Determining the Total Area Required for the Drive

Overall dimensions and weights are illustrated in figures 3.2 to 3.14 as an aid to calculating the total area required by the VTAC 7 drive. Drive dimensions and weights are listed in tables 3.2 to 3.14.

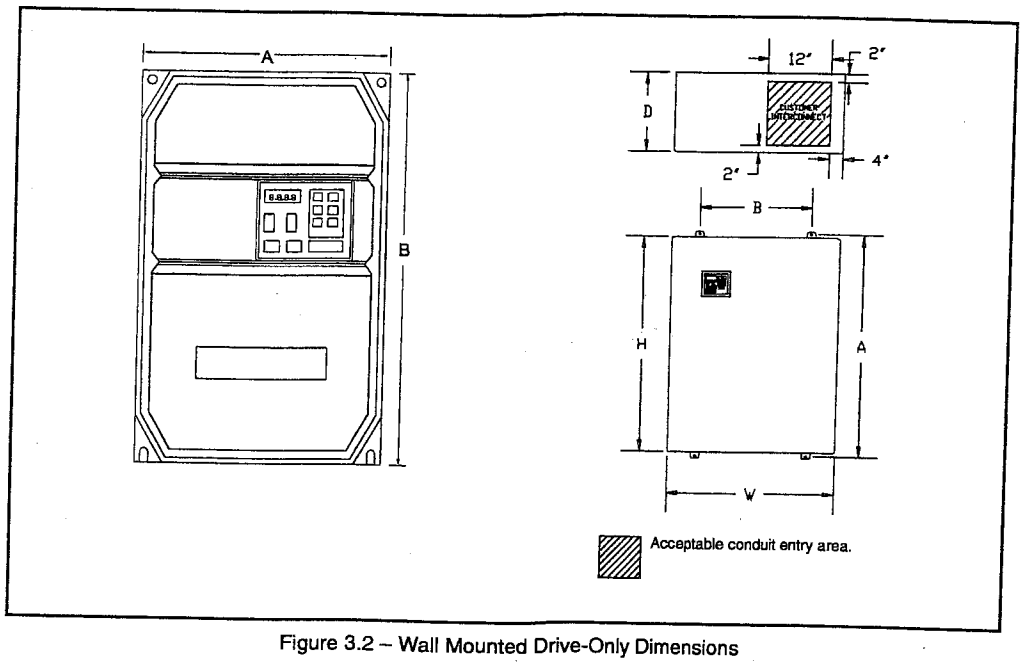


Figure 3.2 – Wall Mounted Drive-Only Dimensions

Table 3.2 – Wall Mounted Drive-Only Dimensions

HP	H (inches)	W (inches)	D (inches)	Weight (lb)	A (inches)	B (inches)
1-5 @ 208 & 460V	11	8.8	7.9	14	7.8	10.0
7.5-10 @ 208 & 460V	13.3	11	7.9	20	9.8	12.2
15-25 @ 208 & 460V	18.2	11.3	9.4	35	8.8	17.4
30-50 @ 208V	36	30	16	174	37.2	24
60-100 @ 208V	42	36	16	215	43.2	30
30-60 @ 460V	23.5	14.3	13.8	60	12.1	22.3
75-100 @ 460V	36	30	16	365	37.2	24
125 @ 460V	42	36	16	575	43.2	30
150-200 @ 460V	48	36	16	675	49.2	30

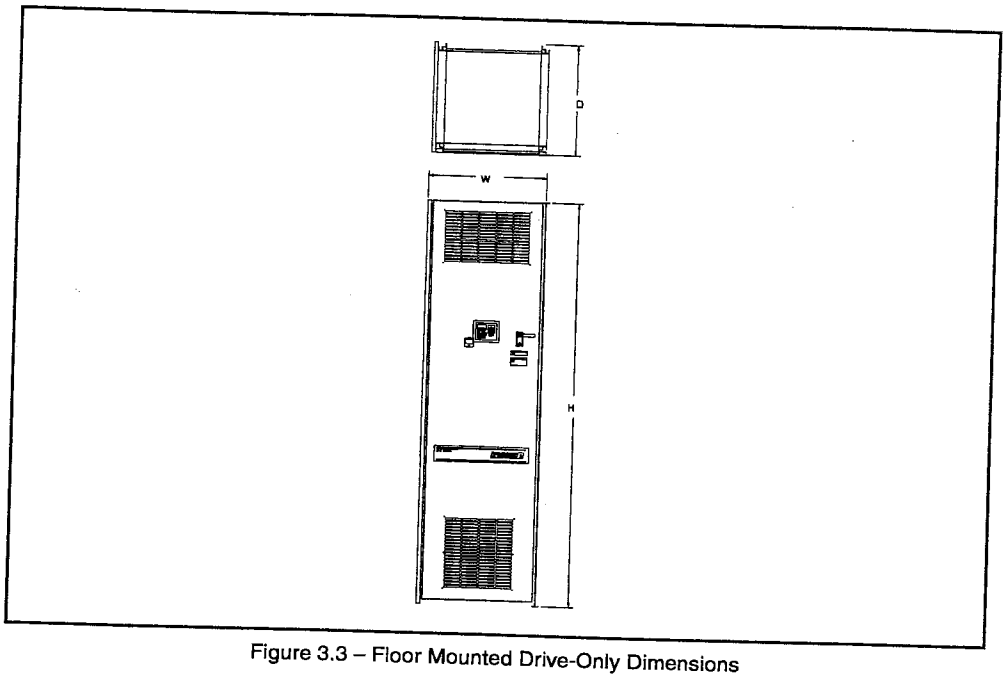


Figure 3.3 – Floor Mounted Drive-Only Dimensions

Table 3.3 – Floor Mounted Drive-Only Dimensions

HP @ 460V	H (inches)	W (inches)	D (inches)	Weight (lb)
75-150	86.6	33.0	19.8	250
200-250	86.6	25.2	23.6	800
300-400	86.6	25.2	23.6	1000

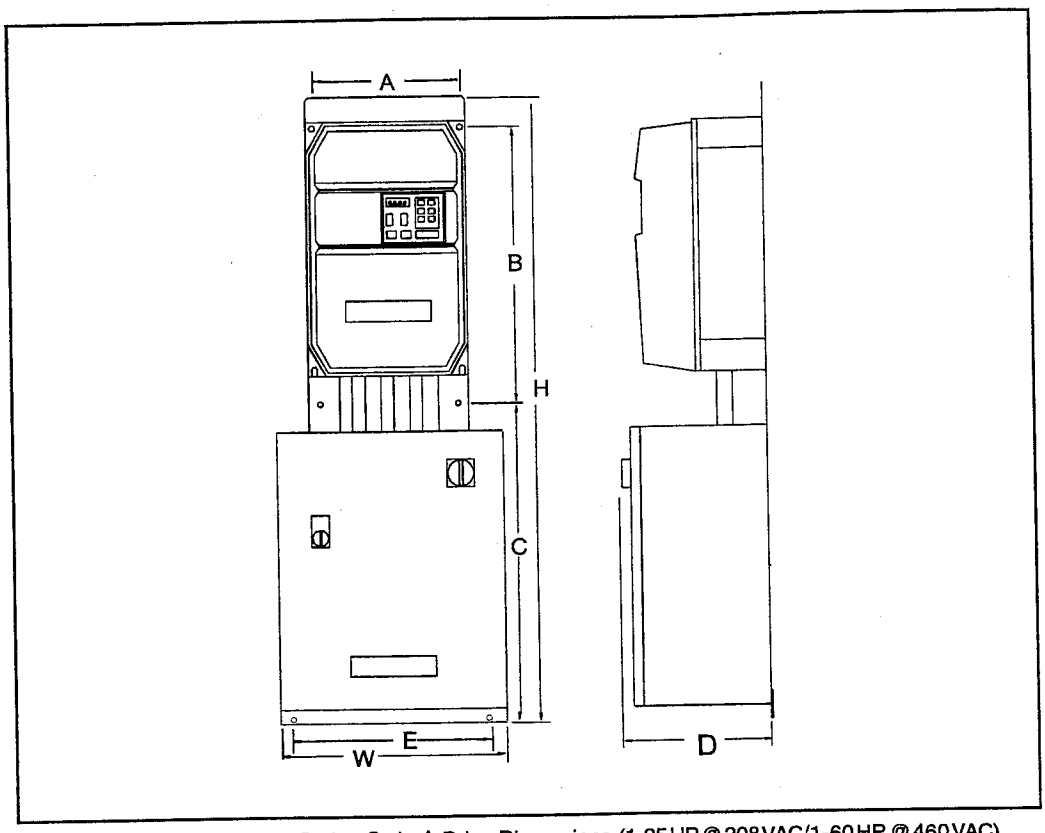


Figure 3.4 – Wall Mount Option Style A Drive Dimensions (1-25HP @ 208VAC/1-60HP @ 460VAC)

Table 3.4 – Wall Mount Option Style A Drive Dimensions (1-25HP @ 208VAC/1-60HP @ 460VAC)

HP	H (inches)	W (inches)	D (inches)	Weight (lb)*	Weight (lb)†	A	B	C	E
1-7.5 @ 208V	29.5	12.3	7.9	30 - 36	30 - 36	7.8	14	14.5	11
10 @ 208V	32* 36†	12.3* 16†	7.9* 8.9†	36	44	10.1	16.5	14.5* 18.5†	11* 15†
15-25 @ 208V	38.6	14	12.3	51	51	10.3	21.5	15.9	12.5
1-5 @ 460V	29.5	12.3	7.9	30	14	7.8	14	14.5	11
7.5-10 @ 460V	32	12.3	7.9	36	20	10.1	16.5	14.5	11
15-20 @ 460V	37	12.3	7.9	51	35	10.3	21.5	14.5	11
25 @ 460V	37* 41†	12.3	9.5	51	42	10.3	21.5	14.5* 18.5†	11* 15†
30-40 @ 460V	44.9	14* 16†	13.8* 10.2†	106	60	13.5	27	16.6* 26.4†	12.5* 22.5†
50-60 @ 460V	54.7	24	13.8	140	60	13.5	27	26.4	22.5

* Main Input Disconnect Switch

† Door Interlocked Main Input Disconnect Switch

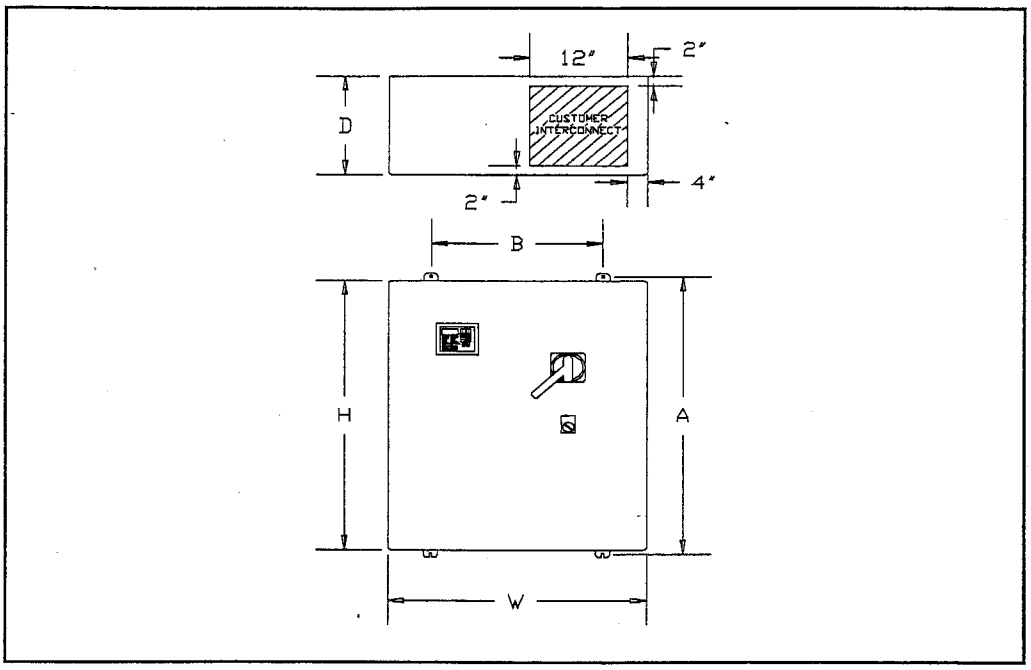


Figure 3.5 – Wall Mount Option Style A Drive Dimensions (30-75 HP @ 208 VAC/75-200 HP @ 460 VAC)

Table 3.5 – Wall Mount Option Style A Drive Dimensions (30-75 HP @ 208 VAC/75-200 HP @ 460 VAC) with Door Interlocked Main Input Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)	A	B
30 @ 208 V	36	30	16	200	37.2	24
40-75 @ 208 V	42	36	16	225 - 255	43.2	30
75 @ 460 V	36	30	16	380	37.2	24
100-125 @ 460 V	42	36	16	415 - 600	43.2	30
150-200 @ 460 V	48	36	16	1150	49.2	30

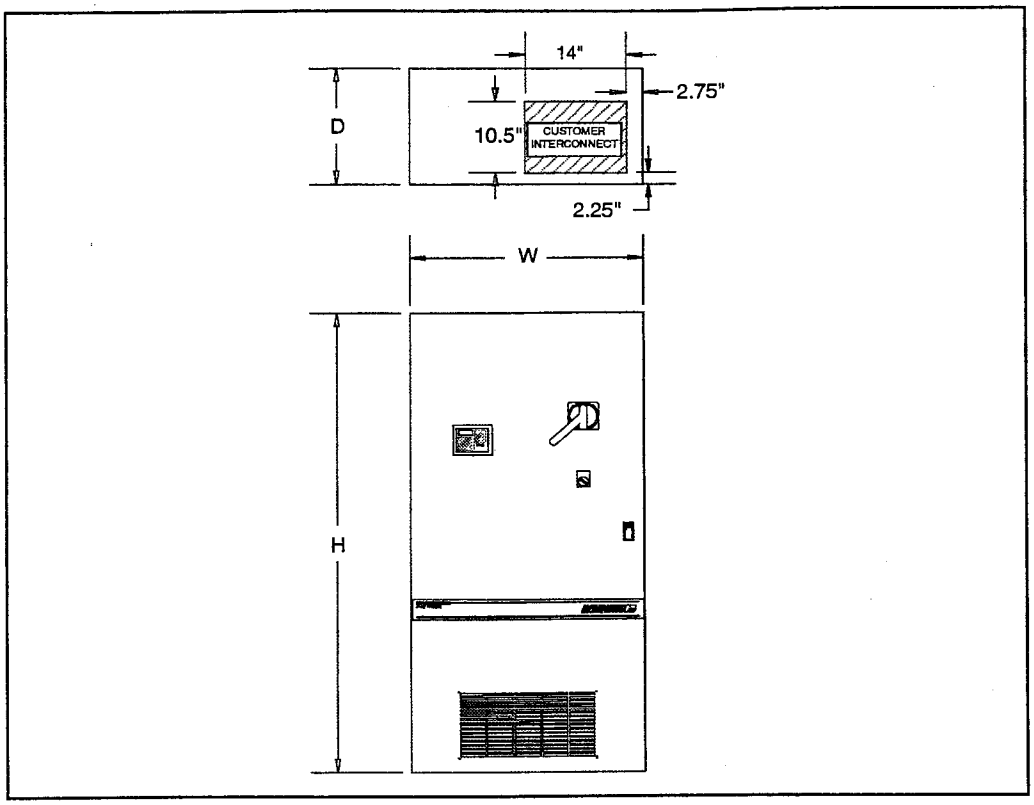


Figure 3.6 – Floor Mount Option Style A Drive Dimensions (100HP @ 208VAC/75-400HP @ 460VAC)

Table 3.6 – Floor Mount Option Style A Drive Dimensions (100HP @ 208VAC/75-400HP @ 460VAC) with Door Interlocked Main Input Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)
100 @ 208V	72	36	18	530
75-150 @ 460V	78.7	31.5	19.7	580 - 1325
200-400 @ 460V	86.6	23.6	23.6	800 - 1400

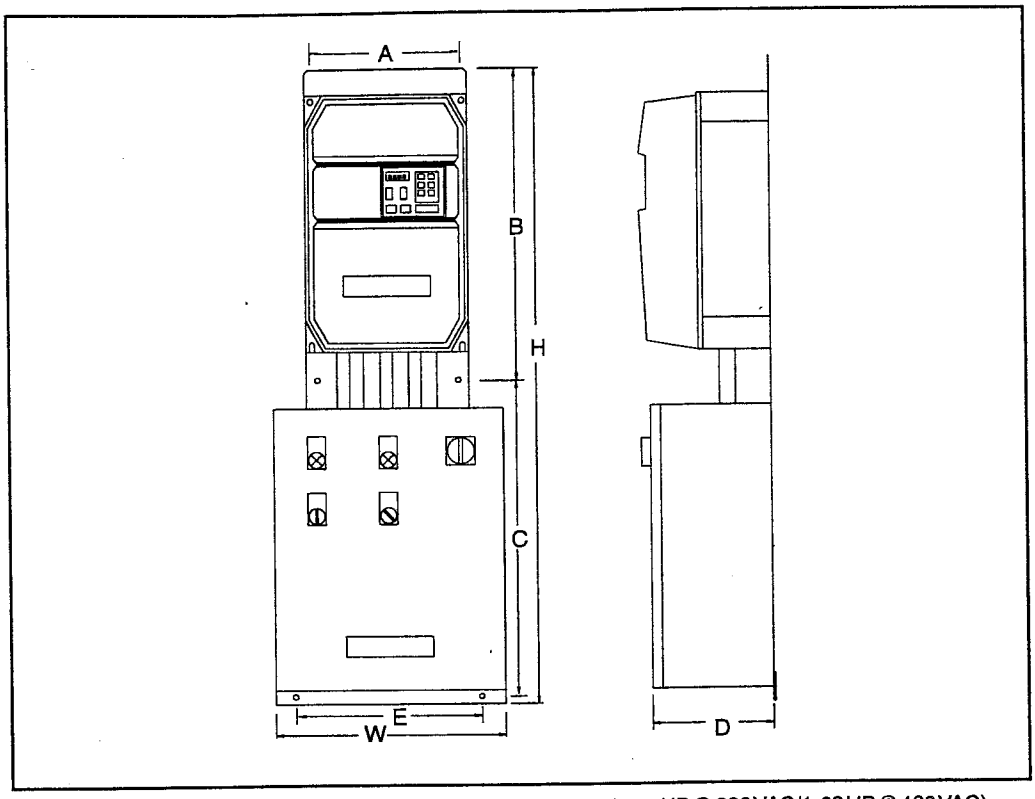


Figure 3.7 – Wall Mount Option Style B Drive Dimensions (1-25HP @ 208VAC/1-60HP @ 460VAC)

Table 3.7 – Wall Mount Option Style B Drive Dimensions (1-25HP @ 208VAC/1-60HP @ 460VAC) with Bypass and Drive Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)	A	B	C	E
1-5 @ 208V	33.5	16.0	8.2	40	7.8	14.0	18.5	15.0
7.5 @ 208V	36.0	16.0	8.2	46	10.1	16.5	18.5	15.0
10 @ 208V	40.0	16.0	10.2	46	10.1	16.5	22.5	15.0
10 @ 208V*	43.9	24.0	12.3	54	10.1	16.5	26.1	22.5
15-25 @ 208V	54.9	24.0	13.3	61	10.3	21.5	32.2	22.5
1-5 @ 460V	33.5	16.0	8.2	40	7.8	14.0	18.5	15.0
7.5-10 @ 460V	36.0	16.0	8.2	46	10.1	16.5	18.5	15.0
15-20 @ 460V	41.0	16.0	9.5	61	10.3	21.5	18.5	15.0
25 @ 460V	45.0	16.0	10.9	63	10.3	21.5	22.5	15.0
25 @ 460V*	48.9	24.0	12.3	72	10.3	21.5	26.1	22.5
30-40 @ 460V	54.7	24.0	13.8	155	13.5	27.0	26.4	22.5
50-60 @ 460V	60.7	24.0	13.8	175	13.5	27.0	32.4	22.5

* Dimensions for drive with optional door-interlocked main input disconnect

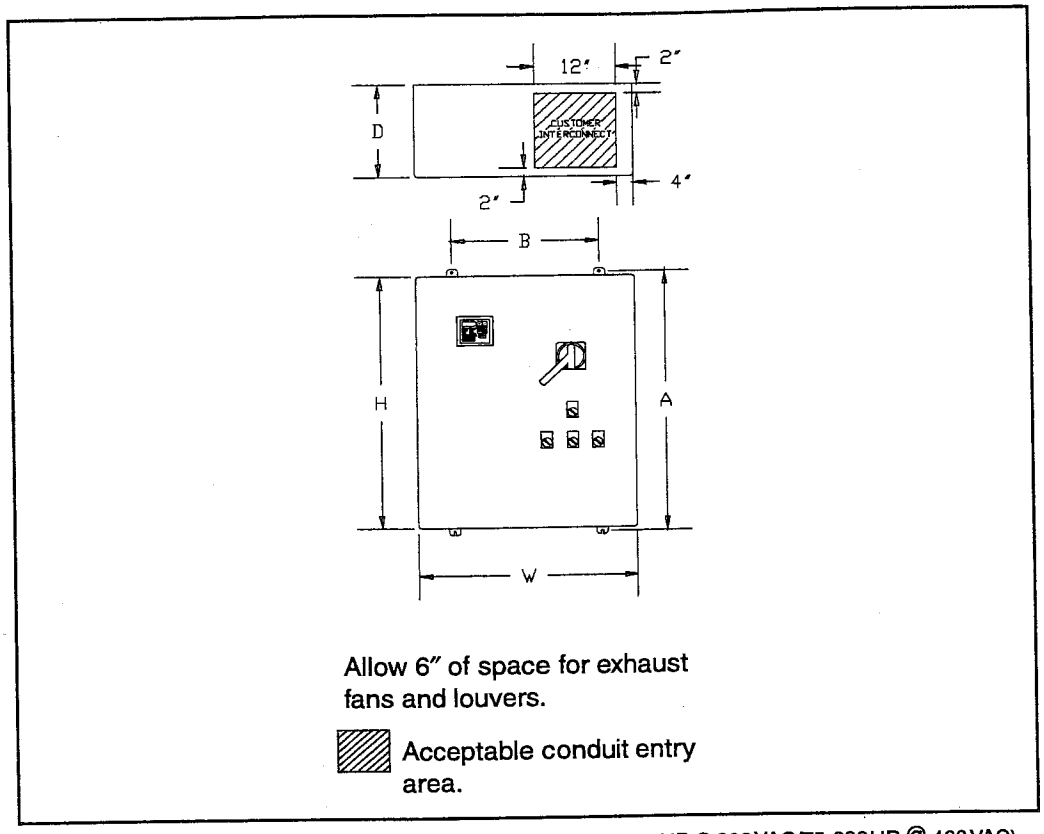


Figure 3.8 – Wall Mount Option Style B Drive Dimensions (30-75HP @ 208VAC/75-200HP @ 460VAC)

Table 3.8 – Wall Mount Option Style B Drive Dimensions (30-75HP @ 208VAC/75-200HP @ 460VAC) with Bypass and Drive Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)	A	B
30 @ 208V	42.0	36.0	16.0	235	43.2	30.0
40-50 @ 208V	48.0	36.0	16.0	290	49.2	30.0
60-75 @ 208V	60.0	36.0	16.0	350 to 365	61.2	30.0
75-100 @ 460V	42.0	36.0	16.0	415 to 450	43.2	30.0
125 @ 460V	48.0	36.0	16.0	625	49.2	30.0
150-200 @ 460V	60.0	36.0	16.0	1200 to 1225	61.2	30.0

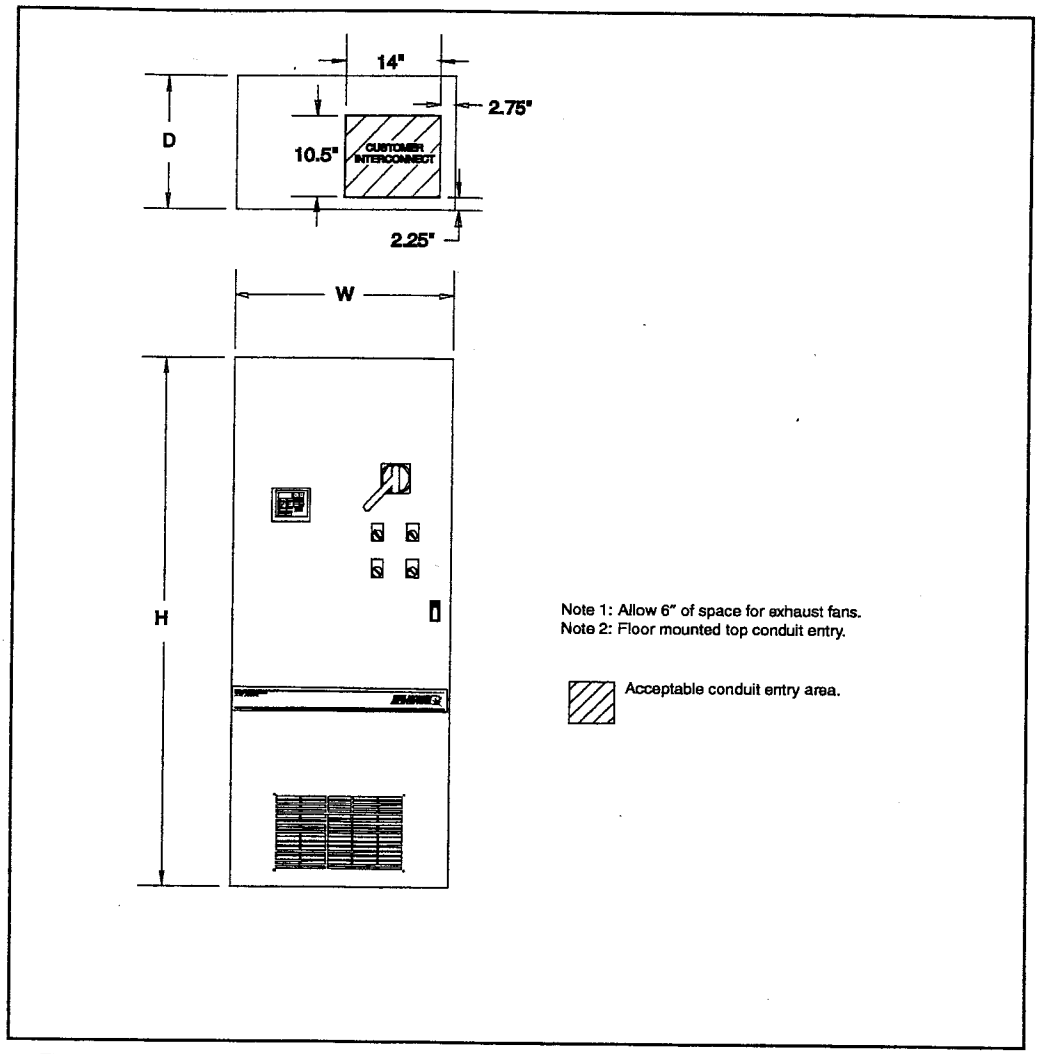


Figure 3.9 – Floor Mount Option Style B Drive Dimensions (100 HP @ 208 VAC/75-150 HP @ 460 VAC)

Table 3.9 – Floor Mount Option Style B Drive Dimensions (100 HP @ 208 VAC/75-150 HP @ 460 VAC) with Bypass and Drive Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)
100 @ 208 V	72.0	36.0	18.0	590
75-150 @ 460 V	78.7	31.5	19.7	615 - 1400

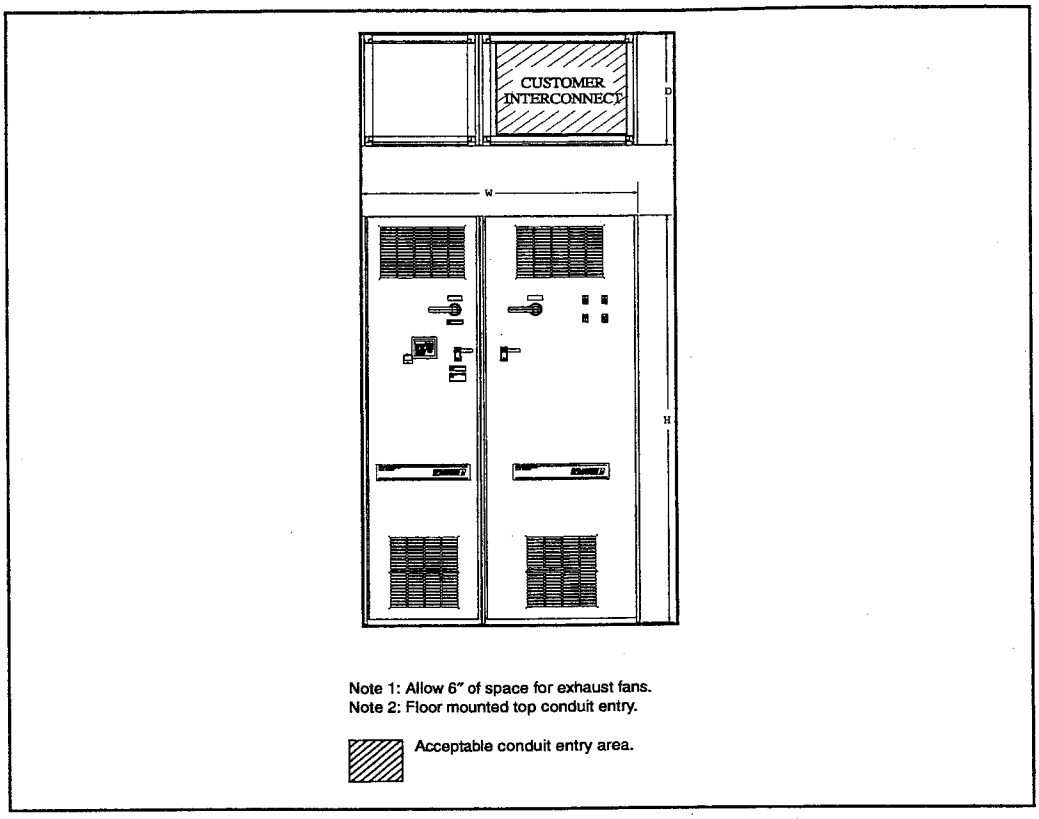


Figure 3.10 – Floor Mount Option Style B Drive Dimensions (200-400HP @ 460VAC)

Table 3.10 – Floor Mount Option Style B Drive Dimensions (200-400HP @ 460VAC) with Bypass and Drive Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)
200-250 @ 460V	86.6	47.2	23.6	1310 to 1800
300-400 @ 460V	86.6	51.1	23.6	1545 to 2015

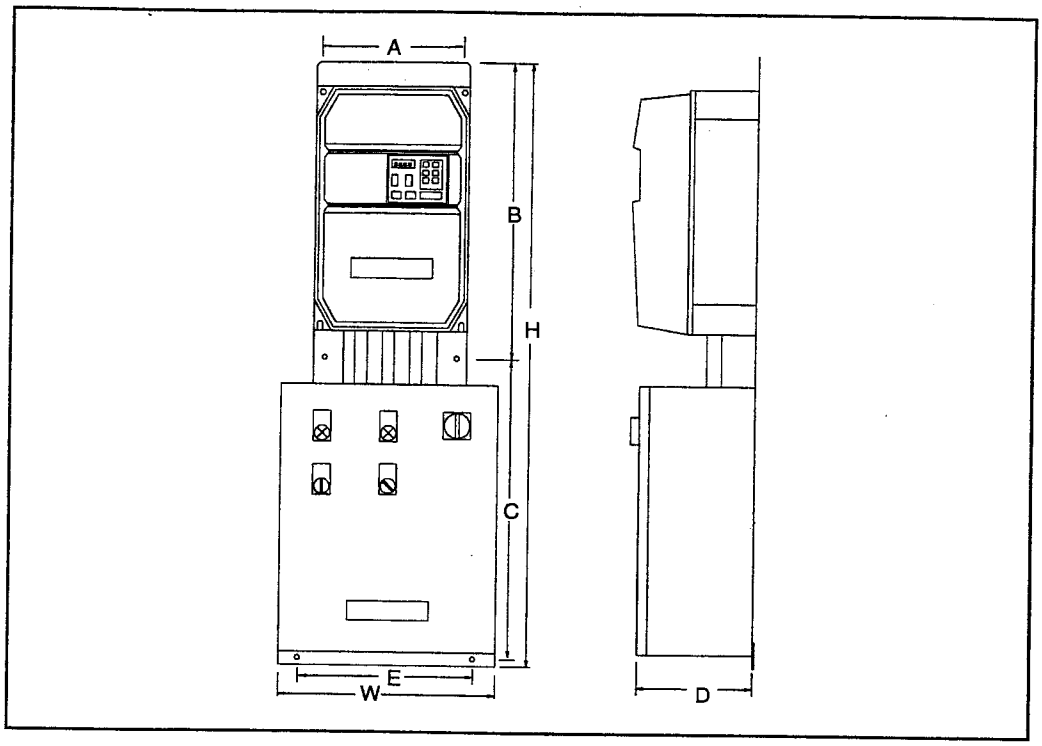
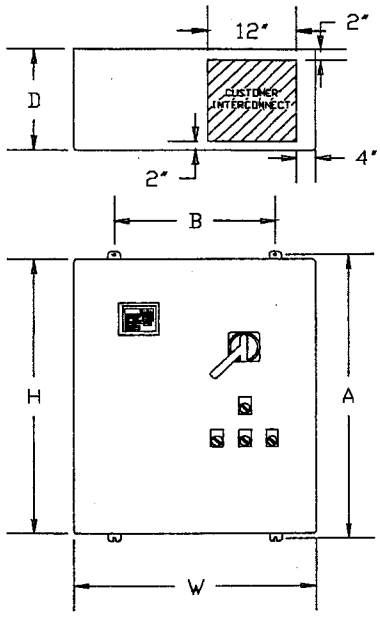


Figure 3.11 – Wall Mount Option Style B+ Drive Dimensions (1-25HP @ 208VAC/1-60HP @ 460VAC)

Table 3.11 – Wall Mount Option Style B+ Drive Dimensions (1-25HP @ 208VAC/1-60HP @ 460VAC) with Three-Phase Input Line Reactor

HP	H (inches)	W (inches)	D (inches)	Weight (lb)	A	B	C	E
1-5 @ 208V	37.5	16.0	10.2	50	7.8	14.0	22.5	15.0
7.5 @ 208V	40.0	16.0	10.2	56	10.1	16.5	22.5	15.0
10 @ 208V	44.0	16.0	10.9	56	10.1	16.5	26.5	15.0
10 @ 208V*	50.0	24.0	13.3	64	10.1	16.5	32.4	23.0
15-25 @ 208V	61.0	24.0	13.3	73	10.3	21.5	32.2	22.5
1-5 @ 460V	37.5	16.0	10.2	50	7.8	14.0	22.5	15.0
7.5-10 @ 460V	40.0	16.0	10.2	56	10.1	16.5	22.5	15.0
15-20 @ 460V	45.0	16.0	10.2	73	10.3	21.5	22.5	15.0
25 @ 460V	49.0	16.0	10.9	78	10.3	21.5	26.5	15.0
25 @ 460V*	55.0	24.0	13.3	97	10.3	21.5	32.4	23.0
30-40 @ 460V	60.7	24.0	13.8	175	13.5	27.0	32.4	23.0
50-60 @ 460V	66.7	24.0	13.8	210	13.5	27.0	38.4	22.5

* Dimensions for Drive with Three-Phase Input Line Reactor and Optional Door-Interlocked Main Input Disconnect.



Allow 6" of space for exhaust fans and louvers.

Acceptable conduit entry area.

Figure 3.12 – Wall Mount Option Style B+ Drive Dimensions (30-75HP @ 208 VAC/75-200HP @ 460VAC)

Table 3.12 – Wall Mount Option Style B+ Drive Dimensions (30-75HP @ 208 VAC/75-200HP @ 460VAC) with Three-Phase Input Line Reactor

HP	H (inches)	W (inches)	D (inches)	Weight (lb)	A	B
30 @ 208V	42.0	36.0	16.0	285 - 300	43.2	30.0
40 @ 208V	48.0	36.0	16.0	325	49.2	30.0
50-75 @ 208V	60.0	36.0	16.0	365-440	61.2	30.0
75-100 @ 460V	42.0	36.0	16.0	475	43.2	30.0
125 @ 460V	48.0	36.0	16.0	550	49.2	30.0
150-200 @ 460V	60.0	36.0	16.0	715-1375	61.2	30.0

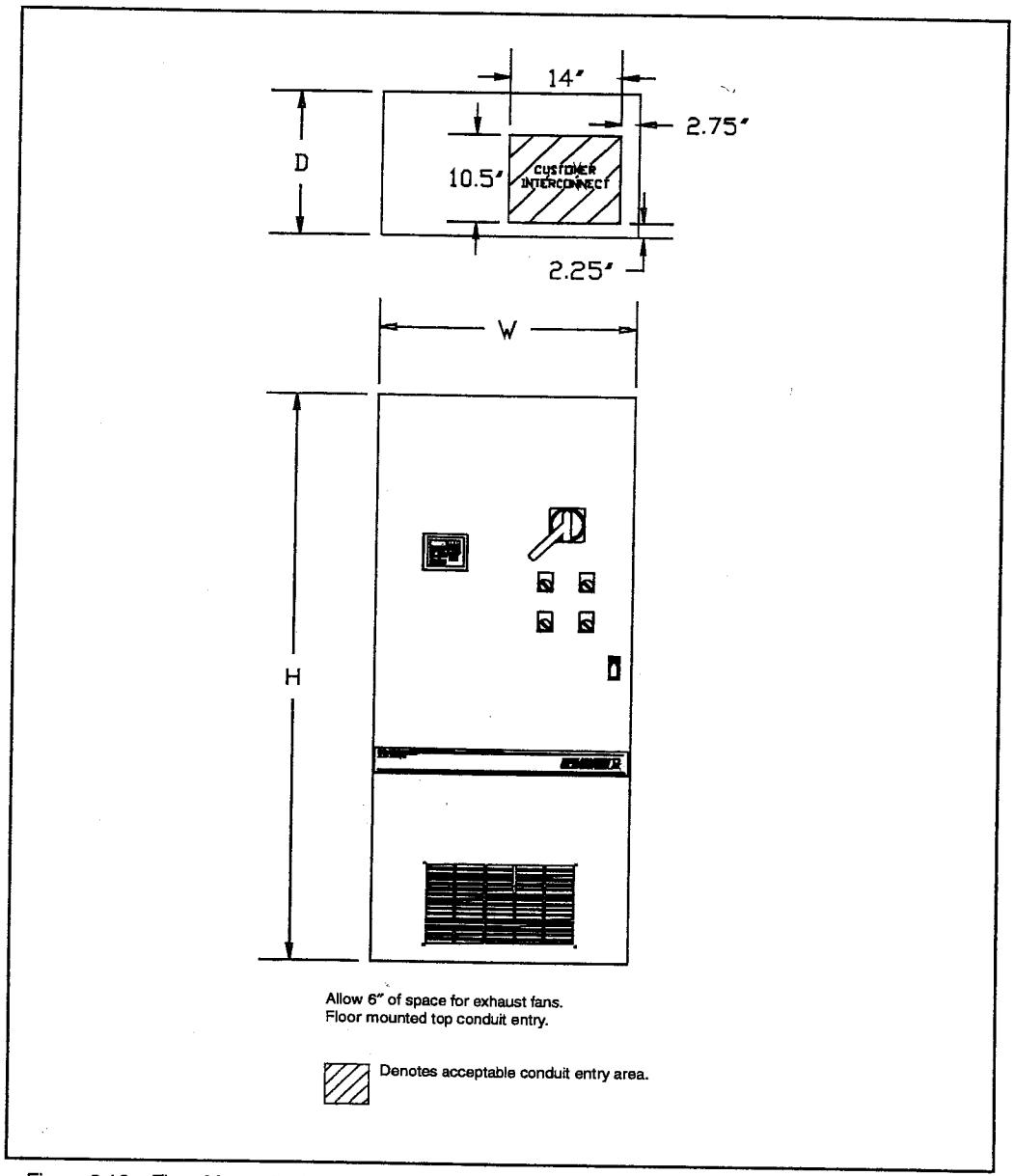


Figure 3.13 – Floor Mount Option Style B+ Drive Dimensions (100 HP @ 208 VAC/75-200 HP @ 460 VAC)

Table 3.13 – Floor Mount Option Style B+ Drive Dimensions (100 HP @ 208 VAC/75-200 HP @ 460 VAC) with Three-Phase Input Line Reactor

HP	H (inches)	W (inches)	D (inches)	Weight (lb)
100 @ 208 V	72.0	36.0	18.0	710
75-150 @ 460 V	78.7	31.5	19.7	670 - 1475

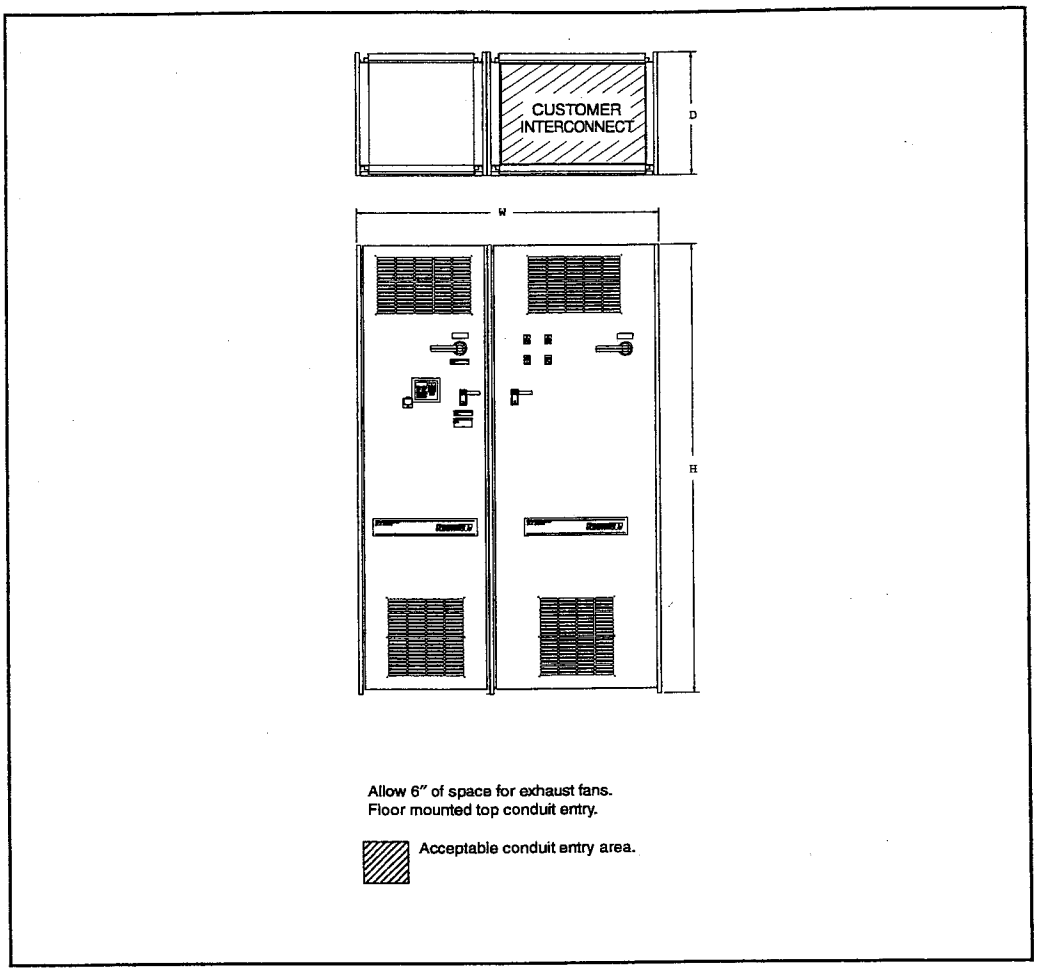


Figure 3.14 – Floor Mount Option Style B+ Drive Dimensions (200-400HP @ 460VAC)

Table 3.14 – Floor Mount Option Style B+ Drive Dimensions (200-400HP @ 460VAC) with Bypass and Drive Disconnect Switch

HP	H (inches)	W (inches)	D (inches)	Weight (lb)
200-250 @ 460V	86.6	47.2	23.6	1310 to 1805
300-400 @ 460V	86.6	51.1	23.6	1545 to 2015

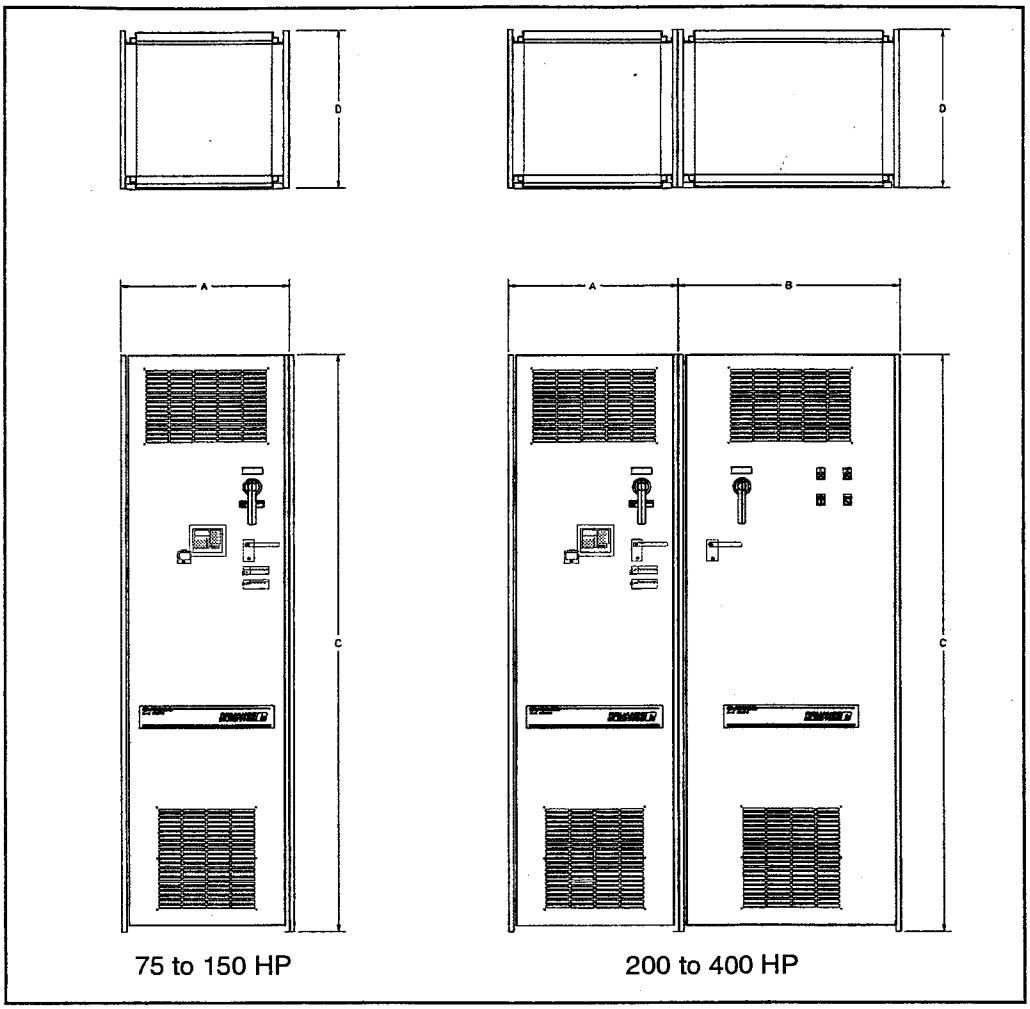


Figure 3.15 – Floor Mount Drive Dimensions (75-400HP @460VAC)

Table 3.15 – Floor Mount Drive Dimensions (75-400HP @460VAC)

HP	A (inches)	B (inches)	C (inches)	D (inches)	Weight (lb)
75-150HP @460V	33.0	n/a	86.6	19.8	250 to 950
200-250HP @460V	25.2	25.2	86.6	23.6	800 to 1300
300-400HP @460V	25.2	33.2	86.6	23.6	1000 to 1400

3.2 Mounting the Drive

Refer to figures 3.2 to 3.14 and tables 3.2 to 3.14 for drive mounting dimensions.

1 to 150 HP Drives: Attach the drive to the vertical surface using the four mounting holes provided. Use washers under the bolt heads.

1-60 HP Drives: Use six 318-16 (MIO) user-supplied mounting bolts and washers.

75-400 HP Drives: Must be floor-mounted. Use the cabinet mounting brackets supplied with the drive.

3.3 Wiring Requirements for the Drive

ATTENTION: You are 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.

Certain drive requirements should be checked before continuing with drive installation. Wire sizes, branch circuit protection, and E-stop wiring (see section 6.1) need to be evaluated.

3.3.1 Meeting Terminal Strip Input and Output Specifications

The terminal strip on the Regulator board provides terminals for 24VDC power for the eight remote control inputs. Refer to tables A.3 to A.6 for control input and output specifications.

3.3.2 Determining Wire Size Requirements

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

3.3.2.1 Conduit Entry Opening Sizes

It is important to accurately determine the size of the conduit openings so that the wire planned for a specific entry point will fit through the opening. Conduit opening sizes are shown in figures 4.1 to 4.14.

3.3.2.2 Maximum 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 table 3.16 for maximum power wire sizes.

Table 3.16 – Maximum Wire Sizes

Type of Wiring and Terminals	Minimum to Maximum Wire Sizes		
	Drive HP	AWG (208V)	AWG (460V)
Type: AC Input/Output Power **Terminals:** R/L1, S/L2, T/L3 U/T1, V/T2, W/T3	1-2	14 to 8	14 to 8
	3	14 to 8	14 to 8
	5	12 to 8	14 to 8
	7.5	8	14 to 8
	10	6 to 4	12 to 8
	15-20	4	8
	20	3 to 1/0	6 to 4
	25	2 to 250 MCM	6 to 4
	30	1/0 to 250 MCM	6 to 4
	40	2/0 to 250 MCM	3 to 1/0
	50	3/0 to 250 MCM	2 to 1/0
	60	250 to 300 MCM	2 to 1/0
	75	350 MCM	2/0 to 250 MCM
	100	500 MCM	3/0 to 250 MCM
	125	n/a	250 to 300 MCM
	150	n/a	350 MCM
	200	n/a	400 to 500 MCM
	250	n/a	(2) 4/0 to (2) 500 MCM
	300	n/a	(2) 250 to (2) 500 MCM
	350	n/a	(2) 300 to (2) 500 MCM
	400	n/a	(2) 400 to (2) 500 MCM
Type: Ground **Terminals:** GND or PE	1-10	10 to 8	14 to 8
	15-20	4 to 1/0	10 to 8
	25-40	4 to 250 MCM	8 to 4
	50	4 to 250 MCM	6 to 1/0
	60	3 to 250 MCM	6 to 1/0
	75	3 to 250 MCM	6 to 250 MCM
	100	2 to 250 MCM	6 to 250 MCM
	75 AC Ground	n/a	6 to 250 MCM
	75-100 DC Ground	n/a	4 to 250 MCM
	200-400	n/a	350 MCM (2X)

3.3.2.3 Recommended Control and Signal Wire Sizes

The recommended wire sizes for connecting I/O signals to the Regulator board terminal strip (terminals 1 to 31) are 20 to 14 AWG. Recommended terminal tightening torque is 4.5 in-lb. Operator controls can be up to 1000 feet from the VTAC 7 drive.

3.3.2.4 Recommended Motor Lead Lengths

These motor lead lengths are recommended to reduce line disturbances and noise. See figure 3.16 and tables 3.17.

For applications:

- Using one motor, motor lead length should not exceed 500 feet.
- With multiple motors, total motor lead length should not exceed 500 feet.

Your application might be restricted to a shorter lead length because of wire type, wire placement (such as in conduit or a cable tray), type of line reactor, or type of motor.

When total lead length exceeds 500 feet, nuisance trips can occur. These trips are caused by capacitive current flow to ground. Note that these capacitively-coupled currents should be taken into consideration when working in areas where drives are running. If the motor lead length must exceed these limits, the addition of output line reactors or other steps must be taken to correct the problem.

Maximum lead lengths were determined by meeting NEMA standard MG1 Part 31.40.4.2 for motor insulation capability (dV/dT not less than 0.1µsec rise time). Voltage spikes at the motor terminals are not to exceed 1600 V due to the reflected wave. 208 V drive applications do not apply in this situation.

Table 3.17 – Maximum Motor Lead Lengths with 460 VAC Motor

460VAC VTAC 7 HP Rating	Filter Type	Maximum Motor Lead Lengths with 460 VAC Motor (in Feet)*		
		Carrier Frequency		
		2kHz	4kHz	8kHz
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 200		800	500	500
250 to 400		1000	1000	N/A

Table 3.17 – Maximum Motor Lead Lengths with 460 VAC Motor (Continued)

460VAC VTAC 7 HP Rating	Filter Type	Maximum Motor Lead Lengths with 460 VAC Motor (in Feet)*		
		Carrier Frequency		
		2kHz	4kHz	8kHz
1 to 2	A 5% MTE 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 200		1000	1000	1000
250 to 400		1000	1000	N/A

* Note that the lead lengths listed are valid with Reliance Electric inverter duty motors.

Table 3.18 – Reactors

VTAC 7 HP Rating	460 V 5% MTE Reactor*		VTAC 7 HP Rating	460 V 5% MTE 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

* These part numbers are for a reactor with a capacitor filter.
MTE standard reactors can be used on VTAC 7 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).

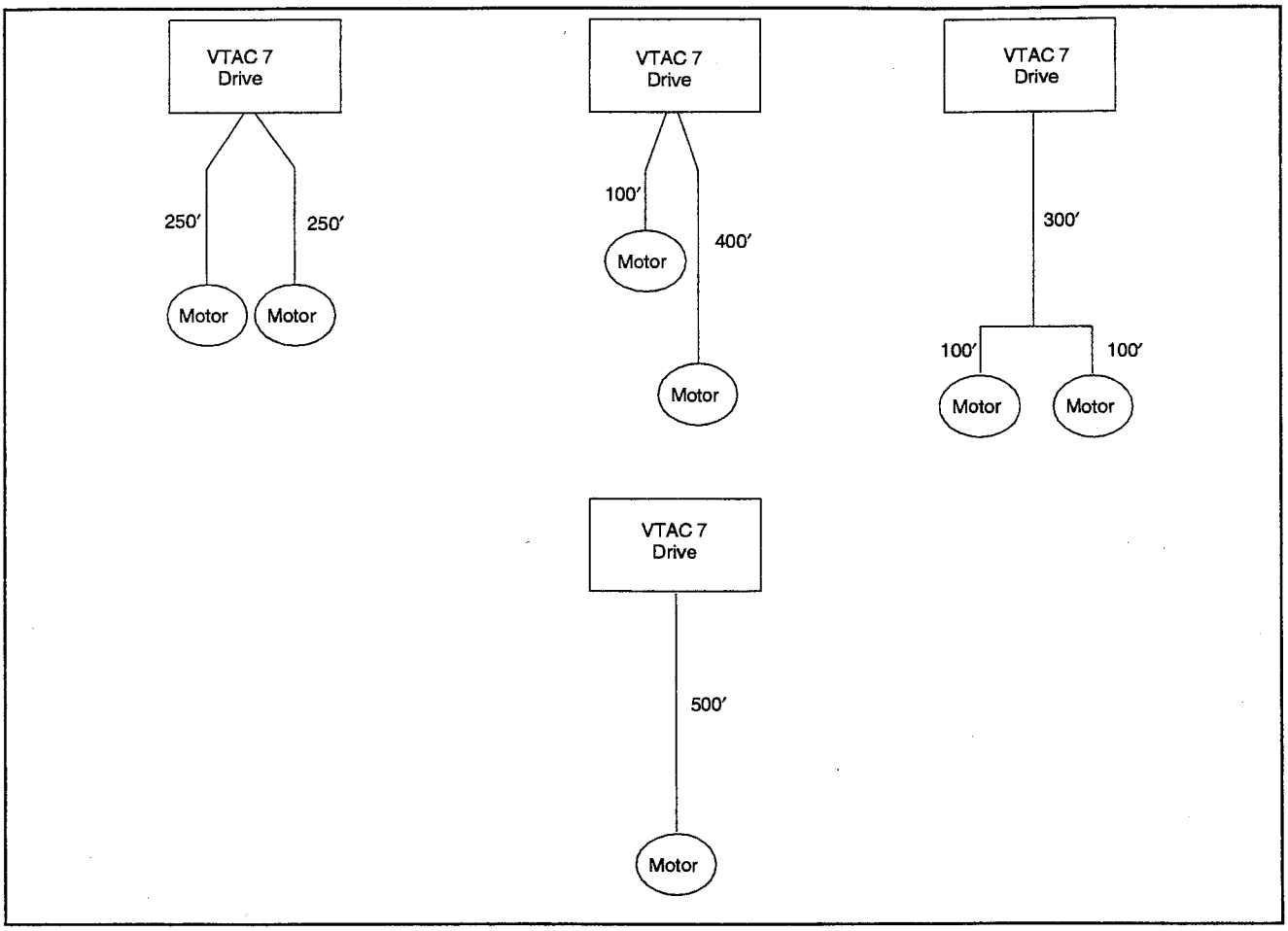


Figure 3.16 – Motor Lead Lengths

3.3.2.5 Recommended Serial Communication Cable Lengths

Connector J8 on the Regulator board is an RS-232 serial communication port. This connector allows the VTAC 7 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:

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

User-constructed cables can be up to 50 feet long. For communication between a VTAC 7 drive and a personal computer, the CS3000 software must also be used. Refer to instruction manual D2-3348 for more information.

The Regulator board has 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 to 3) on the terminal strip, or an Operator Interface Module (OIM).

3.3.3 Verifying Power Module Output Current Rating is Greater than Motor Full Load Amps

Verify that the VTAC 7 drive output current rating is greater than the motor's full load current (amps). Table 2.1 lists the output current values.

3.3.4 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 3.19. 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. If input fuses are not provided with your drive, recommended fuse values are shown in table 3.19. The input fuse ratings listed in table 3.19 are applicable for one drive per branch circuit. No other load may be applied to that fused circuit.

Recommended fuse types:

- Up to 300 HP: UL Class J, 600V, time delay
- Above 300 HP: UL Class L, 600V, time delay

200 to 400 HP drives contain internal fusing sized to protect the drive. Install fuses to protect the input wiring in accordance with local codes.

Table 3.19 – AC Input Line Fuse Selection Values

Model Number	Horsepower Rating (HP)	Input Voltage (VAC)	Fuse Rating (A)
1H2160, 1H2260	1	208	8
2H2160, 2H2260	2	208	15
3H2160, 3H2260	3	208	25
5H2160, 5H2260	5	208	30
7H2160, 7H2260	7.5	208	45
10H2160, 10H2260	10	208	60
15H2160, 15H2260	15	208	70
20H2160, 20H2260	20	208	100
25W2160	25	208	150
30W2160	30	208	175
40W2160	40	208	225
50W2160	50	208	250
60W2160	60	208	350
75W2160	75	208	400
100W2160	100	208	450
1H4160, 1H4260	1	460	4.5
2H4160, 2H4260	2	460	7.5
3H4160, 3H4260	3	460	12
5H4160, 5H4260	5	460	15
7H4160, 7H4260	7.5	460	25
10H4160, 10H4260	10	460	30
15H4160, 15H4260	15	460	45
20H4160, 20H4260	20	460	60
25H4160, 25H4260	25	460	70
30H4160, 30H4260	30	460	80
40H4160, 40H4260	40	460	100
50H4160, 50H4260	50	460	125
60H4160, 60H4260	60	460	150
75H4160, 75W4160	75	460	175
100H4160, 100W4160	100	460	225
125H4160, 125W4160	125	460	300
150H4160, 150W4160	150	460	350
200H4160, 200W4160	200	460	450
250H4160	250	460	600
300H4160	300	460	600
350H4160	350	460	800
400H4160	400	460	800

CHAPTER 4

Wire Routing Locations and Grounding

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

4.1 Verifying the Drive's Watts Loss Rating

When mounting the drive inside another enclosure, 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. Make sure adequate ventilation is provided based on the drive's watts loss rating.

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

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.

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.

All wiring must be installed in conformance with applicable local, national, and international codes, such as 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 to 4.14 show the wire routing, grounding terminal, and power terminal strips of the VTAC 7 drives.

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.

4.3 Grounding the Drive

ATTENTION: You are 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.

To ground the drive (drive only):

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 4.6.

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

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.

To ground the drive (drive with options):

Step 1. Open the option cabinet.

Step 2. Run a suitable equipment grounding conductor unbroken from the terminal strip's ground terminal to the earth ground. See figures 4.7 to 4.14.

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. Close the option cabinet door.

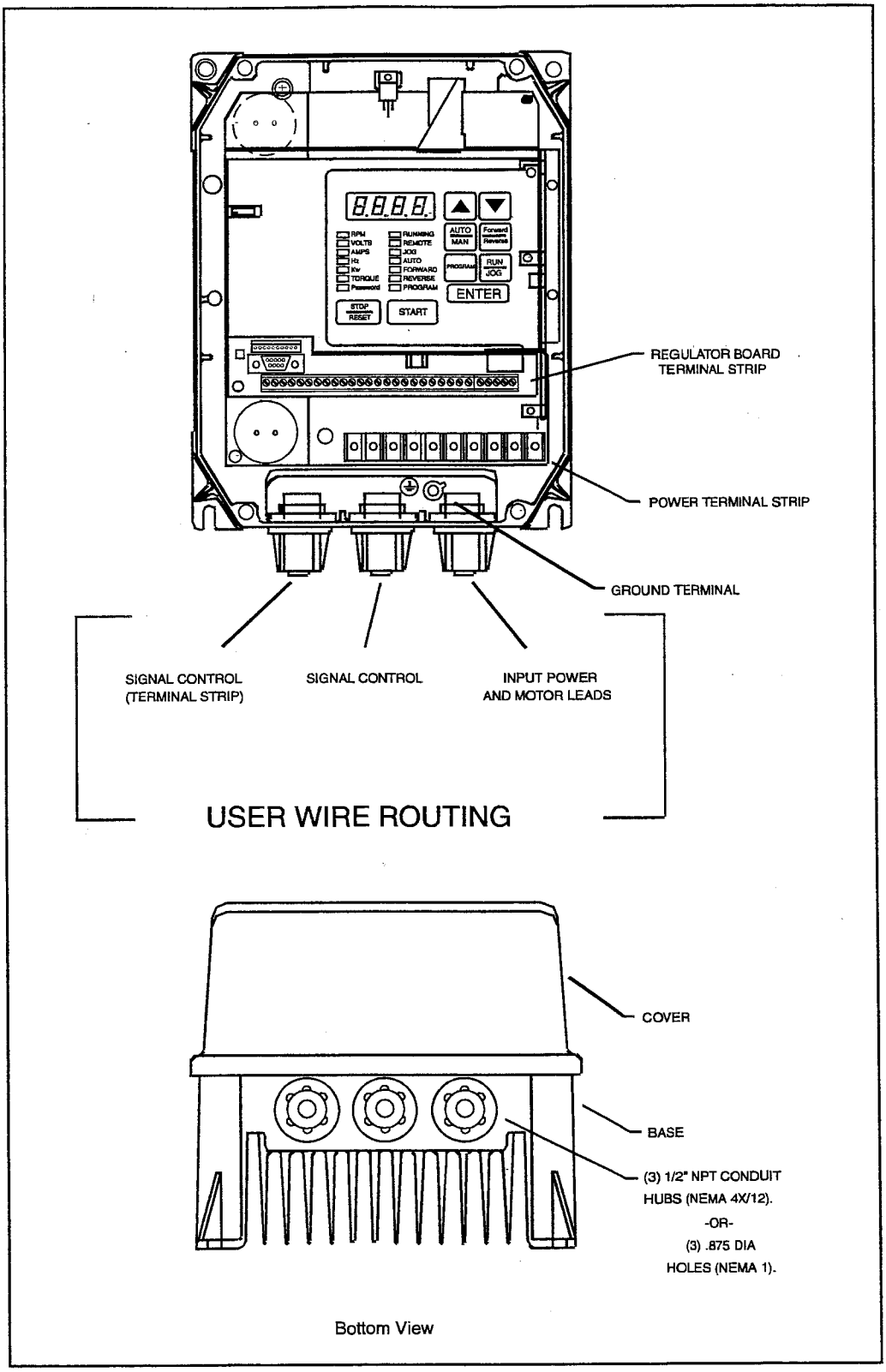


Figure 4.1 – Drive Only Wire Routing and Ground Terminal Locations (1-5HP @ 208VAC or 460VAC)

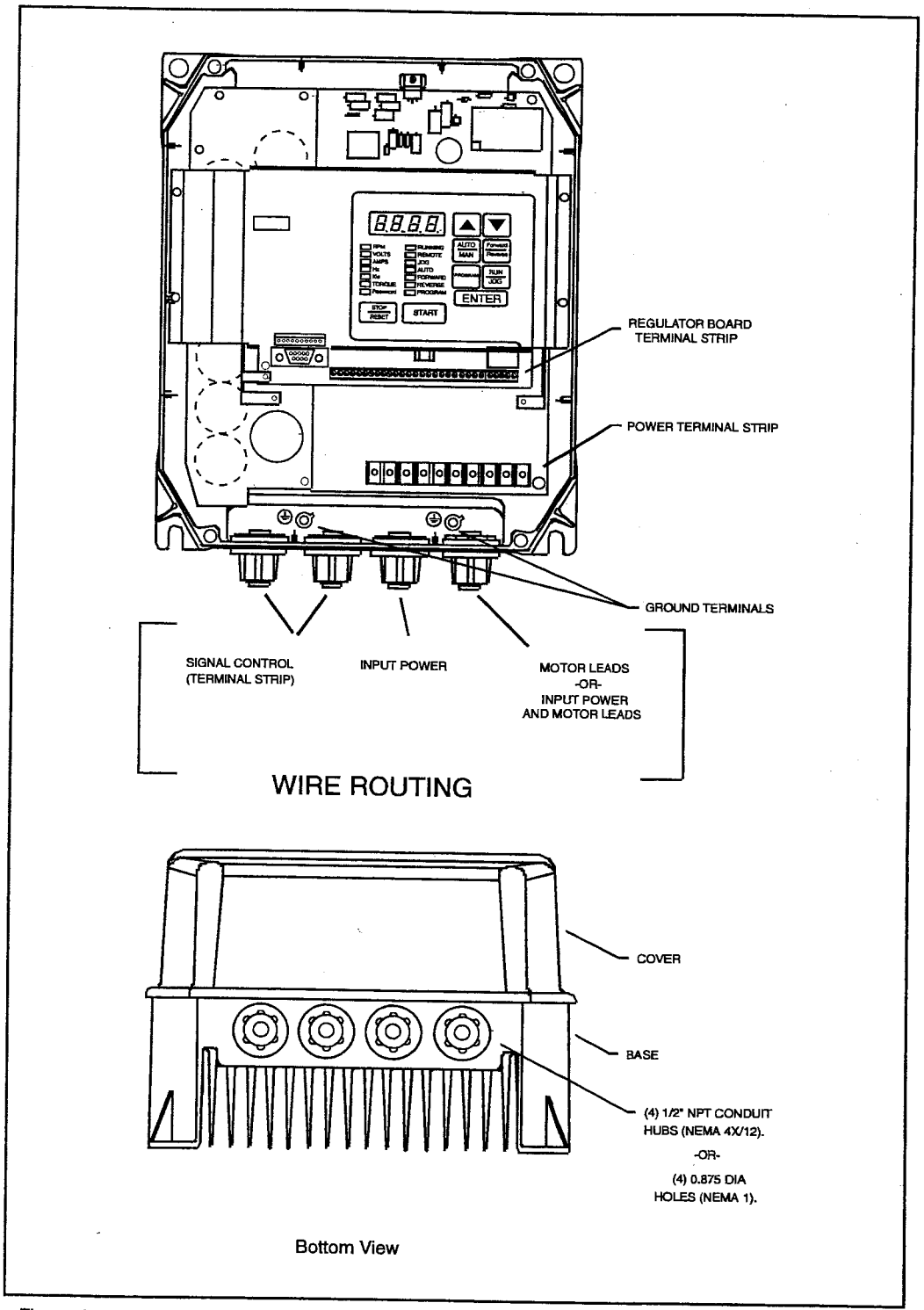


Figure 4.2 – Drive Only Wire Routing and Ground Terminal Locations (7.5-10 HP @ 208 VAC or 460 VAC)

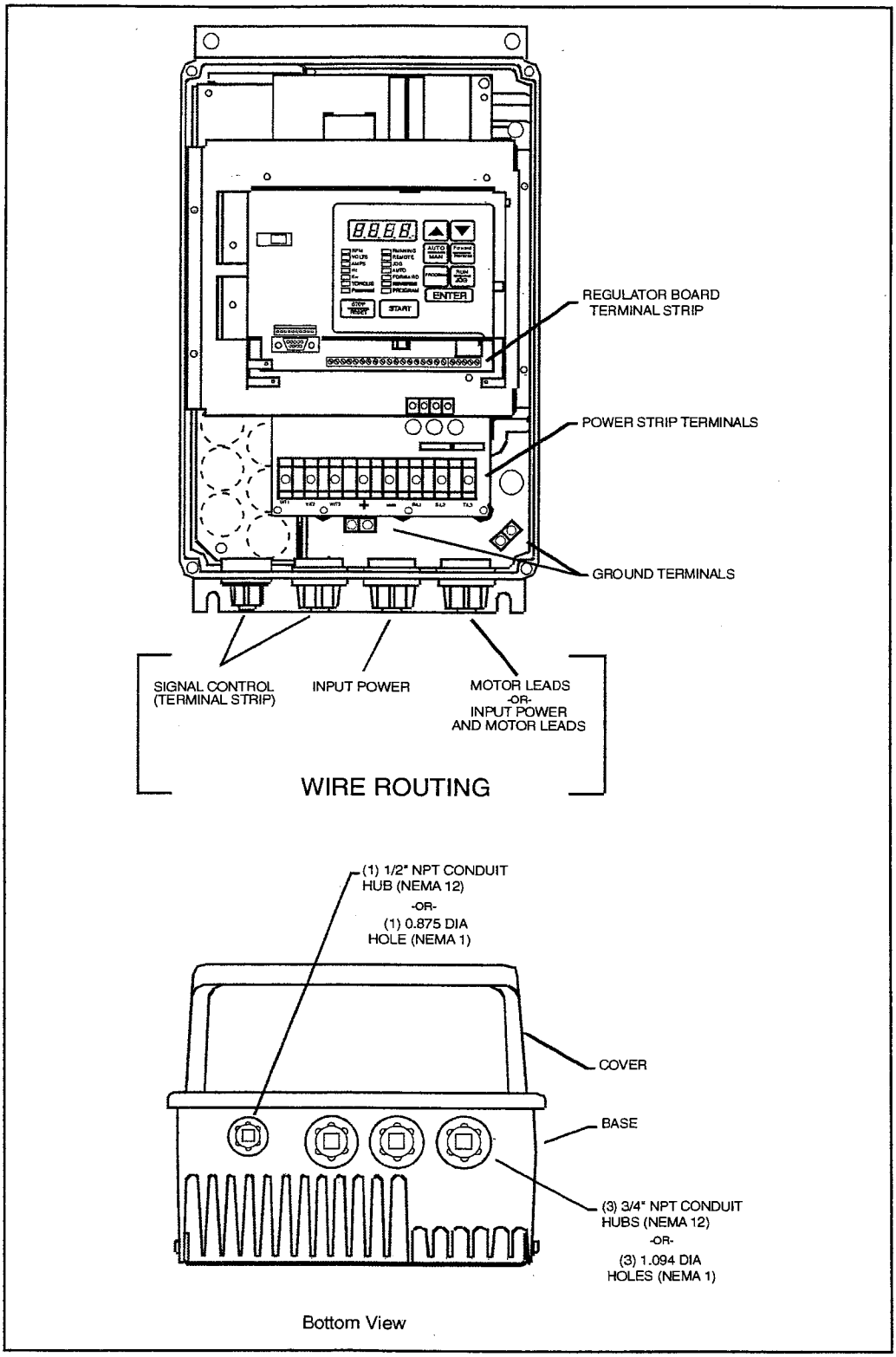


Figure 4.3 – Drive Only Wire Routing and Ground Terminal Locations
(15-20HP @ 208VAC/15-25HP @ 460VAC)

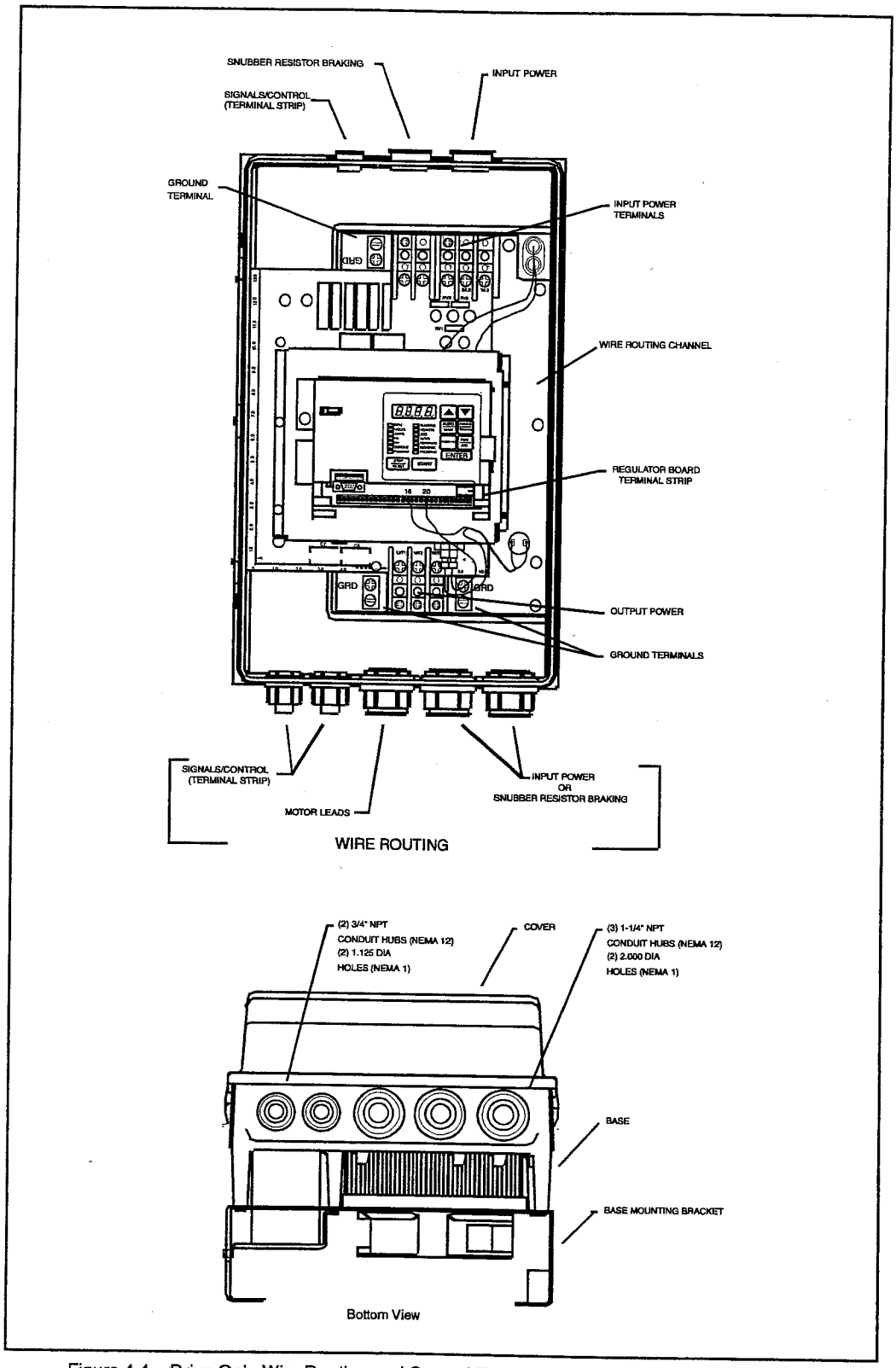


Figure 4.4 – Drive Only Wire Routing and Ground Terminal Locations (30-60HP @ 460VAC)

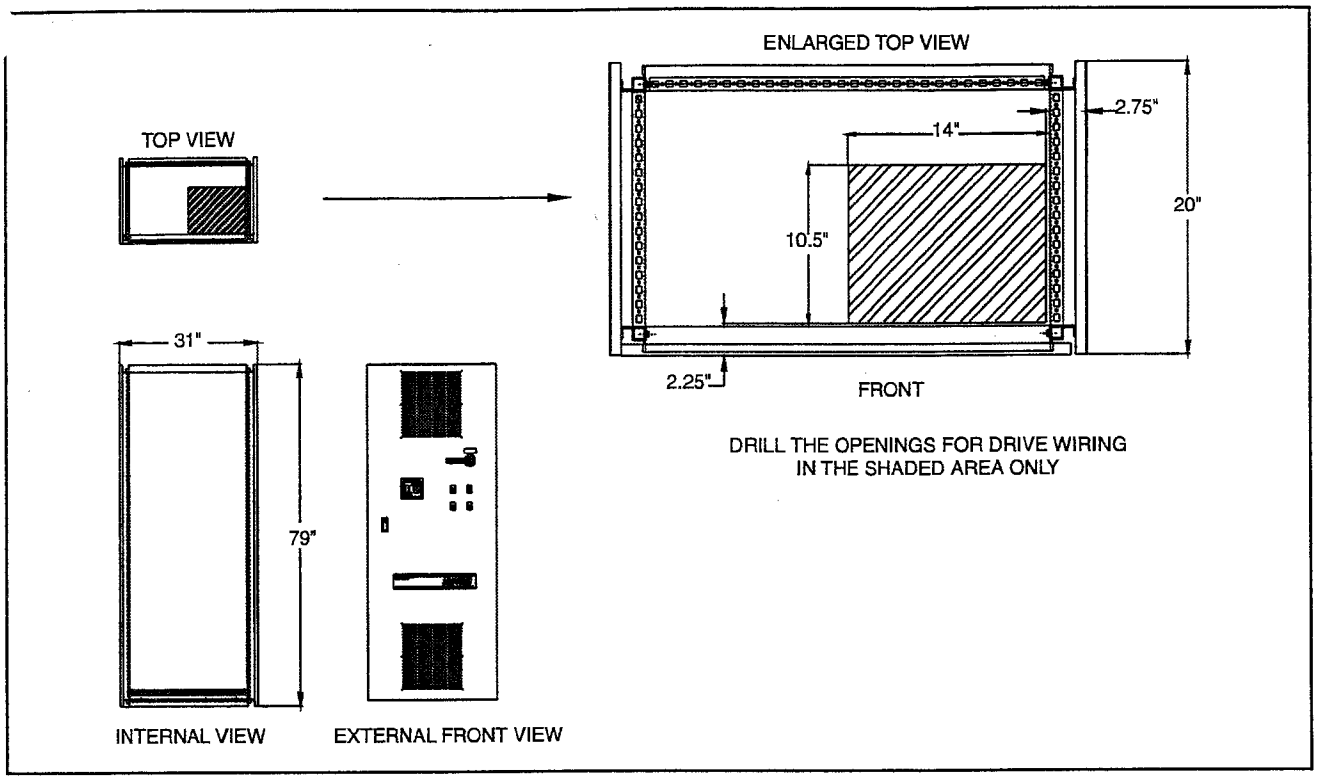


Figure 4.5 – Floor Mount Drive Only: Acceptable Drill Areas for Input and Output Wiring (75-150HP @ 460VAC)

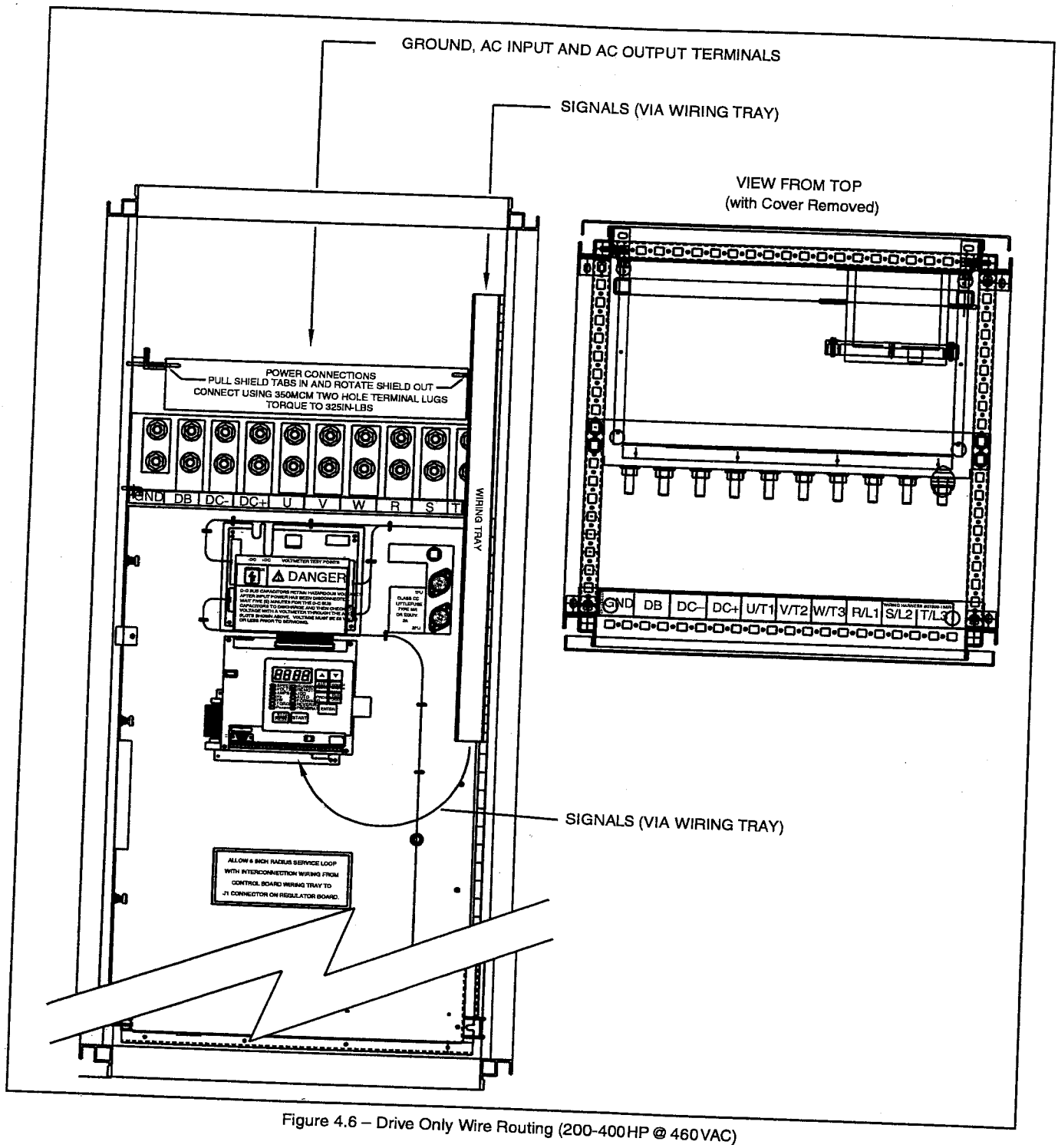


Figure 4.6 – Drive Only Wire Routing (200-400HP @ 460VAC)

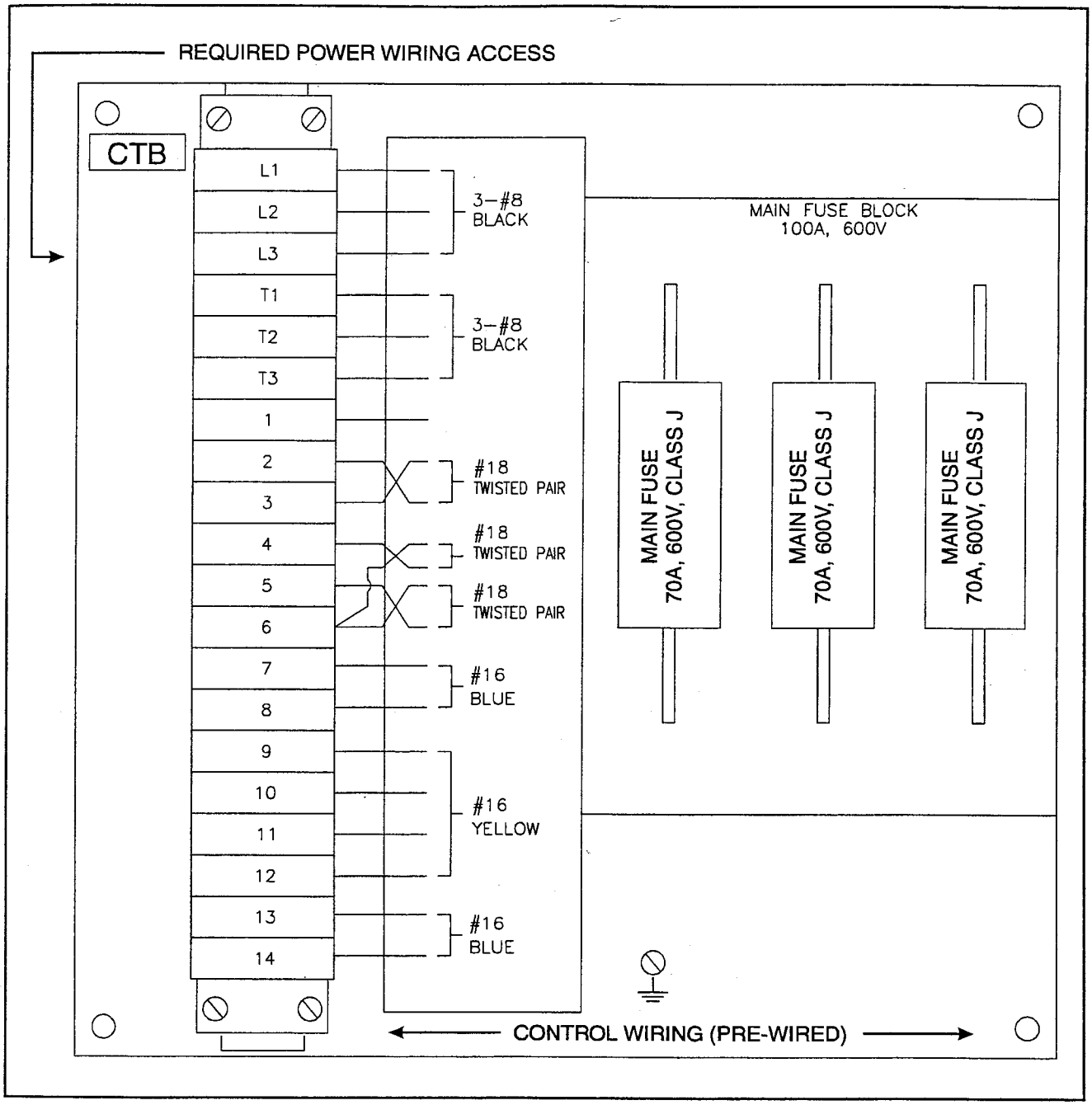


Figure 4.7 – Option Style A Drive Wire Routing (1-25 HP @ 208 VAC/1-60 @ 460 VAC)

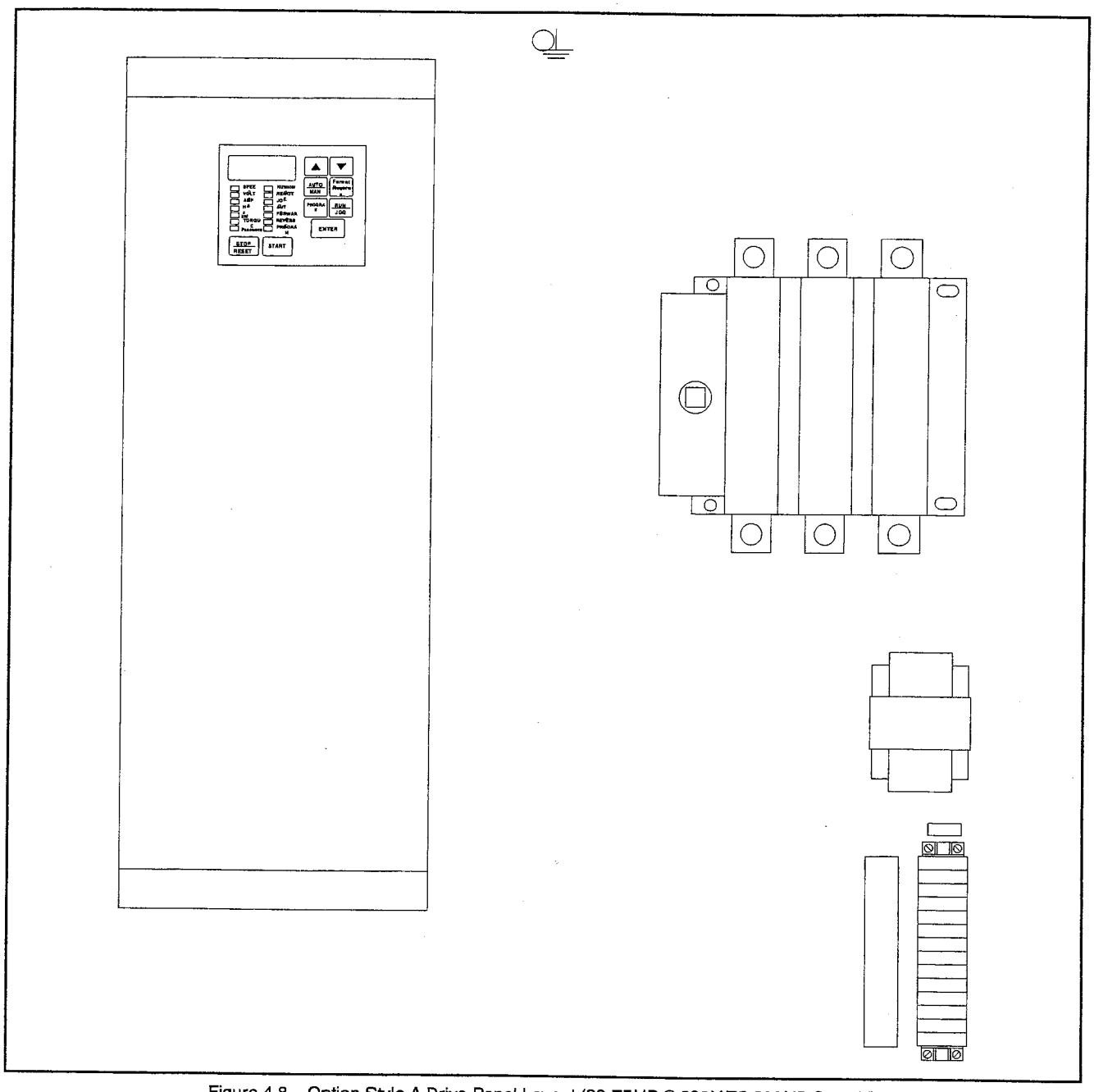


Figure 4.8 – Option Style A Drive Panel Layout (30-75HP @ 208V/75-200HP @ 460V)

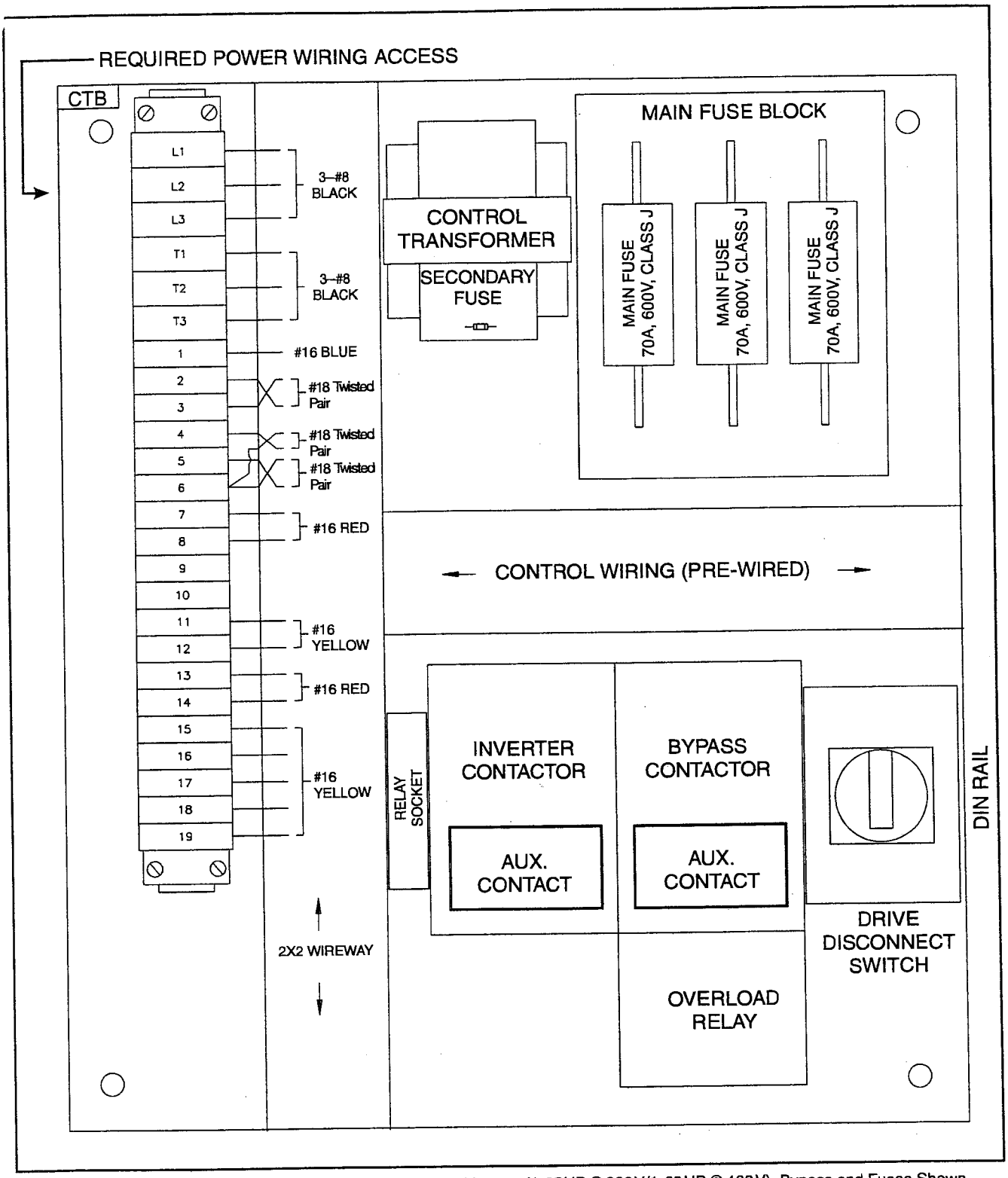


Figure 4.9 – Option Style B Drive Wire Routing and Panel Layout (1-25HP @ 208V/1-60HP @ 460V). Bypass and Fuses Shown

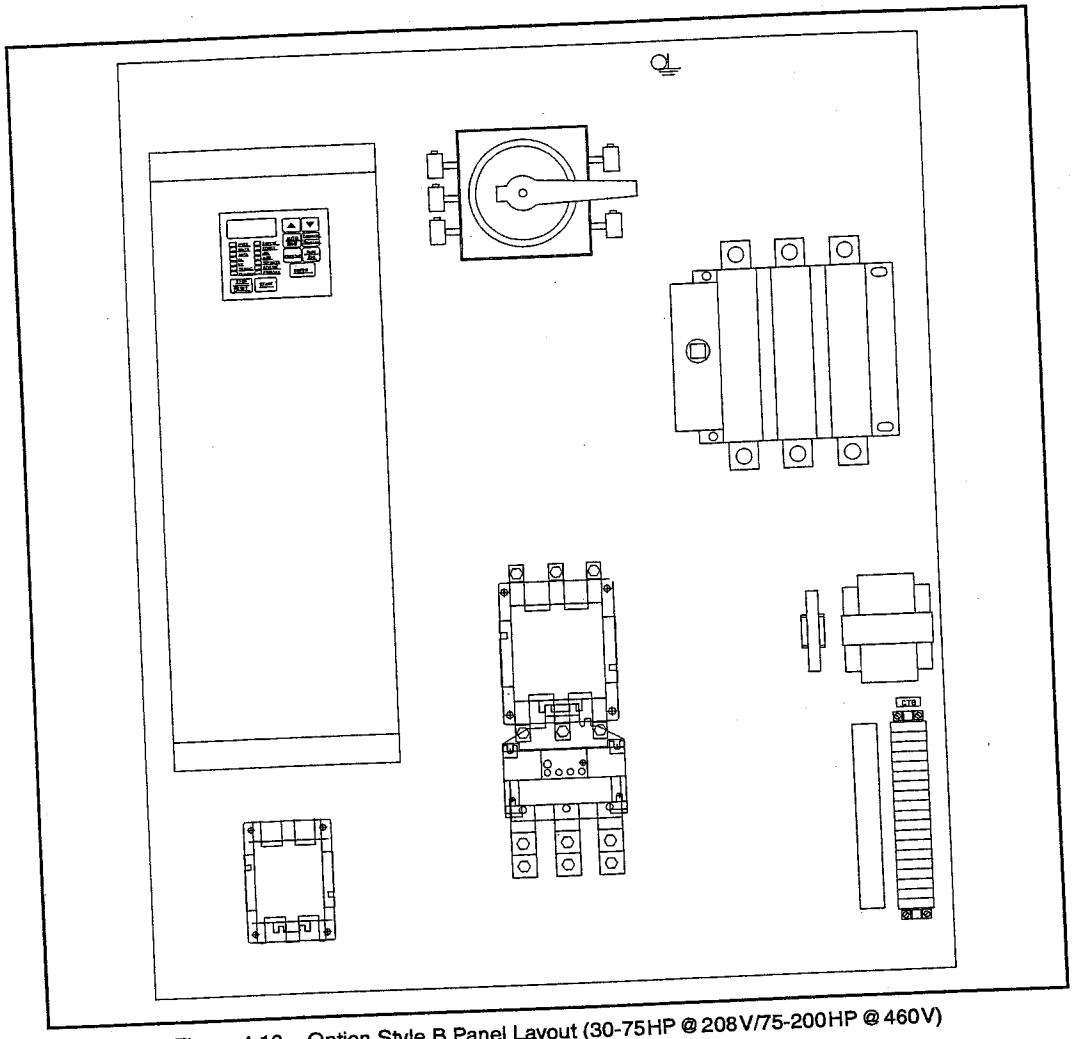


Figure 4.10 – Option Style B Panel Layout (30-75HP @ 208V/75-200HP @ 460V)

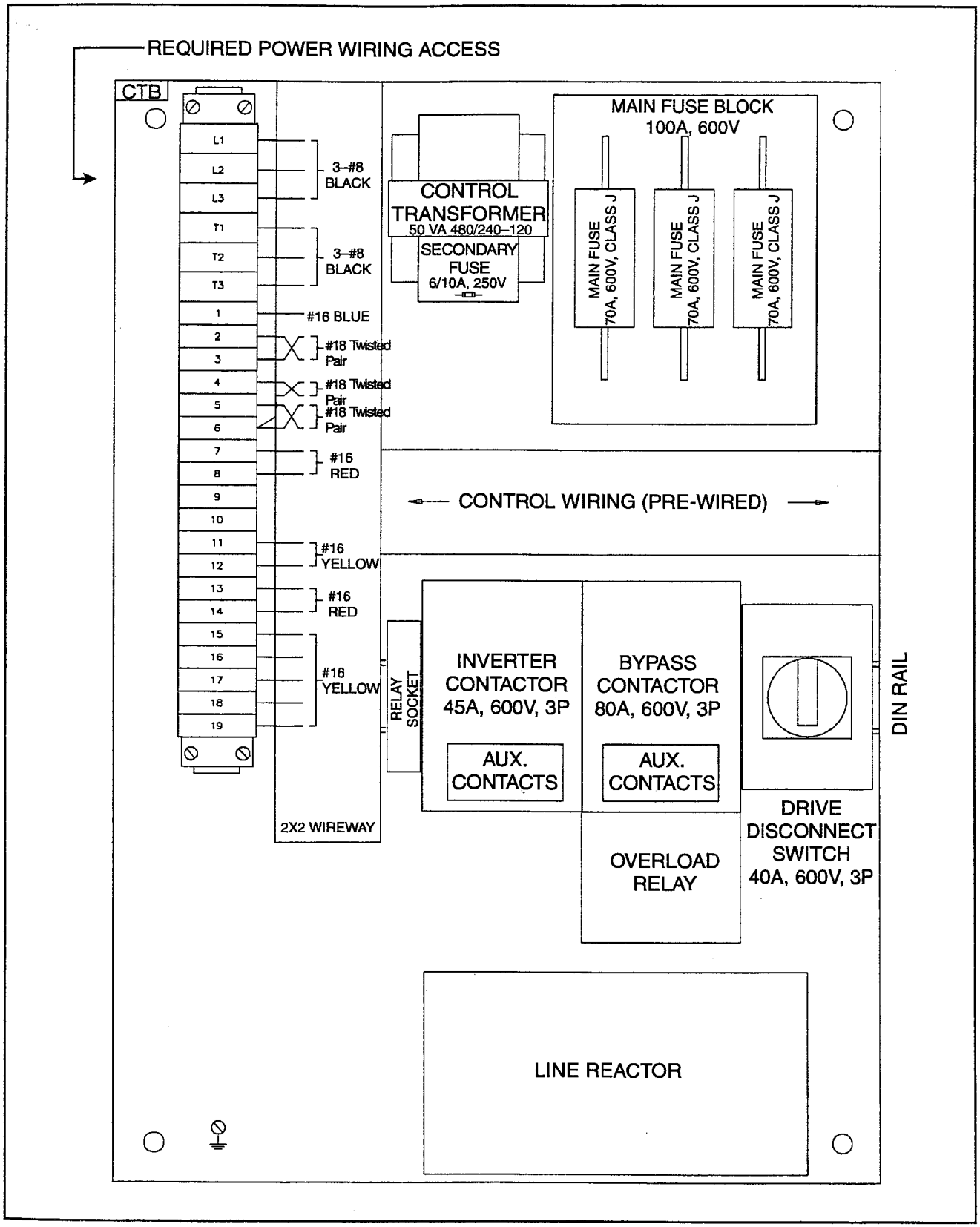


Figure 4.11 – Option Style B+ Drive Wire Routing and Panel Layout (1-25HP @ 208V/1-60HP @ 460V). Line Reactor, Bypass, and Fuses Shown

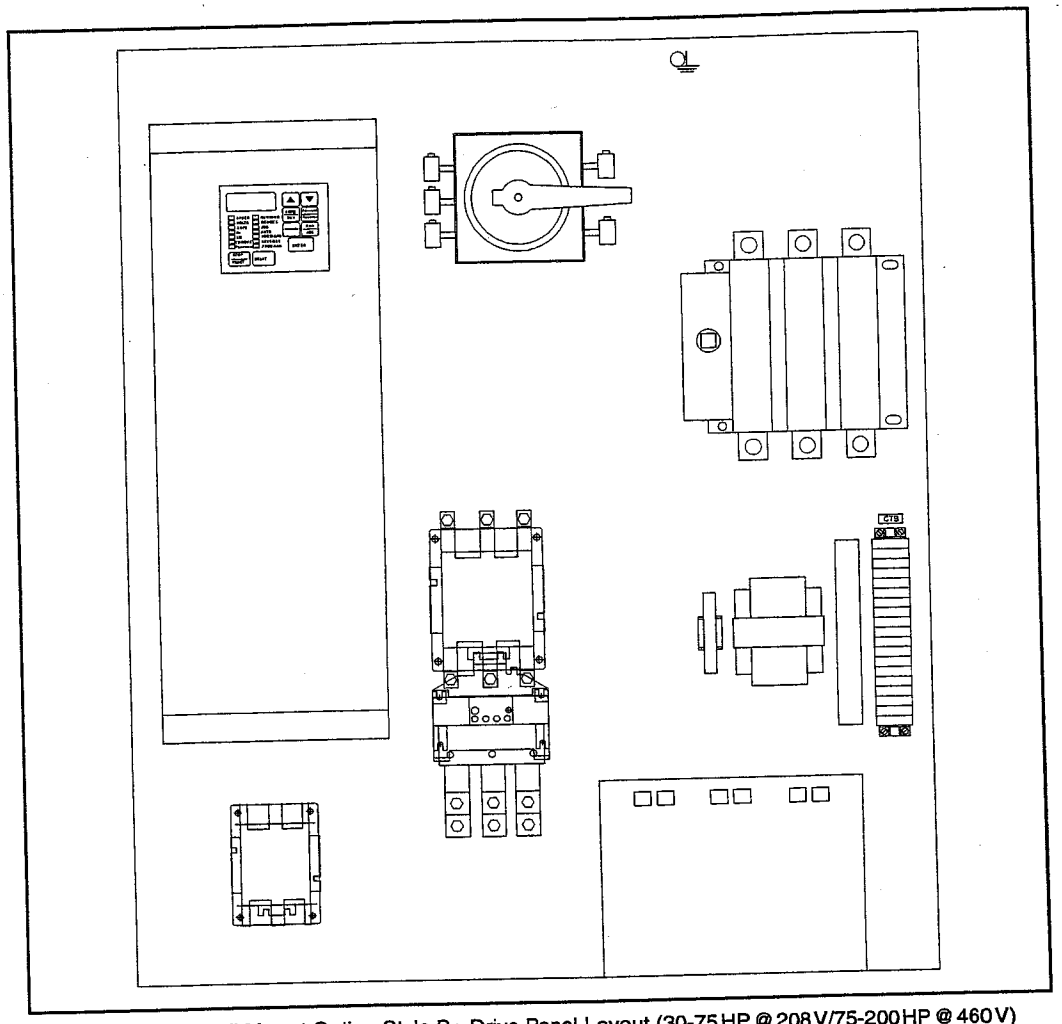


Figure 4.12 – Wall Mount Option Style B+ Drive Panel Layout (30-75 HP @ 208 V/75-200 HP @ 460 V)

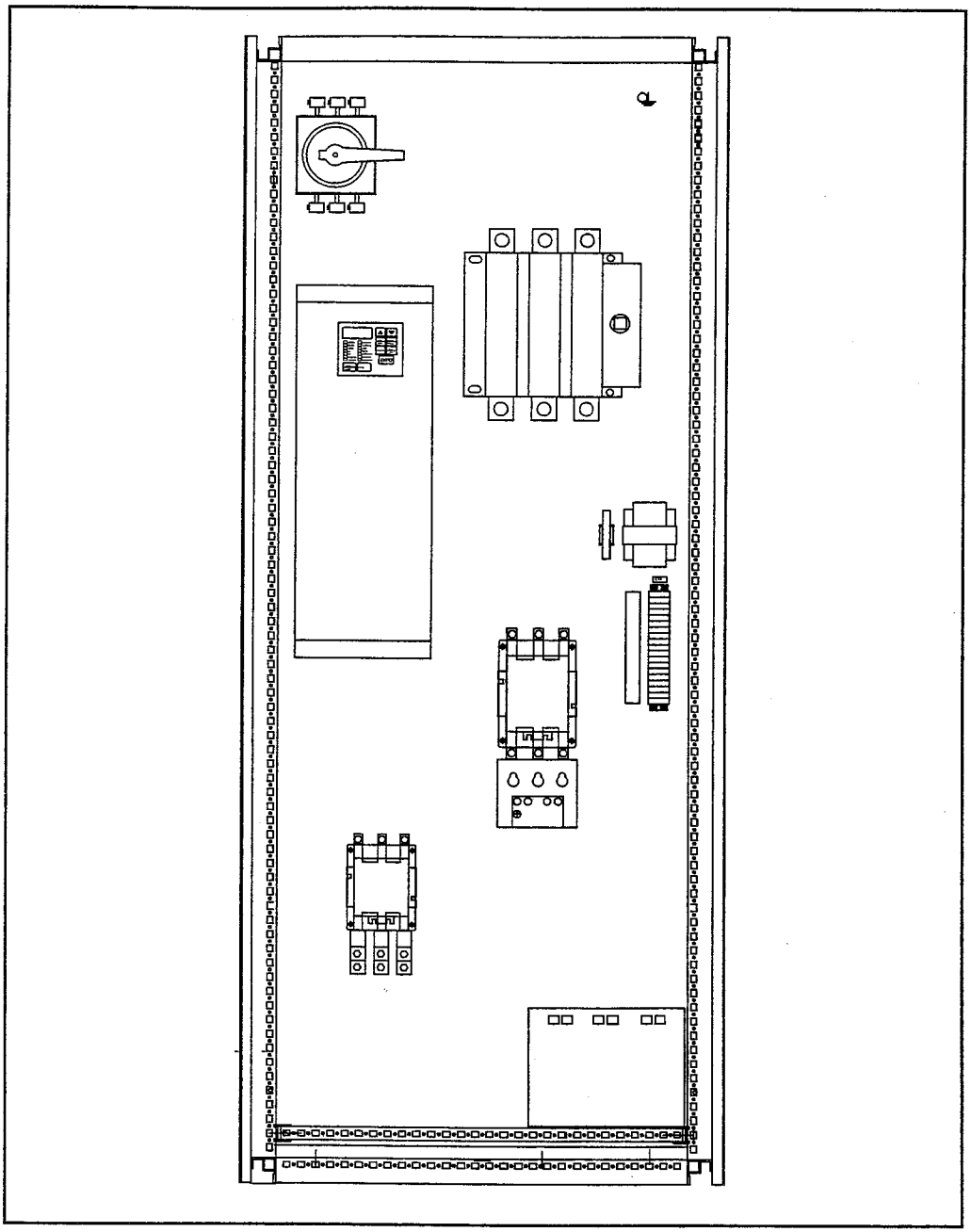


Figure 4.13 – Floor Mount Option Style B+ Drive Panel Layout (100 HP @ 208 V/75-200 HP @ 460 V)

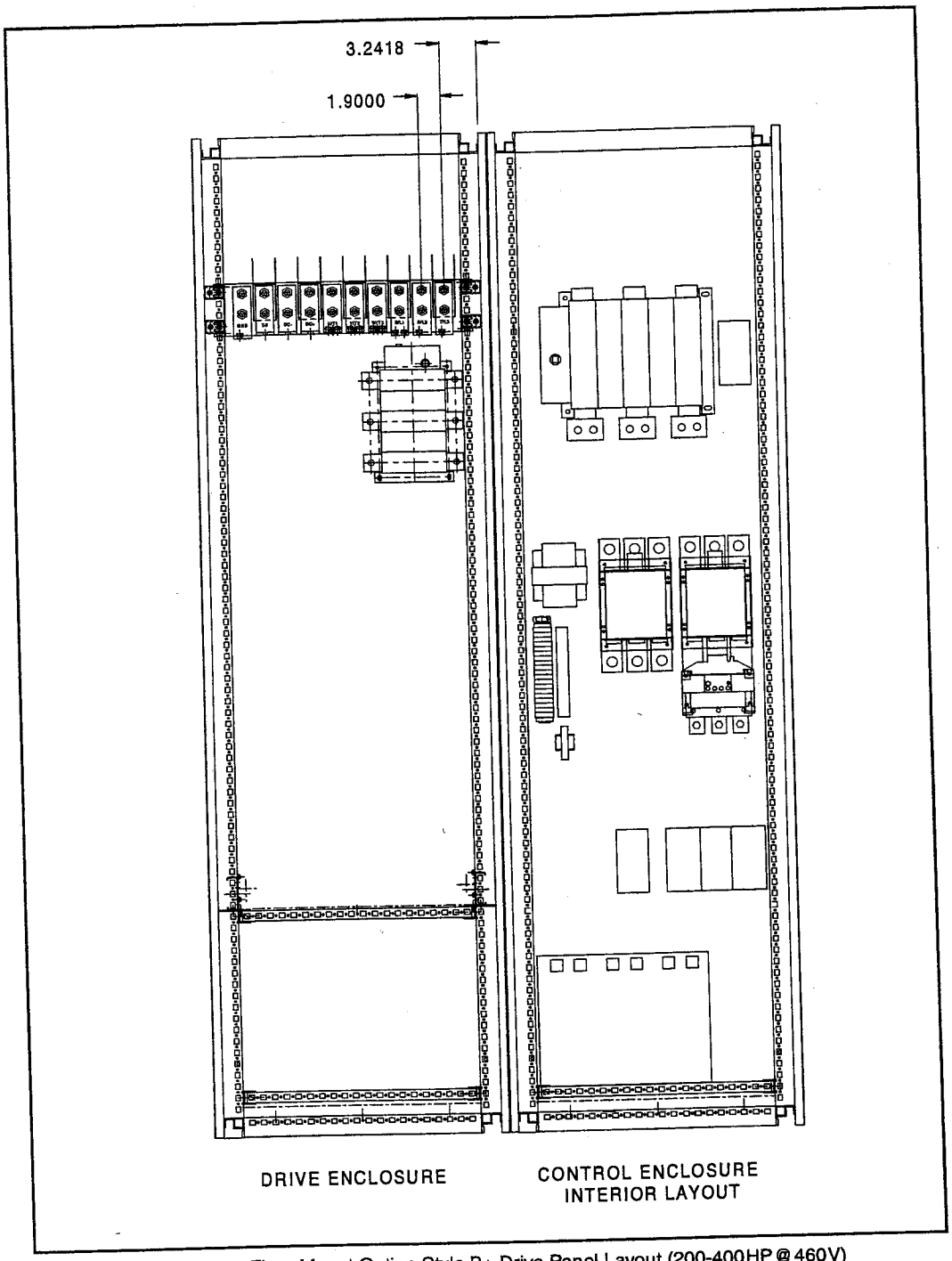


Figure 4.14 – Floor Mount Option Style B+ Drive Panel Layout (200-400HP @ 460V)

CHAPTER 5
Installing Power Wiring

This chapter provides instructions on wiring motor overload protection and output wiring to the motor and installing AC input power wiring.

5.1 Installing Output Power Wiring

Sections 5.1.1 to 5.1.4 provide instructions on wiring output contactors, motor overload protection, and output wiring to the motor.

5.1.1 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.

5.1.2 Installing Mechanical Motor Overload Protection (Optional)

To provide the motor with overload protection, local, national, and international codes, such as NEC/CEC, require that a motor thermostat, internal to the motor, be installed or an electronic thermal motor overload relay, sized to protect the motor, be installed between the motor and the drive's output terminals.

The Motor Overload Enable parameter (P.040) can be used in place of thermal motor overload relays in single motor applications. Note 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. See section 10.6.2 for a description of parameter P.040.

In multiple motor applications, you must supply each motor with overload protection.

5.1.3 Installing Output Wiring from the Drive Output Terminals to the Motor – No Factory Options

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.

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. See figures 4.1 to 4.6 for wire routing locations. Maximum power wiring sizes are shown in table 3.16.

On wall mount drives, route the motor leads through the bottom right opening of the drive base.

On floor mount drives, route the motor leads through the top of the drive.

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.

Step 2. Connect the three-phase AC output power motor leads to terminals U/T1, V/T2, and W/T3 on the power terminal strip.

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

5.1.4 Installing Output Wiring from Drive Option Terminals to the Motor

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.

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 the drive option type. See figures 4.7 to 4.14 for wire routing. Note that you must drill or punch openings in the option cabinet of the desired conduit size, following NEC and all applicable local codes and standards.

Maximum power wiring sizes are shown in table 3.16.

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.

Step 2. Connect the three-phase AC output power motor leads to terminals U/T1, V/T2, W/T3 on the power terminal strip located in the options cabinet.

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

Table 5.1 – Terminal Tightening Torques

Drive (HP)	Maximum Tightening Torque
1 to 25	9.5ft-lb
30 to 60	10.0ft-lb
75 to 150	7.4ft-lb
200 to 400	25.0ft-lb

5.2 Installing Input Wiring

Sections 5.2.1 to 5.2.4 describe incoming line components and how to install them. Note that fuses and an input disconnect are also available as factory-installed options.

5.2.1 Installing an Optional Transformer and Reactor – Drive Only

Input isolation transformers might be needed to help eliminate:

- Damaging AC 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 these 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 user-installed 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.
- Do not use an input isolation transformer rated more than 1000KVA for 460VAC (500KVA for 208 VAC) with less than 5% impedance directly ahead of the drive without additional impedance between the drive and the transformer.

ATTENTION: Distribution system capacity above the maximum recommended system KVA (1000KVA for 460VAC or 500KVA for 208 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 VTAC 7 drive 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 can be increased to 85,000 amps if the appropriate three-phase AC line reactor is used, as shown in table 5.2.

If the optional main input disconnect (MID) is supplied, this device must be model number 194R-style to rate the entire assembly as suitable for an 85,000 amp symetrical fault current capacity, distribution system capacity. This device is the standard factory-supplied MID from 50 to 400HP, and is available on the 1 to 40HP VTAC 7 drives.

Table 5.2 – AC Line Reactors

Drive (HP)	Line Reactor Inductance (±10%)	Reactor Rating (kVAr)
1	12.0 mH	0.42
2 to 3	6.5 mH	0.42
5	3.0 mH	0.42
7.5	2.5 mH	0.42
10	1.5 mH	0.42
15	1.2 mH	0.672
20 to 25	0.8 mH	1.04
30	0.7 mH	1.04
40	0.5 mH	1.43
50 to 60	0.4 mH	1.90
75	0.3 mH	2.76
100	0.2 mH	2.76
125	0.15 mH	3.34
150	0.11 mH	3.34
200	0.09 mH	4.84
250	0.075 mH	6.64
300 to 350	0.06 mH	9.10
400	0.05 µH	11.00

5.2.2 Installing Fuses for Branch Circuit Protection

If they were not installed as a factory option, install the required branch circuit protection fuses according to the applicable local, national, and international codes (such as NEC/CEC). The fuses must be installed in the line before the drive input terminals. Fuse values are provided in table 3.19.

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.

5.2.3 Installing the 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, such as NEC/CEC. If an input disconnect is not installed as a factory option, 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 in-rush current (10 to 12 times full load current) should coordinated with that of the input isolation transformer, if used. Refer to section 5.2.1 for additional information.

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

ATTENTION: Protect the contents of the options cabinet from metal chips and other debris while drilling the conduit openings. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

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.

To connect AC input power to the drive:

Step 1. If you are using a 1 to 60HP VTAC 7 drive with any factory-installed options, you must drill three holes through the bottom of the options cabinet to accommodate the conduits through which the power leads, motor leads, and signal and control wiring will be run.

If you are using a floor mount 75 to 400HP VTAC 7 drive, you must drill three holes through the top of the cabinet to accommodate the conduits through which the power leads, motor leads, and signal and control wiring will be run.

Step 2. Wire the AC input power leads by routing them according to drive type. Refer to figures 4.1 through 4.14. Maximum power wiring sizes are listed in table 3.16. Route power leads as follows:

- 1 to 5HP and 30 to 60 HP drives: Through the bottom right opening of the drive base.
- 7.5 to 25HP drives: Through the middle opening of the drive base.
- 75 to 400HP drives: Through the top of the options cabinet. Note that the knockouts for conduit installation are not provided.

Step 3. Connect the three-phase AC input power leads (three-wire 380-460 VAC) to the appropriate terminals. Connect the AC input power leads as follows:

- 1 to 60 HP drives: To terminals R/L1, S/L2, T/L3 on the power terminal strip.
- 60 to 150HP drives: To terminals 1L1, 1L2, and 1L3.
- 200 to 400HP drives: To terminals R, S, and T.

Step 4. Tighten the AC input power terminals to the proper torque as shown in table 5.1.

CHAPTER 6

Installing Control Wiring

This chapter describes how to wire the Regulator board terminal strip for stop, speed feedback, and remote control signals. For drives that have an options cabinet, the terminal strip is located in the options cabinet. For drives without options, the terminal strip is located on the Regulator board.

The signals available through the terminal strip and their relationship to the Options Cabinet terminals are shown in table 6.1. Wiring of the terminal strip is detailed in table 6.2.

When the Control Source parameter (P.000) is set to remote (rE), the drive is controlled by the signals connected to the terminal strip. See section 10.5.1 for information on how parameter P.000 specifies the control source of the drive.

Table 6.1 – Signal and Control I/O Connections

Regulator Board			Options Cabinet	
Terminal	**Signal**		**Terminal**	**Signal**
Analog Output Connections				
4	+15 VDC for Analog Meter Output		1	+15 VDC for Analog Meter Output
10	Analog Meter Output		2	Analog Feedback Signal
11	Regulator Common		3	Common
The output of this terminal is either 0-10VDC or 4-20mA, as determined by the setting of jumper J17 on the Regulator board. The analog output must also be programmed by parameter P.012 for an indication of speed and direction or percent of torque. See section 2.3.1.2 for instructions on setting jumper J17. See section 10.6.2 for parameter descriptions.				
Analog Speed Reference Connections				
12	Isolated Reference Voltage		4	±10VDC Speed Reference
13	VDC Speed/Torque Reference		5	0-20mA Speed Reference
14	mA Speed/Torque Reference		6	Common
15	Isolated Reference Ground		15	Isolated Reference Ground
The analog speed (P.008) reference is either ±10VDC or 0-20mA, as determined by the setting of jumper J4 on the Regulator board. See section 2.3.1.1 for instructions on setting jumper J4. The analog reference must also be configured using parameters P.009, P.010, and P.011. See section 10.6.2 for parameter descriptions.				

Table 6.1 – Signal and Control I/O Connections (Continued)

Regulator Board			Options Cabinet	
Terminal	**Signal**		**Terminal**	**Signal**
Digital Input Connections				
16	+24VDC (Current Limited) For remote control digital inputs only.		7	Customer Auto Start Contact
			8	Customer Auto Start Common
17	Digital Input 8 (Remote/Local) Programmable		13	Freeze/Fire Stats Contact
			14	Freeze/Fire Stats Common
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	+24VDC Common			
If you installed a function loss input, a smoke or fire purge signal, a coast-to-stop pushbutton, or other external interlock, 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 (digital 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. See chapter 10 for parameter descriptions.				
Status Relay Connections				
28	N.C. Relay Contact		9	N.C. Drive Fault Contact
29	N.C. Relay Common		10	N.C. Drive Fault Common
30	N.O. Relay Contact		11	N.O. Drive Fault Contact
31	N.O. Relay Common		12	N.O. Drive Fault Common
Relay contact closure is programmable through parameter P.013. If your drive is equipped with a contactor bypass, parameter P.013 is factory-set to indicate an IET (a fault that stops the drive). This parameter must not be changed. See section 10.6.2 for parameter descriptions.				

6.1 Stopping the Drive

ATTENTION: You 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 can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

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, you 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.

Depending upon the requirements of the application, the VTAC 7 drive can be configured to provide either a coast-to-rest or a ramp-to-rest operational stop without physical separation of the power source from the motor. A coast-to-rest stop turns off the transistor power device drivers. A ramp-to-rest stop fires the transistor power device drivers until the motor comes to a stop, and then turns off the power devices. For more information on programming the operational stop, see the description on wiring terminals 23 and 24 in table 6.2 and section 10.6.2 for a description of parameter Stop Type (P.025).

In addition to the operational stop, you 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 parameter P.055 description on page 10-38 for more information.

Note that the hardwired emergency stop you install can be used at any time to stop the drive.

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

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

The VTAC 7 drive coast-to-rest stop is a category 0 operational stop. The ramp-to-rest stop is a category 1 operational stop. You can also 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 your risk assessment of the associated machinery. 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.

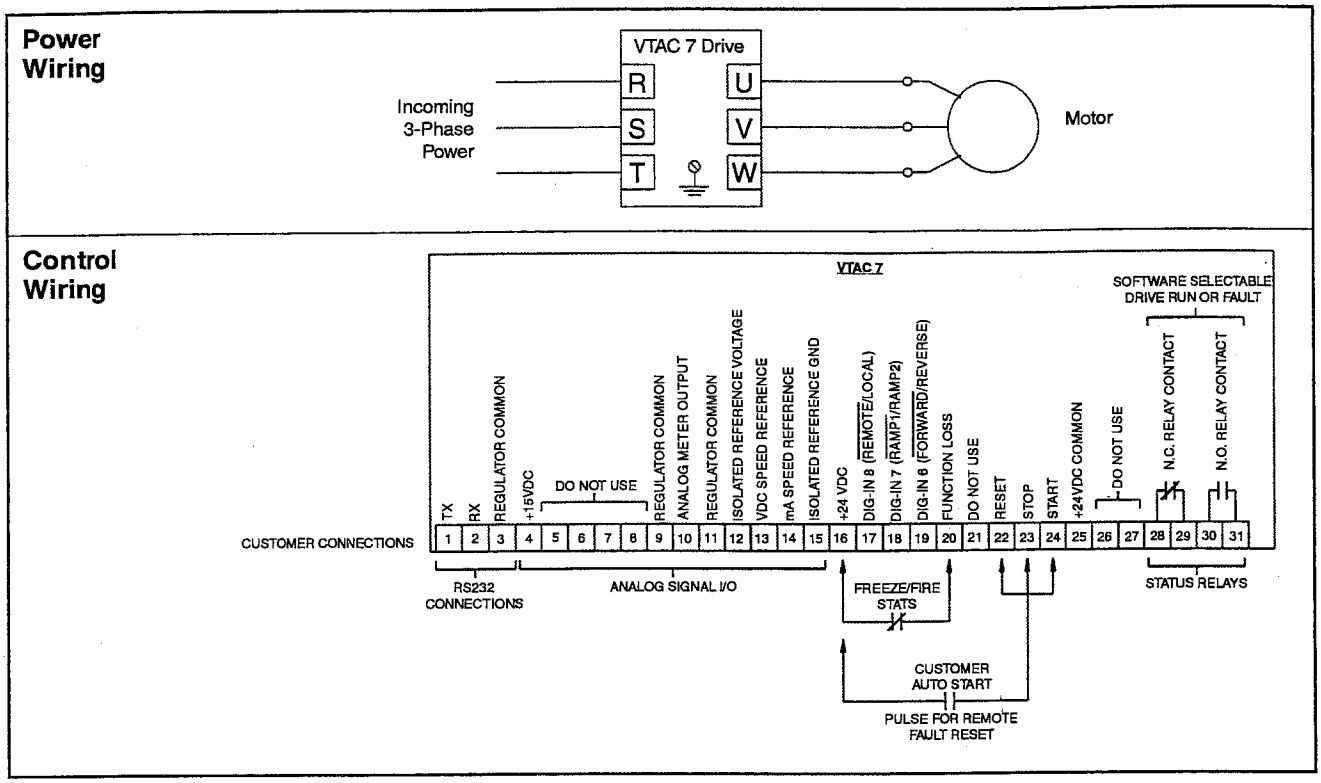


Figure 6.1 – Sample Power and Control Wiring — Drive Only

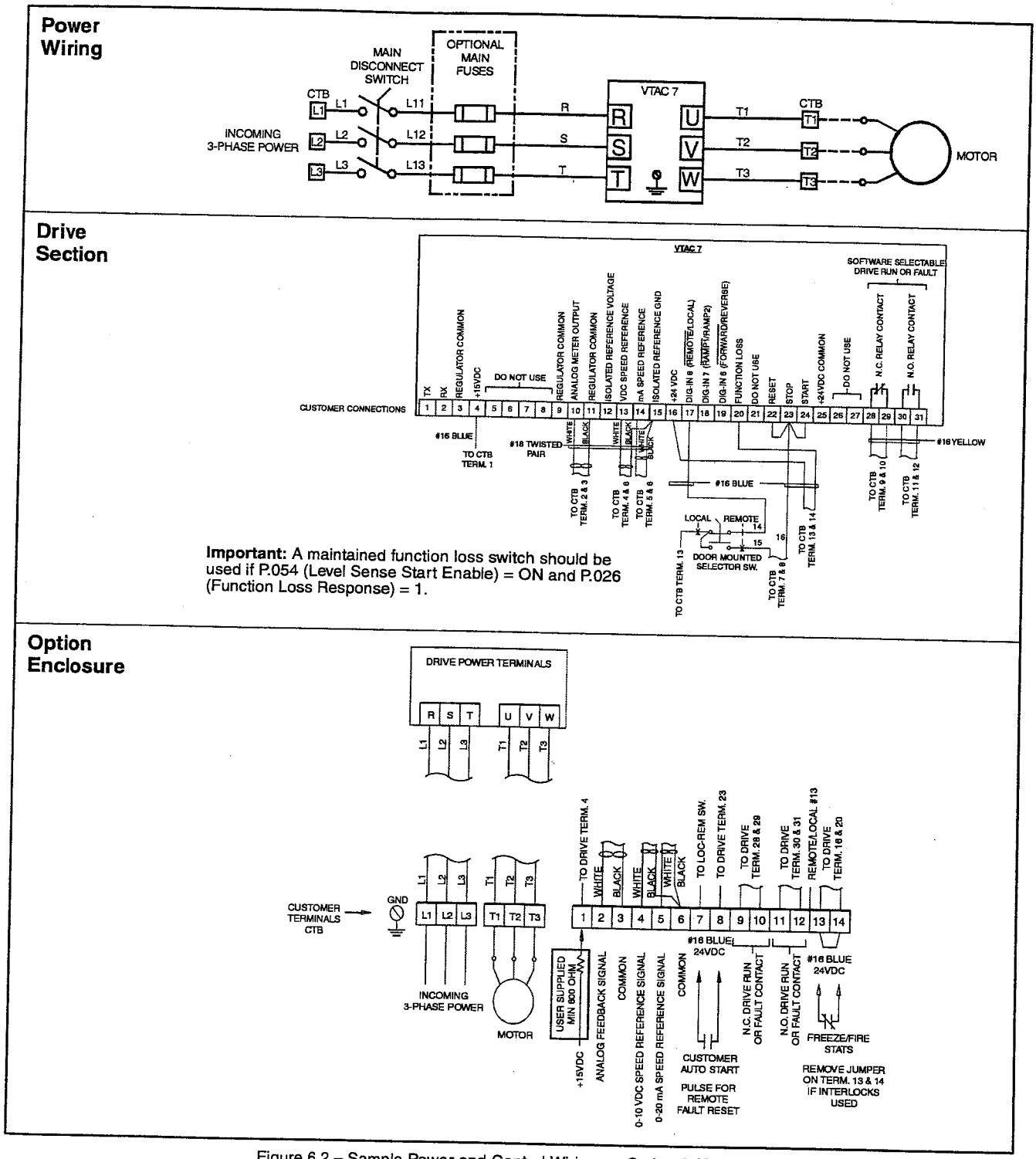
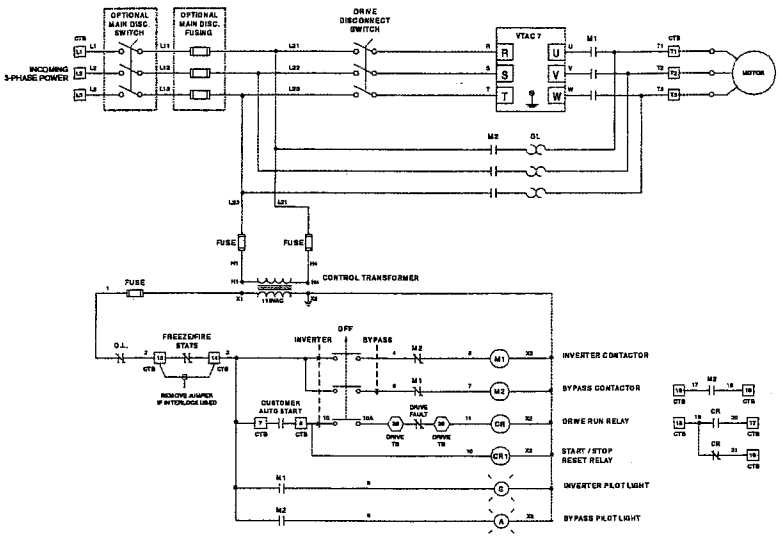
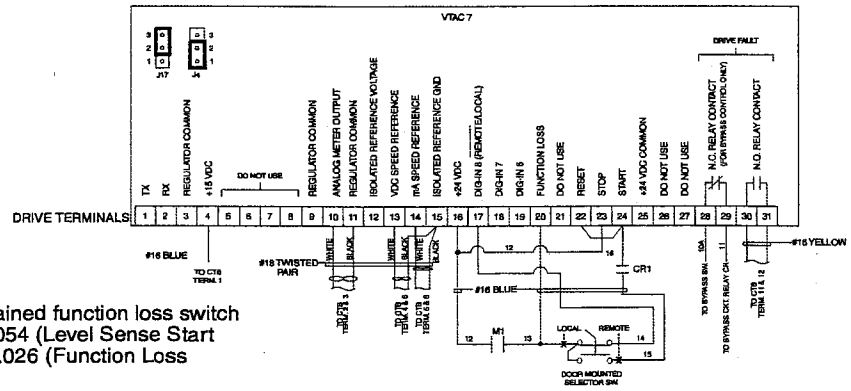


Figure 6.2 – Sample Power and Control Wiring — Option A (All HPs)

Power Wiring



Drive Section



Important: A maintained function loss switch should be used if P.054 (Level Sense Start Enable) = ON and P.026 (Function Loss Response) = 1.

Option Enclosure

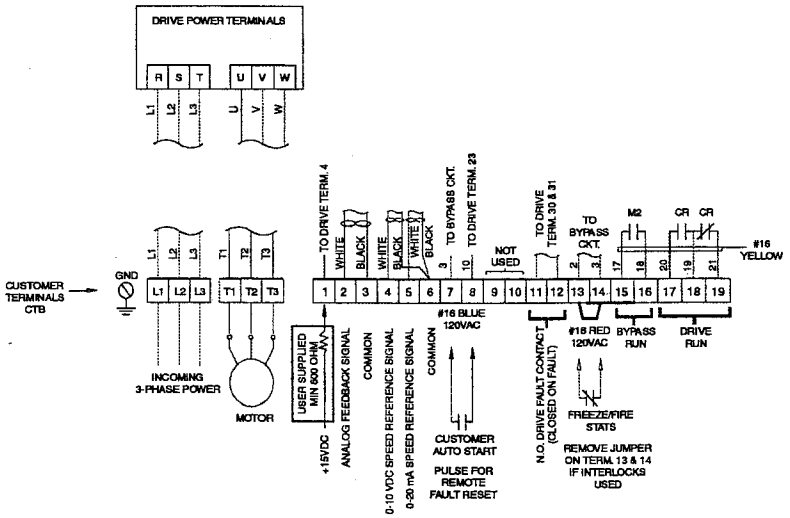


Figure 6.3 – Sample Power and Control Wiring — Option B (All HPs)

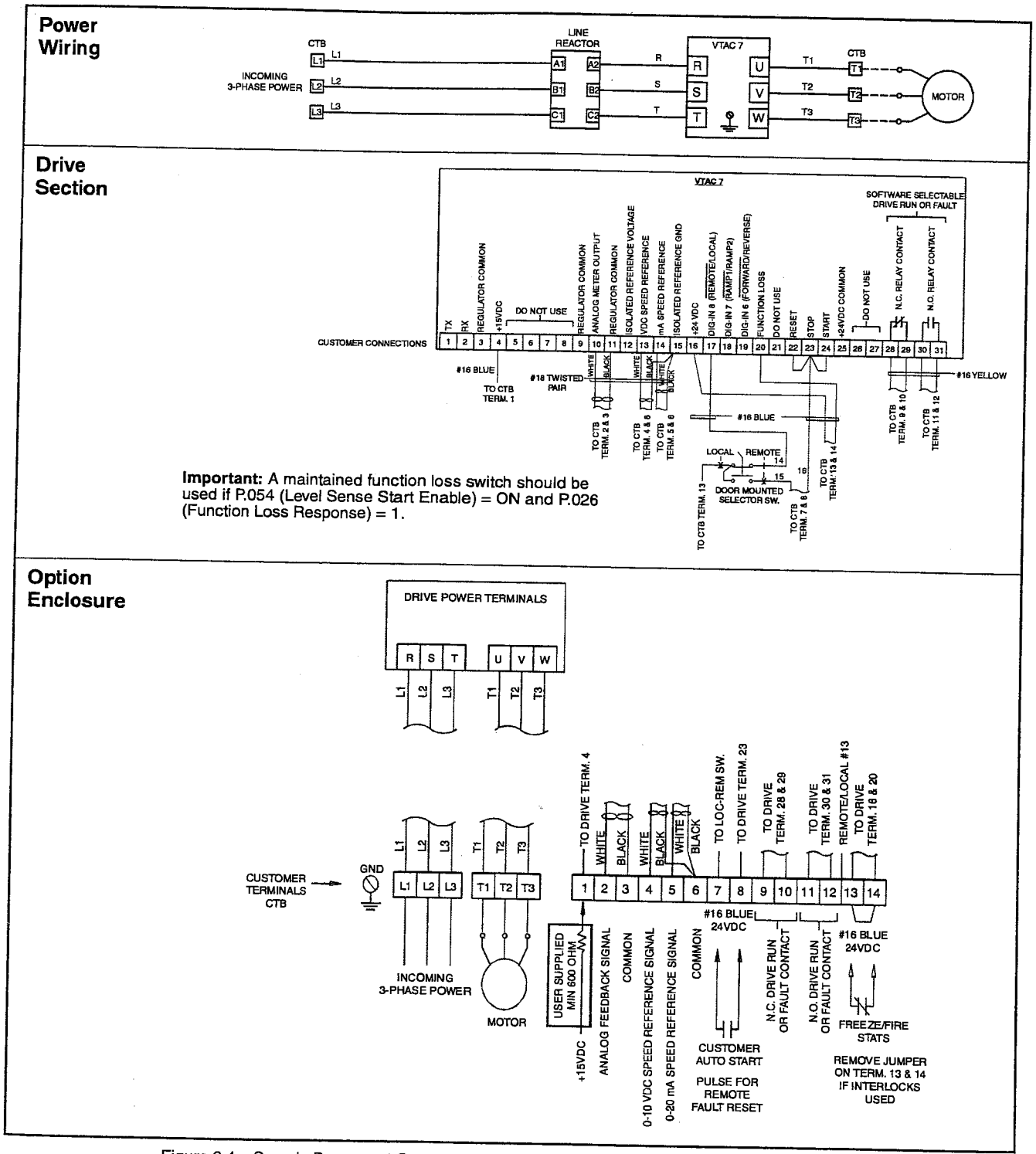
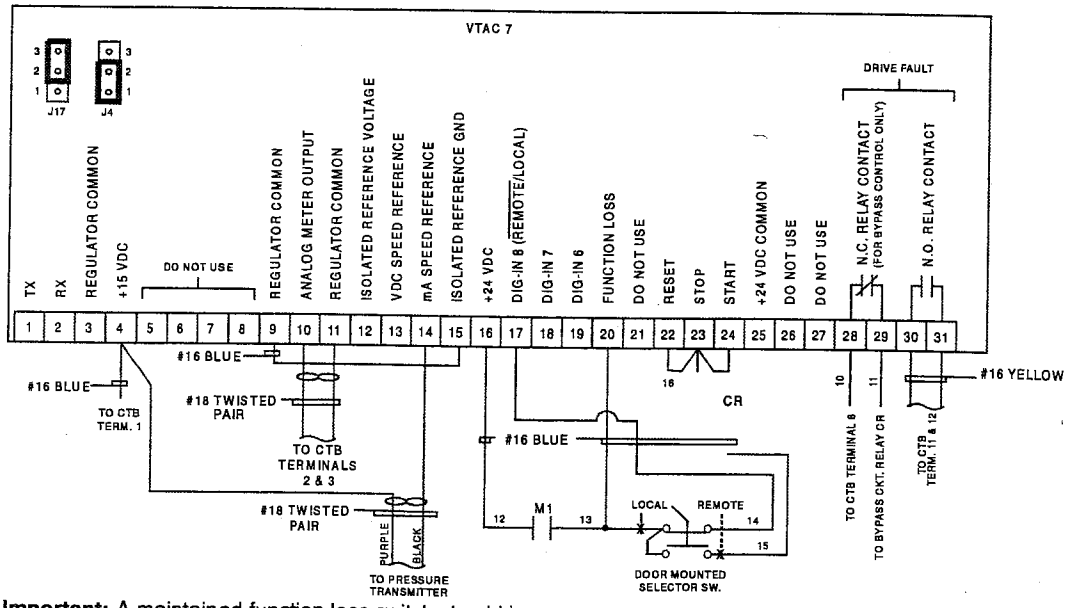


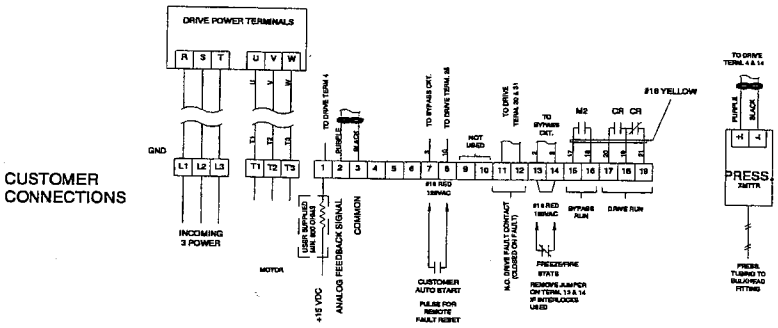
Figure 6.4 – Sample Power and Control Wiring — Option B+ (All HPs; Input Line Reactor Only)

Drive Section



Important: A maintained function loss switch should be used if P.054 (Level Sense Start Enable) = ON and P.026 (Function Loss Response) = 1.

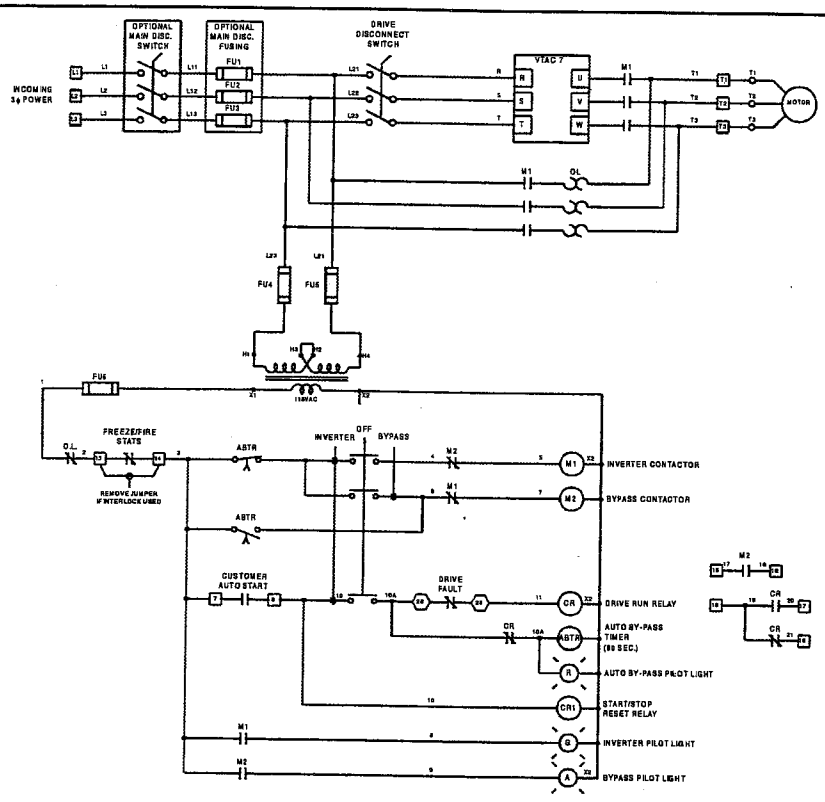
Option Enclosure



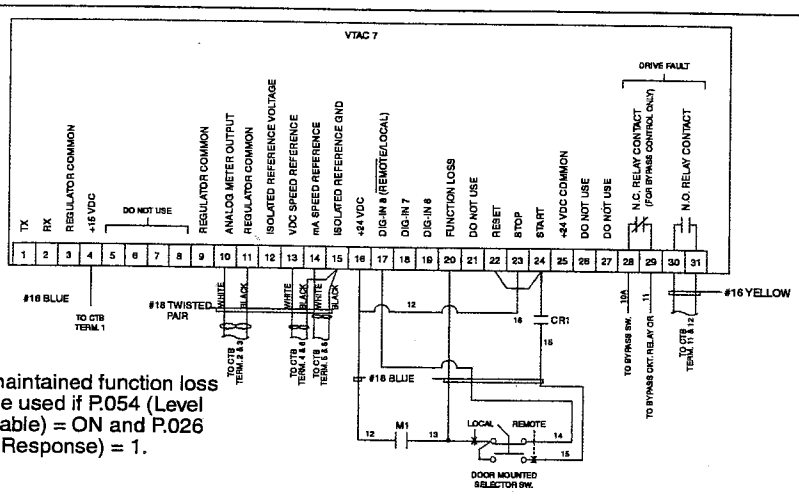
CUSTOMER CONNECTIONS

Figure 6.5 – Sample Power and Control Wiring — Optional P-to-E Speed Reference

Power Wiring



Drive Section



Important: A maintained function loss switch should be used if P.054 (Level Sense Start Enable) = ON and P.026 (Function Loss Response) = 1.

Option Enclosure

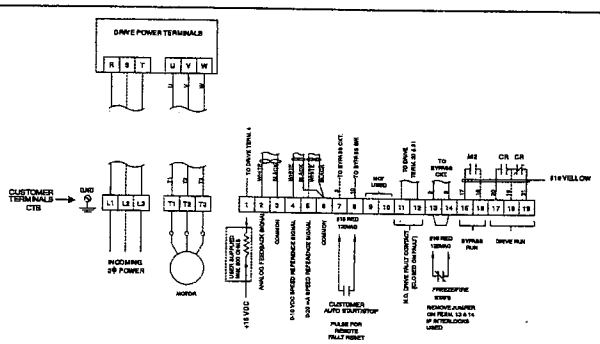
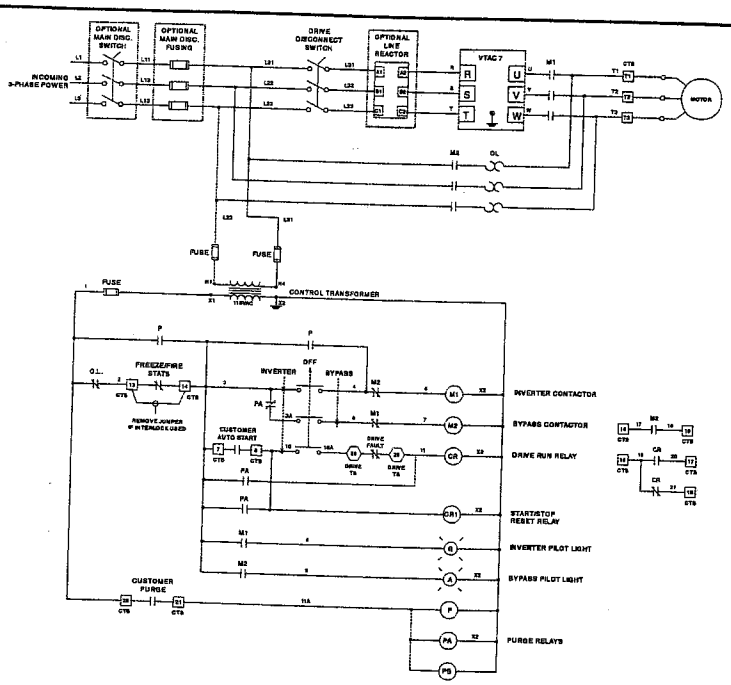
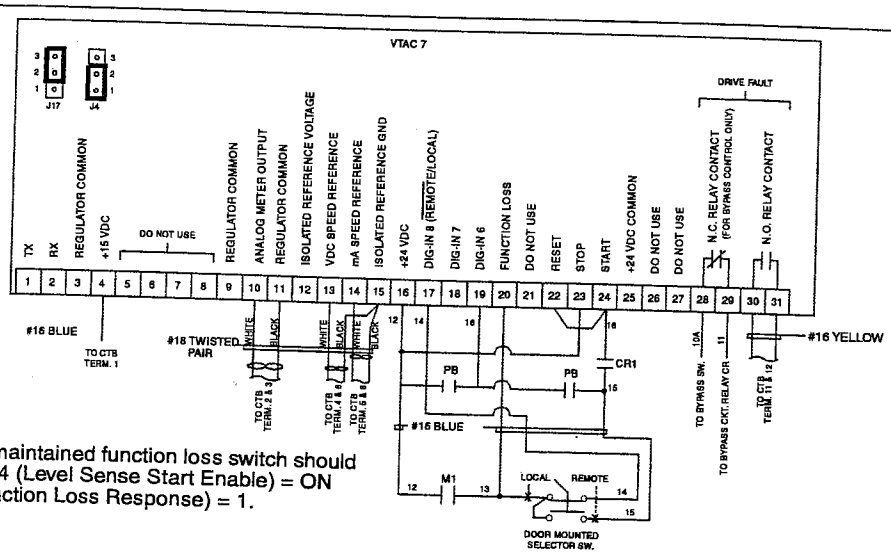


Figure 6.6 – Sample Power and Control Wiring — Typical Auto Bypass

Power Wiring



Drive Section



Important: A maintained function loss switch should be used if P.054 (Level Sense Start Enable) = ON and P.026 (Function Loss Response) = 1.

Option Enclosure

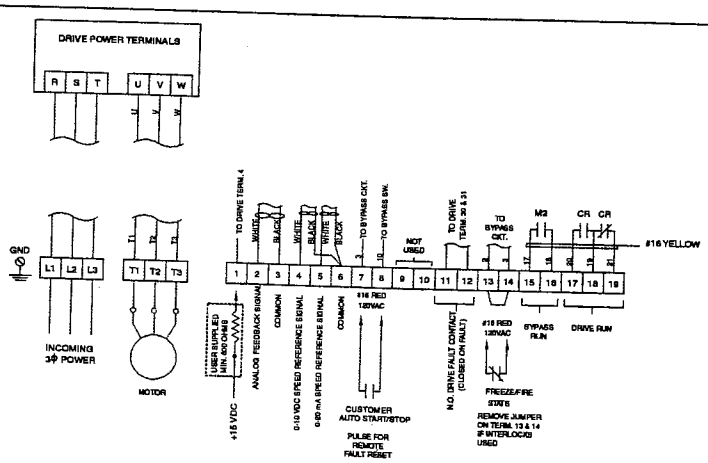


Figure 6.7 – Sample Power and Control Wiring — Optional Purge Relay (All HP Sizes)

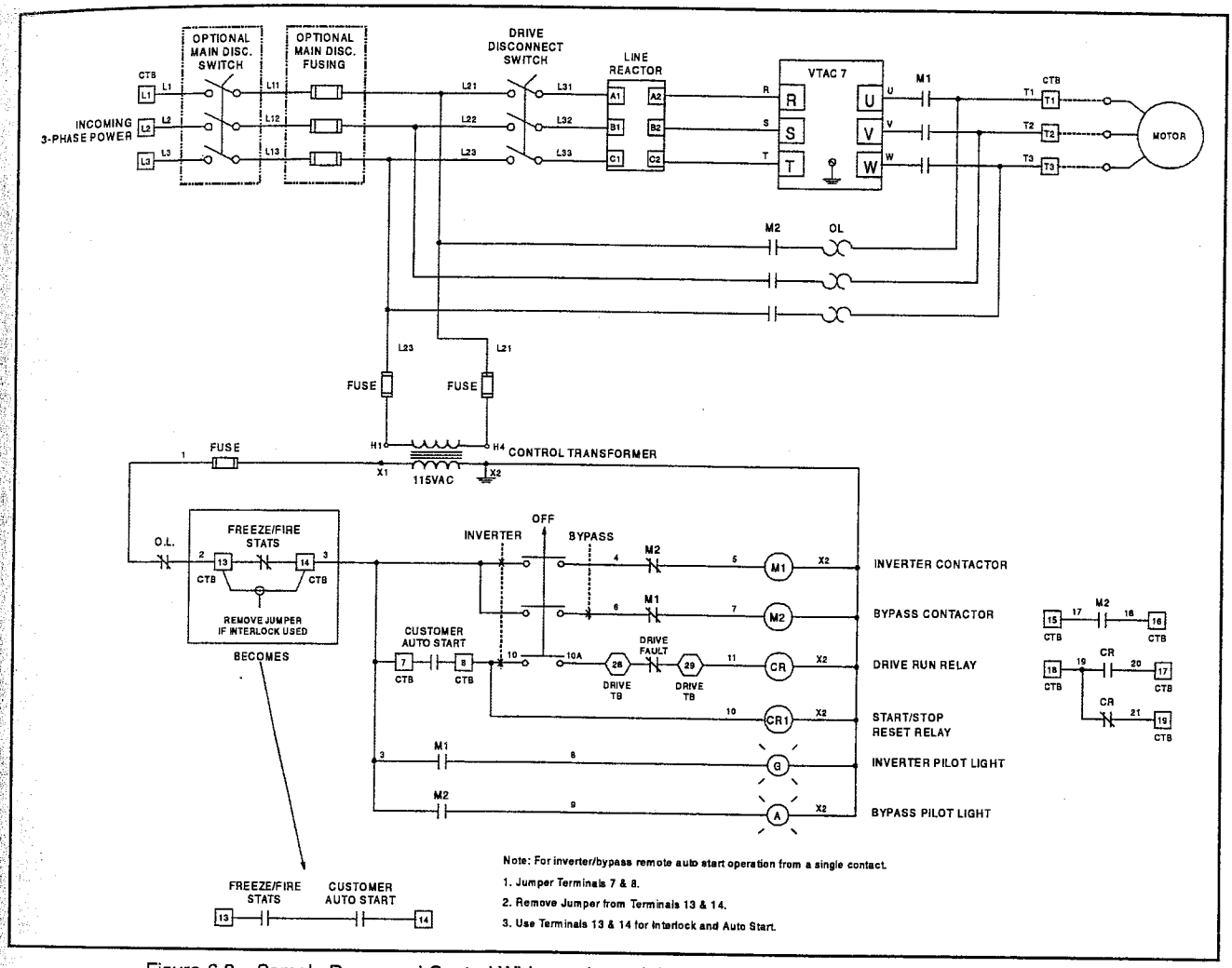


Figure 6.8 – Sample Power and Control Wiring — Inverter/Bypass Remote Auto Start from Single Contact

6.2 Wiring the Signal and Control I/O

Wire the drive's signal and control I/O to the terminal strip as shown in table 6.2.

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip

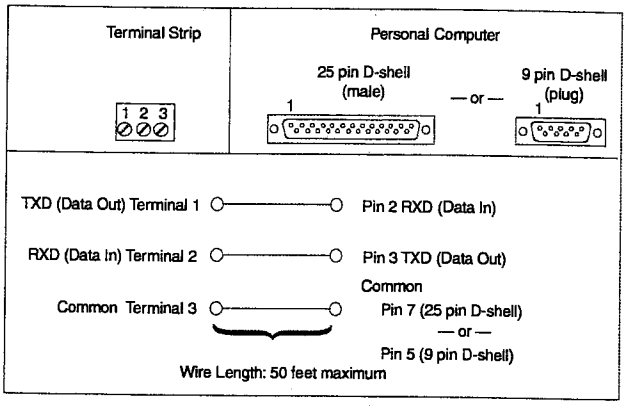
Terminal #	Description	Parameters and Wiring Connections
Wiring RS-232 Signals		
1 2 3	RS-232 Transmit RS-232 Receive RS-232 Signal/Regulator Common	Note that RS-232 communication between the VTAC 7 drive and a personal computer requires the use of the CS3000 software. Refer to instruction manual D2-3348 for information. These terminals should only be used when the RS-232 port (J8) or an Operator Interface Module (OIM) is not being used, as all three devices use the same transmit/receive lines. 
4 to 9	Not Used	

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

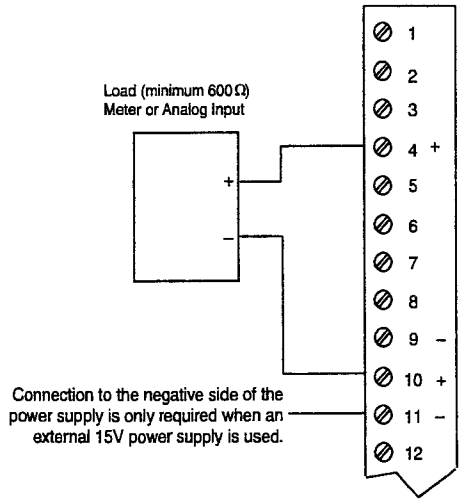
Terminal #	Description	Parameters and Wiring Connections
	Wiring Analog Outputs	
10 11	0-10VDC or 4-20mA Analog Output Reference Regulator Common	Parameter P.012 selects the terminal strip analog output source (speed or torque). Jumper J17 must also be set (see section 2.3.1.2). The 4-20mA current selection requires a power supply for operation, which can be the encoder supply, terminal 4 (15VDC), or an external 15V power supply. The maximum supply current from terminal 4 is 250mA (encoder and current source) at 15V. On the 1 to 60 HP and 200 to 400 HP Regulator boards, terminals 9 and 11 are internally connected. 

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

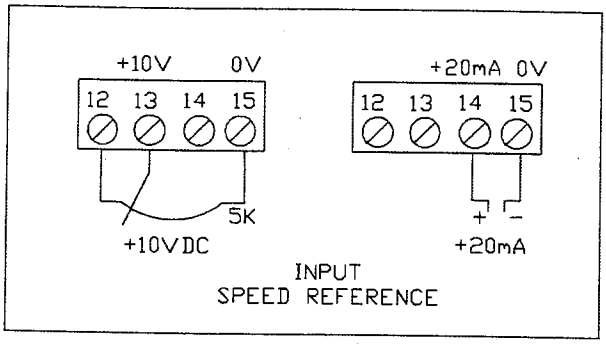
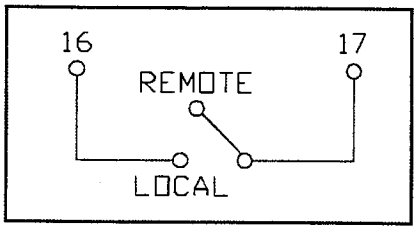
Terminal #	Description	Parameters and Wiring Connections
Wiring Analog Speed Reference Inputs		
12 13 14 15	Isolated Reference Voltage (+10VDC) Analog Speed/Torque Reference Input Voltage (±10VDC) Analog Speed/Torque Reference Input Current (0-20mA) Isolated Speed/Torque Reference Common (Voltage/Current)	See 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 See chapter 10 for parameter descriptions. Jumper J4 must also be set. See section 2.3.1.1. 

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

<table>
<tr><th>Terminal #</th><th>Description</th><th>Parameters and Wiring Connections</th></tr>
<tr><td colspan="3">Wiring a Remote/Local Input</td></tr>
<tr><td>16</td><td>+24 VDC Power Supply</td><td>Current limited for remote input logic use only.</td></tr>
<tr><td>17</td><td>Digital Input 8 (Default = Remote/Local)</td><td>Digital input 8 is control function programmable through parameter P.007.</td></tr>
<tr><td colspan="3">ATTENTION: If a maintained start contact is used when the Control Source (P.000) = rE, switching from local to remote from the terminal strip will cause power to be applied to the motor if the remote start contact is closed. Stay clear of rotating machinery in this case. Failure to observe this precaution could result in bodily injury.</td></tr>
<tr><td></td><td></td><td>Related parameters:
• 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).
If an RMI board is used, based on the settings of parameters P.000, P.007, P.008, and r.030, 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 to 8
See chapter 10 for parameter descriptions.
 

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

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

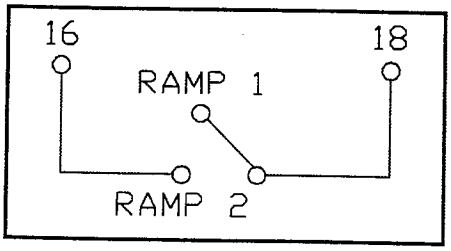
Terminal #	Description	Parameters and Wiring Connections
Wiring an Additional Ramp Input		
18	Digital Input 7 (Default = Ramp1/Ramp2)	Digital input 7 is control function programmable through parameter P.007. Related parameters are: • P.000: Control Source • P.001: Accel Time 1 (Ramp 1) • P.002: Decel 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) If an RMI board is used, based on the settings of parameters P.000, P.007, P.008, and r.030, 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 See chapter 10 for parameter descriptions.  Terminal 18 On = Ramp2 Diagram shows factory setting.

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

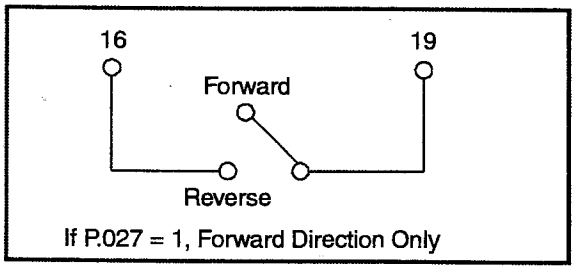
Terminal #	Description	Parameters and Wiring Connections
Wiring a Forward/Reverse Input		
19	Digital Input 6 (Default - Forward/Reverse)	Digital input 6 is control function programmable through parameter P.007. Related parameters: • P.000: Control Source • P.006: Second Menu Password • P.007: Terminal 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 If an RMI board is used, based on the settings of parameters P.000, P.007, P.008, and r.030, these 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 See chapter 10 for parameter descriptions.  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 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

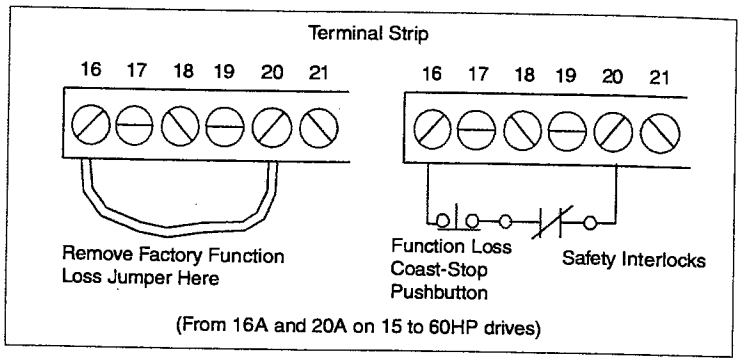
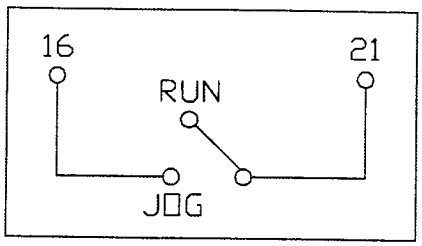
Terminal #	Description	Parameters and Wiring Connections
		Wiring a Function Loss Input
20	Digital Input 5 (Function Loss)	Related parameter: P.026: Function Loss Response A signal must be present at terminal 20 for the drive to be able to start. See figures 6.1 to 6.8. The drive is shipped from the 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.  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 (Function Loss Response) = 1.
		Wiring a Run/Jog Input
21	Digital Input 4 (Run/Jog)	Related parameters: • 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 The drive must be stopped before enabling a preset speed for purge condition.

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

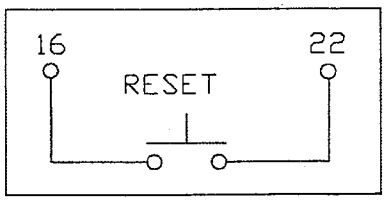
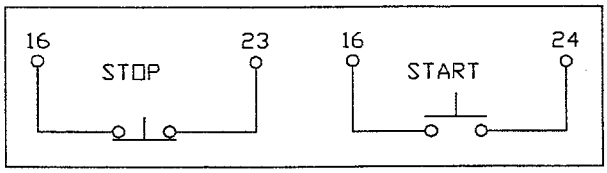
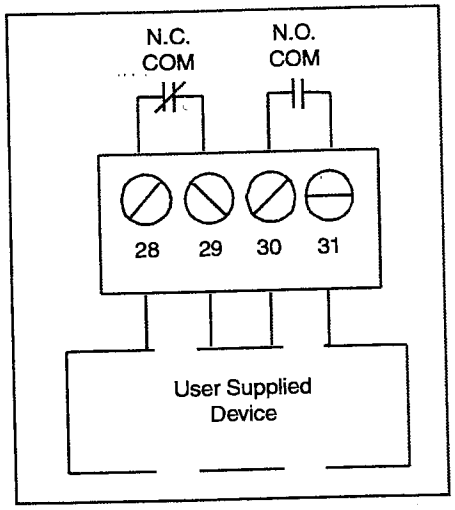
Terminal #	Description	Parameters and Wiring Connections
	Wiring the Reset Input	
22	Digital Input 3 (Reset)	Related parameter: P.000: Control Source  Terminal 22 On = Reset
	Wiring the Stop/Start Inputs	
23 24	Digital Input 2 (Stop) Digital Input 1 (Start)	Related parameters: • P.000: Control Source • P.025: Stop Type  Terminal 23 Off = Stop Terminal 24 On Transition = Start
25	24 VDC Isolated Common	
	Wiring the Snubber Resistor	
26	Snubber Resistor Braking Control Signal	Used with older Snubber Resistor Braking kits that require a gate turn-on signal from the drive (for example, the M/N 2DB4010 series). Terminals 26 and 27 are not to be used with Snubber Resistor Braking kits M/N 2SR40400, 2SR40600, 2SR41200, or 2SR41800.
27	+24 VDC Isolated Common	

Table 6.2 – Wiring Signal and Control I/O to the Terminal Strip (Continued)

Terminal #	Description	Parameters and Wiring Connections
Wiring the Output Status Relays		
28	Normally-Closed Contact (Form B)	Form A and Form B contacts are rated for 250VAC/30VDC at 5 amps resistive or 2 amps inductive load. Related Parameter: P.013: Output Relay Configuration 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). See chapter 10 for parameter description. 
29	Normally-Closed Contact Common (Form B)	
30	Normally-Open Contact (Form A)	
31	Normally-Open Contact Common (Form A)	

CHAPTER 7

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.

7.1 Checking the Installation

> **ATTENTION:** DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.
>
> **ATTENTION:** You 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 can result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

To verify the condition of the installation:

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. See section 11.3.

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.

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

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

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

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

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

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

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

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

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

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

Step 14. Uncouple the motor from any driven machinery.

7.2 Installing the Cover for NEMA 4X/12 Drives

To maintain the integrity of the NEMA 4X/12 enclosures, care must be taken when re-installing the covers. 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 tighten the four captive screws evenly to ensure even compression of the gaskets. Do not exceed 2.2 Nm (20 in-lb) torque on these screws.

7.3 Powering Up after Installation is Complete

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 chapter 9.

CHAPTER 8

Using the Keypad/Display to Program, Monitor, and Control the Drive

The front-panel keypad/display is used to program, monitor, and control the drive. It can be used to stop the drive, reset drive faults, and switch between a manual speed reference or the selected control source auto reference.

The keypad/display operates in two modes, monitor mode and program mode. Different functions are available at the keypad depending on the operating mode of the keypad/display and the drive control source selection.

In monitor mode (the default mode), you can monitor specific drive outputs as well as enter the speed or frequency reference for the drive. In program mode, you can view and adjust drive parameter values, and examine the error log.

If the control source is local (the REMOTE LED is off), the keypad is also used to select run or jog, select motor direction, and start the drive.

Regardless of the control source selection, the keypad/display can be used to stop the drive, reset drive faults, and switch between a manual speed reference or the selected control source auto reference.

Important: The STOP/RESET key can be disabled by parameter P.055. Refer to the P.055 parameter description for more information.

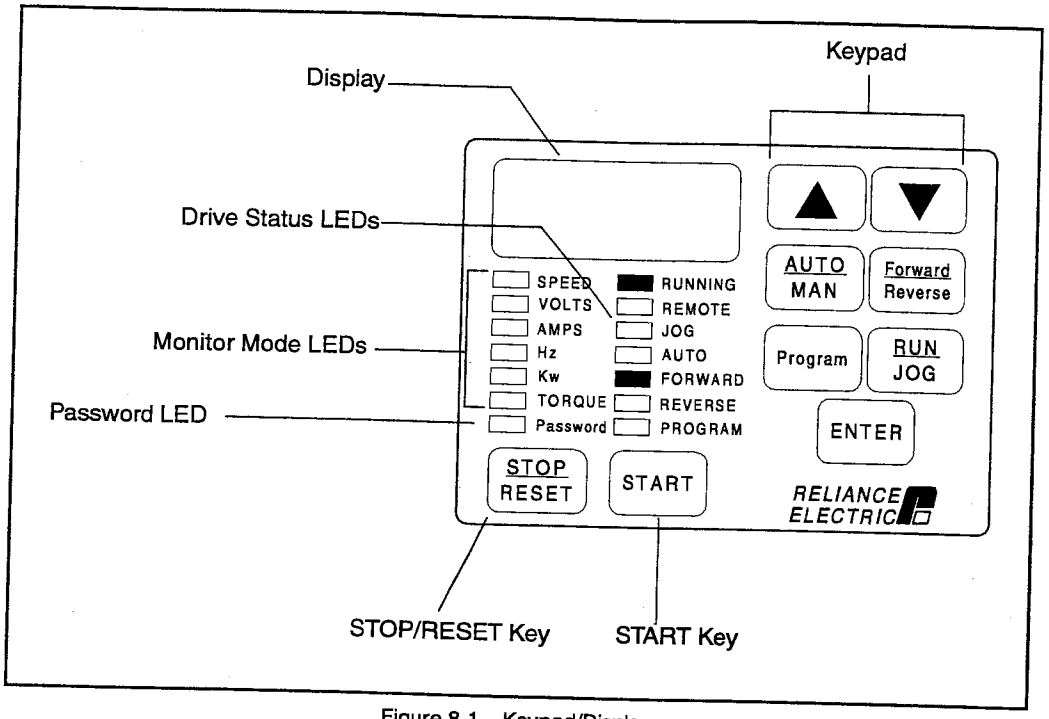


Figure 8.1 – Keypad/Display

8.1 Monitor Mode

Monitor mode is the keypad/display's default mode during drive operation. You can also enter monitor mode by pressing the PROGRAM key until the PROGRAM LED turns off. This output data can be displayed in monitor mode:

- Speed
- Volts
- Amps
- Hz
- Kw
- Selected speed reference

To select a value to monitor, press the ENTER key until the LED turns on next to the desired display item. Pressing the ENTER key advances you through each of the displays. Note that all of the LEDs turn on to indicate the selected reference display.

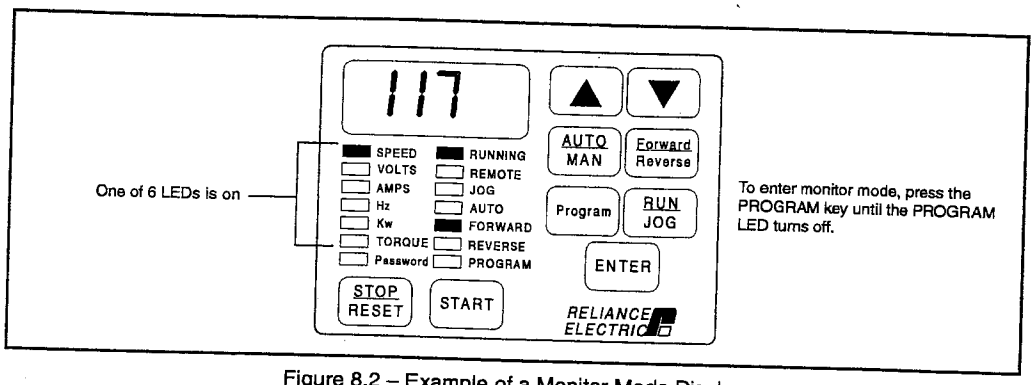


Figure 8.2 – Example of a Monitor Mode Display

8.1.1 Displaying the Selected Reference

In monitor mode, you can display the speed reference (speed or frequency) or the torque reference the drive is using while it is running (RUNNING LED is on, JOG LED is off). To display the selected reference:

Step 1. If you are not already in monitor mode, access it by pressing the PROGRAM key until the PROGRAM LED turns off.

Step 2. Press the ENTER key repeatedly to advance through each of the monitor mode LEDs. All of the monitor mode LEDs will then turn on at once and the reference will be displayed. Note that the displayed speed reference value is scaled based on P.028.

If the selected reference is negative and its value is greater than 999, the SPEED LED will flash. See section 8.4.1.

Pressing the ENTER key again advances you to the SPEED monitor display.

8.1.2 Changing the Manual Speed Reference

You can change the manual speed reference at any time while in monitor mode regardless of the control source. To change the manual speed reference:

Step 1. From monitor mode, press the ▲ key or the ▼ key once. The monitor mode LEDs all turn off, and the current manual speed reference value is displayed.

Step 2. Press the ▲ or ▼ key to change the displayed value. The speed reference is in the units defined in P.028.

Important: The drive accepts the value as it is changed. You do not have to press the ENTER key to save the value as you do with parameter entry.

Step 3. Press the ENTER key or wait approximately 5 seconds without pressing the ▲ or ▼ keys to return to monitor mode. (If the drive is not running, you must press the ENTER key to return to monitor mode.)

8.2 Program Mode

Program mode allows you to display and modify drive parameter values. To enter program mode, press the PROGRAM key until the PROGRAM LED turns on.

In program mode, you can display:

- Parameter numbers
- Parameter values
- Error log information

If the Programming Disable parameter (P.051) has been set to prevent parameter modification from the keypad, the PASSWORD LED will also be on. In this case, you will have to access parameter P.051 and enter the password (a factory-set value) to re-enable programming before any parameter values can be modified. When programming has been enabled, the PASSWORD LED will turn off.

Note that some of the parameters can be changed only when the drive is stopped. See chapters 9 and 10 for programming instructions and parameter descriptions.

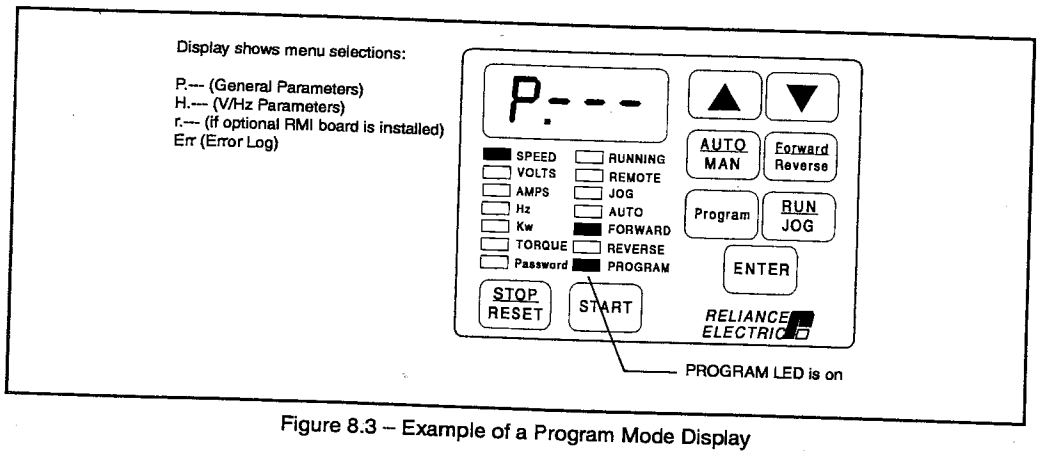


Figure 8.3 – Example of a Program Mode Display

8.3 Drive Control

When the control source is the local keypad/display (the REMOTE LED is off), the keypad controls the drive. This means that the drive will respond to START, RUN/JOG, and FORWARD/REVERSE commands only from the keypad.

Key functions are described in section 8.5. See the description of the Control Source parameter (P.000) in chapter 10 for information on selecting a drive control source.

8.4 The Display

The display part of the keypad/display is a four-character, seven-segment LED. At drive power-up, SELF is displayed as the drive performs power-up diagnostics. During drive operation, the display indicates parameter numbers, parameter values, fault or alarm codes, and drive output values. Figures 8.2 and 8.3 show sample displays.

8.4.1 Display Range

Normally, a minus (–) sign is used as one of the four characters in the display to indicate a negative value. If a value, including the minus sign, exceeds four characters, the display drops the minus sign and displays four digits. In this case, the SPEED LED flashes to indicate that the displayed value is a negative number. See table 8.1.

A decimal point to the right of the last digit in the display indicates there is further resolution (examples A and E) unless a decimal point already appears as part of the number displayed (example G). In either case, the drive uses the full resolution of the number for drive control, not the displayed value.

Table 8.1 – Display Range Examples

Example	If the actual number is ...	It is shown on the display as ...	And the SPEED LED will ...
A	1000.5	1000.	Not flash
B	–999	–999	Not flash
C	–1000	1000	Flash
D	–99.9	–99.9	Not flash
E	–1000.5	1000.	Flash
F	–9.99	–9.99	Not flash
G	–100.25	100.2	Flash
H	–9.999	9.999	Flash

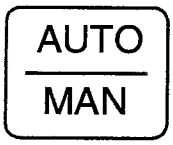
This does not apply for the speed display. For the speed display, the FORWARD or REVERSE LEDs indicate actual speed reference polarity.

8.4.2 Scaling the Manual Reference, Speed, and Reference Display

The values displayed for the manual reference, the output speed, and the selected speed reference represent relative speed as opposed to always being displayed in RPM. These values are scaled using P.028 (Speed Display Scaling). Refer to the Speed Display Scaling parameter description in chapter 10 for information.

8.5 The Keypad

The keypad has nine membrane keys that monitor, program, and control the drive.



Use the AUTO/MAN key to switch between the auto speed reference and the manual speed reference as shown below.

AUTO/MAN Status	Control Source (P.000)	Speed Reference Source
AUTO	Local keypad/display (P.000=LOCL)	Terminal strip
	Terminal strip remote inputs (P.000=rE)	Terminal strip
	Option port (P.000=OP)	Network
	Serial port (P.000=SErL)	Terminal strip
MAN	Local keypad/display (P.000=LOCL)	Local keypad/display or OIM/CS3000
	Terminal strip remote inputs (P.000=rE)	
	Option port (P.000=OP)	
	Serial port (P.000=SErL)	

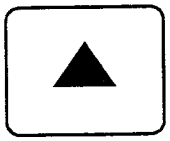
ATTENTION: When switching from auto to manual, or manual to auto, the drive will ramp to the reference level provided by the new source at the rate specified in P.001 (Accel Time 1), P.002 (Decel Time 1), P.017 (Accel Time 2), or P.018 (Decel Time 2). Be aware that an abrupt speed change can occur depending upon the new reference level and the rate specified in these parameters. Failure to observe this precaution could result in bodily injury.

If the control source is changed, the AUTO/MAN selection might be changed as well. When the control source is changed to OP or rE, the AUTO/MAN selection is forced to AUTO. If the control source is changed to LOCL or SErL, the AUTO/MAN selection is forced to MANUAL. However, if the control source is changed from LOCL or SErL or vice versa, the AUTO/MAN selection is not changed.

The AUTO/MAN key is not active if the control source is SErL. See the P.000 parameter description for information on control source selection.

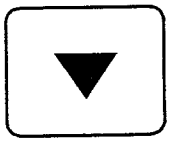
Refer to these parameters for more information on AUTO/MAN:

- P.052 AUTO/MAN Key Disable
- P.053 Manual Reference Preset Enable



Use the ▲ and ▼ keys to:

- Step through the drive parameter menus and error log when the keypad/display is in program mode
- Increase (or decrease) a numeric value (such as the reference or a parameter value)



Hold down these keys to increase the scroll speed.

Use the ENTER key to:

- Display a parameter (or a selection) value in program mode
- Save a value
- Move through each monitor display item when in monitor mode

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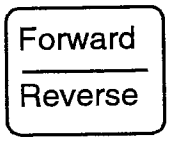
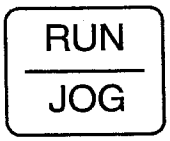


Use the FORWARD/REVERSE key to select the direction of motor rotation when the control source is local (REMOTE LED is off). This key is ignored if the control source is not local (REMOTE LED is on). See the FORWARD and REVERSE LED descriptions for more information.

Refer also to the P.027 (Forward/Reverse Configuration) parameter description.

Use the PROGRAM key to move between program and monitor modes. The PROGRAM LED turns on when the keypad/display is in program mode and turns off when the keypad/display is in monitor mode.



Use the RUN/JOG key to toggle between run and jog when in local control (REMOTE LED is off). When run is selected, pressing the START key results in continuous drive operation. When jog is selected, pressing the START key results in drive operation only until the START key is released.

This key is ignored if the control source is not local (REMOTE LED is on). See the RUN and JOG LED descriptions for more information.

Use the START key to apply power to the motor in local control (REMOTE LED is off). See the RUNNING LED description for more information.

If the drive is running (RUNNING LED is on), the STOP/RESET key stops the drive. If the drive is not running (RUNNING LED is off), pressing this key resets drive faults. Refer also to the STOP/RESET Key Disable Parameter (P.055).

8.6 Drive Status LEDs

Table 8.2 describes the eight drive status LEDs. Table 8.3 describes the monitor mode LEDs.

Table 8.2 – Drive Status LEDs

LED	Status	Description
RUNNING	On	Output power is being applied to the motor.
	Off	Output power is not being applied to the motor.
REMOTE	On	The drive is being controlled (START, RUN/JOG, FORWARD/REVERSE, speed reference) from a source other than the keypad.
	Off	The drive is being controlled from the keypad.
	Flashing	The network connection is lost.
JOG	On	Jog is selected.
	Off	Run is selected.
AUTO	On	The drive is receiving its speed reference from the terminal strip input or network option.
	Off	The drive is receiving its speed reference from the local keypad or serial port (OIM or CS3000); that is, using a manual reference.
FORWARD*	Flashing	The requested motor direction is forward; the actual motor direction is reverse (REVERSE LED is on).
	On	The motor is running in the forward direction.
	Off	The motor direction is not forward.
REVERSE*	Flashing	The requested motor direction is reverse; the actual motor direction is forward (FORWARD LED is on).
	On	The motor is running in the reverse direction.
	Off	The motor direction is not reverse.
PROGRAM	On	The keypad/display is in program mode.
	Off	The keypad/display is in monitor mode.
PASSWORD	On	Parameters cannot be modified from the keypad without entering the correct password into P.051 (Programming Disable). See section 10.4. Note that disabling program changes by means of P.051 does not prevent parameter changes being made from the serial port or the network.
	Off	Parameters can be modified from the keypad.

* If the speed reference is zero (0), pressing the FORWARD/REVERSE key (or toggling the FWD/REV input) will not alter the state of the FORWARD or REVERSE LEDs.

Table 8.3 – Monitor Mode LEDs

Monitor Mode LED	Corresponding Display When LED Is On (Actual Values)
SPEED	Motor speed is displayed. This value is scaled in parameter P.028.
VOLTS	Drive output volts are displayed. This is not DC bus volts.
AMPS	Drive output amps are displayed.
Hz	Drive output frequency in hertz is displayed.
Kw	Output power of the drive in kilowatts is displayed. Note that this is intended for display purposes as a general indication of kilowatt output and should not be used for control or exact metering purposes.
TORQUE	Not used.
All LEDs	Selected speed reference (in P.028 units) is displayed.

CHAPTER 9

Starting Up the Drive

This chapter describes the basic start-up procedure for drives that use open-loop V/Hz regulation. V/Hz regulation is the default method of regulation; you do not need to select it.

The start-up procedure below provides step-by-step instructions for:

- powering up
- checking monitor mode displays
- accessing program mode
- configuring General parameters (designated with a "P")
- configuring specific V/Hz parameters (designated with an "H")
- checking motor rotation direction
- running the drive

This start-up procedure describes how to program the minimum set of parameters that usually need to be programmed. Once you program these parameters, their values are retained even if power is lost. You only need to reprogram them if you want to change how the drive operates.

Your application might require programming other parameters in addition to the ones described in this start-up procedure. Refer to chapter 10 for descriptions of the parameters to verify whether you need to program any additional parameters. Appendix D provides an alphabetic list of parameters.

Throughout this manual, you will see references to parameter names and the numbers that identify them for the drive. This manual uses the format that is shown on the keypad/display to refer to parameters:

- P.nnn
- H.nnn
- r.nnn

where:

- nnn is a number
- P designates General parameters
- H designates Volts/Hertz parameters
- r designates optional RMI parameters

9.1 Preparing for Start Up

Read through the following sections to prepare for the start-up procedure.

What You Need To Know:

- You must be qualified to perform the procedure and be familiar with V/Hz regulation.
- You should be familiar with the keypad/display. See chapter 8.

What You Need To Do:

- Complete all hardware installation as described in chapters 3 to 7. This includes connecting input power, input transformers (if required), disconnects, fuses, and wiring the terminal strip on the drive.
- Record the following motor data from each motor nameplate for use during the procedure. Space is provided for recording information from three motors:

Motor rated amps:	
Motor rated volts:	
Motor base frequency:	

Motor rated amps:	
Motor rated volts:	
Motor base frequency:	

Motor rated amps:	
Motor rated volts:	
Motor base frequency:	

- Connect the drive to the motor.
- Check that you have not been prevented from programming the drive. If the PASSWORD LED on the keypad is on, programming has been prevented by parameter P.051, Programming Disable. See section 10.4 for the procedure to enable programming.

To Exit Program Mode If You Have a Problem:

During most of the start-up procedure, you will be programming parameters in program mode. If you want to stop programming parameters and exit program mode, press the PROGRAM key until the PROGRAM LED turns off. This places the keypad/display in monitor mode. See sections 8.1 and 8.2 for information on modes.

To Restore a Default Parameter Value after Writing over It:

If you enter the wrong value while programming parameters, you can restore the default if you have not yet pressed the ENTER key. To restore the default for a parameter:

1. Press the PROGRAM key.
2. Press the ENTER key. The default value of the parameter is displayed again. You can select it with ENTER or enter a new value and press ENTER.

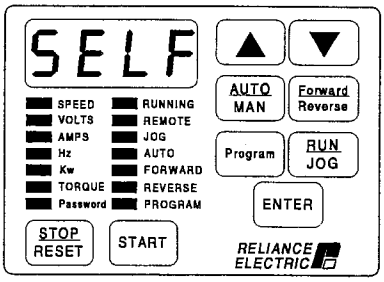
9.2 Start-Up Procedure

This section describes the start-up procedure for drives set up for V/Hz regulation.

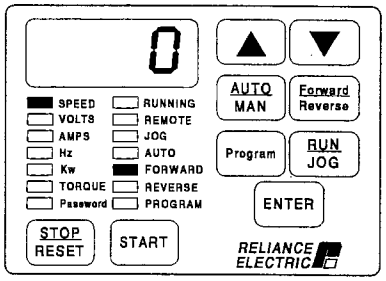
Step 1. Power Up the Drive

This step verifies that the drive powers up and passes the power-up diagnostics. After the drive passes the diagnostics, the keypad/display automatically enters monitor mode with speed displayed.

Turn power on.



The initial display shows SELF, with all monitor mode and status LEDs on, indicating the drive is performing power-up diagnostics.

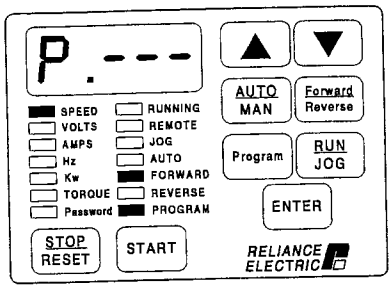


After diagnostics are complete (5 to 6 seconds), the SPEED LED is on and the keypad/display is in monitor mode. The displayed value is zero. You can move through the five items accessible in monitor mode — Speed, Volts, Amps, Hz, and Kw—by pressing the ENTER key.

Step 2. Select Program Mode

In this step, you will select program mode, which gives you access to the First Menu General (P) parameters.

Press the PROGRAM key.

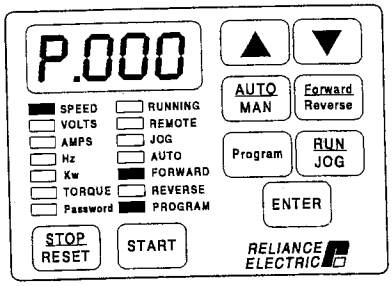


The PROGRAM LED is on and the First Menu General (P) parameters can be accessed.

Step 3. Program First Menu General Parameters P.000 to P.005

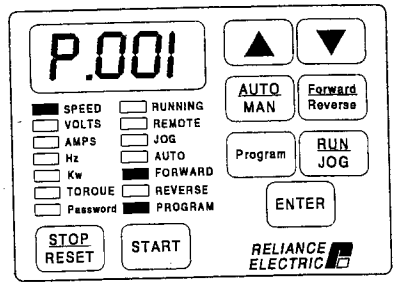
This step describes how to change First Menu General (P) parameters P.000 through P.005. P.000 selects where the drive is controlled from. This procedure assumes local control from the keypad (P.000 = LOCL), which is the default setting for the parameter.

Step 3.1 Press the ENTER key to display the first parameter, P.000 Control Source



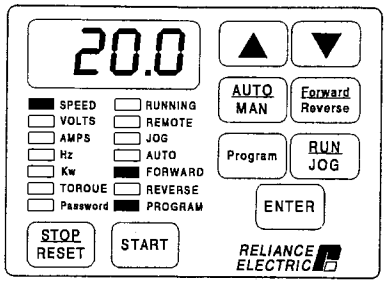
The default setting for P.000 is LOCL, or local control.

Step 3.2 Press the ▲ key to display P.001 Accel Time 1 (RAMP 1).



This parameter sets the acceleration time in seconds.

Step 3.3 Press the ENTER key to display the default setting of P.001.



This displays the default setting for acceleration time (20.0 seconds).

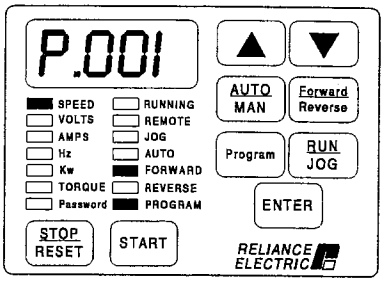
Step 3.4 Press the ▲ key to increase acceleration time, or the ▼ key to decrease acceleration time.

The adjustment range is:

1.0 to 999.9 seconds.

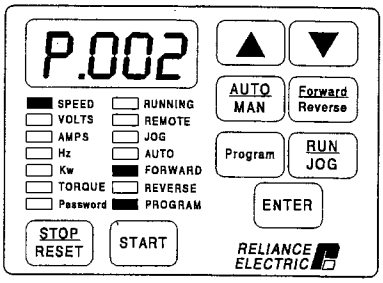
VALUE ENTERED: [ ]

Step 3.5 Press the ENTER key to save the changed value.



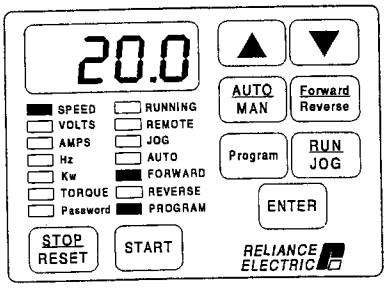
After pressing ENTER, the same parameter number is displayed. You can now go to the next parameter.

Step 3.6 Press the ▲ key to display P.002 Decel Time 1 (RAMP 1).



This parameter sets the deceleration time in seconds. The default stop method is coast-to-stop, set in P.025.

Step 3.7 Press the ENTER key to display the default setting of P.002.



This displays the default setting for deceleration time (20.0 seconds).

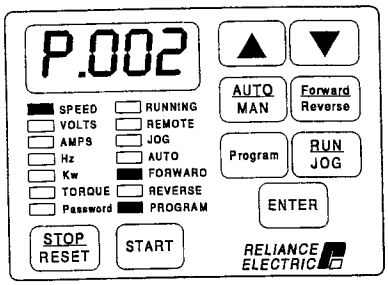
Step 3.8 Press the ▲ key to increase deceleration time, or the ▼ key to decrease deceleration time.

The adjustment range is:

1.0 to 999.9 seconds.

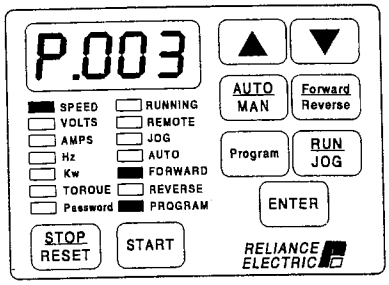
VALUE ENTERED: [ ]

Step 3.9 Press the ENTER key to save the changed value.



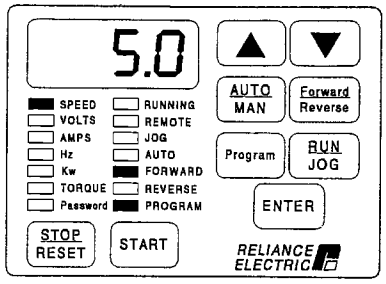
After pressing ENTER, the same parameter number is displayed. You can now go to the next parameter.

Step 3.10 Press the ▲ key to display P.003 Minimum Speed.



This parameter sets the minimum speed in Hz.

Step 3.11 Press the ENTER key to display the default setting of P.003.



This shows that the default setting for Minimum Speed is 5.0Hz.

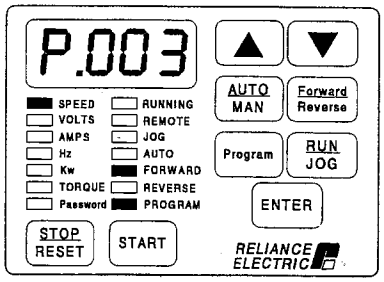
Step 3.12 Press the ▲ key to increase minimum speed or the ▼ key to decrease minimum speed.

The adjustment range is:

0.5 Hz to the value set for P.004 (Maximum Speed).

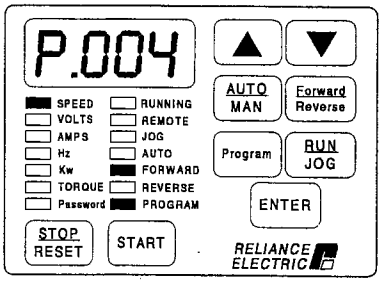
VALUE ENTERED: [ ]

Step 3.13 Press the ENTER key to save the changed value.



After pressing ENTER, the same parameter number is displayed. You can now go to the next parameter.

Step 3.14 Press the ▲ key to display P.004 Maximum Speed.

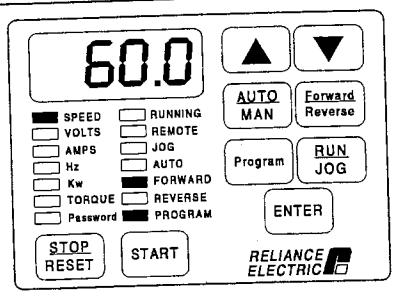


This parameter sets the maximum speed in Hz.

In addition, the drive has overfrequency protection by means of H.022. Refer to the description of this parameter and be sure to set it appropriately for your application.

Step 3.15 Press the ENTER key to display the default setting of P.004.

ATTENTION: You are responsible for ensuring that driven machinery, all drive-train mechanisms, and application material can operate safely at the maximum operating speed of the drive. Overfrequency protection in the drive is provided by means of H.022. Failure to observe this precaution could result in bodily injury.



This shows that the default setting for Maximum Speed is 60.0 Hz.

Step 3.16 Press the ▲ key to increase maximum speed or the ▼ key to decrease maximum speed.

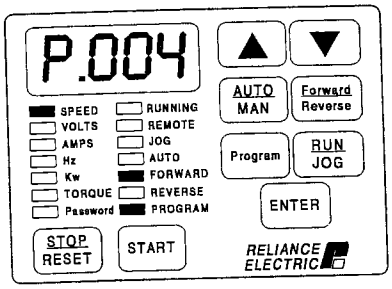
The adjustment range is:

15.0 Hz to the value set for H.022 (Overfrequency Limit).

The maximum value is 210 Hz.

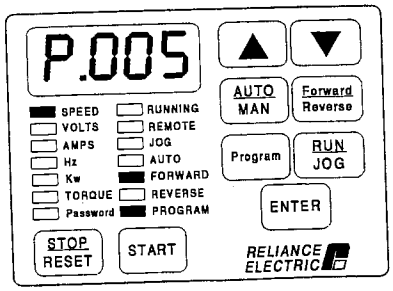
VALUE ENTERED: _____

Step 3.17 Press the ENTER key to save the changed value.



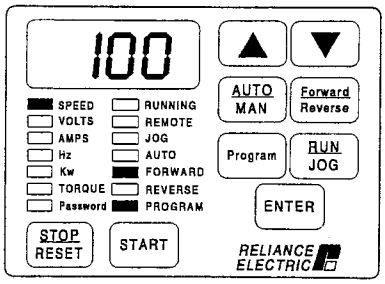
After pressing ENTER, the same parameter number is displayed. You can now go to the next parameter.

Step 3.18 Press the ▲ key to display P.005 Current Limit.



This parameter sets Current Limit, which corresponds to the value in parameter P.095, Power Module Output Amps.

Step 3.19 Press the ENTER key to display the default setting of P.005.



This shows that the default setting for Current Limit is 100.

Step 3.20 Press the ▼ key to decrease current limit. Decrease current limit only if the motor nominal current rating is less than the drive nominal current rating.

Use this equation to calculate current limit:

$$\frac{\text{Motor Rated Amps}}{\text{Rated Drive Output Amps}} \times 100$$

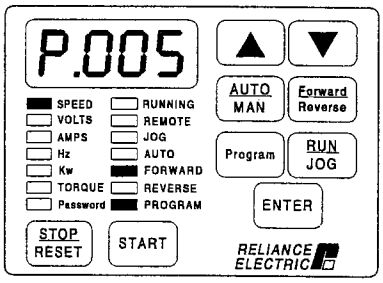
Where:

- Motor Rated Amps are from the motor nameplate
- For Rated Drive Output Amps, see table 2.1

Adjustment Range: 50 to 110

VALUE ENTERED: [ ]

Step 3.21 Press the ENTER key to save the entered value.

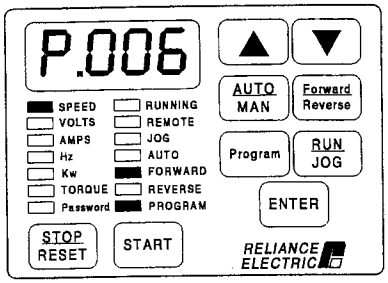


After pressing ENTER, the same parameter number is displayed. You can now move to the next parameter.

Step 4. Enter the Second Menu Password

This step is required to access the Second Menu General (P) parameters and the Volts/Hertz (H) parameters.

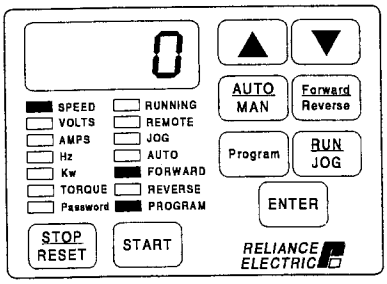
Step 4.1 Press the ▲ key to display parameter P.006 Second Menu Password.



This parameter allows you to enter the factory preset password that allows access to the Second Menu.

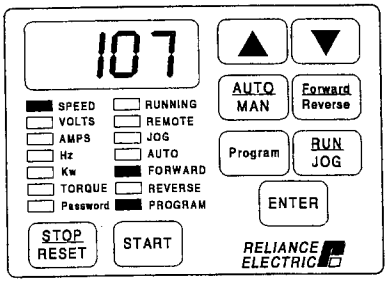
The Second Menu provides access to all parameters and the error log.

Step 4.2 Press the ENTER key.



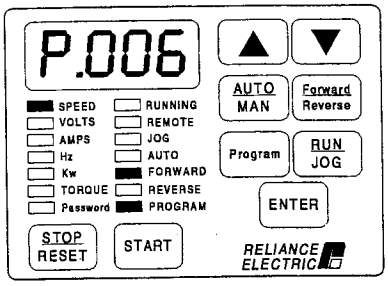
Zero is displayed.

Step 4.3 Press the ▲ key until the password number 107 is displayed.



The password and access to the Second Menu will be retained if the drive loses and regains power.

Step 4.4 Press the ENTER key to save the password number.



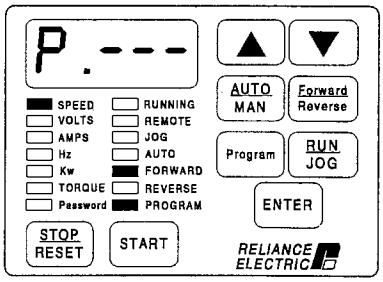
After pressing ENTER, P.006 is displayed. You now have access to all parameters and the error log.

After the password is entered, the parameter value is reset to 0.

Step 5. Program the Second Menu Volts/Hertz (H) Parameters

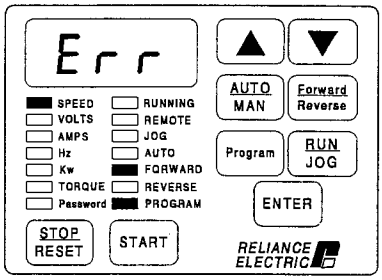
This step describes how to program the parameters that apply to V/Hz regulation only.

Step 5.1 Press the PROGRAM key to return to the First Menu.

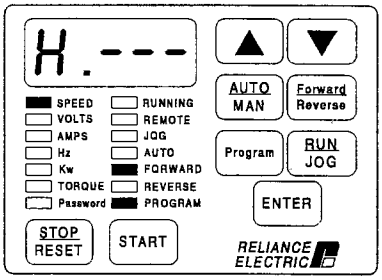


The display returns to the General (P) parameters in the First Menu.

Step 5.2 Press the ▲ key twice.

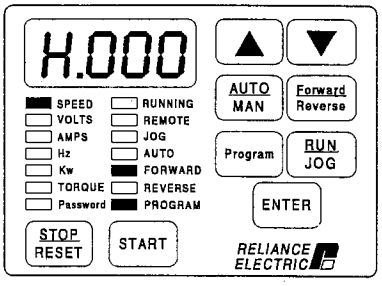


The error log (Err) is bypassed, then...



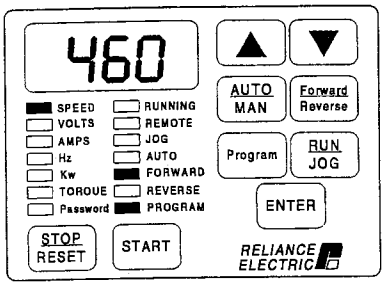
...the Volts/Hertz (H) parameter main menu is displayed.

Step 5.3 Press the ENTER key to access the first Volts/Hertz parameter: H.000, Motor Nameplate Volts.



This parameter sets the Motor Nameplate Volts and is taken directly from the motor nameplate.

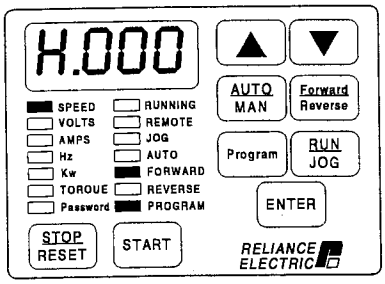
Step 5.4 Press the ENTER key.



Default value varies.

The default setting for H.000 is displayed. The default setting depends on the Power Module rating and is factory set. Check appendix F to make sure the value is correct. The value shown here is only an example.

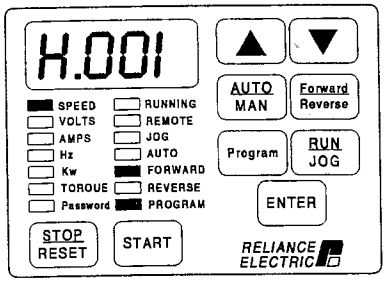
Step 5.5 If no change was made, press the ENTER key to return to the parameter. If you changed the value, press ENTER to accept the change and return to the parameter.



After pressing ENTER, the same parameter is displayed. You can now move to the next parameter.

Step 5.6 Press the ▲ key to display H.001, Motor Nameplate Base Frequency.

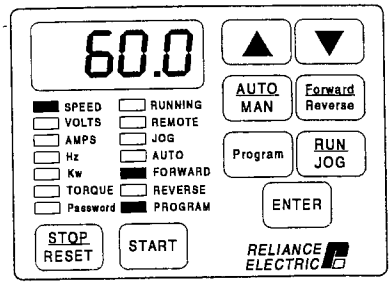
If Motor Nameplate Base Frequency is not set correctly, the monitor mode SPEED display will not be scaled correctly.



This parameter adjusts the volts/hertz ratio. Base frequency is the set frequency at which the output voltage reaches the Motor Nameplate Voltage.

See section 10.6.3 for a description of parameter H.001.

Step 5.7 Press the ENTER key.

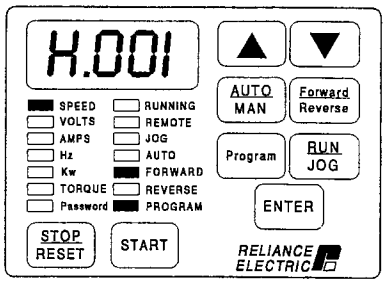


The default setting of 60.0Hz is displayed.

Step 5.8 Press the ▼ key to decrease base frequency, if necessary.

This value will typically not need to be changed from 60 Hz.

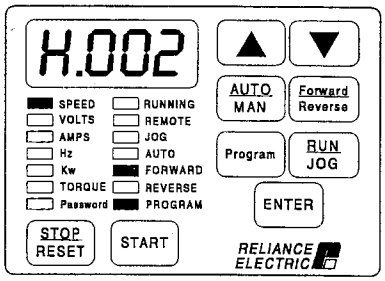
Step 5.9 Press the ENTER key.



After pressing ENTER, the same parameter is displayed. You can now move to the next parameter.

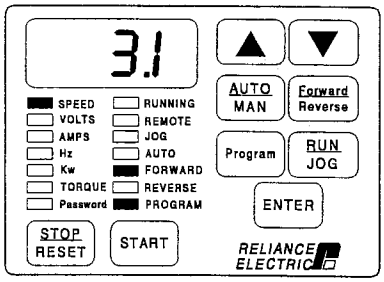
Step 5.10 Press the ▲ key to display H.002, Motor Nameplate Amps.

ATTENTION: This parameter setting must not exceed the rated amps found on the motor nameplate. Overcurrent or excess heating of the motor could result if this is not the case. Failure to observe this precaution could result in damage to, or destruction of, the equipment.



This parameter specifies the Motor Nameplate Amps and is taken directly from the motor nameplate.

Step 5.11 Press the ENTER key.



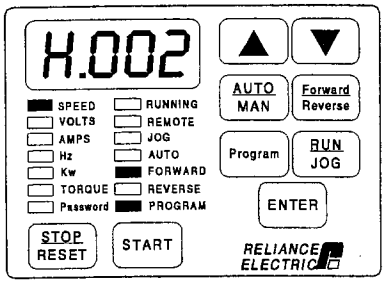
The default setting depends on the drive rating. The display shown here is only an example.

Step 5.12 Press the ▲ key to increase the motor nameplate amps, or the ▼ key to decrease motor nameplate amps.

The adjustment range depends on the drive rating. See appendix F.

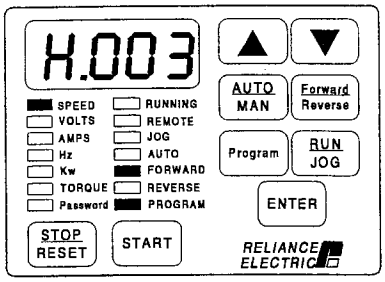
VALUE ENTERED: [ ]

Step 5.13 Press the ENTER key to save the changed value.



After pressing ENTER, the same parameter is displayed. You can now move to the next parameter.

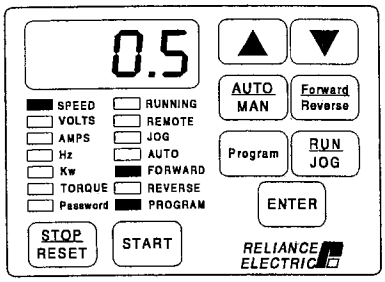
Step 5.14 Press the ▲ key to display H.003, Torque Boost Voltage.



This parameter is required to offset the voltage drop of the motor at low speeds and produce constant torque. For example, high friction loads may require high starting torque.

See section 10.6.3 for a description of parameter H.003.

Step 5.15 Press the ENTER key.



The default setting is 0.5.

Step 5.16 Press the ▲ key to increase the torque boost voltage, or the ▼ key to decrease torque boost voltage.

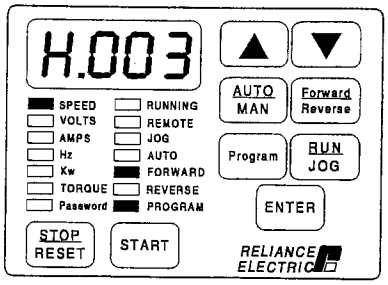
Important: If you set H.003 = 0, you must perform the identification test, controlled by H.020, before running. Refer to the H.020 parameter description.

The adjustment range is:

0.0% to 20.0%

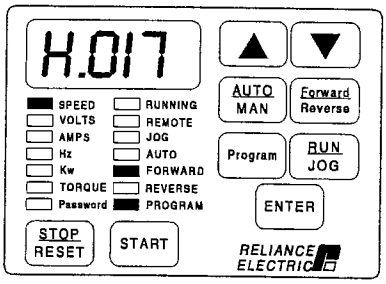
VALUE ENTERED: _____

Step 5.17 Press the ENTER key to save the changed value.



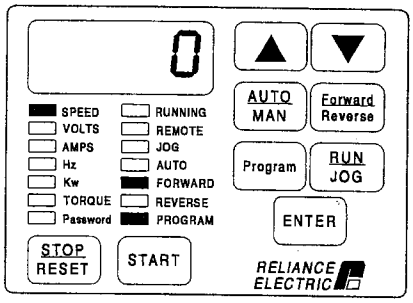
After pressing ENTER, the same parameter is displayed. You can now move to the next parameter.

Step 5.18 Press the ▲ key until H.017, Input Power/Snubber Configuration, is displayed.



This parameter selects the input power supply type/snubber resistor kit configuration. See section 10.6.3 for a description of parameter H.017.

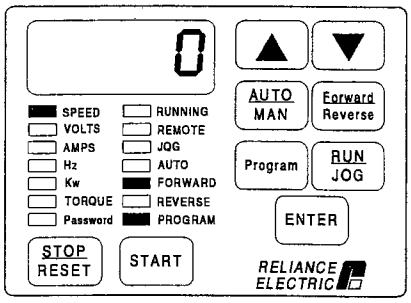
Step 5.19 Press the ENTER key.



The default setting is 0.

Step 5.20 Press the ▲ key to increase the selection value, or leave it at 0.

If you do not have AC input or you are using a snubber resistor, see the H.017 parameter description for more information.

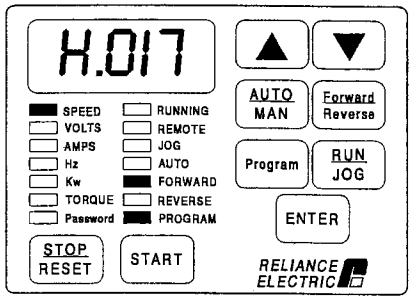


The adjustment range is:

0 = AC input; snubber resistor not used; ride-through enabled.
1 = AC input; snubber resistor used; ride-through enabled.
2 = DC input; snubber resistor not used; ride-through disabled.
3 = DC input; snubber resistor used; ride-through disabled.
4 = DC input; snubber resistor not used; ride-through enabled.
5 = DC input; snubber resistor used; ride-through enabled.

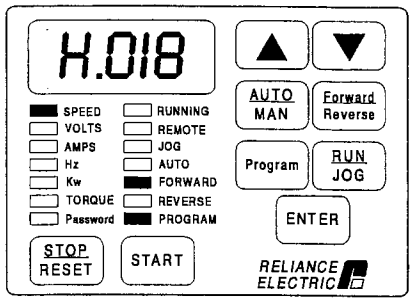
VALUE ENTERED: [ ]

Step 5.21 Press the ENTER key to save the changed value.



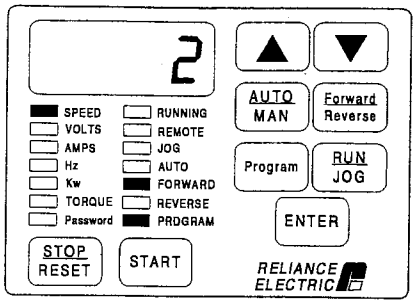
After pressing ENTER, the same parameter is displayed. You can now move to the next parameter.

Step 5.22 Press the ▲ key until H.018, Volts/Hertz Curve Type, is displayed.



This parameter selects the type of curve for volt/hertz regulation. See section 10.6.3 for a description of parameter H.018.

Step 5.23 Press the ENTER key.



The default setting is 2 for centrifugal pump and fan motor applications.

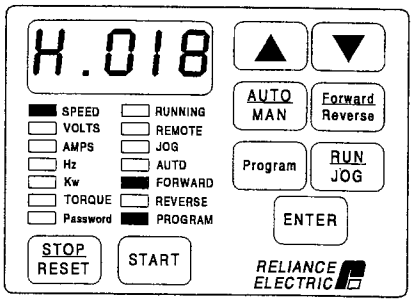
Step 5.24 Press the ▼ key to decrease the selection value to 0 or 1, or leave it at 2.

The adjustment range is:

0 = Linear curve
1 = Optimized curve for Reliance Electric RPM AC motors
2 = For centrifugal pump and fan motor applications

VALUE ENTERED: [ ]

Step 5.25 Press the ENTER key to save the changed value.

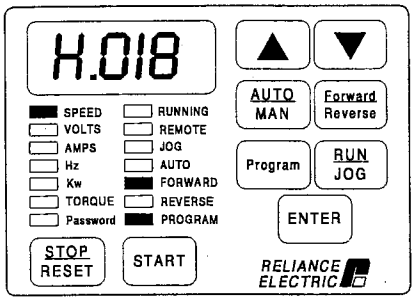


After pressing ENTER, the same parameter is displayed. You can now move to the next parameter.

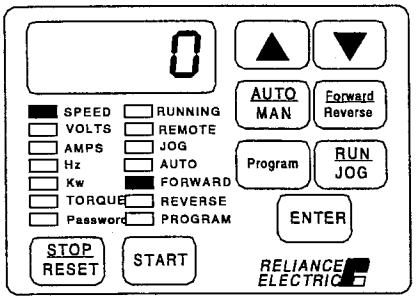
Step 6. Return to Monitor Mode

This step describes how to exit program mode and return to monitor mode.

Step 6.1 The display should now show the last parameter adjusted in step 5, H.018.



Step 6.2 Press the PROGRAM key twice to exit program mode.



The display returns to monitor mode with speed displayed. The SPEED LED is on and the PROGRAM LED is off.

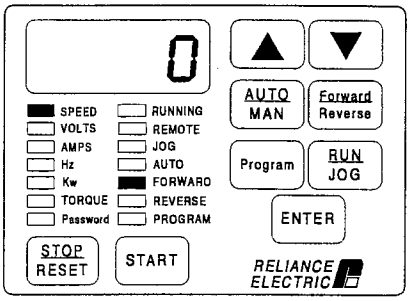
ATTENTION: The subsequent steps require rotating parts and/or electrical circuits to be exposed. Stay clear if the equipment must be running, or disconnect and lock out or tag power source if contact must be made. Failure to observe this precaution could result in severe bodily injury or loss of life.

Important: The stop input on the terminal strip is not active when the Control Source parameter (P.000) is set to LOCL, as it is during this start-up procedure. Use the STOP/RESET key if you need to stop the drive.

Step 7. Check Motor Rotation Direction

This step involves verifying the speed reference is set to minimum speed, starting the drive, and checking that the motor rotates in the correct direction. It is performed with the motor disconnected from the load.

Step 7.1 Press the PROGRAM key until the PROGRAM LED turns off.

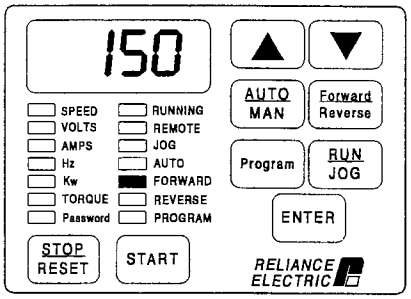


The keypad/display will enter monitor mode.

Step 7.2 Verify that the AUTO LED is off (press the AUTO/MAN key until the AUTO LED turns off).

This selects the local keypad as the speed reference source.

Step 7.3 Press the ▲ or ▼ key once.



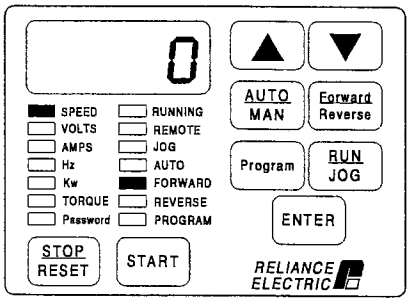
The monitor mode LEDs will all turn off and the manual speed reference value will be displayed. The speed reference value is in the units defined in P.028. The display shown here is only an example.

Step 7.4 If the speed reference is at minimum speed, then go to step 7.6.

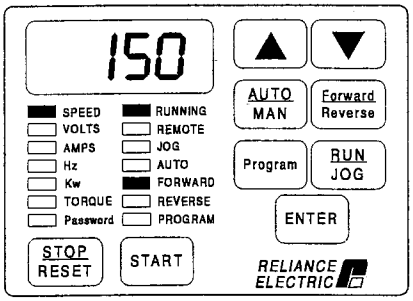
If the speed reference is not at minimum speed, go to step 7.5.

Step 7.5 Press the ▼ key to decrease the speed reference value.

Step 7.6 Press the ENTER key to return to monitor mode.

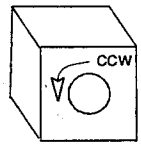


Step 7.7 Verify you have selected RUN and FORWARD. Press the START key.



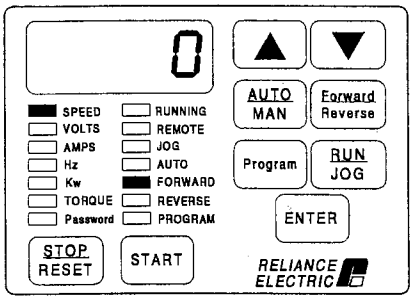
The drive is now running. The keypad/display is in monitor mode and the SPEED, RUNNING, and FORWARD LEDs are on. The drive should be running at minimum speed. The sample display shows 150 RPM.

Step 7.8 Visually check that the motor rotates counter-clockwise (CCW) when viewed from the driven motor shaft end.



Step 7.9 If the rotation direction is:

- Not correct: Press the STOP/RESET key. Continue with step 7.10.
- Correct: Continue with step 7.14.



When the STOP/RESET key is pressed, the RUNNING LED turns off.

Step 7.10 Turn off and lock out or tag power to the drive.

Step 7.11 Verify that the DC bus capacitors are discharged. See section 11.3 for this procedure.

Step 7.12 Drive Only: Switch any two of the motor leads (U, V, or W).
Drive with Options: Switch any two motor leads (T1, T2, or T3) in the options enclosure.

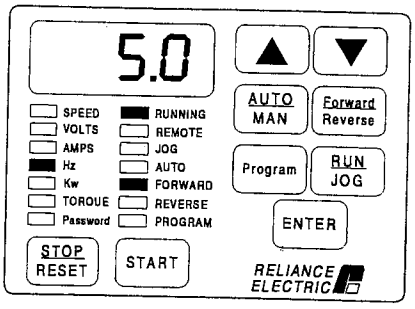
Step 7.13 Turn power on, and press the START key. Repeat step 7.8.

Step 7.14 To make sure that the drive is not inadvertently started, turn off and lock out or tag power to the drive. Verify that motor direction is appropriate for the required machine direction. Connect the motor to the load.

Step 8. Run the Drive

This step describes how to adjust the speed reference from the keypad and run the motor up to maximum speed in Hz. At maximum Hz, you must check values in monitor mode. This step assumes you have connected the motor to the load.

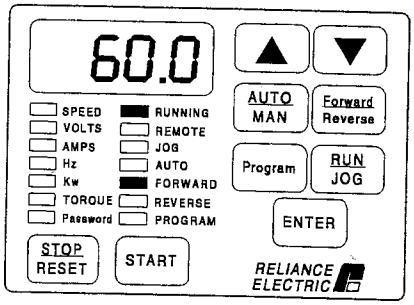
Step 8.1 Press the ENTER key until the Hz LED turns on. (If the drive is not running, press the START key.)



This example shows the minimum hertz setting of parameter P.003.

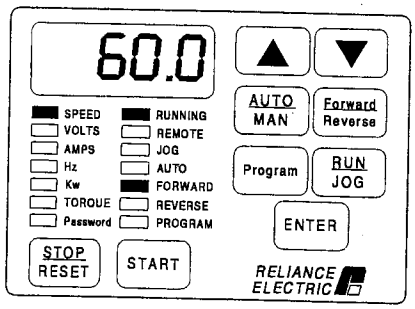
Step 8.2 Press the ▲ or ▼ key once. All of the monitor mode LEDs turn off. Increase the speed reference to the maximum value by using the ▲ key.

Wait five seconds or press the ENTER key to return to monitor mode.



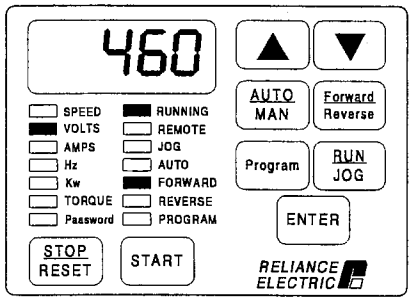
This increases the drive speed reference and the motor will rotate up to maximum speed.

The monitor mode LEDs turn off when the reference is changed.



The display now shows the drive speed. Your speed display might be different.

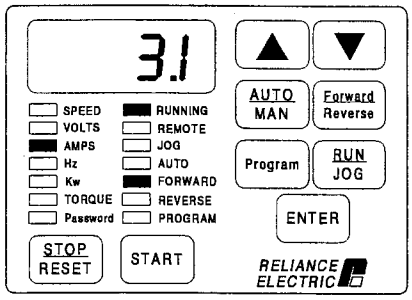
Step 8.3 Press the ENTER key repeatedly to move to the VOLTS display.



This example shows the output volts at Maximum Speed (P.004). Your actual reading might be different.

VALUE READ:

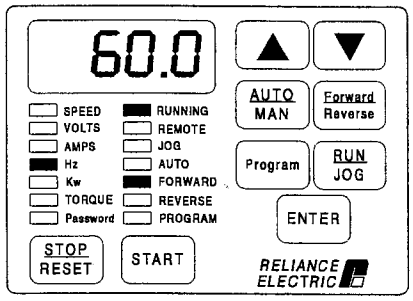
Step 8.4 Press the ENTER key to move to the AMPS display.



This example shows the output amps at Maximum Speed (P.004). Your actual reading might be different.

VALUE READ:

Step 8.5 Press the ENTER key to move to the Hz display.



This example shows the Hz value corresponding to the value set in parameter P.004, Maximum Speed. Your actual reading might be different.

VALUE READ:

Step 8.6 Press the STOP/RESET key. The driven motor should stop as programmed in P.025, Stop Type.

End of Start-Up Procedure

This is the end of the basic start-up procedure. When the start-up values are final, appendix E can be used to record final settings.

To configure the remaining parameters for your application, refer to chapter 10. If you have purchased CS3000 software, save your configuration to a personal computer. Refer to instruction manual D2-3348.

Recall that the Control Source parameter (P.000) was set to LOCL in this start-up procedure. If you need to operate the drive from a different control source, you will need to change the setting in parameter P.000.

CHAPTER 10
Programming Reference

To program the drive for a specific application, you display the appropriate parameter and adjust it as required. The parameters define characteristics of the drive. This chapter provides an overview of the parameter menus as well as detailed descriptions of each parameter. This chapter also describes how to access, display, and modify parameters.

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, see the Metasys Communication Board manual (HE-HGV3MT).

10.1 Parameter Menus

To simplify the configuration process, the VTAC 7 drive software parameter list is divided into two menus: the First Menu and the Second Menu. These are shown in figure 10.1.

The First Menu contains General parameters (P.000 through P.006), which are commonly used for simple applications.

The Second Menu contains parameters that allow drive adjustment for more complex applications. These functions can be safety related and should be used only with a thorough understanding of how they can affect motor operation.

Within the Second Menu are:

- General parameters (P.007 through P.099). These parameters apply to most applications.
- Volts/Hertz parameters (H.000 through H.022). These parameters are used only for VTAC 7 drive applications.
- RMI parameters (r.001 through r.066). These parameters are displayed only if an optional Remote Meter Interface board (M/N 2SI3000) is installed in the drive.
- The error log. The error log is shown as Err on the display. For information on accessing the error log or clearing errors, see section 11.2 of this manual.

Access to the Second Menu parameters is enabled/disabled using the Second Menu Password parameter (P006). Refer to section 10.6.1 for more information.

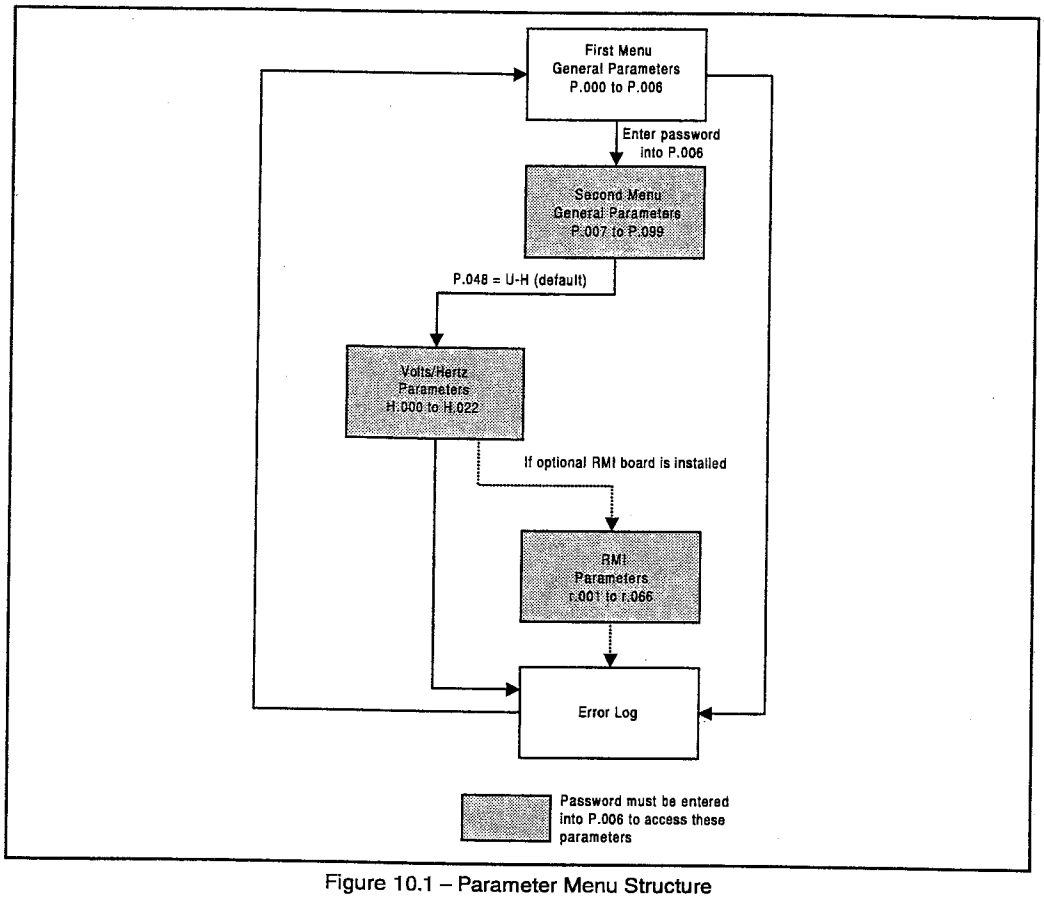


Figure 10.1 – Parameter Menu Structure

10.2 Parameter Types

There are three types of parameters:

Configurable: Can be adjusted or changed only while the drive is stopped.

Tunable: Can be adjusted or changed while the drive is running or stopped.

Read only: Cannot be adjusted.

Each parameter is described in detail in this chapter. The description includes this information:

Parameter Number: The unique number assigned to a parameter. The number is preceded by P, H, or r to identify it as a General, Volts/Hertz, or optional RMI parameter, respectively. The parameter number is displayed on the keypad/display.

Parameter Name: The name assigned to a parameter number. The name is not displayed when programming the drive using the keypad/display. The parameter name is only visible when using the CS3000 software or Operator Interface Module (OIM).

Parameter Description: A description of the parameter's function.

Parameter Range: The pre-defined parameter value limits or selections.

Default Setting: The factory default setting.

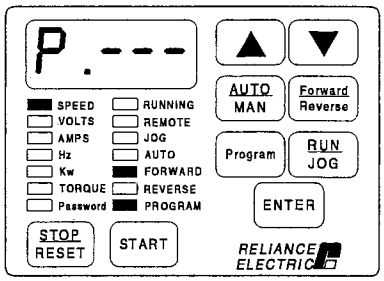
Parameter Type: Identifies if the parameter is tunable, configurable, or read only.

Refer also to parameters: Associated parameters that provide related information.

10.3 Displaying or Changing Parameter Values

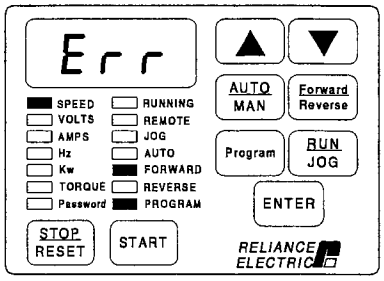
To display or change parameter values:

Step 1. Press the PROGRAM key until the PROGRAM LED turns on to enter program mode.



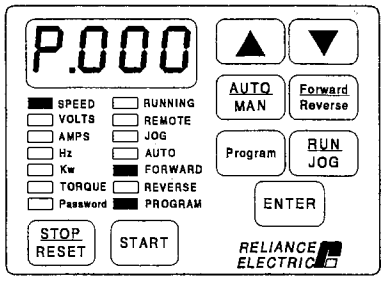
One of the main parameter menus (P.---, H.---, Err) will be displayed.

Step 2. Use the ▲ key or the ▼ key to move through the menus.



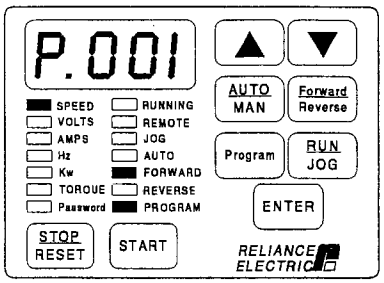
Note that if P.--- and Err are the only two menu selections displayed, access to the Second Menu parameters has been restricted. A password must be entered into parameter P.006 in order to access the Second Menu parameters. Refer to section 10.6.1 for this procedure.

Step 3. Once the desired menu is displayed, press the ENTER key to select it.



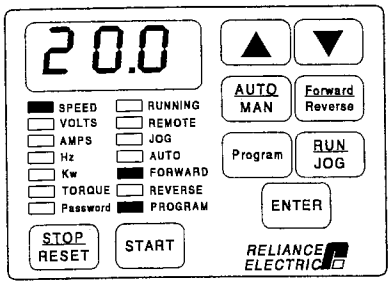
The first parameter number in the menu or the last parameter number previously accessed from that menu will be displayed.

Step 4. Press the ▲ key or the ▼ key to move through the parameters.



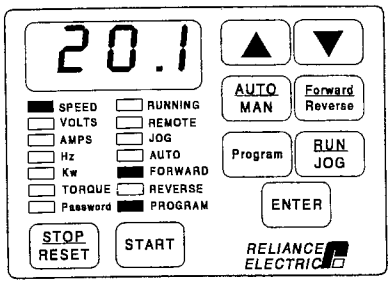
Each parameter number will be displayed as you move through the parameters.

Step 5. Once the desired parameter is displayed, press the ENTER key to access it.



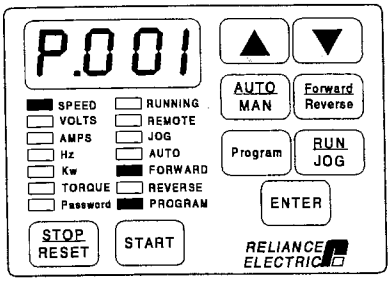
The parameter value will be displayed.

Step 6. Press the ▲ key or the ▼ key to change the value.



Note that if programming is disabled in parameter P.051 (Programming Disable), or if the parameter is configurable and the drive is running, the value stays the same.

Step 7. Press the ENTER key to save the changed value.
– OR –
Press the PROGRAM key to exit the parameter without changing the value.



The parameter number is displayed again.

Important: The value will not be written into memory unless the ENTER key is pressed.

To display or change additional parameters within this menu, repeat steps 4 through 7.

To display or change parameters in a different menu, press the PROGRAM key to return to the main menu selections. Then repeat steps 2 through 7.

To exit program mode, press the PROGRAM key until the PROGRAM LED turns off.

Parameter values and the local keypad status are retained through a line dip or power shutdown.

10.4 Ensuring Program Security

Parameter values can be password-protected using parameter P.051 Programming Disable. When programming is disabled, parameter values can be displayed but cannot be modified from the keypad unless the correct password is entered in P.051.

P.051 only protects against program changes made through the keypad. Changes can still be made from the serial port or the network.

ATTENTION: It is your responsibility to determine how to distribute the password. Reliance Electric is not responsible for unauthorized access violations within the user's organization. Failure to observe this precaution could result in bodily injury.

To disable/enable parameter programming:

(See section 10.3 if you are unfamiliar with modifying parameters using the keypad/display.)

Step 1. Select parameter P.051 from the Second Menu General parameters. P.051 will appear on the display.

Step 2. Press the ENTER key to access the parameter. A zero will be displayed.

Step 3. Use the ▲ key to increment the value to 26. This is the password number.

Step 4. Press the ENTER key to save the value. P.051 will be displayed.

Parameter programming is disabled when the Password LED is on and enabled when the Password LED is off.

To prevent unauthorized password use, a zero value (not the saved password value) is displayed whenever this parameter is accessed.

Note that parameter values and the local keypad status are retained through a line dip or power shutdown.

10.5 First Menu Parameters

The First Menu contains General parameters that are most commonly used for simple applications. No password is required to access First Menu parameters.

P.000 Control Source

This parameter selects the drive control source.

The drive responds to the reference, forward/reverse, run/jog, and start commands (inputs) only from the source selected in this parameter.

Parameter Range:	LOCL = Local keypad/display rE = Terminal strip remote inputs OP = Option port SErL = Serial port (CS3000 or OIM)
Default Setting:	LOCL
Parameter Type:	Configurable
Refer also to parameters:	P.007 Terminal Strip Digital Inputs Configure P.008 Terminal Strip Speed Reference Source P.063 Option Port: Network Reference Source

ATTENTION: If P.000 (Control Source) is set to OP (Option Port) and P.062 is set to 1 (Hold Last Reference), and the drive loses communication with the network, the drive maintains the last frequency command sent to it. Ensure that driven machinery, all drive-train mechanisms, and application material can operate safely at the maximum operating speed of the drive. Failure to observe this precaution could result in bodily injury.

The selected drive control source is determined primarily by the value in P.000. However, if P.000 = rE, the REM/LOC input might toggle the control source between the local keypad and the terminal strip. See P.007 (Terminal Strip Digital Inputs Configure).

Depending on the control source selected, the AUTO/MAN key can be used to switch between speed reference sources as shown in table 10.1.

Table 10.1 – Speed Reference Source Based on P.000 and AUTO/MAN Key Status

Control Source (P.000)	AUTO/MAN Status	Speed Reference Source
Local keypad/display (P.000=LOCL)	AUTO selected	Terminal strip
	MAN selected	Local keypad/display or OIM
Terminal strip remote inputs (P.000=rE)	AUTO selected	Terminal strip
	MAN selected	Local keypad/display or OIM
Option port (P.000=OP)	AUTO selected	Network
	MAN selected	Local keypad/display or OIM
Serial port (P.000=SErL)	AUTO selected	Terminal strip
	MAN selected	Local keypad/display or OIM

Refer to chapter 8 and the description of parameter P.052 (AUTO/MAN Key Disable) in section 10.6 for more information on the AUTO/MAN key.

Set P.000 = OP to select the DeviceNet, AutoMax™, Profibus™, or Metasys Network option board as the drive control source.

The REMOTE LED turns on if a control source other than the local keypad is selected.

P.001 Accel Time 1 (RAMP 1)

This parameter specifies the amount of time in which the motor ramps from zero speed to Maximum Speed (P.004).

Parameter Range:	1.0 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.004 Maximum Speed P.005 Current Limit

The time the motor takes to make any speed increase is directly proportional to the value in this parameter. This parameter does not apply if JOG is selected. See P.021 (Jog Ramp Accel Time).

If the motor load inertia is high, or the Current Limit (P.005) setting is too low, actual motor acceleration time will be longer than the time set in P.001. If Accel Time 1 is set too low, an overcurrent fault might occur.

P.002 Decel Time 1 (RAMP 1)

For V/Hz regulation, this parameter specifies the amount of time in which the motor ramps from Maximum Speed (P.004) to zero speed.

Parameter Range:	1.0 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.004 Maximum Speed P.005 Current Limit

The time the motor takes to make any speed decrease (except a coast-to-rest stop) is directly proportional to the value in this parameter. This parameter does not apply if JOG is selected. See P.022 (Jog Ramp Decel Time).

Note that motor load inertia and input line conditions can extend the deceleration time to a value greater than the preset time. With very fast deceleration times, regenerative motor voltage can charge up the DC bus voltage, causing a high bus voltage (HU) fault. To avoid a fault condition, extend the deceleration time for a longer period. If a deceleration time faster than the acceptable range is required, installing an optional Snubber Resistor Kit or Regenerative Braking Module Kit may prevent the fault.

For V/Hz regulation with dynamic braking (snubber resistor) disabled (H.017=OFF), the deceleration time can be extended to prevent a high bus voltage (HU) fault from occurring.

P.003 Minimum Speed

This parameter limits the speed reference to the drive. Regardless of what speed reference is supplied, the regulator will not command a speed less than the value in P.003.

Parameter Range:	0.5 to P.004 Maximum Speed
Default Setting:	5.0 Hz
Parameter Type:	Tunable
Refer also to parameters:	P.004 Maximum Speed

ATTENTION: The drive can operate at and maintain zero speed. You are responsible for ensuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating or might operate at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

Note that the drive can decrease the output frequency below P.003 (but not below 0.5Hz) to avoid an overcurrent fault.

P.004 Maximum Speed

This parameter limits the speed reference to the drive. Regardless of what speed reference is supplied, the regulator will not command a speed greater than the value in P.004.

Parameter Range:	15.0 to H.022 Overfrequency Limit
Default Setting:	60.0 Hz
Parameter Type:	Tunable
Refer also to parameters:	P.028 Speed Display Scaling H.022 Overfrequency Limit

ATTENTION: You are responsible for ensuring that driven machinery, all drive-train mechanisms, and application material can operate safely at the maximum operating speed of the drive. Overspeed detection in the drive determines when the drive shuts down. This is fixed at the frequency level set in parameter H.022 (Overfrequency Limit). Failure to observe this precaution could result in bodily injury.

This parameter specifies the maximum allowed speed in hertz. The drive is equipped with configurable overspeed protection at the frequency level set in H.022 (Overfrequency Limit).

P.005 Current Limit

This parameter provides the means to limit motor stator current while running at constant speed or during acceleration.

Parameter Range:	50 to 110%
Default Setting:	100%
Parameter Type:	Tunable
Refer also to parameters:	P.095 Power Module Output Amps H.002 Motor Nameplate Amps

Current limit is set as a percentage of the Power Module rated amps with a maximum value of 110%. 110% current limit equals the current value in parameter P.095 (Power Module Output Amps).

When the output current attempts to exceed the preset current limit, the output voltage and frequency will be lowered as the VTAC 7 drive reduces output current.

P.006 Second Menu Password

This parameter enables or disables access to Second Menu General (P), Volts/Hertz (H), and RMI (r) parameters.

Parameter Range:	0 to 9999; 107 = password
Default Setting:	N/A
Parameter Type:	Tunable
Refer also to parameters:	N/A

ATTENTION: It is your responsibility to determine how to distribute the second menu password. Reliance Electric is not responsible for unauthorized access violations within your organization. Failure to observe this precaution could result in bodily injury.

See section 10.6.1 for more information about this password.

Note that if the password is entered to enable access to the Second Menu parameters, the password must then be re-entered to disable access.

10.6 Second Menu Parameters

The Second Menu contains parameters used for more complex applications. Within the Second Menu are General (P.---) parameters that apply to most applications and Volts/Hertz (H.---) parameters. If an optional RMI board is installed in the drive, RMI (r.---) parameters are also in the Second Menu.

For a detailed description of:	Refer to:
Second Menu General parameters	Section 10.6.2
Second Menu Volts/Hertz parameters	Section 10.6.3
Second Menu RMI parameters	RMI instruction manual D2-3341

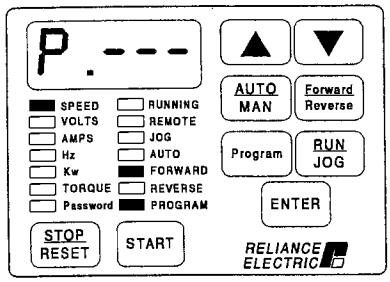
Access to the Second Menu parameters is enabled or disabled using the Second Menu Password parameter (P.006).

10.6.1 Entering the Second Menu Password

ATTENTION: It is your responsibility to determine how to distribute the second menu password. Reliance Electric is not responsible for unauthorized access violations within your organization. Failure to observe this precaution could result in bodily injury.

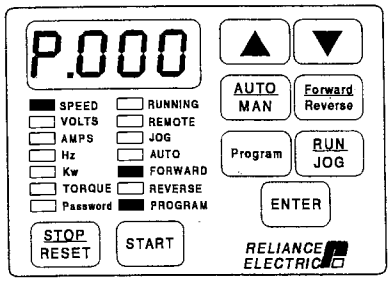
The Second Menu Password parameter (P.006) enables or disables access to the Second Menu parameters. When access is disabled, the Second Menu parameters cannot be displayed or changed (see figure 10.1). To enable access, a factory-set password is entered into P.006. Access to the Second Menu parameters will then remain enabled until the password is entered into P.006 again.

Step 1. Press the PROGRAM key until the PROGRAM LED turns on.



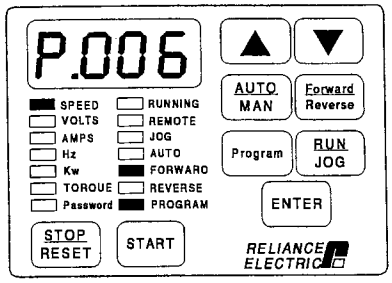
If P.--- is not displayed, press the ▲ key or the ▼ key until it is.

Step 2. Press the ENTER key.



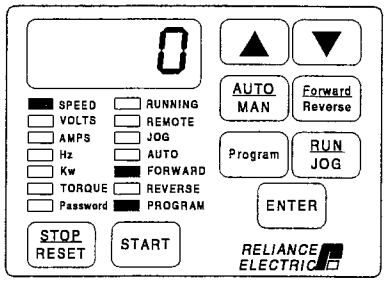
The first parameter number in the First Menu General parameters (P.000) or the last parameter number accessed will be displayed.

Step 3. Press the ▲ key to increment the parameter numbers until P.006 is displayed.



Important: If you are able to display parameter P.007, access to the Second Menu is enabled. Continue with this procedure only if you wish to disable access to the Second Menu.

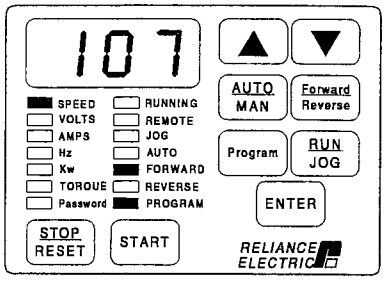
Step 4. Press the ENTER key to access the parameter.



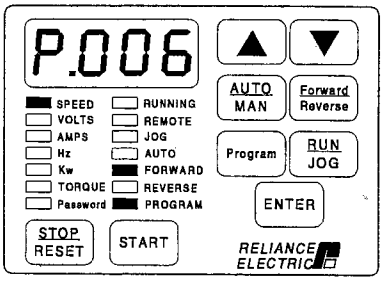
Zero is displayed.

To prevent unauthorized password use, a zero value (not the saved password number) is displayed whenever this parameter is accessed.

Step 5. Press the ▲ key to increment the value until 107 is displayed. This is the password. (Holding down the ▲ key will increase the scroll speed.)

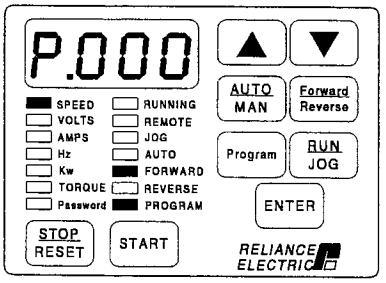


Step 6. Press the ENTER key to select the password.

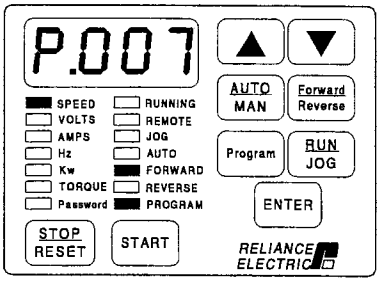


P.006 is displayed.

Step 7. Press the ▼ key to verify the access status.



Access Disabled



Access Enabled

P.007 Terminal Strip Digital Inputs Configure

The VTAC 7 drive provides multiple configurations of digital inputs 6, 7, and 8 on the terminal strip. This parameter determines how these inputs are used.

The P.008 (Terminal Strip Speed Reference Source) selection will limit the selection of P.007 because the P.008 selection can use one or more of digital inputs 6 through 8.

Parameter Range:

	Preset Configurations of Inputs 6, 7, and 8		
	Digital Input 6 (Terminal 19)	Digital Input 7 (Terminal 18)	Digital Input 8 (Terminal 17)
0	FWD/REV	RAMP 1/2	REM/LOC
1	Not used	FWD/REV	RAMP 1/2
2	Not used	FWD/REV	REM/LOC
3	Not used	RAMP 1/2	REM/LOC
4	Not used	Not used	FWD/REV
5	Not used	Not used	RAMP 1/2
6	Not used	Not used	REM/LOC
7	Not used	Not used	Not used

Default Setting: 0

Parameter Type: Configurable

Refer also to parameters: P.008 Terminal Strip Speed Reference Source

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.

An unasserted (open) or asserted (closed) input will select the input functions as shown in table 10.2. If a function is not configured, the unasserted (open) state will be applied.

Table 10.2 – Function Selection for Digital Inputs 6, 7, and 8

Input	Open (Unasserted)	Closed (Asserted)
FWD/REV	Forward	Reverse
RAMP 1/2	Ramp 1	Ramp 2
REM/LOC	Remote	Local

FWD/REV

FWD/REV allows you to select between forward or reverse operation. If the input is closed, this function will invert the selected speed reference. For example, if the selected speed reference value is negative (<0) and the FWD/REV input is closed, the resulting speed reference will be positive.

The digital input for FWD/REV is active only if the control source is remote.

P.007 Terminal Strip Digital Inputs Configure *(continued)*

RAMP 1/2

RAMP 1/2 allows you to select one of two paired acceleration/deceleration rates. RAMP 1 uses acceleration or deceleration rates based on P.001/P.002 (Accel Time 1/Decel Time 1). RAMP 2 uses acceleration or deceleration rates based on P.017/P.018 (Accel Time 2/Decel Time 2).

The digital input for RAMP 1/2 is always active regardless of the control source.

REM/LOC

REM/LOC allows you to switch from terminal strip control to local keypad control. The drive must be stopped in order to do this. (Note that if an OIM is connected, REM/LOC will switch control from the terminal strip to the OIM, not to the local keypad.)

The digital input for REM/LOC is active only if the control source is remote

The following example shows how the REM/LOC input can be used:

REM/LOC Input Example

Assume the drive is stopped and started using an external two-wire control signal. The drive's control source is the terminal strip (P.000 = rE), and a START command is given. The REM/LOC option (P.007 = 2) is selected so that an external REM/LOC switch switches the drive from REMOTE to LOCAL or from LOCAL to REMOTE. This external switch is in the REMOTE position.

This happens:

1. The STOP/RESET key is pressed, and the motor stops.
2. LOCAL is selected using the externally-wired REM/LOC switch.
3. Control of the drive is done locally through the keypad (or through the OIM, if connected). (This could be for troubleshooting purposes, or for viewing or adjusting parameter values.)
4. The REM/LOC switch is switched back to the REMOTE position. The drive runs immediately because there is already an asserted remote start signal.
5. The drive is now being controlled by the remote control source.

Interaction with P.008

The default value of 0 for P.007 will limit P.008 (Terminal Strip Speed Reference Source) to a selection of 0. You must change P.007 to some value other than 0 in order to change P.008 to some value other than 0. See table 10.3 and the selection example in the P.008 parameter description.

See chapter 6 for terminal strip wiring.

P.008 Terminal Strip Speed Reference Source

This parameter selects the source of the terminal strip speed reference.

The terminal strip speed reference is used when:

- the terminal strip is the selected control source (P.000 = rE)

or

- the local keypad or serial port is the selected control source (P.000 = LOCL or SErL) and AUTO is selected (AUTO LED is on).

Parameter Range:

0 = Analog reference. (Digital inputs 6, 7, and 8 are not used. See P.007.)

1 = MOP selection. (Uses terminal strip digital input 6 for MOP increment and digital input 7 for the MOP decrement function. Digital input 8 is not used.)

2 = Two preset speeds. (Uses terminal strip digital input 6. Digital inputs 7 and 8 are not used.)

3 = Four preset speeds. (Uses terminal strip digital inputs 6 and 7. Digital input 8 is not used.)

4 = Eight preset speeds. (Uses all terminal strip digital inputs.)

5 = Analog reference and one preset speed. (Uses terminal strip digital input 6. Digital inputs 7 and 8 are not used.)

6 = Analog reference and three preset speeds. (Uses terminal strip digital inputs 6 and 7. Digital input 8 is not used.)

7 = Analog reference and seven preset speeds. (Uses terminal strip digital inputs 6, 7, and 8.)

Default Setting: 0

Parameter Type: Configurable

Refer also to parameters: P.007 Terminal Strip Digital Inputs Configure
P.031 Preset Speed 1
r.030 Digital Input Configuration

In selections 5, 6, and 7, a digital input will initiate the selected preset speed, which will override the analog speed reference. See table 10.4 in the P.031 parameter description.

The selection is depends on what is selected for parameter P.007 (Terminal Strip Digital Inputs Configure). The selection made in P.007 determines what the remaining free digital inputs are used for. See table 10.3 for acceptable combinations.

Table 10.3 – Acceptable P.007 and P.008 Selection Combinations

P.007 Selections	P.008 Selections							
	0	1	2	3	4	5	6	7
0	✔							
1	✔		✔			✔		
2	✔		✔			✔		
3	✔		✔			✔		
4	✔	✔	✔	✔		✔	✔	
5	✔	✔	✔	✔		✔	✔	
6	✔	✔	✔	✔		✔	✔	
7	✔	✔	✔	✔	✔	✔	✔	✔

✔ = Selection combination is acceptable.

P.008 Terminal Strip Speed Reference Source *(continued)*

P.007/P.008 Selection Example

If you want to select the MOP as the speed reference source, P.008 must be set to 1.

Next, select the value for P.007 using table 10.3. Following the 1 column down under P.008 Selections, the acceptable selections for P.007 are 4, 5, 6, or 7.

If an optional RMI board is installed in the drive, see appendix G for more information regarding digital input configuration.

P.009 Terminal Strip Analog Input Offset

This parameter allows for correcting any offset in the terminal strip analog input before the signal reaches the drive.

Parameter Range:	-900 to +900*
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	P.000 Control Source

* For 0 to 10 V (or −10 V to +10 V input), a value of +1 equals an offset of approximately 10mV. For 0 to 20 mA input, a value of +1 equals an offset of approximately 20μA.

For more information about the analog input, refer to appendix H.

P.010 Terminal Strip Analog Input Gain

This parameter compensates for component tolerance errors or insufficient voltage from the input reference source at the terminal strip.

Parameter Range:	0.100 to 5.000
Default Setting:	1.000
Parameter Type:	Tunable
Refer also to parameters:	P.000 Control Source

For more information about the analog input, refer to appendix H.

P.011 Terminal Strip Analog Input Configure

This parameter selects the type of analog input signal being used and whether to invert it (negate it) after it has been converted from analog to digital by the drive.

Parameter Range:

Jumper J4 on pins 2 and 3:
- 0 = ±10 VDC
- 1 = ±10 VDC inverted
- 2 = 0 to 10 VDC
- 3 = 0 to 10 VDC inverted

Jumper J4 on pins 1 and 2:
- 4 = 4 to 20 mA. Generate fault on signal loss.
- 5 = 4 to 20 mA inverted. Generate fault on signal loss.
- 6 = 0 to 20 mA
- 7 = 0 to 20 mA inverted
- 8 = 4 to 20 mA. Display alarm and use previous reference on signal loss.
- 9 = 4 to 20 mA. Display alarm and use previous reference on signal loss.
- 10 = 4 to 20 mA. Display alarm and use Preset Speed 1 (P.031) as reference on signal loss.
- 11 = 4 to 20 mA inverted. Display alarm and use Preset Speed 1 (P.031) as reference on signal loss.

Default Setting: 2

Parameter Type: Tunable

Refer also to parameters: P.009 Terminal Strip Analog Input Offset
P.010 Terminal Strip Analog Input Gain

Important: Verify that the hardware (jumper J4) and software configurations match each other and the external signal.

If P.011 = 2, the input + offset (P.009) is low limited at 0 and then multiplied by P.010.

If P.011 = 3, the input + offset (P.009) is low limited at 0, multiplied by P.010, then negated

If P.011 = 4, the input is offset by −4 mA + offset parameter (P.009), low limited at 0, and then multiplied by P.010.

If P.011 = 5, 9, or 11, the input is offset by −4 mA + offset parameter (P.009), low limited at 0, multiplied by P.010, and then negated.

If P.011 = 6, the input + offset (P.009) is low limited at 0 and multiplied by P.010.

If P.011 = 7, the input + offset (P.009) is low limited at 0, multiplied by P.010, then negated

For selections 4 and 5, the drive generates a fault (AIn) if the input is less than 1 mA.

For the 4 to 20 mA input selections, the drive can be configured to generate a fault (selections 4 and 5) or an alarm (selections 8 through 11) if the input falls below 2 mA. If P.011 = 8 or 9, the drive continues to run using the value of the analog input 4 to 5 seconds before loss detection. If P.011 = 10 or 11, the drive continues to run using Preset Speed 1 (P.031) as the analog input value. In both cases, once the input returns (≥4 mA), the alarm clears, and the drive uses the converted input.

For more information about the analog input, refer to appendix H. For more information about alarms and faults, see chapter 11.

Note that this parameter has been modified in version 6.04.

P.012 Terminal Strip Analog Output Source

This parameter selects the source of the analog output signal.

Parameter Range:	0 = Speed (bipolar) 1 = Not Used 2 = Speed (unipolar) 3 = Current (unipolar)
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	N/A

Selections 2 and 3 select the same signals as selections 0 and 1, but instead of providing a 5 V (1/2 scale) offset to allow for a bipolar signal, no 5 V offset is used. Instead, the signal is presented in a unipolar manner. The absolute value of the selected signal is used to drive the analog output over its full range of 0 to 10 VDC. This provides greater resolution of the selected signal at the expense of indicating polarity. See figure 10.2.

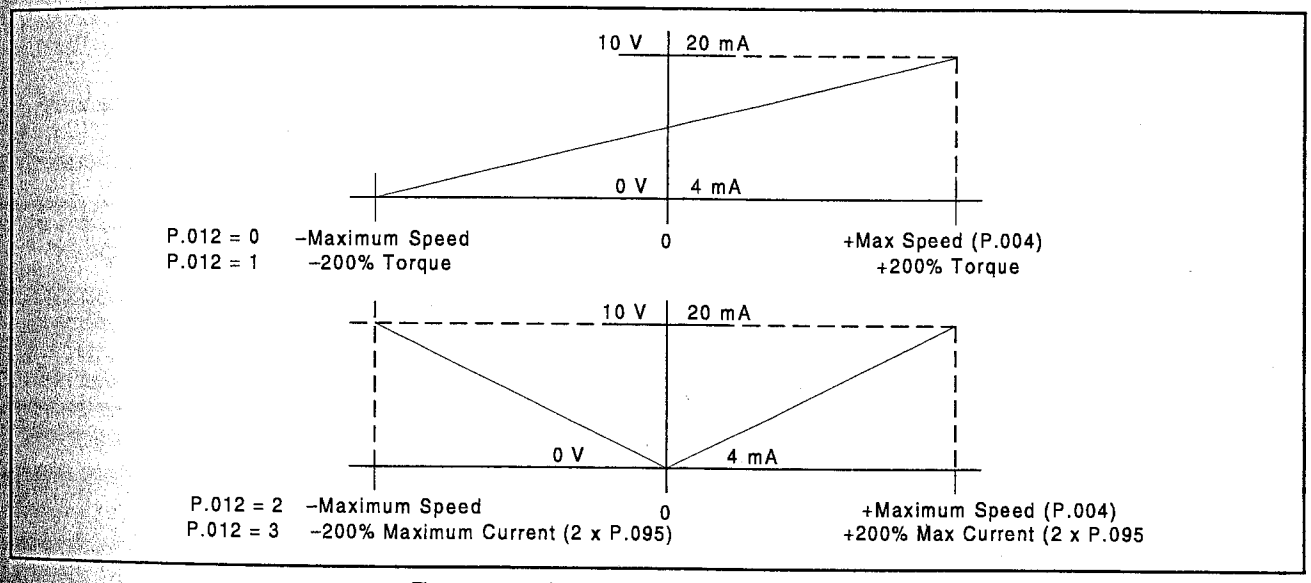


Figure 10.2 – Analog Output Selection and Scaling

P.013 Output Relay Configuration

This parameter specifies the type of status indication provided by the output relay contacts (terminals 28, 29, 30, and 31 on the drive's terminal strip).

Parameter Range:	0 = Output relay is energized to when one or more faults (IET) are active. 1 = Output relay is energized to show state of drive running with 0.5 second delay added between a start assertion and generation of motor voltage. 2 = Output relay is energized to show state of drive running but without 0.5 second start delay. 3 = Output relay is energized when network communication is active. 4 = Output relay is energized when all start permissive conditions are met. 5 = Output relay is energized when one or more alarms are active.
Default Setting:	0
Parameter Type:	Configurable
Refer also to parameters:	N/A

Example 1: For an application using an output contactor, you can get a 0.5 second delay between a start assertion and generation of motor voltage by setting P.013 to 1. The delay provides time for the contactor to close before motor voltage is generated.

Example 2: For an application using mechanical dampers, you can obtain a 0.5 second delay between a START assertion and the generation of motor voltage by setting P.013 to 1.

This parameter has been modified in version 6.04.

P.014 Trim Reference Source

This parameter specifies the source for the trim reference. Trim reference is added to the speed reference.

See figure 10.3.

Parameter Range:	0 = No trim reference used 1 = Terminal strip analog input 2 = Option port trim reference register 3 = Maximum speed 4 = Do Not Use 5 = RMI board analog input 6 = RMI board frequency input 7 = Switched RMI board analog input or frequency input 8 = RMI outer loop PI block (Mode 1) 9 = RMI outer loop PI block (Mode 2)
Default Setting:	0
Parameter Type:	Configurable
Refer also to parameters:	P.015 Trim Gain Percentage

P.014 Trim Reference Source *(continued)*

Selections 5 through 9 are available only if an optional RMI board is installed in the drive. Refer to instruction manual D2-3341 for information about the RMI board.

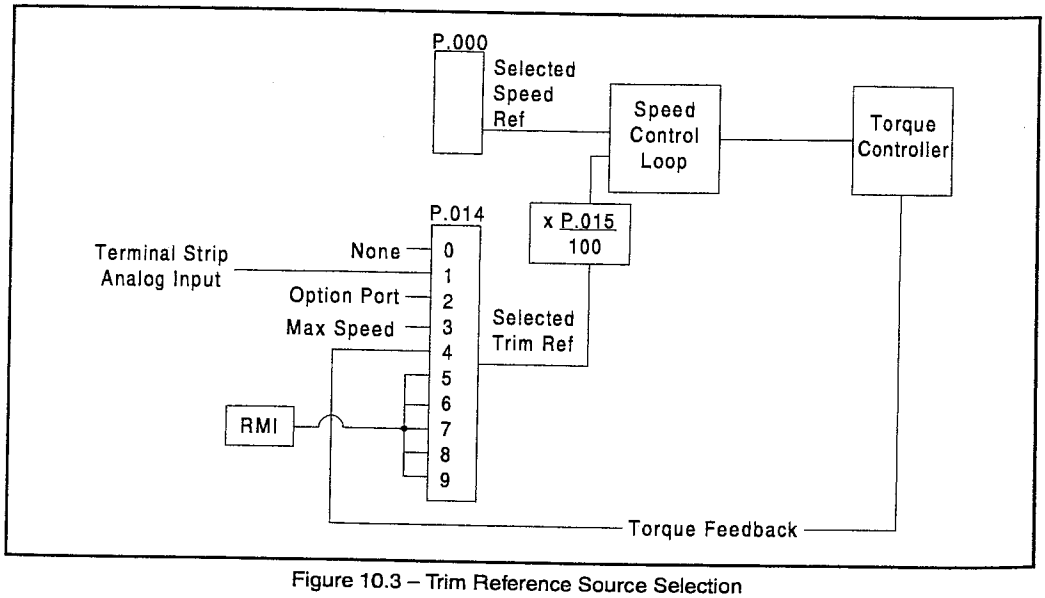


Figure 10.3 – Trim Reference Source Selection

P.015 Trim Gain Percentage

This parameter specifies a percentage of the selected trim reference entering the speed regulator.

See figure 10.4.

Parameter Range:	-99.9 to +99.9% (1.0 = 1%)
Default Setting:	0.0
Parameter Type:	Tunable
Refer also to parameters:	P.014 Trim Reference Source

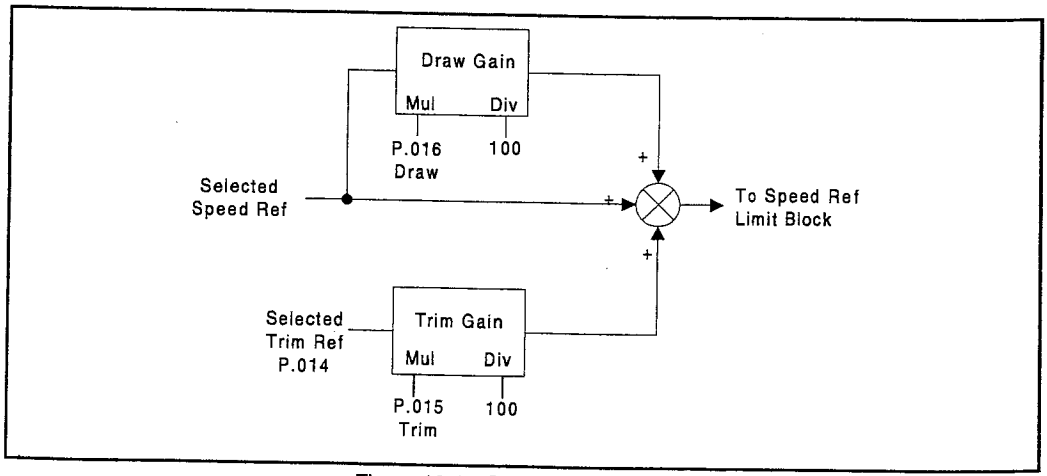


Figure 10.4 – Draw and Trim Gain

P.016 Draw Gain Percentage

This parameter is used to increase or decrease the selected speed reference to the speed regulator.

Parameter Range:	-99.9 to +99.9% (1.0 = 1%)
Default Setting:	0.0
Parameter Type:	Tunable
Refer also to parameters:	N/A

This parameter allows multiple drive sections with a common line reference, but with different values for draw gain, to run at different speeds depending on the percent draw.

P.017 Accel Time 2 (RAMP 2)

This parameter sets the acceleration time when a second ramp selection is configured as a digital input.

Parameter Range:	1.0 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.001 Accel Time 1 P.007 Terminal Strip Digital Inputs Configure

When the RAMP 2 acceleration time digital input is asserted, the RAMP 2 deceleration time also takes effect.

This parameter specifies the time in which the motor ramps from zero speed to Maximum Speed (P.004).

The time it takes the motor to make any speed increase is directly proportional to the value in this parameter. This parameter does not apply if JOG is selected.

P.018 Decel Time 2 (RAMP 2)

This parameter specifies the deceleration time when a second ramp selection is configured as a digital input.

Parameter Range:	1.0 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.002 Decel Time 1 P.007 Terminal Strip Digital Inputs Configure

When the RAMP 2 deceleration time digital input is asserted, the RAMP 2 acceleration time also takes effect.

This parameter specifies the time in which motor speed ramps from Maximum Speed (P.004) to zero speed.

The time it takes the motor to make any speed decrease (except a coast-to-rest stop) is directly proportional to the value in this parameter.

This parameter does not apply if JOG is selected.

P.019 S-Curve Enable

When S-Curve accel or decel is selected, the accel or decel ramp time begins and ends slowly, creating an S-Curve function. See figure 10.5.

For the VTAC 7 drive, this parameter is always set = ON.

Parameter Range:	OFF = Use linear accel/decel function ON = Use S-Curve accel/decel function
Default Setting:	ON
Parameter Type:	Configurable
Refer also to parameters:	P.001 Accel Time 1 P.002 Decel Time 1 P.017 Accel Time 2 P.018 Decel Time 2

Important: This parameter does not apply to the Jog Ramp Accel Time (P.021) or Jog Ramp Decel Time (P.022) parameters.

The acceleration and deceleration times must be set the same for the S-Curve ramp to function the same for acceleration as for deceleration. If the deceleration time is set lower than the acceleration time, the deceleration time specified might not be met.

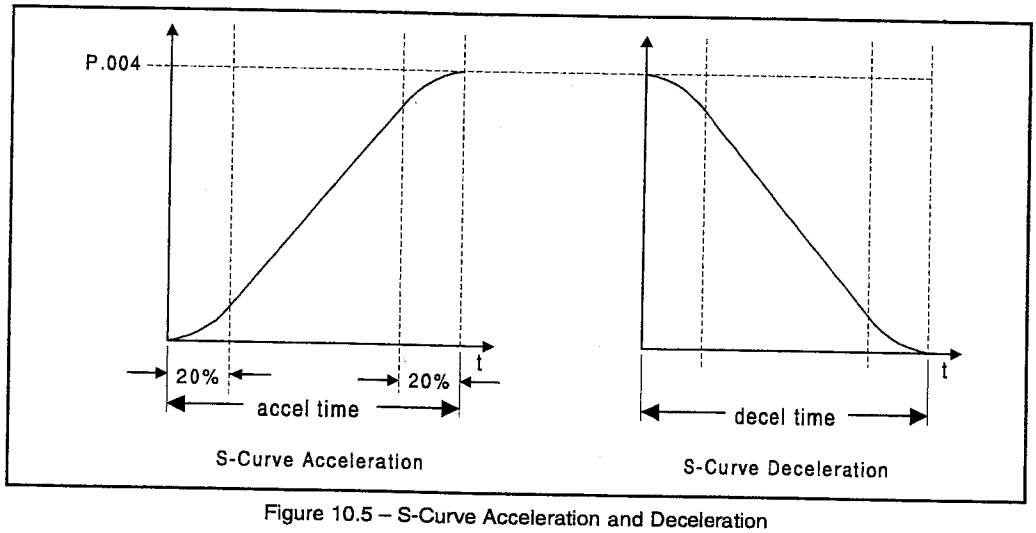


Figure 10.5 – S-Curve Acceleration and Deceleration

P.020 Jog Speed Reference

This parameter is the speed reference for the drive when JOG is selected.

Parameter Range:	Minimum Speed (P.003) to Maximum Speed (P.004)
Default Setting:	5.0 Hz
Parameter Type:	Tunable
Refer also to parameters:	P.003 Minimum Speed P.004 Maximum Speed

Jog reference is independent of any other speed reference. Unlike the run speed reference, the jog speed reference cannot be adjusted using the ▲ or ▼ keys.

P.021 Jog Ramp Accel Time

This parameter specifies the amount of time it takes the motor to ramp from zero speed to Maximum Speed (P.004) when JOG is selected.

Parameter Range:	1.0 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.004 Maximum Speed

The time the motor takes to make any speed increase is directly proportional to the value in this parameter.

P.022 Jog Ramp Decel Time

This parameter specifies the amount of time it takes the motor to ramp from Maximum Speed (P.004) to zero speed when JOG is selected.

Parameter Range:	1.0 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.004 Maximum Speed P.025 Stop Type

The time the motor takes to make any speed decrease (except a coast-to-rest stop) is directly proportional to the value in this parameter.

P.023 MOP Accel/Decel Time

This parameter specifies the amount of time it takes the MOP to ramp from Maximum Speed (P.004) to zero speed and from zero speed to maximum speed.

Parameter Range:	0.1 to 999.9 seconds
Default Setting:	20.0
Parameter Type:	Tunable
Refer also to parameters:	P.004 Maximum Speed P.007 Terminal Strip Digital Inputs Configure P.008 Terminal Strip Speed Reference Source

The MOP (Motor Operated Potentiometer) is a digital reference controlled by the increment/decrement inputs.

P.024 MOP Reset Configuration

This parameter determines when and if the MOP (Motor Operated Potentiometer) reference is reset to Minimum Speed (P.003).

Parameter Range:	0 = Reset MOP reference after IET 1 = Reset MOP reference during each stop 2 = Do not reset MOP reference
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	P.003 Minimum Speed P.008 Terminal Strip Speed Reference Source

Important: If the drive is powered down and powered back up, the MOP function reference will always be reset to equal Minimum Speed (P.003).

The MOP provides a digital speed reference that can be increased and decreased using terminal strip digital inputs.

When the MOP function is set and then disabled by using parameter P.008 (Terminal Strip Speed Reference Source), the last value in effect prior to the MOP being disabled will be retained.

P.025 Stop Type

This parameter selects how the motor will stop when a stop command is given.

Parameter Range:	0 = Coast-to-rest stop 1 = Ramp stop
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	P.002 Decel Time 1 P.018 Decel Time 2 P.022 Jog Ramp Decel Time

ATTENTION: You must provide an external, hardwired emergency stop circuit outside the drive circuitry. This circuit must disable the system in case of improper operation. Uncontrolled machine operation could result if this procedure is not followed. Failure to observe this precaution could result in bodily injury.

A function loss or a fault will always cause a coast-to-rest stop.

If RUN is selected:

- If P.025 = 0, pressing the STOP/RESET key or giving an external stop command will cause the motor to coast-to-rest.
- If P.025 = 1, pressing the STOP/RESET key or giving an external stop command will cause the motor to ramp-to-rest within a time equal to or greater than the preset deceleration time (P.002/P.018).

If JOG is selected, the motor will always perform a ramp stop, regardless of the value in P.025.

Note that when the START input from the selected control source is released (unasserted), the motor will ramp down in speed regardless of the value in P.025.

P.026 Function Loss Response

This parameter specifies how the drive will respond to an open circuit between terminal strip inputs 16 and 20.

Parameter Range:	0 = Generate a fault (LET) and coast to rest 1 = Coast to rest without a fault
Default Setting:	1
Parameter Type:	Tunable
Refer also to parameters:	P.013 Output Relay Configuration

If a function loss occurs, the motor will coast to rest. If P.026 = 0, a function loss fault will be generated, and FL will be displayed. If the drive has a bypass, set P.026 = 1 to prevent faults when the bypass is activated.

P.027 Forward/Reverse Configuration

This parameter specifies how the motor responds to forward or reverse inputs from any control source.

Parameter Range:	0 = Forward or reverse enabled from the selected control source 1 = Reverse disabled from the selected control source 2 = The state of the forward/reverse input is latched when the motor is started
Default Setting:	1
Parameter Type:	Tunable
Refer also to parameters:	N/A

When P.027 is set to 0, the forward/reverse input allows forward or reverse rotation of the motor.

When P.027 is set to 1, reverse rotation of the motor is prohibited and the forward/reverse selection from the front panel or serial port is set to forward. Note that reverse rotation is prohibited regardless of the polarity of the speed reference input.

When P.027 is set to 2, the state of the forward/reverse input is latched when the motor is started (RUNNING LED is on). Direction changes requested from any control source after the motor is started are ignored. However, this selection will not inhibit a motor direction change due to a change in the polarity of the speed reference input.

Setting H.016 (Sync Mode Direction) to any value but OFF or F can cause the motor to operate in the reverse direction briefly regardless of the setting in P.027.

P.028 Speed Display Scaling

This parameter defines the scaling value applied to the manual reference, the selected speed reference, and the output speed displays.

Parameter Range:	10 to 9999
Default Setting:	Synchronous speed based on H.001 (assuming a 4-pole motor)
Parameter Type:	Tunable
Refer also to parameters:	H.001 Motor Nameplate Base Frequency

P.028 corresponds to H.001 as shown here:

$$\frac{\text{Actual Speed in Hz} \times \text{P.028}}{\text{H.001}} = \text{value displayed when SPEED monitor mode or selected reference is selected}$$

Note that the values entered for P.003 and P.004 are automatically converted to P.028 units by the system. Therefore, the adjustment range for the manual reference is limited as shown here:

$$\text{Minimum Reference} = \frac{\text{P.003} \times \text{P.028}}{\text{H.001}} \qquad \text{Maximum Reference} = \frac{\text{P.003} \times \text{P.028}}{\text{H.001}}$$

Speed Display Scaling Example

Your application requires the display to be scaled to show the speed reference or the output speed as 800 gallons/minute when operating at maximum speed.

H.001 (Motor Nameplate Base Frequency) = 60

Step 1. Set parameter P.028 = 800

Step 2. Enter SPEED monitor mode by pressing the PROGRAM key until the PROGRAM LED turns off and the SPEED LED turns on.

Step 3. Start the drive (press the START key).

Step 4. When the drive is running at half of rated speed, the display shows that speed is 400 (gallons/minute).

Using the equation for V/Hz regulation: $\frac{30 \times 800}{60} = 400$

Important: This parameter does not change the speed. It changes only the scaling value applied to the display.

P.029 Elapsed Time Meter

This parameter displays the number of days (24-hour periods) that the drive has been under power or the time elapsed since the Elapsed Time Meter Reset (P.030) parameter was last reset.

Parameter Range:	0 to 9999 days
Default Setting:	N/A
Parameter Type:	Read only
Refer also to parameters:	P.030 Elapsed Time Meter Reset

P.030 Elapsed Time Meter Reset

This parameter sets parameter P.029 (Elapsed Time Meter) and the error log clock to zero. This parameter is set to OFF after the reset operation is carried out.

Parameter Range:	OFF = No action ON = Reset the Elapsed Time Meter (P.029) and the error log clock to zero (0)
Default Setting:	OFF
Parameter Type:	Tunable
Refer also to parameters:	P.029 Elapsed Time Meter

P.031 to P.038 Preset Speed 1 through Preset Speed 8

These parameters allow the setting of up to eight different preset speeds.

Parameter Range:	Minimum Speed (P.003) to Maximum Speed (P.004)
Default Setting:	5.0 Hz
Parameter Type:	Tunable
Refer also to parameters:	P.007 Terminal Strip Digital Inputs Configure P.008 Terminal Strip Speed Reference Source

The presets are configured using parameters P.007 and P.008. P.008 must be set to values of 2 through 7 for preset speeds. See table 10.4 and figure 10.6.

Each speed is selected using external switches connected to terminals 17, 18, and 19 on the Regulator board. The presets can also be selected using the Remote Meter Interface (RMI) board. Refer to the RMI board instruction manual (D2-3341) for more information.

P.031 to P.038 Preset Speed 1 through Preset Speed 8 *(continued)*

Table 10.4 – Preset Speed Digital Inputs

Digital Inputs (Terminals)			Selected Speed Reference
8 (17)	7 (18)	6 (19)	
0 (open)	0 (open)	0 (open)	P.031 or analog input (see P.008, selections 5, 6, and 7)
0 (open)	0 (open)	1 (closed)	P.032
0 (open)	1 (closed)	0 (open)	P.033
0 (open)	1 (closed)	1 (closed)	P.034
1 (closed)	0 (open)	0 (open)	P.035
1 (closed)	0 (open)	1 (closed)	P.036
1 (closed)	1 (closed)	0 (open)	P.037
1 (closed	1 (closed)	1 (closed)	P.038

If you have installed an optional RMI board in your drive, see appendix G for more information.

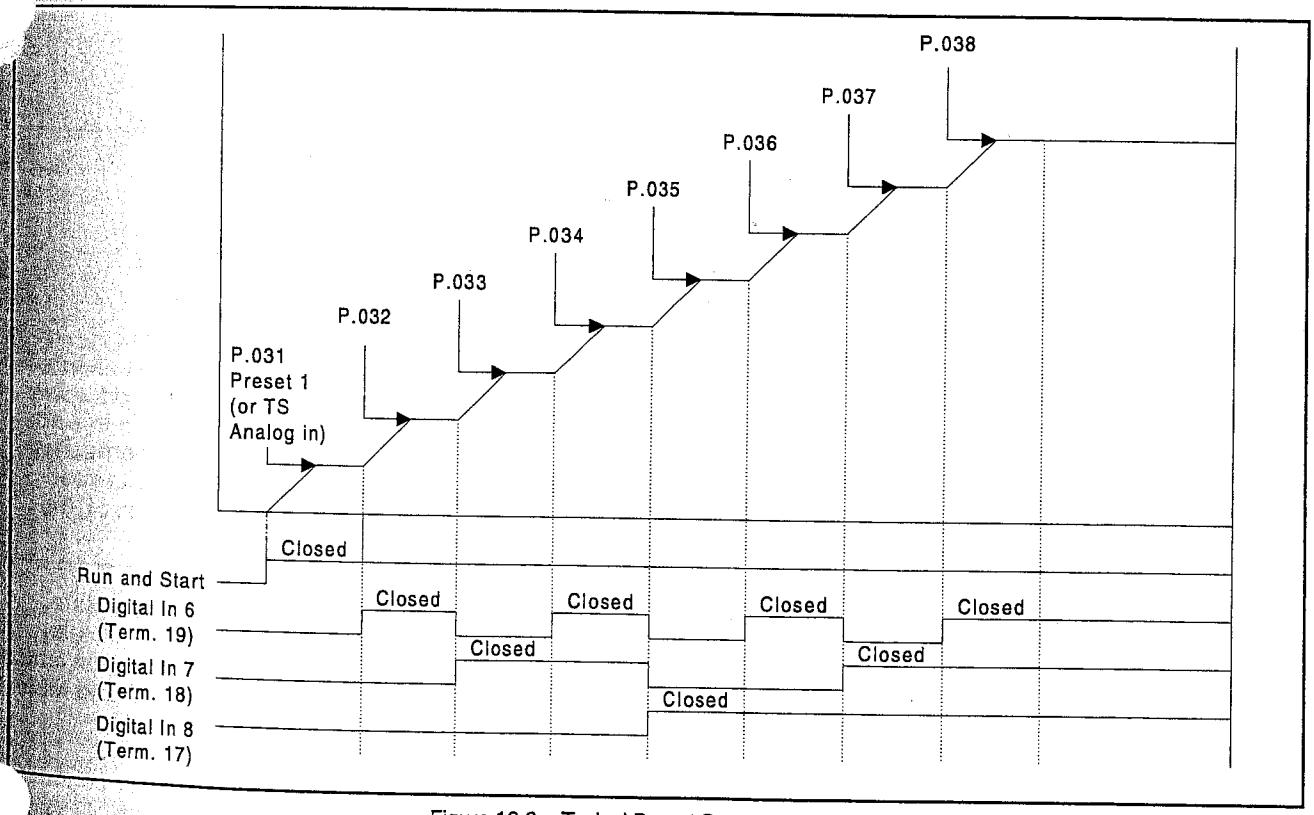


Figure 10.6 – Typical Preset Speed Operation

P.039 Encoder Loss Enable

This parameter enables the encoder loss detection diagnostic.

This diagnostic is available for flux vector control (FVC) only.

Parameter Range:	OFF = Disable encoder loss diagnostic ON = Enable encoder loss diagnostic
Default Setting:	OFF
Parameter Type:	Tunable
Refer also to parameters:	N/A

The encoder loss detection diagnostic is functional only when the drive is operating as a speed regulator (not as a torque regulator).

When the diagnostic is enabled and feedback from the encoder is not detected, a drive fault will be logged (EL will be displayed).

If the encoder fails, loss will be detected down to 1 RPM. If only one of the quadrature feedback wires is disconnected, loss may not be detected below 15 RPM.

P.040 Motor Overload Enable

This parameter enables the electronic motor thermal overload function. This function operates similarly to a motor overload relay to protect the motor from overheating.

P.040 applies to single-motor applications only.

Parameter Range:	OFF = Disable electronic motor thermal overload function ON = Enable motor thermal overload function
Default Setting:	ON
Parameter Type:	Configurable
Refer also to parameters:	P.041 Motor Overload Type H.002 Motor Nameplate Amps

ATTENTION: For single-motor applications with no external thermal overload relay, this parameter should always be set to ON. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

For V/Hz regulation, the drive trips after 60 seconds at 150% of Motor Nameplate Amps (H.002) and will display fault code OL. Lower currents above 100% will take longer to trip (for example, 25 minutes at 110%). The motor overload protection fault level depends on the settings of the Motor Overload Type selection (P.041) and Motor Nameplate Amps (H.002).

Important: While the electronic thermal overload relay is similar to a motor overload relay, neither measures actual motor temperature. Temperature measuring devices integral to the motor are the best way to thermally protect AC motors under all conditions.

P.041 Motor Overload Type

This parameter specifies the type of motor being used to determine the electronic motor thermal overload function characteristics.

Parameter Range:	nC = Standard motor without forced cooling FC = Force-cooled motor
Default Setting:	nC
Parameter Type:	Configurable
Refer also to parameters:	P.040 Motor Overload Enable

P.042 Line Dip Ride-Through Time

This parameter sets the maximum time allowed for the drive to stay active during low line voltage or line voltage loss.

Parameter Range:	0.1 to 999.9 seconds
Default Setting:	10.0
Parameter Type:	Configurable
Refer also to parameters:	H.017 Input Power/Snubber Configuration H.021 AC Line Voltage

If DC bus voltage drops below the low DC bus voltage threshold for more than the time set in P.042, fault code LU is logged. After line voltage has been restored, the fault must be reset, and then the drive may be restarted.

If line voltage is restored before the specified time is exceeded, the drive will accelerate to operating speed at the rate specified in P.001 (Accel Time 1).

Alarm code LIL will flash on the display during a line dip ride-through. The levels for LIL and LU depend on the parameter setting for AC Line Voltage (H.021).

P.043 Fault Auto Reset Attempts

This parameter selects the number of times the drive will attempt to reset drive faults.

Parameter Range:	0 to 10
Default Setting:	3
Parameter Type:	Configurable
Refer also to parameters:	P.044 Fault Auto Reset Time

Important: The drive will restart after a reset if the start input is still asserted.

If the auto reset feature is enabled (P.043 $\neq$ 0), faults detected while the drive is running are logged and reset. The drive will then wait the amount of time specified in P.044 (Fault Auto Reset Time) and, if the start input is asserted from the selected control source, start the drive automatically. Note that the drive must run for at least five minutes to reset the number of fault reset attempts to the value in P.043.

If the fault occurs again, the drive will wait and try to re-start up to the programmed number of attempts. If the drive faults on all of these attempts, it will remain in the faulted state and will display the fault code on the keypad/display.

P.043 Fault Auto Reset Attempts *(continued)*

Table 10.5 lists the faults that can be auto reset:

Table 10.5 – Faults That Can Be Auto Reset

Fault Code	Description
AIn	4 to 20mA analog input signal loss
bYC	DC bus charging bypass contactor
EC	Earth current failure (ground fault)
HIL	High line voltage
HU	High DC bus voltage
LU	Low DC bus voltage
nCL	Network communications loss
OC	Overcurrent steady state
OCA	Overcurrent while accelerating
OCb	Overcurrent during DC braking
OCd	Overcurrent at deceleration
OH	Drive overtemperature
OL	Electronic motor overload
UbS	Asymmetrical bus charge

All other faults cannot be auto reset.

Note that the auto reset feature will be disabled during the identification procedure.

P.044 Fault Auto Reset Time

This parameter specifies the amount of time the drive will wait to attempt to reset drive faults.

Parameter Range:	1 to 60 seconds
Default Setting:	60
Parameter Type:	Configurable
Refer also to parameters:	P.043 Fault Auto Reset Attempts

After the drive has detected the fault and is counting down the auto-reset time period, the display will flash the countdown period in seconds in the format:

"Ar30...Ar29...Ar28.....Ar01...Ar00"

If, during this countdown, you press the keypad STOP/RESET key, or assert the fault reset from the selected control source, the auto-reset countdown will stop, and all faults will be reset.

P.045 Output Phase Loss Enable

This parameter is used to enable the output phase loss detection diagnostic.

Parameter Range:	OFF = Disable output phase loss diagnostic ON = Enable output phase loss diagnostic
Default Setting:	ON
Parameter Type:	Tunable
Refer also to parameters:	N/A

This diagnostic detects phase loss between the drive and the motor. When P.045 is enabled and output phase loss is detected, a drive fault is logged (OPL is displayed).

The output phase loss diagnostic can be disabled to avoid nuisance faults that can occur, for example, when a small motor is used with a large Power Module.

P.047 Carrier Frequency (kHz)

This parameter selects the drive's carrier frequency.

Parameter Range:	2 = 2 kHz carrier frequency 4 = 4 kHz carrier frequency 8 = 8 kHz carrier frequency
Default Setting:	Power Module-dependent; see appendix F
Parameter Type:	Configurable
Refer also to parameters:	N/A

This parameter can compensate for acoustic noise by allowing adjustment of the switching frequency of the transistors in the inverter bridge.

Keeping the carrier frequency at 8 kHz ordinarily provides the quietest motor operation.

See table 2.1 for the Power Module ratings at a 2 kHz carrier frequency. See P.095 in this chapter, which displays the maximum output current rating of the drive. Note that the range is limited from 2 to 4 kHz on M/N 200V41xx, 250V41xx, 300V41xx, and 350V41xx Power Modules. It is limited to 2kHz for 400V41xx Power Modules.

P.048 Volts/Hertz or Vector Regulation

This parameter selects the drive regulator type: volts/hertz (V/Hz) or vector.

This parameter must not be changed.

Parameter Range:	U-H = V/Hz control UEC = vector control
Default Setting:	U-H
Parameter Type:	Configurable
Refer also to parameters:	N/A

For V/Hz control, the drive provides open-loop volts per hertz regulation.

Changing this parameter also restores default values for all First and Second Menu General parameters (P.---) as if a Restore Defaults command (P.050 = ON) was given. However, this will NOT change the value of P.048 or P.049 (Country Defaults).

ATTENTION: The VTAC 7 drive is preconfigured to provide V/Hz regulation. For the drive to operate as described in this instruction manual, parameters P.048, P.049, and P.050 must not be changed by the user. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

P.049 Country Defaults

Selects the factory default settings for the First and Second Menu General parameters. USA default settings are listed in this chapter.

This parameter must not be changed.

Parameter Range:	USA = USA default settings EUr = European default settings JPn = Japanese default settings
Default Setting:	USA
Parameter Type:	Configurable
Refer also to parameters:	N/A

ATTENTION: The VTAC 7 drive is preconfigured to provide V/Hz regulation. In order for the drive to operate as described in this instruction manual, parameters P.048, P.049, and P.050 must not be changed by the user. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

P.050 Restore Defaults

Resets all First and Second Menu General parameters (P.---) to factory default settings.

This parameter must not be changed.

Parameter Range:	OFF = No action ON = Reset parameters to default settings
Default Setting:	OFF
Parameter Type:	Configurable
Refer also to parameters:	P.049 Country Defaults

ATTENTION: The VTAC 7 drive is preconfigured to provide V/Hz regulation. In order for the drive to operate as described in this instruction manual, parameters P.048, P.049, and P.050 must not be changed by the user. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

P.051 Programming Disable

When the password is entered into this parameter, parameter values cannot be modified from the keypad unless the correct password is entered again. Refer to section 10.4 for more information.

Parameter Range:	0 to 9999
Default Setting:	0 (Programming enabled)
Parameter Type:	Tunable
Refer also to parameters:	N/A

ATTENTION: It is your responsibility to determine how to distribute the password. Reliance Electric is not responsible for unauthorized access violations within your organization. Failure to observe this precaution could result in bodily injury.

The PASSWORD LED will be on to indicate that parameters cannot be modified from the keypad.

Note that disabling program changes by means of P.051 will not prevent parameter changes being made from the serial port or the network.

P.052 AUTO/MAN Key Disable

This parameter disables the AUTO/MAN key except from the selected control source.

Parameter Range:	OFF = Enable the AUTO/MAN key regardless of control source ON = Disable the AUTO/MAN key except from the selected control source
Default Setting:	OFF
Parameter Type:	Tunable
Refer also to parameters:	P.000 Control Source P.053 Manual Reference Preset Enable

When this parameter is set to ON, the AUTO/MAN key is functional only from the selected control source. This parameter can be used to protect against inadvertent reference change when the drive is controlled from the terminal strip (P.000 = rE) or the option port (P.000 = OP).

Table 10.6 details whether the AUTO/MAN key is active based on the selected control source and P.052.

P.052 AUTO/MAN Key Disable *(continued)*

Table 10.6 – AUTO/MAN Key Status Based on P.000 and P.052

Control Source (P.000 =)	P.052	Front Panel AUTO/MAN Key	OIM/CS3000 AUTO/MAN Key
Front panel (LOCL)	OFF	Active	Inactive
Terminal strip (rE)	OFF	Active	Active
Network/option board (OP)	OFF	Active	Active
OIM/CS3000 (SErL)	OFF	Inactive	Active
Front panel (LOCL)	ON	Active	Inactive
Terminal strip (rE)	ON	Inactive	Inactive
Network/option board (OP)	ON	Inactive	Inactive
OIM/CS3000 (SErL)	ON	Inactive	Active

P.053 Manual Reference Preset Enable

When ON is selected, the manual reference will be preset with the auto reference value when the transition is made from AUTO to MANUAL.

Parameter Range: OFF = Do not preset the manual reference
ON = Preset the manual reference with the auto reference at the transition from AUTO to MANUAL

Default Setting: OFF

Parameter Type: Tunable

Refer also to parameters: P.027 Forward/Reverse Configuration
P.028 Speed Display Scaling

ATTENTION: The absolute value of the auto reference is used to preset the manual reference. When this feature is enabled (P.053 = ON) and the auto reference is a negative value, a direction change will occur when the transition is made from AUTO to MANUAL. Verify that the auto reference is a positive value and the FORWARD/REVERSE command is appropriate to the application before making the transition from AUTO to MANUAL. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The absolute value of the auto reference is limited between Minimum Speed (P.003) and Maximum Speed (P.004) before it is used to preset the manual reference. Therefore, when this feature is enabled (P.053 = ON) and the auto reference is a negative value, a direction change will occur when the transition is made from AUTO to MANUAL. Verify that the auto reference is a positive value and the FORWARD/REVERSE command is appropriate to the application before making the transition from AUTO to MANUAL.

Important: If the manual reference is being modified using the front-panel keypad/display when the transition from AUTO to MANUAL is made, the manual reference cannot be preset with the auto reference.

See chapter 8 for more information on the AUTO/MAN key and the AUTO LED.

P.054 Level Sense Start Enable

This parameter selects whether the start input is edge sensitive or level sensitive for remote (P.000 = rE) and option port (P.000 = OP) control sources.

Parameter Range:	OFF = Start input is edge-sensitive ON = Start input is level-sensitive
Default Setting:	OFF
Parameter Type:	Configurable
Refer also to parameters:	P.000 Control Source

ATTENTION: Be aware of the following before enabling this function:

- Setting this parameter to ON immediately applies output power to the motor when all start conditions are met.
- If the drive is running from the terminal strip, both the start and stop inputs are closed. If P.054 = ON and a fault occurs, the drive coasts to rest and generates a fault. In this case, resetting and clearing the fault immediately restarts the drive without any change to the start or stop input states
- If P.026 (Function Loss Response) = 1, the control source is the terminal strip (start and stop inputs are closed), and P.054 = ON, the drive coasts to rest if the function loss input is opened and does not generate a fault. In this case, closing the function loss input immediately starts the drive without any change to the start or stop input.

When this function is enabled, you 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. Failure to observe this precaution could result in severe bodily injury or loss of life.

This parameter applies to remote (P.000 = rE) and option port (P.000 = OP) control sources only. Local keypad (P.000 = LOCL) and serial port (P.000 = SErL) control sources always require an off-to-on edge on the start input to start the drive.

Regardless of the status of P.054, the following conditions must be met in order for the drive to start.

- The terminal strip function loss input must be closed.
- No faults can be active.
- The DC bus must be valid.
- No active stop input can be asserted.

When P.054 is set to OFF, and the above requirements are met, the drive requires an off-to-on edge at the start input in order to start.

When P.054 is set to ON, and the above requirements are met, the drive applies output power to the motor when the start input is closed.

P.054 Level Sense Start Enable *(continued)*

Figure 10.7 shows the start, stop, and running status of the drive when configured for edge control versus level control.

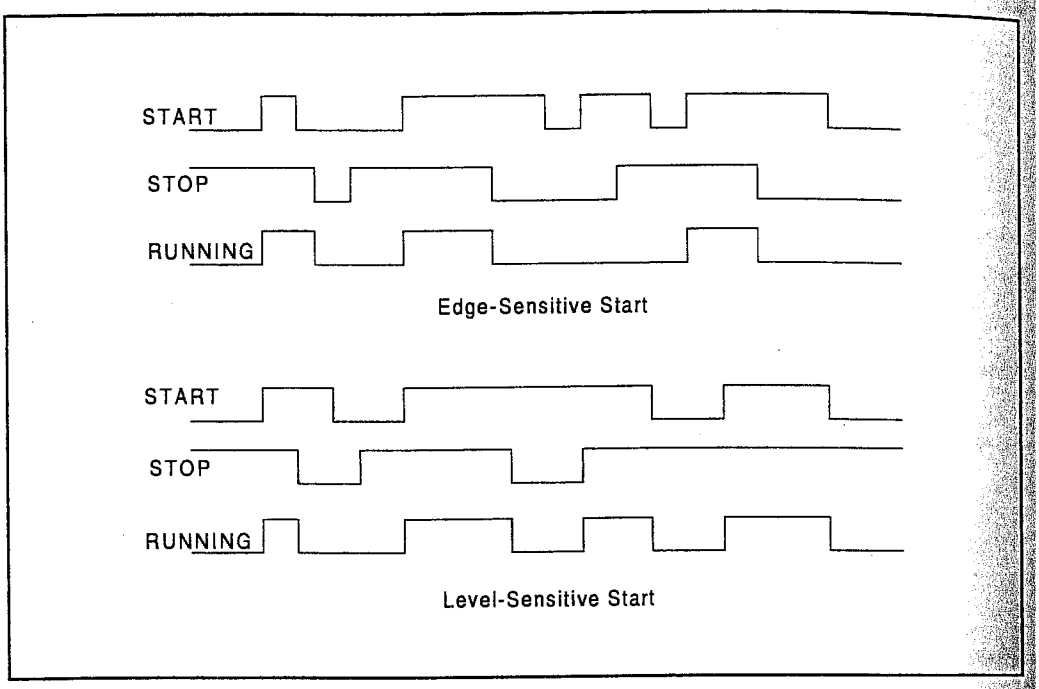


Figure 10.7 – Drive Start, Stop, and Running Status when Configured for Edge Control vs. Level Control

Note that when operating from the terminal strip (rE) or a network option, an edge is required at the start input for this condition, even if P.054 = ON: The front panel keypad/display or OIM STOP is pressed.

These forced edge requirements do not apply if the control source is changed to any other value and then back again as shown in the following example.

Example

Assume the selected control source is the terminal strip (P.000 = rE), level sense start is enabled (P.054 = ON), no faults are active, and both the start and stop inputs are closed. The drive, therefore, is running.

The drive is stopped using the front-panel STOP key. The drive now waits for an open-to-close edge on the terminal strip start input to restart.

The control source is changed to any value other than rE. This is done by changing P.000 to any value but rE or toggling the REM/LOC switch.

The control source is then changed back to the terminal strip (rE).

Since the start input is still closed, the drive starts. A start edge is no longer required because switching from the terminal strip and back again effectively acts as an edge.

P.054 Level Sense Start Enable *(continued)*

ATTENTION: As a safety precaution, Reliance Electric recommends that you provide an audible or visual alarm to indicate that this feature is enabled and the motor can start when power is applied to the drive. You should also post warnings on the motor, the drive, and any other applicable equipment to alert personnel that the application uses an automatic start-up feature. Failure to observe this precaution could result in severe bodily injury or loss of life.

Figure 10.8 shows an example of a typical circuit that can be used on 1 to 150 HP drives. This circuit will energize an alarm device prior to motor start up. For an example of a typical circuit for 200 to 400 HP drives, contact Reliance Electric for assistance.

Note that if P.000 = rE, the terminal strip LOC/REM switch determines the control source (local or remote) at power up.

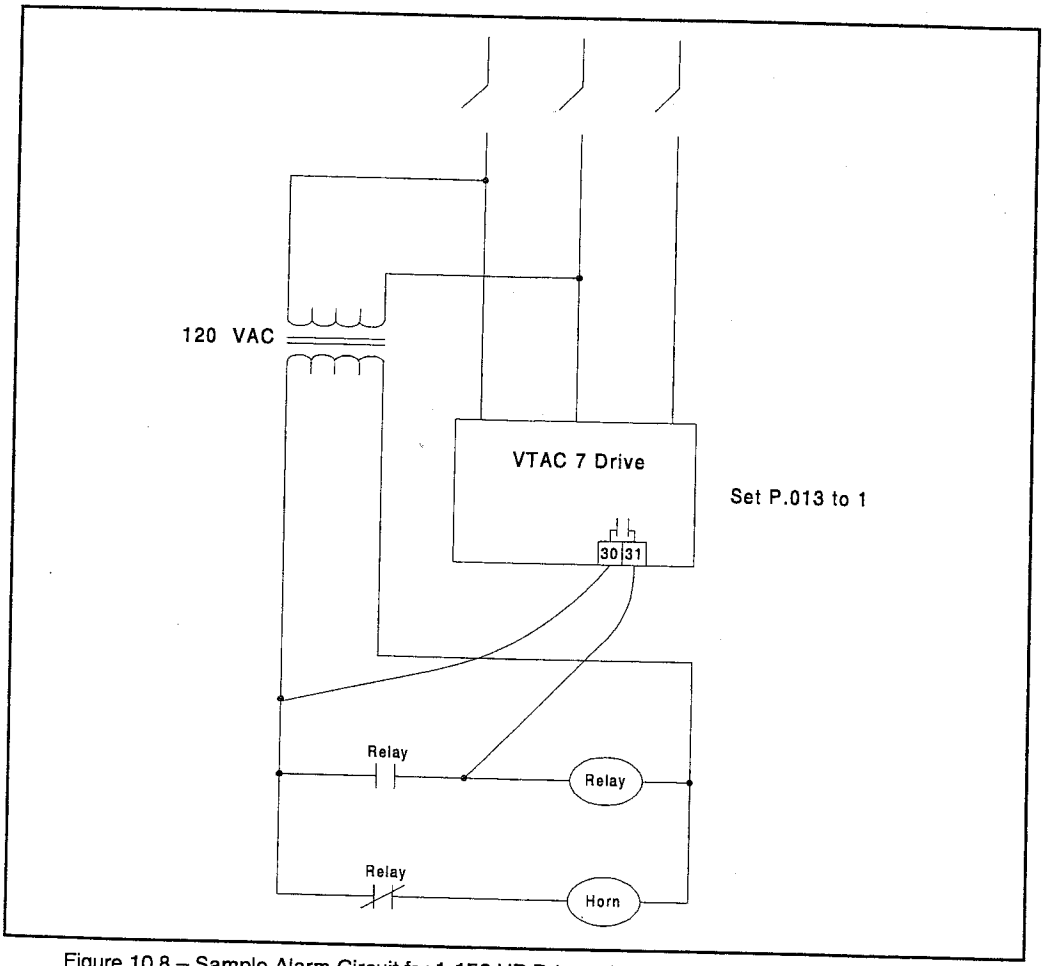


Figure 10.8 – Sample Alarm Circuit for 1-150 HP Drives Using the Level Sense Enable Feature

P.055 STOP/RESET Key Disable

This parameter disables the STOP/RESET key except from the selected control source.

Parameter Range:	OFF = Enable the STOP/RESET key regardless of the control source ON = Disable the STOP/RESET key except from the selected control source
Default Setting:	OFF
Parameter Type:	Tunable
Refer also to parameters:	P.000 Control Source

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, you 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.

Table 10.7 details whether the STOP/RESET key is active based on the selected control source (P.000) and P.055.

Table 10.7 – STOP/RESET Key Status Based on P.000 and P.055

Control Source (P.000 =)	P.055	Front Panel STOP/RESET Key	OIM/CS3000 STOP/RESET Key
Front panel (LOCL)	OFF	Active	Active
Terminal strip (rE)	OFF	Active	Active
Network/option port (OP)	OFF	Active	Active
OIM/CS3000 (SErL)	OFF	Active	Active
Front panel (LOCL)	ON	Active	Inactive
Terminal strip (rE)	ON	Inactive	Inactive
Network/option (OP)	ON	Inactive	Inactive
OIM/CS3000 (SErL)	ON	Inactive	Active

P.060 Network Drop Number

This parameter specifies the base drop number to which the AutoMax Network Communication board responds on the AutoMax network.

Parameter Range:	1 to 55 (Basic drive connection) 1 to 53 (Full drive connection)
Default Setting:	1
Parameter Type:	Configurable
Refer also to parameters:	P.061 Network Connection Type

This parameter must be set at the drive through the keypad/display or a PC serial interface. This parameter cannot be written to the drive by the network master.

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, see the Metasys Communication Board manual (HE-HGV3MT).

P.061 Network Connection Type

This parameter selects one of two network connection types.

Parameter Range:	0 = Basic drive connection 1 = Full drive connection
Default Setting:	0
Parameter Type:	Configurable
Refer also to parameters:	N/A

Setting P.061 = 0 provides basic drive control from the AutoMax network. Only essential drive data (reference, sequencing, basic tuning, and feedback data) are transferred over the network. This allows a higher density network with moderate functionality. Select the basic connection type if your application does not require a complete configuration of the drive over the network.

Using the basic drive connection, you can control functions such as start/stop, reset, reference, and basic tunable parameters such as accel, decel, minimum speed, and maximum speed.

When Basic Drive Connection is selected, the VTAC 7 drive occupies a single network drop. This drop area contains 32 read registers and 32 write registers.

Setting P.061 = 1 provides full drive control from the AutoMax network. Any drive data that has been assigned a network register is transferred over the network. Select this connection type if your application must be able to to configure the drive over the network and have access to most parameters, operating variables, and diagnostic information.

The large amount of data transferred in the full connection type requires that the drive occupy multiple network drops, thus decreasing the potential number of devices on the network. When Full Drive Connection is selected, the VTAC 7 drive will occupy three sequential network drops, beginning with the drop number specified with P.060.

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, see the Metasys Communication Board manual (HE-HGV3MT).

P.062 Option Port: Communication Loss Response

This parameter specifies how the drive responds to a network communication loss when the Control Source (P.000) parameter is set to OP (Option port).

Parameter Range:	0 = IET fault 1 = Hold last reference 2 = Use terminal strip reference
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	P.000 Control Source

If the option port is not in control of the drive, but is only monitoring drive operation, then loss of network communications has no effect on drive operation. In all cases, the Network option kit, upon loss of communication with the network master, will attempt to re-establish the communication link.

To eliminate extraneous fault conditions when a drive configured for network operation is powered up, the drive will delay for approximately 20 seconds after power up before annunciating a fault condition. A fault condition will be annunciated if network communication is not established before the 20-second power-up timer expires, or if network communication was established and then lost.

If the drive loses communication with the network, overspeed protection for the drive will be in effect under all circumstances. You can program overspeed protection in H.022.

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, refer to the Metasys Communication Board manual (HE-HGV3MT).

If P.062 = 0

The drive will consider a loss of network communication a drive fault resulting in an IET-type stop sequence.

When P.062 is set to IET fault (0) and communication is lost:

- The drive latches a fault condition and performs a coast stop.
- The network communication loss fault is generated (nCL is displayed).
- The front panel REMOTE LED blinks, indicating that the network is inactive.

When network communication is re-established, you must reset the fault before the drive can be re-started. See the section 11.2 for information on resetting errors. (A fault reset does not clear the error log.)

P.062 Option Port: Communication Loss Response *(continued)*

If P.062 = 1

The drive continues to operate, using the last reference received from the network master.

ATTENTION: If P.000 (Control Source) is set to OP (Option Port), and P.062 is set to 1 (hold last reference), and the drive loses communication with the network, the drive maintains the last frequency command sent to it. Ensure that drive machinery, all drive-train mechanisms, and application material are capable of safe operation at the maximum operating speed of the drive. Failure to observe this precaution could result in bodily injury.

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 pushbutton 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.

The response to network communication loss is:

- The drive continues to operate, using the last reference received from the network master.
- An entry is made into the drive's error log for each active-to-inactive transition of network communication status.
- The front panel REMOTE LED blinks, indicating that the network is inactive.

If network communication is re-established, the drive will again follow the reference and sequencing control inputs supplied by the network master. Note that if P.054 = ON and the start and stop inputs are on (1), the drive will start.

Note that in this configuration, it might not always be possible to stop the drive over the network.

P.062 Option Port: Communication Loss Response *(continued)*

If P.062 = 2

The drive gets its speed/torque reference from the terminal strip analog input and its stop input from the terminal strip stop input. All other inputs are held at the last values received from the network master.

This allows the network master to continue controlling the drive reference with a direct-wired analog output to input, and to stop the drive with a direct-wired digital output to input.

Note that if P.054 (Level Sense Start Enable) = OFF and the drive is stopped while in this mode, it cannot be re-started until network communication is re-established or the Control Source (P.000) is changed.

ATTENTION: If P.062 = 2 and P.054 (Level Sense Start Enable) = ON and network communication is lost while the drive is running, the terminal strip stop input will function as a STOP/RUN input. If the terminal strip stop input is opened, the drive will stop. If the terminal strip stop input is closed, the drive will re-start. Failure to observe this precaution could result in severe bodily injury or loss of life.

Note that in this configuration, it might not always be possible to stop the drive over the network. You can stop the drive using the hardwired stop input, the OIM STOP/RESET key, or the hardwired stop input (coast/DB stop, Regulator board terminal 23, unless P.055 is set to disable).

The response to network communication loss is:

- The drive continues to operate, using the analog input from the Regulator board terminal strip.
- An entry is made into the drive's error log for each active-to-inactive transition of network communication status.
- The front panel REMOTE LED blinks, indicating that the network is inactive.

If network communication is re-established, the drive will again follow the reference and sequencing control inputs supplied by the network master. Note that if P.054 = ON and the start and stop inputs are on (1), the drive will start.

ATTENTION: The drive is not equipped with a coast-stop pushbutton. You must install a hardwired operator-accesible pushbutton that provides a positive interrupt and shuts down the drive. See chapter 5 for wiring information. Failure to observe this precaution could result in bodily injury.

P.063 Option Port: Network Reference Source

This parameter specifies where the drive gets its speed or torque reference when the option port is selected as the control source (P.000 = OP).

Parameter Range:	0 = Direct reference 1 to 8 = Broadcast
Default Setting:	0
Parameter Type:	Configurable
Refer also to parameters:	N/A

If P.063 = 0, the reference is from register 33 of the drive's Drop_1 register map.

The value in register 33 represents speed in hertz scaled 0 to 4095 for 0 to Maximum Speed (P.004).

If P.063 = 1 to 8, the reference is from one of the eight network broadcast data registers (network drop area 0, registers 32 to 39).

Refer to the AutoMax Network Communications Module instruction manual (J2-3001) for a description of network broadcast registers.

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, see the Metasys Communication Board manual (HE-HGV3MT).

P.064 Option Port: Network Trim Reference Source

This parameter specifies where the drive gets its trim reference when the option port is selected as the control source (P.000 = OP).

Parameter Range:	0 = Direct trim reference register 1 to 8 = Broadcast register 1 to 8, respectively
Default Setting:	0
Parameter Type:	Configurable
Refer also to parameters:	P.063 Option Port: Network Reference Source

The option port trim reference can be used as the outer control loop reference or the speed trim reference (see P.014 Trim Reference Source).

If P.064 = 0, the trim reference is from register 34 of the first drop image.

If P.064 = 1 to 8, the trim reference is obtained from network broadcast register 1 through 8, respectively. For a description of the broadcast registers, refer to the AutoMax Network Communications Module manual (J2-3001).

The trim reference represents speed in hertz scaled 0 to 4095 for 0 to Maximum Speed (P.004).

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, see the Metasys Communication Board manual (HE-HGV3MT).

P.065 Option Port: Type and Version

This parameter displays the option type and the software version number of the option board.

Parameter Range:	N/A
Default Setting:	N/A
Parameter Type:	Read-only
Refer also to parameters:	N/A

The display format is N.vvv, where N represents the option type (1 = RMI, 2 = AutoMax or PROFIBUS network, and 4 = DeviceNet or Metasys network) and v represents the software version number.

For example, if 2.103 is displayed, it means the drive is using the AutoMax network option and is running version 1.03 software.

P.066 to P.069 Network Output Register 1 Source through Network Output Register 4 Source

These parameters select the signal written to the option port network output registers 1 through 4.

See figure below.

Parameter Range:	0 = (P.066) Motor Kw display value (P.067) Motor torque display value (P.068) Output power factor (P.069) Encoder counter (x4) 1 to 8 are not available for the VTAC 7 drive 9 = Terminal strip analog input normalized to speed 10 = Terminal strip analog input scaled 11 to 12 are not available for the
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	N/A

For DeviceNet applications, refer to the DeviceNet Network Communication Option Board manual (HE-HGV3DN).

For Metasys applications, refer to the Metasys Communication Board manual (HE-HGV3MT).

P.066 to P.069 Network Output Register 1 Source through Network Output Register 4 Source *(continued)*

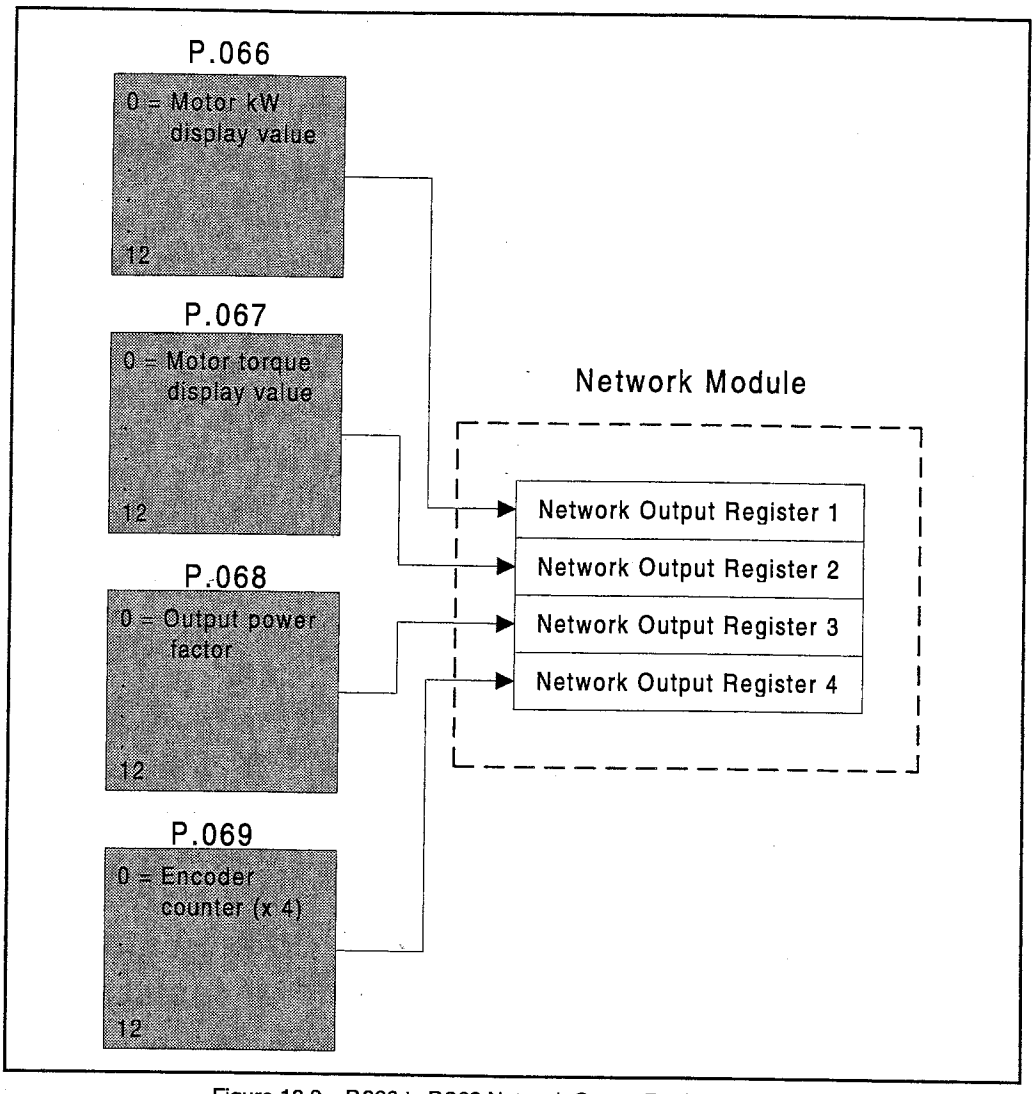


Figure 10.9 – P.066 to P.069 Network Output Register Sources

P.090 Diagnostics Source

This parameter is used to select internal information such as I/O data and network statistics for display in parameter P.091.

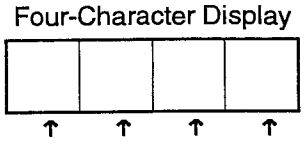
Parameter Range:	0 = Diagnostic not used 1 = Terminal strip digital inputs 4, 3, 2, 1 2 = Terminal strip digital inputs 8, 7, 6, 5 3 = Terminal strip analog input normalized to speed 4 = RMI digital inputs 4, 3, 2, 1 5 = RMI analog input 6 = RMI frequency input 7 = Encoder data 8 = DC bus voltage 9 = Terminal strip analog input scaled (see appendix H) 14 = Network interface: number of messages received from the network 15 = Network interface: number of message receive time-out errors 16 = Network interface: number of message CRC errors 17 = Network interface: number of message overrun errors 18 = Network interface: number of messages aborted 19 = Network interface: number of messages transmitted to the network
Default Setting:	0
Parameter Type:	Tunable
Refer also to parameters:	P.091 Diagnostics Display

P.091 Diagnostics Display

This parameter displays the data selected in P.090.

Parameter Range:	N/A
Default Setting:	N/A
Parameter Type:	N/A
Refer also to parameters:	P.090 Diagnostics Source

The status of the digital inputs (selected by entering a value of 1, 2, or 4 in P.090) is displayed as a four-digit combination of 1s and 0s (1 = on, 0 = off) as follows:



P.090 = 1, terminal strip digital inputs	4	3	2	1
P.090 = 2, terminal strip digital inputs	8	7	6	5
P.090 = 4, RMI digital inputs	4	3	2	1

P.095 Power Module Output Amps

This parameter displays the maximum output current rating of the drive. The maximum value of Current Limit (P.005) corresponds to P.095.

Parameter Range:	N/A
Default Setting:	N/A
Parameter Type:	Read only
Refer also to parameters:	P.005 Current Limit

For example, if P.095 = 11.0 and P.005 = 110% if maximum, then the maximum output current rating with no overload rating (100% rating) = 10.0 amps.

P.098 Software Version Number

This parameter displays the software version number.

Parameter Range:	N/A
Default Setting:	N/A
Parameter Type:	Read only
Refer also to parameters:	N/A

P.099 Power Module Type

This parameter displays the type of Power Module the drive is configured for.

Parameter Range:	N/A
Default Setting:	N/A
Parameter Type:	Read only
Refer also to parameters:	N/A

The Power Module type is displayed in the format V.nnn, where V represents the drive's voltage rating (2 = 208V, 4 = 460V, 5 = 575V), and nnn represents horsepower. For example, the display 4.050 represents 460V, 50HP.

H.000 Motor Nameplate Volts

This parameter identifies the motor nominal voltage as it appears on the motor nameplate.

Parameter Range:	100 VAC to 690 VAC
Default Setting:	460 VAC
Parameter Type:	Configurable
Refer also to parameters:	N/A

H.001 Motor Nameplate Base Frequency

This parameter configures the V/Hz ratio.

Parameter Range:	30.0 to 200.0 Hz
Default Setting:	60.0 Hz
Parameter Type:	Configurable
Refer also to parameters:	H.003 Torque Boost Voltage H.018 Volts/Hertz Curve Type

Base frequency is the frequency at which the output voltage reaches Motor Nameplate Voltage (H.000). Below base frequency, the output voltage varies with output frequency according to the V/Hz adjustment in parameter H.018 (Volts/Hertz Curve Type). Above base frequency, output voltage is held constant as frequency increases (constant horsepower range).

The V/Hz ratio is affected by the selection of Volts/Hertz Curve Type in H.018 and the setting of Torque Boost Voltage in H.003. See figure 10.10.

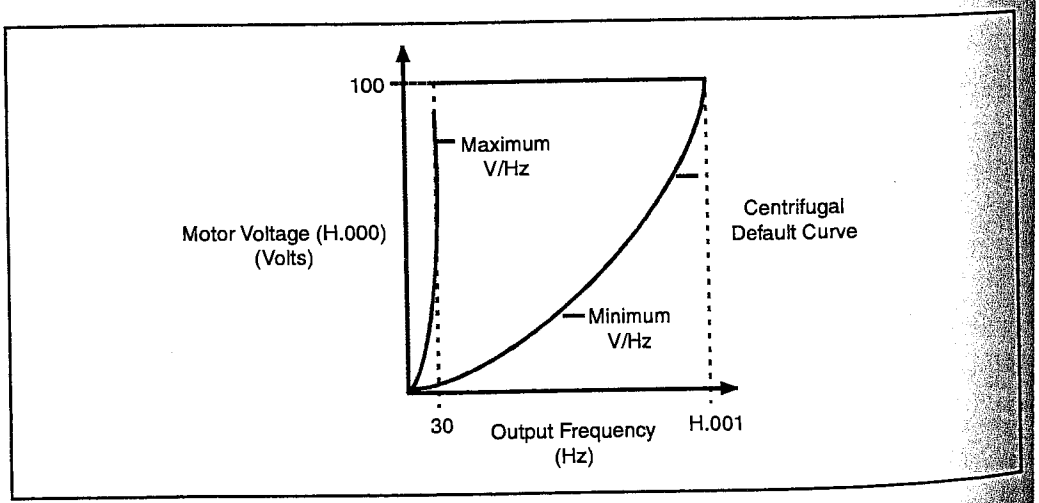


Figure 10.10 – Volts/Hz Ratio

H.002 Motor Nameplate Amps

This parameter is the motor amp rating as it appears on the motor nameplate.

Parameter Range:	Power Module-dependent
Default Setting:	Power Module-dependent; see appendix F
Parameter Type:	Configurable
Refer also to parameters:	N/A

ATTENTION: This parameter must not exceed the rated amps found on the motor nameplate. Overcurrent or excess heating of the motor could result if this is not done. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

H.003 Torque Boost Voltage

This parameter sets the percentage of output voltage boost at zero frequency. It is set as a percent of Motor Nameplate Volts (H.000).

Parameter Range:	0.0% to 20.0% of nominal inverter voltage
Default Setting:	0.5%
Parameter Type:	Configurable
Refer also to parameters:	H.000 Motor Nameplate Volts

Important: If you set H.003 = 0, you must perform the identification test (using H.020) before running.

Torque boost is required to offset the voltage drop of the AC motor at low speeds. For high friction loads and high inertia loads, high starting torque might be needed. Increasing Torque Boost Voltage will increase motor starting torque. See figure 10.11.

If the torque boost voltage setting (H.003) is too high, the motor might draw excessive starting current, resulting in an OL or PUo fault, or the drive may go into current limit and not accelerate. When H.003 = 0, the drive automatically provides torque boost voltage that is a function of motor load. If the motor does not accelerate or a fault occurs, set parameter H.003 equal to 0.

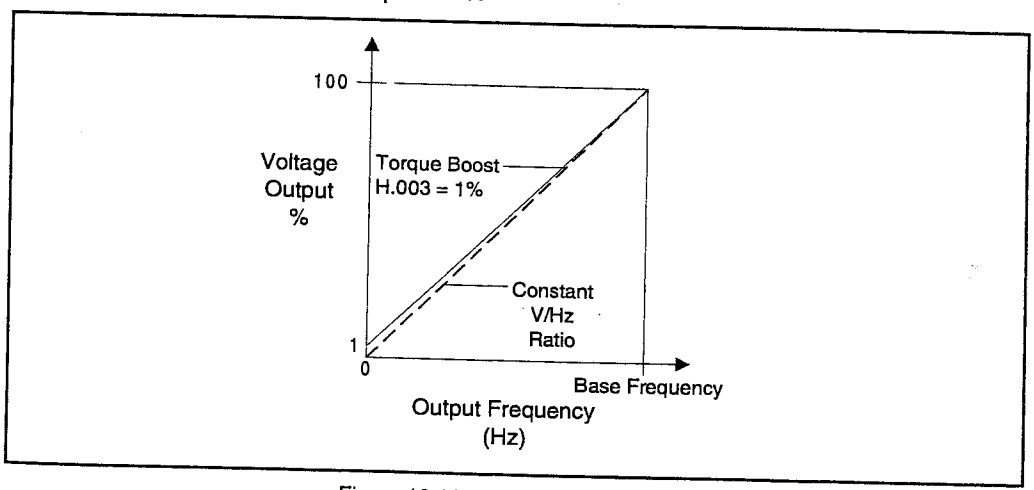


Figure 10.11 – Torque Boost Voltage

H.004 Slip Compensation

This parameter is used to improve motor speed regulation by increasing the output frequency applied to the motor (the percentage of frequency rise at Power Module Output Amps (P.095)).

Parameter Range:	0.0% to 10.0% of base frequency (H.001)
Default Setting:	0.0% (no slip compensation)
Parameter Type:	Tunable
Refer also to parameters:	P.095 Power Module Output Amps H.001 Motor Nameplate Base Frequency

The level of increased output frequency is a function of the value entered in H.004 and the motor current.

Actual motor shaft speed is determined by two factors: inverter output frequency and the slip of the motor. The speed reference is converted into output frequency. Motor slip is determined by the type of induction motor and varies with load.

At rated load, slip compensation measures inverter output current and increases the output frequency by the percentage entered in H.004. Below rated load, slip compensation will increase inverter output frequency by the percentage in H.004 multiplied by the percent of rated load.

Because of load changes, the long-term speed behavior of the motor is greatly improved through the use of this parameter.

To calculate the value entered for H.004, use this equation:

$$\text{H.004} = \frac{100 \times \text{Synchronous RPM} - \text{Nameplate RPM}}{\text{Synchronous RPM}} \times \frac{\text{Max Power Module Amps}}{\text{Motor Nominal Current}}$$

$$\text{Synchronous RPM} = \frac{120 \times \text{F}}{\text{Number of Motor Poles}}$$

Example: 1722 RPM

Motor Nominal Current = 78% of Maximum Power Module Amps (F

V/Hz regulation

2 kHz

$$\text{H.004} = 100 \times \frac{1800 - 1722}{1800} \times \frac{100\%}{78\%} = 5.56\%$$

If the parameter is set to zero, motor speed will not be proportional to reference, b will vary depending on load.

H.005 DC Braking Enable

This parameter enables or disables DC braking.

Parameter Range:	ON = Enable DC braking OFF = Disable DC braking
Default Setting:	OFF
Parameter Type:	Tunable
Refer also to parameters:	P.025 Stop Type H.006 DC Braking Start Frequency H.007 DC Braking Current H.008 DC Braking Time H.017 Input Power/Snubber Configuration

Important: This function will not provide holding torque as a mechanical brake. DC braking is only operative when Stop Type (P.025) is set to 1 (ramp stop).

DC braking is used to provide additional motor braking (by DC current flow through motor windings) at speeds below DC Braking Start Frequency (H.006). If DC braking is required, DC braking functions (H.008, H.007) must be greater than zero (0).

When the motor decelerates to the preset DC Braking Start Frequency (H.006), the DC Braking Current (H.007) is applied to the motor after a Power Module-dependent delay time.

H.006 DC Braking Start Frequency

This parameter sets the frequency at which DC braking begins.

Parameter Range:	0.5 to P.004 (Maximum Speed)
Default Setting:	1.0
Parameter Type:	Tunable
Refer also to parameters:	H.005 DC Braking Enable H.007 DC Braking Current H.008 DC Braking Time

With DC braking enabled (H.005 = ON), braking will be activated after a stop command when the motor speed is less than or equal to DC Braking Start Frequency (H.006).

Note that if H.005 is set to ON, and this value is set too high, faults might occur (OC, OCb, or PUo will be displayed).

H.007 DC Braking Current

This parameter sets the DC current level applied to the motor during DC braking.

Parameter Range:	0 to 100% of motor nameplate amps
Default Setting:	10
Parameter Type:	Tunable
Refer also to parameters:	H.005 DC Braking Enable H.006 DC Braking Start Frequency H.008 DC Braking Time

With DC braking enabled (H.005 = ON), the braking torque by the motor is defined by a percentage of motor rated amps (100% of motor rated amps).

Important: If H.007 is set too high, faults might occur (OC, OCA, OCb, or PUo).

Note that this parameter has been modified in this release. Prior releases scaled voltage instead of current for braking.

H.008 DC Braking Time

This parameter sets the time period for which DC braking will be applied.

Parameter Range:	0.1 to 20.0 seconds
Default Setting:	3.0
Parameter Type:	Tunable
Refer also to parameters:	H.005 DC Braking Enable H.006 DC Braking Start Frequency H.007 DC Braking Current

With DC braking enabled (H.005 = ON), braking will be activated after a stop command when the decelerating drive reaches a speed corresponding to DC Braking Start Frequency (H.006). The braking period ends after the programmed time regardless of the actual motor speed. The value should be set to a level that avoids activation at rest.

H.009 Avoidance Frequency Enable

This parameter enables the avoidance frequency bands selected in H.011, H.013, and H.015.

Parameter Range:	OFF = Disable avoidance frequency processing ON = Enable avoidance frequency processing
Default Setting:	OFF
Parameter Type:	Tunable
Refer also to parameters:	P.003 Minimum Speed P.004 Maximum Speed H.010 to H.015 Avoidance Frequency Midpoint and Band 1, 2, and 3

Operating a motor continuously at a particular frequency can cause vibrational resonance in some machines. Three independent parameter pairs can be configured for avoidance frequency and frequency band to prevent motor vibration by preventing the drive output frequency from operating in the selected band(s). See figure 10.12.

The actual avoidance frequency selection is limited by Minimum Speed (P.003) and Maximum Speed (P.004). Normal acceleration and deceleration is not affected.

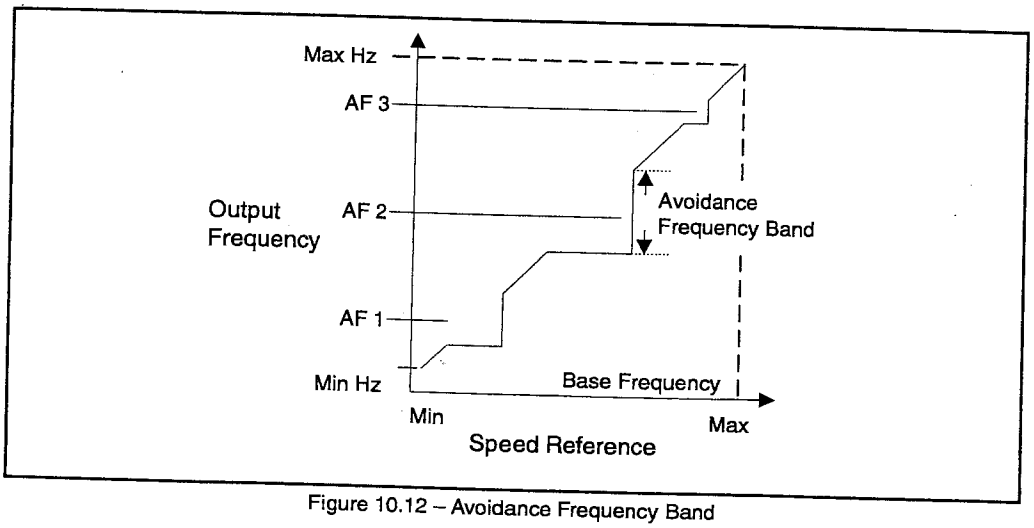


Figure 10.12 – Avoidance Frequency Band

H.010, H.012, H.014 Avoidance Frequency Midpoint 1, 2, and 3

This parameter specifies the midpoint of each avoidance frequency band selected in H.011, H.013, and H.015.

Parameter Range:	0.0 to 200.0 Hz
Default Setting:	0.0
Parameter Type:	Tunable
Refer also to parameters:	H.009 Avoidance Frequency Enable H.011, H.013, H.015 Avoidance Frequency Band 1, 2, and 3

The adjusted values can be in any order. The frequency will not be affected at normal acceleration or deceleration but will be avoided at continuous output frequency.

H.011, H.013, and H.015 Avoidance Frequency Band 1, 2, and 3

This parameter specifies the avoidance frequency band applied to each avoidance frequency midpoint selected in H.010, H012, and H.014.

Parameter Range:	0.2 to 10 Hz
Default Setting:	2.0
Parameter Type:	Tunable
Refer also to parameters:	H.009 Avoidance Frequency Enable H.010, H.012, H.014 Avoidance Frequency Midpoint 1, 2, and 3

The avoided frequency range is:

$$\left(\text{Avoidance Freq. Midpoint n} - \text{Freq. Band } \frac{n}{2}\right) < \text{Range} < \left(\text{Avoidance Freq. Midpoint n} + \text{Freq. Band } \frac{n}{2}\right)$$

where n = 1, 2, or 3.

H.016 Sync Direction

When starting into a rotating load is required, this parameter selects the direction in which the drive will search in order to synchronize to motor speed.

Parameter Range:	OFF = Disable synchronization F = Search starts in motor forward direction r = Search starts in motor reverse direction Fr = Search starts in motor forward then reverse direction rF = Search starts in motor reverse then forward direction
Default Setting:	OFF
Parameter Type:	Configurable
Refer also to parameters:	N/A

Note that when Forward/Reverse Configuration (P.027) is set to 1, setting this parameter to r, Fr, or rF may still cause the motor to operate in the reverse direction.

ATTENTION: When starting with search enabled, there will be a several second delay, and the motor might drift in the forward and reverse direction, before the motor begins operating in the desired direction even if reverse has been disabled in P.027. Stay clear of rotating machinery. Failure to observe this precaution could result in bodily injury.

H.017 Input Power/Snubber Configuration

This parameter is used to identify the input power supply type/snubber resistor/line dip ride-through configuration being used.

Parameter Range:	0 = AC input, snubber resistor not used, ride-through enabled 1 = AC input, snubber resistor used, ride-through enabled 2 = DC input, snubber resistor not used, ride-through disabled 3 = DC input, snubber resistor used, ride-through disabled 4 = DC input, snubber resistor not used, ride-through enabled 5 = DC input, snubber resistor used, ride-through enabled
Default Setting:	0
Parameter Type:	Configurable
Refer also to parameters:	P.042 Line Dip Ride-Through Time P.002 Decel Time 1

ATTENTION: When connected to a non-regenerative common DC bus, regeneration might cause a rise in DC bus voltage. Be aware that other drives on the bus may experience an unexpected speed increase due to the high bus voltage. Failure to observe this precaution may result in bodily injury.

For AC input Power Modules (208V, 3-phase, 50/60Hz or 460V, 3-phase, 50/60 Hz), set H.017 = 0 or 1.

For DC input Power Modules, set H.017 = 2 or 3 if multiple motors are connected to the inverter. Set H.017 = 4 or 5 if a single motor is connected to the inverter.

Snubber Resistor

If a snubber resistor is not used, set H.017 = 0, 2, or 4. If the DC bus voltage rises above a certain threshold (14% above the rectified nominal AC line), the drive will increase the commanded frequency in an effort to reduce bus voltage. The drive will increase the commanded frequency a maximum of 10 Hz but will not exceed the value specified in P.004 (Maximum Speed). The deceleration time (P.002) may be automatically extended to prevent a high bus voltage fault from occurring. If the bus voltage continues to rise, a high bus voltage fault (HU) will be generated.

If a snubber resistor is used, set H.017 = 1, 3, or 5. If the DC bus voltage rises above a certain threshold (14% above the rectified nominal AC line), the drive will not attempt to increase the commanded frequency, but will rely on the hardware snubber resistor to decrease voltage. Note that you may need to extend the deceleration time specified in P.002 (Decel Time) to prevent a high bus voltage fault (HU) from occurring.

H.017 Input Power/Snubber Configuration *(continued)*

Line Dip Ride-Through

Line dip ride-through allows the drive to remain active during low line voltage or line voltage loss for the time period specified in P.042 (Line Dip Ride-Through Time).

To enable line dip ride-through, set H.017 = 0, 1, 4, or 5. If the DC bus drops below the low DC bus voltage threshold or the AC line voltage drops out, the drive reduces the commanded frequency and regenerates to hold up the bus. The drive decelerates at a rate required to hold up the bus, and might not use the value in P.002 (Decel Time 1).

To disable line dip ride-through, set H.017 = 2 or 3. If the bus voltage drops below the low DC bus voltage threshold or the AC line drops out, a low bus voltage fault (LU) will be generated, and the drive will stop.

Refer to P.042 for more information regarding line dip ride-through.

H.018 Volts/Hertz Curve Type

This parameter provides an application-dependent selection of nominal motor voltage versus frequency. This selection is effective from any control source.

Parameter Range:	0 = Linear V/Hz curve 1 = Optimized V/Hz curve 2 = Squared V/Hz curve
Default Setting:	2
Parameter Type:	Configurable
Refer also to parameters:	H.003 Torque Boost Voltage

Set H.018 = 0 for constant torque applications (such as extruders and conveyors).

Set H.018 = 1 for use with Reliance Electric RPM and XE AC motors. A special V/Hz curve (with two different slopes) provides wider constant torque capability and best efficiency.

Set H.018 = 2 for centrifugal fan and pump motor applications.

See figure 10.13.

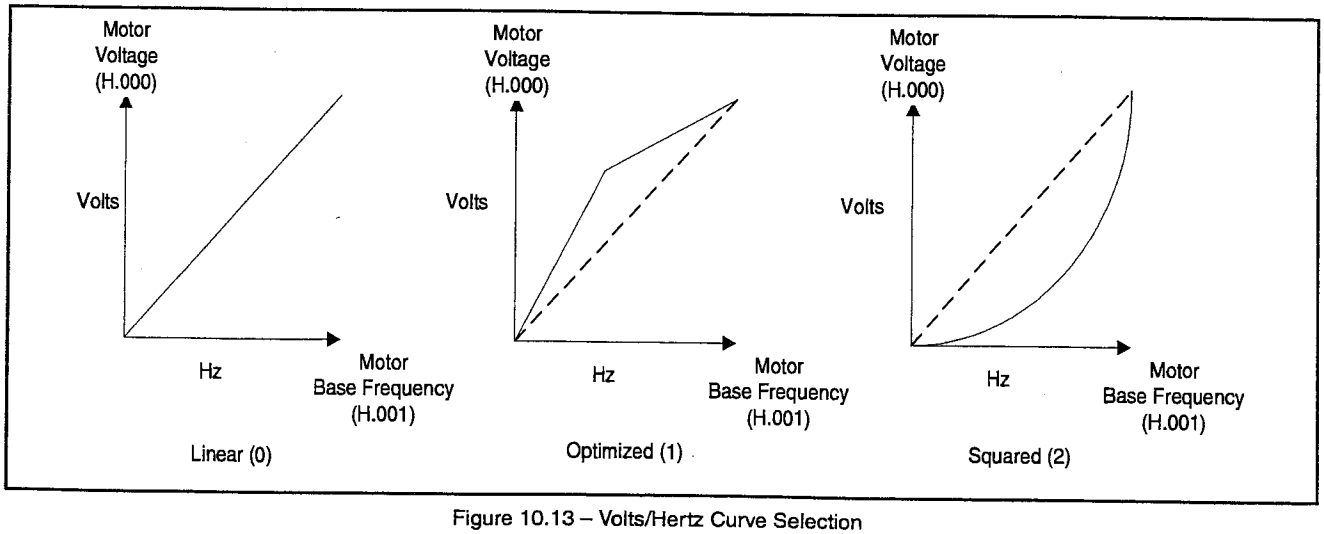


Figure 10.13 – Volts/Hertz Curve Selection

H.019 Identification Result

This parameter displays the result of the identification procedure. Normally, the identification procedure will be successful, and the value in H.019 will be = 0.

Parameter Range:	0 = Identification procedure successful. No fault. 1 = A logged error aborted the identification procedure. Refer to section 5.3 for how to determine the cause of the fault. Remove the cause and repeat the procedure. 2 = A function loss aborted the identification procedure. Depending on Function Loss Response (P.026), this is or is not logged. Remove the cause and repeat the procedure. 3 = A stop command aborted the identification procedure. Repeat the procedure. 4 = The identification procedure aborted because the measured current feedback signal was too low. Feedback signal elements or wiring is defective. Check motor connections, inverter wiring, and feedback devices (current sensors). Repeat procedure. 6 = Calculation result based on identification procedure measurements is out of range. Check causes of incorrect measurements, such as motor connections. Repeat procedure.
Default Setting:	0
Parameter Type:	Read only
Refer also to parameters:	H.020 Identification Request

H.020 Identification Request

This parameter enables the procedure that identifies Power Module and motor characteristics.

Parameter Range:	OFF = Disable identification procedure ON = Enable identification procedure
Default Setting:	OFF
Parameter Type:	Configurable
Refer also to parameters:	P.005 Current Limit P.047 Carrier Frequency (kHz) P.095 Power Module Output Amps H.002 Motor Nameplate Amps H.019 Identification Result

ATTENTION: The motor shaft can rotate in either direction by up to one revolution, providing minimum torque immediately after the identification procedure has been started. Stay clear of rotating machinery. Failure to observe this precaution could result in bodily injury.

ATTENTION: Carrier Frequency (P.047) and Current Limit (P.005) must be set correctly before activating the identification procedure to avoid motor overloading and/or overheating. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

ATTENTION: For M/N 25H41xx, 25H42xx, 25W21xx, 60H41xx, and 60H42xx drives, Current Limit (P.005) must be set to 50% for the duration of the Identification Request procedure to prevent damage to the IGBTs. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

ATTENTION: The motor can rotate in the reverse direction even if reverse disable has been selected in P.027. Uncouple the motor from any driven machinery that could be damaged by reverse rotation. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Before starting this procedure, verify that the motor is at rest and connected to the drive. The motor can be connected to the driven machinery. Verify that Motor Nameplate Volts (H.000), Carrier Frequency (P.047), and Current Limit (P.005) are set correctly.

The identification procedure should be run only in the following cases:

- after the initial assembly of the inverter (performed at Reliance Electric)
- if H.003 (Torque Boost Voltage) = 0
- after the Regulator board has been replaced in M/N 200H41xx or 400H41xx drives.

The ratio of maximum Power Module Output Amps (P.095) to Motor Nameplate Amps (H.002) should not be greater than 3:1. (Maximum Power Module Output Amps is dependent on Power Module size and the selected Carrier Frequency (P.047)). Compare the value of P.095 to H.002 to decide on the adjustment of Current Limit (P.005) to avoid motor damage.

H.020 Identification Request *(continued)*

For M/N 25H41xx, 25H42xx, 25W21xx, 60H41xx, and 60H42xx drives, Current Limit (P.005) must be set to 50% for the duration of the Identification Request procedure to prevent damage to the IGBTs. Set the P.005 to its final value after the test is completed.

Do not connect a motor that cannot withstand maximum Power Module Output Amps reduced by selected Current Limit (P.005).

Note that the identification procedure must not be performed when more than one motor is being driven by the inverter.

To activate the identification procedure after it has been enabled (H.020 = ON), the program mode must be exited. I-En will flash on the display to indicate the procedure has been enabled. The keypad START key must be pressed to start the procedure. I-Ac will flash on the display to indicate the procedure is being performed (active). The results of this procedure are written to parameter H.019.

If the fault code nId is displayed after a start command is asserted, the identification procedure has not been performed. Reset the fault, then repeat the procedure.

If a fault or a stop command is detected, the procedure will abort. HId will be displayed if the procedure is aborted. Refer to Identification Result (H.019).

H.021 AC Line Volts

This parameter is the phase-to-phase line voltage provided to the drive input power terminals.

Parameter Range:	300 to 565 VAC
Default Setting:	460
Parameter Type:	Configurable
Refer also to parameters:	N/A

The value entered should be within 10% of actual line voltage. If this parameter is set too low, it can cause a drive fault on overvoltage.

H.022 Overfrequency Limit

This parameter provides overspeed protection by setting the fault level for maximum frequency output.

Parameter Range:	30.0 to 4 x H.001 + 5% or 210 Hz*
Default Setting:	90.0
Parameter Type:	Configurable
Refer also to parameters:	P.004 Maximum Speed

* Drive will use the lesser value.

ATTENTION: You are responsible for ensuring that driven machinery, all drive-train mechanisms, and application material can operate safely at the overfrequency limit. Failure to observe this precaution could result in bodily injury.

If actual frequency exceeds the set value, the inverter will fault (OF will be displayed on the keypad/display) and the drive will stop.

The overfrequency limit should be set approximately 15Hz above Maximum Speed (P.004).

CHAPTER 11
Troubleshooting the Drive

This chapter describes how to troubleshoot the drive and the required equipment. Also provided are replacement part lists and information on clearing faults.

11.1 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.

11.2 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. See section 11.6.1 for information on alarm codes.

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

See section 11.2 for information on fault codes.

11.3 Verifying DC Bus Capacitors are Discharged

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.

ATTENTION: Do not operate 75-400 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.

The VTAC 7 drive's DC bus capacitors retain hazardous voltages after input power has been disconnected. Perform these 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 75-400 HP drives, open the outer cabinet door.

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 11.1 and 11.2.

For 75-100 HP drives, remove the top two screws of the Regulator panel and tilt the panel forward. See figure 11.3. 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 11.3. 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 11.4. 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 11.4.

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.

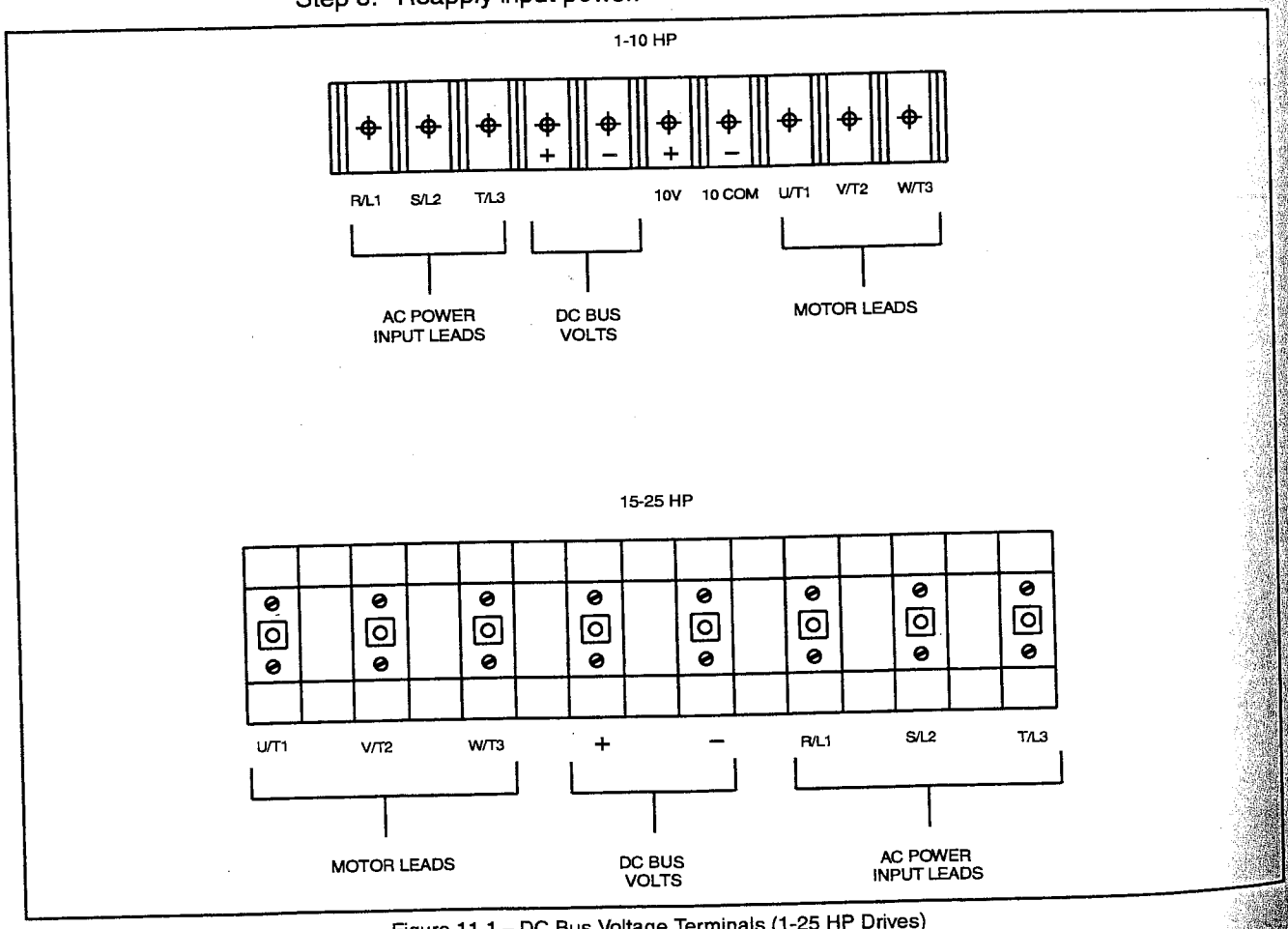


Figure 11.1 – DC Bus Voltage Terminals (1-25 HP Drives)

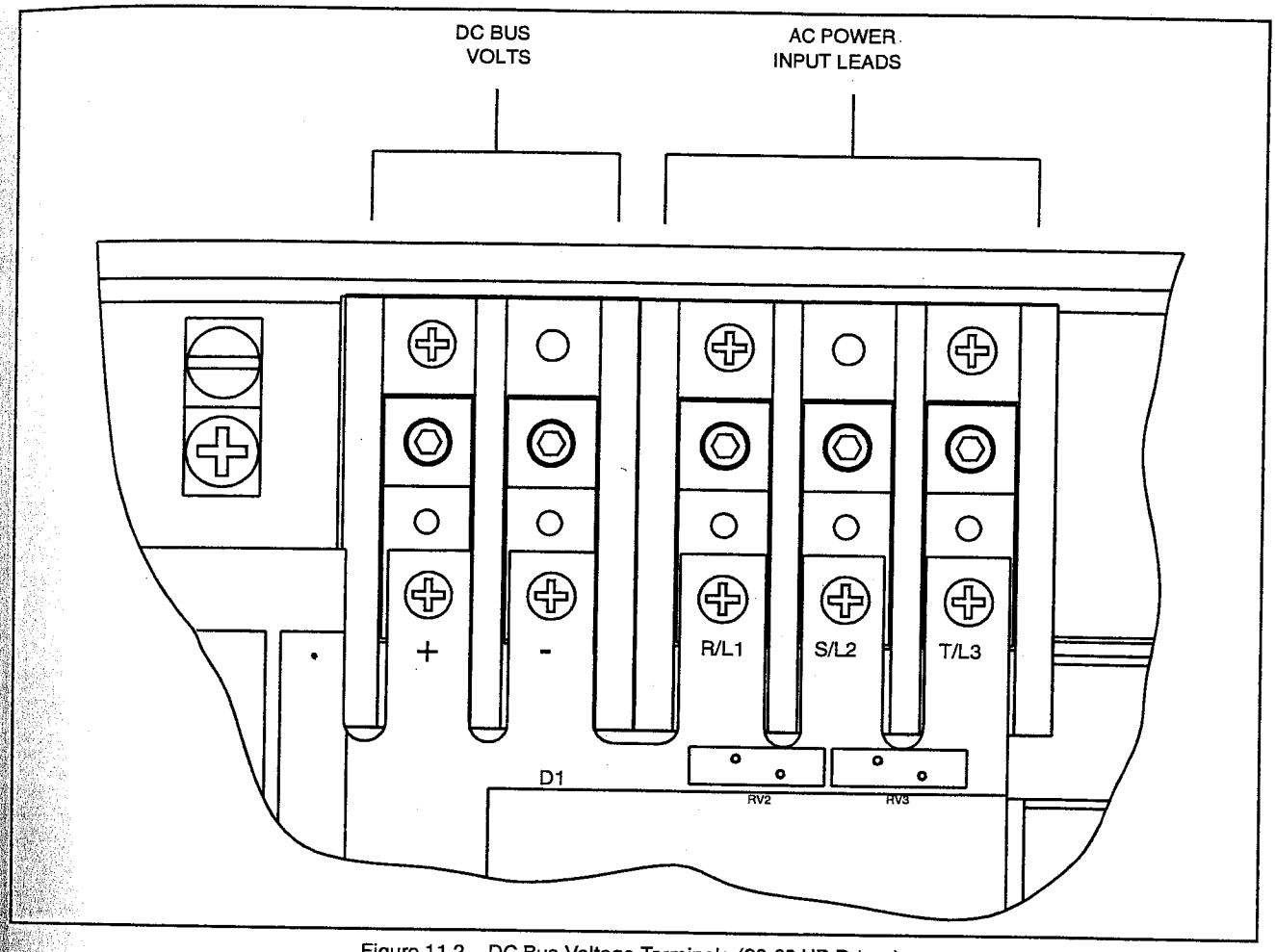


Figure 11.2 – DC Bus Voltage Terminals (30-60 HP Drives)

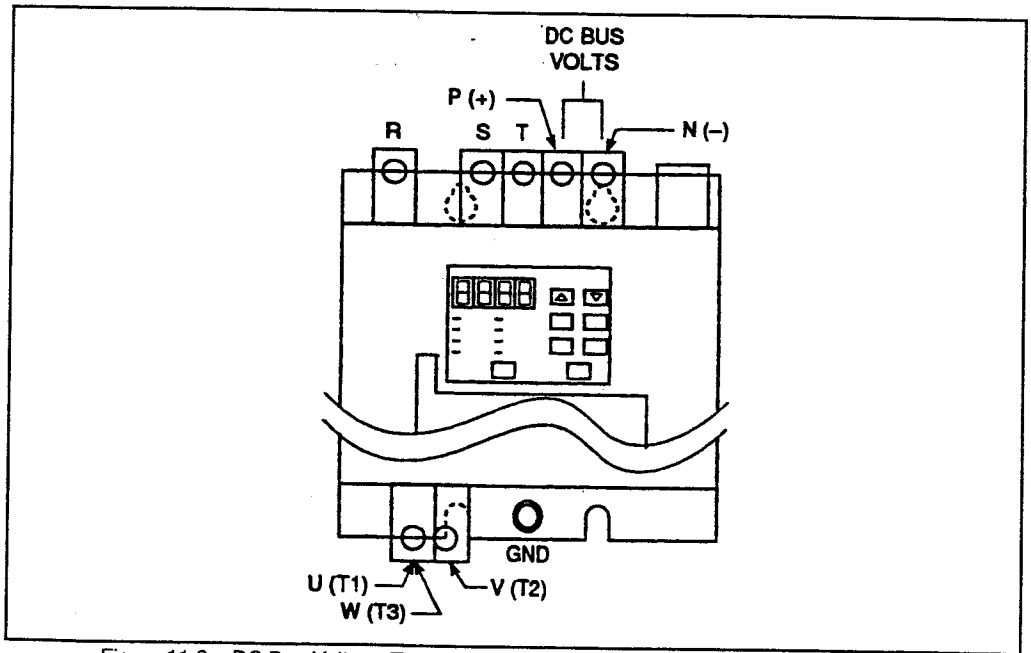


Figure 11.3 – DC Bus Voltage Terminals (25-100HP @ 208V/75-150HP @ 460V Drives)

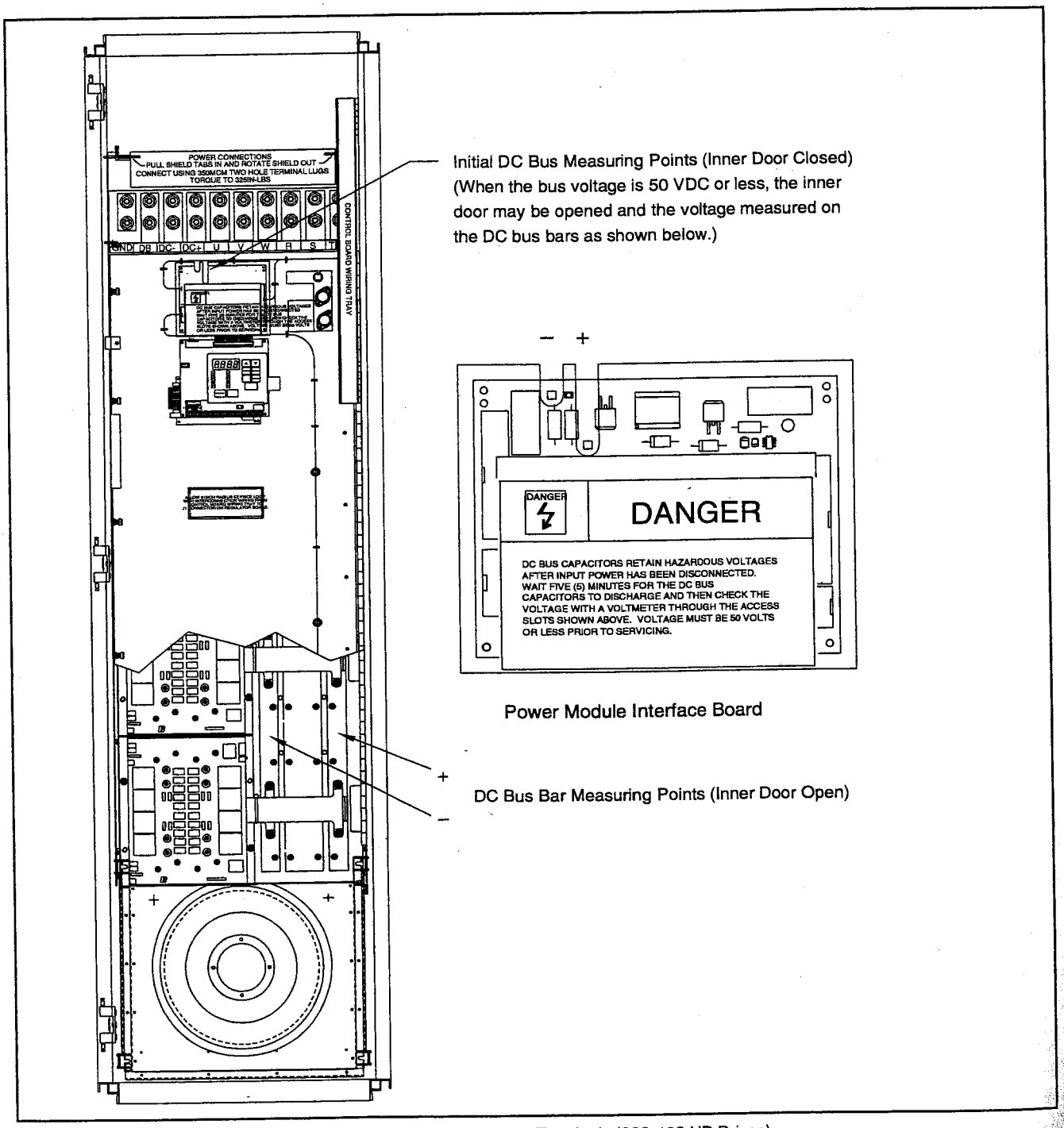


Figure 11.4 – DC Bus Voltage Terminals (200-400 HP Drives)

11.4 Checking the Power Modules with Input Power Off

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.

ATTENTION: Do not operate 75-400 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.

To check the drive's Power Module circuitry:

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

Step 2. Remove the drive's cover. On 75-400HP drives, open the outer cabinet door.

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 11.3 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 tables 11.1and 11.2.

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) can be replaced in 60-150 HP drives.

Step 8. Reconnect the motor to the drive.

Step 9. Reattach the drive's cover. On 75-400 HP drives, close the inner and outer cabinet doors.

Step 10. Reapply input power.

Table 11.1 – Resistance Checks - Input Diode

Input Diode No.	Meter Connection (+)	Meter Connection (–)	Component is OK if resistance (R) is:	Component is defective if:
1-100 HP @ 208 VAC and 1-150 HP @ 460 VAC Drives				
1	*	R/L1	50kΩ < R < 10MΩ	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	†		
200-400 HP Drives				
1	*	R/L1	R > 100 kΩ	Continuity (short circuit)
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

Table 11.2 – Resistance Checks - IGBT

IGBT No.	Meter Connection (+)	Meter Connection (–)	Component is OK if resistance (R) is:	Component is defective if:
1-100 HP @ 208 VAC and 1-150 HP @ 460 VAC Drives				
1	*	W/T3	50kΩ < R < 10 MΩ	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	†		
200-400 HP Drives (with the motor connected)				
All IGBTs tested in parallel	U/T3	*	10Ω < R < 1MΩ	Continuity (short circuit) or open when the meter is connected with reversed polarity
	*	U/T3		
	U/T3	†		
	*	U/T3		
200-400 HP Drives (with the motor disconnected)				
1	*	R/L1	10Ω < R < 1MΩ	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

11.5 Replacement Parts

Tables 11.4 to 11.12 list the replacement parts that are available from Reliance Electric.

Table 11.3 – 1-5HP @ 208VAC Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower			
		1	2	3	5
NEMA 1 Fan Assembly	907004	1	1	1	1
NEMA 4X/12 Fan Assembly	907006	1	1	1	1
NEMA 1 Cover	907007	1	1	1	1
NEMA 4X/12 Cover/Gasket	907010	1	1	1	1
Membrane Switch Keypad/Bracket	907013	1	1	1	1
Internal Fan Assembly	907001	1	1	1	1
Regulator Board	0-56921-6xx	1	1	1	1
Base Board (PISC-3	827003	1	1	1	
Base Board (PISC-5)	827001				1
Input Line Reactor	RL-00402 (MTE) 1321-3R4-B (AB) RL-00802 (MTE) 1321-3R8-B (AB) RL-01202 (MTE) 1321-3R12-B (AB) RL-01802 (MTE) 1321-3R18-B (AB)	1 1	 1 1	 1 1	 1 1

Table 11.4 – 1-5HP @ 460VAC 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 Board	0-56921-6xx	1	1	1	1

Table 11.4 – 1-5 HP @ 460 VAC Drive Replacement Parts (Continued)

Description*	Part Number	Quantity per Horsepower			
		1	2	3	5
Capacitor Board	0-56928-30 0-56928-50	1	1	1	 1
Current Feedback Board	0-56926-20 0-56926-50	1	1	 1	 1
Internal Fan Assembly	615159-1R	1	1	1	1
Base board (208 VAC drives only)	827003 827001	1	1	1	 1
Input Line Reactor	RL-00201 (MTE) 1321-3R2-A (AB) RL-00402 (MTE) 1321-3R4-B (AB) RL-00802 (MTE) 1321-3R8-B (AB)	1 1	 1 1	 1 1	 1 1

Table 11.5 – 7.5-10 HP @ 208 VAC Drive Replacement Parts

Description*	Part Number	Quantity per Horsepower	
		7.5	10
NEMA 1 Fan Assembly	907004	2	2
NEMA 12 Fan Assembly	907006	2	2
NEMA 1 Cover	907008	1	1
NEMA 12 Cover/Gasket	907011	1	1
Membrane Switch Keypad/Bracket	907014	1	1
Internal Fan Assembly	907002	1	1
Regulator Board	0-56921-6xx	1	1
Base board (PISC-10)	827703	1	1
Input Line Reactor	RL-02502 (MTE) 1321-3R25-B (AB) RL-03502 (MTE) 1321-3R25-B (AB)	1 1	 1 1

Table 11.6 – 7.5-10 HP @ 460 VAC 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 Board	0-56921-6xx	1	1
Capacitor Board	0-56934-100	1	1
Current Feedback Board	0-56935-100	1	1
Internal Fan Assembly	615159-1R	1	1
Base board (208 VAC drives only)	827003	1	1
Input Line Reactor	RL-01202 (MTE) 1321-3R12-B (AB) RL-01802 (MTE) 1321-3R18-B (AB)	1 1	 1 1

Table 11.7 – 15-20 HP @ 208 VAC Drive Replacement Parts

Description	Part Number	Quantity per Horsepower	
		15	20
NEMA 1 Fan Assembly	907005	2	2
NEMA 12 Fan Assembly	907006	2	2
NEMA 1 Cover	907009	1	1
NEMA 12 Cover/Gasket	907012	1	1
Membrane Switch Keypad/Bracket	907015	1	1
Internal Fan Assembly	907003	1	1
Regulator Board	0-56921-6xx	1	1
Base Board (PISC-20)	827705	1	1
Base Board (GVPB-20)	827706	1	1
Input Line Reactor	RL-04502 (MTE) 1321-3R45-B (AB) RL-05502 (MTE) 1321-3R55-B (AB)	1 1	 1 1

Table 11.8 – 15-25HP @ 460VAC Drive Replacement Parts

Description	Part Number	Qty. 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/Bracket	805548-1R	1	1	1
Regulator Board	0-56921-6xx	1	1	1
IGBT Module	602909-813AW	3	3	3
Capacitor Board	56961 56962	1	1	1
Power Board	56963	1	1	1
Power Supply Board	0-56950-015 0-56950-020	1	1	1
Gate Driver Board*	0-56960	1	1	1
Internal Fan Assembly	615159-1S	1	1	1
Base Board (208 VAC drives only)	827705 827706	1 1	1 1	
Input Line Reactor	RL-02502 (MTE) 1321-3R25-B (AB) RL-03502 (MTE) 1321-3R25-B (AB) RL-03502 (MTE) 1321-3R25-B (AB)	1 1	 1 1	 1 1

* Replace the Gate Driver Board when the IGBT modules are replaced.

Table 11.9 – 25-100HP @208VAC Drive Replacement Parts

Description	Part Number	Quantity per Horsepower						
		25	30	40	50	60	75	100
Regulator Board	0-56921-6xx	1	1	1	1	1	1	1
Base Board (PISC-40)	827711	1	1	1	1	1	1	1
Membrane Switch Keypad/Bracket Assembly	907021	1	1	1	1	1	1	1
Internal Fan Assembly	907017	1	1	1	1	1	1	1
Diode Module Fan Assembly	907018 907019	2	2	2	 1	 1	 1	 1
IGBT Module Fan Assembly	907020	2	2	2	2	2	2	2
IGBT Module	536664 536174 536175	3	3	3	 3 3	 3 3	 3 3	 3 3
Diode Bridge	512902 514706	1	1	1	 6	 6	 6	 6
DC Bus Fuse	286331 286325	1	1	1	 1	 1	 1	 1
DC Bus Capacitor	453136B	5	5	5	5	5	5	5
Input Line Reactor	RL-08002 (MTE) 1321-3R80-B (AB)	1 1						
	RL-10002 (MTE) 1321-3R100-B (AB)		1 1					
	RL-13002 (MTE) 1321-3R130-B (AB)			1 1				
	RL-16002 (MTE) 1321-3R160-B (AB)				1 1			
	RL-20002 (MTE) 1321-3R200-B (AB)					1 1		
	RL-25002 (MTE) 1321-3R250-B (AB)						1 1	
	RL-32002 (MTE) 1321-3R320-B (AB)							1 1

Table 11.10 – 30-60HP @ 460VAC Drive Replacement Parts

Description	Part Number	Quantity per Horsepower			
		30	40	50	60
Fan	69739-48A	2	2	2	2
Fan Wire Harness	615195-2R	1	1	1	1
NEMA 1 Cover	805534-11S	1	1	1	1
NEMA 12 Cover/Gasket	805534-12S	1	1	1	1
Membrane Switch Keypad/Bracket	805548-1R	1	1	1	1
Regulator Board	0-56921-6xx	1	1	1	1
Input Capacitor	600442-32SS 600442-33SW	2	2	4	4
Power Board	0-56949-040 0-56949-050	1	1	1	1
Power Supply Board	0-56950-025 0-56950-030 0-56950-040 0-56950-050	1	1	1	1
Gate Driver Board*	0-56947-025 0-56947-040 0-56947-050	1	1	1	1
IGBT Module	602909-810AW 602909-811AW 602909-812AW	3	3	3	3
Diode Bridge	701819-113BA 701819-114BA	1	1	1	1
Internal Fan Assembly	615196-2R	1	1	1	1
Input Line Reactor	RL-04502 (MTE) 1321-3R45-B (AB)	1 1			
	RL-05502 (MTE) 1321-3R55-B (AB)		1 1		
	RL-08002 (MTE) 1321-3R80-B (AB)			1 1	1 1

* Replace the Gate Driver Board when the IGBT modules are replaced.

Table 11.11 – 75-150HP @ 460VAC Drive Replacement Parts

Description	Part Number	Quantity per Horsepower			
		75	100	125	150
Fan Assembly	907017	1	1	1	1
Fan Wire Harness	410483-15A	1	1	1	1
Membrane Switch/Keypad	805548-1R	1	1	1	1
Regulator Board	0-56921-6xx	1	1	1	1
Input Capacitor	453136B	8	12	16	16
Power (Gate Driver) Board	827707	1	1	1	1
IGBT Module	536663	3	n/a	n/a	n/a
	534903	n/a	6	n/a	n/a
	534941	n/a	n/a	6	6
Diode Bridge	512783	1	1	1	1
Internal Fan Assembly	286323				
Fuse	286322	1	1	1	1
Input Line Reactor	RL-10002 (MTE) 1321-3R100-B (AB)	1 1			
	RL-13002 (MTE) 1321-3R130-B (AB)		1 1		
	RL-16002 (MTE) 1321-3R160-B (AB)			1 1	
	RL-20002 (MTE) 1321-3R200-B (AB)				1 1

Table 11.12 – 200-400HP @ 460VAC Drive Replacement Parts

Description	Part Number	Quantity
Phase Module Assembly	807300-124R	3
SCR Module Assembly	807300-200R	1
Blower Motor	616300-100R	1
Blower Starter Capacitor	69932-24QQ	1
Fault Thermostat	66012-16B	4
Gate Driver Board	0-56956	3
DC Bus Capacitor	600442-34SU	18

Table 11.12 – 200-400HP @ 460VAC Drive Replacement Parts (Continued)

Description	Part Number	Quantity
SCR Diode	701819-207BA	3
Bus Control Board	0-56966	1
Bus Control Board 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 Board	0-56940-6xx	1
Power Module Interface Board	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	807300-140R	1
Gate Driver/Power Supply Wiring Harness	807300-139R	1
Raceway Wiring Harness	807300-138R	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
Input Line Reactor (200 HP)	RL-25002 (MTE) 1321-3R250-B (AB)	1 1
Input Line Reactor (250 HP)	RL-32002 (MTE) 1321-3R320-B (AB)	1 1
Input Line Reactor (300 HP)	RL-40002 (MTE) 1321-3R400-B (AB)	1 1
Input Line Reactor (350 - 400 HP)	RL-50002 (MTE) 1321-3R500-B (AB)	1 1

Table 11.13 – Main Input Disconnect and Fuses

HP	Main Disconnect			Input Fuses (3 required)	
	Non-Fused	Interlock with Door (Fused)	Interlock with Door (Non-Fused)	208 VAC	460 VAC
1	65242-103CB	65242-101BA	65242-102AA	64676-75Z	64676-75S
2	65242-103CB	65242-101BA	65242-102AA	64676-75AD	64676-75Z
3	65242-103CB	65242-101BA	65242-102AA	64676-75AJ	64676-75AC
5	65242-103CB	65242-101BA	65242-102AA	64676-75AK	64676-75AD
7.5	65242-103CB	65242-101BA	65242-102AA	64676-75AN	64676-75AJ
10	65242-103CB	65242-101BA	65242-102AA	64676-75AQ	64676-75AK
15	65242-103CB	65242-101CA	65242-102CA	64676-75AR	64676-75AN
20	65242-103DB	65242-101CA	65242-102CA	64676-75AW	64676-75AQ
25	65242-103DB	65242-101DA	65242-102DA	64676-75AZ	64676-75AR
30	65242-103DB	65242-101DA	65242-102DA	64676-75BB	64676-75AT
40	65242-103DB	65242-101DA	65242-102DA	64676-75BD	64676-75AW
50	n/a	65242-101EA	65242-102EA	64676-75BF	64676-75AY
60	n/a	65242-101EA	65242-102EA	64676-75BH	64676-75AZ
75	n/a	65242-101EA	65242-102FA	64676-75BJ	64676-75BB
100	n/a	65242-101FA	65242-102FA	64676-75BK	64676-75BD
125	n/a	65242-101FA	65242-102FA	n/a	64676-75BG
150	n/a	65242-101FA	65242-102FA	n/a	64676-75BH
200	n/a	65242-105BA	65242-106BA	n/a	64676-75BK
250	n/a	65242-105BA	65242-106BA	n/a	64676-75BM
300	n/a	65242-105BA	65242-106BA	n/a	64676-75BM
350	n/a	65242-105CA	65242-106CA	n/a	64676-77P
400	n/a	65242-105CA	65242-106CA	n/a	64676-77P

Table 11.14 – Option Cabinet Replacement Parts – Drive Specific

HP	Drive Contactor	Bypass Contactor	Drive Only Disconnect*	Motor Overload	Control Transformer	Control Transformer Fuse
1	705310-60A	705310-60A	65242-11A	64427-23D	417155-RD	64676-29B
2	705310-60A	705310-60A	65242-11A	64427-23D	417155-RD	64676-29B
3	705310-60A	705310-60A	65242-11A	64427-23E	417155-RD	64676-29B
5	705310-60A	705310-60A	65242-11A	64427-23E	417155-RD	64676-29B
7.5	705310-60A	705310-60A	65242-11A	64427-23E	417155-RD	64676-29B
10	705310-60A	705310-60A	65242-11A	64427-23F	417155-RD	64676-29B
15	705310-63A	705310-63A	65242-11A	64427-23F	417155-RD	64676-29B
20	705310-64A	705310-65A	65242-12A	64427-23G	417155-RD	64676-29B
25	705310-64A	705310-65A	65242-13A	64427-23G	417155-RD	64676-29B
30	705310-65A	705310-65A	65242-13A	64427-23H	417155-RD	64676-29B
40	705310-65A	705310-66A	65242-13A	64427-23K	402410-305C	64676-29D
50	705310-65A	705310-66A	65242-13A	64427-23K	402410-305C	64676-29D
60	705310-66A	705310-68A	65242-14A	64427-23B	402410-305C	64676-29D
75	705310-66A	705310-68A	402410-909AA	64427-23B	402410-305C	64676-29H
100	705310-68A	705310-70A	402410-909AA	64427-23C	417155-R	64676-29L
125	705310-68A	705310-70A	402410-909AA	64427-23C	417155-R	64676-29L
150	705310-70A	705310-70A	402410-909AA	64427-25A	417155-R	64676-29L
200	705310-71A	705310-71A	Part of Drive	64427-25A	402410-305D	64676-29P
250	705310-71A	705310-71A	Part of Drive	64427-25B	402410-305D	64676-29P
300	705310-72A	705310-72A	Part of Drive	64427-25B	417155-T	64676-29S
350	705310-72A	705310-72A	Part of Drive	64427-25B	417155-T	64676-29S
400	705310-73A	705310-73A	Part of Drive	64427-25D	417155-T	64676-29S

*Main Input and Drive Only Disconnects are identical. Operator handles are seperate. See table 11.15.

Table 11.15 – Option Cabinet Replacement Parts – Common to All Drives

Description	Reliance Part Number	A-B Part Number
1-30 HP Control Transformer (60VA)	402410-305A / 402410	—
40-60 HP Control Transformer (95VA)	402410-305B	—
1-30 Control Transformer Fuse (0.6A)	64676-29B / 64676-29D	—
40-60 HP Control Transformer Fuse (1A)	64676-29D	—
Remote/Local Selector	413330-20A	800EM-SM22
Remote/Local Selector Contact Block	413330-20C	800E-3LX11
Inverter/Off/Bypass Selector	413330-20B	800EM-SM32
Inverter/Off/Bypass Selector Contact Block	413330-20D	800E-3LX20
Drive Pilot Light	413330-20E	800EM-P3
Bypass Pilot Light	413330-20F 413330-20H	800E-3DL5 800E-3DLT5X11
Pilot Light Power Modules	413330-20G 413330-20H	800E-3DL5 800E-3DLT5X11
1-15 HP Main Disconnect Knob (switch) 1-15 HP Main Disconnect Knob (handle)	413330-20J	194E-E40-1753 194L-HE6G-1751
20 HP Main Disconnect Knob (switch) 20 HP Main Disconnect Knob (handle)	413330-20K	194E-E63-1753 194L-HE6G-1751
25 HP Main Disconnect Knob (switch) 25 HP Main Disconnect Knob (handle)	413330-20L	194E-E80-1753 194L-HE6G-1751
30-40 HP Main Disconnect Knob (switch) 30-40 HP Main Disconnect Knob (handle)	413330-20M	194E-E80-1753 194L-HE6G-1751
1-10 HP Door Interlock Disconnect Knob (switch) 1-10 HP Door Interlock Disconnect Knob (handle) 1-10 HP Door Interlock Disconnect Knob (rod)	413330-20N	194R-NJ030P3 194R-HS4E 194R-R2
15-20 HP Door Interlock Disconnect Knob (switch) 15-20 HP Door Interlock Disconnect Knob (handle) 15-20 HP Door Interlock Disconnect Knob (rod)	413330-20P	194R-NJ060P3 194R-HS4E 194R-R2
25-40 HP Door Interlock Disconnect Knob (switch) 25-40 HP Door Interlock Disconnect Knob (handle) 25-40 HP Door Interlock Disconnect Knob (rod)	413330-20Q	194R-NJ100P3 194R-HM4E 194R-R4
50-60 HP Main Disconnect Handle (handle) 50-60 HP Main Disconnect Handle (rod)	413330-20R	194R-HM4E-N1 194R-R4
75 HP Main Disconnect Handle (handle) 75 HP Main Disconnect Handle (rod)	413330-20S	194R-HM4E-N1 199-LF1

Table 11.15 – Option Cabinet Replacement Parts – Common to All Drives (Continued)

Description	Reliance Part Number	A-B Part Number
100-150 HP Main Disconnect Handle (handle) 100-150 HP Main Disconnect Handle (rod)	413330-20T	194R-HM4E-N1 199-LF1
200 HP Main Disconnect Handle	413330-20V	DETL-NF600ASW YASB-16 OESA-ZK44 OZXA-26
250-300 HP Main Disconnect Handle	413330-20W	DETL-NF600ASW YASB-16 OESA-ZK44 OZXA-27
350-400 HP Main Disconnect Handle	413330-20TX	DETL-NF600ASW YASB-16 OESA-ZK44 OZXA-27
Control Relays	413330-20TY 413330-20TZ	700-HK32A1 700-HN122

11.6 Troubleshooting the Drive Using Error Codes

The drive can display two kinds of error codes, called alarm and fault codes, to signal a problem detected during self tuning or drive operation. Fault and alarm codes are shown in tables 11.16 and 11.17. A special type of fault code, which occurs rarely, is the fatal fault code, described in section 11.6.4.

Alarm Codes

An alarm condition is signified by a two- or three-letter code flashing on the display. The drive will continue to operate during the alarm condition. You should investigate the cause of the alarm to ensure that it does not lead to a fault condition. The alarm code remains on the display as long as the alarm condition exists. The drive automatically clears the alarm code when the condition causing it is removed.

Fault Codes

A fault condition is also signified by a two- or three-letter code flashing on the display. If a fault occurs, the drive coasts to stop and the RUNNING LED turns off. The first fault detected is maintained flashing on the display, regardless of whether other faults occur after it. The fault code remains on the display until it is cleared by the operator using the STOP/RESET key or using the fault reset input from the selected control source (P.000).

Error Log

The drive automatically stores all fault codes for faults that have occurred in the system error log. The error log is accessible through the keypad, the OIM, or the CS3000 software.There is no visual indication that there are faults in the log. You must access the error log to view the faults.

The error log holds the 10 most recent faults that have occurred. The last fault to occur is the first one to appear on the display when you access the error log. The faults in the log are numbered sequentially. The most recent fault is identified with the highest number (up to 9). Once the log is full, older faults are discarded from the log as new faults occur.

For each entry in the error log, the system also displays the day and time that the fault occurred. The day data is based on a relative 247-day counter (rolls over after 247.55). The time is based on a 24-hour clock. The first digits of the clock data represent hours. The last two digits represent minutes. The clock can be reset using P.030 (Elapsed Time Meter Reset).

All entries in the error log and the day and time data are retained if power is lost. See section 11.2 for the procedure for accessing and clearing the error log.

11.6.1 Identifying Alarm Codes and Recovering

VTAC 7 drive alarm codes are shown in table 11.16 . Note that the alarm code will only be displayed for as long as the problem exists. Once the problem has been corrected, the alarm code will disappear from the display.

Table 11.16 – List of Alarm Codes

Code	Alarm Description	Alarm Cause	Corrective Action
AIn	Analog input signal loss	P.011 = 8, 9, 10, or 11 and the 4 to 20 mA analog input is below 2 mA.	Verify that P.011 is set correctly. Check that analog input source supply ≥4 mA.
I-Ac	V/Hz identification procedure active	V/Hz identification procedure is enabled and in progress.	Allow identification procedure to finish. Press keypad STOP/RESET to cancel identification procedure if desired.
I-En	V/Hz identification procedure enabled	H.020 = On; V/Hz identification procedure has been enabled but not started.	Proceed with V/Hz identification procedure, start drive and allow procedure to begin. Display will change to I-Ac when drive is started. Change H.020 to OFF to cancel identification and clear I-En if desired.
LIL	Low AC input line	AC input line is low.	Adjust line voltage parameter (H.021) to match actual AC line voltage.

11.6.2 Identifying Fault Codes and Recovering

ATTENTION: DC bus capacitors retain hazardous voltages after input power has been disconnected. After disconnecting input power, wait five 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.

ATTENTION: Do not operate 75-400HP 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.

VTAC 7 drive fault codes are shown in table 11.17. To clear a single fault that has occurred so that the drive can be started again, correct any problems indicated by the fault code and press the STOP/RESET key on the keypad, or assert the fault reset from the selected control source (P.000). Because multiple faults can occur and only the first will be displayed, you must access the error log in order to view all of the faults that have occurred. See section 11.6.3 for instructions on how to view the error log.

Table 11.17 – List of Fault Codes

Code	Fault Description	Fault Cause	Corrective Action
AIn	Analog input signal loss	P.011 = 4 or 5 and 4 to 20 mA analog input is below 2 mA.	Verify that P.011 is set correctly. Check that the analog input source supply ≥4 mA.
bYC	DC bus charging bypass contactor	Charging bypass contactor did not close or contact closure was not sensed by the system.	Check operation of the bypass contactor. Verify that the contactor is closing when the proper bus voltage is applied. Replace contactor.
CHS	Default parameter restore (checksum error)	During drive operation: Regulator board failure.	Contact Reliance or replace Regulator board.
		After Regulator board replacement:	Contact Reliance.
EC	Earth current failure (ground fault)	Unintentional grounding.	Check isolation between ground and output terminals. Possible leakage current sensor defects; replace sensor.
EEr	Non-volatile memory write failure	Failure on write to non-volatile memory.	Connect CS3000 software to upload parameters or record parameter values by hand. Then replace the Regulator board. Parameter values will be lost when power is cycled.
EL	Encoder loss	Drive is not detecting feedback from the encoder.	Check the connection between the encoder and the drive. Check the encoder/motor coupling.
FL	Function loss	Function loss input on control terminal is opened.	Check external interlocks at terminals 16, 20.

Table 11.17 – List of Fault Codes (Continued)

Code	Fault Description	Fault Cause	Corrective Action
HId	High time identification aborted	Identification process has been aborted.	See H.019 for identification result.
HIL	High line voltage	Input voltage more than 15% above nominal.	Check actual line voltage against H.021.
HU	High DC bus voltage	DC bus voltage too high (capacitor protection).	Check input line voltage; if necessary, add transformer.
		Deceleration time too short.	Increase deceleration time P.002/P.018/P.023 versus Maximum Speed/Hz (P.004). Install DB option with resistors.
IPL	Input phase loss	Voltage ripple on DC bus due to missing input phase or an imbalance between phases.	Verify that proper voltage is being applied to the drive. Check all phases.
LU	Low DC bus voltage	DC bus voltage too low. Line dip too long (P.042).	Check input voltage, line fuses. If necessary, add transformer. Check value of Ride-Through Time (P.042), Line Voltage (H.021).
		Input rectifier diodes defective.	Check DC bus voltage. If incorrect, replace diode set.
nCL	Network comm loss	Communications with the AutoMax Network kit have been lost.	Check network cabling from network master to network option board. Check that network master is operating properly.
nId	Identification Request not yet performed	Drive started but Identification Result = Zero.	Reset fault. Perform Identification Request. Restart drive.

Table 11.17 – List of Fault Codes (Continued)

Code	Fault Description	Fault Cause	Corrective Action
OC	Overcurrent (steady state). Trips at 137% load (based on inverter type current) check Power Module rating.	Output phase-to-phase short.	Check isolation between each output line.
		Bus voltage line-to-line.	Check transistor modules for correct output. If incorrect, possible board defect; replace. Possible Hall effect current sensor defective; replace.
		Ground fault.	Check isolation between ground and output terminals. Possible leakage current sensor defect; replace sensor.
		Momentary overload.	Check for motor overload; reduce load on motor.
		Bad motor.	Check motor for correct operation.
		Overtemperature (internal to drive)	Check ambient temperature. Check minimum clearance around drive.
		Internal fan loss.	Check fans.
		Torque boost / V/Hz too high.	Check parameters H.001, H.002, and/or H.003. Enable Identification Request (H.020)
		Motor unknown to regulator.	Check that regulator was updated with actual motor characteristics via Identification Request (H.020).
		Encoder wired incorrectly, wrong PPR.	Check encoder wiring.
OCA	Overcurrent (at acceleration)	Acceleration time too short.	Increase acceleration time (P.001, P.017, P021).
OCb	Overcurrent (at DC braking)	DC voltage too high.	Check parameters H.006, H.007.
OCd	Overcurrent (at deceleration)	Deceleration time too short.	Increase deceleration time (P.002, P.018, P.022)
OF	Overfrequency	Drive has exceeded maximum allowable output frequency. Regenerating energy is too high. Stability or slip compensation circuit adds frequency reference. If H.016 ON, searching current is too high. Motor is too small.	Check DC bus voltage; increase decelerating time. Check values Maximum Speed (P.004) / Overfreq. (H.022). Check slip compensation (H.004). If H.016 ON, check motor size versus Power Module size, recheck setting of P.005 (too high).

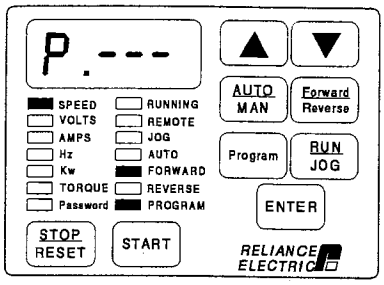
Table 11.17 – List of Fault Codes (Continued)

Code	Fault Description	Fault Cause	Corrective Action
OH	Drive overtemperature	Cooling fan failure.	Check ambient temperature, cooling fan, minimum clearances around drive.
OL	Motor overload	Excess motor current. Torque boost too high, therm. overload level too low.	Check actual current/Torque Boost (H.003). Check that Power Module is sized correctly. Reduce load on motor (for example, at low frequency).
		Excess load on motor, for example, at too low speeds.	Check that Power Module is sized correctly. Reduce load on motor (at low frequency).
		Loss of phase connection.	Check output lines to the motor.
OPL	Motor output phase loss	Phase lost between drive and motor.	Check connections and cable of all 3 phases and motor windings. Replace any damaged cable.
PUc	Missing Power Module ID connector	Bad or disconnected cable between Regulator and Power Module.	Check cables between Regulator board and Power Module.
PUn	Power Module not identified	Drive parameters have been restored to power-up defaults. Regulator has not been configured to match Power Module.	Power Module must be configured by Reliance service personnel.
PUo	Drive power electronic overload	Power Module overloaded. Too high DC Braking Current (H.007) or Torque Boost (H.003).	Check load to Power Module. Check Power Module sizing versus application. Check DC Braking Current value (H.007). Check Torque Boost (H.003).
SrL	Communication loss between Regulator/PC/OIM	Serial port communication cable, PC or OIM communication port setup.	Check connection cable and communication port setup.
UAr	Spurious host PC comm interrupt	Regulator board failure.	Replace Regulator board.
UbS	Asymmetrical bus charge	Bad Power Module.	Contact Reliance.

11.6.3 Accessing, Reading, and Clearing the Faults in the Error Log

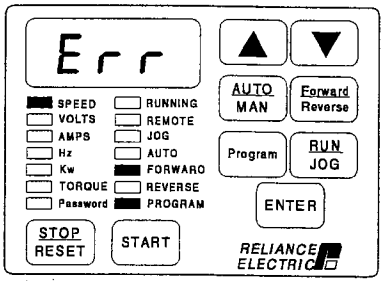
This procedure shows how to access and clear the error log. Note that you cannot clear a single entry from the error log. The entire log, including all the fault codes and the day and time stamp of each fault, are cleared simultaneously using this procedure.

Step 1. Press the PROGRAM key until the PROGRAM LED turns on to enter program mode.

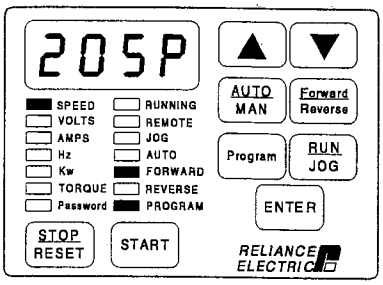


The First Menu General parameters are displayed.

Step 2. Press the ▼ key until Err is displayed.



Step 3. Press the ENTER key.

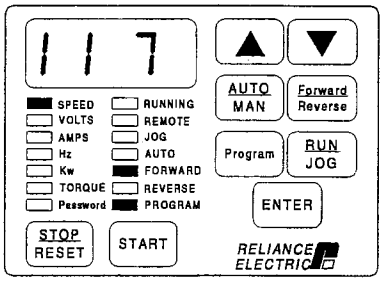


If no faults have occured, Err will be displayed again. If only one fault has occurred, the fault code will be displayed as the first entry in the log. If more than one fault has ocurred, the first entry is the latest fault that occurred.

Step 4. Press the ▲ key or the ▼ key.

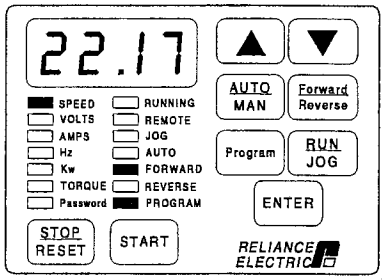
The display steps through the error log entries, which are numbered 0 through 9 (maximum).

Step 5. Press the ENTER key.



The display shows the day stamp, which can range from 0 to 248 days.

Step 6. Press the ▼ key.



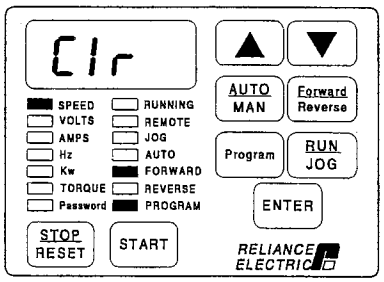
The display shows the time stamp, which is based on a 24-hour clock. Use the arrow keys to move between the day and time data.

Step 7. Press the PROGRAM key, which displays the error log entries again.

The display shows the error log entry prior to or associated with the time stamp.

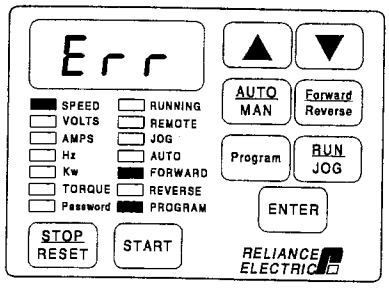
Step 8. Repeat steps 4 though 7 for each additional error log entry to view the time and date for each error log entry.

Step 9. When you have viewed all the entries, you should clear the error log.



Press the ▼ key while you are viewing any entry in the log until the display shows CLr. Press ENTER to clear the error log. All entries will be cleared.

Step 10. Err will be displayed again to indicate that the log is empty.



Step 11. Press the PROGRAM key to access monitor mode.

11.6.4 Identifying Fatal Fault Codes and Recovering

Fatal fault codes are distinguished by the letter F before the code. They normally indicate a malfunction of the microprocessor on the Regulator board. In some cases, fatal fault codes can be reset and the drive can be restarted. Table 11.18 lists the fatal fault codes that can be reset. If any other fault code appears on the display, you will need to replace the Regulator board.

If the fault code FUE appears in error log entry 0, it indicates a fatal fault occurred before power was lost. Contact Reliance or observe the drive for subsequent fatal errors before turning off power. Fatal fault codes are not retained after power loss.

Table 11.18 – Fatal Fault Codes That Can Be Reset

Code	Fault Description	Fault Cause	Corrective Action
F 3	Encoder power-up diagnostic error.	Encoder voltage is less than 10 V.	Turn off power to the drive. Disconnect the encoder wiring from the terminal strip. Turn power to the drive back on. If the F3 error does not re-occur, the problem is in the wiring between the drive and the encoder. If the F3 error occurs again, the problem is in the Regulator board, which should be replaced.
F 60	Option port identification error.	The option board could not be identified by the regulator.	Check the ribbon cable between the Regulator board and the option board. Refer to the appropriate option board instruction manual for more information about the option board.
F 61	Option board power-up diagnostic failure.	Option board has failed one or more power-up diagnostics.	Check the ribbon cable between the Regulator board and the network option board. Replace the option board if necessary. See the appropriate instruction manual for more information about the option board.
F 62 or F 26	Option board runtime error.	During operation, the option board watchdog failed or handshaking with the drive failed.	If intermittent, check for causes of noise, for proper grounding, and that outputs are not exceeding rated current capacities. Replace the option board if necessary. Refer to the appropriate instruction manual for more information about the option board.

APPENDIX A

Technical Specifications

Table A.1 – Service Conditions

AC Line Distribution System Capacity (maximum) for 208 VAC Units	500 KVA, three-phase with 25,000 amps symmetrical fault current capacity with a line impedance of less than 8%.
AC Line Distribution System Capacity (maximum) for 460 VAC Units	1200KVA, three-phase with 85,000 amps symmetrical fault current capacity with a line impedance of less than 5%.
Control Method	All-digital vector, sinusoidal pulse width modulated (PWM)
Displacement Power Factor	0.96
Line Frequency	50/60Hz (±2Hz)
Line Voltage Variation	±10%
Line Dip Ride-Through	Adjustable up to 999.9 seconds (see P.042)
Motor Lead Lengths	250 feet total
Remote Operator Control Wire Length	Up to 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	50% to 110% (based on drive nameplate rating)
Service Factor	1.0
Speed Adjustable Range	From 0 RPM to maximum speed
Speed Regulation	Motor slip dependent
Speed Reference Resolution	±1 RPM with local keypad, ±4095 counts with a network or serial reference
Torque Linearity	±3% with optimal parameter setting (typical)

Table A.2 – Environmental Conditions

Condition	Specification
Operating Temperature (Ambient)	32 to 104°F
Storage Temperature (Ambient)	–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	10V (@ 50Kohm input impedance or 20 mA)
Digital Inputs (1 to 8)	16	+24VDC 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 to 11 (scaled signal)	0-10VDC or 4-20mA
Snubber Resistor	26 to 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 – Input Signal Response Times (Maximum)

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

* 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 VTAC 7 drive complies with these 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
9.2.6	• Combined start and stop controls

EN60204-1 Section	Title
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

APPENDIX C
Drive Regulation Overview

The VTAC 7 drive is a digital drive that provides open loop volts/hertz regulation of AC motors. See figure C.1 for a block diagram of the regulator.

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

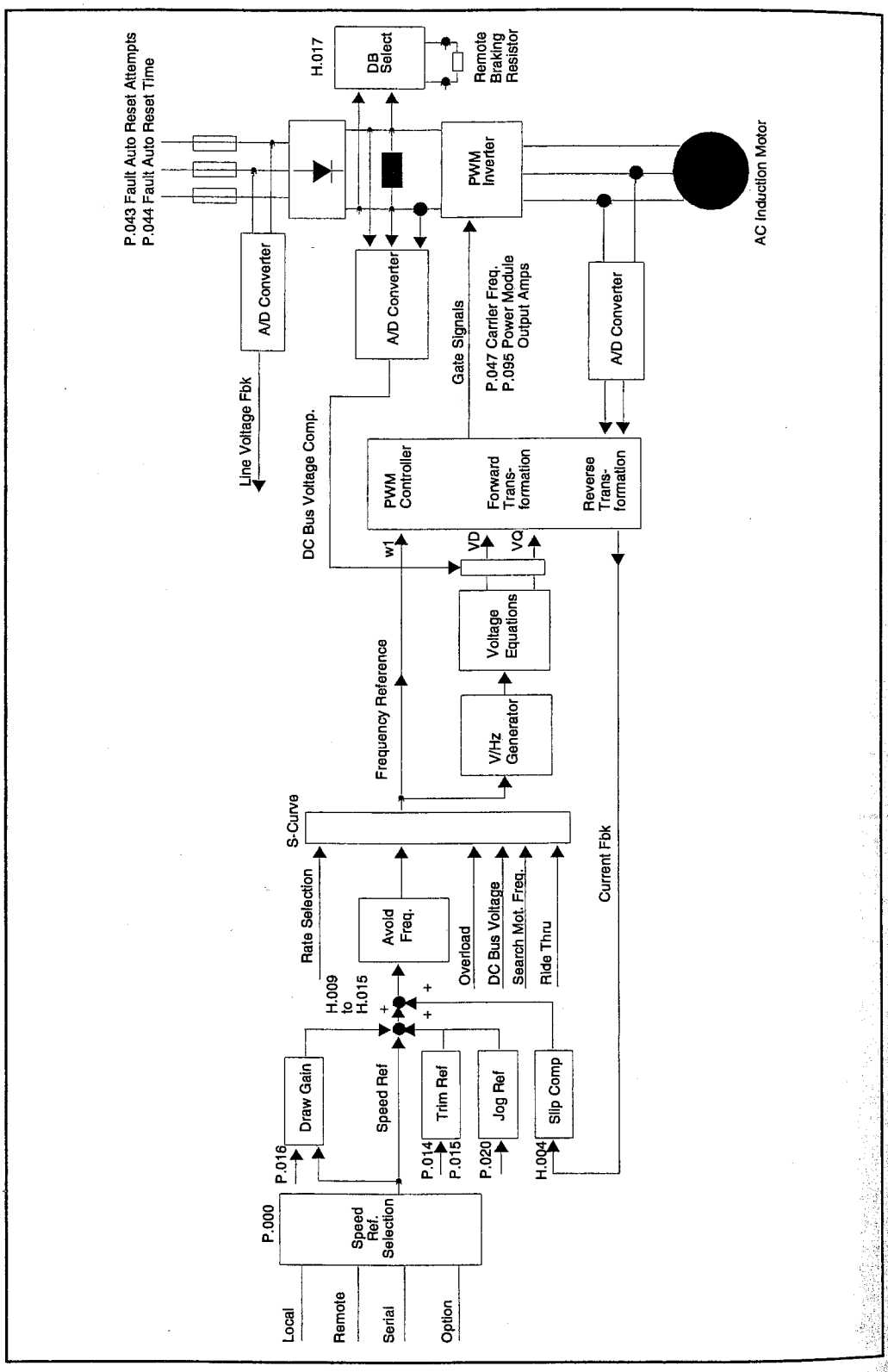


Figure C.1 – Volts/Hertz Regulation Block Diagram

APPENDIX D

Alphabetical Listing of Parameters

First Menu General Parameters

Accel Time 1 (RAMP 1) P.001
Control Source P.000
Current Limit P.005
Decel Time (RAMP 1) P.002
Maximum Speed P.004
Minimum Speed P.003
Second Menu Password P.006

Second Menu General Parameters

Accel Time 2 (RAMP 2) P.017
AUTO/MAN Key Disable P.052
Carrier Frequency (kHz) P.047
Country Defaults P.049
Decel Time 2 (RAMP 2) P.018
Diagnostics Display P.091
Diagnostics Source P.090
Draw Gain Percentage P.016
Elapsed Time Meter P.029
Elapsed Time Meter Reset P.030
Encoder Loss Enable P.039
Fault Auto Reset Attempts P.043
Fault Auto Reset Time P.044
Forward/Reverse Configuration P.027
Function Loss Response P.026
Jog Ramp Accel Time P.021
Jog Ramp Decel Time P.022
Jog Speed Reference P.020
Level Sense Start Enable P.054
Line Dip Ride-Through Time P.042
Manual Reference Preset Enable P.053
MOP Accel/Decel Time P.023
MOP Reset Configuration P.024
Motor Overload Enable P.040
Motor Overload Type P.041
Network Connection Type P.061
Network Drop Number P.060
Network Output Register 1 Source P.066
Network Output Register 2 Source P.067
Network Output Register 3 Source P.068
Network Output Register 4 Source P.069
Option Port: Communication Loss Response P.062
Option Port: Network Reference Source P.063
Option Port: Network Trim Reference Source P.064
Option Port: Type and Version P.065
Output Phase Loss Enable P.045
Output Relay Configuration P.013

Second Menu General Parameters (continued)

Power Module Output Amps P.095
Power Module Type P.099
Preset Speed 1 . . . . . P.031
Preset Speed 2 . . . . . P.032
Preset Speed 3 . . . . . P.033
Preset Speed 4 . . . . . P.034
Preset Speed 5 . . . . . P.035
Preset Speed 6 . . . . . P.036
Preset Speed 7 . . . . . P.037
Preset Speed 8 . . . . . P.038
Programming Disable P.051
Restore Defaults P.050
S-Curve Enable P.019
Software Version Number P.098
Speed Display Scaling P.028
STOP/RESET Key Disable P.055
Stop Type P.025
Terminal Strip Analog Input Gain P.010
Terminal Strip Analog Input Configure P.011
Terminal Strip Analog Input Offset P.009
Terminal Strip Analog Output Source P.012
Terminal Strip Digital Inputs Configure P.007
Terminal Strip Speed Reference Source P.008
Trim Gain Percentage P.015
Trim Reference Source P.014
Volts/Hertz or Vector Regulation P.048

Second Menu Volts/Hertz Parameters

AC Line Volts H.021
Avoidance Frequency Band 1 . . . . . H.011
Avoidance Frequency Band 2 . . . . . H.013
Avoidance Frequency Band 3 . . . . . H.015
Avoidance Frequency Enable H.009
Avoidance Frequency Midpoint 1 . . . . . H.010
Avoidance Frequency Midpoint 2 . . . . . H.012
Avoidance Frequency Midpoint 3 . . . . . H.014
DC Braking Current H.007
DC Braking Enable H.005
DC Braking Start Frequency H.006
DC Braking Time H.008
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Second Menu RMI Parameters

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Analog Input Offset r.010
Analog Output 1 Gain r.003
Analog Output 1 Offset r.002
Analog Output 1 Source r.001
Analog Output 2 Gain r.006
Analog Output 2 Offset r.005
Analog Output 2 Source r.004
Analog Output 3 Gain r.009
Analog Output 3 Offset r.008
Analog Output 3 Source r.007
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Current Detection Level 2 . . . . . r.058
Current Detection Level 3 . . . . . r.059
Digital Input Configuration r.030
Digital Output 1 Configuration r.031
Digital Output 1 Delay Time r.040
Digital Output 2 Configuration r.032
Digital Output 2 Delay Time r.041
Digital Output 3 Configuration r.033
Digital Output 3 Delay Time r.042
Digital Output 4 Configuration r.034
Digital Output 4 Delay Time r.043
Frequency Input Gain r.016
Frequency Input Offset r.015
Frequency Input Sample Period r.014
Low Speed Detection Level r.056
PI Regulator Integral Gain r.022
Pi Regulator Offset r.020
PI Regulator Proportional Gain r.021
Relay Output 1 (NO) Configuration r.035
Relay Output 1 Delay Time r.044
Relay Output 2 (NO/NC) Configuration r.036
Relay Output 2 Delay Time r.045
Relay Output 3 (NO/NC) Configuration r.037
Relay Output 3 Delay Time r.046
Speed Detection Hysteresis Band r.053
Speed Detection Level 1 . . . . . r.050
Speed Detection Level 2 . . . . . r.051
Speed Detection Level 3 . . . . . r.052
Torque Detection Hysteresis r.066
Torque Detection Level 1 . . . . . r.063
Torque Detection Level 2 . . . . . r.064
Torque Detection Level 3 . . . . . r.065
Torque/Current Limit Source r.025

Refer to the Remote Meter Interface board manual (D2-3341) for the RMI parameter descriptions.

APPENDIX E

Record of Your Parameter Settings

Parameter No.		Parameter Name	Setting	Date
First Menu General	P.000	Control Source		
	P.001	Accel Time 1 (RAMP 1)		
	P.002	Decel Time 1 (RAMP 1)		
	P.003	Minimum Speed		
	P.004	Maximum Speed		
	P.005	Current Limit		
	P.006	Second Menu Password		

Parameter No.		Parameter Name	Setting	Date
Second Menu General	P.007	Terminal Strip Digital Inputs Configure		
	P.008	Terminal Strip Speed Reference Source		
	P.009	Terminal Strip Analog Input Offset		
	P.010	Terminal Strip Analog Input Gain		
	P.011	Terminal Strip Analog Input Configure		
	P.012	Terminal Strip Analog Output Source		
	P.013	Output Relay Configuration		
	P.014	Trim Reference Source		
	P.015	Trim Gain Percentage		
	P.016	Draw Gain Percentage		
	P.017	Accel Time 2 (RAMP 2)		
	P.018	Decel Time 2 (RAMP 2)		
	P.019	S-Curve Enable		
	P.020	Jog Speed Reference		
	P.021	Jog Ramp Accel Time		
	P.022	Jog Ramp Decel Time		
	P.023	MOP Accel/Decel Time		
	P.024	MOP Reset Configuration		
	P.025	Stop Type		
	P.026	Function Loss Response		
	P.027	Forward/Reverse Configuration		
	P.028	Speed Display Scaling		
	P.029	Elapsed Time Meter		
	P.030	Elapsed Time Meter Reset		
	P.031	Preset Speed 1		
	P.032	Preset Speed 2		

Parameter No.		Parameter Name	Setting	Date
Second Menu General (cont'd)	P.033	Preset Speed 3		
	P.034	Preset Speed 4		
	P.035	Preset Speed 5		
	P.036	Preset Speed 6		
	P.037	Preset Speed 7		
	P.038	Preset Speed 8		
	P.039	Encoder Loss Enable		
	P.040	Motor Overload Enable		
	P.041	Motor Overload Type		
	P.042	Line Dip Ride-Through Time		
	P.043	Fault Auto Reset Attempts		
	P.044	Fault Auto Reset Time		
	P.045	Output Phase Loss Enable		
	P.047	Carrier Frequency (kHz)		
	P.048	Volts/Hertz or Vector Regulation		
	P.049	Country Defaults		
	P.050	Restore Defaults		
	P.051	Programming Disable		
	P.052	AUTO/MAN Key Disable		
	P.053	Manual Reference Preset Enable		
	P.054	Level Sense Start Enable		
	P.055	STOP/RESET Key Disable		
	P.060	Network Drop Number		
	P.061	Network Connection Type		
	P.062	Option Port: Communication Loss Response		
	P.063	Option Port: Network Reference Source		
	P.064	Option Port: Network Trim Reference Source		
	P.065	Option Port: Type and Version		
	P.066	Network Output Register 1 Source		
	P.067	Network Output Register 2 Source		
	P.068	Network Output Register 3 Source		
	P.069	Network Output Register 4 Source		
	P.090	Diagnostics Source		
	P.091	Diagnostics Display		
	P.095	Power Module Output Amps		
	P.098	Software Version Number		
	P.099	Power Module Type		

Parameter No.		Parameter Name	Setting	Date
Second Menu Volts/ Hertz	H.000	Motor Nameplate Volts		
	H.001	Motor Nameplate Base Frequency		
	H.002	Motor Nameplate Amps		
	H.003	Torque Boost Voltage		
	H.004	Slip Compensation		
	H.005	DC Braking Enable		
	H.006	DC Braking Start Frequency		
	H.007	DC Braking Current		
	H.008	DC Braking Time		
	H.009	Avoidance Frequency Enable		
	H.010	Avoidance Frequency Midpoint 1		
	H.011	Avoidance Frequency Band 1		
	H.012	Avoidance Frequency Midpoint 2		
	H.013	Avoidance Frequency Band 2		
	H.014	Avoidance Frequency Midpoint 3		
	H.015	Avoidance Frequency Band 3		
	H.016	Sync Direction		
	H.017	Input Power/Snubber Configuration		
	H.018	Volts/Hertz Curve Type		
	H.019	Identification Result		
	H.020	Identification Request		
	H.021	AC Line Volts		
	H.022	Overfrequency Limit		
Second Menu RMI	r.001	Analog Output 1 Source		
	r.002	Analog Output 1 Offset		
	r.003	Analog Output 1 Gain		
	r.004	Analog Output 2 Source		
	r.005	Analog Output 2 Offset		
	r.006	Analog Output 2 Gain		
	r.007	Analog Output 3 Source		
	r.008	Analog Output 3 Offset		
	r.009	Analog Output 3 Gain		
	r.010	Analog Input Offset		
	r.011	Analog Input Gain		
	r.014	Frequency Input Sample Period		
	r.015	Frequency Input Offset		
	r.016	Frequency Input Gain		
	r.020	PI Regulator Offset		
	r.021	PI Regulator Proportional Gain		
	r.022	PI Regulator Integral Gain		
	r.025	Torque/Current Limit Source		
	r.030	Digital Input Configuration		
	r.031	Digital Output 1 Configuration		
	r.032	Digital Output 2 Configuration		

Parameter No.		Parameter Name	Setting	Date
Second Menu RMI (cont'd)	r.033	Digital Output 3 Configuration		
	r.034	Digital Output 4 Configuration		
	r.035	Relay Output 1 (NO) Configuration		
	r.036	Relay Output 2 (NO/NC) Configuration		
	r.037	Relay Output 3 (NO/NC) Configuration		
	r.040	Digital Output 1 Delay Time		
	r.041	Digital Output 2 Delay Time		
	r.042	Digital Output 3 Delay Time		
	r.043	Digital Output 4 Delay Time		
	r.044	Relay Output 1 Delay Time		
	r.045	Relay Output 2 Delay Time		
	r.046	Relay Output 3 Delay Time		
	r.050	Speed Detection Level 1		
	r.051	Speed Detection Level 2		
	r.052	Speed Detection Level 3		
	r.053	Speed Detection Hysteresis Band		
	r.056	Low Speed Detection Level		
	r.057	Current Detection Level 1		
	r.058	Current Detection Level 2		
	r.059	Current Detection Level 3		
	r.060	Current Detection Hysteresis		
	r.063	Torque Detection Level 1		
	r.064	Torque Detection Level 2		
	r.065	Torque Detection Level 3		
	r.066	Torque Detection Hysteresis		

APPENDIX F

Power Module-Dependent Parameter Default Values

Second Menu General Parameter Carrier Frequency (P.047) Parameter (USA Defaults)

The default is 8 Hz for these Power Modules:

- Standard 1-25 HP @ 208 V
- Standard 1-200 HP @ 460 V

The default is 4 kHz for these Power Modules:

- Wall-mount 30-100 HP @ 208 V
- Wall-mount 75-200 HP @ 460 V
- Standard 250-350 HP @ 460 V

The default is 2 kHz for Power Modules for standard 400 HP @ 460 V

Second Menu General Parameter Motor Nameplate Amps (H.002) Parameter (USA Defaults)

Power Module	Default	Power Module	Default	Power Module	Default
1H2160 1H2260	2.6	15H4160 15H4260	17.8	75W2160	245
1H4160 1H4260	1.3	20H2160 20H2260	48	75H4160 75W4160	100.0
2H2160 2H2260	5.4	20H4160 20H4260	24.0	100W2160	275
2H4160 2H4260	2.7	25W2160	81	100H4160 100W4160	130.0
3H2160 3H2260	7.6	25H4160 25H4260	29.7	125H4160 125W4160	160.0
3H4160 3H4260	3.8	30W2160	105	150H4160 150W4160	190.0
5H2160 5H2260	12.2	30H4160 30H4260	35.5	200H4160 200W4160	240.0
5H4160 5H4260	6.1	40W2160	135	250H4160	302.0
7H2160 7H2260	18	40H4160 40H4260	48.7	300H4160	361.0
7H4160 7H4260	9.0	50W2160	150	350H4160	414.0
10H2160 10H2260	23.8	50H4160 50H4260	62.5	400H4160	477.0
10H4160 10H4260	11.9	60W2160	195		
15H2160 15H2260	35.6	60H4160 60H4260	68.0		

APPENDIX G

Configuring the Digital Inputs When the RMI Board is Installed in the Drive

The VTAC 7 drive Regulator board contains three user-configurable digital inputs. Parameters P.007 (Terminal Strip Digital Inputs Configure) and P.008 (Terminal Strip Speed Reference Source) specify how these digital inputs are used.

If an optional Remote Meter Interface (RMI) board is installed in the drive, four additional digital inputs are available. RMI parameter r.030 specifies how the RMI digital inputs are used.

The Regulator board digital inputs and the RMI digital inputs cannot be used for the same functions. One parameter cannot be set to a value that requires resources (digital inputs) or a duplication of function that is used or defined by the value of another parameter.

The acceptable values for P.008 are based on the value selected for P.007 and by the value selected for r.030:

- P.008 is limited by P.007 and r.030
- P.007 is limited by P.008
- r.030 is limited by P.008

First determine what functions are to be assigned to the three digital inputs on the Regulator board. Once you have determined this, select the appropriate settings for P.007 and P.008. As shown in the following tables, the desired value for P.008 must be permissible by both the P.007 and r.030 values. If either column indicates that the value is not acceptable, P.008 cannot be set to that value. Use the following tables to help determine the appropriate settings for your application.

Refer to chapter 4 in this manual for a complete description of parameters P.007 and P.008 and their corresponding options. Refer to the RMI board instruction manual (D2-3341) for a complete description of parameter r.030 and its options.

Summary of Options for P.007, P.008, and r.030

P.007 Options			
	DIGIN 6	DIGIN 7	DIGIN 8
0 =	FWD/REV	RAMP 1/2	REM/LOC
1 =	Not used	FWD/REV	RAMP 1/2
2 =	Not used	FWD/REV	REM/LOC
3 =	Not used	RAMP 1/2	REM/LOC
4 =	Not used	Not used	FWD/REV
5 =	Not used	Not used	RAMP 1/2
6 =	Not used	Not used	REM/LOC
7 =	Not used	Not used	Not used

P.008 Options			
	DIGIN 6	DIGIN 7	DIGIN 8
0 =	Not used	Not used	Not used
1 =	MOP ↑	MOP ↓	Not used
2 =	2 Presets	Not used	Not used
3 =	4 Presets		Not used
4 =	8 Presets		
5 =	Analog ref and 1 preset	Not used	Not used
6 =	Analog ref and 3 presets		Not used
7 =	Analog ref and 7 presets		

r.030 Options				
	RMI DIGIN 1	RMI DIGIN 2	RMI DIGIN 3	RMI DIGIN 4
0 =	Ref 1/2	A/F	Aux 2	Aux 1
1 =	Ref 1/2	A/F	Aux 2	PI Enable
2 =	Ref 1/2	MOP ↑	MOP ↓	Aux 1
3 =	Ref 1/2	MOP ↑	MOP ↓	PI Enable
4 =	Ref 1/2	2 Presets	Aux 2	Aux 1
5 =	Ref 1/2	2 Presets	Aux 2	PI Enable
6 =	Ref 1/2	4 Presets	4 Presets	Aux 1
7 =	Ref 1/2	4 Presets	4 Presets	PI Enable
8 =	Ref 1/2	8 Presets	8 Presets	8 Presets

Option Comparison Tables

If P.007 =	Acceptable P.008 Values
0	0
1	0, 2, 5
2	0, 2, 5
3	0, 2, 5
4	0-3, 5, 6
5	0-3, 5, 6
6	0-3, 5, 6
7	0-7 (all)

If r.030 =	Acceptable P.008 Values
0	0-6 (all)
1	0-6 (all)
2	0, 2-6
3	0, 2-6
4	0, 1
5	0, 1
6	0, 1
7	0, 1
8	0, 1

If P.008 =	Acceptable P.007 Values
0	0-12 (all)
1	4-7, 12
2	1-7, 9-12
3	4-7, 12
4	7
5	1-7, 9-12
6	4-7, 12
7	7

If P.008 =	Acceptable r.030 Values
0	0-8 (all)
1	0, 1, 4-8
2	0-3
3	0-3
4	0-3
5	0-3
6	0-3
7	0-3

APPENDIX H

Using the Terminal Strip Analog Input

An analog reference input is provided at terminals 12 through 15 on the drive's Regulator board. This input accepts either a ±10 VDC or 0 to 20 mA signal. The analog-to-digital conversion provides 10-bit plus sign resolution and a digital range of ±1023.

The analog input can be used as a reference for:

- Speed reference (P.000, P.007/P.008)
- Trim reference (P.014)
- Outer control loop feedback (U.040)

Parameters P.009 (Terminal Strip Analog Input Offset) and P.010 (Terminal Strip Analog Input Gain) adjust the converted value for any external signal errors. Parameter P.011 (Terminal Strip Analog Input Configure) specifies the type of signal used and to invert the converted value, if required.

Three quantities are calculated from the analog input value: scaled, speed normalized, and torque reference. The scaled value is used for the outer control loop (OCL) feedback. The speed normalized value is used for either speed or trim reference. Figure H.1 shows the relationship between the input and the calculated values.

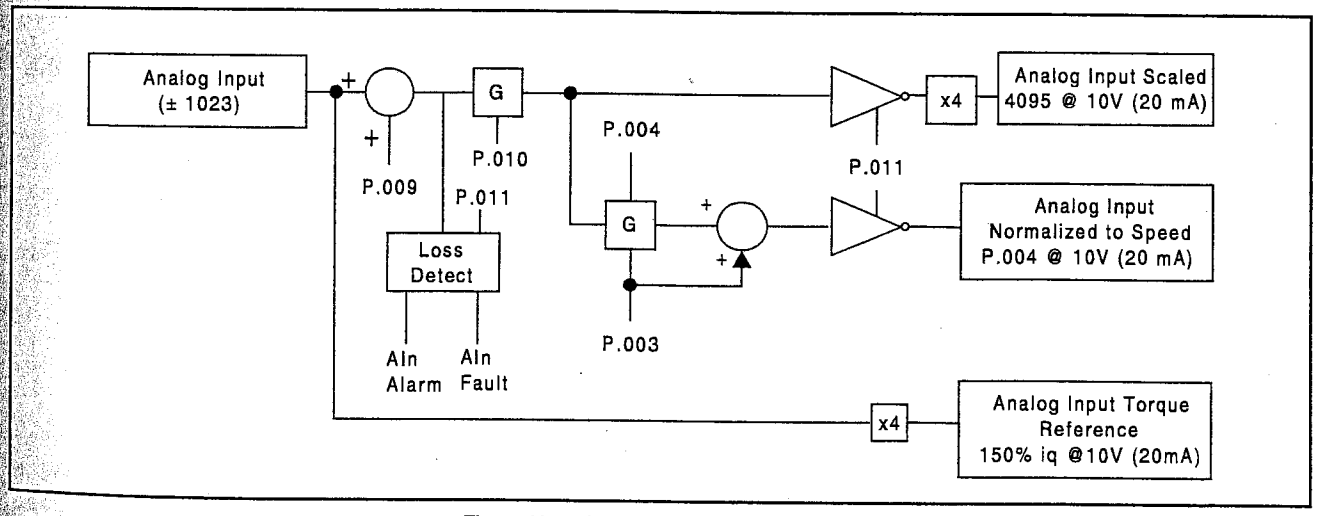

Figure H.1 – Terminal Strip Analog Input

H.1 Configuring the Analog Input

Parameter P.011 specifies the type of input and whether it is to be inverted after it is converted by the drive. The parameter setting should coincide with the position of jumper J4 on the Regulator board. For example, if a voltage input is applied, J4 should be set to ±10 VDC and P.011 should be between 0 and 3. If a current input is applied, J4 should be set to 0 to 20 mA and P.011 should be between 4 and 11.

If P.011 is odd, the digital value of the input is inverted resulting in a positive input inverted to a negative reference value, and a negative input converted to a positive reference value. Note that the Forward/Reverse Configuration parameter (P.027) is applied after the analog input.

The 4 to 20 mA can be configured to generate a drive fault or a drive alarm if the input falls below 2 mA. See the P.011 parameter description for more information.

H.2 Using the Analog Input as Speed or Trim Reference

When the analog input is used as speed or trim reference, the analog input value will be interpreted internally as shown in table H.1 and described below:

Table H.1 – Analog Input Conversion Scaling for Speed or Trim Reference

Analog Input Values	Corresponding Internal Value
+10 VDC (20 mA)	P.004 (Maximum Speed)
0 VDC (0 mA)	P.003 (Minimum Speed)
–10 VDC	–P.004 (Negative Maximum Speed; reverse or 0, see P.027)

- The maximum positive analog input value (+10 VDC or 20 mA) corresponds to the value specified as the maximum speed of the drive (P.004).
- The maximum negative analog input value (–10 VDC) corresponds to –P.004 (reverse or 0, see P.027).
- The minimum analog input value (0 VDC or 0 mA; 4 mA if P.011 = 4, 5, or 8 to 11) corresponds to the value specified as the minimum speed of the drive (P.003).
- When P.011 = 0 or 1, there is no hysteresis provided around zero on the input. Therefore, if the input fluctuates around zero, the reference will toggle between positive minimum speed (+P.003) and negative minimum speed (–P.003).

Note that the analog input is scaled based on the values entered in P.003 and P.004. If these parameters are changed while the drive is running, and the analog input is used as the speed or trim reference, the speed reference will change even though the input value has not.

Figure H.2 illustrates how the analog signal is scaled internally by the drive when it is used as the speed or trim reference. The solid line indicates the conversion when the non-inverted state is selected (P.011 is even). The dashed line indicates the conversion when the inverted state is selected (P.011 is odd).

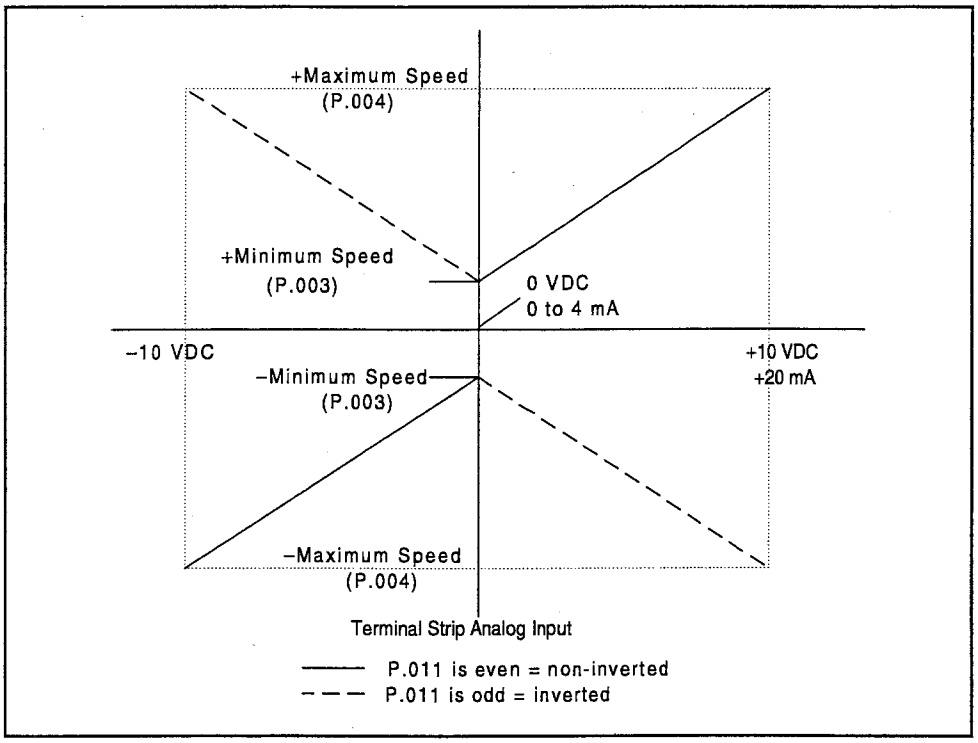

Figure H.2 – Analog Input Conversion Scaling (Speed or Trim Reference)

H.2.1 Adjusting for External Signal Errors Using the Offset and Gain Parameters

When the analog input is used for speed or trim reference, parameters P.009 (Terminal Strip Analog Input Offset) and P.010 (Terminal Strip Analog Input Gain) can be used to compensate for any offset or gain errors in the external circuitry.

The value in P.009 is first added to the converted 10-bit value and then the gain is applied. If an offset or gain adjustment is needed, the offset should be adjusted first, with the minimum input applied, and the gain adjusted last, with the maximum input applied.

To remove a positive external offset, enter a negative value into P.009. In most cases, the offset is left at the default value of zero and is only adjusted to counteract external circuitry errors.

The adjustment range for P.009 is –900 to +900. For 0 to 10V (or –10V to +10V input) a value of +1 equals an offset of approximately 10mV. For 0 to 20 mA input, a value of +1 equals an offset of approximately 20μA.

To adjust the offset (P.009):

Step 1. Verify that the analog input is configured as the speed reference control source (P.000 = rE (or AUTO is selected) and P.008 = 0).

Step 2. Display the converted value of the analog input using the selected speed reference display mode. (Refer to chapter 8 for the procedure for displaying the selected speed reference.)

Step 3. Adjust P.009 to achieve the value of minimum speed when the analog input is set to the position where minimum speed is desired.

The gain parameter is typically used to compensate for saturation or insufficient voltage from the input source.

Unless the input is a 4 to 20 mA signal, before adjusting the gain, set P.011 to 0 to avoid clamping the reference at 0. After adjusting P.009 and P.010, change P.011 to reflect the intended input.

To adjust the gain (P.010):

Step 1. Verify that the analog input is configured as the speed reference control source (P.000 = rE (or AUTO is selected) and P.008 = 0).

Step 2. Display the converted value of the analog input using the selected speed reference display mode. (Refer to chapter 8 for the procedure for displaying the selected speed reference.)

Step 3. Adjust P.010 to achieve the value of maximum speed when the analog input is set to the position where maximum speed is desired. For example, if a speed pot is used, rotate the pot to its maximum position.

The adjustment range for P.010 is 0.100 to 5.000.

APPENDIX I

Default Parameter Settings

These are the VTAC 7 drive factory-set parameter values. They are not the default values if P.050 (Restore Defaults) is set to ON.

ATTENTION: The VTAC 7 drive is preconfigured to provide V/Hz regulation. In order for the drive to operate as described in this instruction manual, parameters P.048, P.049, and P.050 must not be changed by the user. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Table I.1 – First and Second Menu General Parameters

Parameter No.	Parameter Name	USA (P.049 = USA)
P.000	Control Source	LOCL
P.001	Accel Time 1	20.0
P.002	Decel Time 1	20.0
P.003	Minimum Speed	5.0 Hz
P.004	Maximum Speed	60.0 Hz
P.005	Current Limit	100%
P.006	Second Menu Password	N/A
P.007	Terminal Strip Digital Inputs Configure	0
P.008	Terminal Strip Speed Reference Source	0
P.009	Terminal Strip Analog Input Offset	0
P.010	Terminal Strip Analog Input Gain	1.000
P.011	Terminal Strip Analog Input Configure	2
P.012	Terminal Strip Analog Output Source	0
P.013	Output Relay Configuration	0
P.014	Trim Reference Source	0
P.015	Trim Gain Percentage	0.0
P.016	Draw Gain Percentage	0.0
P.017	Accel Time 2	20.0

Table I.1 – First and Second Menu General Parameters (Continued)

Parameter No.	Parameter Name	USA (P.049 = USA)
P.018	Decel Time 2	20.0
P.019	S-Curve Enable	ON
P.020	Jog Speed Reference	5.0 Hz
P.021	Jog Ramp Accel Time	20.0
P.022	Jog Ramp Decel Time	20.0
P.023	MOP Accel/Decel Time	20.0
P.024	MOP Reset Configuration	0
P.025	Stop Type	0
P.026	Function Loss Response	1
P.027	Forward/Reverse Configuration	1
P.028	Speed Display Scaling	See parameter description
P.029	Elapsed Time Meter	N/A
P.030	Elapsed Time Meter Reset	OFF
P.031	Preset Speed 1	5.0 Hz
P.032	Preset Speed 2	5.0 Hz
P.033	Preset Speed 3	5.0 Hz
P.034	Preset Speed 4	5.0 Hz
P.035	Preset Speed 5	5.0 Hz
P.036	Preset Speed 6	5.0 Hz
P.037	Preset Speed 7	5.0 Hz
P.038	Preset Speed 8	5.0 Hz
P.039	Encoder Loss Enable	OFF
P.040	Motor Overload Enable	ON
P.041	Motor Overload Type	nC
P.042	Line Dip Ride-Through Time	10.0
P.043	Fault Auto Reset Attempts	3
P.044	Fault Auto Reset Time	60
P.045	Output Phase Loss Enable	ON

Table I.1 – First and Second Menu General Parameters (Continued)

Parameter No.	Parameter Name	USA (P.049 = USA)
P.047	Carrier Frequency (kHz)	Power Module dependent. See appendix F.
P.048	V/Hz or Vector Regulation	U-H
P.049	Country Defaults	USA
P.050	Restore Defaults	OFF
P.051	Programming Disable	0
P.052	AUTO/MAN Key Disable	OFF
P.053	Manual Reference Preset Enable	OFF
P.054	Level Sense Start Enable	OFF
P.055	STOP/RESET Key Disable	OFF
P.060	Network Drop Number	1
P.061	Network Connection Type	0
P.062	Option Port: Communication Loss Response	0
P.063	Option Port: Network Reference Source	0
P.064	Option Port: Network Trim Reference Source	0
P.065	Option Port: Type and Version	N/A
P.066	Network Output Register 1 Source	0
P.067	Network Output Register 2 Source	0
P.068	Network Output Register 3 Source	0
P.069	Network Output Register 3 Source	0
P.090	Diagnostics Source	0
P.091	Diagnostics Display	N/A
P.095	Power Module Output Amps	N/A
P.098	Software Version Number	6.04
P.099	Power Module Type	N/A

Table I.2 – Second Menu Volts/Hertz Parameters

Parameter No.	Parameter Name	USA (P.049 = USA)
H.000	Motor Nameplate Volts	460
H.001	Motor Nameplate Base Frequency	60.0
H.002	Motor Nameplate Amps	Power Module dependent. See appendix F.
H.003	Torque Boost Voltage	0.5
H.004	Slip Compensation	0.0
H.005	DC Braking Enable	OFF
H.006	DC Braking Start Frequency	1.0
H.007	DC Braking Current	10
H.008	DC Braking Time	3.0
H.009	Avoidance Frequency Enable	OFF
H.010	Avoidance Frequency Midpoint 1	0.0
H.011	Avoidance Frequency Band 1	2.0
H.012	Avoidance Frequency Midpoint 2	0.0
H.013	Avoidance Frequency Band 2	2.0
H.014	Avoidance Frequency Midpoint 3	0.0
H.015	Avoidance Frequency Band 3	2.0
H.016	Sync Direction	OFF
H.017	Input Power/Snubber Configuration	0
H.018	Volts/Hertz Curve Type	2
H.019	Identification Result	0
H.020	Identification Request	OFF
H.021	AC Line Volts	460
H.022	Overfrequency Limit	90.0

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