BALDOR®
MOTORS AND DRIVES

ADJUSTABLE SPEED DRIVE

SERIES 15H
Inverter Control

Installation & Operating Manual

9/97 **MN715**

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Section 5

Section 1
Quick Start Guide

Overview

If you are an experienced user of Baldor controls, you are probably already familiar with the keypad programming and keypad operation methods. If so, this quick start guide has been prepared for you. This procedure will help get your system up and running in the keypad mode quickly and will allow motor and control operation to be verified. This procedure assumes that the Control, Motor and Dynamic Brake hardware are correctly installed (see Section 3 for procedures) and that you have an understanding of the keypad programming & operation procedures. It is not necessary to wire the terminal strip to operate in the Keypad mode (Section 3 describes terminal strip wiring procedures). The quick start procedure is as follows:

1. Read the Safety Notice and Precautions in section 2 of this manual.
2. Mount the control, refer to Section 3, “Physical Location” procedure.
3. Connect AC power, refer to Section 3 “AC Line Connections”.
4. Connect the motor, refer to Section 3, “Three Phase Input Power”.
5. Install Dynamic brake hardware, if required. Refer to Section 3, “Optional Dynamic Brake Hardware”.

Quick Start Checklist

Check of electrical items.

⚠ **CAUTION: After completing the installation but before you apply power, be sure to check the following items.**

1. Verify AC line voltage at source matches control rating.
2. Inspect all power connections for accuracy, workmanship and tightness as well as compliance to codes.
3. Verify control and motor are grounded to each other and the control is connected to earth ground.
4. Check all signal wiring for accuracy.
5. Be certain all brake coils, contactors and relay coils have noise suppression. This should be an R-C filter for AC coils and reverse polarity diodes for DC coils. MOV type transient suppression is not adequate.

⚠ **WARNING: Make sure that unexpected operation of the motor shaft during start up will not cause injury to personnel or damage to equipment.**

Check of Motors and Couplings

1. Verify freedom of motion for all motor shafts and that all motor couplings are tight without backlash.
2. Verify the holding brakes if any, are properly adjusted to fully release and set to the desired torque value.

Quick Start Procedure

The following procedure will help get your system up and running in the keypad mode quickly, and will allow you to prove the motor and control operation. This procedure assumes that the Control, Motor and Dynamic Brake hardware are correctly installed (see Section 3 for procedures) and that you have an understanding of the keypad programming & operation procedures.

Initial Conditions

Be sure the Control (Physical Installation & AC Line Connections), Motor and Dynamic Brake hardware are wired according to the procedures in Section 3 of this manual. Become familiar with the keypad programming and keypad operation of the control as described in Section 4 of this manual.

1. Verify that any enable inputs to J4-8 are open.
2. Turn power on. Be sure no faults are displayed on the keypad display.
3. Set the Level 1 Input block, Operating Mode to “KEYPAD”.
4. Be sure the Level 2 Protection block, Local Enable INP parameter is OFF and the Level 2 Protection block, External Trip parameter is OFF.
5. Set the Level 2 Output Limits block, “OPERATING ZONE” parameter as desired (STD CONST TQ, STD VAR TQ, QUIET CONST TQ or QUIET VAR TQ).
6. Set the Level 2 Output Limits block, “MIN OUTPUT FREQ” parameter.
7. Set the Level 2 Output Limits block, “MAX OUTPUT FREQ” parameter.

Note: JP1 is in position 2–3 as shipped from the factory (<120Hz operation). For operation with MAX OUTPUT FREQ >120Hz, change the position of JP1 to pins 1–2. Refer to Section 3 for jumper location.

8. If the desired peak current limit setting is different than is automatically set by the Operating Zone, set the Level 2 Output Limits block, “PK CURRENT LIMIT” parameter as desired.
9. Enter the following motor data in the Level 2 Motor Data block parameters:
   Motor Voltage (input)
   Motor Rated Amps (FLA)
   Motor Rated Speed (base speed)
   Motor Rated Frequency
   Motor Mag Amps (no load current)
10. If External Dynamic Brake hardware is used, set the Level 2 Brake Adjust block, “RESISTOR OHMS” and “RESISTOR WATTS” parameters.
11. Set the Level 1 V/HZ Boost block, “V/HZ PROFILE” parameter for the correct V/Hz ratio for your application.
12. If the load is a high initial starting torque type, the torque boost and Accel time may need to be increased. Set the Level 1 V/HZ Boost block, “TORQUE BOOST” and the Level 1 Accel/Decel Rate block, “ACCEL TIME #1” as required.
13. Select and program additional parameters to suit your application.

The control is now ready for use in keypad mode or the terminal strip may be wired and the programming changed for another operating mode.

Section 2
General Information

Overview

The Baldor Series 15H control is a PWM inverter motor control. The control operates by converting AC line power into fixed DC power. The DC power is then pulse width modulated into synthesized three phase AC line voltage for the motor. In this way, the control converts the fixed input frequency to variable output frequency to cause the motor to have variable speed operation.

The rated horsepower of the control is based on a NEMA design B four pole motor and 60Hz operation at nominal rated input voltage. If any other type of motor is used, or input voltage other than 230, 460 or 575 VAC is applied to the input terminals, the control should be sized to the motor using the rated output current of the control.

The Baldor Series 15H control may be used in many different applications. It may be programmed by the user to operate in four different operating zones; standard constant torque, standard variable torque, quiet constant torque or quiet variable torque. It can also be configured to function in a number of operating modes for custom operation.

It is the responsibility of the user to determine the optimum operating zone and operating mode for the application. These choices are programmed using the keypad as explained in the programming section of this manual.

Limited Warranty

For a period of two (2) years from the date of original purchase, BALDOR will repair or replace without charge controls and accessories which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. BALDOR shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, BALDOR's total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to BALDOR with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses.

Goods may be returned only with written notification including a BALDOR Return Authorization Number and any return shipments must be prepaid.

Safety Notice:

This equipment contains voltages that may be as great as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

PRECAUTIONS:

⚠ **WARNING: Do not touch any circuit board, power device or electrical connection before you first ensure that power has been disconnected and there is no high voltage present from this equipment or other equipment to which it is connected. Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.**

⚠ **WARNING: Be sure that you are completely familiar with the safe operation of this equipment. This equipment may be connected to other machines that have rotating parts or parts that are controlled by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.**

⚠ **WARNING: Do not use motor overload relays with an automatic reset feature. These are dangerous since the process may injure someone if a sudden or unexpected automatic restart occurs. If manual reset relays are not available, disable the automatic restart feature using external control wiring.**

⚠ **WARNING: This unit has an automatic restart feature that will start the motor whenever input power is applied and a RUN (FWD or REV) command is issued and maintained. If an automatic restart of the motor could cause injury to personnel, the automatic restart feature should be disabled by changing the "Restart Auto/Man" parameter to MANUAL.**

⚠ **WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that grounds are connected. Electrical shock can cause serious or fatal injury.**

⚠ **WARNING: Do not remove cover for at least five (5) minutes after AC power is disconnected to allow capacitors to discharge. Electrical shock can cause serious or fatal injury.**

⚠ **WARNING: Improper operation of control may cause violent motion of the motor shaft and driven equipment. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment. Peak torque of several times the rated motor torque can occur during control failure.**

⚠ **WARNING: Motor circuit may have high voltage present whenever AC power is applied, even when motor is not rotating. Electrical shock can cause serious or fatal injury.**

Continued on next page.

⚠ **Caution:** **To prevent equipment damage, be certain that the electrical service is not capable of delivering more than the maximum line short circuit current amperes listed for 230 VAC, 460 VAC or 575 VAC control rating.**

⚠ **Caution:** **Do not supply any power on the External Trip (motor thermostat) leads at J4-16 or J4-17 as the control may be damaged. Use a dry contact type that requires no external power to operate.**

⚠ **Caution:** **Disconnect motor leads (T1, T2 and T3) from control before you perform a "Megger" test on the motor. Failure to disconnect motor from the control will result in extensive damage to the control. The control is tested at the factory for high voltage / leakage resistance as part of Underwriter Laboratory requirements.**

⚠ **Caution:** **Do not connect AC power to the Motor terminals T1, T2 and T3. Connecting AC power to these terminals may result in damage to the control.**

⚠ **Caution:** **Baldor recommends not using "Grounded Leg Delta" transformer power leads that may create ground loops and degrade system performance. Instead, we recommend using a four wire Wye.**

Section 3
Receiving & Installation

Receiving & Inspection

The Series 15H Inverter Control is thoroughly tested at the factory and carefully packaged for shipment. When you receive your control, there are several things you should do immediately.

1. Observe the condition of the shipping container and report any damage immediately to the commercial carrier that delivered your control.
2. Verify that the control you received is the same as listed on your purchase order.
3. If the control is to be stored for several weeks before use, be sure that it is stored in a location that confirms to published storage specifications. (Refer to Section 6 of this manual).

Physical Installation

The mounting location of the 15H is important. It should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. Exposure to these can reduce the operating life and degrade performance of the control.

Several other factors should be carefully evaluated when selecting a location for installation:

1. For effective cooling and maintenance, the control should be mounted on a smooth, non-flammable vertical surface. Table 3-1 lists the Watts Loss ratings for enclosure sizing.
2. At least two inches clearance must be provided on all sides for air flow.
3. Front access must be provided to allow the control cover to be opened or removed for service and to allow viewing of the Keypad Display. (Keypad may be mounted remotely up to 100 feet from the control.)
4. **Altitude derating.** Up to 3300 feet (1000 meters) no derating required. Above 3300 feet, derate peak output current by 2% for each 1000 feet above 3300 feet.
5. **Temperature derating.** Up to 40°C no derating required. Above 40°C, derate peak output current by 2% per °C above 40°C.
   Maximum ambient is 55°C.

Table 3-1 Series 15H Watts Loss Ratings

Enclosure Size	230 VAC		460 VAC		575 VAC	
	2.5KHz PWM	8.0KHz PWM	2.5KHz PWM	8.0KHz PWM	2.5KHz PWM	8.0KHz PWM
A and B	14 Watts/ Amp	17 Watts/ Amp	17 Watts/ Amp	26 Watts/ Amp	18 Watts/ Amp	28 Watts/ Amp
C, D, E and F	12 Watts/ Amp	15 Watts/ Amp	15 Watts/ Amp	23Watts/ Amp	19Watts/ Amp	29 Watts/ Amp
G			15 Watts/ Amp			

Control Installation

The control must be securely fastened to the mounting surface. Use the four (4) mounting holes to fasten the control to the mounting surface or enclosure.

Shock Mounting

If the control will be subjected to levels of vibration greater than 0.5G at 10 to 60Hz, the control should be shock mounted. Excessive vibration within the control could cause internal connections to loosen and cause component failure or electrical shock hazard.

Through the Wall Mounting

Control sizes E and F are designed for panel or through the wall installation. To mount a control through the wall, a Through the Wall mounting kit must be purchased. These kits are:

Kit No.	Description
KT0000A00	Size A control through the wall mounting kit.
KT0001A00	Size B control through the wall mounting kit.
V0083991	Size E control through the wall mounting kit.
V0084001	Size F control through the wall mounting kit.

Procedure:

1. Refer to Section 6 of this manual for drawings and dimensions of the through the wall mounting kits. Use the information contained in these drawings to layout the appropriate size hole on your enclosure and wall.
2. Cut the holes in your enclosure and wall.
3. Locate and drill holes for mounting hardware as shown in the drawings.
4. Cut foam tape and apply to perimeter of opening as shown.
5. Secure the four (4) brackets to the exterior of the customers panel with the hardware provided.
6. Secure the Control to the Customers Panel using the hardware provided.

Optional Remote Keypad Installation The keypad may be remotely mounted using optional Baldor keypad extension cable. Keypad assembly (white - DC00005A-01; gray - DC00005A-02) comes complete with the screws and gasket required to mount it to an enclosure. When the keypad is properly mounted to a NEMA Type 4X indoor enclosure, it retains the Type 4X indoor rating.

Tools Required:

- Center punch, tap handle, screwdrivers (Phillips and straight) and crescent wrench.
- 8-32 tap and #29 drill bit (for tapped mounting holes) or #19 drill (for clearance mounting holes).
- 1-1/4″ standard knockout punch (1-11/16″ nominal diameter).
- RTV sealant.
- (4) 8-32 nuts and lock washers.
- Extended 8-32 screws (socket fillister) are required if the mounting surface is thicker than 12 gauge and is not tapped (clearance mounting holes).
- Remote keypad mounting template. A tear out copy is provided at the end of this manual for your convenience. (Photo copy or tear out.)

Mounting Instruction: **For tapped mounting holes**

1. Locate a flat 4″ wide x 5.5″ minimum high mounting surface. Material should be sufficient thickness (14 gauge minimum).
2. Place the template on the mounting surface or mark the holes as shown.
3. Accurately center punch the 4 mounting holes (marked A) and the large knockout (marked B).
4. Drill four #29 mounting holes (A). Thread each hole using an 8-32 tap.
5. Locate the 1-1/4″ knockout center (B) and punch using the manufacturers instructions.
6. Debur knockout and mounting holes making sure the panel stays clean and flat.
7. Apply RTV to the 4 holes marked (A).
8. Assemble the keypad to the panel. Use 8–32 screws, nuts and lock washers.
9. From the inside of the panel, apply RTV over each of the four mounting screws and nuts. Cover a 3/4″ area around each screw while making sure to completely encapsulate the nut and washer.

Mounting Instructions: **For clearance mounting holes**

1. Locate a flat 4″ wide x 5.5″ minimum high mounting surface. Material should be sufficient thickness (14 gauge minimum).
2. Place the template on the mounting surface or mark the holes as shown on the template.
3. Accurately center punch the 4 mounting holes (marked A) and the large knockout (marked B).
4. Drill four #19 clearance holes (A).
5. Locate the 1-1/4″ knockout center (B) and punch using the manufacturers instructions.
6. Debur knockout and mounting holes making sure the panel stays clean and flat.
7. Apply RTV to the 4 holes marked (A).
8. Assemble the keypad to the panel. Use 8–32 screws, nuts and lock washers.
9. From the inside of the panel, apply RTV over each of the four mounting screws and nuts. Cover a 3/4″ area around each screw while making sure to completely encapsulate the nut and washer.

Electrical Installation

Interconnection wiring is required between the motor control, AC power source, motor, host control and any operator interface stations. Use listed closed loop connectors that are of appropriate size for wire gauge being used. Connectors are to be installed using crimp tool specified by the manufacturer of the connector. Only Class 1 wiring should be used.

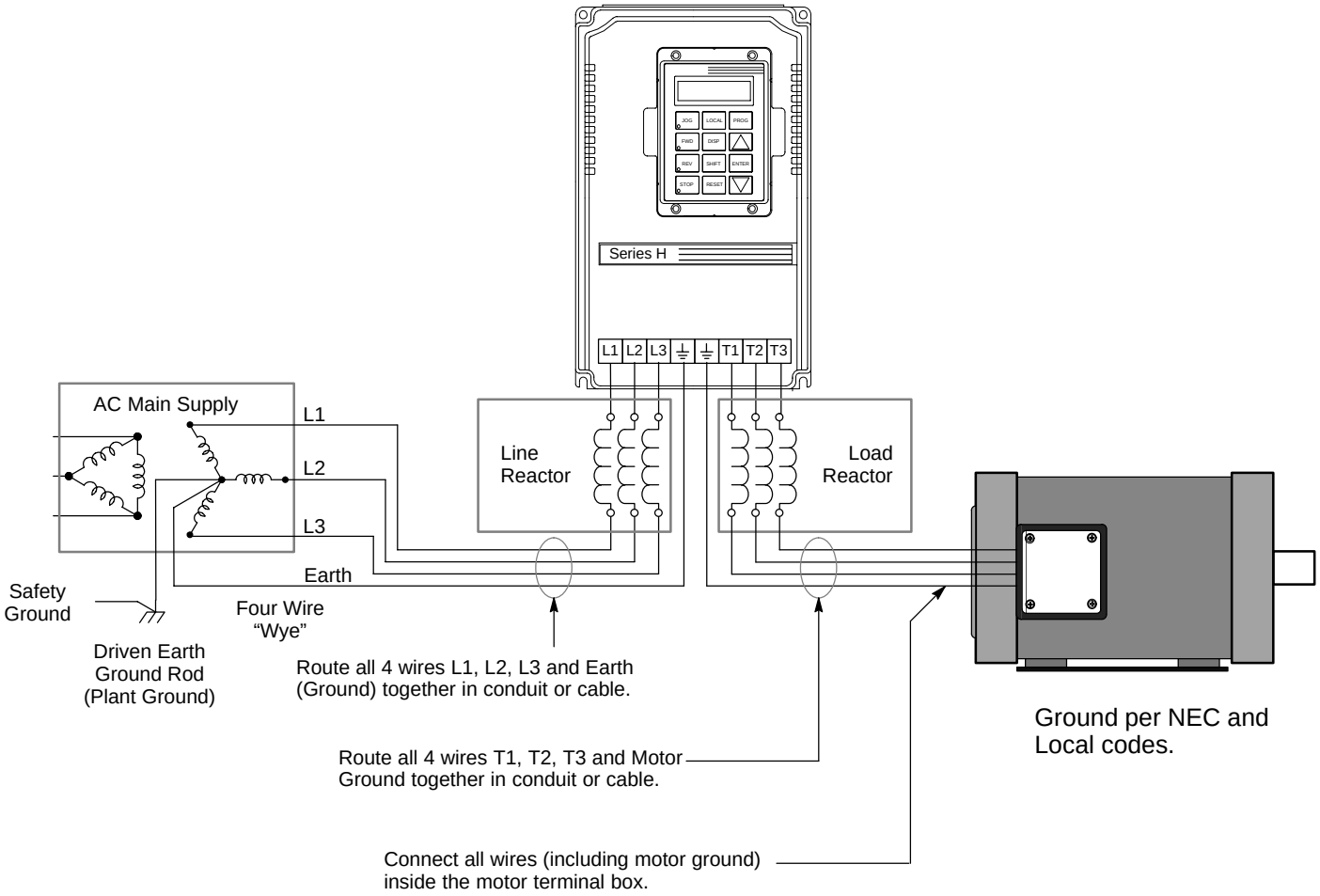
The Baldor Series 15H control requires a minimum line impedance of 3% (voltage drop at the input is 3% when the control draws rated input current). If the incoming power line has less than 3% impedance, a 3 phase line reactor can be used to provide the needed impedance in most cases. Line reactors are optional and are available from Baldor.

System Grounding

Baldor Controls are designed to be powered from standard three phase lines that are electrically symmetrical with respect to ground. System grounding is an important step in the overall installation to prevent problems. The recommended grounding method is shown in Figure 3-1.

⚠ **Caution: Baldor recommends not using "Grounded Leg Delta" transformer power leads that may create ground loops and degrade system performance. Instead, we recommend using a four wire Wye.**

Figure 3-1 Recommended System Grounding



Ungrounded Distribution System
With an ungrounded power distribution system it is possible to have a continuous current path to ground through the MOV devices. To avoid equipment damage, an Isolation transformer with a grounded secondary is recommended. This provides three phase AC power that is symmetrical with respect ground.

Input Power Conditioning
Baldor controls are designed for direct connection to standard three phase lines that are electrically symmetrical with respect to ground. Certain power line conditions must be avoided. An AC line reactor or an isolation transformer may be required for some power conditions.

- Baldor Series H controls require a minimum line impedance of 3%. Refer to “Line Impedance” for additional information.
- If the feeder or branch circuit that provides power to the control has permanently connected power factor correction capacitors, an input AC line reactor or an isolation transformer must be connected between the power factor correction capacitors and the control.
- If the feeder or branch circuit that provides power to the control has power factor correction capacitors that are switched on line and off line, the capacitors must not be switched while the control is connected to the AC power line. If the capacitors are switched on line while the control is still connected to the AC power line, additional protection is required. TVSS (Transient Voltage Surge Suppressor) of the proper rating must be installed between the AC line reactor or an isolation transformer and the AC input to the control.

Line Impedance

The input impedance of the power lines can be determined in two ways:

1. Measure the line to line voltage at no load and at full rated load. Use these measured values to calculate impedance as follows:

$$\%\text{Impedance} = \frac{(\text{Volts}_{\text{NoLoad}} - \text{Volts}_{\text{FullLoad}})}{(\text{Volts}_{\text{NoLoad}})} \times 100$$

2. Calculate the short circuit current capacity of the power line. If the short circuit current capacity is greater than the published maximum short circuit current ratings (Tables 3-2) a line reactor should be installed.

   Two methods of calculating short circuit current capacity are provided:

   A. Method 1
   Calculate short circuit current as follows:

$$I_{SC} = \frac{(KVA_{XFMR} \times 1000 \times 100)}{(\%Z_{XFMR} \times V_{L-L} \times \sqrt{3})}$$

   Example: 50KVA transformer with 2.75% impedance @ 460VAC

$$I_{SC} = \frac{(50 \times 1000 \times 100)}{(2.75 \times 460 \times \sqrt{3})} = 2282 \text{ Amps}$$

   B. Method 2
   Step 1: Calculate KVA short circuit as follows:

$$KVA_{SC} = \frac{(KVA_{XFMR})}{(\frac{\%Z_{XFMR}}{100})} = \left(\frac{50}{.0275}\right) = 1818.2 \text{ KVA}$$

   Step 2: Calculate short circuit current as follows:

$$I_{SC} = \frac{(KVA_{SC} \times 1000)}{(V_{L-L} \times \sqrt{3})} = 2282 \text{ Amps}$$

   where:
   KVA_{XFMR}=Transformer KVA
   I_{sc}=short circuit current
   Z_{XFMR}=Transformer Impedance

Line Reactors

3 phase line reactors are available from Baldor. The size of the line reactor to use is based on the HP rating of the 15H control. If providing your own line reactor, use the following formula to calculate the minimum inductance required. Table 3-3 lists the input current required for this calculation.

$$L = \frac{(V_{L-L} \times 0.03)}{(I \times \sqrt{3} \times 377)}$$

Where:

L	Minimum inductance in henries.
V_{L-L}	Input volts measured line to line.
0.03	Desired percentage of input impedance.
I	Input current rating of control.
377	Constant used with 60Hz power. Use 314 if input power is 50Hz.

Load Reactors

Line reactors may be used at the control output to the motor. When used this way, they are called Load Reactors. Load reactors serve several functions that include:

- Protect the control from a short circuit at the motor.
- Limit the rate of rise of motor surge currents.
- Slowing the rate of change of power the control delivers to the motor.

Load reactors should be installed as close to the control as possible.

*Quad Rated HP of the control refers to the four (4) different HP ratings of the control that are based on operating in Standard (2.5KHz PWM) or Quiet (8.0KHz PWM) in either Constant Torque or Variable Torque. The ratings are provided in Section 6 “Ratings Series 15H Stock Products” of this manual.

Table 3-2 Short Circuit Current Ratings

230VAC		460VAC		575VAC	
Catalog Numbers	**Max. Line Short Circuit Current**	**Catalog Numbers**	**Max. Line Short Circuit Current**	**Catalog Numbers**	**Max. Line Short Circuit Current**
ID15H201–E	250	ID15H401–E	150	ID15H501–E	50
ID15H201–W	350	ID15H401–W	200	ID15H502–E	100
ID15H202–E	350	ID15H402–E	200	ID15H503–E	150
ID15H202–W	550	ID15H402–W	300	ID15H505–E	200
ID15H203–E or W	550	ID15H403–E or W	300	ID15H507–E	300
ID15H205–E	550	ID15H405–E	300	ID15H510–E	400
ID15H205–W	1000	ID15H405–W	500	ID15H515–E, EO or ER	600
ID15H207–E or W	1000	ID15H407–E or W	500	ID15H520–EO or ER	1000
ID15H210–E	1000	ID15H410–E	500	ID15H525–EO or ER	1100
ID15H210L–ER	1500	ID15H410L–ER	800	ID15H530–EO or ER	1500
ID15H215–E, EO or ER	1900	ID15H415–E, EO or ER	1000	ID15H540–EO or ER	1800
ID15H215L–ER	1900	ID15H415L–ER	1000	ID15H550–EO or ER	2200
ID15H220–EO or ER	2400	ID15H420–EO or ER	1200	ID15H560–EO or ER	2700
ID15H220L–ER	2100	ID15H420L–ER	1200	ID15H575–EO or ER	3300
ID15H225–EO or ER	2800	ID15H425–EO or ER	1400	ID15H5100–EO or ER	4200
ID15H225L–ER	2500	ID15H425L–ER	1400	ID15H5150V–EO or ER	4800
ID15H230V–EO or ER	3600	ID15H430V–EO or ER	1800		
ID15H230–EO or ER	3600	ID15H430–EO or ER	1800		
ID15H230L–ER	3600	ID15H430L–ER	1800		
ID15H240–MO or MR	4500	ID15H440–MO or MR	2300		
ID15H240L–MR	4000	ID15H440L–MR	2300		
ID15H250V–MO or MR	4500	ID15H450–EO or ER	2800		
ID15H250–MO or MR	4500	ID15H450L–ER	2800		
		ID15H460–EO or ER	3500		
		ID15H460V–EO or ER	3500		
		ID15H460L–ER	3500		
		ID15H475–EO	4300		
		ID15H475L–EO	4300		
		ID15H4100–EO	5500		
		ID15H4150V–EO	6200		
		ID15H4150–EO	8300		
		ID15H4200–EO	11000		
		ID15H4250–EO	13800		
		ID15H4300–EO	16600		
		ID15H4350–EO	19900		
		ID15H4400–EO	19900		
		ID15H4450–EO	25000		

Input Current Requirements

Table 3-3 Input Current Requirements Stock Products

230 VAC Control Catalog Numbers	Input Amps	460 VAC Control Catalog Numbers	Input Amps	575 VAC Control Catalog Numbers	Input Amps
ID15H201-E or W	6.8	ID15H401-E or W	3.4	ID15H501-E	2.7
ID15H202-E or W	9.6	ID15H402-E or W	4.8	ID15H502-E	4.0
ID15H203-E or W	15.2	ID15H403-E or W	7.6	ID15H503-E	6.1
ID15H205-E	15.2	ID15H405-E or W	11	ID15H505-E	11
ID15H205-W	22	ID15H407-E	11	ID15H507-E	11
ID15H207-E or W	28	ID15H407-W	14	ID15H510-E	11
ID15H210-E	28	ID15H410-E	21	ID15H515-EO	22
ID15H215-E	42	ID15H415-E	21	ID15H520-EO	27
ID15H215-EO	54	ID15H415-EO	27	ID15H525-EO	32
ID15H220-EO	68	ID15H420-E	34	ID15H530-EO	41
ID15H225-EO	80	ID15H425-EO	40	ID15H540-EO	52
ID15H230-EO	104	ID15H430-EO	52	ID15H550-EO	62
ID15H230V-EO	104	ID15H430V-EO	52	ID15H560-EO	62
ID15H240-MO	130	ID15H440-EO	65	ID15H575-EO	100
ID15H250-MO	130	ID15H450-EO	80	ID15H5100-EO	125
		ID15H460-EO	100	ID15H5150V-EO	145
		ID15H460V-EO	100		
		ID15H475-EO	125		
		ID15H4100-EO	160		
		ID15H4150-EO	240		
		ID15H4150V-EO	180		
		ID15H4200-EO	310		
		ID15H4250-EO	370		
		ID15H4300-EO	420		
		ID15H4350-EO	480		
		ID15H4400-EO	540		
		ID15H4450-EO	590		

Table 3-4 Input Current Requirements Custom (Non-Stock) Products

230 VAC Control Catalog Numbers	Input Amps	460 VAC Control Catalog Numbers	Input Amps	575 VAC Control Catalog Numbers	Input Amps
FIF1007C-51	28.8	FIF1007C-50	14.4	IN0100A00	24
IN0001A00	43	IN0036A00	22	IN0102A00	29
IN0006A00	43	IN0044A00	22	IN0104A00	35
IN0003A00	56	IN0041A00	28	IN0106A00	44
IN0004A00	56	IN0042A00	28	IN0108A00	56
IN0008A00	70	IN0048A00	35	IN0110A00	67
IN0009A00	62	IN0049A00	31	IN0367A00	67
IN0013A00	82	IN0053A00	41		
IN0014A00	77	IN0054A00	39		
IN0018A00	107	IN0060A00	54		
IN0021A00	107	IN0063A00	54		
IN0019A00	107	IN0061A00	54		
IN0026A00	134	IN0065A00	67		
IN0024A00	118	IN0066A00	62		
IN0030A00	134	IN0068A00	82		
IN0034A00	134	IN0069A00	62		
IN0446A00	134	IN0071A00	103		
		IN0074A00	103		
		IN0072A00	103		
		IN0076A00	129		

AC Main Circuit

Protective Devices

Be sure a suitable input power protection device is installed. Use the recommended circuit breaker or fuses listed in Section 6 of this manual (Wire Size and Protection Devices). Input and output wire size is based on the use of copper conductor wire rated at 75 °C. The table is specified for NEMA B motors.

Circuit Breaker:	**1 phase**, thermal magnetic. Equal to GE type THQ or TEB for 230 VAC **3 phase**, thermal magnetic. Equal to GE type THQ or TEB for 230 VAC or Equal to GE type TED for 460 VAC and 575 VAC.
Fast Action Fuses:	230 VAC, Buss KTN 460 VAC, Buss KTS to 600A (KTU for 601 to 1200A) 575VAC, Buss FRS
Very Fast Action:	230 VAC, Buss JJN 460 VAC, Buss JJS 575 VAC, Buss JJS
Time Delay Fuses:	230 VAC, Buss FRN 460 VAC, Buss FRS to 600A (KTU for 601 to 1200A) 575 VAC, Buss FRS to 600A (KTU for 601 to 1200A)

Power Disconnect

A power disconnect should be installed between the input power service and the control for a fail safe method to disconnect power. The control will remain in a powered-up condition until all input power is removed from the control and the internal bus voltage is depleted.

Wire Size and Protection Devices

Table 3-5 Series 15H Wire Size and Protection Devices
230 VAC Controls

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
1	5A	5A	5A	14	2.5
2	10A	10A	8A	14	2.5
3	15A	15A	12A	14	2.5
5	20A	25A	12.5A	14	2.5
7.5	25A	30A	25A	12	4
10	35A	40A	35A	10	10
15	50A	60A	50A	8	10
20	60A	80A	60A	4	25
25	80A	100A	80A	4	25
30	100A	125A	100A	3	30
40	125A	150A	125A	1	50
50	150A	200A	150A	2/0	70

Note: All wire sizes based on 75°C copper wire, 3% line impedance. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 25°C ambient, maximum continuous control output current and no harmonic current.

Table 3-6 Series 15H Wire Size and Protection Devices
460 VAC Controls

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
1	4A	4A	3A	14	2.5
2	10A	5A	4A	14	2.5
3	10A	8A	6A	14	2.5
5	10A	12A	9A	14	2.5
7.5	15A	20A	15A	14	2.5
10	20A	25A	17.5A	12	4
15	25A	30A	25A	10	6
20	30A	40A	30A	8	10
25	40A	50A	40A	8	10
30	45A	60A	45A	6	16
40	60A	80A	60A	4	25
50	70A	100A	75A	4	25
60	90A	125A	90A	2	35
75	125A	150A	125A	1/0	54
100	150A	200A	150A	2/0	70
125	175A	250A	175A	2/0	70
150	200A	300A	200A	4/0	120
200	250A	350A	250A	(2)1/0	(2)54
250	350A	450A	350A	(2)3/0	(2)95
300	400A	500A	400A	(2)4/0	(2)120
350	500A	600A	500A	(3)4/0	(3)120
400	600A	800A	600A	(3)250 mcm	(3)125
450	600A	800A	600A	(3)250 mcm	(3)125
500	800A	1000A	800A	(3)350 mcm	(3)185

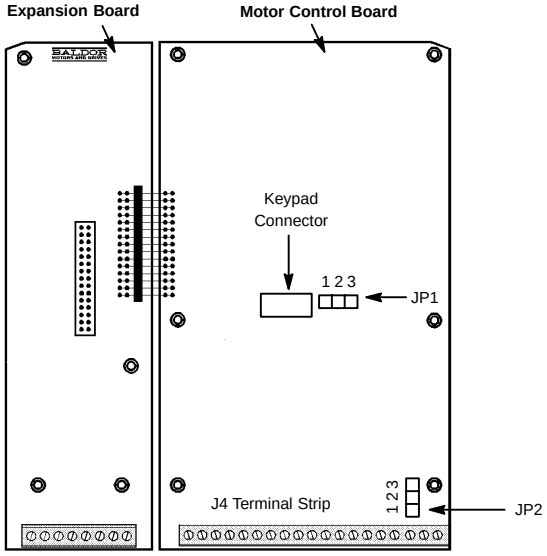
Note: All wire sizes based on 75°C copper wire, 3% line impedance. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 25°C ambient, maximum continuous control output current and no harmonic current.

Table 3-7 Series 15H Wire Size and Protection Devices
575 VAC Controls

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
1	5A	5A	4A	14	2.5
2	10A	5A	4A	14	2.5
3	10A	6A	5A	14	2.5
5	10A	10A	7A	14	2.5
7.5	10A	15A	10A	14	2.5
10	15A	15A	12A	14	2.5
15	20A	25A	20A	12	4
20	25A	35A	25A	10	6
25	30A	40A	30A	8	10
30	35A	50A	35A	8	10
40	45A	60A	45A	6	16
50	60A	80A	60A	4	25
60	70A	90A	70A	4	25
75	120A	150A	120A	3	27
100	120A	150A	120A	1/0	54
125	150A	200A	150A	2/0	70
150	175A	225A	175A	2/0	70

Note: All wire sizes based on 75°C copper wire, 3% line impedance. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 25°C ambient, maximum continuous control output current and no harmonic current.

Figure 3-1 Series 15H Control



J4

1	Analog GND
2	Analog Input 1
3	Pot Reference
4	Analog Input +2
5	Analog Input –2
6	Analog Out 1
7	Analog Out 2
8	Input 1
9	Input 2
10	Input 3
11	Input 4
12	Input 5
13	Input 6
14	Input 7
15	Input 8
16	Input 9
17	Input Common
18	Output Common
19	Opto Out #1
20	Opto Out #2
21	Opto Out #3
22	Opto Out #4

See recommended Terminal Tightening Torques in Section 6.

Table 3-8 Control Board Jumpers

Jumper	Jumper Position	Description of Jumper Position Setting
JP1	1–2	400 Hz Maximum Output Frequency.
	2–3	120 Hz Maximum Output Frequency. (Factory Setting)
JP2	1–2	4–20mA Speed Command Signal.
	2–3	0-5 or 0-10VDC Speed Command Signal. (Factory Setting)

AC Line Connections

Be sure all power to the control is disconnected before proceeding. If power has been applied to the control, wait at least 5 minutes after power disconnect for residual voltage across bus capacitors to discharge.

Reduced Input Voltage Derating All power ratings stated in Section 6 are for the stated nominal AC input voltages (230, 460 or 575VAC). The power rating of the control must be reduced when operating at a reduced input voltage. The amount of reduction is the ratio of the voltage change.

Examples:

For example, a 10HP, 230VAC control operating at 208VAC has a reduced power rating of 9.04HP.

$$10HP \times \frac{208VAC}{230VAC} = 9.04HP$$

Likewise, a 10HP, 460VAC control operating at 380VAC has a reduced power rating of 8.26HP.

$$10HP \times \frac{380VAC}{460VAC} = 8.26HP$$

To obtain the full output rating of 10HP in either case requires a 15HP Control.

380-400 VAC Operation Size A and B controls may be used directly with a 380-400 VAC power source, control modification is not necessary.

Size C, D, E, F and G controls all require modification for operation on the reduced line voltage.

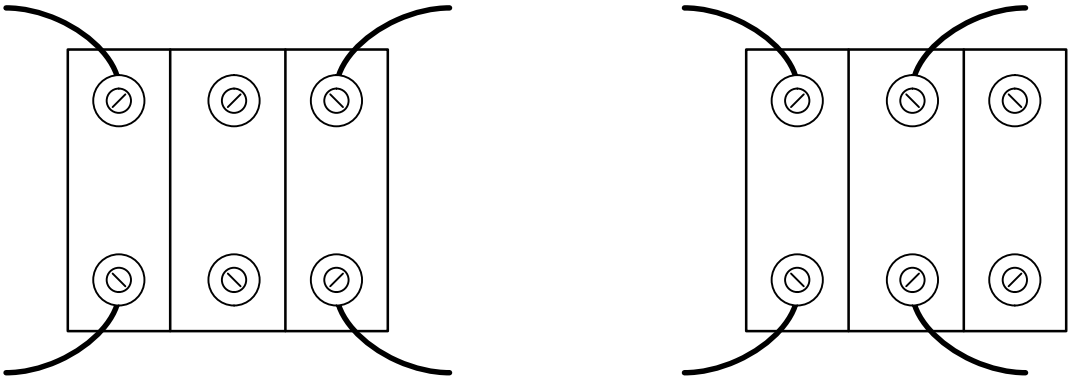
Tap change procedure (size C, D, E and F controls)

1. Be sure drive operation is terminated and secured.
2. Remove all power sources from the control. If power has been applied, wait at least 5 minutes for bus capacitors to discharge.
3. Remove or open the front cover.
4. Remove the wire from terminal 5.
5. Place the wire that was removed from terminal 5 onto terminal 4.
6. Install or close the front cover.

Control Transformer Tap Change Procedure (size G controls). See Figure 3-2.

1. Be sure drive operation is terminated and control is disabled.
2. Remove all power sources from the control. If power has been applied, wait at least 5 minutes for bus capacitors to discharge.
3. Remove or open the front cover.
4. Remove the wires from the two right side terminals.
5. Place the wires on the center terminals as shown.
6. Install or close the front cover.

Figure 3-2 Configuring the Control Transformer Terminal Block for 380 - 400 VAC (Size G)



3 Phase Installation

The AC power and motor connections are shown in Figure 3-3. The 15H control has an electronic I^2t motor overload protection. If motor overloads are desired, they should be sized according to the manufacturers specifications and installed between the motor and the T1, T2 and T3 terminals of the control.

1. Connect the incoming AC power wires from the protection devices to L1, L2 and L3 at the Main Circuit Terminals. The phase rotation is not important as the control is not phase sensitive.
2. * Connect earth ground to the ⏚ "Power Ground" of the control. Be sure to comply with local codes.

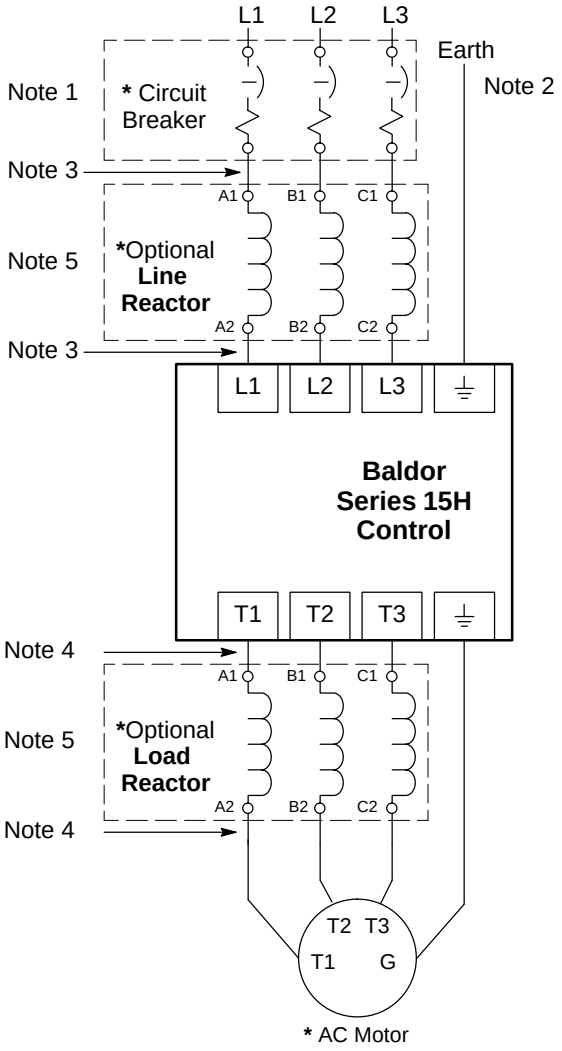
   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.
3. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
4. * Connect motor ground wire to the ⏚ "Motor Ground" of the control. Be sure to comply with all applicable codes.

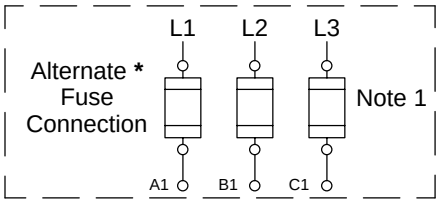
Note: Connect the motor temperature sensor switch to the external trip input, J4-16 (located on the J4 terminal strip). The motor temperature sensor must be a dry contact (N.C.) type that requires no external power to operate. A relay shown in Figure NO TAG is recommended to minimize noise coupling.

Note: A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown in Figure 3-3. The contactor should open the enable input at J4-8 (at least 20 msec) before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.

* Grounding by using conduit or panel connection is not adequate. A separate conductor of the proper size must be used as a ground conductor.

Figure 3-3 3 Phase AC Power and Motor Connections

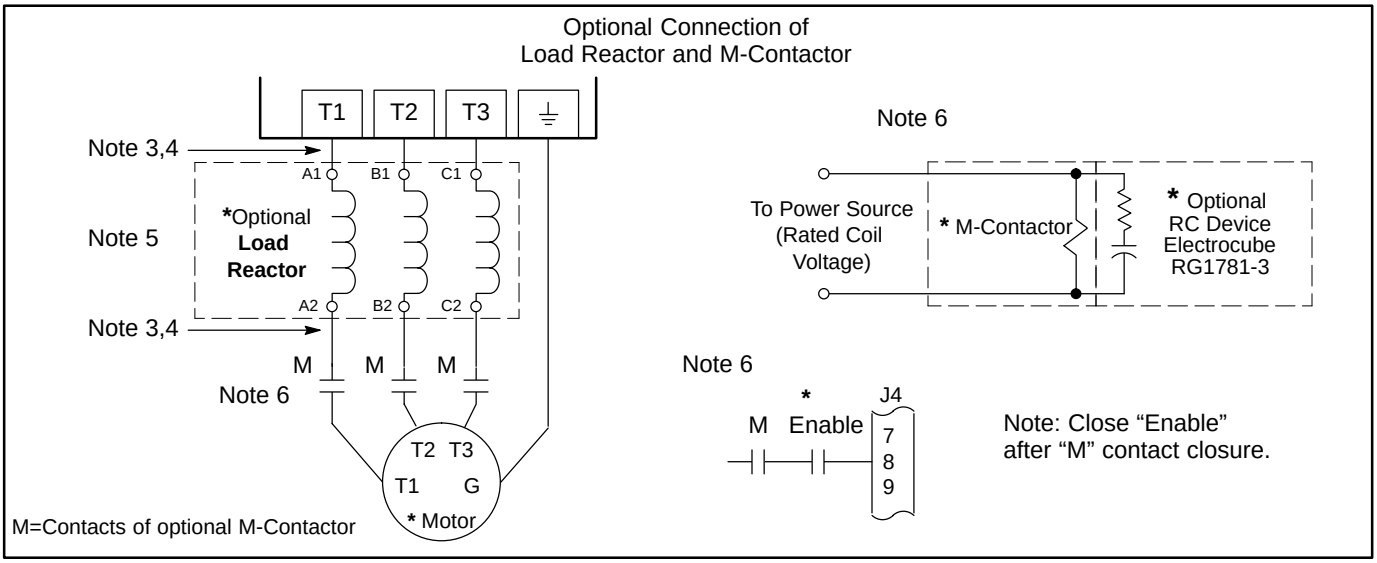




***** Optional components not provided with 15H Control.

Notes:

1. See Protection Devices described in Section 3 of this manual.
2. Connect ground terminal of control to “Earth Ground”.
3. Shield wires inside a metal conduit.
4. Metal conduit should be used to shield output wires (from T1, T2, T3 of control to T1, T2, T3 of motor. Connect conduits so the use of Load Reactor or RC Device does not interrupt EMI/RFI shielding.
5. See Line/Load Reactors described in Section 3 of this manual.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J4-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.



See Recommended Tightening Torques in Section 6.

Table 3-9 Single Phase Rating Wire Size and Protection Devices - 230 VAC Controls Stock Products

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
1	15A	5A	5A	14	2.5
2	15A	10A	10A	14	2.5
3	15A	15A	15A	14	2.5
5	30A	30A	30A	12	4
7.5	25A	25A	25A	14	2.5
10	40A	30A	30A	12	4
15	50A	45A	45A	10	6
20	60A	45A	45A	8	10
25	70A	70A	70A	8	10
30	80A	80A	80A	6	16
40	100A	100A	100A	4	25
50	125A	125A	125A	4	25

Table 3-10 Single Phase Rating Wire Size and Protection Devices - 460 VAC Controls Stock Products

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
1	15A	4A	4A	14	2.5
2	15A	8A	8A	14	2.5
3	15A	10A	10A	14	2.5
5	15A	15A	15A	14	2.5
7.5	15A	15A	15A	14	2.5
10	20A	15A	15A	14	2.5
15	25A	25A	25A	14	2.5
20	30A	30A	30A	14	2.5
25	35A	30A	30A	14	2.5
30	40A	40A	40A	10	6
40	60A	50A	50A	8	10
50	70A	60A	60A	8	10
60	80A	80A	80A	6	16

Note: All wire sizes based on 75°C copper wire, 3% line impedance. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 25°C ambient, maximum continuous control output current and no harmonic current.

Single Phase Input Power Considerations

Single phase AC input power can be used to power the control instead of three phase for control sizes A, B, C, D, E and F. Single phase operation of G size controls is not possible. The specifications and control sizes are listed in Section 7 of this manual. If single phase power is to be used, the rated Horsepower of the control may have to be reduced (derated). In addition, power wiring and jumper changes are required.

Single phase rating wire size and protection devices are listed in Tables NO TAG and NO TAG.

Single Phase Control Derating: Single phase power derating requires that the continuous and peak current ratings of the control be reduced by the following percentages:

1. **1-2 HP 230 and 460 VAC controls:**
   No derating required.
2. **3-15 HP (Size B) 230 and 460 VAC controls:**
   Derate HP by 40% of the nameplate rating.
3. **15 HP (Size C) and Larger 230 and 460 VAC controls:**
   Derate HP by 50% of the nameplate rating.

Size A and B Single Phase Power Installation

Jumper Configuration

Size A and B controls, no jumper changes required.

Power and Control Connections

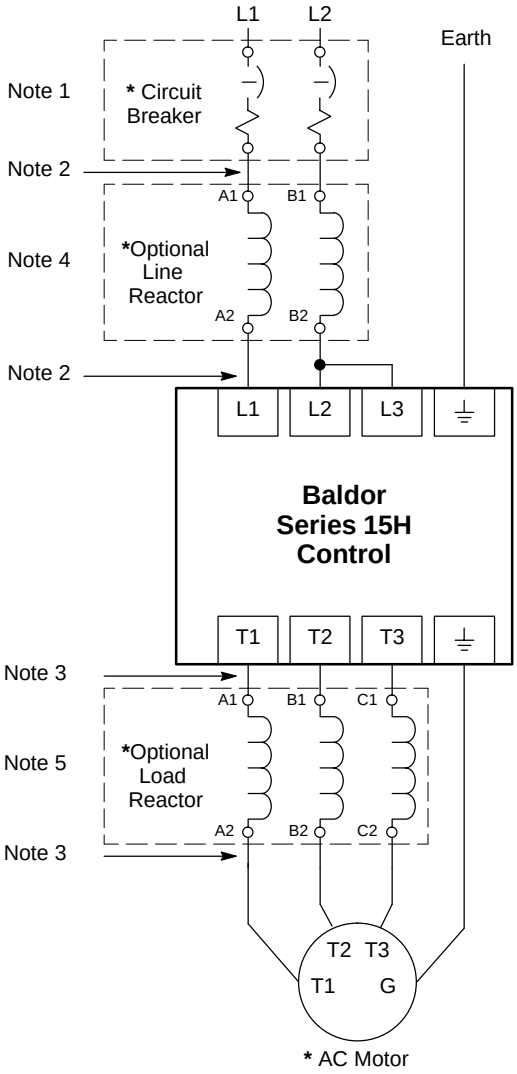
The single phase power and motor connections are shown in Figure 3-4.

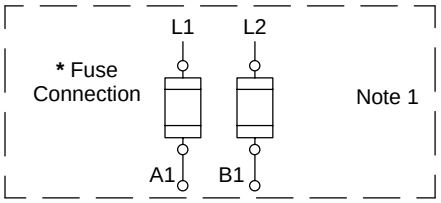
1. Connect the incoming power wires to Main Circuit Terminals L1 and L2.
2. Place a jumper across control power input terminals L2 and L3. Use the same size wire for the jumper as the incoming power wires on L1 and L2.
3. Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.

   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.
4. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
5. Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

Note: In steps 3 and 5 grounding by using conduit or panel connection is not adequate. A separate conductor of the proper size must be used as a ground conductor.

Figure 3-4 Size A & B Single Phase 230/460VAC Power and Motor Connections

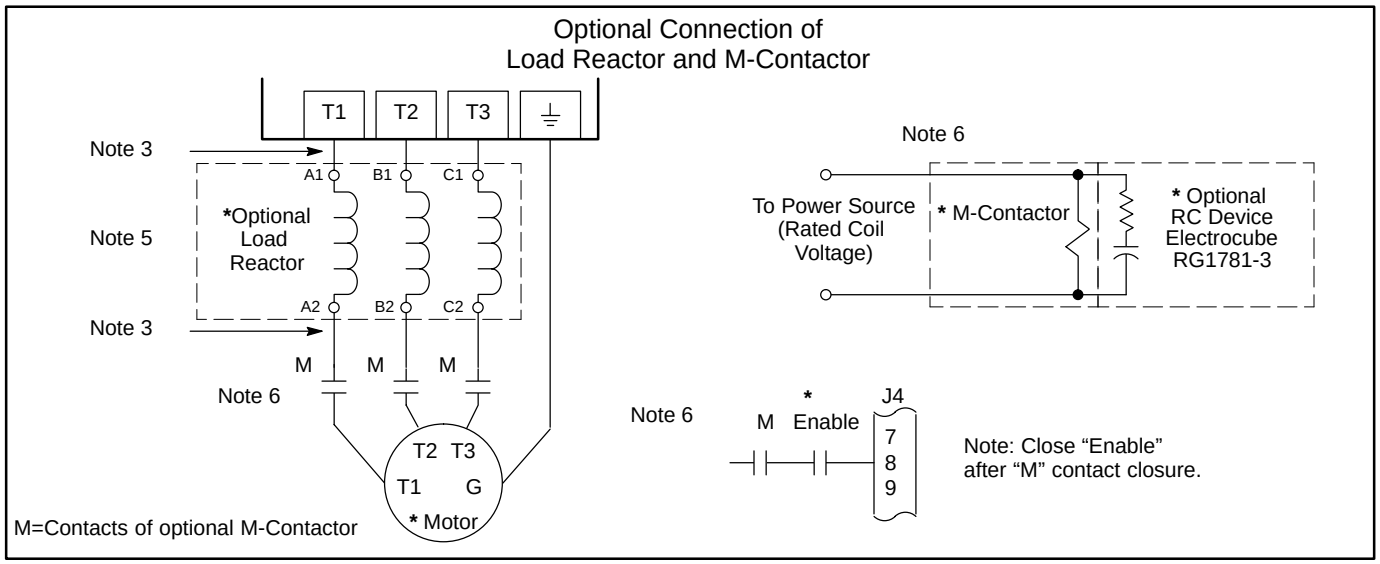




***** Optional components not provided with 15H Control.

Notes:

1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J4-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.

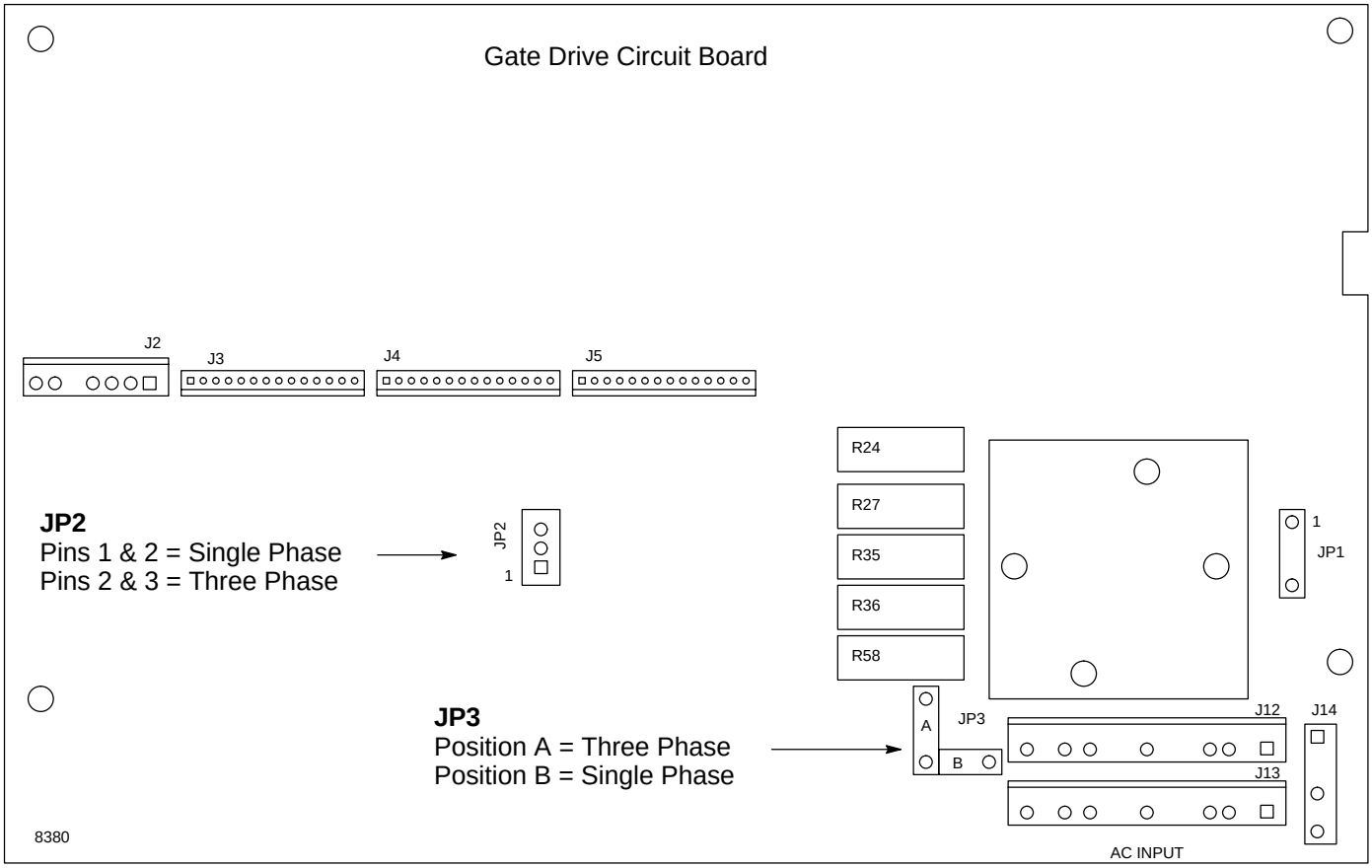


See Recommended Tightening Torques in Section 6.

Size C and D Single Phase Power Installation

Jumper Configuration

Place JP2 on pins 1 & 2 for control single phase operation.
Place JP3 in position B for fan single phase operation.



Power and Control Connections

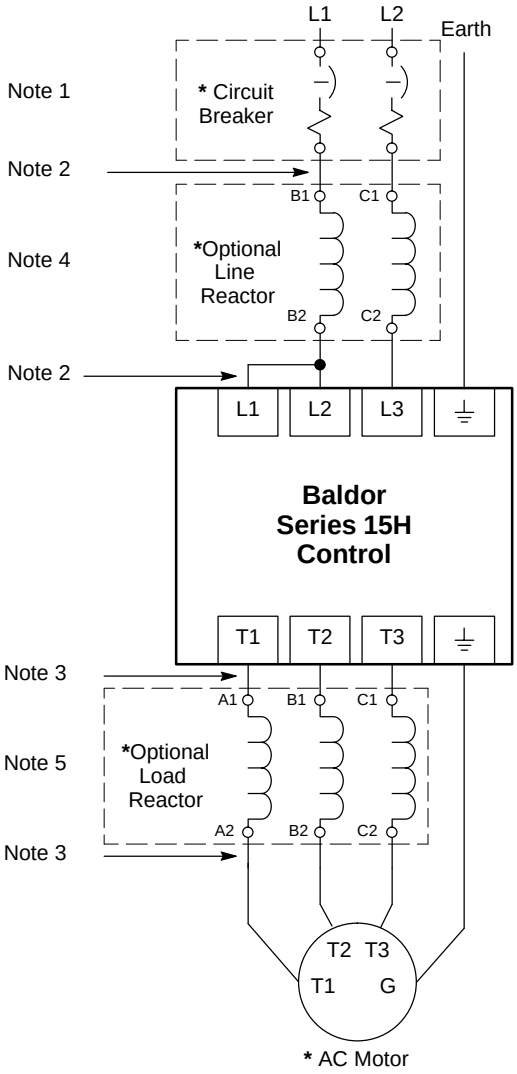
The single phase power and motor connections are shown in Figure 3-4.

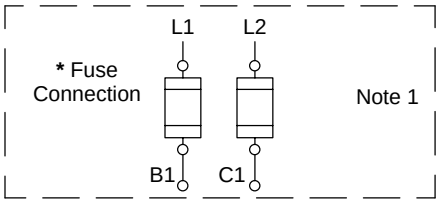
1. Connect the incoming power wires to Main Circuit Terminals L2 and L3.
2. Place a jumper across control power input terminals L1 and L2. Use the same size wire for the jumper as the incoming power wires on L2 and L3.
3. Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.

   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.
4. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
5. Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

Note: In steps 3 and 5 grounding by using conduit or panel connection is not adequate. A separate conductor of the proper size must be used as a ground conductor.

Figure 3-5 Size C & D Single Phase 230/460VAC Power and Motor Connections

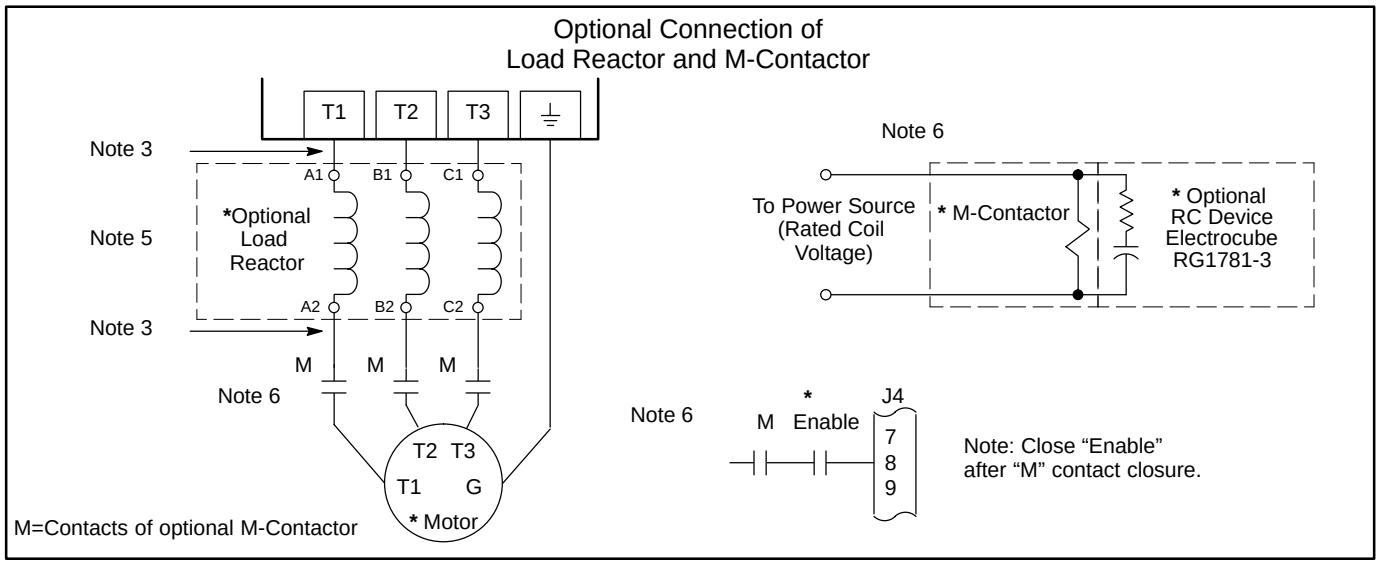




***** Optional components not provided with 15H Control.

Notes:

1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J4-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.

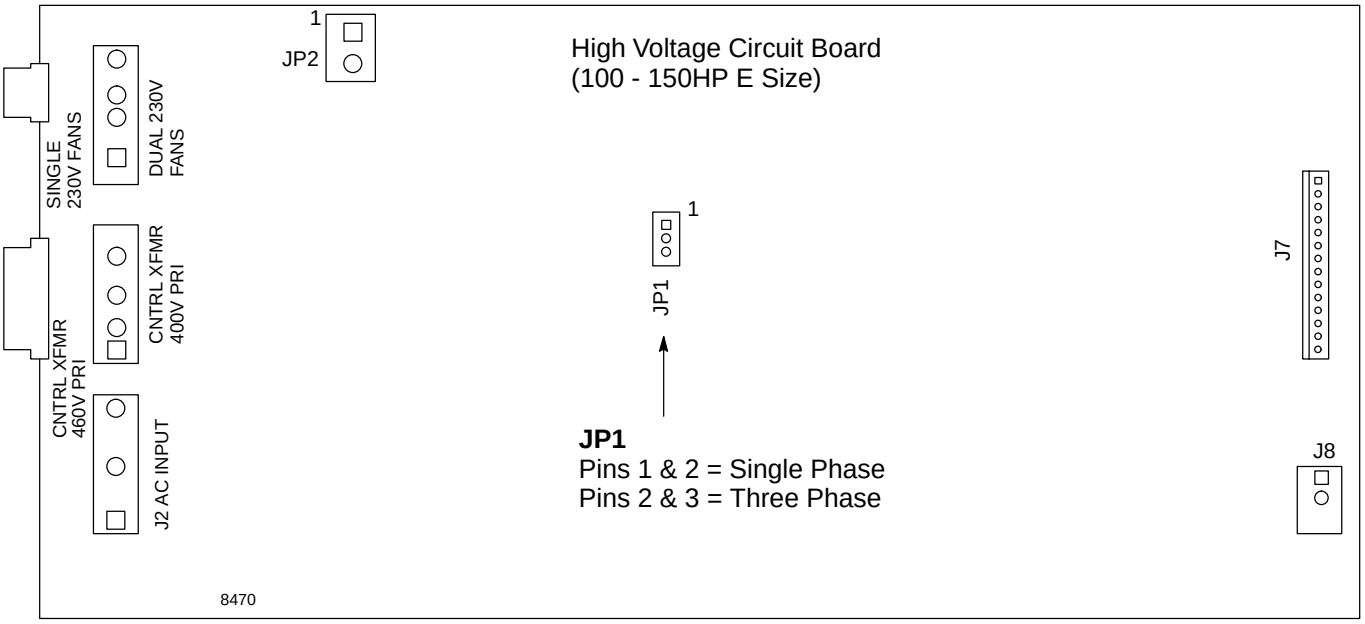


See Recommended Tightening Torques in Section 6.

Size E Single Phase Power Installation

Jumper Configuration

Place JP1 on the High Voltage Circuit Board across pins 1 and 2.



Power and Control Connections

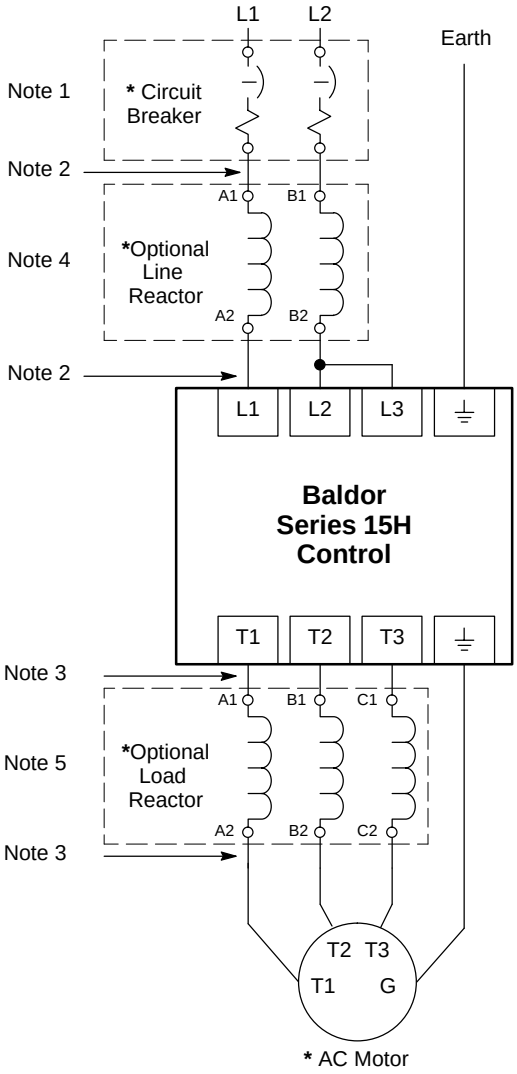
The single phase power and motor connections are shown in Figure 3-6.

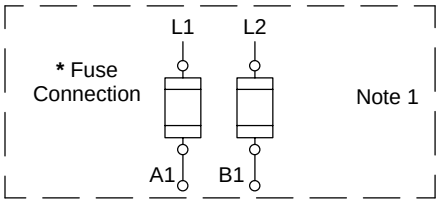
1. Connect the incoming power wires to Main Circuit Terminals L1 and L2.
2. Place a jumper across control power input terminals L2 and L3. Use the same size wire for the jumper as the incoming power wires on L1 and L2.
3. Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.

   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.
4. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
5. Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

Note: In steps 3 and 5 grounding by using conduit or panel connection is not adequate. A separate conductor of the proper size must be used as a ground conductor.

Figure 3-6 Size E Single Phase 230/460VAC Power and Motor Connections

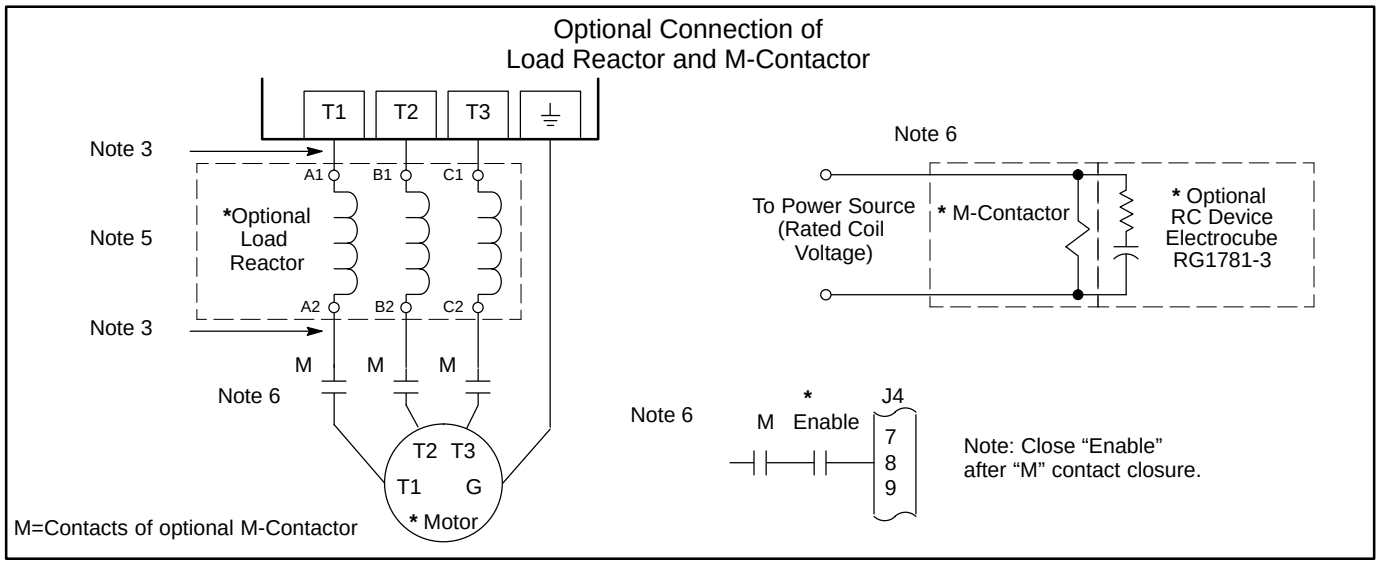




***** Optional components not provided with 15H Control.

Notes:

1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J4-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.

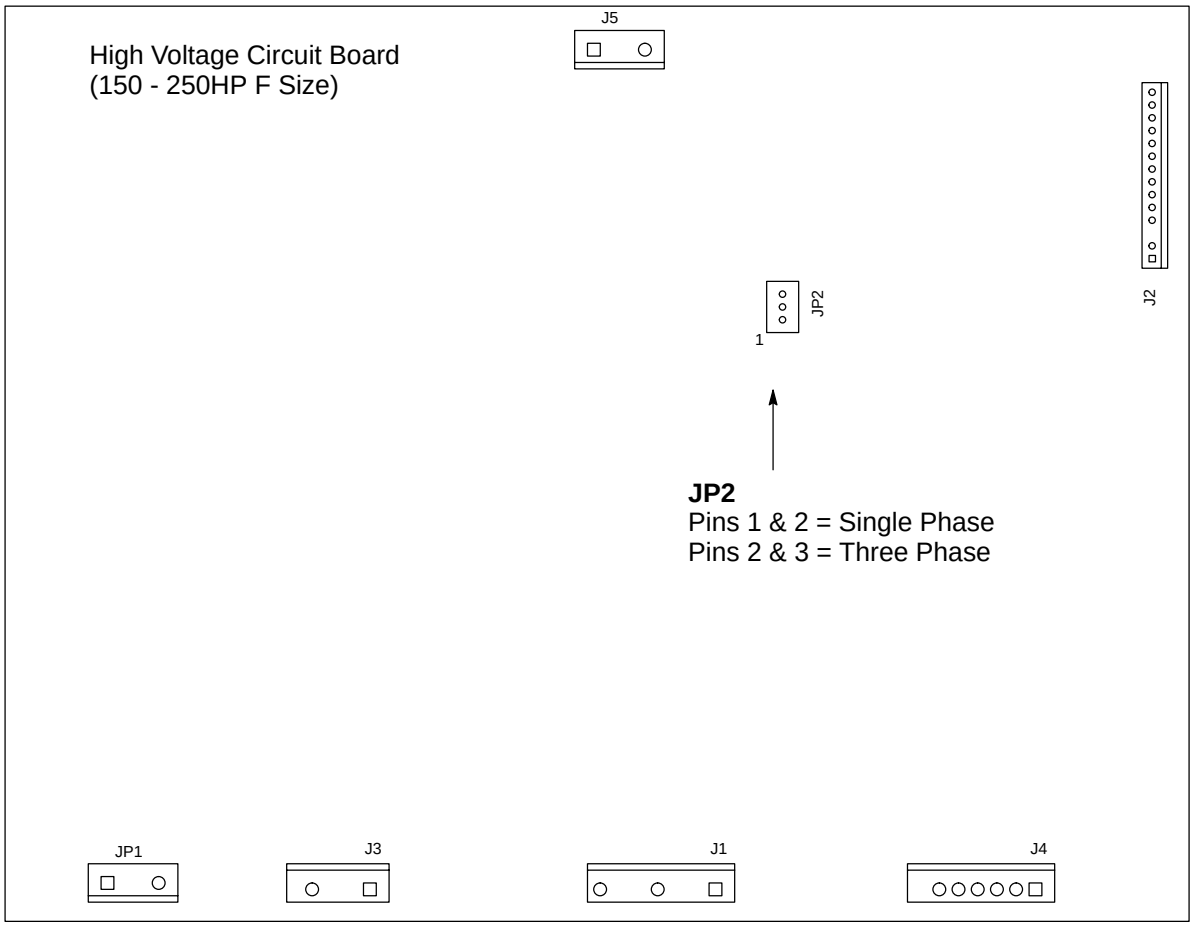


See Recommended Tightening Torques in Section 6.

Size F Single Phase Power Installation

Jumper Configuration

Place JP2 on the High Voltage Circuit Board across pins 1 and 2.



Power and Control Connections

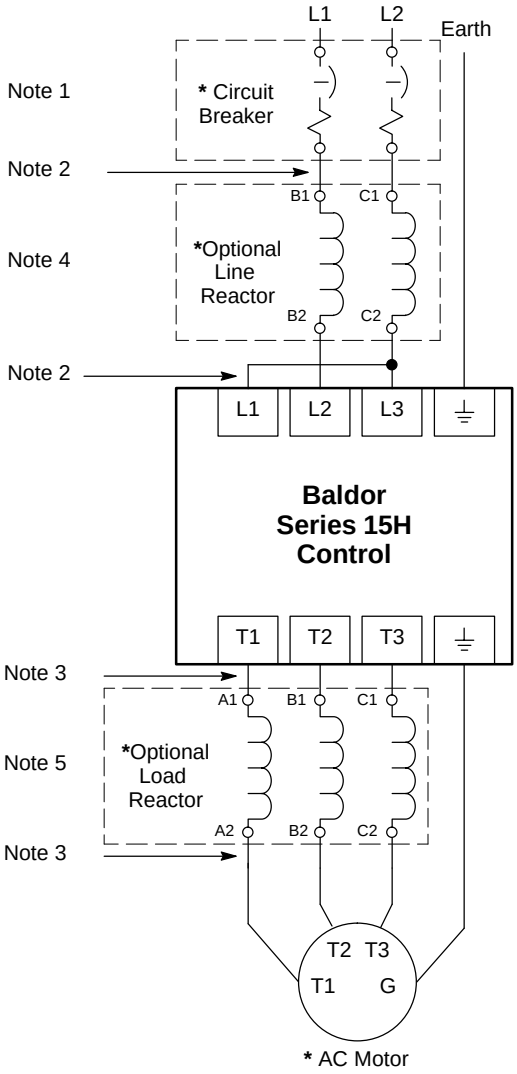
The single phase power and motor connections are shown in Figure 3-7.

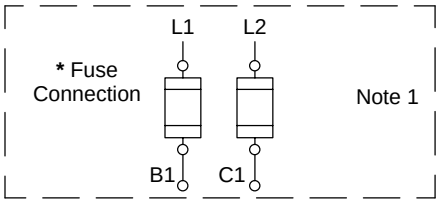
1. Connect the incoming power wires to Main Circuit Terminals L2 and L3.
2. Place a jumper across control power input terminals L1 and L3. Use the same size wire for the jumper as the incoming power wires on L2 and L3.
3. Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.

   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.
4. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
5. Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

Note: In steps 3 and 5 grounding by using conduit or panel connection is not adequate. A separate conductor of the proper size must be used as a ground conductor.

Figure 3-7 Size F Single Phase 230/460VAC Power and Motor Connections

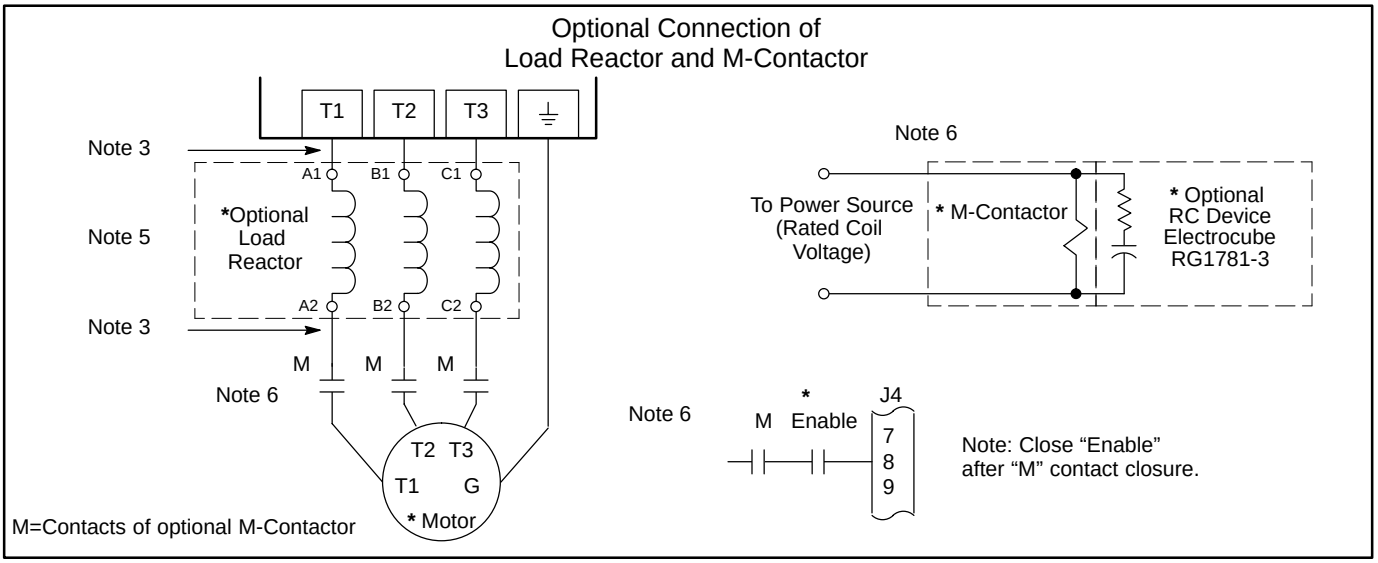




***** Optional components not provided with 15H Control.

Notes:

1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J4-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.



See Recommended Tightening Torques in Section 6.

Optional Dynamic Brake Hardware Dynamic Brake (DB) Hardware must be installed on a flat, non-flammable, vertical surface to obtain effective cooling and operation. The ambient temperature must not exceed 80°C.

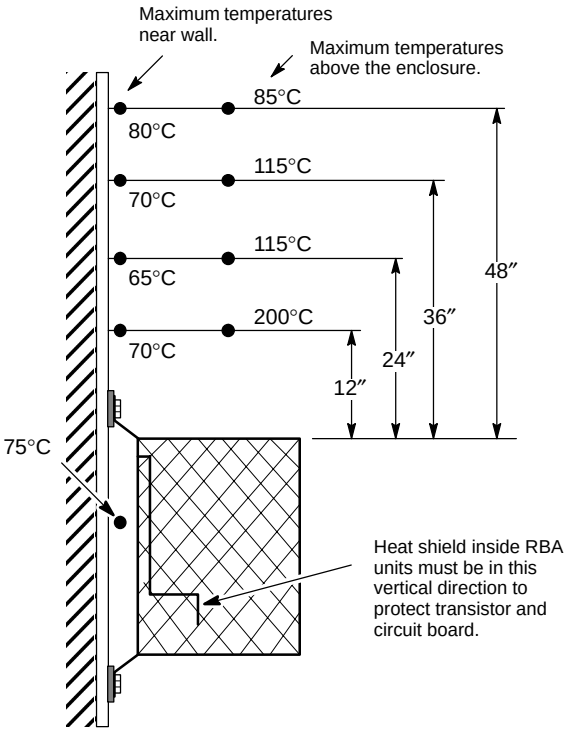
DB Capacity Derating

If the DB hardware mounting is in any position other than vertical (Figure 3-8), the DB hardware must be derated by 35% of its rated capacity.

Physical Installation

1. Select a clean vertical surface that is free from corrosive gasses, liquids, vibration, dust and metallic particles.
2. Mount the DB hardware as shown in Figure 3-8.

Figure 3-8 DB Hardware Installation



Electrical Installation Terminal connections for DB Hardware varies by model number of the 15H Control being installed. See Figure 3-9 for terminal identification.

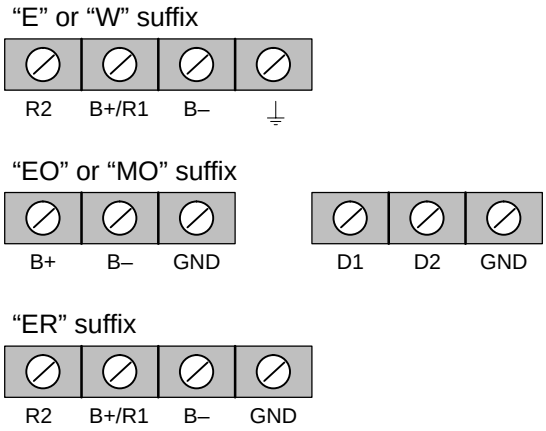
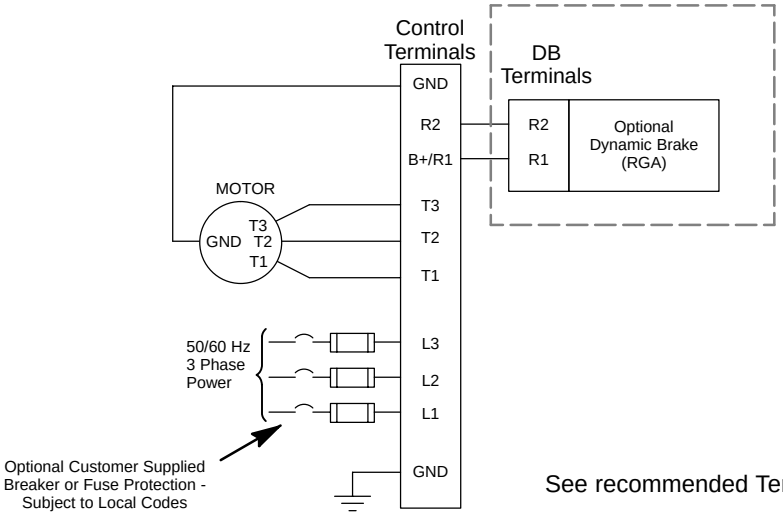


Figure 3-9 DB Terminal Identification

Figure 3-10 Wiring for RGA Assembly

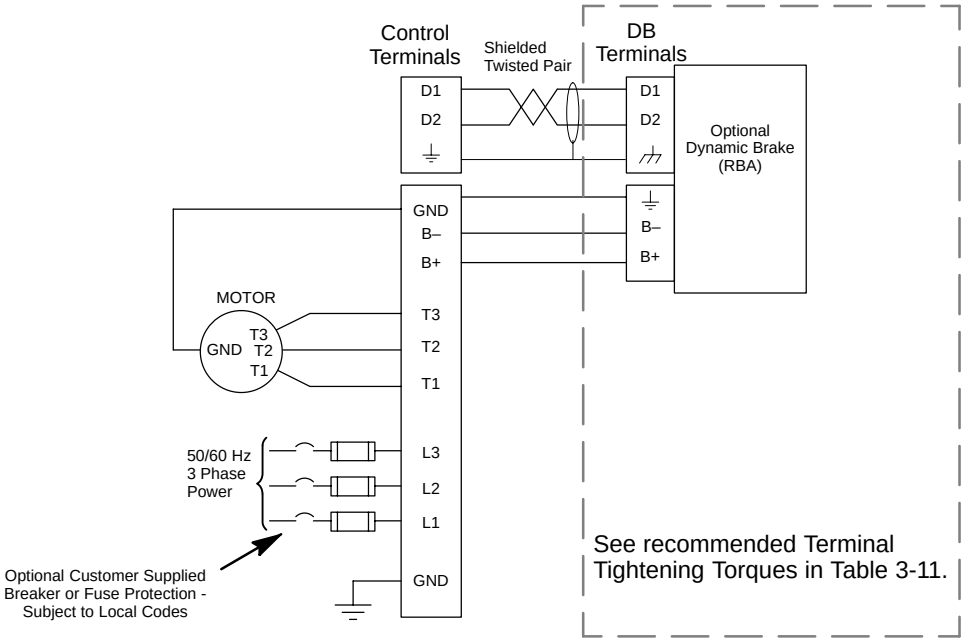


See recommended Terminal Tightening Torques in Table 3-12.

See recommended Terminal Tightening Torques in Section 6.

Note: Although not shown, metal conduit should be used to shield all power wires and motor leads.

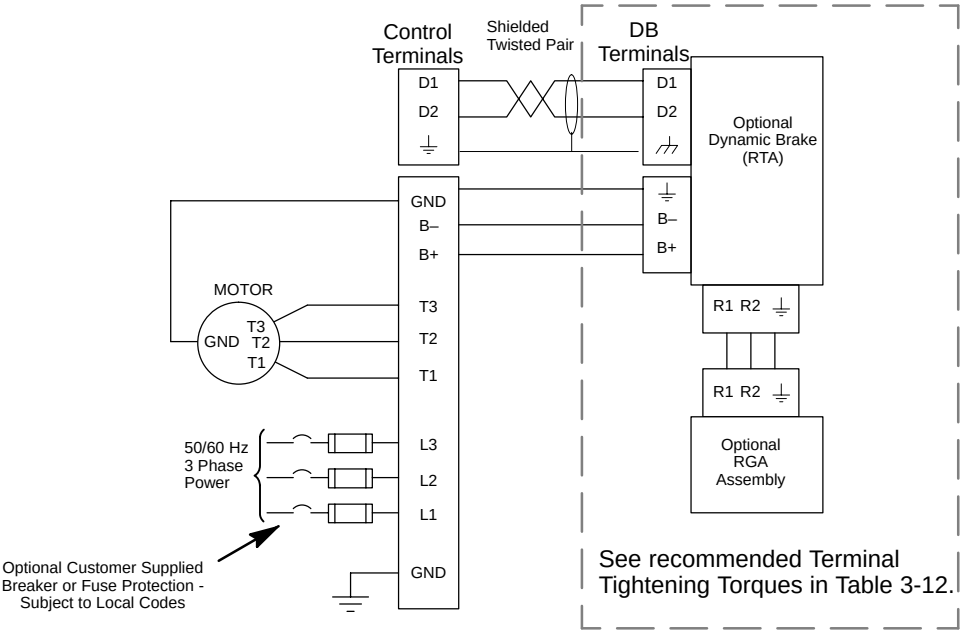
Figure 3-11 Wiring for RBA Assembly



See recommended Terminal Tightening Torques in Section 6.

Note: Although not shown, metal conduit should be used to shield all power wires and motor leads.

Figure 3-12 Wiring for RTA Assembly



See recommended Terminal Tightening Torques in Section 6.

Note: Although not shown, metal conduit should be used to shield all power wires and motor leads.

Table 3-11 Torques & Wire SIze for “E” & “W”

Control Voltage Rating VAC	B+ / B– / R1 / R2 / ⏚ Terminals				
	Wire SIze		Volt	Tightening Torque	
	AWG	mm^2		Nm	Lb–in
230, 460, 575	10	6	600	2.26	20

Table 3-12 Torques & Wire SIze for “ER”, “EO” & “MO”

Control Voltage Rating VAC	Braking Option Watts Rating	B+ / B– and R1 / R2 / ⏚ Terminals					D1 / D2 / ⏚ Terminals				
		Wire SIze		Volt	Tightening Torque		Wire SIze		Volt	Tightening Torque	
		AWG	mm^2		Nm	Lb–in	AWG	mm^2		Nm	Lb–in
230	<10,000	10	6	600	2.26	32	20-22	0.5	600	0.4	3.5
230	>10,000	8	10	600	2.26	32	20-22	0.5	600	0.4	3.5
460	<20,000	10	6	600	2.26	32	20-22	0.5	600	0.4	3.5
460	>20,000	8	10	600	2.26	32	20-22	0.5	600	0.4	3.5
575	<20,000	10	6	600	2.26	32	20-22	0.5	600	0.4	3.5
575	>20,000	8	10	600	2.26	32	20-22	0.5	600	0.4	3.5

Table 3-13 DB Terminal Torques (All)

Tightening Torque	
Nm	Lb–in
2.26	32

Selection of Operating Mode (and Connection Diagram)

Several operating modes are available in the Series 15H Inverter control. These operating modes define the basic motor control setup and the operation of the input and output terminals. These operating modes are selected by programming the Operating Mode parameter in the Input programming Block. Available operating modes include:

- Keypad
- Standard Run, 3 Wire Control
- 15 Speed, 2 Wire Control
- Fan Pump 2 Wire Control Mode
- Fan Pump 3 Wire Control Mode
- Serial
- Process Control
- 3 Speed Analog 2 Wire
- 3 Speed Analog 3 Wire
- Electronic Potentiometer 2 Wire
- Electronic Potentiometer 3 Wire

Note: The Serial Operating Mode requires the optional RS-232 or the optional RS422/485 Serial expansion board. Installation and instruction information for serial expansion boards is provided in Serial Communications Expansion Board Manual No. MN1310. This manual is shipped with all serial expansion boards.

The Keypad operating mode allows the control to be operated from the keypad. In this mode only the External Trip input signal on J4-16 and the Enable input signal on J4-8 are recognized. To activate the fault condition for a motor over temperature condition, the External Trip parameter in the Level 2 Protection block must be set to “ON”.

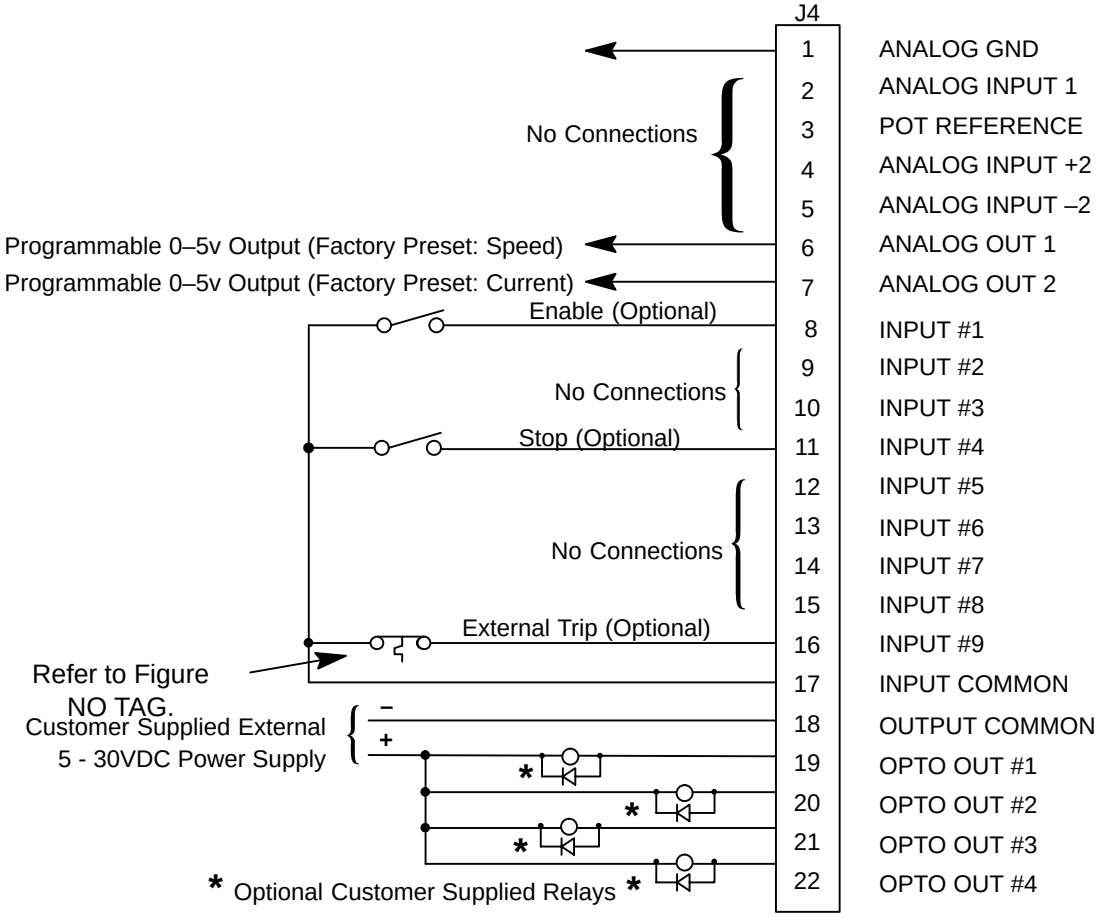
The other modes use the “Enable” input at J4-8. This input must be grounded (to J4–17) before power will be applied to the motor. If your wiring scheme does not provide switched inputs to J4, then simply jumper J4-8 to J4-17. To use the local Enable switch input at J4-8, the Level 2 Protection block, Local Enable INP parameter must be set to ON.

Keypad Operating Mode

For operation in Keypad mode, set the Level 1 Input block, Operating mode parameter to Keypad. At the keypad press the LOCAL key to change between the LOCAL and REMOTE modes. The word “LOCAL” or “Remote” should appear on the keypad display.

When in the Keypad operating mode only the the Enable (J4-8) and External Trip opto-inputs (J4-16) are active. All other opto inputs remain inactive. However, the analog outputs and opto-outputs remain active.

Figure 3-13 Keypad Only Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8 Optional Enable input (not required).
OPEN disables the control and motor coasts to a stop if Level 2 Protection block, Local Enable INP parameter is set to “ON”.
CLOSED allows current to flow in the motor.

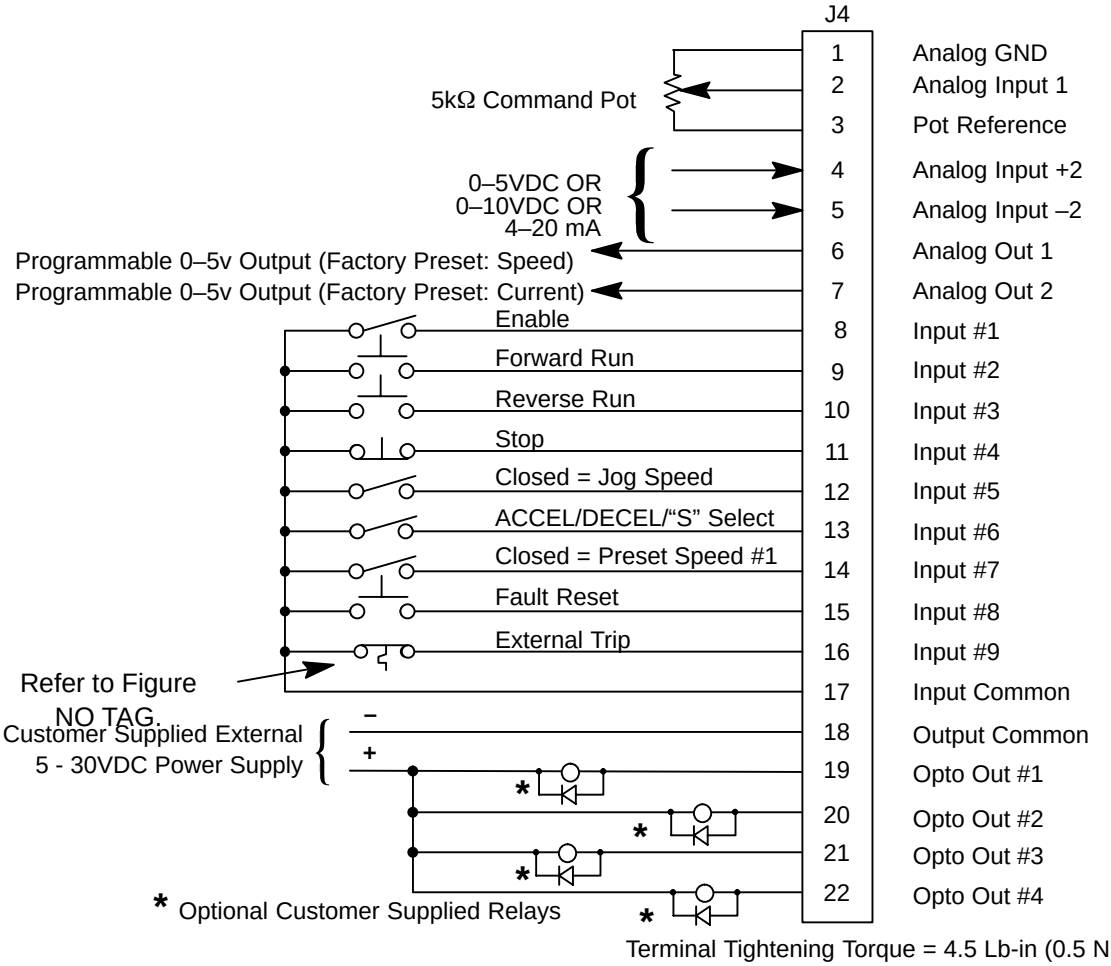
J4-11 Optional STOP input (not required).
OPEN disables the control and motor coasts or brakes to a stop if Level 2 Protection block, LOCAL HOT START parameter is set to “ON”. Motor will restart when switch closes after open.
CLOSED allows current to flow in the motor.

J4-16 OPEN causes an external trip to be received by control. The control will disable and display external trip fault (when Level 2 Protection block, External Trip is set to “ON”). When this occurs, the motor stop command is issued, drive operation is terminated and an external trip fault is displayed on the keypad display (also logged into the fault log). If J4-16 is connected, you must set Level 2 Protection block, External Trip to “ON”.

Standard Run 3 Wire Control Mode

Note: For 4-20mA input move jumper JP2 on the main control board to the bottom two pins (position 4-20mA shown in Figure 3-1).

Figure 3-14 Standard Run 3-Wire Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8 OPEN disables the control and motor coasts to a stop.
CLOSED allows current to flow in the motor.

J4-9 MOMENTARY CLOSED starts motor operation in the Forward direction. In JOG mode (J4-12 CLOSED), continuous CLOSED jogs motor in the Forward direction.

J4-10 MOMENTARY CLOSED starts motor operation in the Reverse direction. In JOG mode (J4-12 CLOSED), CONTINUOUS closed JOGS motor in the Reverse direction.

J4-11 When OPEN motor Decels to stop.

J4-12 CLOSED places control in JOG mode, Forward and Reverse run are used to jog the motor.

J4-13 OPEN selects ACC / DEC / S-CURVE group 1.
CLOSED selects group 2.

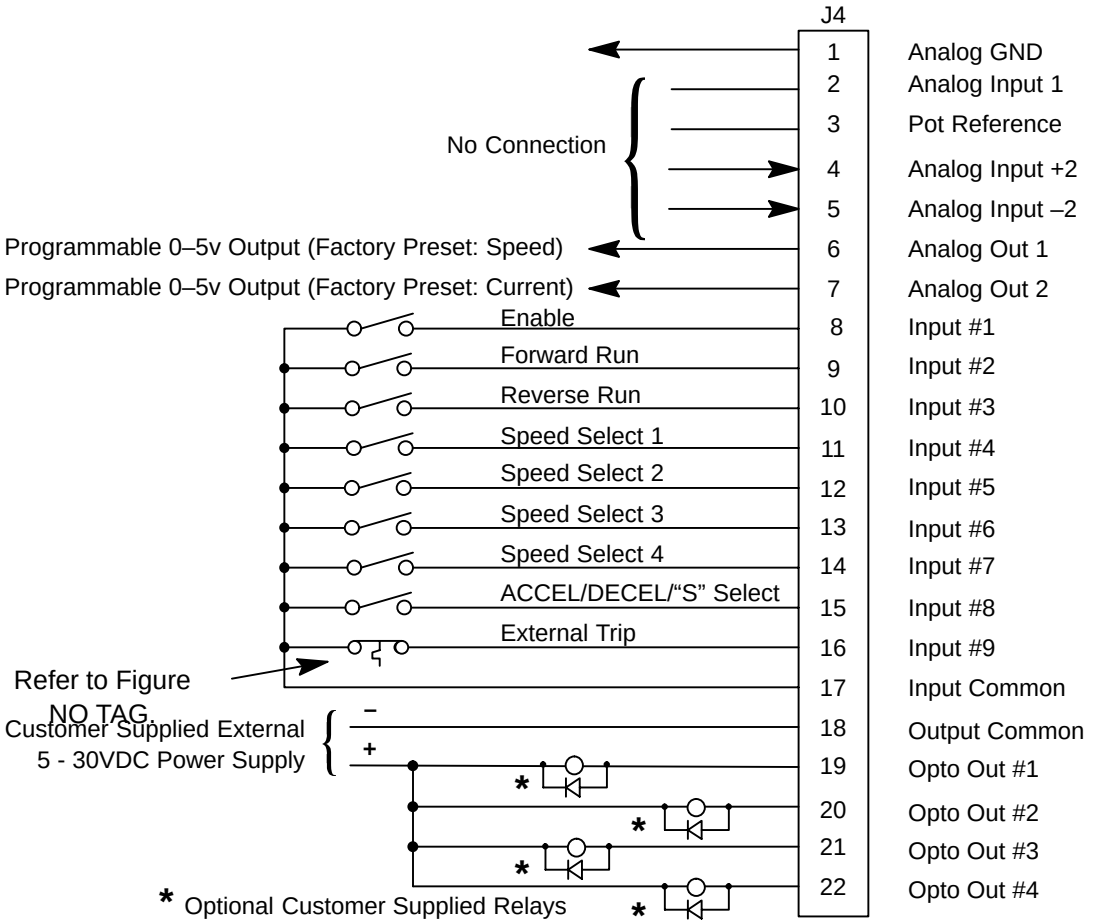
J4-14 CLOSED selects preset speed #1, (Jog Speed, J4-12, will override this),
OPEN allows speed command.

J4-15 OPEN to run, CLOSED to reset fault condition.

J4-16 OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed "ON". When this occurs, the motor stop command is issued, drive operation is terminated and an external trip fault is displayed on the keypad display (also logged into the fault log).
If J4-16 is connected, you must set Level 2 Protection block, External Trip to "ON".

15 Speed 2-Wire Control Mode

Figure 3-15 15 Speed, 2-Wire Control Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

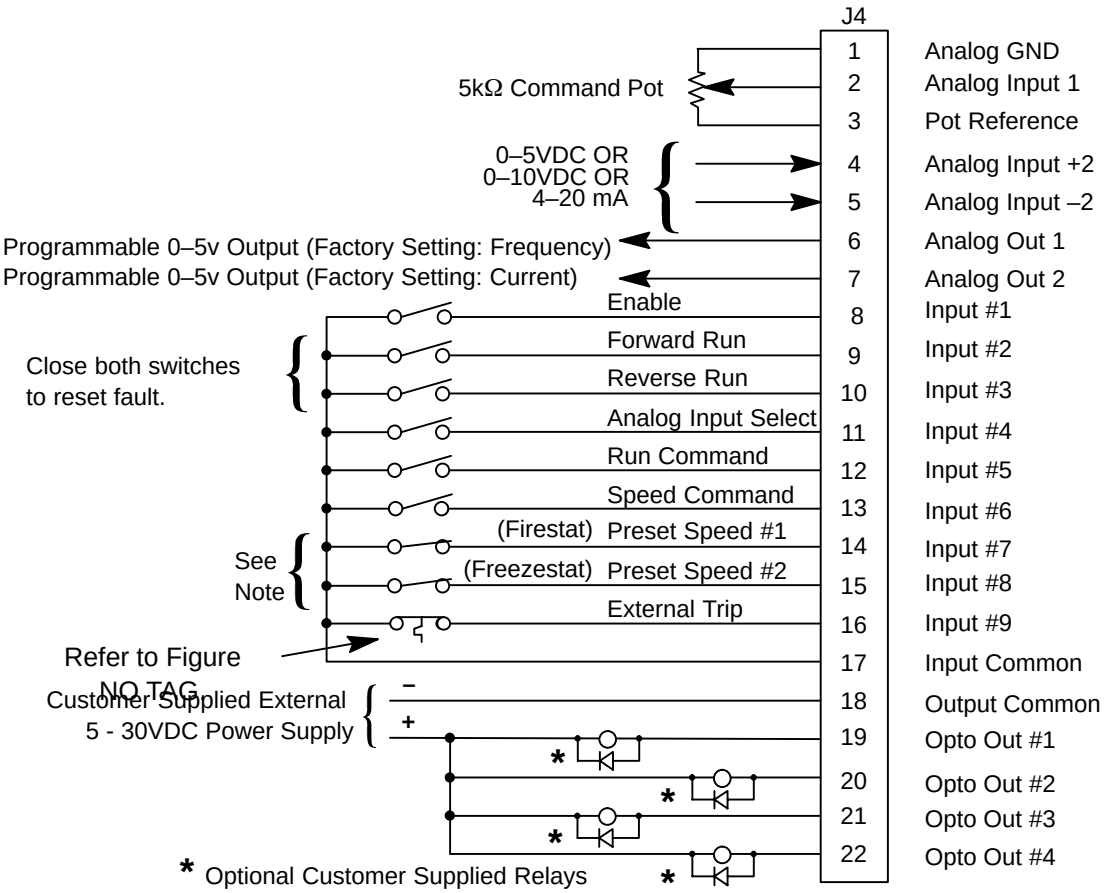
J4-8	OPEN disables the control & motor coasts to a stop. CLOSED allows current to flow in the motor.
J4-9	CLOSED operates the motor in the Forward direction. OPEN Decel to stop.
J4-10	CLOSED operates motor in the Reverse direction. OPEN Decels to stop.
J4-11 to 14	Selects programmed preset speeds as defined in Table 3-14.
J4-15	Selects ACC/DEC group. OPEN selects group 1. CLOSED selects group 2.
J4-16	OPEN causes External Trip to be received by the control. Control will disable and display external trip when programmed to be "ON". When this occurs, the motor stop command is issued, drive operation is terminated and an external trip fault is displayed on the keypad display (also logged into the fault log). If J4-16 is connected, you must set Level 2 Protection block, External Trip to "ON".

Table 3-14 Switch Truth Table for 15 Speed, 2 Wire Control Mode

Function	J4-11	J4-12	J4-13	J4-14
Preset 1	Open	Open	Open	Open
Preset 2	Closed	Open	Open	Open
Preset 3	Open	Closed	Open	Open
Preset 4	Closed	Closed	Open	Open
Preset 5	Open	Open	Closed	Open
Preset 6	Closed	Open	Closed	Open
Preset 7	Open	Closed	Closed	Open
Preset 8	Closed	Closed	Closed	Open
Preset 9	Open	Open	Open	Closed
Preset 10	Closed	Open	Open	Closed
Preset 11	Open	Closed	Open	Closed
Preset 12	Closed	Closed	Open	Closed
Preset 13	Open	Open	Closed	Closed
Preset 14	Closed	Open	Closed	Closed
Preset 15	Open	Closed	Closed	Closed
Fault Reset	Closed	Closed	Closed	Closed

Fan Pump 2 Wire Control Mode

Figure 3-16 Fan Pump, 2 Wire Control Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8 OPEN disables the control and motor coasts to a stop.
CLOSED allows current to flow in the motor.

J4-9 CLOSED starts motor operation in the Forward direction.
OPEN initiates Stop command.

J4-10 CLOSED starts motor operation in the Reverse direction.
OPEN initiates Stop command.

J4-11 OPEN selects setting of "Command Select" parameter. Closed selects Analog Input #1.

Note: If Command Select (Level 1 Input block) is set to Potentiometer, then Analog Input #1 is always selected regardless of this switch position.

J4-12 Run Command. OPEN selects STOP/START and Reset commands from Keypad.
CLOSED selects STOP/START and Reset commands from terminal strip.

J4-13 Speed Command. OPEN selects speed commanded from Keypad.
CLOSED selects terminal strip speed source (selected in the Level 1 Input block, Command Select parameter).

Note: When changing from Keypad to Terminal Strip (J4-12 or J4-13) the motor speed and direction will remain the same after the change.

J4-14 OPEN selects preset speed #1 regardless of the Speed Command input J4-13.

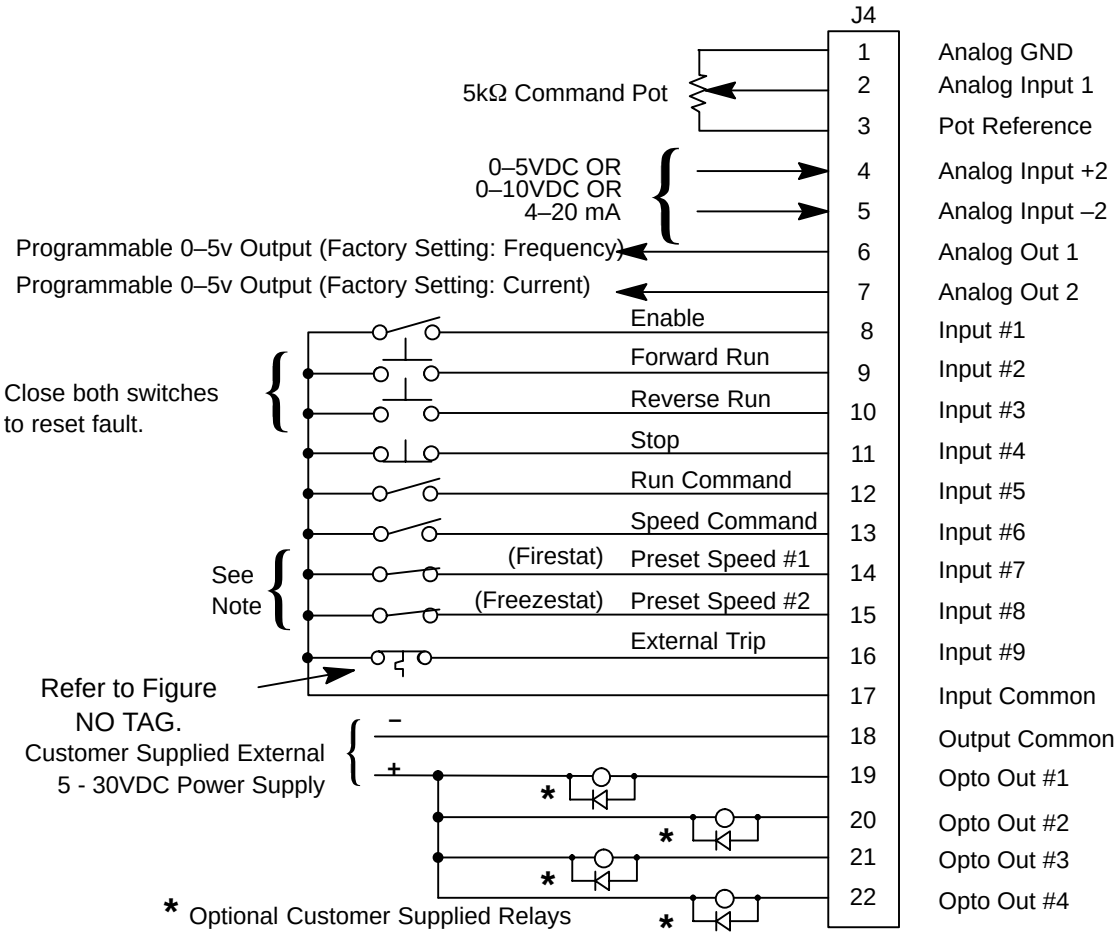
J4-15 OPEN selects preset speed #2 regardless of the Speed Command input J4-13.

Note: If J4-14 and J4-15 are both Open, Preset Speed #1 is selected.

J4-16 OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed "ON". When this occurs, the motor stop command is issued, drive operation is terminated and an external trip fault is displayed on the keypad display (also logged into the fault log).
If J4-16 is connected, you must set Level 2 Protection block, External Trip to "ON".

Fan Pump 3 Wire Control Mode

Figure 3-17 Fan Pump, 3 Wire Control Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8 OPEN disables the control and motor coasts to a stop.
CLOSED allows current to flow in the motor.

J4-9 MOMENTARY CLOSED starts motor operation in the Forward direction.

J4-10 MOMENTARY CLOSED starts motor operation in the Reverse direction.

J4-11 When OPEN motor Decels to stop.

J4-12 Run Command. OPEN selects STOP/START and Reset commands from Keypad.
CLOSED selects STOP/START and Reset commands from terminal strip.

J4-13 Speed Command. OPEN selects speed commanded from Keypad.
CLOSED selects terminal strip speed source (selected in the Level 1 Input block, Command Select parameter).

Note: When changing from Keypad to Terminal Strip (J4-12 or J4-13) the motor speed and direction will remain the same after the change.

J4-14 OPEN selects preset speed #1 regardless of the Speed Command input J4-13.

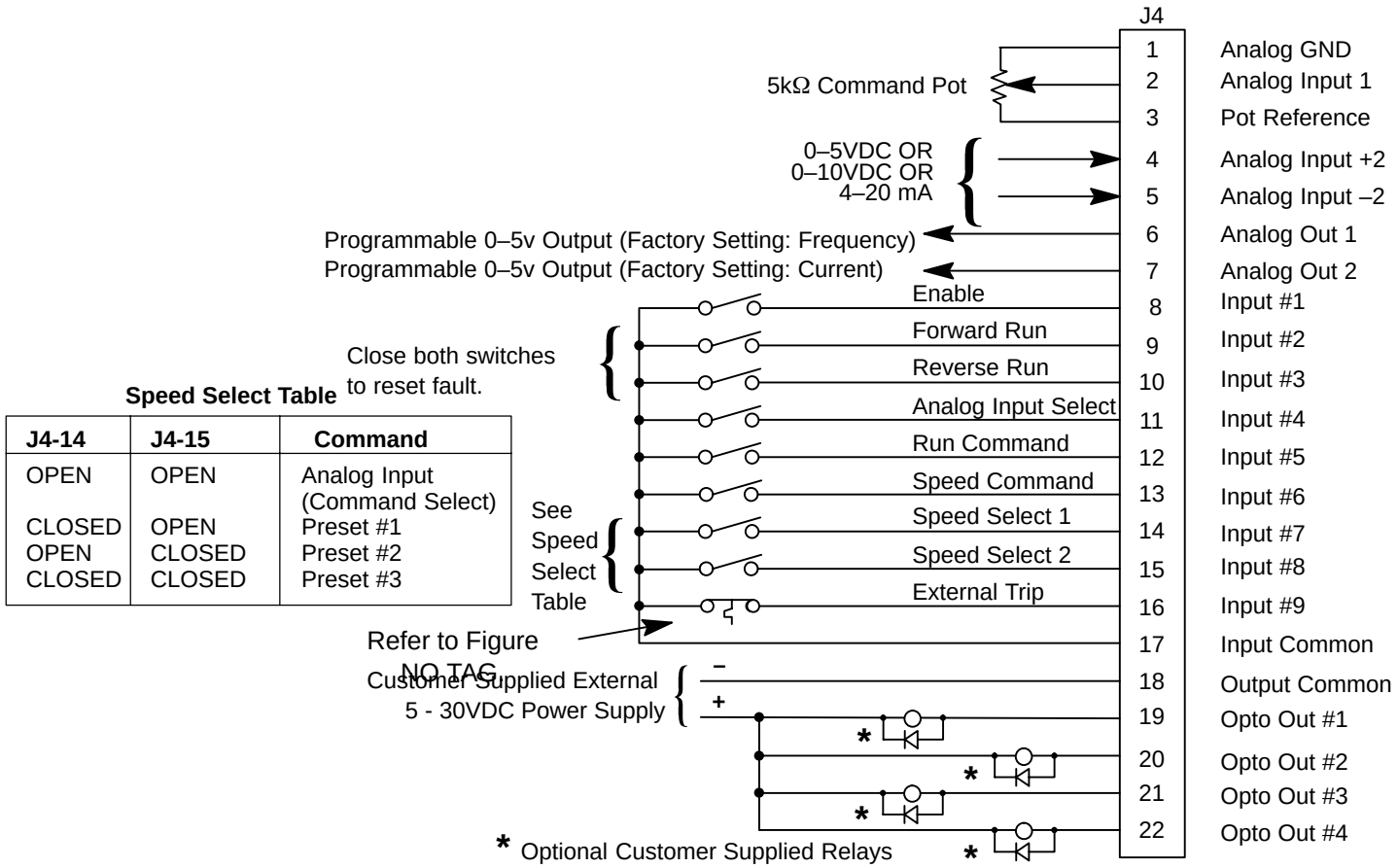
J4-15 OPEN selects preset speed #2 regardless of the Speed Command input J4-13.

Note: If J4-14 and J4-15 are both Open, Preset Speed #1 is selected.

J4-16 OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed “ON”. When this occurs, the motor stop command is issued, drive operation is terminated and an external trip fault is displayed on the keypad display (also logged into the fault log).
If J4-16 is connected, you must set Level 2 Protection block, External Trip to “ON”.

3 Speed Analog 2 Wire Control Mode

Figure 3-18 3 Speed Analog, 2 Wire Control Connection Diagram



Speed Select Table

J4-14	J4-15	Command
OPEN	OPEN	Analog Input (Command Select)
CLOSED	OPEN	Preset #1
OPEN	CLOSED	Preset #2
CLOSED	CLOSED	Preset #3

Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8 OPEN disables the control and motor coasts to a stop.
CLOSED allows current to flow in the motor.

J4-9 CLOSED starts motor operation in the Forward direction.
OPEN initiates Stop command.

J4-10 CLOSED starts motor operation in the Reverse direction.
OPEN initiates Stop command.

J4-11 OPEN selects setting of “Command Select” parameter. Closed selects Analog Input #1.

Note: If Command Select (Level 1 Input block) is set to Potentiometer, then Analog Input #1 is always selected regardless of this switch position.

J4-12 Run Command. OPEN selects STOP/START and Reset commands from Keypad.
CLOSED selects STOP/START and Reset commands from terminal strip.

J4-13 Used with J4-11. Speed Command OPEN selects speed commanded from Keypad.
CLOSED selects Analog Input #1 if J4-11 is CLOSED or Speed Select Table Analog Input value if J4-11 is OPEN.

Note: When changing from Terminal Strip to Keypad (J4-12 or J4-13) the motor speed and direction will remain the same after the change.

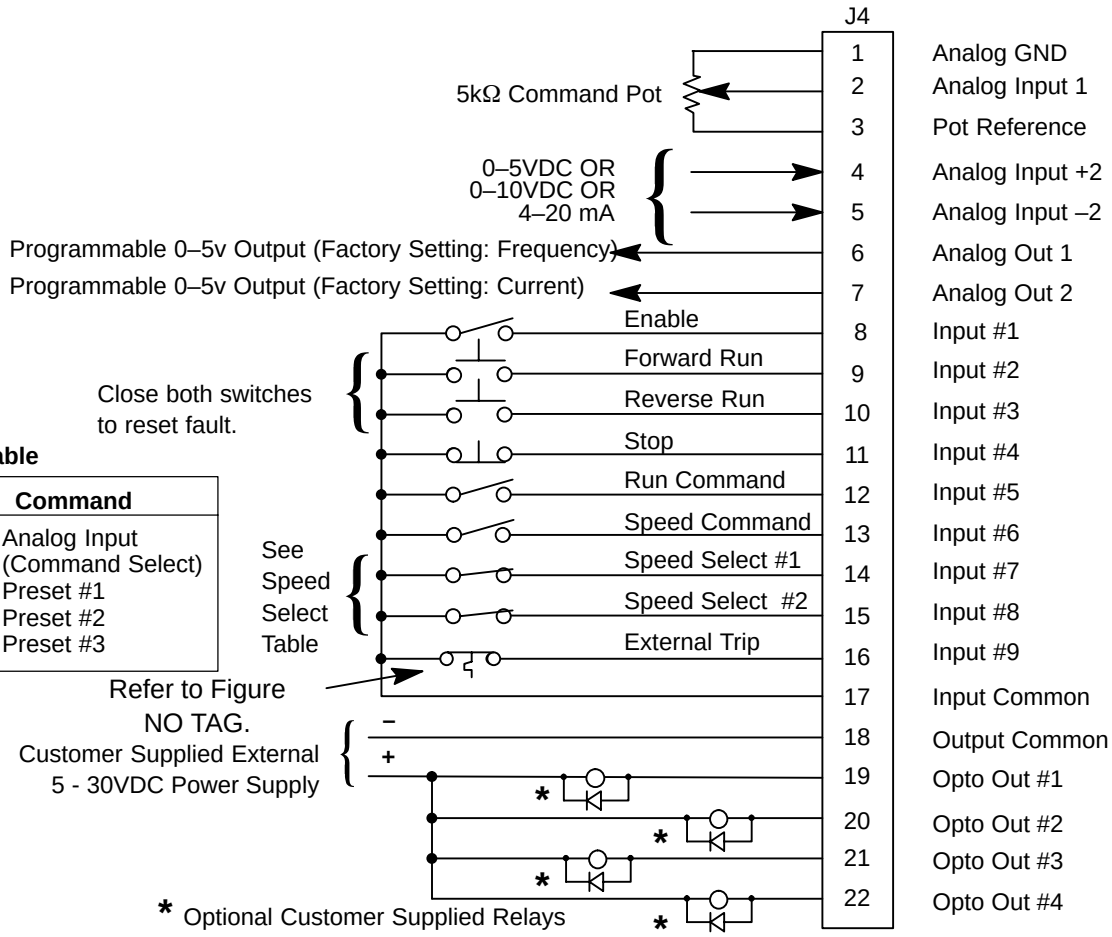
J4-14 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-XX.

J4-15 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-XX.

J4-16 OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed “ON”.

3 Speed Analog 3 Wire Control Mode

Figure 3-19 3 Speed Analog, 3 Wire Control Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

Speed Select Table

J4-14	J4-15	Command
OPEN	OPEN	Analog Input (Command Select)
CLOSED	OPEN	Preset #1
OPEN	CLOSED	Preset #2
CLOSED	CLOSED	Preset #3

J4-8 OPEN disables the control and motor coasts to a stop. CLOSED allows current to flow in the motor.

J4-9 CLOSED starts motor operation in the Forward direction.

J4-10 CLOSED starts motor operation in the Reverse direction.

J4-11 OPEN selects setting of “Command Select” parameter. Closed selects Analog Input #1.

Note: If Command Select (Level 1 Input block) is set to Potentiometer, then Analog Input #1 is always selected regardless of this switch position.

J4-12 Run Command. OPEN selects STOP/START and Reset commands from Keypad. CLOSED selects STOP/START and Reset commands from terminal strip.

J4-13 Used with J4-11. Speed Command OPEN selects speed commanded from Keypad. CLOSED selects Analog Input #1 if J4-11 is CLOSED or Speed Select Table Analog Input value if J4-11 is OPEN.

Note: When changing from Terminal Strip to Keypad (J4-12 or J4-13) the motor speed and direction will remain the same after the change.

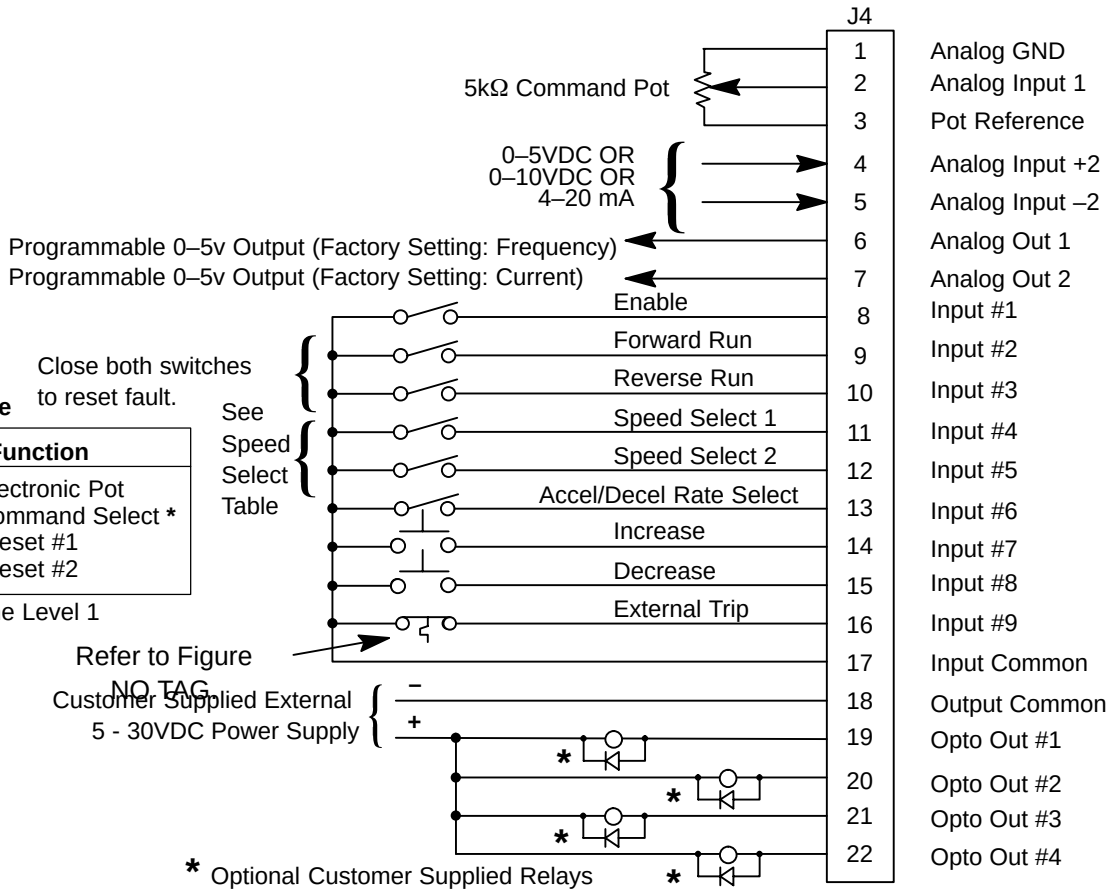
J4-14 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-XX.

J4-15 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-XX.

J4-16 OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed “ON”.

Electronic Pot 2 Wire Control Mode

Figure 3-20 EPOT, 2 Wire Control Connection Diagram



Speed Select Table

J4-11	J4-12	Function
OPEN	OPEN	Electronic Pot Command Select *
CLOSED	OPEN	
CLOSED	CLOSED	Preset #1
OPEN	CLOSED	Preset #2

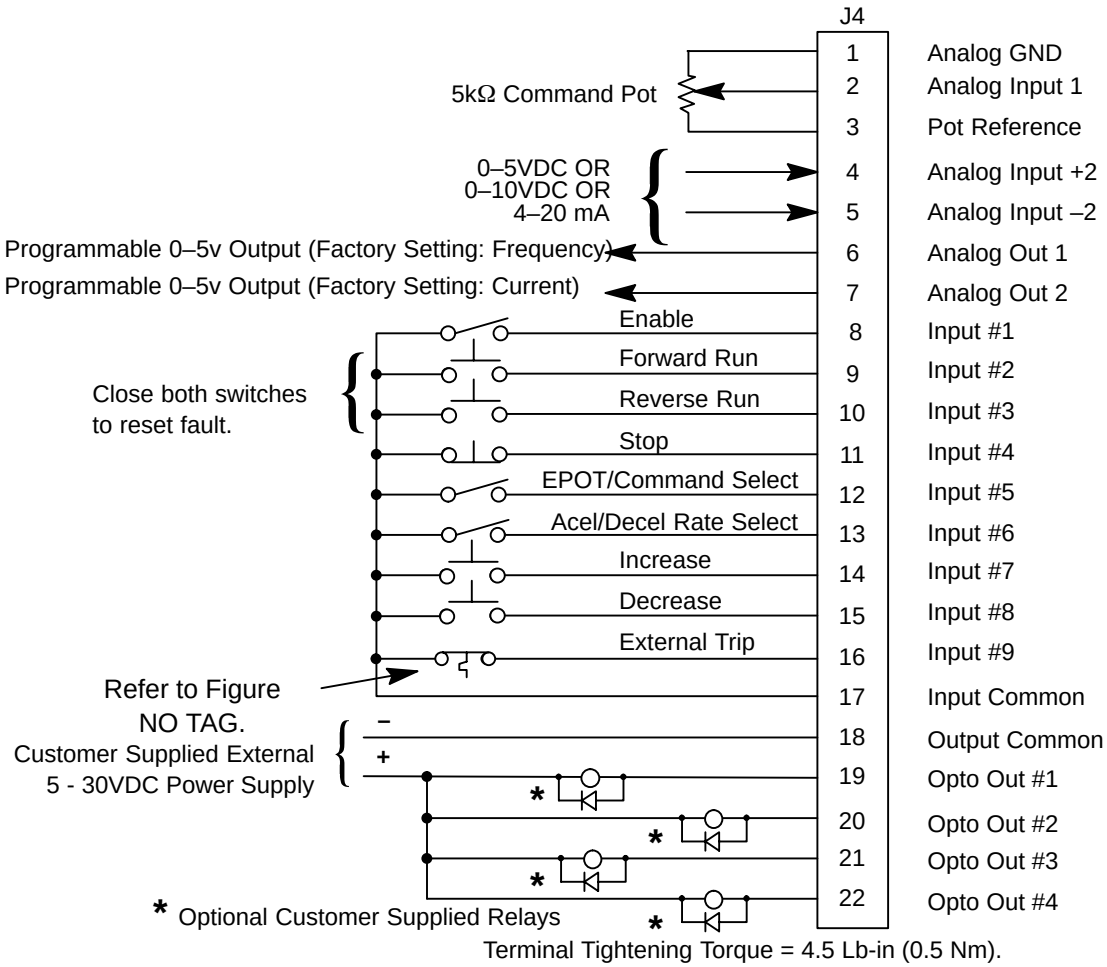
***** Command Select refers to the Level 1 Command Select parameter.

Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8	OPEN disables the control and motor coasts to a stop. CLOSED allows current to flow in the motor.
J4-9	CLOSED starts motor operation in the Forward direction. OPEN initiates Stop command.
J4-10	CLOSED starts motor operation in the Reverse direction. OPEN initiates Stop command.
J4-11	Selects preset speed. (See table in Figure 3-XX.)
J4-12	Selects preset speed. (See table in Figure 3-XX.)
J4-13	Selects ACC/DEC/S-Curve group. OPEN selects group 1. CLOSED selects group 2.
J4-14	Momentary CLOSED increases motor speed while contact is closed.
J4-15	Momentary CLOSED decreases motor speed while contact is closed.
J4-16	OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed “ON”.

Electronic Pot 3 Wire Control Mode

Figure 3-21 EPOT, 3 Wire Control Connection Diagram



J4-8	OPEN disables the control and motor coasts to a stop. CLOSED allows current to flow in the motor.
J4-9	Momentary CLOSED starts motor operation in the Forward direction.
J4-10	Momentary CLOSED starts motor operation in the Reverse direction.
J4-11	Momentary OPEN initiates Stop command.
J4-12	OPEN selects EPOT. CLOSED selects Level 1 Command Select parameter value.
J4-13	Selects ACC/DEC/S-Curve group. OPEN selects group 1. CLOSED selects group 2.
J4-14	Momentary CLOSED increases motor speed while contact is closed.
J4-15	Momentary CLOSED decreases motor speed while contact is closed.
J4-16	OPEN causes an external trip to be received by control. The control will disable and display external trip when programmed “ON”.

Process Control Mode

The process control mode is a secondary closed loop system which includes a general purpose set point PID control. PID control may be setup in two ways. For either method a process feedback signal is required.

1. Two Input PID

The 2 input PID control mode can be used for most general closed loop systems. This is generally known as feedback control. This method compares the value of the Setpoint Source with the Process Feedback and the difference is the process error. The process error signal is used to adjust the motor speed to eliminate the error. A large process error will result in a large change of motor speed. Likewise, a small error signal will produce a small change of motor speed. The end result is the PID control will adjust the motor speed to force the process feedback to be as close as possible to the setpoint source.

2. Three Input PID

3 input PID control mode is used for more complex applications that have a large external disturbance that affect the process feedback. This is useful for processes that have significant time lag between a process disturbance and the generation of a process error signal from the process sensor. This mode uses a **feed-forward command** to anticipate changes in the process. This feed-forward signal directly changes the motor speed or torque without having to develop a process error signal first.

Figure 3-22 shows a block diagram of a 3 input PID Control system.

Figure 3-22 Simplified Process Control Feedback System Diagram

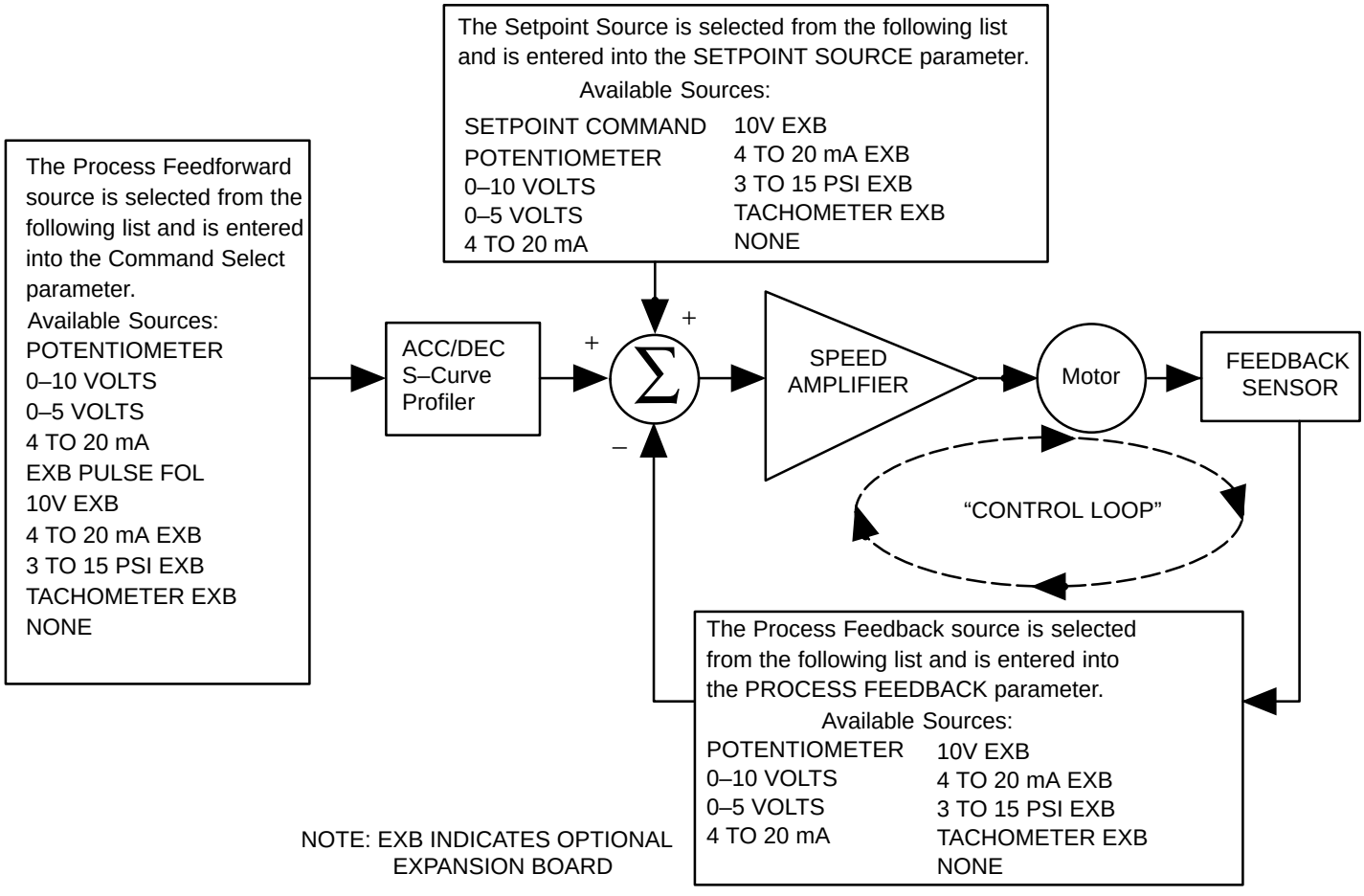


Table 3-15 Process Mode Input Signal Compatibility

Setpoint or Feedforward	Feedback						
	J4-1 & 2	J4-4 & 5	5V EXB[1]	10V EXB[1]	4-20mA EXB[1]	3-15 PSI EXB[2]	DC Tach EXB[3]
J4-1 & 2	■						
J4-4 & 5		■					
5V EXB[1]			■	■	■	▒	
10V EXB[1]			■	■	■	▒	
4-20mA EXB[1]			■	■	■	▒	
3-15 PSI EXB[2]			▒	▒	▒	■	
DC Tach EXB[3]						▒	■
MPR/F EXB [4][1][5]						▒	
Serial EXB [5][1][6]			▒	▒	▒	▒	

[1] Requires expansion board EXB007A01 (High Resolution Analog I/O EXB).

[2] Requires expansion board EXB004A01 (4 Output Relays/3-15 PSI Pneumatic Interface EXB).

[3] Requires expansion board EXB006A01 (DC Tachometer Interface EXB).

[4] Requires expansion board EXB005A01 (Master Pulse Reference/Isolated Pulse Follower EXB).

[5] Used for Feedforward only. Must not be used for Setpoint Source or Feedback.

[6] Requires expansion board EXB001A01 (RS232 Serial Communication EXB). or
Requires expansion board EXB002A01 (RS422/RS485 High Speed Serial Communication EXB).

■ Conflicting inputs. Do not use same input signal multiple times.

▒ Conflicting level 1 or 2 expansion boards. Do not use!

Specific Process Mode Outputs

Process Mode Only, Analog Monitoring Outputs

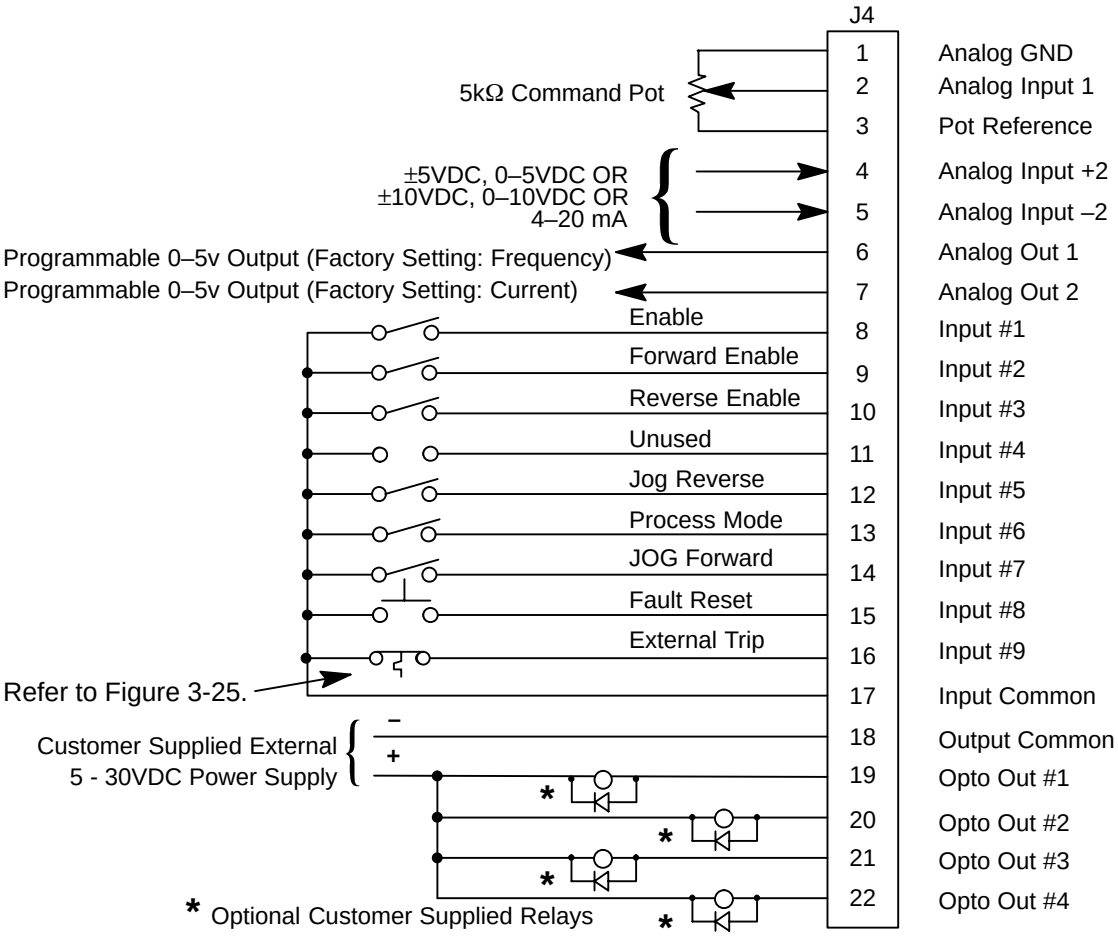
Name	Description
Process FDBK	Process Feedback scaled input. Useful for observing or tuning the process control loop.
Setpoint CMD	Setpoint Command scaled input. Useful for observing or tuning the process control loop.
Speed Command	Commanded Motor Speed. Useful for observing or tuning the output of the control loop.

Process Mode Only, Opto Isolated Outputs

Name	Description
Process Error	CLOSED when the Process Feedback is within the specified tolerance band. OPEN when the Process Feedback is greater than the specified tolerance band. The width of the tolerance band is adjusted by the Level 2 Process Control block Process ERR TOL parameter value.

Process Control Mode Continued

Figure 3-23 Process Mode Connection Diagram



Terminal Tightening Torque = 4.5 Lb-in (0.5 Nm).

J4-8 OPEN disables the control and motor coasts to a stop.
CLOSED allows current to flow in the motor.

J4-9 CLOSED to enable operation in the Forward direction.
OPEN to disable Forward operation. Decel to stop.

J4-10 CLOSED to enable operation in the Reverse direction.
OPEN to disable Reverse operation. Decel to stop.

J4-11 Unused.

J4-12 CLOSED to enable JOG in the reverse direction.

J4-13 CLOSED to enable the closed loop feature of the Process Mode.
OPEN for normal speed mode. Terminal strip speed source is selected in the Level 1 Input block, Command Select parameter.

J4-14 CLOSED to enable JOG in the forward direction.

Note: If J4-12 and J4-14 are closed, JOG Forward is selected.

J4-15 OPEN to run.
CLOSED to reset a fault condition.

J4-16 OPEN causes and external trip to be received by the control. The control will disable and display external trip when programmed “ON”. When this occurs, the motor stop command is issued, drive operation is terminated and an external trip fault is displayed on the keypad display (also logged into the fault log).
If J4-16 is connected, you must set Level 2 Protection block, External Trip to “ON”.

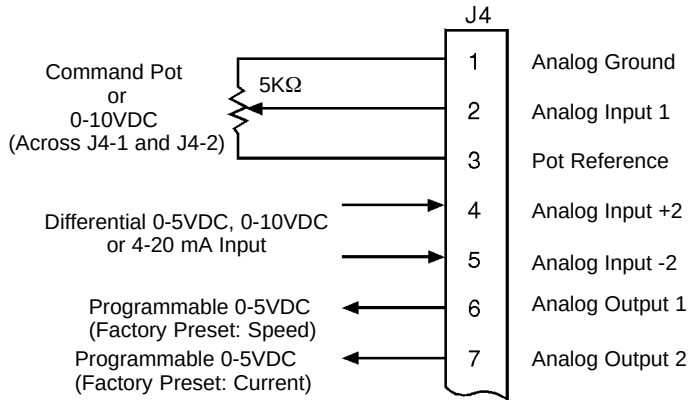
Note: Analog #2 Input: ±5VDC and ±10VDC are selected by Setpoint Source as 0-5VDC and 0-10VDC respectively.

Analog Inputs and Outputs

Analog Inputs

Two analog inputs are available: analog input #1 (J4-1 and J4-2) and analog input #2 (J4-4 and J4-5) as shown in Figure 3-24. Either analog input #1 or #2 may be grounded provided the common mode range is not exceeded. Either analog input may be selected in the Level 1 INPUT block, Command Select parameter value. Analog input #1 is selected if parameter value "Potentiometer" is selected. Analog input #2 is selected if parameter value "+/–10Volts, +/–5 Volts or 4-20mA" is selected.

Figure 3-24 Analog Inputs and Outputs



Terminal Tightening Torque = 7 Lb-in (0.8 Nm).

Analog input #1

The single ended analog input #1 is used when the controller is set to Standard 3 Wire, Fan Pump 2 Wire, Fan Pump 3 Wire, Serial, Process Control, 3 SPD ANA 2Wire, 3 SPD ANA 3Wire, EPOT-2 Wire or EPOT-3 Wire (not Keypad or 15 Speed). When using a potentiometer as the speed command, process feedback or setpoint source, the Level 1 Input block COMMAND SELECT parameter must be set to "POTENTIOMETER".

1. Connect the wires from the 5KΩ pot as shown in Figure 3-24. One end of the pot is connected to J4-1 (analog ground) and the other end is connected to J4-3 (reference voltage).

Note: A potentiometer value of 2KΩ to 10KΩ can be used.

2. Connect the wiper of the pot to J4-2. The voltage across terminals J4-1 and J4-2 is the speed command input.
3. A 0-10VDC speed command signal may be connected across J4-1 and J4-2 instead of a 5KΩ pot.

Note: A 0-10VDC speed command signal may be connected across J4-1 and J4-2 instead of a 5KΩ pot.

Analog input #2

Analog input #2 accepts a 0-5VDC, 0-10VDC or 4-20 mA command input. The operating mode is defined in the of the Level 1 Input block OPERATING MODE parameter.

Note: Analog Input #2 is used with Standard Run 3-Wire, Fan Pump 2 Wire, Fan Pump 3 Wire, Process Control, 3 SPD ANA 2Wire, 3 SPD ANA 3Wire, EPOT-2 Wire or EPOT-3 Wire (not Keypad, 15 Speed or Serial modes).

1. Connect the Analog Input +2 wire to J4-4 and the –2 wire to J4-5.
2. If using a 4-20 mA command signal, jumper JP2 located on the main control board must be on pins 2 & 3. For voltage input, JP2 must be on pins 1 & 2. Refer to Figure 3-1 for jumper position information.

Analog Outputs

Two programmable analog outputs are provided on J4-6 and J4-7. These outputs are scaled 0 - 5 VDC (1mA maximum output current) and can be used to provide real-time status of various control conditions. The return for these outputs is J4-1 analog ground.

Each output function is programmed in the Level 1 Output block, Analog Out #1 or #2 parameter values. The gain of each output is programmable in the Level 1 Output block, Analog Scale #1 or #2.

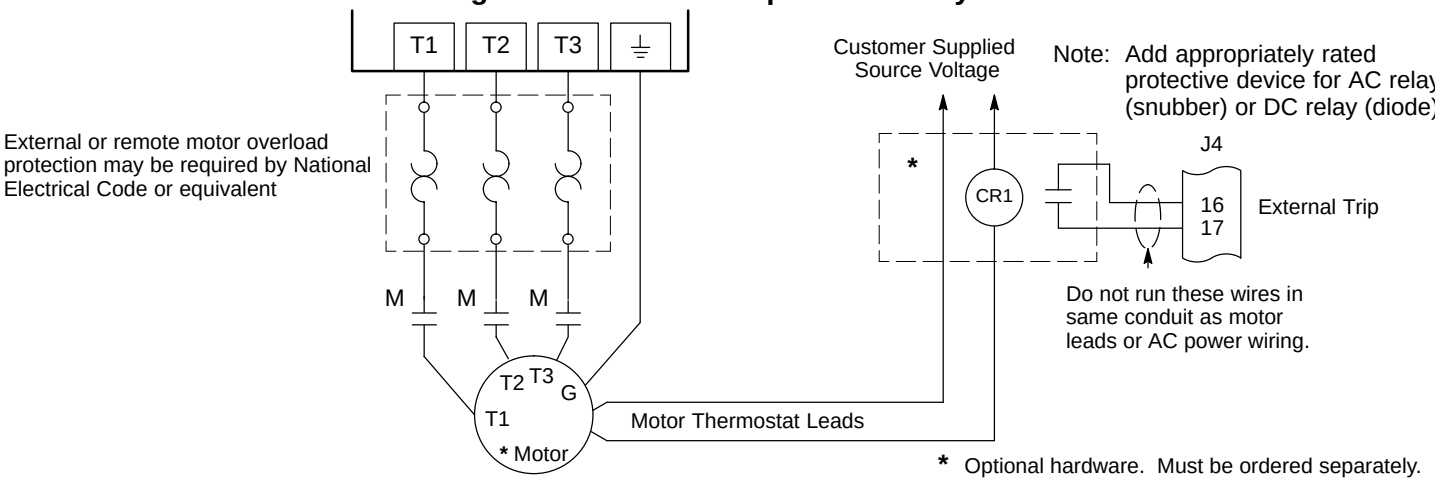
External Trip Input

Terminal J4-16 is available for connection to a normally closed thermostat or overload relay in all operating modes, shown in Figure 3-25. The thermostat or overload relay should be a dry contact type with no power available from the contact. If the motor thermostat or overload relay activates the control will automatically shut down and give an External Trip fault. The optional relay (CR1) shown provides the isolation required and the N.O. contact is closed when power is applied to the relay and the motor is cold.

Connect the External Trip Input wires to J4-16 and J4-17. Do not place these wires in the same conduit as the motor power leads.

To activate the External Trip input, the External Trip parameter in the Level 2 Protection Block must be set to “ON”.

Figure 3-25 Motor Temperature Relay



Opto-isolated Outputs

Four programmable Opto-isolated outputs are available at terminals J4-19 through J4-22.

The Opto-isolated outputs may be configured for sinking 60 mA. The maximum voltage from opto output to common when active is 1.0 VDC (TTL compatible).

If the opto outputs are used to directly drive a relay, a flyback diode rated at 1A, 100 V (1N4002) minimum should be connected across the relay coil. J4-18 is the common for the Opto Output.

1. Connect the positive OPTO OUT #1, relay lead to J4-19 (– lead to J4-18).
2. Connect the positive OPTO OUT #2, relay lead to J4-20 (– lead to J4-18).
3. Connect the positive OPTO OUT #3, relay lead to J4-21 (– lead to J4-18).
4. Connect the positive OPTO OUT #4, relay lead to J4-22 (– lead to J4-18).

Each OPTO OUT is programmed in the Level 1 Output programming block.

Pre-Operation Checklist

Check of Electrical Items

⚠ **CAUTION: After completing the installation but before you apply power, be sure to check the following items.**

1. Verify AC line voltage at source matches control rating.
2. Inspect all power connections for accuracy, workmanship and tightness and compliance to codes.
3. Verify control and motor are grounded to each other and the control is connected to earth ground.
4. Check all signal wiring for accuracy.
5. Be certain all brake coils, contactors and relay coils have noise suppression. This should be an R-C filter for AC coils and reverse polarity diodes for DC coils. MOV type transient suppression is not adequate.

⚠ **WARNING: Make sure that unexpected operation of the motor shaft during start up will not cause injury to personnel or damage to equipment.**

Check of Motors and Couplings

1. Verify freedom of motion for all motor shafts and that all motor couplings are tight without backlash.
2. Verify the holding brakes if any, are properly adjusted to fully release and set to the desired torque value.

Power-Up Procedure

If you are not familiar with programming Baldor controls, refer to Section 4 of this manual before you apply power to the control.

Note: The following procedure adjusts the minimum recommended parameter values to allow operation of the control in Keypad mode for initial start up only.

1. Verify that any enable inputs to J4-8 are open.
2. Turn power on. Be sure no faults are displayed on the keypad display.
3. Set the Level 1 Input block, Operating Mode to “KEYPAD”.
4. Be sure the Level 2 Protection block, Local Enable INP parameter is OFF and the Level 2 Protection block, External Trip parameter is OFF.
5. Set the Level 2 Output Limits block, “OPERATING ZONE” parameter as desired (STD CONST TQ, STD VAR TQ, QUIET CONST TQ or QUIET VAR TQ).
6. Set the Level 2 Output Limits block, “MIN OUTPUT FREQ” parameter.
7. Set the Level 2 Output Limits block, “MAX OUTPUT FREQ” parameter.

Note: JP1 is in position 2–3 as shipped from the factory (<120Hz operation). For operation with MAX OUTPUT FREQ >120Hz, change the position of JP1 to pins 1–2. Refer to Section 3 for jumper location.

8. If the desired peak current limit setting is different than is automatically set by the Operating Zone, set the Level 2 Output Limits block, “PK CURRENT LIMIT” parameter as desired.
9. Enter the following motor data in the Level 2 Motor Data block parameters:
   Motor Voltage (input)
   Motor Rated Amps (FLA)
   Motor Rated Speed (base speed)
   Motor Rated Frequency
   Motor Mag Amps (no load current)
10. If External Dynamic Brake hardware is used, set the Level 2 Brake Adjust block, “RESISTOR OHMS” and “RESISTOR WATTS” parameters.
11. Set the Level 1 V/HZ Boost block, “V/HZ PROFILE” parameter for the correct V/Hz ratio for your application.
12. If the load is a high initial starting torque type, the torque boost and Accel time may need to be increased. Set the Level 1 V/HZ Boost block, “TORQUE BOOST” and the Level 1 Accel/Decel Rate block, “ACCEL TIME #1” as required.
13. Select and program additional parameters to suit your application.

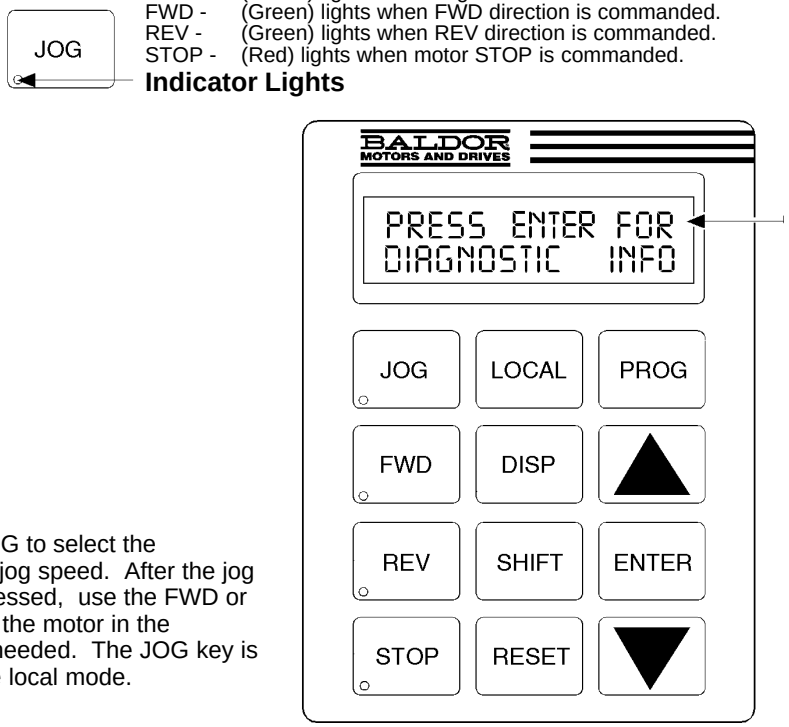
The control is now ready for use in keypad mode or the terminal strip may be wired and the programming changed for another operating mode.

Section 4
Programming and Operation

Overview

The Baldor Series 15H Control programming and operation is done with simple keystrokes on the keypad. The keypad is used to program the control parameters; to operate the motor and to monitor the status and outputs of the control by accessing the display options, diagnostic menus and the fault log.

Figure 4-1 Keypad



Keypad Display - Displays status information during Local or Remote operation. It also displays information during parameter setup and fault or Diagnostic Information.

JOG - Press JOG to select the preprogrammed jog speed. After the jog key has been pressed, use the FWD or REV keys to run the motor in the direction that is needed. The JOG key is only active in the local mode.

FWD - Press FWD to initiate forward rotation of the motor.

REV - Press REV to initiate reverse rotation of the motor.

STOP - Press STOP to initiate a stop sequence. Depending on the setup of the control, the motor will either ramp or coast to a stop. This key is operational in all modes of operation unless it has been disabled by the Keypad Stop parameter in the Keypad (programming) Setup Block.

LOCAL - Press LOCAL to change between the local (keypad) and remote operation. When the control is in the local mode all other external commands to the J1 terminal strip will be ignored with the exception of the external trip input.

DISP - Press DISP to return to display mode from programming mode. Provides operational status and advances to the next display menu item.

SHIFT - Press SHIFT in the program mode to control cursor movement. Pressing the SHIFT key once moves the blinking cursor one character position to the right. While in program mode, a parameter value may be reset to the factory preset value by pressing the SHIFT key until the arrow symbols at the far left of the keypad display are flashing, then press an arrow key. In the display mode the SHIFT key is used to adjust the keypad contrast.

RESET - Press RESET to clear all fault messages (in local mode). Can also be used to return to the top of the block programming menu without saving any parameter value changes.

PROG - Press PROG to enter the program mode. While in the program mode the PROG key is used to edit a parameter setting.

▲ - (UP Arrow).
Press ▲ to change the value of the parameter being displayed. Pressing ▲ increments the value to the next greater value. Also, when the fault log or parameter list is displayed, the ▲ key will scroll upward through the list. In the local mode pressing the ▲ key will increase motor speed to the next greater value.

ENTER - Press ENTER to save parameter value changes and move back to the previous level in the programming menu. In the display mode the ENTER key is used to directly set the local speed reference. It is also used to select other operations when prompted by the keypad display.

▼ - (Down Arrow)
Press ▼ to change the value of the parameter being displayed. Pressing ▼ decrements the value to the next lesser value. Also, when the fault log or parameter list is displayed, the ▼ key will scroll downward through the list. In the local mode pressing the ▼ key will decrease motor speed to the next lesser value.

Display Mode

During normal operation the controller is in the DISPLAY MODE and the keypad displays the status of the control. There are several output status values that can be monitored. When the control is in the DISPLAY MODE the information shown below is displayed.

In addition, the DISPLAY MODE offers a combined display that gives the value of all output conditions simultaneously. The DISPLAY MODE also gives the user the ability to view diagnostic information and the FAULT LOG.

Adjusting Display Contrast

When AC power is applied to the control the keypad should display the status of the control. If there is no display visible, use the following procedure to adjust the display.

Action	Description	Display	Comments
Apply Power	No visible display	BLANK	
Press DISP Key	Places control in display mode	BLANK	
Press SHIFT SHIFT	Allows display contrast adjustment	ADJUST CONTRAST ▲▼[ENTER] TO SAVE	
Press ▲ or ▼ Key	Adjusts display intensity	ADJUST CONTRAST ▲▼[ENTER] TO SAVE	
Press ENTER	Saves level of contrast and exits to display mode	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Typical display

Display Screens

Note: The order of display is as shown (scroll through order). However, the first display after “Baldor Motors & Drives” will be the last display you viewed before power down.

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing Local mode voltage, current & frequency status.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	No faults present. Local keypad mode. If in remote/serial mode, press local for this display.
Press DISP key	Scroll to fault log block.	PRESS ENTER FOR FAULT LOG	Press ENTER to view the fault log if desired.
Press DISP key	Scroll to diagnostic info block.	PRESS ENTER FOR DIAGNOSTIC INFO	Press ENTER to view diagnostic information if desired.
Press DISP key	Scroll to local speed ref. block.	PRESS ENTER FOR LOCAL SPEED REF	Press ENTER to change motor speed.
Press DISP key	Display mode showing output frequency.	STOP FREQUENCY LOCAL 0.00 HZ	
Press DISP key	Display mode showing motor speed (based on output frequency).	STOP MOTOR SPEED LOCAL 0 RPM	
Press DISP key	Display mode showing output current.	STOP CURRENT OUT LOCAL 0.00 A	
Press DISP key	Display mode showing output voltage.	STOP VOLTAGE OUT LOCAL 0 V	

Fault Log Access

When a fault condition occurs, motor operation stops and a fault code is displayed on the Keypad display. The control keeps a log of up to the last 31 faults. If more than 31 faults have occurred the oldest fault will be deleted from the fault log to make room for the newest fault. To access the fault log perform the following procedure:

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing Local mode voltage, current & frequency status.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	No faults present. Local keypad mode. If in remote/serial mode, press local for this display.
Press DISP key	Press DISP to scroll to the Fault Log entry point.	PRESS ENTER FOR FAULT LOG	
Press ENTER key	Display first fault type and time fault occurred.	EXTERNAL TRIP 1: 0:00:30	Typical display.
Press ▲ key	Scroll through fault messages.	PRESS ENTER FOR FAULT LOG EXIT	If no messages, the fault log exit choice is displayed.
Press ENTER key	Scroll to diagnostic info block.	PRESS ENTER FOR DIAGNOSTIC INFO	
Press RESET key	Return to display mode.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode stop key LED is on.

Diagnostic Information Access

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing Local mode voltage, current & frequency status.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	No faults present. Local keypad mode. If in remote/serial mode, press local for this display.
Press DISP key	Scroll to fault log block.	PRESS ENTER FOR FAULT LOG	Press ENTER to view the fault log if desired.
Press DISP key	Scroll to diagnostic info block.	PRESS ENTER FOR DIAGNOSTIC INFO	Press ENTER to view diagnostic information if desired.
Press ENTER key	Access diagnostic information.	STOP FREQ REF LOCAL 2.00 HZ	
Press DISP key	Display mode showing control temperature.	STOP CONTROL TEMP LOCAL 25.0° C	Displays operating temperature in degrees C.
Press DISP key	Display mode showing bus voltage.	STOP BUS VOLTAGE LOCAL 321V	
Press DISP key	Display mode showing bus Current.	STOP BUS CURRENT LOCAL 0.00A	
Press DISP key	Display mode showing PWM Frequency.	STOP PWM FREQ LOCAL 2497 HZ	
Press DISP key	Display mode showing % overload current remaining.	STOP OVRLD LEFT LOCAL 100.00%	
Press DISP key	Display mode showing opto inputs & outputs states.	DIGITAL I/O 000000000 1110	Opto Inputs states (Left); Opto Outputs states (Right).
Press DISP key	Display mode showing actual drive running time since last power up.	TIME FROM PWR UP 0000000.01.43	HR.MIN.SEC format.
Press DISP key	Display operating zone with rated HP and input voltage (for the operating zone) and control type.	1 HP STD CT 230V INVERTER	
Press DISP key	Display mode showing continuous amps; PK amps rating; amps/volt scale of feedback, power base ID.	X.XA X.XAPK X.XXA/V ID:XXX	
Press DISP key	Display mode showing which Group1 or 2 expansion boards are installed.	I NOT INSTALLED II NOT INSTALLED	
Press DISP key	Display mode showing software version and revision installed in the control.	SOFTWARE VERSION XXX-X.XX	
Press DISP key	Displays exit choice. Press ENTER to exit.	PRESS ENTER FOR DIAGNOSTIC EXIT	Press ENTER to exit diagnostic information.

Local Speed Ref Speed Adjustment using Local Speed Reference. (This example changes the Local Speed Ref parameter from 0Hz to 10Hz).

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing Local mode voltage, current & frequency status.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	No faults present. Local keypad mode. If in remote/serial mode, press local for this display.
Press DISP key	Scroll to fault log block.	PRESS ENTER FOR FAULT LOG	Press ENTER to view the fault log if desired.
Press DISP key	Scroll to diagnostic info block.	PRESS ENTER FOR DIAGNOSTIC INFO	Press ENTER to view diagnostic information if desired.
Press DISP key	Scroll to local speed ref. block.	PRESS ENTER FOR LOCAL SPEED REF	Press ENTER to change motor speed.
Press ENTER key	Select the local speed reference.	LOCAL SPEED REF ▲▼ 000.00 0.00 HZ	
Press SHIFT key	Move blinking cursor right one digit.	LOCAL SPEED REF ▲▼ 000.00 0.00 HZ	☐ represents blinking cursor.
Press ▲ key	Increase tens value by one digit.	LOCAL SPEED REF ▲▼ 010.00 0.00 HZ	Value has been changed from 0Hz to 10Hz.
Press ENTER key	Save new value and return to display mode.	PRESS ENTER FOR LOCAL SPEED REF	
Press FWD or REV key	Motor runs FWD or REV at commanded speed.	FWD FREQUENCY LOCAL 10.00 HZ	FWD (REV) LED on.
Press STOP key	Motor stop command issued.	STOP FREQUENCY LOCAL 0.00 HZ	Display mode. Stop LED on.

Program Mode

Use the Program Mode to customize the control for a variety of applications by programming the operating parameters. From the Display Mode press the PROG key to access the Program Mode. To return to the Display Mode, press the DISP key. Note that once a parameter is selected alternately pressing the Disp and Prog keys will toggle between the Display Mode and the selected parameter. Parameters may be programmed in any operating mode. When a parameter is selected for programming, the keypad display gives you the following information:

Parameter Status

All programmable parameters are displayed with a P: in the lower left hand corner of the keypad display. If a parameter is displayed with a V:, the setting may be viewed but not changed while the motor is operating. If the parameter is displayed with an L:, the setting is locked and the security access code must be entered before any changes can be made.

Parameter Blocks Access for Programming

Use the following procedure to access parameter blocks to program the control.

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode.
	If no faults and programmed for REMOTE operation.	STP 0 V 0 RPM REM 0.0 A 0.0 HZ	Display mode.
	If fault is displayed, refer to the Troubleshooting section of this manual.		
Press PROG key		PRESS ENTER FOR PRESET SPEEDS	Press ENTER to access preset speed parameters.
Press ▲ or ▼ key	Scroll to the ACCEL/DECEL block.	PRESS ENTER FOR ACCEL/DECEL RATE	Press ENTER to access Accel and Decel rate parameters.
Press ▲ or ▼ key	Scroll to the Level 2 Block.	PRESS ENTER FOR LEVEL 2 BLOCKS	Press ENTER to access Level 2 Blocks.
Press ENTER key	First level 2 block display.	PRESS ENTER FOR OUTPUT LIMITS	
Press ▲ or ▼ key	Scroll to Programming Exit menu.	PRESS ENTER FOR PROGRAMMING EXIT	Press ENTER to return to display mode.
Press ENTER key	Return to display mode.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	

Changing Parameter Values when Security Code Not Used Use the following procedure to program or change a parameter already programmed into the control when a security code is not being used.

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press PROG key	Access programming mode.	PRESS ENTER FOR PRESET SPEEDS	
Press ▲ or ▼ key	Scroll to Level 1 Input Block.	PRESS ENTER FOR INPUT	Press ENTER to access INPUT block parameter.
Press ENTER key	Access Input Block.	OPERATING MODE P: KEYPAD	Keypad mode shown is the factory setting.
Press ENTER key	Access Operating Mode.	OPERATING MODE ▲▼ KEYPAD	Keypad mode shown is the factory setting.
Press ▲ key	Scroll to make your selection.	OPERATING MODE ▲▼ STANDARD RUN	Typical selection.
Press ENTER	Save selection to memory.	OPERATING MODE P: STANDARD RUN	
Press ▲ key	Scroll to menu exit.	PRESS ENTER FOR MENU EXIT	
Press ENTER key	Return to Input Block.	PRESS ENTER FOR INPUT	
Press DISP key	Return to Display Mode.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Typical display mode.

Reset Parameters to Factory Settings Sometimes it is necessary to restore the parameter values to the factory settings. Follow this procedure to do so.

Note: All specific application parameters already programmed will be lost when resetting the control to factory settings.

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press PROG key	Enter program mode.	PRESS ENTER FOR PRESET SPEEDS	
Press ▲ or ▼ key	Scroll to Level 2 Blocks.	PRESS ENTER FOR LEVEL 2 BLOCKS	
Press ENTER key	Select Level 2 Blocks.	PRESS ENTER FOR OUTPUT LIMITS	
Press ▲ or ▼ key	Scroll to the Miscellaneous block.	PRESS ENTER FOR MISCELLANEOUS	
Press ENTER key	Select Miscellaneous block.	RESTART AUTO/MAN P: MANUAL	
Press ▲ key	Scroll to Factory Settings parameter.	FACTORY SETTINGS P: NO	
Press ENTER key	Access Factory Settings parameter.	FACTORY SETTINGS ▲▼ NO	☐ represents blinking cursor.
Press ▲ key	Scroll to STD SETTINGS, to choose original factory settings.	FACTORY SETTINGS ▲▼ STD SETTINGS	For 50Hz motors, set to 50Hz/400 VOLTS.
Press ENTER key	Restores factory settings.	FACTORY SETTINGS P:LOADING PRESETS	"Loading Presets" is first message "Operation Done" is next "No" is displayed last.
Press ▲ key	Scroll to menu exit.	PRESS ENTER FOR MENU EXIT	
Press ENTER key	Return to Miscellaneous block.	PRESS ENTER FOR MISCELLANEOUS	
Press DISP key	Return to display mode.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.

Initialize New Software EEPROM After new EEPROM is installed, the control must be initialized to the new software version and memory locations. Use the following procedure to Initialize the EEPROM.

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press PROG key	Enter program mode.	PRESS ENTER FOR PRESET SPEEDS	
Press ▲ or ▼ key	Scroll to Level 2 Blocks.	PRESS ENTER FOR LEVEL 2 BLOCKS	
Press ENTER key	Select Level 2 Blocks.	PRESS ENTER FOR OUTPUT LIMITS	
Press ▲ or ▼ key	Scroll to the Miscellaneous block.	PRESS ENTER FOR MISCELLANEOUS	
Press ENTER key	Select Miscellaneous block.	RESTART AUTO/MAN P: MANUAL	
Press ▲ key	Scroll to Factory Settings parameter.	FACTORY SETTINGS P: NO	
Press ENTER key	Access Factory Settings parameter.	FACTORY SETTINGS ▲▼ □ NO	□ represents blinking cursor.
Press ▲ key	Scroll to STD SETTINGS, to choose original factory settings.	FACTORY SETTINGS ▲▼ □ STD SETTINGS	For 50Hz motors, set to 50Hz/400 VOLTS.
Press ENTER key	Restores factory settings.	FACTORY SETTINGS P:LOADING PRESETS	"Loading Presets" is first message "Operation Done" is next "No" is displayed last.
Press ▲ key	Scroll to menu exit.	PRESS ENTER FOR MENU EXIT	
Press ENTER key	Return to display mode.	STOP FREQUENCY LOCAL 0.00 HZ	Display mode. Stop LED on.
Press DISP key	Scroll to diagnostic info block.	PRESS ENTER FOR DIAGNOSTIC INFO	If you wish to verify the software version, enter diagnostic info.
Press ENTER key	Access diagnostic information.	STOP SPEED REF LOCAL 0 RPM	Displays commanded speed, direction of rotation, Local/ Remote and motor speed.
Press DISP key	Display mode showing software version and revision installed in the control.	SOFTWARE VERSION XXX-X.XX	Verify new software version.
Press DISP key	Displays exit choice.	PRESS ENTER FOR DIAGNOSTIC EXIT	Press ENTER to exit diagnostic information.

Operation Examples

Operating the Control from the Keypad

If the control is configured for remote or serial control, the LOCAL Mode must be activated before the control may be operated from the keypad. To activate the LOCAL Mode, first the motor must be stopped using the keypad STOP key (if enabled), remote commands or serial commands.

Note: Pressing the keypad STOP key (if enabled) will automatically issue a motor stop command and change to LOCAL mode.

When the motor has stopped, the LOCAL Mode is activated by pressing the “LOCAL” key. Selection of the LOCAL Mode overrides any remote or serial control inputs except for the External Trip input, Local Enable Input or STOP input.

The control can operate the motor in three (3) different ways from the keypad.

1. JOG Command.
2. Speed adjustment with Keypad entered values.
3. Speed adjustment using the Keypad arrow keys.

Note: If the control has been configured for Keypad in the operating mode parameter (level 1, input block), then no other means of operation is permitted other than from the keypad.

Accessing the Keypad JOG Command

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press JOG key	Access programmed JOG speed.	STOP FREQUENCY LOCAL 0.00 HZ	JOG key LED on.
Press and hold FWD or REV key	Move control forward or reverse at JOG speed.	FWD FREQUENCY LOCAL 7.00 HZ	Control runs while FWD or REV key is pressed. JOG & FWD (or REV) LED’s on.
Press JOG key	Disables JOG mode.	STOP FREQUENCY LOCAL 0.00 HZ	JOG LED off. Stop key LED on.

Speed Adjustment using Local Speed Reference

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press ENTER key	Select the local speed reference.	LOCAL SPEED REF ▲▼ 000.00 0.00 HZ	
Press SHIFT key	Move blinking cursor right one digit.	LOCAL SPEED REF ▲▼ 000.00 0.00 HZ	☐ represents blinking cursor.
Press ▲ key	Increase tens value by one digit.	LOCAL SPEED REF ▲▼ 010.00 0.00 HZ	
Press ENTER key	Save new value and return to display mode.	STOP FREQUENCY LOCAL 0.00 HZ	
Press FWD or REV key	Motor runs FWD or REV at commanded speed.	FWD FREQUENCY LOCAL 10.00 HZ	FWD (REV) LED on.
Press STOP key	Motor stop command issued.	STOP FREQUENCY LOCAL 0.00 HZ	Display mode. Stop LED on.

Speed Adjustment Using Arrow Keys

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press FWD or REV key	Motor runs FWD or REV at selected speed.	FWD FREQUENCY LOCAL 0.00 HZ	FWD key LED on.
Press ▲ key	Increase motor speed.	FWD FREQUENCY LOCAL 20.00 HZ	Display mode.
Press ▼ key	Decrease motor speed.	FWD FREQUENCY LOCAL 10.00 HZ	Display mode.
Press STOP key	Motor stop command issued.	STOP FREQUENCY LOCAL 0.00 HZ	Display mode. Stop LED on.
Press FWD or REV key	Motor runs FWD or REV at commanded speed.	FWD FREQUENCY LOCAL 10.00 HZ	Motor runs at previously set speed.
Press STOP key	Motor stop command issued.	STOP FREQUENCY LOCAL 0.00 HZ	Display mode. Stop LED on.

Security System Changes

Access to programmed parameters can be protected from change by the security code feature. The Security Code is defined by setting the Level 2 Security Control block. To implement the security feature, use the following procedure:

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press PROG key	Enter program mode.	PRESS ENTER FOR PRESET SPEEDS	
Press ▲ or ▼ key	Scroll to Level 2 Blocks.	PRESS ENTER FOR LEVEL 2 BLOCKS	
Press ENTER key	Access Level 2 Blocks.	PRESS ENTER FOR OUTPUT LIMITS	
Press ▲ or ▼ key	Scroll to the Security Control block.	PRESS ENTER FOR SECURITY CONTROL	
Press ENTER key	Access the Security Control block.	SECURITY STATE P: OFF	
Press ▲ key	Scroll to the Access Code parameter.	ACCESS CODE P: 9999	
Press ENTER key	The Access Code parameter can be changed.	ACCESS CODE P: 9999 9999	☐ represents blinking cursor.
Press ▼ key	Use ▼ key to change value. Example: 8999.	ACCESS CODE P: 8999 9999	☐ represents blinking cursor.
Press ENTER key	Save Access Code parameter	ACCESS CODE P: 9999	Keypad Display will not show user access code. Record its' value for future reference.
Press ▼ key	Scroll to Security State.	SECURITY STATE P: OFF	
Press ENTER key	Access Security State parameter.	SECURITY STATE ▲▼ ☐ OFF	☐ represents blinking cursor.
Press ▲ key	Select Local Security.	SECURITY STATE ▲▼ LOCAL SECURITY	
Press ENTER key	Save selection.	SECURITY STATE P: LOCAL SECURITY	P: will change to L: after returning to display mode for longer than time set in Access Time parameter.
Press DISP key	Return to Display mode.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Typical display mode.

Note: Please record your access code and store it in a safe place. If you cannot gain entry into parameter values to change a protected parameter, please contact Baldor. Be prepared to give the 5 digit code located on the lower right side of the Keypad Display at the Enter Code parameter prompt.

Changing Parameter Values with a Security Code in Use

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP OV 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press PROG key	Enter program mode.	PRESS ENTER FOR PRESET SPEEDS	
Press ▲ or ▼ key	Scroll to Input block.	PRESS ENTER FOR INPUT	
Press ENTER key	Access Input block to change Operating Mode setting.	OPERATING MODE L: KEYPAD	L: shows parameter is Locked.
Press ENTER key	When security on, parameter values cannot be changed.	** ENTER CODE ** 9999 23956	
Press ▼ key	Enter the Access Code . Example: 8999.	** ENTER CODE ** 8999 23956	☐ represents blinking cursor.
Press ENTER key		OPERATING MODE KEYPAD	
Press ▲ or ▼ key	Scroll to make your selection.	OPERATING MODE STANDARD RUN	
Press ENTER	Save selected parameter	OPERATING MODE P: STANDARD RUN	P: will change to L: after you return to Display mode for longer than the time specified in the Access Time parameter.
Press ▲ or ▼ key	Scroll to Menu Exit.	PRESS ENTER FOR MENU EXIT	
Press ENTER key	Returns to Input block.	PRESS ENTER FOR INPUT	
Press DISP key	Return to Display mode.	STP OV 0 RPM LOC 0.0 A 0.0 HZ	Typical display mode.

Note: Please record your access code and store it in a safe place. If you cannot gain entry into parameter values to change a protected parameter, please contact Baldor. Be prepared to give the 5 digit code located on the lower right side of the Keypad Display at the Enter Code prompt.

Security System Access Timeout Parameter Change

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.	BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode. Stop LED on.
Press PROG key	Enter program mode.	PRESS ENTER FOR PRESET SPEEDS	
Press ▲ or ▼ key	Scroll to Level 2 Blocks.	PRESS ENTER FOR LEVEL 2 BLOCKS	
Press ENTER key	Access Level 2 Blocks.	PRESS ENTER FOR OUTPUT LIMITS	
Press ▲ or ▼ key	Scroll to the Security Control block.	PRESS ENTER FOR SECURITY CONTROL	
Press ENTER key	Access the Local Security block.	SECURITY STATE L:LOCAL SECURITY	
Press ▲ key	Scroll to the Access Timeout parameter.	ACCESS TIMEOUT L: 0 SEC	
Press ENTER key	Attempt to access the Access Timeout parameter.	•• ENTER CODE •• ▲▼ 9999 23956	☐ represents blinking cursor.
Press ▼ key	Use ▼ key to change value. Example: 8999.	•• ENTER CODE •• ▲▼ 8999 23956	Note: Ignore the 5 digit number to the right (example: 23956).
Press ENTER key	Save Access Code parameter	ACCESS TIMEOUT ▲▼ 000 0 S	Security code entered is correct. All parameters may be changed.
Press SHIFT key.	Move cursor right on digit.	ACCESS TIMEOUT ▲▼ 0 0 0 0 S	Access Timeout can be any value between 0 and 600 seconds.
Press ▲ key 3 times	Change the 0 to 3.	ACCESS TIMEOUT ▲▼ 0 3 0 0 SEC	Example: 30 seconds.
Press ENTER key	Save value.	ACCESS TIMEOUT P: ☐ 30 S	P: will change to L: after you return to Display mode for longer than the time specified in the Access Time parameter.
Press DISP key	Return to Display mode.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Typical display mode.

Note: Please record your access code and store it in a safe place. If you cannot gain entry into parameter values to change a protected parameter, please contact Baldor. Be prepared to give the 5 digit code located on the lower right side of the Keypad Display at the Enter Code prompt.

Control Parameters

LEVEL 1 BLOCKS		LEVEL 2 BLOCKS	
Preset Speeds	**Input**	**Output Limits**	**Brake Adjust**
Preset Speed #1	Operating Mode	Operating Zone	Resistor Ohms
Preset Speed #2	Command Select	Min Output Frequency	Resistor Watts
Preset Speed #3	ANA CMD Inverse	Max Output Frequency	DC Brake Voltage
Preset Speed #4	ANA CMD Offset	PK Current Limit	DC Brake Frequency
Preset Speed #5	ANA CMD Gain	PWM Frequency	Brake on Stop
Preset Speed #6	CMD SEL Filter	REGEN Limit	Brake on Reverse
Preset Speed #7		REGEN Limit ADJ	Stop Brake Time
Preset Speed #8	**Output**		Brake on Start
Preset Speed #9	Opto Output #1	**Custom Units**	Start Brake Time
Preset Speed #10	Opto Output #2	MAX Decimal Display	
Preset Speed #11	Opto Output #3	Value at Speed	**Process Control**
Preset Speed #12	Opto Output #4	Value DEC Places	Process Feedback
Preset Speed #13	Zero SPD Set PT	Value Speed REF	Process Inverse
Preset Speed #14	At Speed Band	Units of Measure	Setpoint Source
Preset Speed #15	Set Speed Point	Units of MEAS 2	Setpoint Command
	Analog Out #1		Set PT ADJ Limit
Accel / Decel Rate	Analog Out #2	**Protection**	At Setpoint Band
Accel Time #1	Analog Scale #1	External Trip	Process PROP Gain
Decel Time #1	Analog Scale #2	Local Enable INP	Process INT Gain
S-Curve #1			Process DIFF Gain
Accel Time #2	**V/HZ and Boost**	**Miscellaneous**	Follow I:O Out
Decel Time #2	Ctrl Base Frequency	Restart Auto/Man	Encoder Lines
S-Curve #2	Torque Boost	Restart Fault/Hr	
	Dynamic Boost	Restart Delay	**Skip Frequency**
Jog Settings	Slip Comp Adj	Language Select	Skip Frequency #1
Jog Speed	V/HZ Profile	Factory Settings	Skip Band #1
Jog Accel Time	V/HZ 3-PT Volts	STABIL ADJ Limit	Skip Frequency #2
Jog Decel Time	V/HZ 3-PT Frequency	Stability Gain	Skip Band #2
Jog S-Curve	Max Output Volts		Skip Frequency #3
		Security Control	Skip Band #3
Keypad Setup		Security State	
Keypad Stop Key		Access Timeout	**Synchro Starts**
Keypad Stop Mode		Access Code	Synchro Starts
Keypad Run Fwd			Sync Start Frequency
Keypad Run Rev		**Motor Data**	Sync Scan V/F
Keypad Jog Fwd		Motor Voltage	Sync Setup Time
Keypad Jog Rev		Motor Rated Amps	Sync Scan Time
3 Speed Ramp		Motor Rated Speed	Sync V/F Recover
Switch on Fly		Motor Rated Frequency	Sync Direction
LOC. Hot Start		Motor Mag Amps	

Control Operation Adjustment The following control adjustments are available to allow tailoring of the drive to a particular application. Table 4-1 and 4-2 provides a description of each parameter block.

Table 4-1 Parameter Block Definitions Level 1

Block Title	Description
PRESET SPEEDS	Allows selection of 15 predefined motor operating speeds. Each speed may be selected using external switches connected to the control terminal strip. For motor operation, a motor direction command must be given along with a preset speed command (at J4).
ACCEL/DECEL RATE	Accel time is the number of seconds required for the motor to increase at a linear rate from 0 Hz to the Hz specified in the "Max Output Frequency" parameter in the Level 2 Output Limits block. Decel time is the number of seconds required for the motor to decrease at a linear rate from the frequency specified in the "Max Output frequency" parameter to 0 Hz. S-Curve is a percentage of the total Accel or Decel time and provides smooth starts and stops. Figure 4-2 illustrates how motor acceleration is changed using a 40% S-Curve. 0% represents no "S" and 100% represents full "S" with no linear segment. Example: Maximum Output frequency =100 Hz; Preset frequency = 50 Hz, Accel Time=10 Sec. In this example, control output frequency will be 50Hz 5 seconds after commanded. Note: Accel #1, Decel #1 and S-Curve #1 are associated together. Likewise, Accel #2, Decel #2 and S-Curve #2 are associated together. These associations can be used to control any Preset frequency or External Speed Command (Pot). Note: Since the motor design uses rotor slip to produce torque, the motor speed will not necessarily increase/decrease in a linear manner with motor frequency. Note: If faults (motor trips) occur during rapid Accel or Decel, selecting an S-curve may eliminate the faults without affecting the overall ramp time. Some adjustment of Accel, Decel and S-Curve settings may be necessary to optimize your application.
JOG SETTINGS	Jog Speed is the commanded frequency used during jog. Jog speed can be initiated from the keypad or terminal strip. At the keypad, press JOG key and the FWD or REV key. At the terminal strip, the JOG input (J4-12) and Forward (J4-9) or Reverse (J4-10) must be closed and maintained. Process control mode is different. If the terminal strip Process Mode input (J4-13) is closed, pressing JOG (or closing J4-14) will cause the drive to move (without pressing FWD or REV). The JOG input also acts as a RUN Command. Jog Accel Time is the Accel Time used during jog. Jog Decel Time is the Decel Time used during jog. Jog S-Curve is the S-Curve used during jog.

Figure 4-2 40% S-Curve Example

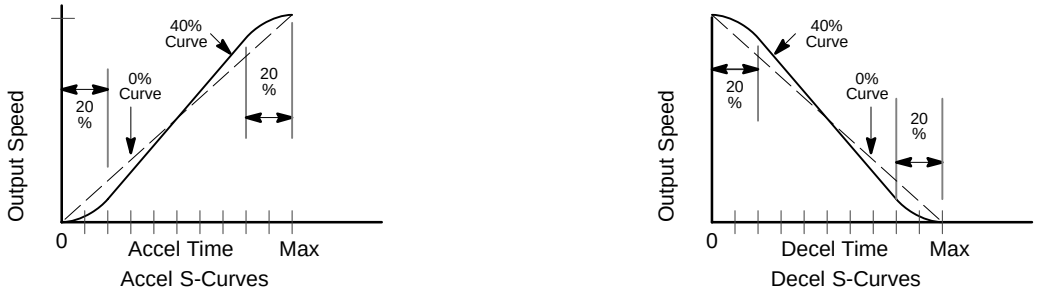


Table 4-1 Parameter Block Definitions Level 1 - Continued

Block Title	Description
KEYPAD SETUP	Keypad Stop Key - Allows keypad "STOP" key to initiate motor stop during remote or serial operation (if set to Remote ON). Pressing "STOP" initiates the stop command and automatically selects Local mode. Keypad Stop Mode - Selects if the Stop command causes the motor to "COAST" to a stop or "REGEN" to a stop. In COAST, the motor is turned off and allowed to coast to a stop. In REGEN, the voltage and frequency to the motor is reduced at a rate set by "Decel Time". Keypad Run FWD - Makes the keypad "FWD" key active in Local. Keypad Run REV - Makes the keypad "REV" key active in Local. Keypad Jog FWD - Makes the keypad "FWD" key active in Local Jog. Keypad Jog REV - Makes the keypad "REV" key active in Local Jog. 3 Speed Ramp - Increases speed in 3 steps while ▲ or ▼ key is pressed. Minimum increment is 0.001Hz when ON (minimum increment is 1.0Hz when OFF). Switch on Fly - Allows switching from Local to Remote mode and back to Local without stopping the drive. Loc. Hot Start - The STOP input at J4-11 in the Keypad mode is enabled (when ON).
INPUT	Operating Mode - Eleven "Operating Modes" are available. Choices are: Keypad, Standard Run 3 wire, 15SPD 2 wire, Fan Pump 2 Wire, Fan Pump 3 Wire, Serial, Process Control, 3 Speed Analog 2 Wire, 3 Speed Analog 3 Wire, Electronic Pot - 2 Wire and Electronic Pot - 3 Wire. External connections to the control are made at the J4 terminal strip (wiring diagrams are shown in Section 3 "Selection of Operating Mode". Command Select - Selects the external speed reference to be used. Potentiometer is the most simple method of speed control is to select Potentiometer and connect a 5KΩ pot to J4-1, J4-2, and J4-3. Select 0-5, 0-10VDC or 4-20mA input command if the input signal is applied to J4-4 and J4-5. 10VOLT EXB - selects optional High Resolution I/O expansion board if installed. 4-20mA EXB - selects the 4-20mA input of the optional High Resolution I/O expansion board if installed 3-15 PSI selects optional 3-15 PSI expansion board if installed. Tachometer EXB - selects optional DC Tachometer expansion board if installed. Pulse Follower EXB selects the Master Pulse Follower Expansion board. Note: When using the 4-20mA input, the JP2 jumper on the main control board must be moved to pins 1 and 2 (Figure 3-1). ANA CMD Inverse - "OFF" will cause a low input voltage (e.g. 0VDC) to be a low motor speed command and a maximum input voltage (e.g. 10VDC) to be a maximum motor speed command. "ON" will cause a low input voltage (e.g. 0VDC) to be a maximum motor speed command and a maximum input voltage (e.g. 10VDC) to be a low motor speed command. ANA CMD Offset - Provides an offset to the Analog Input to minimize signal drift. For example, if the minimum speed signal is 1VDC (instead of 0VDC) the ANA CMD Offset can be set to -10% so the minimum voltage input is seen by control as 0VDC. ANA CMD Gain - Provides a gain factor for the analog speed reference input signal. For example, if the analog speed reference signal is 0 - 9VDC, setting the ANA CMD Gain to 111% allows to control to see 0 - 10VDC as the input signal. CMD SEL Filter - Provides filtering for the analog speed reference input signal. The greater the number (0 - 6) the more noise filtering is provided. For faster response, use a lower number value.

Table 4-1 Parameter Block Definitions Level 1 - Continued

Block Title	Description
OUTPUT	OPTO OUTPUT #1 – #4- Four optically isolated digital outputs that have two operating states, ON or OFF. The Opto outputs and the relay outputs (if a relay expansion board is installed) may be configured to any of the following conditions: **Condition** — **Description** Ready - Active when power is applied and no faults are present. Control is “Ready”. Zero Speed - Active when output frequency to motor is below the value of the “Zero SPD Set Pt” Level 1 Output parameter. At Speed - Active when output frequency is within the commanded range defined by the “At Speed Band” Level 1 Output parameter. At Set Speed - Active when output frequency is at or above the “Set Speed Point” Level 1 Output parameter. Overload - Output is active if there is an Overload fault caused by a time out when output current exceeds control rated current. Keypad Control - Active when control is in Local keypad control. Fault - Active when a fault condition is present. Drive On - Active when control is “Ready” and is being commanded to operate the motor. Reverse - Active when control is running in reverse direction. Process Error - Active when the PID control loop process is outside the range specified by the Level 2 Process Control block, AT Setpoint Band parameter. ZERO SPD SET PT - Sets the output frequency at which the Zero Speed opto output becomes active (turns on). When the output frequency is less than the ZERO SPD SET PT, the Opto Output becomes active. This is useful in applications where a motor brake will be interlocked into the operation of the motor control. AT SPEED BAND - Sets a frequency band within which the At Speed opto output becomes active (turns on). For example, if the At Speed Band is set to ±5 Hz the Opto Output becomes active when the output frequency to the motor is within 5Hz of the commanded motor frequency. This is useful when another machine must not start (or stop) until the motor reaches operating speed. SET SPEED POINT - Sets the frequency at which the AT Set Speed opto output becomes active (turns on). When the frequency is greater than the SET SPEED POINT parameter, the Opto Output becomes active. This is useful when another machine must not start (or stop) until the motor exceeds a predetermined speed.

Table 4-1 Parameter Block Definitions Level 1 - Continued

Block Title	Description
OUTPUT Continued	ANALOG OUTPUT #1 and #2 - Two Analog outputs may be configured so a 0-5VDC (0-10VDC or 4-20mA with High Resolution EXB) output signal represents one of the following conditions: **Condition** — **Description** Frequency - Represents the output frequency where 0VDC = 0 Hz and +5VDC = MAX Hz (slip frequency compensation is not included). Freq Command - Represents the commanded frequency where 0VDC = 0 Hz and +5VDC = MAX Hz. AC Current - Represents the value of the output current where 0VDC = 0A and +5VDC = Full load current (A_{RMS}). AC Voltage - Represents the value of the output voltage where 0VDC = 0 VAC and +5VDC = Control Input Voltage. Torque - Represents load torque where 0V = –100% torque (rated torque), and +5V = 100% torque (rated torque). Power - Represents motor power where 0V = –100% rated power, and +5V = 100% rated power. Bus Voltage - Represents motor power where 0V = 0VDC and 2.5V = 325VDC for 230VAC input (650VDC for 460VAC input). Process Fdbk - Represents the process feedback input where 0V = –100% feedback, and +5V = 100% feedback. Setpoint CMD - Represents Setpoint Command input where 0V = –100% command, and +5V = 100% command. Zero Cal - Output is 0VDC and can be used to calibrate an external meter. 100% Cal - Output is 5VDC and can be used to calibrate full scale for an external meter. ANALOG SCALE #1 & #2 - Scale factor for the Analog Output voltage. Useful to set the full scale range for external meters.

Table 4-1 Parameter Block Definitions Level 1 - Continued

Block Title	Description
V/Hz and Boost	CTRL BASE FREQ - Represents the point on the V/Hz profile where output voltage becomes constant with increasing output frequency. This is the point at which the motor changes from constant or variable torque to constant horsepower operation. In some cases the Max Output Volts and CTRL Base Freq values can be manipulated to provide a wider constant torque or wider constant horsepower speed range than is normally available with the motor. Torque Boost - Adjusts the amount of motor starting torque. The boost adjustment alters the output voltage to the motor from the normal voltage value by increasing or decreasing the stating voltage by fixed values as defined by the V/Hz profile. The factory setting is suitable for most applications. Increasing the boost may cause the motor to overheat. If adjustment is required, increase the boost in small increments until the motor shaft just starts to rotate with maximum load applied. Dynamic Boost - The Dynamic Boost parameter can be adjusted to provide more or less running torque from the motor than is available with the factory setting. The boost adjustment alters the output voltage to the motor from the normal voltage value by increasing or decreasing the voltage per frequency unit as defined by the V/Hz profile. Slip Comp Adjustment - Slip Compensation is used to compensate for varying load conditions during normal operation. This parameter sets the maximum allowable variation in output frequency under varying load conditions (changes of output current). As motor current increases toward 100% of Motor Rated Amps, output frequency is automatically increased to compensate for slip. V/Hz Profile - Sets the Volts/Frequency ratio of the control output (to the motor) for all values of output voltage verses output frequency up to the control base frequency. Because motor voltage is related to motor current, motor voltage can then be related to motor torque. A change in the V/Hz profile can adjust how much torque is available from the motor at various speeds. 3PT profile - allows two linear V/Hz segments by setting the V/Hz 3PT Volts and V/Hz 3PT Frequency parameters. 33%, 67% and 100% Square Law profiles are preset profiles that provide different variations of the squared reduced V/Hz profile. These profiles are shown in Figure 4-3. V/Hz 3-PT Volts - This parameter sets the output voltage associated with the 3PT Frequency parameter. V/Hz 3-PT Frequency - This parameter sets the output frequency associated with the 3PT volts parameter. Max Output Volts - This parameter sets the maximum output voltage available to the motor from the control. This is useful if the motor rated voltage is less than the input line voltage. In some cases the Max Output Volts and the CTRL Base Frequency parameter values can be adjusted to provide a wider constant torque or wider constant horsepower speed range than is normally available.
LEVEL 2 BLOCK	ENTERS LEVEL 2 MENU

Figure 4-3 Volts/Hertz Profile

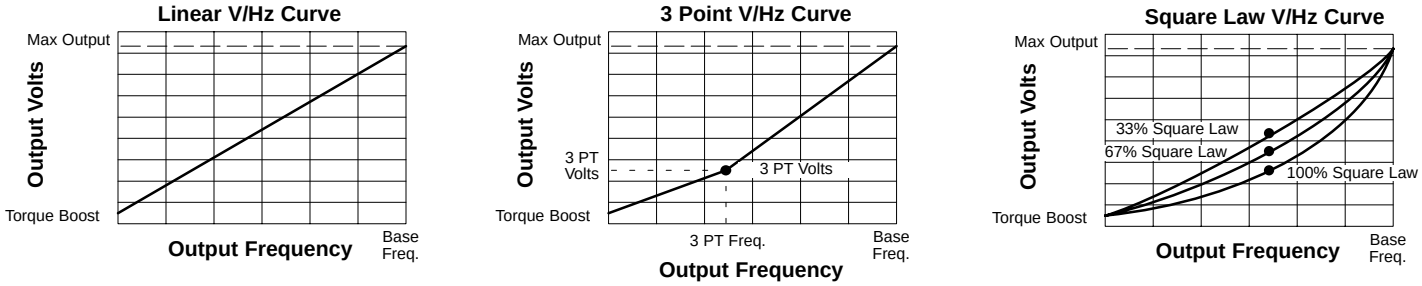


Table 4-2 Parameter Block Definitions Level 2

Block Title	Description
OUTPUT LIMITS	Operating Zone - Sets the PWM operating zone to Standard 2.5KHz or Quiet 8.0KHz. Two operating modes are also selectable: Constant Torque and Variable Torque. Constant Torque allows 170 - 200% for 3 seconds overload or 150% for 60 seconds overload. Variable Torque allows 115% peak overload for 60 seconds. MIN Output Frequency - Sets the minimum output frequency to the motor. During operation, the output frequency will not be allowed to go below this value except for motor starts from 0 Hz or during dynamic braking to a stop. MAX Output Frequency - Sets the maximum output frequency to the motor. Figure 4-4. PK Current Limit - The maximum output (peak) current to the motor. Values above 100% of the rated current are available depending upon the operating zone selected. PWM Frequency - The frequency that the output transistors are switched. PWM should be as low as possible to minimize stress on the output transistors and motor windings. PWM frequency is also referred to as "Carrier" frequency. Figure 4-4. REGEN Limit - Automatically increases the output frequency during REGEN periods for cyclic loads. The output will increase at the rate set by REGEN Limit ADJ but will not exceed Level 2, Output Limits "MAX Output Frequency" parameter value. REGEN Limit ADJ - Sets the amount of automatic frequency adjustment that occurs when REGEN Limit is turned ON.
CUSTOM UNITS	Max Decimal Places - The number of decimal places of the Output Rate display on the Keypad display. This value will be automatically reduced for large values. The output rate display is only available if the "Value At Speed" parameter value is non zero. Value At Speed - Sets the desired output rate value per motor RPM. Two numbers are displayed on the keypad display (separated by a slash "/"). The first number (left most) is the value you want the keypad to display at a specific motor speed (second number, right most). A decimal may be inserted into the numbers by placing the flashing cursor over the up/down arrow. Value DEC Places - Serial Only. * Value Speed REF - Serial Only. * Units of Measure - Allows you to specify units of measure to be displayed on the Output Rate display. Use the shift and arrow keys to scroll to the first and successive characters. If the character you want is not displayed, move the flashing cursor over the special up/down character arrow on the left side of the display. Use the up/down arrows and the shift key to scroll through all 9 character sets. Use the ENTER key to save your selection. Units of MEAS 2 - Serial Only. *
PROTECTION	External Trip - OFF - External Trip is Disabled. (Ignores J4-16 switched input). ON - External Trip is enabled. If a normally closed contact at J4-16 (to J4-17) is opened, an External Trip fault will occur and cause the drive to shut down. Local Enable INP - OFF - Local Enable input is Disabled. (Ignores J4-8 switched input). ON - A normally closed contact at J4-8 (to J4-17) is required to ENABLE the control when operating in the Keypad mode.

* Note: Serial Commands. When using the serial command option, the "Value AT Speed", "Value DEC Places", and "Value Speed REF" parameters must be set. The Value AT Speed parameter sets the desired output rater per increment of motor speed. The Value DEC Places sets the desired number of decimal places of the Value AT Speed number. The Value Speed REF sets the increment of motor speed for the desired for the desired output rate.

The Units of Measure parameter sets the two left most characters of the custom units display while the Units of MEAS 2 parameter sets the two right most characters. For example, if "ABCD" is the custom units, "AB" is set in the Level 2 Custom Units block, Units of Measure parameter and "CD" is set in the Level 2 Custom Units block, Units of MEAS 2 parameter.

Note: Custom Display Units. The output rate display is only available if the Value AT Speed parameter has been changed from a value of 0 (zero). To access the Output Rate display, use the DISP key to scroll to the Output Rate display.

Table 4-2 Parameter Block Definitions Level 2 Continued

Figure 4-4 PWM Frequency vs Output Frequency

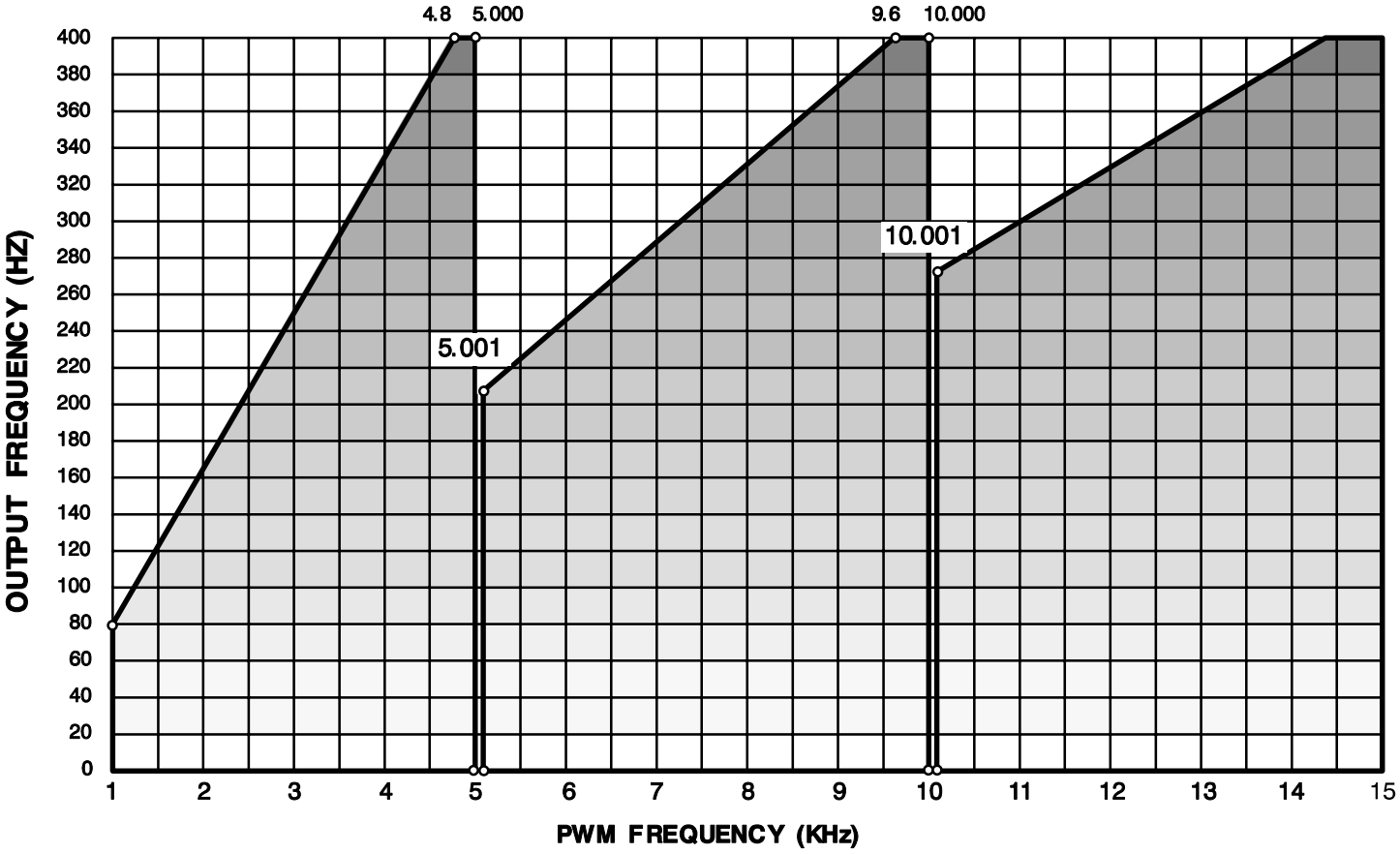


Table 4-2 Parameter Block Definitions Level 2 Continued

⚠ WARNING: If an automatic restart of the motor could cause injury to personnel, the automatic restart feature should be disabled by changing the "Restart Auto/Man" parameter to MANUAL.

Block Title	Description
MISCELLANEOUS	Restart Auto/Man - Manual - If a fault occurs (or power loss), the control must be manually reset to resume operation. Automatic - If a fault occurs (or power loss), the control will automatically reset to resume operation. Restart Fault/Hr - The maximum number of automatic restart attempts before requiring a manual restart. After one hour without reaching the maximum number of faults or if power is turned off and on again, the fault count is rest to zero. Restart Delay - The amount of time allowed after a fault condition for an automatic restart to occur. Useful to allow sufficient time to clear a fault before restart is attempted. Language Select - Selects English or Espanol (Spanish) characters for keypad display. Factory Settings - Restores factory settings for all parameter values. Select STD Settings and press "ENTER" key to restore standard 60Hz factory parameter values. The keypad Display will show "Operation Done" then return to "NO" when completed. Select 50Hz / 400Hz and press "ENTER" key to restore factory parameter values if using a motor with a base frequency of 50Hz. STABIL ADJ Limit - Sets the maximum range of adjustment at low output frequency and light load conditions to eliminate instability. Factory setting is good for most applications. Stability Gain - Sets the response time if instability occurs. Factory setting is good for most applications.
SECURITY CONTROL	Security State - Off - No security Access Code required to change parameter values. Local Security - Requires security Access Code to be entered before changes can be made using the Keypad. Serial Security - Requires security Access Code to be entered before changes can be made using the RS232/422/485 link. Total Security - Requires security Access Code to be entered before changes can be made using the Keypad or serial link. Note: If security is set to Local, Serial or Total you can press PROG and scroll through the parameter settings but you are not allowed to change them unless you enter the correct access code. Access Timeout - The time in seconds the security access remains enabled after leaving the programming mode. If you exit and go back into the program Mode within this time limit, the security Access Code does not have to be re-entered. This timer starts when leaving the Program Mode (by pressing Display etc.). Access Code - A 4 digit number code. Only persons that know the code can change secured Level 1 and Level 2 parameter values. Note: Please record your access code and store it in a safe place. If you cannot gain entry into parameter values to change a protected parameter, please contact Baldor. Be prepared to give the 5 digit code located on the lower right side of the Keypad Display at the Enter Code prompt.
MOTOR DATA	Motor Voltage - The rated voltage of the motor (listed on the motor Nameplate). The value of this parameter has no effect on the output voltage to the motor. Motor Rated Amps - The rated current of the motor (listed on the motor Nameplate). If the motor current exceeds this value for a period of time, an Overcurrent fault will occur. If multiple motors are used on one control, add the Motor Rated Amps for all motors and enter this value. Motor Rated Speed - The rated speed of the motor (listed on the motor Nameplate). If Motor Rated SPD = 1750 RPM and Motor Rated Freq = 60 Hz, the Keypad Display will show 1750 RPM at 60 Hz and 850 RPM at 30Hz. Motor Rated Freq - The rated frequency of the motor (listed on the motor Nameplate). Motor Mag Amps - The motor magnetizing current value (listed on the motor Nameplate). Also called no load current. If multiple motors are used on one control, add the Motor Mag Amps for all motors and enter this value.

Table 4-2 Parameter Block Definitions Level 2 Continued

Block Title	Description
BRAKE ADJUST	Resistor Ohms - The dynamic braking resistor value in ohms. Refer to dynamic braking manual or call Baldor for additional information. If dynamic braking is not installed, enter the value “0”. Resistor Watts - The dynamic braking resistor watts rating. Refer to dynamic braking manual or call Baldor for additional information. If dynamic braking is not installed, enter the value “0”. DC Brake Voltage - The amount of DC braking voltage applied to the motor windings during a Stop Command. Increase this value for more braking torque during stops. The increased braking voltage may cause the motor to overheat for applications that require frequent starts/stops. Be careful in selecting this value. The maximum DC Brake Voltage = (1.414)X(Max Output Volts). Max Output Volts is a Level 1 V/HZ and Boost parameter value. DC Brake FREQ - The output frequency (to the motor) at which DC Injection Braking will begin. Brake on Stop - If set to ON, DC Injection Braking will begin when a Stop Command is issued. After a Stop Command, the DC Brake Voltage will be applied to the motor windings when the output frequency reaches the DC Brake Frequency. Brake on Reverse - If set to ON, DC Injection Braking will begin after a change motor rotation command is issued. After a Stop Command, the DC Brake Voltage will be applied to the motor windings when the output frequency reaches the DC Brake Frequency. Braking continues until the motor is stopped. The motor will then accelerate in the opposite direction. Stop Brake Time - The maximum number of seconds that DC Injection Brake Voltage will be applied to the motor windings after a stop command. After the time specified by this value, DC Injection Braking is automatically turned off. If DC Injection Braking starts at a frequency less than the DC Brake Frequency parameter, the Stop Brake Time is calculated as follows: $$\text{Brake Time} = \text{Stop Brake Time} \times \frac{\text{Output Frequency at Braking}}{\text{DC Brake Frequency}}$$ Brake on Start - If set to ON, turns DC Injection Braking ON for a a period of time (Start Brake TIme) when a RUN command is issued. This ensures the motor is not rotating. Braking will automatically turn off and the motor will accelerate at the end of the Start Brake Time. Start Brake TIme - The amount of time DC Injection Braking will be applied after a RUN command is issued. (This will only occur if Brake On Start is set to ON.) Braking may cause the motor to overheat for applications that require frequent starts/stops. Be careful in selecting this value. The Start Brake Time should be just long enough to ensure the motor shaft is not rotating when a start command is issued.

Table 4-2 Parameter Block Definitions Level 2 Continued

Block Title	Description
PROCESS CONTROL	Process Feedback - Sets the type of signal used for the process feedback in the PID setpoint control loop. Process Inverse - Causes the process feedback signal to be inverted. Used with reverse acting processes that use a unipolar signal such as 4-20mA. If “ON”, the PID loop will see a low value of the process feedback signal as a high feedback signal and a high value of the process feedback signal as a low feedback signal. Setpoint Source - Sets the source input reference signal type to which the process feedback will be compared. If “Setpoint CMD” is selected, a fixed value of the set point that is entered in the Setpoint Command parameter value (of the Level 2 Process Control block) will be used. Note: If “Setpoint Command” is selected, the fixed value of the Level 2 Process Control block Setpoint Command parameter value () will be used. Setpoint Command - The setpoint value for the PID loop that the control will try to maintain. This is only used when the Setpoint Source parameter is set to “Setpoint Command”. Negative percentage values are ignored in the PID loop if the feedback signal contains only positive values (such as 0-10VDC). Set PT ADJ Limit - The maximum frequency correction value to be applied to the motor (in response to the maximum feedback setpoint error). For example, if the Max Output Frequency is 60 Hz, the setpoint feedback error is 100% and the setpoint adjustment limit is 20%, the maximum speed the motor will run in response to the setpoint feedback error is ±12 Hz. (60Hz x 20%= 12Hz or a total of 24 Hz total output band-width centered around the effective setpoint frequency). At Setpoint Band - Sets the operating band within which the At Setpoint Opto Output is active (turned ON). This feature indicates when the process is within the desired setpoint range. For example, if the Setpoint Source is 0-10VDC and the At Setpoint Band value is 10%, the At Setpoint Opto Output will turn on if the process is within(10 x 10% = 1) ±1VDC of the commanded setpoint. Process PROP Gain - Sets the PID loop proportional gain. Process INT Gain - Sets the PID loop Integral gain. Process DIFF Gain - Sets the PID loop differential gain. Follow I:O Ratio - Sets the ratio of the Master input to the Follower output. Requires the Master Pulse Reference/ Isolated Pulse Follower expansion board. For example, the left number is the master input rate. The number to the right of the colon is the follower output rate. If you wish the follower to run twice the speed of the master, a 2:1 ratio is entered. Fractional ratios such as 0.5:1 are entered as 1:2. Follow I:O Out - Only used for serial communications. In Master/Follower configurations this parameter represents the FOLLOWER portion of the ratio. The MASTER portion of the ratio is set in the Follow I:O Ratio parameter. Note: When using Serial Commands, the Follow I:O Ratio parameter value must be set using two separate parameters: Follow I:O Ratio and Follow I:O Out. The follow I:O Ratio sets the the Input (Master) part of the ratio and Follow I:O Out sets the the output (Follower) part of the ratio. For example, a 2:1 (input:output) ratio is set by a Follow I:O Ratio value of 2 and a Follow I:O Out value of 1. Note: The Encoder Lines parameter must be defined if a value is entered in the Follow I:O Ratio parameter. Encoder Lines - Only used if an optional Master Pulse Reference/Isolated Pulse Follower expansion board is installed. Defines the number of pulses per revolution of the master encoder. Is used to define the output master pulse rate for a downstream follower drive to follow.

Table 4-2 Parameter Block Definitions Level 2 Continued

Block Title	Description
SKIP FREQUENCY	Skip Frequency - (#1, #2 and #3) sets the center frequency of the frequency band to skip or treat as a dead-band. Three bands can be defined independently or the three values can be selected to skip one wide frequency band. Skip Band - (#1, #2 and #3) sets the width of the band centered about the Skip Frequency. For example, if Skip Frequency #1 is set to 20Hz and Skip Band #1 is set to 5Hz, continuous operation is not allowed in the dead-band of 15Hz to 25Hz.
SYNCHRO STARTS	Synchro Starts - Used when the motor shaft is rotating at the time the inverter applies power to the motor. If set to Restarts Only, allows Synchro Starts after a fault condition is reset. If set to All Starts, allows Synchro Starts at all fault resets as well as restarts after power failure or after a run command. Sync Start Frequency - Allows the Synchro Start feature to begin scanning motor rotational frequency at the MAX Frequency or a SET Frequency. Sync Scan V/F - Sets the Volts/Hertz ratio for the Synchro Start feature as a percentage of the V/Hz ratio defined by the Max Output Volts/Base Frequency. This Sync Scan V/F percentage value is multiplied by the Max Output Volts/Base Frequency value. If this value is too high, the inverter may fault on Over-current. Sync Setup TIme - The time for the inverter to ramp the output voltage from zero to the voltage that corresponds to the Sync Start Frequency. A 0.5 second delay before the ramp begins is not included in this time. If the Synchro Start feature is not operating quickly enough, decrease the Sync Setup Time value. Sync Scan Time - The time allowed for Synchro Start to scan and detect rotor frequency. Scanning begins at the Sync Start Frequency to 0Hz. Generally, the shorter the Sync Scan Time the more likely a false Synchro Start will be detected. This value should be set high enough to eliminate false Synchro Starts. Sync V/F Recover - The time allowed to ramp up the output voltage from the Synchro Start scan voltage to the normal output voltage. This occurs after the synchronization frequency is detected. This parameter value should be low enough to minimize Synchro Start time without causing the inverter to fault on Over-current. Sync Direction -Allows Synchro Starts in either or both motor rotational directions. If the application requires motor shaft rotation in one direction only, scanning in that direction only will minimize Sync Scan Time.
LEVEL 1 BLOCK	ENTERS LEVEL 1 MENU

Section 5
Troubleshooting

The Baldor Series 15H Control requires very little maintenance, if any, and should provide years of trouble free operation when installed and applied correctly. Occasional visual inspection should be considered to insure tight wiring connections and to avoid the build up of any dust, dirt, or foreign debris which can reduce heat dissipation.

It is important to become familiar with the following information before attempting any troubleshooting or service of the control. Most troubleshooting can be performed using only a digital voltmeter having an input impedance exceeding 1 megohm. In some cases, an oscilloscope with 5 MHZ minimum bandwidth may be useful. Before consulting the factory, check that all power and control wiring is correct and installed per the recommendations given in this manual.

No Keypad Display - Display Contrast Adjustment

The possibility exists of no display in the keypad depending upon the level of contrast for which the display is set. The following procedure provides the steps necessary to adjust the contrast of the display.

Action	Description	Display	Comments
Apply Power	No visible display.	BLANK	
Press DISP key	Ensures control in Display mode.	BLANK	Display mode.
Press SHIFT key 2 times	Allows display contrast adjustment.	ADJUST CONTRAST ▲▼ [ENTER] TO SAVE	
Press ▲ or ▼ key	Adjusts display contrast (intensity).	ADJUST CONTRAST ▲▼ [ENTER] TO SAVE	
Press ENTER key	Saves display contrast adjustment level and exits to display mode.	STOP FREQUENCY LOCAL 0.00 HZ	

How to Access Diagnostic Information

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing Local mode voltage, current & frequency status.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	No faults present. Local keypad mode. If in remote/serial mode, press local for this display.
Press DISP key	Scroll to fault log block.	PRESS ENTER FOR FAULT LOG	Press ENTER to view the fault log if desired.
Press DISP key	Scroll to diagnostic info block.	PRESS ENTER FOR DIAGNOSTIC INFO	Press ENTER to view diagnostic information if desired.
Press ENTER key	Access diagnostic information.	STOP FREQ REF LOCAL 2.00 HZ	.
Press DISP key	Display mode showing control temperature.	STOP CONTROL TEMP LOCAL 25.0° C	Displays operating temperature in degrees C.
Press DISP key	Display mode showing bus voltage.	STOP BUS VOLTAGE LOCAL 321V	
Press DISP key	Display mode showing bus Current.	STOP BUS CURRENT LOCAL 0.00A	
Press DISP key	Display mode showing PWM Frequency.	STOP PWM FREQ LOCAL 2497 HZ	
Press DISP key	Display mode showing % overload current remaining.	STOP OVRLD LEFT LOCAL 100.00%	
Press DISP key	Display mode showing opto inputs & outputs states.	DIGITAL I/O 000000000 1110	Opto Inputs states (Left); Opto Outputs states (Right).
Press DISP key	Display mode showing actual drive running time since last power up.	TIME FROM PWR UP 0000000.01.43	HR.MIN.SEC format.
Press DISP key	Display operating zone with rated HP and input voltage (for the operating zone) and control type.	1 HP STD CT 230V INVERTER	
Press DISP key	Display mode showing continuous amps; PK amps rating; amps/volt scale of feedback, power base ID.	X.XA X.XAPK X.XXA/V ID:XXX	
Press DISP key	Display mode showing which Group1 or 2 expansion boards are installed.	I NOT INSTALLED II NOT INSTALLED	
Press DISP key	Display mode showing software version and revision installed in the control.	SOFTWARE VERSION XXX-X.XX	
Press DISP key	Displays exit choice. Press ENTER to exit.	PRESS ENTER FOR DIAGNOSTIC EXIT	Press ENTER to exit diagnostic information.

How to Access the Fault Log When a fault condition occurs, motor operation stops and a fault code is displayed on the Keypad display. The control keeps a log of up to the last 31 faults. If more than 31 faults have occurred the oldest fault will be deleted from the fault log to make room for the newest fault. To access the fault log perform the following procedure:

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing Local mode voltage, current & frequency status.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	No faults present. Local keypad mode. If in remote/serial mode, press local for this display.
Press DISP key	Press DISP to scroll to the Fault Log entry point.	PRESS ENTER FOR FAULT LOG	
Press ENTER key	Display first fault type and time fault occurred.	EXTERNAL TRIP 1: 0:00:30	Typical display.
Press ▲ key	Scroll through fault messages.	PRESS ENTER FOR FAULT LOG EXIT	If no messages, the fault log exit choice is displayed.
Press RESET key	Return to display mode.	STOP FREQUENCY LOCAL 0.00 HZ	Display mode stop key LED is on.

How to Clear the Fault Log Use the following procedure to clear the fault log.

Action	Description	Display	Comments
Apply Power		BALDOR MOTORS & DRIVES	Logo display for 5 seconds.
	Display mode showing output frequency.	STP 0V 0 RPM LOC 0.0 A 0.0 HZ	Display mode.
Press DISP key	Press DISP to scroll to the Fault Log entry point.	PRESS ENTER FOR FAULT LOG	
Press ENTER key	Displays most recent message.	EXTERNAL TRIP 1: 00000:00:30	
Press SHIFT key		EXTERNAL TRIP 1: 00000:00:30	
Press RESET key		EXTERNAL TRIP 1: 00000:00:30	
Press SHIFT key		EXTERNAL TRIP 1: 00000:00:30	
Press ENTER key	Fault log is cleared.	FAULT LOG NO FAULTS	No faults in fault log.
Press ▲ or ▼ key	Scroll Fault Log Exit.	PRESS ENTER FOR FAULT LOG EXIT	
Press ENTER key	Return to display mode.	PRESS ENTER FOR DIAGNOSTIC INFO	

Table 5-1 Fault Messages

FAULT MESSAGE	DESCRIPTION
Invalid Base ID	Failure to determine control horsepower and input voltage configuration from the Power Base ID value in software.
NV Memory Fail	Failure to read or write to non-volatile memory.
Param Checksum	Parameter Checksum error detected.
Low INIT Bus V	Low bus voltage detected on startup.
HW Desaturation	High output current condition detected (greater than 400% of rated output current).
HW Surge Current	High output current condition detected (greater than 250% of rated output current).
HW Ground Fault	Ground Fault detected (output current leakage to ground).
HW Power Supply	Control Board power supply failure detected.
Hardware Protect	A general hardware fault was detected but cannot be isolated.
1 MIN Overload	Peak output current exceeded the 1 minute rating value.
3 SEC Overload	Peak output current exceeded the 3 second rating value.
Overcurrent	Continuous current limit exceeded.
BUS Overvoltage	High DC Bus voltage.
Bus Undervoltage	Low DC Bus voltage condition detected.
Heat Sink Temp	Control heatsink exceeded upper temperature limit.
External Trip	Connection between J4-16 and J4-17 is open.
New Base ID	Control board detected a change in the Power Base ID value in software.
REGEN RES Power	Excessive power dissipation required by Dynamic Brake Hardware.
Line REGEN	Fault in Line REGEN converter unit - Series 21H Line REGEN Inverter control.
EXB Selection	Expansion board not installed to support the selected Level 1 Input Block, Command Select parameter.
Torque Proving	Unbalanced current in the three phase motor leads.
Unknown FLT Code	Microprocessor detected a fault that is not identified in the fault code table.

Power Base ID

Table 5-2 Power Base ID - Series 15H

230VAC Catalog No.	Power Base ID			
	FIF10 / FIF40		FIF20 / FIF24	
	Bus Cur	Phase Cur	Bus Cur	Phase Cur
201–E	002	802	023	823
201–W	002	802	023	823
202–E	003	803	024	824
202–W	003	803	024	824
203–E	004	804	025	825
203–W	004	804	025	825
205–E	005	805	026	826
205–W	005	805	02A	82A
207–E	006	806	027	827
207–W	006	806	027	827
207L–E			001	801
210–E	007	807	028	828
210–W			028	828
210L–E			02B	82B
215–E	01A	81A	01A	81A
215–W			01A	81A
210L–ER	00C	80C		
215V	008	808		
215L	00A	80D		
220	011	811		
220L	00E	80E		
225	01D	81D		
225V	009	809		
225L	00F	80F		
230	013	813		
230V	016	816		
230L	017	817		
240	014	814		
240L	018	818		
250	015	815		
250V	00A	80A		
250L	01C	81C		
275	829			

460VAC Catalog No.	Power Base ID			
	FIF10 / FIF40		FIF20 / FIF24	
	Bus Cur	Phase Cur	Bus Cur	Phase Cur
401–E	202	A02	23B	A3B
401–W	202	A02	23B	A3B
402–E	203	A03	23C	A3C
402–W	203	A03	23C	A3C
403–E	204	A04	23D	A3D
403–W	204	A04	23D	A3D
405–E	205	A05	241	A41
405–W	205	A05	241	A41
407–E	206	A06	23E	A3E
407–W	206	A06	23E	A3E
407L–E			201	A01
410–E	207	A07	207	A07
410–W			207	A07
410L–E			23F	A3F
415–E	22C	A2C	242	A42
415–W			242	A42
410L–ER	208	A08		
415V	20E	A0E		
415L	20F	A0F		
420	211	A11		
420L	220	A20		
425	212	A12		
425V	20B	A0B		
425L	221	A21		
430	213	A13		
430V	20C	A0C		
430L	222	A22		
440	214	A14		
440L	223	A23		
450	215	A15		
450L	21C	A1C		
460	216	A16		
460V	20A	A0A		
460L	224	A24		
475	217	A17		
475L	21D	A1D		
4100	218	A18		
4100L		A2F		
4125L		A30		
4150		A9A		
4150V	219	A19		
4200		A9B		
4250		AA5		
4300		AAE		
4350		AA6		
4400		AA7		
4450		AA9		

575VAC Catalog No.	Power Base ID			
	FIF10 / FIF40		FIF20 / FIF24	
	Bus Cur	Phase Cur	Bus Cur	Phase Cur
501–E	602	E02	61A	E1A
501–W	602	E02	61A	E1A
502–E	603	E03	61B	EIB
502–W	603	E03	61B	EIB
503–E	604	E04	61C	E1C
503–W	604	E04	61C	E1C
505–E	605	E05	61D	E1D
505–W	605	E05	61D	E1D
507–E	606	E06	61E	E1E
507–W	606	E06	61E	E1E
510–E	607	E07	61F	E1F
510–W	607	E07	61F	E1F
515–E	608	E08	620	E20
515–W	608	E08	620	E20
510L				
515L				
520	611	E11		
520L	60B	EOB		
525	612	E12		
525L	60C	E0C		
530	613	E13		
530L	60D	E0D		
540	614	E14		
540L	60E	E0E		
550	615	E15		
550L	60F	E0F		
560	616	E16		
575	617	E17		
5100	618	E18		
5150		E1A		
5150V	619	E19		
5200		E2A		
5250		E3A		
5300		EA4		
5350		EA5		
5400		EA6		

Table 5-3 Troubleshooting

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
Command Select	Incorrect operating mode programmed.	Change Operating Mode in the Level 1 Input block to one that does not require the expansion board.
	Need expansion board.	Install the correct expansion board for selected operating mode.
Bus Overvoltage Trip or HW Overvoltage	Excessive dynamic braking power.	Check dynamic brake watt and resistance parameter values. Increase the DECEL time. Add external dynamic braking assemblies: RGA resistor kit or RBA transistor assembly.
	DECEL Rate set too low a value	Lengthen DECEL time. Add external dynamic braking resistors or module.
	Overhauling Motor load	Correct problem with motor load. Add external dynamic braking resistors or module.
	Dynamic brake wiring problem.	Check dynamic brake hardware wiring.
	Input voltage too high.	Verify proper AC line voltage. Use step down transformer if needed. Use line reactor to minimize spikes.
Bus Undervoltage	Input voltage too low.	Disconnect dynamic brake hardware and repeat operation. Verify proper AC line voltage. Use step up transformer if needed. Check power line disturbances (sags caused by start up of other equipment). Monitor power line fluctuations with date and time imprint to isolate power problem.
External Trip	Motor ventilation insufficient.	Clean motor air intake and exhaust. Check external blower for operation. Verify motor's internal fan is coupled securely.
	Motor draws excessive current.	Check motor for overloading. Verify proper sizing of control and motor.
	Volts/Hertz ratio is wrong.	Adjust the Volts/Hz parameter value. Adjust the Base Frequency. Adjust the Max Output Voltage.
	No thermostat connected.	Connect thermostat. Verify connection of all external trip circuits used with thermostat. Disable thermostat input at control.
	Poor thermostat connections.	Check thermostat connections.
	External trip parameter incorrect.	Verify connection of external trip circuit at J4-16. Set external trip parameter to "OFF" if no connection made at J4-16.
Hardware Protect	Fault duration too short to be identified.	Reset control. Check for proper grounding of power wiring and shielding of signal wiring. Replace control board.
Heatsink Temp	Motor Overloaded.	Correct motor loading. Verify proper sizing of control and motor.
	Ambient temperature too high.	Relocate control to cooler operating area. Add cooling fans or air conditioner to control cabinet.
	Control built in fans are ineffective or inoperative.	Verify fan operation. Remove debris from fan and heatsink surfaces. Replace fan or check fan wiring.

Table 5-3 Troubleshooting Continued

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
HW Desaturation	Accel/Decel rate set too quickly. Torque Boost set too high. Electrical noise in logic circuits. Motor overloaded.	Lengthen Accel/Decel rate. Reduce torque boost value. Check for proper grounding of power wiring and shielding of signal wiring. Verify proper sizing of control and motor or reduce motor load.
HW Power Supply	Power supply malfunctioned.	Check internal connections. Replace logic power board.
HW Ground Fault	Output current (motor current) leakage to ground.	Disconnect wiring between control and motor. Retry test. If GND FLT is cleared, reconnect motor leads and retry the test. Repair motor if internally shorted. Replace motor lead wire with low capacitance cable. If GND FLT remains, contact Baldor.
Invalid Base ID	Control does not recognize HP and Voltage configuration.	Press “RESET” key on keypad. If fault remains access ”Diagnostic Info” and compare reported ID number with Table 5-2. If different, call Baldor.
Line REGEN	Fault in Line REGEN Converter	Series 21H Line REGEN Inverter only.
Motor Will Not Start	Not enough starting torque.	Increase Current Limit setting.
	Motor overloaded.	Check for proper motor loading. Check couplings for binding. Verify proper sizing of control and motor.
	Control not in local mode of operation.	Place control in local mode.
	Motor may be commanded to run below minimum frequency setting.	Increase speed command or lower minimum frequency setting.
	Incorrect Command Select parameter.	Change Command Select parameter to match wiring at J4.
	Incorrect frequency command.	Verify control is receiving proper command signal at J4.
Motor Will Not Reach Maximum Speed	Max Frequency Limit set too low.	Adjust Max Frequency Limit parameter value.
	Motor overloaded.	Check for mechanical overload. If unloaded motor shaft does not rotate freely, check motor bearings.
	Improper speed command.	Verify control is receiving proper command signal at input terminals. Verify control is set to proper operating mode to receive your speed command.
	Speed potentiometer failure.	Replace potentiometer.
Motor Will Not Stop Rotation	MIN Output Speed parameter set too high.	Adjust MIN Output Speed parameter value.
	Improper speed command.	Verify control is receiving proper command signal at input terminals. Verify control is set to receive your speed command.
	Speed potentiometer failure.	Replace potentiometer.
Motor runs rough at low speed	Torque boost set too high.	Adjust torque boost parameter value.
	Misalignment of coupling.	Check motor/load coupling alignment.
	Faulty motor.	Replace with a Baldor Motor.

Table 5-3 Troubleshooting Continued

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
New Base ID	Replaced Control or circuit board.	Restore parameters to factory settings. Reset control.
No Display	Lack of input voltage.	Check input power for proper voltage.
	Loose connections.	Check input power termination. Verify connection of operator keypad.
	Adjust display contrast.	See Adjust Display Contrast in Sec. 4.
NV Memory Fail	Memory fault occurred.	Press “RESET” key on keypad. Restore parameter values to factory settings. If fault remains, call Baldor.
3 Sec Overload	Peak output current exceeded 3 sec rating.	Check PK Current Limit parameter in the Level 2 Output Limits block. Change Overload parameter In the Level 2 Protection block from Trip to Foldback. Check motor for overloading. Increase ACCEL time. Reduce motor load. Verify proper sizing of control and motor.
1 Min Overload	Peak output current exceeded 1 minute rating.	Check PK Current Limit parameter in the Level 2 Output Limits block. Change Overload parameter In the Level 2 Protection block from Trip to Foldback. Check motor for overloading. Increase ACCEL/DECEL times. Reduce motor load. Verify proper sizing of control and motor.
Over Speed	Motor exceeded 110% of MAX Speed parameter value.	Check Max Output Speed in the Level 2 Output Limits block. Increase Speed PROP Gain in the Level 1 block.
Param Checksum	Memory fault occurred.	Press “RESET” key on keypad. Restore parameter values to factory settings. If fault remains, call Baldor.
Regen RES Power	Incorrect dynamic brake parameter.	Check Resistor Ohms and Resistor Watts parameters in the Level 2 Brake Adjust block.
	Regen power exceeded dynamic brake resistor rating.	Add external dynamic braking assemblies: RGA resistor kit or RBA transistor assembly. Increase Decel Time.
Unknown Fault Code	Microprocessor detected a fault that is not defined in the fault code table.	Press “RESET” key on keypad. Restore parameter values to factory settings. If fault remains, call Baldor.
Unstable Speed	Oscillating load. Unstable input power. Slip compensation too high.	Correct motor load. Correct input power. Adjust slip compensation.

Electrical Noise Considerations

All electronic devices including the Series 15H Control is vulnerable to significant electronic interference signals (commonly called “Electrical Noise”). At the lowest level, noise can cause intermittent operating errors or faults. From a circuit standpoint, 5 or 10 millivolts of noise may cause detrimental operation. For example, analog speed and torque inputs are often scaled at 5 to 10 VDC maximum with a typical resolution of one part in 1,000. Thus noise of only 5 mv represents a substantial error.

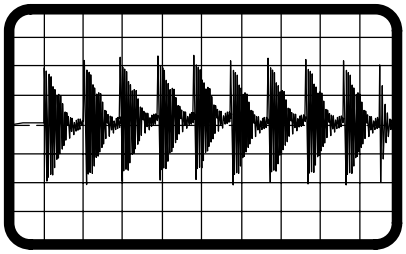
At the extreme level, significant noise can cause damage to the drive. Therefore, it is advisable to prevent noise generation and to follow wiring practices that prevent noise generated by other devices from reaching sensitive circuits. In a control, such circuits include inputs for speed, torque, control logic, and speed and position feedback, plus outputs to some indicators and computers.

Causes and Cures

Unwanted electrical noise can be produced by many sources. Depending upon the source, various methods can be used to reduce the effects of this noise and to reduce the coupling to sensitive circuits. All methods are less costly when designed into a system initially than if added after installation.

Figure 5-1 shows an oscilloscope trace of noise induced in a 1–ft. wire next to lead for size 2 contactor coil as the coil circuit is opened. Scope is set at 20 V/div. (vert.) and 1 µSec/div. (horiz). Max peak voltage is voltage is over 40 V. Scope input impedance is 10KΩ for all scope traces.

Figure 5-1 Electrical Noise Display

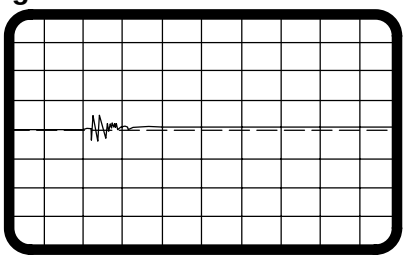


Relay and Contactor Coils

Among the most common sources of noise are the ever–present coils of contactors and relays. When these highly inductive coil circuits are opened, transient conditions often generate spikes of several hundred volts in the control circuit. These spikes can induce several volts of noise in an adjacent wire that runs parallel to a control–circuit wire.

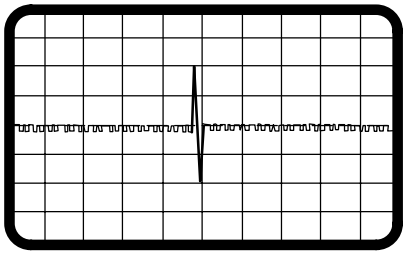
To suppress these noise generators, add an R–C snubber across each relay and contactor coil. A snubber consisting of a 33KΩ resistor in series with a 0.47µf capacitor usually works well. The snubber reduces the rate of rise and peak voltage in the coil when current flow is interrupted. This eliminates arcing and reduces the noise voltage induced in adjacent wires. In our example, the noise was reduced from over 40 V zero–to–peak (V0P) to about 16 V0P. Unless well filtered, this is often enough to turn a productive machine into scrap. Therefore, electrical noise must be prevented by using snubbers and twisted–pair shielded cable for sensitive circuits that are adjacent to coil wires. (See also, “Wiring Practices” later in this chapter).

Figure 5-2 R-C Snubber Circuit



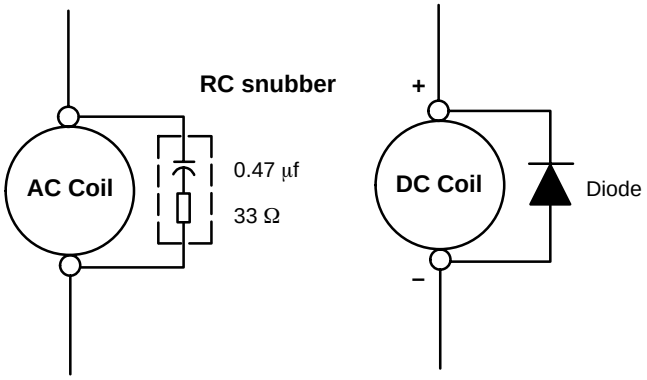
Combining an R-C snubber and twisted pair shielded cable keeps the voltage in a circuit to less than 2 V for a fraction of a millisecond. The waveform shown in Figure 5-3 in addition to the snubber across the coil, the adjacent wire is grounded in a twisted–pair, shielded cable. Note that the vertical scale is 1 V/div., rather than the 20 V/div. in figures 5-1 and 5-2.

Figure 5-3 R-C Snubber Circuit & Twisted Pair



A reverse biased diode across a DC coil achieves the same result as adding an R–C snubber across an AC coil, Figure 5-4.

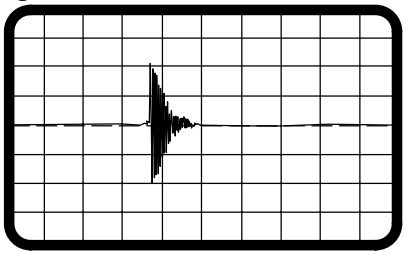
Figure 5-4 Diode with DC Coil



Wires between Controls and Motors

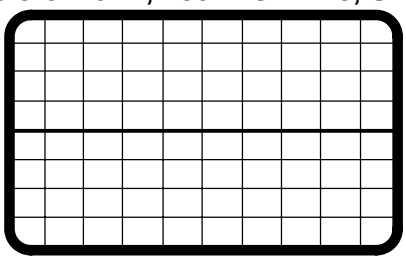
Output leads from a typical 460 VAC drive controller contain rapid voltage rises created by power semiconductors switching 650V in less than a microsecond, 1,000 to 10,000 times a second. These noise signals can couple into sensitive drive circuits as shown in Figure 5-5. For this waveform, a transient is induced in 1 ft. of wire adjacent to motor lead of a 10 hp, 460 VAC drive. Scope is set at 5 V/div. and 2 µsec/div.

Figure 5-5 10HP, 460VAC Drive



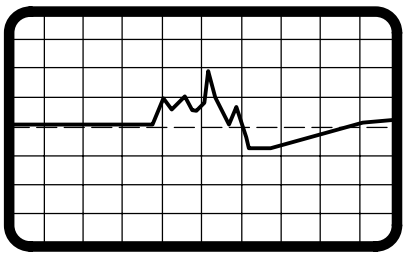
If the shielded pair cable is used, the coupling is reduced by nearly 90%, Figure 5-6.

Figure 5-6 10HP, 460VAC Drive, Shielded



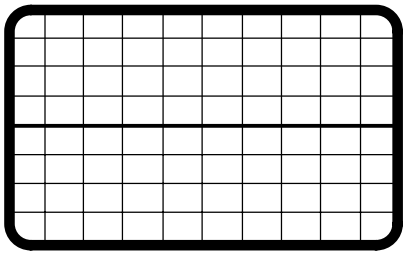
The motor leads of DC motors contain similar voltage transients. The switching rate is about 360 times a second. These noise transients can produce about 2V of noise induced in a wire adjacent to the motor lead. A 30HP, 500VDC Drive, as shown in Figure 5-7. Scope is set at 1 V/div. and 5 µsec/div.

Figure 5-7 30HP, 500VDC Drive



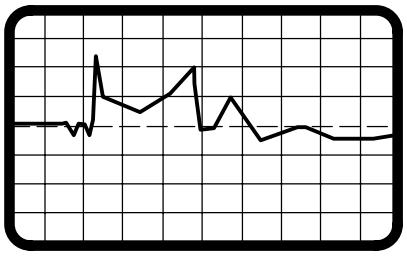
Again, replacing a single wire with a shielded pair cable reduces the induced noise to less than 0.3 V, Figure 5-8.

Figure 5-8 30HP, 500VDC Drive, Shielded



Even input AC power lines contain noise and can induce noise in adjacent wires. This is especially severe with SCR controlled DC drives, current–source and six–step inverters. Figure 5-9 shows a transient induced in 1–ft. wire adjacent to AC input power wire to 30 hp, DC drive. Scope is set at 500 mV/div. and 2µsec/div.

Figure 5-9 30HP, 500VDC Drive, Shielded



To prevent induced transient noise in signal wires, all motor leads and AC power lines should be contained in rigid metal conduit, or flexible conduit. The conduit should be grounded to form a shield to contain the electrical noise within the conduit path. Signal wires - even ones in shielded cable should never be placed in the conduit with motor power wires.

If flexible conduit is required, the wires should be shielded twisted pair. Although this practice gives better protection than unshielded wires, it lacks the protection offered by rigid metal conduit.

Special Drive Situations

For severe noise situations, it may be necessary to reduce transient voltages in the wires to the motor by adding load reactors. Load reactors are installed between the control and motor. This addition is often required where a motor housing lacks the necessary shielding (typically linear motors mounted directly to machine frames) or where the power wires to motors are contained in flexible cables.

Reactors are typically 3% reactance and are designed for the frequencies encountered in PWM drives. These reactors also reduce ripple current in the motor windings and often improve motor life. For maximum benefit, the reactors should be mounted in the drive enclosure with short leads between the control and the reactors. Reactors are available from Baldor.

Drive Power Lines

The same type of reactor as installed on the load side of the control can also suppress transients on incoming power lines. Connected on the line side of the drive, the reactor protects the adjustable–speed drive from some transients generated by other equipment and suppresses some of the transients produced by the drive itself.

Radio Transmitters

Not a common cause of noise, radio frequency transmitters, such as commercial broadcast stations, fixed short–wave stations, and mobile communications equipment (including walkie talkies) create electrical noise. The probability of this noise affecting an adjustable–speed drive increases with the use of open control enclosures, open wiring, and poor grounding .

Control Enclosures

The cure for some electrical noise may be a grounded metallic control enclosure. The enclosure should be grounded to the building ground with a short, heavy gauge wire. Also, the power conduit, motor lead conduit and signal wire conduit must be grounded to the enclosure. Sometimes paint and seals prevent electrical contact between conduit and the cabinet. Sometimes wire or straps are used to ensure good electrical grounding.

Special Motor Considerations

Motor frames are also on the required grounding list. As with control enclosures, motors should be grounded directly to plant ground with as short a ground wire as possible. Here's why. Capacitive coupling within the motor windings produces transient voltages between the motor frame and ground. The severity of these voltages increases with the length of the ground wire. Installations with the motor and control mounted on a common frame, and with heavy ground wires less than 10 ft. long, rarely have a problem caused by these motor–generated transient voltages.

Wiring Practices

The type of wire used and how it is installed for specific applications makes the difference between obtaining reliable operation and creating additional problems.

Power Wiring

Conductors carrying power to anything (motor, heater, brake coil, or lighting units, for example) should be contained in conductive conduit that is grounded at both ends. These power wires must be routed in conduit separately from signal and control wiring.

Control–logic Conductors

Typically, operator's controls (push buttons and switches), relay contacts, limit switches, PLC I/O's, operator displays, and relay and contactor coils operate at 115VAC or 24VDC. Although these devices usually operate at low current levels, they contain switching noise caused by contact open/closure and solid–state switch operations. Therefore, these wires should be routed away from sensitive signal wires and contained within conduits or bundled away from open power and signal wires.

Analog Signal Wires

Analog signals generally originate from speed and torque controls, plus DC tachometers and process controllers. Reliability is often improved by the following noise reduction techniques:

- Use twisted pair shielded wires with the shield grounded at the drive end only.
- Route analog signal wires away from power or control wires (all other wiring types).
- Cross power and control wires at right angles to minimize inductive noise coupling.

Serial Communication Conductors

Standard serial communication cables are usually made with a shield that is connected to the connector shell at both ends. This usually grounds the data source to the grounded drive chassis. If the data source is floating, such a connection offers good data transmission. However, if the data source is grounded, adding a heavy ground wire (#14 or larger) in parallel with the communication cable between the source and the drive chassis usually reduces noise problems.

Optical Isolation

Isolating electrical circuits with some form of light transmission reduces the electrical noise that is transmitted from one part of a circuit to another. That is, an electrical signal is converted to a light signal that is transmitted to a light receiver. This converts the light back to an electrical signal that has less noise than the input. Two methods are commonly used; optical couplers and fiber optics.

Optical Couplers

The common term for optical couplers, opto couplers use a light transmitter and light receiver in the same unit to transmit data while electrically isolating two circuits. This isolation rejects some noise. The magnitude of noise rejection is usually specified by the "common mode rejection, dv/dt rating". Typically, low cost opto couplers have a common mode rejection of 100 to 500 V/μ sec, which is adequate for most control logic signals. High performance opto couplers with common mode ratings up to 5,000 V/μ sec are installed for the most severe noise environments.

Fiber Optics

Special plastic fiber stands transmit light over long as well as short distances. Because the fibers are immune to electromagnetic energy, the use of fiber optic bundles eliminate the problem of coupling noise into such circuits. These noise–free fiber optic cables can be run with power or motor conductors because noise cannot be inductively or capacitively coupled into the fiber optic stands.

Plant Ground

Connecting electrical equipment to a good ground is essential for safety and reliable operation. In many cases, what is perceived as a ground isn't. Result: equipment malfunctions or electrical shock hazard.

It may be necessary to retain the services of an electrical consultant, who is also a licensed professional engineer experienced in grounding practices to make the necessary measurements to establish if the plant ground is really grounded.

Section 6
Specifications and Product Data

Specifications:

Horsepower	1-50 HP @ 230VAC 1-500 HP @ 460VAC 1-150 HP @ 575VAC	
Input Frequency	50/60 HZ ± 5%	
Output Voltage	0 to Maximum Input VAC	
Output Current	See Ratings Table	
Output Frequency	0 to 120 Hz or 0 to 400 Hz (jumper selectable)	
Service Factor	1.0	
Duty	Continuous	
Overload Capacity	Constant Torque Mode:	170-200% for 3 secs 150% for 60 secs
	Variable Torque Mode:	115% for 60 secs
Frequency Setting	Keypad, 0-5VDC, 0-10VDC, 4-20mA	
Frequency Setting Potentiometer	5KΩ or 10KΩ, 1/2 Watt	
Rated Storage Temperature:	– 30°C to +65°C	

Operating Conditions:

Voltage Range:	230 VAC Models	180-264 VAC 3Ø 60 Hz/180-230 VAC 3Ø 50 Hz
	460 VAC Models	340-528 VAC 3Ø 60 Hz/340-460 VAC 3Ø 50 Hz
	575 VAC Models	495-660 VAC 3Ø 60 Hz
Input Line Impedance:	3% Minimum Required	
Ambient Operating Temperature:	0 to +40°C Derate Output 2% per °C over 40°C to 55°C (130°F) Maximum	
Enclosure:	NEMA 1:	E and EO (suffix) Models
	NEMA 4X Indoor:	W (suffix) Models
Humidity:	NEMA 1:	To 90% RH non-condensing
	NEMA 4X Indoor:	To 100% RH condensing
Altitude:	Sea level to 3300 feet (1000 meters) Derate 2% per 1000 feet (303 meters) above 3300 feet	

Keypad Display:

Display	Backlit LCD Alphanumeric 2 Lines x 16 Characters
Keys	Membrane keypad with tactile response
Functions	Output status monitoring Digital speed control Parameter setting and display Fault log display Motor run and jog Local/Remote
LED Indicators	Forward run command Reverse run command Stop command Jog active
Remote Mount	100 feet Maximum from control

Control Specifications:

Control Method	Sinewave Carrier input, PWM output
Frequency Accuracy	0.01Hz Digital 0.05 % Analog
Frequency Resolution	0.01 Hz Digital 0.5% Analog
Carrier Frequency	1KHz to15KHz adjustable 2.5KHz Standard 8.0KHz Quiet
Transistor Type	IGBT (Insulated Gate Bipolar Transistor)
Transistor Rise Time	2500 V/μsec. (dv/dt)
Torque Boost	Automatic adjustment to load (Standard) 0 to 15% of input voltage (Manual)
Volts/Hertz Pattern	Linear, Squared Reduced, Three Point
Accel/Decel Time	0 to 3600 sec. for 2 assignable plus JOG
S-Curve Time	0 to 100%
Base Frequency	10 to 400 Hz
Regenerative Braking Torque	20% Minimum (–E, –W) 100% with optional external braking resistor (–EO, –MO, –ER)
Jog Frequency	0 to Maximum frequency
Skip Frequency	0 to Maximum frequency in 3 zones.
Minimum Output Frequency	0 to Maximum frequency
Maximum Output Frequency	0 to Maximum frequency
Auto Restart	Manual or Automatic
Slip Compensation	0 to 6Hz
Operating modes	Keypad Standard Run 15 Speed Fan Pump 2Wire Fan Pump 3Wire Serial Process CTRL 3SPD ANA 2WIRE 3SPD ANA 3WIRE EPOT – 2WIRE EPOT – 3WIRE

Analog Inputs: (2 Inputs)

Potentiometer Input	0 - 10VDC
Differential Input Full Scale Range	0-5VDC, 0-10VDC, 4-20mA
Differential Input Common Mode Rejection	40db
Input Impedance	20 KΩ

Analog Outputs: (2 Outputs)

Analog Outputs	2 Assignable
Full Scale Range	0 to 5 VDC Nominal (0 to 8VDC Maximum)
Source Current	1 mA maximum
Resolution	8 bits
Output Conditions	7 conditions plus calibration (see parameter table)

Digital Inputs: (9 Inputs)

Opto-isolated Logic Inputs	9 Assignable
Rated Voltage	10 - 30VDC
Input Impedance (Opto-Isolated Logic Inputs)	6.8KΩ (Closed contacts standard)
Leakage Current (Opto-Isolated inputs OFF)	10μA Maximum

Digital Outputs: (4 Outputs)

Opto-isolated Logic Outputs	4 Assignable
Rated Voltage	5 to 30VDC
Maximum Current	60 mA Maximum
ON Voltage Drop	2 VDC Maximum
OFF Leakage Current	0.1 μA Maximum
Output Conditions	9 Conditions (see parameter table)

Diagnostic Indications:

Invalid Base ID
NV Memory Fail
Param Checksum
New Base ID
HW Desaturation
HW Ground Fault
HW Power Supply
Hardware Protect
1 Min Overload
3 Sec Overload
Bus Overvoltage
Bus Undervoltage
Heat Sink Temp
External Trip
REGEN Res Power
Line REGEN
Command Select
Unknown FLT Code

Note: All specifications are subject to change without notice.

Ratings Series 15H Stock Products

CATALOG NO.	INPUT VOLT	SIZE	STANDARD 2.5 kHz PWM								QUIET 8.0 kHz PWM							
			CONSTANT TORQUE				VARIABLE TORQUE				CONSTANT TORQUE				VARIABLE TORQUE			
			HP	KW	IC	IP	HP	KW	IC	IP	HP	KW	IC	IP	HP	KW	IC	IP
ID15H201–E, –W	230	A	1	0.75	4.0	8.0	2	1.5	6.8	7.8	0.75	0.56	3.0	6.0	1	0.75	3.6	4.2
ID15H202–E, –W	230	A	2	1.5	7.0	14	3	2.2	9.6	11	1	0.75	4.0	8.0	2	1.5	6.8	7.8
ID15H203–E, –W	230	A	3	2.2	10	20	5	3.7	16	19	2	1.5	7.0	14	3	2.2	9.6	11
ID15H205–E	230	A	5	3.7	16	32	7.5	5.5	22	25	3	2.2	10	20	5	3.7	16	19
ID15H205–W	230	B	5	3.7	16	32	7.5	5.5	22	25	3	2.2	10	20	5	3.7	16	19
ID15H207–E, –W	230	B	7.5	5.5	22	44	10	7.4	28	32	5	3.7	16	32	7.5	5.5	22	25
ID15H210–E	230	B	10	7.4	28	56	15	11.1	42	48	7.5	5.5	22	44	10	7.4	28	32
ID15H210–W	230	B	10	7.4	28	56	15	11.1	42	48	7.5	5.5	22	44	10	7.4	28	32
ID15H215–E	230	B	15	11.1	42	84	15	11.1	42	48	10	7.4	28	56	15	11.1	42	48
ID15H215–W	230	B	15	11.1	42	84	15	11.1	42	48	10	7.4	28	56	15	11.1	42	48
ID15H215–EO	230	C	15	11.1	42	72	20	14.9	54	62	10	7.4	30	61	15	11.1	42	48
ID15H220–EO	230	C	20	14.9	55	100	25	18.6	68	78	15	11.1	42	92	20	14.9	54	62
ID15H225–EO	230	C	25	18.6	68	116	30	22.3	80	92	20	14.9	54	92	25	18.6	68	78
ID15H230–EO	230	C	30	22.3	80	140	40	29.8	104	120	25	18.6	70	122	30	22.3	80	92
ID15H230V–EO	230	C	30	22.3	80	200	40	29.8	104	120	30	22.3	80	183	40	29.8	104	120
ID15H240–MO	230	D	40	29.8	105	200	50	37.2	130	150	30	22.3	80	160	40	29.8	104	120
ID15H250–MO	230	D	50	37.2	130	225	50	37.2	130	150	40	29.8	105	183	50	37.2	130	150
ID15H250V–MO	230	D	50	37.2	130	260	50	37.2	130	150	50	37.2	130	244	50	37.2	130	150
ID15H401–E, –W	460	A	1	0.75	2.0	4.0	2	1.5	4.0	5.0	0.75	0.56	1.5	3.0	1	0.75	2.0	3.0
ID15H402–E, –W	460	A	2	1.5	4.0	8.0	3	2.2	5.0	6.0	1	0.75	2.0	4.0	2	1.5	4.0	5.0
ID15H403–E, –W	460	A	3	2.2	5.0	10	5	3.7	8.0	10	2	1.5	4.0	8.0	3	2.2	5.0	6.0
ID15H405–E, –W	460	A	5	3.7	8.0	16	7.5	5.5	11	13	3	2.2	5.0	10	5	3.7	8.0	10
ID15H407–E	460	A	7.5	5.5	11	22	10	7.4	14	17	5	3.7	8.0	16	7.5	5.5	11	13
ID15H407–W	460	B	7.5	5.5	11	22	10	7.4	14	17	5	3.7	8.0	16	7.5	5.5	11	13
ID15H410–E, –W	460	B	10	7.4	14	28	15	11.1	21	25	7.5	5.5	11	22	10	7.4	14	17
ID15H415–E	460	B	15	11.1	21	42	20	14.9	27	31	10	7.4	15	30	15	11.1	21	25
ID15H415–W	460	B	15	11.1	21	42	20	14.9	27	31	10	7.4	15	30	15	11.1	21	25
ID15H415–EO	460	C	15	11.1	21	36	20	14.9	27	31	10	7.4	15	30	15	11.1	21	24
ID15H420–EO	460	C	20	14.9	27	54	25	18.6	34	39	15	11.1	21	46	20	14.9	27	31
ID15H425–EO	460	C	25	18.6	34	58	30	22.3	40	46	20	14.9	27	46	25	18.6	34	39
ID15H430–EO	460	C	30	22.3	40	70	40	29.8	52	60	25	18.6	35	61	30	22.3	40	46
ID15H430V–EO	460	C	30	22.3	40	100	40	29.8	52	60	30	22.3	40	92	30	22.3	40	46
ID15H440–EO	460	D	40	29.8	55	100	50	37.2	65	75	30	22.3	40	80	40	29.8	52	60
ID15H450–EO	460	D	50	37.2	65	115	60	44.8	80	92	40	29.8	55	92	50	37.2	65	75
ID15H460–EO	460	D	60	44.7	80	140	75	56	100	115	50	37.2	65	122	60	44.7	80	92
ID15H460V–EO	460	D	60	44.7	80	200	75	56	100	115	60	44.7	80	183	60	44.7	80	92
ID15H475–EO	460	E	75	56	100	200	100	75	125	144	60	44.7	80	160	75	56	100	115
ID15H4100–EO	460	E	100	75	125	220	125	93	160	184	75	56	100	183	100	75	125	144
ID15H4150V–EO	460	E	150	112	180	300	150	112	180	207	100	75	125	240	125	93	160	184
ID15H4150–EO	460	F	150	112	190	380	200	149	240	276	125	93	150	260	150	112	170	200
ID15H4200–EO	460	F	200	149	250	500	250	186.5	310	360	150	112	190	380	175	131	210	240
ID15H4250–EO	460	F	250	187	310	620	300	224	370	430	200	149	250	500	250	187	310	360
ID15H4300–EO	460	G	300	224	370	630	350	261	420	490								
ID15H4350–EO	460	G	350	261	420	720	400	298	480	560								
ID15H4400–EO	460	G	400	298	480	820	450	336	540	620								
ID15H4450–EO	460	G	450	336	540	920	500	373	590	680								
ID15H501–E	575	A	1	0.75	1.5	3.0	2.0	1.5	3.0	4.0	0.75	0.56	1.1	2.2	1	0.75	1.5	1.7
ID15H502–E	575	A	2	1.5	3.0	6.0	3	2.2	4.0	5.0	1	0.75	1.5	3.0	2	1.5	3.0	4.0
ID15H503–E	575	A	3	2.2	4.0	8.0	5	3.7	7.0	8.0	2	1.5	3.0	6.0	3	2.2	4.0	5.0
ID15H505–E	575	A	5	3.7	7.0	14	7.5	5.5	9.0	11	3	2.2	4.0	8.0	5	3.7	7.0	8.0
ID15H507–E	575	A	7.5	5.5	9.0	18	10	7.4	11	13	5	3.7	7.0	14	7.5	5.5	9	11
ID15H510–E	575	B	10	7.4	11	22	15	11.1	17	20	7.5	5.5	9	18	10	7.4	11	13
ID15H515–EO	575	B	15	11.1	17	34	20	14.9	22	26	10	7.4	11	22	15	11.1	17	20
ID15H520–EO	575	C	20	14.9	22	44	25	18.6	27	31	15	11.1	17	34	20	14.9	22	25
ID15H525–EO	575	C	25	18.6	27	46	30	22.3	32	37	20	14.9	22	38	25	18.6	27	31
ID15H530–EO	575	C	30	22.3	32	56	40	29.8	41	47	25	18.6	27	47	30	22.3	32	37
ID15H540–EO	575	D	40	29.8	41	75	50	37.2	52	60	30	22.3	32	58	40	29.8	41	47
ID15H550–EO	575	D	50	37.2	52	92	60	44.7	62	71	40	29.8	41	73	50	37.2	52	60
ID15H560–EO	575	D	60	44.7	62	109	60	44.7	62	71	50	37.2	52	91	60	44.7	62	71
ID15H575–EO	575	E	75	56	77	155	100	75	100	115								
ID15H5100–EO	575	E	100	75	100	200	125	93	125	145								
ID15H5150V–EO	575	E	150	112	145	260	150	112	145	166								

Note: –E, –EO= NEMA 1 Enclosure
–W= NEMA 4X Indoor Enclosure
–MO= Protected Chassis (not NEMA1)

Ratings Series 15H Custom (Non-Stock) High Peak Current Control with Internal DB Transistor

Specification NO.	INPUT VOLT	SIZE	STANDARD 2.5 kHz PWM								QUIET 8.0 kHz PWM							
			CONSTANT TORQUE				VARIABLE TORQUE				CONSTANT TORQUE				VARIABLE TORQUE			
			HP	KW	IC	IP	HP	KW	IC	IP	HP	KW	IC	IP	HP	KW	IC	IP
IN0001A00	230	C	10	7.4	32	72	15	11.1	42	48	7.5	5.5	24	61	15	11.1	42	48
IN0004A00	230	C	15	11.1	46	108	20	14.9	54	62	10	7.4	32	92	20	14.9	54	62
IN0009A00	230	C	20	14.9	60	140	20	14.9	54	62	15	11.1	48	122	20	14.9	54	62
IN0014A00	230	C	25	18.6	75	180	25	18.6	68	78	20	14.9	60	170	20	14.9	54	62
IN0019A00	230	C	30	22.3	90	210	40	29.8	104	120	25	18.6	75	190	30	22.3	80	92
IN0024A00	230	D	40	29.8	115	270	40	29.8	115	133	30	22.3	90	240	40	29.8	104	120
IN0036A00	460	C	10	7.4	16	36	15	11.1	21	24	7.5	5.5	12	30	15	11.1	21	24
IN0042A00	460	C	15	11.1	24	54	20	14.9	27	31	10	7.4	16	46	20	14.9	27	31
IN0049A00	460	C	20	14.9	30	70	20	14.9	27	31	15	11.1	24	61	20	14.9	27	31
IN0054A00	460	C	25	18.6	38	90	25	18.6	34	39	20	14.9	30	90	20	14.9	27	31
IN0061A00	460	C	30	22.3	45	108	40	29.8	52	60	25	18.6	37	95	30	22.3	40	46
IN0066A00	460	C	40	29.8	60	140	40	29.8	60	69	30	22.3	45	122	30	22.3	40	46
IN0069A00	460	D	50	37.2	75	190	60	44.7	80	92	40	29.8	60	170	50	37.2	65	75
IN0072A00	460	D	60	44.7	90	215	75	56	100	115	50	37.2	75	190	60	44.7	80	92
IN0076A00	460	E	75	56	110	270	100	74.6	125	144	60	44.7	90	240	75	56	100	115

Note: IN0076A00 uses external dynamic braking assembly –RBA, or RTA and RGA.

Note: See Section 6 for drawings and dimensions of controls listed in these rating charts.

Ratings Series 15H Custom (Non-Stock) Control with Internal DB Transistor

Specification NO.	INPUT VOLT	SIZE	STANDARD 2.5 kHz PWM								QUIET 8.0 kHz PWM							
			CONSTANT TORQUE				VARIABLE TORQUE				CONSTANT TORQUE				VARIABLE TORQUE			
			HP	KW	IC	IP	HP	KW	IC	IP	HP	KW	IC	IP	HP	KW	IC	IP
IN0006A00	230	C	10	7.4	30	52	15	11.1	42	48	7.5	5.5	22	44	10	7.4	28	32
IN0003A00	230	C	15	11.1	42	72	20	14.9	54	62	10	7.4	30	61	15	11.1	42	48
IN0008A00	230	C	20	14.9	55	100	25	18.6	68	78	15	11.1	42	92	20	14.9	54	62
IN0013A00	230	C	25	18.6	68	116	30	22.3	80	92	20	14.9	54	92	25	18.6	68	78
IN0018A00	230	C	30	22.3	80	140	40	29.8	104	120	25	18.6	70	122	30	22.3	80	92
IN0021A00	230	C	30	22.3	80	200	40	29.8	104	120	30	22.3	80	183	40	29.8	104	120
IN0026A00	230	D	40	29.8	105	200	50	37.2	130	150	30	22.3	80	160	40	29.8	104	120
IN0030A00	230	D	50	37.2	130	225	50	37.2	130	150	40	29.8	105	183	50	37.2	130	150
IN0034A00	230	D	50	37.2	130	260	50	37.2	130	150	50	37.2	130	244	50	37.2	130	150
IN0044A00	460	C	10	7.4	15	30	15	11.1	21	24	7.5	5.5	11	22	10	7.4	14	16
IN0041A00	460	C	15	11.1	21	36	20	14.9	27	31	10	7.4	15	30	15	11.1	21	24
IN0048A00	460	C	20	14.9	27	54	25	18.7	34	39	15	11.1	21	46	20	14.9	27	31
IN0053A00	460	C	25	18.6	34	58	30	22.3	40	46	20	14.9	27	46	25	18.6	34	39
IN0060A00	460	C	30	22.3	40	70	40	29.8	52	60	25	18.6	35	61	30	22.3	40	46
IN0063A00	460	C	30	22.3	40	100	40	29.8	52	60	30	22.3	40	92	30	22.3	40	46
IN0065A00	460	D	40	29.8	55	100	50	37.2	65	75	30	22.3	40	80	40	29.8	52	60
IN0068A00	460	D	50	37.2	65	115	60	44.8	80	92	40	29.8	55	92	50	37.2	65	75
IN0071A00	460	D	60	44.7	80	140	75	56	100	115	50	37.2	65	122	60	44.7	80	92
IN0074A00	460	D	60	44.7	80	200	75	56	100	115	60	44.7	80	183	60	44.7	80	92
IN0100A00	575	C	15	11.1	17	29	20	14.9	22	26	10	7.4	11	19	15	11.1	17	20
IN0102A00	575	C	20	14.9	22	44	25	18.6	27	31	15	11.1	17	34	20	14.9	22	25
IN0104A00	575	C	25	18.6	27	46	30	22.3	32	37	20	14.9	22	38	25	18.6	27	31
IN0106A00	575	C	30	22.3	32	56	40	29.8	41	47	25	18.6	27	47	30	22.3	32	37
IN0108A00	575	D	40	29.8	41	75	50	37.2	52	60	30	22.3	32	58	40	29.8	41	47
IN0110A00	575	D	50	37.2	52	92	60	44.7	62	71	40	29.8	41	73	50	37.2	52	60
IN0367A00	575	D	60	44.7	62	109	60	44.7	62	71	50	37.2	52	91	60	44.7	62	71

Terminal Tightening Torque Specifications

Table 6-4 Series 15H Stock Products

230 VAC Catalog No.	Tightening Torque									
	Power TB1		Ground		Control J4		B+/R1; B+; B–; or R2		D1/D2	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
ID15H201-E or W	8	0.9	15	1.7	4.5	0.5				
ID15H202-E or W	8	0.9	15	1.7	4.5	0.5				
ID15H203-E or W	8	0.9	15	1.7	4.5	0.5				
ID15H205-E	8	0.9	15	1.7	4.5	0.5				
ID15H205-W	20	2.5	20	2.3	4.5	0.5				
ID15H207-E or W	20	2.5	20	2.3	4.5	0.5				
ID15H210-E or W	20	2.5	20	2.3	4.5	0.5				
ID15H215V-EO	20	2.5	20	2.3	4.5	0.5	3.5	0.4	3.5	0.4
ID15H215- E, W or EO	20	2.5	20	2.3	4.5	0.5	3.5	0.4	3.5	0.4
ID15H220-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H225-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H230-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H230V-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H240-MO	140	15.8	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H250V-MO	140	15.8	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H250-MO	140	15.8	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4

Table 6-4 Series 15H Stock Products Continued

460 VAC Catalog No.	Tightening Torque									
	Power TB1		Ground		Control J4		B+/R1; B+; B–; or R2		D1/D2	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
ID15H401-E or W	8	0.9	15	1.7	4.5	0.5				
ID15H402-E or W	8	0.9	15	1.7	4.5	0.5				
ID15H403-E or W	8	0.9	15	1.7	4.5	0.5				
ID15H405-E	8	0.9	15	1.7	4.5	0.5				
ID15H405-W	20	2.5	20	2.3	4.5	0.5				
ID15H407-E or W	20	2.5	20	2.3	4.5	0.5				
ID15H410-E or W	20	2.5	20	2.3	4.5	0.5				
ID15H415V-EO	35	4	20	2.3	4.5	0.5				
ID15H415- E, W or EO	35	4	20	2.3	4.5	0.5				
ID15H420-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H425-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H430-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H430V-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H440-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H450-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H460-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H460V-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H475-EO	140	15.8	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4100-EO	75	8.5	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4150V-EO	75	8.5	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4150-EO	275	31	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4200-EO	275	31	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4250-EO	375	42	375	42	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4300-EO	375	42	375	42	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4350-EO	375	42	375	42	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4400-EO	375	42	375	42	4.5	0.5	3.5	0.4	3.5	0.4
ID15H4450-EO	375	42	375	42	4.5	0.5	3.5	0.4	3.5	0.4

Terminal Tightening Torque Specifications Continued

Table 6-4 Series 15H Stock Products Continued

575 VAC Catalog No.	Tightening Torque									
	Power TB1		Ground		Control J4		B+/R1; B+; B–; or R2		D1/D2	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
ID15H501-E	8	0.9	15	1.7	4.5	0.5				
ID15H502-E	8	0.9	15	1.7	4.5	0.5				
ID15H503-E	8	0.9	15	1.7	4.5	0.5				
ID15H505-E	8	0.9	15	1.7	4.5	0.5				
ID15H507-E	20	2.5	20	2.3	4.5	0.5				
ID15H510-E	20	2.5	20	2.3	4.5	0.5				
ID15H515-E	20	2.5	20	2.3	4.5	0.5				
ID15H520-EO	35	4	20	2.3	4.5	0.5	3.5	0.4		
ID15H525-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H530-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H540-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H550-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H560-EO	35	4	50	5.6	4.5	0.5	3.5	0.4	3.5	0.4
ID15H575-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H5100-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4
ID15H5150V-EO	22	2.5	22	2.5	4.5	0.5	3.5	0.4	3.5	0.4

Terminal Tightening Torque Specifications Continued

Table 6-5 Series 15H Custom Products (Non-Stock) Continued

230 VAC Specification No.	Tightening Torque					
	Power TB1		Ground		Control J4	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
IN0001A00	35	4	50	5.6	4.5	0.5
IN0003A00	35	4	50	5.6	4.5	0.5
IN0004A00	35	4	50	5.6	4.5	0.5
IN0008A00	22	2.5	22	2.5	4.5	0.5
IN0009A00	35	4	50	5.6	4.5	0.5
IN0013A00	22	2.5	22	2.5	4.5	0.5
IN0014A00	35	4	50	5.6	4.5	0.5
IN0018A00	22	2.5	22	2.5	4.5	0.5
IN0021A00	22	2.5	22	2.5	4.5	0.5
IN0019A00	22	2.5	22	2.5	4.5	0.5
IN0026A00	140	15.8	50	5.6	4.5	0.5
IN0024A00	140	15.8	50	5.6	4.5	0.5
IN0034A00	140	15.8	50	5.6	4.5	0.5
IN0030A00	140	15.8	22	2.5	4.5	0.5

Table 6-5 Series 15H Custom Products (Non-Stock) Continued

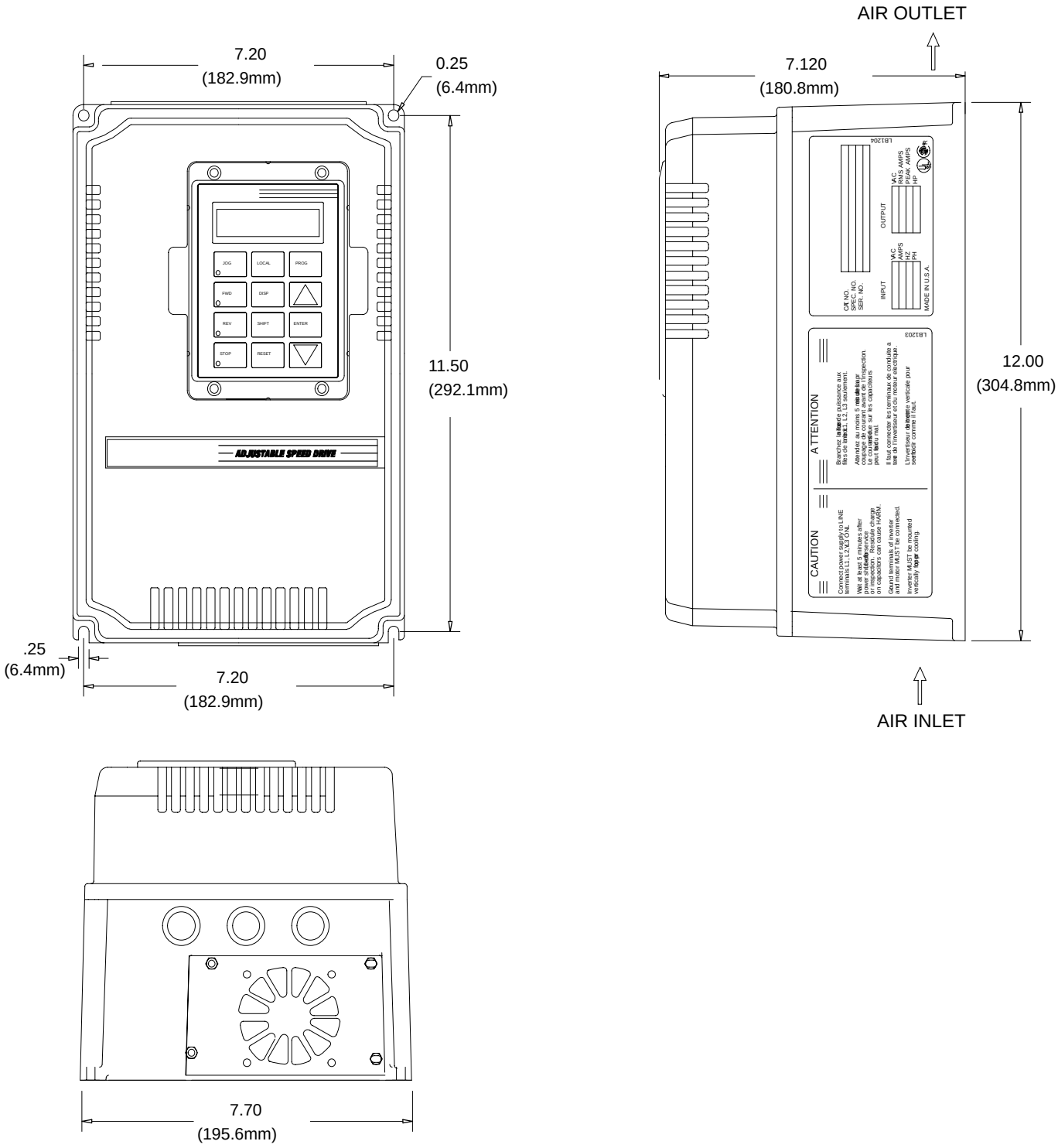
460 VAC Specification No.	Tightening Torque					
	Power TB1		Ground		Control J4	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
IN0036A00	35	4	50	5.6	4.5	0.5
IN0041A00	35	4	50	5.6	4.5	0.5
IN0042A00	35	4	50	5.6	4.5	0.5
IN0048A00	35	4	50	5.6	4.5	0.5
IN0049A00	35	4	50	5.6	4.5	0.5
IN0053A00	35	4	50	5.6	4.5	0.5
IN0054A00	35	4	50	5.6	4.5	0.5
IN0060A00	35	4	50	5.6	4.5	0.5
IN0063A00	35	4	50	5.6	4.5	0.5
IN0061A00	35	4	50	5.6	4.5	0.5
IN0065A00	22	2.5	22	2.5	4.5	0.5
IN0066A00	35	4	50	5.6	4.5	0.5
IN0068A00	22	2.5	22	2.5	4.5	0.5
IN0069A00	22	2.5	22	2.5	4.5	0.5
IN0071A00	22	2.5	22	2.5	4.5	0.5
IN0074A00	22	2.5	22	2.5	4.5	0.5
IN0072A00	22	2.5	22	2.5	4.5	0.5
IN0075A00	75	8.5	50	5.6	4.5	0.5

Table 6-5 Series 15H Custom Products (Non-Stock) Continued

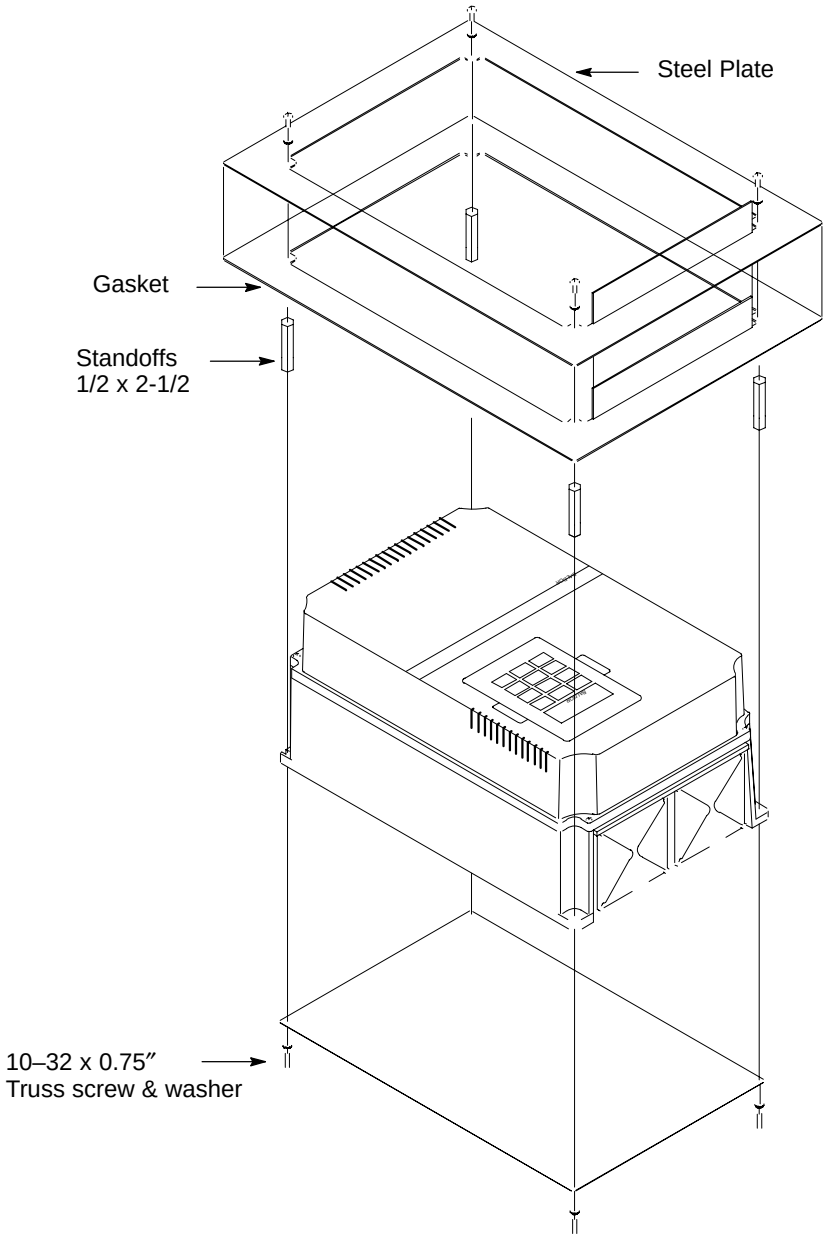
575 VAC Specification No.	Tightening Torque					
	Power TB1		Ground		Control J4	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
IN0100A00	35	4	50	5.6	4.5	0.5
IN0102A00	35	4	50	5.6	4.5	0.5
IN0104A00	35	4	50	5.6	4.5	0.5
IN0106A00	35	4	50	5.6	4.5	0.5
IN0108A00	35	4	50	5.6	4.5	0.5
IN0110A00	35	4	50	5.6	4.5	0.5
IN0367A00	35	4	50	5.6	4.5	0.5

Mounting Dimensions

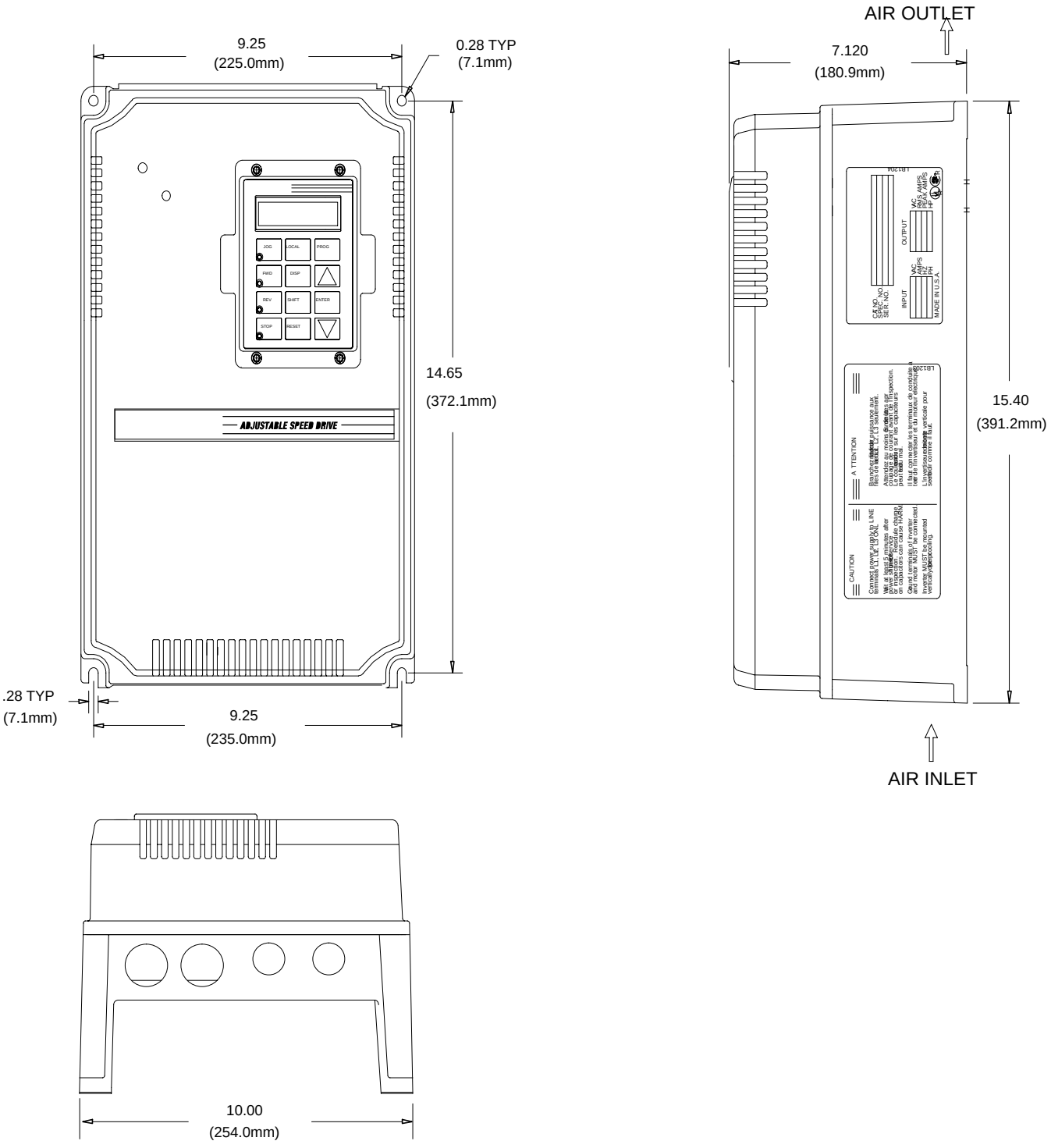
Size A Control



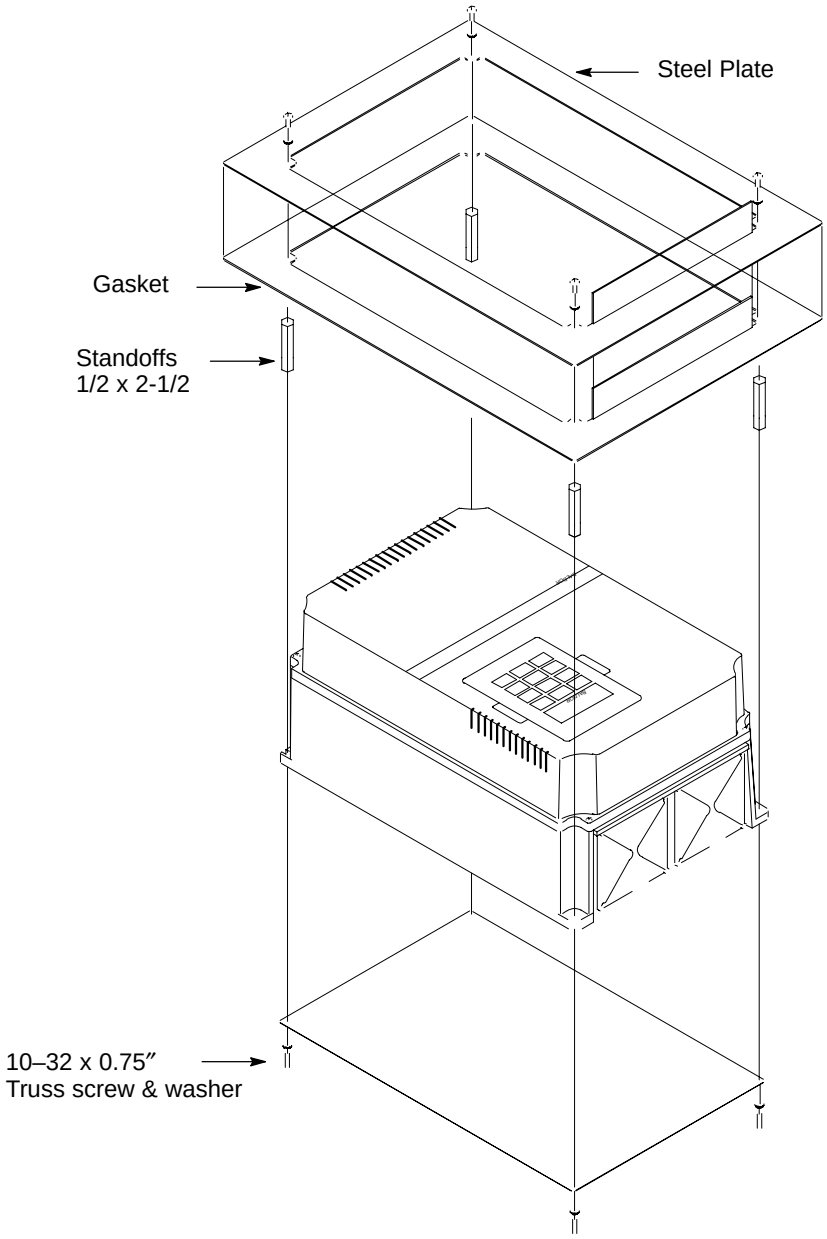
Size A Control – Through–Wall Mounting



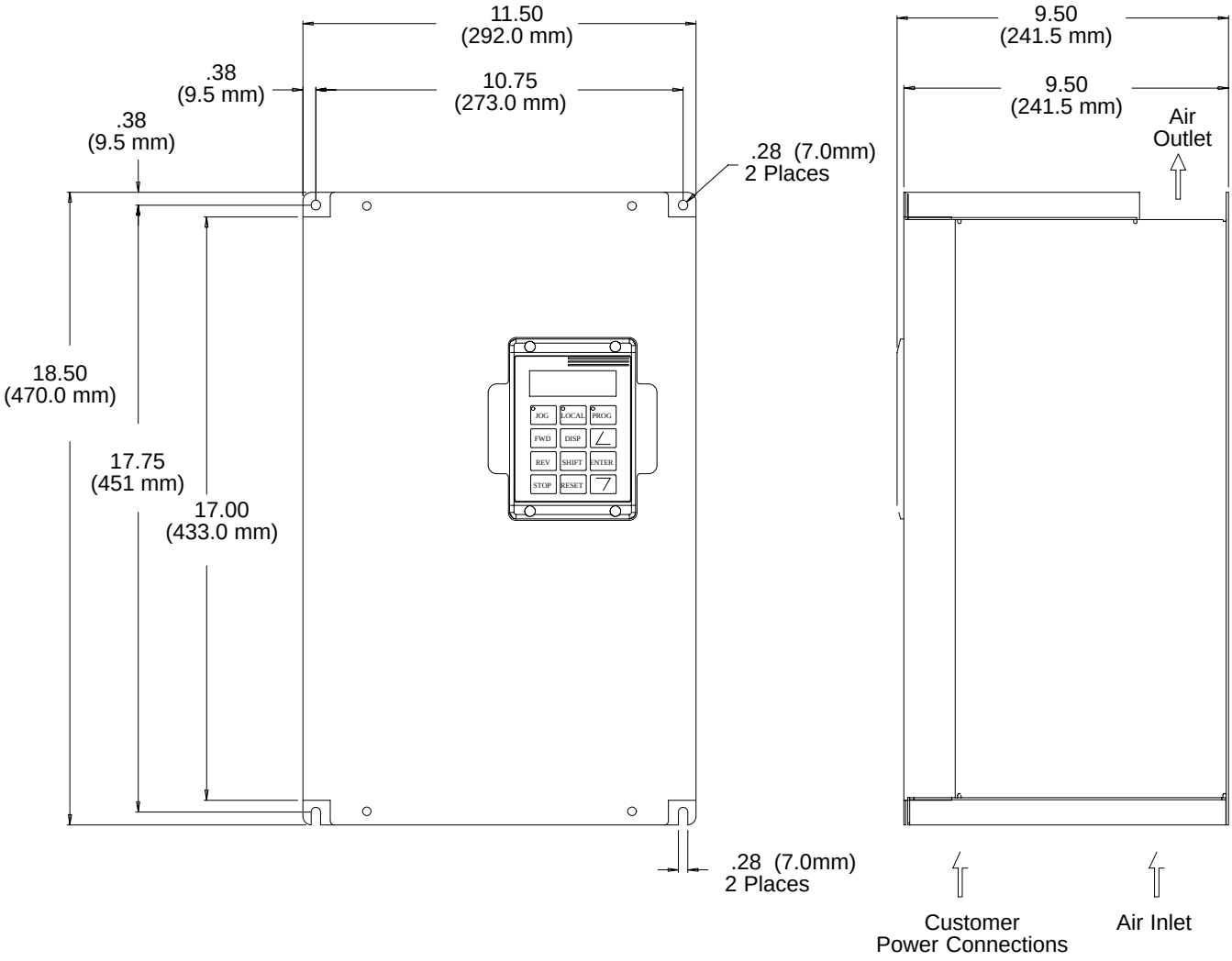
Size B Control

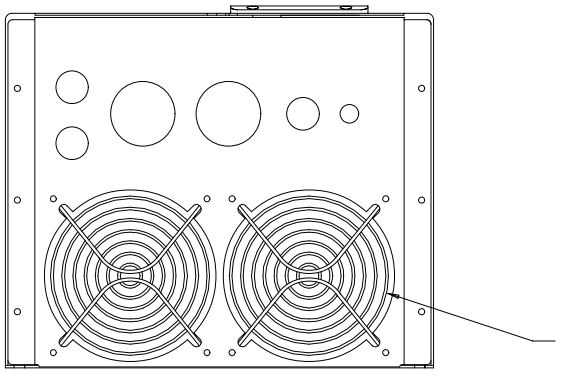


Size B Control – Through–Wall Mounting

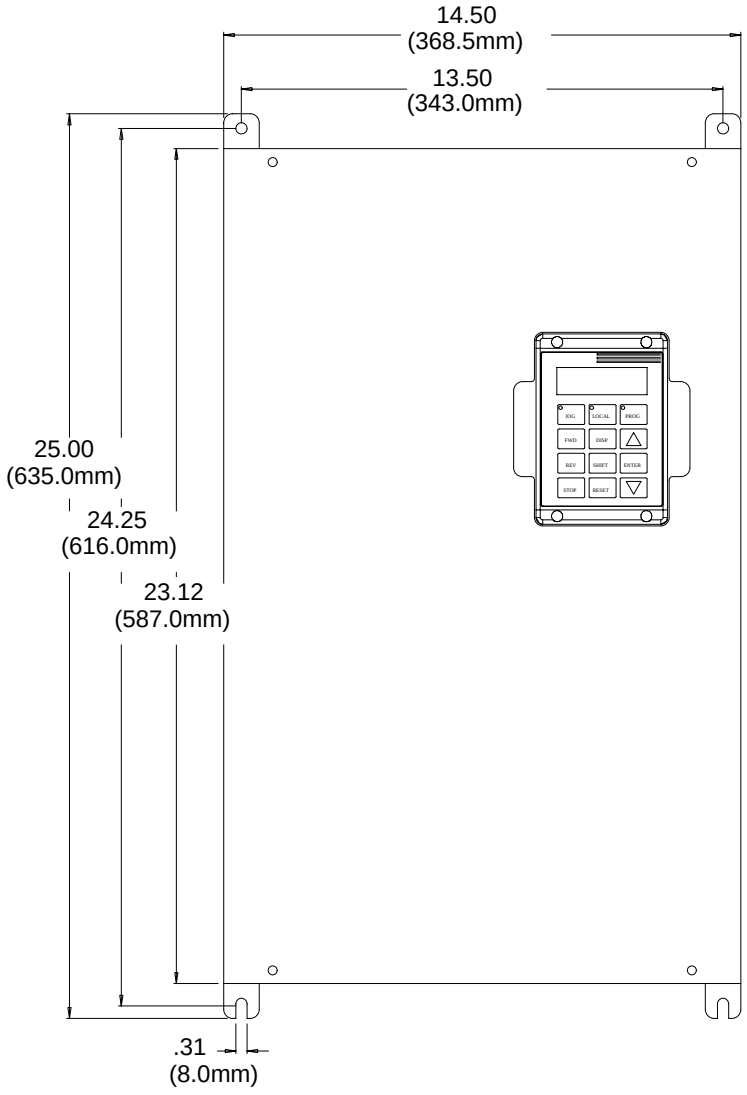


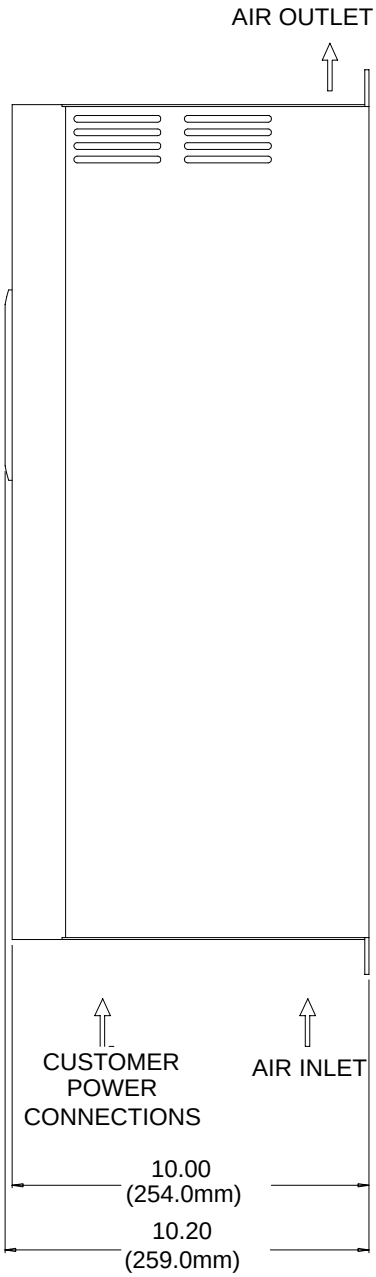
Size C Control

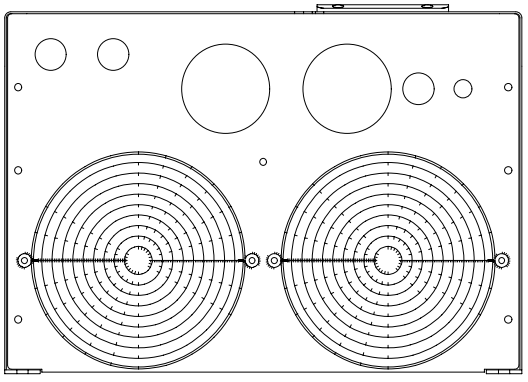




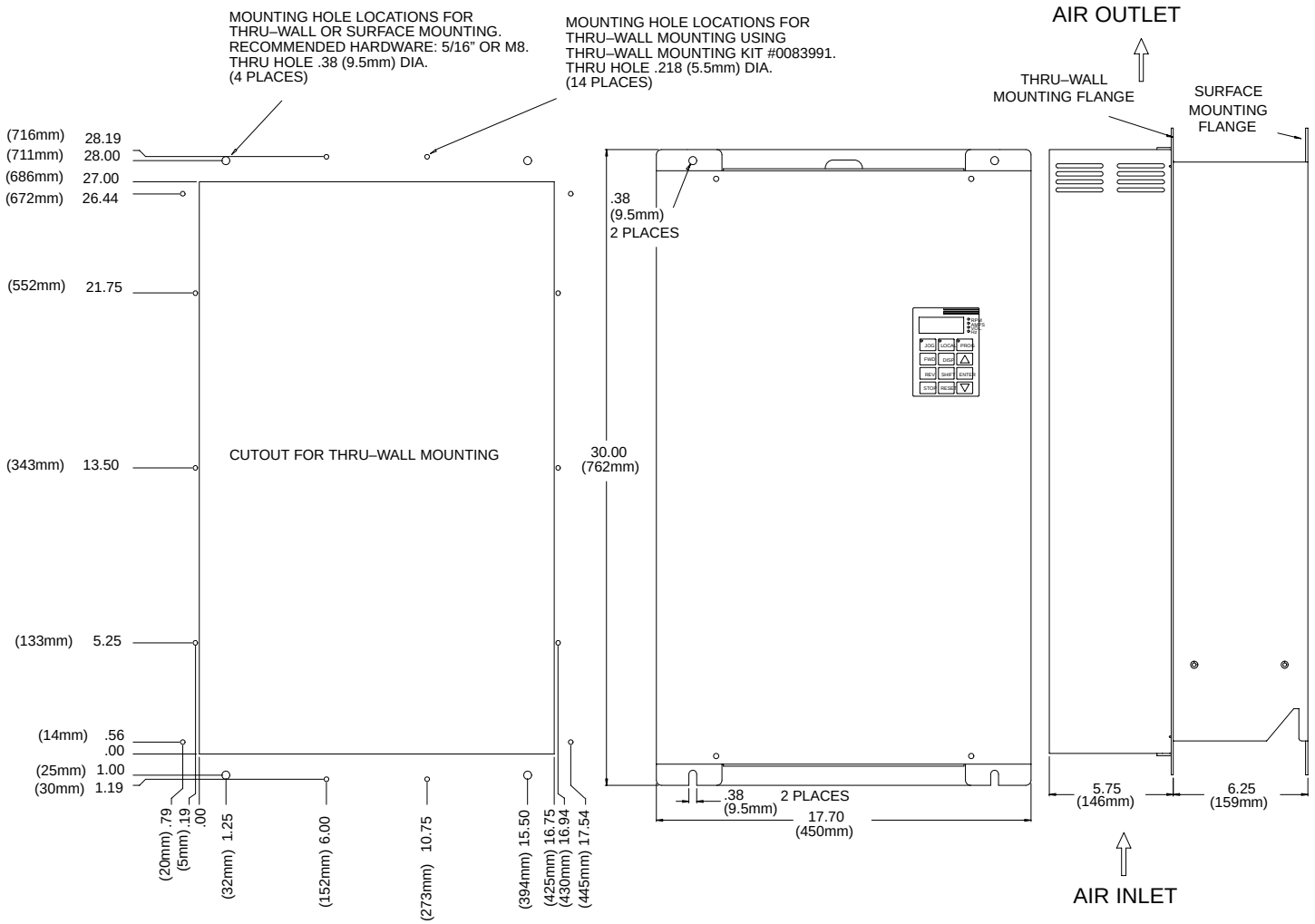
Size D Control



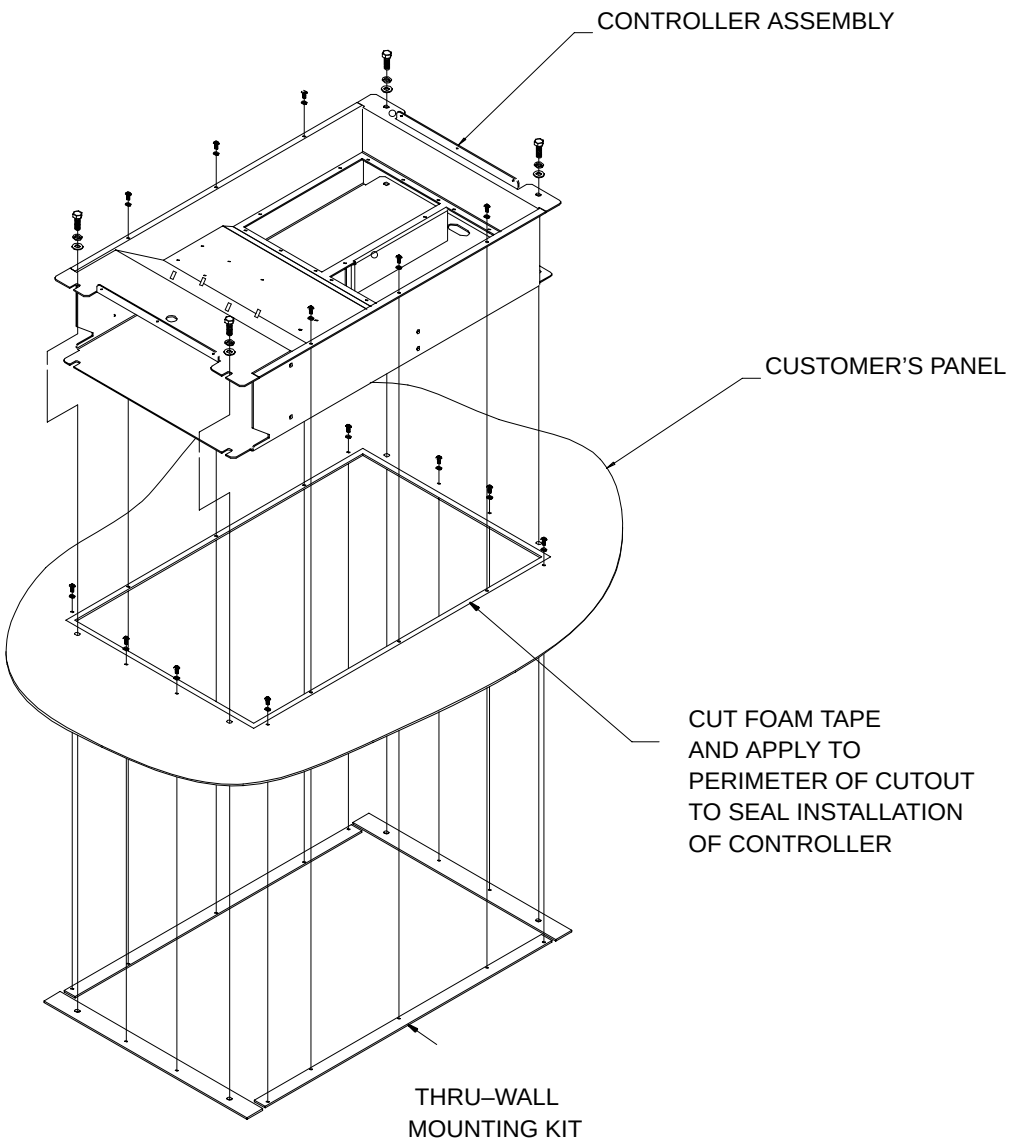




Size E Control



Size E Control – Through–Wall Mounting



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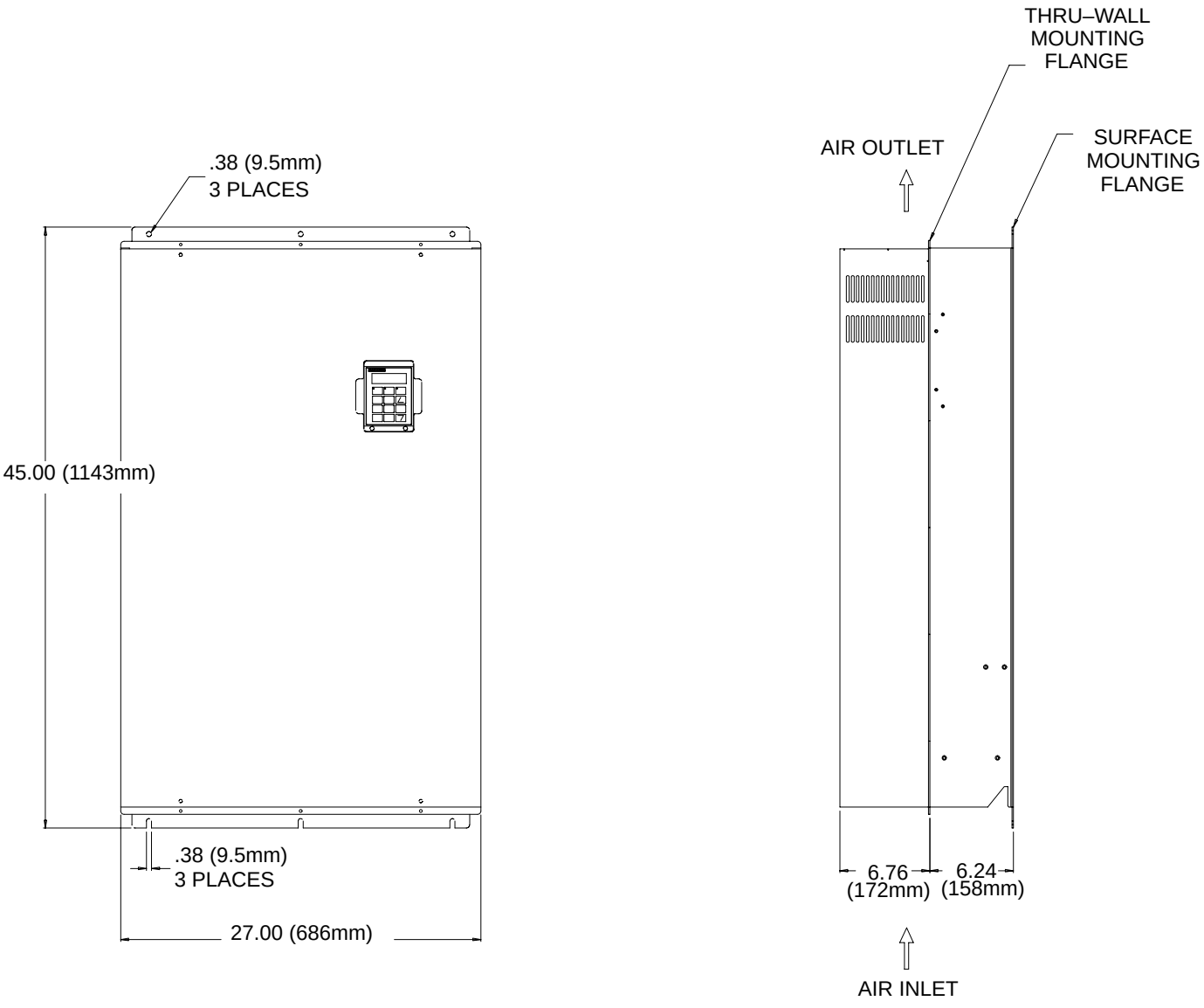

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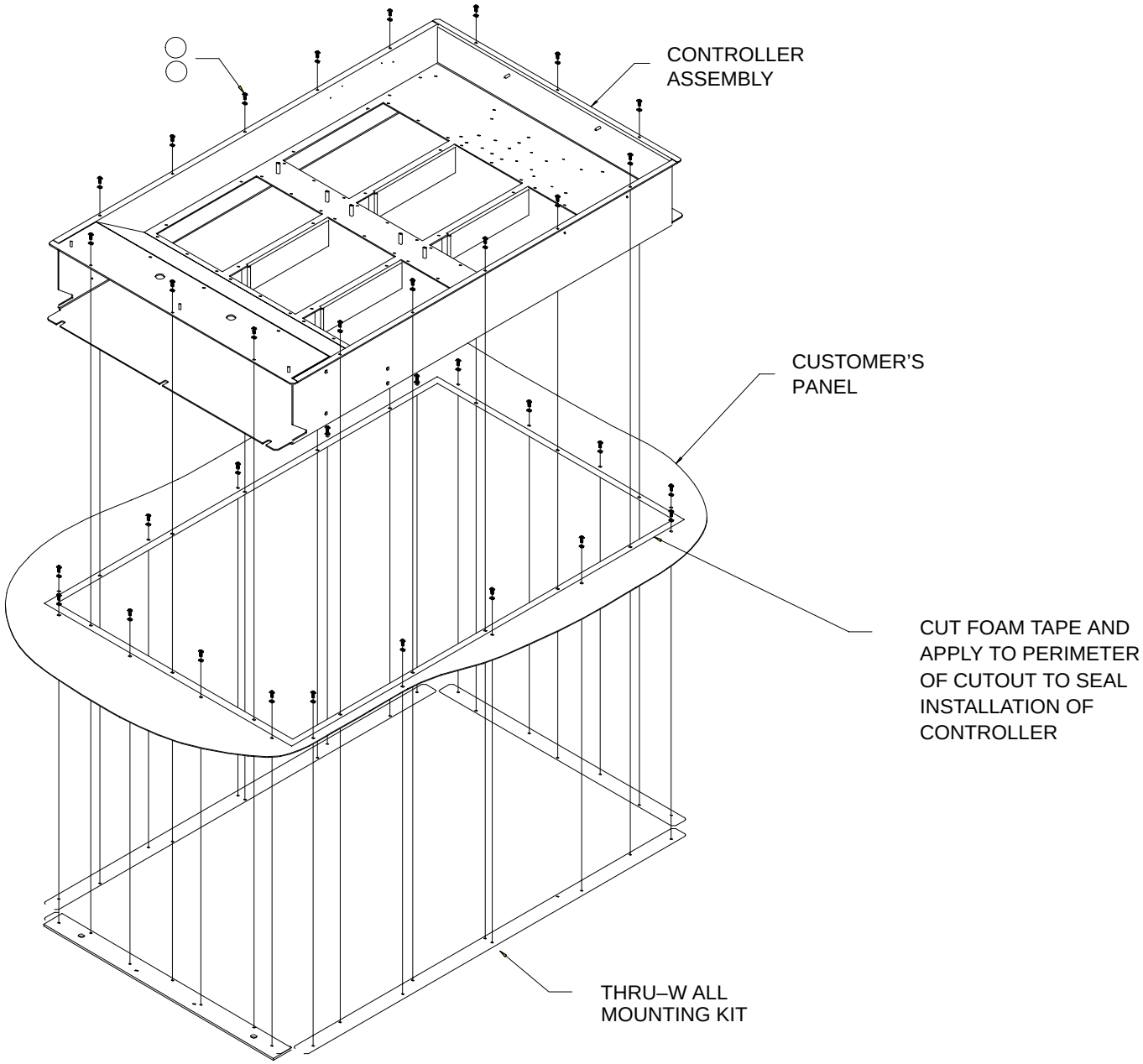
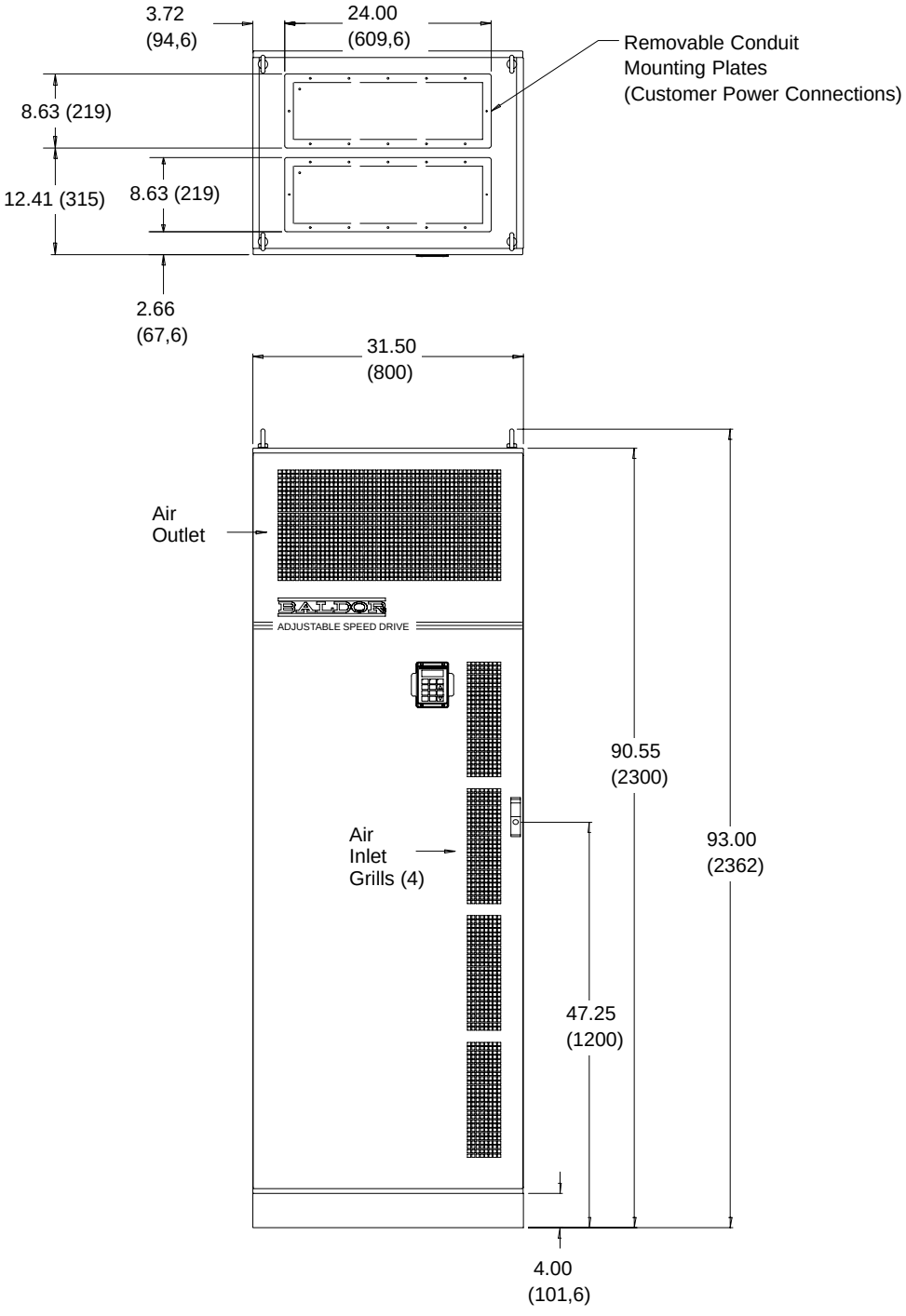


Dimensions Continued

Size G Control



Appendix A

Dynamic Braking (DB) Hardware Whenever a motor is abruptly stopped or forced to slow down quicker than if allowed to coast to a stop, the motor becomes a generator. This energy appears on the DC Bus of the control and must be dissipated using dynamic braking hardware. Dynamic braking (DB) hardware can be a resistor or transistor load. Table A-1 provides a matrix of DB turn ON and turn OFF voltages.

Table A-1

Parameter Description	Control Input Voltage		
Nominal Voltage	230VAC	460VAC	575VAC
AC Input Voltage Range	180-264VAC	340-528VAC	495-660VAC
Overvoltage Fault (Voltage exceeded)	400VDC	800VDC	992VDC
DB ON Voltage	381VDC	762VDC	952VDC
DB UTP *	388VDC	776VDC	970VDC
DB OFF Voltage	375VDC	750VDC	940VDC

* DBUTP (DB Upper Tolerance Peak) $= 1.02 \times \sqrt{2} \times V_{L-L}$

Braking torque and time should not exceed the available drive braking torque and time rating. The drive braking torque is limited to the available peak current and peak current time rating of the control. If the peak current or peak current time limit is exceeded during braking, the control may trip on an over voltage or a regen power fault. Selecting an oversized control or a line regenerative control should be considered in these cases.

Selection Procedure

1. Calculate the watts to be dissipated using the following formulas for the appropriate load type.
2. Identify the control model number and determine which braking hardware is required based on the model number suffix: E, EO, ER, MO or MR.
3. Select appropriate braking hardware from Baldor 501 Catalog or Tables A-2, A-3 and A-4.

Hoisting Load Calculations

1. Calculate braking duty cycle:

$$\text{Duty Cycle} = \frac{\text{Lowering Time}}{\text{Total Cycle Time}}$$

2. Calculate braking watts to be dissipated in dynamic braking resistors:

$$\text{Watts} = \frac{\text{duty cycle} \times \text{lbs} \times \text{FPM} \times \text{efficiency}}{44}$$

where: lbs = weight of load
FPM = Feet Per Minute
efficiency = mechanical efficiency
i.e., 95% = 0.95

Dynamic Braking (DB) Hardware Continued

General Machinery Load Calculations:

1. Calculate braking duty cycle:

$$\text{Duty Cycle} = \frac{\text{Braking Time}}{\text{Total Cycle Time}}$$

2. Calculate deceleration torque:

$$T_{Decel} = \frac{\text{RPM change} \times Wk^2}{308 \times \text{time}} - \text{Friction}_{(Lb.Ft.)}$$

where: T_{Decel} = Deceleration torque in Lb.-ft.
Wk^2 = Inertia in $Lb.ft.^2$
time = In seconds

3. Calculate watts to be dissipated in dynamic braking resistor:

$$\text{Watts} = T_{Decel} \times (S_{max} + S_{min}) \times \text{Duty Cycle} \times (0.0712)$$

where: S_{max} = Speed to start braking
S_{min} = Speed after braking

4. Multiply watts calculated in step 3 by 1.25 to allow for unanticipated loads (safety factor).

Dynamic Braking (DB) Hardware Continued

15H Catalog Numbers with an “E” Suffix

These controls are equipped with a factory installed dynamic brake transistor and brake resistor(s). Size A controls have 400 watts and size B controls have 800 watts of dissipation. These can provide 100% braking torque for 6 seconds of a 20% braking duty cycle. Should additional braking capacity be required an optional externally mounted RGA brake resistor can be used in lieu of the internal resistors. See RGA assemblies.

15H Catalog Numbers with an “ER” or “MR” Suffix

These controls include a factory installed dynamic braking transistor. If dynamic braking is required, use an optional external RGA brake resistor. See RGA assemblies.

15H Catalog Numbers with an “EO” or “MO” Suffix

No dynamic braking hardware is installed in these controls. If dynamic braking is required, an optional RBA assembly or a combination of RTA and RGA assemblies should be added. The RBA assembly provide up to 4,000 watts dynamic braking capacity. Should more capacity be required, a combination of an RTA (DB transistor) and RGA (DB resistor) should be used. Refer to RBA, RTA and RGA Assemblies description.

Dynamic Braking (DB) Hardware Continued

RGA Assemblies

RGA Assemblies include braking resistors completely assembled and mounted in a NEMA 1 enclosure. A listing of available RGA assemblies is provided in Table A-2. The minimum resistance “Minimum Ohms” shown in the table is the minimum resistor value that can be connected to the control without causing damage to the internal dynamic brake transistor for E, ER and MR controls.

RGA assemblies can also be used with EO and MO controls in combination with an RTA assembly when more than 4000 watts of brake capacity is needed. In this case, the minimum resistance of the RGA assembly must be equal to or greater than the minimum resistance specified for the RTA assembly. Refer to Section 3 “Optional Dynamic Brake Hardware” for wiring diagram.

Table A-2 Dynamic Braking Resistor Assemblies (RGA)

Input Volts	HP	Minimum Ohms	Continuous Rated Watts						
			600	1200	2400	4800	6400	9600	14200
230	1 - 2	30	RGA630	RGA1230	RGA2430				
	3 - 5	20	RGA620	RGA1220	RGA2420	RGA4820			
	7.5 - 10	10		RGA1210	RGA2410	RGA4810			
	15 - 20	6		RGA1206	RGA2406	RGA4806			
	25 - 40	4		RGA1204	RGA2404	RGA4804			
	50	2			RGA2402	RGA4802	RGA6402	RGA9602	RGA14202
460	1 - 3	120	RGA6120	RGA12120	RGA24120				
	5 - 7.5	60	RGA660	RGA1260	RGA2460	RGA4860			
	10	30	RGA630	RGA1230	RGA2430	RGA4830			
	15 - 25	20	RGA620	RGA1220	RGA2420	RGA4820			
	30 - 60	10		RGA1210	RGA2410	RGA4810			
	75 - 250	4		RGA1204	RGA2404	RGA4804	RGA6404	RGA9604	RGA14204
	300 - 450	2			RGA2402	RGA4802	RGA6402	RGA9602	RGA14202
575	1 - 2	200	RGA6200	RGA12200	RGA24200				
	3 - 5	120	RGA6120	RGA12120	RGA24120				
	7.5 - 10	60	RGA660	RGA1260	RGA2460	RGA4860			
	15	30	RGA630	RGA1230	RGA2430	RGA4830			
	20 - 30	24		RGA1224	RGA2424	RGA4824			
	40 - 150	14			RGA2414	RGA4814	RGA6414	RGA9614	RGA14214

RBA Assemblies

An RBA Assembly includes a dynamic brake transistor and resistors completely assembled and mounted in a NEMA 1 enclosure. The are designed for EO and MO controls. Select the RBA based on the voltage rating of the control and the dynamic brake watt capacity required. Use Table A-3 to select the RBA assembly. If more than 4,000 watts of brake capacity is required, use a combination of RTA (DB transistor) and RGA (DB resistor) assemblies. Refer to Section 3 “Optional Dynamic Brake Hardware” for wiring diagram.

Table A-3 Dynamic Braking Assemblies (RBA)

	MAXIMUM BRAKING TORQUE IN % OF MOTOR RATING													Cont. Watts	Catalog No.
INPUT VOLTAGE	HP	20	25	30	40	50	60	75	100	150V	150	200	250		
	200 to 240	90%	75%	60%	45%	36%								600	RBA2-610
		150%	125 %	100%	75%	62%								1800	RBA2-1806
		150%	150 %	150%	115 %	92%								4000	RBA2-4004
	380 to 480	150%	150 %	120%	90%	72%	60%	48%	36%	28%				600	RBA4-620
		150%	150 %	120%	90%	72%	60%	48%	36%	28%				1800	RBA4-1820
		150%	150 %	150%	150 %	150 %	120 %	96%	72%	56%	48%	36%	29%	4000	RBA4-4010
	550 to 600	150%	150 %	120%	90%	72%	60%	48%	36%	28%				600	RBA5-624
		150%	150 %	120%	90%	72%	60%	48%	36%	28%				1800	RBA5-1824
		150%	150 %	150%	150 %	150 %	120 %	96%	72%	56%				4000	RBA5-4014

Dynamic Braking (DB) Hardware Continued

RTA Assemblies

RTA assemblies include a dynamic brake transistor and gate driver circuit board completely assembled and mounted in a NEMA 1 enclosure. Brake resistors are not included in the RTA assembly. Each RTA assembly is designed to be used with an RGA dynamic brake resistor assembly. The minimum resistance of the RGA assembly must be equal to or greater than the minimum resistance specified for the RTA assembly. Select the RTA based on the voltage rating of the control and HP which provides the dynamic brake watt capacity required. Use Table A-4 to select the RTA assembly. Refer to Section 3 “Optional Dynamic Brake Hardware” for wiring diagram.

Table A-4 Dynamic Braking Transistor Assemblies (RTA)

HP	MAXIMUM BRAKING TORQUE IN % OF MOTOR RATING									
	208 - 230 VAC			380 - 480 VAC				550 - 600 VAC		
20	150%	150%	150%	150%	150%	150%	150%	150%	150%	150%
25	125%	150%	150%	150%	150%	150%	150%	150%	150%	150%
30	100%	150%	150%	120%	150%	150%	150%	150%	150%	150%
40	75%	115%	150%	90%	150%	150%	150%	127%	150%	150%
50	62%	92%	150%	72%	150%	150%	150%	100%	150%	150%
60				60%	150%	150%	150%	85%	145%	150%
75				48%	96%	150%	150%	68%	116%	150%
100				36%	72%	150%	150%	50%	87%	150%
150V				28%	56%	150%	150%	40%	70%	150%
150					48%	126%	150%	34%	58%	150%
200					36%	95%	150%	25%	44%	150%
250					29%	76%	150%		35%	122%
300						62%	125%		29%	100%
350						54%	108%			87%
400						47%	94%			76%
450						41%	84%			68%
CAT. NO.	**RTA2-6**	**RTA2-4**	**RTA2-2**	**RTA4-20**	**RTA4-10**	**RTA4-4**	**RTA4-2**	**RTA5-24**	**RTA5-14**	**RTA5-4**
Minimum Ohms	6	4	2	20	10	4	2	24	14	4

Appendix B

Parameter Values

Table B-1 Parameter Block Values Level 1

Level 1 Blocks					
Block Title	**Parameter**	P#	**Adjustable Range**	**Factory Setting**	**User Setting**
PRESET SPEEDS	PRESET SPEED #1	1001	0-MAX Speed	0 Hz	
	PRESET SPEED #2	1002	0-MAX Speed	0 Hz	
	PRESET SPEED #3	1003	0-MAX Speed	0 Hz	
	PRESET SPEED #4	1004	0-MAX Speed	0 Hz	
	PRESET SPEED #5	1005	0-MAX Speed	0 Hz	
	PRESET SPEED #6	1006	0-MAX Speed	0 Hz	
	PRESET SPEED #7	1007	0-MAX Speed	0 Hz	
	PRESET SPEED #8	1008	0-MAX Speed	0 Hz	
	PRESET SPEED #9	1009	0-MAX Speed	0 Hz	
	PRESET SPEED #10	1010	0-MAX Speed	0 Hz	
	PRESET SPEED #11	1011	0-MAX Speed	0 Hz	
	PRESET SPEED #12	1012	0-MAX Speed	0 Hz	
	PRESET SPEED #13	1013	0-MAX Speed	0 Hz	
	PRESET SPEED #14	1014	0-MAX Speed	0 Hz	
	PRESET SPEED #15	1015	0-MAX Speed	0 Hz	
ACCEL/DECEL RATE	ACCEL TIME #1	1101	0 to 3600 Seconds	3.0 S	
	DECEL TIME #1	1102	0 to 3600 Seconds	3.0 S	
	S-CURVE #1	1103	OFF, 20, 40, 60, 80, 100%	OFF	
	ACCEL TIME #2	1104	0 to 3600 Seconds	3.0 S	
	DECEL TIME #2	1105	0 to 3600 Seconds	3.0 S	
	S-CURVE #2	1106	OFF, 20, 40, 60, 80, 100%	OFF	
JOG SETTINGS	JOG SPEED	1201	0-MAX Speed	7 Hz	
	JOG ACCEL TIME	1202	0 to 3600 Seconds	3.0 S	
	JOG DECEL TIME	1203	0 to 3600 Seconds	3.0 S	
	JOG S-CURVE	1204	OFF, 20, 40, 60, 80, 100%	OFF	
KEYPAD SETUP	KEYPAD STOP KEY	1301	REMOTE ON REMOTE OFF	REMOTE ON	
	KEYPAD STOP MODE	1302	COAST, REGEN	REGEN	
	KEYPAD RUN FWD	1303	ON, OFF	ON	
	KEYPAD RUN REV	1304	ON, OFF	ON	
	KEYPAD JOG FWD	1305	ON, OFF	ON	
	KEYPAD JOG REV	1306	ON, OFF	ON	
	3 SPEED RAMP	1307	ON, OFF	OFF	
	SWITCH ON FLY	1308	ON, OFF	OFF	
	LOC. HOT START	1309	ON, OFF	OFF	

Table B-1 Parameter Block Values Level 1 Continued

Level 1 Blocks - Continued					
Block Title	**Parameter**	P#	**Adjustable Range**	**Factory**	**User Setting**
INPUT	OPERATING MODE	1401	Keypad Standard Run 15 Speed Fan Pump 2Wire Fan Pump 3Wire Serial Process CTRL 3SPD ANA 2WIRE 3SPD ANA 3WIRE EPOT – 2WIRE EPOT – 3WIRE	KEYPAD	
	COMMAND SELECT	1402	Potentiometer 0-10 VOLTS 0-5 VOLTS 4-20 mA EXB PULSE FOL 10V EXB 4-20 mA EXB 3-15 PSI EXB Tachometer EXB None	POTENTIO-METER	
	ANA CMD INVERSE	1403	ON, OFF	OFF	
	ANA CMD OFFSET	1404	-20.0 to +20.0% (where ±0.5V=±20%)	0.0 %	
	ANA CMD GAIN	1405	80.0% to 120%	100.0%	
	CMD SEL FILTER	1406	0-6	3	
OUTPUT	OPTO OUTPUT #1	1501	READY ZERO SPEED AT SPEED AT SET SPEED OVERLOAD KEYPAD CONTROL FAULT DRIVE ON REVERSE PROCESS ERROR	READY	
	OPTO OUTPUT #2	1502		ZERO SPEED	
	OPTO OUTPUT #3	1503		AT SPEED	
	OPTO OUTPUT #4	1504		FAULT	
	ZERO SPD SET PT	1505	0-MAX Speed	6 Hz	
	AT SPEED BAND	1506	0-20 Hz	2 Hz	
	SET SPEED POINT	1507	0-MAX Speed	60 Hz	

Table B-1 Parameter Block Values Level 1 Continued

Level 1 Blocks - Continued					
Block Title	**Parameter**	P#	**Adjustable Range**	**Factory**	**User Setting**
OUTPUT (Continued)	ANALOG OUT #1	1508	FREQUENCY FREQ COMMAND AC CURRENT AC VOLTAGE TORQUE (Load) POWER BUS VOLTAGE PROCESS FDBK SETPOINT CMD ZERO CAL 100% CAL	FREQUEN-CY	
	ANALOG OUT #2	1509		AC CURRENT	
	ANALOG #1 SCALE	1510	10 - 160%	100%	
	ANALOG #2 SCALE	1511	10 - 160%	100%	
V/HZ AND BOOST	CTRL BASE FREQUENCY	1601	50.00 - 400.00 HZ	60 HZ	
	TORQUE BOOST	1602	0.0 - 15.0%	2.5%	
	DYNAMIC BOOST	1603	0.0 - 100%	0.0%	
	SLIP COMP ADJ	1604	0.00 - 6.00 HZ	0.00 HZ	
	V/HZ PROFILE	1605	LINEAR, 3 POINTS, 33% SQR LAW, 67% SQR LAW, 100% SQR LAW	LINEAR	
	V/HZ 3–PT VOLTS	1606	0-100%	0.0%	
	V/HZ 3–PT FREQUENCY	1607	0-9.99 HZ	0.00 HZ	
	MAX OUTPUT VOLTS	1608	0-100	100%	
LEVEL 2 BLOCK	ENTERS LEVEL 2 MENU - See Table B-2.				
PRESS ENTER FOR PROGRAMMING EXIT	Exit programming mode and return to display mode.				

Table B-2 Parameter Block Values Level 2

Level 2 Blocks					
Block Title	**Parameter**	**P#**	**Adjustable Range**	**Factory**	**User Setting**
OUTPUT LIMITS	OPERATING ZONE	2001	STD CONST TQ STD VAR TQ QUIET CONST TQ QUIET VAR TQ	STD CONST TQ	
	MIN OUTPUT FREQ	2002	0-400	0 HZ	
	MAX OUTPUT FREQ	2003	0-400	60 HZ	
	PK CURRENT LIMIT	2004	1A to Peak Rated Current	PK Control Rating	
	PWM FREQUENCY	2005	1.0-5.0 KHZ (Standard) 1.0-15.0 KHZ (Quiet)	2500 HZ	
	REGEN LIMIT	2006	ON, OFF	OFF	
	REGEN LIMIT ADJ	2007	0 - 500	0Hz/S	
CUSTOM UNITS	MAX DECIMAL PLACES	2101	0-5	0	
	VALUE AT SPEED	2102	1-65535/1-65535	0./ 01000	
	VALUE DEC PLACES	2103	0-5 (Serial Only)	0	
	VALUE SPEED REF	2104	1 to 65535 (Serial Only)	00000/ 01000	
	UNITS OF MEASURE	2105	See Table 4-2.	-	
	UNITS OF MEASURE 2	2106	See Table 4-2. (Serial Only)	-	
PROTECTION	EXTERNAL TRIP	2202	ON, OFF	OFF	
	LOCAL ENABLE INP		ON, OFF	OFF	
MISCELLANEOUS	RESTART AUTO/MAN	2301	AUTOMATIC, MANUAL	MANUAL	
	RESTART FAULT/HR	2302	0-10	0	
	RESTART DELAY	2303	0-120 SECONDS	0 S	
	LANGUAGE SELECT	2304	English, Espanol	ENGLISH	
	FACTORY SETTINGS	2305	STD Settings, 50Hz / 400Volts, NO	NO	
	STABIL ADJ LIMIT	2306	0-1.50Hz	1.00Hz	
	STABILITY GAIN	2307	0-9	1	
SECURITY CONTROL	SECURITY STATE	2401	OFF LOCAL SECURITY SERIAL SECURITY TOTAL SECURITY	OFF	
	ACCESS TIMEOUT	2402	0-600 Seconds	0 S	
	ACCESS CODE	2403	0-9999	9999	
MOTOR DATA	MOTOR VOLTAGE	2501	0-999 VOLTS	Factory Set	
	MOTOR RATED AMPS	2502	0-999.9	Factory Set	
	MOTOR RATED SPD	2503	0-32767 Hz	1750 Hz	
	MOTOR RATED FREQ	2504	50-400 HZ	60.0 Hz	
	MOTOR MAG AMPS	2505	0-85% Rated Current	Factory Set	

Table B-2 Parameter Block Values Level 2 Continued

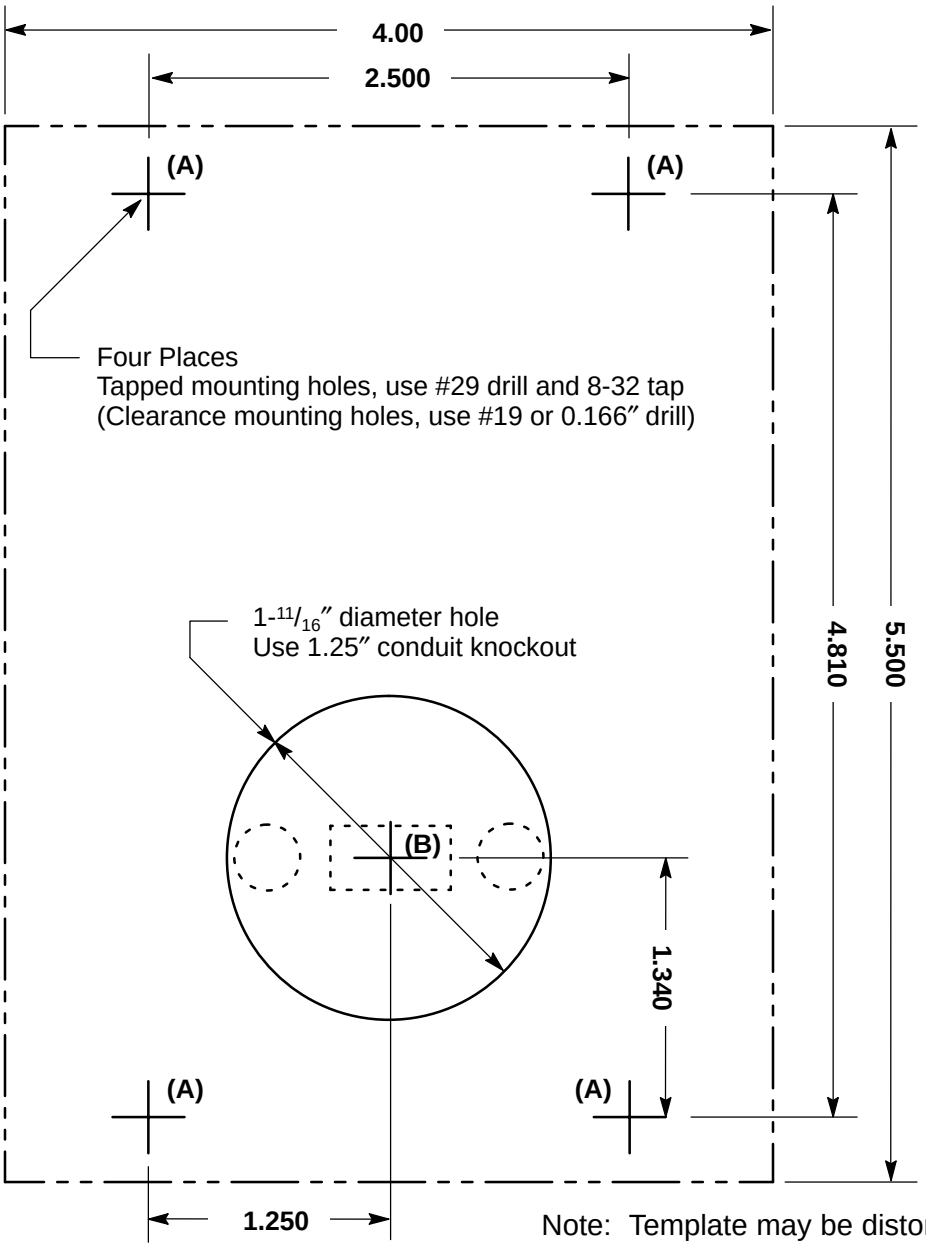
Level 2 Blocks - Continued					
Block Title	**Parameter**	**P#**	**Adjustable Range**	**Factory**	**User Setting**
BRAKE ADJUST	RESISTOR OHMS	2601	0-255 OHMS	Factory Set	
	RESISTOR WATTS	2602	0-32767 WATTS	Factory Set	
	DC BRAKE VOLTAGE	2603	1.0 to 15%	5.0%	
	DC BRAKE FREQ	2604	0.00 to 400.00 Hz	6.00 Hz	
	BRAKE ON STOP	2605	ON, OFF	OFF	
	BRAKE ON REVERSE	2606	ON, OFF	OFF	
	STOP BRAKE TIME	2607	0.0 to 60.0 Seconds	3.0 S	
	BRAKE ON START	2608	ON, OFF	OFF	
	START BRAKE TIME	2609	0.0 to 60.0 Seconds	3.0 S	
PROCESS CONTROL	PROCESS FEEDBACK	2701	Potentiometer 0-10VOLTS 0-5 VOLTS 4-20mA 10V EXB 4-20mA EXB 3-15 PSI TACHOMETER EXB NONE	NONE	
	PROCESS INVERSE	2702	ON, OFF	OFF	
	SETPOINT SOURCE	2703	Setpoint Command Potentiometer 0-10VOLTS 0-5 VOLTS 4-20mA 10V EXB 4-20mA EXB 3-15 PSI Tachometer EXB None	NONE	
	SETPOINT COMMAND	2704	–100% to +100%	0.0 %	
	SET PT ADJ LIMIT	2705	0-100%	10 %	
	AT SETPOINT BAND	2706	0-100%	10 %	
	PROCESS PROP GAIN	2707	0-2000	0	
	PROCESS INT GAIN	2708	0-9.99 HZ	0.00 HZ	
	PROCSS DIFF GAIN	2709	0-1000	0	
	FOLLOW I:O RATIO	2710	1-65535:1-65535	1:1	
	FOLLOW I:O OUT	2711	1-65535 (Serial Only)	1	
	ENCODER LINES	2712	20-65535	1024 PPR	

Table B-2 Parameter Block Values Level 2 Continued

Level 2 Blocks - Continued					
Block Title	**Parameter**	**P#**	**Adjustable Range**	**Factory**	**User Setting**
SKIP FREQUENCY	SKIP FREQ #1	2801	0–400Hz	0Hz	
	SKIP BAND #1	2802	0–50Hz	0Hz	
	SKIP FREQ #2	2803	0–400Hz	0Hz	
	SKIP BAND #2	2804	0–50Hz	0Hz	
	SKIP FREQ #3	2805	0–400Hz	0Hz	
	SKIP BAND #3	2806	0–50Hz	0Hz	
SYNCHRO-START	SYNCHRO-STARTS	2901	Restarts Only, All Starts, OFF	OFF	
	SYNC START FREQUENCY	2902	Max Frequency, Set Frequency	MAX FREQUENCY	
	SYNC SCAN V/F	2903	5.0-100.0%	10.0%	
	SYNC SETUP TIME	2904	0.2-2.0 Seconds	0.2 S	
	SYNC SCAN TIME	2905	1.0-10.0 Seconds	2.0 S	
	SYNC V/F RECOVER	2606	0.2-2.0 Seconds	0.2 S	
	SYNC DIRECTION	2907	Sync Forward, Sync Reverse, Sync Forward and Reverse	SYNC FWD & REV	
LEVEL 1 BLOCK	Enters Level 1 Menu - See Table B-1.				
PRESS ENTER FOR PROGRAMMING EXIT	Exit programming mode and return to display mode.				

Appendix C

Remote Keypad Mounting Template



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9/97 C&J2500