BALDOR
MOTORS AND DRIVES

ADJUSTABLE SPEED DRIVE

SERIES 21H
Line Regen
Inverter Control

Installation & Operating Manual

3/99 **MN721**

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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”.
6. Plug in the keypad. Refer to Section 3, “Keypad Installation” procedure.

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 of motor shaft.
2. Verify that all motor couplings are tight without backlash.
3. 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 21H control is a PWM inverter motor control and Line Regenerative control that has a near unity power factor. 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 Line Regen Inverter control provides several advantages over non-regenerative drives:

- Regenerated energy from the motor is returned to the power source. The control can provide regenerated energy absorption up to it's full rating on a continuous basis.
- Input current is controlled to be a near unity power factor at rated load.
- Line harmonic distortion is reduced.
- DC Bus voltage is always controlled. Therefore, line voltage transients do not affect the output voltage to the motor.

The Baldor Series 21H control may be used in many different applications. It may be programmed by the user to operate in different operating zones. It can also be configured to operate in a number of modes depending upon the application requirements and user preference.

It is the responsibility of the user to determine the optimum operating zone and mode to interface the control to the application. These choices are made with the keypad as explained in the programming section of this manual.

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.

Year 2000 Compliance

The motor control products listed below are manufactured or offered for sale by Baldor Electric and are certified to be year 2000 compliant.

DC Motor Controls: Series BC100/200, BC19H, BC20H, TSD, UM, UMH.

AC Motor Controls: Series ID10, ID1100, ID15H, ID15J, ID15V, ZD17H, ZD18H, ID21H, ZD22H, SD23H, ZD24M, ZD25M, SD26M, BSC, DBSC, BTS, SBTS.

Position Controllers: PMC, SmartMove, NextMove.

Furthermore, year 2000 compliance means that the product will:

Not use dates or perform any date processing.
Date information is irrelevant to proper operation; and
There are no problems or issues to address to ensure continued and proper operation of the product listed due to changes in century dates.

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:** **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 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:** **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 provide unstable power to the motor controller. Instead, we recommend using a four wire Wye.**

⚠ **Caution:** **Do not use power factor correction capacitors at the input power lines to the 21H Line Regen control. Installing power factor correction capacitors may damage the control.**

Section 3
Receiving & Installation

Receiving & Inspection

The Series 21H 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 conforms to published storage specifications. (Refer to Section 6 of this manual).

Physical Installation

The mounting location of the 21H 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 vertically on a flat, smooth, non-flammable vertical surface. Size G+ are floor standing NEMA 1 enclosures.
2. At least two inches clearance must be provided on all sides for airflow.
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.
6. Table 3-1 lists the Watts Loss ratings for the Series 21H controls.

Table 3-1 Series 21H Watts Loss Ratings

CONTROL			STD PWM CONV & INV Losses	QUIET PWM CONV & INV Losses	CONTROL FIXED Losses	BOOST REG Loss At Full Load	Line Reactor Loss At Full Load		STD PWM Total Losses	QUIET PWM Total Losses
MODEL No.	SIZE	INPUT VAC	(Watts)	(Watts)	(Watts)	(Watts)	Cat. No.	(Watts)	(Watts)	(Watts)
ID21H210-EL	C+	230	268	315	102	80	LRAC03501	49	499	546
ID21H215-EL	C+	230	397	311	102	109	LRAC04501	54	662	576
ID21H220-EL	C+	230	527	458	102	136	LRAC05501	64	829	760
ID21H225-EL	C+	230	690	611	102	137	LRAC08001	82	1011	932
ID21H230-EL	D+	230	571	768	170	164	LRAC08001	82	987	1184
ID21H240-EL	D+	230	1095	942	170	187	LRAC10001	94	1546	1393
ID21H250-EL	D+	230	1437	1286	170	225	LRAC13001	108	1940	1789
ID21H410-EL	C+	380-415	240	326	102	80	LRAC01802	43	465	551
ID21H415-EL	C+	380-415	336	259	102	86	LRAC02502	52	576	499
ID21H420-EL	C+	380-415	432	379	102	110	LRAC03502	54	698	645
ID21H425-EL	D+	380-415	544	504	102	134	LRAC04502	62	842	802
ID21H430-EL	D+	380-415	640	740	170	158	LRAC04502	62	1030	1130
ID21H440-EL	D+	380-415	880	738	170	228	LRAC05502	67	1345	1203
ID21H450-EL	D+	380-415	1040	1023	170	217	LRAC08002	86	1513	1496
ID21H460-EK	D+	380-415	1280	1236	100	299	LRAC08002	86	1765	1721
ID21H475-EK	E	380-415	2400	2322	153	395	LRAC10002	84	3032	2954
ID21H4100-EK	E	380-415	3000	2928	153	420	LRAC13002	180	3753	3681
ID21H4150-EK	F	380-415	3610	CONTROL RATINGS NOT AVAILABLE	191	750	LRAC25003	219	4770	CONTROL RATINGS NOT AVAILABLE
ID21H4200-EK	F	380-415	4750		191	850	LRAC32003	351	6142	
ID21H4250-EL	G+	380-415	6200		1000	900	LRAC32002	264	8364	
ID21H4300-EL	G+	380-415	8140		1000	1620	LRAC40002	333	11093	
ID21H4450-EL	G+	380-415	8400		1000	1650	LRAC50002	340	11390	
ID21H4400-EL	G+	380-415	10560		1000	1750	LRAC60002	414	13724	
ID21H4450-EL	G+	380-415	11880		1000	1850	LRAC75003	552	15282	

Table 3-1 Series 21H Watts Loss Ratings Continued

CONTROL			STD PWM CONV & INV Losses	QUIET PWM CONV & INV Losses	CONTROL FIXED Losses	BOOST REG Loss At Full Load	Line Reactor Loss At Full Load		STD PWM Total Losses	QUIET PWM Total Losses
MODEL No.	SIZE	INPUT VAC	(Watts)	(Watts)	(Watts)	(Watts)	Cat. No.	(Watts)	(Watts)	(Watts)
ID21H410-EL	C+	460	240	326	102	80	LRAC01802	43	465	551
ID21H415-EL	C+	460	336	259	102	86	LRAC02502	52	576	499
ID21H420-EL	C+	460	432	379	102	110	LRAC03502	54	698	645
ID21H425-EL	D+	460	544	504	102	134	LRAC03502	54	834	794
ID21H430-EL	D+	460	640	740	170	158	LRAC04502	62	1030	1130
ID21H440-EL	D+	460	880	738	170	228	LRAC05502	67	1345	1203
ID21H450-EL	D+	460	1040	1023	170	217	LRAC08002	86	1513	1496
ID21H460-EK	D+	460	1280	1236	100	299	LRAC08002	86	1765	1721
ID21H475-EK	E	460	2400	2322	153	395	LRAC10002	84	3032	2954
ID21H4100-EK	E	460	3000	2928	153	420	LRAC13002	180	3753	3681
ID21H4150-EK	F	460	3610	CONTROL RATINGS NOT AVAILABLE	191	750	LRAC20002	168	4719	CONTROL RATINGS NOT AVAILABLE
ID21H4200-EK	F	460	4750		191	850	LRAC25002	231	6022	
ID21H4250-EL	G+	460	6200		1000	900	LRAC32002	264	8364	
ID21H4300-EL	G+	460	8140		1000	1620	LRAC40002	333	11093	
ID21H4450-EL	G+	460	8400		1000	1650	LRAC50002	340	11390	
ID21H4400-EL	G+	460	10560		1000	1750	LRAC50002	340	13650	
ID21H4450-EL	G+	460	11880		1000	1850	LRAC60002	414	15144	

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 shock greater than 1G or 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
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.

Keypad Installation

Procedure:

1. Refer to the Remote Keypad Installation procedure and mount the keypad.
2. Connect the keypad cable to the keypad connector of the main control board.

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.

Baldor Series 21H controls feature UL approved adjustable motor overload protection suitable for motors rated at no less than 50% of the output rating of the control. Other governing agencies such as NEC may require separate over-current protection. The installer of this equipment is responsible for complying with the National Electric Code and any applicable local codes which govern such practices as wiring protection, grounding, disconnects and other current protection.

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 and 3-2.

⚠ **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 - EL

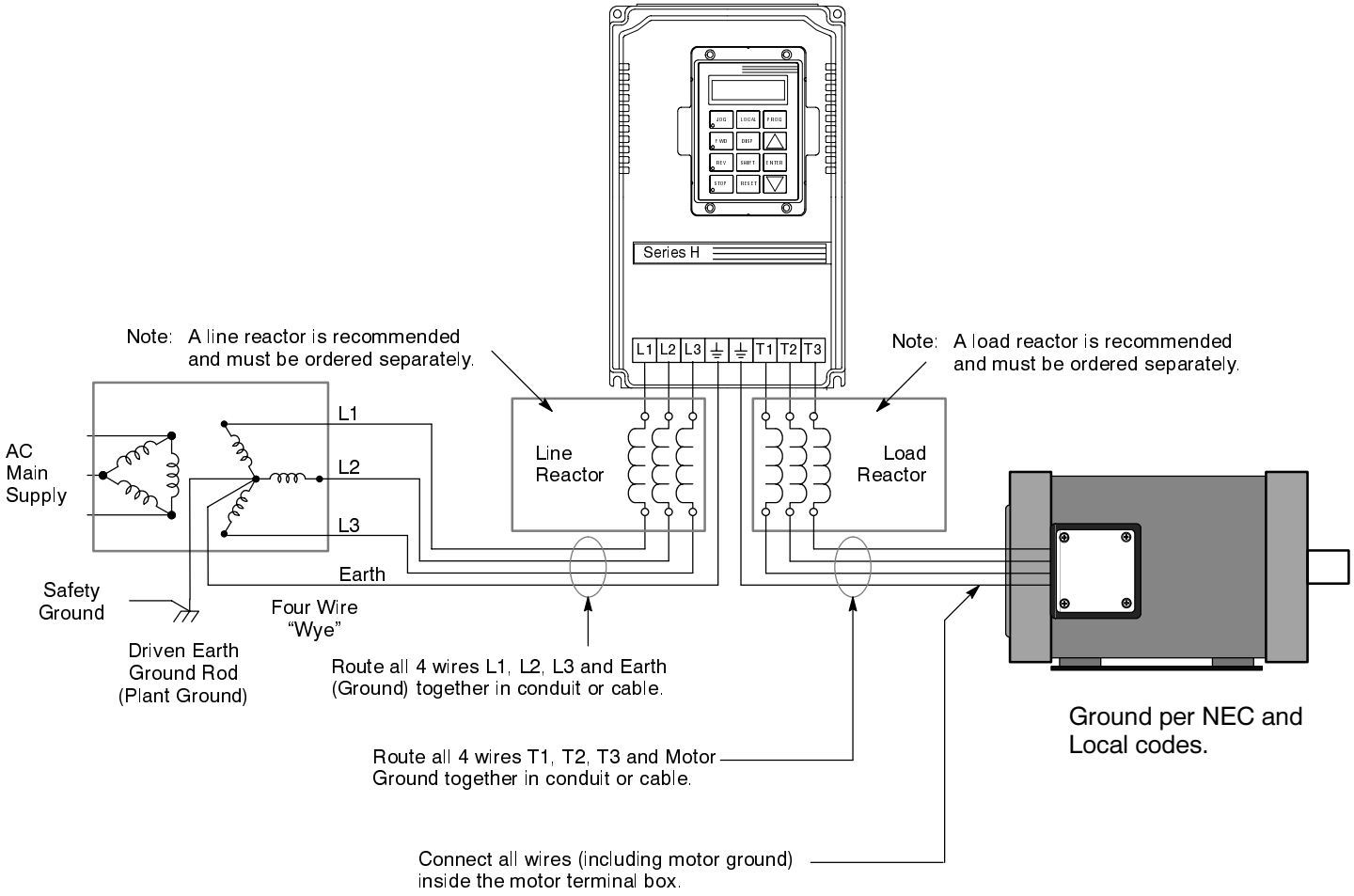
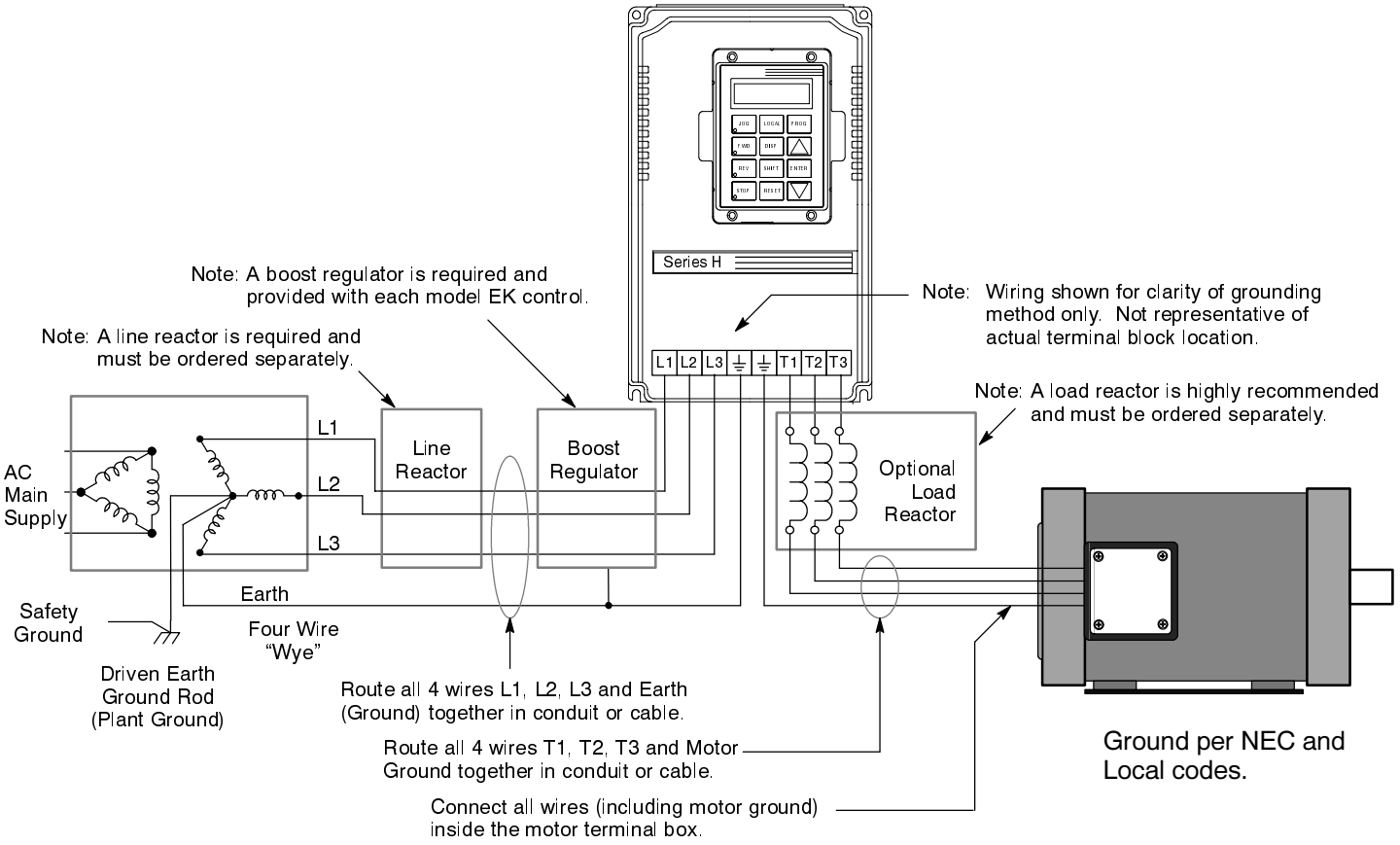


Figure 3-2 Recommended System Grounding - EK



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 to 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% for all sizes.
- 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.

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. Select the load reactor that matches the full load amperes (FLA) stated on the nameplate of the motor you are using.

AC Main Circuit

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.

Protective Devices

Recommended fuse sizes are based on the following:
115% of maximum continuous current for time delay.
150% of maximum continuous current for Fast or Very Fast action.

Note: These general size recommendations do not consider harmonic currents or ambient temperatures greater than 40°C.

Be sure a suitable input power protection device is installed. Use the recommended circuit breaker or fuses listed in tables 3-3 through 3-4 (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:	3 phase, thermal magnetic. Equal to GE type THQ or TEB for 230 VAC or GE type TED for 460 VAC
Fast Action Fuses:	230 VAC, Buss KTN 460 VAC, Buss KTS to 600A (KTU 601 - 1200A)
Very Fast Action:	230 VAC, Buss JJN 460 VAC, Buss JJS
Time Delay Fuses:	230 VAC, Buss FRN 460 VAC, Buss FRS to 600A (KLU 601 - 1200A)

Internal Fuses

Table 3-2 Internal Fuses

Control Size	Zero Crossing (Input Interface Board)		Filter Fuses (Filter Board)		Control Transformer		Soft Start Transformer		Fan Control Transformer	
	Rating	Type	Rating	Type	Rating	Type	Rating	Type	Rating	Type
C+	3/10 A 500VAC	FLQ-3/10 or Equiv.	5A 500VAC	FNQ-5 or Equiv.	3.2A 250VAC	MDA-3 2/10 or Equiv.				
D+	3/10 A 500VAC	FLQ-3/10 or Equiv.	5A 500VAC	FNQ-5 or Equiv.	3.2A 250VAC	MDA-3 2/10 or Equiv.				
D	3/10 A 500VAC	FLQ-3/10 or Equiv.	10A 600VAC	KTK-10 or Equiv.	3.2A 250VAC	MDA-3 2/10 or Equiv.				
E	3/10 A 500VAC	FLQ-3/10 or Equiv.	10A 600VAC	KTK-10 or Equiv.	3.2A 250VAC	MDA-3 2/10 or Equiv.	1/2 A 250VAC	ABC 1/2 or Equiv.		
F	3A 600VAC	ATM-3 or Equiv.	3A 500VAC	KTK-3 or Equiv.	3A 600VAC	KTK-3 or Equiv.	3A 600VAC	KTK-3 or Equiv.		
G+ 250HP			50A 600VAC	JJS or Equiv.	3 1/2 A 500VAC	FNQ-3 1/2 or Equiv.	4A 500VAC	FNQ-4 or Equiv.	3A 500VAC	FNQ-3 or Equiv.
G+300HP			50A 600VAC	JJS or Equiv.	3 1/2 A 500VAC	FNQ-3 1/2 or Equiv.	4A 500VAC	FNQ-4 or Equiv.	3A 500VAC	FNQ-3 or Equiv.
G+350HP			60A 600VAC	JJS or Equiv.	3 1/2 A 500VAC	FNQ-3 1/2 or Equiv.	4A 500VAC	FNQ-4 or Equiv.	3A 500VAC	FNQ-3 or Equiv.
G+400HP			70A 600VAC	JJS or Equiv.	3 1/2 A 500VAC	FNQ-3 1/2 or Equiv.	4A 500VAC	FNQ-4 or Equiv.	3A 500VAC	FNQ-3 or Equiv.
G+450HP			70A 600VAC	JJS or Equiv.	3 1/2 A 500VAC	FNQ-3 1/2 or Equiv.	4A 500VAC	FNQ-4 or Equiv.	3A 500VAC	FNQ-3 or Equiv.

Not applicable.

Wire Size and Protection Devices

Table 3-3 Series 21H Wire Size and Protection Devices
230VAC Controls (3 Phase)

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
0.75	3	5	4	14	2.08
1	7	6	5	14	2.08
2	15	12	9	14	2.08
3	15	15	12	14	2.08
5	20	25	20	12	3.31
7.5	30	35	30	10	5.26
10	40	45	35	10	5.26
15	60	70	60	8	8.37
20	70	80	70	6	13.3
25	90	100	90	4	21.2
30	100	125	110	4	21.2
40	150	175	150	2	33.6
50	175	200	175	1	42.4
60	200	225	200	1/0	53.5
75	250	300	250	3/0	85.0

Note: All wire sizes are based on 75°C copper wire. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 40°C ambient, maximum continuous control output current and no harmonic current.

Table 3-4 Series 21H Wire Size and Protection Devices
460VAC Controls (3 Phase)

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm^2
0.75	3	2	2	14	2.08
1	3	3	2.5	14	2.08
2	7	5	4.5	14	2.08
3	7	8	6.3	14	2.08
5	15	12	10	14	2.08
7.5	15	17.5	15	14	2.08
10	20	20	17.5	14	2.08
15	30	30	25	10	5.26
20	40	40	35	10	5.26
25	50	50	45	8	8.37
30	50	60	50	8	8.37
40	70	80	70	6	13.3
50	90	100	90	6	13.3
60	100	125	100	4	21.2
75	125	150	125	3	26.7
100	175	200	175	1	42.4
125	200	250	200	2/0	67.4
150	225	300	250	3/0	85.0
200	300	350	300	(2) 1/0	(2) 53.5
250	400	450	400	(2) 3/0	(2) 85.0
300	450	600	450	(2) 4/0	(2) 107.0
350	500	650	500	(3) 2/0	(3) 67.4
400	600	750	600	(3) 3/0	(3) 85.0
450	650	800	700	(3) 4/0	(3) 107.0
500	750	900	800	(3) 250MCM	(3) 127.0

Note: All wire sizes are based on 75°C copper wire. Higher temperature smaller gauge wire may be used per NEC and local codes. Recommended fuses/breakers are based on 40°C ambient, maximum continuous control output current and no harmonic current.

Single Phase Operation
Single phase operation is not possible for Series 21H Line Regen Controls.

Operating the Control at a Reduced Input Voltage
Series 21H Controls use a DC Bus regulation technique that provides full output voltage (240VAC for 230VAC Controls; or 480VAC for 460VAC controls) for the full input voltage range. However, at reduced input voltages the output current of the control may have to be derated. Table 3-5 lists the % derating of the output current for various motor voltage ratings and input power voltage levels to the control.

Table 3-5 Output Current Derating at Reduced Input Voltages (2.5KHz PWM)

Input Voltage		% of Output Current after Derating		
230VAC Control	**460VAC Control**	**240/480VAC Motor**	**230/440VAC Motor**	**208/400VAC Motor**
180VAC	340VAC	77%	84%	93%
190VAC	360VAC	82%	89%	98%
208VAC	400VAC	90%	99%	100%
230VAC	440VAC	100%	100%	100%
240VAC	480VAC	100%	100%	100%

For example:
A 460VAC Control that has a 400VAC input line can provide 90% of the rated current to a 480VAC motor. In the Section 6 specifications we find our example 10HP control is ID21H410-EL has a continuous current rating of 15 Amps. The derated current can be calculated as follows: 15A x 90% = 13.5A derated value.

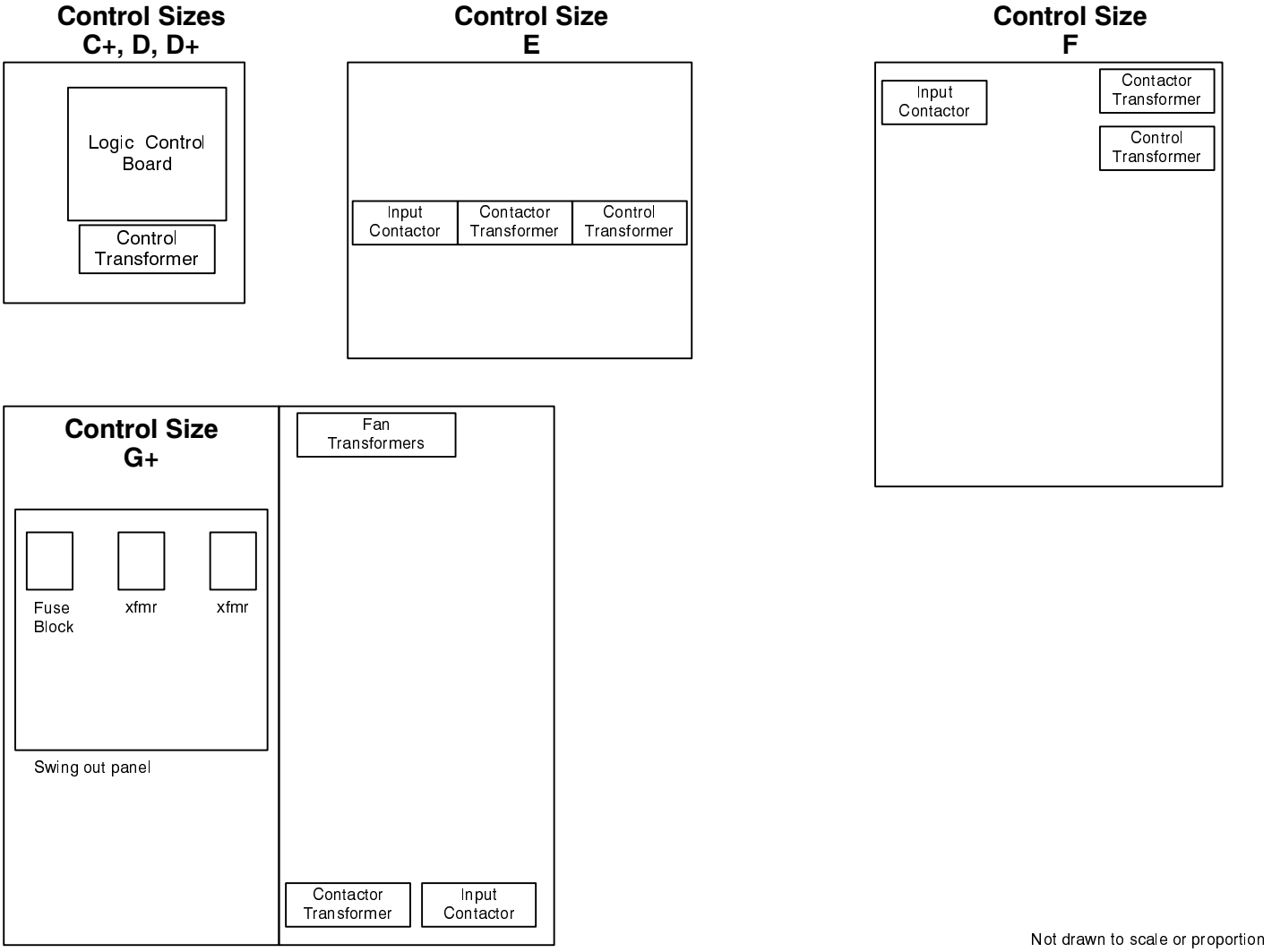
Hardware Changes for Reduced Voltage Input

Size C+, D+,D, E, F and G+ controls all require modification for operation at a reduced line voltage (less than rated nominal). Table 3-6 defines the modifications for each enclosure size. Figure 3-3 shows the locations of the transformer locations for each enclosure size.

Table 3-6 Hardware changes for 380-400VAC operation

Enclosure Size	Control Transformer Tap Change	Contactor Transformer Tap Change	Fuse Block Connection Change
C+	Yes	No	
D+	Yes	No	
D	Yes	No	
E	Yes	Yes	
F	Yes	Yes	
G+	No	Yes	Yes

Figure 3-3 Control and Contactor Transformer Locations



Not drawn to scale or proportion

Size C+, D, D+ E, and F size control procedure:

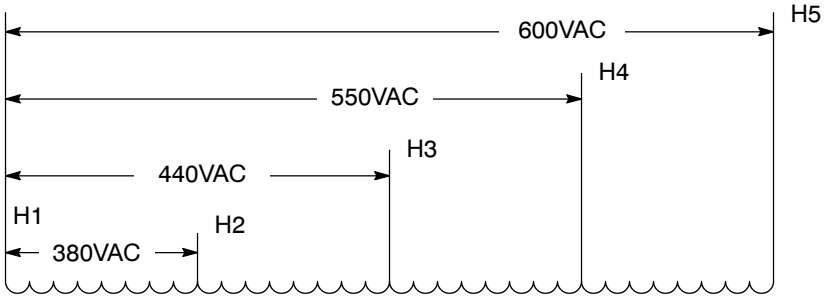
Control Transformer

1. Terminate drive operation and disable the control.
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 of the control transformer.
5. Place the wire that was removed from terminal 5 onto terminal 4.
6. Install or close the front cover.

Contactor Transformer

Only size E and F controls require a change of the contactor transformer tap. See Figure 3-4. Use the taps (H1 to H5) that are correct for the input voltage.

Figure 3-4 Contactor Transformer Tap Change (380 -400VAC Input)



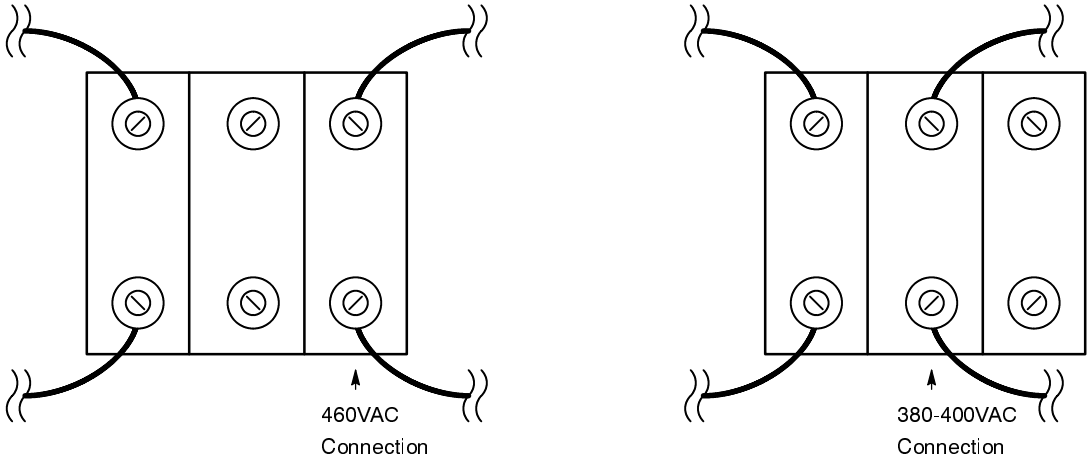
Frequency	Voltage	Taps
50 / 60 Hz	380	H1 - H2
	440-460	H1 - H3
	550	H1 - H4
	600	H1 - H5

Size G+control procedure: (Refer to Figure 3-5.)

Control Transformer

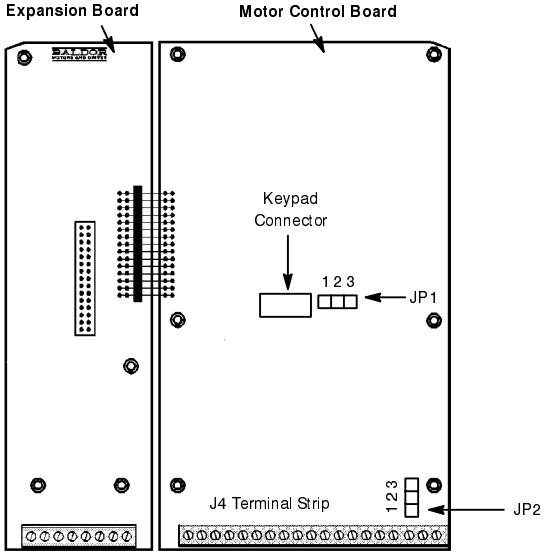
1. Be sure drive operation is terminated and control is disabled.
2. Remove all power sources from the control. If power has been applied, wait at least 5 minutes for bus capacitors to discharge.
3. Remove or open the front cover. Locate the control transformer fuse block (see Figure 3-3).
4. Remove the wires from the two right side terminals (460VAC connection).
5. Place the wires on the center terminals as shown (380VAC connection).
6. Install or close the front cover.

Figure 3-5 Configuring the Control Transformer Fuse Block for 380 - 400 VAC Installation



For Fuse Block, location refer to Figure 3-3.

Figure 3-1 Series 21H 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 3-7 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 Input Power & Motor Connections

AC power and motor connections are different for controls that have a model number suffix of “EL” and “EK”. Be sure to use the correct procedure for your control.

⚠ **Caution: Do not use power factor correction capacitors at the input power lines to the 21H Line Regen control. Installing power factor correction capacitors may damage the control.**

Note: “EK” Controls are input phase sensitive. Be sure all connections are correct.

“EL” suffix

The AC power and motor connections are shown in Figure 3-2. Overloads are not required. The 21H 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.

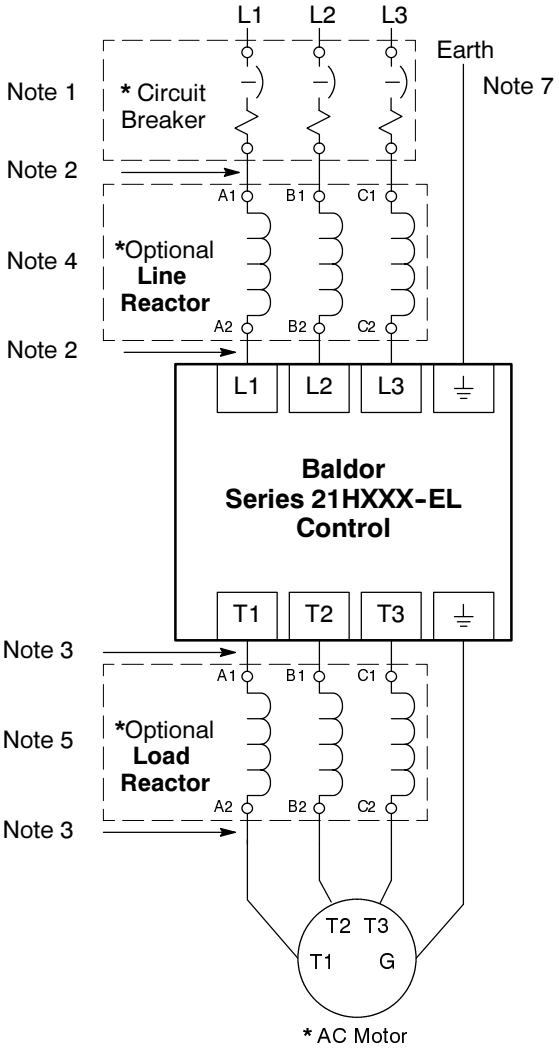
⚠ **Caution: Do not connect AC power to the Motor terminals T1, T2 and T3. Connecting AC power to these terminals may result in damage to the control.**

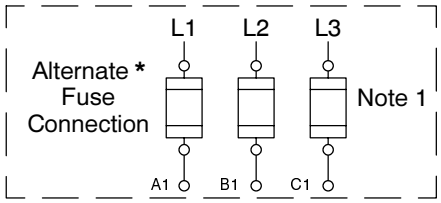
⚠ **Caution: Baldor recommends not using “Grounded Leg Delta” transformer power leads that may create ground loops and degrade system performance. Instead, we recommend using a four wire Wye.**

1. Connect the incoming AC power wires from the protection devices to terminals A1, B1 and C1 at the 3% line reactor.
2. Connect A2, B2 and C2 3% line reactor terminals to the L1, L2 and L3 power input terminals of the control.
3. * Connect earth ground to the “⏚” of the control. Be sure to comply with local codes.
4. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the control.
5. * Connect motor ground wire to the “⏚” of the control. Be sure to comply with all applicable codes.

* 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 3-2 "EL" Control 3 Phase AC Power and Motor Connections

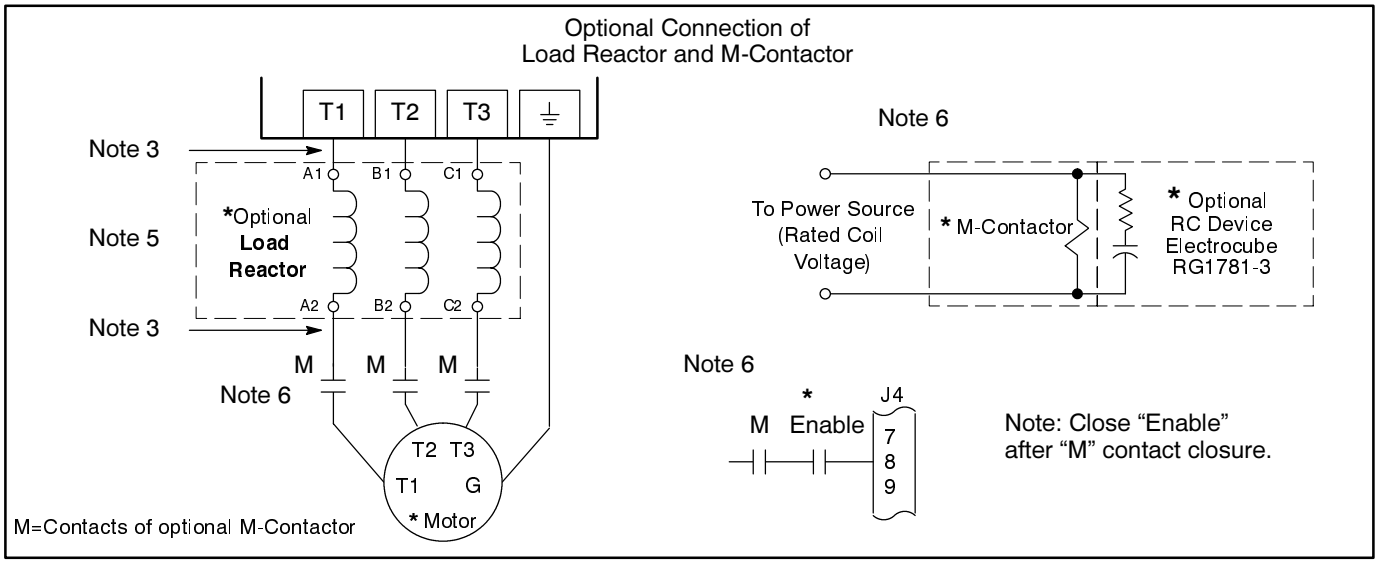




* Optional components not provided with 21H Control.

Notes:

1. See Protection Devices described in this section.
2. Shield wires inside a metal conduit.
3. Conduit should be connected so that it acts as an unbroken shield from AC Line to the enclosure or enclosure to the motor.
4. 3% Line Reactor is required at input.
5. See Load Reactors described in this section.
6. See M-Contactor described in this section.
7. Connect ground terminal of control to "Earth Ground".



See Recommended Tightening Torques in Section 6.

"EK" suffix

Note: "EK" Controls are input phase sensitive. Be sure all connections are correct.

> ⚠ **Caution: Do not use power factor correction capacitors at the input power lines to the 21H Line Regen control. Installing power factor correction capacitors may damage the control.**

The AC power and motor connections are shown in Figure 3-3. Overloads are not required. The 21H 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.

> ⚠ **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.**

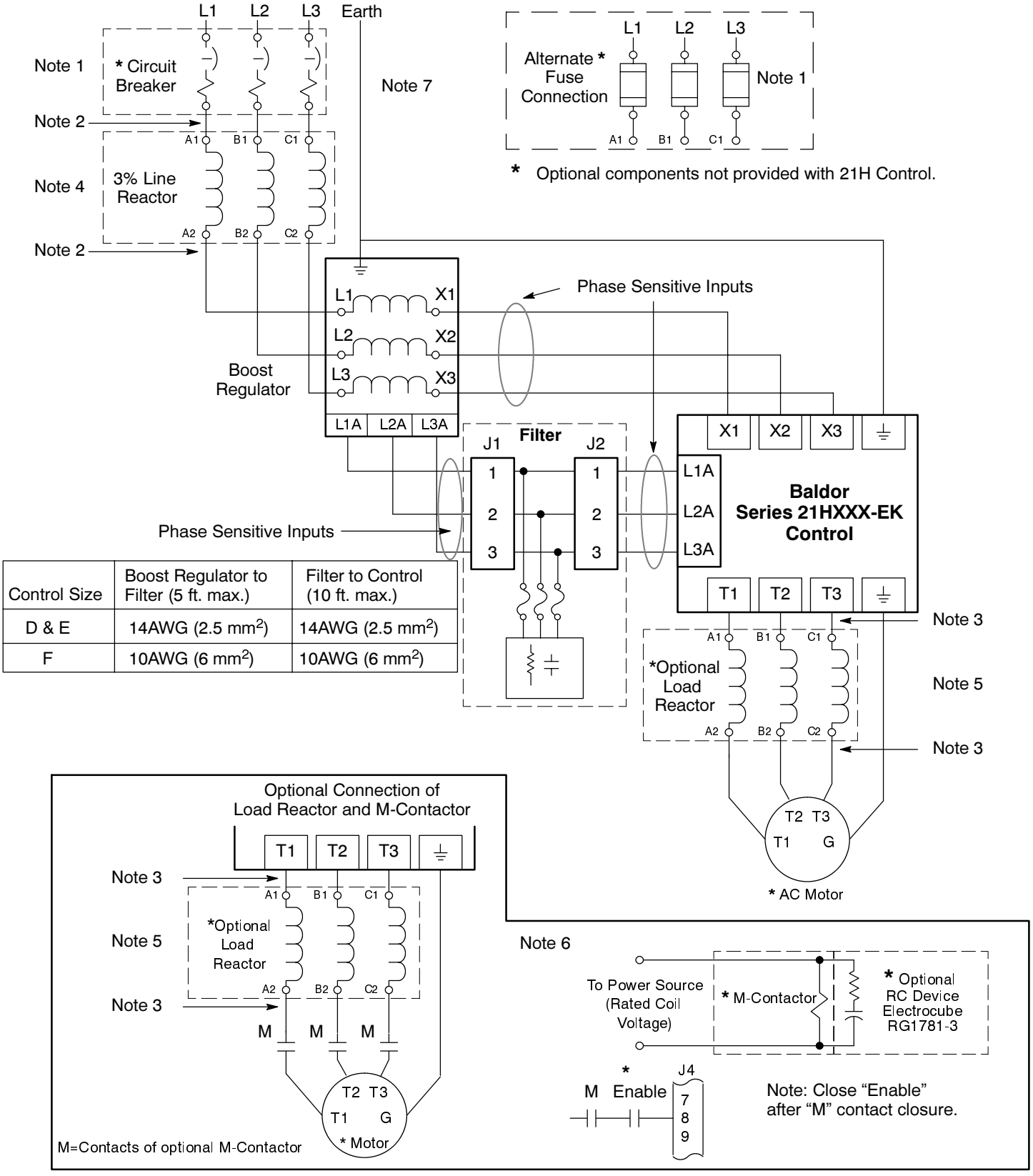
1. Connect the incoming AC power wires from the protection devices to terminals A1, B1 and C1 of the 3% line reactor.
2. Connect A2, B2 and C2 3% line reactor terminals to the L1, L2 and L3 of the boost regulator.
3. Connect X1, X2 and X3 boost regulator terminals to X1, X2 and X3 of the control.
4. * Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.
5. Connect boost regulator terminals L1A, L2A and L3A to Filter terminals J4-1, J4-2 and J4-3.
6. Connect filter terminals J2-1, J2-2 and J2-3 to control terminals L1A, L2A and L3A.
7. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the control.
8. * Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

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

Notes (for Figure 3-3):

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). Connect conduits so the use of Load Reactor or RC Device does not interrupt EMI/RFI shielding.
4. 3% Line Reactor is required at input.
5. See Load Reactors 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.
7. Connect ground terminal of control to "Earth Ground".

Figure 3-3 "EK" Control 3 Phase AC Power and Motor Connections (Size D, E & F)



Control Size	Boost Regulator to Filter (5 ft. max.)	Filter to Control (10 ft. max.)
D & E	14AWG (2.5 mm^2)	14AWG (2.5 mm^2)
F	10AWG (6 mm^2)	10AWG (6 mm^2)

See Recommended Tightening Torques in Section 6.

Motor Brake Connections

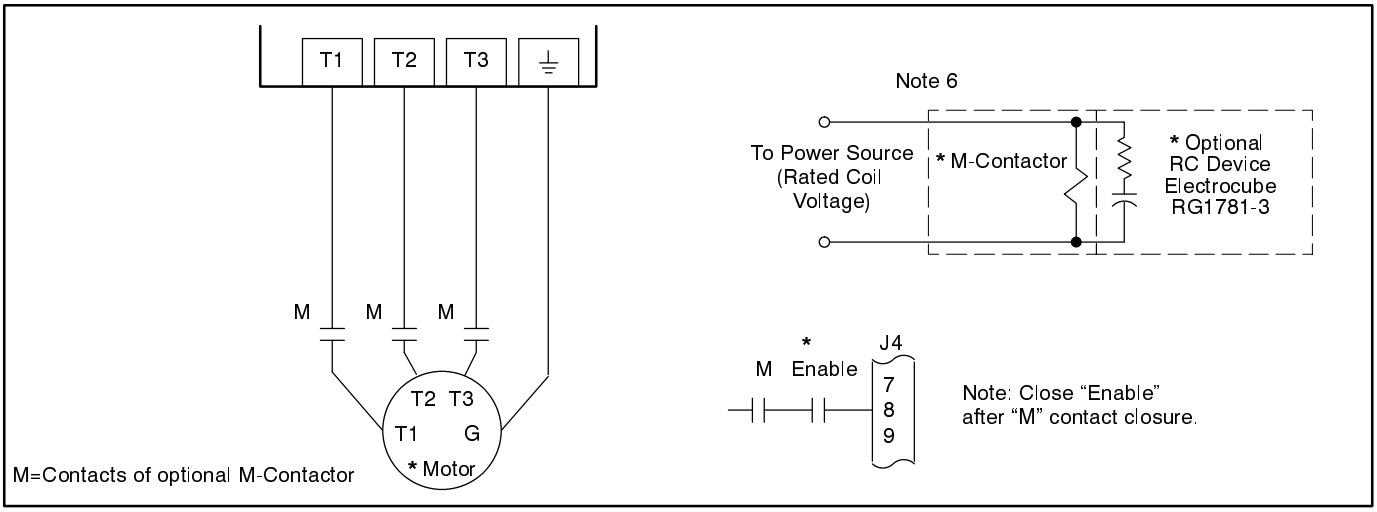
For motors with spring set brakes, connect the brake power leads and the motor power leads separately. Because the inverter has variable voltage output to the motor, the inverter may not supply enough power at low frequencies for proper brake operation. If using a motor with an internally connected brake, the brake power leads must be connected to a separate power source for proper brake operation.

M-Contactor

If required by local codes or for safety reasons, an M-Contactor (motor circuit contactor) may be installed. However, incorrect installation or failure of the M—contactor or wiring may damage the control.

⚠ **Caution:** **If an M-Contactor is installed, the control must be disabled for at least 20msec before the M-Contactor is opened. If the M-Contactor is opened while the control is supplying voltage and current to the motor, the control may be damaged.**

Figure 3-4 M-Contactor Diagram



See Recommended Tightening Torques in Section 6.

A motor circuit contactor provides a positive disconnect of the motor windings from the control. Opening the M-Contactor ensures that the control cannot drive the motor. This may be required during certain manual operations (like cleaning cutting knives etc.). Figure 3-4 shows how an M-Contactor is connected to the H series control.

Control Circuit Connections

There are two control boards in a Series 21H Vector Control. The Converting Control Board is used to rectify and process the incoming power. The Power Output Control Board provides the inverting and power output functions. The keypad is normally connected to the Power Output Control Board. Each converter board has its own J4 terminal strip. The Power Output Control Board provides the user interface for most external connections.

Converting Control Board Connections

All necessary connections for the Converting Control Board have been made at the factory prior to shipment.

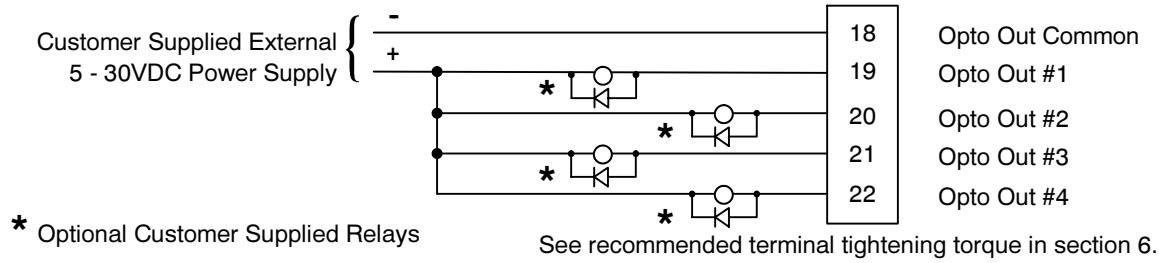
The jumper between J4-8 and J4-17 provides the enable signal to allow converter operation. These jumpers should remain installed at all times.

Sometimes it is necessary to troubleshoot the converter section using the isolated opto outputs. Figure 3-5 shows how to connect external relays to the board.

The function of each opto output is as follows: (these functions cannot be changed)

J4-19	Ready
J4-20	At Voltage
J4-21	Fault
J4-22	Overtemperature Warning

Figure 3-5 Converting Control Board Opto Output Wiring



* Optional Customer Supplied Relays

See recommended terminal tightening torque in section 6.

Power Output Control Board Connections (and Connection Diagram)

Several operating modes are available in the Series 21H 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.

Keypad Operating Mode (see Figure 3-6)

The Keypad operating mode allows the control to be operated from the keypad. In this mode no control connection wiring is required. However, the Enable, Stop and External Trip inputs may optionally be used. All other opto inputs remain inactive. However, the analog outputs and opto-outputs remain active at all times. To use one of the three opto inputs, you must set the associated parameter value.

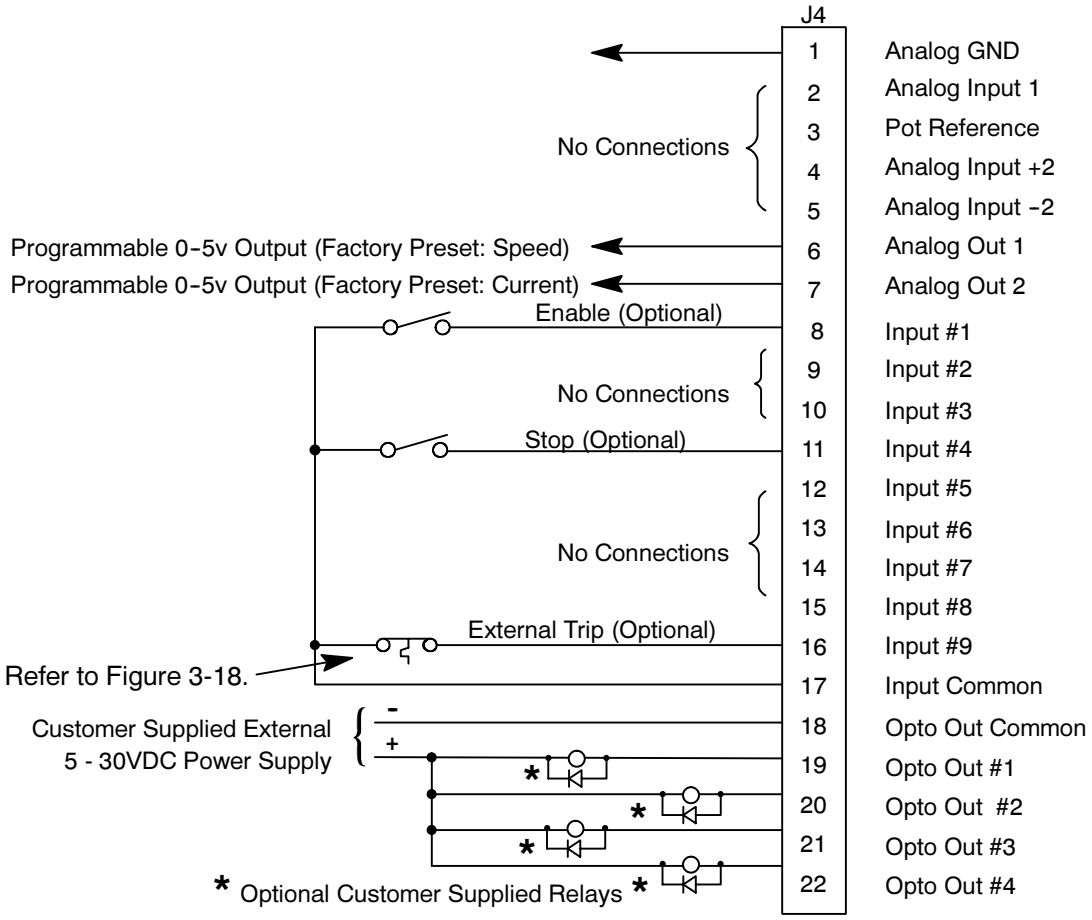
For operation in Keypad mode, set the Level 1 Input block, Operating mode parameter to Keypad. At the keypad press the LOCAL key to change between the LOCAL and REMOTE modes. The word “LOCAL” or “Remote” should appear on the keypad display.

To use the Enable input, J4-8 must be connected and the Local Enable INP parameter in the Level 2 Protection block must be set to ON. The Enable line is normally closed. When opened, the motor will COAST to a stop. When the enable line is again closed, the motor will not start until a new direction command is received from the keypad (▲ or ▼ key).

To use the Stop input, J4-11 must be connected and the Level 1 Keypad Setup block, LOC. Hot Start parameter must be set to ON. The Stop line is normally closed. When opened, the motor will COAST or REGEN to a stop depending upon the setting of Level 1 Keypad Setup block Keypad Stop Key parameter value. Closing the input will immediately start the motor.

The External Trip input is used to cause a fault condition during a motor over temperature condition. The External Trip input (J4-16) must be connected and the External Trip parameter in the Level 2 Protection block must be set to ON. When J4-16 is opened, the motor will coast to a stop and an External Trip fault is displayed on the keypad.

Figure 3-6 Keypad Only Connection Diagram



See recommended terminal tightening torque in section 6.

J4-8 Optional Enable input (not required).
OPEN disables the control and motor coasts to a stop if Level 1 KEYPAD block, Local Enable INP parameter is set to "ON".
CLOSED allows current to flow in the motor.

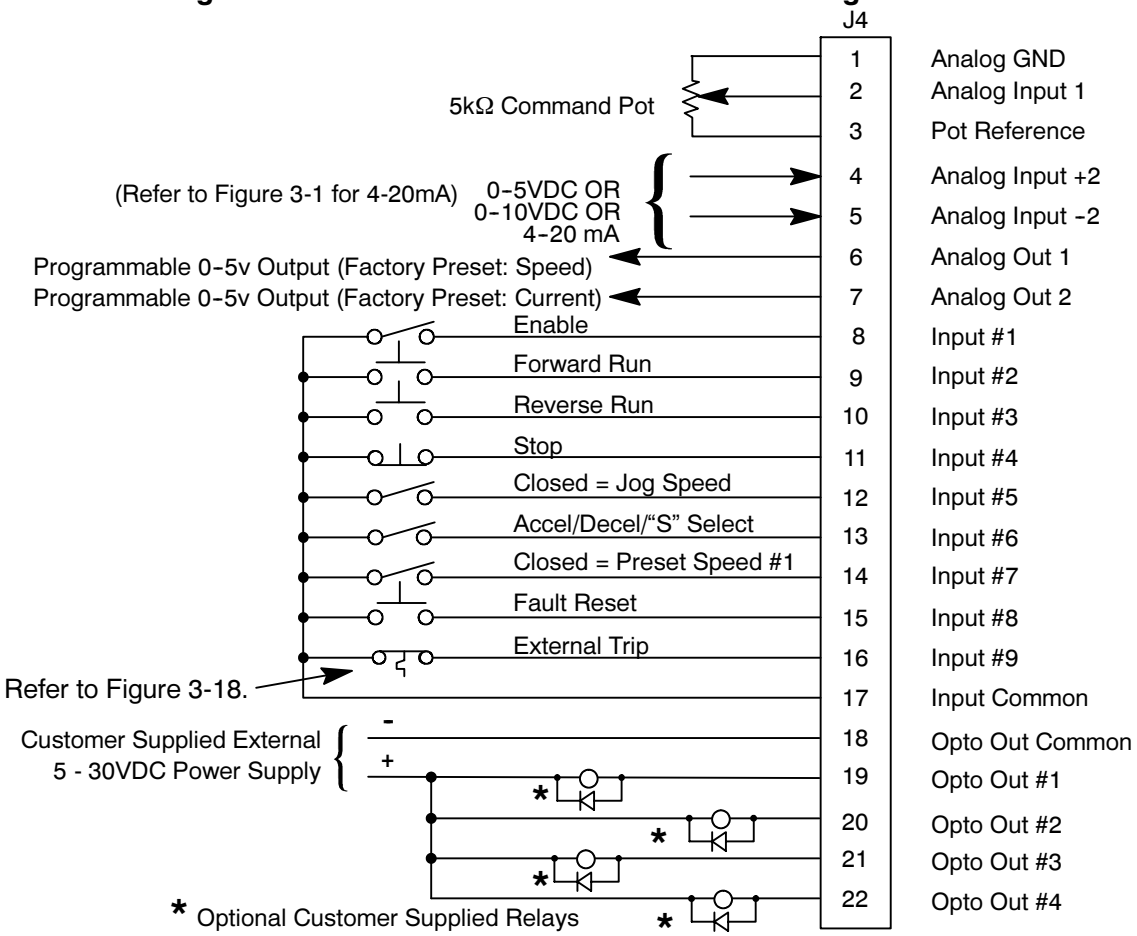
J4-11 Optional STOP input (not required).
OPEN disables the control and motor coasts or brakes to a stop if Level 1 KEYPAD block, LOCAL HOT START parameter is set to "ON". Motor will restart when switch closes after open.
CLOSED allows current to flow in the motor.

J4-16 Optional External Trip input (not required).
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 3-7 Standard Run 3-Wire Connection Diagram



See recommended terminal tightening torque in section 6.

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.

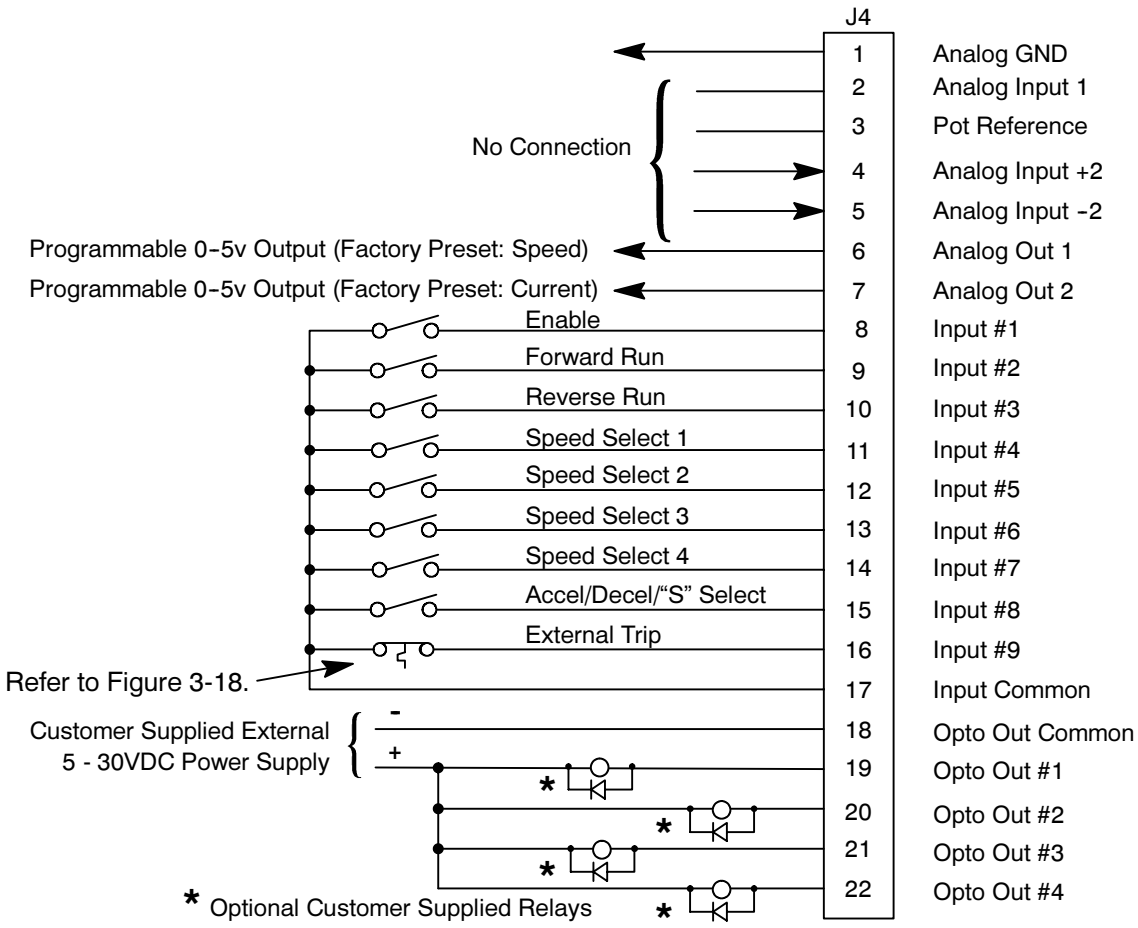
J4-14 CLOSED selects preset speed #1, (Jog Speed, J4-12, will override this),
OPEN allows speed command.

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 3-8 15 Speed, 2-Wire Control Connection Diagram



See recommended terminal tightening torque in section 6.

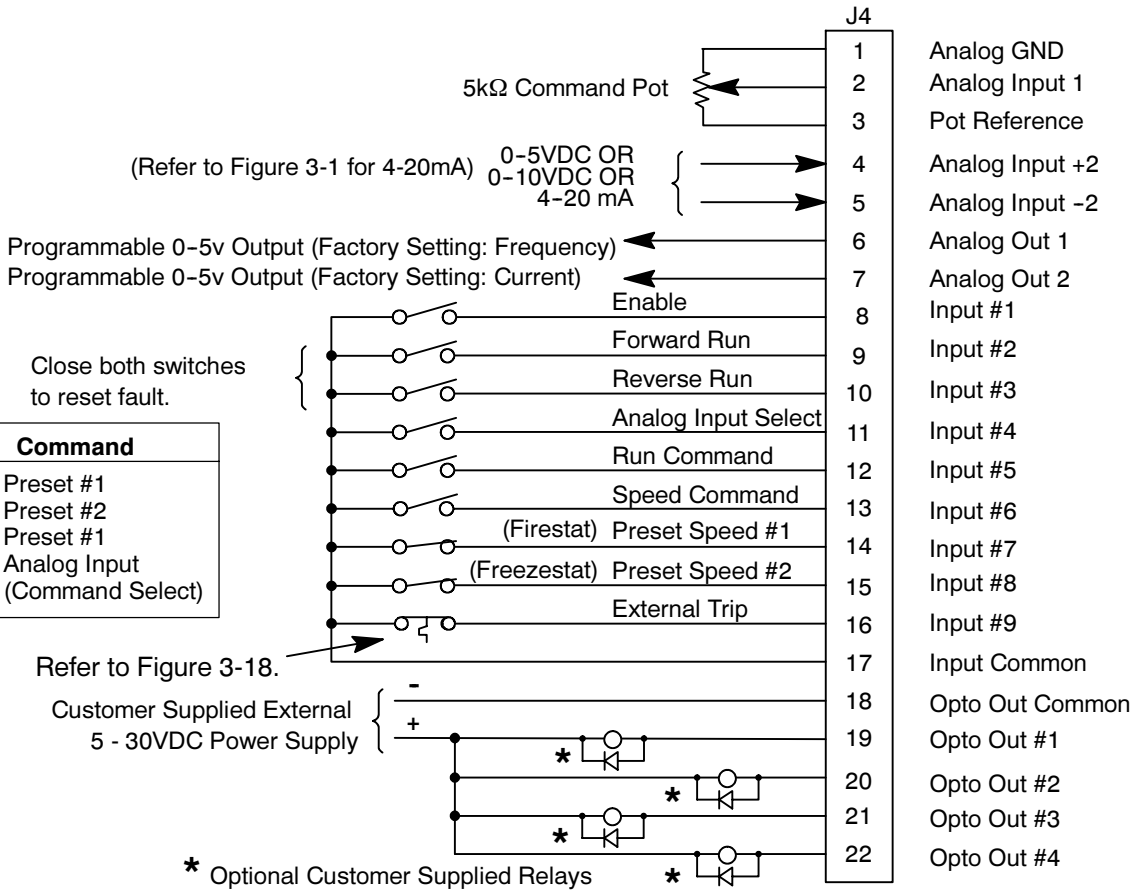
J4-8	OPEN disables the control & motor coasts to a stop. CLOSED allows current to flow in the motor.
J4-9	CLOSED operates the motor in the Forward direction. OPEN Decel to stop.
J4-10	CLOSED operates motor in the Reverse direction. OPEN Decels to stop.
J4-11 to 14	Selects programmed preset speeds as defined in Table 3-8.
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 3-8 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 3-9 Fan Pump, 2 Wire Control Connection Diagram



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

See recommended terminal tightening torque in section 6.

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 Terminal Strip to Keypad (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.

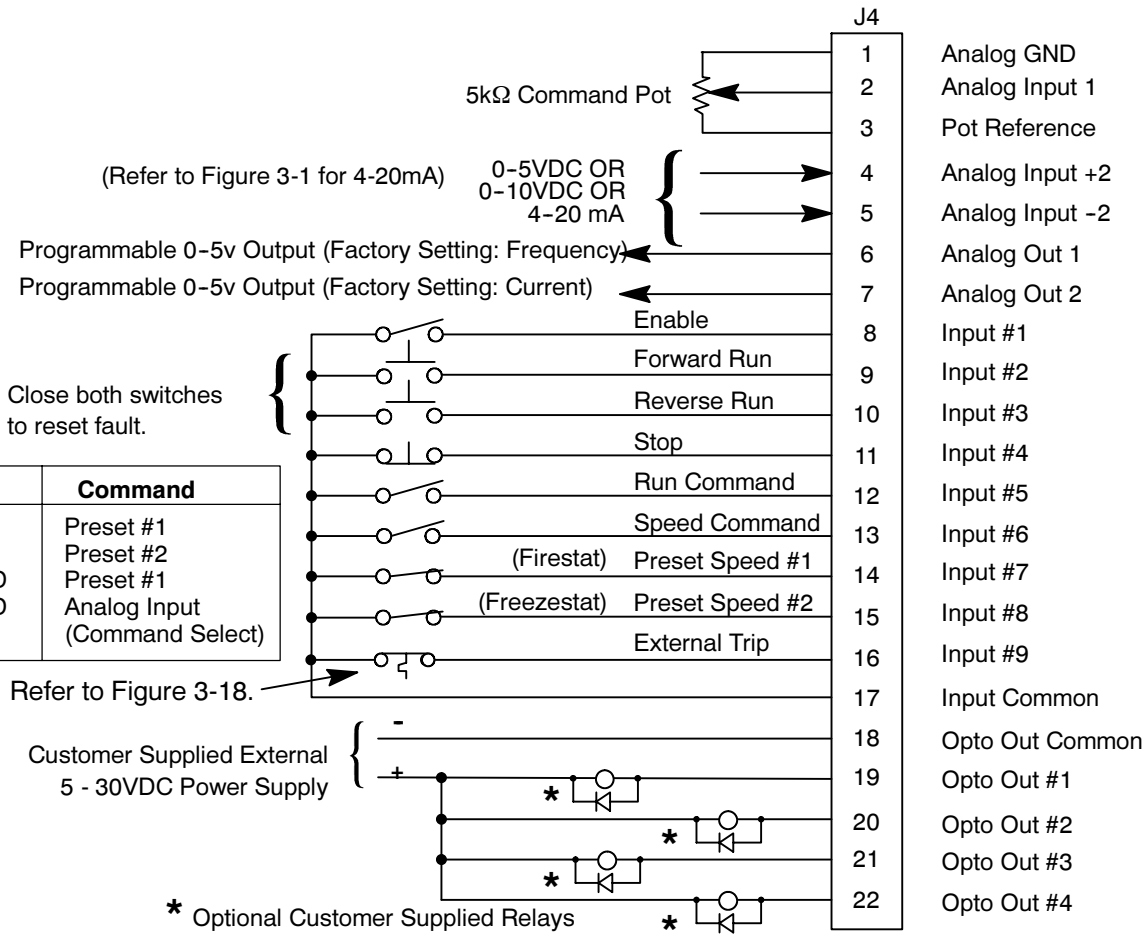
J4-15 OPEN selects preset speed #2 regardless of the Speed Command input J4-13.

Note: If J4-14 and 15 are both closed, the 5k pot provides the speed command input.
If J4-14 and 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 3-10 Fan Pump, 3 Wire Control Connection Diagram



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

See recommended terminal tightening torque in section 6.

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 Terminal Strip to Keypad (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.

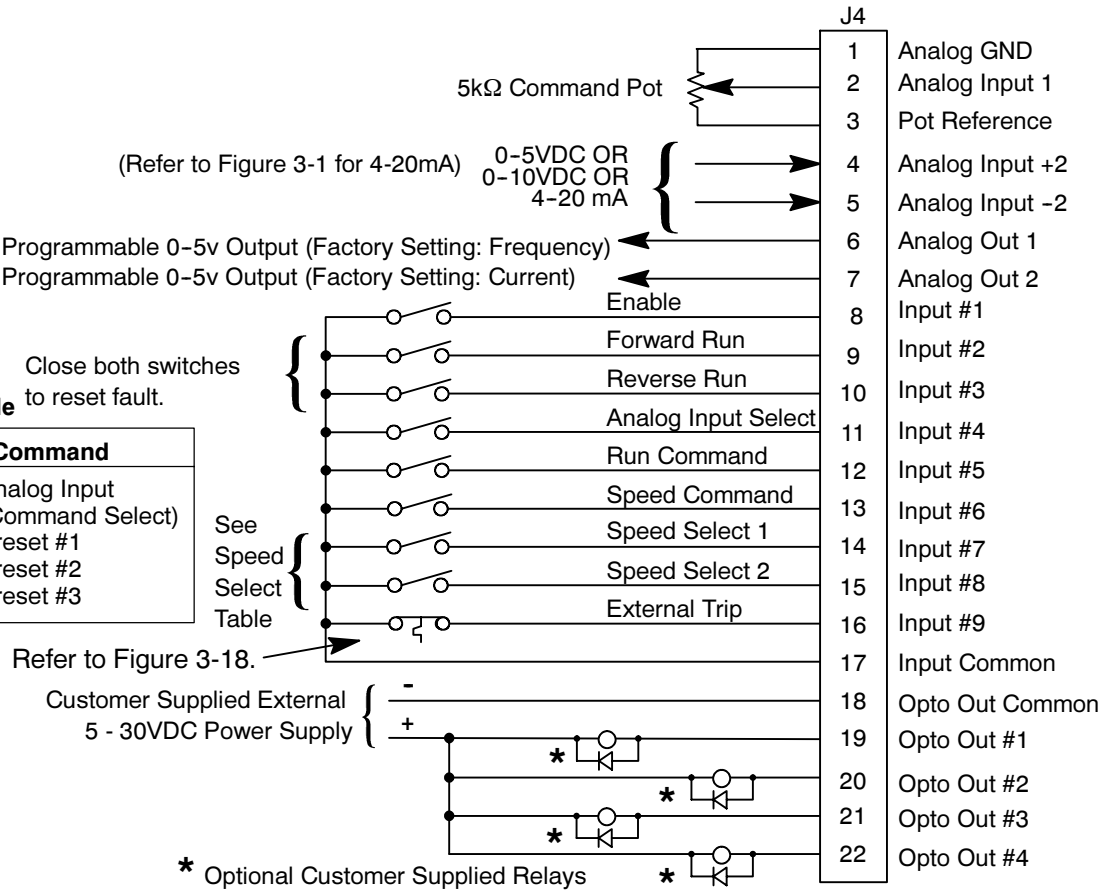
J4-15 OPEN selects preset speed #2 regardless of the Speed Command input J4-13.

Note: If J4-14 and 15 are both closed, the 5k pot provides the speed command input.
If J4-14 and 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 3-11 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

See recommended terminal tightening torque in section 6.

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.

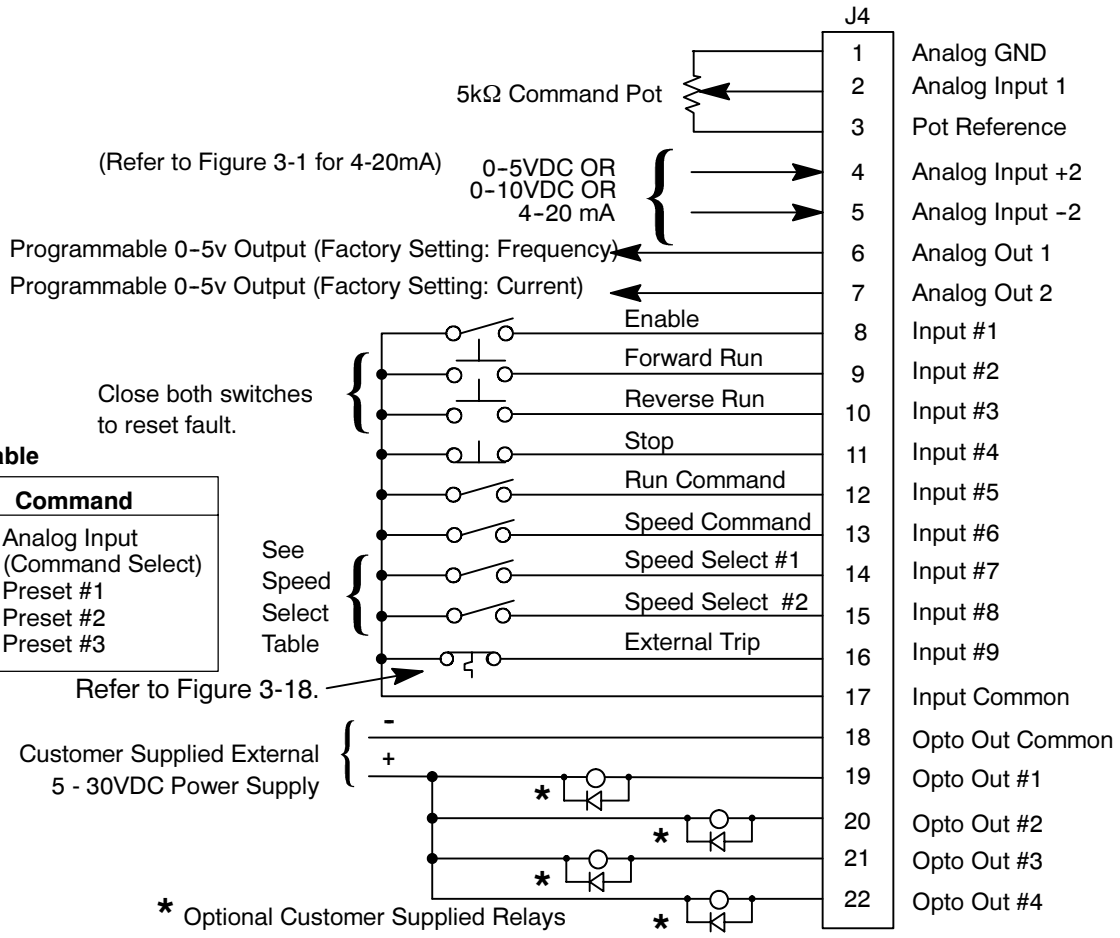
J4-14 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-11.

J4-15 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-11.

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 3-12 3 Speed Analog, 3 Wire Control Connection Diagram



See recommended terminal tightening torque in section 6.

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 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 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.

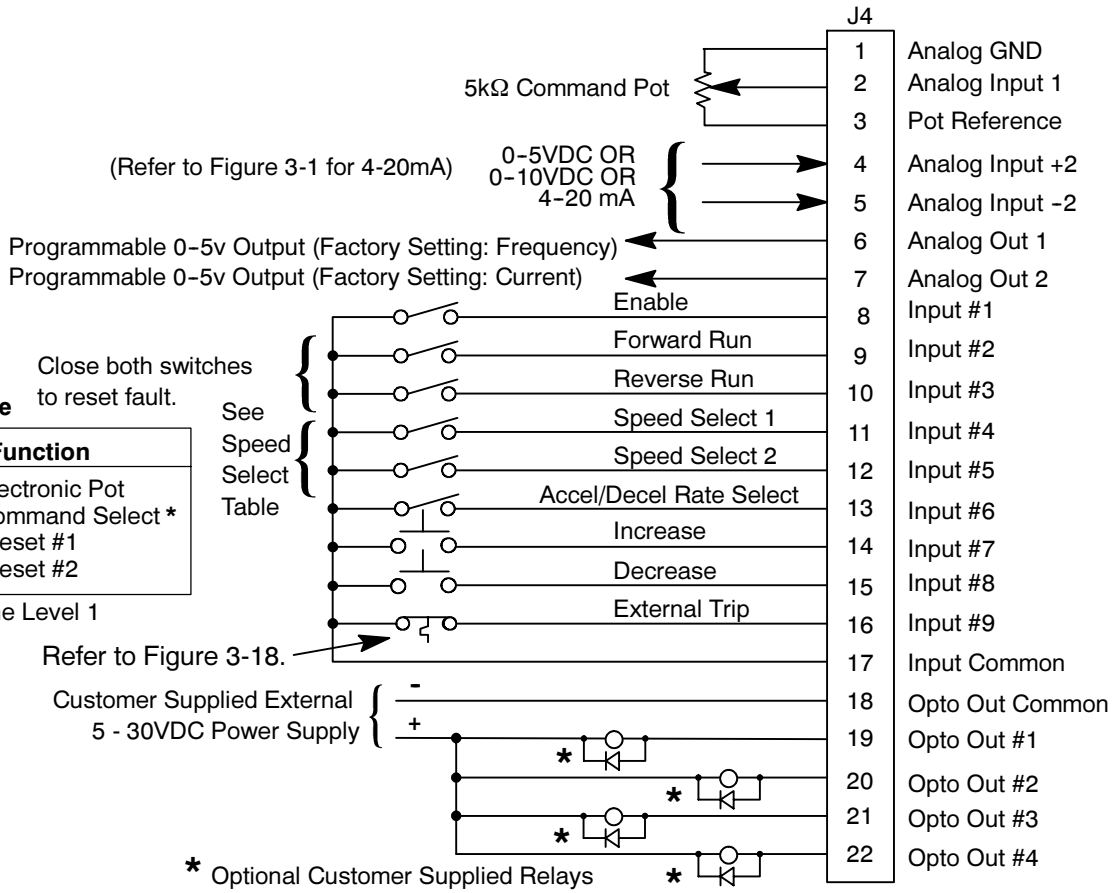
J4-14 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-12.

J4-15 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-12.

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 3-13 EPOT, 2 Wire Control Connection Diagram



Speed Select Table

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

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

See recommended terminal tightening torque in section 6.

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 programmed preset speeds as defined in the Speed Select Table in Figure 3-13.

J4-12 Selects programmed preset speeds as defined in the Speed Select Table in Figure 3-13.

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

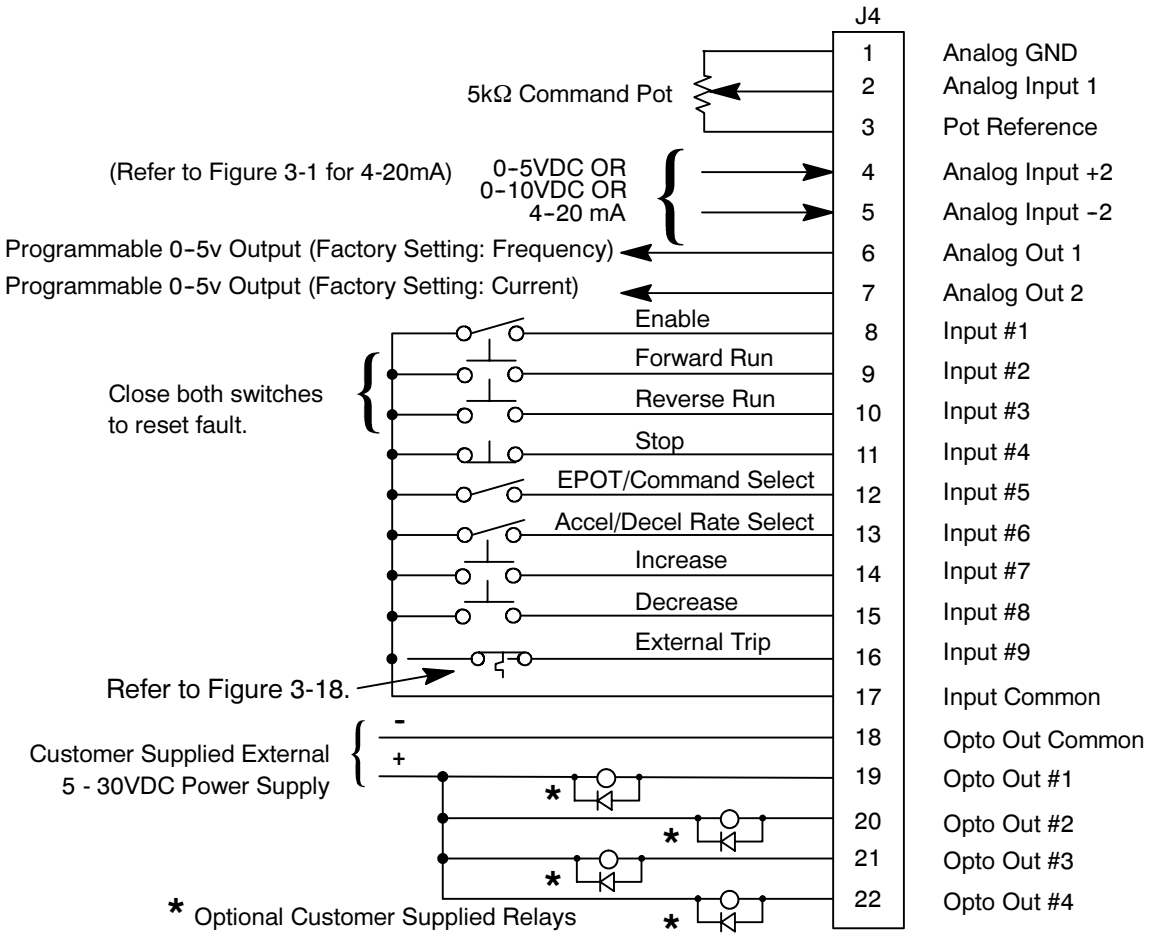
J4-14 Momentary CLOSED increases motor speed while contact is closed.

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 3-14 EPOT, 3 Wire Control Connection Diagram



See recommended terminal tightening torque in section 6.

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 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 3-15 shows a block diagram of a 3 input PID Control system.

Figure 3-15 Simplified Process Control Feedback System Diagram

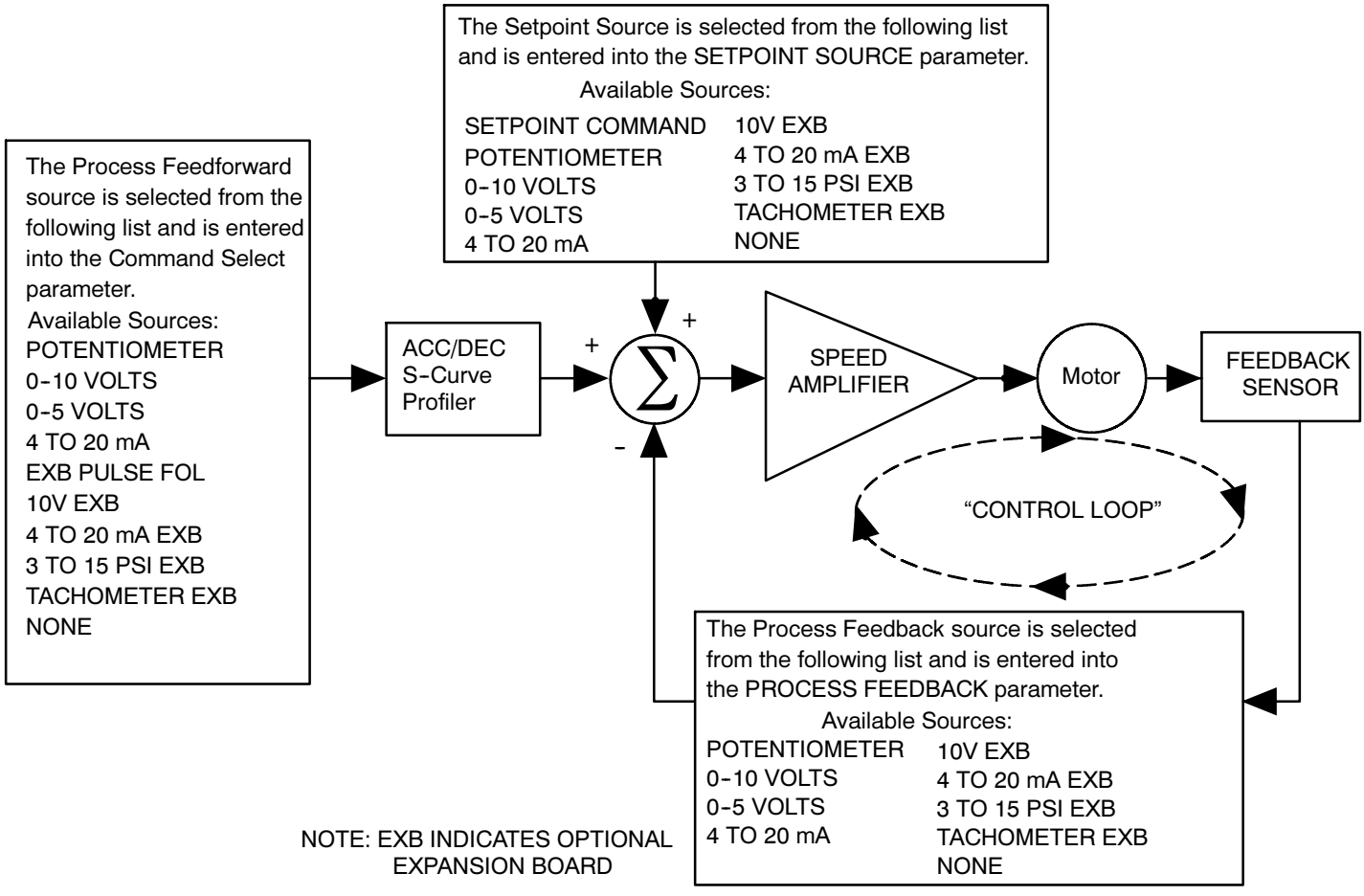


Table 3-9 Process Mode Input Signal Compatibility

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] [5]						▥	
Serial EXB [5] [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

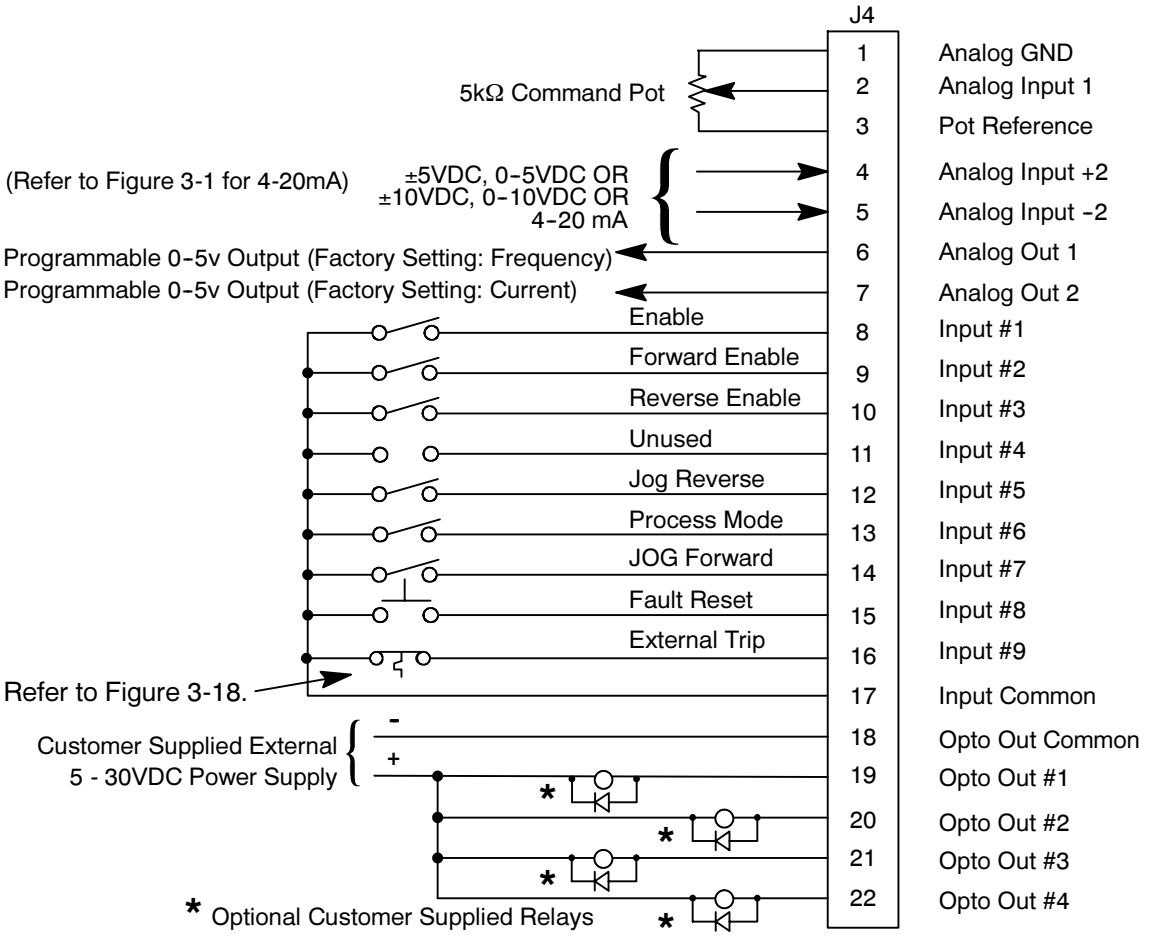
Name	Description
Process FDBK	Process Feedback scaled input. Useful for observing or tuning the process control loop.
Setpoint CMD	Setpoint Command scaled input. Useful for observing or tuning the process control loop.
Speed Command	Commanded Motor Speed. Useful for observing or tuning the output of 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 3-16 Process Mode Connection Diagram



See recommended terminal tightening torque in section 6.

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”.

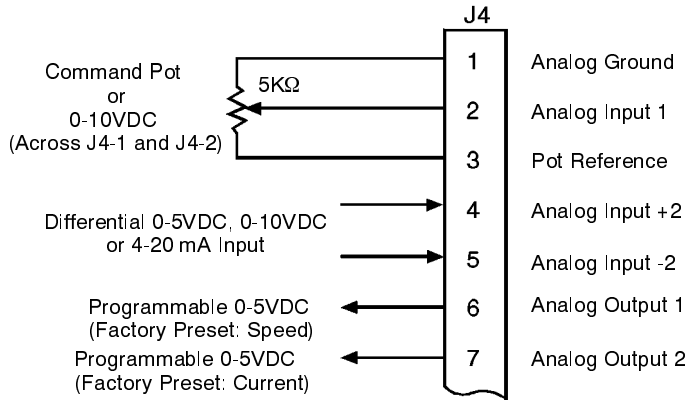
Note: Analog #2 Input: ±5VDC and ±10VDC are selected by Setpoint Source as 0-5VDC and 0-10VDC respectively.

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 3-17. 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 3-17 Analog Inputs and Outputs



See recommended terminal tightening torque in section 6.

Analog Input #1 (Single Ended)

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).

The single ended analog input #1 can be used in one of three ways. Speed command (Level 1 Input block, Command Select=Potentiometer). Process Feedback (Level 2 Process Control block, Process Feedback=Potentiometer). Setpoint Source (Level 2 Process Control block, Setpoint Source=Potentiometer).

When using Analog Input #1, the respective parameter must be set to "POTENTIOMETER".

Note: A potentiometer value of 5kΩ to 10kΩ, 0.5 watt may be used.

1. Connect the wires from the 5KΩ pot at the J4 terminal strip. One end of the pot is connected to J4-1 (analog ground) and the other end is connected to J4-3 (reference voltage).
2. Connect the wiper of the pot to J4-2. The voltage across terminals J4-1 and J4-2 is the speed command input.

Analog Input #2
(Differential)

Analog input #2 accepts a 0-5VDC, 0-10VDC or 4-20 mA in all operating modes and ±5VDC and ±10VDC in Bipolar or Process Control modes. The operating mode is defined in 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 wires from the source voltage to Analog Input +2 (J4-4) and the Analog Input –2 (J4-5).
2. If using a 4-20 mA command signal, jumper JP2 located on the main control board must be on pins 1 & 2. For voltage input, JP2 must be on pins 2 & 3. Refer to Figure 3-1 for jumper position information.

Note: Analog Input #2 can be connected for single ended operation by grounding either of the inputs, provided the common mode voltage range is not exceeded. The common mode voltage can be measured with a voltmeter. Apply the maximum command voltage to analog input 2 (J4-4, 5). Measure the AC and DC voltage across J4-1 to J4-4. Add the AC and DC readings together. Measure the AC and DC voltage from J4-1 to J4-5. Add the AC and DC readings together.

If either of these measurement totals exceeds a total of ±15 volts, then the common mode voltage range has been exceeded. If the common mode voltage range has been exceeded, the solution is either to change the command voltage source or isolate the command voltage with a commercially available signal isolator.

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 scaling of each output is programmable in the Level 1 Output block, Analog Scale #1 or #2.

External Trip Input

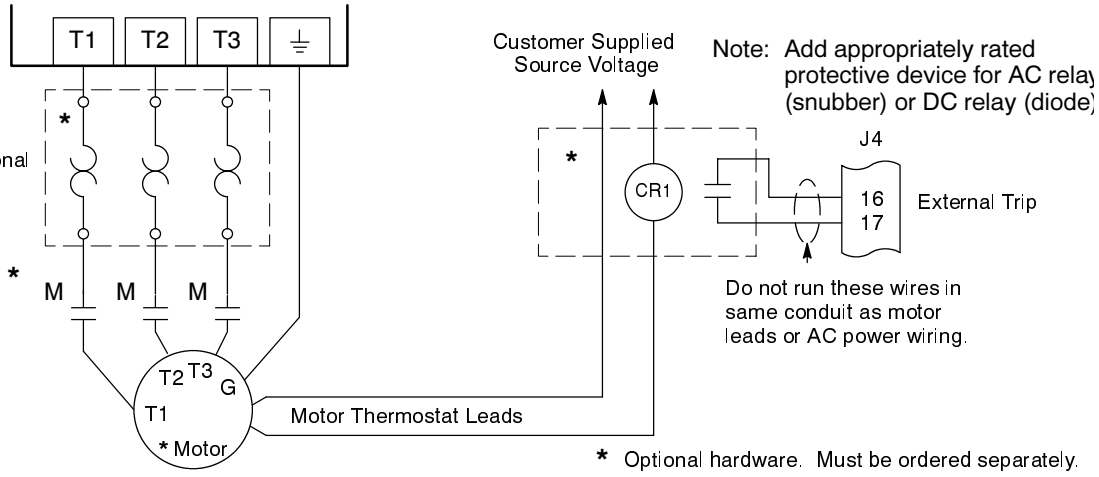
⚠ **Caution: Do not supply any power on the External Trip (motor thermostat) leads at J4-16 or J4-17 as the control may be damaged. Use a dry contact type that requires no external power to operate.**

Terminal J4-16 is available for connection to a normally closed thermostat or overload relay in all operating modes, shown in Figure 3-18. 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. 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 3-18 Motor Temperature Relay



Opto-isolated Outputs

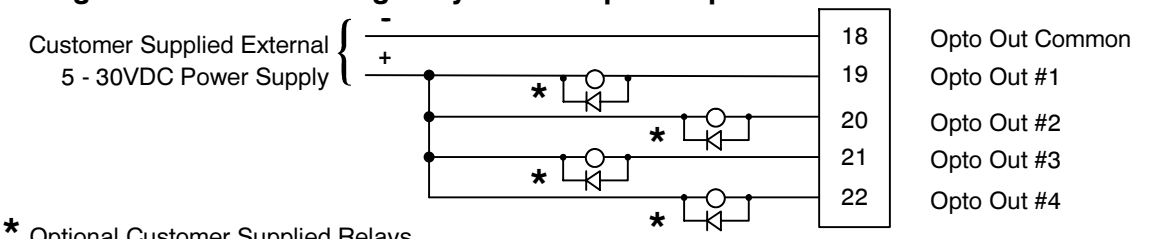
Four programmable opto-isolated outputs are available at terminals J4-19 through J4-22.

The active low 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, 100V (1N4002) minimum should be connected across the relay coil. J4-18 is the common for the opto output. Connect the relays as shown in Figure 3-19.

Each opto out is programmed in the Level 1 Output programming block.

Figure 3-19 Connecting relays to the Opto Output Terminals



See recommended terminal tightening torque in section 6.

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 of motor shafts.
2. Verify that all motor couplings are tight without backlash.
3. 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 Figure 3-1 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 Series 21H Inverter Line Regen Control has two control boards installed. The "Converting Control Board" is used to rectify and process the incoming power. The "Power Output Control Board" provides the inverting and power output functions. Each converter board has its own J1 terminal strip.

The Power Output Control Board normally has the keypad connected to it. The J1 terminal strip of the Power Output Board provides the user interface for most external connections and software parameters. The Power Output Control board is mounted above the Converting Control Board.

The Converting Control Board is programmed at the factory and should not require program changes. However, you can change the values of several parameters within the firmware (refer to parameters in Appendix B). The J1 terminal strip of the Converting Control Board is factory wired for normal operation.

The keypad must be plugged into the Converting Control Board to change parameter values, or access the fault log or the diagnostic information of the Converting Control Board. A sheet metal panel separates the two control boards and there is a small access hole the the sheet metal panel to attach the keypad to the Converting Control Board. To attach the keypad to the converting control board, use the following procedure:

Keypad Installation in the Converting Control Board

1. Be sure all power is disconnected from the Series 21H Control. Wait at least 5 minutes for the bus capacitors to discharge before you proceed.
2. Open the Series 21H cover.
3. Remove the keypad from the Power Output Control Board (secured by 4 screws).
4. Remove the extension ribbon cable from its retaining strap (secured to the sheet metal panel).
5. Connect one end of the ribbon cable into the keypad connector in the Converting Control Board (through the access hole in the sheet metal panel).
6. Connect the other end of the ribbon cable to the keypad.

The control can now be powered up and the Converting Control Board can be programmed or the fault log may be examined. To restore the keypad as factory installed, use the following procedure:

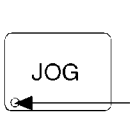
Keypad Installation in the Power Output Control Board

1. Be sure all power is disconnected from the Series 21H Control. Wait at least 5 minutes for the bus capacitors to discharge before you proceed.
2. Remove the keypad from the ribbon cable and remove the ribbon cable from the keypad connector in the Converting Control Board.
3. Store the extension ribbon cable in its retaining strap (secured to the sheet metal panel).
4. Install the keypad on Power Output Control Board (secured by 4 screws).
5. Close and secure the Series 21H cover.

Baldor Keypad

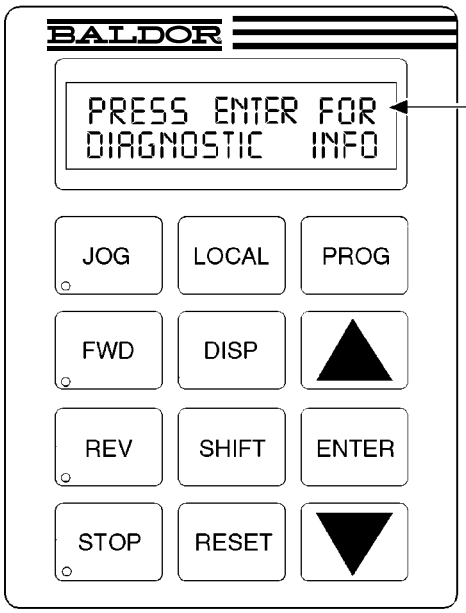
The keypad is used to program the control parameters, to operate the motor and to monitor the status and outputs of the control by accessing the display options, diagnostic menus and the fault log.

Figure 4-1 Keypad



JOG - (Green) lights when Jog is active.
FWD - (Green) lights when FWD direction is commanded.
REV - (Green) lights when REV direction is commanded.
STOP - (Red) lights when motor STOP is commanded.

Indicator Lights



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 regen 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.

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.

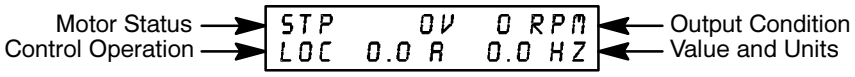
▲ - (UP Arrow).
Press ▲ to change the value of the parameter being displayed. Pressing ▲ increments the value to the next greater value. Also, when the fault log or parameter list is displayed, the ▲ key will scroll upward through the list. In the local mode pressing the ▲ key will increase motor speed 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. Several output status values 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		
Press DISP Key	Places control in display mode		
Press SHIFT SHIFT	Allows display contrast adjustment		
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	Display mode showing 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 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	Display mode showing 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 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 real time opto inputs & outputs states. (0=Open, 1=Closed)	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. In the Display Mode, press the PROG key to access the Program Mode. To return to the Display Mode, press the DISP key. Note that when a parameter is selected alternately pressing the Disp and Prog keys will change 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	At the flashing cursor, select mode desired. Standard run is shown.
Press ENTER	Save selection to memory.	OPERATING MODE P: STANDARD RUN	Press ENTER to save selection.
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 parameter values already programmed will be changed 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 a 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.

Note: All parameter values already programmed will be changed 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 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.

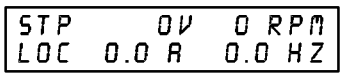
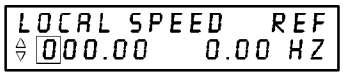
1. JOG Command.
2. Speed adjustment with Keypad entered values.
3. Speed adjustment using the Keypad arrow keys.

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.

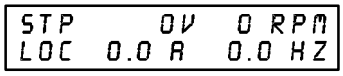
Accessing the Keypad JOG Command

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.		Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.		Display mode. Stop LED on.
Press ENTER key	Select the local speed reference.		
Press SHIFT key	Move blinking cursor right one digit.		☐ represents blinking cursor.
Press ▲ key	Increase tens value by one digit.		
Press ENTER key	Save new value and return to display mode.		
Press FWD or REV key	Motor runs FWD or REV at commanded speed.		FWD (REV) LED on.
Press STOP key	Motor stop command issued.		Display mode. Stop LED on.

Speed Adjustment Using Arrow Keys

Action	Description	Display	Comments
Apply Power	Keypad Display shows this opening message.		Logo display for 5 seconds.
	If no faults and programmed for LOCAL operation.		Display mode. Stop LED on.
Press FWD or REV key	Motor runs FWD or REV at selected speed.		FWD key LED on.
Press ▲ key	Increase motor speed.		Display mode.
Press ▼ key	Decrease motor speed.		Display mode.
Press STOP key	Motor stop command issued.		Display mode. Stop LED on.
Press FWD or REV key	Motor runs FWD or REV at commanded speed.		Motor runs at previously set speed.
Press STOP key	Motor stop command issued.		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 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 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 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.

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.

Parameter Definitions

Converter Control Board Parameters

Converting section parameters are programmed at the factory. Table 4-1 is a list of the parameters that can be changed. However,to make any parameter adjustments the keypad must be installed in the Converting Control Board as described previously in this section. Each Converting section parameter is defined in Table 4-2.

Table 4-1 Converting Section Parameter List

LEVEL 1 BLOCKS
Miscellaneous
Factory Settings
Line Inductor
Bus Capacitance
DAC Selection
Security Control
Security State
Access Timeout
Access Code

Table 4-2 Converter Control Board Parameter Definitions

Block Title	Parameter	Description
MISC	Factory Settings	Restores factory settings for converter section parameters. Select YES and press ENTER to restore factory parameter values. The Keypad Display will show "Operation Done" then return to "NO" when complete.
	Line Inductor (Boost Regulator)	The value of the internal or external boost regulator inductor in "mH". This parameter sets the current loop gain of the converter section. This value is factory set and should not require adjustment.
	Bus Capacitance	Sets the nominal DC Bus capacitance. This parameter sets the voltage loop gain for the converter section. This value is factory set and should not require adjustment unless more capacitance or more controls are added across the DC Bus.
	DAC Selection	This parameter configures both Analog Outputs #1 (J1-6) and #2 (J1-7) at the same time for troubleshooting purposes. AB BC Cross- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents the Line-Line voltage (L1-L2). Analog Output #2 represents the Line-Line voltage (L2-L3). DQ CONTRLR- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents the Direct Control voltage. Analog Output #2 represents the Quadrature Control voltage. DQ Currents- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents the Direct Control current. Analog Output #2 represents the Quadrature Control current. IQ Command- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents the Quadrature Command signal. Analog Output #2 represents the Quadrature Feedback signal. IB and IC- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents the Phase B current feedback. Analog Output #2 represents the Phase C current feedback. Va and Vb- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents the PWM voltage for Phase A. Analog Output #2 represents the PWM voltage for Phase B. Ia and Ib- This selection provides a scaled 0-5VDC signals at Outputs #1 and #2. Analog Output #1 represents Phase A current. Analog Output #2 represents Phase B current.
SECURITY CONTROL	Security State	Off - No security Access Code required to change parameter values. Local - Requires security Access Code to be entered (using the keypad) before parameter changes can be made using the Keypad. Serial - Requires security Access Code to be entered (over the Serial Link) before parameter changes can be made using the Serial Link. Total - Requires security Access Code to be entered (using Keypad or Serial Link) before parameter 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 values and view their values but you are not allowed to change their values 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 DISP). Note: This feature is not available when using the Serial operating mode or if power is cycled.
	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 shown on the lower right side of the Keypad Display at the Security Control Access Code parameter prompt.

Power Output Control Board Parameters

To make programming easier, parameters have been arranged into the two level structure shown in Table 4-3. Press the PROG key to enter the programming mode and the “Preset Speeds” programming block will be displayed. Use the Up (▲) and Down (▼) arrows to scroll through the parameter blocks. Press ENTER to access parameters within a programing block.

To make programming easier, parameters have been arranged into the two level structure shown in Table 4-3. Press the PROG key to enter the programming mode and the “Preset Speeds” programming block will be displayed. Use the Up (▲) and Down (▼) arrows to scroll through the parameter blocks. Press ENTER to access parameters within a programing block.

Tables 4-2 and 4-3 provide an explanation of each parameter. A complete Parameter Block Values list is located at the end of this manual. This list defines the programmable range and factory preset value for each parameter. The list has a space to record your settings for future reference.

Table 4-3 Power Output Section Parameter List

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	

Table 4-1 Parameter Block Definitions Level 1

Block Title	Parameter	Description
PRESET SPEEDS	Preset Speeds #1 – #15	Allows selection of 15 predefined motor operating speeds. Each speed may be selected using external switches connected to the control terminal strip (J4). For motor operation, a motor direction command must be given along with a preset speed command (at J4).
ACCEL/DECEL RATE	Accel Time #1,2	Accel time is the number of seconds required for the motor to increase frequency at a linear rate from 0 Hz to the frequency specified in the "Max Output Frequency" parameter in the Level 2 Output Limits block.
	Decel Time #1,2	Decel time is the number of seconds required for the motor to decrease frequency at a linear rate from the frequency specified in the "Max Output frequency" parameter to 0 Hz.
	S-Curve #1,2	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	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	Jog Accel Time is the Accel Time used during jog.
	Jog Decel Time	Jog Decel Time is the Decel Time used during jog.
	Jog S-Curve	Jog S-Curve is the S-Curve used during jog.

Figure 4-2 40% S-Curve Example

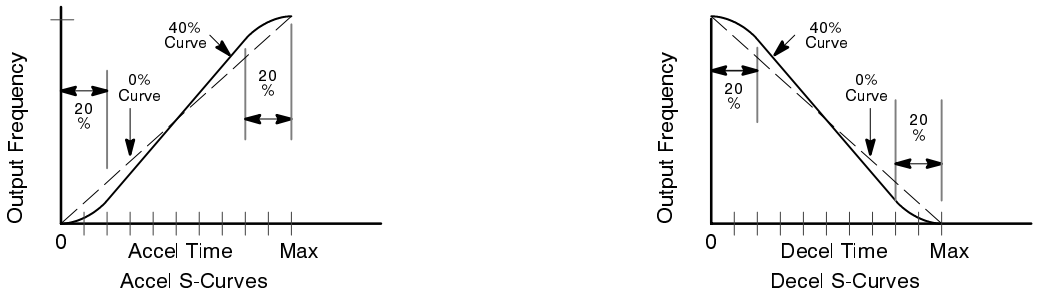


Table 4-1 Parameter Block Definitions Level 1 - Continued

Block Title	Parameter	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	Cause the motor to coast to a stop or regen to a stop for a stop command. 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	ON makes the keypad FWD key active in Local.
	Keypad Run REV	ON makes the keypad REV key active in Local.
	Keypad Jog FWD	ON makes the keypad FWD key active in Local Jog.
	Keypad Jog REV	ON 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 0.01Hz when ON (minimum increment is 1.0Hz when OFF).
	Switch on Fly	Allows switching from local to remote mode or back to local without stopping the drive.
	Loc. Hot Start	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. Select Potentiometer and connect a 5KΩ pot at J4-1, J4-2, and J4-3. 0-5 or 0-10VDC input is selected when the input signal is applied to J4-4 and J4-5. 4-20mA selection should be considered if long distance is required between the external device and the control. Current loop allows longer cable lengths at J4-4 and J4-5 with less attenuation of the command signal. 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). 10VOLT EXB - selects the 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 the optional 3-15 PSI expansion board if installed. Tachometer EXB - selects the optional DC Tachometer expansion board if installed. Pulse Follower EXB selects the optional Master Pulse Follower Expansion board if installed.
	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 the 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 the 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 smaller number.

Table 4-1 Parameter Block Definitions Level 1 - Continued

Block Title	Parameter	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. 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 the output current is greater than 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 the 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	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	A frequency band within which the at speed opto output becomes active (turns on). For example, if the at speed band is set to ±5Hz 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	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	Parameter	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	Parameters	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 starting 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	Compensates 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 versus 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	The output voltage associated with the 3PT Frequency parameter.
	V/Hz 3-PT Frequency	The output frequency associated with the 3PT Volts parameter.
	Max Output Volts	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

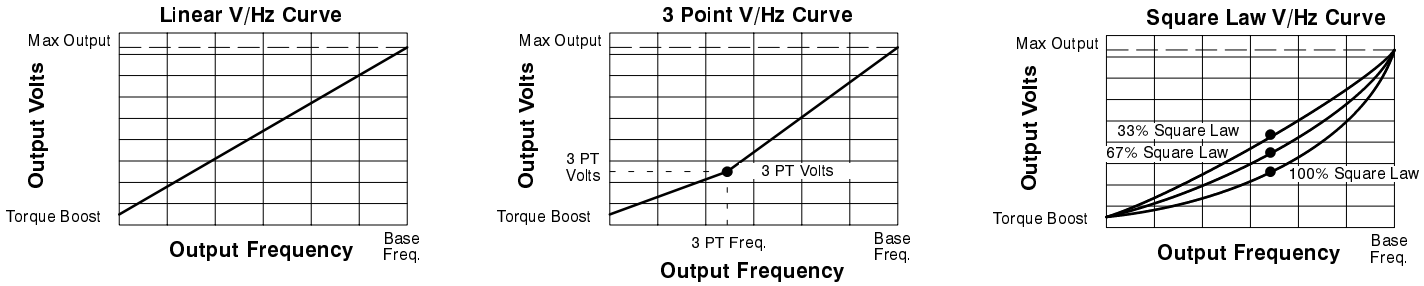


Table 4-2 Parameter Block Definitions Level 2

Block Title	PARAMETER	Description
OUTPUT LIMITS	Operating Zone	The PWM operating zone; 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	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	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 frequency will increase at the rate set by REGEN Limit ADJ but will not exceed the Level 2, Output Limits "MAX Output Frequency" parameter value.
	REGEN Limit ADJ	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 rate 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 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

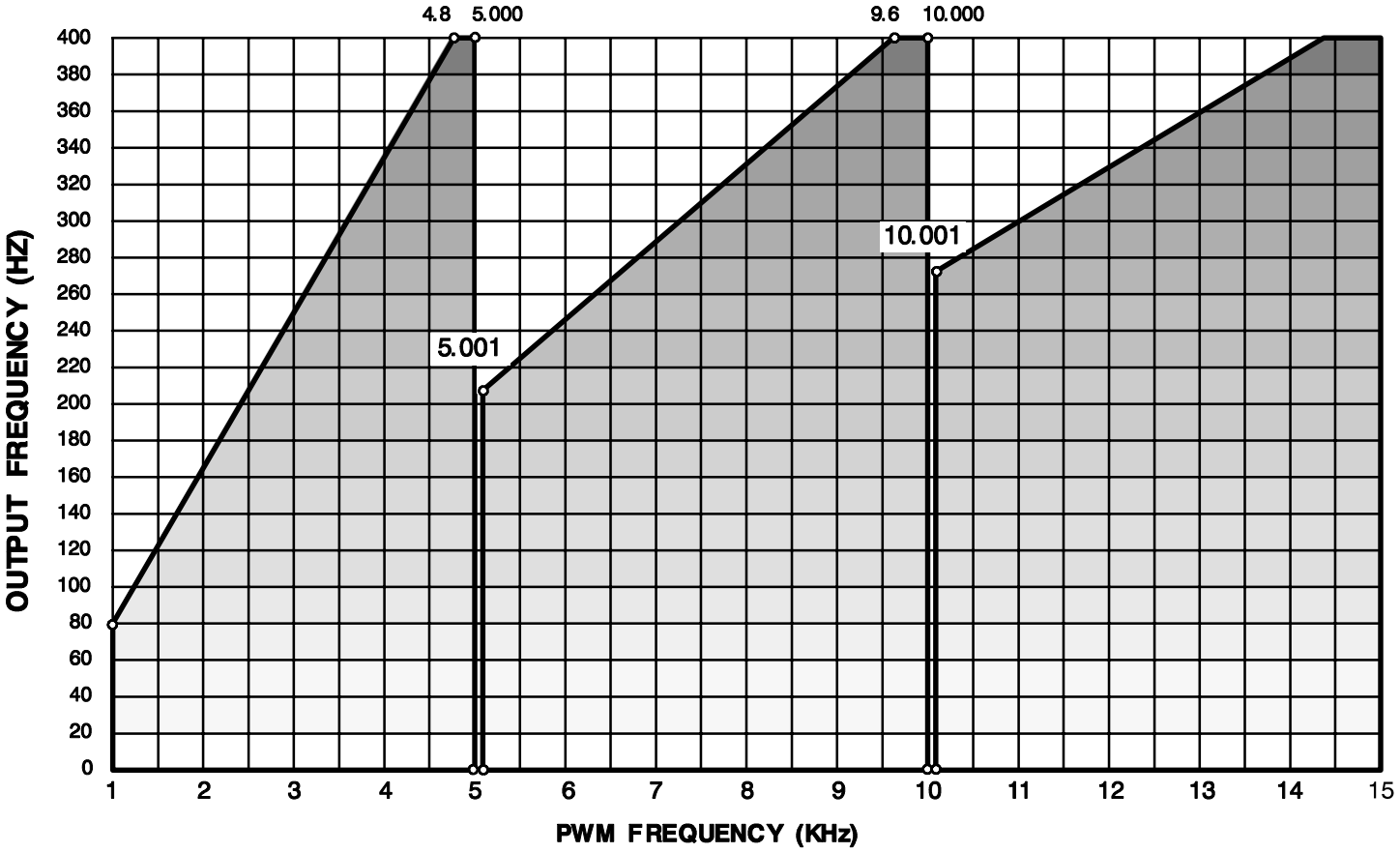


Table 4-2 Parameter Block Definitions Level 2 Continued

⚠ **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	Parameter	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	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	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 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	Parameter	Description
BRAKE ADJUST	Resistor Ohms	The dynamic braking resistor value in ohms. Refer to MN701 (dynamic braking manual) or call Baldor for additional information. If dynamic braking is not installed, enter zero.
	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 zero.
	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: $\text{Brake Time} = \text{Stop Brake Time X} \frac{\text{Output Frequency at Braking}}{\text{DC Brake Frequency}}$
	Brake on Start	If set to ON, turns DC injection braking ON for 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 that 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	Parameter	Description
PROCESS CONTROL	Process Feedback	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	The source input reference signal type to which the process feedback will be compared. If “Setpoint CMD” is selected, a fixed value that is entered in the setpoint command parameter (of the Level 2 Process Control block) 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	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 setpoint.
	Process PROP Gain	The PID loop proportional gain.
	Process INT Gain	The PID loop Integral gain.
	Process DIFF Gain	The PID loop differential gain.
	Follow I:O Ratio	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 Input (Master) part of the ratio and Follow I:O Out sets 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. This parameter defines the output master pulse rate for a downstream follower drive.

Table 4-2 Parameter Block Definitions Level 2 Continued

Block Title	Parameter	Description
SKIP FREQUENCY	Skip Frequency (#1, #2 and #3)	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)	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	Synchronizes motor and load speed 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 21H Control requires very little maintenance, if any, and should provide years of trouble free operation when installed and applied correctly. Occasional visual inspection and cleaning should be considered to ensure tight wiring connections and to remove dust, dirt, or foreign debris which can reduce heat dissipation.

Operational failures called faults are displayed on the keypad display as they occur. A comprehensive list of these faults and their meaning is provided in this section. The procedure to access the fault log and diagnostic information is also provided.

When a fault condition occurs, motor operation stops and the fault is displayed on the Keypad Display. If a REGEN FLT is displayed, this indicates a fault in the converter section of the control. To determine the specific converter section fault, the keypad must be moved to the Converting Control Board keypad connector. The fault log can be examined and the specific faults will help to further isolate the failure. A list of possible Converting Control Board Fault Messages is given in Table 5-1. Other fault messages that pertain to the Power Output Control Board are given in Table 5-2.

When a fault has been identified, all input power must be removed from the control to avoid the possibility of electrical shock. The servicing of this equipment should be handled by a qualified electrical service technician experienced in the area of high power electronics.

It is important to familiarize yourself 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

At power up, the display could be blank if the contrast is improperly set. The following procedure is used to adjust the display contrast. Be sure keypad is plugged into the keypad connector on the main control board.

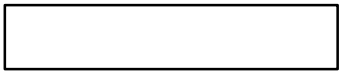
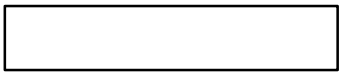
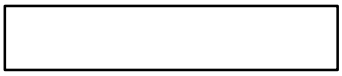
Action	Description	Display	Comments
Apply Power	No visible display.		
Press DISP key	Places control in Display mode.		Display mode.
Press SHIFT key 2 times	Allows display contrast adjustment.		
Press ▲ or ▼ key	Adjusts display contrast (intensity).		
Press ENTER key	Saves display contrast adjustment level and exits to display mode.		

Table 5-1 Converter Control Board Fault Messages

FAULT MESSAGE	DESCRIPTION
Current Sens FLT	Defective phase current sensor or open circuit detected between control board and current sensor.
DC Bus High	Bus over voltage condition occurred.
DC Bus Low	Bus under voltage condition occurred.
GND FLT	Low impedance path detected between an output phase and ground.
High INIT CUR	Phasing between main power connections, zero crossing detectors, line reactor and control does not match.
ID:No Feedback	Control board installed in power base that does not have current feedback and current feedback is required.
INT Over-Temp	Temperature of control heatsink exceeded safe level.
Invalid Base ID	Control does not recognize power base ID.
Logic Supply FLT	Logic power supply not working properly.
Lost AB Phase	Missing phase detected by μP.
Lost BC Phase	Missing phase detected by μP.
Lost User Data	Battery backed RAM parameters have been lost or corrupted. When fault cleared (Reset), the control should reset to factory preset values.
Low INIT Bus V	Insufficient bus voltage on startup.
Memory Error	EEPROM error occurred. Contact Baldor.
μP Reset	Watchdog timer detected error.
New Base ID	Control board sensed a different power base since last time it was powered up.
No Faults	Fault log is empty.
Overcurrent FLT	Instantaneous over current condition detected by bus current sensor.
Overload	Output current exceeded allowable rating.
PWR Base FLT	Desaturation of power device occurred or bus current threshold exceeded.
Sync To Line	Incorrect line phasing or frequency detected on startup.

Table 5-2 Power Output Control Board Fault Messages

FAULT MESSAGE	DESCRIPTION
Current Sens FLT	Defective phase current sensor or open circuit detected between control board and current sensor.
DC Bus High	Bus over voltage condition occurred.
DC Bus Low	Bus under voltage condition occurred.
Encoder Loss	Encoder coupling slipping or broken; noise on encoder lines, encoder power supply loss or defective encoder.
External Trip	An open circuit on J1-16 typically indicating an external over temperature condition.
Following Error	Excessive following error detected between command and feedback signals.
GND FLT	Low impedance path detected between an output phase and ground.
INT Over-Temp	Temperature of control heatsink exceeded safe level.
Invalid Base ID	Control does not recognize power base ID.
Inverter Base ID	Control board installed on power base without current feedback.
Line Regen FLT	Indicates a converter section fault.
Logic Supply FLT	Logic power supply not working properly.
Lost User Data	Battery backed RAM parameters have been lost or corrupted. When fault cleared (Reset), the control should reset to factory preset values.
Low INIT Bus V	Insufficient bus voltage on startup.
Memory Error	EEPROM error occurred. Contact Baldor.
New Base ID	Control board sensed a different power base since last time it was powered up.
No Faults	Fault log is empty.
No EXB Installed	Programmed parameter requires an expansion board.
Over Current FLT	Instantaneous over current condition detected by bus current sensor.
Overload - 1 min	Output current exceeded 1 minute rating.
Overload - 3 sec	Output current exceeded 3 second rating.
Over speed	Motor RPM exceeded 110% of programmed MAX Motor Speed.
μP Reset	Power cycled before the residual Bus voltage reached 0VDC.
PWR Base FLT	Desaturation of power device occurred or bus current threshold exceeded.
Resolver Loss	Resolver feedback problem is indicated (if resolver used).
Torque Prove FLT	Unbalanced current between all 3 motor phases.
User Fault Text	Custom software operating fault occurred.

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 the last 31 faults. If more than 31 faults have occurred, the oldest fault will be deleted from the fault log. 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 5-3 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.
uP RESET	A software watchdog timer has reset the processor because a process has timed out.
FLT Log MEM Fail	Corrupt data in fault log (may occur on older systems only).
Current SENS FLT	Failure to sense phase current.
Bus Current SENS	Failure to sense bus current.

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 real time opto inputs & outputs states. (0=Open, 1=Closed)	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.

Table 5-4 Converter Section Troubleshooting

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
Current Sense FLT	Open circuit between control board and current sensor or defective current sensor.	Check control wires between control board and current feedback sensor.
DC Bus High	Incorrect setting of converter bridge parameter.	Check Bus Capacitance value of converter section parameters.
	Decel rate too fast.	Increase Decel time parameter setting.
DC Bus Low	Input voltage too low.	Monitor power line fluctuations with date and time imprint to isolate power problem. Check power line disturbances (sags caused by start up of other equipment). Use step up isolation transformer if needed.
GND FLT	Improper wiring.	Disconnect wiring between control and motor. Retry test. If GND FLT is cleared, reconnect motor leads and retry the test. Rewire as necessary. Repair motor. If GND FLT remains, contact Baldor.
High INIT CUR	Incorrect phasing between input power, filter assembly and line reactors.	Check connections for proper phasing as detailed in Section 3 of this manual.
ID:No Feedback	Control board is installed on wrong power base.	Change power base to one that has current feedback sensors.
INT Over-Temp	Ambient temperature too high.	Relocate control to a cooler area. Add cooling fans or air condition the cabinet.
	Drive overloaded.	Verify proper sizing of control and motor. Correct loading of motor.
	Cooling fans or air path is clogged.	Clean fans and air path. Ensure fans are operating.
Invalid Base ID	Control does not recognize converter power base.	Press “RESET” key on keypad. If fault remains, call Baldor.
Logic Supply FLT	Power supply malfunctioned.	Replace logic power supply.
Lost AB Phase	Wire disconnected or phase lost.	Check for input power on all 3 phases. Check wiring and correct errors in all output wiring and wiring between individual components on EK type controls. Press “RESET” key on keypad. If fault remains, call Baldor.
Lost BC Phase	Wire disconnected or phase lost.	Check for input power on all 3 phases. Check wiring and correct errors in all output wiring and wiring between individual components on EK type controls. Press “RESET” key on keypad. If fault remains, call Baldor.
Lost User Data	Battery backed memory failure.	Parameter data was erased. Disconnect power to control and apply power (cycle power). Enter all parameters. Cycle power. If problem persists, contact Baldor.
Low INIT Bus V	Improper AC line voltage.	Check input AC voltage level.
Memory Error	EEPROM memory fault occurred.	Press “RESET” key on keypad. If fault remains, call Baldor.
μP Reset	Power was cycled before Bus voltage reached 0VDC.	Press “RESET” key on keypad. Disconnect power and allow at least 5 minutes for Bus capacitors to discharge before applying power. If fault remains, call Baldor.
New Base ID	Software parameters are not initialized on newly installed control board.	Press “RESET” key on keypad to clear the fault condition. Cycle power (turn power OFF then ON). Refer to Section 4 and initialize new software. Access diagnostics and compare power base ID number to list in Table 5-6 to ensure a match. Re-enter the Parameter Block Values you recorded in the User Settings at the end of this manual. Autotune the control. If fault remains, call Baldor.

Continued on next page.

Table 5-4 Converter Section Troubleshooting Continued

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
Over Current FLT	Possible converter transistor failure.	Check transistors for shorted junctions.
	Incorrect inductance set in Line Inductor parameter.	Check inductance parameter value.
Overload FLT	Drive overloaded.	Verify proper sizing of control and motor.
PWR Base FLT	Incorrect phase connections.	Check connections for proper phasing of EK drive components as detailed in Section 3 of this manual.
	Excessive current draw.	Disconnect motor wiring and retry test. If fault remains, call Baldor.
	Power device saturated.	
	Electrical noise from DC coils.	Install flyback diodes (reverse biased 1N4002 or equivalent)across all external DC relay coils..
	Electrical noise from AC coils.	Install RC snubbers on all external AC coils.
Sync To Line	Incorrect phase connections.	Check connections for proper phasing as detailed in Section 3 of this manual.
	Incorrect frequency detected at startup.	Check incoming line voltage and frequency.

Table 5-5 Power Output Section 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.
	Built-in fans are ineffective or inoperative.	Verify fan operation. Remove debris from fan and heatsink surfaces. Replace fan or check fan wiring.

Table 5-5 Power Output Section Troubleshooting Continued

INDICATION	POSSIBLE CAUSE	CORRECTIVE ACTION
HW Desaturation	Accel/Decel rate set too short. 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 5-5 Power Output Section 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.
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. 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. 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.
uP Reset	A software watchdog timer has reset the processor because a process has timed out.	Press “RESET” key on keypad. If fault remains, call Baldor.
FLT Log MEM Fail	Corrupt data in fault log (may occur on older systems only).	Press “RESET” key on keypad. If fault remains, call Baldor.
Current SENS FLT	Failure to sense phase current.	Press “RESET” key on keypad. If fault remains, call Baldor.
Bus Current SENS	Failure to sense bus current.	Press “RESET” key on keypad. If fault remains, call Baldor.

Table 5-6 Power Base ID - Series 21H

230VAC		460VAC	
Catalog Numbers	**Power Base ID No.**	**Catalog Numbers**	**Power Base ID No.**
ID21H210-EL	919	ID21H410-EL	B2D
ID21H215-EL	910	ID21H415-EK	B10
ID21H220-EL	911	ID21H420-EL	B11
ID21H225-EL	91D	ID21H425-EL	B12
ID21H230-EL	913	ID21H430-EL	B13
ID21H240-EL	914	ID21H440-EL	B14
ID21H250-EL	915	ID21H450-EL	B15
		ID21H460-EK	B16
		ID21H475-EK	BAB
		ID21H4100-EK	B18
		ID21H4150-EK	B9A
		ID21H4200-EK	B9B
		ID21H4250-EL	BC3
		ID21H4300-EL	BAE
		ID21H4350-EL	BA6
		ID21H4400-EL	BA7
		ID21H4450-EL	BA9

Note: The Power Base ID number of a control is displayed in a Diagnostic Information screen as a hexadecimal value.

Note: The power Base ID number is the same for both the converter and the power output sections of the control.

Electrical Noise Considerations

All electronic devices are 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 10VDC maximum with a typical resolution of one part in 1,000. Thus, noise of only 5 mV represents a substantial error.

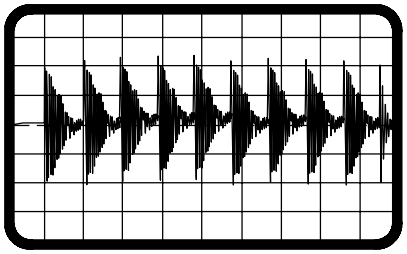
At the extreme level, significant noise can cause damage to the drive. Therefore, it is advisable to prevent noise generation and to follow wiring practices that prevent noise generated by other devices from reaching sensitive circuits. In a control, such circuits include inputs for speed, torque, control 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 20V/div. (vert.) and 1μSec/div. (horiz). Max peak voltage is voltage is over 40V. Scope input impedance is 10kΩ for all scope traces.

Figure 5-1 Electrical Noise Display

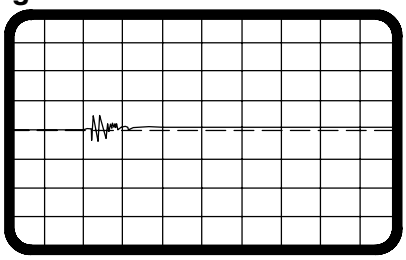


Relay and Contactor Coils

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.

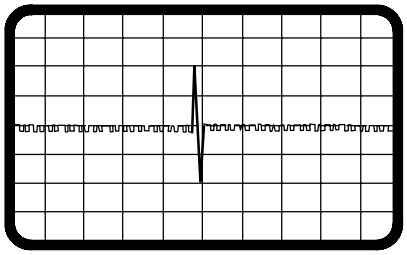
To suppress these noise generators, add an R-C snubber across each relay and contactor coil. A snubber consisting of a 33Ω resistor in series with a 0.47μF capacitor usually works well. The snubber reduces the rate of rise and peak voltage in the coil when current flow is interrupted. This eliminates arcing and reduces the noise voltage induced in adjacent wires. In our example, the noise was reduced from over 40V peak to about 16V peak as shown in Figure 5-2.

Figure 5-2 R-C Snubber Circuit



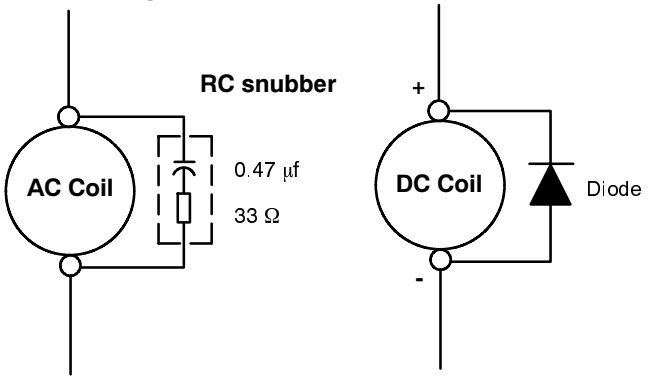
Combining an R-C snubber and shielded twisted pair cable keeps the voltage in a circuit to less than 2V for a fraction of a millisecond. Note that the vertical scale is 1V/div., rather than the 20V/div. in figures 5-1 and 5-2.

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).

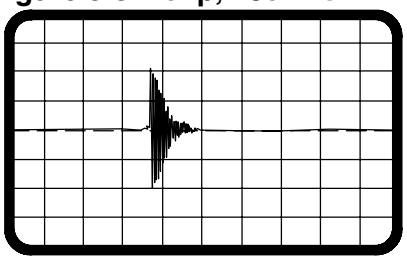
Figure 5-4 Diode with DC Coil



Wires between Controls and Motors

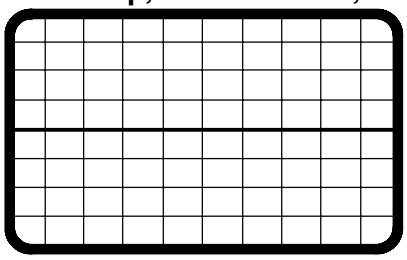
Output leads from a typical 460VAC drive controller contain rapid voltage rises created by power semiconductors switching 650V in less than a microsecond, 1,000 to 10,000 times a second. These noise signals can couple into sensitive drive circuits as shown in Figure 5-5. For this waveform, a transient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

Figure 5-5 10hp, 460VAC Drive



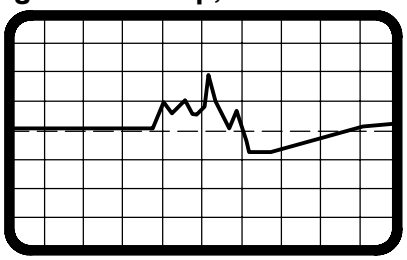
If the shielded pair cable is used, the coupling is reduced by nearly 90%, Figure 5-6.

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



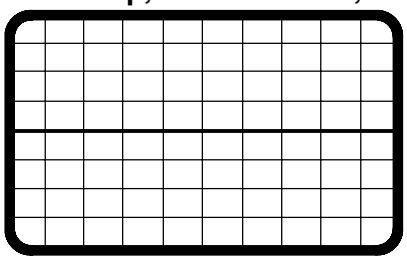
The motor leads of DC motors contain similar voltage transients. The switching rate is about 360 times a second. These noise transients can produce about 2V of noise induced in a wire adjacent to the motor lead. The noise induced by a 30hp, 500VDC Drive, is shown in Figure 5-7. Scope is set at 1V/div.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

Figure 5-7 30hp, 500VDC Drive



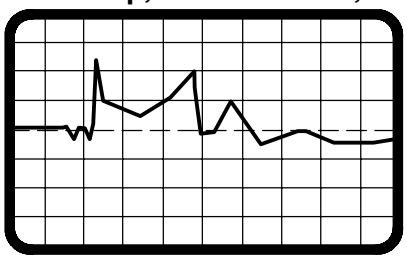
Again, replacing a single wire with a shielded pair cable reduces the induced noise to less than 0.3V, Figure 5-8.

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 the AC input power wire of a 30hp, 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 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. In addition, 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. 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 low current levels. However, switching noise is 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 shielded twisted pair 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

Two optical isolation 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 500V/µsec, which is adequate for most control logic signals. High performance opto couplers with common mode ratings up to 5,000V/µsec 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 strands.

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 is not ground.
Result: equipment malfunctions or electrical shock hazard exits.

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	10-50 HP @ 230VAC 10-450 HP @ 460VAC
Input Frequency	50/60Hz ± 5% Note: 50Hz operation requires a 15% control derating.
Output Voltage	0 to Maximum Input VAC
Output Current	See Ratings Table
Output Frequency	0 to 120Hz or 0 to 400Hz (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 460 VAC Models	180-264 VAC 3ϕ 60Hz/180-230 VAC 3ϕ 50Hz 340-528 VAC 3ϕ 60Hz/340-457 VAC 3ϕ 50Hz
Input Line Impedance:	3% Minimum Required (all except C2 Size) 1% for C2 Size
Ambient Operating Temperature:	0 to +40°C Derate Output 2% per °C over 40°C to 55°C (130°F) Maximum
Enclosure:	NEMA 1: EL (suffix) Control Module NEMA 1: EK (suffix) Control Module NEMA1: EK (suffix) Filter Assembly Open Chassis: EK 12% Boost Regulator 3% Line Reactor
Humidity:	NEMA 1: 10% To 90% RH non-condensing
Altitude:	Sea level to 3300 feet (1000 meters) Derate 2% per 1000 feet (303 meters) above 3300 feet
Shock:	1G
Vibration:	0.5G at 10Hz to 60Hz

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	0.01Hz Digital 0.5% Analog
Carrier Frequency	1kHz to15kHz adjustable 2.5kHz Standard 8.0kHz Quiet
Transistor Type	IGBT (Insulated Gate Bipolar Transistor)
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 400Hz
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
Standard Frequency Version	Full rating 1-2.5 KHz PWM frequency, Adjustable to 5 KHz with linear derating (between 2.5 - 5KHz) by 10% at 5 KHz
Quiet Frequency Version	Full rating 1-8 KHz PWM frequency, Adjustable to 16 KHz with linear derating (between 8 - 16KHz) by 30% at 16 KHz

Control Specifications: Continued

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

Differential Analog Input: Analog Input #2

Common Mode Rejection	40 db
Differential Input Full Scale Range	0-5VDC, 0-10VDC, 4-20mA, ±5VDC and ±10VDC
Differential Input Common Mode Rejection	40db
Resolution	9 bits + sign
Input Impedance	20kΩ

Other Analog Input: Analog Input #1

Common Mode Rejection	40 db
Differential Input Full Scale Range	0-10VDC
Differential Input Common Mode Rejection	40db
Resolution	9 bits + sign
Input Impedance	20kΩ

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 Surge Current
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
Low INIT Bus V
Overcurrent
EXB Selection
Torque Proving
uP Reset
FLT Log MEM Fail
Current SENS FLT
Bus Current SENS

Converter Section:

Current Sense Fault
GND Fault
Over Current Fault
Overload Fault
New Base ID
Microprocessor Reset
Int Over temperature
Invalid Base ID
ID No Feedback
Power Base Fault
Lost User Data
DC Bus High
Sync to Line Fault
Logic Supply Fault
DC Bus Low Fault
High Initial Current Fault
Lost AB Phase
Lost BC Phase
Low Init Bus Volts
Memory Error

Note: All specifications are subject to change without notice.

Series 21H Inverter Control Ratings

CATALOG NO.	INPUT VOLT	ENCLO-SURE 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
ID21H210-EL	230	C+	10	7.4	28	56	10	7.4	28	32	10	7.4	28	48	10	7.4	28	32
ID21H215-EL	230	C+	15	11.1	42	84	15	11.1	42	48	10	7.4	30	61	15	11.1	42	48
ID21H220-EL	230	C+	20	14.9	55	100	20	14.9	55	62	15	11.1	42	92	20	14.9	54	62
ID21H225-EL	230	C+	25	18.6	68	116	25	18.6	68	78	20	14.9	54	92	25	18.6	68	78
ID21H230-EL	230	D+	30	22.3	80	140	30	22.3	80	92	25	18.6	70	122	30	22.3	80	92
ID21H240-EL	230	D+	40	29.8	105	200	40	29.8	105	120	30	22.3	80	160	40	29.8	104	120
ID21H250-EL	230	D+	50	37.2	130	225	50	37.2	130	150	40	29.8	105	183	50	37.2	130	150
ID21H410-EL	460	C+	10	7.4	15	30	10	7.4	15	17	7.5	5.5	11	22	10	7.4	15	17
ID21H415-EL	460	C+	15	11.1	21	36	15	11.1	21	24	10	7.4	15	30	15	11.1	21	24
ID21H420-EL	460	C+	20	14.9	27	54	20	14.9	27	31	15	11.1	21	46	20	14.9	27	31
ID21H425-EL	460	C+	25	18.6	34	58	25	18.6	34	39	20	14.9	27	46	25	18.6	34	39
ID21H430-EL	460	D+	30	22.3	40	70	30	22.3	40	46	25	18.6	35	61	30	22.3	40	46
ID21H440-EL	460	D+	40	29.8	55	100	40	29.8	55	63	30	22.3	40	80	40	29.8	52	60
ID21H450-EL	460	D+	50	37.2	65	115	50	37.2	65	75	40	29.8	55	92	50	37.2	65	75
ID21H460-EK	460	D	60	44.7	80	140	60	44.7	80	92	50	37.2	65	122	60	44.7	80	92
ID21H475-EK	460	E	75	56	100	170	75	56	100	115	60	44.7	80	140	75	56	100	115
ID21H4100-EK	460	E	100	75	125	220	100	75	125	144	75	56	100	180	100	75	125	144
ID21H4150-EK	460	F	150	112	190	380	150	112	190	220	125	93	150	260	150	112	170	200
ID21H4200-EK	460	F	200	149	250	500	200	149	250	290	150	112	190	380	175	131	210	240
ID21H4250-EL	460	G+	250	187	310	620	250	187	310	356								
ID21H4300-EL	460	G+	300	224	370	630	300	224	370	425								
ID21H4350-EL	460	G+	350	261	420	720	350	261	420	480								
ID21H4400-EL	460	G+	400	298	480	820	400	298	480	552								
ID21H4450-EL	460	G+	450	336	540	920	450	336	540	620								

IC = Continuous Output Current (in Amps)
IP= Peak Output Current (in Amps)
EL= NEMA 1 enclosure
EK= Control, filter, and boost regulator shipped separately. Control and filter in NEMA1 enclosure. Boost regulator and 3% line reactor are open chassis.

PWM Frequency Continuous and Peak Current Derating:
2.5KHz Ratings - Full rating from 1 - 2.5KHz
Adjustable from 1 - 5KHz with linear derating to 10% at 5KHz
8.0KHz Ratings - Full rating from 1 - 8.0KHz
Adjustable from 1 - 16KHz with linear derating to 30% at 16KHz

Custom Order.

Not Available.

Table 6-7 Matched Component Matrix

Control Catalog No.	Control Specification No.	230 VAC 3% Line Reactor Catalog No.	380-415 VAC 4% Line Reactor Catalog No.	460 VAC 3% Line Reactor Catalog No.	Boost Regulator Specification No.	Filter Specification No.
ID21H210-EL	VE0574A00	LRAC03501			Included in "EL" Suffix Catalog Numbers	
ID21H215-EL	VE0575A00	LRAC04501				
ID21H220-EL	VE0576A00	LRAC05501				
ID21H225-EL	VE0577A00	LRAC08001				
ID21H230-EL	VE0568A00	LRAC08001				
ID21H240-EL	VE0569A00	LRAC10001				
ID21H250-EL	VE0570A00	LRAC13001				
ID21H410-EL	VE0565A00		LRAC01802	LRAC01802	Included in "EL" Suffix Catalog Numbers	
ID21H415-EL	VE0082A00		LRAC02502	LRAC02502		
ID21H420-EL	VE0088A00		LRAC03502	LRAC03502		
ID21H425-EL	VE0090A00		LRAC04502	LRAC03502		
ID21H430-EL	VE0092A00		LRAC04502	LRAC04502		
ID21H440-EL	VE0094A00		LRAC05502	LRAC05502		
ID21H450-EL	VE0096A00		LRAC08002	LRAC08002		
ID21H460-EK	VE0097A00		LRAC08002	LRAC08002	V2090709	LF1015
ID21H475-EK	VE0099A00		LRAC10002	LRAC10002	V2080710	LF1015
ID21H4100-EK	VE0077A00		LRAC13002	LRAC13002	V2080711	LF1015
ID21H4150-EK	VE0079A00		LRAC25003	LRAC20002	V2080712	LF2015
ID21H4200-EK	VE0084A00		LRAC32003	LRAC25002	V2080713	LF2015
ID21H4250-EL	VE0671A00		LRAC32002	LRAC32002	Included in "EL" Suffix Catalog Numbers	
ID21H4300-EL	VE0631A00		LRAC40002	LRAC40002		
ID21H4350-EL	VE0632A00		LRAC50002	LRAC50002		
ID21H4400-EL	VE0633A00		LRAC60002	LRAC50002		
ID21H4450-EL	VE0634A00		LRAC75003	LRAC60002		

Included in EL Suffix Control Catalog Number.

Not applicable.

Note: Line reactor, boost regulator, filter assembly and control must be ordered separately.

Terminal Tightening Torque Specifications

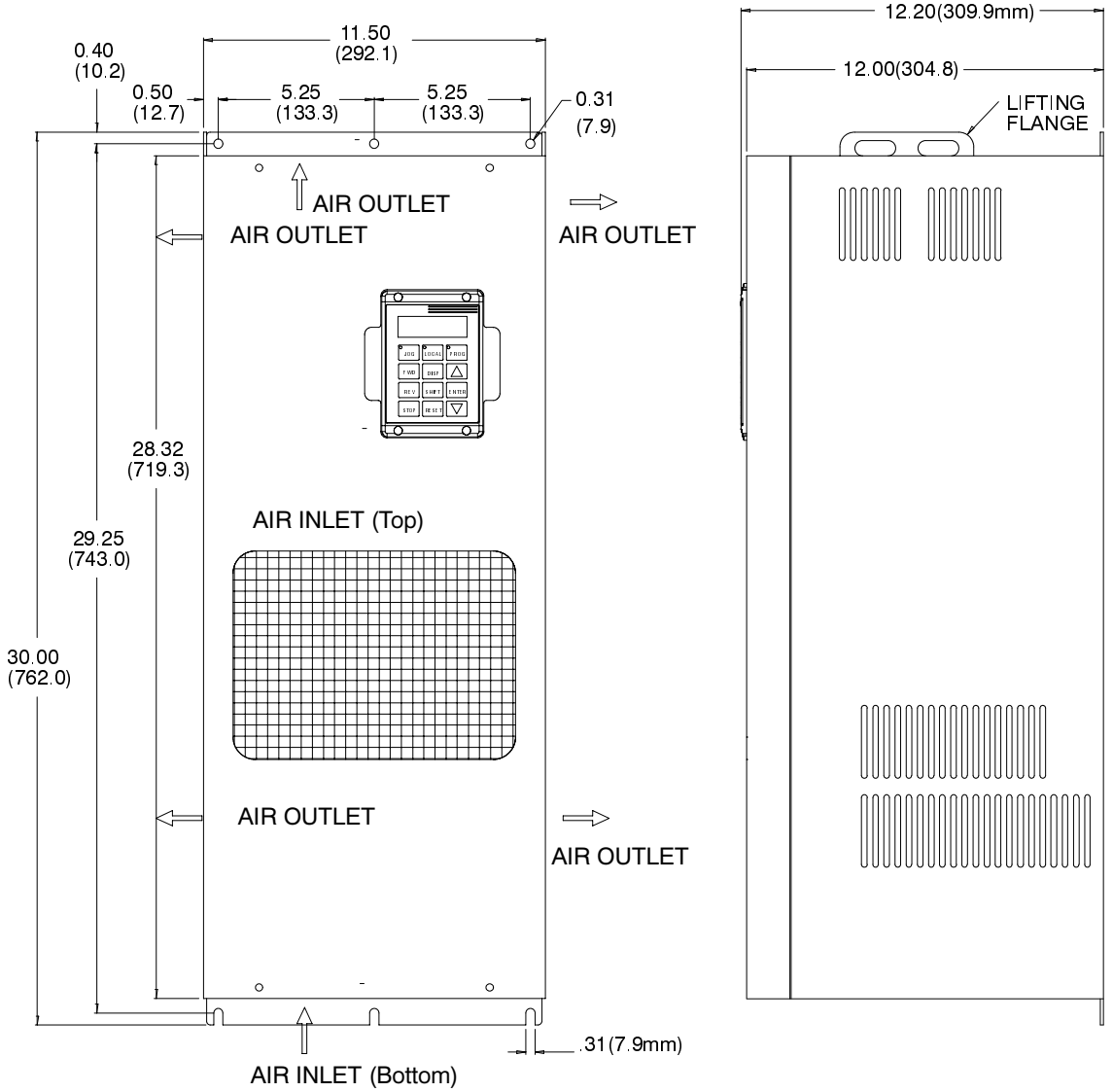
Table 6-8 Tightening Torque Specifications

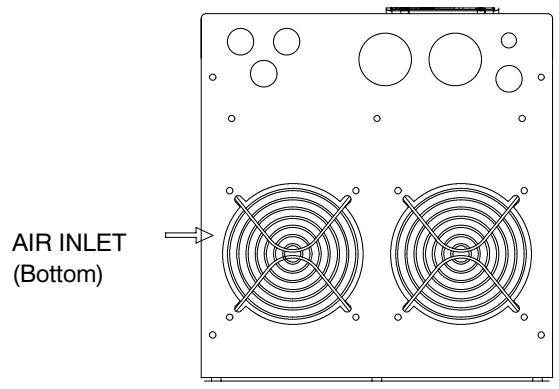
Catalog No.	Tightening Torque											
	Power TB1		Ground		Control J4		Interface J3 & L1A, L2A, L3A		Filter J4 & J2		Line Reactor	
	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm	Lb-in	Nm
ID21H210-EL	35	4	50	5.6	4.5	0.5						
ID21H215-EL	35	4	50	5.6	4.5	0.5						
ID21H220-EL	35	4	50	5.6	4.5	0.5						
ID21H225-EL	35	4	50	5.6	4.5	0.5						
ID21H230-EL	35	4	50	5.6	4.5	0.5						
ID21H240-EL	35	4	50	5.6	4.5	0.5						
ID21H250-EL	35	4	50	5.6	4.5	0.5						
ID21H410-EL	35	4	50	5.6	4.5	0.5						
ID21H415-EL	35	4	50	5.6	4.5	0.5						
ID21H420-EL	35	4	50	5.6	4.5	0.5						
ID21H425-EL	35	4	50	5.6	4.5	0.5						
ID21H430-EL	35	4	22-26	2.5-3	4.5	0.5						
ID21H440-EL	22-26	2.5-3	22-26	2.5-3	4.5	0.5						
ID21H450-EL	22-26	2.5-3	22-26	2.5-3	4.5	0.5						
ID21H460-EK	22-26	2.5-3	22-26	2.5-3	4.5	0.5	7	0.8	7	0.8	50	5.6
ID21H475-EK	22-26	2.5-3	50	5.6	4.5	0.5	7	0.8	7	0.8	50	5.6
ID21H4100-EK	140	15	50	5.6	4.5	0.5	7	0.8	7	0.8	50	5.6
ID21H4150-EK	275	31	275	31	4.5	0.5	7	0.8	7	0.8	50	5.6
ID21H4200-EK	275	31	275	31	4.5	0.5	7	0.8	7	0.8	50	5.6
ID21H4250-EL	275	31	275	31	4.5	0.5						
ID21H4300-EL	375	42	375	42	4.5	0.5						
ID21H4350-EL	375	42	375	42	4.5	0.5						
ID21H4400-EL	375	42	375	42	4.5	0.5						
ID21H4450-EL	375	42	375	42	4.5	0.5						

Not Applicable.

Dimensions

Size C+ Control





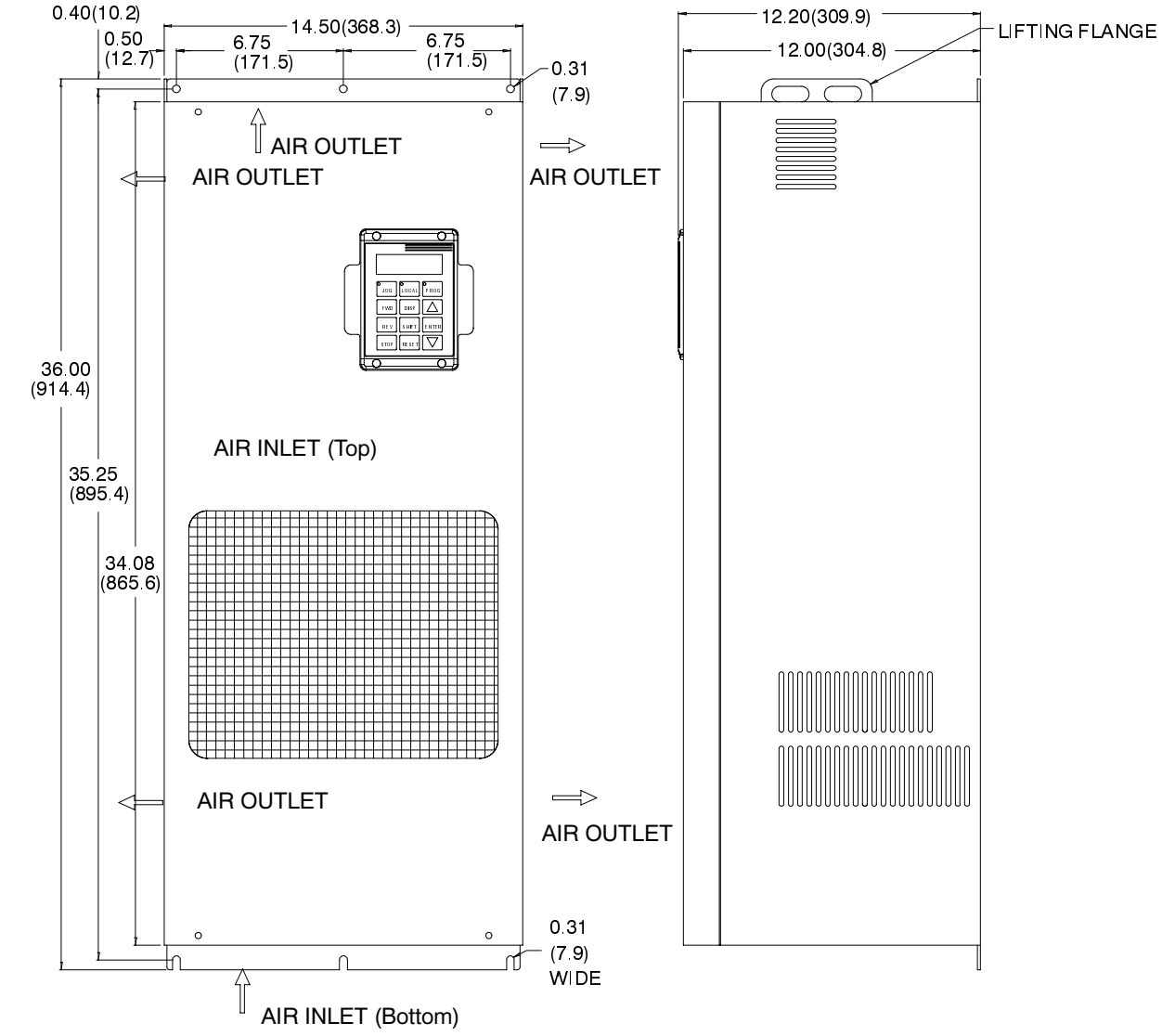
Note:

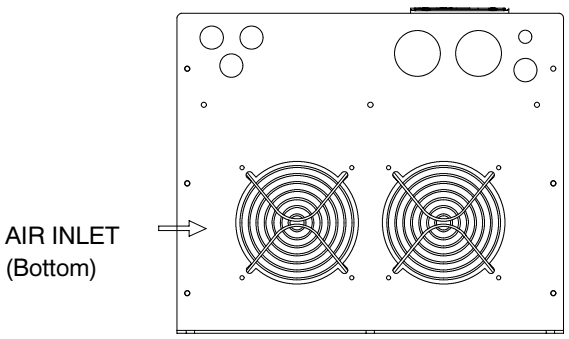
Allow 2 inches minimum clearance on all sides for ventilation.

An internal baffle divides the enclosure into two parts. The upper and lower parts each have separate air inlets and outlets as shown.

Dimensions Continued

Size D+ Control





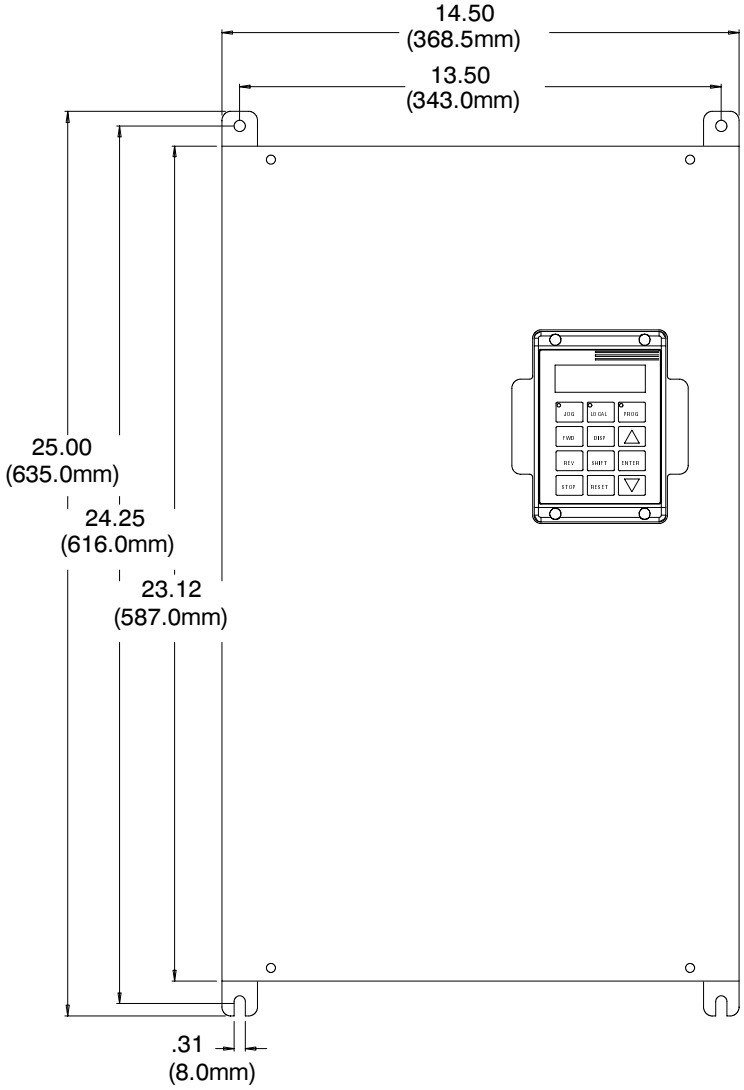
Note:

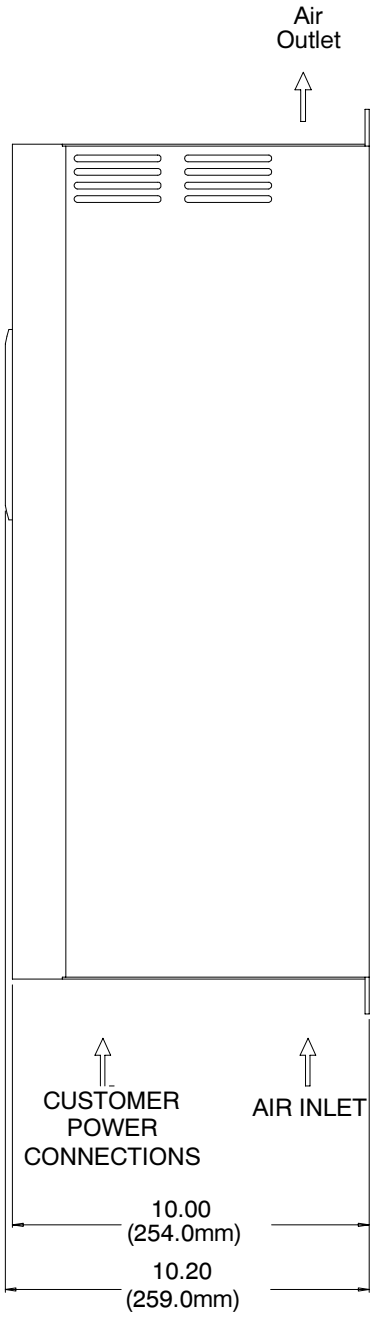
Allow 2 inches minimum clearance on all sides for ventilation.

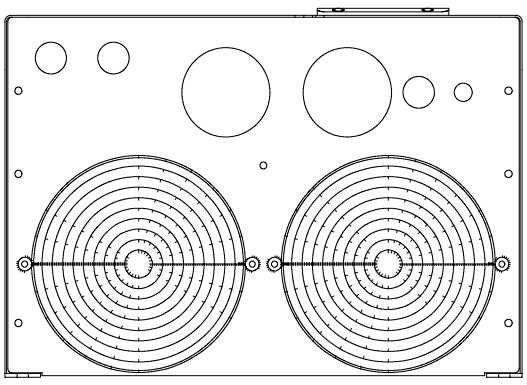
An internal baffle divides the enclosure into two parts. The upper and lower parts each have separate air inlets and outlets as shown.

Dimensions Continued

Size D Control

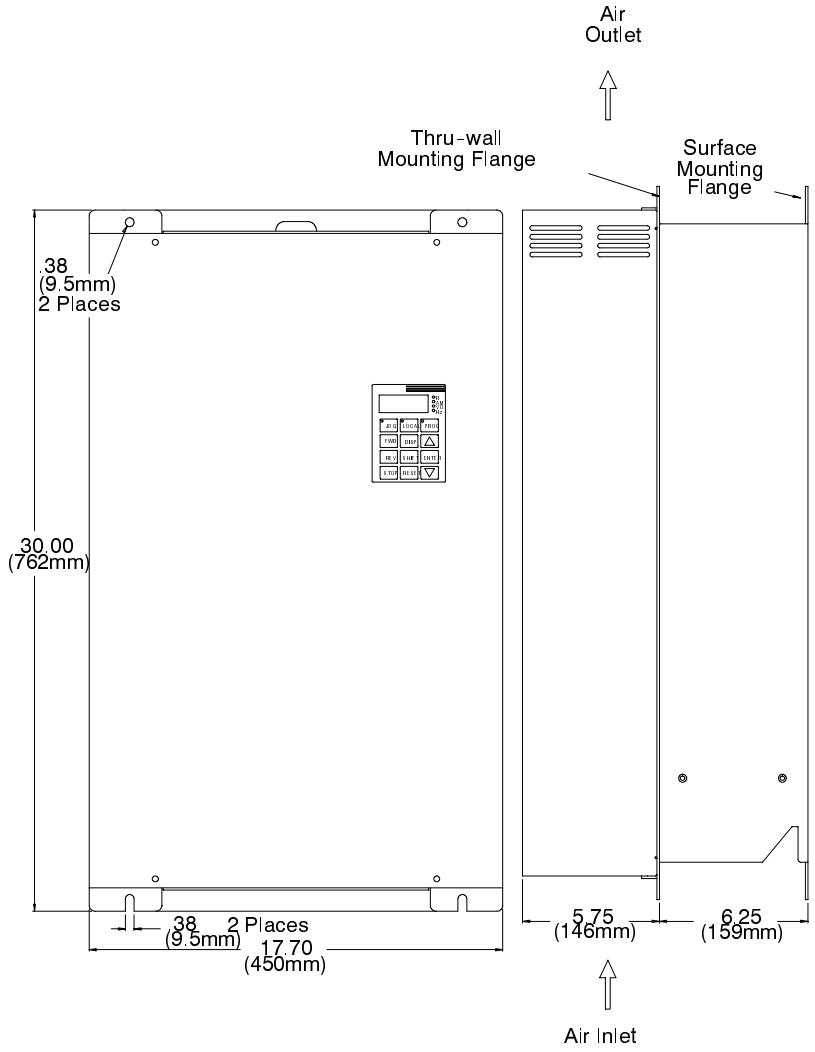






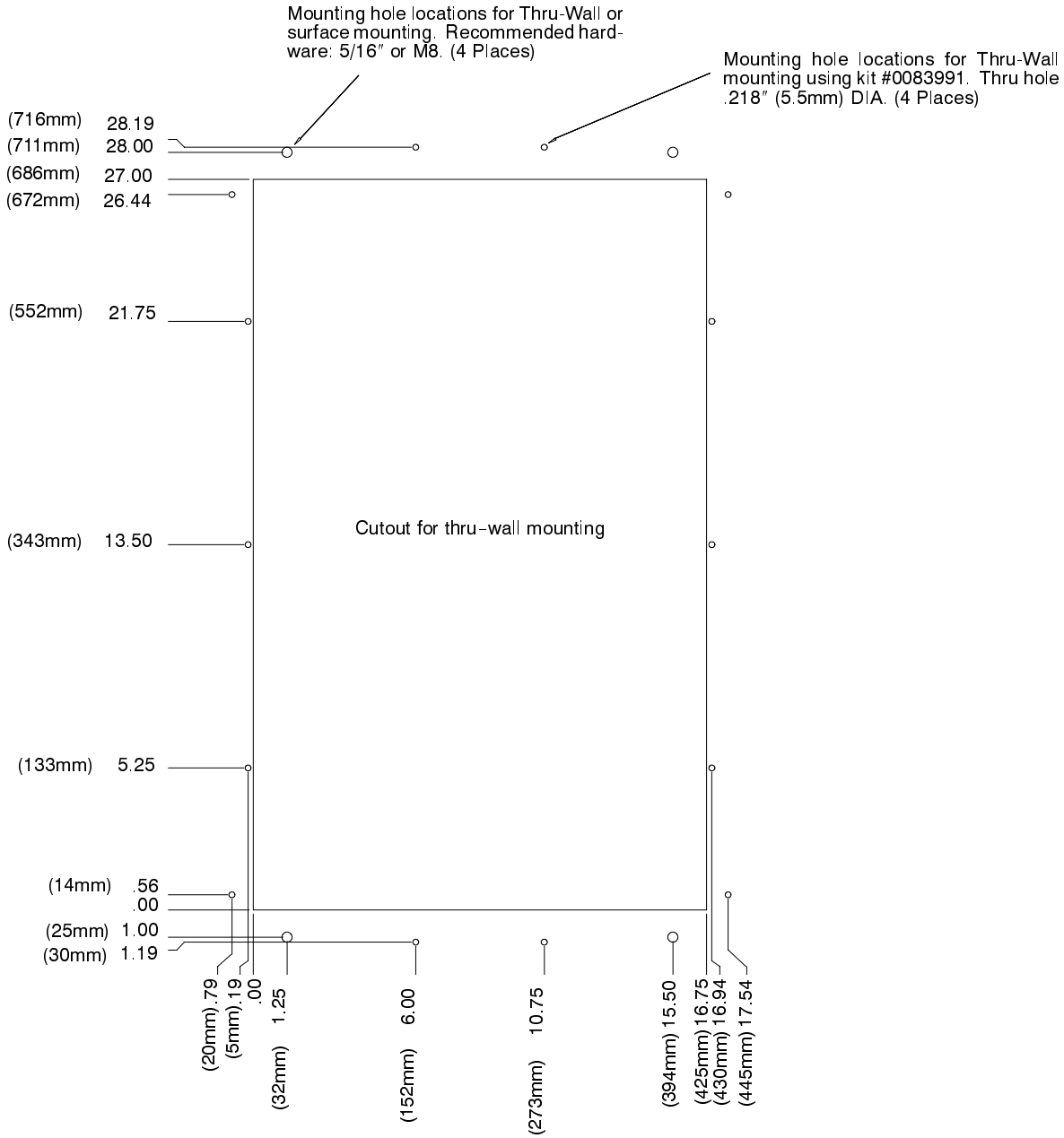
Dimensions Continued

Size E Control



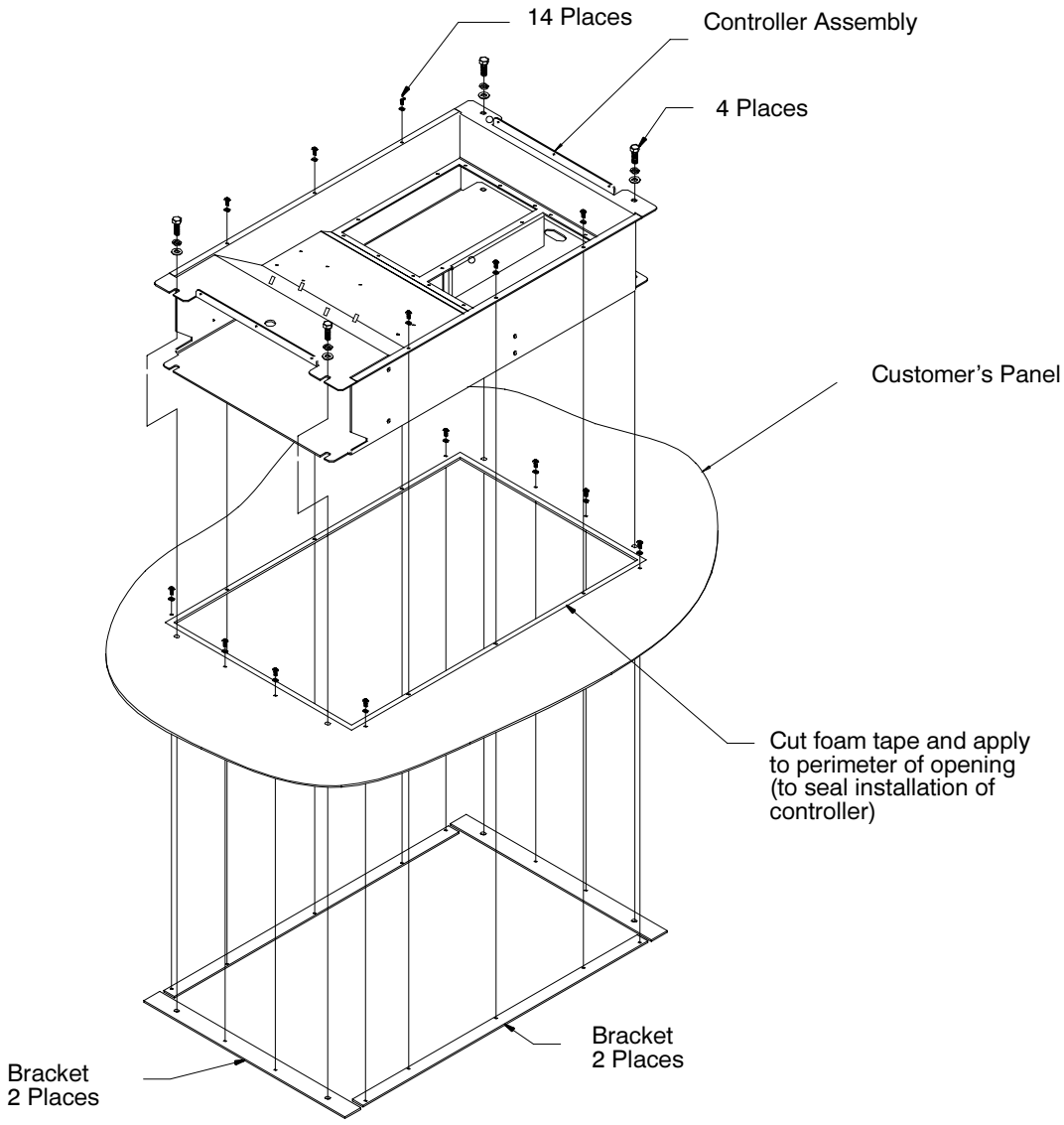
Dimensions Continued

Size E Control – Through-Wall Mounting



Dimensions Continued

Size E Control – Through-Wall Mounting Continued



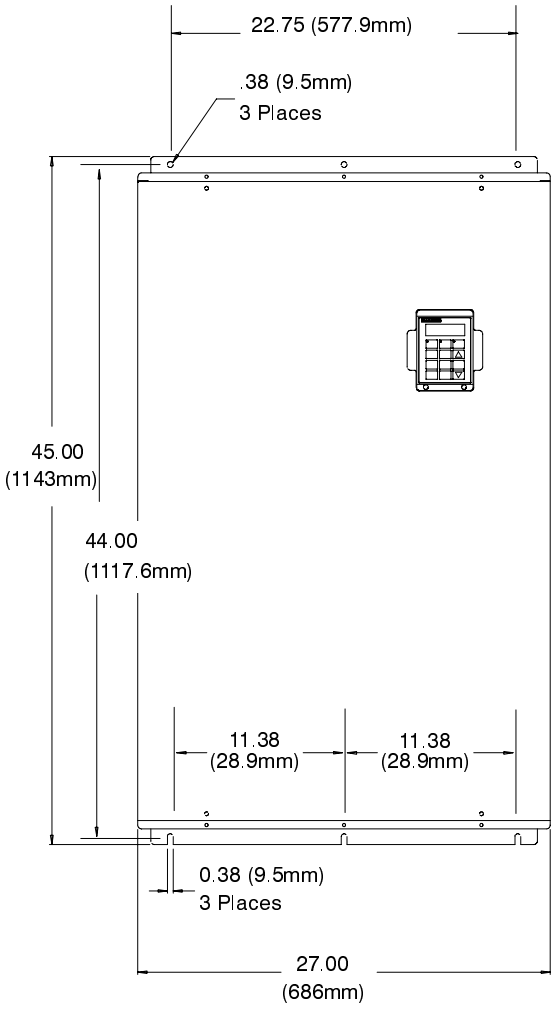
Thru-Wall Mounting Kit No. V0083991

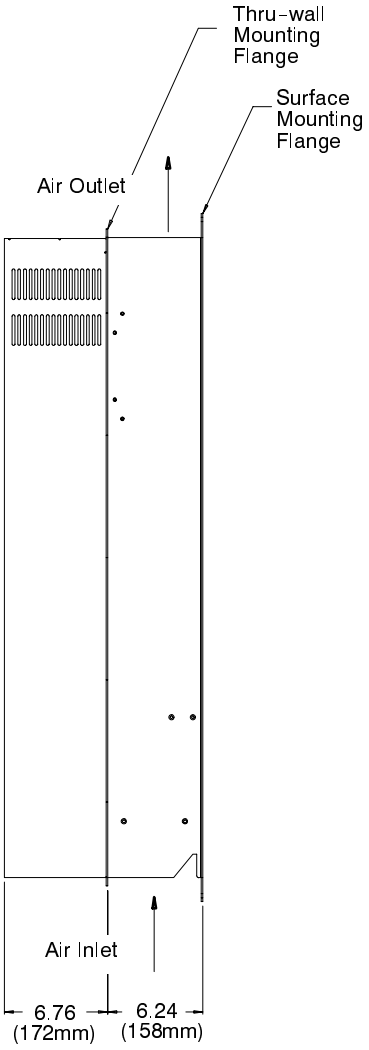
Parts List

QTY	Part No.	Description
2	V1083991	Bracket, small (left & right)
2	V1083992	Bracket, Large (top & bottom)
14	V6300710	Screw, 10-32 x 5/8
14	V6420010	Lock Washer No. 10
4	V6390205	Hex Bolt 5/16-18 x 5/8
4	V6420032	Lock Washer 5/16
4	V6410132	Flat Washer 5/16
1	C6990204	Tape, Single coated vinyl – 3.0 Yards (2.74m)

Dimensions Continued

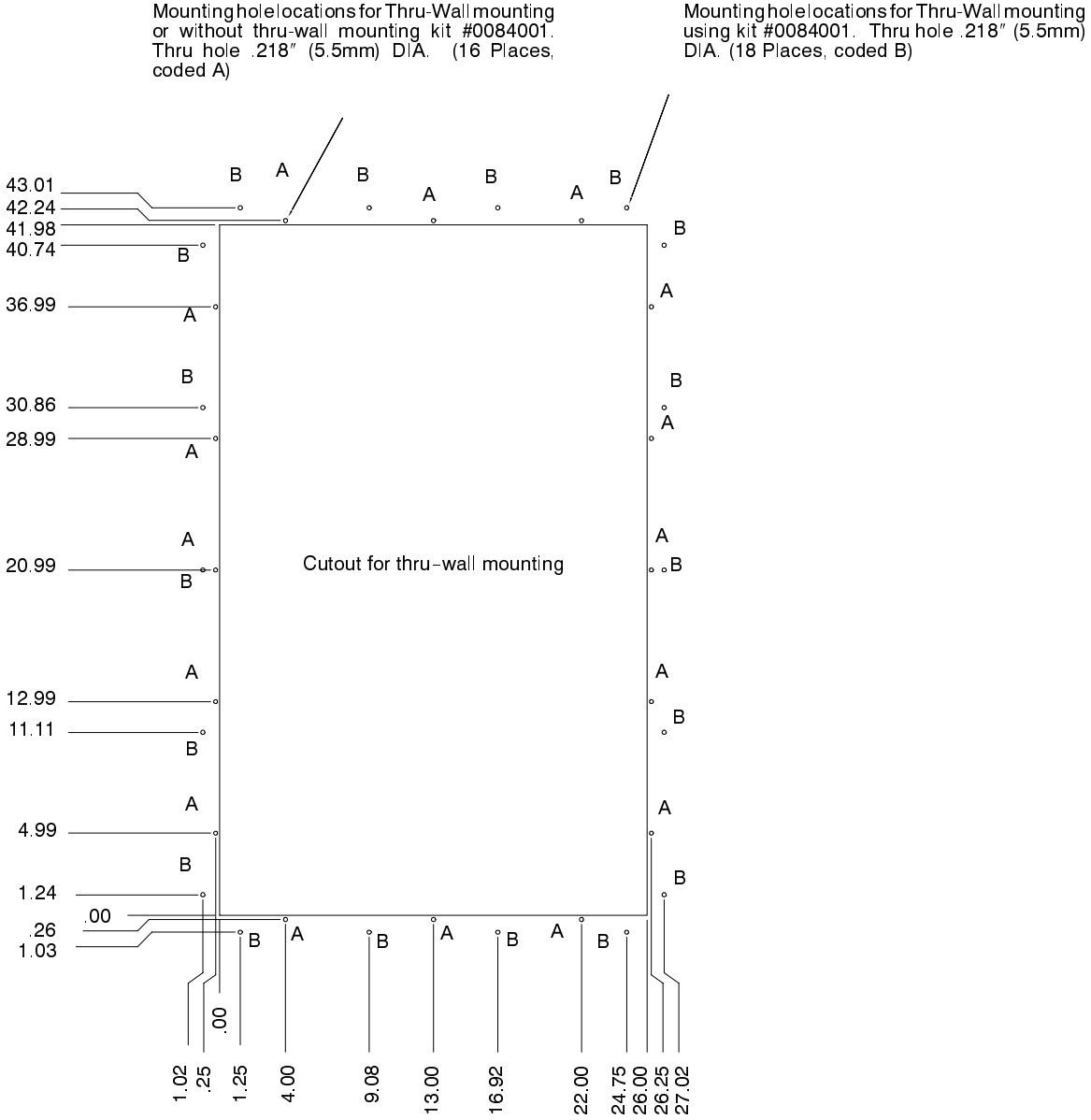
Size F Control





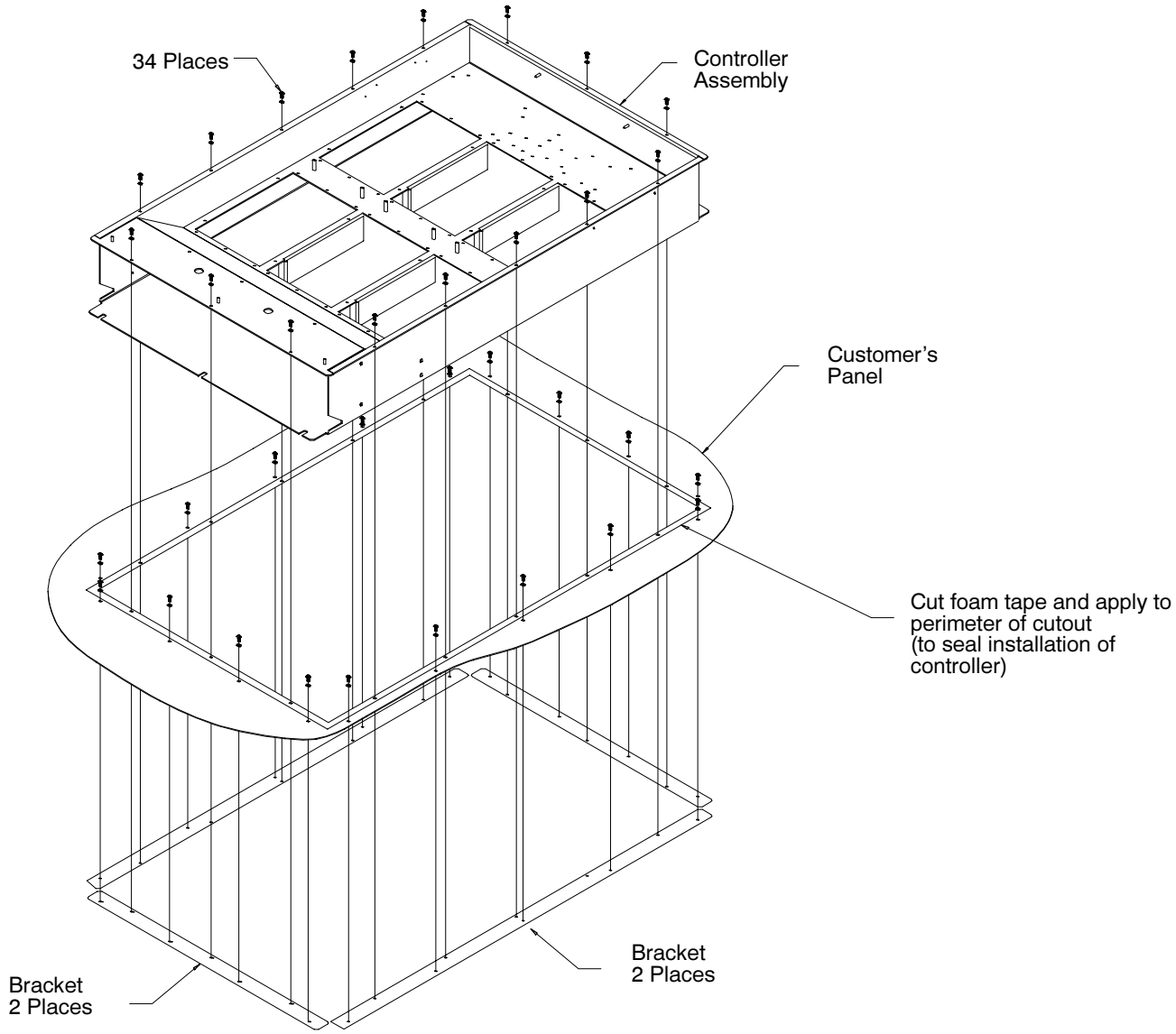
Dimensions Continued

Size F Control - Through-Wall Mounting



Dimensions Continued

Size F Control - Through-Wall Mounting Continued



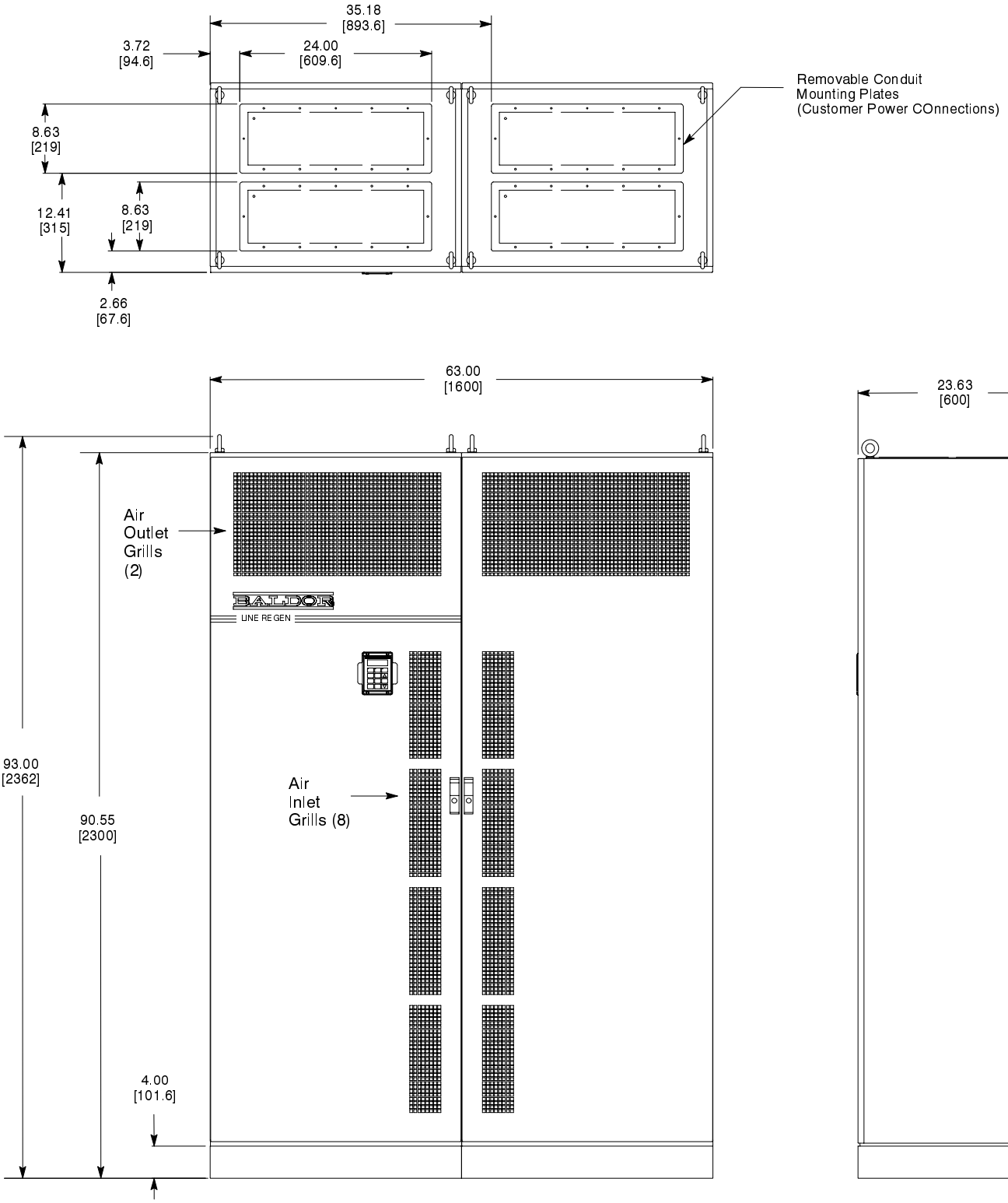
Thru-Wall Mounting Kit No. V0084001

Parts List

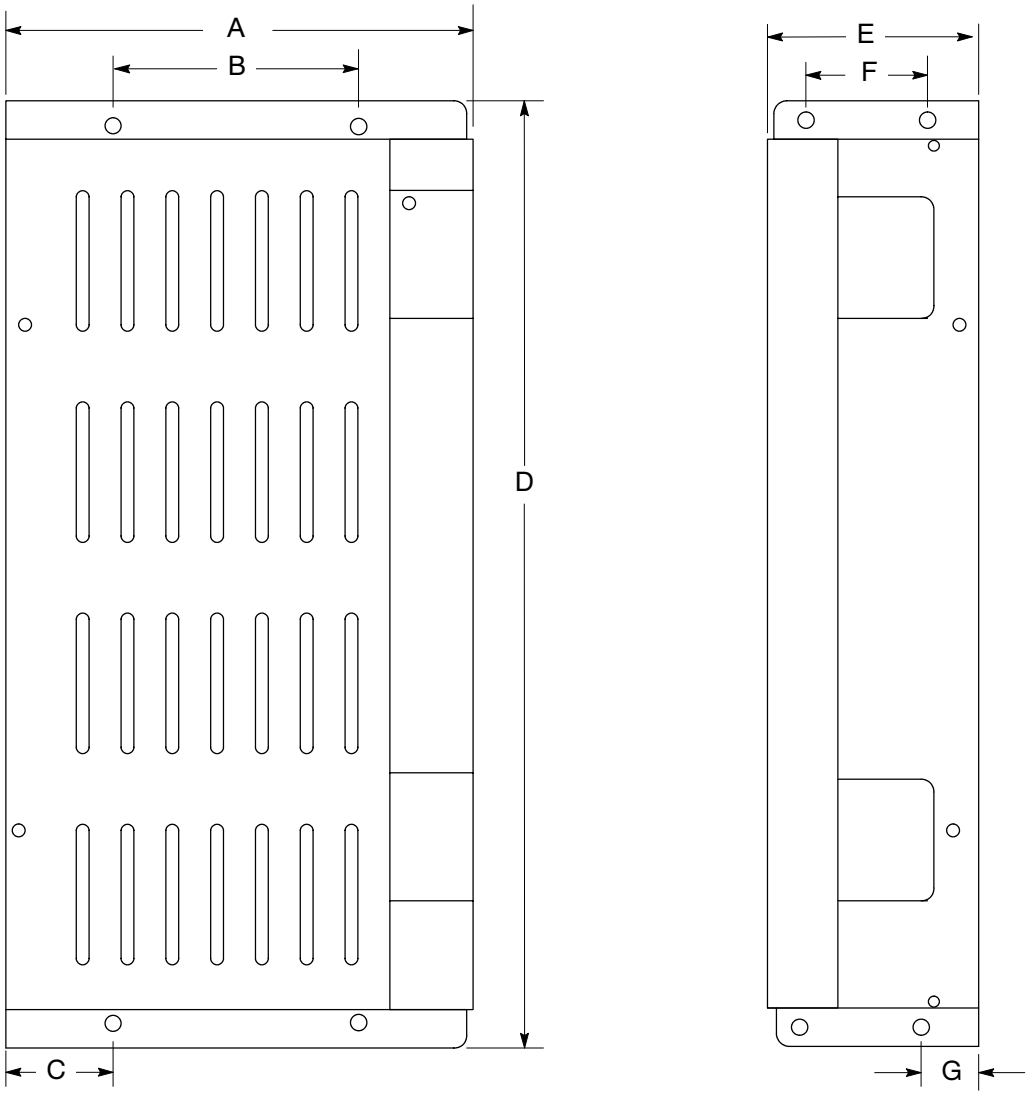
QTY	Part No.	Description
2	V1084002	Bracket, small (left & right)
2	V1084001	Bracket, Large (top & bottom)
34	V6300710	Screw, 10-32 x 5/8
34	V6420010	Lock Washer No. 10
1	C6990204	Tape, Single coated vinyl - 4.0 Yards (3.65m)

Dimensions Continued

Size G+ Control

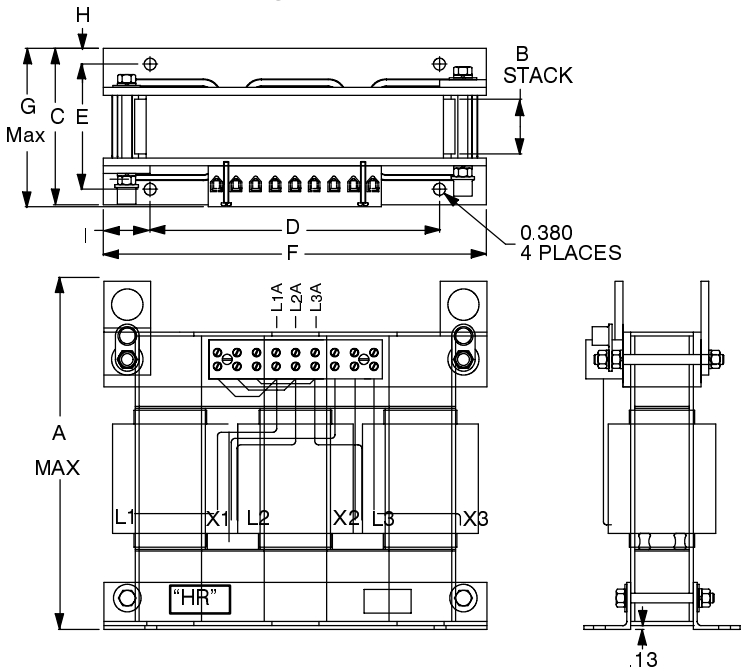


EK Controls - Filter Assembly

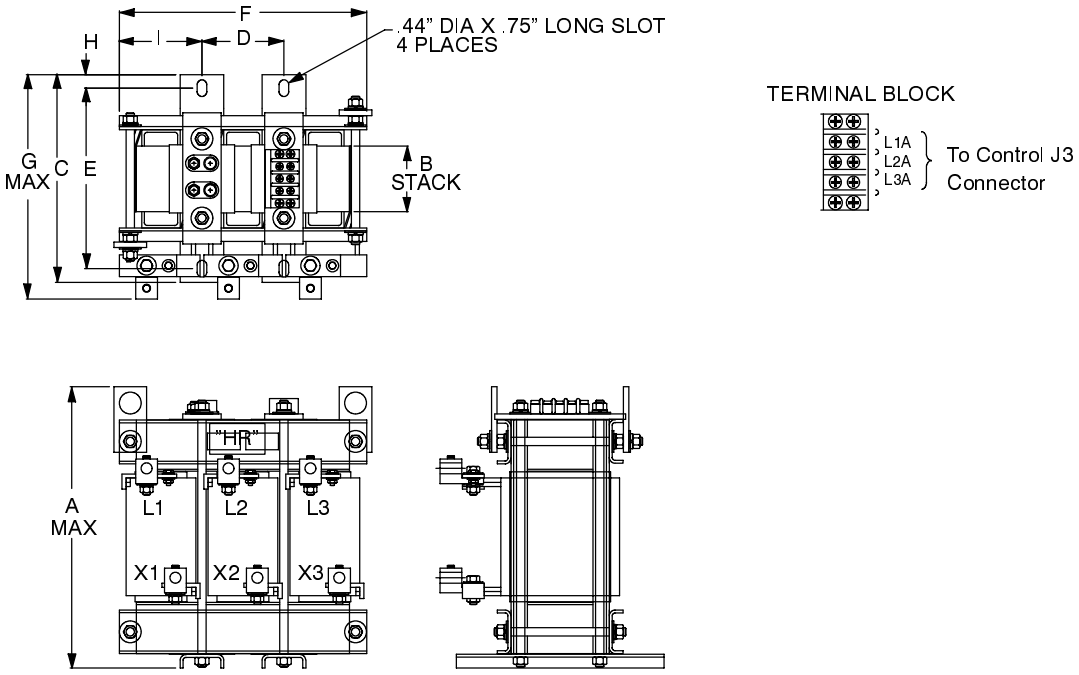


Dimension	LF1015		LF2015	
	In	mm	In	mm
A	7.75	196.9	10.25	260.3
B	4.00	101.6	5.00	127.0
C	1.81	46.0	3.31	84.1
D	15.25	387.4	18.00	457.2
E	3.52	89.4	3.65	92.7
F	2.00	50.8	2.00	50.8
G	0.92	23.3	0.92	23.3

EK Controls - Boost Regulators

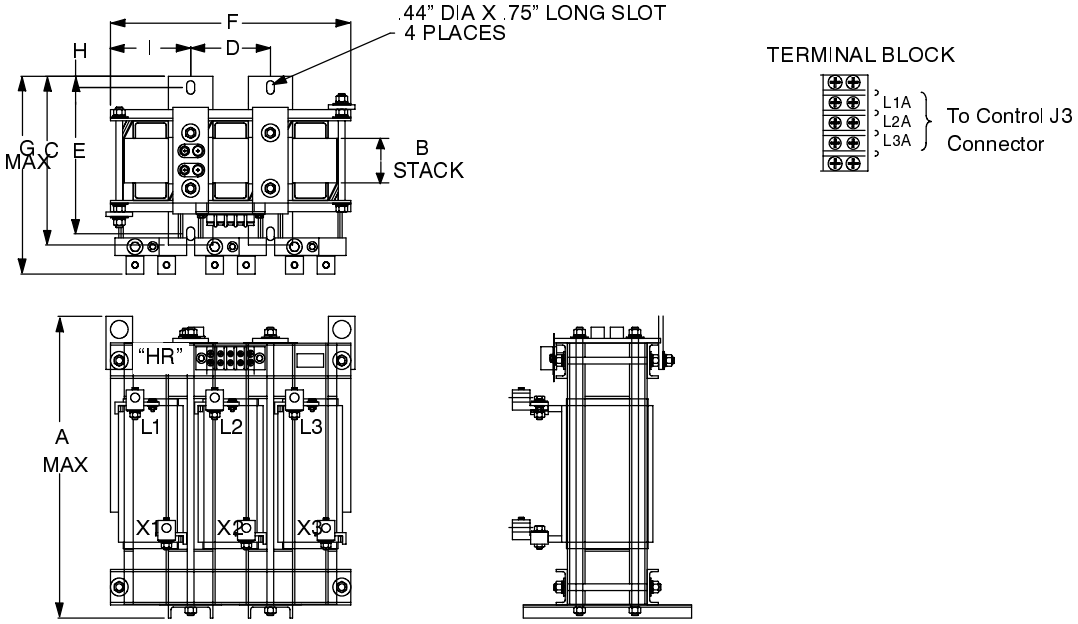


Electrical Specification/Approximate Weight					Dimensions - inches								
HP	Baldor P/N	mH	Amps	Lbs	A	B	C	D	E	F	G	H	I
60	V2080709	1.20	68	80	11.75	2.25	5.50	9.25	4.50	12.25	5.75	0.50	1.50

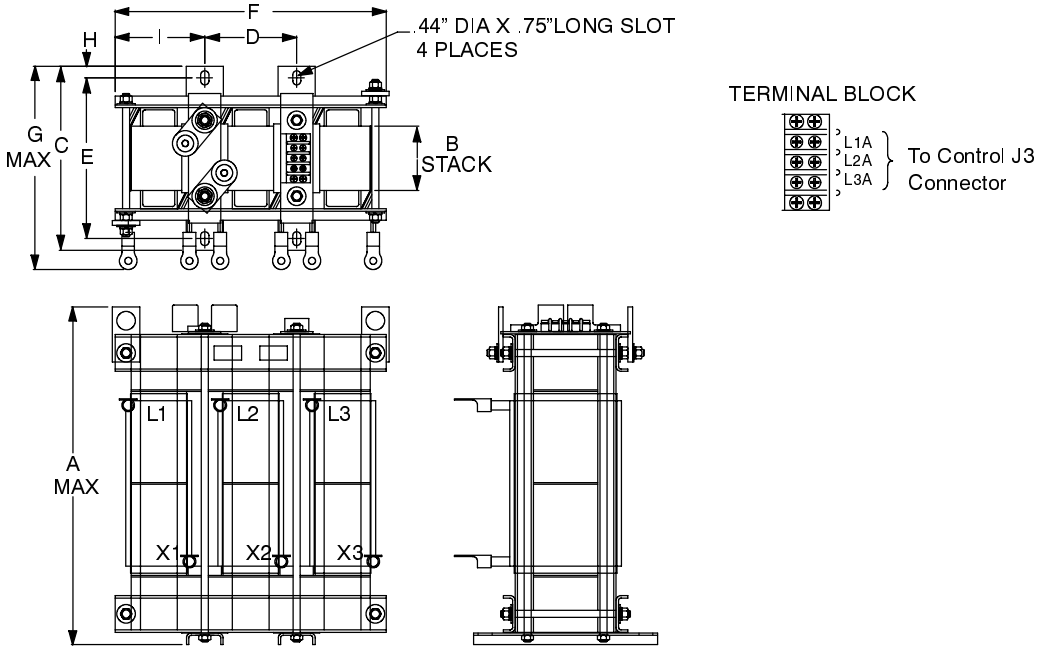


Electrical Specifications/Approximate Weight					Dimensions - inches								
HP	Baldor P/N	mH	Amps	Lbs	A	B	C	D	E	F	G	H	I
75	V2080710	1.00	85	100	13.50	3.00	9.50	3.75	8.25	11.32	10.75	0.62	3.79
100	V2080711	0.75	106	125	15.50	3.00	9.25	3.75	8.25	11.32	11.00	0.63	3.79

EK Controls - Boost Regulators Continued



Electrical Specifications/Approximate Weight					Dimensions - inches								
HP	Baldor P/N	mH	Amps	Lbs	A	B	C	D	E	F	G	H	I
150	V2080712	0.50	162	155	18.00	2.50	9.50	4.50	8.25	13.56	12.00	0.63	4.53



Electrical Specifications/Approximate Weight					Dimensions - inches								
HP	Baldor P/N	mH	Amps	Lbs	A	B	C	D	E	F	G	H	I
200	V2080713	0.40	213	220	19.00	3.50	10.00	5.00	8.74	14.75	11.75	0.63	4.88

Appendix A

Parameter Values

Converter Section Parameter Values

Table A-1 Converter Section Parameter Block Values Level 1

Level 1 Blocks				
Block Title	**Parameter**	**Adjustable Range**	**Factory Setting**	**User Setting**
MISC	FACTORY SETTINGS	YES, NO	NO	
	LINE INDUCTOR		CALC	
	BUS CAPACITANCE	50 – 500%	100%	
	DAC SELECTION	AB BC CROSS AB CROSS DQ CONTRLR DQ CURRENTS IQ COMMAND IB AND IC Va AND Vb Ia AND Ib	AB BC CROSS	
SECURITY CONTROL	SECURITY STATE	OFF LOCAL SERIAL TOTAL	OFF	
	ACCESS TIMEOUT	0 – 600 SEC	0 SEC	
	ACCESS CODE	0 – 9999	9999	

Table A-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	0.00Hz	
	PRESET SPEED #2	1002	0-MAX Speed	0.00Hz	
	PRESET SPEED #3	1003	0-MAX Speed	0.00Hz	
	PRESET SPEED #4	1004	0-MAX Speed	0.00Hz	
	PRESET SPEED #5	1005	0-MAX Speed	0.00Hz	
	PRESET SPEED #6	1006	0-MAX Speed	0.00Hz	
	PRESET SPEED #7	1007	0-MAX Speed	0.00Hz	
	PRESET SPEED #8	1008	0-MAX Speed	0.00Hz	
	PRESET SPEED #9	1009	0-MAX Speed	0.00Hz	
	PRESET SPEED #10	1010	0-MAX Speed	0.00Hz	
	PRESET SPEED #11	1011	0-MAX Speed	0.00Hz	
	PRESET SPEED #12	1012	0-MAX Speed	0.00Hz	
	PRESET SPEED #13	1013	0-MAX Speed	0.00Hz	
	PRESET SPEED #14	1014	0-MAX Speed	0.00Hz	
	PRESET SPEED #15	1015	0-MAX Speed	0.00Hz	
ACCEL/DECEL RATE	ACCEL TIME #1	1101	0 to 3600seconds	3.0s	
	DECEL TIME #1	1102	0 to 3600seconds	3.0s	
	S-CURVE #1	1103	OFF, 20, 40, 60, 80, 100%	OFF	
	ACCEL TIME #2	1104	0 to 3600seconds	3.0s	
	DECEL TIME #2	1105	0 to 3600seconds	3.0s	
	S-CURVE #2	1106	OFF, 20, 40, 60, 80, 100%	OFF	
JOG SETTINGS	JOG SPEED	1201	0-MAX Speed	7Hz	
	JOG ACCEL TIME	1202	0 to 3600seconds	3.0s	
	JOG DECEL TIME	1203	0 to 3600seconds	3.0s	
	JOG S-CURVE	1204	OFF, 20, 40, 60, 80, 100%	OFF	
KEYPAD SETUP	KEYPAD STOP KEY	1301	REMOTE OFF REMOTE ON	REMOTE ON	
	KEYPAD STOP MODE	1302	REGEN, COAST	REGEN	
	KEYPAD RUN FWD	1303	OFF, ON	ON	
	KEYPAD RUN REV	1304	OFF, ON	ON	
	KEYPAD JOG FWD	1305	OFF, ON	ON	
	KEYPAD JOG REV	1306	OFF, ON	ON	
	3 SPEED RAMP	1307	OFF, ON	OFF	
	SWITCH ON FLY	1308	OFF, ON	OFF	
	LOC. HOT START	1309	OFF, ON	OFF	

Table A-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	OFF, ON	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	6.00Hz	
	AT SPEED BAND	1506	0-20Hz	2.00Hz	
	SET SPEED POINT	1507	0-MAX Speed	60Hz	

Table A-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	Frequency	
	ANALOG OUT #2	1509		AC Current	
	ANALOG #1 SCALE	1510	10 - 160%	100.0%	
	ANALOG #2 SCALE	1511	10 - 160%	100.0%	
V/HZ AND BOOST	CTRL BASE FREQUENCY	1601	50.00 - 400.00Hz	60.0Hz	
	TORQUE BOOST	1602	0.0 - 15.0%	2.5%	
	DYNAMIC BOOST	1603	0.0 - 100%	0.0%	
	SLIP COMP ADJ	1604	0.00 - 6.00Hz	0.00Hz	
	V/HZ PROFILE	1605	LINEAR, 33% SQR LAW, 67% SQR LAW, 100% SQR LAW 3 POINTS	Linear	
	V/HZ 3–PT VOLTS	1606	0-100%	0.0%	
	V/HZ 3–PT FREQUENCY	1607	0-9.99Hz	0.00Hz	
	MAX OUTPUT VOLTS	1608	0-100	100.0%	
LEVEL 2 BLOCK	ENTERS LEVEL 2 MENU - See Table A-2.				
PRESS ENTER FOR PROGRAMMING EXIT	Exit programming mode and return to display mode.				

Table A-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-MAX Frequency	0.00Hz	
	MAX OUTPUT FREQ	2003	0-MAX Frequency	60.00Hz	
	PK CURRENT LIMIT	2004	1A to Peak Rated Current	PK Control Rating	
	PWM FREQUENCY	2005	1-5kHz (Standard) 1-15kHz (Quiet)	2500Hz	
	REGEN LIMIT	2006	OFF, ON	OFF	
	REGEN LIMIT ADJ	2007	0 - 500	0Hz	
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	2201	OFF, ON	OFF	
	LOCAL ENABLE INP	2202	OFF, ON	OFF	
MISCELLANEOUS	RESTART AUTO/MAN	2301	Automatic, Manual	Manual	
	RESTART FAULT/HR	2302	0-10	0	
	RESTART DELAY	2303	0-120Seconds	0s	
	LANGUAGE SELECT	2304	English, Espanol	English	
	FACTORY SETTINGS	2305	NO, STD Settings, 50Hz / 400Volts	NO	
	STABIL ADJ LIMIT	2306	0-1.50Hz	1.00Hz	
	STABILITY GAIN	2307	Bus Current Method: 0-9 Phase Current Method: 1-6	1 1	
SECURITY CONTROL	SECURITY STATE	2401	Off Local Security Serial Security Total Security	OFF	
	ACCESS TIMEOUT	2402	0-600seconds	0s	
	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	0-32767RPM	1750RPM	
	MOTOR RATED FREQ	2504	50-400Hz	60.0Hz	
	MOTOR MAG AMPS	2505	0-85% Rated Current	Factory Set	

Table A-2 Parameter Block Values Level 2 Continued

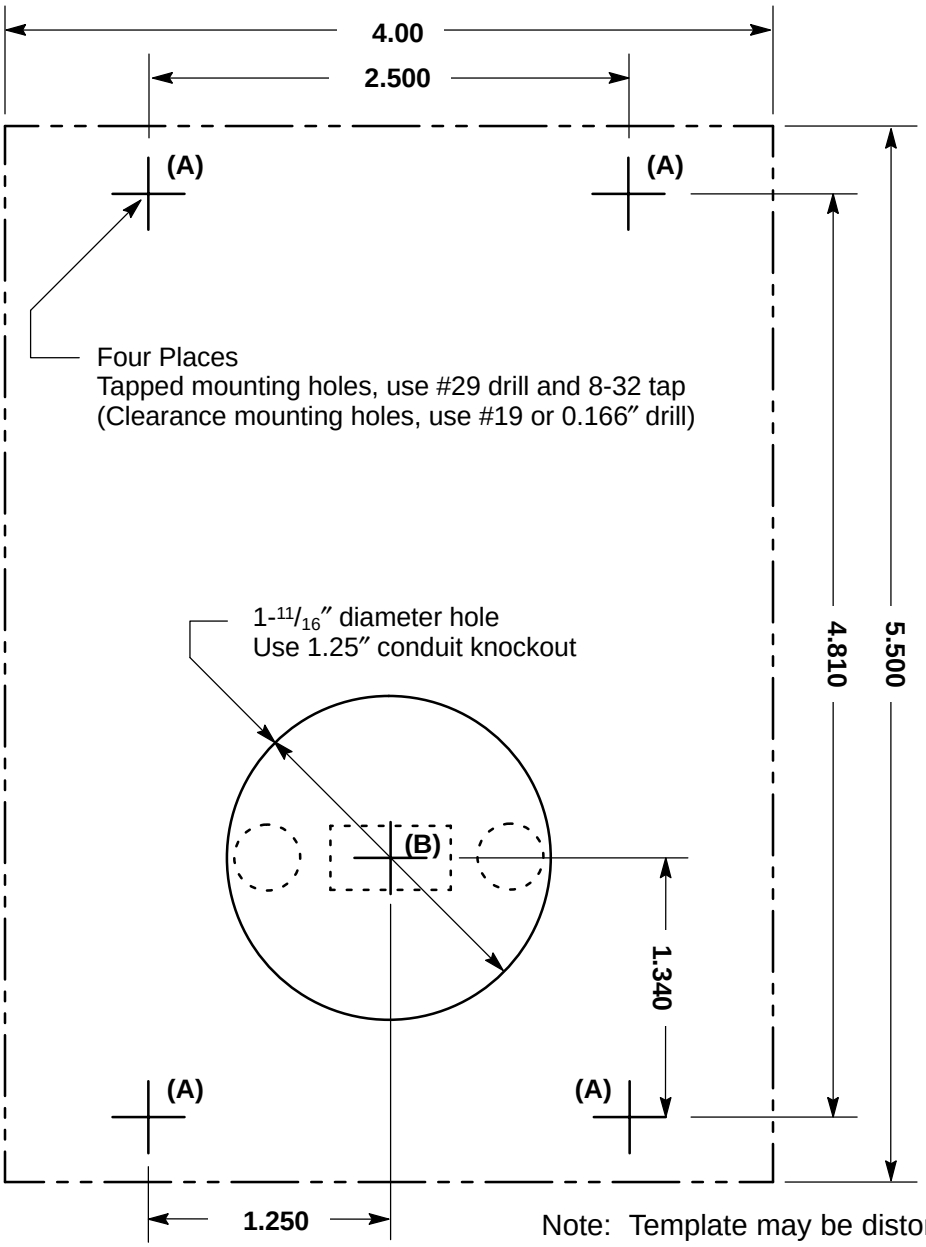
Level 2 Blocks - Continued					
Block Title	**Parameter**	**P#**	**Adjustable Range**	**Factory**	**User Setting**
BRAKE ADJUST	RESISTOR OHMS	2601	0-255 OHMS	Factory Set	
	RESISTOR WATTS	2602	0-32767 WATTS	Factory Set	
	DC BRAKE VOLTAGE	2603	1.0 to 15%	5.0%	
	DC BRAKE FREQ	2604	0.00 to 400.00Hz	6.00Hz	
	BRAKE ON STOP	2605	OFF, ON	OFF	
	BRAKE ON REVERSE	2606	OFF, ON	OFF	
	STOP BRAKE TIME	2607	0.0 to 60.0seconds	3.0s	
	BRAKE ON START	2608	OFF, ON	OFF	
	START BRAKE TIME	2609	0.0 to 60.0seconds	3.0s	
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	OFF, ON	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	0-9.99Hz	0.00Hz	
	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 A-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	OFF, Restarts Only, All Starts	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	0.2-2.0seconds	0.2s	
	SYNC SCAN TIME	2905	1.0-10.0seconds	2.0s	
	SYNC V/F RECOVER	2906	0.2-2.0seconds	0.2s	
	SYNC DIRECTION	2907	Sync Forward and Reverse Sync Forward, Sync Reverse,	Sync FWD & REV	
COMMUNICATIONS	PROTOCOL	3001	RS–232 ASCII, RS-485 ASCII RS–232 BBP, RS-485 BBP	RS–232 ASCII	
	BAUD RATE	3002	9600, 19.2KB, 38.4KB, 57.6KB, 115.2KB, 230.4KB	9600	
	DRIVE ADDRESS	3003	0 - 31	0	
LEVEL 1 BLOCK	ENTERS LEVEL 1 MENU - See Table A-1.				
PRESS ENTER FOR PROGRAMMING EXIT	Exit programming mode and return to display mode.				

Appendix B

Remote Keypad Mounting Template



Note: Template may be distorted due to reproduction.

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