BALDOR®
MOTORS AND DRIVES

ENCODERLESS VECTOR DRIVE

SERIES 17H
Encoderless Vector Control

Installation & Operating Manual

9/97 **MN717**

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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. This 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 “Three Phase Motor and Control Connections”.
4. Connect the motor, refer to Section 3 “Three Phase Motor and Control Connections”.
5. Install dynamic brake hardware, if required. Refer to Section 3 “Optional Dynamic Brake Hardware”.

Quick Start Checklist

Check of electrical items.

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

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

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

Check of Motors and Couplings

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

Quick Start Procedure

Initial Conditions

Be sure the 17H control, motor and dynamic brake hardware are installed and 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 J1-8 are open.
2. Turn power on. Be sure no errors are displayed.
3. Set the Level 1 Input block, Operating Mode parameter 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. Enter the following motor data in the Level 2 Motor Data block parameters:
   Motor Voltage (Nameplate, VOLTS)
   Motor Rated Amps (Nameplate, FLA)
   Motor Rated Speed (Nameplate, RPM)
   Motor Rated Frequency (Nameplate, HZ)
   Motor Mag Amps (Nameplate, NLA)
7. At the Level 2 Motor Data block, press ENTER, at CALC PRESETS select YES (using the ▲ key) and let the control calculate preset values for the parameters that are necessary for control operation.
8. Disconnect the motor from the load (including coupling or inertia wheels). If the load can not be disconnected, refer to Section 6 and manually tune the control. After manual tuning, perform steps 10, 11, 15 and 16.

⚠ **WARNING: The motor shaft will rotate during this procedure. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment.**

9. Go to Level 2 Autotune block, and perform the following tests:
   CMD OFFSET TRIM
   STATOR R1
   FLUX CUR SETTING
10. Set the Level 2 Output Limits block, “MIN OUTPUT SPEED” parameter.
11. Set the Level 2 Output Limits block, “MAX OUTPUT SPEED” parameter.
12. Remove all power from the control.
13. Couple the motor to its load.
14. Turn power on. Be sure no errors are displayed.
15. Run the drive from the keypad using one of the following: the arrow keys for direct speed control, a keypad entered speed or the JOG mode.
16. Select and program additional parameters to suit your application.

The control is now ready for use in the keypad mode. If a different operating mode is desired, refer to Section 3 Control Connections and Section 4 Programming and Operation.

Section 2
General Information

Overview

The Baldor Series 17H control may be used in many different applications. It may be programmed by the user to operate in four different operating zones; standard or quiet constant torque or variable torque. 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.

Note: These choices can also be made using the Serial interface if this option has been added.

The control's rated horsepower is based on the use of a NEMA design B four pole motor and 60Hz operation at nominal rated input voltage. If any other type of motor is used, the control should be sized to the motor using the rated current stated on the motor nameplate.

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 high 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: 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. If an automatic restart of the motor could cause injury to personnel, the automatic restart feature should be disabled by changing the Level 2 Miscellaneous block, Restart Auto/Man parameter to Manual.

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

⚠ 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: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. 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. Certain failure modes of the control can produce peak torque of several times the rated motor torque.

⚠ 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.

⚠ WARNING: Dynamic brake resistors may generate enough heat to ignite combustible materials. Keep all combustible materials and flammable vapors away from brake resistors.

⚠ WARNING: The motor shaft will rotate during the autotune procedure. Be certain that unexpected motor shaft movement will not cause injury to personnel or damage to equipment.

Continued on next page

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

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

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

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

⚠ **Caution:** **Do not supply any power to the External Trip (motor thermostat) leads at J1-16 and 17. Power on these leads can damage the control. Use a dry contact type that requires no external power to operate.**

Section 3
Receiving & Installation

Receiving & Inspection

The Series 17H Encoderless Vector 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 part number of the control you received is the same as the part number 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 7 of this manual).

Physical Location

The location of the 17H is important. It should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, shock and vibration. Exposure to these elements and/or conditions 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. Table 3-1 lists the Watts Loss ratings for enclosure sizing.
2. At least two inches clearance must be provided on all sides for air flow.
3. Front access must be provided to allow the control cover to be opened or removed for service and to allow viewing of the Keypad Display. (The keypad may optionally be remote mounted up to 100 feet from the control.)

   Controls packaged in a floor mounted enclosure must be positioned with clearance to open the enclosure door. This clearance will also provide sufficient air space for cooling.
4. **Altitude derating**. Up to 3300 feet (1000 meters) no derating required. Above 3300 ft, derate the continuous and peak output current by 2% for each 1000 ft.
5. **Temperature derating**. Up to 40°C no derating required. Above 40°C, derate the continuous and peak output current by 2% per °C. Maximum ambient is 55°C.

Table 3-1 Series 17H Watts Loss Ratings

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

Control Installation

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

Through the Wall Mounting

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

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

Procedure:

1. Refer to Section 7 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 panel using the hardware provided.

Optional Remote Keypad Installation The keypad may be remotely mounted using the optional Baldor keypad extension cable. The keypad assembly (white - DC00005A-01; grey - 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.

Mounting Instructions: 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.

Each control is equipped with MOV type surge suppression that is designed to protect the control from transient overvoltages between line to line and line to ground. Transient noise can be caused by lightening, motor starters, DC SCR drives, other electrical equipment or by switching power factor capacitors onto or out of the line.

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.

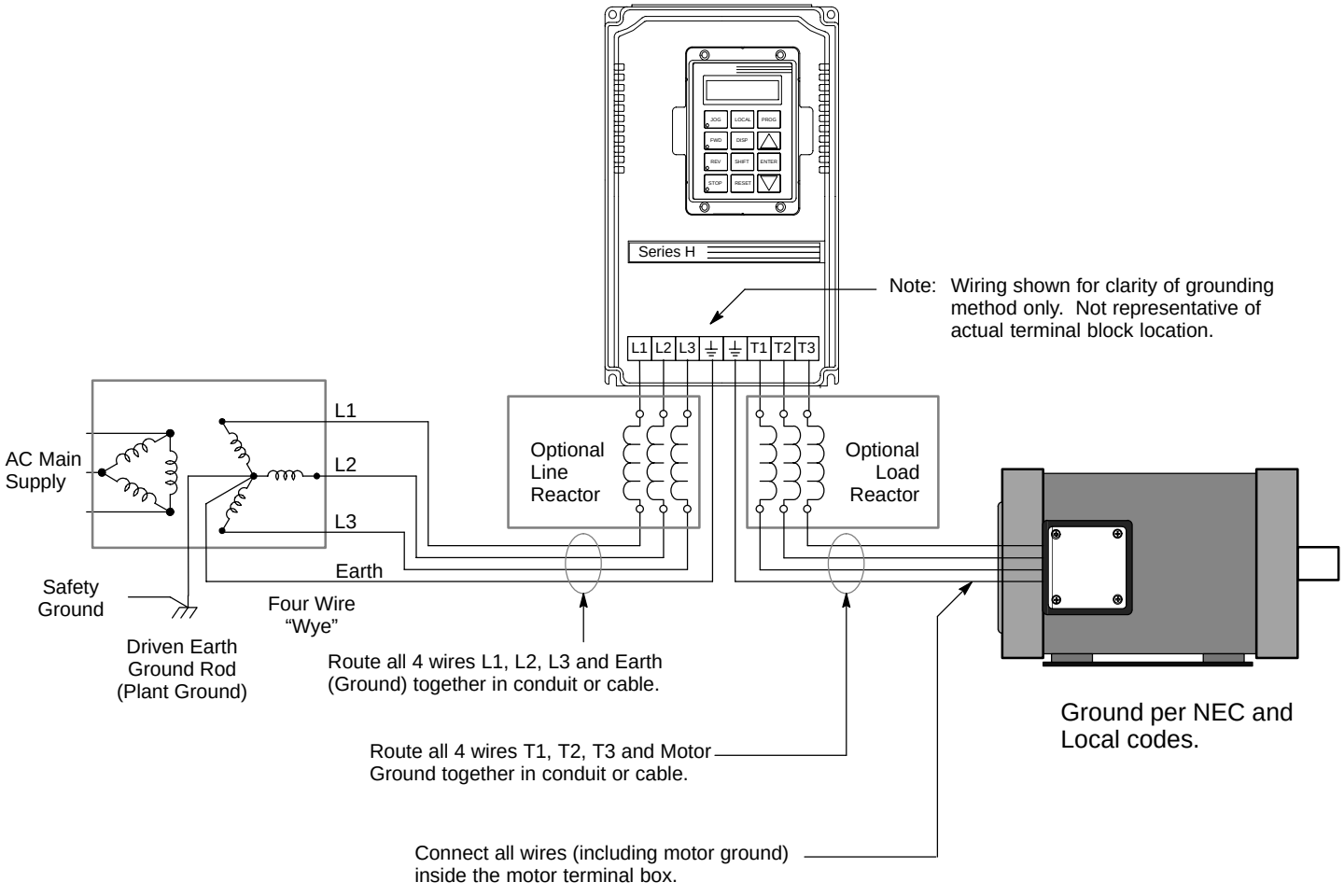
Baldor Series H controls feature UL approved adjustable motor overload protection suitable for motors rated at no less than 50% of the output rating of the control. Other governing agencies such as NEC may require separate over–current protection. The installer of this equipment is responsible for complying 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 NO TAG.

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

Figure 3-1 Recommended System Grounding



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

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

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

Line Impedance

The Baldor Series 17H control requires a minimum line impedance of 3% (voltage drop across the reactor is 3% when the control draws rated input current). If the incoming power line has less than 3% impedance, a 3 phase line reactor can be used to provide the needed impedance in most cases. Line reactors are optional and are available from Baldor.

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

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

$$\%\text{Impedance} = \frac{(\text{Volts}_{\text{No Load Speed}} - \text{Volts}_{\text{Full Load Speed}})}{(\text{Volts}_{\text{No Load Speed}})} \times 100$$

2. Calculate the short circuit current capacity of the power line. If the short circuit current capacity is greater than the published maximum short circuit current ratings for the control, a line reactor should be installed.

   Two methods of calculating short circuit current capacity are provided:

   A. Method 1
   Calculate short circuit current as follows:

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

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

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

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

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

   Step 2: Calculate short circuit current as follows:

$$I_{SC} = \frac{(KVA_{SC} \times 1000)}{(V_{L-L} \times \sqrt{3})} = \frac{1818.2 \times 1000}{460 \times \sqrt{3}} = 2282 \text{ Amps}$$

   where:
   KVA_{XFMR}=Transformer KVA
   I_{sc}=short circuit current
   Z_{XFMR}=Transformer Impedance
   V_{L-L}=Input volts measured line to line

Line Reactors

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

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

Where:

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

Load Reactors

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

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

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

*Quad Rated HP of the control refers to the four (4) different HP ratings of the control that are based on operating in Standard (2.5KHz PWM) or Quiet (8.0KHz PWM) in either Constant Torque or Variable Torque. The ratings are provided in Section 7 of this manual.

Table 3-2 Short Circuit Current Ratings

230VAC		460VAC		575VAC	
Catalog Numbers	**Max. Line Short Circuit Current**	**Catalog Numbers**	**Max. Line Short Circuit Current**	**Catalog Numbers**	**Max. Line Short Circuit Current**
ZD17H201–E	250	ZD17H401–E	150	ZD17H501–E	50
ZD17H201–W	350	ZD17H401–W	200	ZD17H502–E	100
ZD17H202–E	350	ZD17H402–E	200	ZD17H503–E	150
ZD17H202–W	550	ZD17H402–W	300	ZD17H505–E	200
ZD17H203–E or W	550	ZD17H403–E or W	300	ZD17H507–E	300
ZD17H205–E	550	ZD17H405–E	300	ZD17H510–E	400
ZD17H205–W	1000	ZD17H405–W	500	ZD17H515–E, EO or ER	600
ZD17H207–E or W	1000	ZD17H407–E or W	500	ZD17H520–EO or ER	1000
ZD17H210–E	1000	ZD17H410–E	500	ZD17H525–EO or ER	1100
ZD17H210L–ER	1500	ZD17H410L–ER	800	ZD17H530–EO or ER	1500
ZD17H215–E, EO or ER	1900	ZD17H415–E, EO or ER	1000	ZD17H540–EO or ER	1800
ZD17H215L–ER	1900	ZD17H415L–ER	1000	ZD17H550–EO or ER	2200
ZD17H220–EO or ER	2400	ZD17H420–EO or ER	1200	ZD17H560–EO or ER	2700
ZD17H220L–ER	2100	ZD17H420L–ER	1200	ZD17H575–EO or ER	3300
ZD17H225–EO or ER	2800	ZD17H425–EO or ER	1400	ZD17H5100–EO or ER	4200
ZD17H225L–ER	2500	ZD17H425L–ER	1400	ZD17H5150V–EO or ER	4800
ZD17H230V–EO or ER	3600	ZD17H430V–EO or ER	1800		
ZD17H230–EO or ER	3600	ZD17H430–EO or ER	1800		
ZD17H230L–ER	3600	ZD17H430L–ER	1800		
ZD17H240–MO or MR	4500	ZD17H440–MO or MR	2300		
ZD17H240L–MR	4000	ZD17H440L–MR	2300		
ZD17H250V–MO or MR	4500	ZD17H450–EO or ER	2800		
ZD17H250–MO or MR	4500	ZD17H450L–ER	2800		
		ZD17H460–EO or ER	3500		
		ZD17H460V–EO or ER	3500		
		ZD17H460L–ER	3500		
		ZD17H475–EO	4300		
		ZD17H475L–EO	4300		
		ZD17H4100–EO	5500		
		ZD17H4150V–EO	6200		
		ZD17H4150–EO	8300		
		ZD17H4200–EO	11000		
		ZD17H4250–EO	13800		
		ZD17H4300–EO	16600		
		ZD17H4350–EO	19900		
		ZD17H4400–EO	19900		
		ZD17H4450–EO	25000		

Input Current Requirements

Table 3-3 Input Current Continuous Amps Requirements

230 VAC Control Catalog Numbers	Input Amps	460 VAC Control Catalog Numbers	Input Amps	575 VAC Control Catalog Numbers	Input Amps
ZD17H201-E or W	6.8	ZD17H401-E or W	3.4	ZD17H501-E	2.7
ZD17H202-E or W	9.6	ZD17H402-E or W	4.8	ZD17H502-E	4.0
ZD17H203-E or W	15.2	ZD17H403-E or W	7.6	ZD17H503-E	6.1
ZD17H205-E	15.2	ZD17H405-E or W	11	ZD17H505-E	11
ZD17H205-W	22	ZD17H407-E	11	ZD17H507-E	11
ZD17H207-E or W	28	ZD17H407-W	14	ZD17H510-E	11
ZD17H210-E	28	ZD17H410-E	21	ZD17H515-EO or ER	22
ZD17H210L-ER	42	ZD17H410L-ER	21	ZD17H520-EO or ER	27
ZD17H215-E	42	ZD17H415-E	21	ZD17H525-EO or ER	32
ZD17H215-EO or ER	54	ZD17H415-EO or ER	27	ZD17H530-EO or ER	41
ZD17H220-EO or ER	68	ZD17H415L-ER	27	ZD17H540-EO or ER	52
ZD17H220L-ER	60	ZD17H420-E or ER	34	ZD17H550-EO or ER	62
ZD17H225-EO or ER	80	ZD17H420L-ER	30	ZD17H560-EO or ER	62
ZD17H225L-ER	75	ZD17H425-EO or ER	40	ZD17H575-EO	100
ZD17H230-EO or ER	104	ZD17H425L-ER	38	ZD17H5100-EO	125
ZD17H230V-EO or ER	104	ZD17H430-EO or ER	52	ZD17H5150-EO	145
ZD17H230L-ER	104	ZD17H430L-ER	52		
ZD17H240-MO or MR	130	ZD17H430V-EO or ER	52		
ZD17H240L-MR	115	ZD17H430L-ER	52		
ZD17H250-MO or MR	130	ZD17H440-EO or ER	65		
ZD17H250V-MR	130	ZD17H440L-ER	60		
		ZD17H450-EO or ER	80		
		ZD17H450L-ER	80		
		ZD17H460-EO or ER	100		
		ZD17H460V-EO or ER	100		
		ZD17H460L-ER	100		
		ZD17H475-EO	125		
		ZD17H475L-EO	125		
		ZD17H4100-EO	160		
		ZD17H4150-EO	240		
		ZD17H4150V-EO	180		
		ZD17H4200-EO	310		
		ZD17H4250-EO	370		
		ZD17H4300-EO	420		
		ZD17H4350-EO	480		
		ZD17H4400-EO	540		
		ZD17H4450-EO	590		

AC Main Circuit Considerations

Protection Devices

Be sure a suitable input power protection device is installed. Use the recommended circuit breaker or fuses listed in Tables 3-4 through 3-6 (Wire Size and Protection Devices). Input and output wire size is based on the use of copper conductor wire rated at 75 °C. The table is specified for NEMA B motors.

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

Power Disconnect

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

Wire Size and Protection Devices

Table 3-4 Wire Size and Protection Devices - 230 VAC Controls

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

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

Table 3-5 Wire Size and Protection Devices - 460 VAC Controls

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

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

Table 3-6 Wire Size and Protection Devices - 575 VAC Controls

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

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

AC Line Connections

Reduced Input Voltage Derating All power ratings stated in Section 7 are for the stated nominal AC input voltages (230, 460 or 575VAC). The power rating of the control must be reduced when operating at a reduced input voltage. The amount of reduction is the ratio of the voltage change.

Examples:

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

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

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

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

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

380-400 VAC Operation Size A and B 460VAC controls may be used directly with a 380-400 VAC power source, control modification is not necessary.

Size C, D, E, F and G 460VAC controls all require modification for operation on the reduced line voltage. Specifically, the control transformer must have the wire on terminal 5 (for 460V) moved to terminal 4 (for 380-400V).

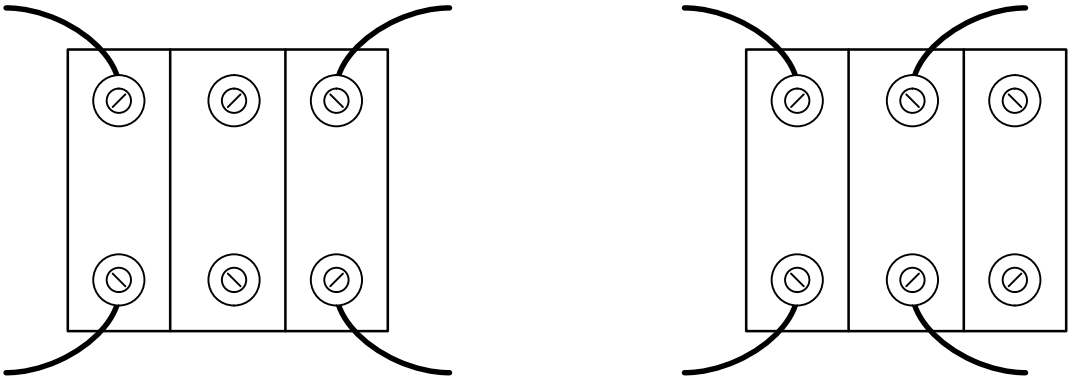
Control Transformer Tap Change Procedure (size C, D, E, and F controls).

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

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

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

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



Three Phase Motor and Control Connections

The AC power and motor connections are shown in Figure 3-1. Overloads are not required. The 17H 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.**

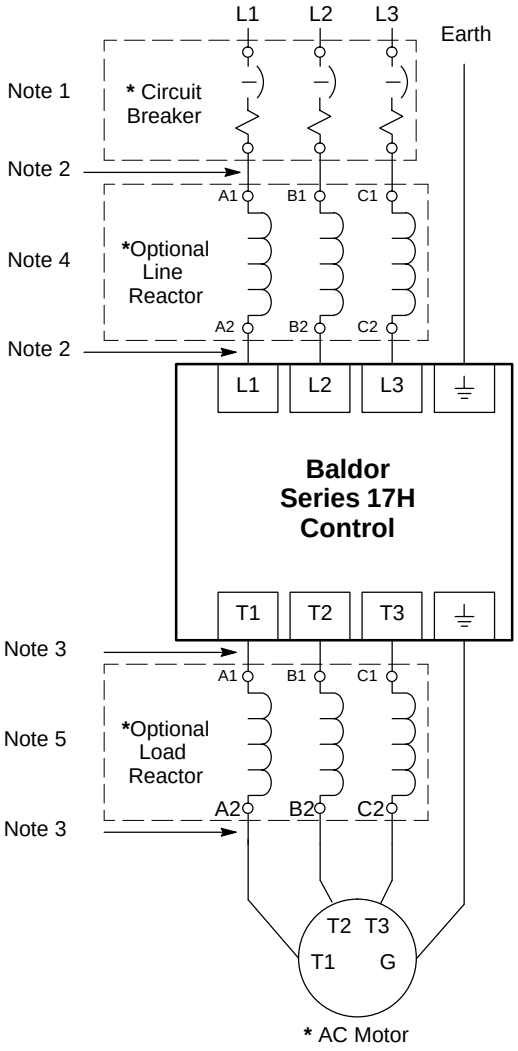
⚠ **Caution: Baldor recommends not using "Grounded Leg Delta" transformer power leads that may create ground loops and degrade system performance. Instead, we recommend using a four wire Wye.**

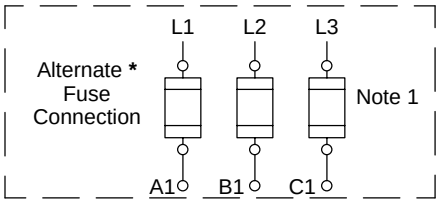
1. Connect the incoming AC power wires from the protection devices to L1, L2 and L3 at the main circuit terminals. The phase rotation is not important as the control is not phase sensitive.
2. * Connect earth ground to the "⏚" of the control. Be sure to comply with all applicable codes.

   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.
3. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the main circuit terminals.
4. * Connect motor ground wire to the "⏚" 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 3-1 3 Phase AC Power and Motor Connections

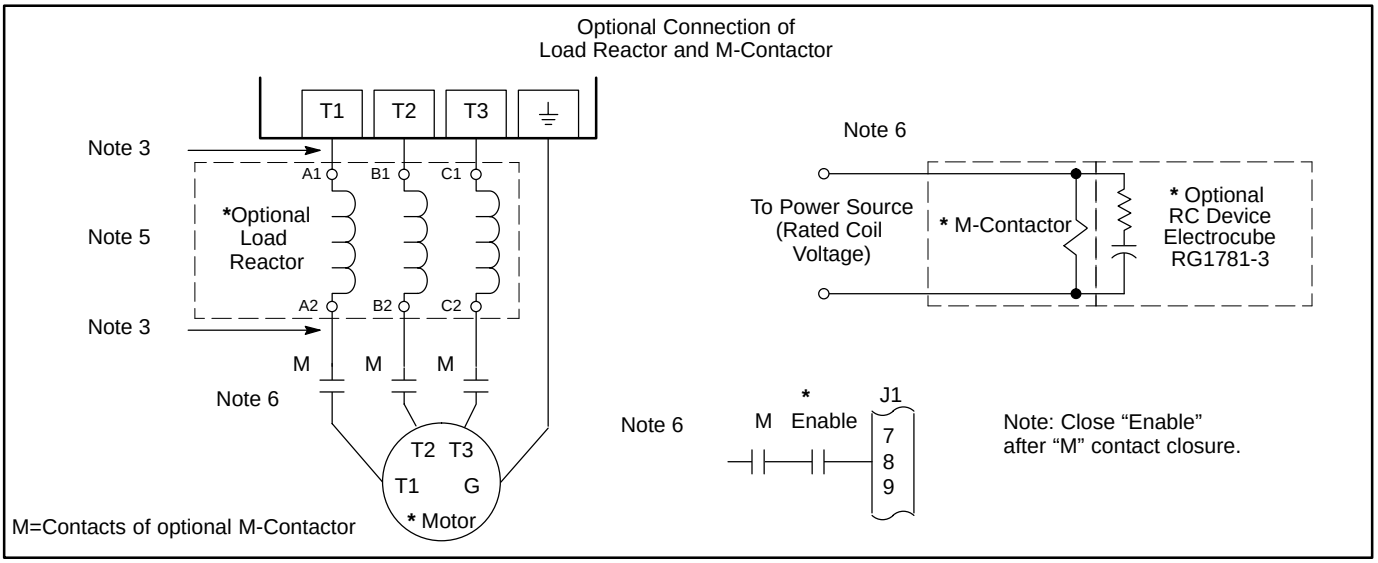




***** Optional components not provided with 17H Control.

Notes:

1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J1-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.



See Recommended Tightening Torques in Section 7.

Table 3-7 Single Phase Rating Wire Size and Protection Devices - 230 VAC Controls

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm²
1	15A	5A	5A	14	2.5
2	15A	10A	10A	14	2.5
3	15A	15A	15A	14	2.5
5	30A	30A	30A	12	4
7.5	25A	25A	25A	14	2.5
10	40A	30A	30A	12	4
15	50A	45A	45A	10	6
20	60A	45A	45A	8	10
25	70A	70A	70A	8	10
30	80A	80A	80A	6	16
40	100A	100A	100A	4	25
50	125A	125A	125A	4	25

Table 3-8 Single Phase Rating Wire Size and Protection Devices - 460 VAC Controls

Control Output Power Rating	Input Breaker	Input Fuse		Wire Gauge	
		Fast Acting	Time Delay	AWG	mm²
1	15A	4A	4A	14	2.5
2	15A	8A	8A	14	2.5
3	15A	10A	10A	14	2.5
5	15A	15A	15A	14	2.5
7.5	15A	15A	15A	14	2.5
10	20A	15A	15A	14	2.5
15	25A	25A	25A	14	2.5
20	30A	30A	30A	14	2.5
25	35A	30A	30A	14	2.5
30	40A	40A	40A	10	6
40	60A	50A	50A	8	10
50	70A	60A	60A	8	10
60	80A	80A	80A	6	16

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

Single Phase Input Power Considerations

⚠ **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.**

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

Single phase rating wire size and protection devices are listed in Tables 3-7 and 3-8.

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

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

Size A and B Single Phase Power Installation

Jumper Configuration

Size A and B controls, no jumper changes required.

Power and Control Connections

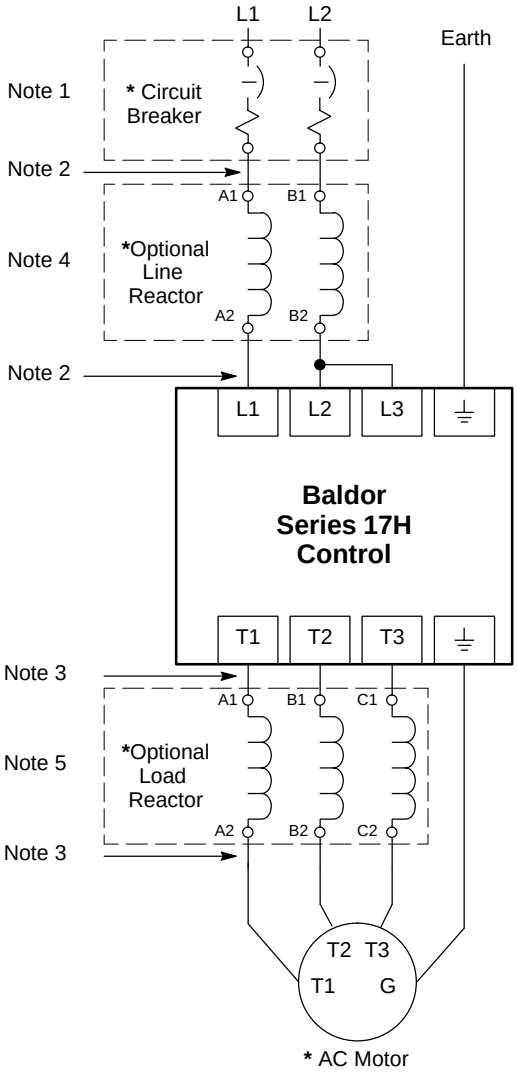
The single phase power and motor connections are shown in Figure 3-2.

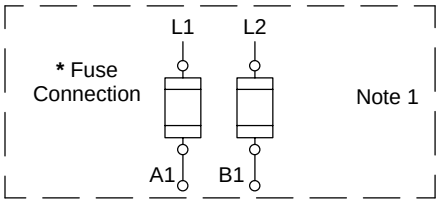
1. Connect the incoming power wires to Main Circuit Terminals L1 and L2.
2. Place a jumper across control power input terminals L2 and L3. Use the same size wire for the jumper as the incoming power wires on L1 and L2.
3. Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.

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

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

Figure 3-2 Size A & B Single Phase 230/460VAC Power and Motor Connections

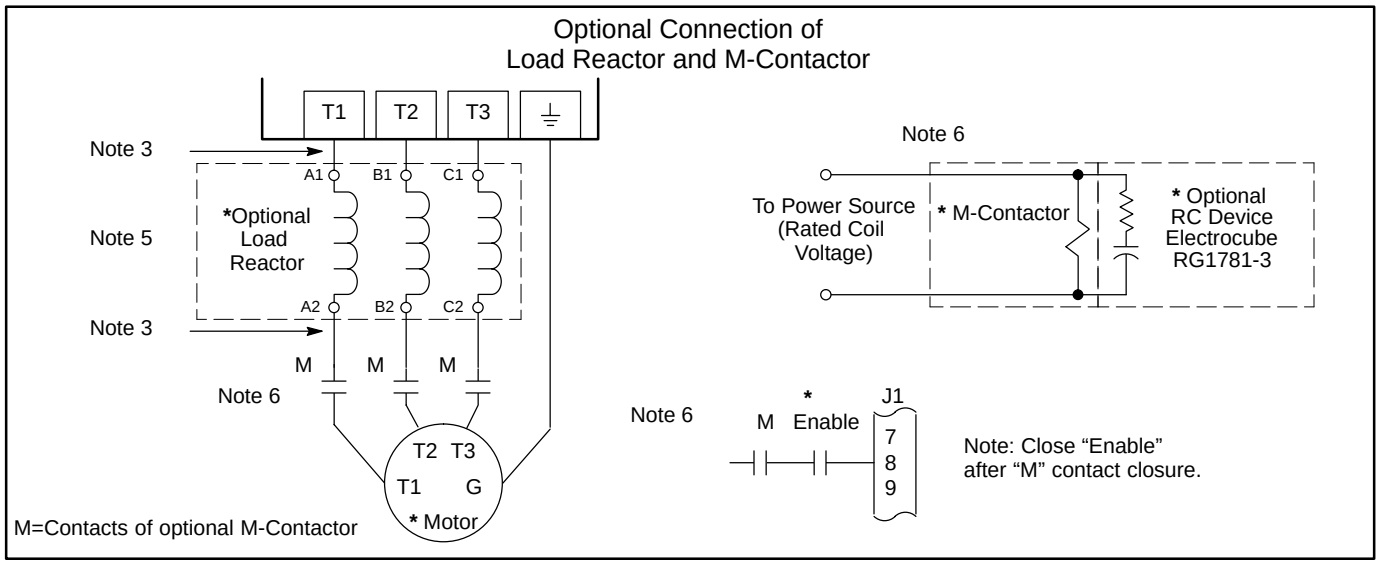




***** Optional components not provided with 17H Control.

Notes:

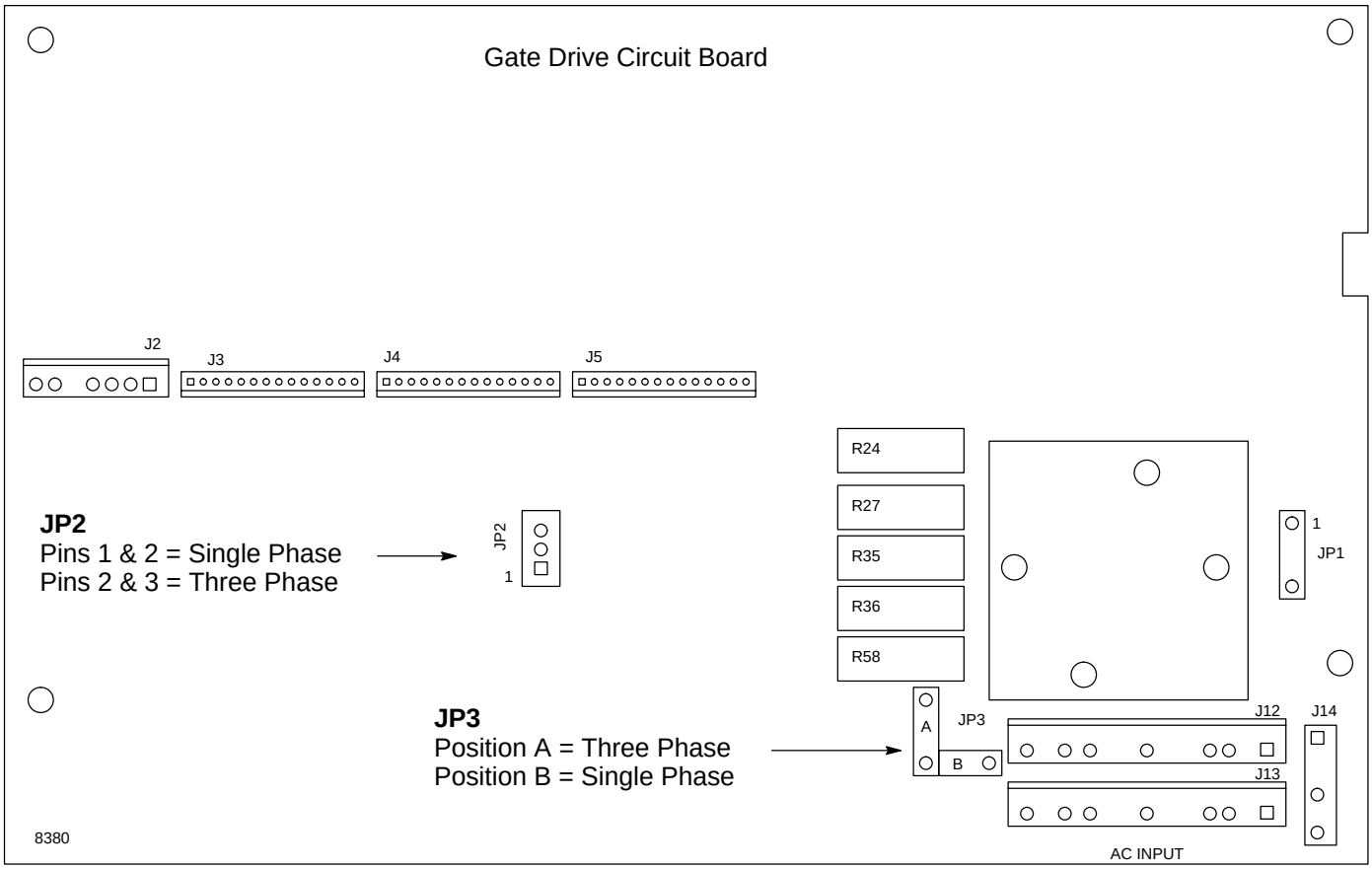
1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J1-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.



See Recommended Tightening Torques in Section 7.

Size C and D Single Phase Power Installation

Figure 3-3 Jumper Configuration



Power and Control Connections

The single phase Gate Drive board jumpers are shown in Figure 3-3.

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

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

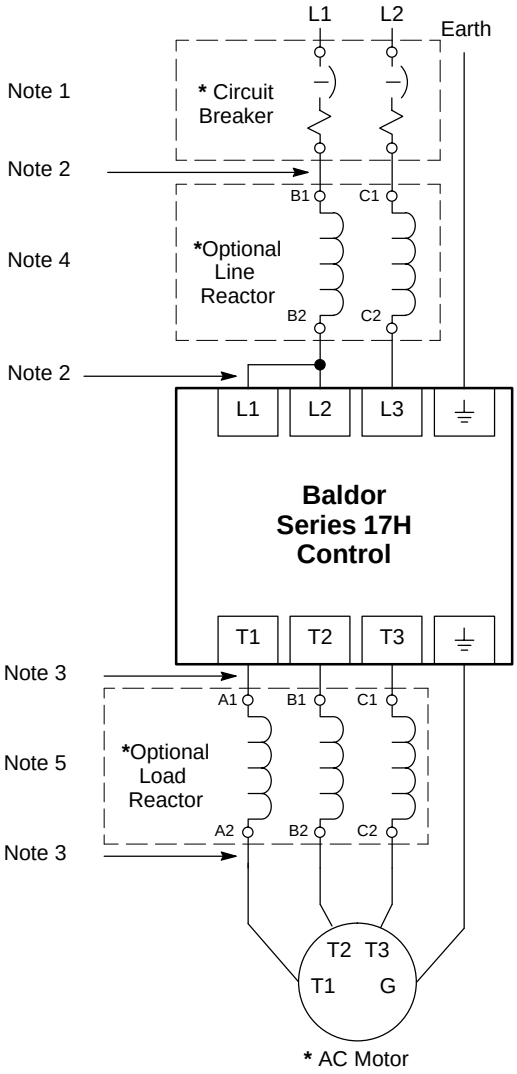
2. Connect the incoming power wires to Main Circuit Terminals L2 and L3.
3. Place a jumper across control power input terminals L1 and L2. Use the same size wire for the jumper as the incoming power wires on L2 and L3.
4. Connect earth ground to the "⏚" of the control. Be sure to comply with local codes.

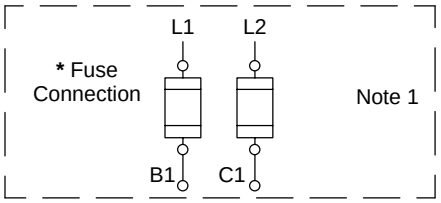
   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.

5. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
6. Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

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

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

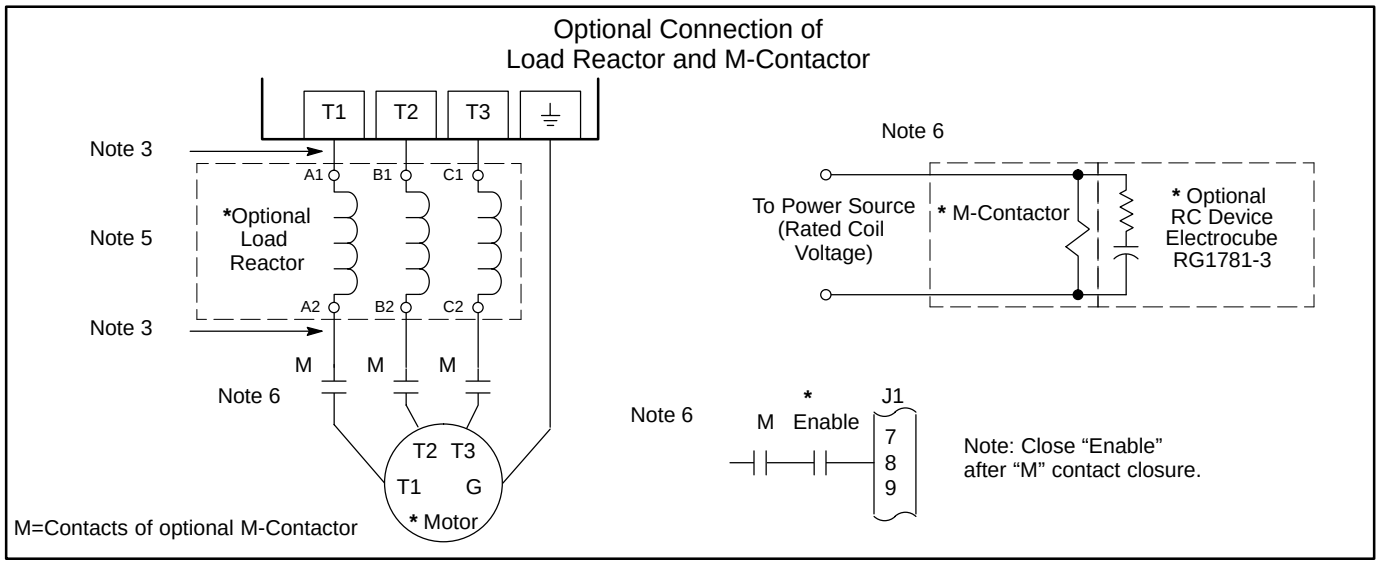




***** Optional components not provided with 17H Control.

Notes:

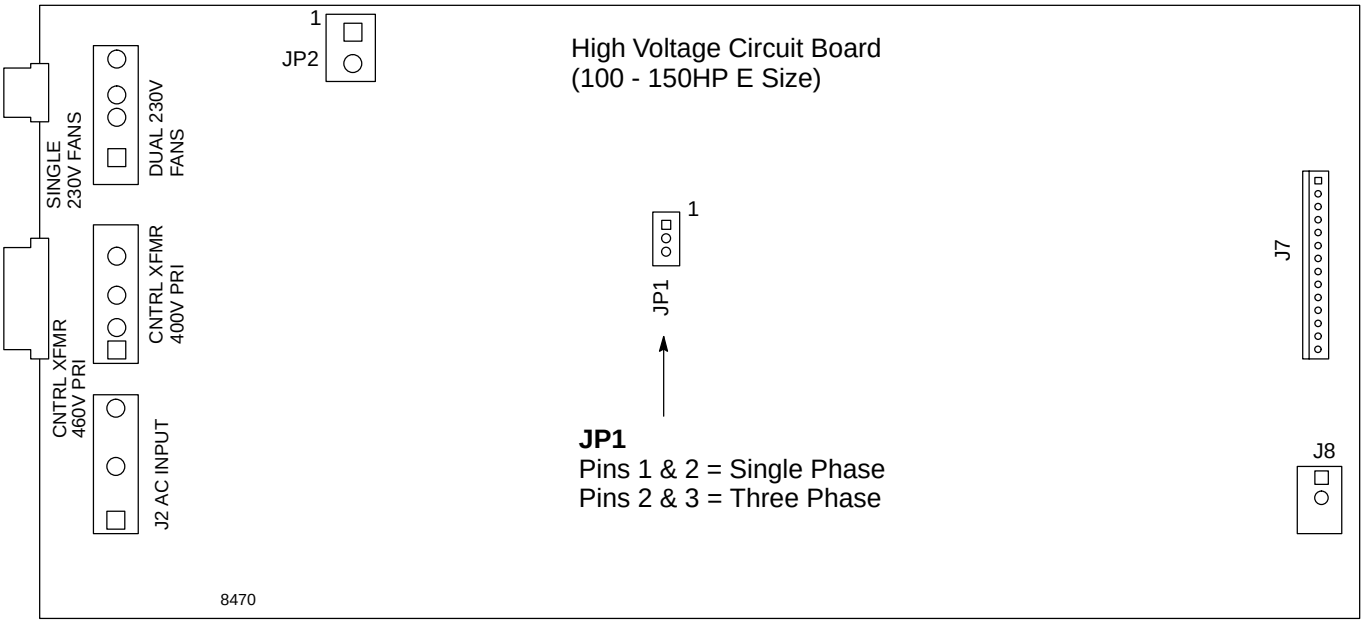
1. See “Protective Devices” described previously in this section.
2. Shield wires inside a metal conduit.
3. Metal conduit should be used to shield output wires (between control and motor).
4. See “Line Impedance” described previously in this section.
5. See Line/Load Reactors described previously in this section.
6. A motor circuit contactor is recommended to provide a positive disconnect and prevent motor rotation which could pose a safety hazard. Connect the M-Contactor as shown. The contactor should open the enable input at J1-8 at least 20 msec before the main M-contacts open to prevent arcing at contacts. This greatly increases contactor life and allows use of IEC rated contactors.



See Recommended Tightening Torques in Section 7.

Size E Single Phase Power Installation

Figure 3-5 Jumper Configuration



Power and Control Connections

The single phase High Voltage board jumpers are shown in Figure 3-5.

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

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

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

   Note: Use same gauge wire for earth ground as is used for L1, L2 and L3 connections. Refer to the Wire Size and Protection Devices tables shown previously in this section.

5. Connect the three phase power leads of the AC motor to terminals T1, T2, and T3 of the Main Circuit Terminals.
6. Connect motor ground wire to the "⏚" of the control. Be sure to comply with all applicable codes.

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