INSTALLATION AND OPERATION MANUAL
KBCC SERIES

CHASSIS MOUNT SOLID STATE DC MOTOR SPEED CONTROLS

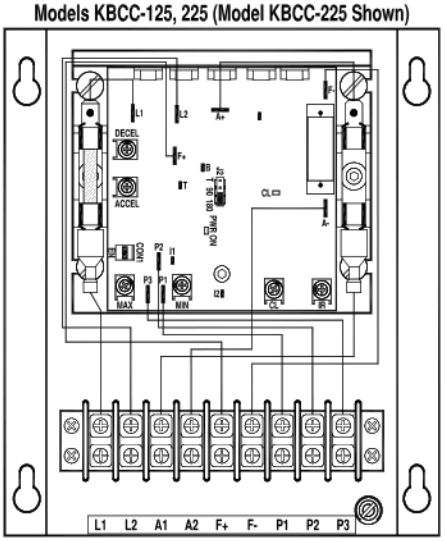
All Models Contain the KBMM* Speed Control
"R" Suffix Models Contain the APRM-3* for Fast Anti-Plug Reversing

Models KBCC-125, 125R: Rated 115 Volt AC Line Input for 1½ HP (1.13 kW) Motors

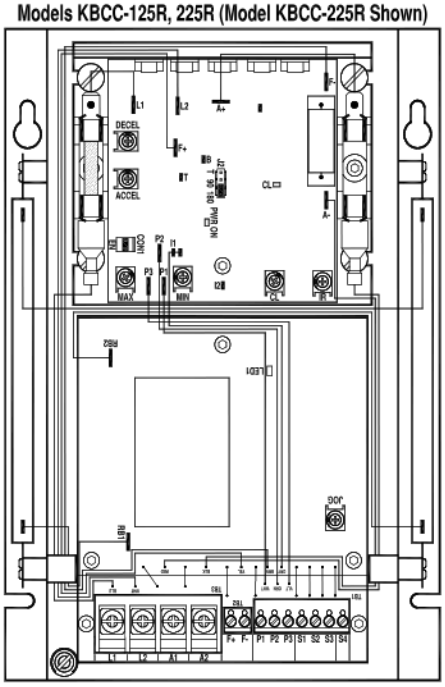
Models KBCC-225, 225R: Rated 208/230 Volt AC Line Input for 3 HP (2.25 kW) Motors

Model KBCC-255: Rated 208/230 Volt AC Line Input for 5 HP (3.75 kW) Motors

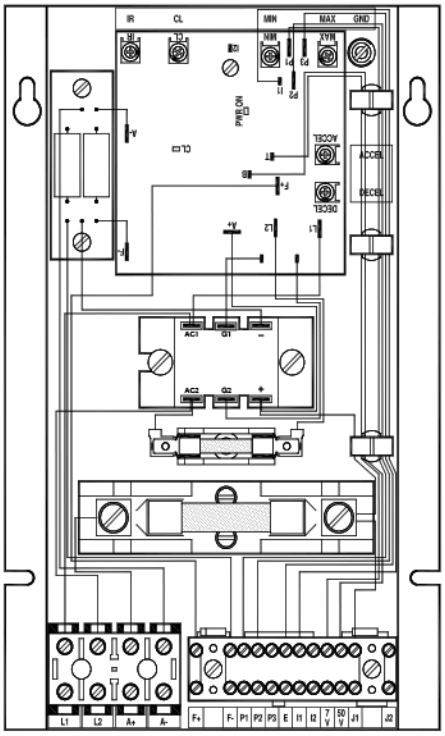
Models KBCC-125, 225 (Model KBCC-225 Shown)



Models KBCC-125R, 225R (Model KBCC-225R Shown)



Model KBCC-255



- Multiple horsepower capability with Plug-In Horsepower Resistor® (Models KBCC-125, 125R, 225, 225R only).
- Models KBCC-125R, 225R contain the APRM® which provides instant anti-plug reversing and solid state dynamic braking.
- Direct-Fed™ current limit prevents PM motors from demagnetizing.
- AC Line and Motor Armature Fusing.
- Short circuit protection (at the motor only).

See Safety Warning on page 6.

Models KBCC-125, 125R, 225, 225R
A Plug-In Horsepower Resistor®
and Motor Armature Fuse, both supplied separately,
must be installed for this product to operate.
See Sections 9.2 and 10 on pages 25 and 26.

RoHS COMPLIANT

Designed and Assembled in USA

This Manual Covers Models
KBCC-125 (Part No. 9936), KBCC-125R (Part No. 9937), KBCC-225 (Part No. 9938), KBCC-225R (Part No. 9924), KBCC-255 (Part No. 9940)

The information contained in this manual is intended to be accurate.
However, the manufacturer retains the right to make changes in design, which may not be included herein.

KBMM and APRM are Patented

PENTA KB POWER
A Complete Line of Motor Drives

KBCC Manual

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Items Included in This Package: KBCC Series Control, Installation and Operation Manual, Trimpot Adjustment Tool, 5 kΩ Main Speed Potentiometer Kit, Enable Connector Kit.

UL NOTICE

230 VAC Controls: Suitable for use on a circuit capable of delivering not more than 5 kA RMS symmetrical amperes, 230 Volts maximum. Use copper conductors rated 75 ºC. Suitable for operation in a maximum surrounding air temperature of 40 ºC.

To Validate the 18 Month Warranty, Please Register this Product Online

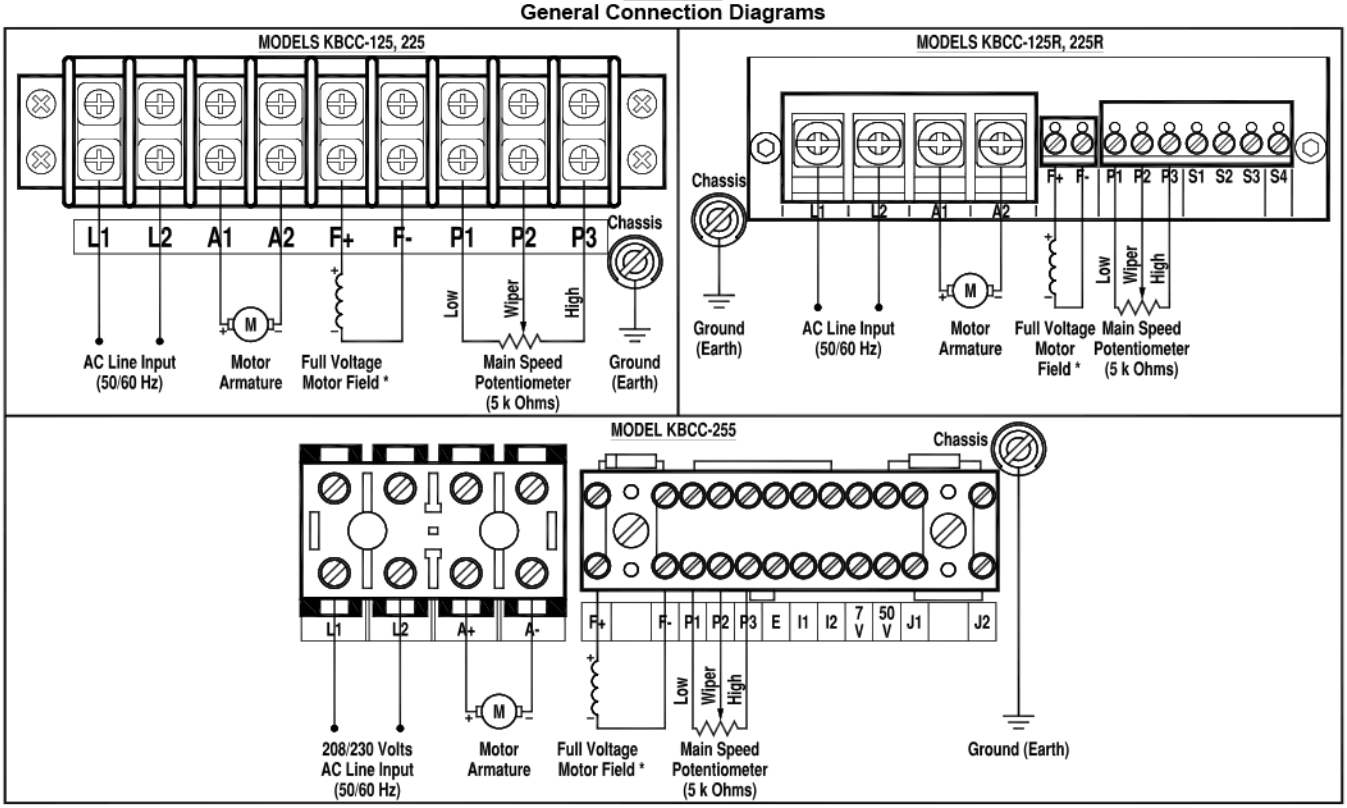
↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

KBelectronics.com/registration.htm

1 – QUICK-START INSTRUCTIONS

IMPORTANT: These instructions are to be used as a reference only and are not intended to replace the detailed instructions provided herein. You must read the Safety Warning on page 6 before proceeding.

FIGURE 1
General Connection Diagrams



**Field connection is for shunt wound motors only.*

1.1 – AC Line Input: The rated AC line voltage of the control must match the actual AC line input voltage. Models KBCC-125, 125R are rated for 115 Volt AC Line input only. Models KBCC-225, 225R, 255 are rated for 230 Volt AC Line input only. Wire the AC Line input to Terminals L1 and L2. See Table 2 on page 7. See Section 6.1 on page 14.

Notes: 1. *If one of the AC line inputs is a neutral (N), wire it to Terminal L2.* ***2.*** *Be sure to fuse each ungrounded AC Line supply conductor. Do not fuse neutral or grounded conductors.*

1.2 – Ground: Connect the ground wire (earth) to the green ground screw, located on the chassis. See Section 6.2 on page 15.

1.3 – Motor Armature: Wire the motor armature positive (+) lead to Terminal A1 (Models KBCC-125, 125R, 225, 225R) or A+ (Model KBCC-255) and the negative (-) lead to Terminal A2 (Models KBCC-125, 125R, 225, 225R) or A- (Model KBCC-255). See Section 6.4 on page 15.

Note: *If the motor runs in the improper direction, disconnect power to the control, wait until the motor has stopped, and interchange the motor armature leads.*

1.4 – Motor Field (Shunt Wound Motors Only): Wire the full voltage field positive (+) lead to Terminal F+ and the negative (-) lead to Terminal F-. Wire the half voltage field (for 90 Volt DC motors with 50 Volt DC fields and 180 Volt DC motors with 100 Volt DC fields) positive (+) lead to Terminal F+ and the negative (-) lead to Terminal L1. See Section 6.5 on page 16.

Notes: 1. *Do not connect the motor armature leads to Terminals F+ and F-.* ***2.*** *Do not use Terminal F+ for any purpose other than to power the field of a shunt wound motor.* ***3.*** *Shunt wound motors may be damaged if the field remains energized without motor armature rotation for an extended period.*

1.5 – DC Tach-Generator: A DC tach-generator can be used for load regulation of 1% of the base speed. The tach-generator input circuit is designed for a 7 Volts per 1000 RPM DC tach-generator (see Section 6.6.1 on page 17) or a 50 Volts per 1000 RPM DC tach-generator (see Section 6.6.2 on page 18) used with an 1800 RPM motor. For a tach-generator other than 7 Volts or 50 Volts per 1000 RPM, see Section 6.6.3 on page 18.

1.6 – Main Speed Potentiometer (Supplied): The control is supplied with a 5 kΩ Main Speed Potentiometer to control motor speed. Wire the low side to Terminal P1. Wire the wiper to Terminal P2. Wire the high side to Terminal P3. See Section 6.7 on page 19.

1.7 – Voltage Following: An isolated 0 – 9 Volt DC analog signal input can be used to control motor speed in lieu of the Main Speed Potentiometer. The control output voltage will linearly follow the analog signal input. The signal input must be isolated from the AC line. The source impedance of the signal input should be 10 kΩ or less. Connect the signal input positive (+) to Terminal P2 and the negative (-) to Terminal P1. See Section 6.8 on page 19.

1.8 – Enable: An Enable switch or contact or open collector can be used to electronically start and stop the control. On Models KBCC-125, 125R, 225, 225R, use the supplied prewired connector to wire the Enable Circuit to Connector CON1. On Model KBCC-255, wire Enable to Terminals P3 and E. When the switch or contact is closed or the open collector is turned on, the control will run (Enable). When the switch or contact is opened or the open collector is turned off, the control will stop. See Section 6.9 on page 20.

1.9 – Inhibit: An Inhibit switch or contact or open collector can be used to electronically start and stop the control. Wire the Inhibit switch or contact or open collector to Terminals I1 and I2. When the switch or contact is opened or the open collector is turned off, the control will run. When the switch or contact is closed or the open collector is turned on, the control will stop (Inhibit). See Section 6.10 on page 22.

1.10 – Direction Selection (Models KBCC-125R, 225R Only): For forward direction, connect Terminals S1 and S2. For reverse direction, connect Terminals S2 and S3. If no connection is made, the control will be in Brake Mode and the Brake LED, located on the APRM, will illuminate red. See Section 7 on page 22.

1.11 – Jumper J2 (Models KBCC-125, 125R, 225, 225R Only): On Models KBCC-125, 125R, the jumper can be used to select either motor armature feedback (set to the "90" position for 90 Volt DC motors) or DC tach-generator feedback (set to the "T" position and a DC tach-generator wired to the control). On Models KBCC-225, 225R, the jumper can be used to select either motor armature feedback (set to the "90" position for 90 Volt DC motors with 208/230 Volt AC Line input (step-down mode) or the "180" position for 180 Volt DC motors) or DC tach-generator feedback (set to the "T" position and a DC tach-generator wired to the control). See Section 8 on page 25.

1.12 – AC Line Fuse: Models KBCC-125, 125R, 225, 225R contain a factory installed 25 Amp AC Line fuse. Model KBCC-255 does not contain a built-in AC Line fuse holder; therefore, an external 40 Amp fuse or circuit breaker fuse must be installed in each ungrounded AC Line input. Do not fuse neutral or grounded conductors. See Table 2 on page 7. Also see Section 9.1 on page 25.

1.13 – Motor Armature Fuse (Supplied Separately): Install the correct motor armature fuse on Models KBCC-125, 125R, 225, 225R. Model KBCC-255 contains a factory installed 40 Amp motor armature fuse. See Table 2 on page 7. Also See Section 9.2 on page 25.

1.14 – Plug-In-Horsepower Resistor® (Supplied Separately) (Models KBCC-125, 125R, 225, 225R Only): Install the correct Plug-in Horsepower Resistor® to match the control to the motor horsepower and voltage. Plug-in Horsepower Resistors® are stocked by your distributor. See Section 10 on page 26.

1.15 – Trimpot Settings: All trimpots have been factory set for most applications. The trimpots may be readjusted to tailor the control for a specific application. See Section 11 on page 27.

1.16 – Diagnostic LEDs: After power has been applied to the control, observe the LEDs to verify proper control operation. See Section 12 on page 28.

2 – IMPORTANT APPLICATION INFORMATION

2.1 – **Motor Type:** The controls are designed for permanent magnet (PM) and Shunt Wound DC motors.

2.2 – **Torque Requirements:** The motor selected for the application must be capable of supplying the necessary torque. To ensure the motor is not overloaded, a DC ammeter should be connected in series with the motor armature. Be sure the current under full load does not exceed the motor nameplate rating.

2.3 – **Acceleration Start:** The control contains an adjustable acceleration start feature which allows the motor to smoothly accelerate from zero speed to full speed.

2.4 – **Limitation in Use:** The control is designed for use on machine applications. Consult our Sales Department before using this control on constant horsepower applications such as saws and drill presses. Do not use this control in an explosive atmosphere. Be sure the control is used within its ratings.

2.5 – **Motor Armature Switching:** Do not wire the control for motor armature switching without taking proper precautions. See Section 7 on page 22.

WARNING! Do not switch the motor armature in and out of circuit or catastrophic failure will result. If motor armature switching is required for reversing or dynamic braking, use Model KBCC-125R or KBCC-225R.

2.6 – **Step-Down Transformer and AC Line Switching:** When using a step-down transformer (460 Volts AC to 230 Volts AC), be sure the output current rating of the transformer is at least 3 times the current rating of the motor. Do not switch the primary side of the transformer to disconnect power or catastrophic failure can result. Always disconnect the control from the secondary side of the transformer.

3 – SAFETY WARNING

Definitions of Safety Warning Symbols

Electrical Hazard Warning Symbol: Failure to observe this warning could result in electrical shock or electrocution.

Operational Hazard Warning Symbol: Failure to observe this warning could result in serious injury or death.

This product must be installed and serviced by a qualified technician, electrician, or electrical maintenance person familiar with its operation and the hazards involved. Proper installation, which includes electrical connections, fusing or other current protection, and grounding, can reduce the chance of electrical shocks, and/or fires, in this product or products used with this product, such as electric motors, switches, coils, solenoids, and/or relays. Do not use this drive in an explosion-proof application. Eye protection must be worn and insulated adjustment tools must be used when working with drive under power. This product is constructed of materials (plastics, metals, carbon, silicon, etc.) which may be a potential hazard. Proper shielding, grounding, and filtering of this product can reduce the emission of radio frequency interference (RFI) which may adversely affect sensitive electronic equipment. It is the responsibility of the equipment manufacturer and individual installer to supply this Safety Warning to the ultimate end user of this product. (SW 8/2012)

The control contains electronic Start/Stop circuits, which can be used to start and stop the control. However, these circuits are never to be used as safety disconnects since they are not fail-safe. Disconnect the input power for this purpose. Be sure to read and follow all instructions carefully. Fire and/or electrocution can result due to improper use of this product.

4 – INTRODUCTION

Thank you for purchasing the KBCC Series DC Motor Speed Control. KB Electronics, Inc. is committed to providing total customer satisfaction by producing quality products that are easy to install and operate.

The control offers the user the ultimate in reliability and performance at an affordable price. The controls contain a unique patented super-fast Direct-Fed™ current limit circuit that protects the SCR power bridge against direct shorts.[1] The reliability of the control is further enhanced with the use of high-surge, SCRs, and AC Line and motor armature fusing.[2,3] The control is designed with KB's exclusive Plug-In Horsepower Resistor®, which eliminates the need for recalibrating IR Compensation and Current Limit when the control is used on various horsepower motors.[3] Models KBCC-225 and KBCC-225R also allow operation of 90 Volt DC motors when used on 208/230 Volt AC line input.[4]

The versatility of the control is confirmed by its extensive list of standard features, such as: selectable motor armature and tach-generator feedback[5] voltages and adjustable trimpots for minimum speed, maximum speed, current limit, IR compensation, linear acceleration and deceleration, and jog[6]. The control includes Auto-Inhibit®, which eliminates surging during rapid AC line switching; pulse transformer triggering, which provides cogless operation at low speed; and superior noise rejection circuitry, which eliminates false starts and blown SCRs. Enable (normally closed) and Inhibit (normally open) functions provide electronic switching of control output.
The output voltage of the control is a linear function of the Main Speed Potentiometer rotation. In addition, the control can be used in a voltage following mode by supplying an *isolated* analog input signal to Terminals P2 (+) and P1 (-).[7] The control is supplied with a 5 kΩ Main Speed Potentiometer. All models are UL Listed (USA and Canada) and CE Approved.

***Notes:* 1.** *Short circuit protected at the motor only.* **2.** *KB Limited Warranty applies. See back page.* **3.** *Fuses and Plug-In Horsepower Resistor® are supplied separately, by your distributor. Models KBCC-125, 125R, 225, 225R only. See Sections 9.1 and 10 on pages 25 and 26.* **4.** *Step-Down operation.* **5.** *Models KBCC-125, 125R, 225, 225R only.* **6.** *Jog trimpot is available on Models KBCC-125R, 225R only.* **7.** *If an isolated signal input is not available, or if using a 4 – 20 mA DC signal input, a signal isolator must be used.*

4.1 – Features and Functions

- **Plug-In Horsepower Resistor® (Models KBCC-125, 125R, 225, 225R Only):** Eliminates the need to calibrate the control for IR Compensation and Current Limit when used on various horsepower motors.
- **Auto-Inhibit® Circuit:** Allows the control to be rapidly switched "on" and "off" using the AC line.
- **Enable (Connector CON1):** Allows the control to be turned "on" and "off" using electronic switching. Close to run (Enable) and open to stop. A wired connector is supplied, which can be used to connect an Enable circuit (switch or contact or open collector (PNP)) to the Enable connector CON1.
- **Inhibit (Terminals I1 and I2):** Allows the control to be turned "on" and "off" using electronic switching. Close to stop (Inhibit), open to run. Connect the Inhibit circuit (switch or contact or open collector (NPN)) to the Inhibit Terminals I1 and I2.
- **Adjustable Trimpots:** Minimum Speed (MIN), Maximum Speed (MAX), IR Compensation (IR), Current Limit (CL), Acceleration (ACCEL), and Deceleration (DECEL). The Jog Trimpot is available on Models KBCC-125R and KBCC-225R only.
- **Selectable Jumper J2 (Feedback):** On Models KBCC-125, 125R, the jumper can be used to select either motor armature feedback (set to the "90" position for 90 Volt DC motors) or DC tach-generator feedback (set to the "T" position and a DC tach-generator wired to the control). On Models KBCC-225, 225R, the jumper can be used to select either motor armature feedback (set to the "90" position for 90 Volt DC motors with 208/230 Volt AC Line input (step-down mode) or the "180" position for 180 Volt DC motors) or DC tach-generator feedback (set to the "T" position and a DC tach-generator wired to the control).
- **Protection Features:** MOV transient protection. Short Circuit protected (at motor only).
- **Diagnostic LEDs:** Power On (PWR ON) and Current Limit (CL).
- **Ratings:** Models KBCC-125, 125R operate on 115 Volt AC Line input only with 90 Volt DC motors. Models KBCC-225, 225R, 255 operate on 208/230 Volt AC Line input with 180 Volt DC motors or 90 Volt DC motors (step-down). Selectable with Jumper J2.
- **Fuse Holders:** Models KBCC-125, 125R, 225, 225R contain built-in AC Line and motor armature fuse holders. Model KBCC-255 contains a built-in motor armature fuse holder with a 40 Amp factory installed fuse.
- **Main Speed Potentiometer:** 5 kΩ (supplied).
- **Jog Trimpot (Models KBCC-125R, 225R Only):** Provides a jog speed, which can be used to index a machine into position. It can also be used as a secondary speed setting, as described in Section 11.7 on page 27.

TABLE 1
General Performance Specifications

Description	Specification	Factory Setting
115 Volt AC Line Input Operating Range (Volts AC)	115 (±15%)	
208/230 Volt AC Line Input Operating Range (Volts AC)	208 (-15%) / 230 (+15%)	
Speed Range (Ratio)	50:1	—
Motor Armature Feedback Load Regulation (0 – Full Load, 50:1 Speed Range) (% Base Speed)[1]	1	—
Tach-Generator Feedback Load Regulation (0 – Full Load, 50:1 Speed Range) (% Base Speed)[1]	1	—
Line Voltage Regulation (at Full Load, ± 10% AC Line Variation) (% Base Speed)[1]	0.5	—
Control Linearity (% Output Voltage vs. Signal Input Voltage)	2	—
Acceleration Trimpot (ACCEL) Range (Seconds)	0.2 – 10	2
Deceleration Trimpot (DECEL) Range (Seconds)	0.2 – 10	2
Maximum speed Trimpot (MAX) Range (% Base Speed)	50 – 110	100
Minimum Speed Trimpot (MIN) Range (% Base Speed)	0 – 30	0
Current Limit Trimpot (CL) Range (% Full Load)	0 – 200	150
IR Compensation Trimpot (IR) Range (at Specified Full Load at 90 Volts DC Output (Volts DC)	0 – 24	3
IR Compensation Trimpot (IR) Range (at Specified Full Load at 180 Volts DC Output (Volts DC)	0 – 48	6
Jog Trimpot (JOG) (Models KBCC-125R, 225R Only) (% Base Speed)	0 – 100	50
Maximum Number of Starts/Stops or Reversals (Operations per Minute) (Models KBCC-125R, 225R Only)[2]	30	—
Operating Temperature Range (°C / °F)	0 – 40 / 32 – 104	—
Operating Humidity Range (% Relative, Non-Condensing)	0 – 95	—
Storage Temperature Range (°C / °F)	-25 – 85 / -13 – 185	—

Notes: 1. *Performance is for SCR rated permanent magnet motors only. Lower performance can be expected with other motors types. Factory setting is 3% load regulation. To obtain superior regulation, see Section 6.6 on page 17.* ***2.*** *Rating is based on a one second brake time. For increased operations per minute or longer brake time, contact our Sales Department.*

TABLE 2
Electrical Ratings

		AC Line Input				Output				Net Weight	
Model No.	Part No.	Volts AC (50/60 Hz)	Phase (Φ)	Maximum Current (Amps AC)	AC Line Fuse or Circuit Breaker (Amps AC)	Voltage Range (Volts DC)	Maximum Continuous Load Current (Amps DC)	Maximum Horsepower (HP (Kw))	Motor Fuse (Amps DC)	Lbs.	kg
KBCC-125	9936	115	1	24	25[1]	0 – 90	16	1½ (1.13)	See Section 9.2	2.8	1.3
KBCC-125R	9937	115	1	24	25[1]	0 – 90	16	1½ (1.13)	See Section 9.2	3.8	1.7
KBCC-225	9938	208/230	1	24	25[1]	0 – 90[3]	16	1½ (1.13)	See Section 9.2	2.8	1.3
						0 – 180	16	3 (2.25)	See Section 9.2		
KBCC-225R	9924	208/230	1	24	25[1]	0 – 90[3]	16	1½ (1.13)	See Section 9.2	3.9	1.8
						0 – 180	16	3 (2.25)	See Section 9.2		
KBCC-255	9940	208/230	1	38	40[2]	0 – 180	26	5 (3.75)	40[4]	3.8	1.7

Notes: 1. *Models KBCC-125, 125R, 225, 225R contain a factory installed 25 Amp AC Line fuse.* ***2.*** *Model KBCC-255 does not contain a built-in AC Line fuse; therefore, an external 40 Amp fuse or circuit breaker must be installed in each ungrounded AC Line input.* ***3.*** *Step-down operation. May have reduced brush life. Consult motor manufacturer.* ***4.*** *Model KBCC-255 contains a factory installed 40 Amp motor armature fuse.*

FIGURE 2

Models KBCC-125, 225 Control Layout and Internal Connection Diagram (Model KBCC-225 Shown)

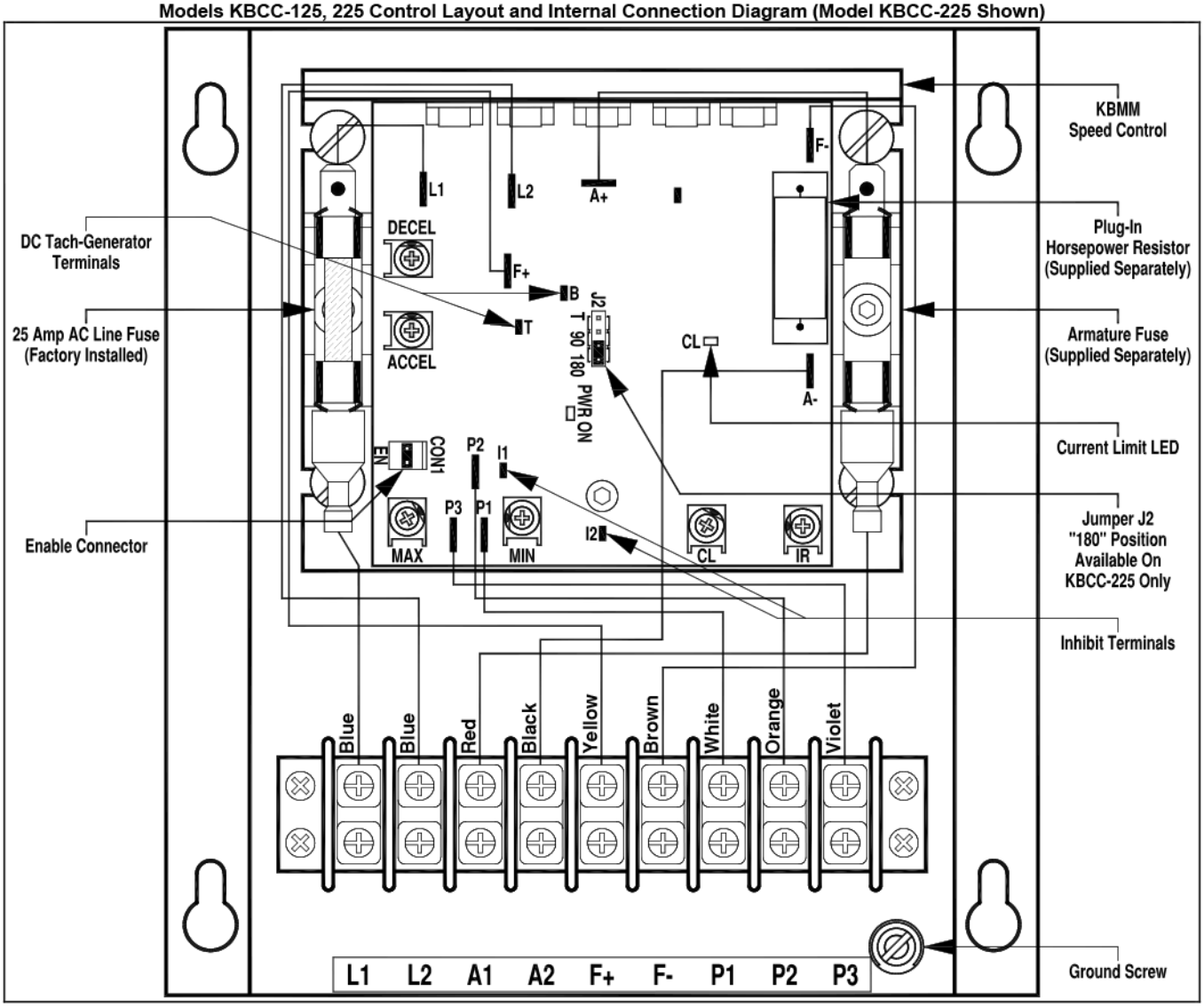


FIGURE 3

Models KBCC-125R, 225R Control Layout and Internal Connection Diagram (Model KBCC-225R Shown)

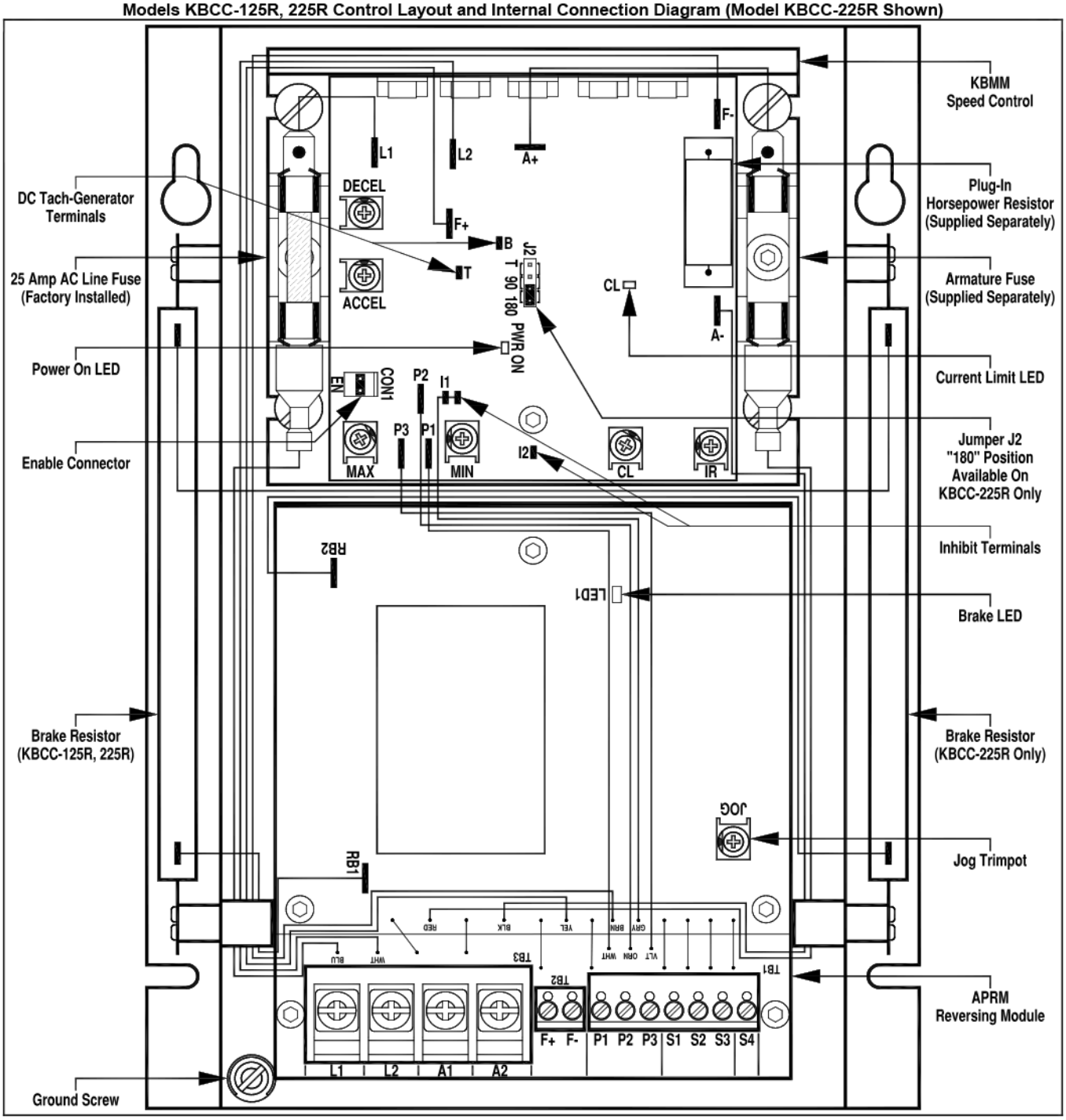
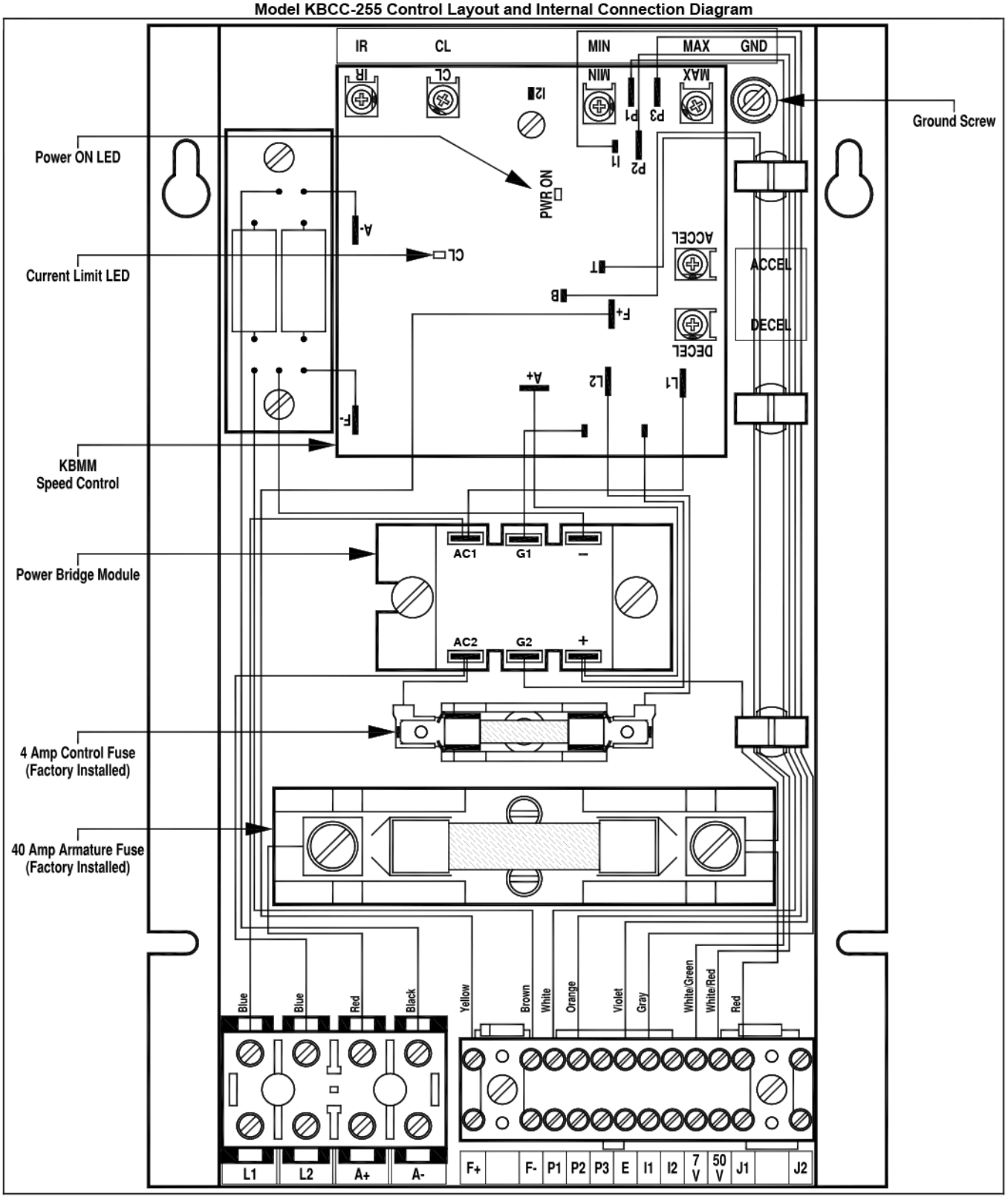


FIGURE 4
Model KBCC-255 Control Layout and Internal Connection Diagram



5 – MOUNTING

It is recommended that the control be mounted on a flat surface with adequate ventilation. Leave enough room to allow for AC line, motor connections, and other wiring that is required. Care should be taken to avoid extreme hazardous locations where physical damage can occur. When mounting the control in an enclosure, the enclosure should be large enough to allow for proper heat dissipation so that the ambient temperature does not exceed 40 °C (104 °F) at full rating. See Figures 5 – 7 on pages 11 – 13.

FIGURE 5
Models KBCC-125, 225 Mechanical Specifications (Inches / mm)
(All Wiring and PCB Components Omitted for Clarity)

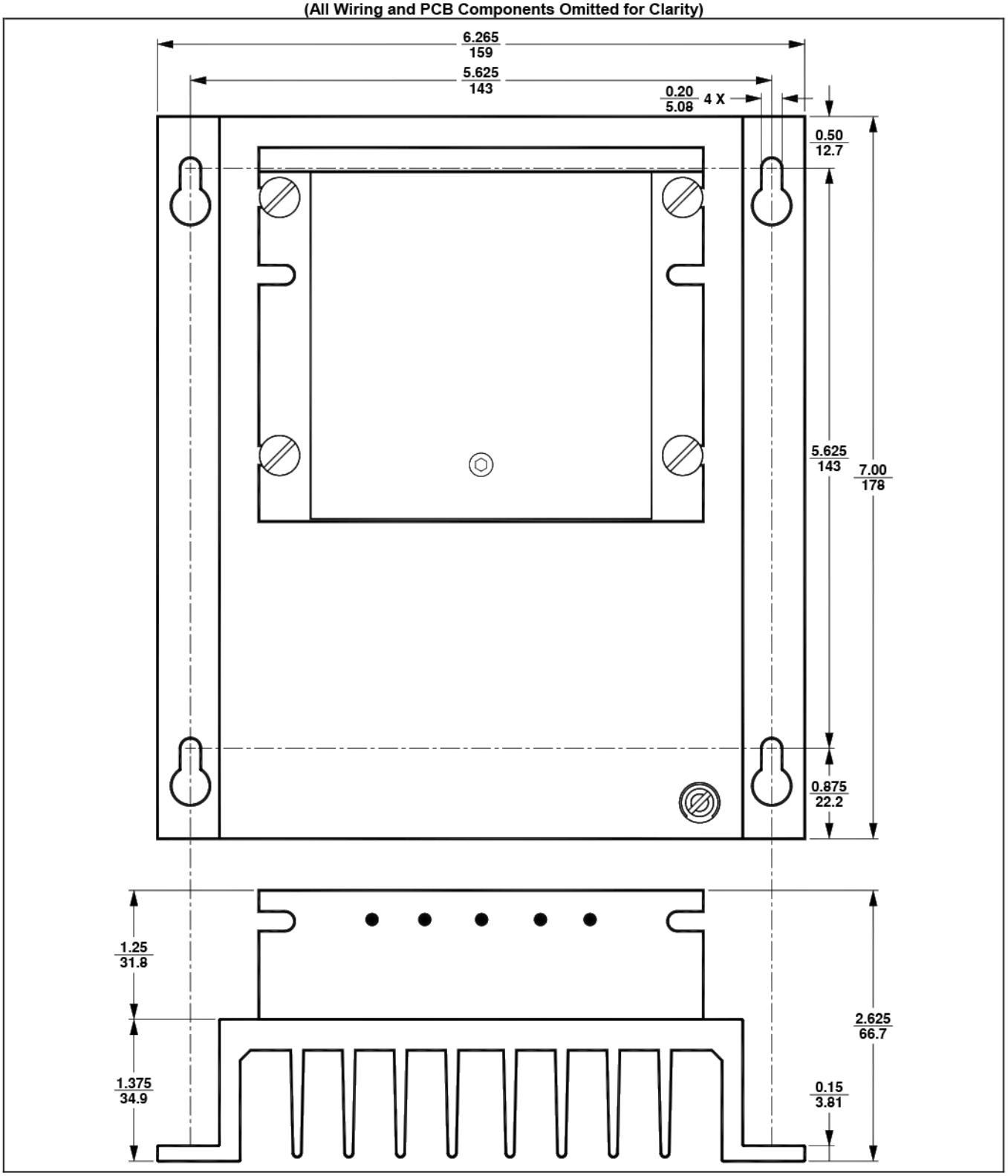


FIGURE 6
Models KBCC-125R, 225R Mechanical Specifications (Inches / mm)
(KBCC-225R Shown) (All Wiring and PCB Components Omitted for Clarity)

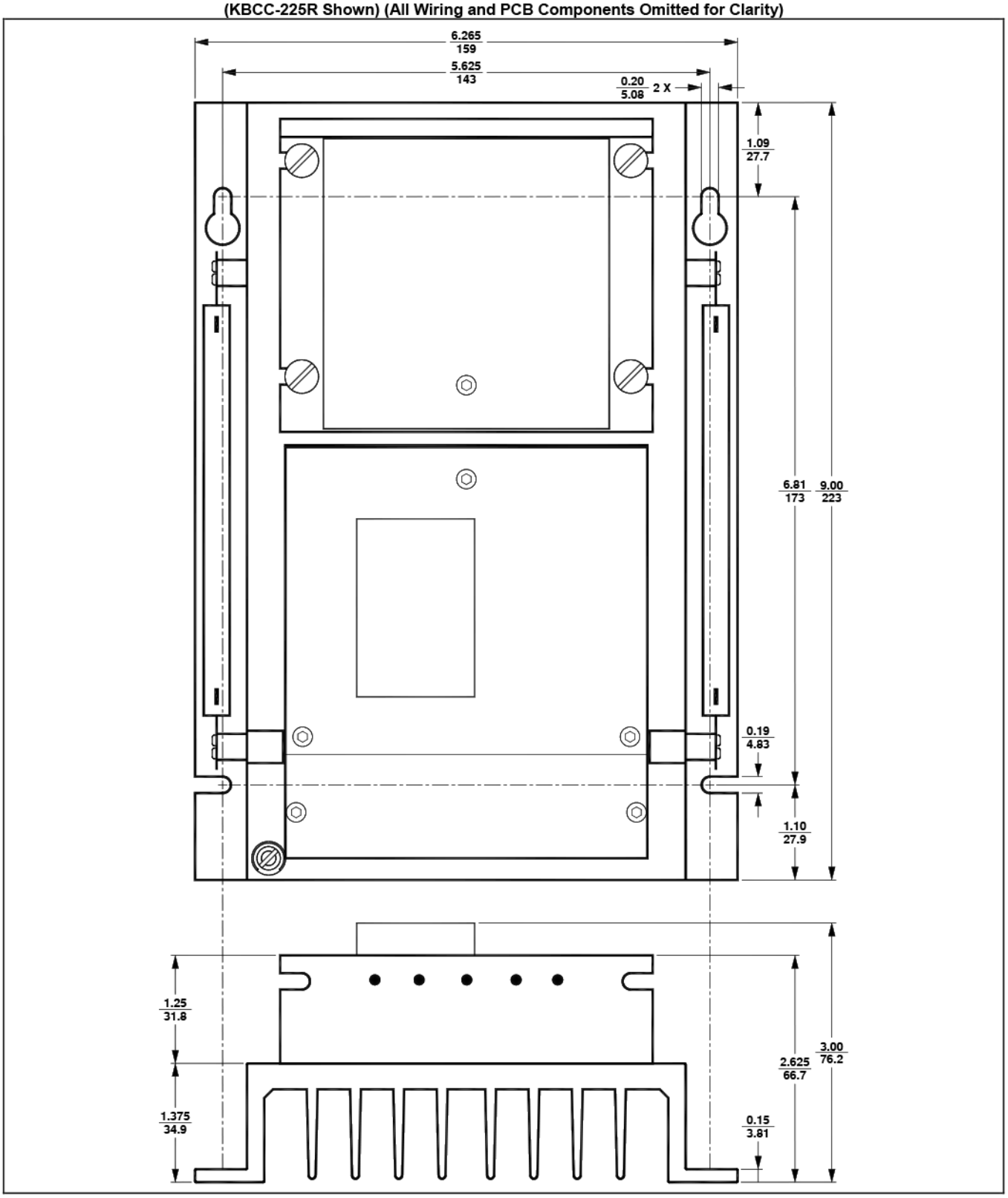
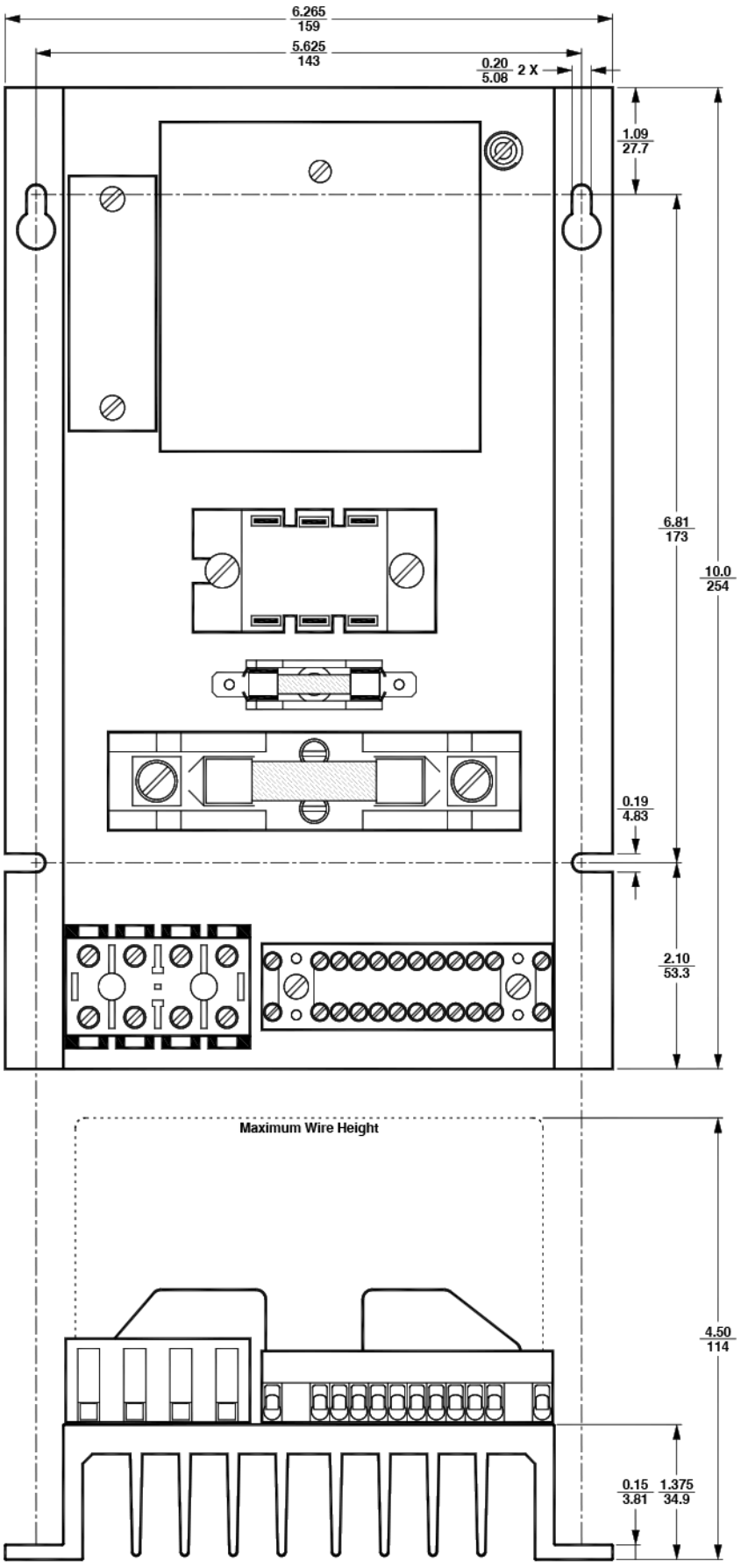


FIGURE 7
Model KBCC-255 Mechanical Specifications (Inches / mm)
(All Wiring and PCB Components Omitted for Clarity)



6 – ELECTRICAL CONNECTIONS

Important Application Note: To avoid erratic operation, do not bundle the AC line and motor wires with wires from signal following, start/stop contacts, or any other signal wires. Also, do not bundle motor wires from multiple controls in the same conduit. Use shielded cables on all signal wiring over 12" (30 cm). The shield should be earth grounded on the control side only. Wire the control in accordance with the National Electrical Code requirements and other local codes that may apply. See Tables 3 and 4 for the minimum wire size requirements.

TABLE 3
Models KBCC-125, 125R, 225, 225R AC Line Input and Motor Armature Minimum Wire Size Requirement

Maximum Motor Current (Amps DC)	Maximum HP (HP (kW))		Minimum Wire Size (Cu)			
			Maximum 50 Ft.		Maximum 100 Ft.	
	90 – 130 Volt DC Motors	180 Volt DC Motors	AWG	mm^2	AWG	mm^2
6	1/2 (0.373 kW)	1 (0.75 kW)	16	1.31	14	2.08
12	1 (0.75 kW)	2 (1.5 kW)	14	2.08	12	3.31
16	1½ (1.13 kW)	3 (2.25 kW)	12	3.31	12	3.31

TABLE 4
Model KBCC-255 AC Line Input and Motor Armature Minimum Wire Size Requirement

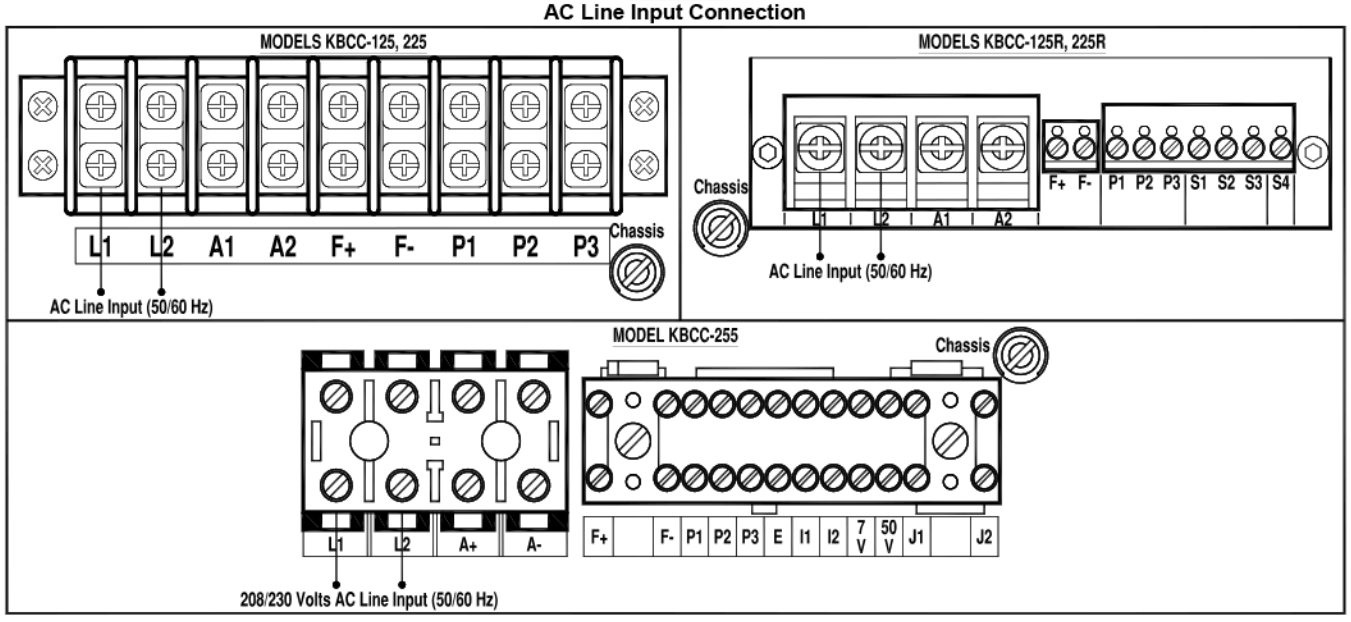
Maximum Motor Current (Amps DC)	Maximum HP (HP (kW)) 180 Volt DC Motors	Minimum Wire Size (Cu)			
		Maximum 50 Ft.		Maximum 100 Ft.	
		AWG	mm^2	AWG	mm^2
26	5 (3.75 kW)	10	5.26	8	8.36

6.1 – AC Line Input: Wire the AC Line to Terminals L1 and L2, as shown in Figure 8. If one of the AC Line inputs is a neutral (N), wire it to Terminal L2 only. Models KBCC-125, 25R operate on 115 Volt AC Line input only. Models KBCC-225, 225R, 255 operate on 208/230 Volt AC Line input only.

See Table 3 above for the minimum AC Line input wire size requirement for Models KBCC-125, 125R, 225, 225R. See Table 4 above for the minimum AC Line input wire size requirement for Model KBCC-255.

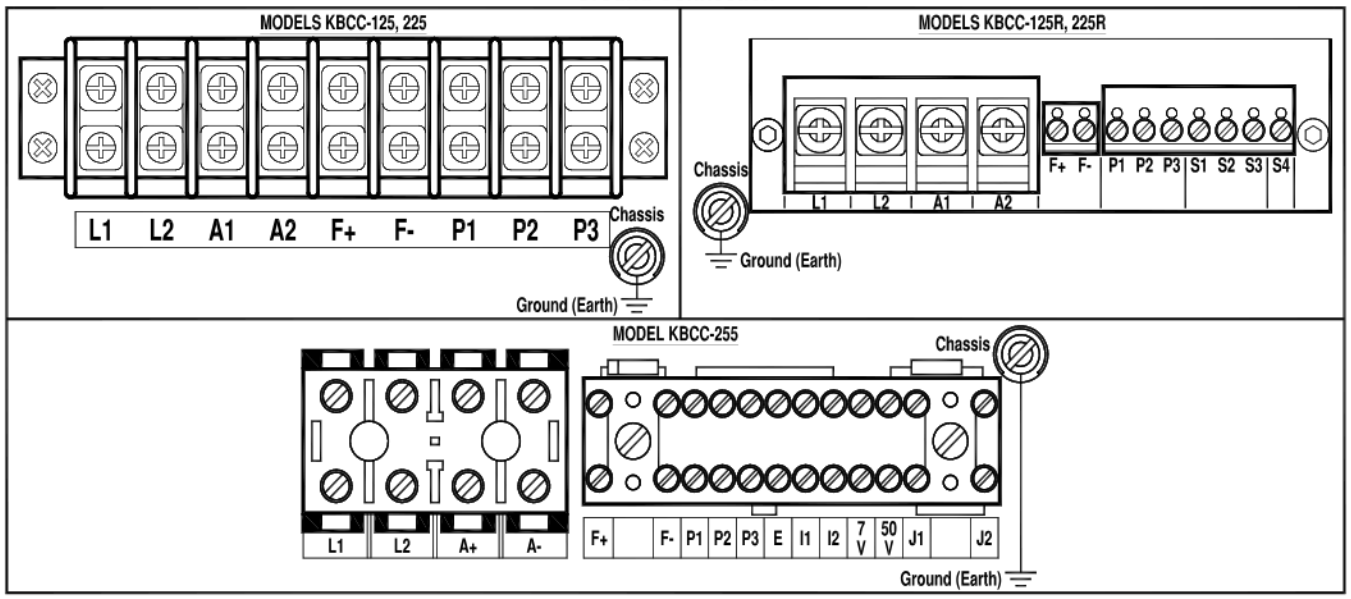
⚠ **CAUTION!** The rated AC Line voltage of the control must match the actual AC Line input voltage. See Table 2 on page 7.

FIGURE 8
AC Line Input Connection



6.2 – **Ground:** Connect the ground wire (earth) to the green ground screw (chassis). See Figure 9.

FIGURE 9
Ground Connection



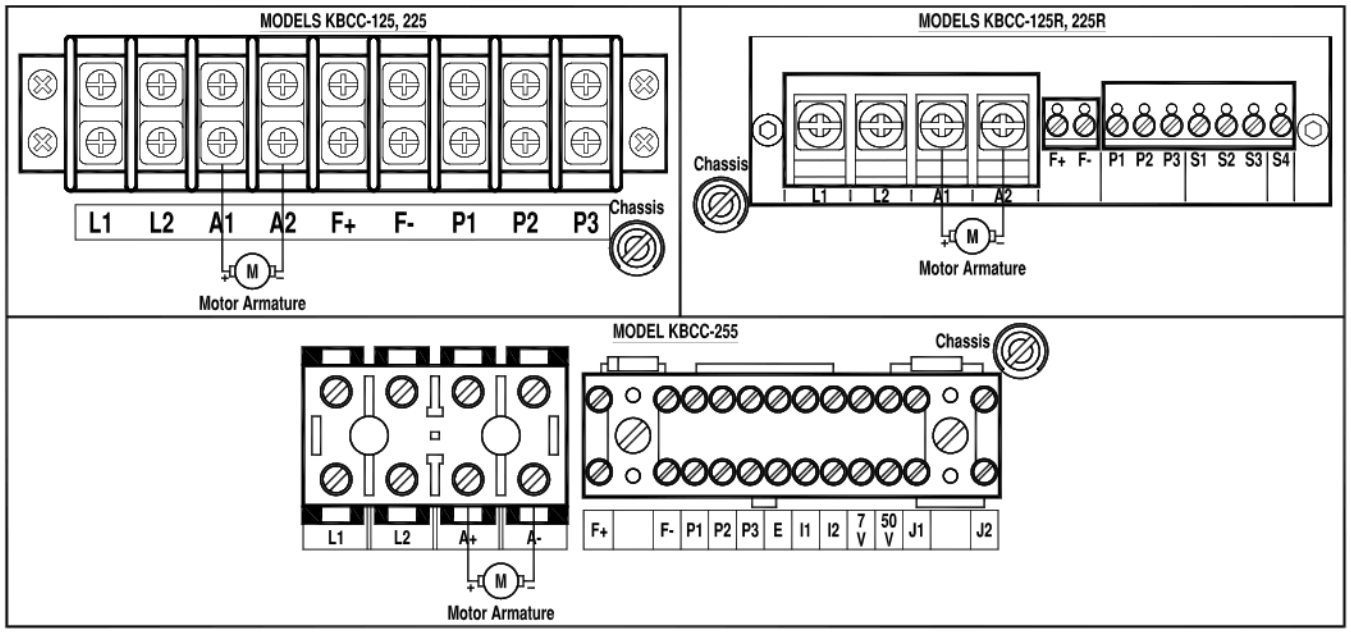
6.3 – On/Off AC Line Switch: To remove power to the control, a separate On/Off AC Line Switch should be used. Use a single pole switch (SPDT ON-OFF) for hot and neutral AC supply lines and a double pole switch (DPDT ON-OFF) for two hot AC supply lines. This switch can also be used as a "Safety Disconnect".

6.4 – **Motor Armature:** Wire the motor armature positive (+) lead to Terminal A1 (Models KBCC-125, 125R, 225, 225R) or A+ (Model KBCC-255) and the negative (-) lead to Terminal A2 (Models KBCC-125, 125R, 225, 225R) or A- (Model KBCC-255). See Figure 10.

See Table 3 on page 14 for the minimum motor wire size requirement for Models KBCC-125, 125R, 225, 225R. See Table 4 on page 14 for the minimum motor wire size requirement for Model KBCC-255.

Notes: 1. *On Models KBCC-225, 225R be sure Jumper J2 is set to the corresponding motor voltage. See Section 8 on page 25.* ***2.*** *On Models KBCC-125, 125R, 225, 225R be sure the correct Plug-In Horsepower Resistor® is installed. See Section 10 on page 26.*

FIGURE 10
Motor Armature Connection



6.5 – Motor Field (Shunt Wound Motors Only): For full voltage motor field, see Section 6.5.1. For half voltage motor field, see Section 6.5.2. Table 5 lists the required terminal connections for the motor field voltage.

Notes: 1. *Do not connect motor armature leads to Terminals F+ and F-.* ***2.*** *Do not use Terminal F+ for any purpose other than to power the field of a shunt wound motor.* ***3.*** *Shunt wound motors may be damaged if the field remains energized without armature rotation for an extended period.*

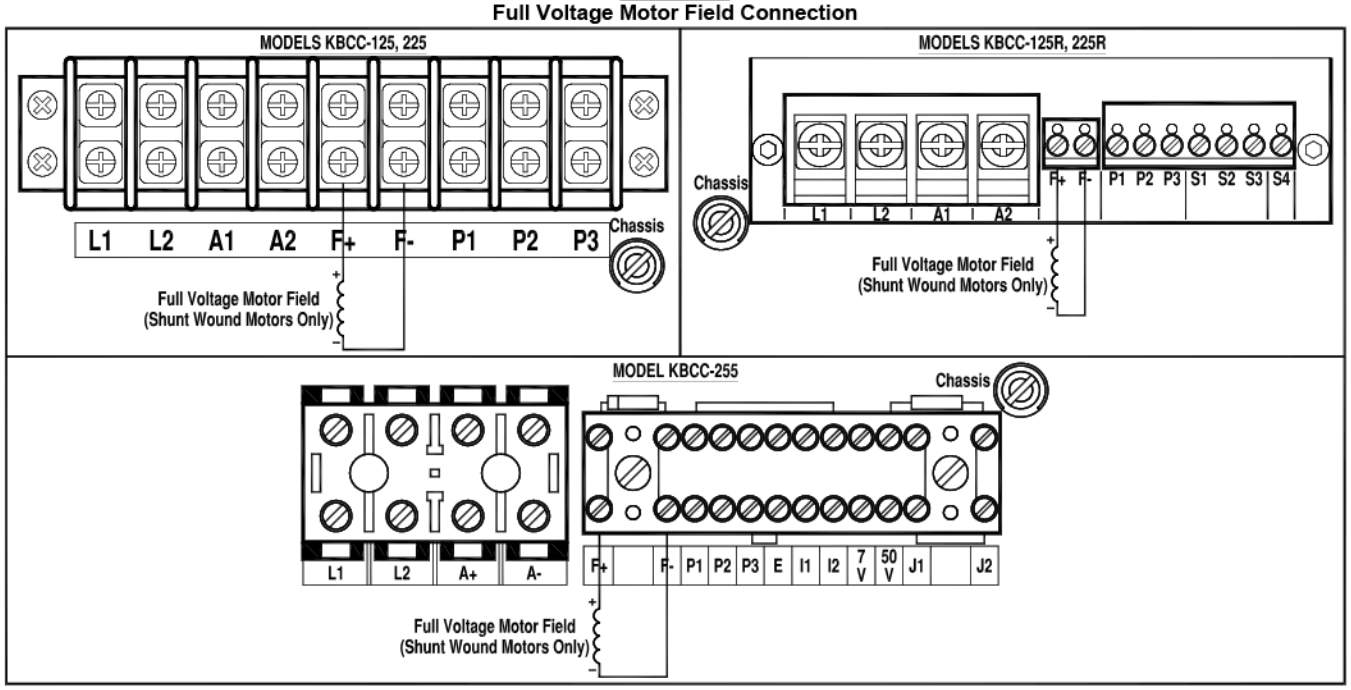
TABLE 5
Motor Field Connection (Shunt Wound Motors Only)

Model No.	AC Line Input Voltage (Volts AC)	Motor Armature Voltage (Volts DC)	Field Voltage (Volts DC)	Terminal Connections
KBCC-125, 125R	115	0 – 90	100	F+, F-
			50	F+, L1
KBCC-225, 225R	208/230	0 – 180	200	F+, F-
			100	F+, L1
		0 – 90*	100	F+, L1
KBCC-255	208/230	0 – 180	200	F+, F-
			100	F+, L1

**Step-down operation.*

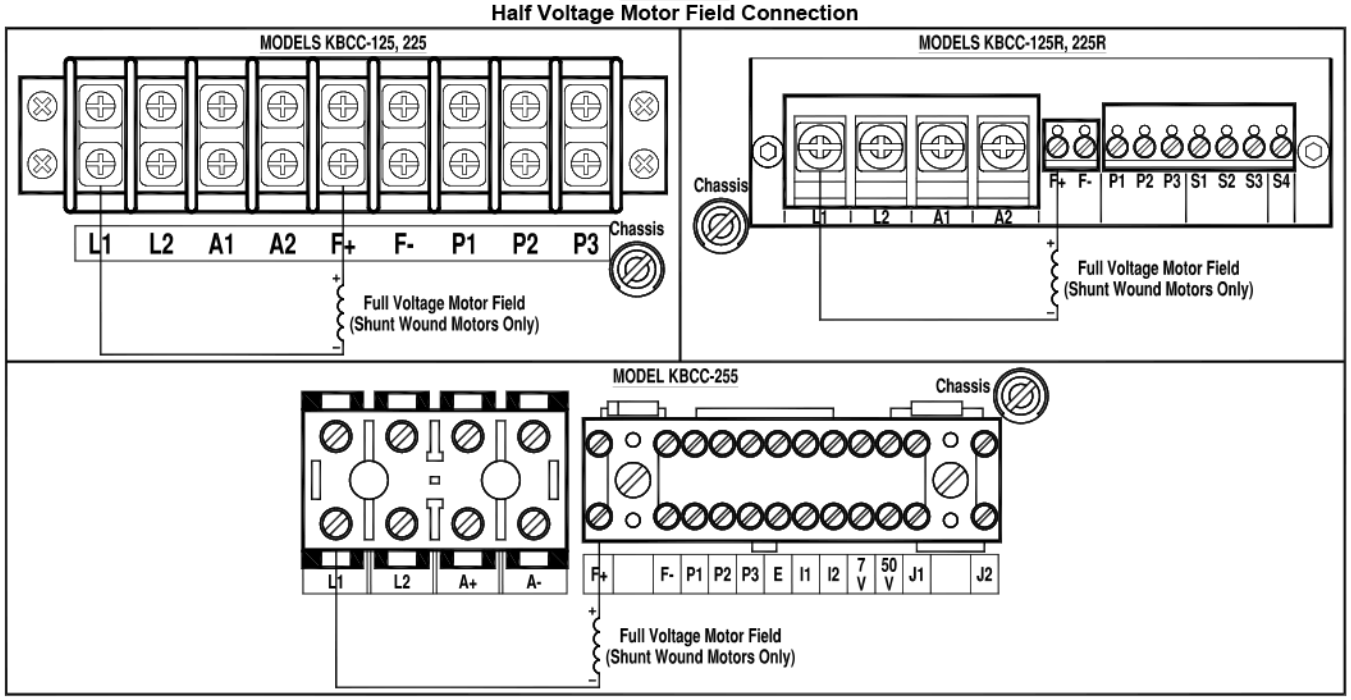
6.5.1 – Full Voltage Motor Field: For 90 Volt DC motors with 100 Volt fields and 180 Volt DC motors with 200 Volt fields. Wire the field positive (+) lead to Terminal F+ and the negative (-) lead to Terminal F-. See Figure 11.

FIGURE 11
Full Voltage Motor Field Connection



6.5.2 – **Half Voltage Motor Field:** For 90 Volt DC motors with 50 Volt DC fields and 180 Volt DC motors with 100 Volt fields. Wire the field positive (+) lead to Terminal F+ and the negative (-) lead to Terminal L1. See Figure 12.

FIGURE 12
Half Voltage Motor Field Connection



6.6 – **DC Tach-Generator:** A tach-generator can be used for load regulation of 1% of the base speed. The tach-generator input circuit is designed for a 7 Volts per 1000 RPM tach-generator (see Section 6.6.1) or a 50 Volts per 1000 RPM tach-generator (see Section 6.6.2 on page 18) used with an 1800 RPM motor. For a tach-generator other than 7 Volts or 50 Volts per 1000 RPM, see Section 6.6.3 on page 18.

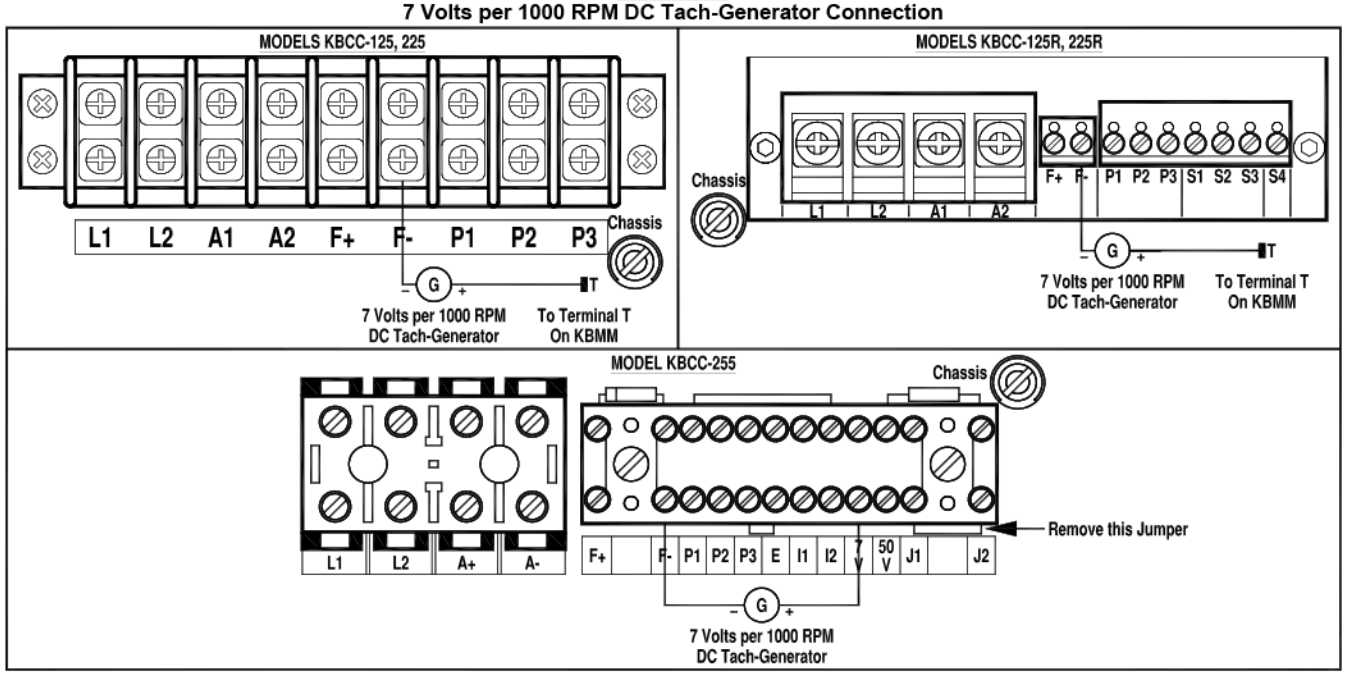
⚠ **CAUTION!** Setting Jumper J2 to the "T" position without a tach-generator connected will cause the motor will run at full speed.

⚠ **CAUTION!** On Models KBCC-125R, 225R the tach-generator connections must also be reversed when reversing motor direction or the motor will run at full speed.

Notes: *On Models KBCC-125, 125R, 225, 225R Jumper J2 (on the KBMM) must be set to the "T" position.* ***2.*** *On Model KBCC-255 remove the Jumper that is installed on Terminals J1 and J2.* ***3.*** *On all models, initially set the IR Comp Trimpot fully counterclockwise. Once the tach generator is connected, the IR Comp Trimpot may be increased for additional speed stabilization.*

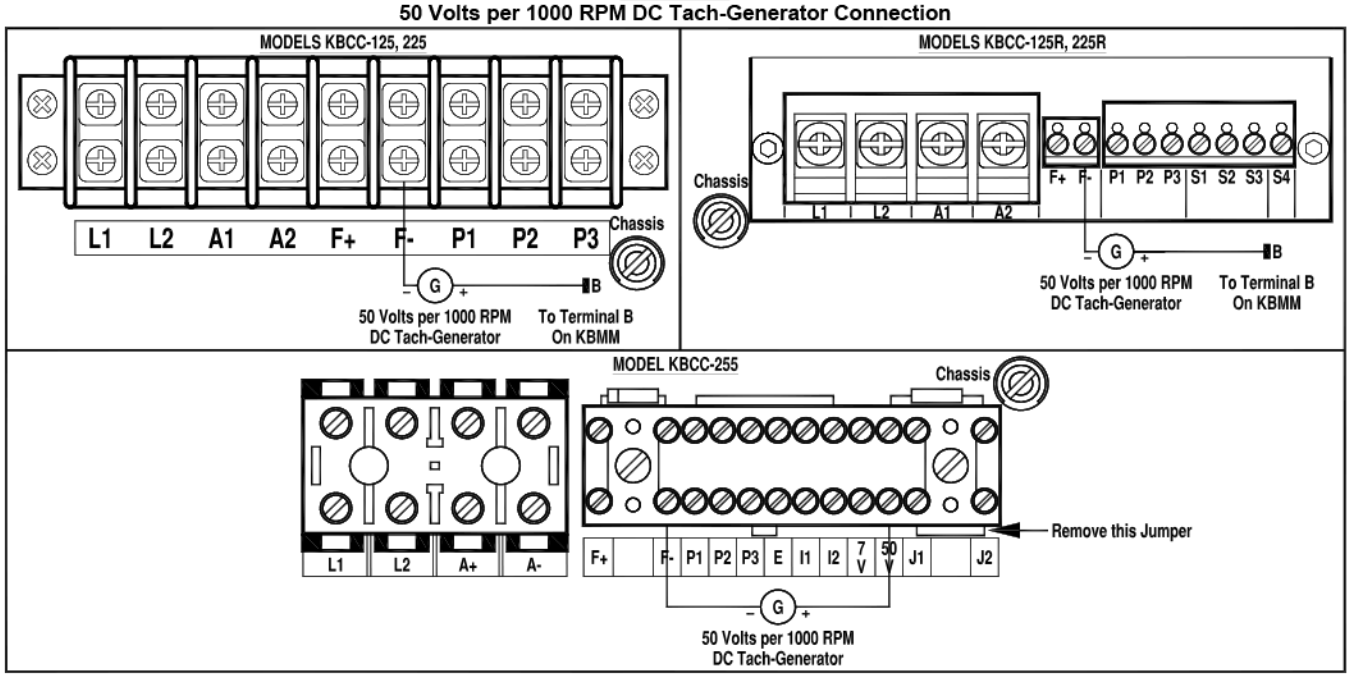
6.6.1 – **Seven (7) Volts per 1000 RPM DC Tach-Generator:** Connect the tach-generator positive (+) lead to Terminal T and the negative (-) lead to Terminal F- (or I2 on the KBMM). See Figure 13.

FIGURE 13
7 Volts per 1000 RPM DC Tach-Generator Connection



6.6.2 – **Fifty (50) Volts per 1000 RPM DC Tach-Generator:** Connect the tach-generator positive (+) lead to Terminal B and the negative (-) lead to Terminal F- (or Terminal I2 on the KBMM). See Figure 14.

FIGURE 14
50 Volts per 1000 RPM DC Tach-Generator Connection



6.6.3 – **Other DC Tach-Generator Voltages:** For a tach-generator other than 7 Volts or 50 Volts per 1000 RPM, or for a motor other than 1800 RPMs, an external 1/2 Watt resistor (RT) must be installed. Install RT in series with the tach-generator. See Figure 15.

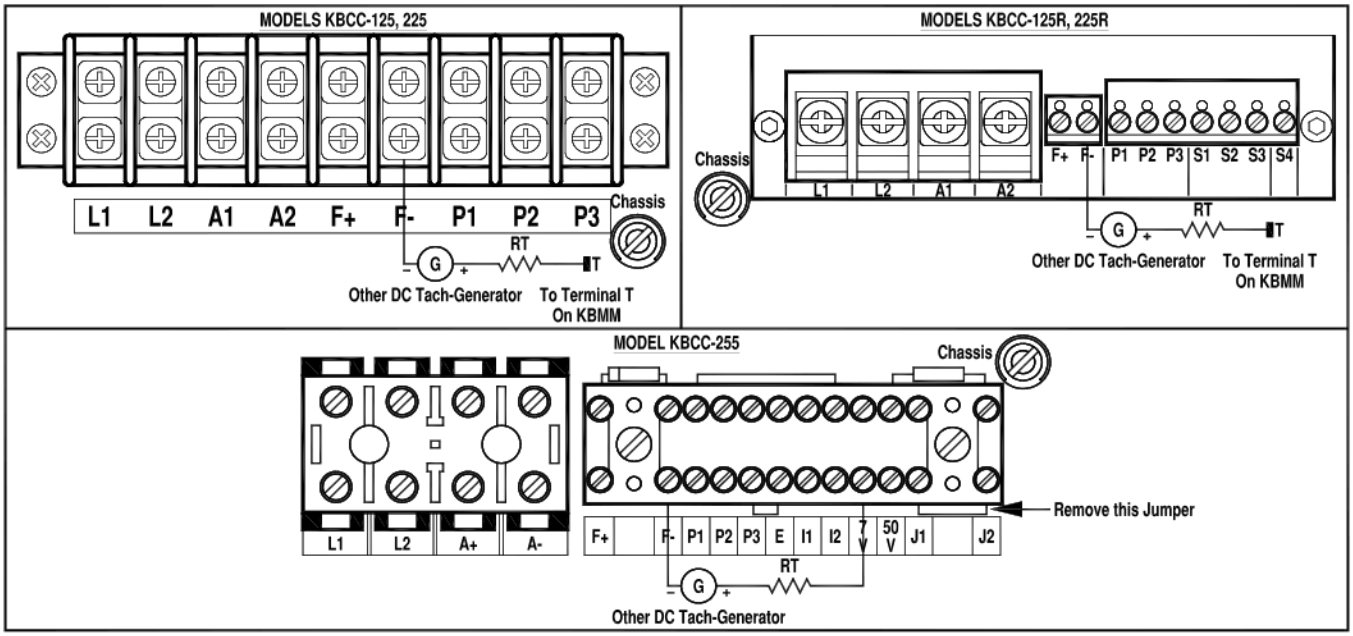
On Models KBCC-125, 125R, 225, 225R connect one end of RT to Terminal T on the KBMM and the other end of RT to the tach generator positive (+) lead. On Model KBCC-255 connect one end of RT to Terminal 7V and the other end of RT to the tach generator positive (+) lead. Connect the negative (-) lead of the tach-generator to Terminal F-.

The Value of RT (Ω) Can be Calculated Using the Following Formula: RT = (1.3 X VT X S) – 16000 Ω

Where "VT" is the tach-generator voltage (in Volts per 1000 RPM) and "S" is the base speed of the motor (in RPM).

Example: If a 20 Volt per 1000 RPM tach-generator is to be used with a 3600 RPM motor:
RT = (1.3 X 20 X 3600) – 16000 = 77600 Ω
Choose the closest 1/2 Watt resistor value, which is 75000 Ω (75 kΩ).

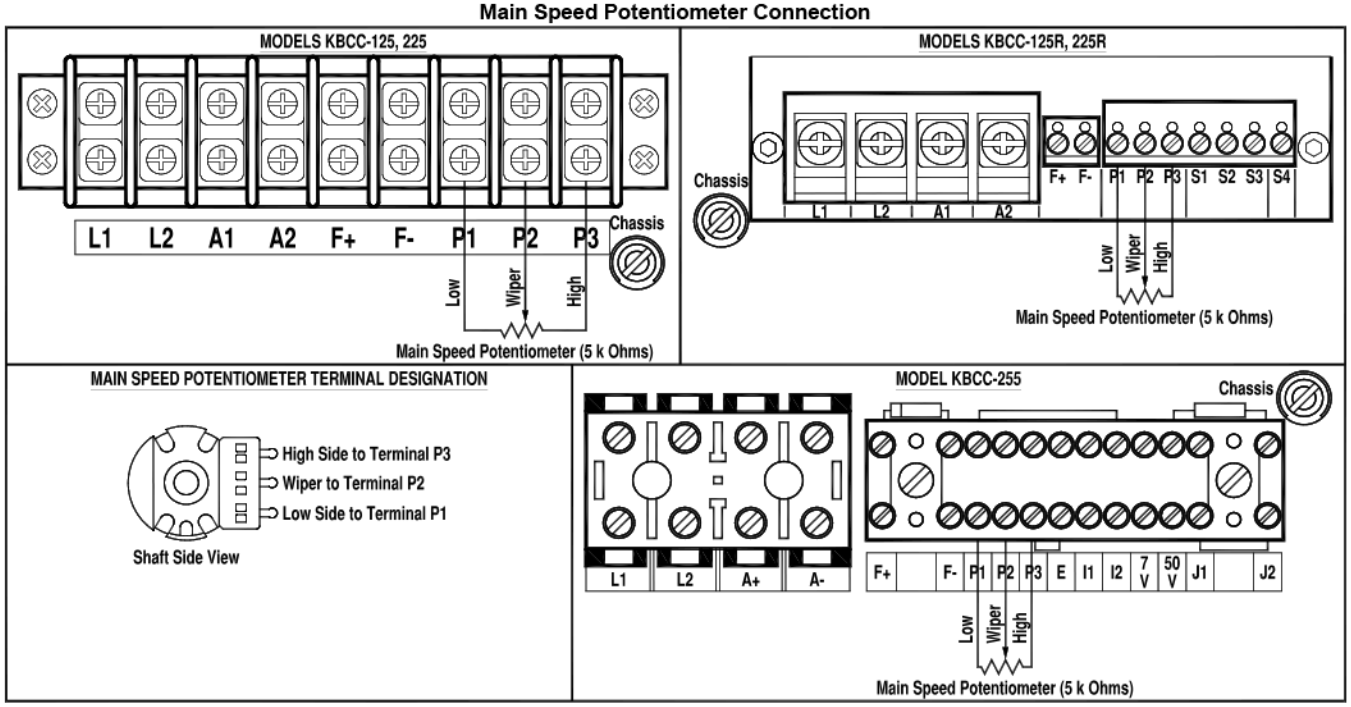
FIGURE 15
Other DC Tach-Generator Connection



6.7 – **Main Speed Potentiometer:** The supplied 5 kΩ potentiometer can be used to control motor speed. Connect the low side to Terminal P1, the wiper to Terminal P2, and the high side to Terminal P3. See Figure 16.

Note: *See Section 6.9.2 on page 20 for instructions on wiring Enable in series with the high side of the Main Speed Potentiometer.*

FIGURE 16
Main Speed Potentiometer Connection

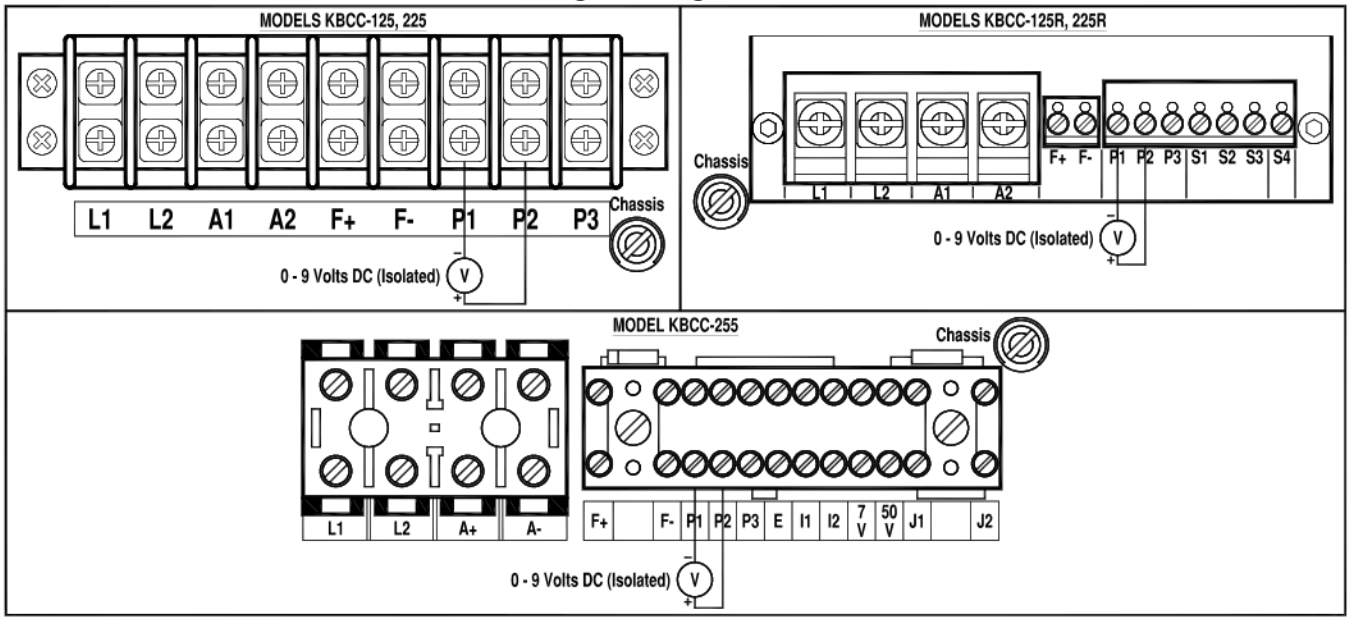


6.8 – **Voltage Following:** An isolated 0 – 9 Volt DC analog signal input can be used to control motor speed in lieu of the Main Speed Potentiometer. The control output voltage will linearly follow the analog signal input. The signal input must be isolated from the AC line. The source impedance of the signal input should be 10 kΩ or less. Connect the signal input positive (+) to Terminal P2 and the negative (-) to Terminal P1. See Figure 17.

⚠ **CAUTION!** Do not earth ground any input terminals.

Notes: ***1.*** *The MAX Trimpot is not operational in voltage following mode. Use the MIN trimpot to set an initial value of input signal. If necessary, use auxiliary trimpots to scale and/or limit the input voltage.* ***2.*** *If an isolated signal input is not available, or if using a 4 – 20 mA DC signal input, install the optional KBSI-240D Signal Isolator (Part No. 9431). This will also allow direct connections to process controllers and microprocessors.* ***3.*** *If multiple follower motors are to be controlled from a single leading motor or a single leading Main Speed Potentiometer, install the optional KBSI-240D Signal Isolator (Part No. 9431).* ***4.*** *Terminal F- may be used in lieu of Terminal P1.*

FIGURE 17
Voltage Following Connection



6.9 – **Enable:** The control can be started and stopped with an Enable Switch or Contact (close to run, open to stop) or Open Collector (PNP) (on to run, off to stop). See Section 6.9.1 to wire Enable to the control.

Note: *See Section 6.9.2 for instructions on wiring Enable in series with the high side of the Main Speed Potentiometer.*

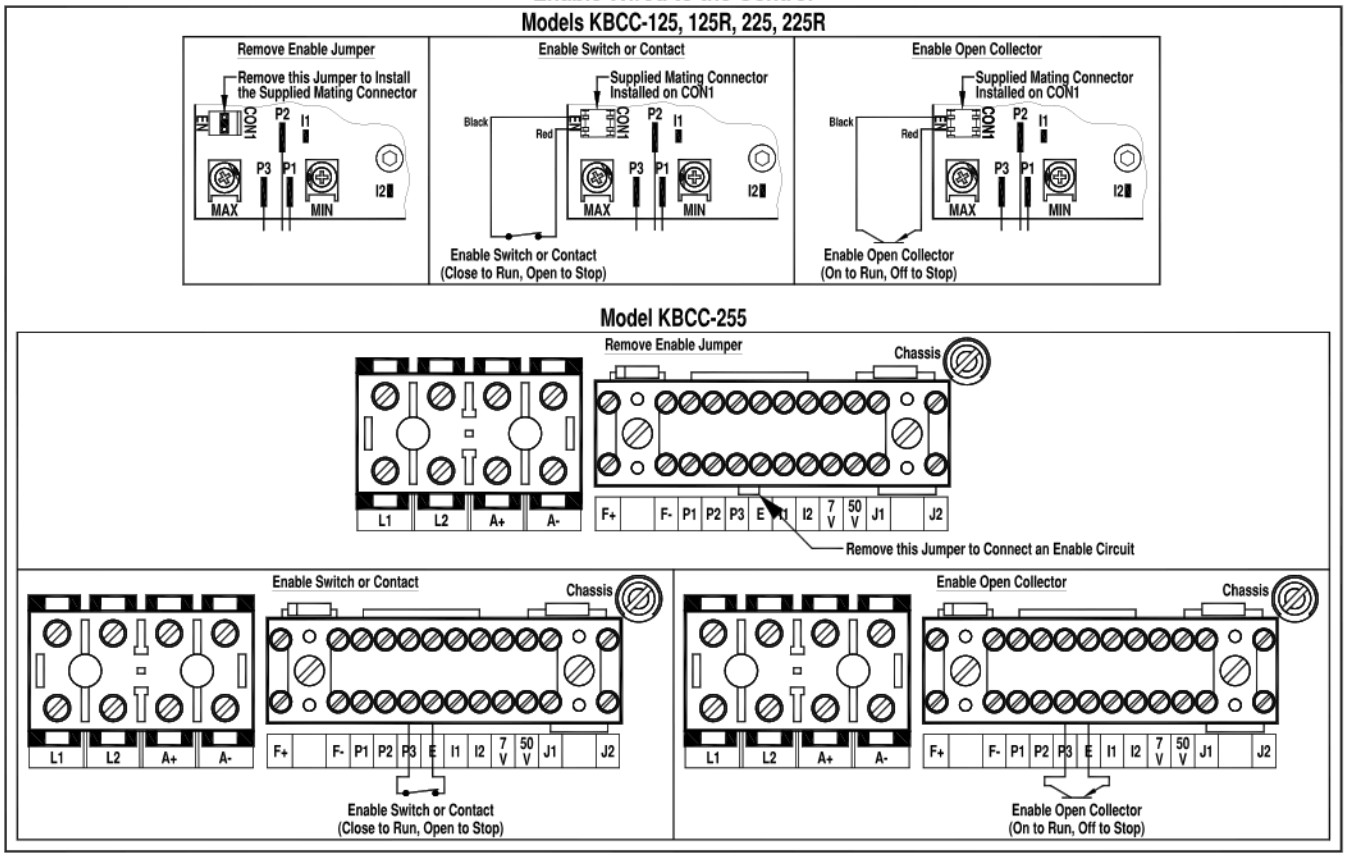
⚠ **WARNING!** Enable is never to be used as a Safety Disconnect since it is not fail-safe. Use only the AC line for this purpose.

6.9.1 – **Enable Wired to the Control:** On Models KBCC-125, 125R, 225, 225R install the supplied wired mating connector to wire the Enable to CON1 on the KBMM. On Model KBCC-255 wire the Enable to the terminal block. See Figure 18.

When the switch or contact is closed or the open collector is turned on, the motor will accelerate to the Main Speed Potentiometer setting. When the switch or contact is opened or the open collector is turned off, the motor will decelerate to stop.

Notes: 1. *To install the wired mating connector on Models KBCC-125, 125R, 225, 225R remove the jumper that is factory installed on CON1.* ***2.*** *The deceleration time can only be made longer than the normal coasting time of the load.*

FIGURE 18
Enable Wired to the Control



6.9.2 – **Enable Wired to the Main Speed Potentiometer:** Wire the Enable in series with the Main Speed Potentiometer high side and Terminal P3. See Figures 19 and 20 on page 21.

When the switch or contact is closed or the open collector is turned on, the motor will accelerate to the Main Speed Potentiometer setting.

When the switch or contact is opened or the open collector is turned off, the motor will decelerate to the MIN Trimpot setting (factory set to 0 Volts DC). If the MIN Trimpot is set to other than 0 Volts DC, the motor will run at that speed when the switch or contact is opened or the open collector is turned off.

Notes: 1. *On Models KBCC-125, 125R, 225, 225R the jumper must be installed on the KBMM Enable Connector (CONN1). On Model KBCC-255, the jumper must be installed between Terminal P3 and Terminal E.* ***2.*** *The deceleration time can only be made longer than the normal coasting time of the load.*

FIGURE 19

Enable Switch or Contact Wired to the Main Speed Potentiometer

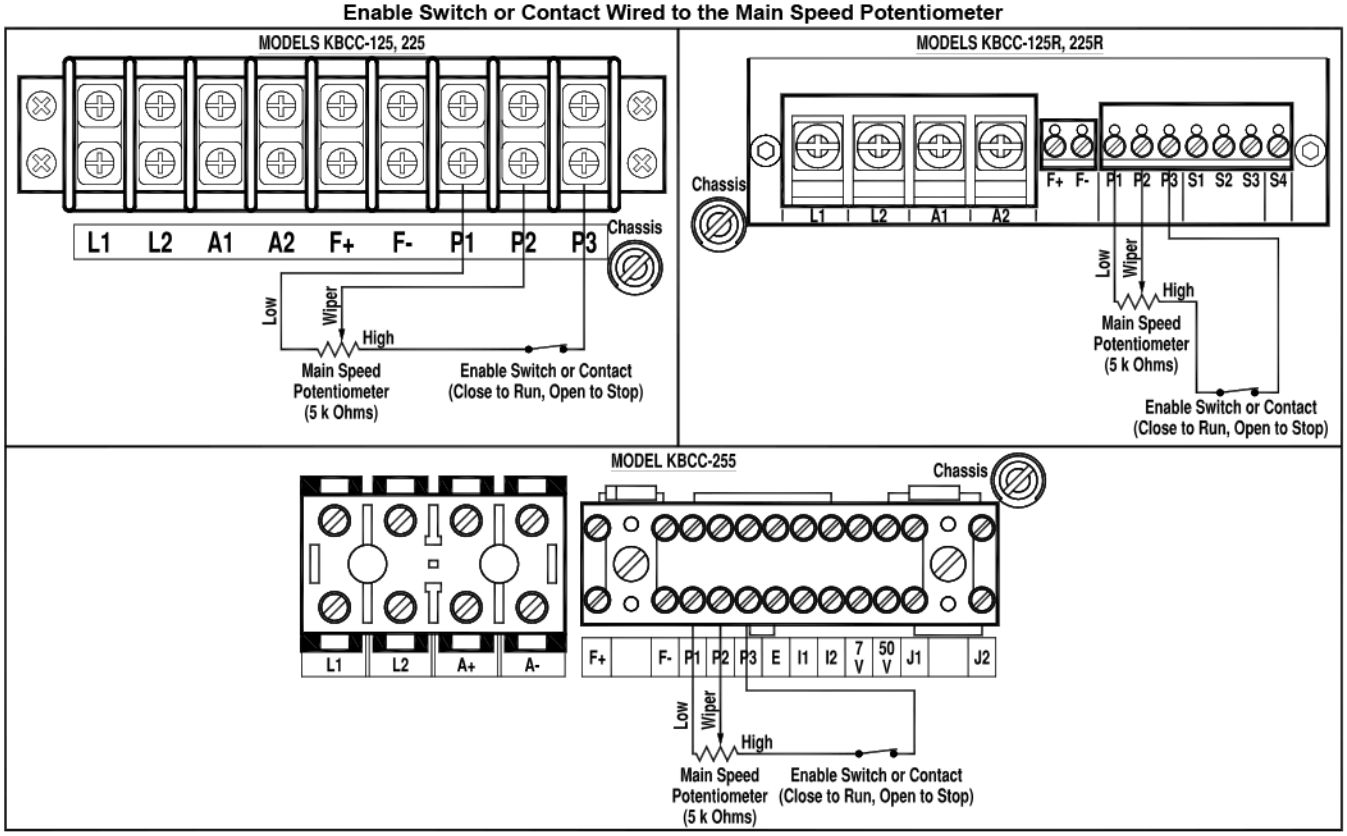
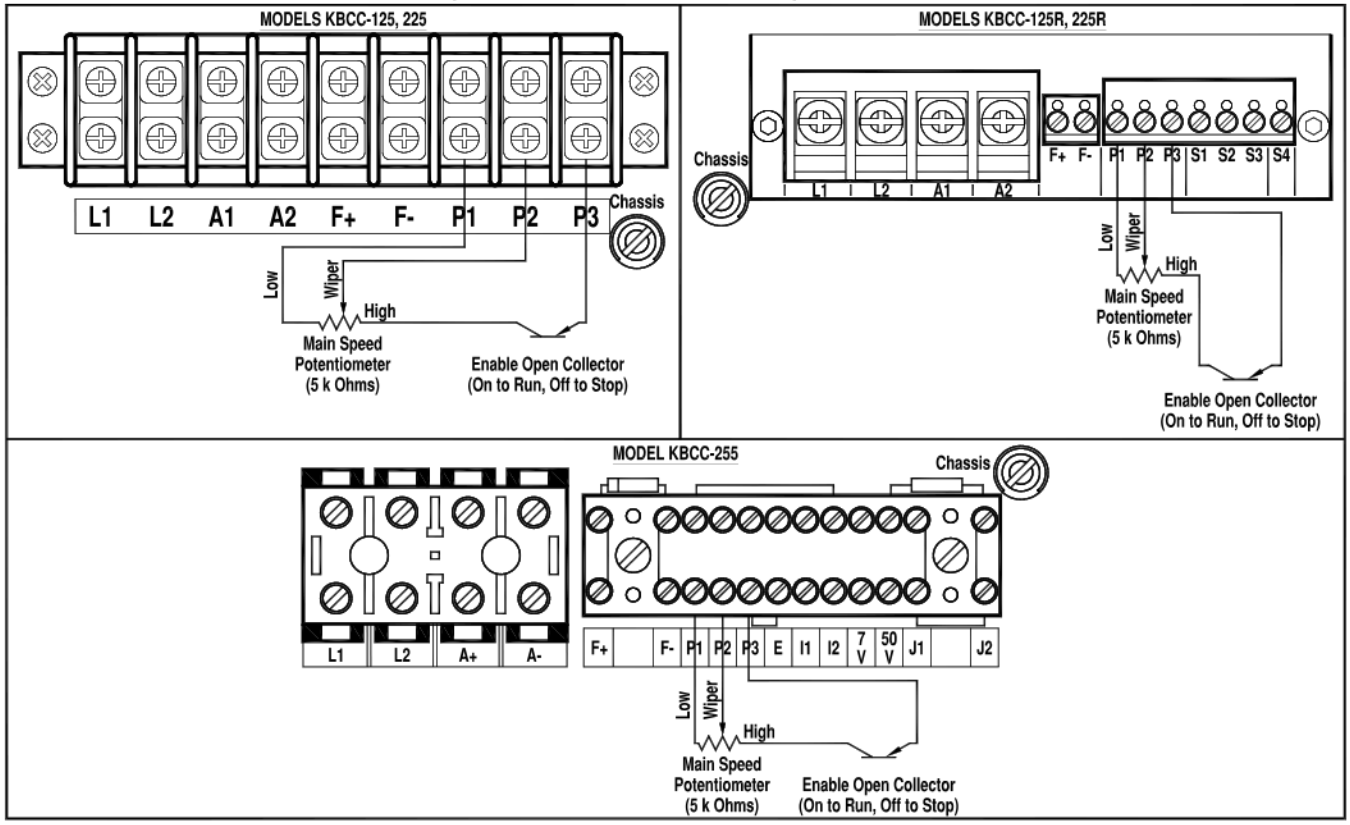


FIGURE 20

Enable Open Collector Wired to the Main Speed Potentiometer

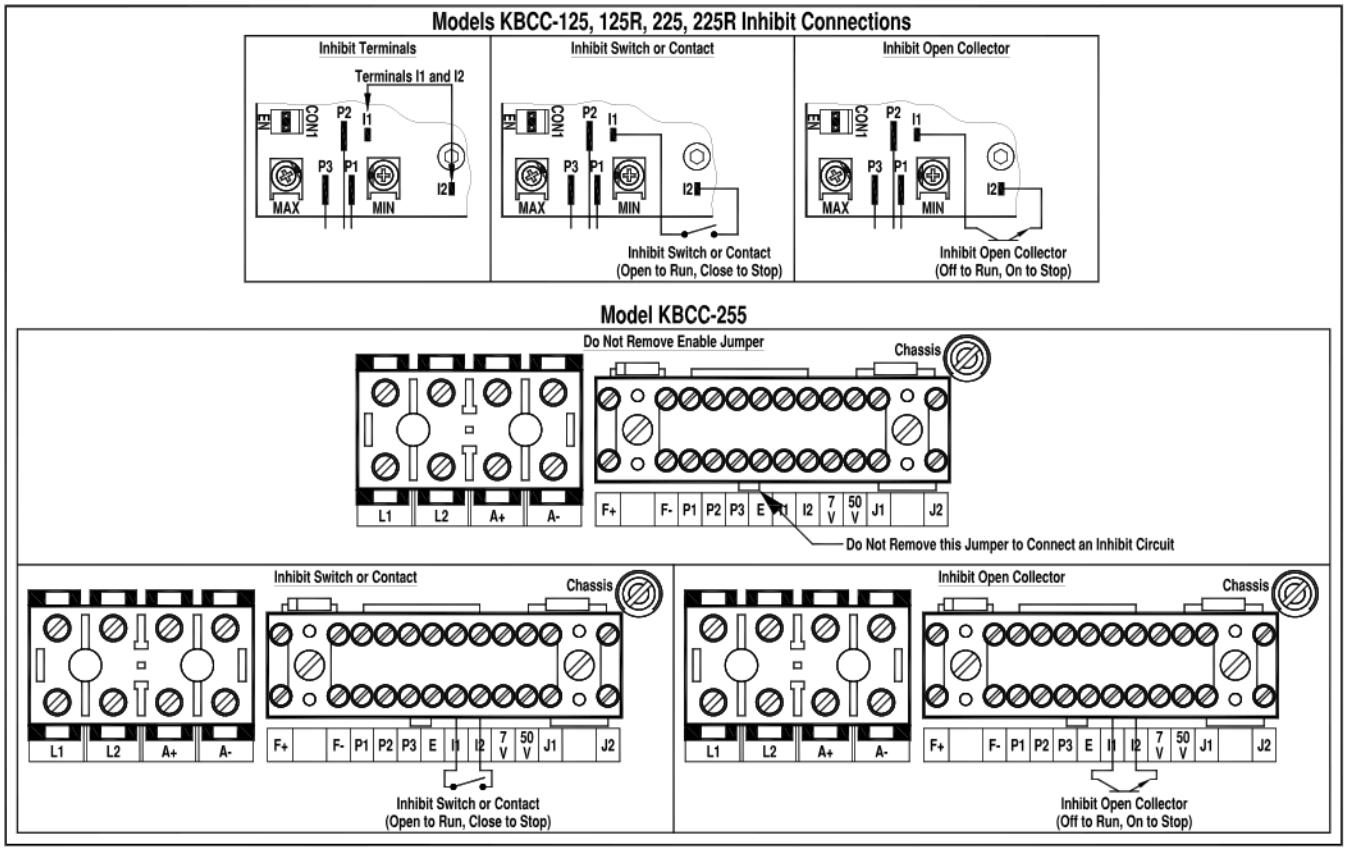


6.10 – **Inhibit:** The control can be stopped and started with an Inhibit (close to stop, open to run). Wire the switch or contact to Terminals I1 and I2, as shown in Figure 21.

When the switch or contact is closed, the motor will coast to stop. When the switch or contact is opened, the motor will accelerate to the Main Speed Potentiometer setting. An open collector (NPN) can be wired in lieu of a switch or contact.

⚠ **WARNING!** Inhibit is never to be used as a Safety Disconnect since it is not fail-safe. Use only the AC line for this purpose.

FIGURE 21
Inhibit Connection



7 – SWITCHING FUNCTIONS (MODELS KBCC-125R, 225R ONLY)

Models KBCC-125R, 225R are designed to offer a variety of switching functions. The APRM reversing module is the interface between command signals and the KBMM speed control module. By using Terminals S1, S2, and S3, the KBCC-125R, 225R can perform the following functions: Run-Brake, Forward-Brake-Reverse, and Forward-Reverse (instant anti-plug reverse).

Terminal S4 is used to supply a control voltage which is adjustable with the Jog Trimpot on the APRM. This voltage is used to preset a Jog or Run speed, either in Forward or Reverse direction (DECEL trimpot does not affect the brake time).

In order for the KBCC-125R, 225R to drive a motor, S1 and S2 must be connected together for Forward and S2 and S3 must be connected together for Reverse. If no connection is made to S2, the control will be in a Brake Mode. The brake circuit consists of an SCR and dynamic brake resistor(s). The LED on the APRM will illuminate red when in the Brake Mode.

Important Application Notes: 1. If the control will be used in unidirectional operation only, such as Run-Brake, use the forward direction (Terminals S1 and S2). This allows for the relay to be used in the forward direction, which does not require it to be energized (as it does in the reverse direction (Terminals S2 and S3) and, therefore, prolong its longevity. If the motor runs opposite to the desired direction, reverse the motor armature leads. **2.** When switching terminals S1, S2, and S3, approximately 10 mA DC of current with full motor voltage may be present. Other terminals (I1, 12, P1, P2, P3, and S4) are low voltage to each other, but at line potential with respect to ground. Any switch or relay can be used for switching except solid state relays or contacts with R-C networks (snubbers). S1 and S2 must be opened before S2 and S3 are closed and vice versa.

Figures 22 – 26 on pages 23 – 25 are presented to demonstrate some of the switching capabilities of Models KBCC-125R, 225R.

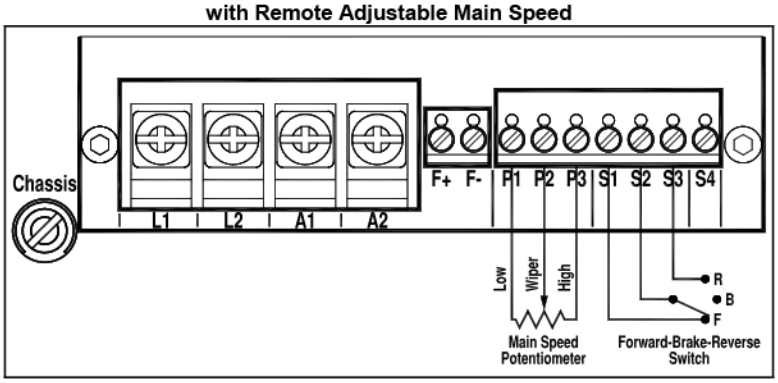
7.1 – **Forward-Brake-Reverse Operation with Remote Adjustable Main Speed:** Use a SPDT switch with center off (ON-OFF-ON) for the Forward-Brake-Reverse Operation. Wire the circuit as shown in Figure 22.

In the "Forward" (F) position, the Forward-Brake-Reverse Switch will close Terminals S1 and S2 for the motor to run in the forward direction. In the "Reverse" (R) position, the Forward-Brake-Reverse Switch will close Terminals S2 and S3 for the motor to run in the reverse direction. In the "Brake" (B) position, the Forward-Brake-Reverse Switch will open Terminal S2 for Brake Mode. In Brake Mode, the Brake LED on the APRM will illuminate red.

Adjust the motor speed with the Main Speed Potentiometer.

Note: *If braking is not required (Forward/Reverse Operation), a SPDT ON-NONE-ON (no center off) switch may be used. This provides instant anti-plug reversing.*

FIGURE 22
Forward-Brake-Reverse Switch
with Remote Adjustable Main Speed

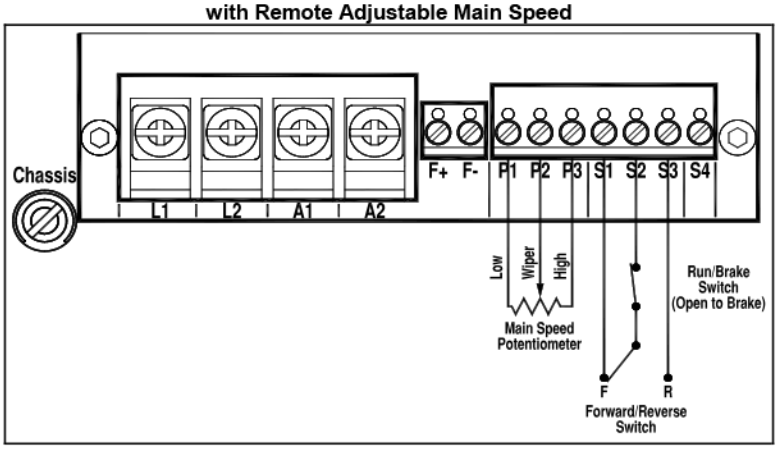


7.2 – **Forward/Reverse and Run/Brake Operations with Adjustable Main Speed:** Use a SPDT switch with no center off position (ON-NONE-ON) for the Forward/Reverse Operation. Use a SPST switch (ON/OFF) for Run/Brake Operation. Wire the circuit as shown in Figure 23.

In the "Forward" (F) position, the Forward/Reverse Switch will close Terminals S1 and S2 for the motor to run in the forward direction. In the "Reverse" (R) position, the Forward/Reverse Switch will close Terminals S2 and S3 for the motor to run in the reverse direction. For "Brake", open the Run/Brake Switch, which will open Terminal S2. In Brake Mode, the Brake LED on the APRM will illuminate red.

Adjust the motor speed with the Main Speed Potentiometer.

FIGURE 23
Forward/Reverse and Run/Brake Switches
with Remote Adjustable Main Speed



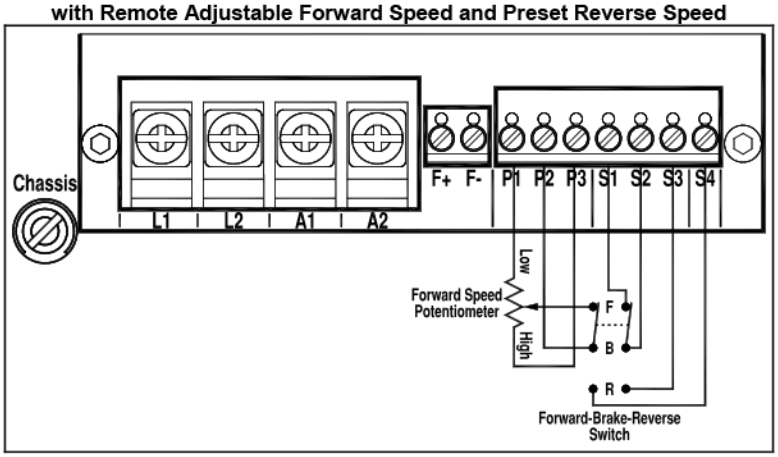
7.3 – **Forward-Brake-Reverse Operation with Adjustable Forward Speed and Preset Reverse Speed:** Use a DPDT switch with center off (ON-OFF-ON) for the Forward-Brake-Reverse Operation. Wire the circuit as shown in Figure 24 on page 24.

The supplied potentiometer may be used for Forward Speed adjustment. The Reverse Speed is adjustable with the Jog Trimpot (on the APRM).

In the "Forward" (F) position, the Forward-Brake-Reverse Switch will close Terminals S1 and S2 for the motor to run in the forward direction and simultaneously connect the potentiometer for Forward Speed adjustment. In the "Reverse" (R) position, the Forward-Brake-Reverse Switch will close Terminals S2 and S3 for the motor to run in the reverse direction and simultaneously connect the Jog Trimpot (on the APRM) for Reverse Speed adjustment. In the "Brake" (B) position, the Forward-Brake-Reverse Switch will open Terminal S2 for brake. In Brake Mode, the Brake LED on the APRM will illuminate red.

Note: *If braking is not required, a DPDT ON-NONE-ON (no center off) switch may be used. If, while in the forward or reverse position, a separate brake function is required, Terminal S2 may be interrupted using a limit switch or relay.*

FIGURE 24
Forward-Brake-Reverse Switch
with Remote Adjustable Forward Speed and Preset Reverse Speed



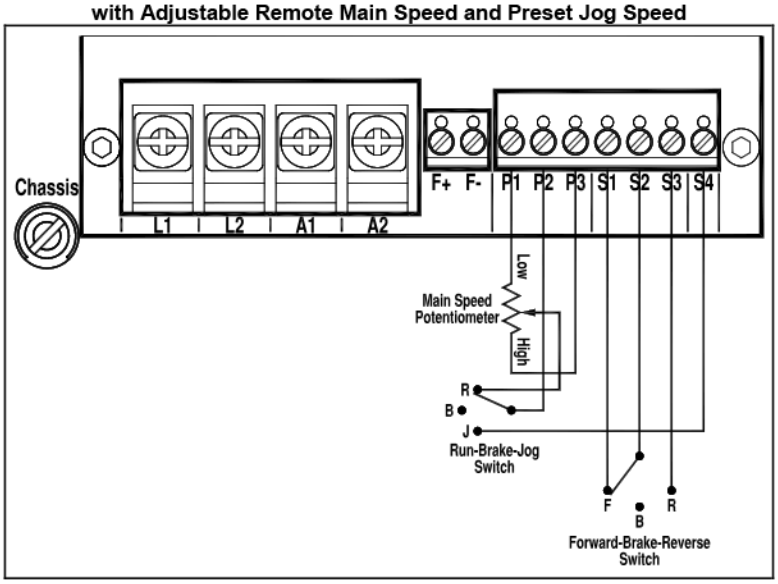
7.4 – Forward-Brake-Reverse and Run-Brake-Jog Operations with Adjustable Remote Main Speed and Preset Jog Speed: Use a DPDT switch with center off (ON-OFF-ON) for the Run-Brake Jog Operation. Use a DPDT switch with center off (ON-OFF-ON) for the Run-Brake Jog Operation. Wire the circuit as shown in Figure 25.

In the Run mode, the remote potentiometer is used. In the Jog Mode P2 is connected to S2, and the Jog Trimpot, located on the APRM, is used for speed adjustment.

The Jog speed is adjustable with the trimpot on the APRM.

Application Note: If Brake position is not required, a DPDT switch (non-center OFF) may be used. If, while in Forward or Jog position, a separate Brake function is required. S2 may be interrupted using a limit switch or relay.

FIGURE 25
Forward-Brake-Reverse and Run-Brake-Jog Switches
with Adjustable Remote Main Speed and Preset Jog Speed



7.5 – Forward-Brake-Reverse and Run-Brake-Jog Operations with Adjustable Remote Main Speed and Adjustable Remote Jog Speed: Use a SPDT switch with center off (ON-OFF-ON) for the Forward-Brake-Reverse Operation. Use a DPDT switch with center off (ON-OFF-ON) for the Run-Brake-Jog Operation. Wire the circuit as shown in Figure 26 on page 25.

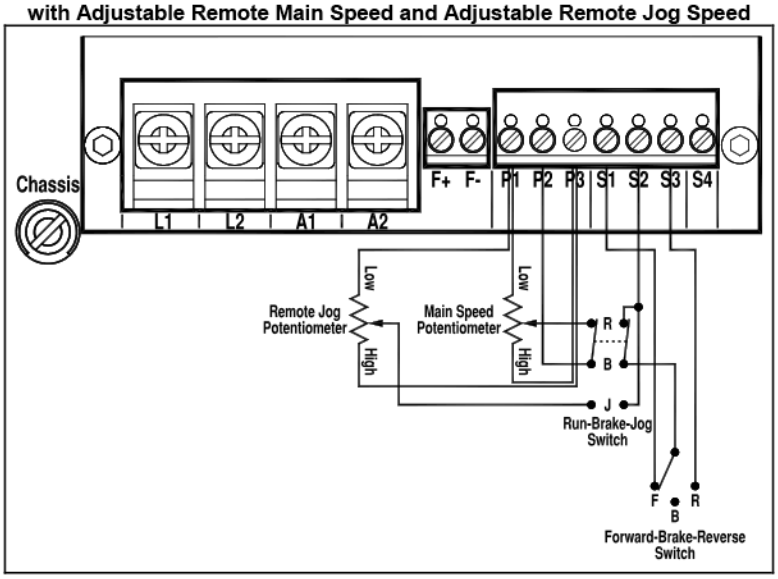
The supplied 5 kΩ potentiometer may be used for Main Speed adjustment. Jog speed is adjusted with a customer supplied 5 kΩ remote speed potentiometer.

In the "Forward" (F) position, the Forward-Brake-Reverse Switch will close Terminals S1 and S2 for the motor to run in the forward direction. In the "Reverse" (R) position, the Forward-Brake-Reverse Switch will close Terminals S2 and S3 for the motor to run in the reverse direction. In the "Brake" (B) position, the Forward-Brake-Reverse Switch will open Terminal S2 for brake.

In the "Run" (R) position, the Run-Brake-Jog Switch will connect the Main Speed Potentiometer and simultaneously connect the Forward-Brake-Reverse Switch. In The "Jog" position, the Run-Brake-Jog Switch will connect the Remote Jog Potentiometer and simultaneously connect the Forward-Brake-Reverse Switch.

Note: *If the application requires momentary operation for Jog, a SPDT switch with momentary contacts in the Jog Position (ON-OFF-(ON)) may be used for the Run-Brake-Jog Switch.*

FIGURE 26
Forward-Brake-Reverse and Run-Brake-Jog Switches with Adjustable Remote Main Speed and Adjustable Remote Jog Speed



8 – SETTING SELECTABLE JUMPER J2 (MODELS KBCC-125, 125R, 225, 225R ONLY)

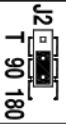
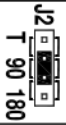
The control has a selectable jumper which must be set before it can be used. See Figures 2 – 4 on pages 8 – 10 for the location of Jumper J2.

Jumper J2 is factory set to the "90" position on Models KBCC-125, 125R for 90 Volt DC motors, and factory set to the "180" position on Models KBCC-225, 225R for 180 Volt DC motors. To set Models KBCC-225, 225R for step-down operation (208/230 Volt AC line input and 90 Volt DC output), set Jumper J2 to the "90" position). To set the control for DC tach-generator connection, set Jumper J2 to the "T" position). See Figure 27.

Note: *On Models KBCC-125, 125R, the "180" position is not available on Jumper J2.*

⚠ **CAUTION!** Setting Jumper J2 to the "T" position without a tach-generator connected will cause the motor will run at full speed.

FIGURE 27
Jumper J2 Settings (Models KBCC-125, 125R, 225, 225R Only)

KBCC-125, 125R*	KBCC-225, 225R		KBCC-125, 125R, 225, 225R
Jumper J2 Set for 90 Volt DC Motors (Factory Setting)	**Jumper J2 Set for 180 Volt DC Motors (Factory Setting)**	**Jumper J2 Set for 90 Volt DC Motors (Step-Down Operation)**	**Jumper J2 Set for DC Tach-Generator**
			

**On Models KBCC-125, 125R, the "180" position is not available on Jumper J2.*

9 – AC LINE AND MOTOR ARMATURE FUSING

All fuses should be normal blow ceramic 3AG, MDA, or equivalent. On domestic 230 Volt AC Lines, separate branch circuit protection for each line must be used. Fuses are available from your distributor.

9.1 – **AC Line Fuse:** The AC Line fuse protects the control against catastrophic failure. If the AC Line fuse blows, the control is miswired, the motor is shorted or grounded, or the control is defective.

Models KBCC-125, 125R, 225, 225R contain a factory installed 25 Amp AC Line fuse. Model KBCC-255 does not contain provision for an AC Line fuse. Fuse each ungrounded AC Line conductor.

9.2 – **Motor Armature Fuse:** The motor armature fuse provides overload protection for the motor and control. The motor armature fuse required can be calculated by multiplying the maximum DC motor current times 1.7. Select the correct fuse, as shown in Table 6 on page 26

Models KBCC-125, 125R, 225, 225R do not contain a factory installed motor armature fuse. A motor armature fuse must be installed for the control to operate. Model KBCC-255 contains a factory installed 40 Amp motor armature fuse.

TABLE 6
Motor Armature Fuse (Models KBCC-125, 125R, 225, 225R Only)

Motor Horsepower				Approximate Motor Current (Amps DC)	Fuse Rating (Amps)
90 Volt DC Motors		180 Volt DC Motors			
HP	kW	HP	kW		
1/30	0.025	1/15	0.05	0.33	0.5
1/20	0.0373	1/10	0.075	0.5	0.75
1/15	0.05	1/8	0.09	0.65	1
1/12	0.062	1/6	0.12	0.85	1.25
1/8	0.09	1/4	0.19	1.3	2
1/6	0.012	1/3	0.25	1.7	2.5
1/4	0.19	1/2	0.373	2.5	4
1/3	0.25	3/4	0.56	3.3	5
1/2	0.373	1	0.75	5.0	8
3/4	0.56	1½	1.13	7.5	12
1	0.75	2	1.5	10.0	15
1½	1.13	3	2.25	15.0	25

10 – PLUG-IN HORSEPOWER RESISTOR® (MODELS KBCC-125, 125R, 225, 225R ONLY)

A Plug-In Horsepower Resistor® (supplied separately) must be installed to match the control to the motor horsepower and voltage. Plug-In Horsepower Resistors® are available from your distributor. Install the Plug-In Horsepower Resistor®, as shown in Figures 2 – 4 on pages 8 – 10. Select the correct Plug-In Horsepower Resistor® as shown in Table 7.

Application Notes: 1. The Plug-In Horsepower Resistor® is used to calibrate the IR Compensation and Current Limit based on motor horsepower and voltage. The Plug-In Horsepower Resistor® eliminates the need to recalibrate IR Compensation and Current Limit in most applications. **2.** Be sure the Plug-In Horsepower Resistor® is inserted completely into the mating sockets.

TABLE 7
Plug-In Horsepower Resistor® (Models KBCC-125, 125R, 225, 225R Only)

Motor Horsepower[1]				Plug-In Horsepower Resistor®[2]	
90 – 130 Volt Motors		180 Volt Motors			
HP	kW	HP	kW	Value (Ohms)	Part No.
1/100 – 1/50	0.0075 – 0.015	1/50 – 1/25	0.015 – 0.04	1	9833
1/50 – 1/30	0.015 – 0.025	1/25 – 1/15	0.04 – 0.05	0.51	9834
1/30 – 1/20	0.025 – 0.0373	1/15 – 1/10	0.05 – 0.075	0.35	9835
1/20 – 1/12	0.0373 – 0.062	1/10 – 1/6	0.075 – 0.12	0.25	9836
1/12 – 1/8	0.062 – 0.09	1/6 – 1/4	0.12 – 0.19	0.18	9837
1/8 – 1/5	0.09 – 0.15	1/4 – 1/3	0.19 – 0.25	0.1	9838
1/4	0.19	1/2	0.373	0.05	9839
1/3	0.25	3/4	0.56	0.035	9840
1/2	0.373	1	1.75	0.025	9841
3/4	0.56	1½	1.13	0.015	9842
1	0.75	2	1.5	0.01	9843
1½	1.13	3	2.25	0.006	9850

Notes: 1. *Motor horsepower and armature voltage must be specified when ordering so that the proper resistor will be supplied.* ***2.*** *For overlapping motor horsepower range, use the next lower value Plug-In Horsepower Resistor®.*

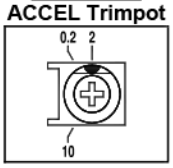
11 – TRIMPOT ADJUSTMENTS

The control contains trimpots which have been factory set for most applications. Some applications may require readjustment of the trimpots to tailor the control for a specific requirement. Readjust the trimpots as described in Sections 11.1 – 11.7.

⚠ **Warning! If possible, do not adjust trimpots with the main power applied. If adjustments are made with the main power applied, an insulated adjustment tool must be used and safety glasses must be worn. High voltage exists in this control. Electrocution can result if caution is not exercised. The Safety Warning, on page 6, must be read and understood before proceeding.**

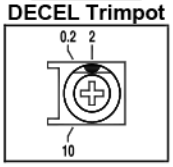
11.1 – **Acceleration Trimpot (ACCEL) (All Models):** Allows for a smooth start over an adjustable time period each time the AC power is applied or the Main Speed Potentiometer is adjusted to a higher speed. Factory set to 2 seconds, which is the time it will take for the motor to accelerate from zero speed to full speed. To increase the acceleration time, rotate the ACCEL Trimpot clockwise. To decrease the acceleration time, rotate the ACCEL Trimpot counterclockwise. See Figure 28.

FIGURE 28
ACCEL Trimpot



11.2 – **Deceleration Trimpot (DECEL) (All Models):** Sets the ramp-down time when the Main Speed Potentiometer is adjusted to a lower speed. Factory set to 2 seconds, which is the time it will take for the motor to decelerate from full speed to zero speed. To increase the deceleration time, rotate the DECEL Trimpot clockwise. To decrease the deceleration time, rotate the DECEL Trimpot counterclockwise. See Figure 29.

FIGURE 29
DECEL Trimpot

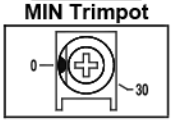


Note: *The deceleration time cannot be made less than the natural coast time of the motor and actual load.*

11.3 – **Minimum Speed Trimpot (MIN) (All Models):** Sets the minimum speed of the motor when the Main Speed Potentiometer is set fully counterclockwise. Factory set to 0 % of base speed. To increase the minimum speed, rotate the MIN Trimpot clockwise. To decrease the minimum speed, rotate the MIN Trimpot counterclockwise. See Figure 30.

Note: *Readjusting the MIN Trimpot will affect the maximum speed setting. Therefore, it is necessary to readjust the MAX Trimpot if readjusting the MIN Trimpot. It may be necessary to repeat these adjustments until both the minimum and maximum speeds are set to the desired levels.*

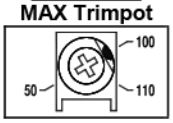
FIGURE 30
MIN Trimpot



11.4 – **Maximum Speed Trimpot (MAX) (All Models):** Sets the maximum speed of the motor when the Main Speed Potentiometer is set fully clockwise. Factory set to 100 % of base speed. To increase the maximum speed, rotate the MAX Trimpot clockwise. To decrease the maximum speed, rotate the MAX Trimpot counterclockwise. See Figure 31.

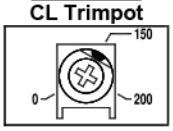
⚠ **CAUTION!** Do not set the maximum speed above the rated motor RPM since unstable motor operation may occur.

FIGURE 31
MAX Trimpot



11.5 – **Current Limit Trimpot (CL) (All Models):** Sets the current limit (overload), which limits the maximum current (torque) to the motor. The CL also limits the AC line inrush current to a safe level during startup. Factory set to 1.5 times the full load rating of the motor. To increase the current limit, rotate the CL Trimpot clockwise (do not exceed 2 times motor current rating (maximum clockwise position)). To decrease the current limit, rotate the CL Trimpot counterclockwise. See Figure 32.

FIGURE 32
CL Trimpot

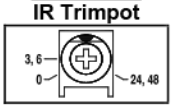


Note: *The correct Plug-In Horsepower Resistor® must be installed for the CL to operate properly. Calibration of the CL Trimpot is normally not required when the proper Plug-In Horsepower Resistor® is installed.*

To Recalibrate the CL Trimpot:

1. Disconnect the AC power and wire a DC ammeter in series with either motor armature lead.
   Note: If only an AC ammeter is available, wire it in series with either AC line input lead.
2. Set the Main Speed Potentiometer to approximately 30 – 50 % clockwise position.
3. Set the CL Trimpot fully counterclockwise. The CL LED will illuminate red.
4. Lock the motor shaft (be sure the CL Trimpot is set fully counterclockwise).
5. Apply power and rotate the CL Trimpot clockwise until the desired current reading is observed on the DC ammeter. Factory Current Limit setting is 1.5 times the full load rating of the motor (with a DC ammeter wired in series with the motor armature). If using an AC ammeter wired in the AC line input, the factory Current Limit setting will read 0.75 times the full load rating of the motor. Do not exceed 2 times motor current rating (maximum clockwise position).

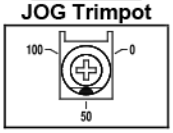
FIGURE 33
IR Trimpot



Note: *On cyclical loads, it may be normal for the CL LED to momentarily flash.*

⚠ **WARNING!** Do not leave motor shaft locked for more than 2 – 3 seconds or motor damage may result.

FIGURE 34
JOG Trimpot



11.6 – **IR Compensation Trimpot (IR) (All Models):** Sets the compensating voltage required to keep the motor speed constant under changing loads. If the load does not vary substantially, the IR Trimpot may be set to a minimum level (approximately 1/4 of full clockwise rotation). Factory set to provide 3 Volts of compensation for controls with 90 Volt DC output and 6 Volts of compensation for controls with 180 Volt DC output. To increase the compensating voltage, rotate the IR Trimpot clockwise. To decrease the compensating voltage, rotate the IR Trimpot counterclockwise. See Figure 33.

Notes: ***1.*** *Models KBCC-125, 125R, 225, 225R Only: The correct Plug-In Horsepower Resistor® must be installed for the motor and input voltage being used for the IR Compensation to operate properly. Calibration of the IR Trimpot is normally not required when the proper Plug-In Horsepower Resistor® is installed.* ***2.*** *Excessive IR Compensation will cause the motor to become unstable, which causes cogging.* ***3.*** *For DC tach-generator feedback applications, set the IR Trimpot fully counterclockwise. See Section 6.5 on page 16.*

To Recalibrate the IR Trimpot:

1. Set the IR Trimpot to approximately 25% rotation.
2. Run the motor unloaded at approximately 1/3 speed and record the RPMs.
3. Run the motor at the maximum load and adjust the IR Trimpot so the RPMs under load equal the unloaded RPMs recorded in step 2.
4. Remove the load and recheck the RPMs.
5. If the unloaded RPM has changed, repeat steps 2 – 4 for more exact regulation. The control is now compensated to provide minimal speed change due to changing loads.

11.7 – **Jog Trimpot (JOG) (Models KCC-125R, 225R Only):** Provides a jog speed, which can be used to index a machine into position. It can also be used as a secondary speed setting. Factory set to 50 % of base motor speed. Io increase the Jog speed, rotate the JOG Trimpot clockwise. To decrease the Jog speed, rotate the JOG Trimpot counterclockwise. See Figure 34.

12 – DIAGNOSTIC LEDs

The control is designed with PC board mounted LEDs to display the control's operational status. See Figures 2 – 4 on pages 8 – 10 for the location of the LEDs.

12.1 – Power On LED (PWR ON): The Power On LED is located on the KBMM. The LED will illuminate green when the AC line is applied to the control.

12.2 – Current Limit LED (CL): The Current Limit LED is located on the KBMM. The LED will illuminate red when the control goes into current limit, indicating that the current limit set point has been reached (set by the CL Trimpot). See Section 11.5 on page 27.

12.3 – Brake LED (Models KBCC-125R, 225R Only): The Brake LED is located on the APRM. The LED will illuminate red when the control is in the Brake Mode.

13 – OPERATION

After the control has been properly setup and all connections completed, the start-up procedure can begin. If the AC power has been properly brought to the control, the PWR LED will illuminate green.

WARNING! Do not depend on the LEDs to no longer be illuminated as a guaranteed power off condition. Be sure the main power switch or circuit breaker is in the "OFF" position before servicing the control.

14 – RECOMMENDED HIGH VOLTAGE DIELECTRIC WITHSTAND TESTING (HI-POT TESTING)

Testing agencies such as UL, CSA, etc., usually require that equipment undergo a hi-pot test. To prevent catastrophic damage to the control, which has been installed in the equipment, it is recommended that the following procedure be followed. All controls have been factory hi-pot tested in accordance with UL requirements. Typical hi-pot test setups are shown in Figures 35 – 37 on pages 28 and 29.

⚠ **WARNING!** When performing the hi-pot test, disconnect the AC power.

Connect all equipment AC power input lines together and connect them to the H.V. lead of the Hi-Pot Tester. Connect the RETURN of the Hi-Pot Tester to the frame on which the control and other auxiliary equipment are mounted. The Hi-Pot Tester must have an automatic ramp-up to the test voltage and an automatic ramp-down to zero voltage.

Note: If the Hi-Pot Tester does not have automatic ramping, then the hi-pot output must be manually increased to the test voltage and then manually reduced to zero. This procedure must be followed for each machine to be tested. A suggested Hi-Pot Tester is Slaughter Model 2550.

⚠ **CAUTION!** Instantaneously applying the hi-pot voltage will cause irreversible damage to the control.

FIGURE 35
Models KBCC-125, 225 Typical Hi-Pot Test Setup

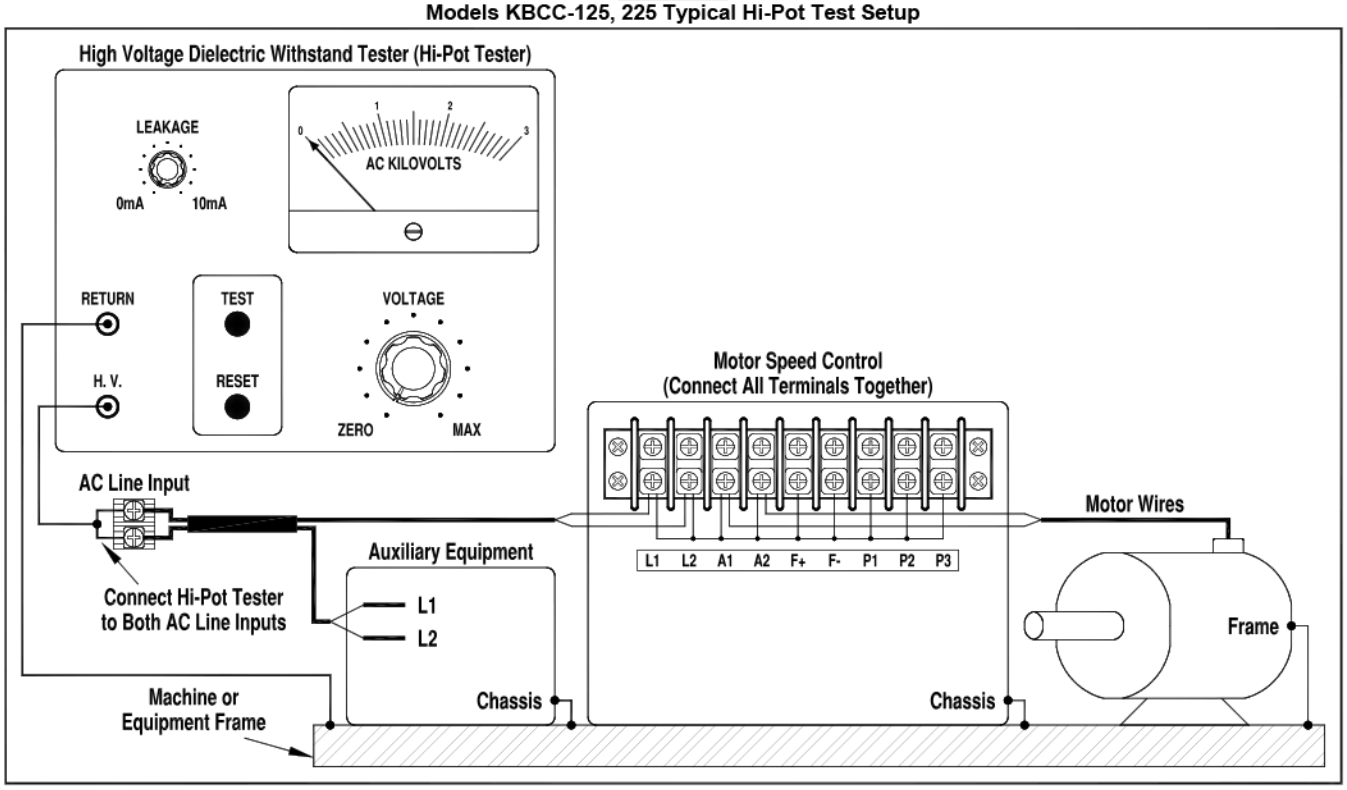


FIGURE 36
Models KBCC-125R, 225R Typical Hi-Pot Test Setup

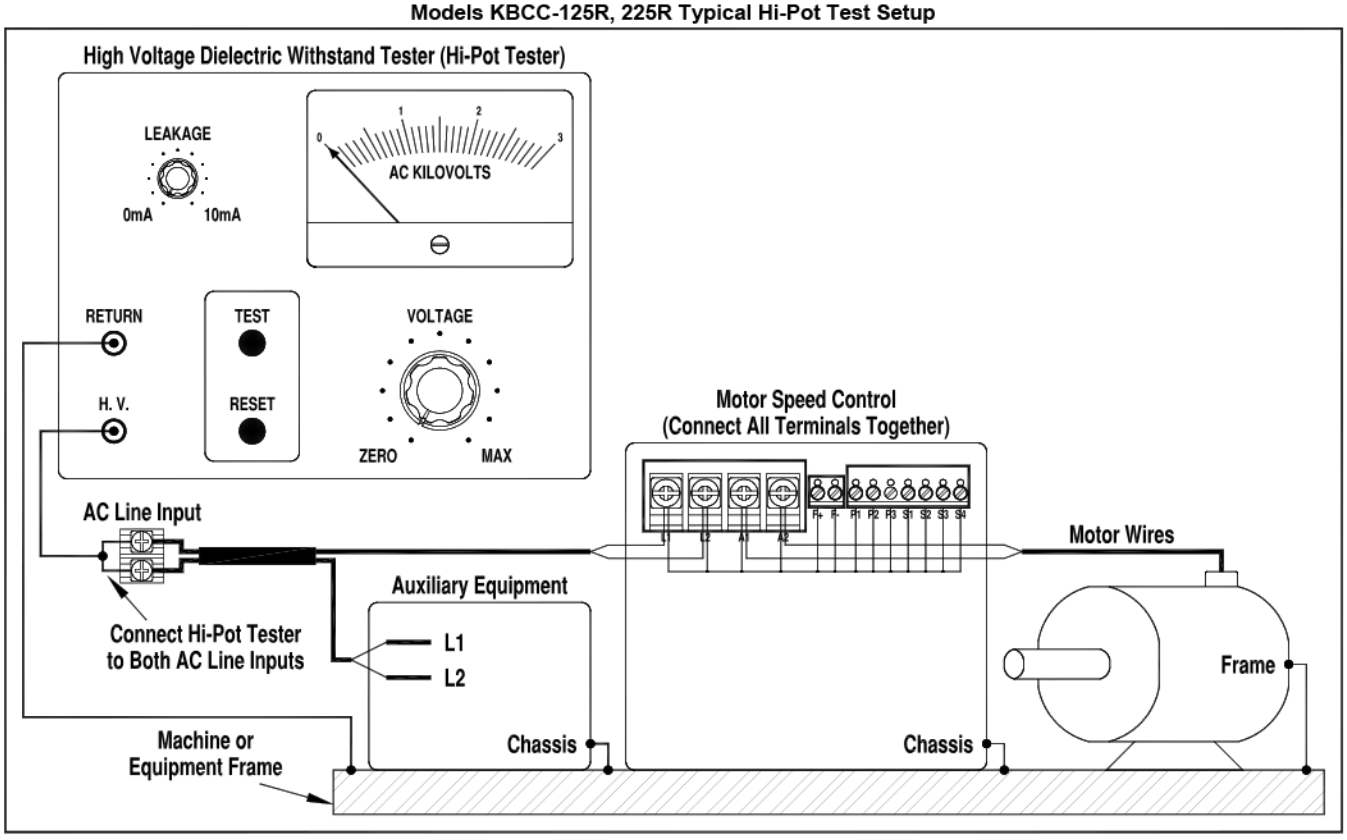
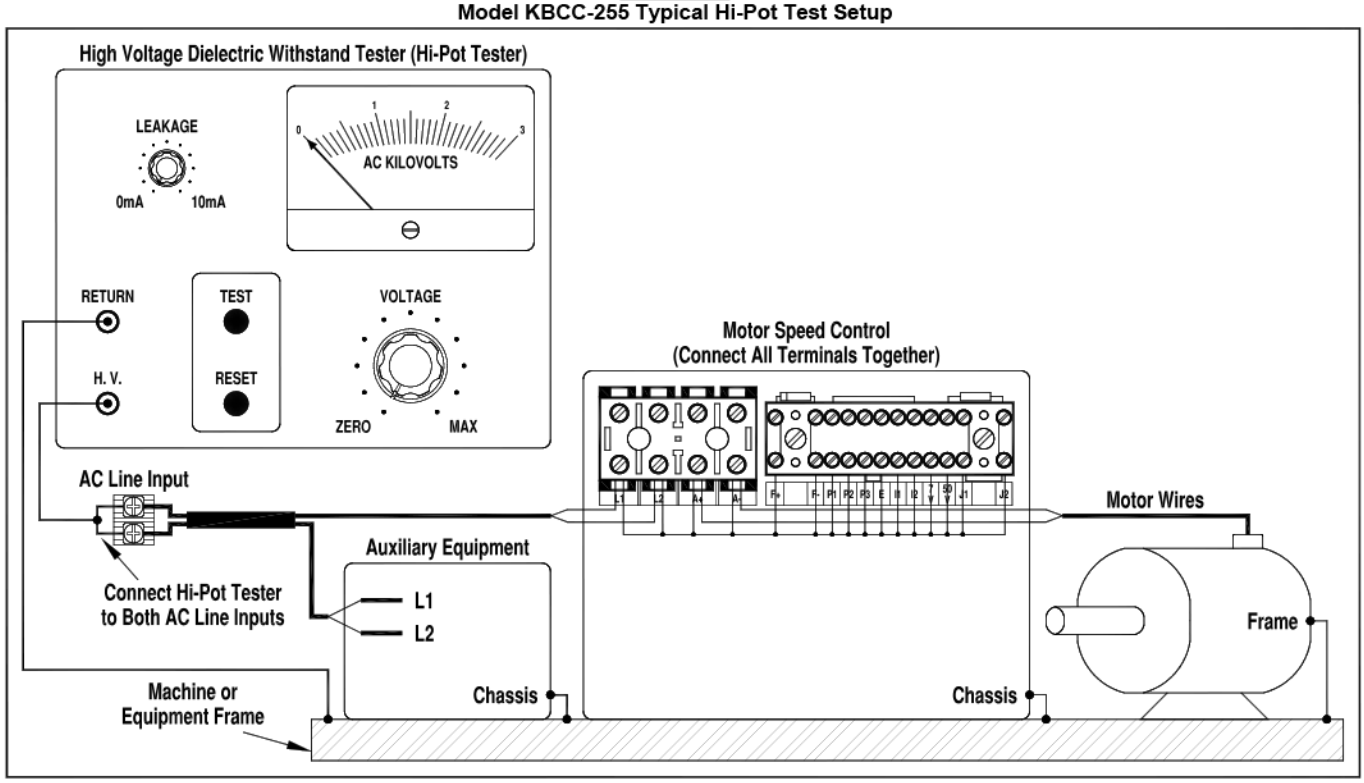


FIGURE 37
Model KBCC-255 Typical Hi-Pot Test Setup



15 – TROUBLESHOOTING

The following Troubleshooting Guides are intended for use by a qualified technician. The guides are designed to isolate common malfunctions. See Tables 8 and 9.

TABLE 8
Troubleshooting Guide for All Models

Symptom	Possible Cause	Corrective Action
Motor does not run.	AC Line input voltage not brought to Terminals L1 and L2.	Apply the correct AC Line input to Terminals L1 and L2.
	Blown AC Line or motor armature fuse.	Replace blown fuse(s) with properly rated type. ***Note:*** *If the fuse blew due to miswiring, the KBMM or the power bridge module (Model KBCC-255 only) may have been damaged.*
	Main Speed Potentiometer set to zero.	Turn Main Speed Potentiometer clockwise.
	Signal input set to zero.	Apply signal.
	Plug-In Horsepower Resistor not installed.	Install the correct Plug-in Horsepower Resistor.
	Defective motor (worn brushes, etc.).	Repair or replace motor.
Motor hums, or runs at very low speed (with control knob set at high number) or motor slows down substantially when load is applied.	Low AC Line input voltage.	Check the AC Line input voltage. The AC Line input voltage must match the voltage rating of the control.
	Overload condition. The KBMM is in current limit mode. CL Trimpot is not set properly.	Reduce loading. The CL Trimpot setting may have to be increased.
	Incorrect Plug-in Horsepower Resistor.	Replace with the proper Plug-in Horsepower Resistor.
	Incorrect wiring. The motor armature and field connections are interchanged (shunt wound motors only).	Correct wiring (the motor armature has lower resistance than the motor field).
Erratic motor performance.	Overload condition.	Remove the overload.
	Incorrect Plug-in Horsepower Resistor.	Replace with the proper Plug-in Horsepower Resistor.
	IR Trimpot and/or CL Trimpot not set properly.	Readjust IR Trimpot and/or CL Trimpot.
	Defective motor (worn brushes, etc.).	Repair or replace motor.
	Defective KBMM.	Replace the KBMM.
Motor continues to run when the Main Speed Potentiometer is set to zero.	MIN Trimpot is not set to zero.	Readjust MIN Trimpot.
	IR Trimpot setting is too high.	Lower IR comp trimpot setting.
Motor runs in the wrong direction.	Motor armature leads are reversed.	Reconnect motor armature leads.
Motor runs at full speed.	Main Speed Potentiometer wired incorrectly.	Rewire Main Speed Potentiometer.
	Tach-generator polarity reversed.	Interchange tach-generator connections.

TABLE 9
Troubleshooting Guide for Models KBCC-125R, 225R Only

Symptom	Possible Cause	Corrective Action
Motor will not run in either forward or reverse direction.	Incorrect switch wiring or faulty reversing switch.	Correct switch wiring or replace switch.
	Defective APRM.	Replace APRM.
No braking action when the reversing switch is in the brake position.	Incorrect switch wiring or faulty reversing switch.	Correct switch wiring or replace switch.
	Defective brake resistor(s).	Replace resistor(s).
	Defective APRM.	Replace APRM.

– NOTES –

To Validate the 18 Month Warranty, Please Register this Product Online

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

KBelectronics.com/registration.htm

LIMITED WARRANTY

For a period of 18 months from the date of original purchase, KB Electronics, Inc. will repair or replace without charge, devices 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. The foregoing is in lieu of any other warranty or guarantee, expressed or implied. KB Electronics, Inc. is not responsible for any expense, including installation and removal, inconvenience, or consequential damage, including injury to any person, caused by items of our manufacture or sale. Some states do not allow certain exclusions or limitations found in this warranty and therefore they may not apply to you. In any event, the total liability of KB Electronics, Inc. under any circumstance, shall not exceed the full purchase price of this product. (rev 2/2000)

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(A40387) – Rev. A00 – 5/15/2017