

SI-5/SI-6 Installation and Operation Manual Rev. B Supplemental Information

The following information pertains to page 11
of the SI-5/SI-6 Installation and Operation Manual Rev. B (Part No. A40256).

 **WARNING!** Disconnect main power when making connections to the SI-6 or KBMM™.

Description of Changes

- Tach-generator feedback formula is corrected to include the subtraction symbol which was missing.
- Note above Figures 12A and 12B is changed. Do not cut Jumper J1 (on SMT KBMM™).
- Figure 12A is updated to show new terminals and their orientation.
- Figure 12B is corrected to show the tach-generator connection to Terminals "I1" and "F-" on SI-6.

Application Note: Be sure to connect the gray wire to Terminal "I1" on the SI-6 and to Terminal "T" on the KBMM™. **Do not connect the tach-generator to Terminals "COM" and "I1".**

This page →
replaces page 11

$$R = (1.26 \times V \times S) - 15,900$$

R = Resistor in series with tach-generator positive lead (Ohms).
V = Tach-generator voltage at 1000 RPM (Volts DC).
S = Maximum motor speed (RPM).

Note: To activate the tach feature, set Jumper J2, on the KBMM™, to the "T" position.

Figure 12A - Jumper Connection

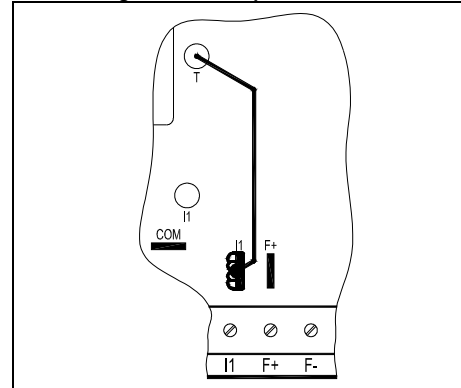
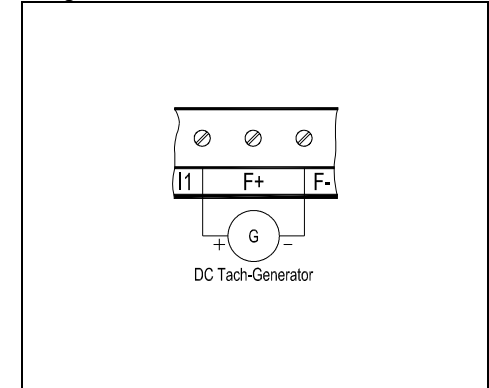


Figure 12B Tach-Generator Connection on SI-6



IV. Adjustments and Operation

CAUTION! Before applying power, be sure the AC line input voltage, 120 or 240 Volts AC, corresponds to the speed control rated voltage and proper J2A and J2B jumper setting of the SI-5 or SI-6. (See Table 3, on page 12.)

SI-5/SI-6 Installation and Operation Manual Rev. B Supplemental Information

The following information pertains to page 11
of the SI-5/SI-6 Installation and Operation Manual Rev. B (Part No. A40256).

 **WARNING!** Disconnect main power when making connections to the SI-6 or KBMM™.

Description of Changes

- Tach-generator feedback formula is corrected to include the subtraction symbol which was missing.
- Note above Figures 12A and 12B is changed. Do not cut Jumper J1 (on SMT KBMM™).
- Figure 12A is updated to show new terminals and their orientation.
- Figure 12B is corrected to show the tach-generator connection to Terminals "I1" and "F-" on SI-6.

Application Note: Be sure to connect the gray wire to Terminal "I1" on the SI-6 and to Terminal "T" on the KBMM™. **Do not connect the tach-generator to Terminals "COM" and "I1".**

This page →
replaces page 11

$$R = (1.26 \times V \times S) - 15,900$$

R = Resistor in series with tach-generator positive lead (Ohms).
V = Tach-generator voltage at 1000 RPM (Volts DC).
S = Maximum motor speed (RPM).

Note: To activate the tach feature, set Jumper J2, on the KBMM™, to the "T" position.

Figure 12A - Jumper Connection

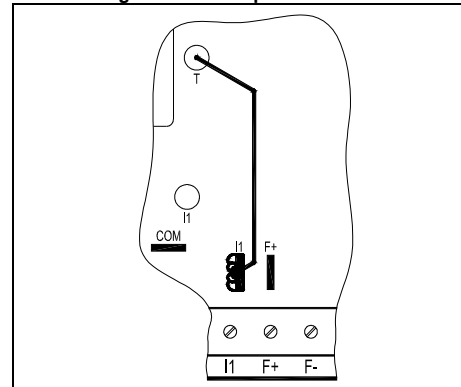
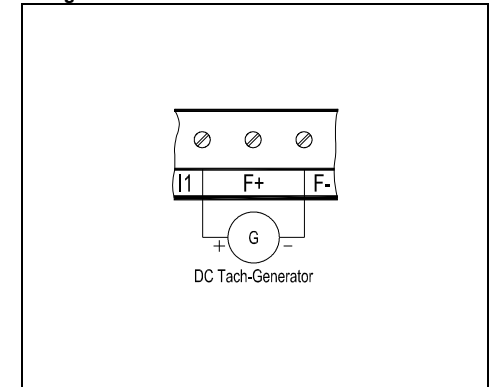


Figure 12B Tach-Generator Connection on SI-6



IV. Adjustments and Operation

CAUTION! Before applying power, be sure the AC line input voltage, 120 or 240 Volts AC, corresponds to the speed control rated voltage and proper J2A and J2B jumper setting of the SI-5 or SI-6. (See Table 3, on page 12.)

INSTALLATION AND OPERATING INSTRUCTIONS

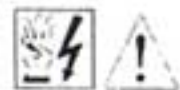
SI-5, SI-6

Barrier Terminal Board
Signal Isolators

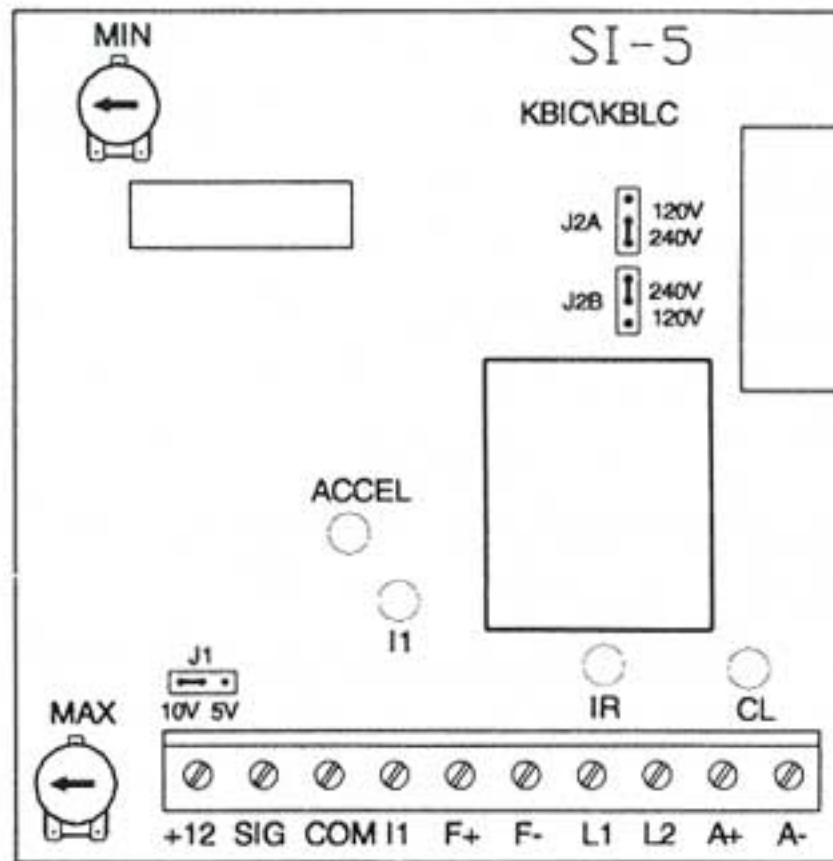
for

KBIC[®] & KBMM[™]

DC Motor Speed Controls



See Safety Warning on Page 1



SI-5 (P/N 9443) for KBIC — SI-6 (P/N 9444) for KBMM


PENTA **KB** POWER[™]

A COMPLETE LINE OF MOTOR DRIVES

1998 KB ELECTRONICS, INC.

TABLE OF CONTENTS


<u>Section</u>	<u>Page</u>		<u>Page</u>
i. Safety Warning	1		
I. Introduction	2		
II. Installation	5		
III. Wiring	5		
IV. Adjustments and Operation	11		
V. Limited Warranty	18		
<u>TABLES</u>			
1. General Performance Specifications	2		
2. Field Connections (Shunt Wound Motors Only)	7		
3. AC Line Voltage with Corresponding Control Model	12		
4. SI-5, SI-6 Parts List	15, 16		
<u>FIGURES</u>			
1A. SI-5 Layout and Mechanical Specifications ...	3		
1B. SI-6 Layout and Mechanical Specifications ...	4		
2. KBMM	5		
3. AC Line Voltage Jumper Settings	5		
		Figures (Continued)	
4. AC Line Connection	6		
5. Armature Connection	6		
6A. Full Voltage Field	7		
6B. Half Voltage Field	7		
7. "SI" Input Voltage Connections	8		
8. Potentiometer Connections	9		
9. Current Source Connections	9		
10. Inhibit Jumper Connection	10		
11. Inhibit Operation	10		
12A. Jumper Connection	11		
12B. Tach-generator Connection	11		
13. Max Speed Trimpot Adjustment	13		
14. Min Speed Trimpot Adjustment	14		
15. SI-5, SI-6 Schematic	17		

i.  **SAFETY WARNING! — PLEASE READ CAREFULLY**

This product should 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 wiring, mounting in proper enclosure, fusing or other overcurrent protection and grounding, can reduce the chance of electric shocks, fires or explosion in this product or products used with this product, such as electric motors, switches, coils, solenoids and/or relays. Eye protection must be worn and insulated adjustment tools must be used when working with control 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. If information is required on this product, contact our factory. It is the responsibility of the equipment manufacturer and individual installer to supply this safety warning to the ultimate user of this product. (SW effective 11/92)

This control contains electronic circuits that 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. Use only the AC line for this purpose.

Be sure to follow all instructions carefully. Fire and/or electrocution can result due to improper use of this product.

 This product complies with all CE directives pertinent at the time of manufacture. Contact factory for detailed installation instructions and Declaration of Conformity. Shielded motor cable and/or AC line cables may be required.

I. INTRODUCTION

The SI-5 and SI-6 Barrier Terminal Board Signal Isolators "SI" convert standard KBIC[®] and KBMM[™] controls to an isolated input. They isolate, amplify and condition DC voltage and current signals from any source, such as motors, tachometers and transducers. The isolators contain a selectable jumper (J1) that allows for either a 0-5 or 0-10VDC input signal. By using external resistors, the input signal can be changed to 0-100VDC, 0-200VDC and 4-20ma. The output voltage is 0-10VDC which can be rescaled via the built-in MIN and MAX trimpots. Selectable AC line jumpers (J2A, J2B) allow the SI-5 and SI-6 to be used either with 120 or 240VAC controls. In addition, an isolated +12VDC power supply voltage is furnished which can be used to power remote transducers or a remote speed potentiometer. Installation is made by simply mating the SI-5 with the KBIC[®] and the SI-6 with the KBMM[™] speed controls via the built-in quick-connect terminals.

TABLE 1 – GENERAL PERFORMANCE SPECIFICATIONS

AC Power Requirements	120 or 240VAC 50/60Hz
Signal Input Voltage	0-5, 0-10, 0-100 ⁽¹⁾ , 0-200 ⁽²⁾
Signal Input Current	4-20ma ⁽³⁾
Maximum Output Voltage	11 volts DC
Maximum Output Current	10ma
Range of MIN Trimpot	± 3 volts
Range of MAX Trimpot	0-2 times input voltage (11VDC Max.)
Linearity	± .1% ⁽⁴⁾
Temperature Drift	4mV per °C
Temperature Operating Range	Range 0-50°C

- NOTES:**
- (1) Requires the addition of a 330K-1W resistor in series with input signal (J1 set to "10V").
 - (2) Requires the addition of a 680K-2W resistor in series with input signal (J1 set to "10V").
 - (3) Requires the addition of a 270 ohm-1/2W resistor in parallel with input signal (J1 set to "5V").
 - (4) Linearity of SI-5 and SI-6 does not include the linearity specification of the speed control.

FIG. 1A – SI-5 LAYOUT AND MECHANICAL SPECIFICATIONS INCHES / [mm]

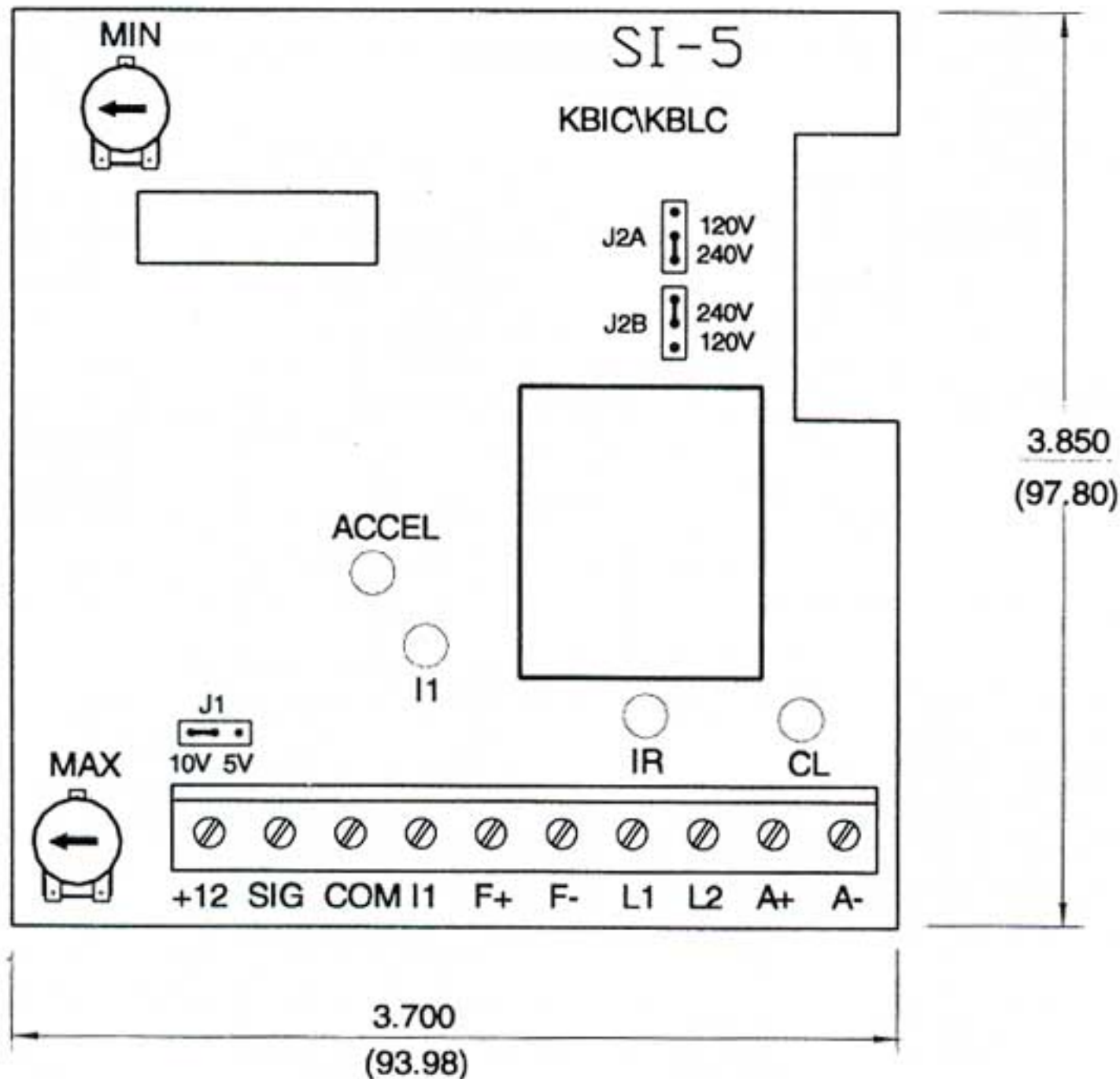
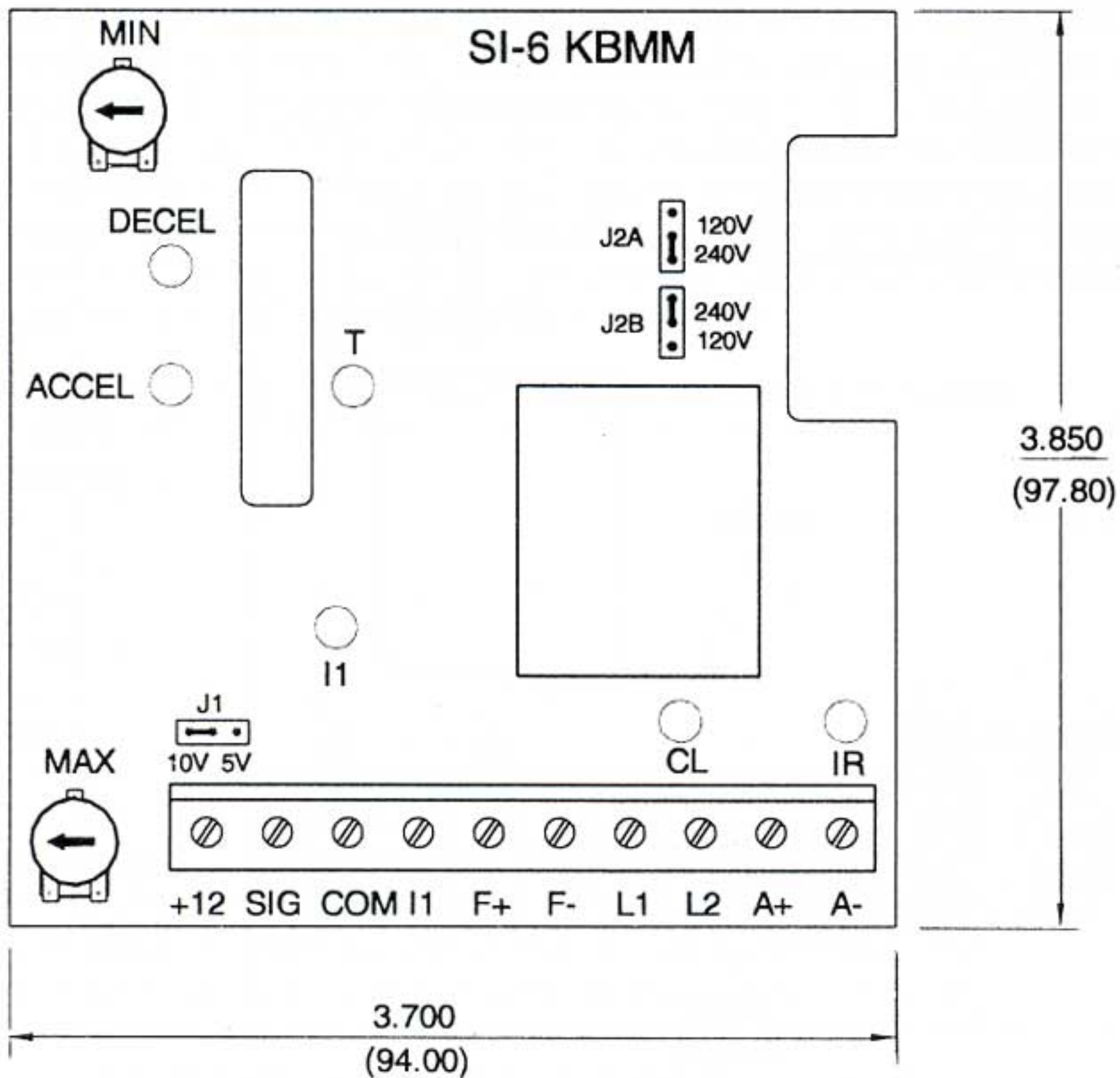


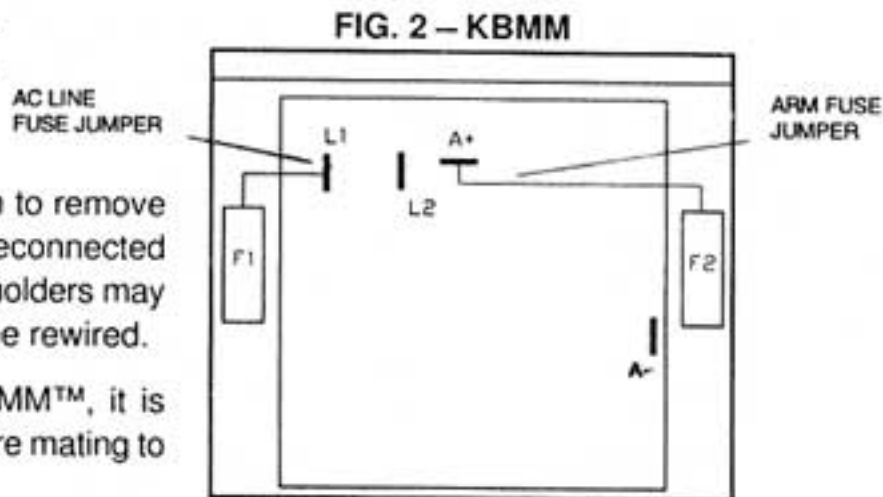
FIG. 1B – SI-6 LAYOUT AND MECHANICAL SPECIFICATIONS INCHES / [mm]



II. INSTALLATION.

Application Notes:

- (1) To facilitate installation the Plug-in Horsepower Resistor[®] should be inserted in KBIC[®] or KBMM[™] before installing the "SI."
- (2) KBMM[™] - Before installing the SI-6 into the KBMM[™] it is necessary to remove the AC line fuse jumper from L1 and the armature fuse jumper from A+. Using long-nose pliers carefully, rock the Q-D terminals back and forth to remove jumper. It is recommended that these fuses be reconnected after the SI-6 installation (see FIG. 2). The fuse holders may be left in place on the KBMM[™] or removed to be rewired.
- (3) If tachometer feedback is required for the KBMM[™], it is necessary to cut jumper J1 on the KBMM[™] before mating to the SI-6. (See Section III E (v), page 10.)







Orient the "SI" so that the quick-connect terminals line up to the mating terminals on the speed control. (Start with the potentiometer terminals P1, P2 and P3.)

Apply gradual pressure between the "SI" and control until the quick-connect terminals are fully engaged.

III. WIRING.

Caution! Before wiring the AC line to the "SI" it is necessary to set both jumpers J2A and J2B to the proper AC line input voltage, "120" or "240" VAC. Be sure the speed control model, "SI" setting, and input AC line voltage all correspond to the same AC line voltage.

**FIG. 3 – AC LINE VOLTAGE
JUMPER SETTINGS**

J2 Set for 120 VAC	J2 Set for 240 VAC
J2A  120V 240V	J2A  120V 240V
J2B  240V 120V	J2B  240V 120V

Warning! To avoid erratic operation do not bundle AC Line and motor wires with potentiometer, voltage following, enable, inhibit or other signal wiring. Use shielded cables on all signal wiring over 12" (30 cm) – Do not ground shield.

A. AC Line – Connect AC line to "SI" terminals L1 and L2. (Be sure jumpers J2A and J2B are set to the correct position to match the AC line input voltage. See fig. 3, p. 5.

B. MOTOR ARMATURE – Connect motor armature to terminals A(+) and A(-). It is recommended that the proper size armature fuse be installed in series with the armature connection. (Consult speed control manual.)

WARNING: Do not wire switches or relays in series with the armature. Armature switching can cause failure of motor and/or control.

C. Field – (For Shunt Wound Motors Only): Do not use terminals F+ and F- for any other purpose than to power the field on a shunt wound motor. Connect motor shunt field to terminals F+ and F- for 90VDC motors with 100VDC fields and 180VDC motors with 200VDC fields. For motors with half voltage fields, 90VDC motors with 50VDC fields and 180VDC motors with 100VDC fields, connect field to terminals F+ and L1. See table 2, page 7 for summary of Field Connections. See fig. 6A and 6B on page 7 for field wiring diagrams.

D. Ground – Do not earth ground any connections to the "SI" except the "COM" terminal in special applications where the input must be grounded. See Input Signal Connection ("SIG").

Fig. 4 – AC LINE CONNECTION

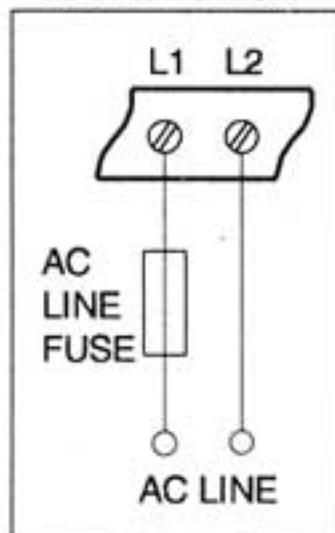


FIG. 5 – ARMATURE CONNECTION

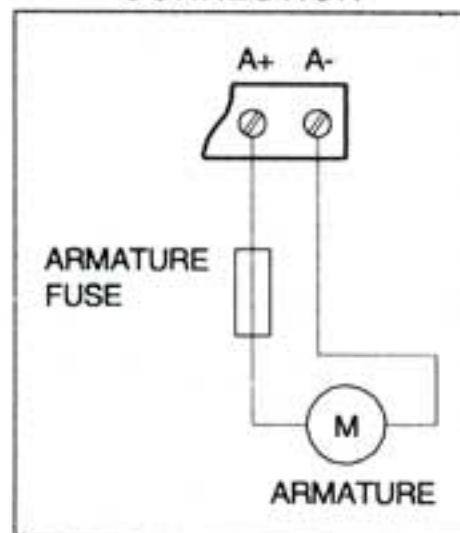


TABLE 2 – FIELD CONNECTIONS (Shunt Wound Motors Only)

AC LINE VOLTAGE	SHUNT FIELD VOLTAGE (VDC)	SHUNT FIELD CONNECTION	FIELD TYPE
120	100	F+, F-	Full Voltage
120	50	F+, L1	Half Voltage
240	200	F+, F-	Full Voltage
240	100	F+, L1	Half Voltage

FIG. 6A – FULL VOLTAGE FIELD

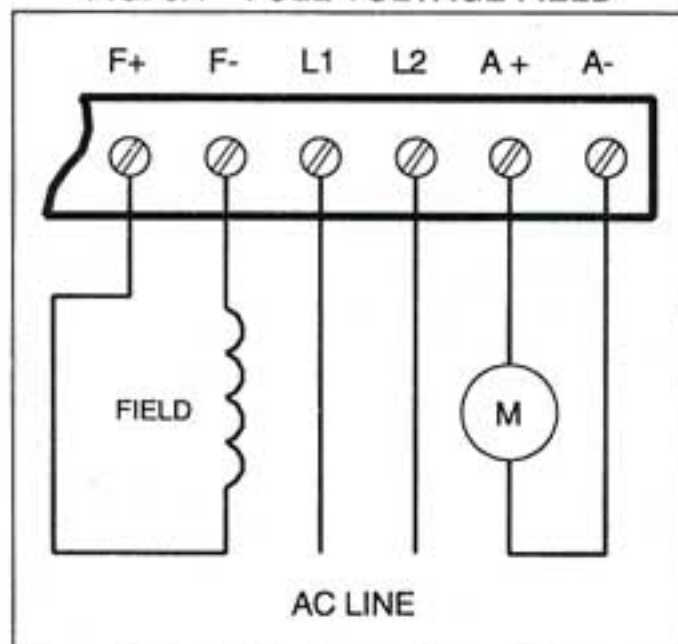
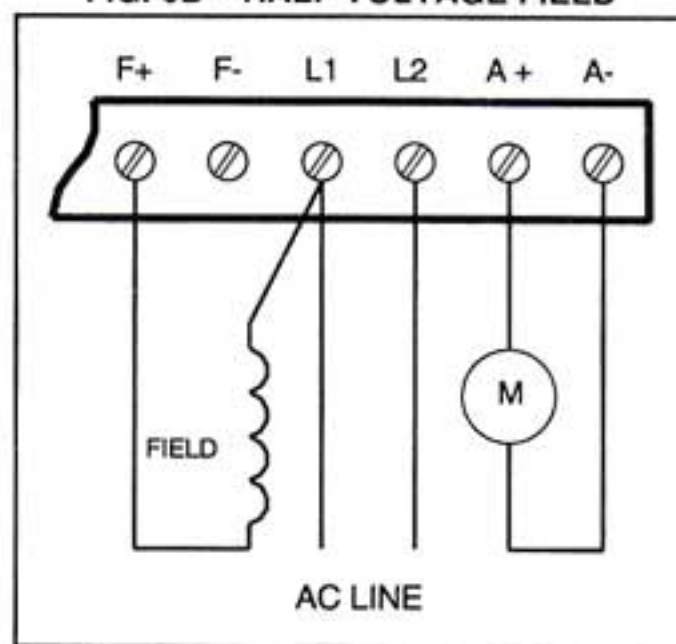


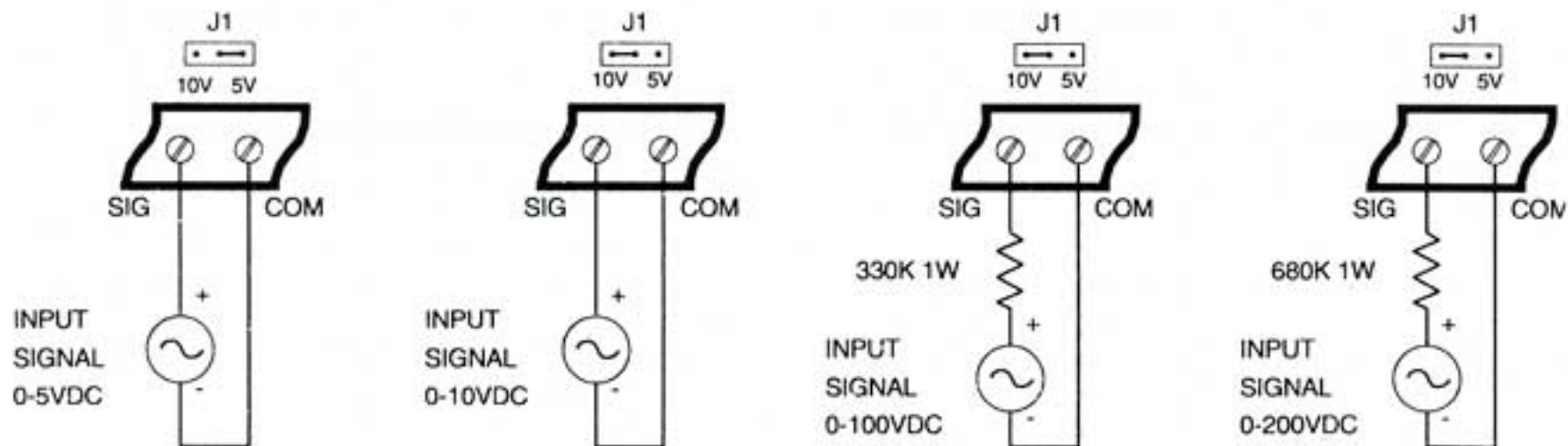
FIG. 6B – HALF VOLTAGE FIELD



E. Input Signal Connections – Application Note: Input signals need not be isolated from live voltages or ground to operate the SI-5 and SI-6. In some cases the common wire ("COM") may need to be grounded to eliminate noise. However, for applications with long runs or where signal wires are bundled with power wires, a shielded cable should be used. It is normally not necessary or desirable to ground the shield since the ground itself may contain noise.

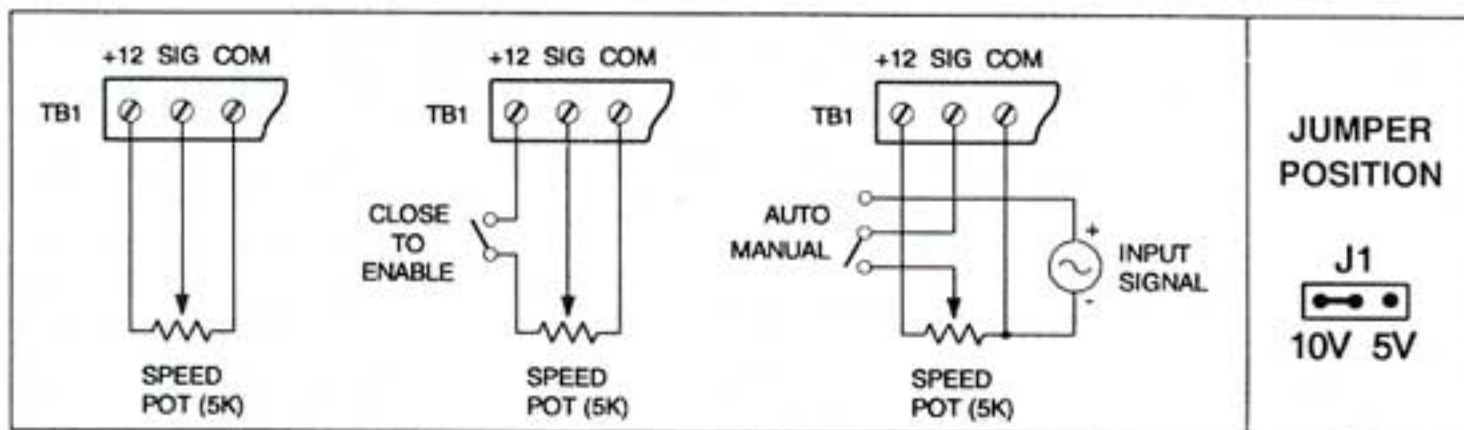
- i. Voltage Input Signal – The "SI" is factory calibrated so that a 0-10VDC signal provides approximately 0-full motor speed. Jumper J1 is provided to be able to rescale the "SI" so that a 0-5VDC signal provides 0-full motor speed. For a 0-5VDC input signal range remove J1 from "10V" and move to "5V." Other input signal voltage ranges may be obtained by maintaining J1 in the 10V position and with the use of external resistors (see fig. 7).

FIG. 7 – "SI" INPUT VOLTAGE CONNECTIONS



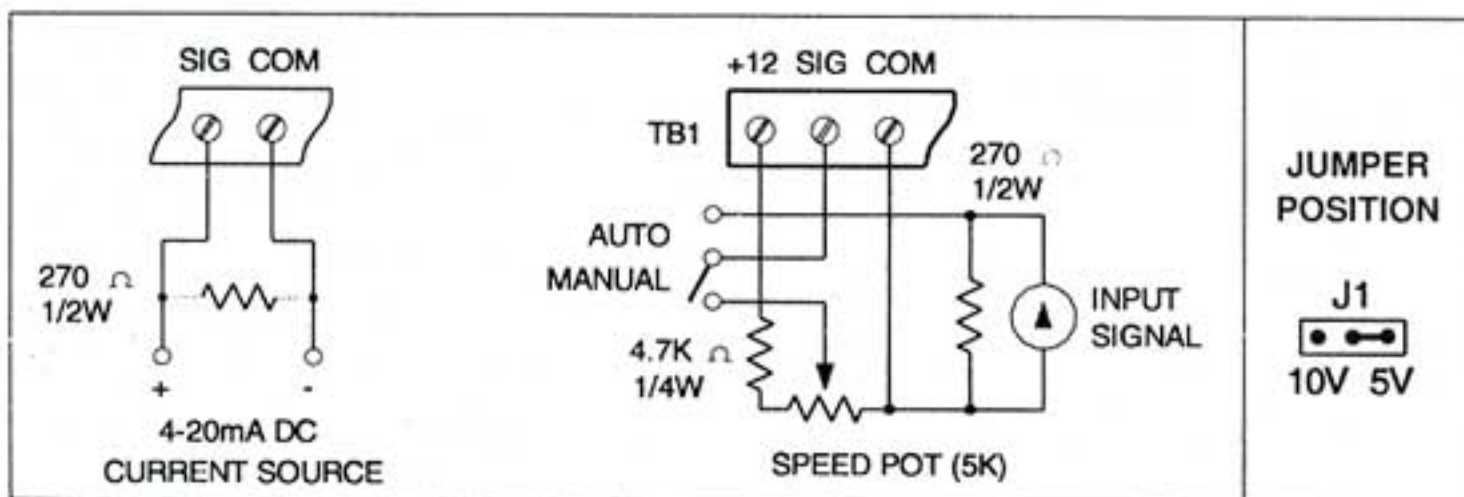
- ii. Potentiometer Input – A potentiometer may also be used to provide an input signal. It can be used with Enable and Auto/Manual circuits. **Jumper J1 must be in the "10V" position for potentiometer operation.**

FIG. 8
POTENTIO-
METER
CONNECTIONS



- iii. Current Input – The SI-5 and SI-6 can also be used as a current source (4-20ma) by adding a 270 ohm- $\frac{1}{2}$ W resistor across the input signal terminals. **Jumper J1 must be placed in the "5V" position.**

FIG. 9
CURRENT
SOURCE
CONNECTIONS



- iv. Inhibit Connection – The speed control can be turned "ON" and "OFF" electronically with the Inhibit Circuit using an isolated external contact.

To connect the Inhibit function the jumper must be installed from the I1 terminal on the SI to the I1 terminal on the KBIC or KBMM™ speed control (see fig. 10).

FIG. 10 – INHIBIT JUMPER CONNECTION

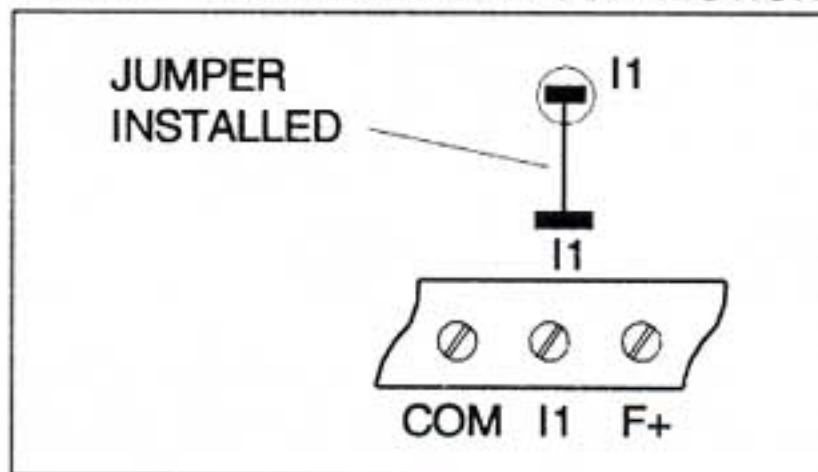
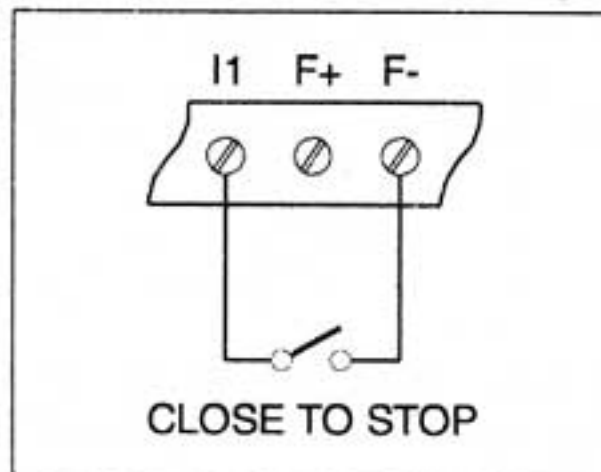


FIG. 11 – INHIBIT OPERATION



WARNING! The Inhibit Circuit is not isolated and, therefore, must be used with an isolated contact. Also, the Inhibit must not be used for a safety disconnect. Use only the AC line for that purpose.

- v. Tachometer Feedback – KBMM™ only. If tachometer feedback is required for the KBMM™ control, the jumper adjacent to the I1 terminal on the SI-6 must be inserted through the hole marked "T" and engaged with the mating "T" terminal on the KBMM™ PC board. (See fig. 12A, and 12B, on page 11).

Application Note: The "T" connection on the KBMM™ provides for 7V/1000 RPM tachometers at a maximum motor speed of 1800 RPM. For other tachometer voltages and motor RPM's use the following formula:

$$R = [(1.26 \times V \times S) / 15,900]$$

- R = Series resistor in series with tach lead (ohms)
- V = Tach-generator voltage at 1000 RPM (VDC)
- S = Maximum motor speed (RPM)

Note: To activate the tach feature, it is first necessary to cut jumper J1 on the KBMM™ board. (See sec. II, B, ii in the KBMM™ instruction manual.)

FIG. 12A – JUMPER CONNECTION

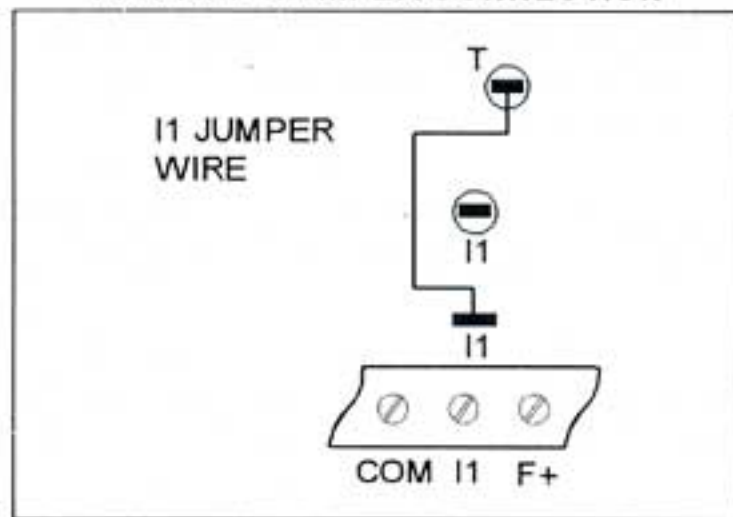
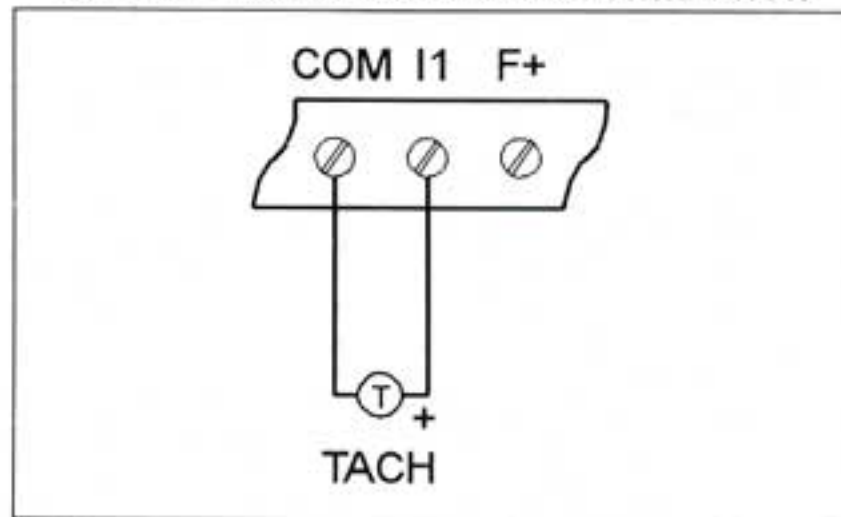


FIG. 12B – TACH-GENERATOR CONNECTION



IV. ADJUSTMENTS AND OPERATION.

CAUTION! Before applying power, be sure the AC line input voltage, 120 or 240VAC, corresponds to the speed control rated voltage and the proper J2A and J2B jumper setting of the SI-5 or SI-6. (See table 3, p. 12.)

TABLE 3 – AC LINE VOLTAGE WITH CORRESPONDING CONTROL MODEL

AC LINE INPUT VOLTAGE (VAC)	KBIC MODELS	KBMM™ MODELS	SI-6, SI-6 J2 JUMPER SETTING
120	KBIC-120, 125	KBMM-125	J2A, J2B - "120"
240	KBIC-240, 225	KBMM-225	J2A, J2B, - "240"
	KBIC-240D, 240DS	KBMM-225D	



WARNING! High voltage exists in this control! Read Safety Warning on page 1. This warning must be read and understood before proceeding to adjust or operate control with power on or severe injury, electrocution and/or fire can result. Do not adjust trimpots with power on if possible. If adjustments are made with power on, insulated adjustment tools must be used and safety glasses must be worn.

- A. Operation** – After AC line, motor and input signal wiring is complete, the SI and speed control combination can be operated. Turn AC power on. Increase signal input to maximum. The motor should increase in speed proportionately to the input signal magnitude.
- B. Calibration.**
- i. **Maximum Speed (MAX)** – With the input signal at maximum, the maximum motor speed should be adjusted to the desired level with the MAX trimpot on the SI. (See fig. 13, page 13.)
 - ii. **Minimum Speed (MIN)** – After adjusting the maximum speed, decrease the input signal to minimum. Using the MIN trimpot on the "SI," adjust the motor minimum speed to the desired level see fig. 14 on page 14. **Note:** For zero signal output adjust MIN trimpot on "SI" so that a nominal output voltage is achieved (.1 - .5 VDC). Then slowly reduce the MIN trimpot setting to zero. (Note: On KBMM™ controls, the MIN speed trimpot on the control itself is operational and must be set to a zero setting approximately 9 o'clock position.) The system is now adjusted so that the motor speed will follow the input signal over the desired range.

FIG. 13 – MAX SPEED TRIMPOT ADJUSTMENT

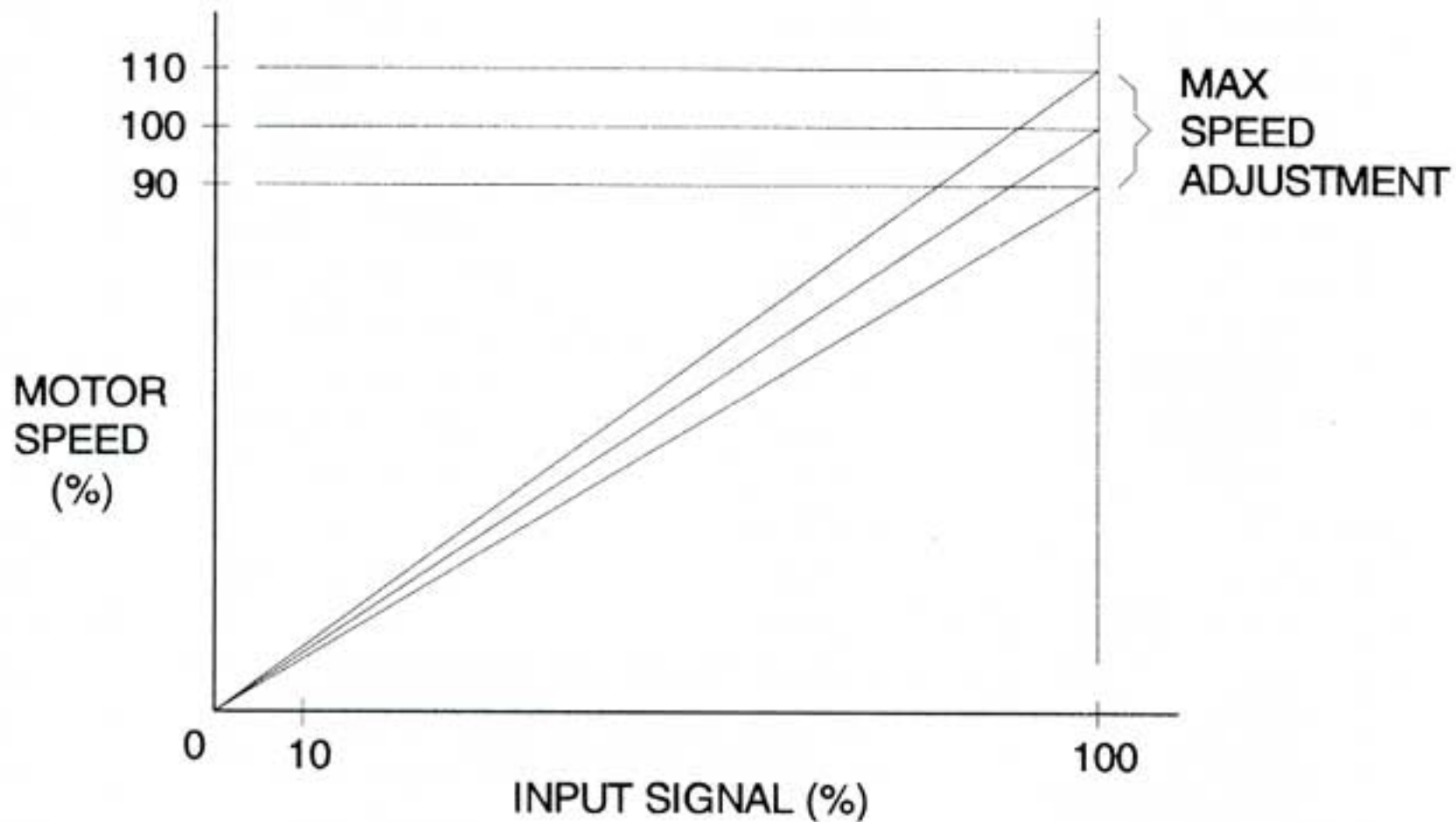


FIG. 14 – MIN SPEED TRIMPOT ADJUSTMENT

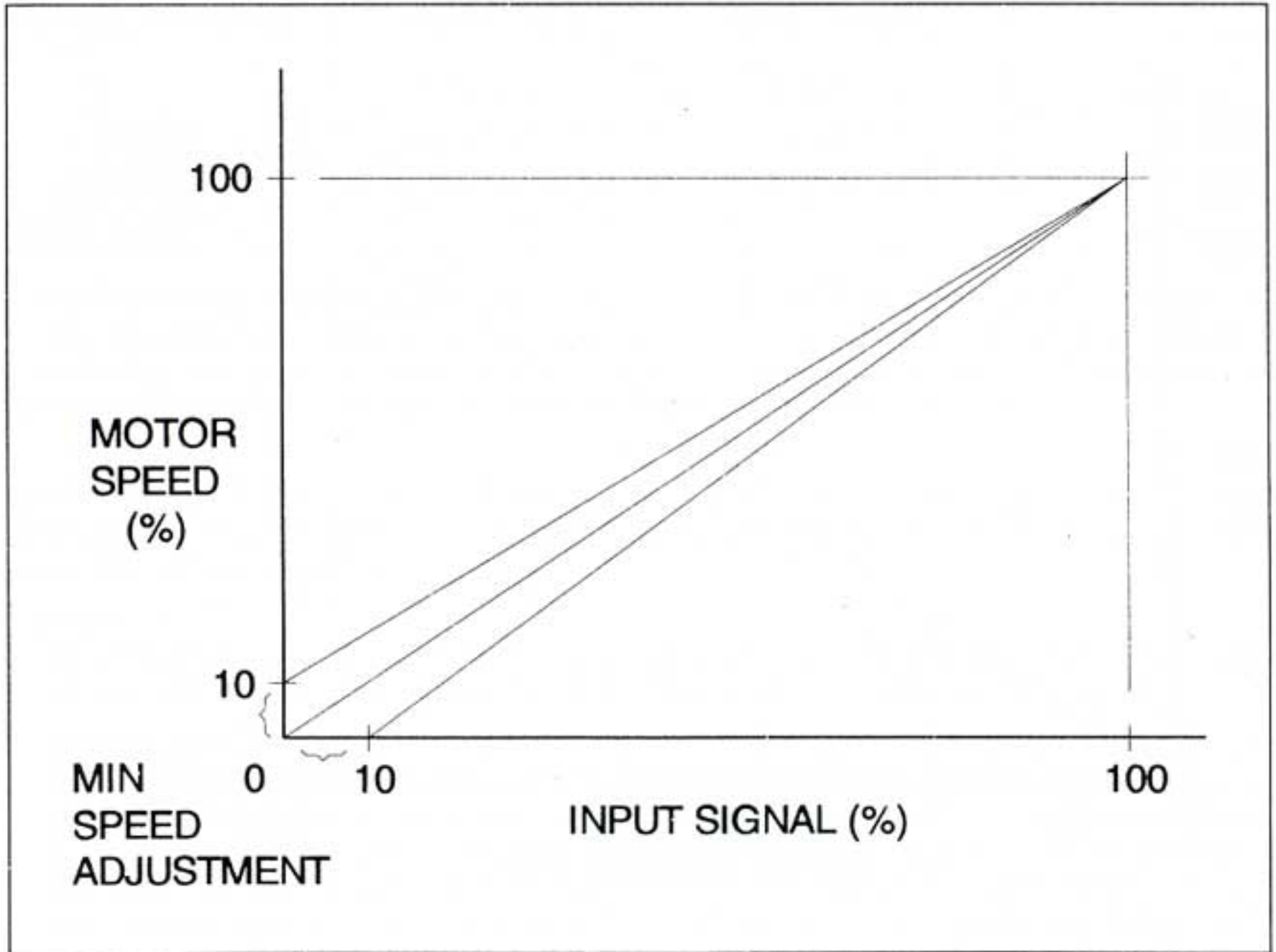


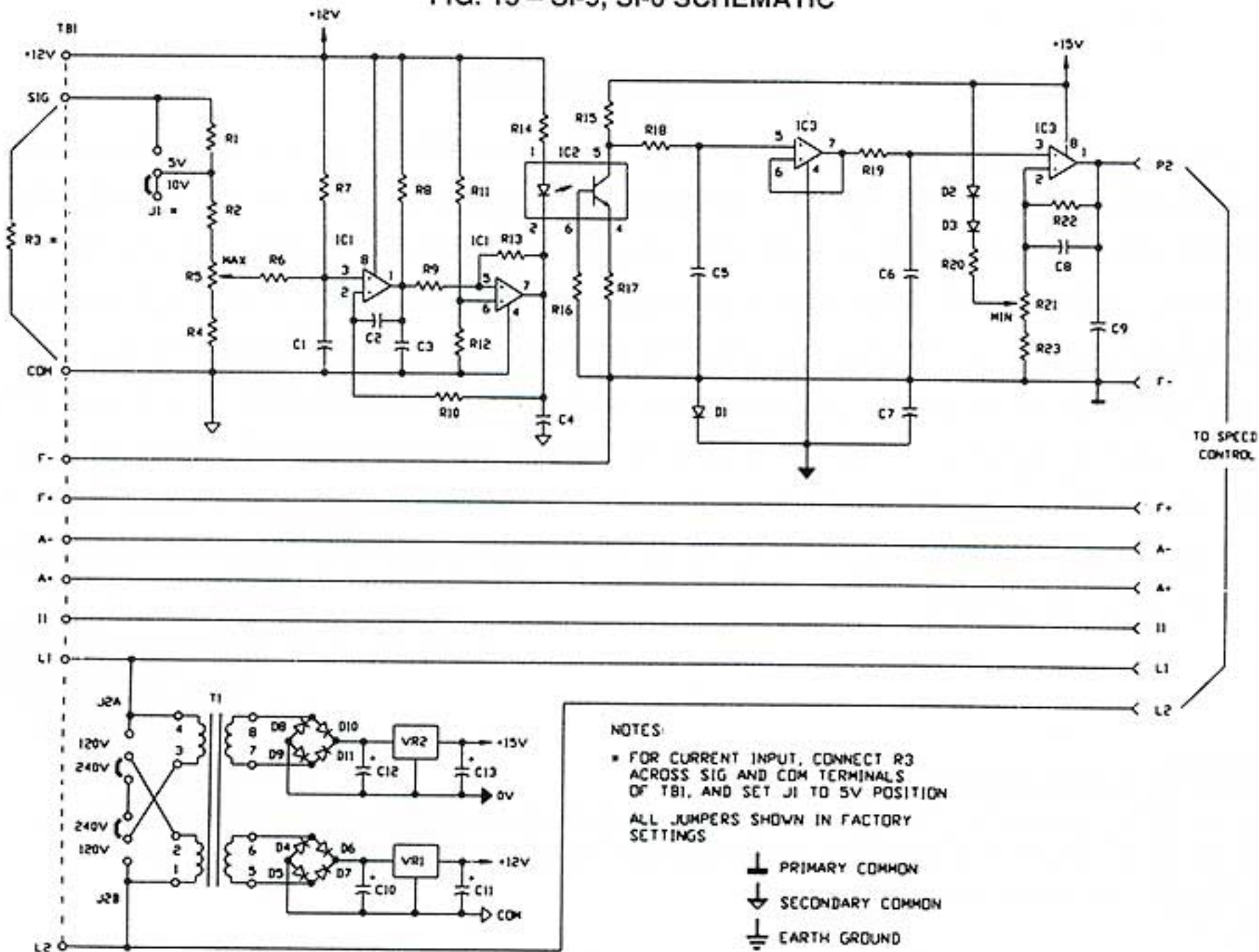
TABLE 4 – SI-5, SI-6 PARTS LIST

Ckt Ref	Specification	Manufacturer-Type	Function
C1,9	0.1 μ F-50V-20%	Metal Film	Capacitor
C2	0.022 μ F-50V-20%	Metal Film	Capacitor
C3,8	0.047 μ F-50V-20%	Metal Film	Capacitor
C4	0.01 μ F-50V-20%	Ceramic	Capacitor
C5	0.047 μ F-50V-20%	Metal Film	Capacitor
C6	0.1 μ F-50V-20%	Metal Film	Capacitor
C7	0.1 μ F-50V-20%	Metal Film	Capacitor
C10,12	100 μ F-35V-20%	Electrolytic	Capacitor
C11,13	10 μ F-35V-20%	Electrolytic	Capacitor
D1-11	0.15A-100PIV	1N4148	Diode
IC1	-----	LM393	Dual Comparator
IC2	-----	4N37	Opto Isolator
IC3	-----	LM358	Dual Op Amp
R1	20K-0.25W-5%	Carbon Film	Resistor
R2	6.2K-0.25W-5%	Carbon Film	Resistor
R4	3.3K-0.25W-5%	Carbon Film	Resistor
R5	10K-0.33W-20%	Cermet	Max Trimpot
R6,18	240K-0.25W-5%	Carbon Film	Resistor

TABLE 4 – SI-5, SI-6 PARTS LIST (Continued)

Ckt Ref	Specification	Manufacturer-Type	Function
R7	1.5M-0.25W-5%	Carbon Film	Resistor
R8	4.7K-0.25W-5%	Carbon Film	Resistor
R9-11	47K-0.25W-5%	Carbon Film	Resistor
R10	47K-0.25W-5%	Carbon Film	Resistor
R12	22K-0.25W-5%	Carbon Film	Resistor
R13,19	100K-0.25W-5%	Carbon Film	Resistor
R14	1.6K-0.25W-5%	Carbon Film	Resistor
R15	6.8K-0.25W-5%	Carbon Film	Resistor
R16	180K-0.25W-5%	Carbon Film	Resistor
R17	220Ω-0.25W-5%	Carbon Film	Resistor
R20	27K-0.25W-5%	Carbon Film	Resistor
R21	10K-0.33W-20%	Cermet	MIN Trimpot
R22	27K-0.25W-5%	Carbon Film	Resistor
R23	5.6K-0.25W-5%	Carbon Film	Resistor
T1	30mA-36V	DST236	Transformer
VR1	100mA-12V-POS	78L12ACP	Voltage
VR2	100mA-15V-POS	78L15ACP	Voltage

FIG. 15 – SI-5, SI-6 SCHEMATIC



V – LIMITED WARRANTY

For a period of 18 months from date of original purchase, KB 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, and we are 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 so that they may not apply to you. In any event, KB's total liability, under all circumstances, shall not exceed the full purchase price of this unit. (rev 4/88)



KB ELECTRONICS, INC.

12095 NW 39th Street, Coral Springs, FL 33065-2516 • (954) 346-4900 • (954) 346-3377

Outside Florida Call **TOLL FREE** (800) 221-6570 • **E-mail** – info@kbelectronics.com

www.kbelectronics.com