

## **KBIC DC Motor Speed Control Simplified Troubleshooting Guide for Non SMT drives**

Please follow the next few steps in order to determine if the control is in warranty.

**EQUIPMENT NEEDED:** Digital voltmeter (VOM) with diode test, alignment tool, and potentiometer, line cord, 100-watt bulb

**STEP 1:** Visually inspect the KBIC drive for broken components, burn and/or smoke marks, or blown devices. Mishandling of the control causes broken Components. Miswiring of the control causes burn or Smoke Marks.

Blown Devices, such as SCR's or flat pack diodes, are caused by shorted or possibly grounded armature leads. Blown Devices, such as MOV's, are usually caused by an over line voltage condition or line surges greater than the MOV can tolerate.

**STEP 2:** Set scale of VOM to diode scale. Remove Plug-In-Horsepower® Resistor.

(A) Check resistance across L1 and L2. Reading should show infinite or open circuit. Be sure to reverse leads across L1 and L2. Reading should still be infinite. Measurement values shown below are approximate only and reflect measurements made with a Beckman 310 digital VOM. Other meters will have different results. I suggest you use a known good control as your guide and compare its readings with the suspect control.

If "0" ohms is observed, check field diodes D4 and D7.

With (+) lead on L2 and (-) lead on L1,

If .66 ohms is observed, replace diode D7

If .56 ohms is observed, replace diode D2.

With (+) lead on L1 and (-) lead on L2,

If .66 ohms is observed, replace diode D4

If .56 ohms is observed, replace power diode D1.

(B) Check resistance across F+ and F-. With (+) lead on F+ and (-) lead on F-, reading should be infinite. With reversed leads, reading should be 1.2 ohms. If reading is less, check diodes D4 and D7 (see above).

(C) Check resistance across A+ and L2. Reading should be infinite. If reading is less than infinite, check SCR2.

(D) Check resistance across A+ and L1. Reading should be infinite. If reading is less than infinite, check SCR1.

(E) Check resistance from A+ to F-. With (+) lead on F- and (-) lead on A+, reading should be .55 ohms. With leads reversed, reading should be infinite. If readings are "0" ohms, check power diode D3.

(F) Change resistance scale to 10K or nearest selection. Check resistance from P3 to P1. Set MAX trimpot to 50% rotation. Resistance should read about 5,000 ohms. If resistance is infinite, MAX pot must be replaced.

(G) Check resistance from P1 to I2. Set MIN trimpot to 50% rotation. Reading should be about 1200 ohms. If reading is "0" or infinite, MIN pot must be replaced.

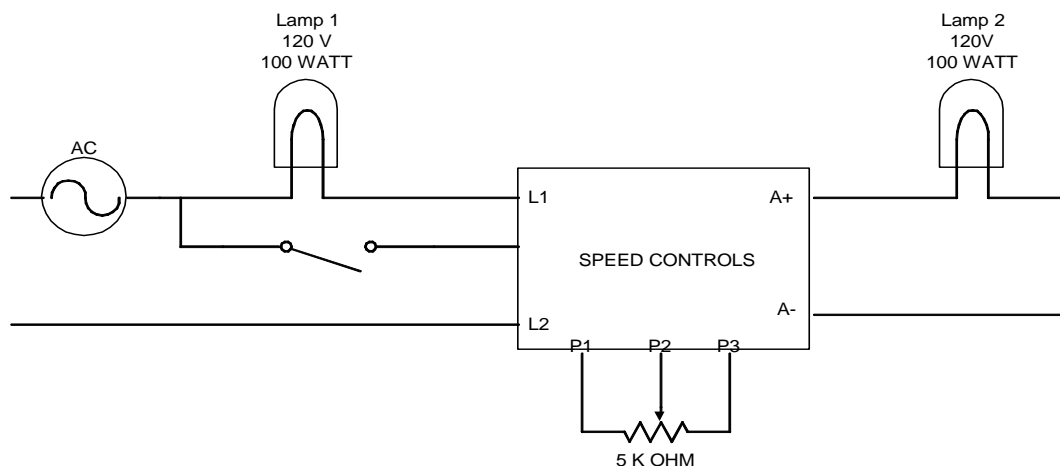
(H) Change scale back to diode scale. Check resistance across Zener diode Z1. With (+) lead on stripped end and (-) lead on plain end, reading should be infinite. With reversed leads, resistance should be .7 ohms ([ ]) your reading here). If reading is "0" or infinite with leads this way, replace Z1.

(I) Repeat Step (H) across Zener diode Z2.

(J) Check the resistance across the Plug-In-Horsepower® Resistor. It should equal the value printed on the resistor, or at least indicate continuity, not an open.

STEP 3: On-Line Test. Connect 5K pot to P1, P2, and P3. Connect 100W lamp to A+, A-. If testing a 120V control, be sure to use a 120V lamp. Likewise, use a 240V lamp for 240V controls or two 120V lamps in series. A 240V lamp may be used for 120V controls. However, the lamp brightness will be reduced.

In order to avoid any unnecessary damage to controls, I strongly recommend that you add a 100W lamp in series with the AC line. This will protect the control from shorting in case any steps were overlooked. Also, add a simple SPST toggle switch in parallel with the lamp. This will allow you to put direct line voltage on the control. (See Fig. 1)



Be sure SPST switch is in OPEN position and 5K pot is set fully CCW. Be sure to replace plug-in-resistor. Apply line voltage. If control is good, lamps 1 and 2 should be dim or off. If lamp 1 is at full brightness, then there is a short circuit in the Power Bridge of the KBIC control. Remove control from test and repeat Step 2 (A)-(E).

If lamp 1 is dim or off, slowly rotate 5K pot until lamps 1 and 2 increase in brightness. If this is not the case, some voltage checks should be made.

Using the digital VOM, select the proper AC scale to measure the incoming AC voltage across L1 and L2. This will verify that AC voltage is present at the control terminals. Next, change scales from AC to DC 250V range. Check voltage from F+ to F-. On 120V controls the reading should be approximately 106VDC. Double that for 240V controls. On 240V controls the field voltage may vary depending on the actual line voltage. If field voltage is not present, or ½ the required voltage, check diode D4 or D7. Next, measure the voltage from A+ to A-. Be sure to rotate 5K pot fully CW. Readings should be 90 or 180VDC, depending on input line voltage. If voltage reading is low, adjust MAX trimpot to proper setting. If output is not adjustable either with MAX trimpot or with 5K pot, then check the following test points.

Reset scale on digital VOM to nearest range above 20VDC. With (-) lead on F-, measure voltage at junction of R17 and Z2. Reading should be 18+ volts. If reading is below 20 (such as 15 or 12), then Zener diode Z2 is wrong value and/or defective. It should be replaced with 22 volt, 1-watt device. If reading is "0", then Z2 or Q3 may be shorted. Check resistance of Z2 with AC power off. If normal (infinite and .7), then with the power off clip out Q3 and retest.

If voltage is 18V, observe reading while removing AC power. Voltage should drop instantly to 1.2V, then to "0" in 1 sec. This will confirm that the auto inhibit circuit (consisting of Q3 and Q2) is working.

If voltage is 20V, then check voltage on left terminal of MAX trimpot. It should read 12-15VDC.

If reading is less than or greater than this voltage, then Z1 is defective. Next, measure voltage on P3, while varying the MAX trimpot. Voltage should vary from 12-15 to 7-9VDC. If no reading is observed, MAX pot is open.

Next, adjust MIN pot to full CCW position. Measure voltage on P2 while varying the 5K pot. It should vary from 0 to 7+. The MAX voltage depends on where the MAX pot is set. If the voltage does not vary over this range, the MIN pot is open. While measuring the voltage on P2, vary the MIN pot. The voltage on P2 should increase smoothly. If it suddenly jumps to a higher value, then the MIN pot is open.

Next, measure the voltage on I1. Increase the 5K pot from 0 to full CW. The voltage on I1 should increase smoothly as a result of our controlled acceleration circuit (R5 & C101). Decreasing the 5K pot from full CW to 0 should cause the voltage to drop very quickly. This will confirm that diode D101 is OK.

This completes the simplified testing procedure that should help resolve 99% of all problems encountered.

