

DOUG'S TECH NOTES

By Doug Jones

Capacitor
 **WIZARD**®
IN-CIRCUIT ESR METER

What happens if I accidentally test a CHARGED CAP? Often no damage is done. If damaged, the Capacitor Wizard® is easy to fix.

How do I know if I damaged my Wizard? Measure some low value resistors. Verify agreement with the Capacitor Wizard®. If the Capacitor Wizard® closely agrees then it is working properly and in calibration. Measure Capacitor Wizard® input resistance using a standard multimeter with a low ohms capability. Zero out the **multimeter** probe resistance. Measure the resistance between the Capacitor Wizard® probes. The resistance between the probes should read between 2.3 to 2.5 ohms.

Why must I discharge Capacitors? The input resistance of the Capacitor Wizard® is held very low by two one ohm resistors (R51 & R52) and the low probe lead resistance of 500 milliohm. This low impedance insures a proper ESR measurement discarding transients. If you attempt to test a charged cap these resistors will often just discharge the capacitor, no damage done. However if the unit under test is turned on or if the capacitor has a lot of stored energy you will damage one or both of these resistors. You may also damage (2) capacitors (C23, 33uf@25v & C8, .1uf@50v), (Q5) 2N3904, (Q6) 2N3906, (R53) 100ohm 1/8w, U1 - TLC2274 (or Raytheon RC3403) - Do not substitute a LM324, MC3403 or any other part for the TLC2274 as they don't have enough gain @100khz to zero the meter.

"Get Well" parts kit: We sell a "get well" kit containing the parts discussed above. Present cost \$30 + shipping and handling. Or you may return the Capacitor Wizard® to the factory for a flat rate repair charge of \$65 + major parts(if any) & shipping and handling. Exception: Damage caused by battery leakage will be estimated at repair time. Check our web site <http://www.midwestdevices.com> for current prices, contact info and shipping instructions. Prices are subject to change.

CapSavr: If you must have protection we sell an easy to install protection kit (CapSavr): \$30 plus shipping & handling. Check our web site <http://www.midwestdevices.com> for ordering instructions and current pricing.

Repair Procedure: Refer to page 2. Select the appropriate diagram - Cap1A or Cap1B (Cap1B for all Wizards after 1997). Check R51 and R52 with an ohm meter. They should each measure 1 ohm. Check R53 is 100ohm. If defective replace these resistors and check for operation. If still not working get an oscilloscope and set it to AC coupled 200mv/div vertical and 2us/div horizontal. Check on both sides of C23 to ground for 2 cycles of 1.6vpp 100khz sine wave. Ground is the wide outside PC trace that the 1 ohm resistors are soldered to. If the waveform is missing, 0.15V higher or lower than 1.6vpp, badly distorted, or indicates crossover distortion, replace C23, Q5 and Q6. Q5 is a 2N3904 NPN and Q6 is a 2N3906 PNP. Replace these transistors **in pairs**! It has been our experience that if one transistor is bad, the other has been damaged even if it checks good.

Signal Trace AC Amp CAP1A ONLY: Short the Capacitor Wizard® test leads together and keep them shorted for the following tests. With scope check U1 for these 100khz sine waves: U1 pin 1 = 30mvpp, U1 pin 7 = 160mvpp, U1 pin 8 = 900mvpp. If waveforms are missing or vary drastically from a sine wave, replace U1.

Signal Trace AC Amp CAP1B ONLY: Short the Capacitor Wizard® test leads together and keep them shorted for the following tests. With scope check U1 for these 100khz sine waves: U1 pin 8 = 30mvpp, U1 pin 7 = 160mvpp, U1 pin 1 = 900mvpp. If waveforms are missing or vary drastically from a sine wave, replace U1.

Repair Technique: Use a de-soldering tool to remove the bad resistors and capacitors. If not socketed, the IC is best removed by cutting all pins next to the IC body and then using a soldering iron and a pair of long nose pliers to remove each pin separately. Use a de-soldering tool to clear the holes. You can add a low profile IC socket if you want. The IC's are socketed in current production units.

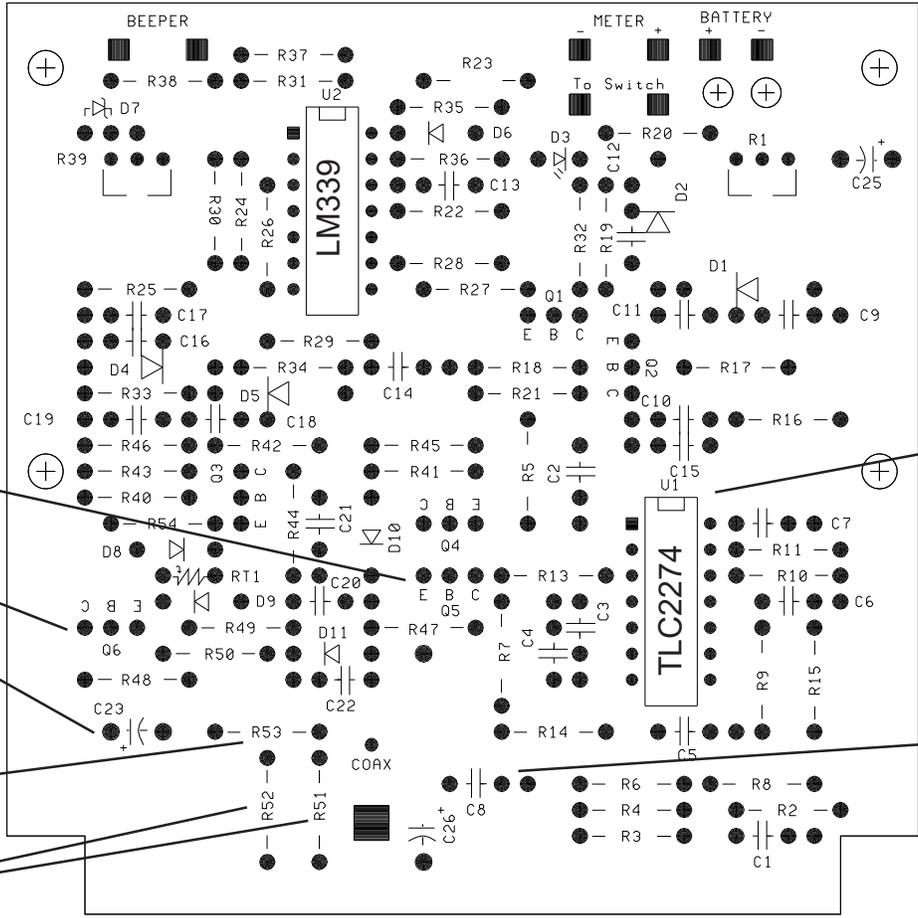
Calibration: The calibration is permanently set by the accuracy of R51 and R52. To confirm calibration measure some 5% resistors such as 1 ohm, 2 ohm, 3 ohm. Zero the Capacitor Wizard® as closely as you can, then measure the test resistors you have selected. If the Capacitor Wizard® closely agrees with the test resistors then the it is working properly and in calibration. Any large difference in measured resistance (1 ohm measures 3 ohm and so on) indicates damage. A repair kit will fix the damage.

Capacitor Wizard®

© Copyright by Doug Jones 1995-2021

Midwest Devices LLC, 16657 East 23rd St. Suite 353 Independence, Missouri 64055

Cap1A
Component Side



Q5
2N3904

Q6
2N3906

C23
33uf
25vdc

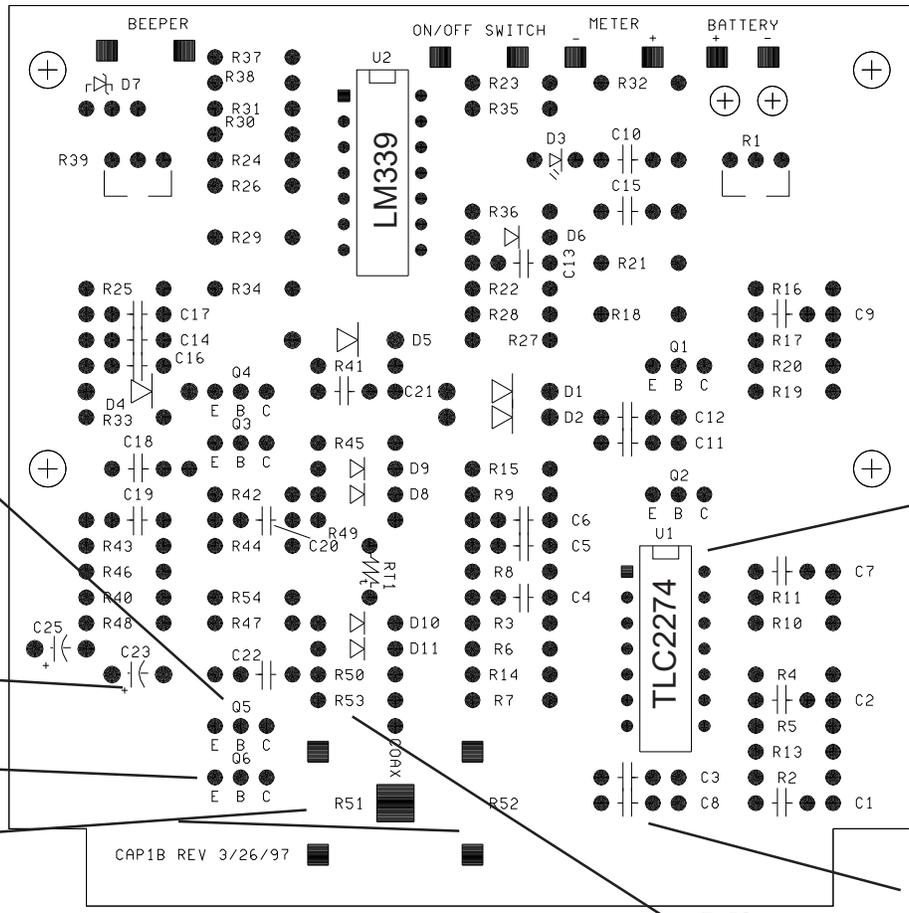
R53
100 ohm 1/4w

R51 & R52
1 ohm 1% 1/4 watt

U1
RC3403
Use TLC2274

C8
0.1uf 50vdc

Cap1B
Component Side



Q5
2N3904

C23
33uf
25vdc

Q6
2N3906

R51 & R52
1 ohm 1% 1/4 watt

U1
RC3403
USE
TLC2274ACN

C8
0.1uf 50vdc

R53
100 ohm 1/8w

CAP1B REV 3/26/97