

DOUGS TECH NOTES

Capacitor

IN-CIRCUIT ESR METER

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Repair Procedure

What happens if I accidentally try to test a CHARGED CAP and break the Wizard?? 7/23/2007

Often no damage is done. Fortunately, if the Capacitor Wizard® is damaged, the damage done is easy to fix. The parts are NOT EXPENSIVE and are easy to replace.

First Identify Your PC Board (Cap1A or Cap1B)

The PC board is marked on the SOLDER side Cap1A or Cap1B. Cap1A & Cap1B are electrically identical - only the PC board layout & parts sizes are different. Choose the correct parts layout diagram on the next page. **If you have a BLACK BOX or the Capacitor Wizard® was purchased after July 1997 you have a Cap1B PC board.**

How do I know if I Damaged My Wizard?

Simply measure some low value resistors and check for agreement with the Capacitor Wizard® scale. The input resistance of the Capacitor Wizard® is held very low by two one ohm 1% 1/4 watt resistors (R51 & R52). If you attempt to test a charged cap these resistors will often just discharge the capacitor and no damage done. However if the unit under test is turned on or if the capacitor has a lot of stored energy you will open up or change the value of one or both of these resistors. To check these resistors **use a standard ohm meter and measure the resistance between the Capacitor Wizard® probes.** The resistance should read between **2.3 to 2.5 ohms**. If the resistors have been damaged the reading will be **high**. If the charge is large enough you may also damage (2) capacitors (C23, 33uf@25v & C8, .1uf@50v), (Q5) 2N3904 & (Q6) 2N3906, (R53) 100ohm 1/8w, and/or the op amp U1 - TLC2274 (Raytheon RC3403) - **WARNING: Do not use a LM324, MC3403 or any other substitute!** U1 must be a **TLC2274ACN or a Raytheon manufactured RC3403!** These are the only parts we have found bad due to checking charged caps. The transistors, caps, and R53 have only been bad on a few units, when the technician attempted to use the Capacitor Wizard® while the device under test was still turned on!!

If you can't locate the parts locally you may order them from us. We presently charge \$25 + shipping and handling for a "get well" kit containing the parts discussed above. You may return the Capacitor Wizard® to the factory for a flat rate repair charge of \$45 + major parts(if any) & shipping and handling. Check our website <http://www.midwestdevices.com> for contact info and shipping instructions. Prices are subject to change.

I know of no way to protect from mishaps without trading off sensitivity, accuracy and cost for protection. It is my opinion that you need the sensitivity and accuracy to find today's bad capacitors so therefore there is minimal protection - discharge the caps before you measure for ESR! We have now sold thousands of Capacitor Wizard®'s and this has not been a major problem! I have asked our customers who have had the misfortune to blow the Wizard® how they feel about trading off accuracy and sensitivity for protection. They all say to leave the Capacitor Wizard® design alone because it works so well. If you must have protection we can sell you a protection kit for \$25 plus shipping. Check our website <http://www.midwestdevices.com> for ordering instructions and current pricing.

Capacitor Wizard® Repair Procedure: Check R51 and R52 with an ohm meter. They should each measure 1 ohm. Check R53 for 100ohm. If open 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. **WARNING: Replace these transistors in pairs!** It has been our experience that if one is bad, the other has been damaged even if it checks good.

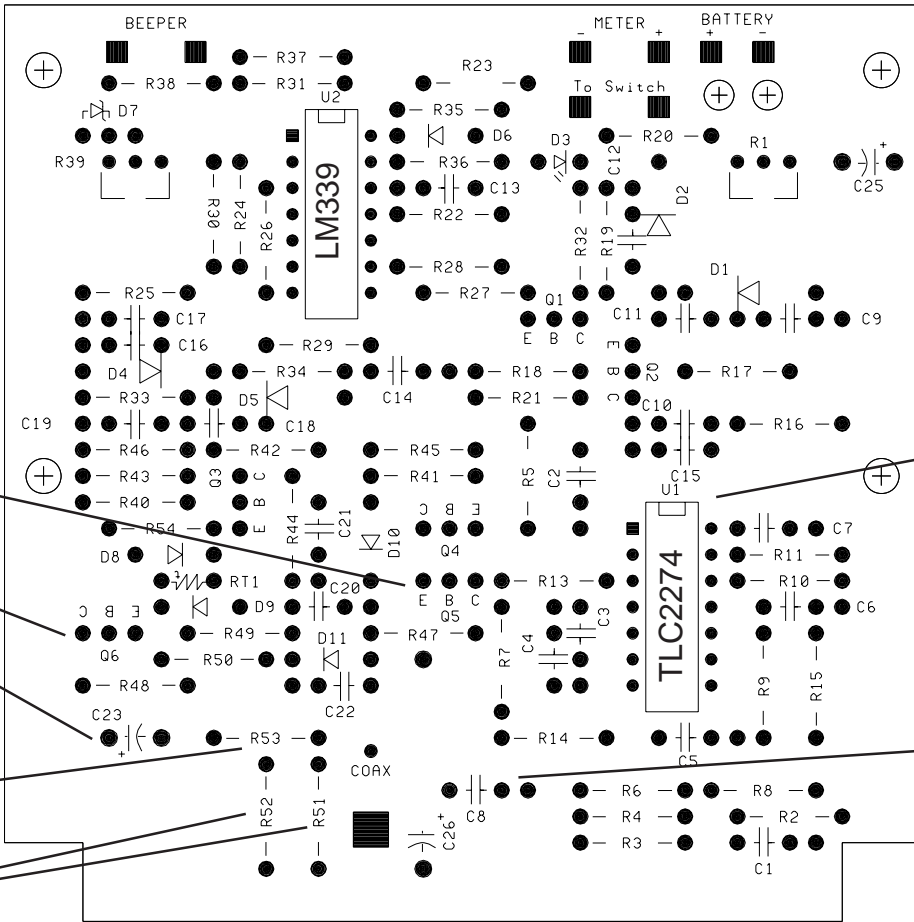
Check AC Amp **CAP1A ONLY!** --- Short the Capacitor Wizard® test leads together and keep them shorted for the following tests. With scope check U1 for these 100khz sine waves: U1 pin 1 = 30mvpp, U1 pin 7 = 160mvpp, U1 pin 8 = 900mvpp. If waveforms are missing or vary drastically from a sinewave, replace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

Check 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 sinewave, replace U1.

Use a de-soldering tool to remove the bad resistors and capacitors. The IC is best removed by cutting all pins next to the IC body and then using a soldering iron and a pair of longnose 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 check your repair measure some known resistors. Measure fixed resistors (such as 1 ohm, 2 ohm 3 ohm) of the same value as the ESR resistances printed on the Capacitor Wizard® scale. Zero the meter as closely as you can, then measure the test resistors you have selected. The scale should closely agree with the test resistors values. Any large difference indicates resistors R51, R52 have changed value and/or U1 TLC2274ACN has been zapped.

Cap1A
Component Side



Q5
2N3904

Q6
2N3906

C23
33uf
25vdc

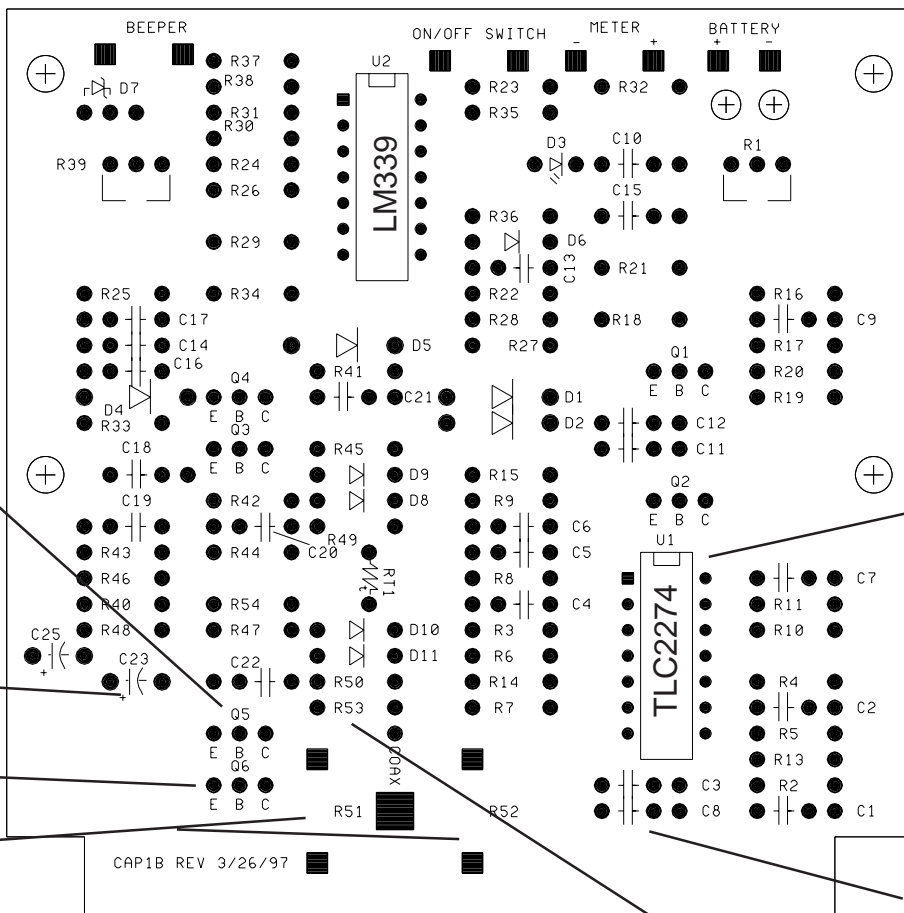
R53
100 ohm 1/4w

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

R53
100 ohm 1/8w

U1
RC3403
USE
TLC2274ACN

C8
0.1uf 50vdc