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# TECHNICAL SERVICE BULLETIN

## Electronic Tachometer, Part II

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This is the second in a series of articles detailing the operation, repair, and calibration of the Smiths electronic tachometer RVI 2602/00A as fitted to the Austin-Healey 3000, series BJ8. In the first article we looked at setting up a bench-test rig to check out the operation and calibration of the tachometer by recreating the current pulse train similar to the pulse train in the car's ignition system. We will now take a look inside the tachometer.

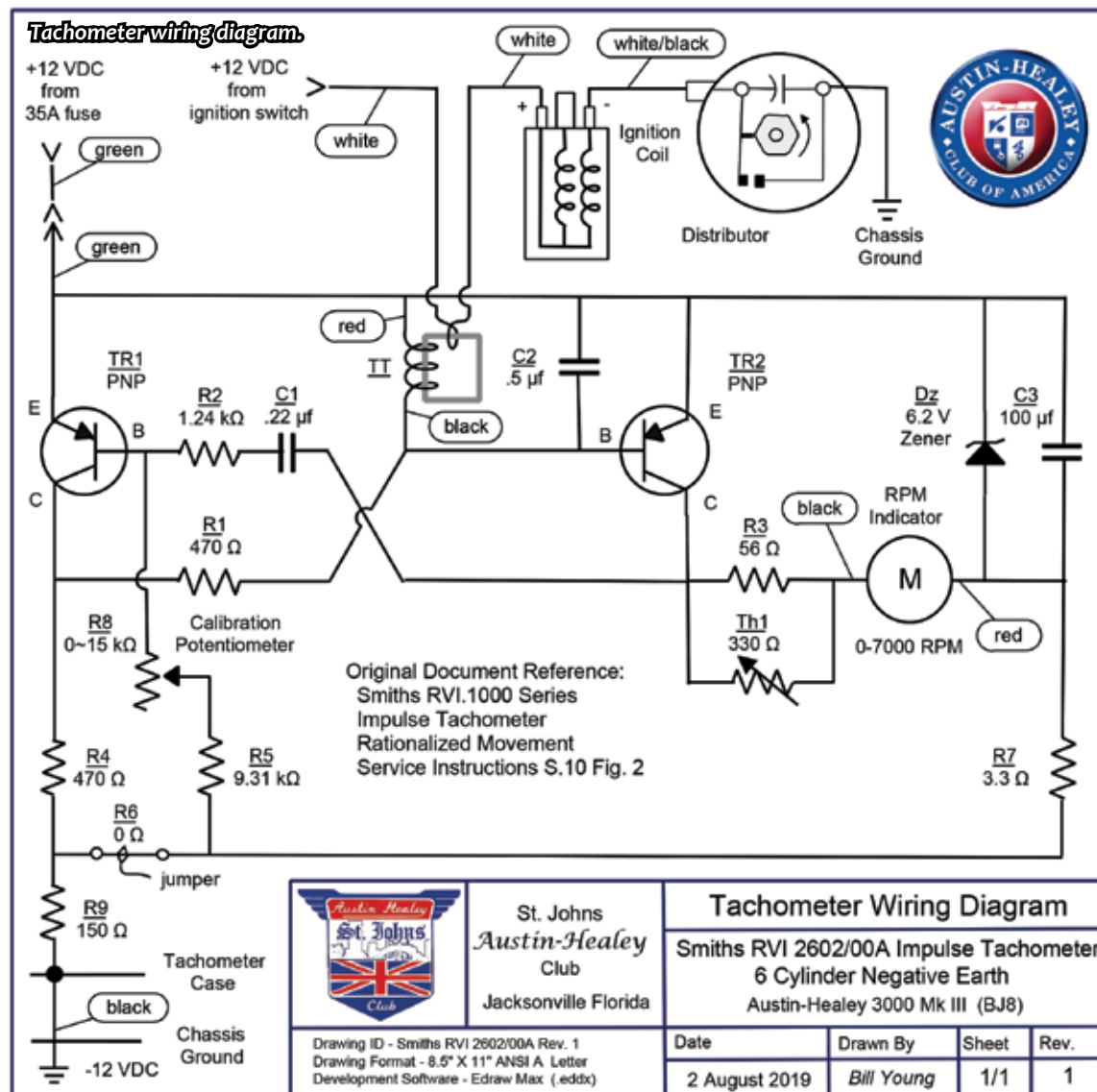
Smiths Motor Accessory Division published a set of Service Instructions for the RVI.1000 Series impulse tachometers with both 6 VDC and 12 VDC terminal connections. The latest revision included modifications for a "rationalized movement" with only a 12 VDC terminal connection. Referencing this

document, page 10 fig. 2, I developed a new electrical diagram (Tachometer Wiring Diagram) illustrating the tachometer circuitry configured for a negative-earth application. The diagram is an inverted presentation of the original positive earth configuration. A 12 VDC nominal voltage value is assigned to this system for the purpose of conveniently designating its voltage class. The actual voltage at which the tachometer operates on can vary within a range of approximately 11 to 14 volts.

The circuit is designed as a two-transistor monostable (single shot) multivibrator creating a pulse train proportional to the engine RPM. In steady state, transistor TR1 is "on" and transistor TR2 is "off." Capacitor C1 is charged to 6 volts

(nominal). When the distributor points open, the triggering transformer TT coil pulses the base of TR2, turning it "on." Transistor TR1 is turned "off" and capacitor C1 now discharges until the voltage level on the base of TR1 reaches the point that TR1 is turned back "on." TR2 is turned "off" returning the circuit back to the stable condition. The pulse width is determined by the RC time constant of capacitor C1, resistors, and the calibration potentiometer R8. When transistor TR2 is "on," the D'Arsonval DC moving coil meter movement reads current produced by the RMS (root-mean-square) voltage value of the pulse train and resistor network. The meter faceplate is scaled in RPM.

These tachometers are now more than 50 years old and may not be accurate over the RPM range, or



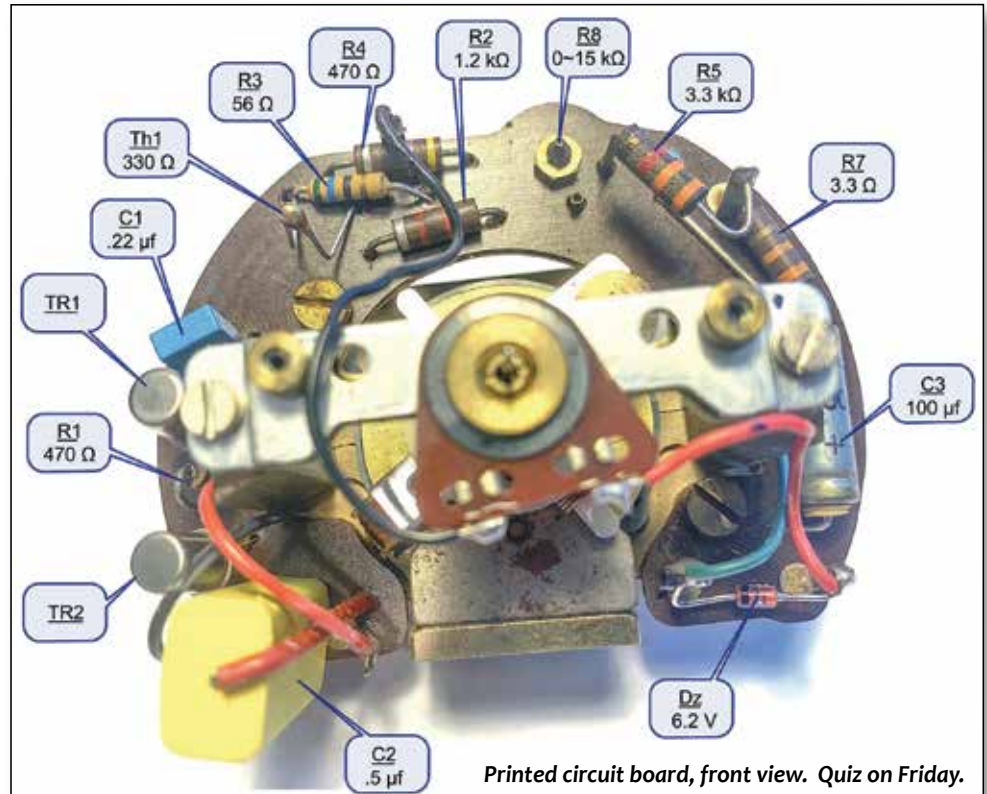


just may not work at all. The resistors seem to hold up over time, however, the semiconductors and capacitors are more likely to fail. It is possible to replace failed components on the PCB (Printed Circuit Board). This takes a little skill, a lot of patience, and a good soldering workstation with adjustable heat and fine soldering iron work tips. See the front and side view photographs showing the component layout for reference.

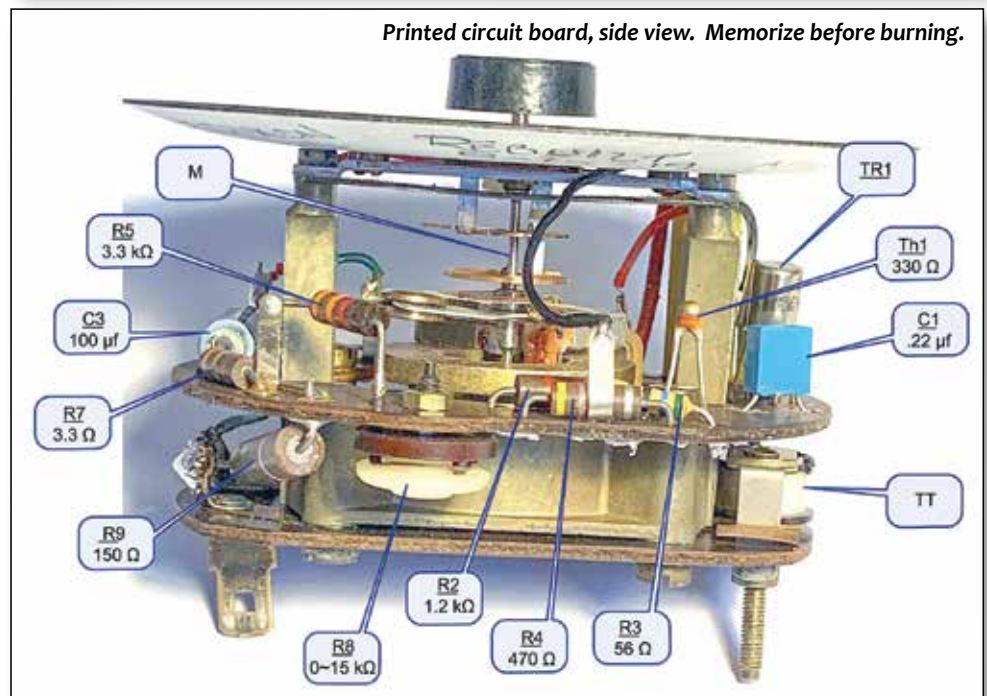
The most common component failure is capacitor C1. This was originally a .25 mfd (microfarad) capacitor, however, it is no longer commercially available. An Epcos #B32529C1224K000 .22 mfd 100 VDC capacitor will work in place of the .25 mfd (Digikey 495-2492-ND). The PNP transistors TR1 and TR2 can be replaced with NTE Electronics #NTE158 available on Amazon. The zener diode creates the 6 VDC internal power supply. A 6.2 volt 1 watt ON Semiconductor #1N4735ATR works well (Digikey 1N4735AFSCT-ND).

The thermistor Th1 varies the resistance of the network to compensate for temperature change and keeps the indication constant over a wide range of temperatures our Austin-Healey's experience. Working with Tom Hayden from the Sunbeam Alpine Club, we have found that the best replacement for this component is the Vishay type NTC 330 ohm 3560k thermistor #NTCLE100E3331JB0 (Digikey BC2418-ND). Tom has done some extensive heat rise testing on this temperature compensation circuit to confirm the best available replacement for the original thermistor.

It is both interesting and challenging to understand the electronic circuitry used in the Smiths RVI series tachometers.



Printed circuit board, front view. Quiz on Friday.



Printed circuit board, side view. Memorize before burning.

There are new circuit boards available to replace the old TTL logic, but there is some degree of satisfaction restoring the original back to operation.

In the next article, I will have some oscilloscope trace pictures of the wave forms across the C1 capacitor showing the charging and dis-charging timing traces. We will also look at the three calibration set-points and how they relate to the linear accuracy over the RPM range from idle to red line. **HM**