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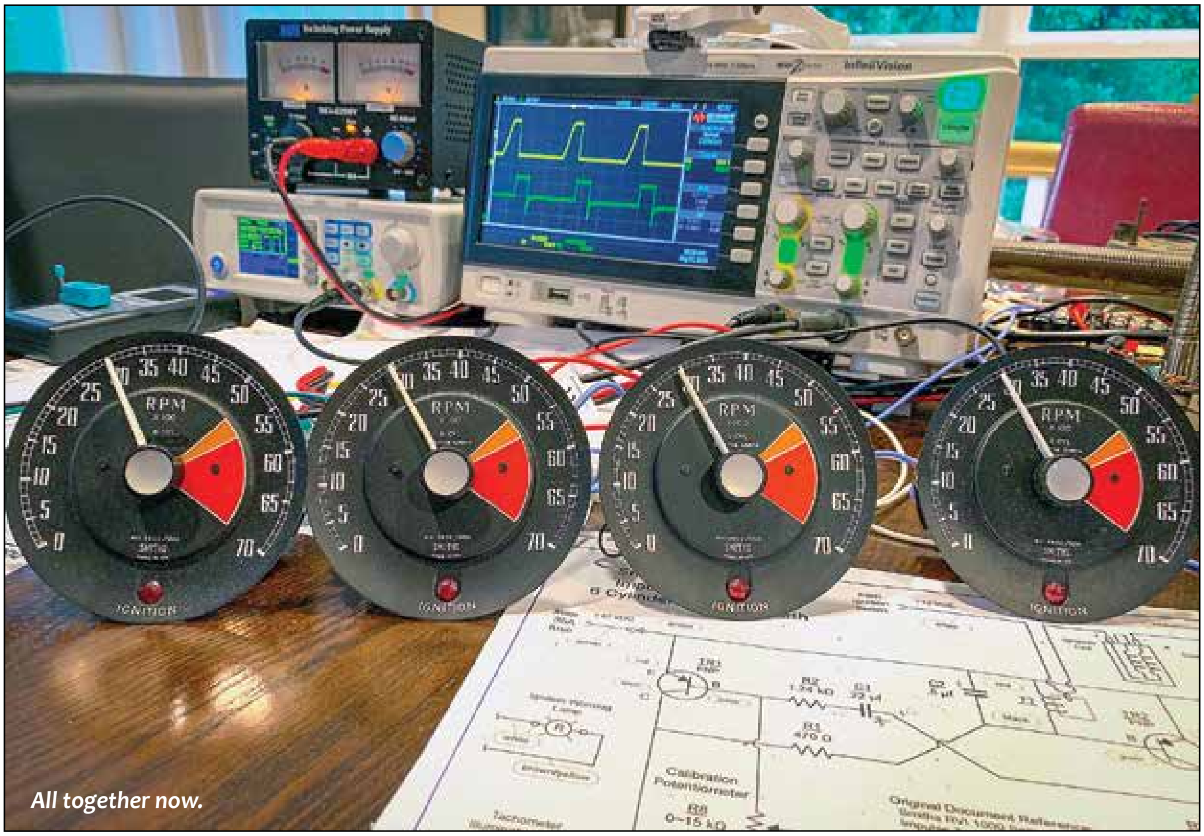
Electronic Tachometer, Part III

Bill Young, Jacksonville, Florida, St. Johns Austin-Healey Club



All together now.

This is the third 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 second article we looked the electrical wiring, printed circuit board configuration and components, and transistor logic operation. Now we will look at some oscilloscope trace pictures of the waveforms showing the pulse trains and the charging and discharging timing curves. 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.

Perhaps this is all a bit more than you want to know about the brief period of time in the 1960s where the engineers at Smiths Motor Accessory Division used transistors in place of the mechanical tachometer assembly to measure RPM. They had to develop a transistor-based monostable multivibrator timing circuit using resistors and a capacitor network to create the pulses for the tachometer meter to read.

Referencing the Tachometer Electrical Diagram in the healey marque February issue, capacitor C1 is the main component in this timing circuit. It is interesting to see the oscilloscope trace waveforms on each side of this capacitor when the tachometer is in operation. Open a cold brew (I recommend Young's Bitter Fine Ale) and take a look at the waveform traces on the screen capture in this article.

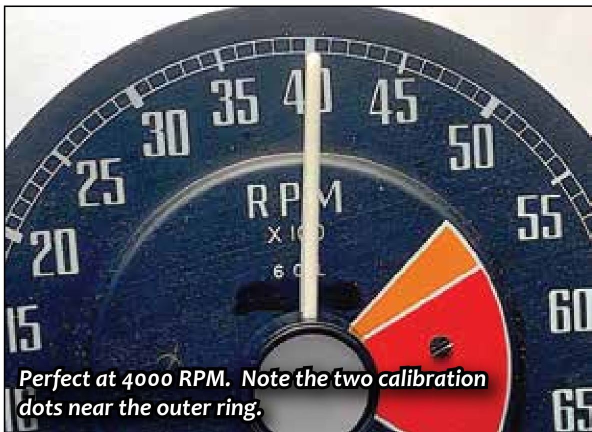
Trace #1 is the pulse train created by the bench test setup much like the assembly published in the healey marque January issue to simulate the ignition system pulses created from the operation of the points in the distributor. The current in this circuit is inductively coupled to the trigger transformer (TT) through the single loop on the back of the tachometer.

Trace #2 is the output side of the trigger transformer connected to the base of transistor TR2. The trigger transformer secondary coil stores a small amount of energy which is released when the points open driving the base voltage on TR2 low and turning it "on."

Trace #3 is on the transistor TR1 side of capacitor C1. This trace illustrates the waveform when TR2 is "on" summing the 12-volt collector voltage with the 6-volt C1 capacitor voltage to apply 18 volts to the base of TR1 turning it "off." Capacitor C1 then discharges until the voltage reaches the point where TR1 turns back on returning the circuit back to stable condition.

Trace #4 is on the collector side of TR2. This trace illustrates the internal circuit pulse train created when TR2 is turned "on" and "off." The RMS voltage of this pulse train is what the meter reads. The frequency of these pulses determines the voltage proportional to engine RPM.

Right on at 1500 RPM. Note the two small calibration marks - dashes - next to the outer ring.



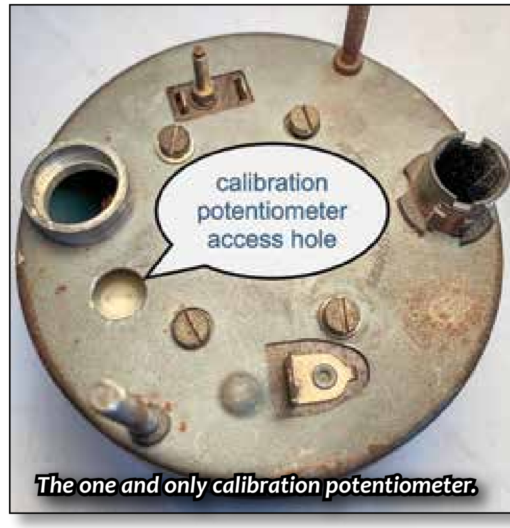
Perfect at 4000 RPM. Note the two calibration dots near the outer ring.

As good as it gets at 6000 RPM. Note calibration dash-marks near outer ring.

With the tachometer meter working correctly, it is time to calibrate it. There is only one calibration potentiometer (R8) and it is located on the printed circuit board enclosed in the case. It is recommended that the tachometer be calibrated in the case, therefore, I drilled a small access hole in the back of the case to allow access to this adjustment.

You will see calibration set points (small marks) on the dial face at 1500, 4000, and 6000 RPM. I have found that a good operating tachometer can be linearly calibrated within these set points.

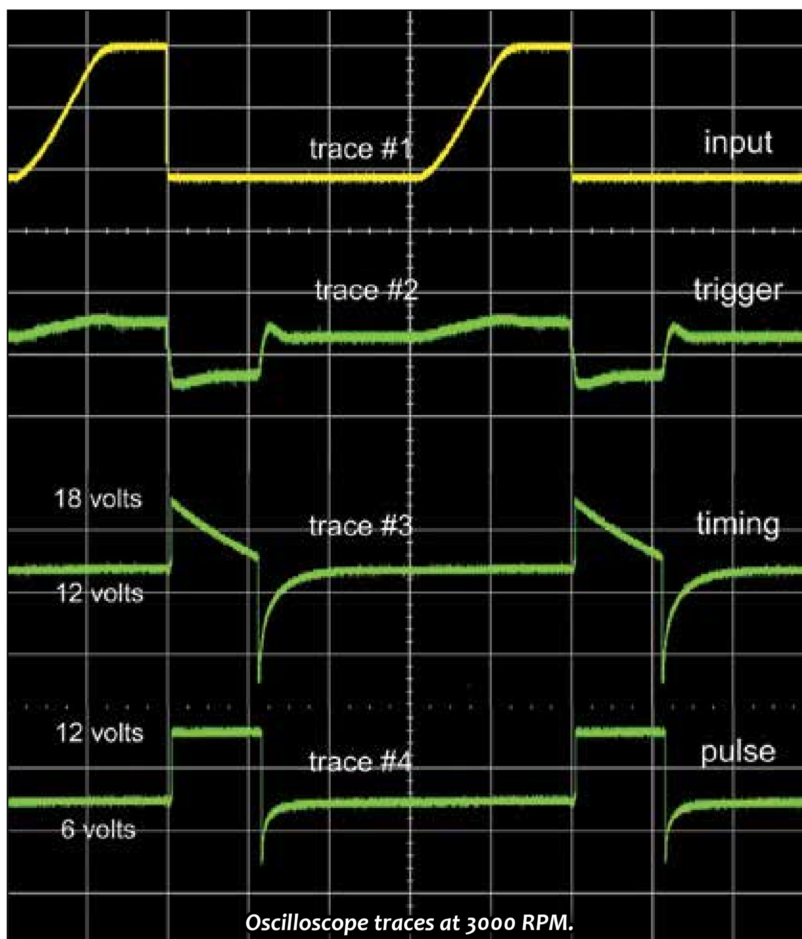
Using the bench test set-up, set the signal generator 150 Hz. and adjust the R8 potentiometer to 3000 RPM. Wait a few minutes for the unit to stabilize and reduce the signal to 75 Hz. and confirm 1500 RPM indication. Move up to 300 Hz. and confirm 6000 RPM. A small amount of back and forth adjustment may be necessary to keep the three settings within the calibration set points on the dial face.



The one and only calibration potentiometer.

It wasn't long before Integrated Circuits (IC) replaced this earlier TTL circuitry. Just as transistor radios and cassette tapes were replaced with new technology, electronic tachometers advanced as well. However, there is some satisfaction to be had in knowing how these devices worked at the time they were state of the art.

In the next article we will be going out on the byway and do some field tests using a GPS and a digital RPM measuring instrument comparing indicated road speed and RPM against GPS set actual speed, tire circumference, differential gear ratio, and mathematically calculated parameters. Did you know there are 63,360 inches in a mile? HM



Oscilloscope traces at 3000 RPM.