AUSTIN HEALEY BJ8 SMITHS ELECTRONIC TACHOMETER

INSTRUCTIONS FOR REBUILDING THE ELECTRONICS

Overview

This paper details how I rebuilt the electronics of my Smiths tach. Before the rebuild, it would often act very erratic, especially when hot. The tach is now rock-stable.

What needs to be done is the following: You need to remove the mechanism from the housing, to expose the circuit board. You need to replace two transistors, one diode, three capacitors, and a number of resistors. Some skill at working on and soldering/de-soldering a printed circuit board is required. You will also need to exercise great care while performing all of this work, to be sure that you don't damage the very delicate indicator needle. You will then need to reassemble, and recalibrate the tach.

Dismantling

To open up the tach, you must do two things You must remove the chrome bezel and the glass, and you must remove two screws. Usually you can just hold the bezel in one hand, while holding the housing in the other You then twist the bezel until the locking tabs route to the position where you can pull off the bezel. After time, the rubber gasket inside the bezel will have hardened. But with effort you can get it off. There are 4 brass screw on the back of the housing. Two hold the mechanism into the housing, and two hold the internal mechanism together. You must remove only the two that do actually hold it into the housing. You can tell because they actually clamp up to the housing. The other two are clearing the housing . they do not touch it. Don't remove those screws. You can now CAREFULLY cup your hand over the face of the instrument, and allow the mechanism to fall out of the housing and into your hand. Be very careful not to damage the needle with your hand.

Rebuilding the Electronic Circuit

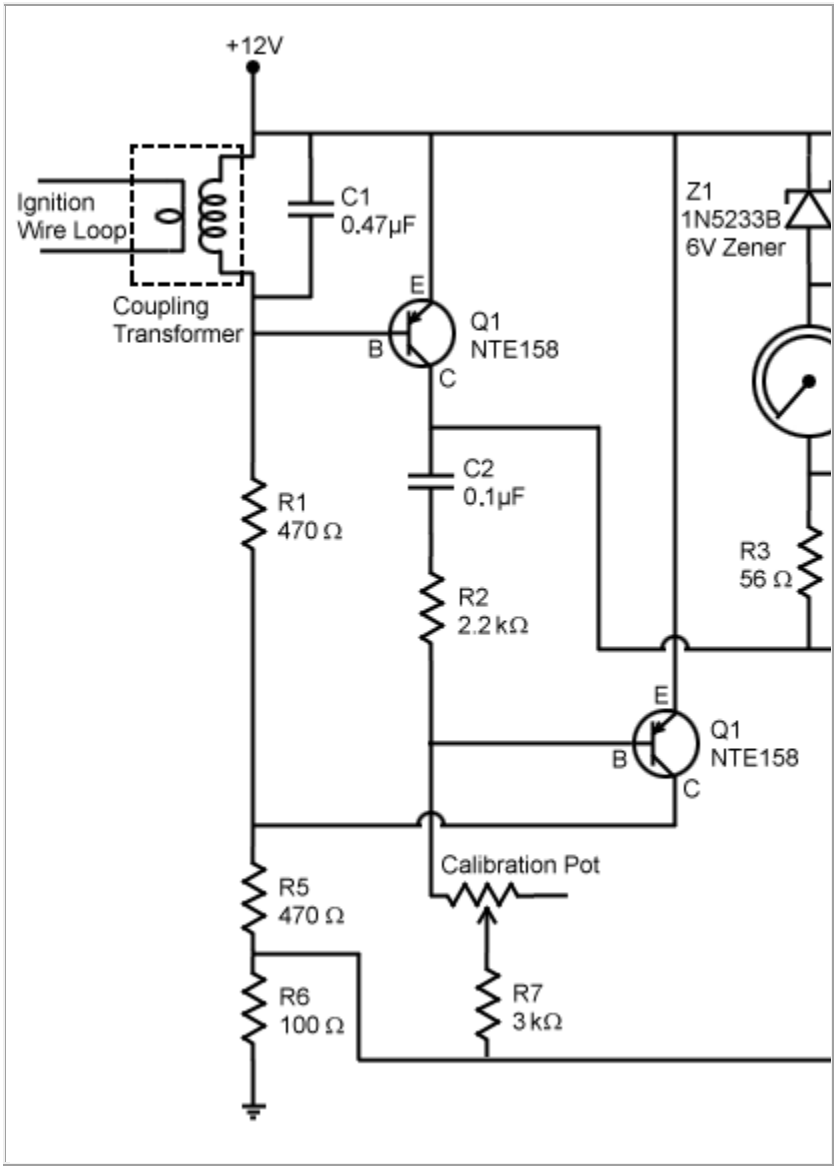
Once the internal mechanism is out of the housing, you will see the meter movement and on the back of the movement is a printed circuit board. This board holds all of the parts that you need to replace. On this board you will find the two transistors (little metal cans with 3 wires protruding), one diode (glass bead with two wires), and a number of resistors (brown cylinders with color bands around them - two wires). There will also be 3 capacitors (two wires), and a thermistor. I would recommend that you replace each part one at a time, with its replacement. Then proceed on to the next part. The resistors

are color coded to show their value. I will show how to read that in the table below. You will notice a part on the schematic called a thermistor. This is designed to compensate for circuit changes that happen with temperature. I do not know the intended temperature coefficient of this, and I didn't replace mine. This is not the cause of erratic behavior. If this part doesn't work properly, you'd probably notice that the tach reading might change relative to temperature. What I mean is a drift in the reading based on how hot things are. Do not confuse this with the erratic behavior with heat that we are fixing with this rebuild. I haven't seen that problem, so leave it alone.

Below are the schematic, the drawings of the transistor areas of the circuit board, and the parts list... You can purchase all parts at www.mouser.com. Or you can go to one of many other electronic supply houses. The parts list below lists Mouser part numbers, along with the generic part numbers. The price for the resistors is 80 cents for a pack of 10 of each value. So you'll have extras of all resistors.

Parts List

Item	Qty	mouser.com Part Number	Price ea.
NTE158 Transistor	2	S26-NTE158	$ 2.24
1N5233B Zener Diode	1	78-1N5233B	$ 0.06
0.1uF Capacitor	1	140-PF2A104J	$ 0.22
0.47uF Capacitor	1	140-PF2A474J	$ 0.37
100uF Capacitor	1	140-TG101M1E-0813	$ 0.75
5 Ohm Resistor	1	293-5.1	$ 0.80/pkg
56 Ohm Resisto	1	293-56	$ 0.80/pkg



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100 Ohm Resistor	1	293-100	$ 0.80/pkg
470 Ohm Resistor	2	293-470	$ 0.80/pkg
2.2k Ohm Resistor	1	293-2.2K	$ 0.80/pkg
3k Ohm Resistor	1	293-3K	$ 0.80/pkg
Note: Use 1/2 Watt carbon resistors			

Table 1. Here's the parts list, including the part numbers for mouser.com

Fig. 1. Circuit Diagram - Smiths Electronic Tachometer

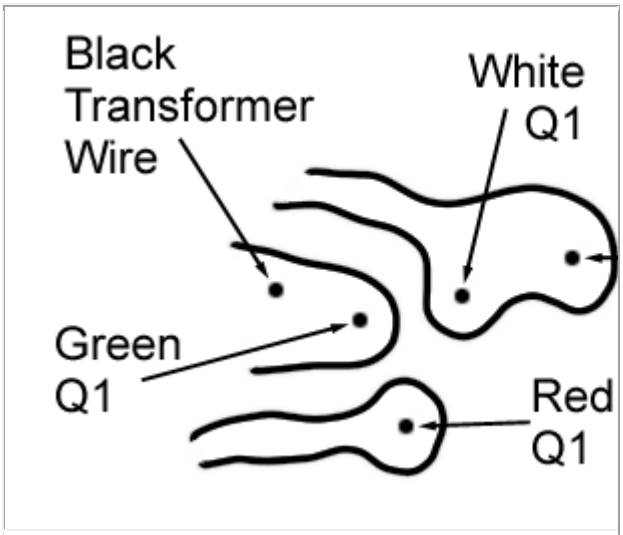

Fig. 2. Here's the drawing for the first transistor Q1

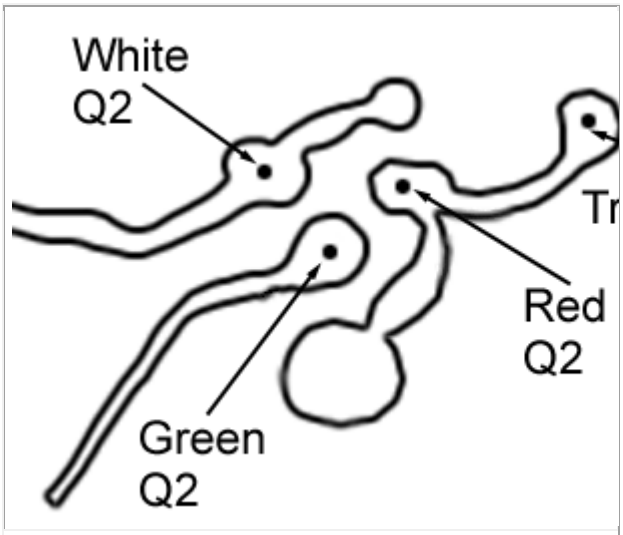

Fig. 3. Here's the drawing for the second transistor Q2

So...pick a part, and unsolder it. Insert its replacement all the way into the holes in the board, and solder it. Then clip off the extra wire. Proceed to the next part. Do all the resistors first. Then the capacitors. The l00uF capacitor will have a negative wire marked with some form of pointer on the body of the part. The original is the same way, but the markings might not look the same. You will have to figure out this "polarity", and install the new part the same way. Then replace the diode. The replacement may not look exactly like the original, that's okay. The diode also has polarity, and it too must be installed in the proper direction. There will be a black band closer to one side. Make a note of that and install the replacement diode in the same direction. I have hand drawings included to show how the transistors must be installed. It is critical to get this right The two transistors are identical. Refer to the picture for Ql. There will be 3 wires. One of the 3 wires will be closer to the other wires. That's the BASE (B). With the part in your hand, hold it so that the wires are away from you. That's the "top view". Notice on my drawing (lower right of Q1 drawing) that I have drawn a top view. You can see the orientation of the BASE, the EMMITER (E), and the COLLECTOR (C). You're looking down onto the top of the transistor. Now notice that I drew a picture of the circuit traces on the board. That's the bottom of the board. From the TOP of the board, you must insert the base wire into the hole marked "green Ql ". The wire should now protrude from the bottom insert the part so that the EMMITER wire protrudes through the hole marked "red Ql", and the COLLECTOR wire protrudes through the hole marked "white Ql". NOTE: On the original transistors, there was colored tubing on the wires. That's where the color designation came from You don't need to use the tubes, but you may if you wish to. Installing transistor Q2 is the same process as Ql, just follow the picture titled Q2, as that shows the circuit traces for that part Remember to push the part closely to the board, and then solder the wires. Then, clip off the excess.

Troubleshooting

Problems? There is no directional issue with the resistors. But the 100uF capacitor, the diode, and transistors MUST be installed correctly. If your rebuild does not work after reassembly, suspect either a bad solder connection, a solder bridge (short), or an incorrectly installed part. If you do install a part incorrectly, and you reconnect the tach into the car, the transistors, and/or the diode may be damaged. These parts are cheap. I bought extras just in case . .didn't need them but I got 'em.

Calibration

Before you put the tach back together, you will need to calibrate the rebuilt tach. There is an adjustment control (POT) on the circuit board for that purpose. Now here's a tough decision for you purist guys! It's difficult to calibrate the tach with the mechanism still out of the housing. You'd have to temporarily hook it up to the car, and set it in a position where it's oriented with the 4000RPM pointing up...as in the dash. Then you have to run the car with a tach/dwell meter sitting on your windshield. Run the car and adjust the Smiths tach to match the meter, and then disconnect, reassemble, and reinstall into the car. Here's what I did. You can make your choice. I drilled a hole into the back of the housing so that it lines up with the adjustment pot. (I can now insert a screw driver

through the hole to adjust the tach. I then put electrical tape over the hole to prevent dust from contaminating the internals). I then put my tach together, and reinstalled it into the car. I then hooked up my tach/dwell meter and set in onto the windshield. I started up the car, and ran it up to about 3000RPM as indicated on the meter. I then adjusted the Smiths tach to match that reading. NOTE: This tach is a very simply device. It was never very accurate. That means it does not track very well, and maintain good accuracy all across the RPM range. If you adjust it at idle, it will be way off at 4500RPM. If you adjust it at 4500 RPM, it'll be way off at idle. I chose to adjust it where I spend most of my time...around 2500 to 3000 RPM. You can play around, and make your own call on this one. It's the nature of the beast (simple but crude circuit) I'm afraid.

Conclusion

So . I hope this paper was useful. And I wish you success. It's really great to have a stable tach after all this time with it misbehaving. It's rock solid now! Here's another little tip. There's a capacitor with a value of .1 µF. If you make that cap slightly larger in value (say .15µF), the tach will respond to RPM changes slower. If you make it smaller, (say .08 µF), it will respond quicker. Too small though, and it will flutter at low RPM's. Too large, and it will stop responding properly at high RPM. Play with that at your own risk Oh by the way, DO THIS REBUILD AT YOUR OWN RISK. I wrote this up to help people out. I take ZERO responsibility if you have problems!!! I will however be happy to chat with someone having a problem and I will try to help if I can.