Caerbont Smiths RVC2816 Tachometer
Repair Report
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R1.1

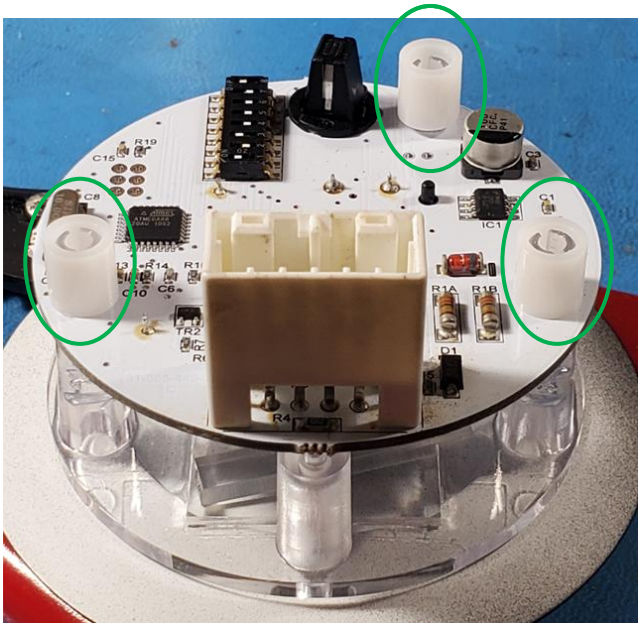
I was asked to try to repair a failed Caerbont Smiths RVC2816-00CB Stepper tachometer out of a vintage Shelby 289 Cobra. The symptom of the failure was the needle would vibrate a little for a few seconds after power on and then drop back to 0.

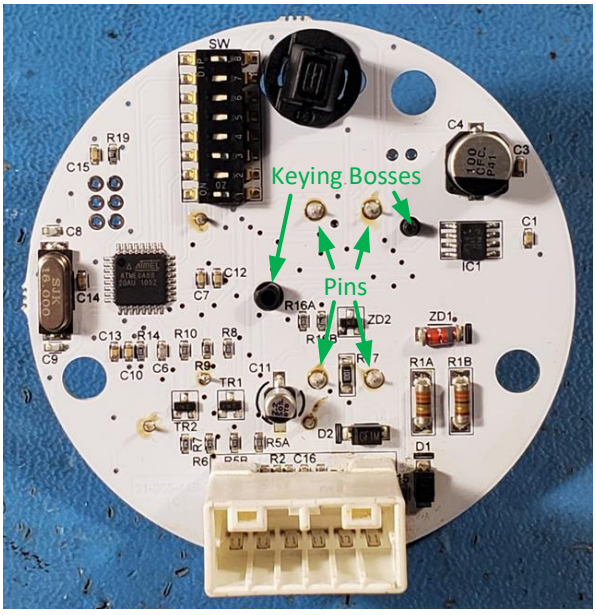






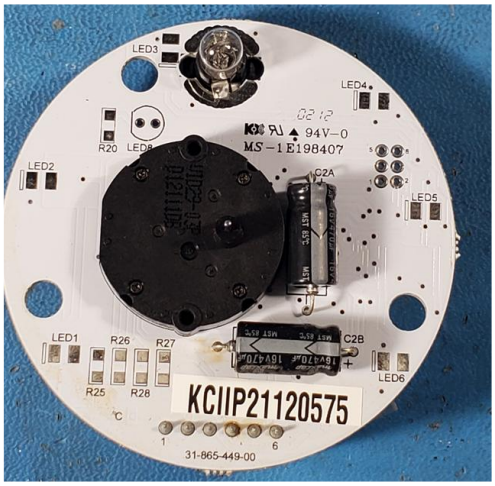
To dismantle the tachometer, bend up to tabs around the bezel and remove the bezel, glass and inside trim ring. Remove the 3 screws on the back of the tachometer to release the tachometer innards from the case. Remove the 3 cylindrical spacers from the case mount bosses. Remove the pressed on tachometer needle by rotating the needle button counterclockwise until it comes off. At this point, the PCB will come off of the frame mounting bosses.

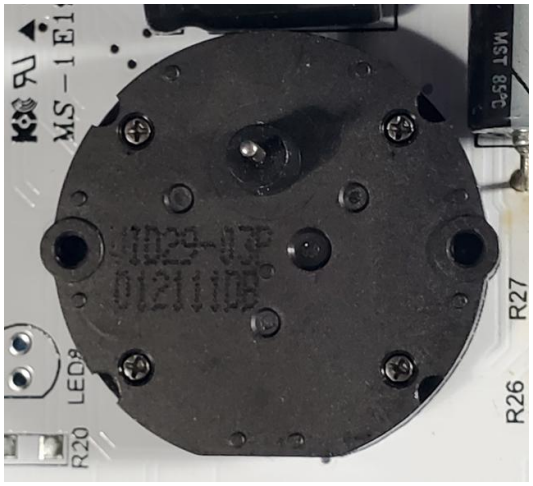





The needle is driven by a small stepper motor (actually developed from inexpensive stepper motors used in wrist watches). These motors are virtually the same as those used in instrument clusters from late model Fords and GMs. Those stepper motors are notorious for failing, so I suspected that this stepper motor has failed as well. The stepper motor is soldered to the PCB at 4 pins shown above. There are two plastic keying bosses on the motor as well.

The stepper motor used in this tachometer is a VID29-03P. This stepper motor is no longer available. However, a BKA30-F3 stepper motor is a good replacement. AI also says that a VID29-03 will also work as a replacement.




The stepper motor is controlled directly by 0-5V digital outputs from the Atmel Atmos microprocessor. Since there is no feedback regarding shaft position from the motor, on power-on, the processor steps the motor counter-clockwise for the full scale of the tachometer. That way, the processor knows that the needle is set to zero RPM. If the needle is anywhere other than at 0, it will rotate back to zero and then just vibrate until the power-on steps are done. If the needle is already at zero RPM at power-on, it will just vibrate at zero until the power-on steps are done.

I did not know this when I first started working on this tachometer. I assumed that it swept the needle full scale to calibrate the needle and then swept it back to zero. I assumed this because other stepper motor designs I have seen do this. As a result, I thought that the stepper motor had gone bad when it just vibrated at zero. That led me to order a new stepper motor. Had I just manually moved the needle off of zero and then powered the tach up, I would have seen that the stepper motor was actually working.

AI recommended the BKA30-F2 stepper motor as a good replacement for the VID29-03P, so I ordered one. When I received it, I unsoldered the 4 pins of the VID29-03P and removed it. I used plenty of solder flux paste and copper braid to remove virtually all of the solder from each of the 4 pins. Then I hit each pin wut the soldering iron to ensure that the pins were not still soldered to the sides of the pad holes. After that it was very easy to pull the stepper motor from the PCB.

When I soldered in the BKA30-F2, the tach suddenly moved the needle to the end of the scale when I powered it up, so I knew the stepper motor worked. I had moved the needle before powering it up. But the tachometer still did not move after power-on when I applied a calibration signal to it.

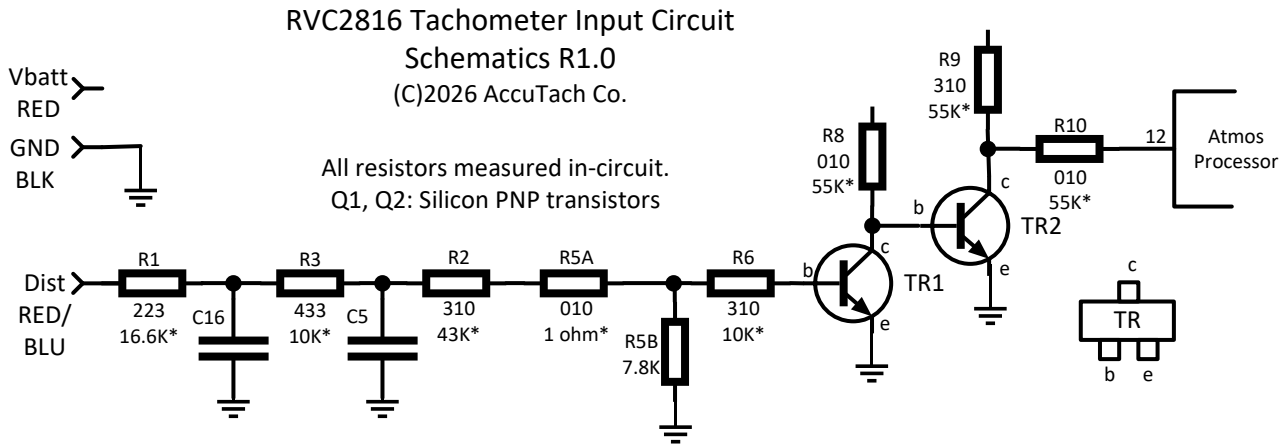
I wondered if there was an issue with the ignition signal input circuit, so I traced the input circuit from the tachometer input pin to the input pin on the Atmos processor. I used my scope to follow the signal through the circuit and found that the signal did not make it past resistor R1, the first component in the circuit. As I pressed on R1 with my scope probe, the tach suddenly started working. I could cause it to fail and to start working again by pressing with my scope probe on R1. This implied a cold solder joint on R1.

R1 is located under the tachometer connector to the outside world so I could only get soldering iron access to one side of it without removing the connector. Fortunately, I was able to repair the tach by resoldering the accessible side of R1.

I put the tach back together to test it, and set the calibrator to 4K RPM. I powered it up and installed the needle at 4K RPM. When I changed the calibration RPM to different settings, the tachometer worked backwards. It turned out that I had bought the wrong stepper motor. Instead of the BKA30-F2 that I bought, I should have bought the BKA30-F3 which rotates in the correct direction. If anyone ever has one of thee tachometers with a bad stepper motor, make sure you buy the correct replacement motor.

I replaced the BKA motor with the original VID29 motor and the tachometer started working perfectly.

The schematics for the tachometer's input circuit is on the next page in case you need to trace the calibration signal as I did.

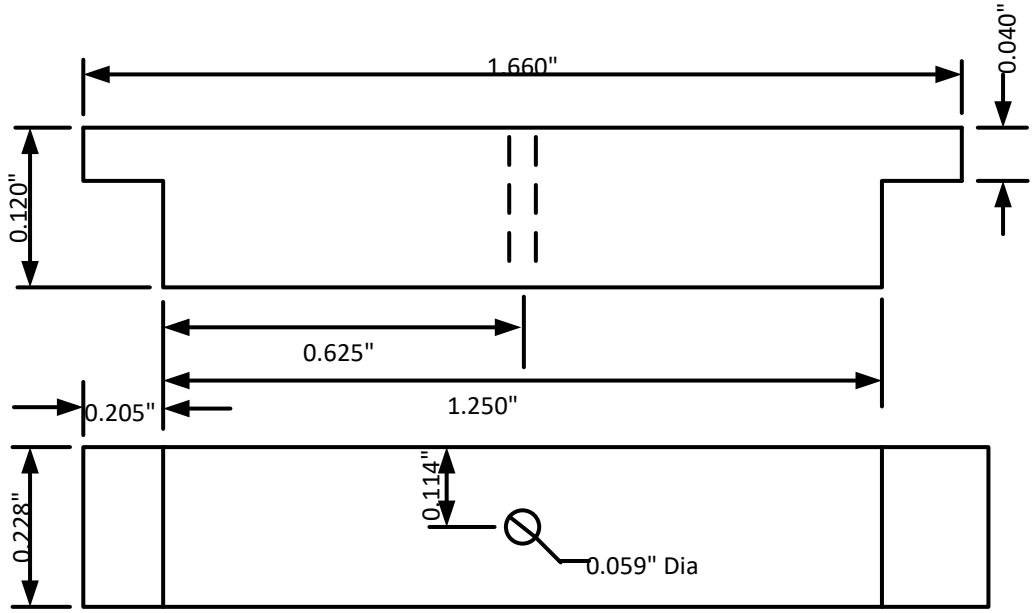



One strange thing I noticed is that the resistor markings are inconsistent with the resistances that I measured in circuit,

In addition to the electronic problems with this tachometer, there is a little plastic bar that goes across a rectangular hole in the tachometer frame. The bottom face screw screws into the bar to clamp the bottom of the face to the frame. That bar had broken.



I had a replacement bar 3D printed which fixed this problem. Here is a drawing of that plastic bar, not drawn to scale.




Not drawn to scale