

# Vintage Mallory Tachometer

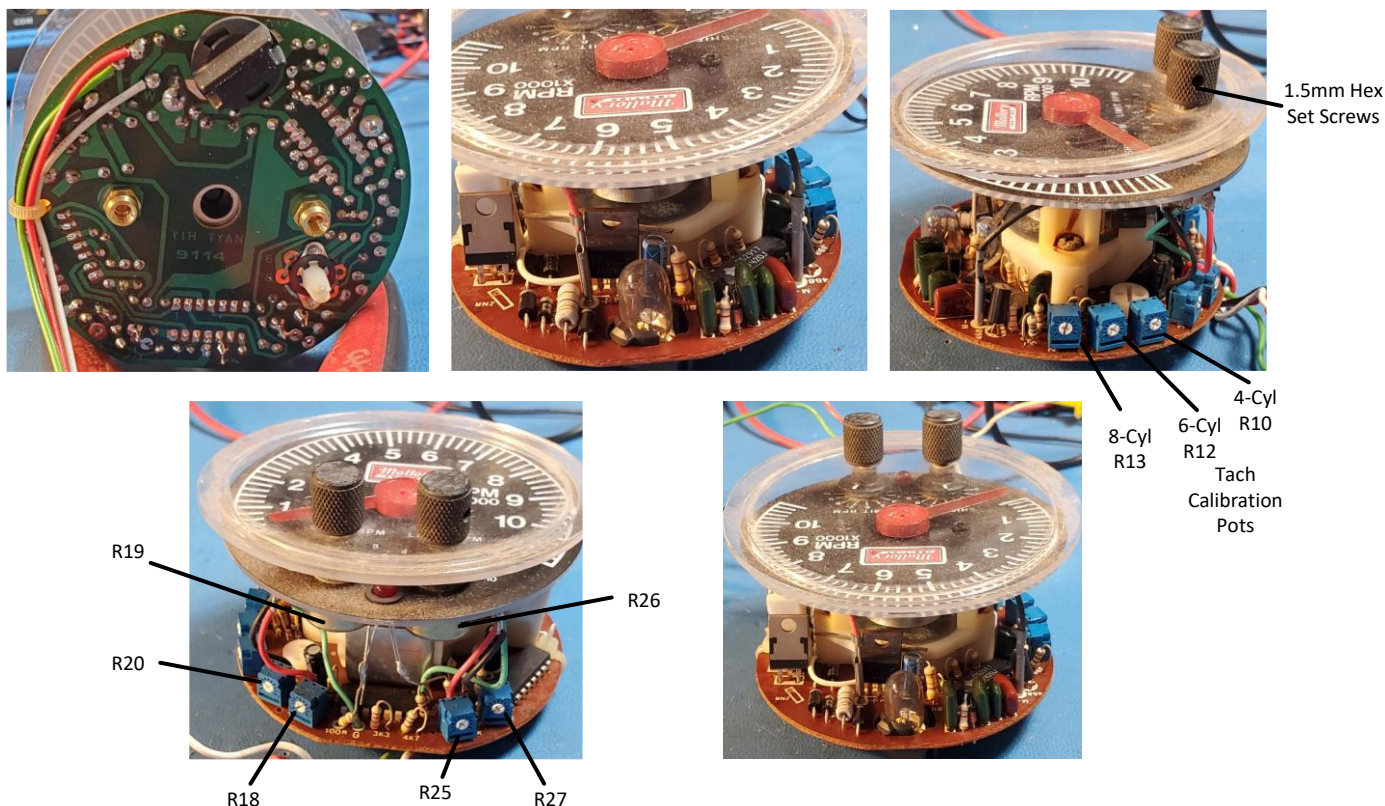
## Reverse Engineering Analysis

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AccuTach Co.

This is a reverse engineering analysis of a vintage Mallory tachometer. This tachometer has an 11K RPM range and a switch that selects between 4, 6 and 8-cylinder mode of operation. It also have a user selectable shift light and a user selectable rev limiter. The tachometer was made for Mallory by the Yih Tyan company of Taiwan.

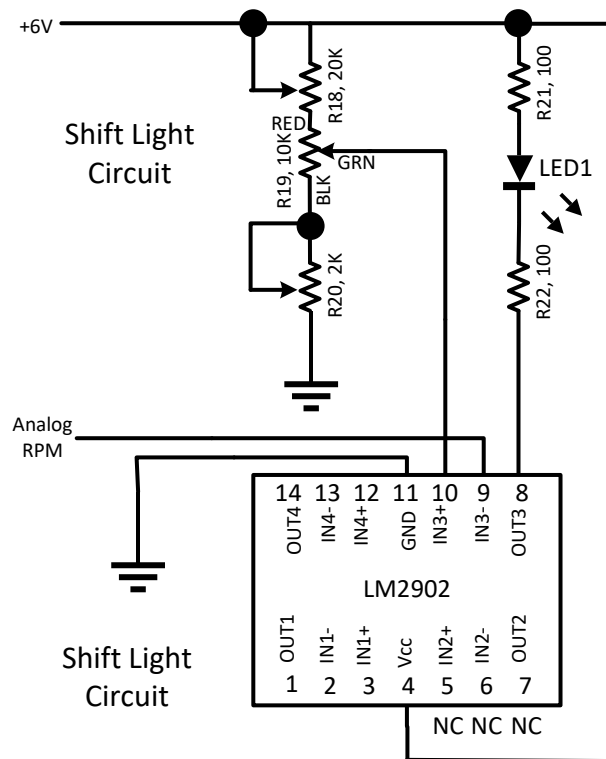


The component side of the PCB is under the tach face, which makes it impossible to get a photo of the PCB top without removing the tach knobs, lens, needle and face. Here are photos of the bottom of the PCB and the components on top from different sides:



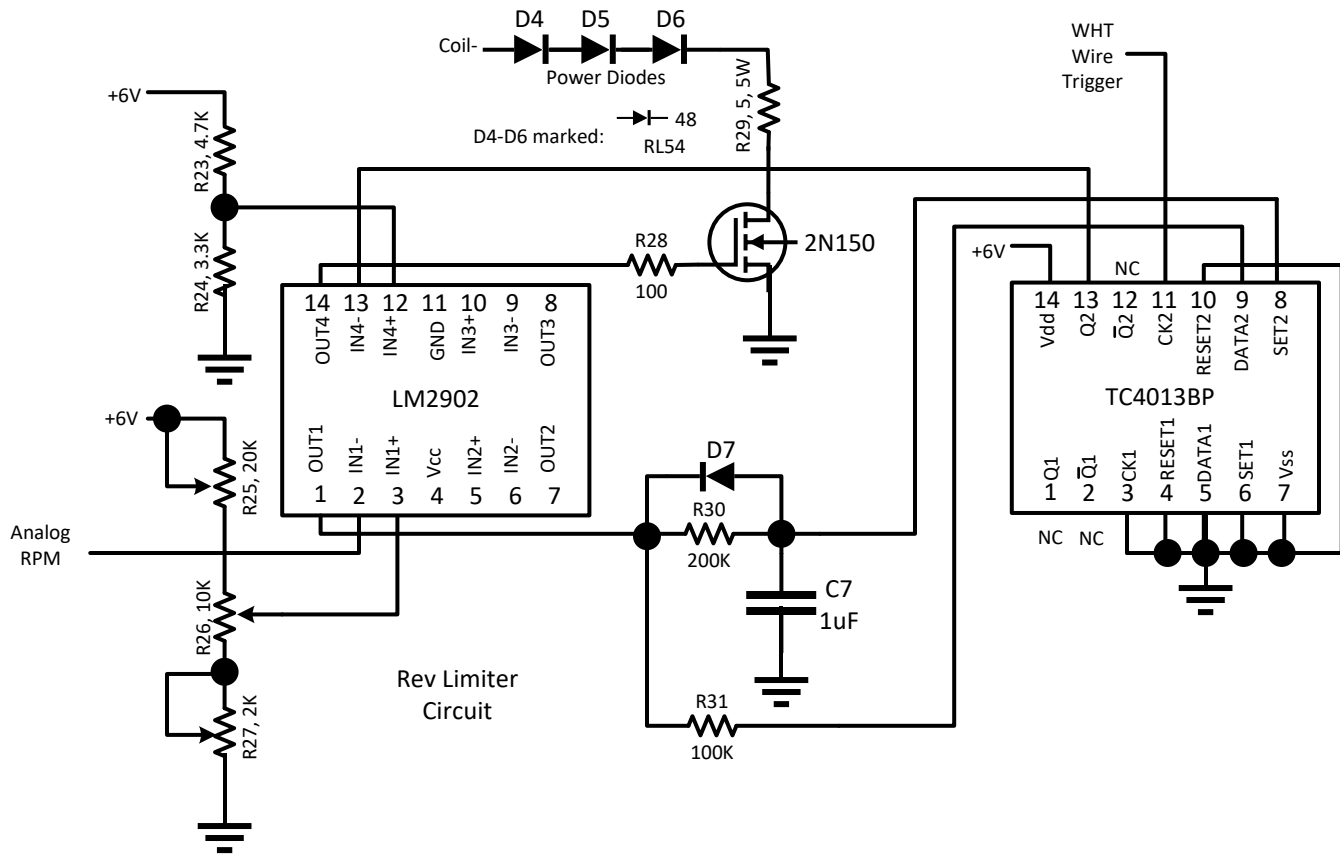
There are 3 major circuits in this tachometer, the tachometer circuit, the shift light circuit and the rev limiter circuit. The schematics for all 3 circuits are on the following 3 pages. The pages after that are photos of the factory installation instructions.





The heart of the shift light circuit is op amp 3 of the LM2902 Quad Op Amp IC. It is used at a comparator. The analog RPM signal from the tach circuit goes to the positive input to the op amp. The negative op amp input is supplied by the voltage divider formed by R18 and R19. R18 and R20 are trimpots that calibrate the current so that the RPM numbers on the user selected R19 are accurate. I did not have to adjust these trimpots, so I am not sure of the proper calibration procedure for the shift light knob.

The output of the op amp pulls the cathode of LED 1 down to turn it on with the current being limited by R20 and R21.



When the RPM threshold set by R25 is exceeded, the 2N150 power transistor turns on, which effectively grounds the coil negative signal, disabling the vehicle's ignition signal for a short amount of time. When the Analog RPM signal is below the threshold, the output of op amp 1 will be high. After the R29/C7 time constant, the flip-flop SET signal goes high which drives Q high. Op amp4 is set up to be an inverter so the output of op amp 4 goes low which turns off the 2n150 transistor leaving the ignition system enabled.

When the RPM exceeds the R25 threshold, the output of op amp1 goes low which takes both the flip-flop SET and DATA lines low. On the next ignition pulse, the Flip-flop CLK causes the Q output to go low. The op amp 1 inverter output goes high which turns on the 2N150, disabling the vehicle's ignition signal. With no ignition signal, the tach circuit's Analog RPM signal immediately falls low, driving the output of op amp 1 hi. After the R29/C7 time delay, the SET signal goes high which re-enables the vehicle's ignition. The delay ensures that the engine has had a little time for the RPM to fall a bit.

I did not have to adjust these trim pots, so I am not sure of the proper calibration procedure for the rev limiter knob.



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# Mallory

IGNITION

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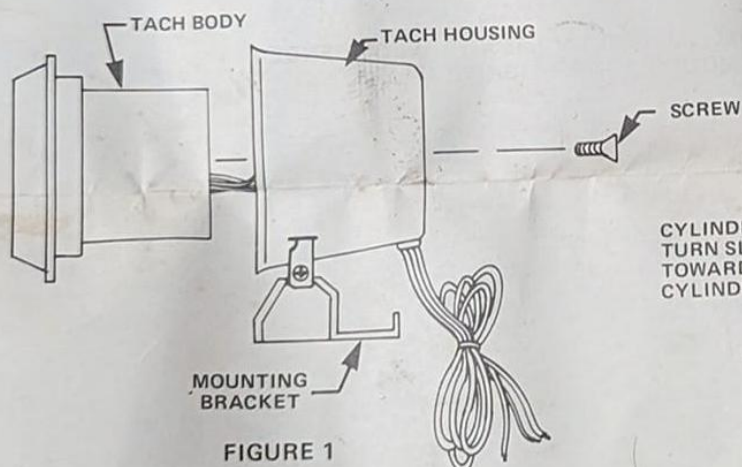
## RPM LIMITING TACHOMETER INSTALLATION INSTRUCTIONS

Mallory's R.P.M. Limiting Tach is a three function system: a) It is a tachometer which reads to 11 thousand RPM with 2% full scale accuracy; b) it provides an adjustable shift point indicator. The desired shift RPM is set with the front panel control, and when this RPM is reached a bright light comes "ON". The shift light is sufficiently bright so that one not need be looking at the Tach to make accurately timed shifts. The light may also be used for an overspeed warning; c) it is an RPM limiter. The maximum safe RPM is set with the front panel adjustment. When this RPM is reached, the ignition is interrupted to prevent over-revving and destruction of the engine. The spark is interrupted in a "proportional control" manner by removing first one of many ignition pulses and increasing the removal of spark firings as the RPM limit is approached. Thus, the RPM is limited by reducing power rather than shutting off the engine. This prevents harmful fuel build-up with its accompanying backfiring.

**NOTE:** Numbers on shift and limit dial are for reference only. Accurate setting of shift light and limit RPM should be done in conjunction with Tachometer reading.

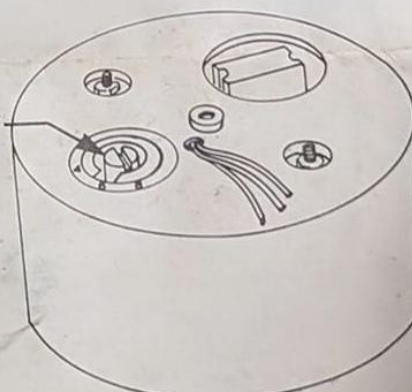
Mallory's RPM Limiting Tachometer is very easily installed on any negative ground 4, 6 or 8 cylinder automobile. The Tachometer can be rotated 360 degrees within the outer housing, allowing the instrument to be mounted in any position. Be sure to follow instructions and recheck electrical connections before starting engine.

1. Before mounting or connecting Tachometer in the car it will be necessary to set Tachometer for either 4, 6 or 8 cylinder application. To set Tach remove philips screw in rear of housing. Remove Tachometer body from housing body making sure that mounting bracket is loose. (See figure 1.) Using a small straight blade screwdriver rotate slot until it points to your particular cylinder number. (See figure 2.)
2. After Tachometer has been set reassemble making sure that wires are not pinched or cut.



SCREW

CYLINDER ADJUSTMENT  
TURN SLOT TO POINT  
TOWARDS NUMBER OF  
CYLINDERS IN CAR



3. Select a good location for your Tachometer. Preferably some place for easy reading without having to strain to see. The Tachometer mounting bracket is designed so that the Tach can be mounted on steering column or on the dash-board. If mounting Tach on the dash use the mounting bracket as a template for the correct hole location.



4. The "GREEN" wire is the ignition sensing lead. This wire is connected to the negative (-) terminal on the coil. On electronic ignitions the "GREEN" wire is connected to the negative (-) terminal on the coil or to the Tachometer hook up. (See figure 3.)
5. The "RED" wire is how the Tachometer receives its power. This wire should be connected to a point in the electrical system that is switched "ON" by the ignition switch. This is easily done at the fuse box. The wires that go to the radio or instruments are the best. (See figure 3.)
6. The "WHITE" wire is connected to the instrument lamp terminal of the light switch. (See figure 3.)
7. The "BLACK" wire is ground. Connect this wire to a good ground point under the dashboard. (See figure 3.)

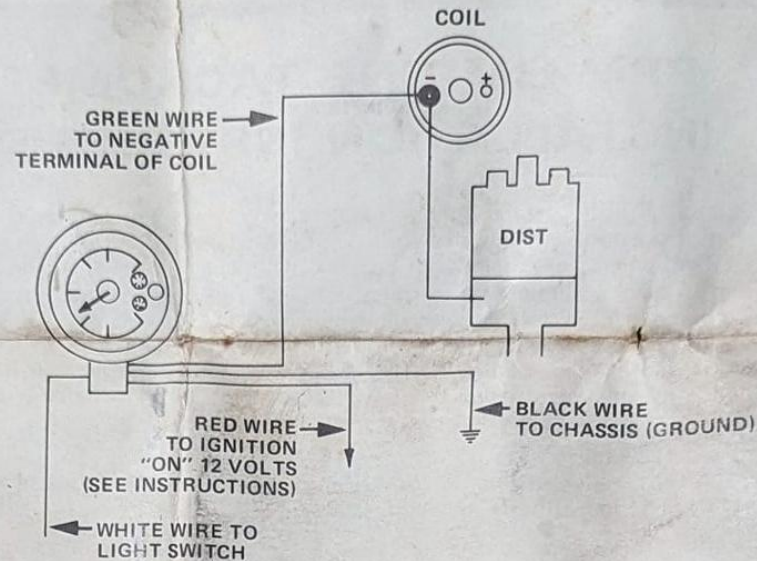


FIGURE 3

8. Before starting the engine check that all Tach wire connections are secure and in the right locations.

### APPLICATIONS

No. 657 for 4, 6 and 8 cylinder standard and electronic ignition, 5" face Tachometer.

**WARNING: MALLORY'S RPM LIMITING TACH IS NOT RECOMMENDED FOR USE WITH MULTIPLE-SPARK IGNITION SYSTEMS.**