Vintage Dixco Tachometers
Rev. 1.0

Dixco made a number of electronic tachometers in the 60s and 70s that were popular with the muscle car crowd. I was asked by Pete of Pete's Vintage Gauges on eBay to analyze some of his tachometers.

The first set of tachometers consisted of a couple of Model 97 (8 grand) units, a Model 797 (10 grand) unit, a couple of Model 47 (8 grand) units. The circuits in these tachs were made using a plastic substrate with holes for the component leads. The component leads were soldered to each other so a printed circuit board (PCB) was not needed. Note that the calibration resistors are mounted to the meter terminals on the back of the case. I also analyzed a newer 8 grand unit made with a printed circuit board and an IC who's model number is unknown. This first section covers all of the units except for the last one with the PCB.

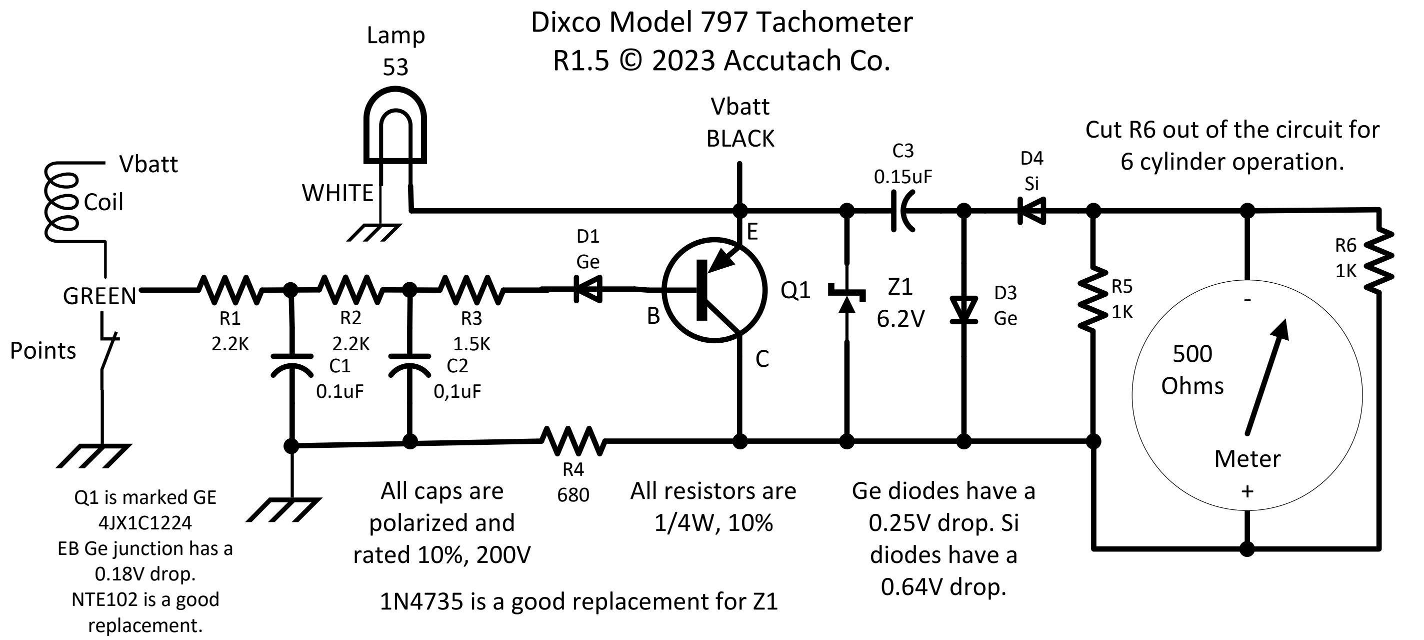
Older Transistor-based Tachometers (Models 97, 797 and some Model 47)

The Dixco engineers decided to use the positive rail as their reference rail, so many people today will find the design feels "upside-down". All of these tachometers use a circuit with two major blocks, and input section and an output section. The input section filters and conditions the ignition signal coming from the coil/points and the output section provides the correct average current to drive the sensitive ammeter that is calibrated in RPMs.

All of the tachometers in the first group except for one had an input section with RC filtering and an output section that uses one transistor. One of the Model 47 units had an input section with RLC filtering and an output that uses only diodes. One of the units with RC filtering had a one stage RC filter while all of the others had 2-stage filters. Also each of the tachometers had slightly different resistor and capacitor values. There were also different board layouts on some of the tachometers. If you are working on your own tachometer, take note of the differences between your tachometer and the ones I have in this document.

The following will describe the theory of operation.

Here are the schematics for the Model 797 tachometer:



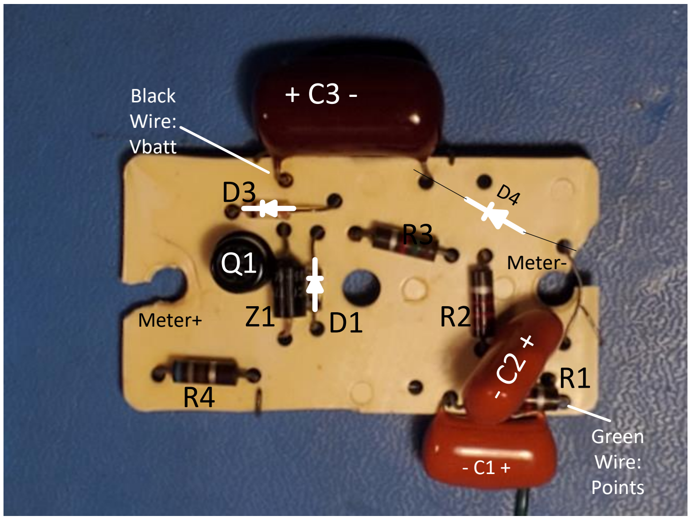
The input section consists of R1, C1, R2, C2, R3 and D1. The purpose of this part of the circuit is to turn Q1 on when the points are closed and to turn Q1 off when the input is pulled up to battery voltage via the coil primary winding. R1/C1 and R2/C2 make up a two-stage low-pass filter that takes any ringing or noise out of the signal so it is a nice square wave. R3 limits the current through the transistor's EB junction when the points are closed to protect Q1. D1 prevents any high voltage transients from the coil primary winding from damaging Q1.

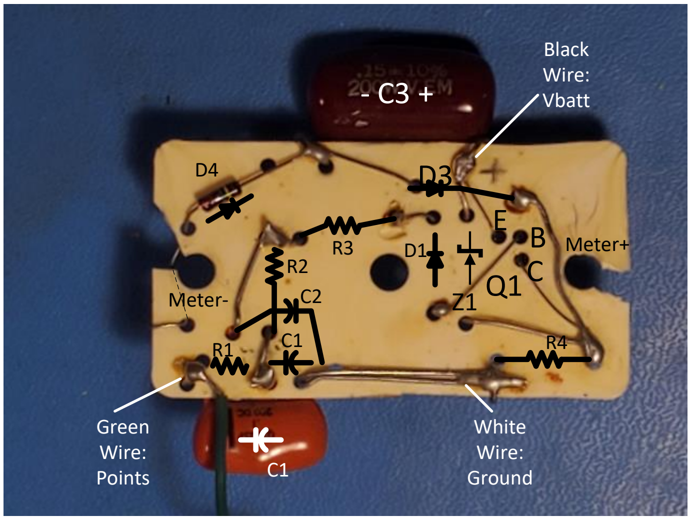
The output section is designed to put a measured amount of charge through the meter for each ignition pulse. When the points open and Q1 turns off, current flows through Z1 and R4 (which limits the current through Z1.) The 6.2V drop across the Zener diode sets the collector voltage at 6.2V below the battery voltage. Current flows through D3 until C3 is charged to 6.2V. D4 prevents current from flowing backwards through the meter and calibration resistors R5 & R6.

When the points close and Q1 turns on, the collector and meter + goes to battery voltage, but the bottom of C3 is still at 6.2V below battery voltage, so current flows through the meter and calibration resistors R5 & R6 until C3 is discharged so both sides are at battery voltage..

As the frequency of the ignition pulses goes up, the average current flowing through the meter goes up, increasing the needle deflection and as the frequency of the ignition pulses goes down, the average current flowing through the meter goes down, decreasing the needle deflection. R5 and R6 act as current dividers with the meter. By removing R5 and/or R6 from the circuit, the amount of current flowing through the meter will be increased. This is how the tachometer is recalibrated for engines with 6 or 4 cylinders.

Here are photos of the 797 substrate with the components identified:





Common Failures and Repair

The illumination bulbs are number 53 bulbs and they do burn out. They are socketed in some of the tachometers and soldered in others. Just pry the socket out, replace the bulb and push the socket back in for the socketed units. You will have to unsolder and resolder the bulbs in the other tachometers.

A lot of the tachometers have issues with the meter. The needle will consistently stop at one point on the scale and go no further without manual intervention. I have not been able to find where the mechanical issue is to this point. Unfortunately, if you can't get the meter to cover the whole scale, I do not know how to fix it.

Several of the transistorized tachometers I have analyzed have had failed Zener diodes. It is very easy to diagnose a failed Zener diode without even taking the tachometer apart. To test the Zener diode, first put a DC voltmeter across ground and one of the meter terminals on the back of the tach. Power up the tachometer with battery voltage and ground and then put battery voltage on the input wire to turn Q1 off. At this point, the voltmeter will read close to 6.2V below the battery voltage if the Zener diode is working. If your battery voltage is 12V, then you should see about 5.8V on the voltmeter. If it reads close to 0V, then the Zener diode has likely failed. If it reads close to battery voltage, Q1 may have failed.

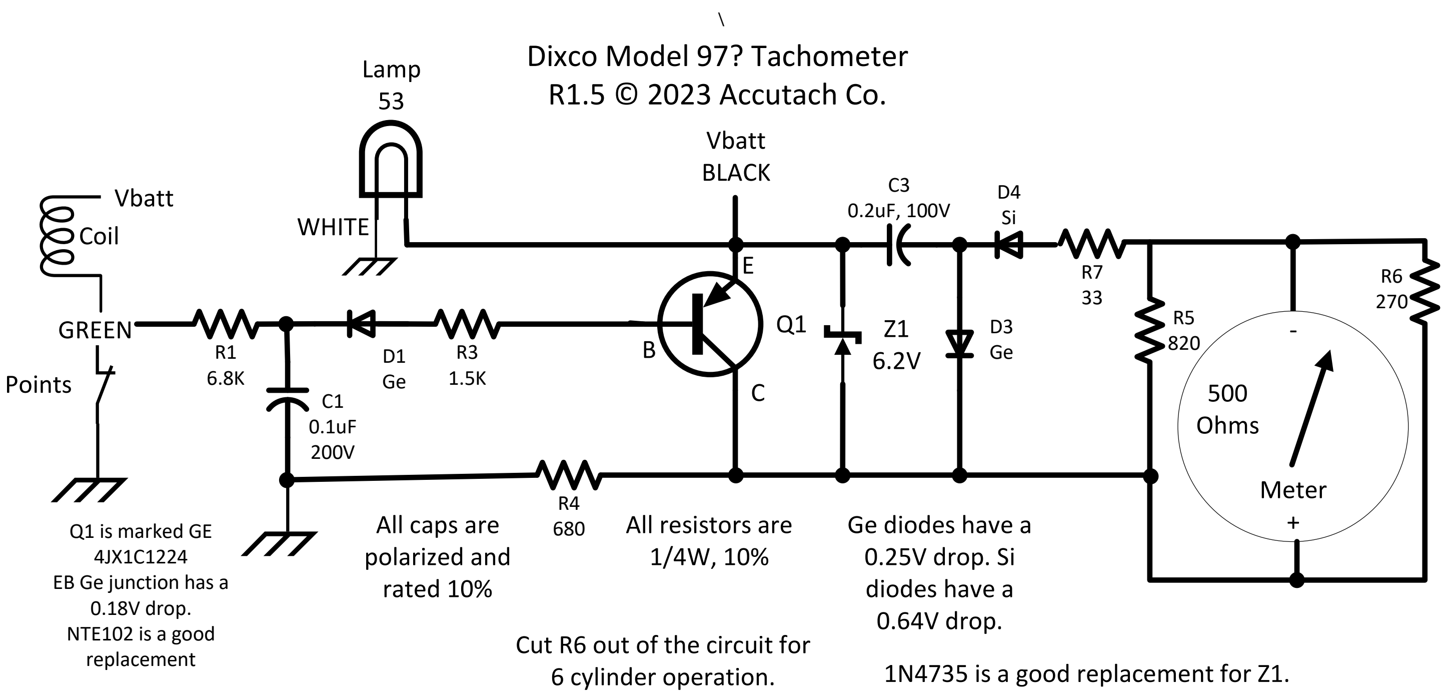
If the Zener diode is functional, you can then test Q1 by grounding the tachometer input with the same test setup. The voltmeter should go to battery voltage. If it doesn't, Q1 has probably failed.

When I have replaced the Zener diodes, I have had to change the calibration resistors to recalibrate the tachometers, so be sure to check your tachometer's calibration after you have repaired it. I use a function generator set to 12V square wave mode. I set the function generator to 7000 RPM and use a pot across the meter terminals to move the needle to point at the 7000 mark. I then read the resistance of the pot and select a standard resistor that is closest to the pot setting and put that across the meter terminals just like the OEM calibration resistors were.

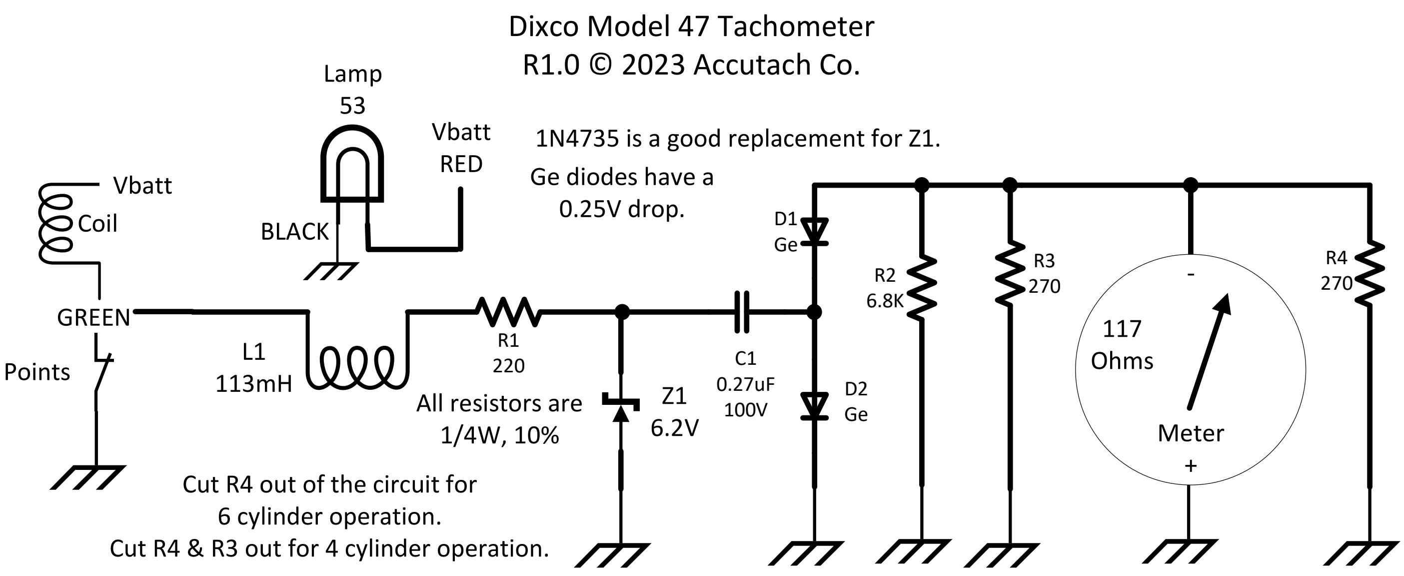
Variations

I have seen a number of variations of the same a similar designs. Most of the other tachometers have cap C3 as a 0.2uF cap rather than a 0.15uF cap in the Model 797. But the Model 47 unit with a transistor also had a 0.15uF cap. In two of the Model 97 units, R4 was 580 ohms rather than the 680 ohms in the rest of the units. In the two Model 47 units, the meters were 117 ohm meters rather than the 500 ohm meters in all of the other units. The calibration resistors have been different for every tachometer that I have examined. I will put the schematics for each of the tachometers I have studied at the end of this document for your reference.

One of the tachometers that looks like a Model 97, but was not marked had a much simpler input circuit:



One of the Model 47 tachometers had a very different circuit in it, one with no transistors:



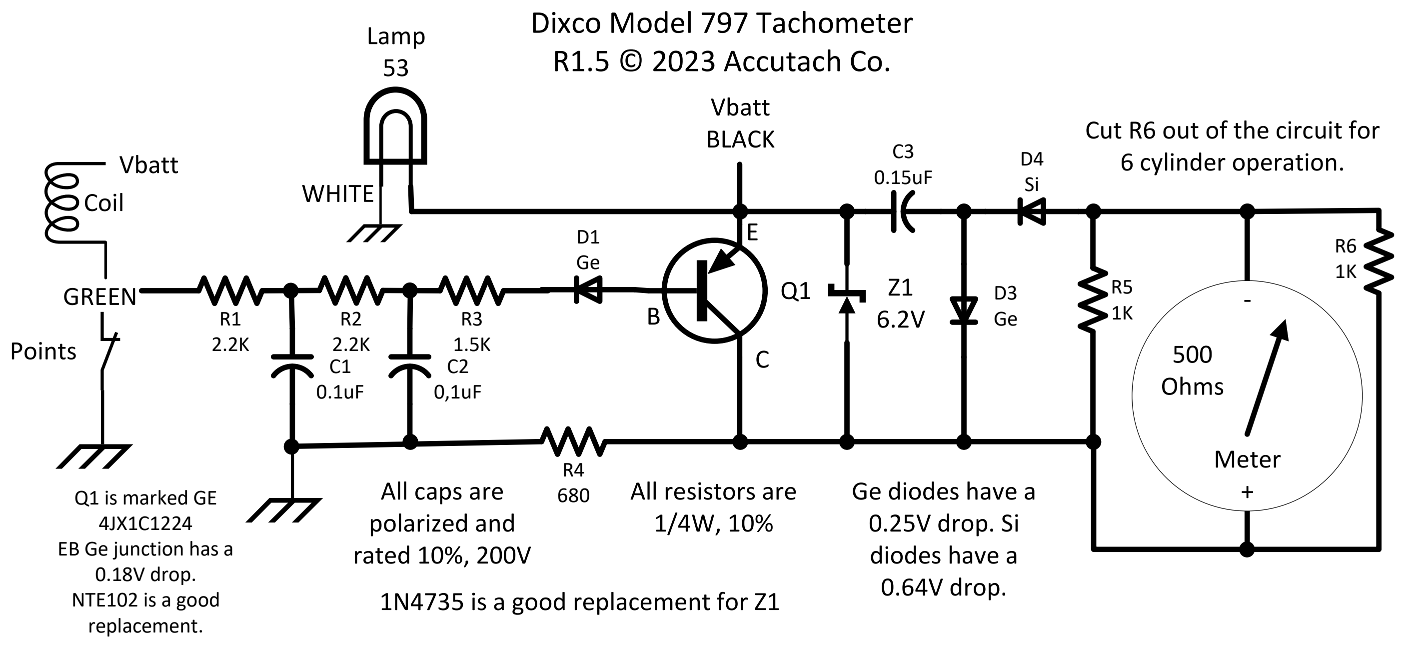
The input circuit uses an RLC filter to clean up the input signal. But the R is also the current limiting resistor for the Zener diode. When the points are open, the coil primary winding pulls the voltage at the input of the cap up to 6.2V. D2 puts the other side of the cap at one Ge diode drop (~0.2V) above ground, so the cap charges to about 6V. When the points close, the input to the cap goes very quickly to 0V. Since the charge in the cap can't change immediately, the voltage on the other side of the cap goes to -6V. Current flows through the meter, calibration resistors R2-R4 and D1 until the cap is discharged, moving the needle.

Note that all of the power needed to drive this tachometer comes via the input wire from the coil primary. This means that the power wire coming into the tachometer is only used by the illumination bulb. With this tachometer, the bulb can be used with the car's dimmer if it is the type that controls the positive side of the dash bulbs.

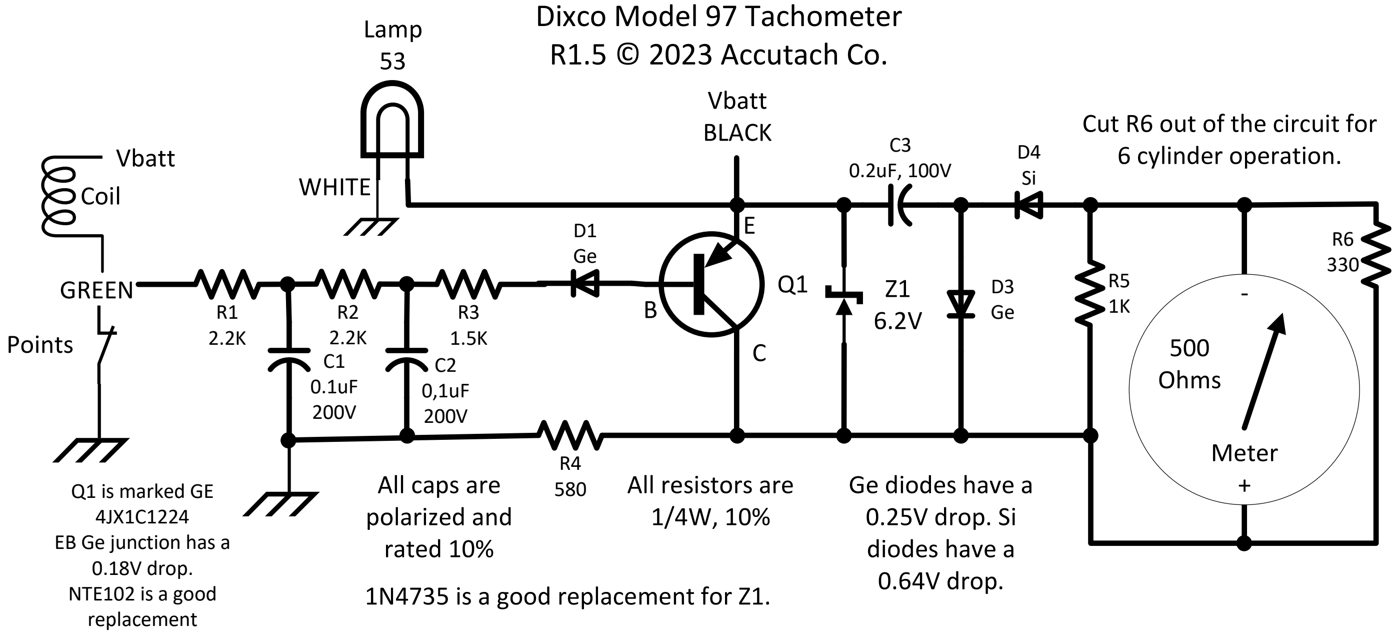
I have not seen a failed tachometer of this type, so I can't say what common failures might be. By grounding the tachometer and putting 12V on the input, you should see 6.2V at the top of the Zener diode. If you see close to 0 or 12V, then replace the Zener diode with a 1N4735.

Appendix

The following are the schematics for all of the tachometers that I examined along with a few notes about each:



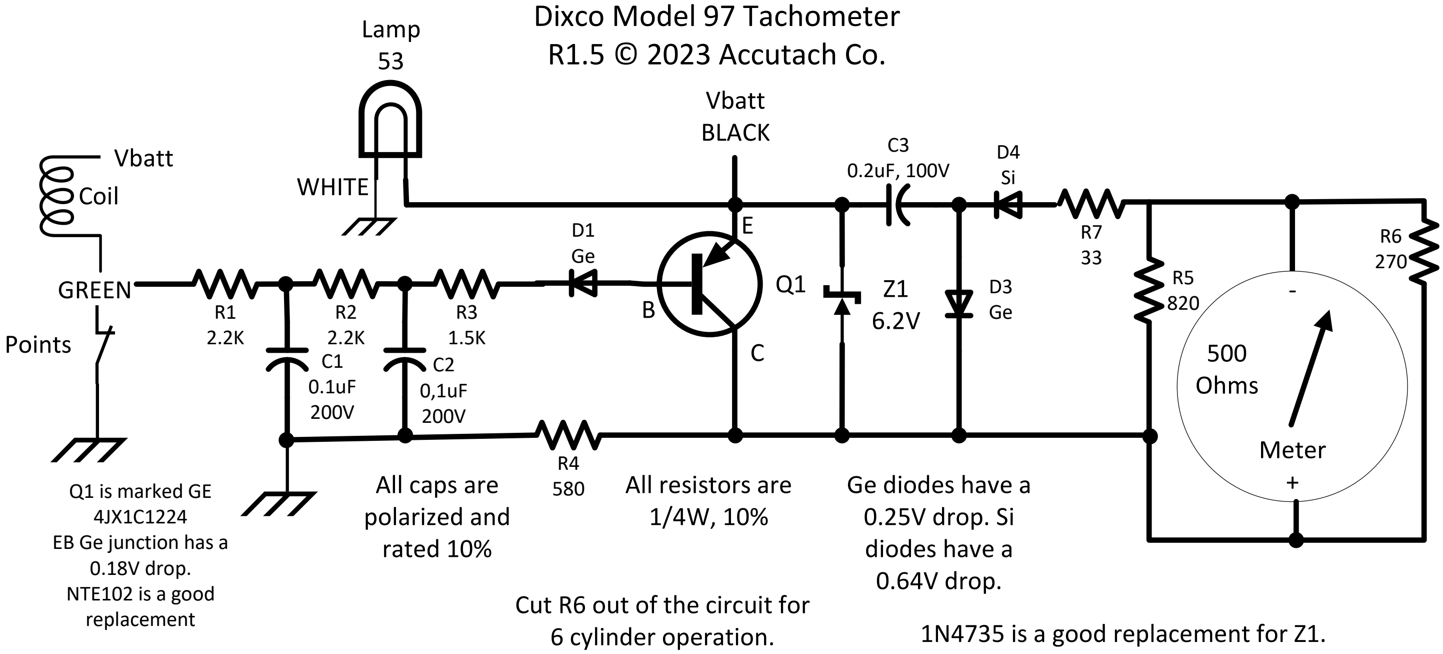
Dixco Model 97 Tachometer
R1.5 © 2023 Accutach Co.



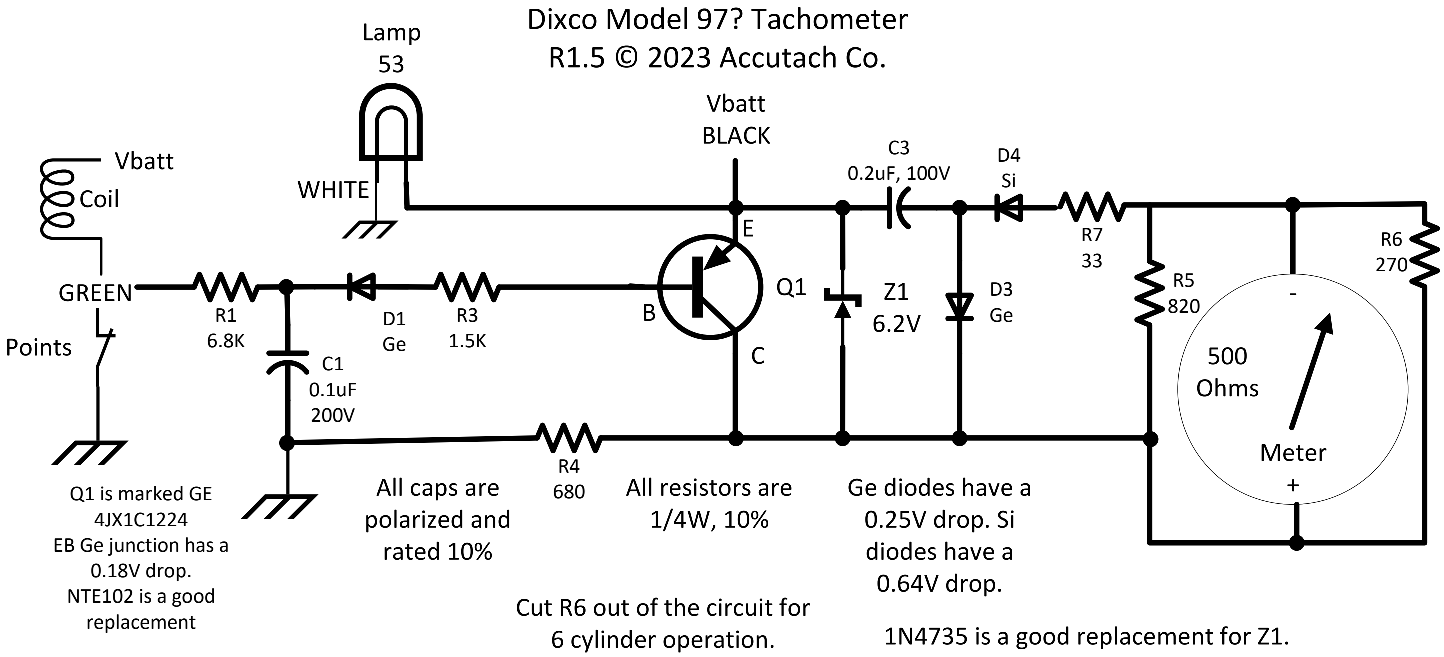
The first model 97 I looked at has basically the same circuit as the Model 797, with different values for three components, R4, R6 and C3.

The second Model 97 I looked at is similar to the first, with the addition of a 33 ohm resistor in series with D4 and different values for R5 & R6. Also, the polarities of C1 and C2 were reversed from each other. This makes me think that the polarity doesn't matter. These are the schematics of the second Model 97 I looked at:

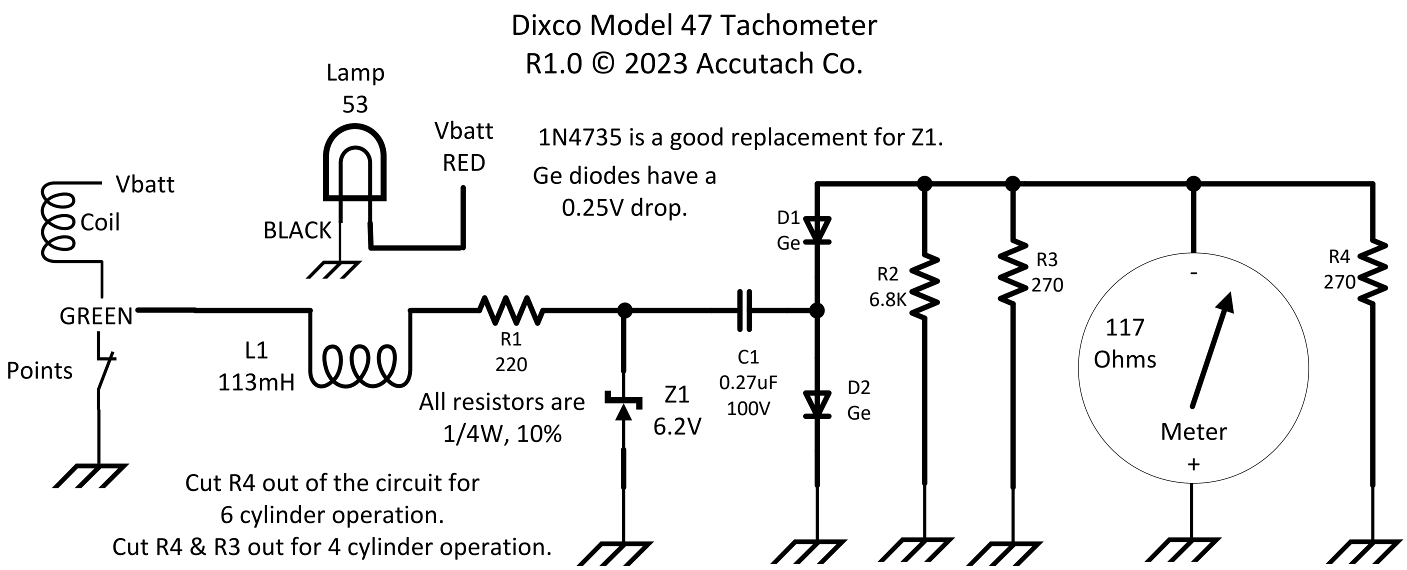
Dixco Model 97 Tachometer
R1.5 © 2023 Accutach Co.



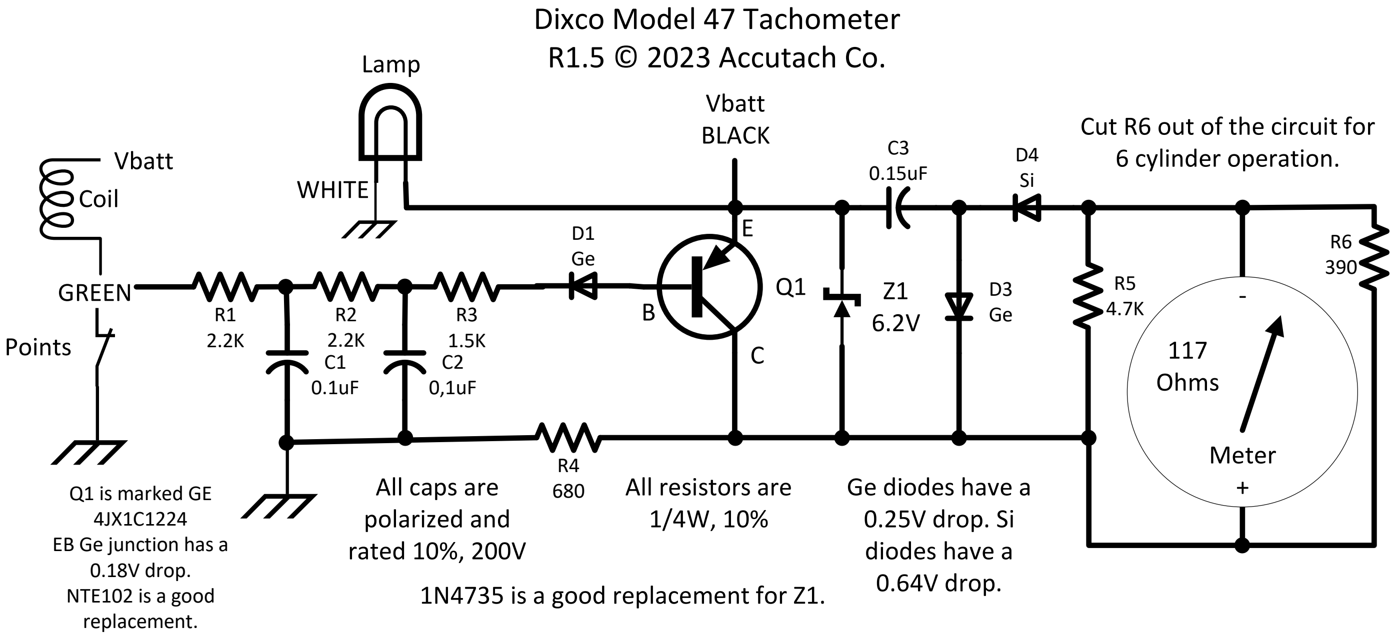
I then looked at a tachometer that has a somewhat similar circuit as the Model 797 and 97. It has a simpler input filter circuit. The meter has a date of DEC 1963 printed on it. It is marked #369.



I also reverse engineered a Dixco Model 47 tachometer marked #8 which does not use a transistor. Here are the schematics for that unit:



I also reverse engineered a Dixco Model 47 tachometer marked #7 which does use a transistor. The circuit is similar to that of the Model 97s. Here are the schematics for that unit:



The 117 ohm meter is in such bad shape that all it was able to do is verify that the electronics were working since the needle would move some with a little coaxing. It was not reliable enough to be able to create a transfer function for the meter.