How to fix your 260Z or 280Z clock.

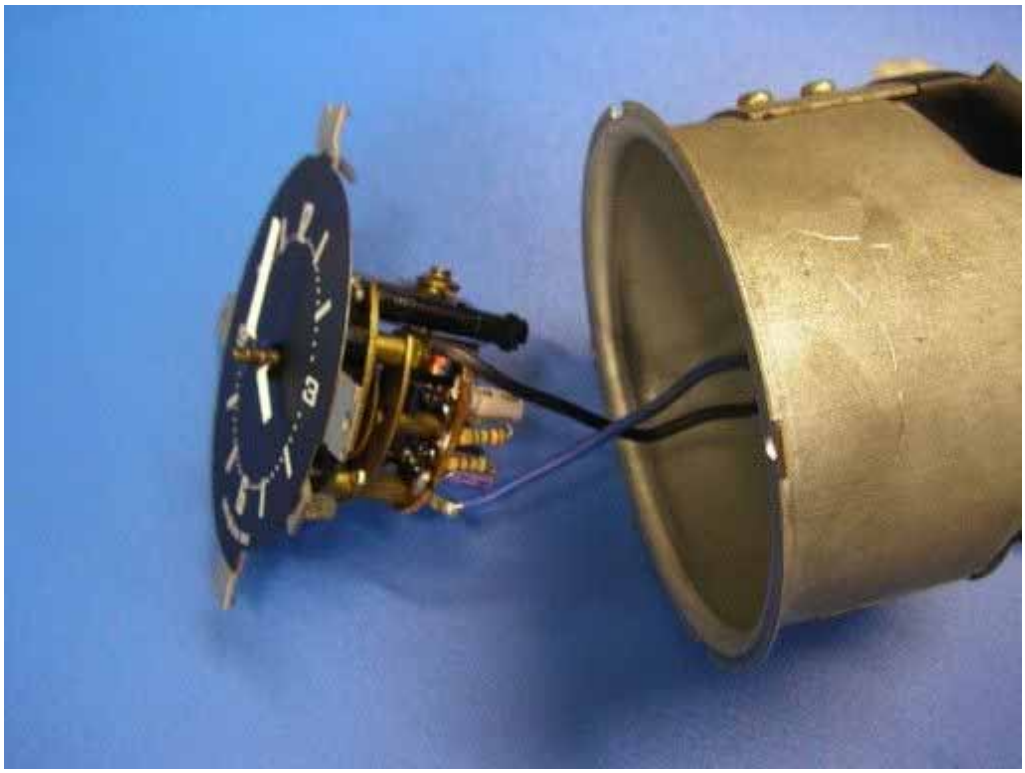
I first wrote this up about two years ago. This is the second version of this procedure. It is not very much different to my first effort except it corrects one (major) mistake. I had the diagram with the transistor pin assignments wrong. I had two of the transistors mixed up. That is now fixed.

I have tried to fix the earliest clocks with the motor drives but had no success. These had 'Jeco' stamped on the clock face and were found on the 240Zs. If you have one of these, this document won't help you.

I have also tried fixing my 260Z clock (and the clocks out of some other 260Zs). These had an electronic card rather than a motor inside that drove the clock movement. They had 'Kanto Seiki' printed on the clock face (though partly obscured by the bezel). I expect that the 280Zs also used the same clock (we did not see the 280Z in Australia). Chris A also tells me the 'Citizen' clock works the same way. If you have any of these clocks, and a little bit of electronics know-how (or a friend with some electronics know-how), then hopefully this can help you fix your old clock.

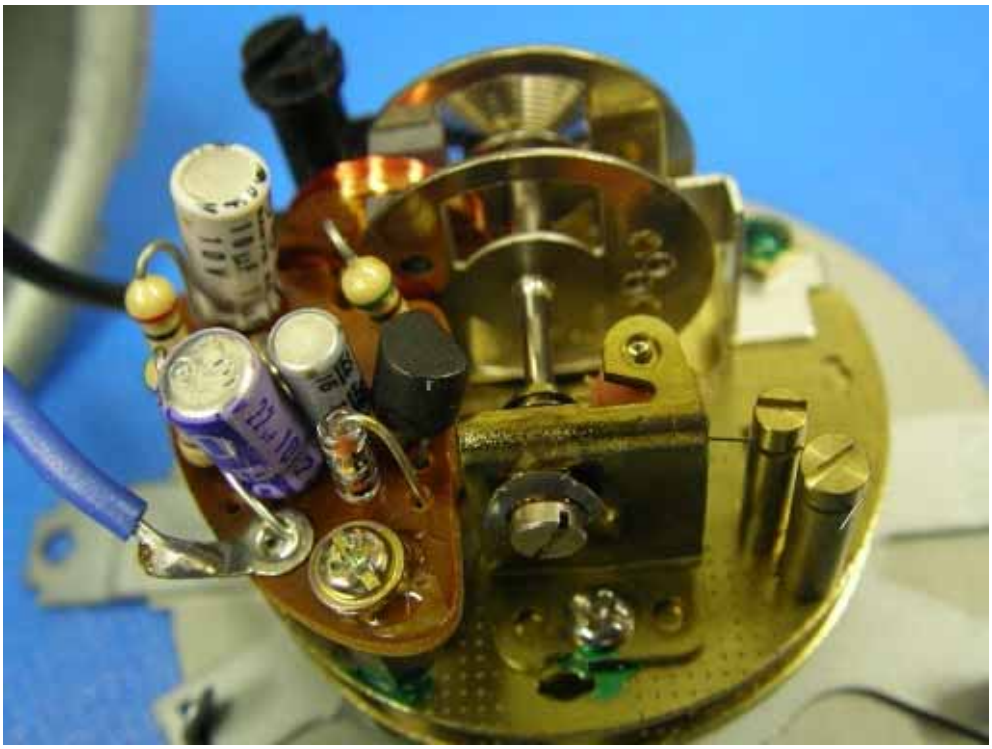
1. Clock removal.

Remove the clock from the car (you may have to do this through the glove box), and then remove the clock from the housing. You will have to pull the cables through their entrance point at the rear of the housing. Once you extract the clock some of the way, note where the blue and black cables go and de-solder them.



2. Visual inspection.

Does everything look ok? Any burnt-out or broken components? Any broken gear teeth? (There hasn't been anything visually wrong with the clocks I have dealt with yet.)



3. Circuit board removal.

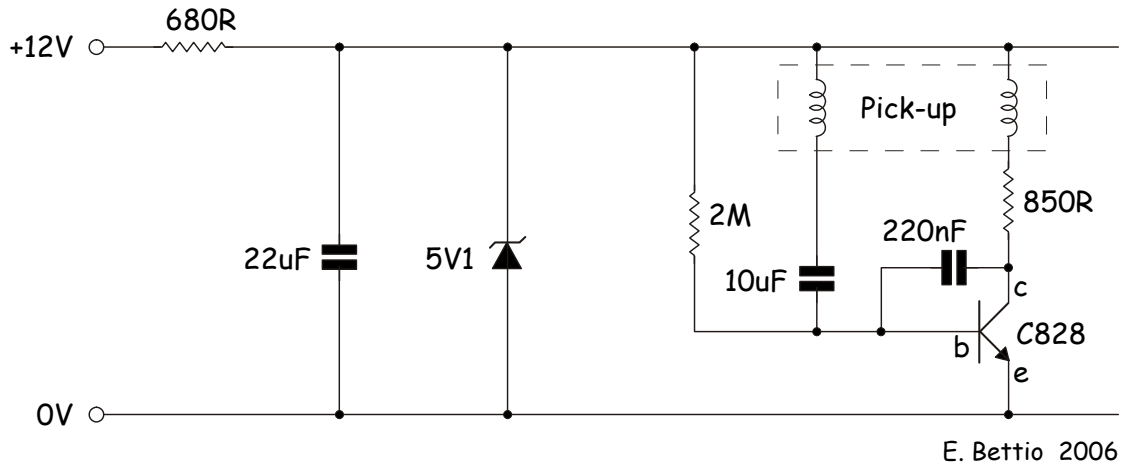
Remove the circuit board. It is held in place by two screws. Be careful when you remove it because the object that looks like a copper disk is actually and mass of tightly wound, very fine enamelled wire. Be careful not to damage it.

4. Capacitors.

There are three electrolytic capacitors on the board. These are over thirty years old now and were the first things I replaced. I tested them all when I removed them and found that one had gone open circuit on two of the three clocks I fixed. I replaced them all. I replaced two of them on each clock with equivalent electrolytic capacitors, the third smaller one (220nF) I replaced with a polyester capacitor (I have more confidence in polyester capacitors). As the electrolytics are polarised, note the orientation of the ones you remove (which side has the minus sign marked on it), and ensure the new capacitor goes in the same way. A polyester capacitor is not polarised and can go in either way.

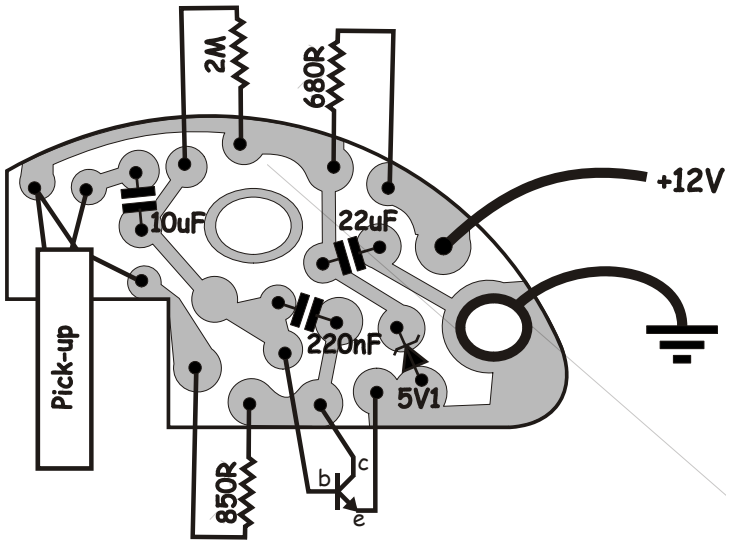
5. Circuit analysis.

After replacing the capacitors, my first clock worked for a while, then slowed, then stopped. My second clock still didn't work, and my third clock worked. It was time to consult the circuit diagram… of which there was none (that I could find). I traced it out and what I came up with is shown below. The dotted box represents the disk-like object. I could see four tiny wires coming from it, and it seems as if it is two windings in the one component. After analysing the circuit around it, I came to the conclusion it was some sort of 'pick-up'



How it works:

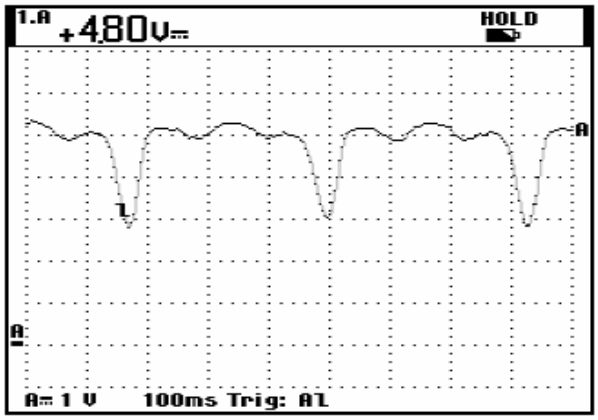
The 680R resistor, the 22uF capacitor (in one clock it was 10uF) and the 5.1V zener diode together provide a smoothed 5V supply for the rest of the circuit. The 2M resistor provides the bias for the transistor so that it is almost turning on. The first winding in the disk-like object (lets call it a 'pick-up') detects the magnets on the oscillating pendulum as they sweep past. As they sweep past, they generate a small electrical pulse in the first pick-up winding. This pulse passes through the 10uF capacitor into the base of the transistor, briefly turning it on. When the transistor turns on, current flows through the second pick-up winding and the 850R resistor. This short burst of current through the winding creates a small magnetic pulse that gives the magnets a small nudge when they pass to keep them going. It's a bit like sitting at the bottom of a playground swing and every time you see it swing past you, you give it a little push to keep it going.



Board layout - View from underneath

6. Testing.

As I said above, once I replaced the capacitors on the first clock, it worked for a while then it slowed (the oscillating pendulum was still rocking back and forth, but not enough). Eventually it stopped. I had a look at the voltage at the transistor collector (bottom of the 850R resistor) before it stopped. The voltage waveform looked like this:



Original C828 transistor

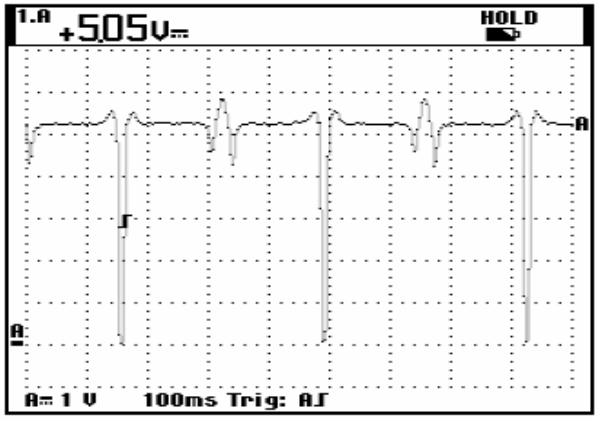
The collector voltage drops to only about three volts (The 'A' on the lower left of the screen-shot indicates the zero volt line; each division is one volt). If the transistor was turning on hard, the dips would drop to almost zero volts. This transistor was not turning on very hard at all.

First failed attempt to fix it:

I first tried to reduce the bias resistor from 2M to 1M2 so that the pulse from the pick-up would turn the transistor on easier. I also lowered the 850R resistor to get a bit more current through the second pick-up coil and hopefully get a bigger push on the pendulum. This worked for a day then stopped. The transistor had failed.

Second attempt (this one worked):

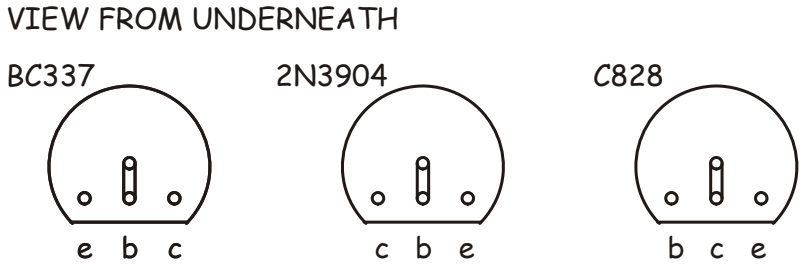
Maybe the transistor was always a bit flakey, so I returned all the resistors to their original value and removed the C828 transistor. I couldn't find anyone selling C828s nor could I find much information on them. I tried replacing it with a general purpose NPN transistor (a BC337 I had available) and the clock worked well. I had another look at the transistor collector voltage and this time I saw:



New BC337 transistor

The transistor is turning on a lot harder now, generating a stronger pulse in the second winding of the pick-up. I replaced the transistor on all three clocks and they all worked.

Note:
I used a general purpose BC337 to replace the C828. I expect any other general purpose NPN transistor (like a 2N3904) would work fine, though there might be a need to adjust the bias current (the 2M resistor). You must be careful replacing the transistor with an equivalent because the pin arrangements might be different. The C828, the BC337 and the 2N3904 are all different. See below:



In summary:

Change the capacitors, and change the transistor.

I had them running on a bench power supply for a week or two each to check and adjust their accuracy. There is a lead screw adjustment on the back (there is a marking on the clock housing showing the direction of adjustment). My original clock has been back in my car for nearly two years now, it is still running and I rarely have to adjust the time.

Good luck,

Eric.