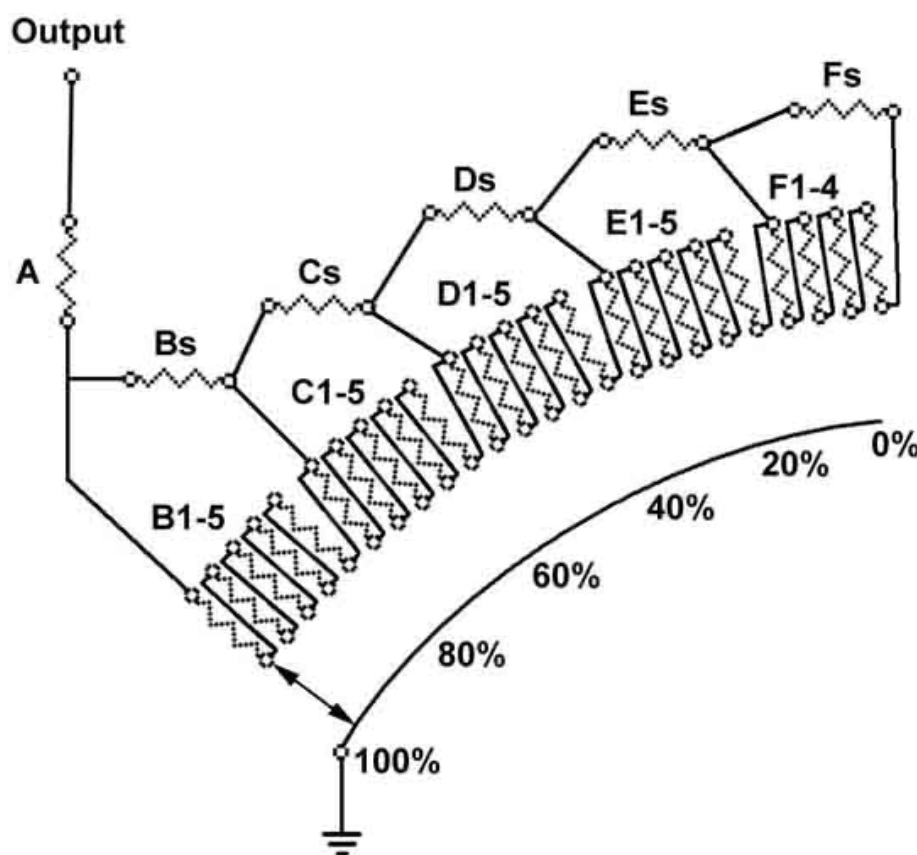


The resistance track comprises a network of series and parallel resistances that increases resistance in a non-linear fashion to match the non-linear characteristics of the thermal gauge. The 'sawtooth' section indicated by the middle arrow of 'F' consists of a line of individual resistances in series with each junction connected to a short piece of the track 'C'. The first 'tooth' with 6 segments, then 10, another 10, then 4, and finally 4. Within each 'tooth' the segments get progressively shorter as the fuel level drops, so even though the resistance is increasing from segments being added, it increases less and less with each segment. Near the beginning of each 'tooth' a parallel path is added back to the output via another resistance, so each 'tooth' consists of a number of different resistances in series, with another resistance in parallel with those series resistances, and there are five sets of those in series with each other. This creates a much more nuanced change in resistance as the wiper moves along the track than is possible with the original wire-wound sender, which only has one basic change in former shape (and hence the length of each turn) and one change in the spacing of the turns across the whole of its range of movement. Despite that and the non-linear markings on the gauge which are another attempt to match the tank contents to the gauge indication, my gauges at least move a lot more rapidly from 1/2 to 1/4 than they do anywhere else, a 'feature' which has startled me more than once. Whether this new sender has been designed to replicate the original, or whether they have taken the opportunity to better match tank contents to gauge indication, I don't know.

Schematically the circuit is somewhat as shown here, the double-headed arrow is the slider that moves around the arc as the contents vary, currently showing as a full tank:



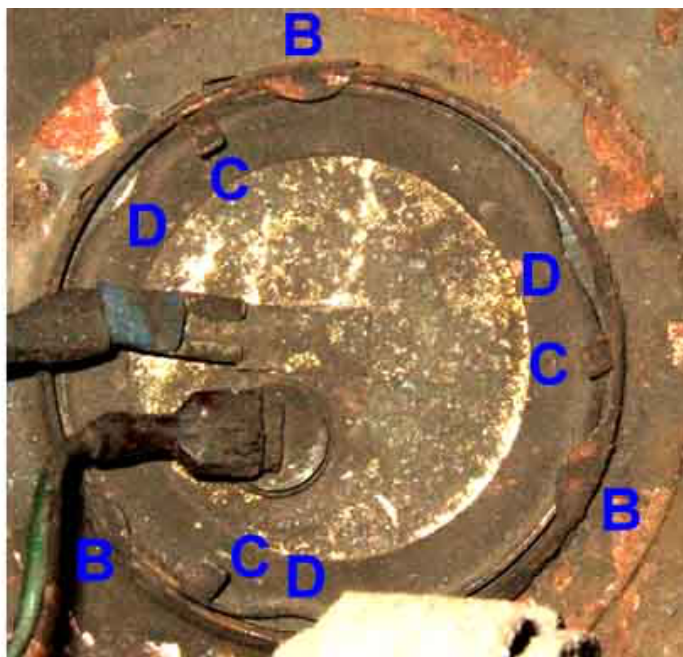
The earth goes through resistor B1 and A to the output, which gives the minimum resistance of about 20 ohms. As well as that a small portion of the current can flow through B2 to B5 and back towards the output via Bs, which are all in series with each other as well as being in parallel with B1. With two resistors in parallel the effect is to lower the overall resistance, for example if a 100 ohm resistor is connected in parallel with a 10 ohm resistor the overall resistance will become 9.09 ohms (you can [try your own values here](#)), so B2 to B5 and Bs will only reduce the effect of B1 by a small amount. As the slider moves through B2 to B5 the series value increases each time as each segment is added to the previous one. The parallel value is reducing as this happens, but the overall effect is a non-linear increase in resistance which takes account of the non-linear action of the fuel gauge.

While the slider is on contacts B1 to B5 all the C, D, E and F resistances are bypassed. But when the slider moves to the bottom of C1, that resistor is now in series with Bs and A, with B1 to B5 being in parallel with Bs. Additionally a small proportion of the current is now passing through C2 to C5 and Cs all in series, which are all in parallel with C1, as when the slider was on B1, and again the series resistance increases as the slider moves through C2 to C5, with the parallel resistance reducing, but the overall effect increasing with reducing tank contents, of course. The same happens through D, E and F.

As well as this network of resistances causing the overall resistance to increase in a non-linear fashion to match the characteristics of the gauge, the 'sawtooth' appearance of each section implies the individual resistances change one to another adding to the non-linearity, which may well give a more accurate indication of contents than you can get with the original wire-wound type. At the time of writing I have no personal experience of this type of sender to see if that is the case.

Locking-ring: Three tapered sections (A) on the ring slot under turned-over lugs (B) on the tank. Originally [Service Tool 18G1001](#) would have been used, but in the absence of that I've always done it by going round the three tabs (C) on the ring in turn bit by bit tapping carefully, turning the ring anti-clockwise to remove and clockwise to replace. If there is petrol in the vicinity you should be careful not to make a spark, perhaps by using non-ferrous tools, but you

shouldn't be striking it that hard anyway. When removing turn the ring anti-clockwise far enough to align the three recesses in the ring (D) with lugs 'B' so the ring can be completely removed, reverse for refitting. When tightening tabs 'C' should stop short of lugs 'B'. All three tapered sections should be locked under their respective lugs or the sender will not seal.



If the three tabs 'C' have been sheared off (as happened to Mark Morris) you will have to try something else. One possibility is to carefully drill through the locking ring in at least two of the recesses 'D' and use self-tappers with the points ground down once the thread has been started. If you leave the points on they could dig into the tank part of the fitting and you will be no better off.

Locking ring removal tool 18G1001. On the basis of that not difficult to fabricate one. I'm not sure why it needs a cut-out, much less an L-shaped one, surely one would disconnect the wires before undoing the locking ring?



A couple of hours - first looking for something about the right size (plastic cap of aerosol contact adhesive) to act as a pattern, then for a suitable bit of metal (an off-cut from an exhaust trim that's been in a box of metal bits for years). Longitudinal cut so I can open it out to the right size (about 6cm), then three slots at 120 degree spacing (about 5mm square), and Bob's my uncle. Haven't used it anger as I don't want to break the seal until I need to. May need a couple of holes drilled through the outer end for a tommy-bar. I don't think that end will need welding up like the above as it's pretty hard metal and needed quite a bit of effort with two pairs of pliers to open up.



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