1991 Toyota Soarer fuel sender removal, dismantling for cleaning and calibration

Depending on the year model and variant, mostly early Soarers were fitted with fuel senders of uncommon design. Such senders are very accurate but with years of service tend to loose the accuracy and require cleaning and calibration to restore it. Much simpler float-type fuel senders were fitted to later model Soarers.

This procedure is concerned with the early design.

Open the boot and remove floor-board and carpet (if any).

Remove plastic fastener from the boof floor at the right, holding the large piece of trim covering the fuel tank.

Remove plastic fastener from the boof floor at the left, holding the large piece of trim covering the fuel tank.

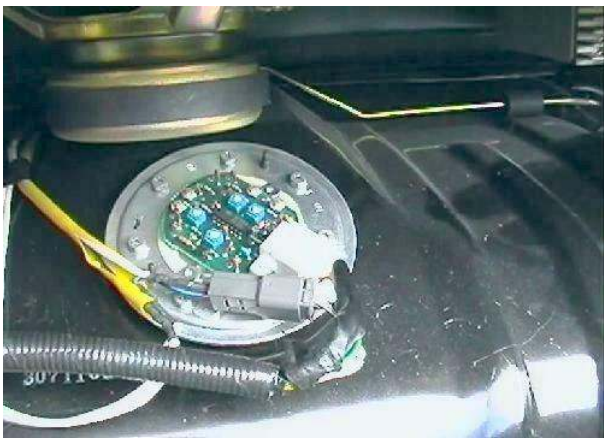
Remove the large piece of trim covering the fuel tank by pulling on it to dislodge five spring clips along the top edge. At the top in the centre there is a boot light fitting and the trim has a cut out to fit around it.

The fuel tank becomes accessible.

The round part directly under the bass speaker is the top part of the fuel sender. In this picture please disregard the white and red wires. They are non-standard equipment associated with a fuel pump kill-switch fitted to this Soarer as a simple but effective anti-theft device.

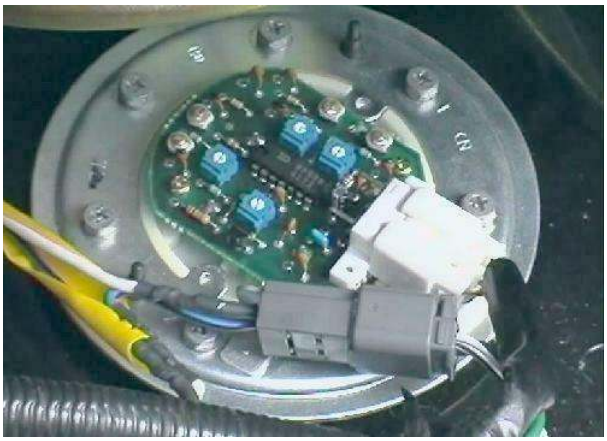
Remove one of the screws holding metal cover over the fuel sender electronic circuit.

Remove the other screw holding metal cover over the fuel sender electronic circuit. nbsp;



The metal cover removed and fuel sender electronic circuit exposed.

Remove the white plug from socket of the fuel tank sender electronic circuit, slide the grey fuel pump connector off its steel supporting tab (without uplugging it).



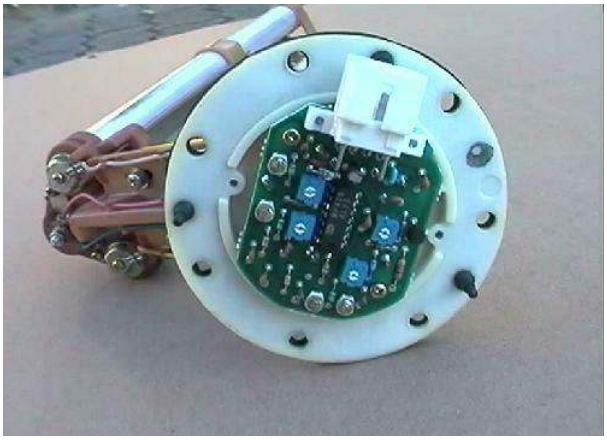
Unscrew 7 small bolts (8 mm ring spanner needed) holding the fuel sender to the top flange of fuel tank. Pull out the fuel sender from the tank.
This can be done with all the other parts in place (such as the fuel tank and bass speaker) but care must be taken to rotate the sender unit whilst it is being pulled out.
Note: The strong magnetic field generated by the speaker magnet can make work difficult when using steel tools near the speaker.

The top of fuel tank with the fuel sender removed.
This is the right time to empty the tank completely for

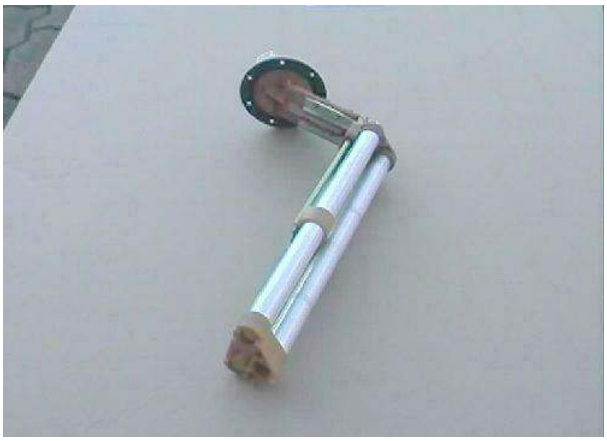
later calibration of the fuel gauge. (Small electric fuel pump is recommended as siphoning the fuel from the tank can be rather unpleasant alternative.)

The fuel sender removed from the fuel tank.
It works by measuring capacitance in capacitors formed by three alloy tubes filled with petrol, serving as dielectricum. The two outer tubes with wires on tops have single smaller diameter alloy tubes inside and the centre tube has one alloy inner tube and even smaller sized solid alloy core, clearly visible in further pictures. The terms "outer" and "centre" tube is further used to describe the tubes with and without wires on the top. Furthermore, "internal" tube describes the tube of smaller diameter located inside the "outer" and "centre" tubes.

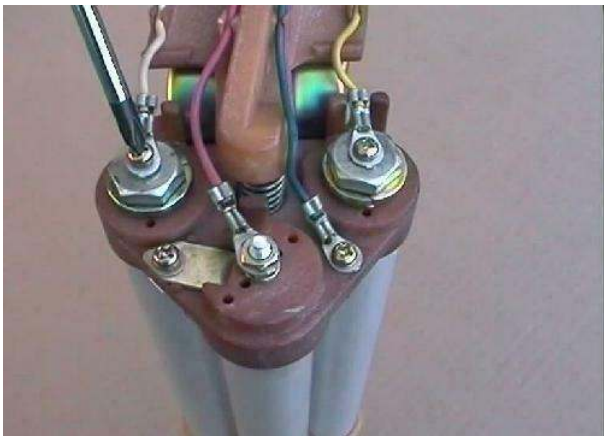
Another view of the fuel sender removed from the fuel tank.
The complicated electronic circuit compares measurements from three independent capacitors and provides signal to the combination meter for accurate display of fuel quantity.

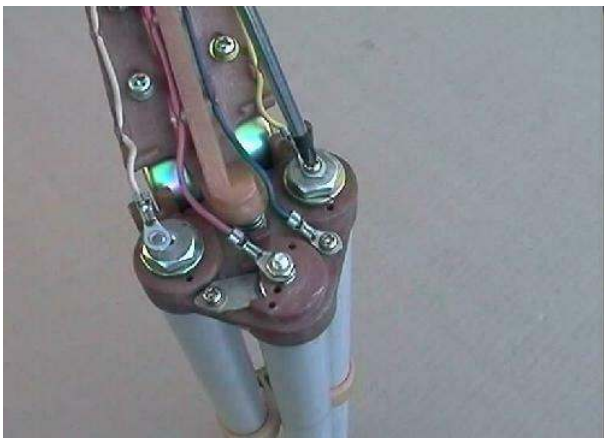


Yet another view of the fuel sender removed from the fuel tank and ready to be dismantled and cleaned.
The problems with faulty indications of the fuel gauge in the combination meter are caused by deposits on and in all three alloy capacitor tubes. Cleaning the tubes inside and out restores the correct function. I used a general purpose paint thinner.



Remove the screw securing beige wire eylet to outer tube.



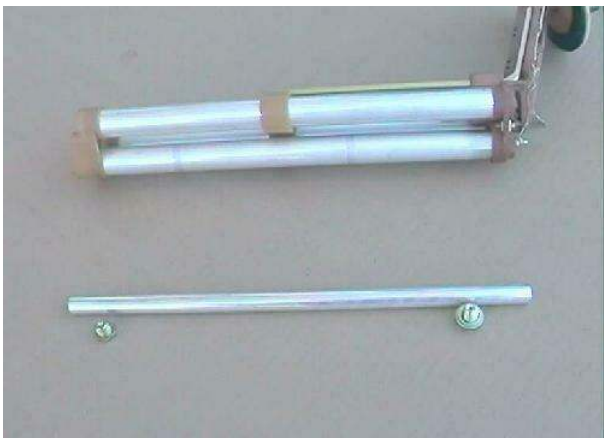


Remove the screw securing yelow wire eylet to outer tube.

By using a 14 mm spanner, undo the top nut from one of the outer alloy tubes.

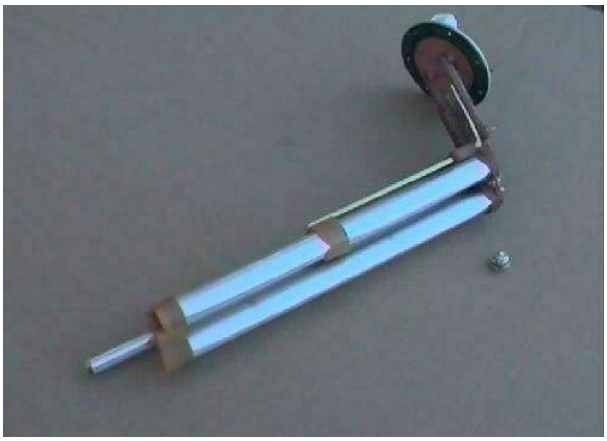
The design is such that threaded plugs are used at the top and bottom. Undoing the top nut can result in either the top plug coming off and the internal alloy tube staying inside the outer alloy tube for sliding out through the bottom, or as shown here, in the bottom threaded plug becoming undone and the top threaded plug remaining in the internal tube to be taken out through the top.

The bottom threaded plug mentioned above.



The internal alloy tube and its two threaded plugs.

By using a 14 mm spanner, undo the top nut from the other outer alloy tube.



This time the internal alloy tube is removed from the outer alloy tube by sliding out through the bottom.

The internal alloy tube and its two threaded plugs.

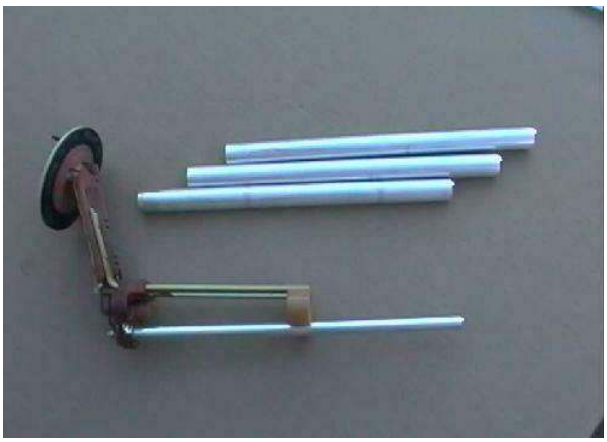
Removal of the bottom plastic spacer is easy by pulling it off the outer and centre alloy tubes.

The bottom plastic spacer separated from alloy tubes.

When the internal alloy tubes were removed, the outer alloy tube will easily slide out.

The second outer alloy tube will also slide out easily.

The centre alloy tube is fastened differently. At the top end it has external thread and must be unscrewed from the top bracket.



The internal alloy tube inside the centre tube has also got an external thread and must be unscrewed from the top bracket.

Detailed picture of the threaded internal alloy tube.

All outer, centre and internal tubes were removed. A solid alloy core of the centre capacitor remains in

position.
All these parts (including the other two internal alloy tubes removed from the outer capacitor tubes - not shown here) must be thoroughly washed inside and out and dried out.

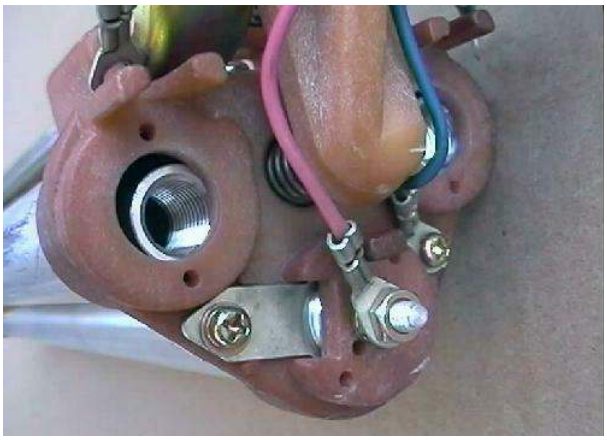
Assembly is reversal of the dismantling procedure.
The centre capacitor is assembled by screwing in the threaded internal tube first and then the outer centre alloy tube.
The treaded plugs are screwed to the bottom ends of both internal alloy tubes.
Only points of importance will follow:

Re-installation of the bottom plastic spacer involves insertion of two inner alloy tubes (of the outer capacitors) with their threaded plugs attached.

All three large diameter alloy tubes (2 outer and 1 centre tube) must be properly seated in the bottom plastic spacer, as shown here.

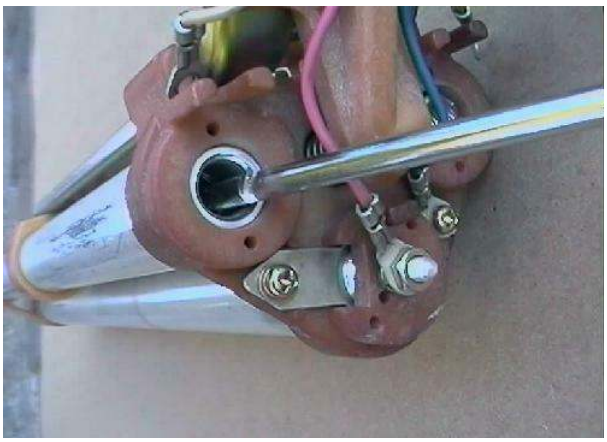
When the bottom plastic spacer is being re-fitted it is improtant to ensure that the inner alloy tubes of the two

outer capacitors (the centre one is already firmly screwed in) do in fact come through the top holes before the top threaded plugs can be installed.
This picture shows this not being achieved yet.



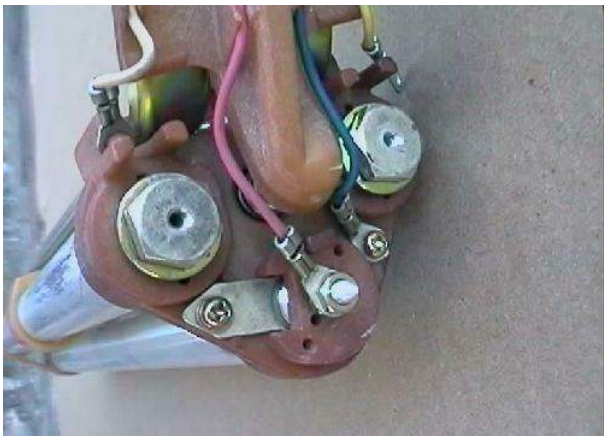
Another indication of this undesirable condition is the bottom threaded plug/s protruding slightly from the plastic spacer rather than fitting snugly inside the spacer.

The internal alloy tubes can be guided through the top holes with the help of a screwdriver and a push from the bottom.



All is now well at the (top and) bottom end.

The two top threaded plugs can now be installed.



The two eylets with beige and yellow wires can be re-attached.

The fuel sender is ready to be returned to the fuel tank.

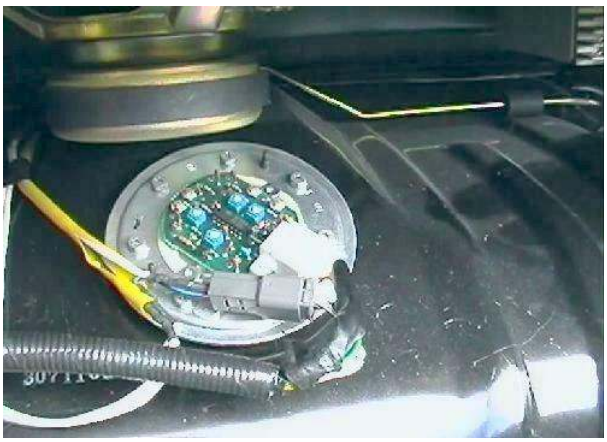
When installing the fuel sender in the tank, check the orientation of the flange. The seven mounting holes are irreguarly spaced and there is only one position of the flange when all holes line up.
This picture shows how NOT to fit the fuel sender in the tank. Before putting in the seven bolts I forgot to install the steel plate on top of the fuel sender.
WARNING: Omitting to fit the steel plate will result in damage/destruction of the fuel tank, as shown here.

This picture shows the steel spacer to the right of the sender, laying on the top of fuel tank. Of course, it must

be seated on top of the sender and seven fastening bolts must pass through holes in the steel spacer AND the fuel sender to engage threads in the fuel tank flange.

This IS the correct way of fitting fuel sender to the tank.

Re-connect the white plug in its socket and attach the grey connector to metal supporting tab.



When filling the fuel tank with petrol at home or in workshop, it is necessary to open up the safety flap inside the tank filler by a screwdriver.

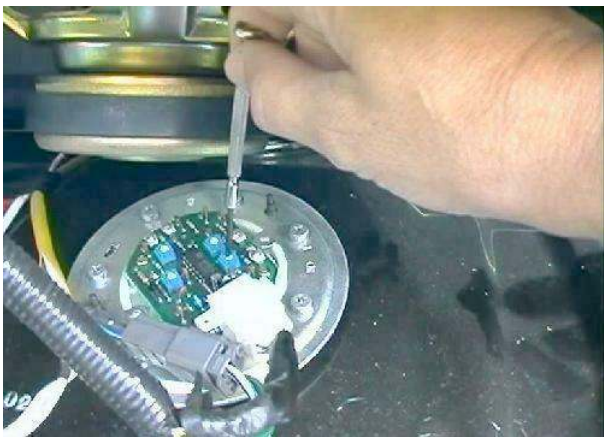
When small enough funnel is not available, the screwdriver must remain in position to keep the flap open when filling up (watch for it not to fall inside the tank).

I must stress at this point that the following procedure is NOT entirely scientific. However, it does work, even if it has elements of black magic to it. No technical information is available on the wiring of the electronic circuit of the fuel sender, not even in the Japanese Repair Manuals. Through expriementation I came to an understanding of how it works but, please, do not expect full explanation here.

If the blue trimpots on the round circuit board on top of the sender have not been touched/disturbed since the sender last produced correct readings, then the following re-calibration procedure may not be necessary. This will become apparent when petrol is added to the tank and fuel gauge indications are correct.

Calibration of the fuel sender will be done by filling 5 litres of petrol at a time. (It may also be possible to do the calibration by adding 10 litres of petrol at a time).
The white fuel sender plug must be connected first and engine started to display the fuel quantity in the combination meter. If the ignition is on and the engine not running, only the graphic fuel gauge display will be available but the exact quantity readout in the LCD display will not be active when pushing the FUEL button.

Start by turning any and/or all four BLUE trimports to a position where ZERO fuel indication is shown in the combination meter (see next picture).
DO NOT TOUCH ANY OF THE OTHER FOUR WHITE TRIMPOTS AT ANY TIME!
If zero reading cannot be readily achieved, settle for the lowest possible reading (press FUEL button located next to the time adjustment buttons in the combination meter to display litres in the fuel tank) and allow several minutes for the reading to stabilize. Zero will be achieved in time and calibration can proceed.
If the fuel tank was empty and zero cannot be achieved in 15 minutes, fill the tank with 5 litres of petrol and adjust the trimports to achieve zero reading.

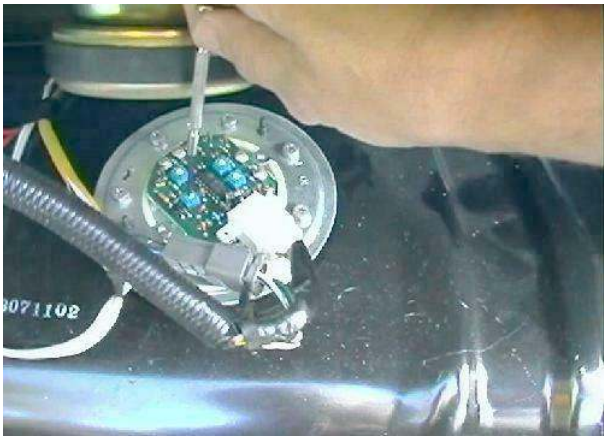


Zero fuel reading is shown as display of no segments in the fuel gauge, orange reserve fuel light on, bing sound and Japanese writing in the "clock" section of the LCD display.

After zero was set, add 5 litres of petrol to the tank. By turning the trimpot No. 1 located roughly at "3-o'clock position" on the fuel sender circuit board, or nearest above the white socket, adjust the fuel gauge display in the combination meter to show 1 bar. The reserve light should still be on.
It may be necessary to also adjust slightly the next trimpot No. 2 to the left (or clockwise) from the starting trimpot at "3-o'clock position". The black magic comes into play when 2 or more trimpots must be adjusted so that the reading is right. It appears that trimpot 1 affects readings at the lower range and trimpots 2, 3 and 4 affect readings at higher range between 0 and 76 litres.
NOTE: Blue trimports are numbered clockwise from 1 to 4 starting at "3-o'clock position".

Add another 5 litres (total of 10 litres from empty). Accept reading with the tolarance of 1 or 2 liters as absolute accuracy is hardly achievable. With more than 10 litres in the tank the orange reserve fuel light should come off.

Adjust trimpot No. 2 to get accurate reading. With more litres in the tank avoid re-adjusting trimpots of lower numbers (e.g. No.1).



Add more fuel to the tank in 5 litre increments and adjust trimpots.

Add even more fuel to the tank in 5 litre increments and adjust trimpots. At times it should be possible to add more fuel to the tank and observe the readings to rise accurately with no need to adjust trimports for those additions of fuel.

Add more fuel to the tank and adjust trimpot No.3.

Keep adding petrol in 5 litre increments and adjusting trimpots.

Add more fuel to the tank and adjust trimpot No.4.

Keep adding peterol to the tank and adjusting trimpots.

With more than 70 litres of fuel in the tank the display should indicate full fuel.

Re-install metal cover over the fuel sender electronic circuit.

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Put the trim piece back, boot floor board and carpet. All done.