

Installing Starter Solenoid and Aux Pump Indicator Lights on Panel **by David Clark ICS 08592 A/P**

A friend of mine had a starter solenoid stick in his Seneca last year that, unknown to him at the time, caused the starter to be destroyed. Because it is relatively easy to install an indicator light on the starter solenoid circuit, I elected to install two such lights in my Twin Comanche: one for each solenoid. Since I was going to drill two holes in my panel and do some wiring behind it, it occurred to me that this would be a good time to put in two more indicator lights telling me that the aux fuel pumps were on, thereby reminding me to turn them off after they were no longer needed. While I realize that the aux pumps should be part of our normal checklist, so is putting down the landing gear and yet, each year a few of us forget to extend our undercarriage before reuniting with Mother Earth. Therefore, if there is some small reminder that I can use to help me remember items that I should be doing at the same time that ATC is often interrupting my concentration, then I want to avail myself of it.

To that end, I spoke with my neighbor in the next hangar who is an electrical engineer and also an IA mechanic. Together we designed a very simple circuit for both the starter solenoid “engaged” indicators and the boost pump indicators. Refer to figure 1 for the wiring diagram. We already had on hand some PTT (press-to-test) indicator lights with red and amber lenses, so we chose to use the red lights for the starters and the amber ones for the boost pumps. Next we made a small thin aluminum template out of scrap material to hold the lights in place while we soldered the leads to the back of the lights.

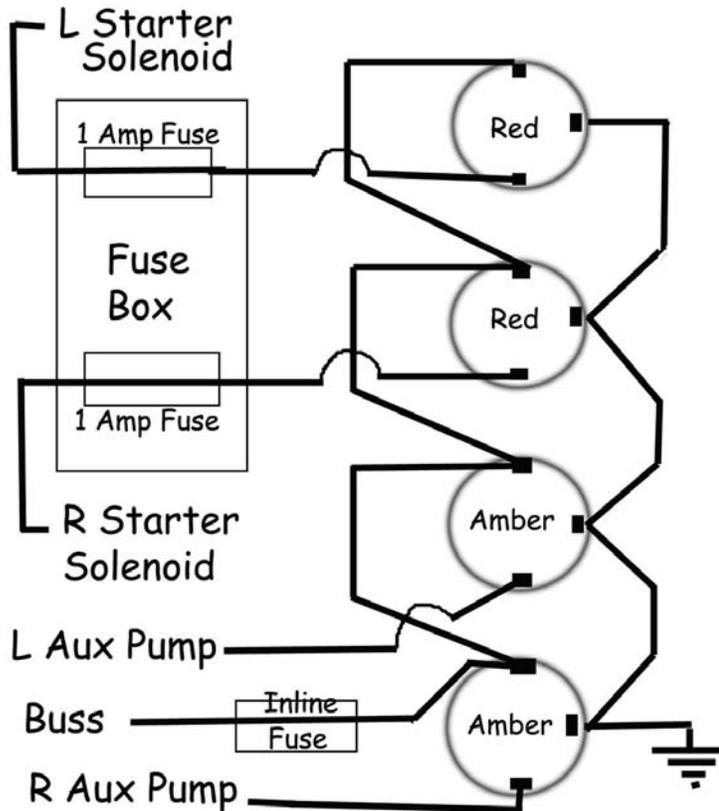
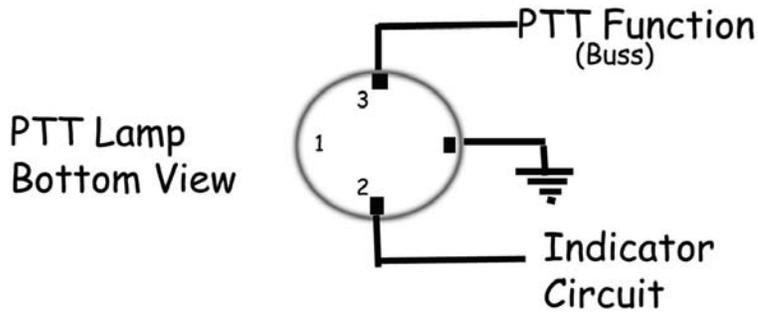


Figure 1 Wiring Diagram

After deciding where to put the lights on my panel, I made another small template out of a piece of scrap aluminum for drilling four pilot holes. Once I drilled these, I used a Unibit step drill to make four perfectly round openings of exactly the size required for the PTT lights. The light sockets are pushed through the holes from behind the panel and secured with lock washers and hex nuts. Once the sockets are in place, you can screw in the lenses that contain the bulbs. Refer to figure 2.



Figure 2 Panel Lights Configuration

As you can see in the wiring diagram, we “daisy-chained” the ground terminals and the “always hot” PTT terminals to avoid redundancy in the circuitry. One wire came off the RH Aux Pump light ground terminal that, after crimping on a small ring connector terminal, we screwed to bare metal in a convenient location under the panel. Ideally we would have attached the power wire from the PTT terminal of the same lamp to the buss. Since running a wire under the flooring to a circuit breaker is not very convenient, we elected to attach this wire to the “always hot” terminal on the back of one of the boost pump switches with an inline fuse holder soldered into that lead. Refer to figure 3.

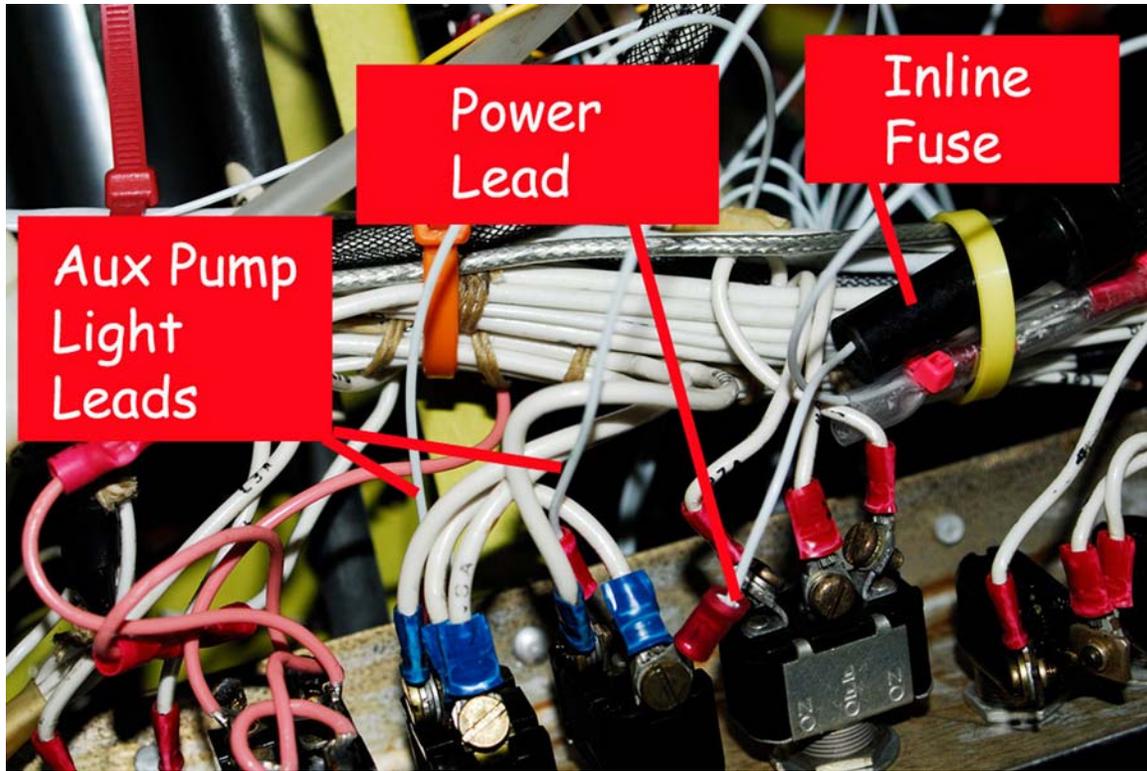


Figure 3 Behind The Panel Wiring

We ran the two indicator wires from the red starter lights through one of the several pre-existing holes in the firewall into the nose compartment and down to the starter solenoids which are located in the lower right side of that space about 10 inches forward of the firewall. We made these wires approximately 7 feet long to give ourselves plenty to work with and we tied a small knot in the end of the left wire to identify it. It is easy to have these two wires join the pre-existing wiring bundle in the rear of the nose section and secure them with tie-wraps. We brought these two wires to the lower right front surface of the firewall to join a newly created fuse box that we had mounted there with screws. It is best to drill the two holes from the nose compartment through the firewall into the cabin just behind your rudder pedals on the co-pilot side. Be careful to avoid the large wiring bundle running on the cabin side behind a plastic “tunnel” molding. One can easily identify the boundaries of this bundle from the nose compartment side by looking for the screws that hold the plastic molding in place on the nose side. Since it was virtually impossible to solder down inside the crowded lower nose compartment, we crimped on the female connectors to the two indicator wires and pushed them onto the male connectors in the top of the fuse box. We had built the small plastic fuse box from parts readily available at Radio Shack or any electronics supply. Refer to figure 4. We drilled holes in the bottom of the fuse box and riveted two individual fuse holders in place. At the same time we drilled two additional holes in the bottom of the fuse box floor that would accommodate the screws for attaching it to the firewall. We then used a mill file and cut slots in the relatively soft plastic ends of the box to allow the wires to pass through. We also used small rubber grommets around the wires that ran through the

slots. Next we attached two wires (approx 18 inches in length) from the bottom of the fuse box to go toward the starter solenoids.

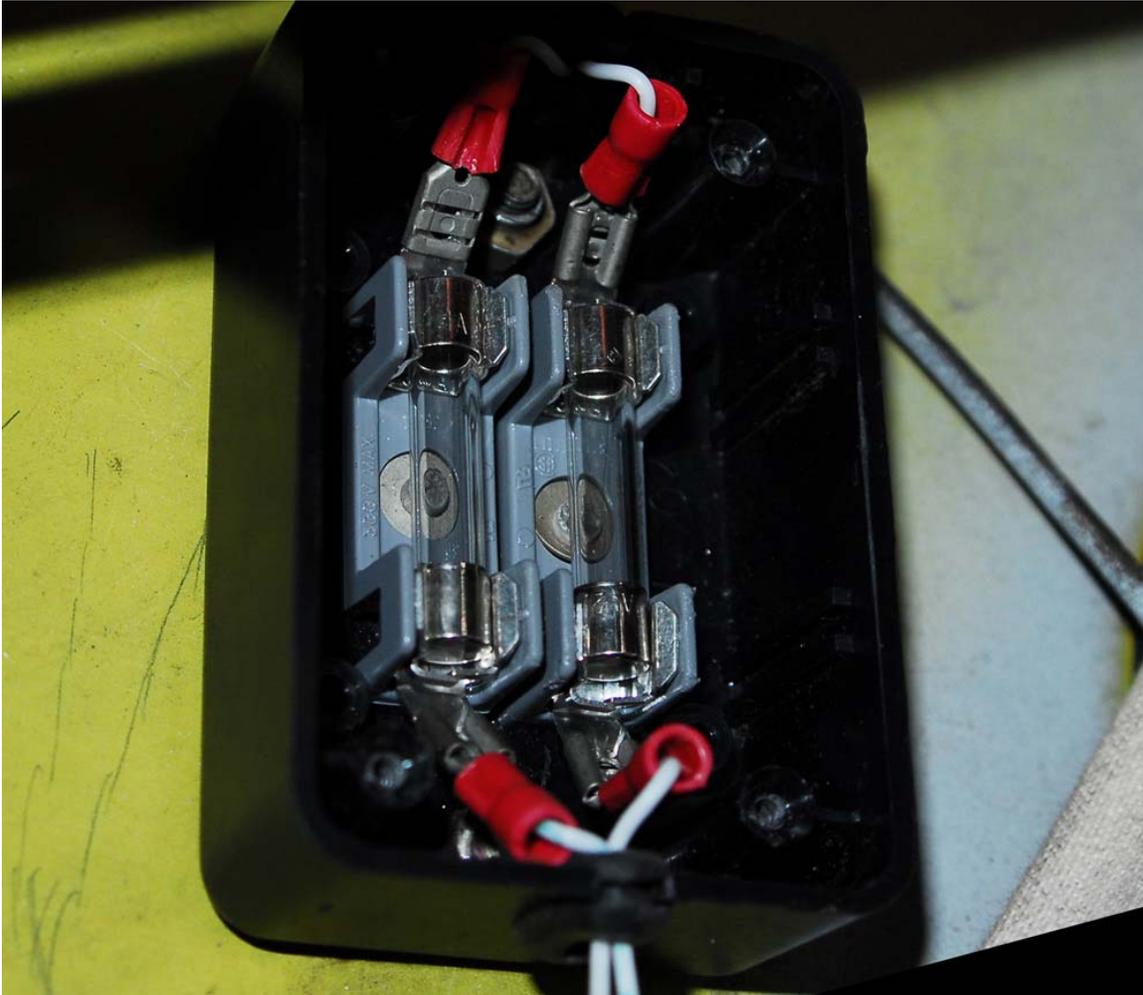


Figure 4 The Fuse Box

The most difficult part of the process was as follows: On each of the starter solenoids, we peeled back the rubber boot that covers the power terminal connector and stud and removed the nut and split washer. We then ran each wire from the fuse box through the rubber boot on its respective solenoid so that it would run parallel to the large power wire going to the starter. We had to use some surgical hemostats to pull the smaller wires through this very tight place. The outboard solenoid for the right engine starter was much easier to access than the inboard one for the left starter. On the two Twin Comanches that I have installed these lights, I have noted that the studs and lugs are different sizes on the two solenoids. I surmised that this was intended so that one will not confuse the two wires to their respective starters when replacing them. I then crimped a 5/16" ring terminal connector to the right wire and a 3/8" connector to the left wire from the fuse box and attached these to the solenoid studs. Warning: don't crimp on these connectors

before you pull the wires through the boots. Refer to figure 5. Once the nuts and washers were back on the solenoid studs, I replaced the rubber boots and put new 1-amp fuses in the fuse box and tried out the new starter indicator light circuits. Since each red light came on temporarily when I was cranking its corresponding engine and went out promptly when the engine started, I placed the cover on the fuse box and replaced the nose cowling. The process for installing one of these indicator lights on a single Comanche would be almost identical but would involve bringing the wire through the firewall into the engine compartment and attaching a small fuse box to that firewall before running the wiring to the starter solenoid itself.

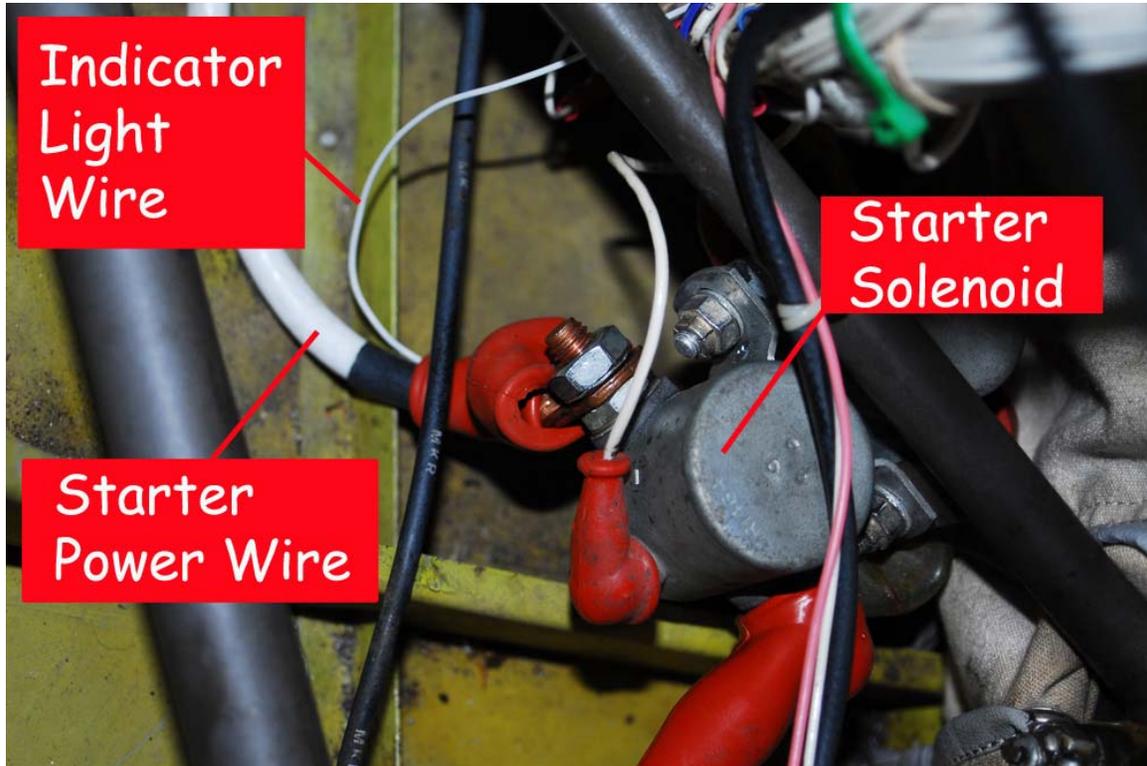


Figure 5 Starter Solenoid Wiring

The wiring for the aux pump indicator lights is much easier. All I did was run the wire from each boost pump indicator light to the back of the boost pump switch on the lower panel. We measured what we needed, cut the wires and crimped on two ring terminal connectors. The screw terminal on each switch to which one must attach the lamp wire is not the convenient one on the bottom of the switch but rather the one on the side of the switch. I had to loosen the hex nut on the front side of the panel and turn the switch slightly so that I could access the screw on the side terminal of each switch. Once the wires were attached, I could easily tell if these lights were working properly by simply turning the aux pumps on and off.

You will have noted that for safety concerns we inserted 1-amp fuses in the wires coming off of the starter solenoid power terminals (the fuse box) due to the large amounts of current drawn in those circuits. Likewise we inserted a 1-amp inline fuse into the PTT

circuit of our indicator lamps. This is a project that you and your A & P can easily do in an afternoon, or you can get your avionics shop to do it. It required about 4 hours of work. It can be done by one person, but two will make it go faster as one can be working in the nose while the other is in the cabin. A simple logbook entry will suffice for this procedure. You have cut no wires nor made any significant alterations. No change in the weight in balance is needed. Be sure to mention that the wiring was done "IAW AC43:13-1b & 2a."

In the second Twin Comanche in which we installed these lights we used simple panel indicator lights without the press-to-test function which makes the wiring even easier. We eliminated the PTT circuit and only "daisy-chained" the ground terminals on these lamps. The other terminal on the back of each of these lights was wired exactly the same as the #2 terminal (indicator circuit) on the lights in our wiring diagram.

The parts needed are:

- 4 PTT lamps
- 1 inline fuse holder
- 1 plastic fuse box with two fuse holders, mountable type
- 3 fuses, 1-amp
- 25 feet of 22 gauge insulated wire
- 4 spade connectors
- 1 ring terminal connector 5/16", solderless or crimp-on insulated type
- 1 ring terminal connector 3/8", solderless
- 4 small ring terminal connectors, solderless
- Some heat shrink for soldered leads on back of PTT lamps
- 2 small grommets for fuse box
- 4 screws and locking nuts
- 2 rivets, squeeze type
- 20 Tie wraps
- 2 pieces of 2 x 4 inch scrap aluminum for templates

Editor's Note: Comanche owners are aware of the varying requirements imposed by different GADOs for this type of work, as some GADOs may not accept a logbook entry. It is therefore imperative that owners seek appropriate guidance from their IA before attempting such alterations