# FJ Cruiser Accessory Power System

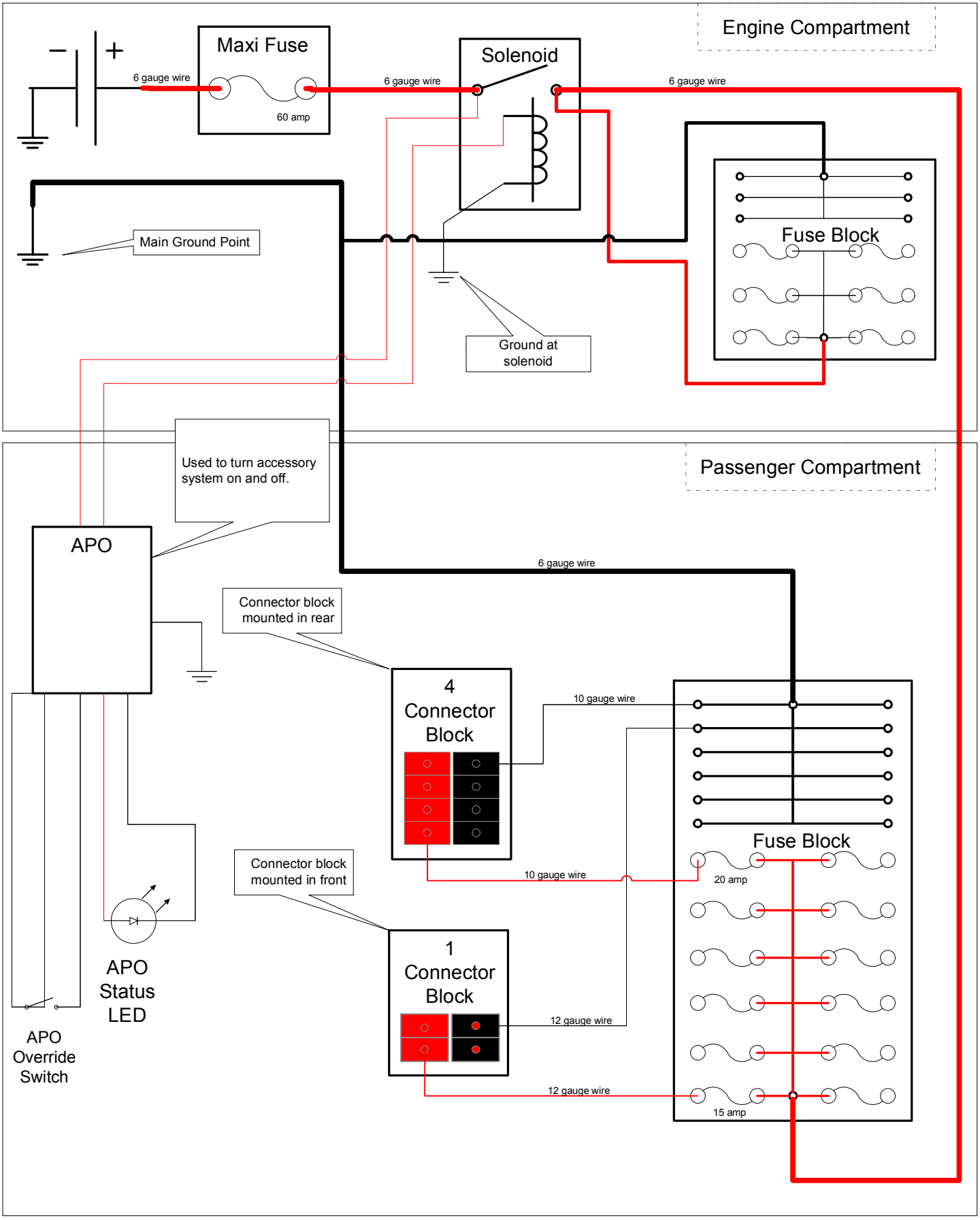
Being a HAM radio operator as well as a geek that wants to install a number of items in the FJ that use DC 12 volts I decided to get a 12 Volt Accessory system installed. I wanted a system that could handle up to 60 AMPS with spikes even higher. I also did not want to tap the FJ wiring harness so as to prevent any warranty issues. I also have found the FJ harness to be very tight in its tolerances for amps drawn. The available FJ accessory plug is rated at 15 amps and I would highly discourage anyone from tapping the circuit to add additional accessory outlets.

## System objectives

1. Automatic power up and down with FJ.
2. Have a fuse block in the passenger compartment and under the hood.
3. Provide accessory plugs in two additional places in the FJ using Anderson Powerpoles (Powerpoles are very popular with ham radio operators and provide a MUCH better connection than a cigarette/accessory plugs, which tend to fall out) These will be located in the driver/passenger area and above the 115 volt inverter connection in the back.
4. Use standard AGE fuses.
5. Allow for easy integration of a secondary battery system.
6. Avoid taping the FJ wiring harness.
7. Provide switched power for camper trailer charge circuit. (This power will be taken from the solenoid directly)
8. Provide switched power for other future systems.
9. Provide Limited Battery power after

NOTE: I in no way guaranty success with this installation, nor do I guaranty that the system is designed to the correct specifications for your needs. Remember, messing the power system in your auto can lead to an electrical fire due to shorts or other errors. If you have any doubt in your ability to install this system you should have a professional complete the install for you.

Accessory Power System



## System components

1. Fuse Blocks
    a. Inside: Blue Sea Systems ST* Blade Fuse Block With Cover - 12 Circuit with Negative Bus **PN:** 5026
    b. Engine Compartment: ST* Blade Fuse Block With Cover - 6 Circuit without Negative Bus
    **PN:** 5028 (This fuse block is going to be installed at a later date when needed)


2. Solenoid: Current Solenoid is a continuous duty solenoid available from most RV parts houses. I will be replacing it with the Blue Sea Systems L-Series Solenoid Switch with Coil Economizer **PN:** 9012 (This solenoid has a reduce current draw once closed and can handle 300 amps so it will be functional for switch winch power as well.)


3. Automatic Power Off controller: The APO cannot handle the amp rating that I want so it is used to control the solenoid. The APO will only allows the accessory power system to run when the voltage on the battery is 13.5 volts or higher. Once the FJ is turned off the APO monitors the voltage and once it has dropped below 13.5 it starts a 10 second timer after which the power to the solenoid will be shutdown and the system turned off. The APO has an override switch that will allow me to turn the system on when the ignition is off. To allow remote monitoring and control, an external LED and switch need to be added to the APO.(Available from [APRS World]

4. Main harness wire: I found a 6 gauge aircraft quality dual wire at the local Truck Parts house (6 gauge can carry 65-85 amps for a 7 foot run):


5. Main System Fuse: MAXI Fuse Block **PN:** 5006 with 60 amp fuse installed (The Maxi fuse is a slow burn fuse so a voltage spike will not burn it.)

6. Anderson Powerpole chassis mount connectors (Available at Powerwerx)

7. Accessory wire: Red/Black zip cord in appropriate gauge for application. The wire I use is from www.powerwerx.com and is rated to 170°F and automotive use.

# Installation

## Maxi Fuse Block

The Maxi fuse block is the main fuse protection for the entire system. For maximum protection the fuse needs to be as close to the battery as possible. The mounting point I chose uses preexisting threaded holes on the left front fender. This placed the Maxi fuse block about 1 foot from the battery with a clear run for the positive wire. Aluminum "L" stock was used to fabricate the bracket. The Maxi fuse installed is a 60 amp slow burn fuse which is rated for the 6 gauge wire being used and will allow for momentary spikes.

1. Build your bracket for the Maxi fuse block. (I used alunimum "L" stock for this"
2. Mount the fuse block as close to the battery as posible. I used existing threaded holes right beside the main fuse box. Be sure the mount location allows access to the terminal screw and for the cover to be romoved and replaced.

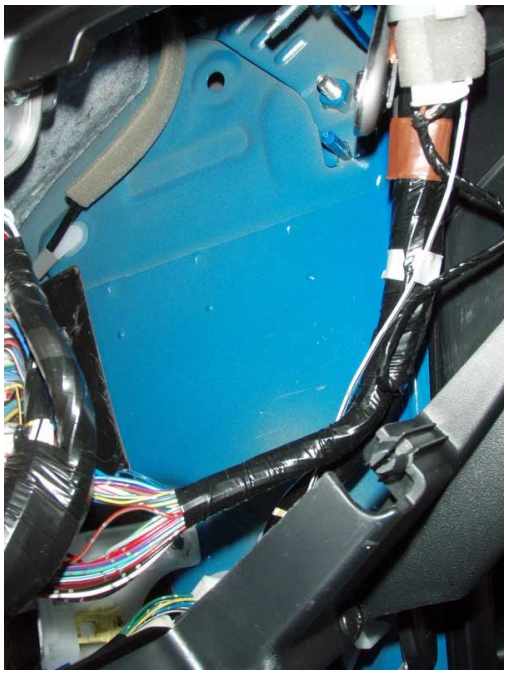
## Solenoid and APO

I chose to mount the solenoid above the right fender in the same location a second battery will be placed when implemented. I added an aluminum plate again using existing mounting holes. This plate will be used to mount the solenoid as well as other items when needed. (NOTE: I do not have the APO in hand at this time so I have bypassed the solenoid for testing.) If your do not want your system to be automated you can install a switch to control the solenoid. If you use this option BE SURE to fuse the switch.

## Interior Fuse Bus

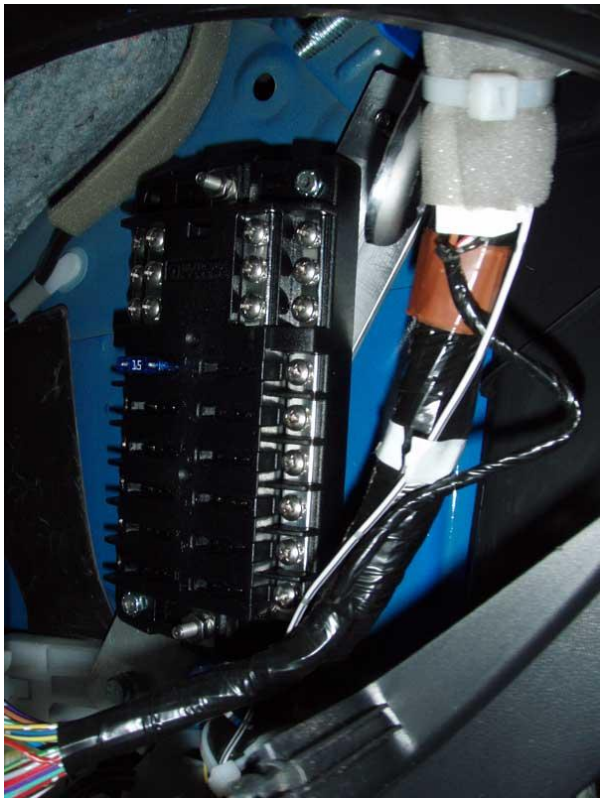
I wanted the interior fuse bus to be in a location that could be easily accessed for fuse replacement. The location I chose is on the right kick panel behind the glove box. This is the same location for the XM satellite radio mount.

1. Remove the glove box
2. Locate the two mounting points. The bottom mount uses the same bolt as the large plastic wiring harness FJ control module. The top point is the back side of a bolt and the allinment pin right below it.



3. Create a cardboard template for the fuse bus mounting bracket.
4. Cut and drill the mounting bracket using the template. I used 2 inch wide aluminum stock for the bracket.
5. Verify the fit of the bracket in the FJ.
6. Mount the fuse bus to the bracket so it will be vertical when mounted in the FJ. You also need to position the fuse bus for the best clearance.

7. Mount the fuse bus in the FJ.



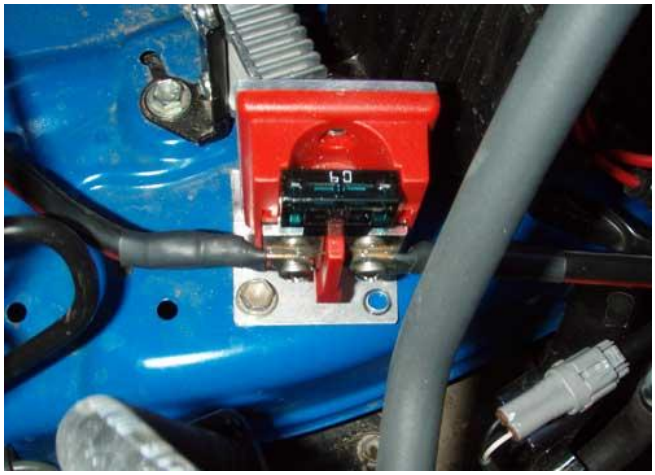
## Main Feed Wire

To facilitate ease of installation a 2 wire 6 gauge line was used. The wire has a very thick housing and appears to be rated for aircraft installation. The wire has a high strand count which help with flexibility and current capacity. For the main feed wire you will need small ring connectors for the fuse block and Maxi fuse and large ring connectors for the battery, solenoid and ground point. I solder all connections and cover them with 2 layers of shrink wrap.

All the connectors are soldered for least resistance and corrosion prevention and have 2 layers of heat shrink on them. I also use dielectric grease on all the connections under the hood. The grease fills any small gaps in the connection and helps prevent corrosion and arcing which deteriorates the connection over time.

1. Route the wire starting at the battery and across the back of the engine compartment along the existing wiring harness. Before you tie wrap it in place be sure there is enough wire at the battery end. If you are using zip wire like I am then split the wire and so you have enough to route the positive through the Maxi fuse and the negative to the main ground point by the battery.

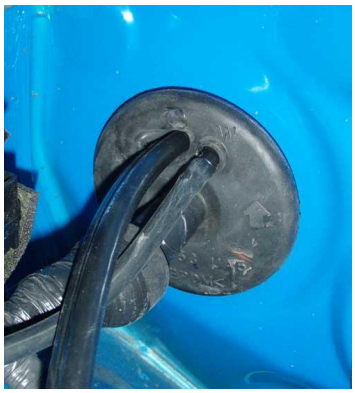

2. Cut the wire at the Maxi fuse and terminate both sections with ring connectors. Then connect to the Maxi fuse.



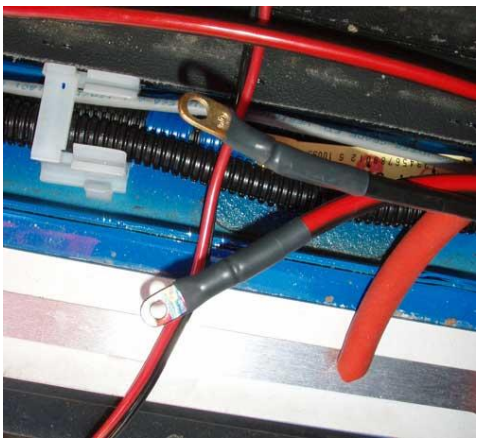
3. Terminate the other end of the short positive section with a ring connector that will fit the mount on the battery connector. (DO NOT CONNECT AT THIS POINT)
4. Cut the black wire the correct length to route behind the main fuse box and terminate at the main ground point.

5. Route the remaining wire through the firewall using the existing large rubber grommet. I had to create a slit in the rubber and then open the hole with a screw driver prior to feeding the wire through

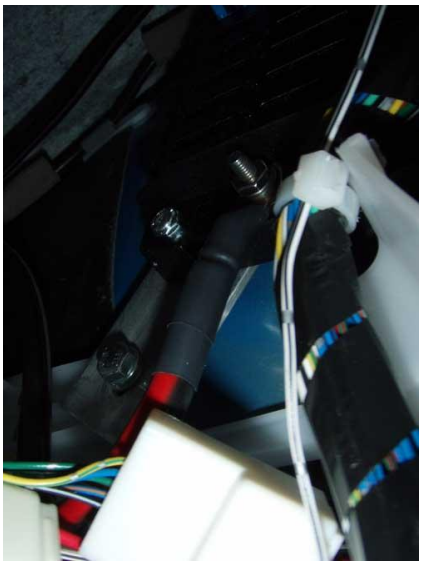
leaving a large enough loop to be able to cut the positive wire and hook it up to the solenoid.



6. Cut the wire at the fuse bus providing enough slack to reach bottom the positive and negative attachment points.
7. Now pull all the wire through the firewall taking up the loop you had left for the solenoid connections so you have enough slack to terminate the wire with ring connectors.



8. Pull the solenoid loop back through the fire wall so the connectors are at the fuse bus. (A second person can help with this step)
9. Connect the wire to the fuse bus. The positive wire is connected to the bottom of the fuse block near the fuse bus and the negative wire is connected to the top of the fuse block near the ground bus.



10. Spit the positive wire at the solenoid and terminate with ring connectors.
11. Connect the positive wire to the both sides of the solenoid. There is no polity for the connections.

12. Using an Ohm meter verify that the ground bus on the fuse block is good and the fuse bus is open to ground indicating no short. If the positive side is not open to ground the trace your system to find the problem.
13. Connect the positive wire at the battery then reconnect the battery.
14. Now test the positive side of the fuse bus using a volt meter. You should get 12 volts. Be sure you are checking a connector with a fuse in place. If no voltage is present you will need to trace the system and locate the problem.
15. At this point you are ready to continue with the rest of the installation.

## Engine Compartment Fuse Bus

Install fuse bus next to Solenoid and connect to the switched side on the solenoid. Mount the fuse bus next to the solenoid. (I will be adding this fuse bus at a later date.)

## Accessory Plugs

As noted, I am utilizing Anderson Powerpole connections. These connectors are much more compact then cigarette adapters and provide a much better and more positive connection. I have converted most of my 12 volt applications to this connector and for those that are not converted I use an accessory plug adapter.

The plugs being used are designed for chassis mount and require a rectangular cut opening. For the rear connector the logical spot was above the 115 volt connector. The front connector took a little more thought. I wanted the connector to be easy to access but in a spot that was out of the way.

NOTE: Each connection you make to the accessory panel also needs to be fused at the correct rating for the application and wire used for the connection. The 20 amp fuse for the panel is to protect the installed circuit NOT the application that you hookup. The accessory plug adaptor show above includes a fuse that can be changed to suite whatever your application is.

### Rear Accessory Plug

Toyota provides a GREAT place the rear accessory plug. This has been used by others for this application. There is a large space above the 115 volt inverter outlet that is covered with the warning label.

### *Run Accessory Panel Wire*

I used 10 gauge automotive grade black white pared wires for my rear panel which is rated to be fused at 30 amps. For an additional safety factor I am going to fuse my rear panel at 20 amps. The 20 amps will be the combined total for all 4 plugs and will be labeled as such.

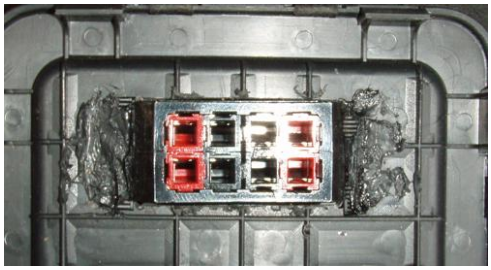
1. Remove the tray in the right trim panel that is over the wheel well.
2. Remove the right side trim panel, front right kick panel and door sill trim. Instructions for this step are included in the XM satellite radio installation instruction which can be downloaded from www.trdsource.com.
3. Remove the 115 Volt panel.
4. Run the rear panel wire from the panel to where the rear accessory plugs will be.
5. I tie wrapped the wire to the existing harness from the end of the wire tray on the door sill to the read panel location. I also have a wire loom running in the same tray that carries the power and speaker wires for my ham radio that is mounted next to the inverter.
6. Once the wire is run reinstall the read trim panel. (Prior to reinstalling be sure to run any other wires you may need for other applications like a radio)
7. Terminate the accessory wire in the rear with Anderson Powerpole connector and ring or spade connectors at the front.

### *Install Accessory plugs in Panel*

At this point you have the panel with the 115 volt connector in it removed. I installed my Anderson Powerpole chassis connector in this location; however you can use whatever type of plug you want. (Using cigarette plugs will only allow for 2 connections)

1. Remove the warning label from the panel. I used a hot air gun on low heat to make removal easer.
2. Put a hole in the panel sized to the specification for your plug. The Anderson Powerpole connector required a 1”x1.88” rectangular whole. I made a template and stuck it to the panel the cut it out by using a box knife heated by a torch.


3. Install the accessory plug in the panel. The clip on the adapter required about twice the thickness of the plastic in the panel so I added an additional layer using a piece of a tie wrap and used plastic from the removed portion of the panel to melt it into place. Another way to fix this issue would be to make a small bezel on go on the front of the panel under the accessory plug.



4. Once the plugs are installed turn the panel over and make sure the installation is tight and will not pull out.


### *Build the Accessory Plug Harness*

The accessory plug Powerpole hookup requires 4 positive and 4 negative connections. I built the harness out of 10 gauge wire by splicing the 4 wires into one for the feed connector. The harness was built with an Anderson Powerpole connector on the end to allow the removal of the panel. I wrote another article about using Anderson Powerpoles that can be seen at http://www.ppares.org/tips/Power_is_key.pdf.

### *Reinstall the Panel*

Connect both the 115 volt power connector and the new accessory panel to the wire and reinstall the panel. Once the harness is connected to the feed wire the Anderson Powerpoles should either be wrapped with electrical tape or a secured with a Powerpole Block Lock.

*Block Lock*

### *Connect Accessory Power Wire*

Connect the accessory panel wire to the fuse bus.

### *Rear Accessory Panel System Test*

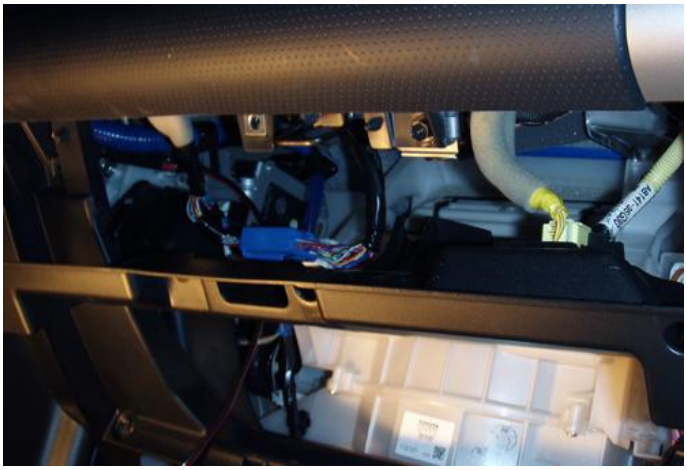
Prior to installing the fuse I always like to test my system.

1. Test the ground plug for a positive ground using an Ohm meter.
2. Check all the positive outlets for an open connection to ground. (The tests for shorts)

### Front Accessory Plug

The front accessory plug took a lot less time due to the minimal trim removal required. I chose to locate the mount on the left side of the area that the glove box is located. The small size of the Anderson Powerpole 2 connector chassis mount was perfect for this location. I wired this connector as a 15 amp circuit using 12 gauge wires.

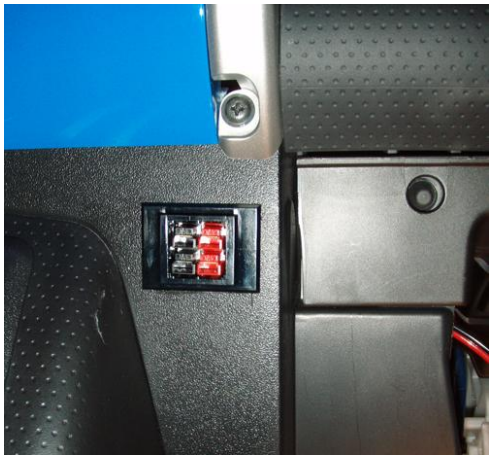
1. I removed the glove box and dropped the cover above the glove box down to allow for the wire to be routed along the reinforcement bar. To remove this trim piece there is one screw to the left of the glove box latch. Once the screw is removed pull the piece forward and it will drop down and be held in place by the wiring harnesses attached. Be sure not to put any weight on the panel so the wiring connectors do not get stressed.



2. Mark the location for the connector.
3. Mark and cut the hole for the power connector. I used a torch to heat the blade on a box knife and I was able to melt right through the plastic.

4. Build the harness for the connector.

5. Install the Anderson Powerpole connector to the end of the feed line.
6. Attach the feed wire to the harness. I wrapped the connector with tape for added security. There are special clips available to hold the Anderson Powerpole connectors together but a little tape is much less expensive.
7. Insert the chassis mount connector in the hole.

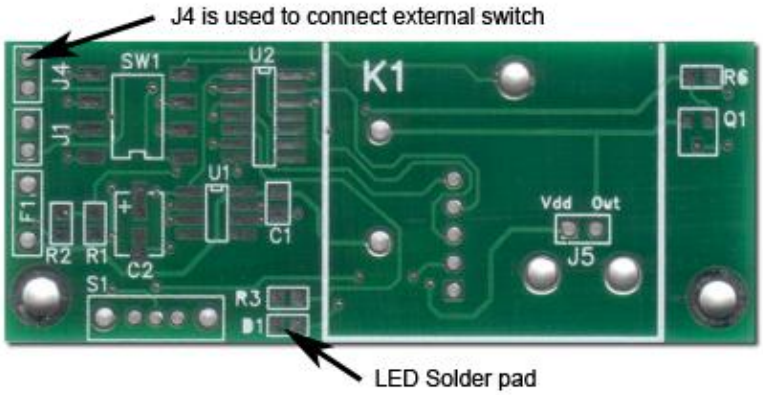


8. Route the feed wire to the fuse bus along the reinforcement bar that is above the glove box.
9. Once the length of the feed wire is determined attach the ring connector and hook up to the fuse bus.
10. Follow the same testing procedure used for the read mount.

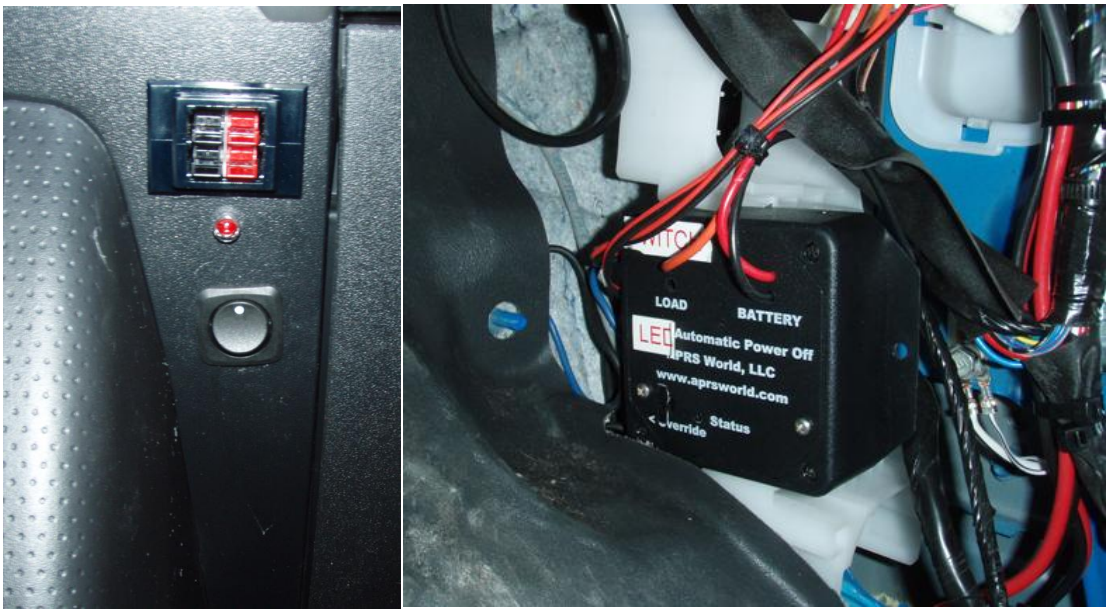
## Install the APO

If you purchased the APO as a kit now is the time to finish the kit. The APO needs to be modified prior to installation to provide an external LED and override switch. The installation of the external LED needs to be done with care due to the internal LED being surface mounted. For the LED ground I used the ground solder pad on the back of the board. There is

a jumper location that the external switch can be connected. I also eliminated one of the ground wires running into the APO. Once I completed the modifications I tested the APO prior to install.




1. Determine mounting location for switch and LED. (I mounted these under my front power connector)
2. The APO fits perfect in the plastic wire harness mount under the right kick panel.




3. Run wires to the LED and Switch.
4. Connect ground to the chassis ground next to the APO location.
5. Wire the Battery sensor wire to the hot side of the solenoid and with an inline fuse at the solenoid side.
6. Wire the Load wire to the small solenoid control stud.

## Final System Test

Your power system should now be complete and ready for some final tests.

1. Reconnect the battery.
2. Check for power at the solenoid.
3. Start the FJ and check to see the APO has closed the solenoid by checking the voltage on the other solenoid post.
4. Shut off the FJ and complete the following tests will the APO has the accessory power on.
5. Check the voltage on all the accessory plugs.
6. Once these tests are completed with success the Accessory Power System is ready to be used