

## C5 Front and Rear (backup) Cameras 12/19/16

I have a 2001 C5 coupe. I did a lot of researching before doing this upgrade and found that no one showed how to do various aspects, like routing the wire, so I decided to thoroughly document my project. Maybe some aspect of my project will help others.

I used a Rear View Safety RVS-776718-CT mirror and camera (\$280). Its camera was used in the front (for parking curbs) with RVS-778 (\$100) for the back, and has a license plate bracket so you don't need to drill holes in the body. The 778 shows only a mirrored image so it can only be used in the back but the camera that comes with the 776718 kit can be ordered as either a normal or mirrored image. I like the monitor in this mirror because the image is large, it looks like its OEM, it has a compass, and it has two camera inputs. It also has the temperature, but I don't really care about that. Just a note, when using the camera in the rear the image needs to be "mirrored" or reversed otherwise when looking at the mirror/monitor an object coming from the right would appear on the left with a rear facing camera. With all the equipment coming from the same manufacturer it's easier to make it all work together- like mirroring the image, and switching inputs. And **yes** you can definitely buy less expensive equipment. BTW, the sales and tech lines are manned by the same people and are **not** tech savvy. You may get different information from different people, and sometimes from the same person. I finally reverted to email so all the answers were in writing and followed them up with phone calls. This took several weeks. When I was finally satisfied I took the plunge, and still got some surprises. The equipment seems to be good quality, but their instructions are crap and they need good tech help desperately.

The two items come with 33' cables but I asked for some of their shorter standard cables with 16' for the front and 21' for the rear. The remote came **without** a battery, and the only way to get the battery number was a phone call, its CR2025 in case they forget yours too. They put one in the mail.



RVS-776718-CT, mirror camera kit with compass and temperature is shown above.

The wires are arranged as they would connect. To the left is the box, the instruction booklet below, next to it on the right is the adjustable wire channel (not used) that hides the wires coming from the mirror,

below that are wire ties, an Allen wrench to tighten the mirror, and the remote control used for programming. Right top is the mirror/monitor which has two small wires that are 12" long. They connect to a two wire cable. The connection is .338" at its widest, and the cable is 18' long with a short connection to the gray colored temp sensor. I'm telling you all this so you know how they will fit in the car. Back to the mirror, the large cable which is 24" long with a DIN connection that is 0.387" in diameter, and connects to the power harness that is 8' long. It has two camera connections, AV1 for the front and AV2 for the rear, and three stripped wires. They are BK (ground), GR (backup light wire), and R (accessory +12v). AV1 connects to the 16' cable in the bottom left corner. That goes up to a 14" long adapter that connects to the camera cable which is 30" long. There is a grommet to the left of the camera on the cable that is unneeded for the front but will work fine on the back, just cut it off. It will go in a .780" dia. hole (13/16" will work fine) and can have a thickness up to 0.100. To the right of the camera is a foam gasket for the camera base and to the right of that is a bag of screws for the camera.



RVS-778, the rear camera is shown above.

Counter clockwise from top right, the box, 21' of camera cable, the instruction booklet, the camera mounted on the license bracket. The two small green wires are not shown in any picture or talked about in the instructions and the ends are stripped and unprotected. The yellow connector is video, the red is power, the next adapter has yellow, red and white RCA jacks at one end and a connector for the long cable at the other. The white connector is for audio and is unused. The cable in the right middle is for power and will not be used. The bag of fasteners will not be used.

You need several other items. A 0.156 header is one. This will plug into the existing plug for the old mirror. The existing mirror has lights on it and without them you will only have the two in the footrest areas and the two in the back. That's not very convenient so I decided to add LEDs to the new mirror by making use of the existing mirror's wiring. This header lets you tap into everything you need for this project *except* accessory power. Why the old mirror needs the "backup light wire" is beyond me (must be an option not on my car) but happily its there. Since I do a lot of electronic tinkering I had a .156 header. You can get one at Fry's, DigiKey, Newark Electronics or any number of places that sell electronic components, and this part will be less than \$4.00. The plug on the mirror has 7 pins but this only has 6 so you have to be careful when you plug it in, to position it properly from pins 2 to 7. A 7 pin header would be ideal but not necessary.



The Add-A-Circuit was \$6.99 from AutoZone. It is used to get power from the fuse box #22. We will use accessory power so the cameras and mirror only use power when the key is on. Our cars already drain the battery at an alarming rate and there is no reason to make it worse. An assortment of low amp fuses was \$4.99. This was the only way I could get a fuse smaller than 10A at AutoZone. Size does matter and when dealing with fuses, and you want the smallest one practical. The mirror uses 8W which works out to 0.67A. I intend to use a 2A fuse, which is 3 times larger than the current draw and leaves a comfortable safety margin.



We need a SPDT center off mini switch so we can turn the lights 1) on; 2) off completely; or 3) connect them to the courtesy light circuit, where they will go out 60 seconds after the doors/hatch close. The existing mirror allows you to do all of that except turn them off completely. Initially I tried a mini

toggle switch but it didn't have the look of original equipment so I switched to a mini rocker from DigiKey that is a C&K #CKN2017-ND for \$7.95.

The plugs are from Fry's for \$4.99. I like these because they are small and easy to hide behind the mirror. You don't want to hardwire the LEDs/switch into the car or you won't be able to easily remove the new mirror, so the plugs help with that.



Two sided Mounting Tape is used to attach the switch bracket to the mirror, \$4.79 Advance Auto.



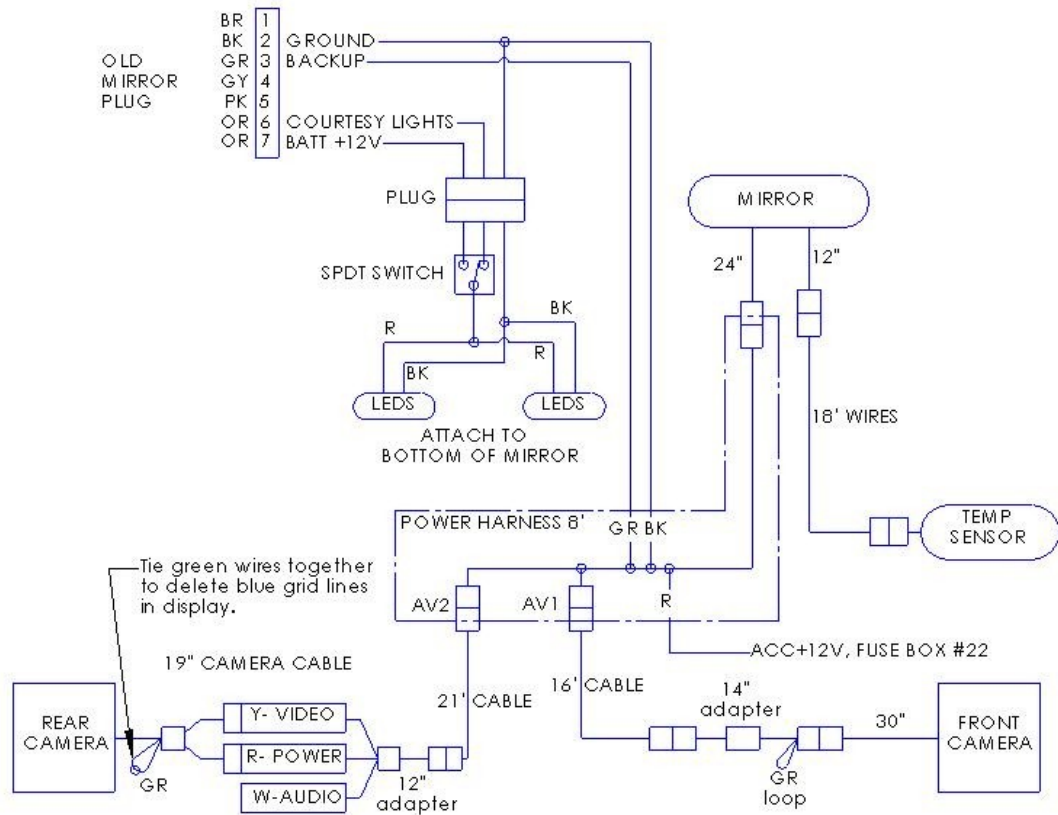
These are the LEDs. I got them on line from Pilot Lights.net. They were \$20.65 for both. Look under convenience lights, 6 LED Under Panel Map/Convenience Light

SKU: W008- Under Panel Series, \$8.95 ea.

They are adhesive backed and will be attached to each side under the new mirror.



Following is the wire diagram. Note that my harness to the rear camera 778 had two loose **and stripped** green wires. The mirror produces its own grid and the camera can too but you don't want both on at the same time. Connecting the two green wires removes the camera's blue grid, although the tech wasn't *sure* how to do this, and it was nowhere in the instructions. Unfortunately, cutting the green loop on the front camera will not give you a front grid. The AV1 input does not support grid lines.



I started taking stuff off the car. The License plate trim is removed by releasing four tabs one at a time by inserting a small flat blade screwdriver and pressing toward the outside of the car. The trim is shown here upside down so you can see the tabs. Remove the 4 screws and the plate comes off.



The passenger side A pillar trim, the trim right below it next to the dash and the door sill trim all need to come off. To protect the car from scratches, get plastic trim removal tools. You can get them for \$10-15 on EBay:



The trim next to the dash comes off first. Pry the little button on the top out and pull out at the top and the clip in the middle will release:



Next I removed the A pillar trim. Start at the top and pull it off. I didn't notice until looking at this picture that the top clip (on the right) came off and remained in the car. I had to retrieve it and pop it back on its post, but it's not shown in this picture:



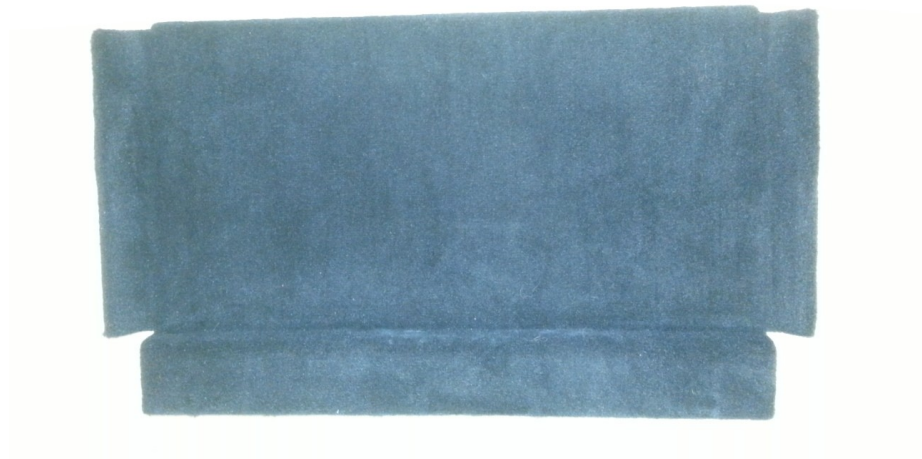
Next was the door sill trim. Start at the back and work forward. I put painters tape on the paint just to make sure nothing was scratched:



Next I went to the back and removed the passenger side upholstery. The Hook that holds the cargo net that goes across the rear is threaded on a bolt that goes in the bottom left hole you see here. Just unscrew it and pull the bottom edge out. Stop when you can see the plug for the light, unplug it and continue rotating the panel out.



Now you can remove the middle rear panel. Rotate it out from under the remaining left side panel.



The old mirror was a real booger to remove. You are supposed to wiggle and pull up. Nothing I tried worked until I squirted the spring with penetrating oil and let it sit for a while. I took the top off and stood with one foot on each seat then pulled and wiggled with force. Eventually I heard a snap and said OH SHIT! Then it just came right off, and fortunately nothing was damaged. You can see that \*#@\$!! spring and the header for the plug on the old mirror.



As I said, I did considerable research. We need to run a cable from the rear camera into the cabin, and from the front into the cabin. I have read that there are a number of ways to do that:

1. Drill a hole in the back inner tub and go under the carpet to the console- this is the easiest and least intrusive way.
2. Use the cabin fresh air vent located on the driver's side. However, if you pass a cable through the vent you effectively disable the vent so it is always open. Since you may get exhaust fumes into the cabin if you do so I decided against using it, but others have used it.
3. Antenna grommet. Perhaps this is on a convertible, but not on my coupe.
4. Rear light harness grommet. Supposedly the harness comes in behind the right-most tail light, but not on mine.
5. From the Z06 forum I got: "if you remove the passenger seat there is a hole behind it on the rear bulkhead"- nope, not on my coupe. The two fuel tanks are behind the bulkhead.
6. There are two large holes in the center tunnel for the shifter and EM brake. You have to be sure you don't interfere with the existing mechanisms. I tried using the EM brake hole but found that the only way to get up to the hole was from the front of the passenger side fuel tank. The route up to the hole goes right by the exhaust pipe, and by the time I protected the cable from the heat it just looked like a kludge, so I ripped the cable out and went back to #1 above.
7. There are reportedly 3 holes in the firewall for the front camera. I one I used is behind the battery.



Left is a picture of the driver's side (only) cabin air vent. It's the white rectangular object at the middle top with the hatch latch to the left of it. That's what the vent looks like, but as I said, I didn't use it. Use your own judgement.



Above shows the EM brake grommet. Again- it was not used.

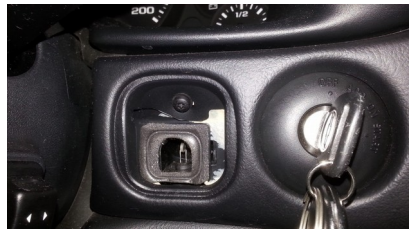
No matter which route you choose for the rear cable, you will need to remove the console. There is a good video, Google: MGW-C5 Corvette Shifter Removal & Console Removal.

1. Most of us have automatics: put it in 2<sup>nd</sup>, set the EM brake, passenger seat ½ way forward.
2. Remove ash tray and lighter, put the steering wheel all the way up.

3. Remove the cover to the left of the key.



4. Remove (3) Torx #15 screws, one under cover and two in ashtray area





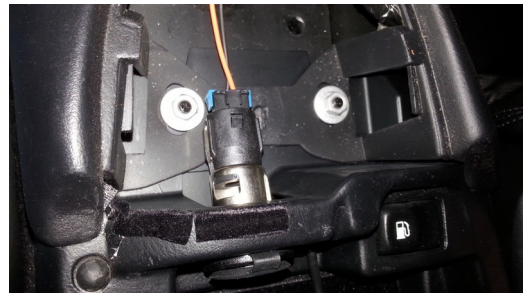
5. Open console cover, remove plug covers and two 10mm nuts (why the hell is this thing metric??)



6. Pry up section for Active Handling and Ride Control. Remove two plugs and set section aside.



7. Disconnect cigarette lighter and remove two 10mm nuts.



8. The back half of the console is now loose except for the plug on the fuel door switch. Pull the console back and up slightly. The wire is very short. I sat in the passenger seat on my knees, facing the drivers side and looked over it, lifted the driver's side up and reached down to the plug. Set the console aside. This would be a lot easier if you were a lefty.

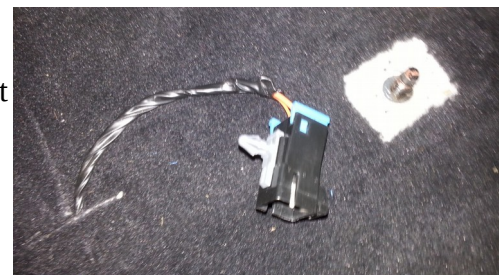
9. The entire front console section (from around the key, the radio and heater and below that) will now move back and up and off- enough for you to unplug the cigarette lighter. Set the front console aside.

10. Remove the passenger seat to make it easier to route the cable under the rear carpet. Pull the pins on the front bolt covers partially out and then pull the covers forward. Remove the front 15mm nuts.

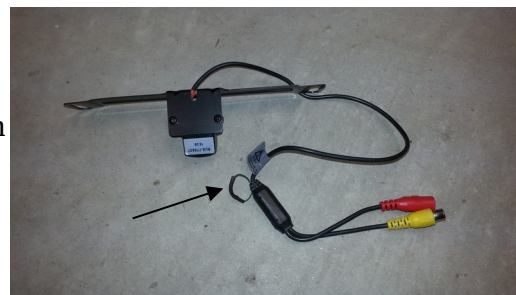


11. Move seat forward and remove the two rear nuts.

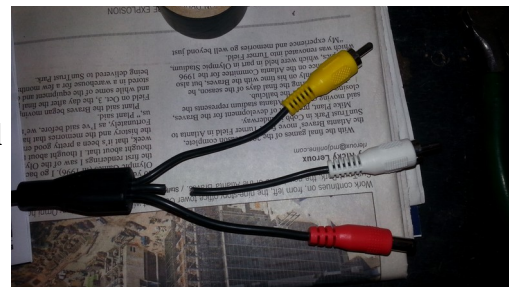
12. The power seat plugs need to come apart **and** the plug that stays with the car also needs to disconnect from the seat (this is ass backwards). Disconnect it and remove the seat.



Connect the two green wires at the rear camera. I soldered them and used shrink sleeving. Connecting these two wires will turn off the camera's blue grid. The mirror makes its own three color grid and having both grids on is confusing. Plus, the position of the mirror's grid is adjustable whereas the camera's grid is not.



Since the white Audio plug is not used I cut it off the "12 adapter" and taped the end. Connect the yellow to yellow and red to red on the camera and secure them with tape.



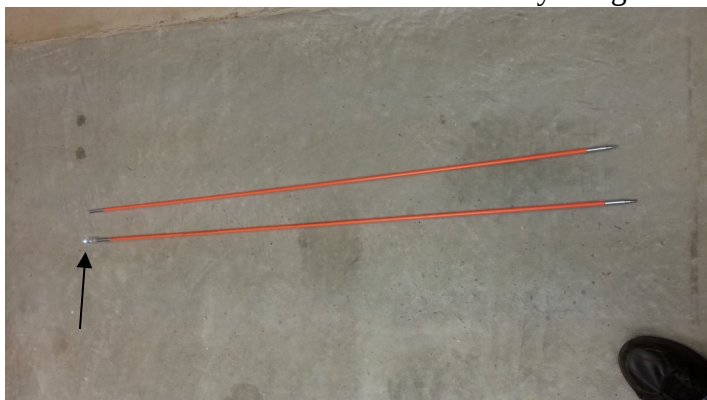
Take out the inside passenger tail light and let it hang. Route the wires through the hole above the license plate. See my arm going through the tail light opening and my fingers sticking out at the license plate?



I used a step drill to put a 13/16" hole below the passenger side hatch latch. The tub is about 1/16" thick and made of a fiberglass composite of some sort. A drill will go through it like it's made of hot butter, so go slowly. Fiberglass will be frayed around the edges and needs to be cleaned up with sand paper. I used the grommet from the front camera, and cut it from the edge down to the middle then slipped it over the rear cable. Use lots of silicone to seal-up around the cable, and around the grommet to the tub.



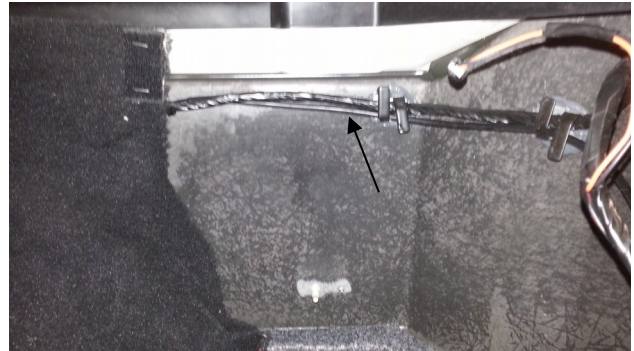
A word about wire routing- I looked everywhere to see how to route the wires but the only thing I found were a couple of videos for front mounted curb sensors. These were done by shops that install the devices and they were only interested in getting the job done quickly. One of these guys said you could run the wire along the frame rail next to the engine, then up to the battery box area. The wires aren't marked with a temperature rating, but I definitely would not run them in a heat zone. One of the best tools I have for pulling wire is from Home Depot and is called a Fishing Rod.



It consists of 3 flexible fiberglass rods that screw together and has an LED light that screws on the end so you can see where it is poking out. I only needed to use one or two 4' sections on the car and you can see the LED lit up on the bottom left rod.

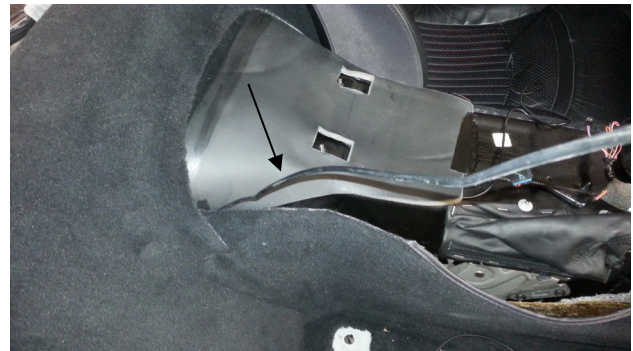


Here the fish rod is inserted under the rear carpet, as seen from the back with the hatch open.



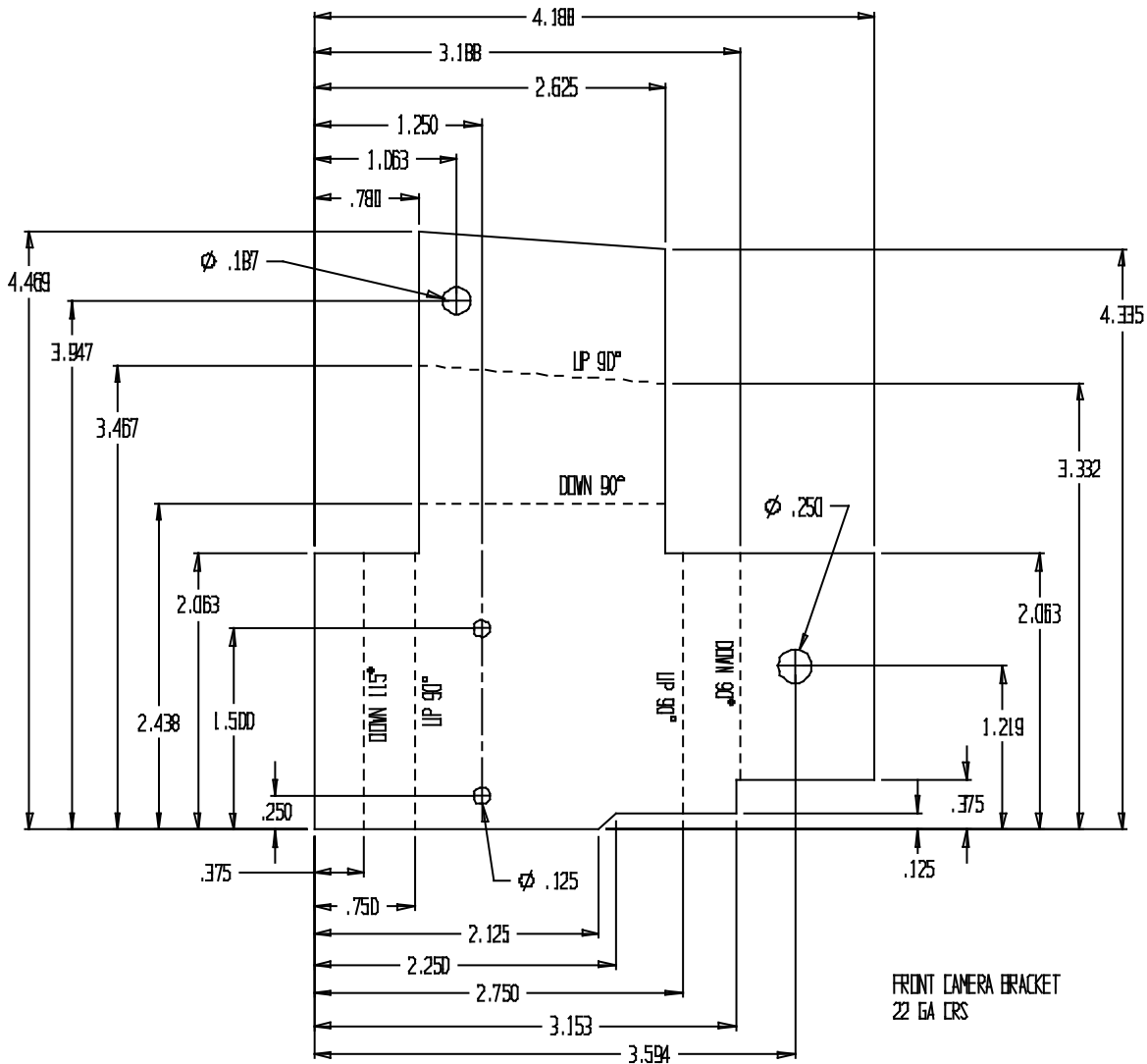
Route the cable with the wire harness in the right rear.

I kept the cable up close to the wall by the speaker all the way to the back as there was a void where the pad under the carpet didn't come close to the wall. With the seat out its easy to route the cable over the hump by the rear speaker (under the carpet) shown above, and then over to the console area shown to the right.



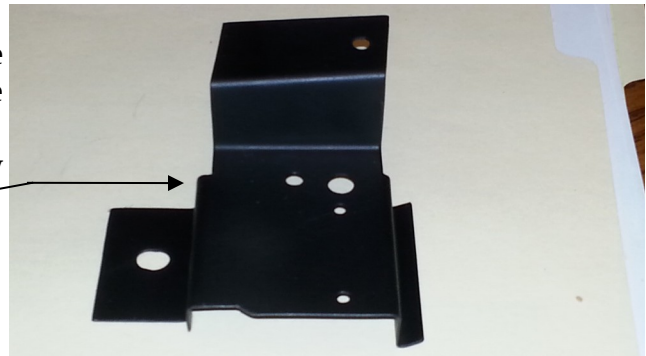
You would think that there would be an easy way to go forward through the console area, and under the dash and to the fuse panel on the right, but I could not get light penetration from either side. Instead I went forward through the console area, and under the edge of the dash, then tucked it up out of sight.





With the rear cable now in the fuse box area, I turned my attention to the front camera. This bracket for the front camera could be done with a simple sturdy “L” bracket, but this method doesn’t require any holes be drilled in the car. The part is made of sheet metal from Home Depot. Back In The Day a model maker would use Dykem marking fluid which would put a dark purple color on the steel, then they would layout the part in the flat using a very sharp scribe to scratch the metal. I use a black Sharpie Magnum. The tip is 5/8” and lays down a lot of ink. Then I use the point of a sheet rock screw and scratch the pattern I want to cut into the metal using a square and scale. The screw makes a fine visible line.

In this picture the bracket is upside down and the right side in the picture faces the front of the car. The top hole takes a pop rivet into the existing hole in the right skid bracket under the front bumper (or a large sheet metal screw). The left most hole uses the screw attaching the two body panels.



The large and small holes in the middle **were** for the temp sensor but I found its proximity here to the radiator gave a false reading and the two small holes vertically aligned are for the camera.

Remove the front spoiler by loosening the two bolts in the center and removing the two at the ends. They are 10mm.



For the front camera cable and temp sensor wire I routed the fish rod up through a hole to the right of the radiator and out behind the passenger side headlight.



Pull the fish rod through and disconnect the wires. The wires at the top need to be routed back in and around the structure to get them over at the right side of the headlight and laying out and over the fender.

You will need to raise the right headlight to the up “Froggy” position. Take the rubber cap off the end of the motor (seen here just a little left of center) and turn it counter-clockwise by hand. It turns up very slowly.



Remove the cover from around the front of the light by removing its three Phillips screws. When reinstalling, the feature in the top middle needs to go above the clip and the slot around the short wall sticking down.





Connect the camera to the cable and tape the joint. This is the camera installed on the bracket using two 4-40 screws and nuts. Attach the bracket to the skid with a 3/16" pop rivet into the existing hole in the skid at the front. And the bolt that holds the two body panels is used at the rear. A simple "L" shaped bracket attached to the skid **could** be used here. BTW, I tried all the available locations in the front for the camera and this gave the best view.



Now route the wires from the headlight to the door area. To do this, insert the fish rod **above** the top door hinge (see the orange rod in the door opening), then it is routed over the tire between the skirt and fender, and ends up with the LED sticking out at the head light. Attach the wires to the rod with tape and pull it back out.

This is the other end of the fish rod above the door hinge. Some guys run the wires above the hinge and into the end of the door weatherstrip, then into the cabin. Since this is visible and near the edge of the door as it swings I didn't like this.



Instead I took the battery out and found this entrance to the battery box below the bumper for the hood. After the wires are pulled from the front to the door area, fish them back into the battery box here.





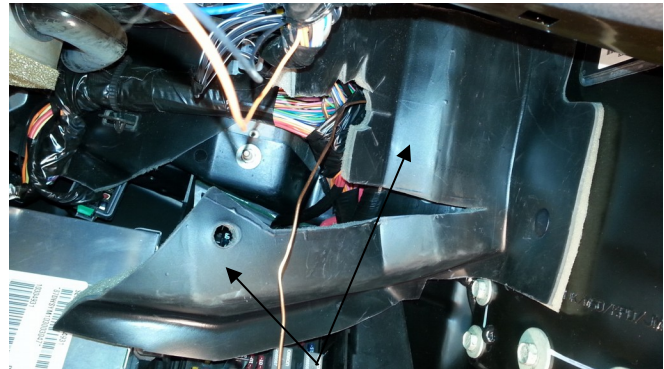
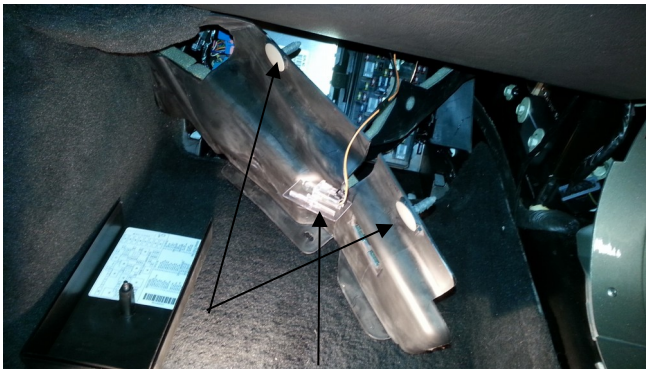
The wires enter the battery box as shown, then go through the grommet into the cabin. I'm touching the wires with a screwdriver here. Remove the tape at the grommet and insert a screwdriver to pull it open. Be careful as this is a big part of the cars electrical spinal column. Re-tape the grommet to keep the weather out.



This is where the wires enter the cabin (the two on the right)

To get to the grommet shown above, you need to drop the cover below the dash/glovebox. You can see the 2 push-in plastic fasteners. Since the courtesy light was in the way, I popped it out of its hole.

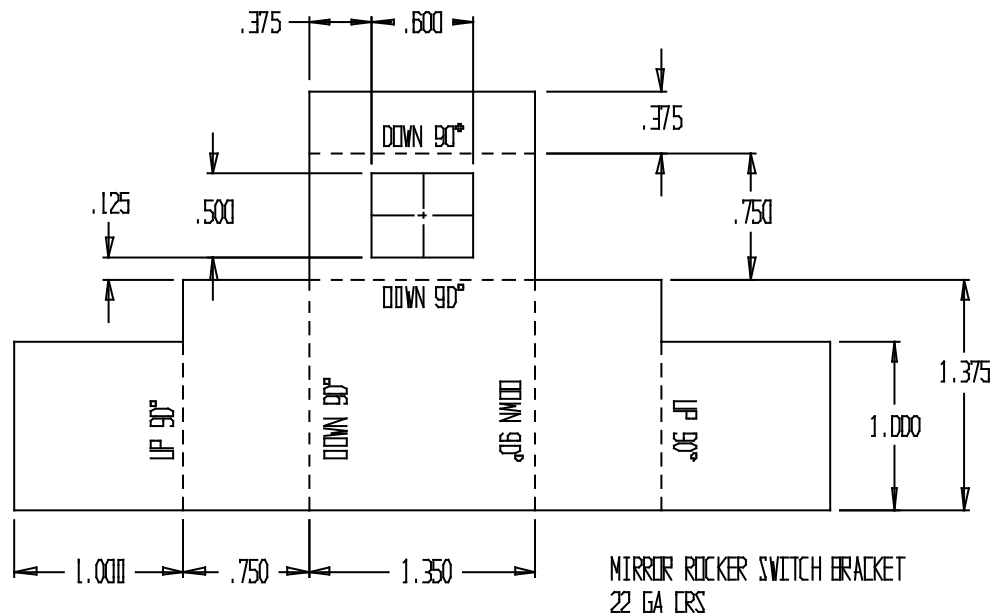
This is a rubber cover you can just pull to the right to see the grommet above.



### Switch Bracket

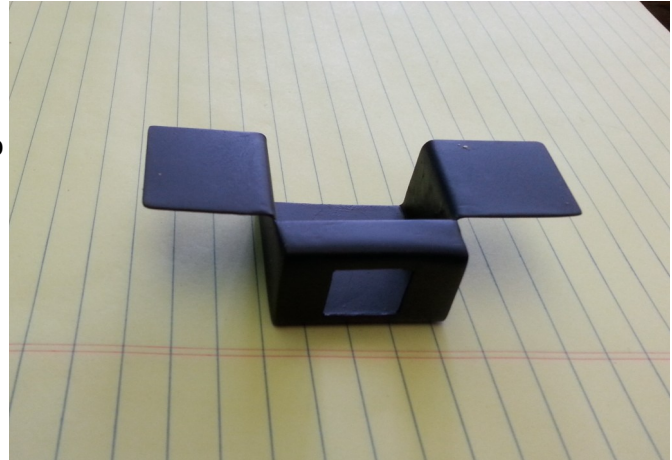
I wanted a LED switch that looked like original equipment, so I got a rocker switch from Digi-Key that is C&K # CKN2017-ND for \$7.95 (the shipping cost more than the dang switch). The bracket was easy to make and has lots of surface area for the tape to adhere to.



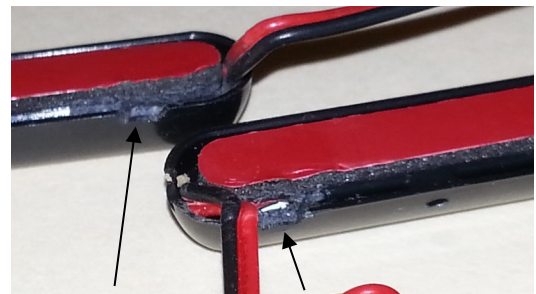


For fun I soldered the corners to close them up, just because I'd never tried that before. I used a propane torch and the same solder used for wiring. Wear a mask- you don't want to breathe lead when sanding. Leave the switch hole out to make forming easier. The hardest part was adding the hole. Fortunately I had a cutting disc for my Dremel that was well used and pretty small in diameter and could make the four cuts.

This is what the bracket above looks like after painting. The switch slips into the hole and has clips to hold it in place. The bracket is attached to the back of the mirror, in the center using two sided 3M Mounting Tape. Use four strips since the tape is only 1/2" wide. Twist and tweak the "wings" as needed to conform to the shape of the back of the mirror. I did this with my thumbs.



The wires come out the ends of the LEDs and I didn't want the wires showing so I used a 1/16" drill to hog-out the channel running around the **underside** and cut a little relief for the wires to come out the back. I will use a black marker to "black-out" the visible part of the red wire to further hide the wires as they wrap around the back of the mirror.



**Back of mirror.** The mirror looks good from inside or outside the car. Follow the wiring diagram for wire connections from the plug to switch and LEDs. You could use the extra wire that's cut off the LEDs to complete the circuit. I used 24ga stranded wire. See my note on solder below.



You need to make a small harness. Take the header from page 3 and plug it into the old mirror plug from 2 to 7. I took masking tape, put that on the side of the header and wrote the pin numbers on the header. Disconnect the header, and cut 3 wires 12" long (I used 24ga stranded wire). Strip one end 1/2" and wrap them around header pins 2, 6, and 7. Be certain to wrap it around the pins on the side of the header that DOESN'T plug into the old mirror plug. For me these were the long pins. Solder with 60-40 tin-lead resin core solder. Cut off excess header pin material and cover pins 6 and 7 with shrink sleeving.

Put plug terminals on the other ends, solder and position them appropriately in the 3 position plug from page 4 which is the opposite of the one shown above on the mirror. The terminals are opposites too. Cut two 18ga. 84" wires and solder them to header pins 2 and 3. Cut off the excess header pin material and put shrink sleeving on pin 3. Cover the solder connection on pin 2 with tape, then wrap all the wires from the header to the plug and then all the way down the wires from pins 2 and 3 until about 4" from the end. If wires 2 and 3 are the same color, mark the ends for proper hookup.

Put the mirror in the car and connect the 3 position plug from the harness to the mirror. Connect the header to the old mirror plug from pins 2-7. Tape them up and stuff the header and old mirror wire under the top window trim.

Use the trim tools to pry the top inside windshield trim up and slip the wires under. There's plenty of room even for the plugs.



Then run the long wires from pins 2 and 3 (now bundled together in tape) under the top window trim to the right "A" pillar. Pull the black tape off the pillar and place the wires in the channel. Go from the bottom of the pillar under the dash to the fuse box area.



The temp wires and power harness wires need to go from the fuse box area **up** the right A pillar and across to the mirror. Connect and tape them, then stuff them under the top window trim. Here they are shown just above the dash at the pillar.



Connect the camera cables to the power harness; AV2 to the rear and AV1 to the front. Connect header pin 2 wire to power harness black wire and header pin 3 wire to power harness green wire. Solder and tape them.

The Add-A-Circuit is intended to share a slot with an existing circuit, which is why it has two fuse positions; the bottom one for the existing fuse and a second fuse on top for the red wire and added circuit. We aren't using the bottom fuse.

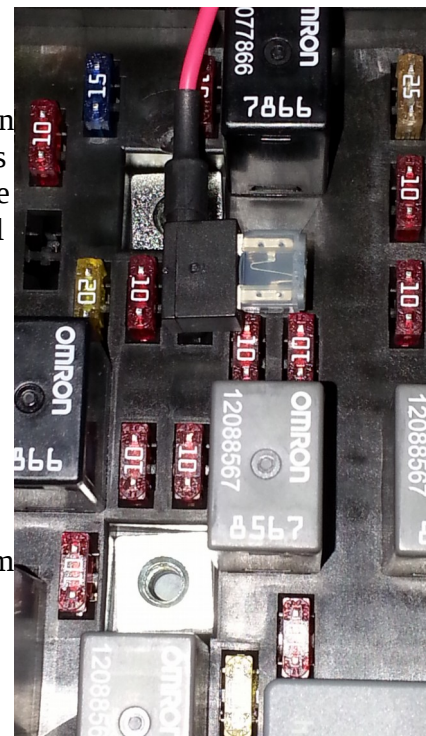
The red wire connects to the power harness wire marked ACC. Since the wire in the power harness is fairly small, double it over before crimping the connector.



The C5s have an open slot at #22 in the fuse box that is supposedly on with ACC, but in fact is only on with the key in the ON position. This works out well for us. Remove the passenger side floor mat and in the footrest area are two latches- pop them up and remove the floor panel to expose the fuse box. It is the black box on the right side. Loosen the knob and remove the plastic cover. Take a look at the map of the fuses on the back side of the fuse box cover.

I've been following the wiring diagram and at this point I've got everything hooked up and working.

Now I just have to button everything back up and use the remote to make some adjustments. I found that the front 16' cable was 8' too long and the rear 21' cable was 7' too long, but there is plenty of room to coil them up and hide them above the fuse box.





Here is the car with the nose at the curb and the image from the front camera is shown below. Just one caution, don't watch the front image while driving. Since the camera is rather close to the ground it looks like you're traveling at warp speed.



This is the rear view with the grid adjusted to the edges of the car. Looks like its time to blow leaves again! For reference, the back of the car is positioned about 7' from the door here.



The interior light level is a nice improvement using these LEDs to the right.

Interior view of mirror



The front camera and temp sensor are not visible, but the rear camera is- you can just see it above the "E" in GEORGIA.

