

Backup camera installation 2005 Prius (probably same on earlier, not later)

Those without a backup camera, which first became available on 2006 Prii, have found that view behind the car is pretty limited. Here is how to solve it. When you are done, you will have a clear display of things behind, especially close behind, that comes on when the car is put in reverse. This setup works well, and is almost invisible. It also provides a second video input, which can be switched in for another camera, a dvd player, a computer, or a smartphone display (but you would not have touchscreen). It requires that the car have the Navigation unit, which is located under the driver seat. It will take you two to several hours, and cost a bit more than \$200 for parts.

### **Components**

Navics video converter \$180 on ebay

<http://www.ebay.com/itm/like/251307661536?lpid=82&chn=ps>

Backup camera (includes cables and hole saw) \$19 on ebay

<http://www.ebay.com/itm/181565361172>

T-wiretaps (obtained locally, like these: <http://www.modelec.com/pdf/new/WireClamps.pdf>.)

3M inline taps could work, less easily.

solder, sealant, wire ties, electrical tape (for attaching wire loom or instead of heat shrink)

Optional for better job: rubber grommet, wire loom (=split bumpy tubing used to bundle and protect wires), heat-shrink tubing, double stick foam mounting pad, license plate lamps (while you are in there)

### **Tools**

Soldering iron, drill motor, 10mm (preferably deep) socket, 14 mm wrench or socket, ratchet, wire stripper, heat gun or lighter, trim panel tool or paint stick, pliers for closing T-taps (vise grip better than needle nose)

### **Installing the camera and routing the cable (the most work).**

Start by pulling off the interior trim panels on the hatch. When you do this, some of the plastic clips (3 different kinds) may stay in the their holes in the metal rather than coming off with the panel. It is quite important to remove them and put them back on the panels before reinstallation (some will just keep it from attaching well, some will be pushed into cavities in the body from which they can't be retrieved. Don't ask me how I know. Don't ask me what dealerships charge for these little bits of plastic.

Next, remove the 4 10mm nuts that hold the outside latch/license light/backup camera ledge, (best with a 10mm deep socket). Then unplug the connector for the wire that goes through a rubber boot and to the latch. Then, from the outside pull

the ledge off (it also has plastic clips, same caveat as above), and work the rubber out so you get the whole thing free for installation.

The 2005 prius did not have a backup camera option in the US, but it does have a knockout where one would have been installed, toward the left (port, or drivers) side of the car from the left license plate lamp. This knockout is too big for many aftermarket cameras, including the one I used, so you will make a cutout in it instead. Also, there is not an inviting hole to pass the camera wires through. I drilled one. It would be nicest to have a rubber grommet that fits this hole and seals against the small wire (or seal it with silicone.).

The camera listed comes with a simple 20mm hole saw that works fine for cutting into the knockout, and I also used it to cut another hole through the hatch steel behind that one. This is bigger hole than you might need (it does need to pass the RCA connector and choke on the camera lead, ½ inch might do, but I used ½ inch wire loom to protect the camera wire, and it was a good size for this.

You are going to need about all the length of both the camera lead and the provided cable to reach to the Nav unit beneath the driver's seat. But, cable routing is better on the passenger side of the hatch (there are other cables there to tie to). So I brought the camera lead, put inside of wire loom to protect it through the hole and then across inside between the plates of the hatch, and out a hole a bit to the right of center.

Here the video cable and power cable will attach to connectors on the camera wires. The video cable provided with the camera had an extra lead inside, which came out as red pigtails from the RCA connectors. This was very handy to carry the positive power for camera, which is connected to a source which positive when the car is in reverse. If your cable does not have this, you will need to run another wire. Many installations make this connection at the backup light, but it turns out it can also be made at the nav unit, which is what I did. I split the leads on the power plug provided with the camera, and cut the red one fairly short, then slipped a length of shrink wrap tube on, soldered it to the red pigtail from the video cable, moved the shrink tube over the splice and shrunk it. The black lead I routed to a ground bolt near the center of the hatch which had other ground lines connected to it, cut it to length, stripped the end, and secured it under the bolt.

From there I routed the video cable around the rear window, attaching it to existing wires with cable ties, to the boot connecting the hatch wiring and tubing to the rest of the car. I used the left side one. Getting the cable through this can be tricky. Works best to pull the washer tubing apart at a joint just above it, work the boot free on both ends, and pull it off the washer tubing. Then work the RCA plug of the video cable through it, and then push the washing tubing back through. Put the video cable through the boot hole of the car cab, where it will be in space above the headliner. You can access this space by pulling the edge of the headliner free of the weatherstrip.

At this point, knowing what I know now, I might have taken a different route. You want this cable to reach to below the driver seat. The most direct route might be under the headliner to the column between the left side doors, or perhaps behind the rear door. I did not explore this route, because I thought I was going to make connection at the backup lights, and the cable turned out just long enough for my more inefficient route.

I routed it down along the left side of the hatch opening. The trim there can be pried back (clips, as before); it's helped if you remove the 10mm bolt at the back end of this trim (where the cargo tonneau cover latches). Then go down the rear left corner, to the access panel by the left side tail lights. Once I got the Navics unit, I realized it too needed a backup power connection, and that one was available at the Nav unit, so cutting into the video cable did not make sense, and I just routed it forward from there. Remove the tray under the cargo floor, and the plastic bin on the left (Phillips screw nut on a stud in the bottom). The cable will go through an opening to the left of the traction battery.

Remove the lower seat cushion (pull up on the front to detach it from a clip on each side, then pull it forward. Now is a good time to vacuum up all the cracker crumbs etc. the former owner's kids left there. Now, looking backward, you can see through the opening you need. I needed to push a stick through from the front and tape the cable to it to get it through. From there, it follows the rocker panel beneath trim pieces on the rear door sill, behind the between-door column trim, and part way along under the trim at the bottom of the driver door.

Now you need to remove the driver's seat. There are 4 bolts (14mm heads), the two in back are underneath plastic covers which snap off. The seat has several sensor wires, and it is easier to leave these connected and just push unbolted seat forward or back as needed.

The final cable route went under the carpet to emerge where the cables for the nav unit came up. I put a stiffer wire in first, and pulled the video cable through with it.

**Installing the video converter** What this small box of electronics does is to convert the NTSC composite video signal from the camera to the RGB signal used by the MultiPurpose Display in your dash, and to provide some switching between 3 different signals 1) the nav unit output, which is the stock display on the MPD, 2) the backup camera you are installing, and 3) any other composite video source you might want to plug in. This could be another camera, the video from a DVD player, or video from a smartphone or computer, with the correct adaptor. Note that sound would have to get to the car stereo some other way. Which of these will be displayed is controlled by a trigger wire and a switch. If the trigger wire is hot, which we will wire up to be when the car is in reverse, the video from input 2 of the Navics unit is routed to the MPD. When the trigger is ground, the nav unit output is passed through, except when a supplied toggle switch is closed, and then it is the

video from input 1 (or a blank screen if nothing is connected to input 1). The wiring on the toggle switch is not long enough to get it to the dash. I'm not using it yet.

The Navics unit is almost plug and play. Its D connector is attached, which leads to two plugs, male and female. The similar plug on the Nav unit is pulled out (you need to depress a lever in the middle of its wire-side edge), and is plugged into the female Navics plug, and the male Navics plug takes its place in the Nav unit.

All that remains is to provide the Navics unit 12V power, a ground, and a trigger signal (hot on reverse). All three of these are available on a second, larger 18 connector plug on the nav unit. The Navics unit instructions identified which wires in the connector were the needed ones. It is unfortunate that Navics did not include a similar male/female plug arrangement to tap these, which would have made it fully plug and play, but they did not, so you need to tap into them.

I got some T wire taps from my local electronics store, sized for the 20-25 gauge wire. These are better for the purpose than the (red) inline 3M style, because of the small clearances in the bundle of wires going to the 18 pin connector, but the 3M would probably work. Connecting them is easier if you pull the plug out first.

The trigger from the Navics unit and the power lead from the pigtail of the video cable both are to be connected to the high-in-reverse signal. I cut and slid the insulation near the end of the red pigtail wire to expose a short section of the conductor, and soldered to blue trigger wire from the Navics module onto it, then slipped on a length of shrink wrap and shrunk it. The end of the red wire went to a T-tap connected to the red wire leading to pin 9 of the 18 pin. 12V power (switched to be on with ACC) is on pin 18 (this was gray wire), and ground on pin 17 (this was a white/black wire, not brown as Navics suggested).

The Navics converter is quite small, and easily sits on top of the Nav unit. A double stick foam mounting square keeps it from sliding around. There are some extra length of wires, they could be trimmed, but I just bundled them with a wire tie.

I was pretty nervous, because there was not a good way to test whether this setup would work in the car until everything was hooked up.

Well, it DID work. The picture from the rear view camera is very clear. It also includes some colored guidelines. These are useful but clearly not custom for an installation on Prius, so you need to learn how to interpret them relative to the back and edges of your car. I was pleased with both the particular camera I got and the converter unit, and would recommend them.

While you have the trim off the hatch is a good time to replace the license plate lamps with LED ones, maybe these:

<http://www.amazon.com/gp/product/B00DBEMGP4>