

Adding B&W backup camera/TV/DVD/MP3 to the Toyota 2004 Prius with navigation

Version 18 Dec 2004 Mike Brosnan

Introduction and overview

By adding a small TV camera, a video converter and a Blaupunkt DVD-ME3, you can have black and white video from multiple sources displayed on the built-in LCD panel. As a bonus, you can play MP3 files from CDROM. This project involves quite a bit of work – soldering, drilling, buying odd parts in foreign countries, wire cutting, etc so is only for the dedicated hobbyist. I consider it the first step toward what I really want (color, auto-video switching in reverse, web browsing...- you might want first look at <http://www.priuschat.com/forums/-vp57602.html#57602> for a better version with some of these features but a bit higher price), but thought I'd share what I'd done anyway. Despite the lack of automatic switching, none of this is appropriate (nor legal) for use while driving forward. If you build this project and crash while watching T2 on DVD, that's your mistake, not mine. Don't say I didn't warn you.

Details

Video converter

The 10 pin navigation ECU video output cable seems to be the best place to inject alternate video signals (such as from a backup camera) in the 2004 Prius. The connector is referred to as N3 in the service schematics and can be seen in Photo 1.



Photo 1 – back of navigation ECU under driver's seat

Unfortunately it has different electrical format than regular NTSC video. Instead it has 4 active signals – SYNC, RED, GREEN and BLUE. Each is about 1V peak to peak and together they form a 60Hz interlaced color video signal to drive the display. The output from the navigation ECU is only active after pressing MAP, MENU or DEST buttons. Otherwise the MultiFunction Display generates video internally. So you need a converter from NTSC to RGBS. The only one I know of which is reasonably priced (~\$70) is the Toyota 08635-28020 Television Camera control. As far as I know it's only available in Japan, but I was lucky enough to get one from a friend. You might be able to get one through <http://www.japanparts.com/>. The next challenge is that the connectors used in N3 don't seem to be available for purchase (unless you are Toyota). So the 4 video signals + shield need to be cut (or you need to make a custom connector such as the one described at <http://www.priuschat.com/forums/-vp57935.html#57935>.

Video switch

Then we need to build a switch box to select between the nav ECU output and our alternate video source. I used a 4 Pole Double Throw (4PDT) toggle switch and a bunch of RCA jacks in an aluminum box to switch between sources. You can see the video converter and the switch box in Photo 2



Photo 2 – video converter and switch box

I figured out most of the wiring needed for the Toyota video converter thanks to Toyo's home page at <http://userwww.aimnet.ne.jp/user/sa-sa-ki/ESTIMA/Back%20mon5.htm> where he added a backup camera to a 2001 Estima. His wiring diagram is repeated in Figure 3.

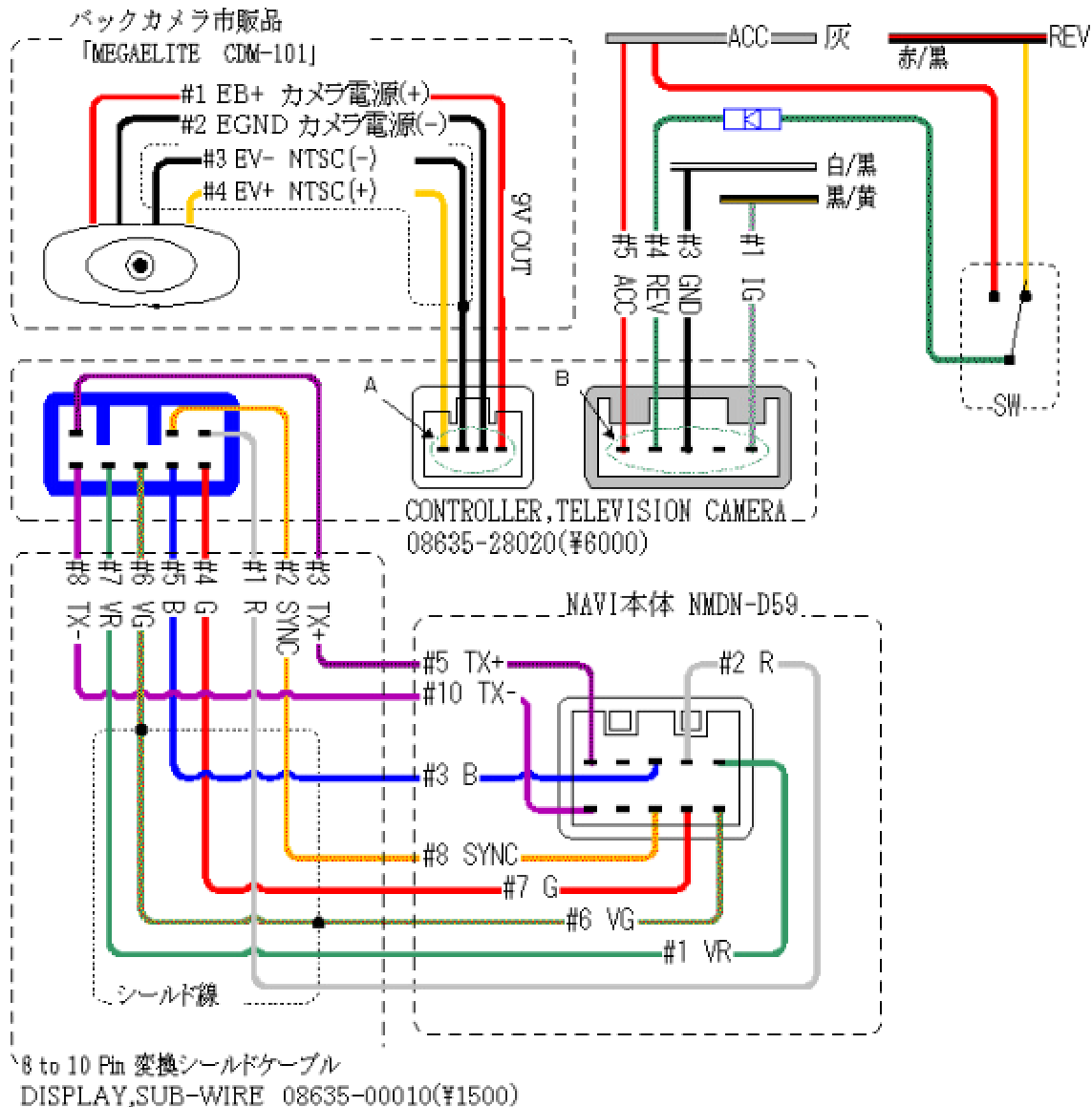


Figure 3.

Don't pay any attention to the NMDN-D59 box 0 that doesn't apply to the Prius. I also used a different (12V) camera, so didn't use the 9VOUT wire. IG and ACC need to be tied to switched 12V. GND of course needs to go to chassis ground. I didn't use the REV wire nor the TX+ nor TX- lines since the Prius LAN didn't seem to talk to the converter properly and thus never activated it. Instead, I went inside the video converter and grounded the analog switch selection line which is highlighted in figure 3.5. This makes the video output active whenever power is present.

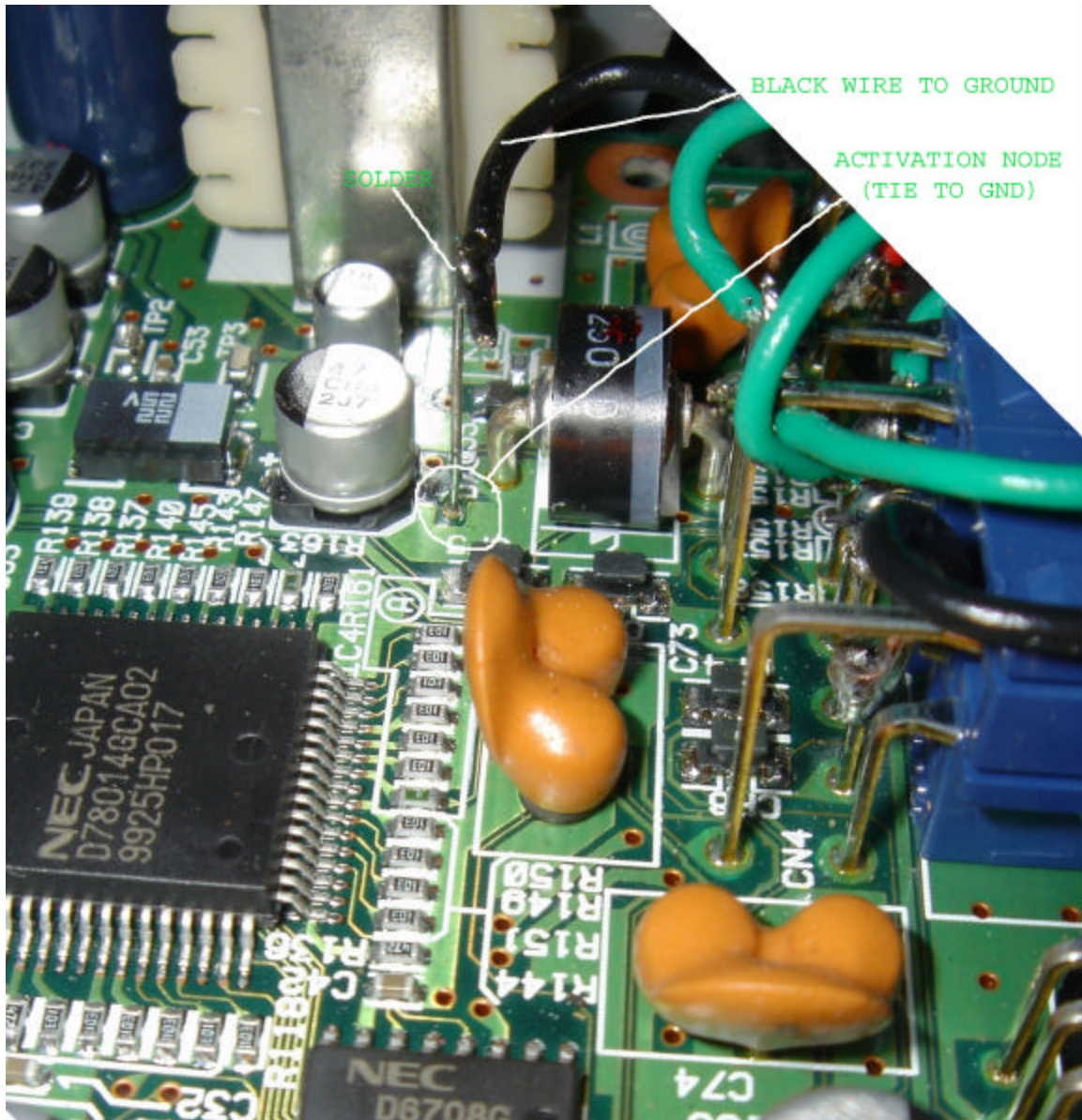


Figure 3.5 – location of ground wire to enable video out

By the way, one easy place to steal power from is behind the rear seat drink holder. Snap this off the center console by pulling toward the back of the vehicle (aren't these snaps great?!). Photo 4 shows where I've tapped into the 2 wire cable which feeds the power outlet inside the storage compartment. This area also provides a convenient cable routing path when crossing the vehicle under the seats.



Photo 4 – power available behind rear drink holder..

Camera mount

Next we need to mount the camera. Even though the Japanese model has a nice built-in camera option (Photo 5), we've only got a snap-out plastic part (Photo 6) in the US but no mounting holes. Break this free.



Photo 5 – Japanese 2005 Prius backup camera



Photo 6 – after breaking away snap-off cover

Then you need to drill holes in the steel hatch (!) for the cable and for mounting the camera. First unsnap the plastic cover from the lower inside of the hatch (Photo 7,8)



Photo 7 – lower hatch cover



Photo 8 – hatch with cover removed

Then drill a ¼” hole for a mounting bracket and a ½” hole for the camera cable in the opening behind the camera mounting area (Photo 9 shows this after the larger hold was drilled) . Be careful not to drill into the plastic bezel when you punch through!

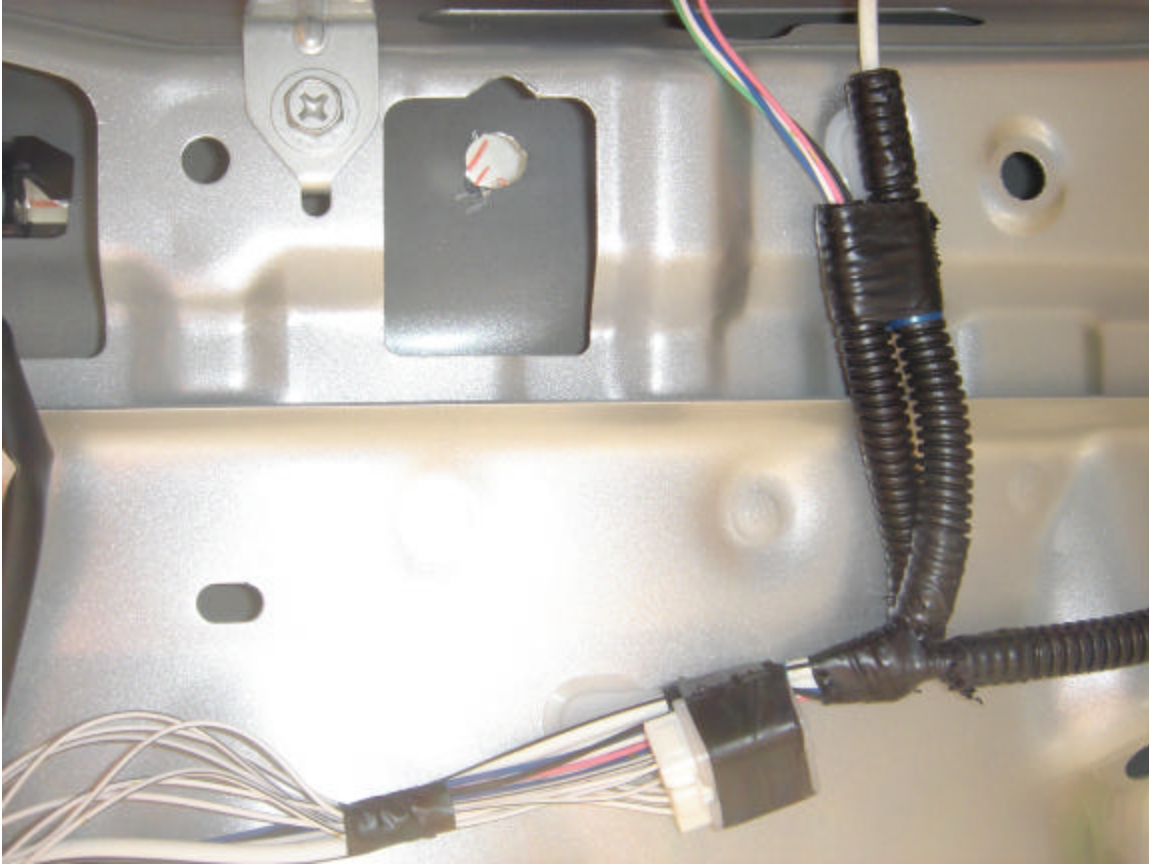


Photo 9 – drilling the holes.

Next we need to make a bracket to hold the camera. I opted for a plastic angle mount with $\frac{1}{4}$ x20 threaded holes (Photo 10) plus an aluminum plate (Photo 11) screwed to the camera. The \$40 camera I bought at Fry's had 2mmx0.4mm screws holding the cover on, so I replaced them with longer screws to attach the aluminum plate. Also, I sawed off the swivel stand which was originally attached to the camera. This camera's not really very high quality so you might consider an alternate.

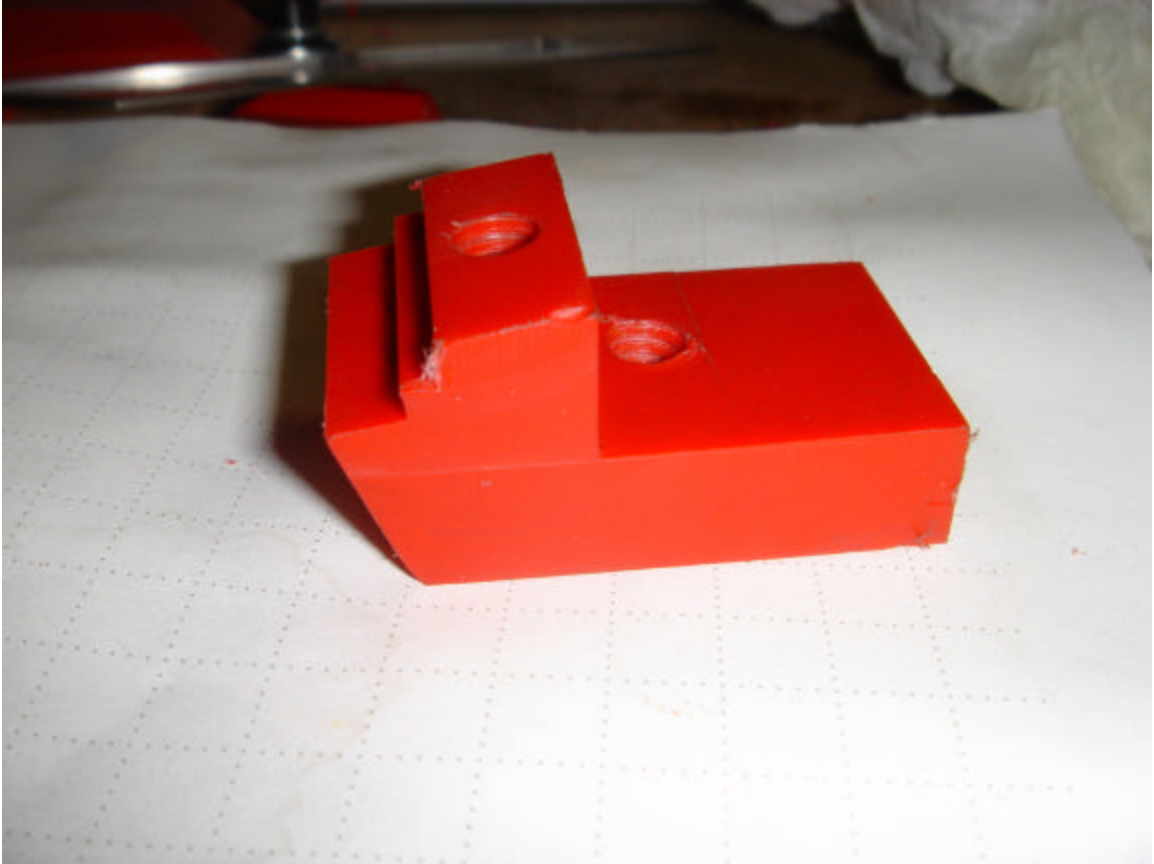


Photo 10– plastic angle mount for camera



Photo 11– aluminum mounting plate for camera

Now thread the camera cable through the hold and secure the mounting bracket with $\frac{1}{4}$ -20 screws. See Photo 12



Photo 12 – cable entry for camera

Then route the cable through the black plastic trim panels of the hatch. These don't seem to snap as easily as other sections of the car - be careful not to break off internal pieces (I've got something rattling around inside now). Then come down inside the gray plastic seal trim (Photo 13) and down into the cargo area via the battery well.



Photo 13 – cable transition

Final view of the camera in place: Photo 14.



Photo 14 – camera

DVD/TV/MP3 player installation

I used the Blaupunkt DVD-ME3 to select amongst various sources – backup camera, DVD, TV, MP3 or auxiliary video. It is < \$200, has an IR remote and is simple enough to install. I put it in the cargo area so it would be out of the way (Photo 15). Since I haven't figured out how to feed audio directly into the stereo system yet, I used a Belkin FM modulator to get audio out – that's also visible in Photo 15. I mounted the IR eye on the passenger sidewall (Photo 16) after snaking the cable through the back seat and under the cable channels on the passenger side. I mounted the TV antenna on the glass for the hatch and you can also see that cable in Photo 13.



Photo 15 – DVD/TV/MP3 player and FM modulator



Photo 16 – IR Remote and receiver eye

Screen shots

So – what can it do? Well, here are a few screen shots to get you going. Now I've got to make a custom DVD (Welcome to Mike's Prius ... you can imagine the rest.



Photo 17 – backup camera



Photo 18-TV



Photo 19 – about to play a DVD



Photo 20– MP3 file list while playing music

Ideas for improvement

- Color video converter (see <http://www.priuschat.com/forums/-vp57602.html#57602>)
- Auto backup video selection on reverse (see same link)
- Lockout when moving forward
- Auto powerup of Blaupunkt (right now I need to press the remote's power button)
- Higher quality camera (AGC on this one's weak)
- Left/Right video flip (to make it act like a mirror on the backup cam)
- Easier installation (CoastalEtech???)
- Better FM modulator (remember frequency through power cycles, non-battery)
- Direct audio input rather than FM modulator

Revision history

17 Oct 2004 Original version

18 December 2004 – corrected error in what to ground to activate it (was CD4066) and references to color

Thanks to all those on PriusChat who helped provide many clues about how to do this.