Jeep Cherokee AW-4 to AX-15 Swap

Parts you'll need:

AX-15 transmission from a Jeep Cherokee 4.0 6 cyl (1993-1999)

Bell housing for AX-15 (NV3550 is the same)

Manual transmission clutch housing spacer

Clutch kit (pilot bearing, clutch disk, pressure plate, throw out bearing)

4.0 flywheel and all bolts

Hydraulics - Master/Slave cylinder assembly from the same year as the trans you are swapping in

Clutch/brake pedals assembly from the year of your vehicle, or as close as possible

PCM from a Jeep with a manual trans from a year compatible with yours (yes, you need it to pass inspection!)

Shifter boots (one screws into trans tunnel, one cosmetic cover over center console)

Transmission tunnel plate adapter for manual trans (has cut-out for shifter to come through)

All transmission mount hardware and brackets

Transfer case shift linkage and underside brackets from transmission and body

Front and rear drive shafts from a manual with the same rear as you have

NOTES: This may be obvious to many people, but manual XJs with the 4.0 came from the factory with 3.07 gearing, whereas automatics came with either 3.55 or (rarely) 3.73. I love the 3.55 ratio with the manual for up to 31" tires, but if you do not plan to run at least slightly oversized (at least 235/75R15 ~28") tires, this is something to consider. If you are already lifted/re-geared with oversized tires, make sure you check a tire size to gear ratio chart and read up on what size tires and gears you should run with the manual transmission.

Also, get a good manual, such as Chilton's or Haynes manuals from your year of Jeep as well as the year of the Jeep you are using the majority of your parts from. Many of the torque specs you will need are extremely important for this swap, so be sure to double check all torque specifications when installing all transmission and clutch parts.

Contact – Hopefully this write-up is complete, but feel free to ask any questions you may have, I'll be happy to answer if I can.

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Getting Started / PCM Swap:

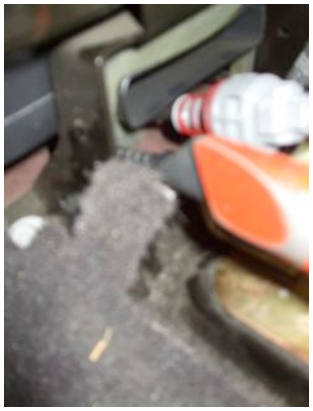
Make sure you have all the parts you need before starting this! You WILL need everything listed above, and of course, this is a perfect time to make sure you get years of service out of your swap by getting a new clutch kit that replaces everything listed under "clutch kit" above. If you are installing a used flywheel of unknown integrity, you should also consider having it resurfaced now, it's just one of those things that's worth the money. You should also take a look at this thread to make sure that the auto trans you are replacing has the same output shaft as the manual trans you hope to install
http://www.naxja.org/forum/showthread.php?t=101120

DO THIS FIRST!

Give Auto Computer exchange a call. www.autocomputerexchange.com - (888) 664-8787 and talk to Steph if you can. Tell them that you are converting your Jeep from an automatic to a manual and stress that this is the only reason you need a new computer. Give them the OEM P/N off your original PCM unit, but assure them that it is irrelevant, you just need a unit programmed for a manual XJ from your year. If you can, ask for Steph, she was my contact there. It will take about 3-5 days to get your new computer, so that is why I say do this first, so when your project is done you are good to go. They are about $225-250 at the time I am writing this. I say call because if you do it online like I did, it may complicate things. Just because I know people will ask: Yes, you can drive your Jeep without swapping the PCM. It will run fine, as long as you follow my instructions on wiring up the NSS. It will set code P1698 (if you have the TCU unplugged) because the PCM is not communicating with the TCU. With the TCU plugged in you will see 3 codes related to transmission sensors. You can run this way until you need inspection, the only "malfunction" I found is that your engine will not idle correctly (1-200 RPM high)

01. Interior prep:

Remove all your old slush box parts and put them for sale on eBay, somebody will want them, but these trannies are a dime a dozen, so don't expect to get much for it. Remove the center console, disconnect shifter cables from shifter and remove screws from the auto transmission tunnel plate (8mm or 5/16"). You will also need to remove the bolts from the 4wd shifter that are closest to the plate and at least loosen the other bolts mounting it to make removing the plate possible. Making two small cuts in the carpet will also help you get to the bolts for the shifter plate on the trans tunnel. Make one cut in the front small strip that goes across the shift cables, and one in the rear corner about 2" long – you should be able to tell where the center console sits on the carpet so just note that and you won't have to worry about making the cuts too big that it won't cover them.


Cutting the front


Cutting the rear

02. Installing the clutch:

Install the new pilot bearing into the crankshaft by tapping it gently. This works best by finding a socket or short piece of tube that is as close as possible to the OD of the bearing. Tap the bearing in evenly, making sure it is not going in crooked, until it has seated at the full depth of the race in the crankshaft. Now install the flywheel to the transmission using only bolts for bolting a flywheel to the motor – do not use flex plate bolts, as the flex plate is much thinner than a flywheel. New bolts are highly recommended, and don't forget the lock-tite! These bolts get cranked down to a knuckle-busting 100 ft-lb of torque, so you will need a friend to hold the crank shaft from turning by putting a wrench on the front of the crank at the harmonic balancer (3/4"). Make sure you tighten these in an alternating fashion, as you would your lug nuts. Next install the clutch and pressure plate. This is where if you have a new clutch kit, your life will be easier. You need a little plastic piece molded like the input shaft of the transmission to hold the clutch in place as you bolt in the pressure plate (should come with a clutch kit). Once you have the clutch aligned bolt these down tight, again in an alternating pattern.

Pilot Bearing Installed

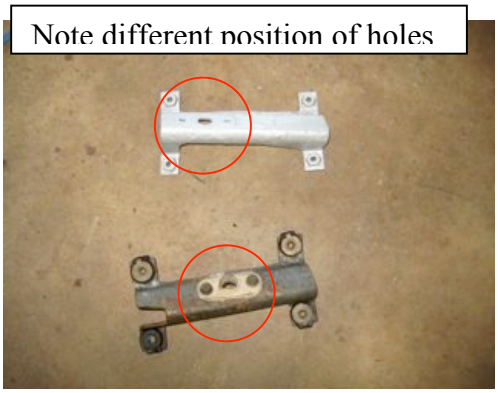
03. Installing the transmission:

Remove the old throwout bearing (if necessary) and install the new one. Make sure the clutch fork is hooked up and working properly. Get your transmission placed on your jack and hoist it into place. The most tedious part of this will just be getting the splines on the input shaft and the bolt holes lined up with those on the clutch and the bellhousing tight to the back of the block. TIP: Make sure you have the transmission parallel with the engine – a jack & block on the oil pan to give the engine some adjustability will help. Making sure everything is as straight and lined up as possible, mate the trans to the engine block and start bolting it together with the two bolts at the very bottom of the block first (the two that are horizontally across from each other). You may want to find 2 long 6" long 7/16" bolts and nuts/washers to help line this up and pull the trans and engine together.

You can save this step for later if you like, but now is a good time to re-install the transfer case and all shift linkage while you're still under the jeep. While your friend is still relatively sober, have him help you bolt the transfer case shift linkage bracket to the underside of the transmission tunnel. This is easiest to do before you put in the cross member. Next you will need to bolt the transmission mount bracket onto the AX-15, but notice whether the exhaust pipe mount is the same on that as it is on your jeep. If not you will have to custom fab something, like I did. Install the rubber trans mount and brackets, and bolt the trans cross member back in place. Your new trans is in place! While you're still under the Jeep bolt the slave cylinder in to the bellhousing and you're all set. If you are using used parts, you can keep the whole hydraulic system intact and closed by just feeding the slave cylinder down along the firewall and to the underside of the Jeep. This saves a lot of bleeding of the hydraulic system. Make sure the length of your push rod is correct and does not need to be

extended (see optional step 06). You can also install the front and rear drive shafts at this point and you should be done with the crawling under the Jeep part of the swap (at least the majority of it).

Different Trans mount brackets
(Bottom one is for manual)



Shift Linkage brackets
(silver one is for manual)

Auto Shifter

Manual Shifter (and trans plate with hole cutout in it)

04. Transfer case:

To get the transfer case linkage working, you will need to unbolt the bracket from the underside of the transmission tunnel and bolt on the one from the jeep with the manual trans. You will also need to mount the bracket on the transfer case itself and as long as you have all the right linkage from a jeep with the AX-15, everything will just snap into place. Hook up your driveshafts and your work on the underside of the jeep is done.

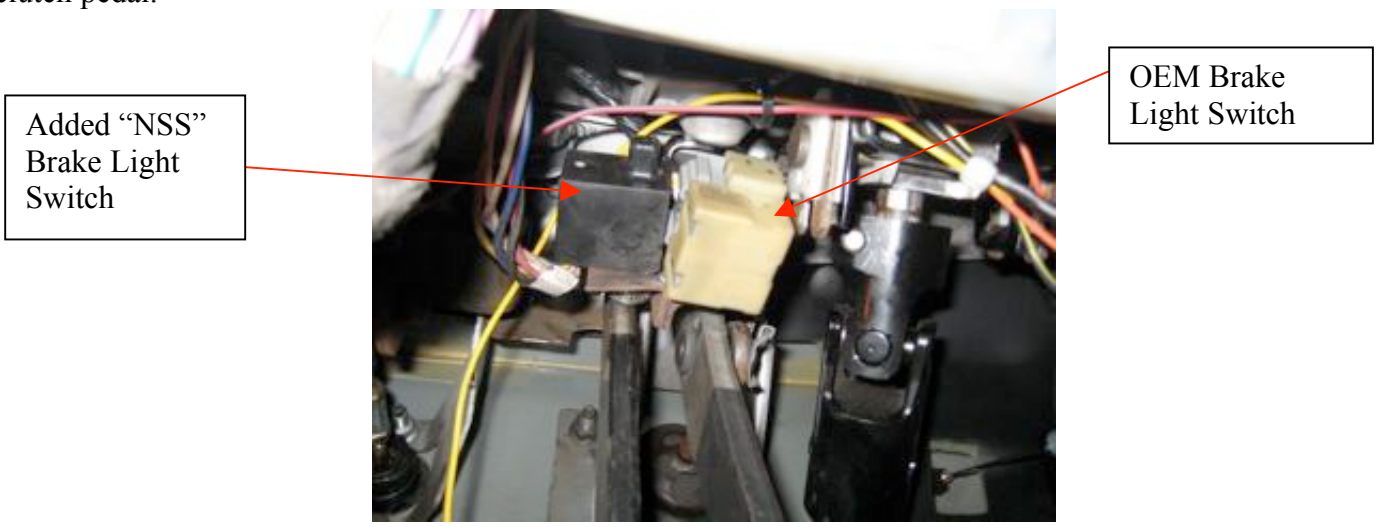
Shift Linkage Installed

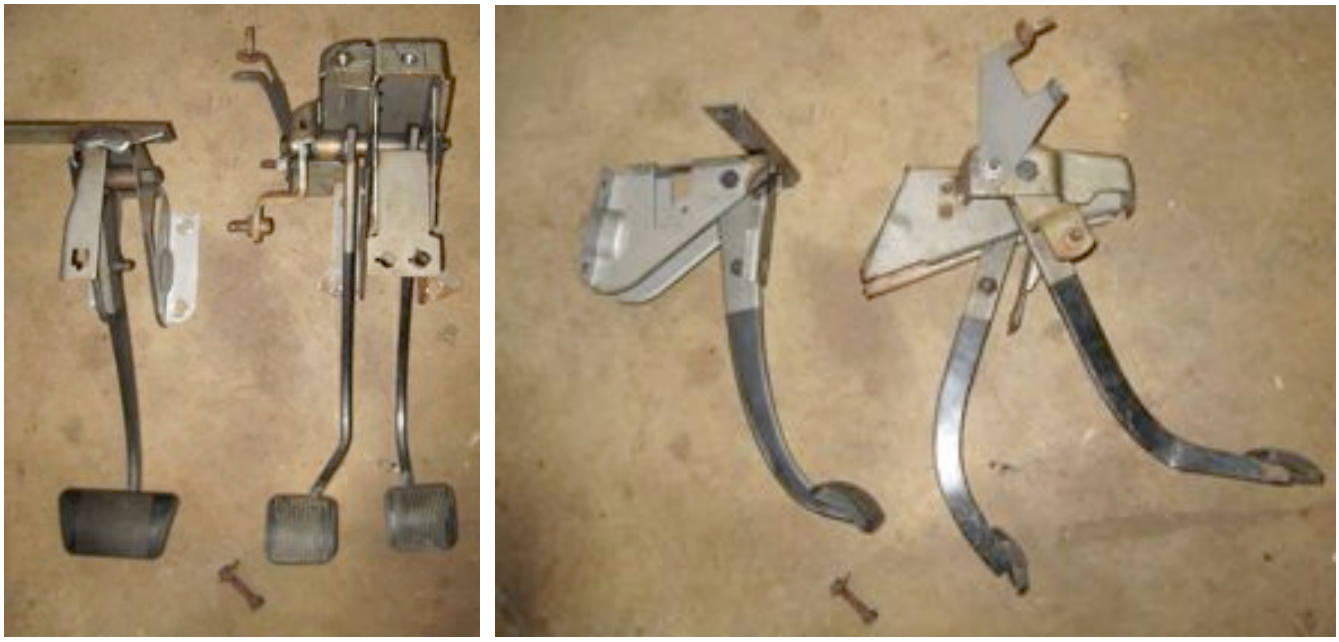
Different Linkage – Left=Manual Right=Auto

05. Clutch Pedal Assembly:

This was by far my least favorite part of the swap. You really need to make sure that you have the pedals from your year jeep (84-94, 95-96, 97-01 should be the years that are interchangeable). In my case, I was installing parts from a 94 into a 00. The clutch/brake pedals are way different between these years. As you can see from the pictures I basically fabricated a whole new assembly by combining the two. Because the booster is totally different on the 00 (changed to dual diaphragm in 95), I wanted to keep the brake pedal as original as possible, and basically just add the clutch pedal. To do this I had to drill out all the spot welds on the 94 assembly to separate the clutch bracket and then weld it onto the 00 brake pedal bracket. Doing this moved the clutch pedal further away from the firewall than it had been on the 94, so I had to extend the bracket that supports the clutch master cylinder and extend the rod for the clutch master cylinder.

Neutral Safety Switch (NSS) add-on Optional: With the proper PCM for a manual, this is not necessary. All you really need to do is to close the circuit for the NSS as shown in step 08. What I did was to add a small extension off of the brake light switch tab for another brake light switch. This will take some work to get a Jeep switch to work, and it will be very tight. You can use a much simpler 2-wire switch, I have heard of using a GM switch, though I used a Jeep switch. Make sure the pedal will open the switch when the pedal is fully released. The way mine worked, I barely have to push the pedal to close the switch, so it is still possible to "bump" the Jeep using the starter with the transmission in gear, but you cannot start without acknowledging the clutch pedal.

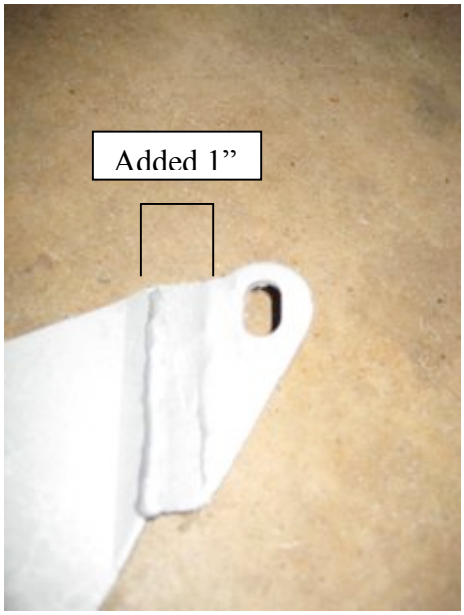


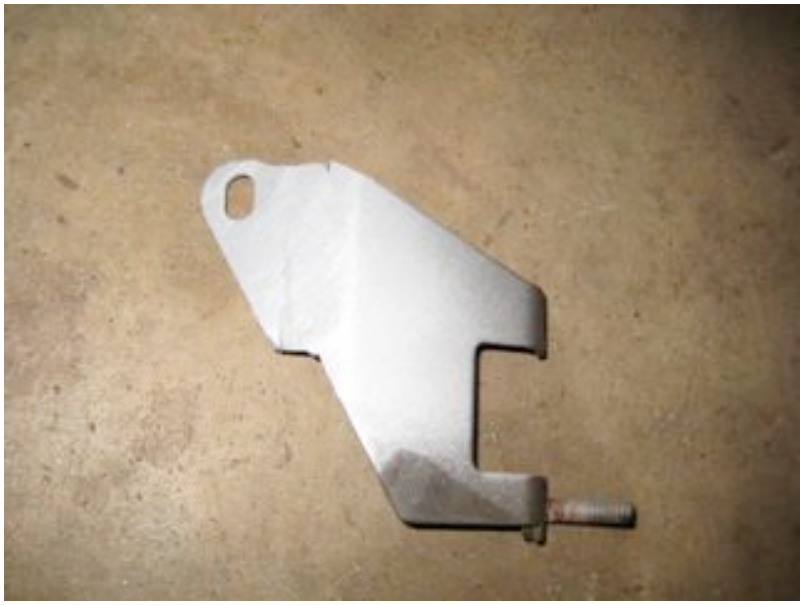


Clutch/brake pedal comparisons. Notice the difference in length of the brackets


Removal of the clutch pedal part of the assembly.





Clutch master cylinder brace with about 1” added

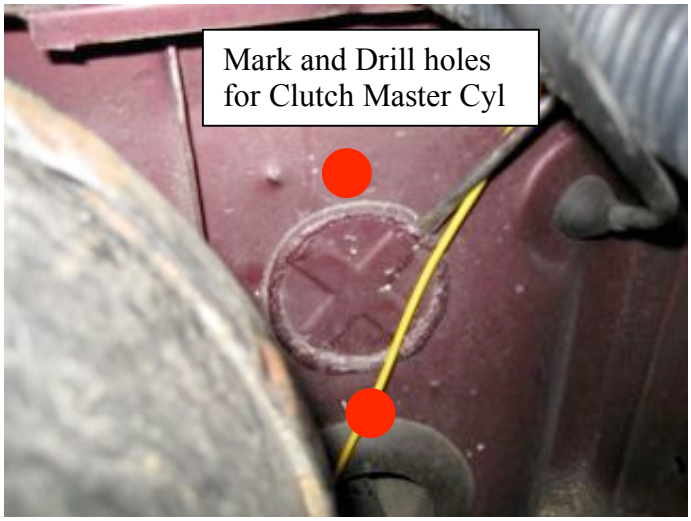
06. Extending the clutch master cylinder rod (may not be necessary)

As noted above, with the parts not being exactly what would have been used in a 97+ XJ from the factory, I had to extend the push rod for the clutch master cylinder. To do this, I cut the rod in the middle. I purchased a 5/16-18 coupler from Lowes, and got out my tap and die set, grabbed a 5/16-18 die, and cut threads on each end of the now split clutch master cylinder rod. I then threaded a 5/16 jam nut on each end and then threaded the two halves together into the coupler. I then installed the master cylinder, adjusted the rod to the proper length, and tightened down the jam nuts. Works great, but if I ever need a new cylinder I will be getting an aftermarket adjustable one.

Cut & Extended master cylinder rod

07. Installing the clutch master cylinder in the firewall

Locate the picture plug in the firewall next to the brake booster by the driver's side fender. Using a flat head screwdriver, pop the plug out and discard. Carefully mark and drill 2 7/16" holes, one above and center, one below and center of this hole, for the master cylinder bolts to go through. Install the master cylinder into the bracket and make sure the bolts line up with the holes in the support bracket that attaches to the pedal assembly. If you are using new parts, run the hydraulic line down to the slave cylinder and bleed, otherwise you should be good to go from step 03.



Clutch Master Cylinder hole (between DS fender And brake booster)


Plug just pops out with a screwdriver

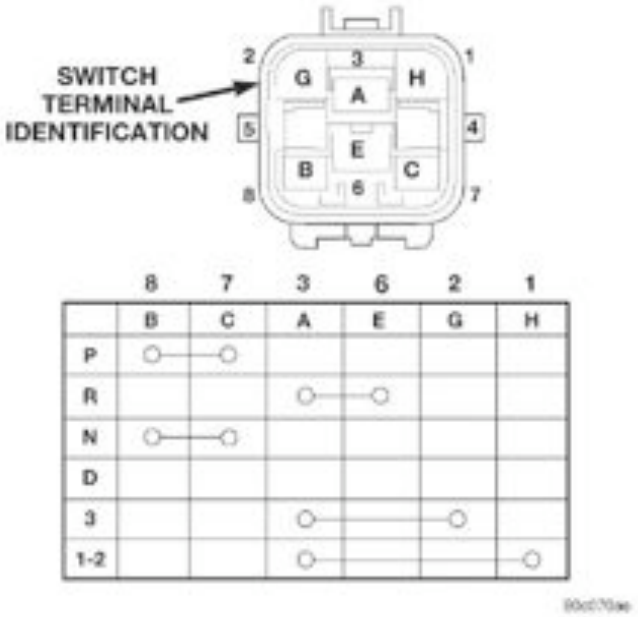
08. NSS Wiring & PCM Swap

If you followed the preliminary instructions, you should already have your new PCM in hand and ready to install. With the battery still disconnected, un-bolt the three 8mm bolts that mount the PCM to the drivers side fender. Unplug the three connectors from the PCM and remove it. Plug the new one in and bolt it in place. On the driver's side of the transmission tunnel, under the dashboard (near the gas pedal) you will find the TCU. Unplug and remove this small (about the size of a cassette tape) unit and sell it too.

Now comes the fun and exciting part, where you get to play with the NSS wiring. If your NSS is in good shape, you can probably get a fair bit of cash for it, because these are a very expensive part. That being said, if you can, get a NSS side plug from the junk yard that you can hack into for the wiring you are about to do and sell the unmolested NSS.

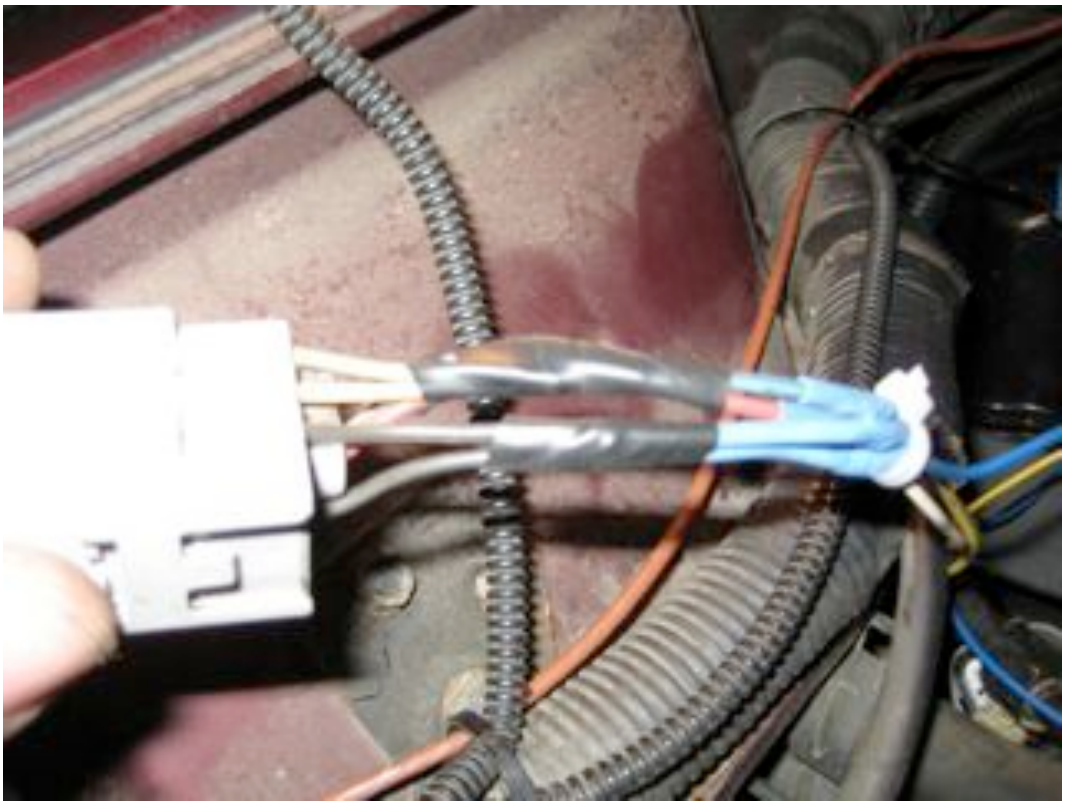
Using the diagram below, you will need to use the wires running to terminals B and C to run to your clutch pedal NSS. You can also just connect these two wires together for a permanent no-NSS solution. You will need to connect the two wires from terminals A and E to the wires coming from your reverse light (doesn't matter which wire goes to which lead). Now, if you are wiring the NSS to your clutch pedal, run those two wires to the switch at the pedal and you're done – really, go drive it!!

DIAGNOSIS AND TESTING (Continued)



	8	7	3	6	2	1
	B	C	A	E	G	H
P	○	○				
R			○	○		
N	○	○				
D						
3			○		○	
1-2			○			○

From http://webpages.charter.net/laurajeff44/NSS/nss.htm



09. Wrap up the Loose Ends

Obviously you will need to put your interior back together, make sure the boot is on over the shifter and the center console is back in and all that. Getting a cosmetic shifter boot is up to you, make your own custom one or find an OEM replacement online. I plan to do leather seats, and would like to make my own custom black or dark gray leather shifter boot. Check over all accessible bolts and make sure everything is still tight.

Enjoy the full power and control of your 4.0 – I hope the swap is a worthwhile one for you.