# Fiero TH440/4T60 Automatic Transmission Conversion

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**by Karl Hamilton**

I became a Fiero owner a little over two years ago when I purchased a black 88 formula with a 2.8L engine and 3 speed automatic transmission. It has been the most fun to drive of any car I have ever owned. When I went looking for a Fiero I wanted an automatic. I haven't driven a stick shift in years and all of my other cars are automatics. The engine and transmission combination provided good performance for in-town driving but the 3.33 final drive ratio of the automatic was geared a little low for highway driving. The engine would be running at over 3000 RPM at 70 MPH. This is not an advantage when your car has an 11 gallon gas tank. One answer to the problem would be to get a Fiero automatic transmission with a 2.84 final drive ratio. The extra torque of a larger engine such as a 3.4L could compensate for the low-end performance loss, but this seemed to be a very unexciting way to use the higher displacement engine. A better solution would be to keep the 1st, 2nd, 3d, and final drive ratios the same and add a 4th overdrive gear. GM manufactured a transmission with this configuration called the TH440 / 4T60. It is roughly the same size and shape as the TH125C and can be made compatible with the Fiero electrically and mechanically.

| Model | 1st | 2nd | 3d | 4th | Reverse |
|---|---|---|---|---|---|
| TH125C | 2.840 | 1.600 | 1.000 | —— | 2.067 |
| TH440 | 2.921 | 1.568 | 1.000 | 0.705 | 2.385 |

From the above chart you can see that the first three gear ratios of the 4T60 are close enough to the original to leave performance the same (for transmissions with the same drive ratio). When the 4T60 shifts into 4th gear however a large improvement should be noted. Engine RPM will drop to a little over 2/3 of the original transmission's value at the same cruising speed.

I decided that if the drive train was going to be pulled out of the car for the new transmission that I might as well put a 3.4L engine in at the same time. I bought a 3.4L Camaro motor with only 6,000 miles on it from Ed Parks at the Fiero Factory and found a 87 Cutlass Ciera with a blown motor and a 4T60 transmission. Buying the whole car was a good deal because it allowed me to get all the extra parts that are needed for a conversion such as drive axles, electrical connectors, transmission mounts, etc. One of my goals for this conversion was to leave the engine compartment looking relatively unchanged when the car was finished. To make a long story short, the conversion done at the Fiero Factory resulted in a car with an excellent balance of performance / economy and an engine compartment that looks stock.

## Transmission Type

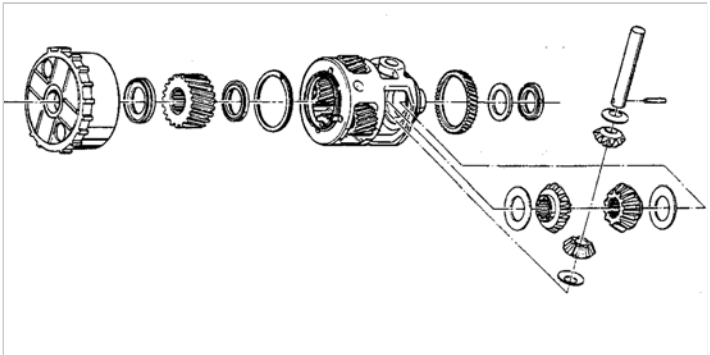
There are two main varieties of 4T60 transmissions, the hydraulically shifted TH440/4T60 and its close cousin the electrically controlled 4T60-E. The 4T60-E transmission requires an external computer to control the shifting and is not compatible with the Fiero engine computer, which has neither the circuitry nor wiring to interface with it. The hydraulic 4T60 transmissions were used in GM cars from 1984 to 1990. Later years tend to be more reliable so try to find a transmission manufactured between 1987 – 1990. If you have the transmission rebuilt see if your mechanic can use later year (stronger) replacement parts where applicable.

## Engine Type

The 4T60 is designed for use in front wheel drive cars powered by V6 engines. A 2.8L or 3.4L engine works well and is probably a good match for this transmission.

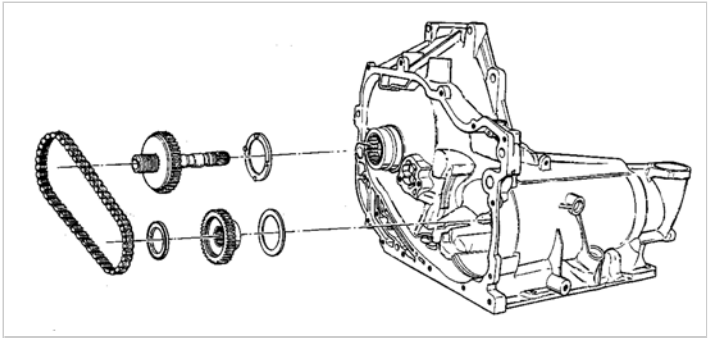
## Transmission Gearing

As I mentioned before the transmission drive ratio is important, but just what determines it? In cars with in-line drivetrains, the drive ratio is set by the gear ratio of the rear axel. With transverse drivetrains the differential and what is equivalent to the ring and pinion gear are inside the transmission.



**Final Drive Assembly**

This unit, called the final drive, consists of a differential gearset and housing attached to a sun and planetary gear set. An outer shell with internal teeth called the ring gear meshes with this assembly. Ok, so if we know the gear ratio of the final drive we know the overall drive ratio right? Well the GM engineers didn't make it quite that simple. Inside the transmission power is transferred from the output of the torque converter to the input of the gears and clutches by two sprockets and a drive chain.



**Chain Drive Assembly**

Most of the time both sprockets have 35 teeth each which makes the chain ratio 1:1, but some times other ratios are used which will affect the overall drive ratio. A total of four different chain ratios and three different final drive ratios allowed GM to produce the 4T60 in twelve different drive ratios. The three final drives in the picture below show the difference in size of the center sun gear. The smallest gear is the 3.33 ratio, followed by the mid sized gear at 3.06, and finally the largest sun gear is the 2.84 drive ratio.

**(L to R) 3.33, 3.06, and 2,84 final drive**

| Chain Ratio | 33/37 | 35/35 | 37/33 | 38/32 |
|---|---|---|---|---|
| Final Drive | Overall Drive Ratio | | | |
| 2.84 | 3.18 | 2.84 | 2.53 | 2.39 |
| 3.06 | 3.43 | 3.06 | 2.73 | 2.58 |
| 3.33 | 3.73 | 3.33 | 2.97 | 2.80 |
| Overall ratio from final drive and chain ratios | | | | |

One of the first questions that needs to be answered before obtaining a new transmission is what is the overall drive ratio of your current transmission and does it suit your driving style. The easiest way to find out the ratio of your TH125C transmission is to look at the ID tag located near the gear selector lever. Depending on the year and engine one of the following code may be found.

| Fiero TH125C 3 speed automatic transmission | | | |
|---|---|---|---|
| Engine CID/Liter | Year | Drive Ratio | Identification Tag Number |

| | | | |
|---|---|---|---|
| 2.5L/151 | 1984/86 | 3.18 | 4PF, 5PF, 6PF |
| | 1987 | 2.84 | 7PSC |
| 2.8L/173 | 1985/86 | 3.06 | 5CD, 6CD |
| | 1986/87 | 3.33 | 6CP, 7CPC |
| | 1988 | | 8CPC |

For myself, I decided that I liked the 3.33 ratio of my original transmission. Unfortunately the transmission I had obtained was missing its ID tag which didn't seem to be a problem until I realized just how many drive ratio variations there were and the importance of knowing which one I had. Most 4T60 transmissions were made with a 2.84 overall drive ratio so a usable lower geared (higher ratio number) transmission may be hard to find. The ID codes in the chart below may help if your searching for a 3.33 ratio. Keep in mind though that unless you know the history of the donor car, its transmission may have been rebuilt or had parts swapped which means the ID tag (if it still exists) may not be accurate.

| GM TH440 / 4T60 4 speed automatic with 3.33 final drive | |
|---|---|
| Year | Identification Tag Number |
| 1987 | 7ACH, 7CAH |
| 1988 | 8AJH, 8CDH, 8CFH, 8CMH, 8CRH, 8CTH, 8CWH, 8CXH |
| 1989 | 9CDH, 9CLH. 9PAH, 9PBH, 9YAH, 9YBH, 9YFH, 9YJH |
| 1990 | 0AJH, 0CHH, 0CJH, 0KHH, 0LAH, 0LMH, 0LNH, 0PAH, 0WXH, 0YDH, 0YHH, 0YKH, 0YLH, 0YRH, 0YSH, 0YTH |
| 1991 | 1WXH, 1YAH, 1YDH, 1YHH, 1YSH, 1YTH |
| 1992 | 2YAH, 2YBH, 2YKH |

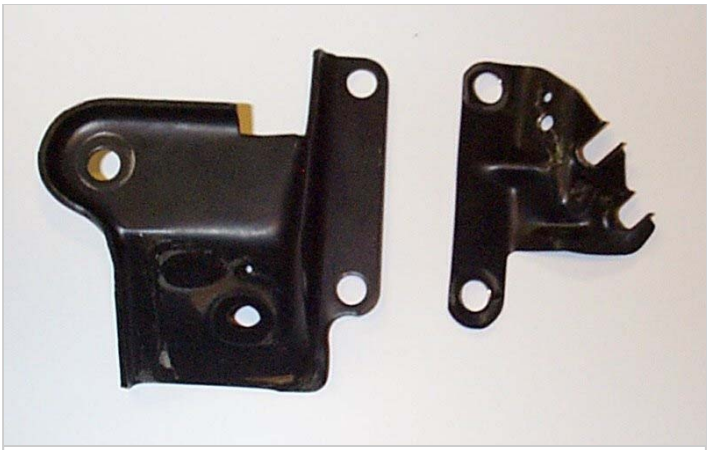
If you plan to rebuild the 4T60 transmission and the final drive unit in your original TH125C transmission is the right ratio there may be a solution. GM likes to reuse parts whenever possible to reduce their

costs. In designing the 4T60 transmission the final drive of the earlier TH125C was reused. The final drive and the sun gear from the TH125C will work in the 4T60. The ring gears of the two transmissions are different and will not interchange. This is not a problem since the planetary gears will fit either ring gear unit. Keep the 4T60 ring gear and have your transmission rebuilder assemble it to the TH125C sun gear and final drive.

## Transmission to Frame/Engine Mounts and Adapters

The 4T60 transmission has the same bellhousing and torque converter bolt pattern as the original TH125C and will bolt up to either the 2.8L or 3.4L engines without adapter plates.

The mounting brackets in the picture are off of a 4T60 at the local junkyard that was out of the car and headed for the aluminum recycling bin. I have no idea the model of car they are from but they must be fairly common as I saw several in the transmission scrap pile.

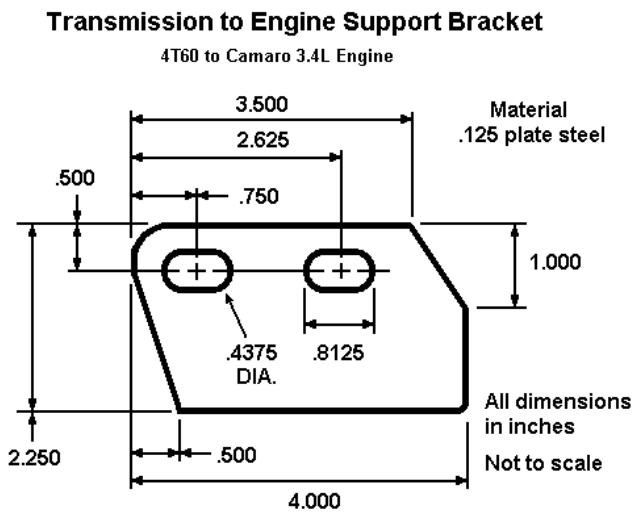


**Front transmission mount and oil tube support**

**Rear transmission mount**

My transmission was mounted using these brackets without moving the engine from the stock location. The the forward transmission bracket bolted to the front transmission mount without modification. The rear transmission mount was moved about 3/4 inch toward the center of the car by slotting the rear transmission mount holes of the 88 cradle. The stock Fiero rear transmission mount was used. The 4T60 transmission sets between the frame rails with adequate clearance on all sides. In the above picture the rear transmission mounting bracket is on the right and the front transmission mounting bracket is on the left. The piece in the middle is the hydraulic cooling tube support, which mounted over the right two bolts of the front transmission mounting bracket.

**Transmission to engine mount (for 3.4 L)**




**Bracket extender plate**

On the passenger side of the car just above the transmission axel seal another bracket is used to bolt the engine block to the transmission case. It keeps the transmission housing from flexing under high load conditions (like when your accelerator foot is mashed to the floor boards). I have not found any bolt in replacements that will join the 4T60 and the 3.4L engine block but fortunately it is fairly easy to modify a TH125C to 2.8L bracket to work. You will need a .125 x 2.25 x 4.0 inch piece of plate steel. Trim it to the shape shown in the above picture. Exact dimensions on the angled sides and rounded corners are not critical. Notice that the 7/16 holes are slotted about 3/8 of an inch to make the job of positioning the plate for welding less critical. The left hole at the bottom of the factory bracket (see the above picture) must also be slotted about 3/8 inch toward the center and parallel with the curved bottom edge. When this is done, position the plate on the bracket as shown in the picture. The plate should be as close to the bottom and right side of the bracket as possible without resting on the curved bends on these sides (the plate should lay flat against the bracket). This should result in the bottom edge of the plate being about 1/8 inch away from the long side of the bracket. The right side is not as critical since the holes are sloted in this direction. Lightly tack weld the plate to the bracket and try it on the engine and transmission. If it fits, finish welding it, if not the grind off the tack welds and try again.

## Drive Axels

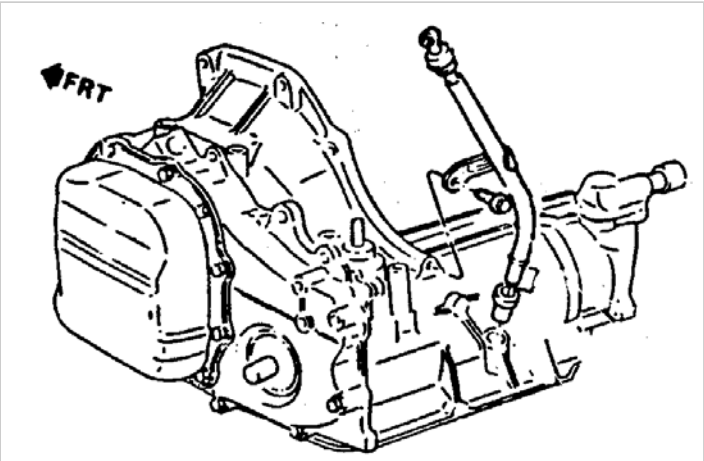
Save the drive axels from the donor car. You will also need a set of axels for a **Manual Transmission** Fiero. Yes, you heard correctly. The axels for a 4T60 are a larger diameter than the Fiero automatic transmission axels but almost exactly the same diameter as the Fiero stick shift units.

**Drive axel Assembly**

The axel joint closest to the tires is called the constant velocity (CV) joint and the end closest to the transmission is called the tripot joint (because of its 3 lobed shape). The tripots from the 4T60 transmission will need to replace the Fiero tripots on the manual axels. The length of the axel shafts will need to be altered also. How much will depend on the mounting placement of the transmission. The axel shafts must be long enough to keep the tripot joint from coming apart as it extends and short enough to prevent it from bottoming out when it compresses (failure in either case will be disastrous). On my car the driver's side stock axel shaft needed to be shortened 1 inch. The passenger's side used one of the axels from the donor car.

## Transmission Dipstick / Filler Tube and Pan Gasket

This is another small detail that will make the conversion work better. The dipstick tube must fit into the seal grommet at the bottom of the transmission and be bolted securely to the engine or transmission.




If the tube does not enter the grommet straight a slow leak will develop since the fluid level inside the transmission is above this seal. Don't use a filler tube that bolts to the engine, as the 2.8L/3.4L will probably not have a mounting point for it. Modifying the mount brace or tube will most likely cause a leak at the grommet if not done just right. A better option is to find a different filler tube of the correct type at your local wrecking yard. If you make changes in this area make sure that the new dipstick projects the same distance past the end of the tube and has the same markings as the one that originally came with

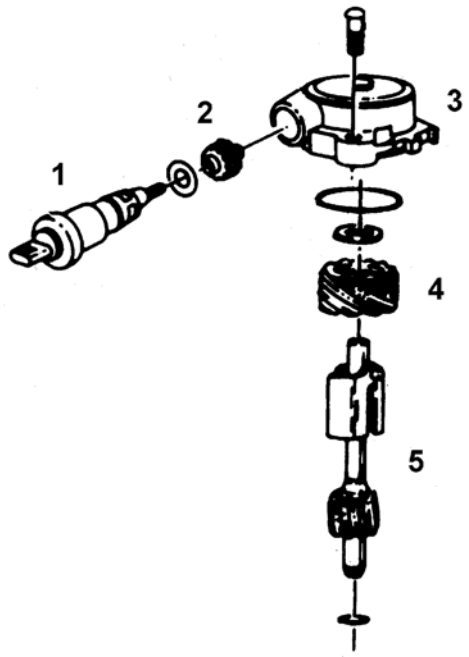
the 4T60 you are planning to use. Try to find a filler tube and dipstick like the one shown. It fits the Fiero's engine compartment with the top of the filler tube setting at the correct height and in a convenient location. The tube is about 19.5 inches long measured end to end and the side brace is 5 inches long. The side brace bolts to the transmission just below the gear selector lever. It is from a 4T60 transmission / 3800 engine front wheel drive GM car. The dipstick when fully inserted projects approximately 1.625 inches past the end of the tube.

Another area for oil leaks is the pan gasket. Cork gaskets will leak if the pan bolts are not torqued just right and silicone gasket sealers must be put on clean surfaces and allowed to cure for 24 hours. Both stick like glue when you later try to change the oil and both have to be cleaned off before re-sealing the pan. GM makes a high quality steel core rubber gasket for this transmission that solves these problems. It has steel crush limiter rings around each bolt hole so that leaks from over tightening pan bolts is eliminated. The gasket doesn't stick to the pan or transmission case when removed and with care can be used over and over again. If the pan – case mating surfaces are undamaged, this gasket positively will not leak. Disadvantages are the price, about $25, and the need to use the oil pan designed for this gasket (it doesn't have a stamped ridge on the gasket mating surface like the one for cork gaskets). It has a GM part number of 867-8681.

## Speedometer

The governor – speedometer assembly is located on top of the transmission above the passenger side axle shaft coupling on both the 4T60 and TH125C.

**Governor housing is located below alternator**




**Governor and Speedometer Sensor**

1 Speedometer Sensor
2 Speedometer driven gear
3 Governor cover
4 Speedometer drive gear
5 Governor assembly

**Transmission governor assembly**

There are 3 variations of speedometer assemblies that I have seen on 4T60 transmissions. One type is almost exactly the same as the one used on the TH125C transmission and will plug directly into the Fiero speedometer connector. A 2nd type is almost the same as the first except the speed sensor (item 1) has been replaced with an assembly that screws into a mechanical speedometer cable. This type can be used if reassembled with speedometer sensor from your old transmission. Both the mechanical cable and sensor type speedometer assemblies are held in place by a 1-inch wire clip on the top of the governor cover. NOTE: The TH125C governor cover (item 3) is NOT interchangeable with the 4T60.

**Fiero compatible governor assembly**

**Pulse type governor assembly**

A 3d type is an electronic pulse generator assembly that looks quite different from the original TH125C governor speedometer sensor. The electrical connector and more importantly the signal generated by this unit are not compatible with the Fiero. If your transmission has one of these units the entire assembly must be replaced with one of the previously mentioned types. CAUTION: Check with the supplier or rebuilder of the transmission before changing parts on it to avoid voiding any warrantees.

It should be noted also that while the governor assemblies (item 5) from various 4T60 transmissions look the same, there are small differences in the fly weights that control the shift points. The governor assembly's weights are matched to the final drive's gear ratio. If you change the final drive ratio make sure the governor assembly you use comes from a transmission with the same ratio. Using a different governor will work but the transmission may shift at too low or too high a rpm for optimum performance.

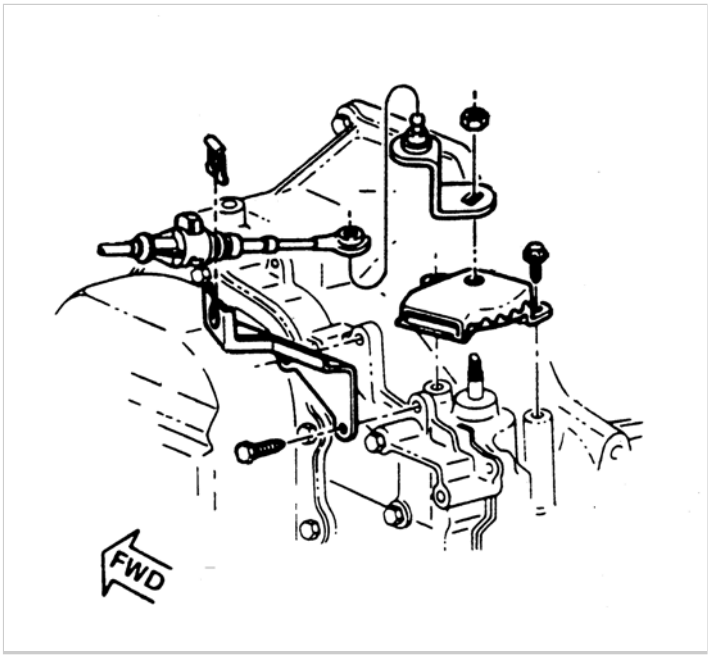
## Speedometer Calibration

The accuracy of the reading on your speedometer can be affected by changing tire size or final drive ratios. Changing your transmission will almost certainly change the speedometer calibration. Getting the speedometer to read with acceptable accuracy will require changing the ratio of the drive and driven gears in the governor assembly. Most 4T60 transmissions will have a 10 tooth green drive gear on the governor and a 28 tooth yellow driven gear on the speed sensor. Write down the ratios of the gears in your transmission. After the transmission is in and the car is safe to drive, travel 10 miles or more on the freeway, counting mile markers, and determine the percentage of inaccuracy in the speedometer. Then calculate the gear ratios needed and try to correct the speedometer by changing the driven (speed sensor) gear since it is the easiest to remove. For example, if the speedometer is 10% fast you will need a driven gear with 10% MORE teeth. The drive (governor) gear will only work with a narrow range of driven gears so if too great a correction is required, both gears may have to be changed. Correcting my

speedometer required using the original 10 tooth green drive gear and the 30 tooth blue driven gear from my old TH125C transmission

## Start-Backup Switch

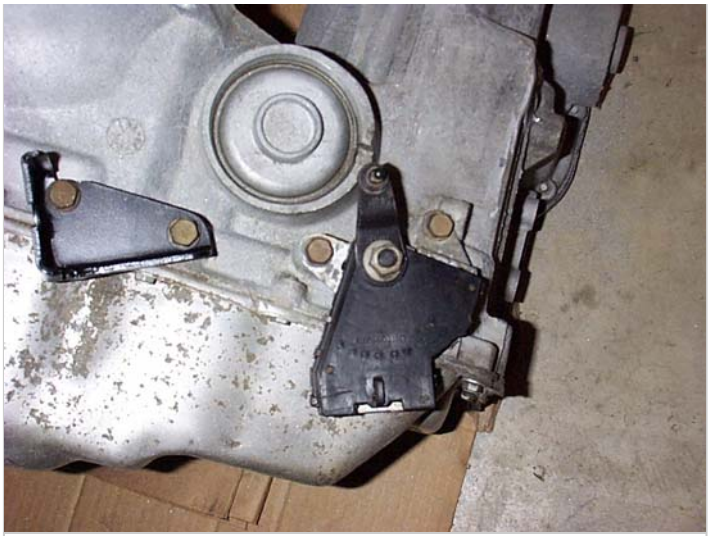
This switch keeps the car from starting in drive and turns on backup lights in reverse. It is located on the driver's side at the top of both the 4T60 and TH125C transmissions. There are 2 types of switch modules. One has a connector built into it, and the other has several connectors on a short cable attached to the switch module. The first type (without the cable) is the one to use. It will plug directly into the Fiero wiring harness without modification.




## Transmission Shift Cable

The shift lever for the Fiero automatic only has 6 positions (P-R-N-D-2-1). Your new transmission will have 7 (P-R-N-D-3-2-1). The shifter could be modified but it would be hard to retain the stock look. Since I cannot remember the last time I used the 1st gear position on any of the automatic cars I drive, I decided to simply not use the 7th position of the new transmission. The shifter remains unaltered with labeling indicating a P-R-N-D-2-1 shift pattern but the transmission's shift pattern is actually P-R-N-D-3-2 with the 1st gear position unused. Making the shifter detents and the transmission detents lineup requires that the shifter and the transmission control lever move through the same arc distance. A control lever with a distance of 1.6875 from the center of the cable pivot to the center of the transmission control shaft will match the transmission to the stock Fiero shifter. Note that the flats in the shifter lever hole are not inline with the lever but point off to the right at about a 30 deg angle (see picture below).

**(L to R) Stock bracket, modified bracket, and shift lever**



**Bracket on transmission with shift lever in neutral**

The shift cable bracket for the TH125 bolts to the side of the transmission. On the 4T60 the bolt holes for this purpose are on the top of the transmission near the start-backup switch. A stock bracket can be used by cutting off the lower part that bolts to the side of the old transmission and drilling two new holes in the horizontal part of the bracket to bolt to the top of the new transmission.

To mark the bracket for drilling, put the transmission control lever in the neutral (N) position with the cable attached and set to the middle of its adjuster setting. Insert the cable and retaining clip into the bracket and position the bracket over transmission mounting holes. Try to line up the bracket so that the cable shaft and the transmission control lever form a 90 degree angle and mark the bracket for drilling. The cable can bend to make up for some misalignment but too much will cause binding.

## Transmission Kickdown Cable (TV) and Vacuum Modulator

Automatic transmissions need to monitor engine parameters to know when and how hard to shift gears. Most transmissions use either a TV (throttle valve) cable to monitor throttle position, or a vacuum modulator to monitor intake manifold pressure. The 4T60 transmission is different in that both devices are used. The 4T60 uses the vacuum modulator to control the main line pressure (the shift firmness). Adjusting the modulator to raise or lower line pressure will cause the transmission to shift firmer or softer, with no change in shift timing. The TV cable, and valve, control shift timing, but not shift feel. This may seem to overly complicate things but it allows the 4T60 to be adjusted more precisely than other transmissions.

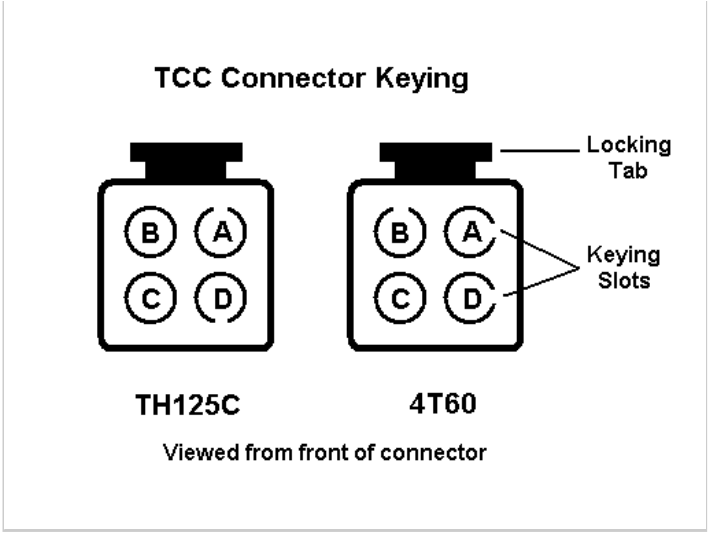
The TH125 downshift (TV) cable will work with the 4T60 transmission without modification. The TV cable adjustment procedure is the same as for the old transmission. With the engine off push in on the adjuster lock button on the TV cable and push the cable end in (away from the throttle body). Release the lock button and then fully open the throttle. The cable will click several time as the end is pulled back out. The TV cable should not require further adjustment.

The TH125C did not use a vacuum modulator, so a vacuum line will need to be run from the modulator to one of the intake manifold vacuum fittings. I tapped into the small vacuum port on the upper intake manifold just above the distributor with a plastic T fitting and some rubber vacuum line hose.

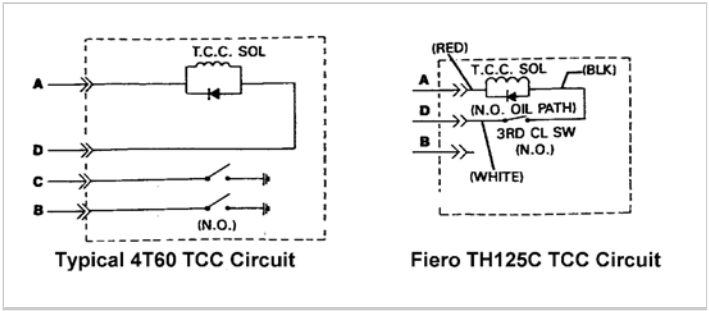
There are two types of modulators for 4T60 transmissions. One type is adjustable and the other is fixed. Either type will work but the larger non-adjustable unit comes very close to interfering with the engine coolant pipe. The smaller adjustable type will fit better and allow you to play with the shift firmness.

## Torque Converter Clutch (TCC)

The torque converter of an automatic transmission is designed to slip. If it didn't't your engine would die every time you stopped the car at a traffic light. Slippage while at cruising speed however is just wasted power (fuel economy). Modern transmissions such as the TH125C and the 4T60 have an electrically operated clutch called the TCC that eliminates the slip at cruising speeds. The electrical connector for the TCC is located on the driver's side top-front of both the 4T60 and TH125C transmissions. There are several variations on the 4T60 transmissions that I have seen. One type uses a 4 pin square weather pack connector that at first glance looks exactly like the original TH125C. The difference is that the connector shells are keyed differently.



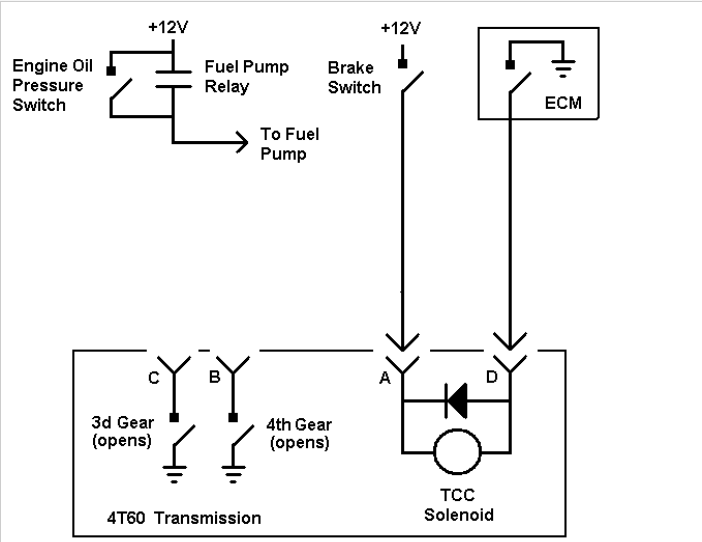

The other type uses a 5 pin round connector. There are several ways to adapt the transmission to the Fiero wiring harness. The most obvious solution is to get the connector used with the 4T60 from the donor car and splice it into the Fiero wiring harness. Another solution is to get a weather pack terminal extractor (Belden part# 725153 sold at NAPA automotive stores for about $6.00) and use it to remove the connector pins from the Fiero TCC connector shell and replace it with the shell from the donor vehicle. This may also work for the 5 pin type but I have not tried it. Pins A and D are connected to the TCC solenoid on the TH125C. Get an electrical schematic of the donor car's TCC circuit and compare it to one for the Fiero to figure out what connections to make on the new transmission.



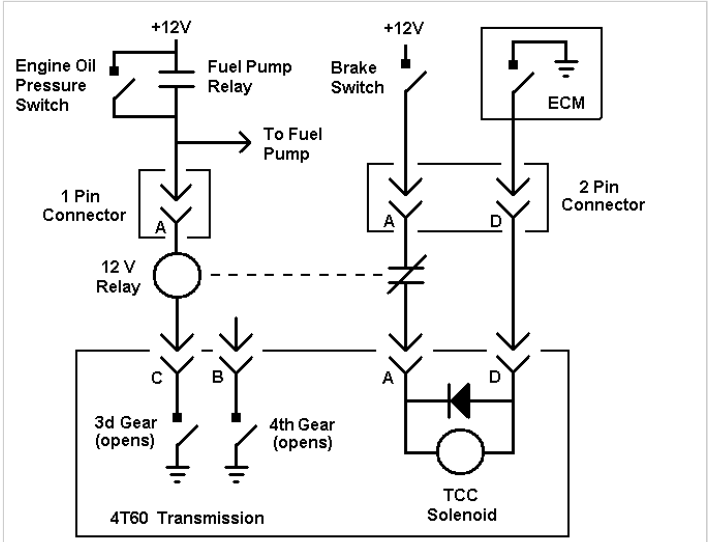

Please notice that the TCC solenoid coil has an electrical device called a diode connected across it. This makes the TCC solenoid polarity sensitive. Power can be applied in only one direction for the TCC to work. If the wires are reversed to the TCC coil the engine computer which commands the TCC may be damaged. Be careful and double check your work. On my car pin A and D of the Fiero harness went to pin A and D respectively of the new transmission connector ( pin A to A and pin D to D).

There is one other detail that should be mentioned here. The TH125C had a pressure switch located inside the transmission wired in series with the TCC coil. The purpose of this device is to prevent the TCC from locking the torque converter in any gear but 3d by opening its contacts in 1st and 2nd gears. The 4T60 has several gear activated switches but it is not possible to use them because only one side of the switch is wired to the connector and the contacts are normally closed instead of being normally open. The other side of the switch is internally grounded to the transmission case. Two different transmission rebuilders told me that not having the high gear switch in series with the TCC should not

be a problem. The transmission did seem to work without the switch. Lockup occured in both 3d and 4th gears at steady speeds and shifting seemed normal but occasionally while at a stop the engine would stumble or die as I released the brakes (but before I touched the gas pedal). My only explanation for this annoying feature was that the ECM was sometimes calling for TCC lockup at zero speed and was only prevented from accomplishing this by the open brake switch. When the brake was released and the switch closed the TCC tryed to lockup which stalled the engine. Most of the time the drop in engine rpm causes the ECM to open the TCC circuit fast enough to prevent a complete stall. This problem seems to occur only at random intervals. It was several months before it had happened enough times that I was able to figure out what the problem was. Cars that suddenly stall (even occasionally) can be very dangerous to drive in heavy traffic so I added the circuit below.




**Original TCC circuit**




**New TCC circuit**

The new relay is used to change the grounded normally closed transmission pressure switch function to an isolated normally open contact like the original TH125C switch. The ECM can only lock the TCC when the transmission is in 3d gear (or higher) and the brake is off (switch closed). I mounted the new relay next to the fuel pump and air compressor control relays on the fire wall behind the air cleaner. This was also a convenient spot to splice into a 12 volt power line (the fuel pump) that is only hot when the engine is running. Other power hookup schemes are possible but the power source chosen should only be hot when the ignition is on. This will prevent a small but constant battery drain thru the relay coil and the closed transmission switch when the car is not running.