PERFECT

TORC Transmission Control

Installation Instructions

PERFECT TORC
GM 4L60/65E and 4L80/85E
Part #66501

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If you have any questions concerning the installation of this product or use of this product, feel free to call the Painless Performance Product tech line at 1-800-423-9696. Calls are answered from 7:30am to 5pm central time, Monday thru Thurs, and 7:30am to 4:30pm central time Friday, except holidays.

We have attempted to provide you with as accurate instructions as possible, and are always concerned about corrections or improvements that can be made. If you have found any errors or omissions, or if you simply have comments or suggestions concerning these instructions, please call or email using the number or email address above. We sincerely appreciate your business.

Perfect Performance Products, LLC shall in no event be liable in contract or tort (including negligence) for special, indirect, incidental, or consequential damages, such as but not limited to, loss of property damage, or any other damages, costs or expenses which might be claimed as the result of the use or failure of the goods sold hereby, except only the cost of repair or replacement of the Painless Product.

P/N 66501 Painless Instruction

June 2022
Version II

Painless Performance Products recommends you, the installer, read this installation manual from front to back before installing the PERFECT TORC system. Due to the variables in modifications done to transmissions and vehicles; reading this manual will give you considerable insight on the proper installation of this product. It is likely if this manual is not read completely that either the product not work due to improper installation and/or damage to this product or the transmission may result. SO PLEASE READ THIS ENTIRE INSTALLATION MANUAL BEFORE PROCEEDING!!! THANK YOU.

CONTENTS

INTRODUCTION

On non-EFI or mechanically injected diesel engines, a throttle position sensor must be sourced and installed for use of this control module.

4L60E/65E Transmission:

- The PERFECT TORC Transmission Controller only supports 1996 and newer 4L60E transmissions.

- When using a later model 4L65E transmission it will not be necessary to plug into the input shaft speed sensor. The TORC Controller does not need the input shaft speed to properly control the transmission.

4L80/85E Transmission:

- The PERFECT TORC Transmission Controller supports 1993 to present 4L80E transmissions. However, the 1993 and earlier 4L80E transmissions use a different internal wiring harness and main pass-through connector. These early designs inherently leak fluid through their pass-through connector. General Motors has several Technical Service Bulletins recommending the upgrade to the newer style connector and harness. The TORC Controller's main harness connector is not compatible with the early harnesses. If an early 4L80E transmission is being used the harness must be upgraded to the 1993 and newer style to use with this system.

- The 1994 and earlier 4L80E transmissions use a "Bosch" style pressure control solenoid. This solenoid is not compatible with the PERFECT TORC Transmission Controller. It is necessary to upgrade to the 1994 and later "Holley" style pressure control solenoid. The "Bosch" solenoid is silver in color and the later "Holley" style solenoid is black in color. If your solenoid is black in color, it is the correct one and does not need to be changed. If your solenoid is silver in color, it is the incorrect one and the GM part number 8684216 must be installed. This number can also be cross referenced at most transmission parts suppliers and purchased.

Kit Contents Photo: 66501

Included: **(1) PERFECT TORC Module**
(1) 4L60/65E / 4L80/85E Transmission Harness
(1) PERFECT TORC Vehicle Harness
(1) USB communication cable
(1) Spare 10amp ATO Fuse
(1) 1 3/8" Firewall Grommet w/ ½"Hole
(2) Mounting Screws
(2) Mounting Bolts w/ Nuts
(4) Hook & Loop Mounting Tape
(10) Large 7" Zip Ties
(30) Small 4" Zip Ties
(1) Installation Instruction Manual
(X) Necessary crimp on terminals to complete installation

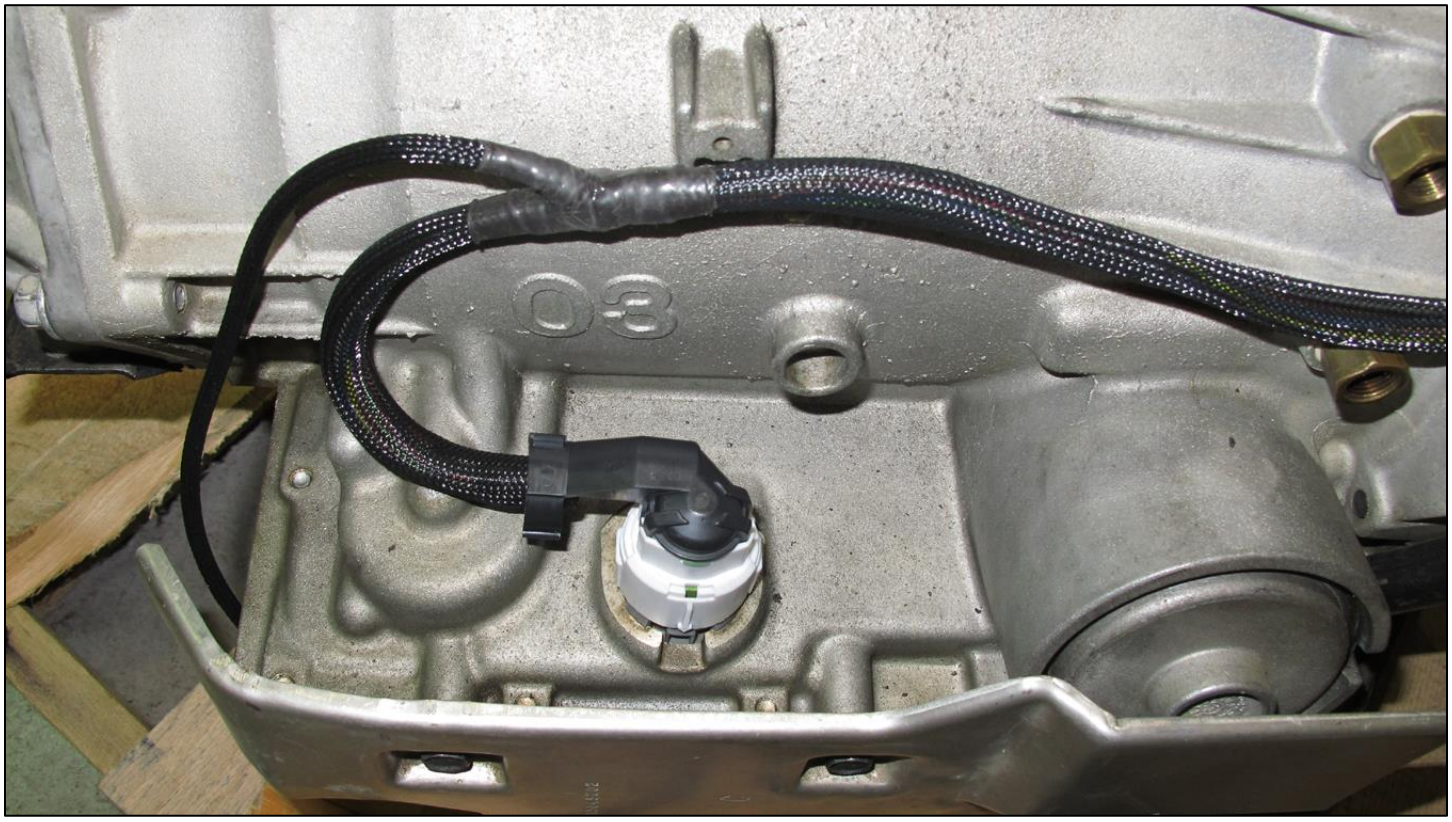
Software Note:

Due to the growing number of PCs lacking a CD drive, the software is not included with this kit, but rather downloadable to a Windows PC from the 66501 product page on the Painless website. You will need the "Second Generation Software" with this module. If a CD is preferred, contact Painless at 800-423-9696 and we will gladly mail you a copy.
https://www.painlessperformance.com/wc/66501

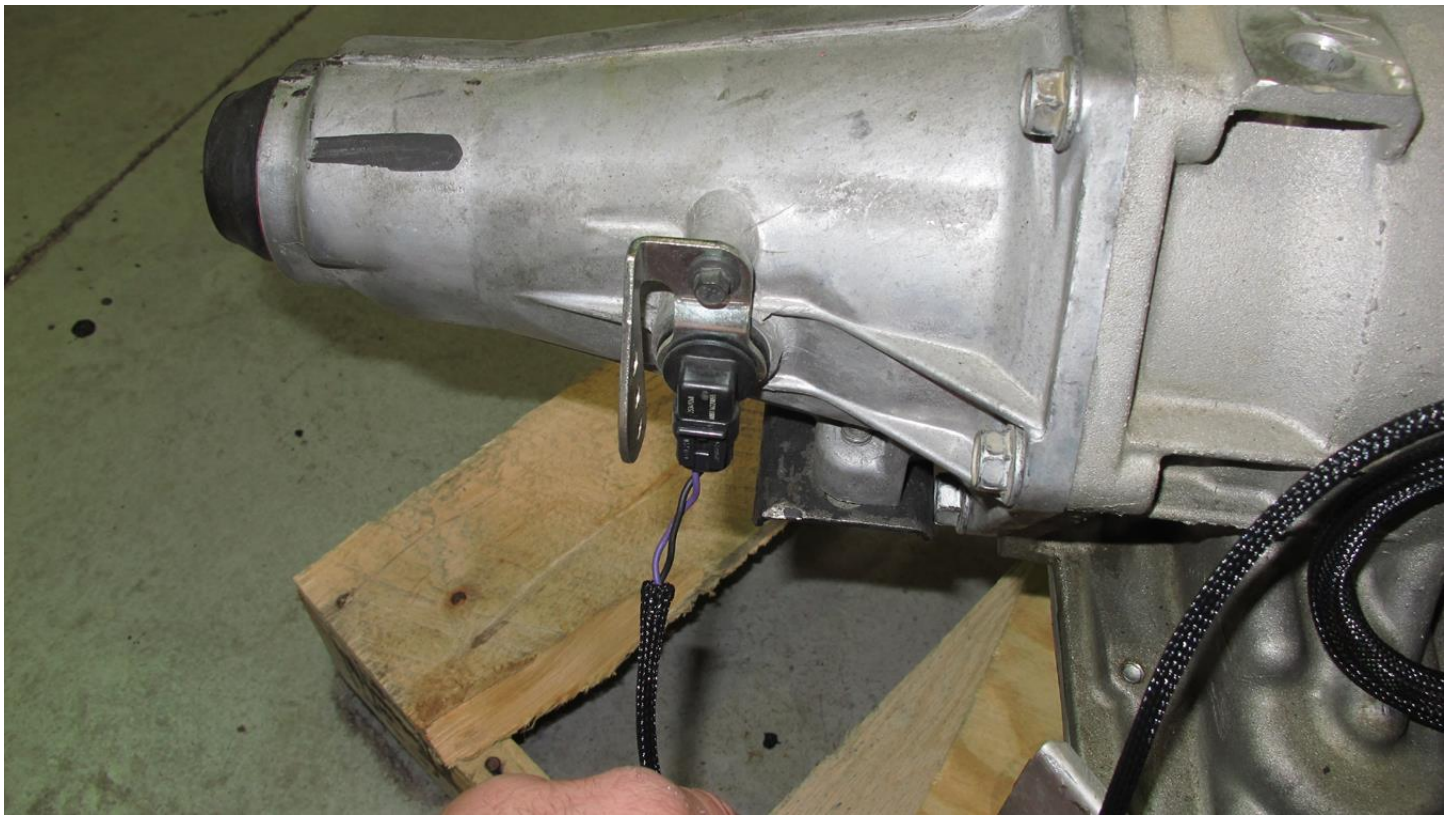
Installation Steps: Transmission Harness

1. Start by removing the system from the box and carefully laying it across a workbench or table. Take notice of the loomed transmission harness which contains the round transmission connector and vehicle speed sensor connector. These are the only two connections needed for both 4L60E (65E) or a 4L80E (85E) transmissions. This system does NOT require the use of the input shaft speed sensors on the 4L65E or the 4L80E/85E transmissions. See Figure 1, page 7, for the pin out of required connections.

2. Next, plug in the transmission connector and the vehicle speed sensor connector into their appropriate locations on the transmission. The transmission connector is located on the passenger side of the 4L60E transmission housing and on the driver side of the 4L80E transmission housing. The vehicle speed sensor is located in the tail shaft housing on the passenger side. See Install Pictures 1 & 2 below and on the next page.



Install Picture 1 – Main Transmission Connector



Install Picture 2 – VSS (Vehicle Speed Sensor) Connector

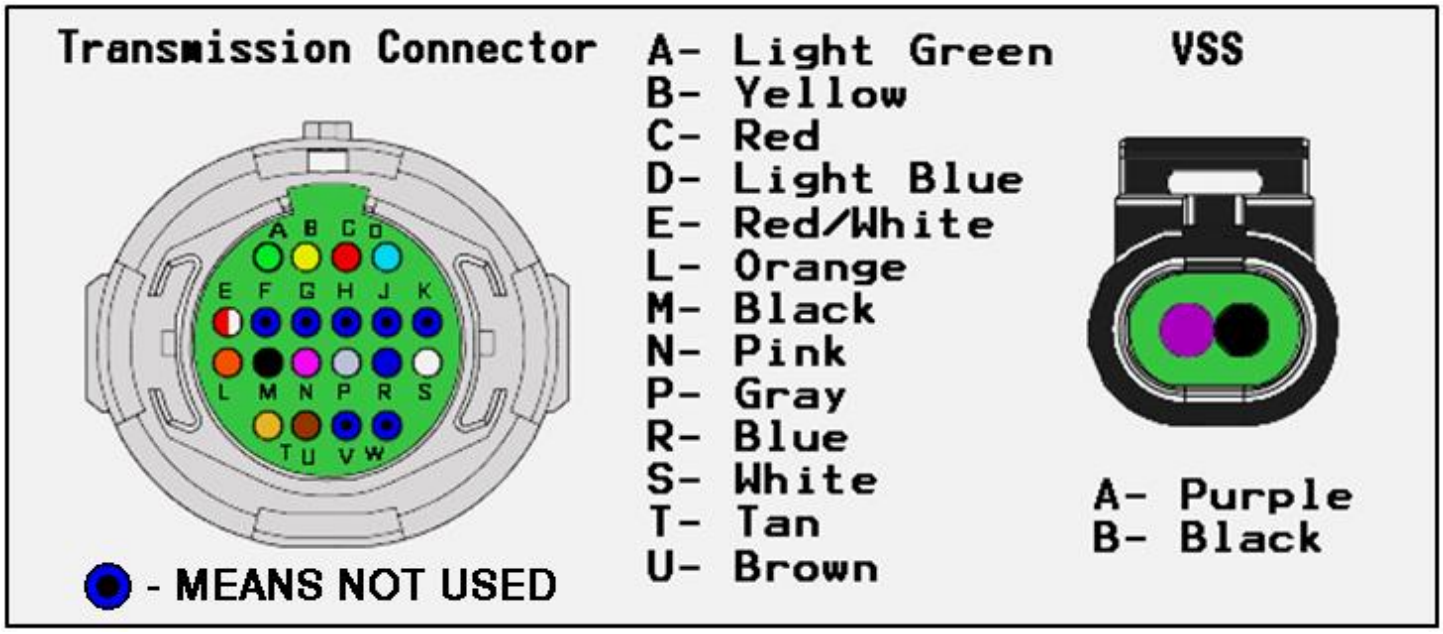


Figure 1 – Transmission Harness Connections on Transmission

Installation Steps: Module Mounting & Connections

THIS MODULE IS NOT INTENDED TO BE PLACED OR MOUNTED UNDER THE HOOD OR ANY PLACE EXPOSED TO EXSESSIVE HEAT OR MOISTURE.

1. The three TORC Module connectors from the transmission harness will need to be routed through the firewall. If you are not routing though an existing hole, a grommet has been provided with this kit. This grommet will require a 1 7/16" hole to be drilled.

2. When mounting the module, one should remember to provide easy access to the USB port, which is used to interface with a PC for programming and diagnostics, as well as the display and function control knob. For this reason, be sure to mount the unit in a way that gives easy access to the USB port, knob, and display. If you will be using a desktop PC for programming, install the unit so that it can be unplugged and moved easily.

3. To mount the module, #10 bolts & nuts and #8 self tapping screws have been provided if permanent mounting is desired. Hook & Loop strips have also been provided to allow installation, but also easy removability.

4. The Transmission harness has three connectors which plug into the bottom of the TORC Module. Each of the three connector positions are labeled on the TORC Module: (1) Solenoids, (2) PRNDL, and (3) VSS. There is an additional connector position on the TORC Module, labeled Vehicle, for inputs from the vehicle the module is being installed into. Each connector has a different number of pins; therefore, preventing them from being connected improperly.

Figure 2 –Connections on TORC Module

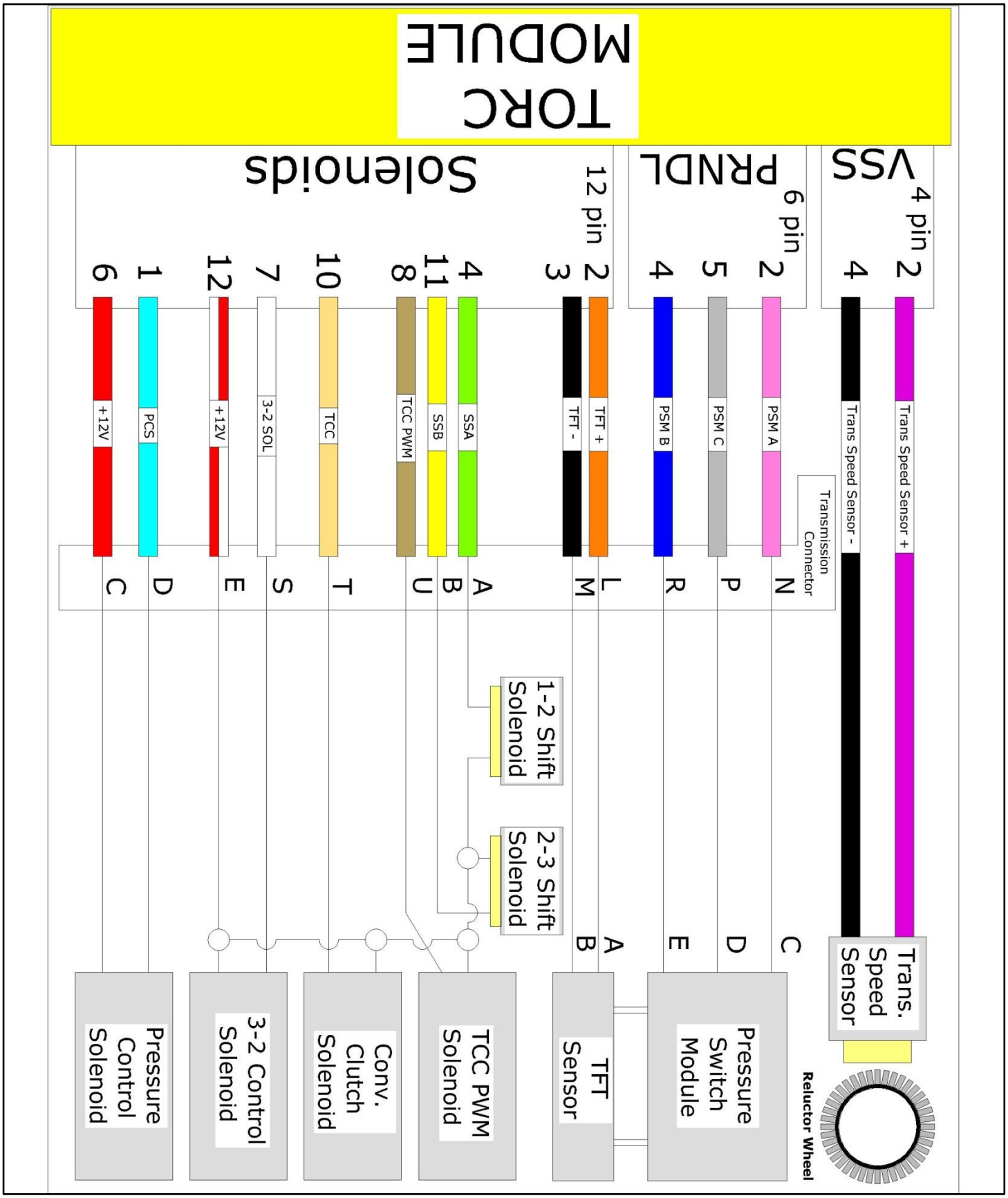


Diagram 1 – 4L60E/65E Connection Diagram

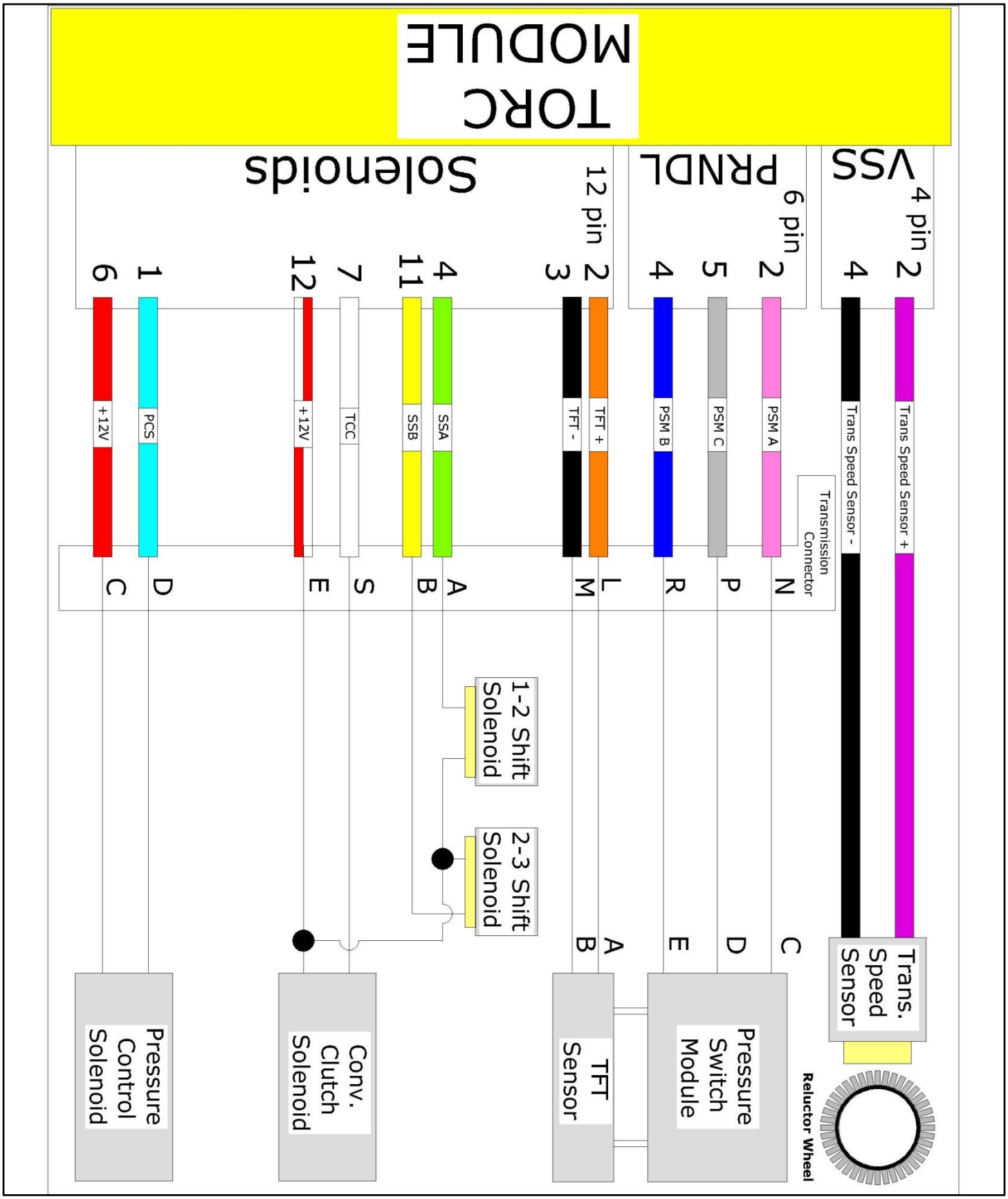


Diagram 2 – 4L80E/85E Connection Diagram

Installation Steps: Vehicle Harness

1. The Vehicle Harness has a 16 pin connector that plugs into the left side of the TORC Module. See Figure 2 on page 8 for the connection. See Diagram 3 on page 15 for a diagram identifying the wires in this connector.

2. See below for a detailed list of all the individual connections needed for the Vehicle Harness with this system.

A. Red Wire – "Ignition Switched Power"
B. Black Wire(s) – "System Ground One" and "System Ground Two"
C. Green Wire – "Throttle Position Sensor"
D. Orange Wire – "+5 Volt Feed" Throttle Position Sensor
E. Tan Wire – "Speedometer Signal Output"
F. Yellow Wire – "Engine RPM Input"

A. Red Wire Labeled – "Ignition Switched Power"

Connect to a 12volt power source that has power when the Ignition Switch is in the "On/Run" and "Start" position. Splices and a Posi-Tap have been provided to make this connection.

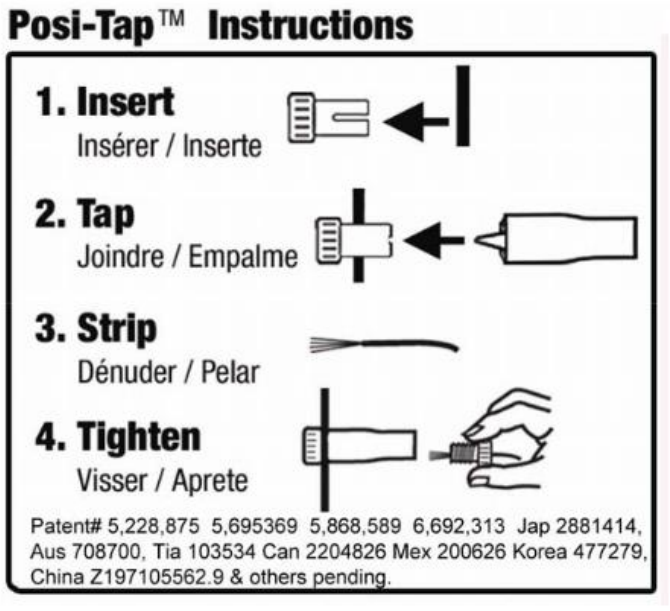
Posi-Tap Instructions

1. **Unscrew the larger cap from the end of the Posi-Tap. The slot in this cap will slide over the existing wire you are tapping into.**

2. **Screw the body of the Posi-Tap onto the cap, watching the needle of the body to insure it pierces the wire insulation.**

3. **Strip about 3/8 of an inch of insulation from the wire coming from the module.**

4. **Remove the small cap from the end of the Posi-Tap body and thread the stripped wire into the end of the cap. Push the wire into the body of the Posi-tap and tighten the cap back onto the Posi-Tap body.**

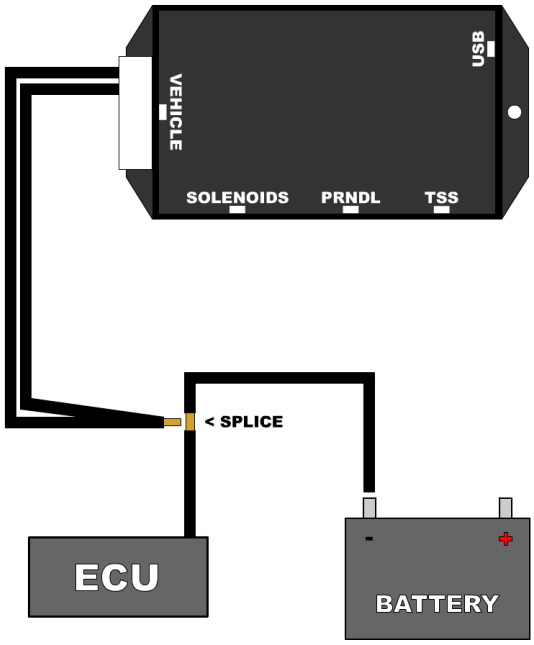


B. Black Wire(s) Labeled – “Module Ground” & “TPS Ground”

Connection of these wires will depend on what type of throttle position sensor you are using: one that is part of an EFI system or one fitted to a carburetor or mechanically injected diesel engine.

Electronic Fuel Injection Systems

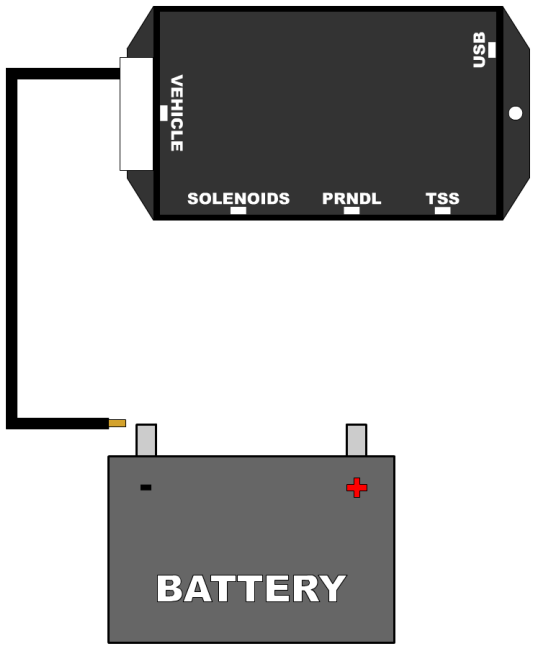
Splice both, “MODULE” and “TPS” ground wires (Pins 15 & 16 Black) into the main ECU ground wire. **Do NOT connect the ground wires to sheet metal or other ground sources**. The TORC Module MUST be connected to the Main ECU ground, as close to the ECU as possible. The reason for this connection method is because the TPS is shared between the two systems and improper grounding will corrupt the TPS signal. Splices and a Posi-Tap have been provided to allow this connection.



If this step is overlooked there is a good possibility the Throttle Position Sensor (TPS) will not read correctly.

Carbureted / Mech. Injected Diesel

Connect the “MODULE GROUND” wire (Pin 15 Black) directly to the battery ground post or negative battery cable. Do NOT connect the ground wire to sheet metal or other ground sources. The TORC Module must be connected directly to the battery ground post or negative battery cable for the cleanest (less noise) ground possible.



Pin 16, “TPS GROUND” will be connected on the following page.

C. Green Wire Labeled – “Throttle Position Sensor Signal”

Connection of this wire will depend on what type of throttle position sensor you are using: one that is part of an EFI system or one fitted to a carburetor

Electronic Fuel Injection Systems

Connect this wire to the Throttle Position Sensor signal on a “Throttle-By-Cable” engine or an Accelerator Pedal Position Sensor signal on a “Throttle-By-Wire” engine.

On most GM “Throttle-By-Cable” applications this is the Dark Blue wire at the Throttle Position Sensor connector.

Splices and a Posi-tap have been provided to make this connection.

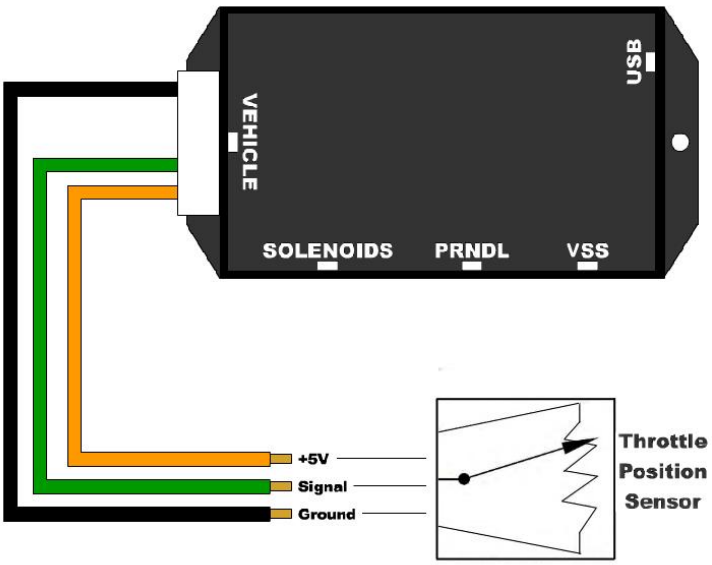
Carbureted / Mech. Injected Diesel

See below for connection of the TPS signal wire

D. Orange Wire printed – “+5 Volt TPS Feed”

This is the +5 volt power source for carbureted and mechanical injected diesel applications where an external Throttle Position Sensor must be installed. This orange wire will not be needed on vehicles with an EFI system installed.

Connect the Orange “+5 VOLT…”, Green “…SIGNAL”, and Black “TPS GROUND” wires to your throttle position sensor.



Identifying the Terminals of an Unknown Throttle Position Sensor

This is a procedure for identifying the correct terminal connections of any potentiometer-style throttle position sensor (almost all three-terminal TP sensors). A DVOM or analog Ohmmeter is required.

1. Set the meter to resistance mode and set it to a scale that can read up to 10K or 20K Ohms (if it is not auto-ranging). Please keep in mind when setting up and reading the meter that "K" means thousands of Ohms. In other words, 15K Ohms is the same as 15,000 Ohms.

2. Connect the meter to two pins at a time while operating the lever or cam of the TPS. Watch the meter while rotating the sensor. Check all three pairs of pins until you find a pair that does not change resistance when you rotate the sensor. The two pins that do not change resistance are the fixed ends of the resistance element (+5V and ground). The remaining pin that did change is known as the "wiper". It is the moving contact that slides along the resistance element to give the varying voltage. This is the output or signal terminal of the sensor and should be connected to the green wire (Vehicle pin 3).

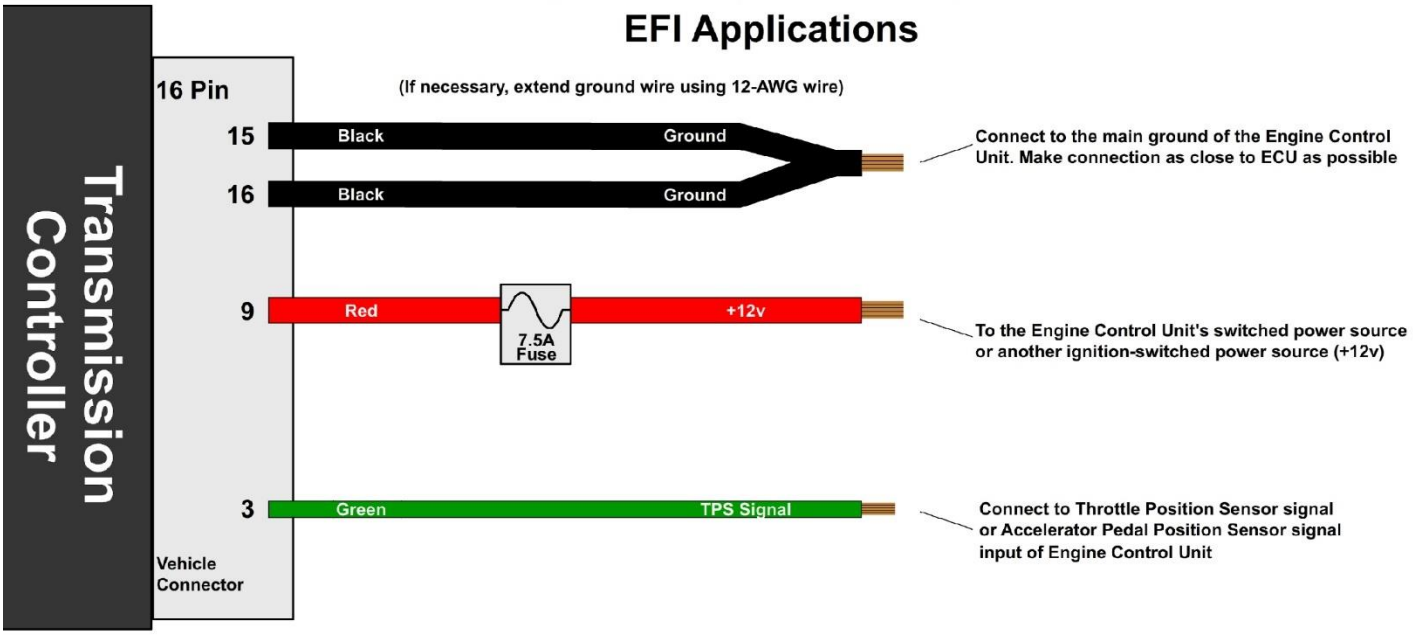
3. Next, with the sensor at the idle or closed throttle position, measure the resistance between the wiper (output) and each of the end terminals (the two whose resistance did not change in step 2) of the sensor. The end terminal with the lowest resistance to the wiper (at idle) is the ground terminal, and should connect to the black, “TPS GROUND” wire of the controller (Vehicle pin 16). The terminal with the higher resistance to the wiper is the 5 volt reference input to the sensor and should connect to the orange wire (Vehicle pin 11) in the harness.

General Guidelines for setting up Throttle Position Sensors

The linkage to a throttle position sensor should use most of the rotating range of the throttle position sensor. This can be adjusted by changing the ratio of the linkage. Also, please make sure that a small amount of the sensor's travel is being used at idle. You will want a TPS voltage of at least 0.35 volts at idle, never zero. This is done to allow the controller to detect problems with the TP sensor. For instance, if the sensor becomes disconnected or the linkage falls off, the TPS voltage will fall below the set idle threshold. If the TPS voltage goes below the idle threshold, the controller assumes that the TPS is bad and will switch to failsafe line pressure and default shift points. This is done to prevent damage to the transmission from low line pressure and will provide a safe "limp home" mode.

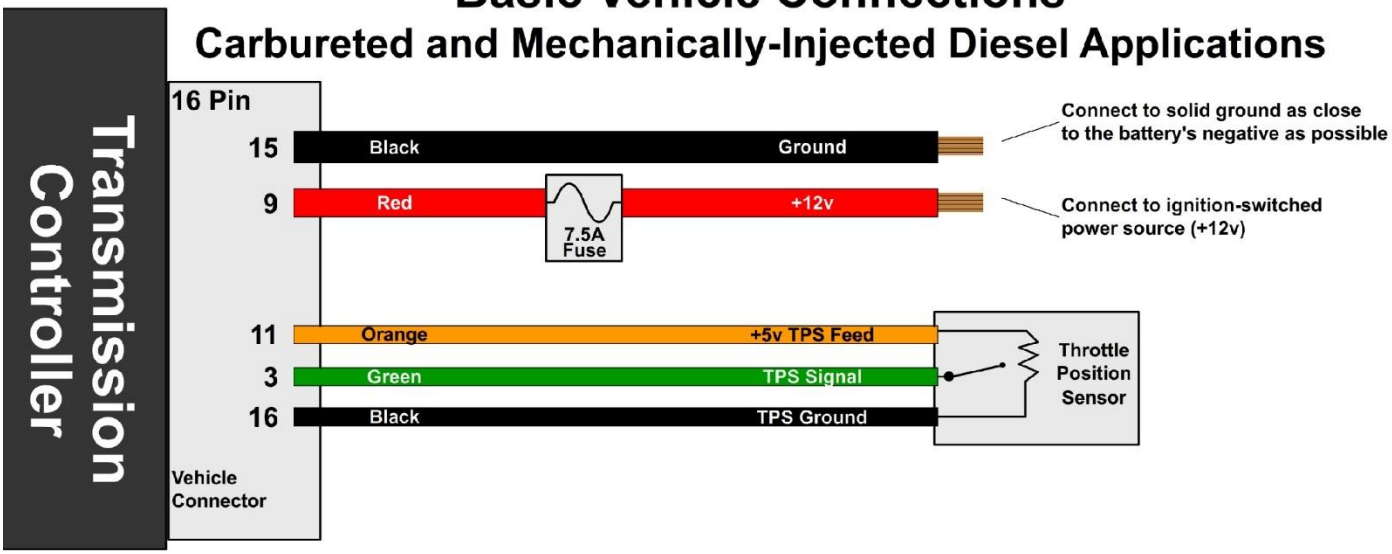
Basic Vehicle Connections

EFI Applications



Basic Vehicle Connections

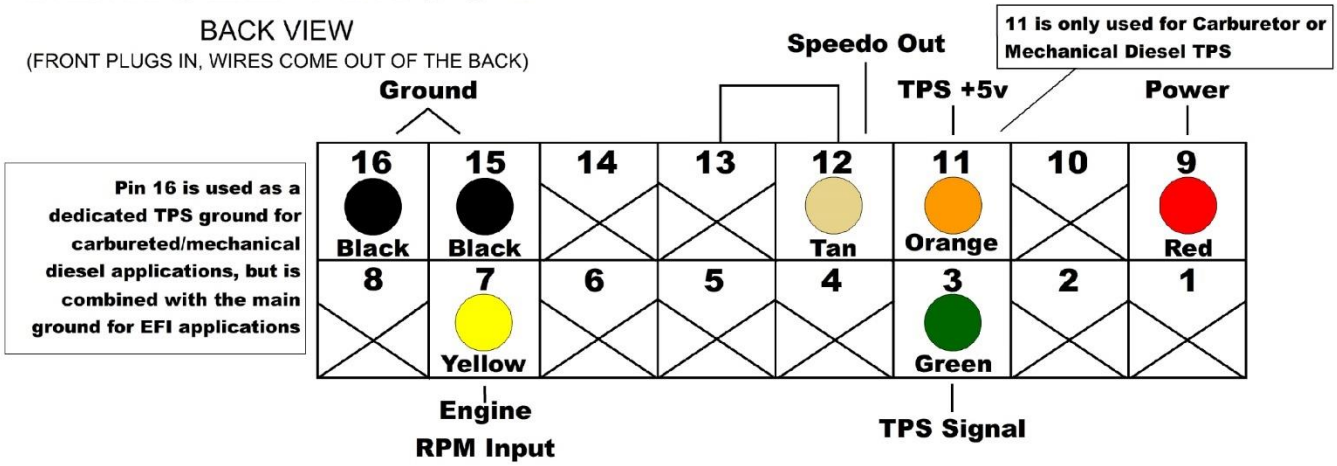
Carbureted and Mechanically-Injected Diesel Applications



VEHICLE PINOUT

BACK VIEW

(FRONT PLUGS IN, WIRES COME OUT OF THE BACK)



Optional Accessories within the TORC Module

E. Tan Wire printed – "Speedometer Signal Output"

We have provided an adjustable speed signal output on the tan wire on pin 12 of the vehicle connector that can be used to drive an electronic speedometer. Use of this output signal is not necessary, but it can be helpful if your speedometer can not be driven correctly from another source. This signal can also be corrected for different gear ratios and tire heights, so it can be very useful in some applications. The speedometer output signal is provided as a 12 Volt square wave or 5 Volt AC signal.

The speedometer output modes can be selected via the built-in tuning interface in Setup Menu>Speedo Out or in the tuning software. After entering the Speedo Out menu, the current mode and ratio will be displayed. Push the knob to configure speedo out options. You can choose between 5V AC, 12V Pulse, Disable, Replicated, Adjustable, and Reset SPO. After making your choice, you can then fine tune the speedometer ratio using the knob. Choosing replicated will provide an amplified and squared replica of the speed sensor signal on the speedometer output. Reset SPO will clear all saved data for the speedometer output and revert to using values from the tune. The speedometer output is adjustable and is essentially the electronic equivalent of a ratio corrector gear box for a mechanical speedometer. When adjusting the speedometer output, the correction factor is entered as a decimal number. The correction factor is the frequency ratio of the speedometer output frequency to the speed sensor frequency. This number can be easily adjusted to synchronize the vehicle speedometer to a GPS or other instrument.

If you have a 4WD transfer case with low range capability and want the speedometer to be accurate while in low range, you will need to adjust the speedometer ratio in both high and low range. Reset SPO will allow you to use the tune values. In some cases, such as driving the input of an engine control ECU, the 0-12 Volt square wave signal will not be able to properly drive the device that it is connected to. This is because some devices are only designed to accept an input signal from a variable reluctance (magnetic coil) sensor. Because of this, they may expect the input signal to swing below ground (0 Volts). To drive this type of input, use the 5 Volt AC signal mode. In this mode, the driven device will see a -2.5V to +2.5V signal.

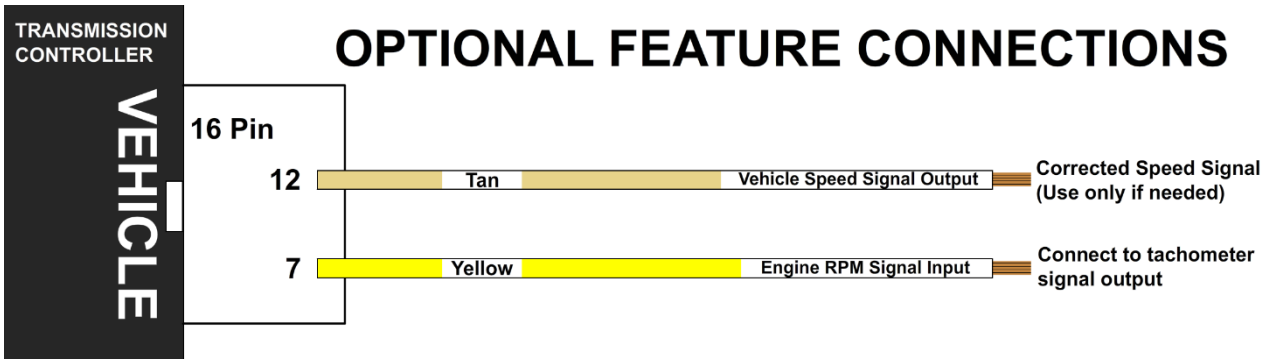
F. Yellow Wire printed – “Engine RPM Input”

This is not a signal to operate a tachometer, but the same signal from your ignition system that operates a tachometer.

The engine RPM signal input on the yellow lead (pin 7) can be connected to a digital tachometer output from an engine computer or the tachometer output from an MSD ignition or similar CDI (Capacitive Discharge Ignition) system, but NEVER to the coil outputs (coil negative stud) of a CDI system like MSD.

For breaker points (or conventional electronic ignition systems such as GM HEI, Ford Duraspark or TFI), it can be connected to the coil negative terminal. For this configuration, add the supplied 47K Ohm resistor (yellow, violet, orange, and gold bands) to the yellow lead (pin 7) in-line with the tachometer signal. The correct setting will need to be set in the tuning software under Settings>Speed Sensor & Gearing.

For COP (Coil on Plug) ignition systems that do not have a conventional tachometer output (such as later Mustang engines or 2007+ GM ECMs), one of the coil trigger wires can be used, but the update rate will be slow. A better approach for such applications would be to use a tachometer adapter such as the AutoMeter 9117. Painless offers a tach driver for 2007-2014 GM ECMs, part # 60150. DO NOT run the engine RPM signal wire in the same wiring harness as the speed sensor as this can cause interference.



SETTING UP THE TORC MODULE

Software

Due to the growing number of PCs lacking a CD drive, the software is not included with this kit, but rather downloadable to a Windows PC from the 66501 product page on the Painless website. You will need the "Second Generation Software" with this module. If a CD is preferred, contact Painless at 800-423-9696 and we will gladly mail you a copy.
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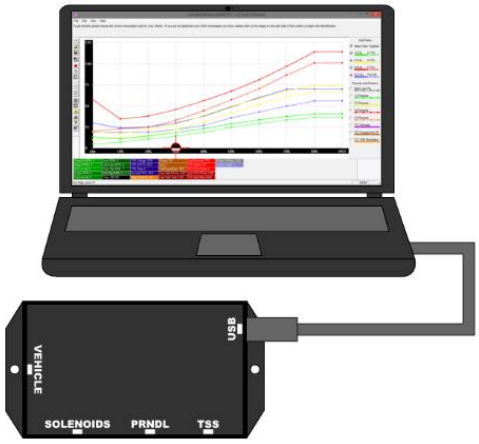
Calibration



Verify that the correct calibration is loaded on the TORC MODULE. A basic calibration for a 4L60e is loaded into the module before shipment. However, if a 4L80/85e is being used, you'll need to connect the module to a Windows PC and load the calibration that matches your transmission's configuration.

Throttle Position Sensor Calibration

Whether you have electronic fuel injection or a carburetor, you will need to set the throttle position. To do this, use the throttle position calibration option on the built-in tuning interface. Turn the knob until "Setup Menu" is highlighted. Click the knob to enter the menu. The first item that will be highlighted is "TPS Setup". Click the knob to enter the TPS screen. It will show the current idle and WOT voltage values as well as the current throttle position sensor voltage. Press the knob again to enter the TPS setup menu.

To calibrate throttle position, the ignition should be in the ON position but the engine not running. For carbureted engines, make sure the choke is fully open and off the fast idle cam before beginning. In the TPS setup menu, highlight "AutoSet TPS" and click the knob. It will begin detecting the idle throttle position right away, so leave the pedal untouched.

Next, the display will show "Press Accel Pedal". Push the accelerator pedal all the way to the floor and hold it. After a few seconds, "Release Accl Pedal" will be displayed and you can release the pedal. If no errors occur, "AutoSet Success!" will display and the values will be shown to the left. If an error occurs during calibration, the display will show the error and abort calibration. If this happens, you can try running the calibration again. If errors continue, you may need to check your wiring for problems.

If needed, you can manually adjust TPS values by choosing “Adjust Idle” or “Adjust WOT” in the TPS setup menu. Once the TPS calibration procedure is completed, the values are permanently stored in the controller and will be active for every tune written. TPS values displayed within individual tunes are then irrelevant. If you require TPS customization for individual tunes or are using a negative slope TPS, then the TPS values stored in the controller can be reset by choosing “Reset TPS” from the TPS setup menu. Our provided tuning software, Shiftware, can then be used to calibrate TPS values for specific tunes.

Possible TPS Calibration Errors:

Pedal Not Pressed / Acc Pedal Not Held

The throttle wasn’t pushed or held at maximum long enough for the test to complete. Accelerator pedal must be held for 3 seconds and voltage must not drop more than 0.168V below the maximum recorded value.

Pedal Not Released

The throttle wasn’t released within 5 seconds. The voltage must drop at least 0.96V below the maximum measured WOT value.

TPS V. Not Stable

The idle throttle position has changed values too drastically over the course of the calibration. The idle voltage is more than 0.6V greater than the lowest recorded value.

Error: TPS V. Low

The voltage is below the minimum allowed 0.2V during any of the tests.

M. Busy, Try Again

EEPROM is busy, so the TPS settings couldn’t be written to it.

BUILT-IN DISPLAY

The second generation built-in display of the Torc is easier to use and more intuitive than our previous module. It provides useful information, such as current speed, gear, transmission temperature, and TCC lock status, along with any fault messages. Using the menus, you'll be able to access many of the same options found in Shiftware.

BASIC OPERATION

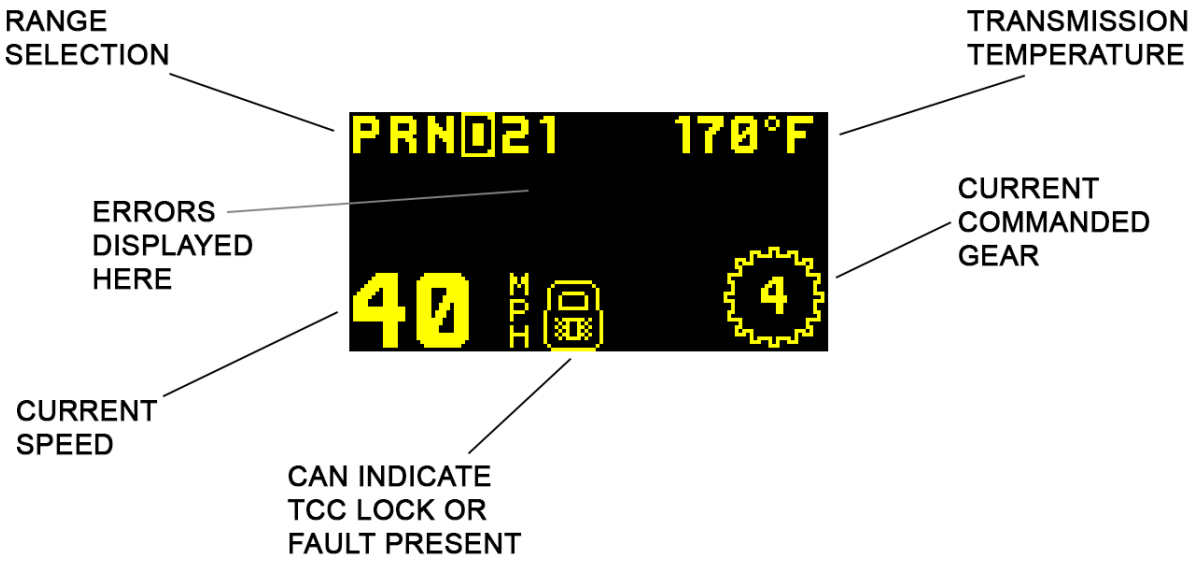
While the home screen is shown, you can turn the function knob in either direction to bring up the main menu. The highlighted phrase in the center of the screen is your selection. When you've found the menu item you wish to access, push the knob down to click it. Sub-menus work the same as the main menu. Each sub-menu has an EXIT option which will return you to the previous menu or the home screen.

HOME SCREEN

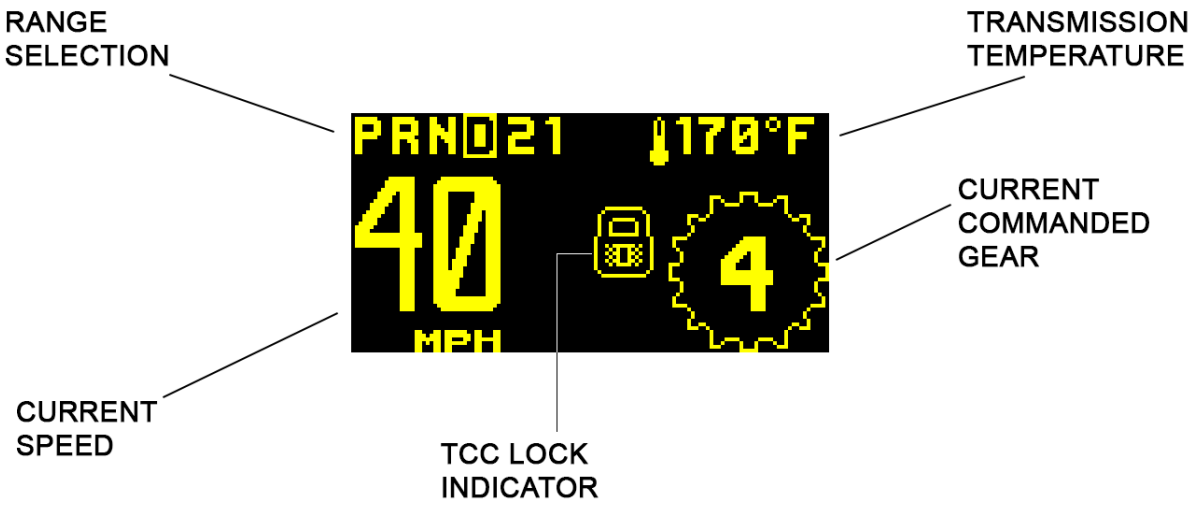
Shows real-time transmission information such as speed, current commanded gear, transmission temperature, TCC lock, PRNDL position, and any active faults. When low range is engaged, "LO" will be shown beside speed. "KEY OFF" will show in the PRNDL location if ignition is off and the controller is being powered by USB. "Error" will show in the PRNDL location if there is a PRNDL sensor error. When in park or neutral, P/N will be displayed because 4L60E/4L80E transmissions don't provide a way for the controller to see which is engaged. Fault messages will be shown in the center of the display and will cycle through them if there are multiple errors. While no errors are present, the home screen will automatically switch to enlarged mode for easier visibility.

Because the Pressure Switch Manifold (PSM) that is used for range indication in 4L60E/4L80E transmissions does not distinguish between park and neutral, the PRNDL display will normally show the position strip as "RNOD21" with the current range highlighted. When in park or neutral, "Neu/Pk" will be displayed instead. Since the PSM requires hydraulic pressure to function, the PRNDL display will not be valid while the engine isn't running. Due to this constraint, a "2" will be displayed instead of "Neu/Pk" on 4L80E transmissions.

Home Screen Normal Mode



Home Screen Enlarged Mode



MAIN MENU

Home Screen = Chooses the home screen as your default view.

Info Screen = Shows current sensor values, replacing the home screen as default view. Info includes TPS voltage and percentage, battery voltage, commanded pressure in PSI, and engine RPM.

Setup Menu = Use this menu to choose preliminary settings essential for operating the vehicle.

Tune Menu = The tune menu can be used to make adjustments to shift timing, shift feel, and torque converter clutch settings.

Diagnostics = The diagnostics menu provides access to advanced troubleshooting data and procedures.

Tutorial = Plays a demo on the display with instructions on how to use the interface. It can be interrupted by turning the knob, which will show the main menu. The tutorial will continue to play until you select home screen, info screen, or turn off the vehicle.

Display Off = Keeps the screen off until you turn the knob. The display will continue to switch off until you select home screen, info screen, or turn off the vehicle.

SETUP MENU

TPS Setup = Clicking this will take you to the TPS Setup menu, which shows the idle and WOT settings as well as the current voltage of the TPS. Clicking once will open the menu. Clicking AutoSet TPS will take you through the steps to calibrate your throttle position sensor settings. You can also manually adjust these settings by clicking Adjust Idle or Adjust WOT. Reset TPS will erase the saved TPS data from the controller, reverting back to the TPS voltages saved in the loaded tune file. See page 18 for more details.

Speedo Out = Provides configuration options for the speedometer output. See page 16 for more details.

Speed Sensor = This menu allows you to choose your speed sensor type and configure its details such as speedometer drive gear teeth, driven gear teeth, and pulses per revolution. Rotating the knob in this screen changes the speed sensor type. Available speed sensor types will vary depending on the current transmission type. If other options, such as speedometer gear teeth, pulses per revolution etc. are available for a specific sensor type, pushing the knob will bring up a menu that allows you to change the adjustment mode or to exit. If no options are available for the selected sensor type, pressing the knob will exit this screen and save the settings. After scrolling through all the speed sensor types, the last option is to reset the speed sensor settings. This will revert all of the settings for the speed sensor, axle ratio, and tire diameter back to the defaults from the currently loaded tune.

Axle Ratio = Allows you to input your axle ratio, which improves speed display accuracy in the home screen and will also will affect speed sensor calibration for certain types of speed sensors.

Tire Diam = Allows you to input your tire diameter, which improves speed display accuracy in the home screen and will also will affect speed sensor calibration for certain types of speed sensors.

Engine RPM In = Allows the adjustment of the engine RPM input configuration. This includes pulses per revolution and type of RPM sensor or signal. Turning the knob allows adjustment of pulse rate, while pressing the knob will bring up a menu of options including preset pulse rates, signal types, and the exit option (which also saves these settings).

TUNE MENU

Shift Points = Sets the RPM at which shifts occur for all shifts. You will be presented with a menu showing 10% throttle, 40% throttle, and Wide Open Throttle. Under each is shown shift point RPM. You can adjust each throttle percentage individually. Changes won't be saved to the tune until you click "Save & Exit".

Firmness = Set shift firmness for all shifts or each individual shift. Once you've chosen a shift to adjust, you will be presented with a menu showing 10% throttle, 40% throttle, and Wide Open Throttle. Under each is shown a number representing firmness. You can adjust each throttle percentage individually. Changes won't be saved to the tune until you click "Save & Exit".

Tq Conv Cl = This allows you to adjust the minimum RPM for TCC engagement. Changes won't be saved to the tune until you click "Save & Exit".

DIAGNOSTICS

Dyno Mode = Enable this mode if you are doing a dyno test. While enabled, you can use the knob to shift gears. Push the knob to access options, such as enabling torque converter clutch (TCC) activation above 1800 RPM, disabling the TCC, and exiting dyno mode.
***Please note that it is not safe to use this mode while driving.

Data Display = Allows you to see readings on the inputs and outputs, such as Solenoid Ohms and current, PRNDL values, and the voltage or status of various inputs, such as table select and manutronic. Manutronic, push button shifting, is not supported with this module. These screens will be helpful when using the troubleshooting guide or working with our tech support department. Please note that the solenoid current screen uses the knob to manually select the current gear, similar to dyno mode. This allows you to easily verify proper solenoid function in each gear.

Clear Learn = Clicking on this item will allow you to chose which learned data to clear. You might want to use this if something has changed with the vehicle or transmission to allow the controller to re-learn the data. The options are "TCC Learn", "Shift Timing", "All Learning", and "Exit".

Sys Info = Displays firmware and hardware version information as well as serial number (ID), copyright, and patent information.

Override = There are several options in this menu which are useful when troubleshooting.

“Line Prs” can be used to override line pressure manually. Use this only if you were instructed to do so by a Painless technician.

“TCC Sol” can be used to manually lock the TCC by holding the knob down. When released, the TCC will unlock. Doing this while idling in gear will usually cause the engine to stall if your transmission allows TCC engagement in first gear.

“Mode Lamp” -not used on this module

SHIFTWARE SOFTWARE

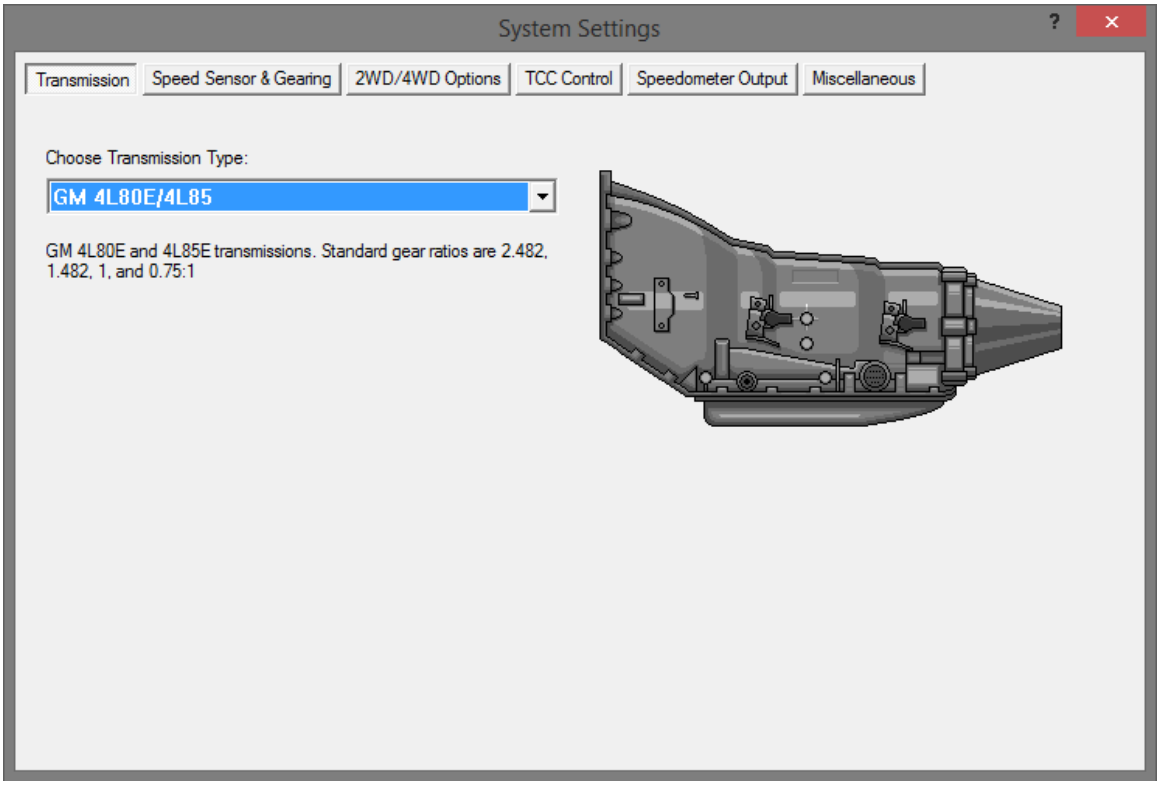
Introduction

Using the Shiftware software allows you to modify the way your Torc Transmission Control System behaves. You can customize shift-points as well as monitor and diagnose the Torc unit in real-time.

Setup

To create a calibration for the Torc module, it is best to start with one of the standard calibrations which are included with the software. To load a standard configuration for your transmission, click the **Open** button on the toolbar, left hand side of the screen, then browse to the folder where the transmission calibration files are located. (Default location is C:\Shiftware\) The files are named according to the transmission and RPM range and have the .btc file extension. Choose the calibration file and click **Open**.

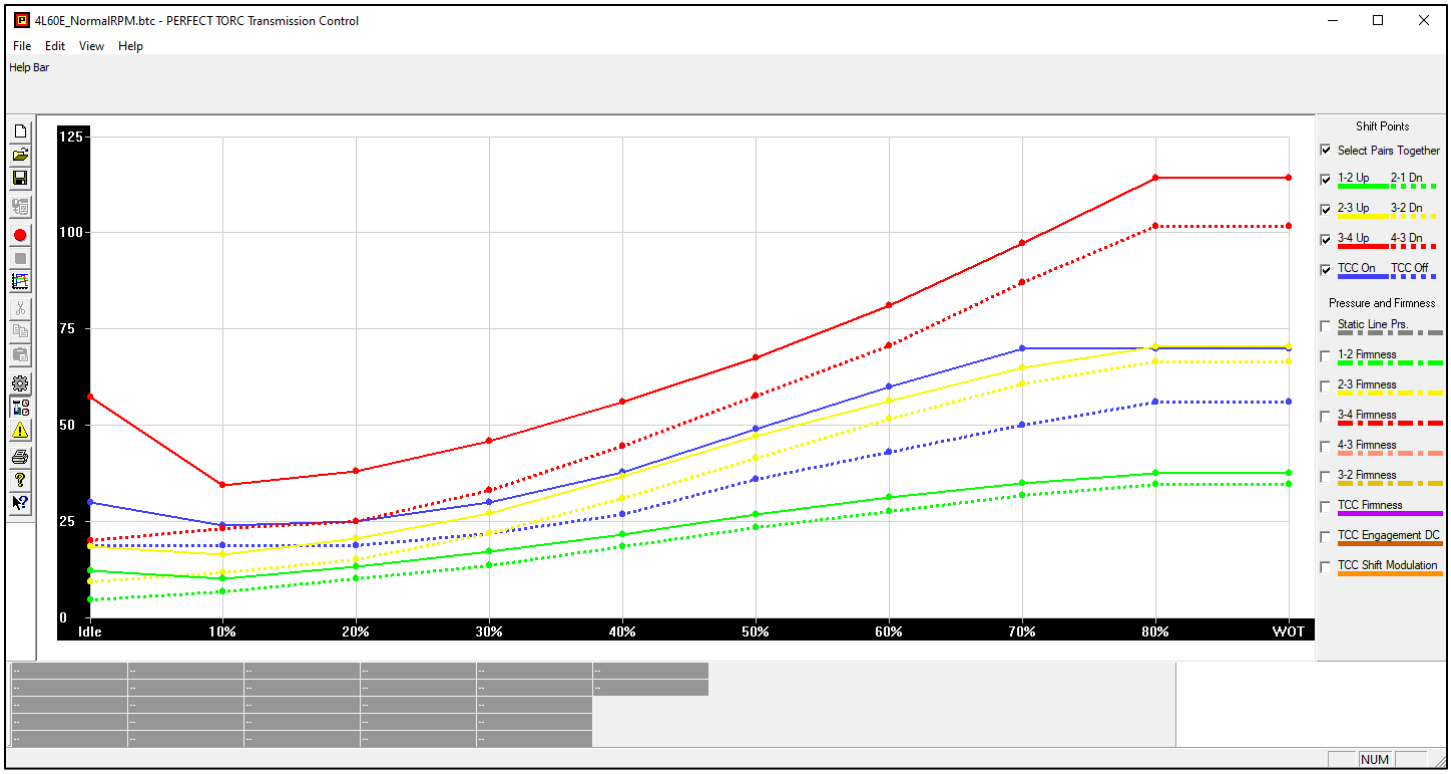
Once the calibration file is loaded, click the **System Settings** button on the toolbar to check the settings and make sure that they are correct for your transmission. The System Settings window has several tabs within it. Click each one to see each section of settings specific for your transmission.



The System Settings Window

Customize

The main window is where all of the shift points and line pressure editing is done. The graph displays the up-shift and down-shift speeds in relation to throttle position for each shift. It also displays the line pressure & firmness curve in relation to throttle position. The line pressure curve is displayed in PSI, so the higher the curve, the more firm shifts will be. You can use the checkboxes on the right to turn on the curves for individual shift firmness and adjust them independently.



The Main Window

You can get help on anything by clicking the **Question** button and then clicking on an item. This can be used in any area of the software. Pressing F1 will show help on whatever item is currently active. The help messages in the settings pages are transmission-specific and are more like getting professional advice than normal help tips.

The graph has ten points from left to right, 0 being idle and 9 being Wide-Open-Throttle (WOT). On the left side of the graph is the vehicle speed at which the shift will take place, line pressure when looking at firmness data, and duty cycle when looking at TCC Engagement or Shift Modulation. When you hover over a graph point, you can also see the corresponding shift speed in RPM or the applicable unit values for items other than shift points. Click on a point in the graph to select it.

If **Select Pairs Together** is enabled, then the corresponding down-shift point will be automatically selected along with the up-shift point. This can be turned off by clicking the Select Pairs Together checkbox on the right. You can select multiple points by holding CTRL while clicking the points or a range of points by holding SHIFT and clicking the two points on each end. You can move between adjacent points using the LEFT and RIGHT arrow keys.
Once a point (or points) is selected, you can drag it with the mouse to raise and lower its value. A yellow box will appear in the graph telling you what the value of the point is.

Shift Timing Learning

By default, the Torc Module will learn the shift and TCC timing characteristics of your transmission. It will complete a learning cycle over the first few hard-throttle passes and will use the learned data to optimize shifts. For learning to occur, the engine RPM input signal must be connected and functioning properly. During the learning cycle, you may notice unusual TCC operation. This is normal and will end once learning is complete. Once learned, the data will not change unless it is erased using the clear command on the controller's user interface, found in Diagnostics > Clear > Shift Timing. Clearing the data will cause another learning cycle to begin. This could be useful if the transmission is altered or upgraded in some way.

For optimum accuracy, learning should be done at the same transmission fluid temperature that it will be run at during normal operation. Once learned, shift point accuracy will only be limited by the consistency of your transmission's valve body.

To view a report on the learned data, connect the controller to a PC with Shiftware installed. Click File, then Generate Diagnostic Report. This will read the data from the controller and open the report in a browser window.

If you wish to disable learning, enter Settings in the tuning software and switch to the Miscellaneous tab. Uncheck the checkbox. This will stop the controller from using learned data, but will not erase the learned data. This would be useful if you plan to make changes to the transmission or are unable to complete a proper learning cycle.

Save & Load

Once you have created your calibration, you can save the file to your hard drive or an external storage device. To save, click the **Save**  button on the toolbar. Then, browse to the location where you want it saved and click **Save**. Use "Save As" under the FILE menu to leave the original file unchanged and create a new version. Type the desired filename and click **Save**. Files are saved with a .btc extension.

To load a calibration file, click the **Open**  button on the toolbar. Then, browse to the file and click **Open**.

Writing a Calibration to the Torc Module

For the changes you've made to take effect on the Torc Module, you first must write the calibration to the unit. Connect the module to your computer using a standard USB cord (Type A to Type B). Click the **Write Calibration**  button on the toolbar to write the calibration to the controller. The Torc Module can now be disconnected from the computer. When the Torc Module unit is disconnected from the computer, the **Write Calibration**  button will be grayed out.

IMPORTANT INFORMATION

How to Avoid Errors

The Shiftware software gives you complete freedom and flexibility to customize your shifting calibration however you want. This freedom requires diligence to avoid errors.

It is *very* important that the up-shift and down-shift curves for a given gear do not cross. The up-shift point at any throttle position should usually be at least 15% greater than the down-shift point. For instance, if the 2-3 up-shift point at ½-throttle is 45MPH, then the 3-2 down-shift point should usually be less than 40MPH.

The "On-Off" differential between up-shift and down-shift points is called Deadband (also known as Hysteresis). The more deadband you use for your shift points, the more stable the system will be. Not using enough deadband can result in erratic shift behavior. Too much deadband will result in sluggish behavior due to a reluctance to down-shift.

Pay close attention to the interaction between different shifts. Overlapping the 1-2 and 2-3 shifts can cause skipped gears and other drivability problems.

Also note that torque converter slip at low speeds renders engine RPM values meaningless. It is usually desirable to have light-throttle shift points within a low RPM range. In this case, it is best to base light-throttle shift points on vehicle speed rather than engine RPM (as most auto manufacturers do).

TROUBLESHOOTING ERROR MESSAGES

WARNING! If the transmission does not begin to operate correctly within the first few feet of the road test, STOP immediately, check the for error messages, and troubleshoot. In some cases, just a few blocks of operation with low fluid pressure can destroy a transmission.

Error Messages

When the Torc Module detects an error, it will show one of the following error messages on the home screen. If there are multiple errors, it will cycle through them on the home screen. Error messages can also be viewed in **Controller Fault Display** in the tuning software. History is cleared when the controller powers down completely (ignition turned off and USB cable removed from computer.) It is a good idea to periodically check the display for errors as you drive, so it is wise to consider an accessible mounting location.

Battery voltage is too low

The voltage to the controller has dropped below 8 volts.

Battery voltage is too high

The voltage to the controller is above 17.2 volts.

Shift Solenoid A (SSA) overcurrent error

An over-current condition was detected on the indicated shift solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable the solenoid with the over-current condition until the ignition is turned off.

Shift Solenoid B (SSB) overcurrent error

An over-current condition was detected on the indicated shift solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable the solenoid with the over-current condition until the ignition is turned off.

3-2 D/S Solenoid overcurrent error

An over-current condition was detected on the 3-2 downshift solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable the solenoid with the over-current condition until the ignition is turned off.

TCC Solenoid overcurrent error

An over-current condition was detected on the torque converter clutch pressure solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable the TCC solenoid until the ignition is turned off.

TCC On/Off Solenoid overcurrent error

An over-current condition was detected on the torque converter clutch solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable both TCC solenoids until the ignition is turned off.

TCC PWM Solenoid overcurrent error

An over-current condition was detected on the torque converter clutch pressure solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable both TCC solenoids until the ignition is turned off.

EPC (PCS) Solenoid overcurrent error

An over-current condition was detected on the line pressure control solenoid. A short circuit may be present in the solenoid circuit. The controller will attempt to disable the solenoid with the over-current condition until the ignition is turned off.

Shift Solenoid A (SSA) undercurrent error

Current measured on the indicated shift solenoid was too low, indicating that the solenoid circuit may be open.

Shift Solenoid B (SSB) undercurrent error

Current measured on the indicated shift solenoid was too low, indicating that the solenoid circuit may be open.

3-2 D/S Solenoid undercurrent error

Current measured on the 3-2 downshift solenoid was too low, indicating that the solenoid circuit may be open.

TCC On/Off Solenoid undercurrent error

Current measured on the torque converter clutch solenoid was too low, indicating that the solenoid circuit may be open. The controller will attempt to disable both TCC solenoids until the ignition is turned off.

TCC PWM Solenoid undercurrent error

Current measured on the torque converter clutch pressure solenoid was too low, indicating that the solenoid circuit may be open. The controller will attempt to disable both TCC solenoids until the ignition is turned off.

TCC Solenoid undercurrent error

Current measured on the torque converter clutch pressure solenoid was too low, indicating that the solenoid circuit may be open. The controller will attempt to disable the TCC solenoid until the ignition is turned off.

EPC (PCS) Solenoid undercurrent error

Current measured on the line pressure control solenoid was too low, indicating that the solenoid circuit may be open.

Shift Solenoid A (SSA) circuit shorted

The indicated Shift Solenoid's resistance measured too low during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

Shift Solenoid B (SSB) circuit shorted

The indicated Shift Solenoid's resistance measured too low during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

3-2 D/S Solenoid circuit shorted

3-2 downshift solenoid resistance measured too low during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TCC On/Off Solenoid circuit shorted

TCC on/off solenoid resistance measured too low during the power-on solenoid check. The controller will attempt to disable both TCC solenoids until the ignition is turned off. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TCC PWM Solenoid circuit shorted

TCC pressure solenoid resistance measured too low during the power-on solenoid check. The controller will attempt to disable both TCC solenoids until the ignition is turned off. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TCC Solenoid circuit shorted

TCC pressure solenoid resistance measured too low during the power-on solenoid check. The controller will attempt to disable the TCC solenoid until the ignition is turned off. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

EPC (PCS) Solenoid circuit shorted

Line Pressure Control Solenoid resistance measured too low during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

Shift Solenoid A (SSA) circuit open

The indicated Shift Solenoid's resistance measured too high during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

Shift Solenoid B (SSB) circuit open

The indicated Shift Solenoid's resistance measured too high during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

3-2 D/S Solenoid circuit open

3-2 downshift solenoid resistance measured too high during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TCC On/Off Solenoid circuit open

TCC on/off solenoid resistance measured too high during the power-on solenoid check. The controller will attempt to disable both TCC solenoids until the ignition is turned off. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TCC PWM Solenoid circuit open

TCC pressure solenoid resistance measured too high during the power-on solenoid check. The controller will attempt to disable both TCC solenoids until the ignition is turned off. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TCC Solenoid circuit open
TCC pressure solenoid resistance measured too high during the power-on solenoid check. The controller will attempt to disable the TCC solenoid until the ignition is turned off. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

EPC (PCS) Solenoid circuit open
Line Pressure Control Solenoid resistance measured too high during the power-on solenoid check. Refer to the data display screen in the diagnostic menu to see the measured solenoid resistance.

TPS Voltage Low; run TPS Setup
The Throttle Position Sensor is in fault mode due to the voltage being below the idle threshold value that was set. Run TPS calibration in the setup menu.

TFT Circuit Voltage Low or Shorted
The Transmission Fluid Temperature sensor voltage is too low. A possible cause of this could be that it is shorted to ground.

TFT Circuit Voltage High or Open
The Transmission Fluid Temperature sensor voltage is too high. The TFT sensor circuit could be open.

Transmission is Overheating
The temperature in the transmission is above the allowed threshold.

OSS Circuit Open or Sensor Missing
The Output Shaft Speed Sensor circuit is open or the sensor is missing.

ISS Circuit Open or Sensor Missing
The Input Shaft (Turbine) Speed Sensor circuit is open or the sensor is missing. (if equipped)

OSS Sensor Signal Plausibility Error
The controller detected an unexpected value from this sensor and marked it as faulty.

ISS Sensor Signal Plausibility Error
The controller detected an unexpected value from this sensor and marked it as faulty. (if equipped)

Checksum error in table
A Checksum error has been found in the calibration table. It will also disable saving Setup Menu changes and disable the tuning menu. Connect the controller to a PC and load a calibration using Shiftware.

Torque Converter Clutch Slip Error
Torque converter clutch slip detected when fully engaged.

Transmission Slip in Gear(s) 1, 2, 3, etc.
Transmission appears to be slipping in the indicated gear or gears.

Transmission Slip with Max Pressure
Transmission continued to slip after maximum line pressure was commanded.

Transmission Slip Repeated > 2x
Transmission slip was detected more than twice in this drive cycle (max. line pressure latched).

Ratio too High in Gear(s) 2, 3, 4, etc.
Transmission gear ratio appears to be too high in the indicated gear or gears.

Error: PRNDL Out of Range
Sensor voltage is out of tolerance limits, but within approximate range.

Error: PRNDL Signal Low
Sensor voltage is low.

Error: PRNDL Signal High
Sensor voltage is high.

Error: No PRNDL PWM Signal
Connect the controller to a PC and use Shiftware to reload the calibration using a calibration that matches your transmission.

Error: Invalid PRNDL Code=XX-XX
DTR or PSM signal combination not valid. XX-XX indicates high/low status of all 4 DTR pins (1 or 0)

Low-Side Driver Shorted
A low-side output driver appeared to be shorted on during power-on solenoid check. Contact Baumann Electronic Controls technical support for assistance.

Painless Performance Limited Warranty and Return Policy

Chassis harnesses and fuel injection harnesses are covered under a lifetime warranty. All other products manufactured and/or sold by Painless Performance are warranted to the original purchaser to be free from defects in material and workmanship under normal use. Painless Performance will repair or replace defective products without charge during the first 12 months from the purchase date. No products will be considered for warranty without a copy of the purchase receipt showing the sellers name, address and date of purchase. You must return the product to the dealer you purchased it from to initiate warranty procedures.