PCS TCM2800 QUICK START GUIDE v1.0

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Revision History

N/A

SECTION 1. INSTALLATION INSTRUCTION CONTENTS

1.1 Introduction

Please check your new transmission control system contents. These transmissions are fully electronic and will not shift automatically without a transmission control system connected to it. Powertrain Control Solution's TCM, computer software and wiring harness. The programmable TCM has many features such as; fully tunable part throttle and WOT shift points, shift firmness for various throttle/torque level, Sport/Tow Haul calibration tables. The torque converter lock-up vehicle speeds are fully adjustable as well as the lock up on rate. All of the wiring harness connectors are clearly labeled.

You should have received the following items:
• TCM-2800 Transmission Control Unit (TCM)
• Complete wiring harness with labeled connectors
• USB Drive with Software
• 5ft communications cable for TCM to laptop

1.2 Check TCM and Harness

Your TCM should come preloaded with a starting calibration file. Check the sticker on the bottom of the controller to see what calibration file has been preloaded. If the sticker has "Cal to be loaded by OEM/Dealer" contact the dealer the controller was purchased from to see if a calibration has been loaded or to acquire the initial calibration. If using the controller on an unsupported transmission, a more in depth setup is required and is beyond the scope of this document. Verify the connectors on the harness match the ones on your transmission and sensors. The Wiring harness schematics have views of all the connectors and should be matched to your applications prior to any installation.

1.3 TCM and Harness Guidelines

The TCM itself is weatherproof, but there are some basic rules to follow when you are deciding a location to mount it Mounting it in the engine compartment is acceptable or under the vehicle is acceptable. Also verify the wiring harness has ample length to reach the other connections before permanently mounting it. The TCM requires an 12v power,12V Switched, ground connection, Throttle Position input to operate correctly. The power connection to the TCM is prewired to an unterminated wire.

Function	Wire Color
12V Power	Red
12V Switched	Yellow
Ground	Black
TPS	Yellow/Black
TPS Ground	Black/White
Engine RPM	Orange/Black
Engine RPM Ground	Black/White

1.4 Connections

1.4.1 Inputs

Transmission Control Module (TCM) Connector

The main transmission connector varies depending on the transmission model you are working with. Verify the connector and wiring diagram match your transmission prior to beginning the installation. PCS harnesses connect all of the internal transmission solenoids, sensor switches that the TCM requires to control the transmission. Simply plug it into the connector of the transmission. *Reference Figure 1.4.1-1.*

Figure 1.4.1-1: TCM Connector

Laptop Calibration Connector

This connector allows the TCM to interface with your laptop. The laptop calibration connector plugs into the supplied communication cable. *Reference Figure 1.4.1-2.*

Figure 1.4.1-2: Laptop Calibration Connector

A - Red
B - White
C - Black

TCU Communication

Location: next to TCU
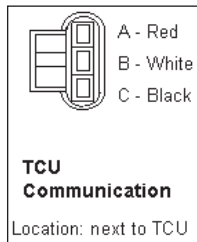
Throttle Position Sensor (TPS)

Throttle position is required for all transmissions to function properly.. There is a three wire connector used for the throttle position sensor. Typically, the mating connector has 2 wires, Yellow and Black for the TPS reference signal and black and white for the analog sensor ground. This is typically the AD1 input under the Digital Input setup. *Reference Figure 1.4.1-3.*

Figure 1.4.1-3: Throttle Position Sensor (TPS)

RPM Wires (unterminated)

There are 2 wires in the harness that are used for the RPM input. There Orange and Black for the RPM signal and the Black and White for RPM Ground. This signal will need to be configured. This wire is not required for operation of your TCM-2800 unit but it is recommended to offer comprehensive diagnostic capabilities. To utilize the full diagnostic function of your TCM-2800, connect this wire to the tachometer output wire of your ignition system. The TACHOMETER GROUND wire must also be connected in the Hardware Setup, there are 4 windows that are used to configure this input. The Speed Input Selection is preconfigured for Speed 1, since this is what the standard harness utilizes. *Reference Figure 1.4.1-4.*
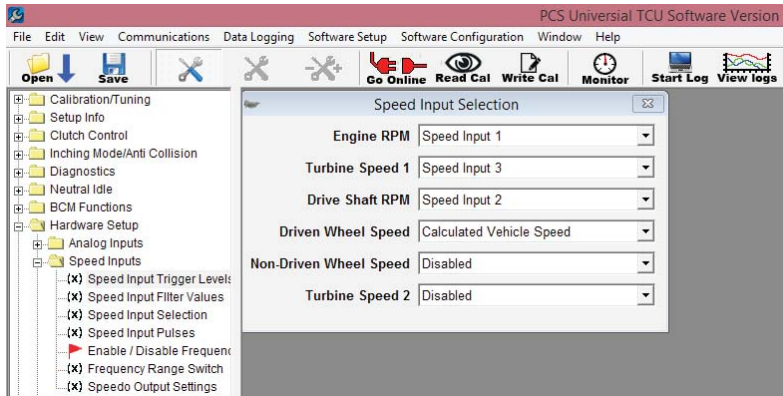
Figure 1.4.1-4: Speed Input Selection

The "Speed input Trigger Value" for speed 1, needs to be set to the signal input value from your engine management system. *Reference Figure 1.4.1-5.*
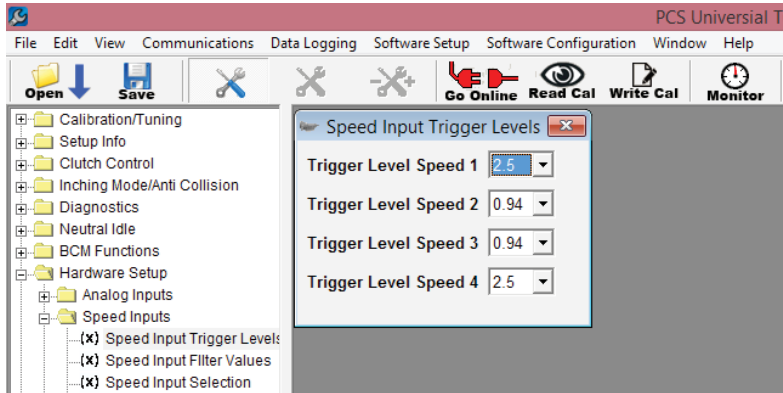
Figure 1.4.1-5: Speed Input Trigger Levels

The settings for "Speed Input 1 Pulses Per Revolution", need to be configured. The value for this will depend on what type of input you are using to monitor Engine RPM. *Reference Figure 1.4.1-6.*

Figure 1.4.1-6: Speed Input Pulses

The "Speed Input Filter Values" settings filters will assist in receiving a stable signal. Reference Figure 1.4.1-7.

Figure 1.3.1-7: Speed Input Filter Values

CAL A/B Wire

This single wire is one of the unterminated digital inputs that can be used to enable a secondary calibration, Such as Sport mode. This gives you the ability to create a completely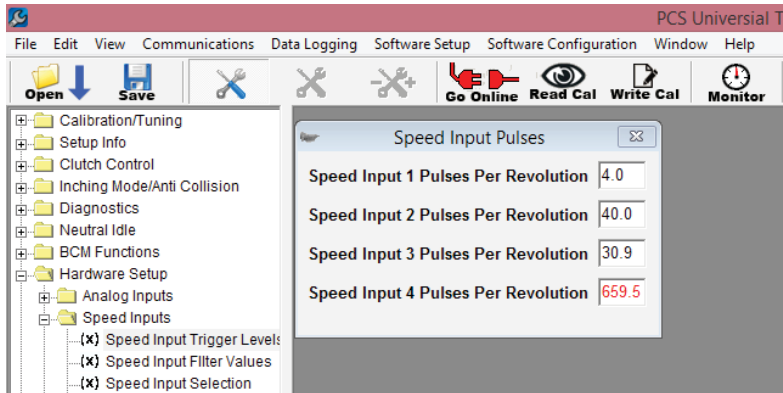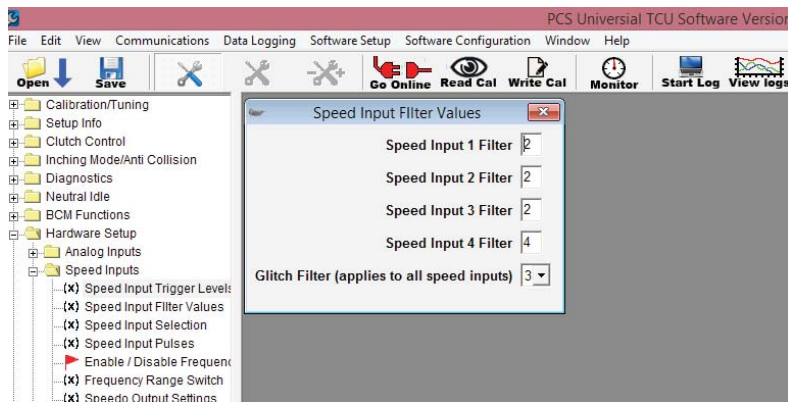 separate shift map and pressure tables for use as a sport or tow mode. This lead can be attached to a switch that will enable it when pulled low (Grounded) to change to a completely different calibration. When it is not activated the default position (off) will be the Cal A setting. When switched on (grounded), the TCM will change to operate from the Cal B calibration.

Cancel Overdrive

When enabled this cancels gear ratios over a 1:1 ratio (overdrive). In automatic transmissions this is almost always the highest gear.

4WD Low

When enabled, this acts as an output speed divisor. This is for 4WD applications where the transfer case and the speed output are connected to the output of the transmission. Without any correction, this would cause the speedometer to read abnormally high. The correction factor enabled by this digital input must be programmed in the gear ratio tables. This input should be wired to the 4WD low button or (if lever activated) to the 4WD low sensor in the transfer case or shift lever.

Dyno Mode

When enabled, this mode will allow you lockup the torque converter and choose a gear for dynamometer use. Locking up the torque converter will lower transmission loss and may increase power numbers on the dyno. Typically you will want to choose a gear that is 1:1 to use for the dyno as this gear ratio usually has the smallest amount of loss in the transmission. Both parameters are configurable. All upshifts/downshifts will occur at the value specified by 0% TPS in the upshift/downshift tables. Upshifts will occur until reaching the desired gear specified in the dyno mode form. TCC lockup will occur based on the speed set in the dyno mode form.

Manual Mode

When enabled, this setting allows the user to upshift or downshift with the press of a button. An analog multiplexed steering wheel input or two digital inputs may be used for the upshift and downshift commands.

Upshift

This digital input will issue an upshift command to the TCM. This command is only effective when in manual mode.

Downshift

This digital input will issue a downshift command to the TCM. This command is only effective when in manual mode.

Brake Light Wire
Although not necessary, the wire labeled "brake light" should be run to a factory brake pedal switch (NC) so the TCC will unlock when you apply the brakes

1.4.2 Outputs

Overdrive Cancel Indicator
This output is driven when Overdrive Cancel is selected. It can be used to activate an LED to indicate that Overdrive Cancel is in use.

Spare Output (unterminated)
This output can be configured for other indicators such as TCC Status, Dyno Mode etc…

Speedometer Drive
Some speedometers may not be driven correctly by the normal speedometer output of the TCU. In such cases, a digital output may be programmed to output the same speed signal. The default is 2000 PPM. This value can be modified in the Tuning Software if needed. Under the Hardware Setup/Speedo Output Settings Window. *Reference Figure 1.4.2-1.*
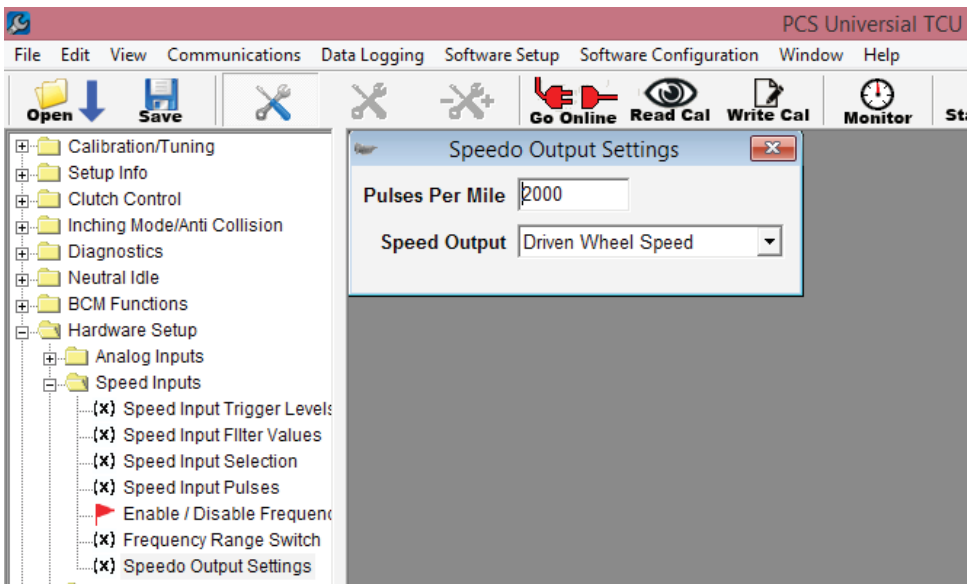

Figure 1.4.2-1: Speedo Output Settings

SECTION 2. INSTALL PC SOFTWARE

2.1 System Overview
Use the supplied USB drive or download link to install the PC tuning software. The PC software installation also includes drivers for any supplied communication cables. Leave the cable unplugged from the PC until this process has completed. Once software installation is complete, you can plug in the communication cable.

2.2 System Requirements
PC: 80386 or higher CPU
Operating System: Microsoft® Windows XP /Vista/Windows 7, Windows 8, Windows 10
Graphics: VGA
RAM: 2MB minimum
Hard Disk: 1 MB minimum
RS-232: A free COM port (#1, 2, 3 or 4 without conflicting interrupts) is required. Use of a USB to RS-232 adapter is required in the event your PC is only equipped with a USB port.

2.3 Configurable Tuning Software Installation

Option 1: Installation from Download Link
Visit the link below and download **"TCM2800_Tuning-Install.exe"** to your computer.

https://www.powertraincontrolsolutions.com/download/Released/Public/TCM2800_Tuning-Install.exe

1. Double click the downloaded file to begin the installation.
2. Follow the instructions that appear on the screen to complete the installation.

Option 2: Installation from USB Drive

1. Insert the supplied software on the USB into your computer's USB port.
2. Open the contents of your USB drive.
3. Double click **"TCM2800_Tuning-Install.exe"**
4. Follow the instructions that appear on the screen to complete the installation

2.4 Connecting the Communication Cable

Exectuing the Software
To execute the program once it's installed, click on the desktop shortcut open the software. The software is also installed in the Start Menu Programs folder.

Special Notes
If the TCM is not connected and powered (key off) when the software is executed for the first time, the software will be in an 'Offline' mode. *Reference Figure 2.4-1.* If the software is executed after the TCM is powered up (key on) and connected (by the communication cable), communication will be attempted. You can also press the CTRL G keys to cause the software to attempt communication with the TCM. Once controller installation has been completed, power on the controller from its switched 12V source. With the communication cable connected, start the PC software. If everything has been installed correctly, the software will automatically find the controller and connect. This is indicated by the software background turning blue and by a green icon on the Tool Bar. *Reference Figure 2.4-2.*
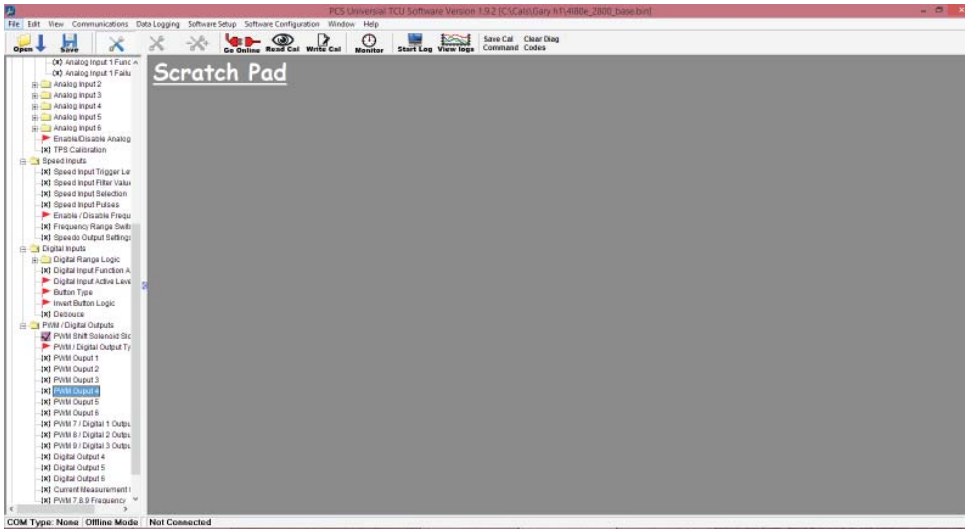
Figure 2.4-1: Software Offline
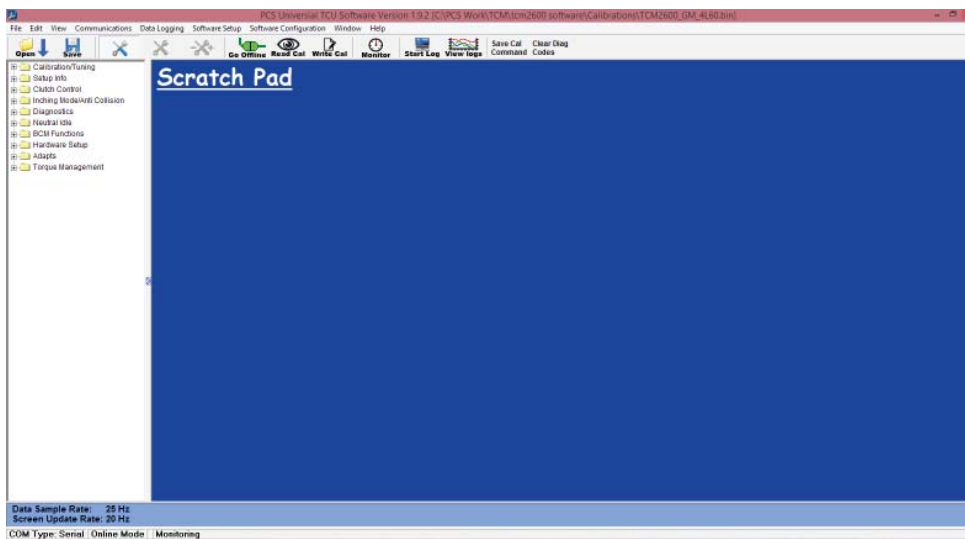
Figure 2.4-2: Software Online

SECTION 3. SAVE CALIBRATION FILE

When the software is connected with the controller, click the "Read Cal" tool bar button. *Reference Figure 3-1.* You will be prompted, with a window, to select where to save the calibration file and what to name it. It is recommended that you save a copy of the calibration file, that your controller came with, before you start making changes. After clicking "save," the calibration will be retrieved from the controller and saved in the selected location. After this process completes, the software will automatically open the retrieved calibration. When a calibration file is open in the software, you will have the calibration tree view on the left hand side of the software. *Reference Figure 3-2.*

Figure 3-1: Read Calibration Button

Figure 3-2: Tree View

SECTION 4. INITIAL SETUP

4.1 Tire Size and Axle Ratio Setup

The two most important settings that must be done before going any further are the Vehicle Speed and the Throttle Position calibrations. In order to calibrate the vehicle speed that is used by the controller, the tire size and 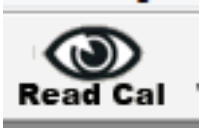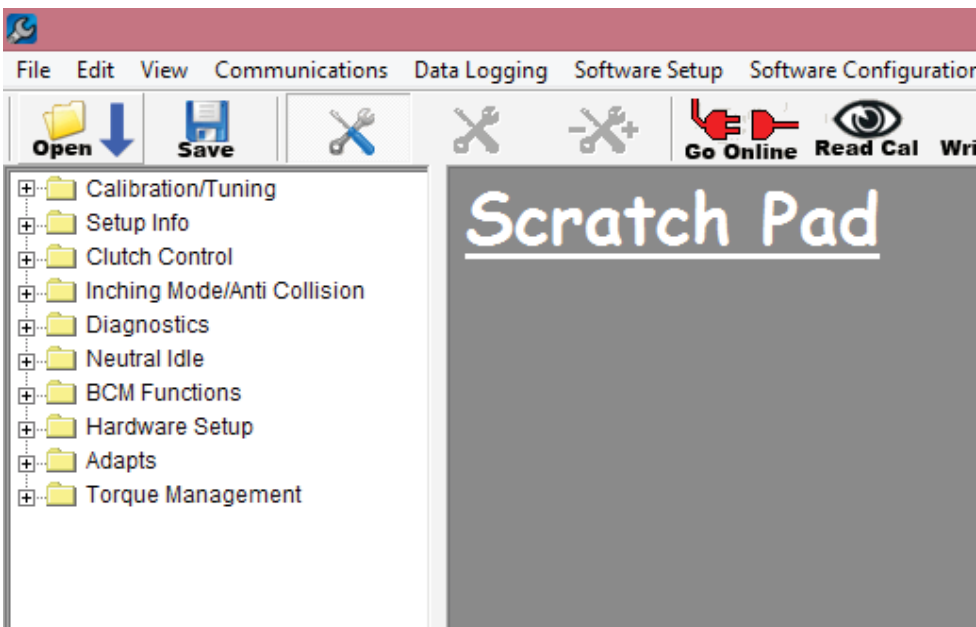final drive ratio need to be entered into the calibration. Tire size is entered in inches. If this is not known, you can use the calculator in the software to enter the side wall information and get the size. The final drive ratio will be the ratio of the rear end on a rear wheel drive vehicle. In the calibration tree view select "Setup Info/Gear Ratio and Tire Size". Enter your vehicles axle ratio and tire size only. The transmission ratios typically do not need
to be changed. *Reference Figure 4.1-1.*
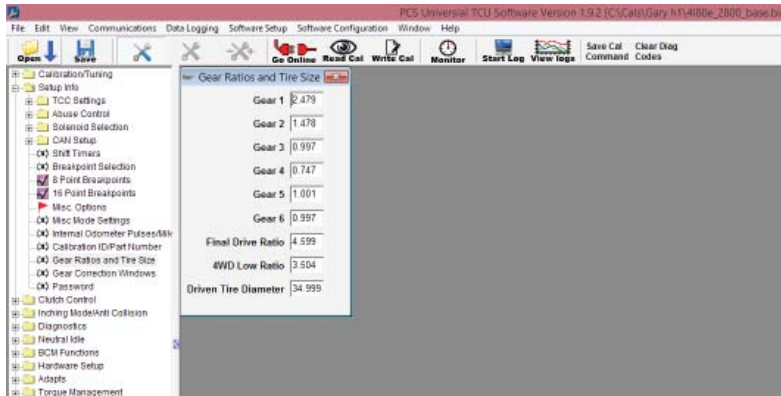
Figure 4.1-1: Gear Ratios and Tire Size

4.2 Throttle Position Setup

Throttle position calibration may or may not need to be done, depending on installation. The most common installations consist of wiring into an existing TPS or supplying the TCM with a dedicated TPS. If set up in this way, the minimum and maximum voltages of the throttle range must be entered into the calibration. The analog input pin from the TCM will be wired to the signal output pin of the TPS. The TCM wiring harness provides a +5v reference voltage signal (red wire with white stripe) and a ground reference signal (black with white stripe). The TPS output pin should increase in voltage as you open the throttle. A typical closed throttle voltage value is .45v. A typical wide open throttle (WOT) value is 4.5v. After you connect the wires you can verify the voltage readings on the TCM Monitor window. Click on the monitor icon or use CTRL M. when you are online with the ignition on and the engine off you will be able to monitor and record the min voltages at 0 Throttle and Max throttle voltage when you depress the pedal to the floor. *Reference Figures 4.2-1 - 4.2-2.*

Figure 4.2-1: Monitor Screen, TPS Voltage Range

Figure 4.2-2: TPS Calibration

SECTION 5. VERIFY OPERATION OF INITIAL SETUP

When connected to the TCM, open the monitor screen by selecting the "Monitor" icon on the tool bar. Instructions for verifying TPS and VSS operation. *Reference Figure 5-1.*
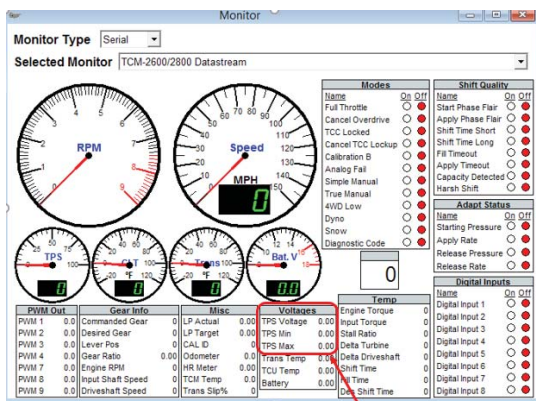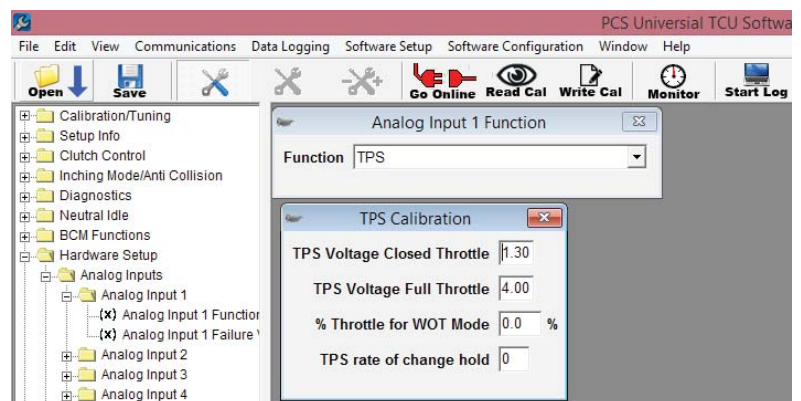

Figure 5-1: Monitor Button

SECTION 6. CALIBRATING THE TRANSMISSION

This section will walk through the basics of tuning an electronic automatic transmission. First verify that the transmission setup has been correctly programmed for your transmission. New calibration files provided with your install will give you a good starting point. It is recommended you work on the calibration "A" tables first. Then use these as a starting point for Calibration "B". The pressure tables are the most critical. It these are command a low pressure during shifting or steady state, your transmission will fail. For this reason, we recommend getting these settings adjusted first.

6.1 Shifting into Gear Pressure
Shifting Pressure are controlled by an electronic pressure control solenoid. The greater the amperage (Y-Axis) the lower the Line pressure (shift pressure in this case). As TPS increases for a commanded shift, the amperage should decrease to increase the shift pressure Keep in mind too low of pressure will cause long, soft shifts and will cause a durability problem. Setting these values to low numbers and then gradually increasing them in the individual TPS/Load areas to achieve the desired shift feel is a safer approach. Due this for each shift event. For the best results the transmission calibration should be performed in the normal operating region (160-200). Remember to save your calibration file to your computer. *Reference Figure 6.1-1.*
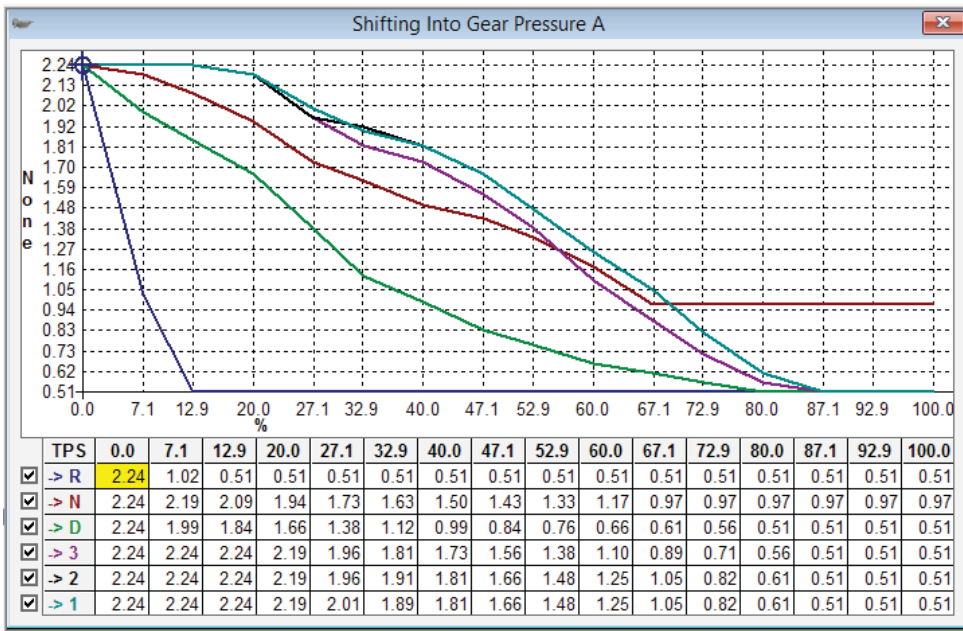

	TPS	0.0	7.1	12.9	20.0	27.1	32.9	40.0	47.1	52.9	60.0	67.1	72.9	80.0	87.1	92.9	100.0
☑	-> R	2.24	1.02	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
☑	-> N	2.24	2.19	2.09	1.94	1.73	1.63	1.50	1.43	1.33	1.17	0.97	0.97	0.97	0.97	0.97	0.97
☑	-> D	2.24	1.99	1.84	1.66	1.38	1.12	0.99	0.84	0.76	0.66	0.61	0.56	0.51	0.51	0.51	0.51
☑	-> 3	2.24	2.24	2.24	2.19	1.96	1.81	1.73	1.56	1.38	1.10	0.89	0.71	0.56	0.51	0.51	0.51
☑	-> 2	2.24	2.24	2.24	2.19	1.96	1.91	1.81	1.66	1.48	1.25	1.05	0.82	0.61	0.51	0.51	0.51
☑	-> 1	2.24	2.24	2.24	2.19	2.01	1.89	1.81	1.66	1.48	1.25	1.05	0.82	0.61	0.51	0.51	0.51

Figure 6.1-1: Shifting Into Gear Pressure A

6.2 Steady State Pressure
Steady state pressure is the amount of pressure required to hold the applied clutch without slipping after the shift has completed. As TPS/Load increases the amount of holding force needs to increase. This table is the transmission line pressure that is commanded per gear after the shift is completed. Typically, these values are lower the shifting pressure since the load transfers are completed at this point. While you may think it is safer to just let the transmission run at High pressure all the time during this drive condition, you should consider the following. First, high pressure outputs from the pump cause the transmission to run hotter. Second this also creates addition load which reduce engine power and decreases fuel economy. Ideally you should set these to a point that has enough pressure to hold the clutch. Similar to the "Shifting into Gear Pressure Tables", Shifting Pressure are controlled by an electronic pressure control solenoid. The greater the amperage (Y-Axis) the lower the Line pressure (shift pressure in this case). *Reference Figure 6.2-1* on the following page.
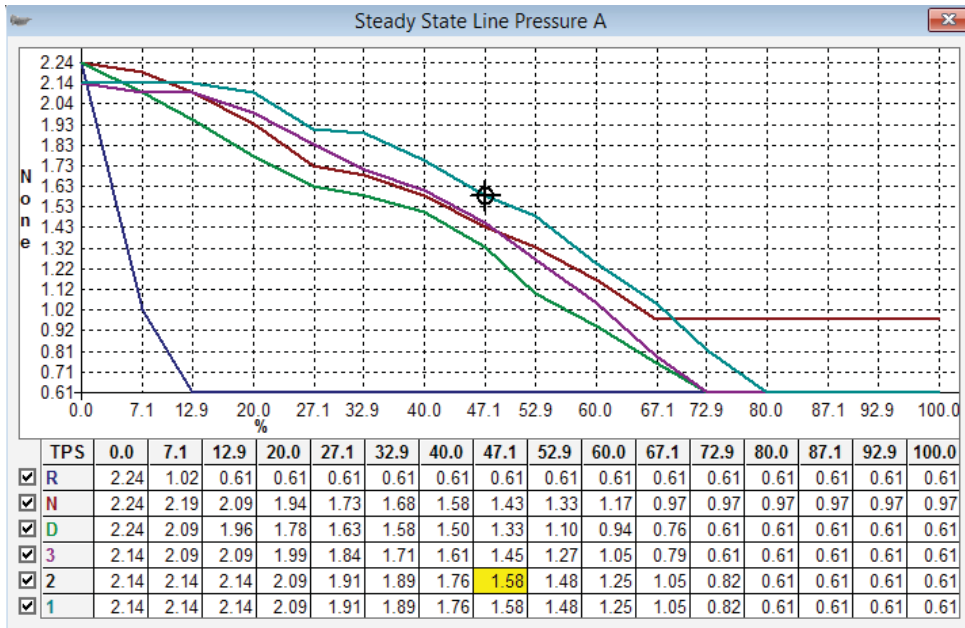
Figure 6.2-1: Steady State Line Pressure A

TPS	0.0	7.1	12.9	20.0	27.1	32.9	40.0	47.1	52.9	60.0	67.1	72.9	80.0	87.1	92.9	100.0
☑ R	2.24	1.02	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
☑ N	2.24	2.19	2.09	1.94	1.73	1.68	1.58	1.43	1.33	1.17	0.97	0.97	0.97	0.97	0.97	0.97
☑ D	2.24	2.09	1.96	1.78	1.63	1.58	1.50	1.33	1.10	0.94	0.76	0.61	0.61	0.61	0.61	0.61
☑ 3	2.14	2.09	2.09	1.99	1.84	1.71	1.61	1.45	1.27	1.05	0.79	0.61	0.61	0.61	0.61	0.61
☑ 2	2.14	2.14	2.14	2.09	1.91	1.89	1.76	1.58	1.48	1.25	1.05	0.82	0.61	0.61	0.61	0.61
☑ 1	2.14	2.14	2.14	2.09	1.91	1.89	1.76	1.58	1.48	1.25	1.05	0.82	0.61	0.61	0.61	0.61

6.3 Manual Range Pressure

The manual range pressure tables are used to increase the transmissions pressure when you shift the transmission down in the D3,D2 and D1 Positions. Additional pressure is sometime desired to assist in applying and holding the clutches and bands. Especially when using the transmission to assist in engine braking on a grade. *Reference Figure 6.3-1.*
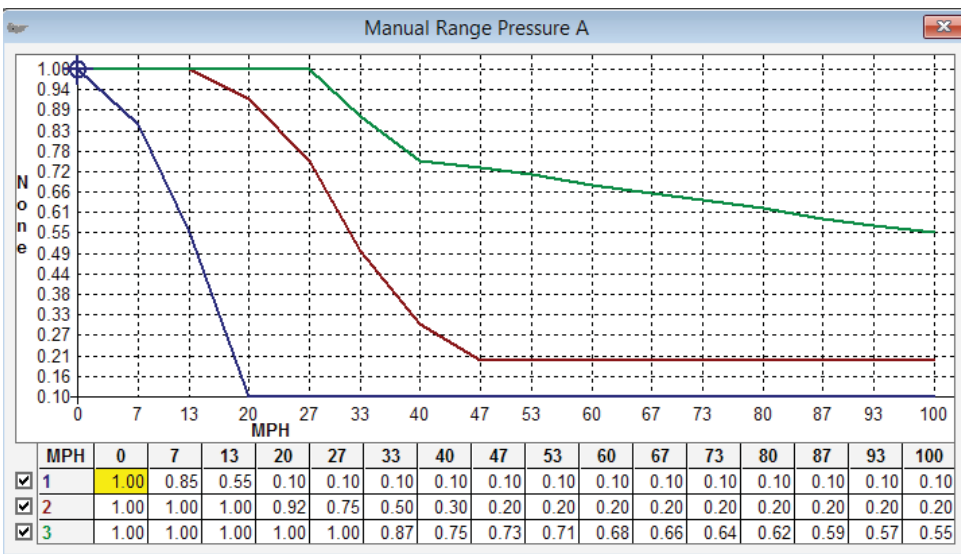

MPH	0	7	13	20	27	33	40	47	53	60	67	73	80	87	93	100
☑ 1	1.00	0.85	0.55	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
☑ 2	1.00	1.00	1.00	0.92	0.75	0.50	0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
☑ 3	1.00	1.00	1.00	1.00	1.00	0.87	0.75	0.73	0.71	0.68	0.66	0.64	0.62	0.59	0.57	0.55

Figure 6.3-1: Manual Range Pressure A

6.4 Upshift/Downshift Tables

Shift points are determined by MPH (miles per hour) and TPS (throttle position sensor) percent. Open the calibration "A" folder then the shift points Cal A folder. There is a table, figure X, that when first opened lets you view all the shift points for each gear. This table controls the part throttle upshift and downshift parameters for each gear. There is a second set of tables that are identical to this in the Calibration "B" folder. These give you the option of creating two distinct patterns, such as Normal and Sport mode or Tow Haul mode etc. Keep in mind while editing this table that the WOT settings, if enabled, contain your full throttle upshift and downshift parameters and should be matched to these tables. Also keep in mind that your TPS input must be configured to determine what WOT throttle is.

You will notice that next to the shift lines are boxes with check marks. This lets you choose the shift lines that are plotted in the chart. For explanation purposes, we have selected Low gear to high gear shift (upshift). A good example to walk through is pictured in Figure X. The shift table below shows a 1st to 2nd gear shift with a purple line. In most configurations you will want to use load (TPS or MAP) as an indicator of desired shift speed. At low load you will want a low shift speed to keep the engine from revving too high. Maintaining a low shift speed will also lead to smoother shifting as line and accumulator pressure are typically programmed for softer operation at low load. At high load you will want a high shift speed to utilize full engine power before shifting. Your upshift points (purple line) should always be higher than your downshift points (blue line). In each cell, the transmission will not upshift until reaching the speed value in the box for each load point. Be careful not to exceed your maximum RPM with any speed value.

Shift points are determined by MPH (miles per hour) and TPS (throttle position sensor) percent. In the example below, you will see we are in the Shift Table A, with all the boxes checked. This lets you view all the upshift and downshift lines. *Reference Figure 6.4-1 and Figure 6.4-2.*
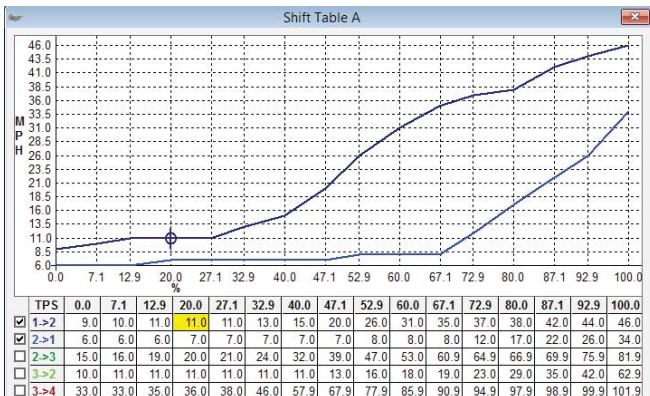

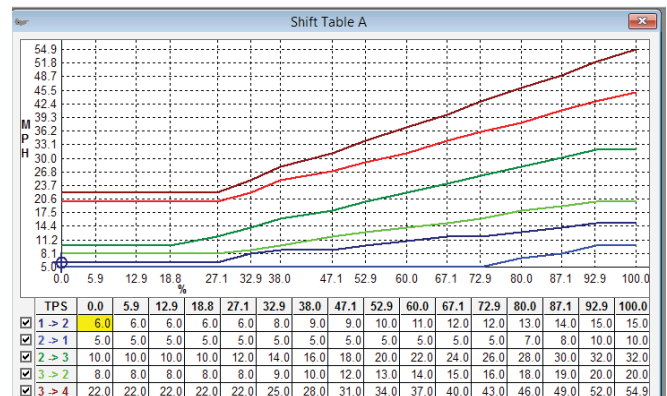Figure 6.4-1: Shift Table A showing shifts from 1st to 2nd

Figure 6.4-2: Shift Table A showing all shifts

6.5 Wide Open Throttle (WOT) Upshift RPM A

There are setting for Wide Open Throttle engines RPMs for both Calibration "A" and Calibration "B". These are used for the upshifts only. You can set this to the desired engine RPM per gear. *Reference Figure 6.5-1.*
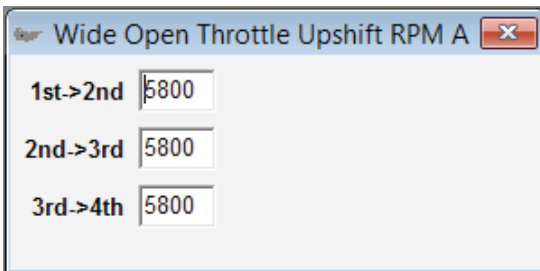

Figure 6.5-1: Manual Range Pressure A

6.6 Wide Open Throttle (WOT) Downshift Speeds A

There are setting for Wide Open Throttle Downshift Speed settings for both Calibration "A' and Calibration "B". These are used for the downshifts only. Set these to the point where you want to perform a downshift in each gear at 100% throttle. The speed usually matches what is in you shift tables downshift point. With the RPM calculator, you can verify that the speed you enter is lower than you upshift RPM. There should be approximately a 1800-2000 RPM delta between the upshift and downshift *Reference Figure 6.6-1.*

NOTE: This function is only available if it is enabled and you have an RPM signal.
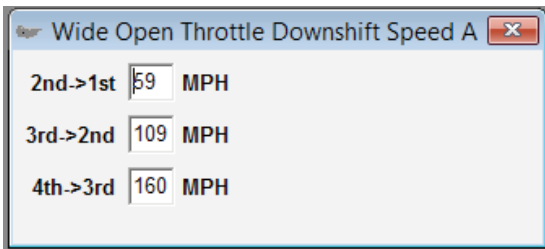

Figure 6.6-1: Wide Open Throttle Downshift Speeds A

6.7 TCC Lockup Settings

The torque converter lockup settings need to be configured for each Calibration "A" and "B", depending on what pattern are being utilized.

The TCC Lockup Flags have setting to keep the converter applied during upshift, downshifts and during coast mode. Enabling these settings.

The setting to enable control slip can be enabled to allow the converter to maintain a small amount of slip instead of fully locking. This Feature can only be used on certain torque converters that were designed to run at a controlled slip. Enabling this also requires configuring the TCC Settings under Setup info folder (see advanced user guide for further information on calibrating these).

Use Lockup Per Gear. If this is unchecked the Single Point TC Lockup tables are used. This table has just apply and release points and are used in conjunction with the TCC Lockup Parameters to set the lowest gear to use the apply and release lines. *Reference Figure 6.7-1.*
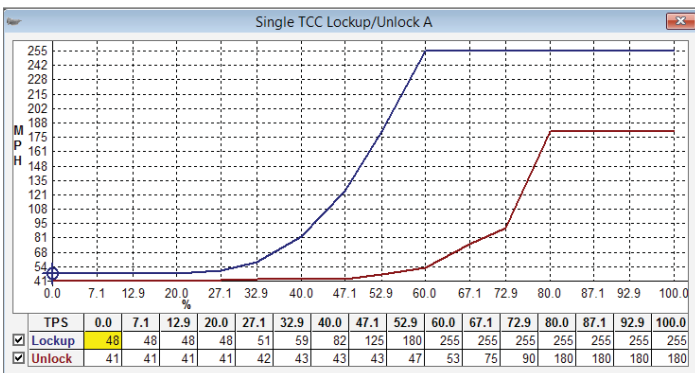

Figure 6.7-1: Single TCC Lockup/Unlock A

NOTE: In order to use the "Use Lockup Per Gear" setting must be checked. This gives you the ability to set the TCC Lockup Points for each gear set. This is for experienced calibrators only. More information on these settings is available in the full manual.

SECTION 7. DATALOGGING

7.1 Datalogging Menu

Datalogging is one of the most powerful features offered by the TCM. It allows a user to see transmission behavior and engine behavior. The extra analog and digital inputs offered by the TCM also allows the TCM to be used as a general datalogging device for any other vehicle functions you may wish to record.

To begin a datalog, do the following:

1. The TCM power must be on and the TCM must be communicating/online with your computer.

2. Select "Datalog" from the file menu and double click"Start/Stop Datalogging" or double click on the "Start Log" button on the toolbar. *Reference Figure 7.1-1 and Figure 7.1-2.*
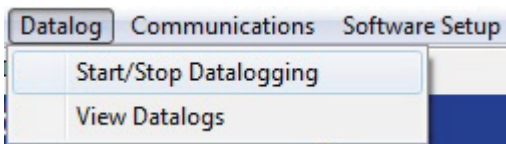

Figure 7.1-1: Datalog Dropdown	Figure 7.1-2: Start Log Button

3. A window will appear with the option to "Start Logging" and several datalogging rates will be offered. Choose your datalogging rate and click on the "Start Log" button. When prompted, choose a file name and location for your datalog. As with calibration files you may want to choose a descriptive name including the time, date, and/or application of your datalog. Once you have chosen a name and location, click save or press enter.
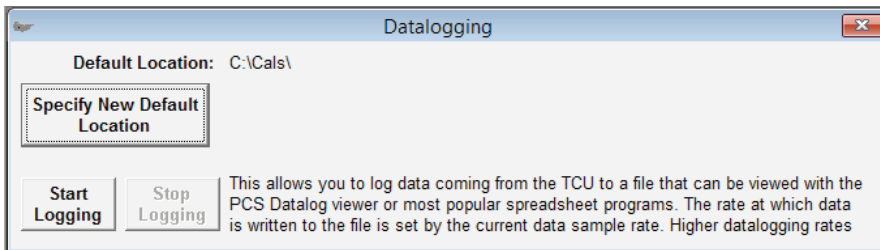

Figure 7.1-3: Choose File Name and Location/Start Logging

4. The software and your computer will now begin datalogging. You may view the transmission behavior through the monitor screen while datalogging. When you have completed your datalog, you may click on the "Stop Logging" button. This will complete your datalogging session and save your datalog file to the location you specified.

7.2 View Datalogs

Datalogs may be viewed with the Datalog Viewer software, Microsoft Excel or any other program that can handle tab delimited values contained in the datalog. The Datalog Viewer software offers a much stronger set of capabilities and datalogging viewing options; however we understand that many users may wish to use other tools or analysis methods which do not fall within the scope of the TCM software. The datalog files use the file extension .tlg which is associated with the Datalog Viewer Software; however this does not prevent users from opening the same file in Microsoft Excel.

To view a datalog, do the following:

1. Select "Datalog" from the file menu and double click "View. Datalogs"

2. A blank screen will appear. Click the "Load" button or go to File->Open and choose the location and name of your datalog.

3. The datalog initially opens in graph view. o begin viewing the data, click in the boxes next to the data fields you wish to see near the top of the screen. You may view this data in a tabular view by clicking the "Table View" button.

    NOTE: You may also double click the datalog file to open it in the Datalog Viewer software.

ZOOMING

Several zooming options are available by right clicking your mouse button. You may zoom in by clicking on a beginning time and an ending time for your graph selection. You may also choose to view all the data, zoom to a percentage, or zoom to a particular time period.