

MSD INSTALLATION INSTRUCTIONS

MSD Atomic Transmission Control Module PN 2760

Thank you for purchasing the MSD Atomic Transmission Control Module (TCM). MSD is pleased to announce that this transmission controller was designed with performance reliability, practicality, and ease of use in mind. Using the correct adapter harness, this unit will plug directly into the factory connectors on 4L60E/4L70E/4L80E GM transmissions, or the Ford AODE, 4R70W/E, 4R75W/E, E4OD, and 4R100 transmissions. The Atomic TCM was designed to work as a stand-alone transmission controller. Programming the transmission controller is done through the handheld monitor, which eliminates the need for a computer to program the transmission controller.

Parts Included:

- 1 - AtomicTransmission Control Module
- 1 - Handheld monitor
- 1 - 4G Micro SD Card

Parts required but not included:

- Transmission Harnesses
(*only transmission specific harness is needed*)
- PN 2770 - 4L6XE (1992+) / 4L7XE (2006-on) / 4L8XE (1993+) harness
- PN 2771 - 4L7XE (2009+) harness
- PN 2772 - Ford 4R7XW/E (1998+) harness
- PN 2773 - Ford AODE/4R70W/E (1992-1997) harness
- PN 2774 - Ford 4R100 (1998+) harness
- PN 2775 - Ford E4OD (1995-1997) harness
- PN 2776 - Ford E4OD (1989-1994) harness

ATOMIC TRANSMISSION CONTROL MODULE INSTALLATION

It is important to select a proper mounting location for the TCM. The unit can be mounted in the interior or the engine compartment as long as it is away from direct heat sources. It is not recommended to mount the unit in an enclosed area, such as the glove box. When a suitable location is found, make sure all wires reach their connections. Use the TCM as a template and mark the location of the holes. Use a size #20 drill bit to prepare for the supplied self tapping screws. Assemble the sleeves in the TCM (Figure 1).

Note: Mounting this module near headers or high heat sources may affect the operation of the TCM.

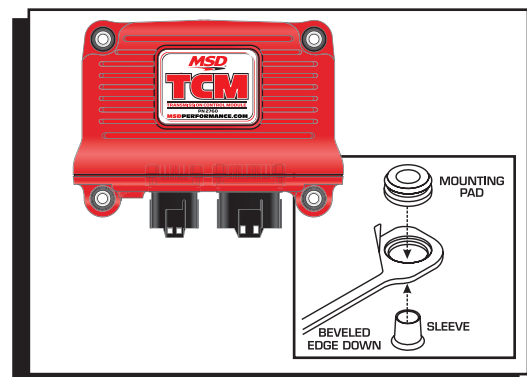


Figure 1

WIRING

CONNECTOR	Pin	Color	Function
	VSS	2	Brown
1		White	Signal
Transmission GT Series 12 Pin	1	Brown	Overdrive Cancel (Ford Applications Only)
	2	Black	TPS Ground Reference
	3	Gray	Calibration Select
	4	Dark Blue	Manual Bump up / Manual Mode Select
	5	Green	TCC Lock
	6	Tan	Speed Out
	7	Red	TCC Unlock
	8	Orange	TPS 5V
	9	Lt. Blue	Manual Bump Down
	10	Pink	12V Ignition in
	11	White	RPM/Tach In
	12	Yellow	TPS Signal In

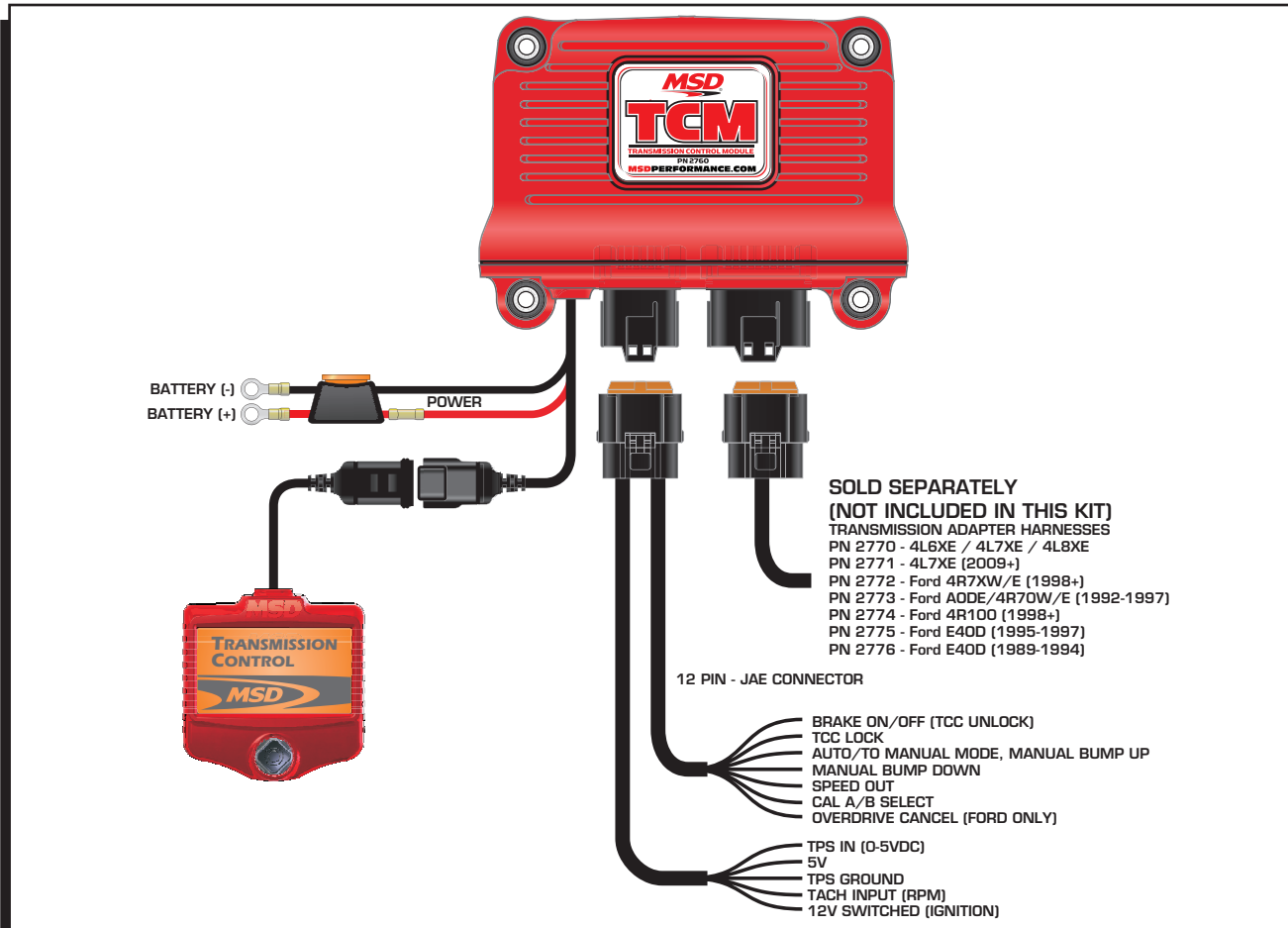


Figure 2

WIRING (FIGURE 2)

BROWN (OVERDRIVE CANCEL): (FORD ONLY) Toggles Overdrive function on/off with momentary connection to 12v(+) or ground(-).

BLACK (TPS GROUND REFERENCE): Connect to ground reference on throttle position sensor (TPS).

GRAY (CALIBRATION SELECT): Switch to ground to select Calibration B. In race applications Calibration B can be used for aggressive shift characteristics. In 4x4 applications Calibration B is used as a shift point compensation using the Transfer Ratio (INITIAL SETUP) setting to compensate for transfer case reduction ratio in AUTOMATIC shift mode. Connect to a switched ground to activate.

BLUE (MANUAL BUMP UP / MANUAL MODE SELECT): Momentarily switch to ground for 3 seconds to activate MANUAL MODE. Once in MANUAL MODE, momentarily switch to ground to UPSHIFT.

GREEN (TCC LOCK): Switch to ground to lock Torque Converter Clutch in 2nd-4th gear regardless of vehicle speed.

TAN (SPEED OUT): Speedometer signal output (12v square wave; 20,000 pulses per mile).

RED (TCC UNLOCK): Switch to 12v to unlock Torque Converter Clutch. Normally connected to brake pedal switch to unlock TCC when brakes are applied.

Note: This function will prevent the TCC from locking under any operating condition while activated with 12v.

ORANGE (TPS 5V): Connect to 5v reference on throttle position sensor (TPS).

LT. BLUE (MANUAL BUMP DOWN): Once in MANUAL MODE, momentarily switch to ground to DOWNSHIFT.

PINK (12V IGNITION IN): Connect to switched ignition 12v source.

WHITE (RPM/TACH IN): Connect to tach output on MSD Ignition or coil (-) on inductive ignition.

Note: Will accept 5V(+) used to trigger GM LS coil packs.

YELLOW (TPS SIGNAL IN): Connect to TPS sensor signal.

ATOMIC TCM HANDHELD MENU

SELECT PRODUCT: The Atomic TCM handheld will connect to the TCM, and allow user changes to the TCM display setup (Figure 3).

DISPLAY SETUP: The Display Setup controls the look of the handheld unit and the Firmware version. (Figure 3).

LCD CONTRAST: Adjust the contrast on the LCD screen. Using the joystick, the brightness level can be adjusted up or down in 5% increments (Figure 3).

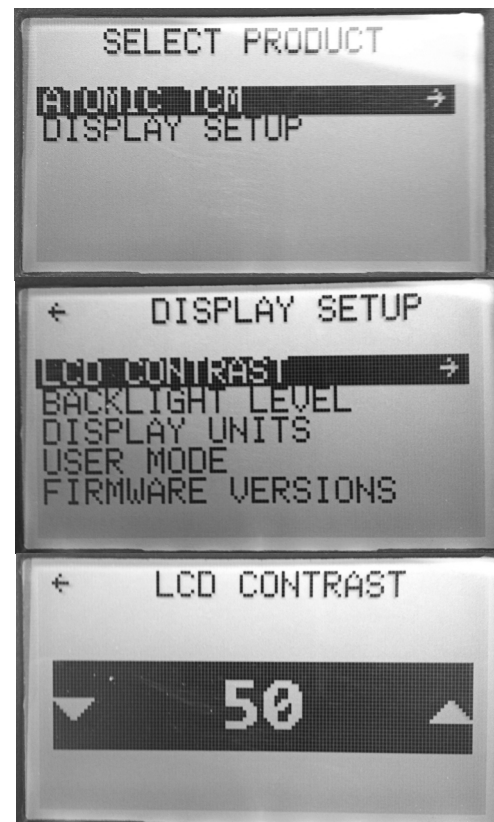


Figure 3

BACKLIGHT LEVEL: Adjust the brightness of the screen. The brightness can be adjusted up or down using the joystick in five percent increments (Figure 4).

DISPLAY UNITS: Display items in either English (inches, Fahrenheit, MPH) or Metric (mm, Celsius, KPH) (Figure 4).

USER MODE: Used for changing parameters in Atomic LS EFI systems. This setting doesn't change any menus in the Atomic TCM (Figure 4).

FIRMWARE VERSIONS: Displays Transmission Control Module and handheld programmer Firmware versions (Figure 4).

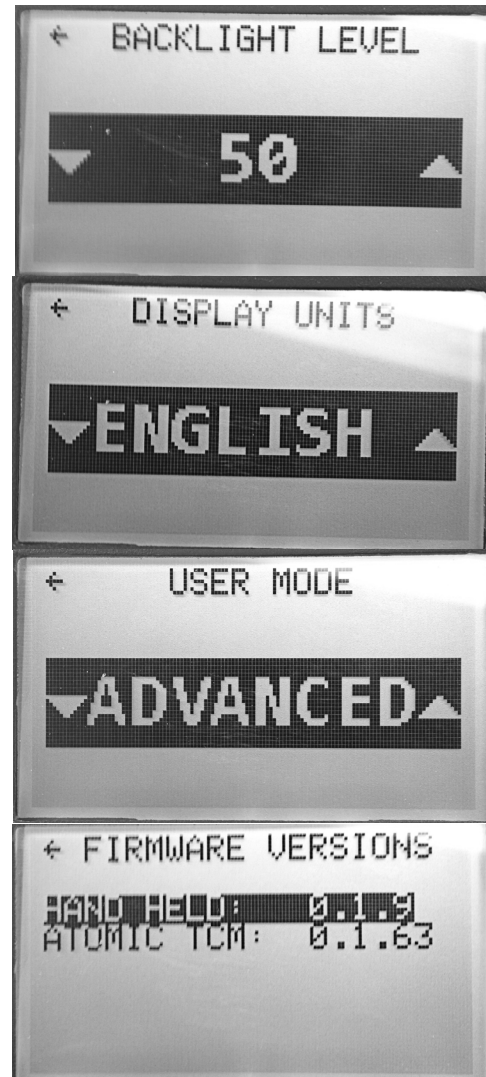


Figure 4

ATOMIC TCM HANDHELD MENU

TCM DASH: Eleven parameters are displayed in real-time: CAL SELECT, ENGINE RPM, SPEED, TPS, FLUID TEMP, PCS DUTY CYCLE, SHIFT POS., GEAR, TCC LOCKED, SHIFT MODE, and DTC COUNT (Figure 5).

Refer to the table labeled TCM DASH for a complete description of each parameter in the Atomic Dash (Figure 5).

TCM GAUGES: Displays RPM, TPS, TFT, MPH, Commanded Gear, Shifter Position, Active Calibration, Mode, and TCC Status in real time gauge format. THIS SCREEN IS NOT CONFIGURABLE (Figure 5).

INITIAL SETUP: The basic controller input parameters; which must be configured prior to vehicle operation.

ADVANCED SETUP: Advanced program settings for optional features and optimized drivability (Figure 5).

INITIAL SETUP

Note: In order for changes to INITIAL SETUP parameters to be stored in memory, the Atomic TCM must be powered off for at least three (3) seconds prior to subsequent power-up and operation. Upon power-up, it is a good idea to check and make sure the new parameters appear as expected BEFORE attempting vehicle operation.

TRANS TYPE: Selection menu for transmission type. Choices include the following (Figure 6):

- GM: 4L6XE (Early93+), 4L7XE (2009+), 4L8XE (1992+)
- Ford: AODE 1992-1995, 4R70W/E 1993-1997, 4R70W/E 1998+, E4OD 1989-1997, and 4R100 1998+

Note: Both the early model Ford Manual Lever Position Sensor (MLPS) and later model Digital Transmission Range (DTR) sensors are supported. The controller automatically detects the type of range sensor connected; however, the proper harness is required to interface with the type of sensor used.

CYLINDER SELECT: Configure the pulse count for the tachometer signal input. Configurable from 1-12 cylinder. Settings available include 1, 2, 4, 6, (2 settings for 6 odd & 1 setting for 6 even fire), 8, 10, and 12 cylinders (Figure 6).

Note: GM LS applications should be set to 1 CYL if tach signal wire is connected to 5v trigger on single coil pack. Ford Mod Motor applications (Coil On Plug) should be set to 1 CYL if tach signal wire is connected to coil(-) on single coil. Ford Mod Motor applications (Dual coil pack) should be set to 2 CYL if tach signal wire is connected to either coil(-) on one coil pack.

REAR END RATIO: Selection menu for rear end gear ratio. Adjustable from 1.00 to 10.00 in .01 increments (Figure 6).

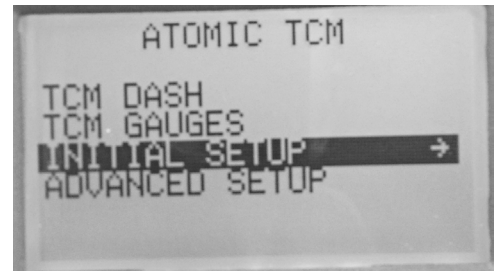


Figure 5

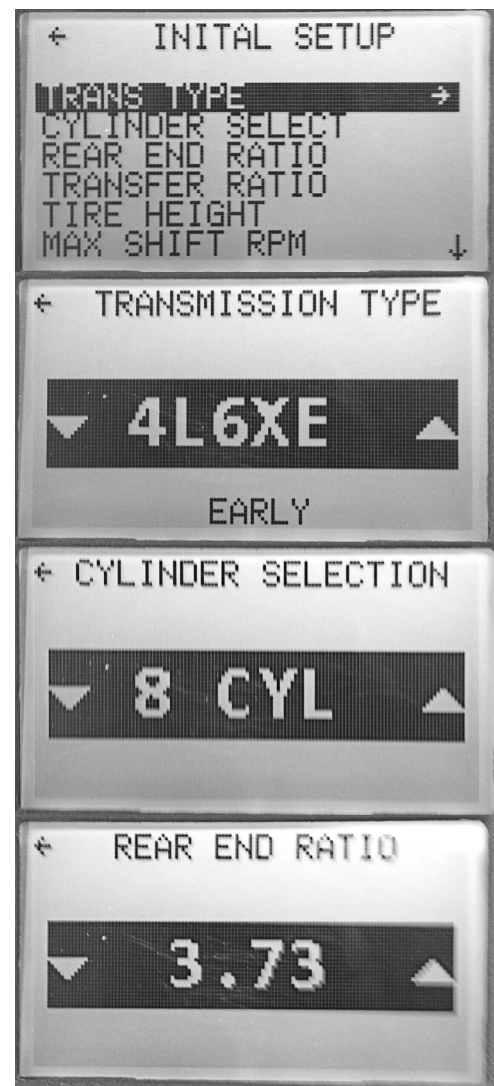


Figure 6

TRANSFER RATIO: Selection menu for transfer case gear ratio. Adjustable from 0.50 to 10.00 in 0.01 increments. Leave this value set to the default (1.00) unless the vehicle is equipped with a transfer case. **NOTE:** Changes made in this menu selection only apply to Calibration B (grey activation wire) (Figure 7).

TIRE HEIGHT: Selection menu for tire height (in inches). Adjustable from 15.00 to 72.00 inches in 0.01-inch increments (Figure 7).

MAX SHIFT RPM: Selection menu for setting the maximum Engine RPM allowed before the controller forces an automatic upshift. Adjustable from 800RPM to 10,000RPM (Figure 7).

Note: This MAX SHIFT RPM applies primarily to automatic shifts when operating in the Overdrive (OD) or Drive (D) range. However, when operating in Manual Mode, the controller will automatically force an upshift if engine RPM exceeds the max shift RPM for more than 0.5 seconds.

CALIBRATE TPS: Calibration menu for a standalone TPS signal input. Default selection is "NO." To start a calibration turn the key on, but keep the engine off. Using the joystick, toggle the selection to "YES" and press the joystick down in the center. This will start a 5 second calibration timer. Once the count down begins, depress the accelerator pedal to the Wide Open Throttle (WOT) position and release. The handheld should display a calibration successful message. If the calibration was unsuccessful, repeat the calibration process (Figure 8).



Figure 7

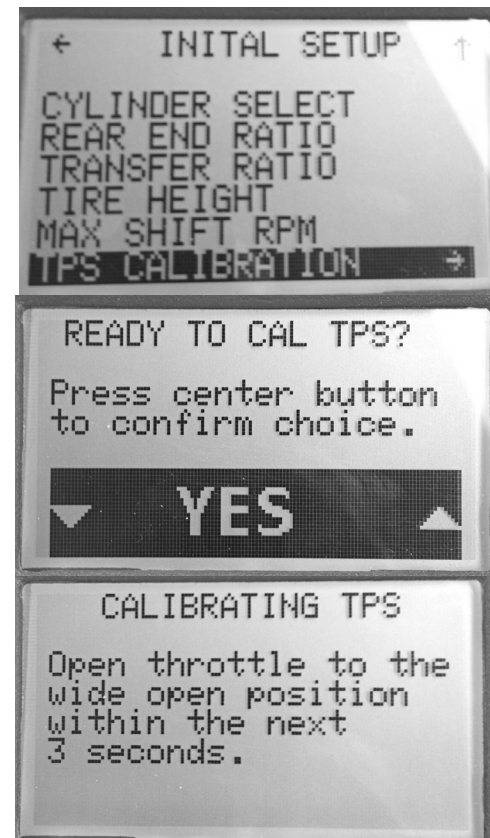


Figure 8

ADVANCED SETUP

Note: Changes to Calibration A and Calibration B parameters (SHIFT MULTIPLIER, TCC MULTIPLIER, and FIRMNESS MULTIPLIER) take effect in real time and do not require power cycling of the Atomic TCM in order to be committed to memory.

Changes to all other ADVANCED SETUP parameters require that the Atomic TCM be powered off for at least three (3) seconds prior to subsequent power-up and operation. Upon power-up, it is a good idea to check and make sure the new parameters appear as expected BEFORE attempting vehicle operation.

CALIBRATION A/B: The Atomic TCM supports two calibration modes. Calibration A is enabled by default and can be considered a street or daily driven calibration. Calibration B can be used for racing, off road, or aggressive shifting settings. When the grey wire is grounded, Calibration B is enabled. When Calibration B is enabled, the setting under Transfer Ratio (INITIAL SETUP) is factored into the shift strategies to accommodate the additional gearing in off road applications. If the vehicle isn't equipped with a 4X4 transfer case, leave the Transfer Ratio setting at the default setting of 1.00 (Figure 9).

Note: It is recommended to connect a micro-switch to the transfer case shifter in off-road applications. This will switch into calibration B automatically when the transfer case is engaged.

Note: Calibration A/B swaps are inhibited while the vehicle is moving. To effect an A/B cal swap using the grey wire, vehicle speed (VSS) must be zero (0).

SHIFT MULTIPLIER: Selection menu for scaling automatic upshift / downshift speeds (MPH). The multiplier range is 0.75 to 1.50 in 0.01 increments. Increasing the SHIFT MULTIPLIER above the default value (1.00) raises the upshift and downshift speed for a given TPS value. Decreasing the SHIFT MULTIPLIER below the default value (1.00) lowers the upshift and downshift speed for a given TPS value (Figure 9).

TCC MULTIPLIER: Selection menu for scaling Torque Converter Clutch (TCC) lock and unlock speeds (MPH). The multiplier range is 0.75 to 1.50 in 0.01 increments. Increasing the TCC MULTIPLIER above the default value (1.00) raises the lock and unlock speed for a given TPS value. Decreasing the TCC MULTIPLIER below the default value (1.00) lowers the lock and unlock speed for a given TPS value (Figure 9).

FIRMNESS MULTIPLIER: Selection menu for adjusting part throttle shift firmness. The multiplier range is 0.80 to 2.00 in 0.01 increments. Increasing the FIRMNESS MULTIPLIER above the default value (1.00) increases part throttle shift firmness. Decreasing the FIRMNESS MULTIPLIER below the default value (1.00) decreases part throttle shift firmness. WOT shifts occur at maximum firmness and are not affected by this multiplier (Figure 9).

Warning: Decreasing the FIRMNESS MULTIPLIER value will result in lower line pressure at part throttle conditions – resulting in possible slippage and damage to internal transmission components. Used or worn transmissions will be more susceptible to damage sustained while operating with insufficient line pressure.



Figure 9

WOT THRESHOLD: (Wide Open Throttle) The Atomic TCM module utilizes a MPH/KPH shifting strategy. When the throttle position exceeds the WOT Threshold setting, the TCM will switch to an RPM shifting strategy, and will upshift automatically when the ENGINE RPM reaches the MAX SHIFT RPM (set in the Initial Setup menu). Adjustable from 0% to 100% in 1% increments (Figure 10).

VSS PULSE PER REV: Vehicle Speed Sensor pulses-per-revolution selection menu. Default values (and reluctor locations) are as follows (Figure 10):

All GM Transmissions: 40 Pulses per Rev (Located on Transmission Output Shaft)

Ford AODE, Early 4R70W/E: 6 Pulses per Rev (Integral to Forward Drum)

Ford Late 4R7XW/E: 6 Pulses per Rev (Integral to Forward Drum), some applications may be 24 Pulses per Rev.

Ford E4OD: 108 Pulses per Rev (Between Ring Gear and Carrier in Rear End)

Ford 4R100: 6 Pulses per Rev (Located on Transmission Output Shaft) Diesel transmissions may be 18 Pulses per Rev.

Ford Speedometer Transmitter: 4 Pulses per Rev (This "hybrid" transducer had both a mechanical cable drive and 2-pin electronic Vehicle Speed Sensor (VSS) Output. An example is Dorman Part Number 917 614.)

Note: Default values can be changed from this screen to accommodate a custom reluctor tooth count or inaccurate speedometer reading. The speedometer can be checked for accuracy with a GPS, if any inaccuracy is found, adjust the Pulse per Rev until speed in the dash is reporting an accurate vehicle speed.

DYNO MODE: ENABLE/DISABLE: Dyno mode is intended for use when operating the vehicle on a chassis dyno. Enabling Dyno Mode will force the earliest possible upshifts until the transmission is in direct (3rd gear). Once in third gear, the transmission controller will prevent downshifts under increased throttle opening – up to, and including, WOT. This feature enables dyno pulls to be made without the possibility of an unintentional downshift. Dyno Mode will also lock the Torque Converter Clutch (TCC) when the vehicle speed equals (or exceeds) 30 mph. The transmission will follow a closed-throttle downshift and TCC unlock schedule when Dyno Mode is enabled. Dyno Mode can be disabled manually from this screen, or it will automatically be disabled if power to the transmission controller is cycled off (i.e. run through a key off cycle) (Figure 10).

Note: Dyno Mode Enable is inhibited when vehicle speed is equal to, or greater than, 50 MPH. When attempting to enable Dyno Mode, be sure the vehicle speed is less than 50 MPH.

DIFF MOUNTED VSS: Default value is "NO". When selecting the Ford E4OD transmission, this value may need to be changed to "YES". 1992-96 E4OD applications used the Rear Anti-Lock Brake Sensor (RABS) for vehicle speed sensing. The tone ring is located in the rear differential between the ring gear and carrier. If using an E4OD in a vehicle utilizing a different VSS / reluctor configuration (i.e. on the driveshaft or transmission output shaft), select "NO". Failure to configure this parameter correctly with an application using the RABS VSS will result in the Atomic TCM computing speed incorrectly (Figure 11).



Figure 10



Figure 11

LOAD DEFAULTS: This selection resets the Transmission Control Module back to default settings. Toggle from “NO” to “YES” using the joystick on the hand held. Then press down on the joystick in the center. This setting is useful for installing the transmission control module on another transmission or for troubleshooting.

Note: MSD recommends loading the Atomic TCM defaults after performing a software update.

TCM DASH AND GAUGE PARAMETERS (FIGURE 12)

Engine RPM	Displays Engine Speed (Revolutions per Minute)
SPEED	Displays Vehicle Speed (Miles per Hour/Kilometers per Hour)
TPS	Displays Throttle Position Sensor (0 @ idle – 100 @ Wide Open Throttle)
Fluid Temp	Displays Transmission Fluid Temperature (°F or °C)
PCS DC	Displays Pressure Control Solenoid Duty Cycle (Higher number indicates lower line pressure, Zero indicates maximum line pressure)
SHIFT	Displays Shifter Position
GEAR	Displays Commanded Gear
CAL SELECT	Displays active calibration (“A” or “B”)
MODE	Displays “A” for Auto and “M” for Manual
TCC Status	Displays “L” when TCC is locked (no character present when TCC is unlocked)



Figure 12

OPERATIONAL NOTES AND SAFEGUARDS: The following section describes some of the Atomic TCM's built-in safeguards, as well as operational notes:

Shifter Position Error: In the event that the Atomic TCM cannot recognize a valid signal from the transmission's Range Switch, and translate it to a corresponding shifter position, "ERROR" will be displayed on the handheld in the SHIFT POS field. If the cause is intermittent, the "ERROR" message will clear and normal operation will resume. If the error is persistent, the transmission can be operated in its OEM limp mode (i.e. Park, Reverse, Neutral, and 2nd or 3rd – depending on the transmission model and OEM limp mode strategy).

Excessive Transmission Fluid Temperature (TFT): If, at any point during operation, the Transmission Fluid Temperature exceeds 266°F, the Atomic TCM will lock the Torque Converter Clutch (TCC) in 2nd, 3rd, and 4th gear when the Throttle Position Sensor (TPS) is above 2%. The TCC will unlock when the TPS is less than 2% - regardless of the TFT reading. Normal TCC operation will resume once the TFT drops below 257°F.

Insufficient Transmission Fluid Temperature (TFT): Overdrive (OD) engagement is prohibited until the TFT reaches 47°F and Torque Converter Clutch (TCC) lockup is prohibited until the TFT reaches 84°F.

Engine Braking in Manual Mode: The transmissions supported by the Atomic TCM typically do not provide engine braking when operating with the shifter in the Overdrive (OD) position. In order to take advantage of engine braking, it is necessary to move the shifter position to Drive (D) or OD Cancel (Ford only). When operating the Atomic TCM in Manual Mode, DO NOT do so with the expectation of engine braking occurring with the shifter in Overdrive (OD). All supported transmissions should provide engine braking with the shifter in the Manual 2 or Manual 1 position.

Low Speed Operation in Manual Mode: When operating in Manual Mode, thresholds are in place to provide automatic downshifts, and prevent premature upshifts, at low vehicle speeds. This prevents the possibility of pulling away from a stop in too high a gear, or upshifting through the gears too quickly and loading the engine excessively. The thresholds are summarized in the table below:

Gear Transition	Vehicle Speed (MPH)
1-2 / 2-1	5
2-3 / 3-2	10
3-4 / 4/3	15

Alternately, you do not necessarily have to worry about Manual Mode downshifting when coming to a stop. The Atomic TCM ensures a subsequent 1st gear start.

Engine Overrev Protection in 1st Gear: Whether you are in Manual 1 and forget to upshift, or attempting a high-speed downshift to first gear (Auto or Manual Mode), the Atomic TCM will not allow the engine speed to exceed the value entered for MAX SHIFT RPM (see Initial Setup menu). Based on the rear gear ratio, tire height, and maximum engine speed entered during the Initial Setup phase, the Atomic TCM automatically computes the corresponding maximum vehicle speed allowed in 1st gear. If MAX SHIFT RPM is exceeded in Manual 1, the Atomic TCM will force an upshift to 2nd gear. Conversely, high-speed 2-1 downshifts are prohibited until the vehicle speed has dropped below a value that will not cause MAX SHIFT RPM to be exceeded.

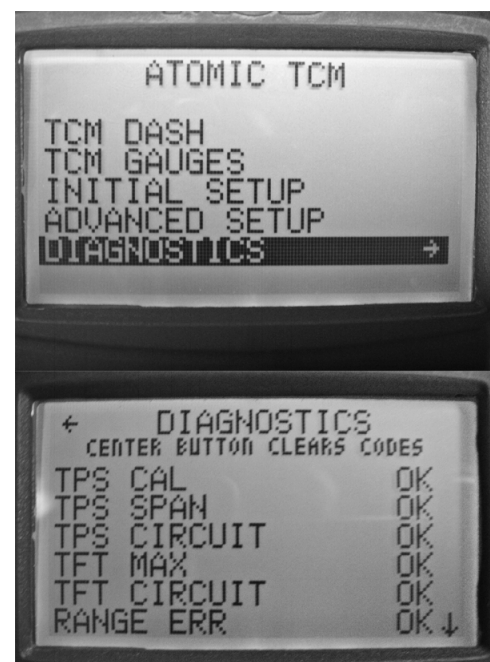


Figure 13

DIAGNOSTICS (FIGURE 13)

The Atomic TCM provides some basic diagnostics codes that are useful for troubleshooting purposes. The status of each associated parameter can be shown in one of three ways.

- “OK”: the parameter value is within its normal range
- “Error C”: the parameter is currently out-of-range
- “Error H”: The parameter experienced an out-of-range condition at some point with in the last 10 key-on/off cycles

CLEARING DIAGNOSTIC ERRORS

CODE NAME	WHAT IT MEANS	PROBABLE CORRECTION(S)
TPS CAL	The controller has detected a TPS value that exceeds the minimum/maximum values after the TPS calibration.	This code will set if throttle linkage was not fully seated against the idle stop, or fully depressed to Wide Open Throttle (WOT) during the initial TPS calibration and exceeds the calibration window. Repeat the TPS calibration procedure ensuring the full range of throttle stop travel is utilized. A faulty TPS sensor may also cause this code to set if the voltage drifts over time. TPS replacement and re-calibration may be required.
TPS SPAN	The controller has detected TPS value that is outside the lower/upper voltage window.	This code will set if the Throttle Position Sensor (TPS) is operating beyond the normal 0-0.5V window at an idle or 4.5-5V in the WOT range. Re-indexing of the TPS mounting position or sensor replacement may be required.
TPS CIRCUIT	The controller has detected a short in the TPS circuit, or an open TPS circuit.	This code will set if the Yellow TPS sensor wire is shorted to ground, +5VDC power, or if no TPS is detected. Check the routing and condition of the Orange, Black and Yellow wires in the auxiliary harness; and/or replace TPS.
TFT MAX	The Transmission Fluid Temperature (TFT) has exceeded 266°F for more than one minute.	This code will set if operating conditions are such that excessive heat is being generated while the transmission is operating. Occasional appearance of this code is normal while towing heavy loads on steep grades with the Torque Converter Clutch (TCC) unlocked. Regular appearance of this code under normal operating conditions may indicate excessive internal slippage, excessive line pressure, or inadequate transmission fluid cooling.
TFT CIRCUIT	The controller has detected a short or an open in the Transmission Fluid Temperature (TFT) circuit.	This code will set if there is a break or a short in the Violet or Green TFT sensor wires, or if the TFT sensor is defective. Check the routing and condition of the wires, and/or replace the TFT sensor.
RANGE ERR	The controller was unable to determine a valid shifter position for more than one second.	This code will set if there is a problem with the transmission range indicator switch, or the main transmission harness. If applicable, execute OEM procedures for indexing external transmission range switches. Check the condition and routing of all main harness wires and connectors, and/or replace range switch.
EEPROM ERR	The controller has detected a problem with its internal Electronically Erasable Programmable Read-Only Memory (EEPROM).	This code will set if an internal problem prevents EEPROM interrogation when the unit is powered on. Return the unit to MSD for testing or replacement.
SYS VOLT LO	The controller has detected a system voltage below 10.5 VDC for more than 5 seconds.	Ensure that the battery is fully charged, the alternator is working properly, and there are no large parasitic loads on the main electrical system. Check the controller wiring and ensure that the 14-gauge Red and Black wires are connected directly to battery power, and that the Pink ignition wire has at least 12VDC applied when the controller is operating.

INSTALLATION INSTRUCTIONS

CODE NAME	WHAT IT MEANS	PROBABLE CORRECTION(S)
SYS VOLT HI	The controller has detected a system voltage above 17.0 VDC for more than five (5) seconds	Ensure that the alternator and external voltage regulator (if equipped) are working properly.
TRANS SLIP	The controller has detected excessive internal transmission slippage.	This code will set if the controller detects an abnormally large difference between the engine speed and the output shaft speed with the Torque Converter Clutch (TCC) locked. Slippage can be caused by internal component wear and/or insufficient line pressure. Follow applicable OEM procedures for checking line pressure and diagnosing internal mechanical problems.
DTC COUNT*	Diagnostic Trouble Code (DTC) count.	This value displays the number of Current Diagnostic Trouble Codes (DTCs).

* The last line displayed on the Atomic TCM dash

Note: When the Atomic TCM is powered up for the first time, it is normal for some History codes to appear – particularly those related to the TPS and range position switch. Once the correct transmission type has been selected, and initial TPS calibration has been successfully completed, clear any remaining History codes prior to operating the vehicle.