



Installation Instructions

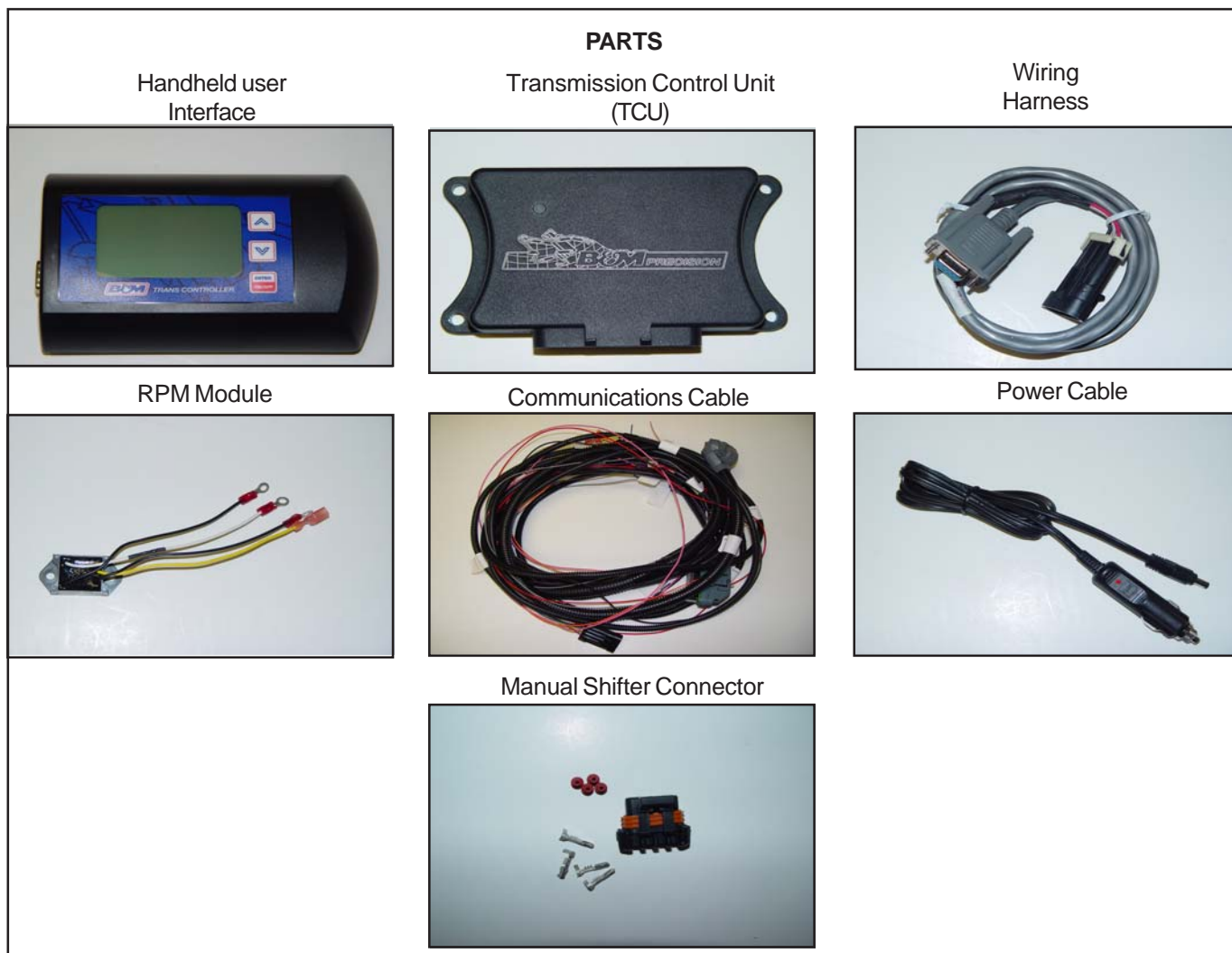
Shift Plus 2 TCU

for 4L60E, 4L65E, 4L70E, 4L80E and 4L85E

Part Number 120001

©2011 by B&M Racing and Performance Products

Thank you for purchasing the B&M Shift Plus 2 Transmission Controller Unit (TCU). The Shift Plus 2 TCU allows users to adjust nearly any aspect of a transmissions behavior for street/strip use. No software, laptop computer or tuning experience is required. This kit provides tuning right out of the box. Simply install this new transmission control unit according to the enclosed instructions, and then start the system by answering the simple setup wizard questions on the included hand-held unit. Read the instructions and review the illustrations thoroughly before beginning the installation.



TCU - IMPORTANT!:

The TCU is water tight when connected to the wiring harness. It can be mounted in the engine compartment or in the vehicle's interior. It is good practice to mount the TCU with the connector facing down. This way, there is less chance of moisture getting into the TCU if it needs to be disconnected in wet conditions.

The TCU should not be mounted close to other electrically "noisy" components. In particular, keep good spacing (try for 2 feet minimum) from ignition components (ignition boxes, coils, distributors, etc.)

If mounting the TCU in the engine compartment, selecting a location towards the rear will make it easier to route the communications cable to the interior to allow the handheld user interface to be monitored while driving.

There is an LED on the front face of the TCU (the side with the logo). It will flash if the on-board diagnostics detects a problem (the LED is lit solid when the TCU is powered up and working normally). To take advantage of this feature, the TCU will need to be mounted so that the front face of the TCU is visible. The handheld user interface will also indicate if any faults have been detected.

WIRING HARNESS- IMPORTANT!:

The wiring harness should be kept away from ignition components (ignition boxes, coils, distributors, etc.) as much as possible. Do not bundle the wiring harness together with other "noisy" wiring in the vehicle.

As with any wiring, it is good practice to avoid routing the wiring harness around sharp edges or near high temperature components such as headers or exhaust components.

WIRING HARNESS CONSISTS OF THE FOLLOWING CONNECTION:

BATTERY POSITIVE (red wire) / NEGATIVE (black wire)

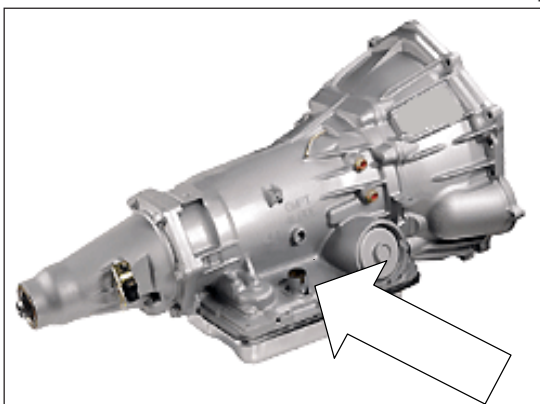
These must be connected **DIRECTLY** to the positive (red wire) and negative (black wire) posts of the battery. These must be run independently to the battery. **DO NOT** splice other power or ground wires into these wires. Failure to follow these requirements invites problems with electrical noise. These kinds of problems are difficult to diagnose. The wires may be extended if needed using automotive grade 16 gauge (or larger) wire.

12V SWITCHED (pink wire)

Connect this wire to a switched ignition source that is hot with the key in the On/Run and Crank positions. **DO NOT** connect to the positive side of an ignition coil. Strange problems can sometimes arise when tapping into existing switched ignition sources. When in doubt, run this wire through its own switch and then directly to the positive post of the battery.

TRANS

This connects to the round connector on the passenger side of a 4L60E transmission or on the driver side of 4L80E. Note: Pre-1993 4L80E's will need an updated internal wiring harness. B&M part# 120003, GM part# 24200161 or equivalent.



4L60E



4L80E

OUTPUT SHAFT SPEED

This connects to a speed sensor at the rear of the transmission. In the case of the 4L80E transmissions, use the rear most sensor.

THROTTLE / TPS SIGNAL

The THROTTLE connector can be plugged into an early style GM TPS sensor. Wiring adapters are available from FAST™ (fuelairspark.com) to accommodate a later style GM TPS (round, 3 pin connector). The harness can also be modified for use with any 0-5V TPS.

<u>Original Pin Location</u>	<u>Color</u>	<u>Function</u>
A	Black/Pink	Ground
B	White/Red	TPS signal
C	Red/White	5V

The loose TPS SIGNAL wire is provided to facilitate sharing the TPS signal between two systems (TCU and a fuel injection system, for example) if needed. It splits off from the THROTTLE connector's signal wire inside the harness.

Remote mount TPS kits are available from B&M to provide a TPS signal for carbureted applications (part # 120002) . When installing one, adjust the linkage so that there is some preload on the sensor when the throttle is closed. Also adjust it so that opening the throttle all the way causes the sensor to sweep through a majority of its range - but without the sensor reaching its mechanical limit. Allowing the sensor to operate at its mechanical limits (high or low) can lead to premature failure. It will cause a TPS error code to be set if the signal voltage goes above or below approximately 4.9V or 0.1V respectively. If needed, the signal voltage can be measured on the TPS SIGNAL wire.

TACH IN / RPM MODULE

The wire with the female terminal can go from the tach output from an ignition box, other RPM signal source or to the Shift Plus 2 RPM Module depending on the application. See RPM Module notes. **DO NOT** connect this directly to the ignition coil.

A second wire is provided to facilitate sharing the tach signal between two systems (TCU and a fuel injection system, for example) if needed. The terminal on the second wire is the opposite gender. So something that would normally connect to an ignition box tach output or the Shift Plus 2 RPM Module can instead be plugged into this second wire in the TCU harness for a splice-free hook up.

MANUAL SHIFT

This connector contains the wires needed to enable and use manual bump up/bump down shifting. Buttons can be mounted where ever they are convenient in the vehicle – on the steering wheel, on the shift lever, etc.

<u>Pin</u>	<u>Color</u>	<u>Function</u>	<u>Notes</u>
A	Red	Bump Down	Use momentary switch to ground to request a downshift.
B	Yellow	Bump Up	Use momentary switch to ground to request an upshift.
C	Blue	Auto/Manual	Use a toggle switch to ground to enable Manual Shifting.
D	Black	Ground	Can be used as the ground source for switches.

SPEEDOMETER OUTPUT (orange wire)

This wire puts out a 12V square wave to drive an electronic speedometer. The number of pulses per mile is selected in the handheld user interface.

ECONOMY / PERFORMANCE (purple wire)

When switched to ground through a toggle switch, this TCU input can be used to select a more performance oriented shift strategy. Line pressure and shift points will be altered according to settings entered in the handheld user interface.

TCC APPLY (grey wire)

When switched to ground, (and when some very basic requirements are met) this TCU input forces the torque converter clutch to lock up. Otherwise, the TCC will lock and unlock automatically based on user configurable settings.

FLASH ENABLE (blue wire)

This wire is only used in the rare case that new firmware needs to be loaded into the TCU. This wire would be grounded as the TCU is keyed on. Be sure that this wire is not accidentally grounded in normal operation. If the TCU accidentally starts up in Flash Mode (LED flashing steady on/off pattern – a slower pattern than the rapid flashing that indicates an error code has been set), the transmission will not function properly. If that occurs, make sure the FLASH ENABLE wire is not grounded, then key off, wait about 10 seconds and key back on.

HANDHELD

This connects to the communications cable that links the main wiring harness to the handheld user interface.

SPEEDOMETER CONTROL UNIT

This connects to an optional B&M Speedometer Control Unit (SCU) (part# 120004). A SCU uses an electric motor to spin a special speedometer cable to drive a mechanical speedometer.

RPM MODULE:

There are two basic options for supplying the Shift Plus 2 with an RPM input.

1. Clean, processed Tach signal from engine electronics

Electronics involved in running the engine – fuel injection, ignition, etc. – will need to know engine RPM. So there may be an existing tach signal wire that can be tapped into. The Shift Plus 2 requires a square wave type tach signal that pulses once per cylinder firing. Ignition systems – such as aftermarket capacitive discharge (CD) ignition boxes – often have dedicated “Tach” outputs that are a perfect RPM signal source for the TCU.

If using a clean, processed Tach signal, the TACH IN / RPM MODULE wire in the Shift Plus 2 wiring harness is connected directly to that source - the “Tach” output from an ignition box, etc. The RPM Module included with the kit is not used in this case and no part of the Shift Plus 2 system is connected to the coil.

2. Inductive coil

Another RPM signal source is the negative side of the ignition coil in a traditional dwell controlled inductive ignition system. One in which the coil is fed power on one side and is charged by grounding the other side - either by “points” or some form of electronic module. An HEI is one example of this type of ignition system.

To use this RPM signal option, the RPM Module is required. The RPM Module connects to the negative side of the coil and outputs a “Tach” signal to the TCU. The RPM Module is connected as follows:

<u>Wire color</u>	<u>Connection</u>
Black	Engine block
Black	Engine block
White	Negative side of coil
Yellow	TACH IN / RPM MODULE wire in the Shift Plus 2 wiring harness

The RPM Module is provided to allow this convenient installation option. But keep in mind that it has limitations. The negative side of an ignition coil is one of the noisiest points on the engine. In most applications, the RPM Module will be able to deal with this and feed a clean RPM signal to the TCU. But the old saying – garbage in, garbage out - applies here. If the inductive ignition system is just too noisy or inconsistent, a different RPM signal source will be needed. A poor RPM signal can cause the RPM display on the Live Data screen to appear erratic. It can also lead to inconsistent shift points under heavy load.

RPM MODULE - IMPORTANT:

HEI distributors (and possibly others) have a terminal labeled "TACH". However, this is usually not a clean, processed tach signal like many aftermarket ignition boxes would supply. Instead, it is simply another terminal connected to the negative side of the coil. **DO NOT** connect the TACH IN / RPM MODULE wire in the Shift Plus 2 wiring harness directly to these terminals. The TCU will be damaged. In cases like this, the supplied RPM Module is required and will allow connection to the negative side of a dwell controlled coil.

DO NOT bypass the RPM Module and connect the TACH IN / RPM MODULE wire in the Shift Plus 2 wiring harness directly to the negative side of the coil. This may actually function for a short time but eventually the TCU will be damaged and system performance will degrade.

DO NOT connect anything from the Shift Plus 2 system to the coil – RPM Module or TACH IN / RPM MODULE wire when using an aftermarket ignition box.

Use resistor type spark plugs. Non-resistor plugs are very electrically noisy and cause interference with electronics—including the Shift Plus 2 system. **DO NOT** use solid core spark plug wires, these are also very noisy.

B&M Speedometer Control Unit (SCU) (Not include in kit):

An optional B&M SCU is available, part# 120004. It uses an electric motor to spin a special speedometer cable to drive a mechanical speedometer. The SCU wiring mates directly to the Shift Plus 2 wiring harness.

To configure the SCU for use with the Shift Plus 2, remove the SCU's lid to access a row of DIP switches. Set switches 4,5 and 8 to the "ON" position. All others should be "OFF". Once the switches are set, the lid can be replaced. In the setup wizard or in the advanced options menu, set the SPEEDO PPM to "4000PPM OR SCU".

In other applications, the SCU needs the DIP switches to be set according to a formula based on various drive train information. The calculation is not required for use with the Shift Plus 2. Once the switches are set as described above, the Shift Plus 2 handles the rest. It sends a calibrated speed signal to the SCU.

Installation

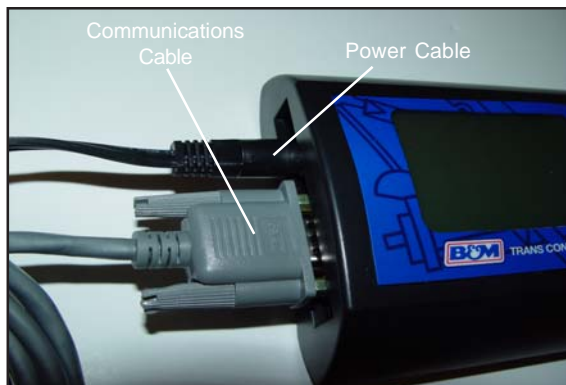
This is a general outline of the installation process. Read all of the component specific installation instructions for more detail before beginning the installation.

1. Connect the TRANS and OUTPUT SHAFT SPEED connectors from the wiring harness to the transmission. Route the rest of the harness into the engine compartment.
2. Determine the appropriate method for getting an RPM signal into the TCU. Install RPM Module if needed.
3. Connect the wiring harness to the RPM signal source.
4. Connect the wiring harness to a TPS signal source.
If a mechanical speedometer will be used, install the optional B&M SCU and connect the wiring harness to it.
5. Find a suitable location and mount the TCU. Make sure the wiring harness will reach the mounting location.
6. Connect the BATTERY POS and BATTERY NEG wires DIRECTLY to the battery. These must be run independently to the battery. **DO NOT** splice other power or ground wires into these wires. Extend the wires if necessary to reach the battery. Use automotive grade 16 gauge (or larger) wire.
7. Connect the 12V SWITCHED wire to a switched ignition source (hot in On/Run and Crank). **DO NOT** connect to the positive side of an ignition coil.

8. If Manual Shifting will be used, route the MANUAL SHIFTING connector into the cockpit and wire in an enable switch and a pair of buttons for upshift and downshift.
9. To use the Forced TCC Lockup feature, route the TCC APPLY wire into the cockpit and connect it to a switch or button.
10. To access Performance Mode, route the ECONOMY/PERFORMANCE wire into the cockpit and connect it to a switch.
11. If an electronic speedometer will be used, route the SPEEDOMETER OUTPUT wire into the cockpit and connect it to the speedometer.
12. Connect the wiring harness to the TCU.

HANDHELD:

The Shift Plus 2 handheld serves as the user interface with the Shift Plus 2 system. It has a straight forward menu system that offers advanced features without requiring a laptop or any computer skills. Its first task is to take you through the Setup Wizard. It also serves as a scan tool by displaying live data and diagnostics information. Beyond basic setup, you can also adjust other settings to suit your preferences.



HANDHELD - IMPORTANT:

The handheld has two cables that must be connected. A communications cable that links the handheld to the HANDHELD connector on the main wiring harness. And a power cable that goes to a cigarette lighter receptacle. For convenience, the handheld power source should be hot in On/Run and Crank. If it loses power while cranking, there will be a short wait before the handheld can be used as it powers back up.

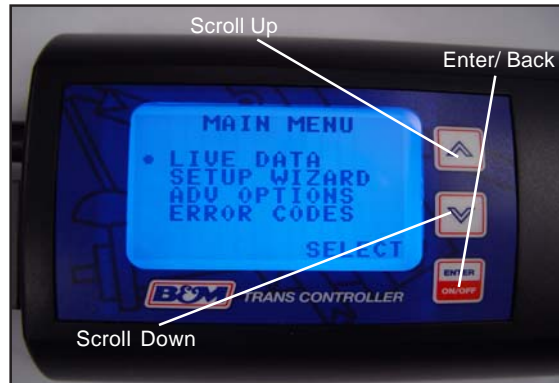
The B&M Racing logo will appear once the unit is turn on. To turn off the handheld, disconnect the power cable either at the handheld itself or from the cigarette lighter receptacle. Reconnect the power cable to restart the handheld.

If the handheld displays a "COMM ERROR" message, make sure the handheld's communication cable is connected and that the TCU is powered on. Reset the handheld.

If monitoring live data or making adjustments while driving is necessary. Be safe by bringing a friend along to operate the handheld while driving.

Live Data:

The Live Data feature allows the monitoring of various engine and transmission parameters in real time. There are two screens that can be selected using the UP and DOWN arrows. To return to the main menu, press the POWER/MENU button.



In addition to live data readings, the Live Data screens also feature several Status Indicators. They show when certain conditions are met. In the picture below-on the left, the TC indicator is “off”. The PM and MM indicators are “on”. These indicators can serve as a troubleshooting tool by offering a way to verify that the various switched inputs are wired and functioning properly.



DASH 1

RPM Engine speed
 MPH Vehicle speed
 GEAR Current gear

Status Indicator	Meaning
TC	Torque Converter Clutch. This indicates that the torque converter clutch is locked. It is normally controlled automatically by the TCU but can also be forced to lock by grounding the TCC APPLY wire.
PM	Performance Mode. This indicates that the ECONOMY / PERFORMANCE wire has been grounded to select the more aggressive Performance Mode. When this indicator is off, the TCU operates in normal Economy Mode.
MM	Manual Mode. This indicates that manual bump up bump down shifting has been enabled by grounding the Auto/Manual wire in the MANUAL SHIFT connector. The TCU will hold the current gear until told to shift, unless the vehicle comes to a stop. In that case, it will downshift into 1st gear.



DASH 2

TOT(F) Transmission Oil Temperature in degrees Fahrenheit.

BAT(V) Battery voltage.

TPS% Throttle Position Sensor. It's range is from 0 (resting idle position) to 100 (full open position). The Setup Wizard takes care of calibrating this sensor. It can easily be verified using this display. If you ever notice the TPS reading is not 0 at idle, it should be re-calibrated by selecting TPS CALIBRATE in the Advanced Options section of the handheld.

SGR Selected Gear. This shows the position of the shift lever.

- PN Park/Neutral
- R Reverse
- OD 4th lever detent / Overdrive
- L3 3rd lever detent / Drive
- L2 2nd lever detent / 2nd
- L1 1st lever detent / 1st

Status Indicator	Meaning
BU	Bump Up. This indicates that an upshift is being requested by grounding the Bump Up wire in the MANUAL SHIFT connector. Manual Shifting must be enabled for the Bump Up input to be recognized by the TCU and for this indicator to work.
BD	Bump Down. This indicates that a downshift is being requested by grounding the Bump Down wire in the MANUAL SHIFT connector. Manual Shifting must be enabled for the Bump Down input to be recognized by the TCU and for this indicator to work.
SE	System Error. This indicates that an error code has been set. It acts like a Check Engine Light. Select ERROR CODES from the main menu to check and clear error codes.

Setup Wizard:

The Shift Plus 2 Setup Wizard will walk you through the initial TCU setup. Once you select SETUP WIZARD from the main menu, you will be asked:

START A NEW TUNE?:

YES - will let you continue the Setup Wizard. It will also reset most settings in the Advanced Options menu.

NO - will take you back to the main menu.

TRANSMISSION MODEL: Select the transmission type.

NUMBER OF CYLINDERS: Enter the number of cylinders your engine has.

TIRE DIAMETER:

If you know the rear wheel tire diameter, select ENTER DIAMETER and enter the value when prompted.

Or

select USE TIRE SIZE to use the tire size calculator. It will prompt you to enter the tire section width, aspect ratio and wheel size that is molded into the sidewall of the tire. The tire diameter will be calculated and displayed for you to review before continuing.

SPEEDO OUTPUT: Different speedometers require different numbers of pulses per mile (PPM). Select the appropriate PPM setting.

If an optional B&M Speedometer Control Unit (SCU), part# 120004, will be used to drive a mechanical speedometer, select "4000PPM OR SCU".

If you won't be using the Shift Plus 2 speedometer output, it doesn't matter what setting is selected.

If you will be using the Shift Plus 2 speedometer output but you don't know what PPM your speedometer requires, select the "4000PPM OR SCU" option. Later while driving, this setting can be adjusted with the SPEEDO PPM setting in the Advanced Options menu.

Some aftermarket speedometers are programmable. For those speedometers, this setting may not be critical.

REAR AXLE GEAR RATIO: Enter the gear ratio. This is an important setting. If you aren't sure of the exact ratio, enter your best guess for now. Later, you should use the ADJUST SPEEDO setting in the Advanced Options menu to dial in the TCU's speed reading.

MAX SHIFT RPM: Enter the highest RPM you want your engine to reach during wide open throttle shifting.

TPS CALIBRATION SCREENS: The throttle position sensor (TPS) sends a voltage to the TCU that varies with throttle movement. The TCU needs to know what voltage corresponds to closed and full throttle. You will be asked to leave the throttle at the idle / closed position. Once that value is captured, you'll be asked to hold the throttle wide open. The Setup Wizard will tell you how long to hold the throttle open while it captures that value.

NOTE: The full throttle procedure is meant to be performed with the engine NOT running!

That's it! The TCU is configured and almost ready to go. The only remaining step is to power cycle the TCU - key-off, wait 10 seconds, and turn it back on.

Advanced Options:

The Advanced Options menu allows you to make adjustments beyond the basic settings configured by the Setup Wizard.

Advanced Setup 1:



SPEEDO PPM: Different speedometers require different numbers of pulses per mile (PPM). If the wrong PPM setting is used, the speedometer readings will be off by a large margin. The speedometer would read quarter speed, half speed, double speed, etc. - something pretty obvious. If you don't know what input your speedometer is expecting, try other PPM settings until the speedometer displays a reasonable speed.

Some aftermarket speedometers are programmable. For those speedometers, this setting may not be critical.

ADJUST SPEEDO: This setting can be used to fine tune the TCU's speed reading. It compensates for errors in the entered tire size and rear axle gear ratio.

(NOTE: If an external speedometer - as opposed to the MPH display on the Shift Plus 2 handheld - is grossly miscalibrated, refer to the SPEEDO PPM setting.)

While the vehicle is being driven, the screen will display the TCU's current speed reading. Using the arrow keys, the speed reading can be adjusted up or down. Once satisfied that the displayed speed is accurate, use the DONE button to lock in the adjustment.

Since the point of this adjustment is to verify the speed as reported by the TCU, you will need an independent speed reference for comparison. For example, you could...

- pace yourself against another car being driven at a known speed
- use a GPS unit that displays ground speed
- drive the car on a chassis dyno

TPS CALIBRATE: The throttle position sensor is calibrated in the Setup Wizard. This lets you repeat that process by itself. Just like in the Setup Wizard, you will be asked to leave the throttle at the idle / closed position. Once that value is captured, you'll be asked to hold the throttle wide open.

NOTE: The full throttle procedure is meant to be performed with the engine NOT running!

TIRE SIZE: Rear wheel tire diameter can be adjusted or re-calculated here.

DIFF GEAR: Rear axle gear ratio can be adjusted here.

MORE: This brings up another page of Advanced Options.

Advance Setup 2:



MAX SHIFT RPM: The highest RPM you want your engine to reach during wide open throttle shifting can be adjusted here.

LOWSPEED SHIFT: This setting is used to adjust the vehicle speeds at which the transmission shifts under very light load, i.e., when the TPS reading is small. A higher number means the transmission will shift at higher speeds.

NOTE: The handheld uses the setting entered here to perform calculations related to shift speeds. The results are what actually get written to the TCU (not this value setting itself) Anytime you access this setting, it will display the same default value to start. This is not an indication of a problem. The TCU does retain the shift speed information.

SHIFT AGGRESS: This setting adjusts how aggressive the overall shift strategy is. A higher number means that the transmission will hold gears longer and be quicker to downshift. This setting has a big impact on the overall demeanor of the transmission.

SHIFT FIRMNESS: This setting adjusts the base transmission line pressure. A higher number means higher pressure which is felt as firmer shifts. Higher pressure also tends to allow less slip as the gears engage. Line pressure automatically increases with increasing throttle and will always be maxed out during full throttle operation. So line pressure does not need to be set uncomfortably high in normal part throttle driving in order to get full pressure shifts under heavy load.

Keep in mind that the parts and techniques used in assembling a transmission can have a large effect on line pressure and shift feel. Adjusting this setting will cause the TCU to call for more or less pressure. But it is possible for the mechanical/hydraulic components of the transmission to overpower the control the electronics can have on line pressure and shift feel.

MORE: This brings up another page of Advanced Options.

Advance Setup 3:



MIN TCC LOCK: This setting is the minimum vehicle speed required for the TCU to lock the torque converter clutch. Locking the TCC while cruising is good for fuel economy. It also allows the transmission fluid to cool. However, TCC lockup can be completely disabled if desired by entering an unobtainable speed in this setting. The vehicle would then always be below the minimum speed for TCC lockup.

MAX TCC TPS: This setting is the maximum throttle opening allowed before the torque converter clutch is unlocked. When the TCC locks up, it can feel similar to shifting into a higher gear. RPM's typically drop and the engine has to work harder to accelerate the vehicle. If this setting is too low, TCC will unlock too easily. This can be an annoyance as it locks and unlocks too often in the course of normal cruising. If this setting is too high, the vehicle may feel unresponsive during medium to high speed cruising. As more throttle is applied, the engine may feel like it is struggling until the TCC finally unlocks and allows the engine to more easily accelerate the vehicle. The proper setting is subjective and also dependant on the characteristics of the vehicle and its powertrain – vehicle weight, engine torque, etc. Some experimentation will likely be required to find the preferred value for this setting.

PERF AGGRESS: This setting determines how much more aggressive the shift strategy becomes when in Performance Mode. A higher number means that the transmission will hold gears longer and be quicker to downshift. This adjustment is applied on top of whatever adjustment is already in place through the SHIFT AGGRESS setting.

PERF FIRMNESS: This setting determines how much shifts are firmed up when in Performance Mode. A higher number means firmer shifts. This adjustment is applied on top of whatever adjustment is already in place through the SHIFT FIRMNESS setting.

DONE: This will take you back to the main menu.

Error Codes:

The Shift Plus 2 system features a diagnostics feature. The TCU constantly monitors various inputs for any deviations from normal operation. If any is detected, the LED on the front face of the TCU flashes rapidly as a warning that there is a problem (the LED is lit solid when the TCU is powered on and working normally or it will flash a slower on/off pattern if the TCU started up in Flash Mode). Also, the SE Status Indicator displayed on the Live Data screen acts like a Check Engine Light. It will signal if an error code has been set. The handheld can be used to read any error codes that have been set.

Once an error code is set, it is saved in the TCU until the TCU is reset by keying-off and allowing the TCU to complete its shutdown procedure (takes approximately 5-10 seconds) Error codes can be cleared with the handheld at any time.

The picture on the left is showing error codes. After clearing them, the picture on the right shows what the Shift Plus 2 Codes screen normally looks like.



The following error codes are possible:

Fault

TOT

OVER TEMP

TPS

BATT

PSWM

Monitors

Transmission oil temperature sensor open or shorted. The sensor is inside the transmission.

Transmission oil temperature has gone over 262°F.

Throttle position sensor signal voltage above or below approximately 4.9V or 0.1V respectively.

Battery voltage below 7V or above 19V for 10 seconds.

Invalid pattern from pressure switch manifold (internal transmission sensor that tells TCU what gear is selected.)

If the TCU is completely disabled – power is lost, harness is cut, etc. – the transmission can still be driven with limited functionality. Line pressure will be maxed out. The reverse gear will work. The transmission will default to 3rd gear with the shift lever in Overdrive or L3/Drive. 2nd gear can be selected by moving the shift lever into the L2 position.

Shift Plus 2 System Features and Operations:

Performance Mode

When Performance Mode is enabled, the TCU will use a more aggressive shift strategy (transmission will hold gears longer and be quicker to downshift) and higher line pressure for firmer shifts. The degree to which both are affected by enabling Performance Mode can be adjusted independently through the Advanced Options in the handheld. This allows Performance Mode to be adjusted to suit the driver's preferences.

Manual Shifting (Bump Up / Bump Down)

By enabling Manual Shifting, the transmission can be controlled with two buttons – one for upshift, one for downshift. The buttons can be mounted where ever they are convenient in the vehicle – on the steering wheel, on the shift lever, etc.

In this mode, the TCU will hold the current gear until told to shift, unless the vehicle comes to a stop. In that case, it will downshift into 1st gear to ensure easy acceleration away from the stop. A side effect of this feature is that the rear wheels must be turning before the TCU will accept an upshift request.

Because the TCU will not upshift on its own when Manual Shifting is enabled, care should be taken to avoid over revving the engine. A rev limiter in a fuel injection or ignition system can act as a safety net to protect the engine in case the driver waits too long to upshift.

Depending on vehicle speed, the TCU may ignore downshift requests. This is done to prevent over revving the engine and/or destabilizing the vehicle.

TCC Lockup / Forced TCC Lockup

The TCU locks up the torque converter clutch during cruising conditions for improved fuel economy and to allow the transmission fluid to cool. In order for the TCC to lock, several conditions must be met:

- Transmission fluid warmed up
- Transmission above 3rd gear (unless transmission fluid is overheated)
- Vehicle speed above user adjustable minimum (see MIN TCC LOCK setting)
- Throttle above idle position
- Throttle below user adjustable maximum (see MAX TCC TPS setting)

NOTE: TCC lockup can be completely disabled if desired by entering an unobtainable speed for the MIN TCC LOCK setting. The vehicle would then always be below the minimum speed for TCC lockup.

There is also a Forced TCC Lockup mode. When the TCC APPLY wire is grounded, the TCC will lock without the normal requirements being met. The only conditions that must be met are in place to prevent stalling if this feature is accidentally turned on or left on:

- Transmission above 1st gear
- Vehicle speed above 10 mph

L2 Shift Lever Position

In normal operation, the TCU controls shifting and the transmission will upshift through the gears at the appropriate speeds up to the shift lever position. For example, it will upshift until it gets to 3rd gear when the shift lever is in the L3/Drive position. Putting the shift lever into the L2 position is a special case. Instead of just being the upper limit for gear selection, it actually puts the transmission directly into 2nd gear. This can be useful in special situations. For example, it may help reduce wheel spin when pulling away from a stop on a slippery surface.

Speed Checks

There are vehicle speed checks in place to protect the drive train if a gear is selected (either with the shift lever or with manual bump up / bump down shifting) that is too low for the current vehicle speed. In this case, the TCU will not electronically execute the requested downshift. However, due to the mechanical / hydraulic makeup of a transmission, the TCU does not always have absolute control over gear selection. So even though the TCU is programmed to do all it can to protect the drive train, the driver must still use caution and common sense when requesting a downshift. Ultimately, the well being of the vehicle and its occupants is the driver's responsibility.

The LED on the front face of the TCU operates as follows:

On Solid: TCU powered up and working normally.

Rapid Flashing: An error code has been set. Select ERROR CODES from the main menu to check and clear error codes.

Slow flashing: TCU is in Flash Mode. Make sure the FLASH ENABLE wire is not grounded, then key off, wait about 10 seconds and key back on.

Transmission Information

Transmission Troubleshooting

The Shift Plus 2 system relies on properly functioning components within the transmission to do its job correctly. Some of those components can be checked by measuring resistance between the appropriate terminals in the TCU's main connector. To perform the testing, disconnect the main connector from the TCU and probe the pairs of terminals with a multi-meter set to measure resistance. Terminal number are molded into the main connector.

Component (4L60E / 4L80E)	Terminals at...				Ohms (at 70°F)	
	TCU		Trans		4L60E	4L80E
Shift Solenoid A	4	13	E	A	20 - 30	
Shift Solenoid B	4	14	E	B	20 - 30	
Force Motor	1	10	D	C	3.5 – 8.0	
----- / TCC / TCC	4	11	E	S	n/a	10 - 15
TCC / ----- / -----	4	20	E	T	20 - 30	n/a
TCC PWM / ----- / Sol. C	4	15	E	U	10 – 15	n/a

Transmission Retrofit Details

The mechanical portion of this transmission swap is similar to swapping a 700R4 into an older model vehicle that was originally equipped with a Powerglide, TH350 or TH400 transmission. Depending on the application, the driveshaft may need to be lengthened or shortened. The crossmember may need to be moved and the transmission mount, bellhousing and shift linkage may need to be modified. The starter may need to be replaced as well. If you are installing a high performance aftermarket converter, you may even need to drill the flexplate holes oversize in order to accommodate larger-than-factory bolts. Be sure to check this before attempting the swap. (It's a hassle to have to remove the transmission from the car simply because the converter bolts would not go through the flexplate!)

Use the dimensions listed below to determine the proper amount to move the crossmember and the amount to have the driveshaft shortened or lengthened.

Transmission	Overall Length	Distance to Crossmember Mount	Bellhousing Bolt Pattern
4L60E (1993-1996)	30 ¾"	22 ½"	Chevy
4L60E/4L65E (1996-later w/ removable bellhousing, non-LS1)	30 ¾"	23 ¾"	Chevy
4L60E/4L65E (1998-later w/ LS1)	31 5/32"	23 19/32"	Chevy
4L80E/4L85E (Std. 2WD)	32 11/16"	30 3/8"	Chevy
4L80E/4L85E (HD 2WD)	31 15/16"	30 3/8"	Chevy
4L80E/4L85E (HD long)	33"	30 3/8"	Chevy
700R4/4L60	30 ¾"	22 ½"	Chevy
2004R	27 11/16"	27"	Chevy, BOP, Fit-all*
Powerglide	27 11/16"	20 9/16"	Chevy, BOP
TH350 (6" tailshaft)	27 11/16"	20 3/8"	Chevy, BOP, Fit-all*
TH350 (9" tailshaft)	30 11/16"	20 3/8"	Chevy, BOP, Fit-all*
TH350 (12" tailshaft)	33 27/32"	20 3/8"	Chevy, BOP, Fit-all*
TH400 (C tailshaft)	28 3/8"	26 15/16"	Chevy, BOP
TH400 (D tailshaft)	33 27/32"	27 15/16"	Chevy, BOP
TH400 (13" tailshaft)	37 7/8"	27 21/32"	Chevy, BOP

***Fit-all: refers to a bellhousing configured to accept either a Chevy or BOP engine (BOP = Buick, Olds, Pontiac, Cadillac)**

Both the 4L60E/4L65E and 4L80E/4L85E have Chevy bellhousing bolt patterns.

Additional 4L60E/4L65E Notes

Header / Exhaust Clearance

There are several different bellhousing configurations for the 4L60E/4L65E transmission. The earlier models (1993-1996) have an integral bellhousing identical to the 700R4. In some cases, the dust cover mounting ears will have to be cut off to accommodate header collectors. This can easily be accomplished with a hacksaw. The later models (1996-later) have a fully circumferential, bolt-on bellhousing. It is important to use the correct bellhousing for your application. The LS1-style 4L60E/4L65E transmissions have a unique bellhousing and input shaft. These types are not direct replacements for the non-LS1 applications.

Some headers will interfere with the starter hump on the bolt-on bellhousings. It may be necessary to either dimple the header or cut off the starter hump.

Starter Clearance

The bellhousing may require modifications if you intend to use a stock starter.

Shift Lever

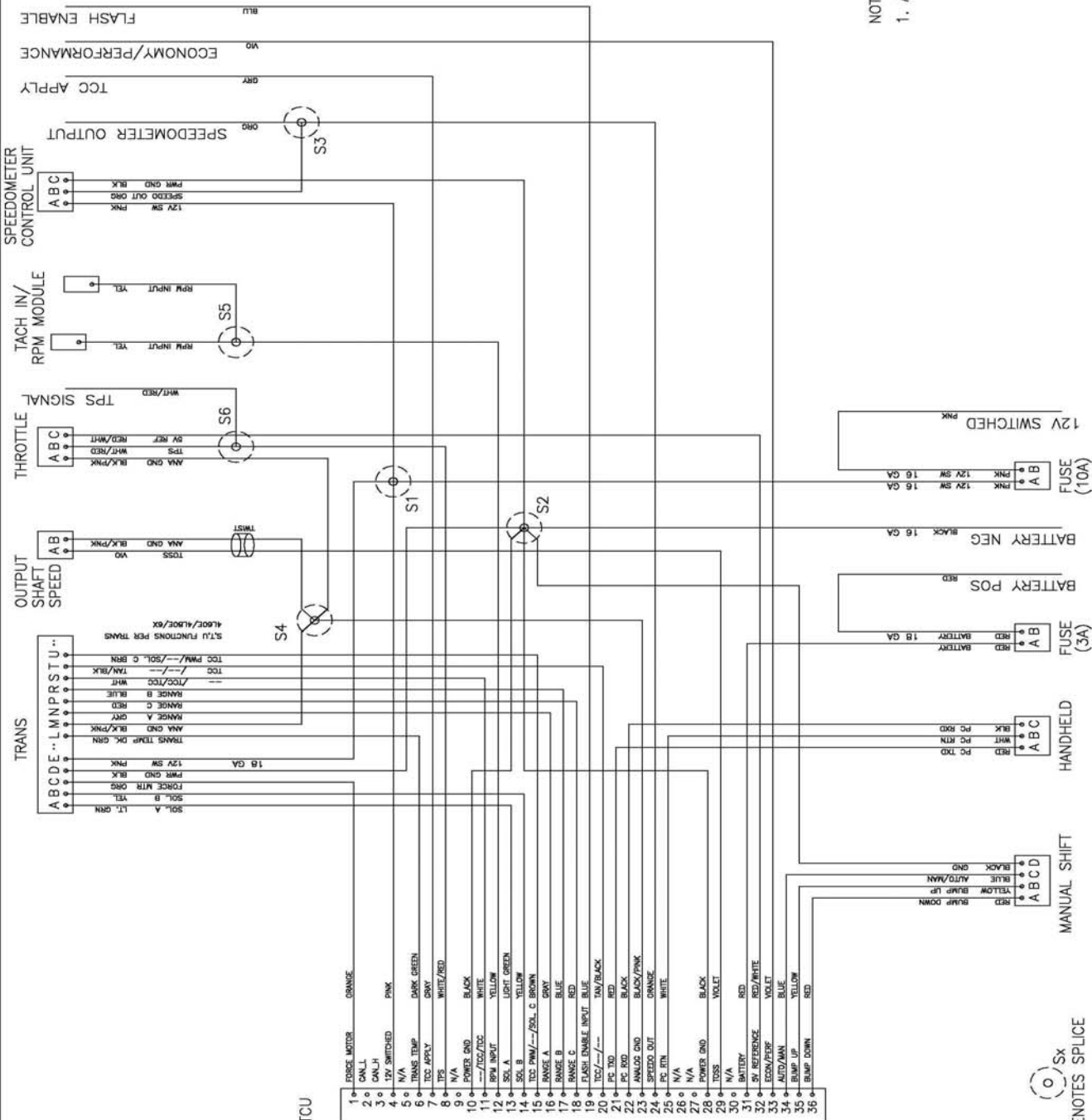
Many 1996-later, two-piece case transmissions (primarily trucks) have a shift lever that is about 1" longer than the early-style found on 700R4, TH350 and TH400.

Cooler Lines

Your existing lines may have to be bent to connect to a 1996-later, two-piece case transmission. These units have fittings that are parallel to the ground instead of being angled down. You may also need to change the case fittings as many 1996-later transmissions are equipped with the factory quick-connect style.

NOTE: Do not use Teflon® tape if replacing cooler fittings. It can cause the case to crack due to over tightening.

REV	REVISIONS	DATE
1	INITIAL RELEASE (BASED ON PROTOTYPE (REV. B))	05/25/10



NOTES:
1. ALL WIRE IS 20 AWG EXCEPT AS NOTED.

HARNES	
WIRING SCHEMATIC	
DATE: 05/25/10	
REV: A	INSTRUC. PN: SHEET NO. 1 OF 1

--1 Year Limited Warranty --

This B&M product is covered for one year from the date of retail purchase to be free of defects in material and workmanship to the original purchaser (not warranted against normal wear, misuse or abuse). This warranty covers the original purchasing consumer. This warranty is limited to repair or replacement by B&M of any B&M part that fails because of a defect in materials or workmanship. Implied warranty: Any warranties implied by law are limited to the duration of this warranty. (except in those states where prohibited by law).

Note: Complement your Shift Plus 2 Transmission Control Unit with some of the following products. Check the B&M Racing website at www.bmracing.com for various shifter, transmission, and torque converter options:



Cast Aluminum Deep Pan
#70295 (4L80E)
#70260 (4L60E)



Bracket/Lever Kit
4L60E/4L65E/4L80E/4L85E
with PRNDL switch
#70499 (Bracket only)
#75498 (Bracket and Lever)



B&M Throttle Position Sensor
for
Carbureted applications
#120002



B&M Speedometer Control Unit
#120004



Pro Stick Shifter
4L80E / 4L85E
with PRNDL switch
#80706 (with aluminum cover)
#80701 (without aluminum cover)



Quicksilver Shifter
4L60E/4L65E/4L80E/4L85E
with PRNDL switch
#80683

Technical Service

A highly trained technical service department is maintained by B&M Racing to answer your technical questions, provide additional product information and offer various recommendations.

Technical service calls, correspondence, and warranty questions should be directed to the following address:

B & M Racing and Performance Products
9142 Independence Ave.
Chatsworth, CA 91311
Phone (818) 483-1366
Monday-Friday 7AM to 4PM PST