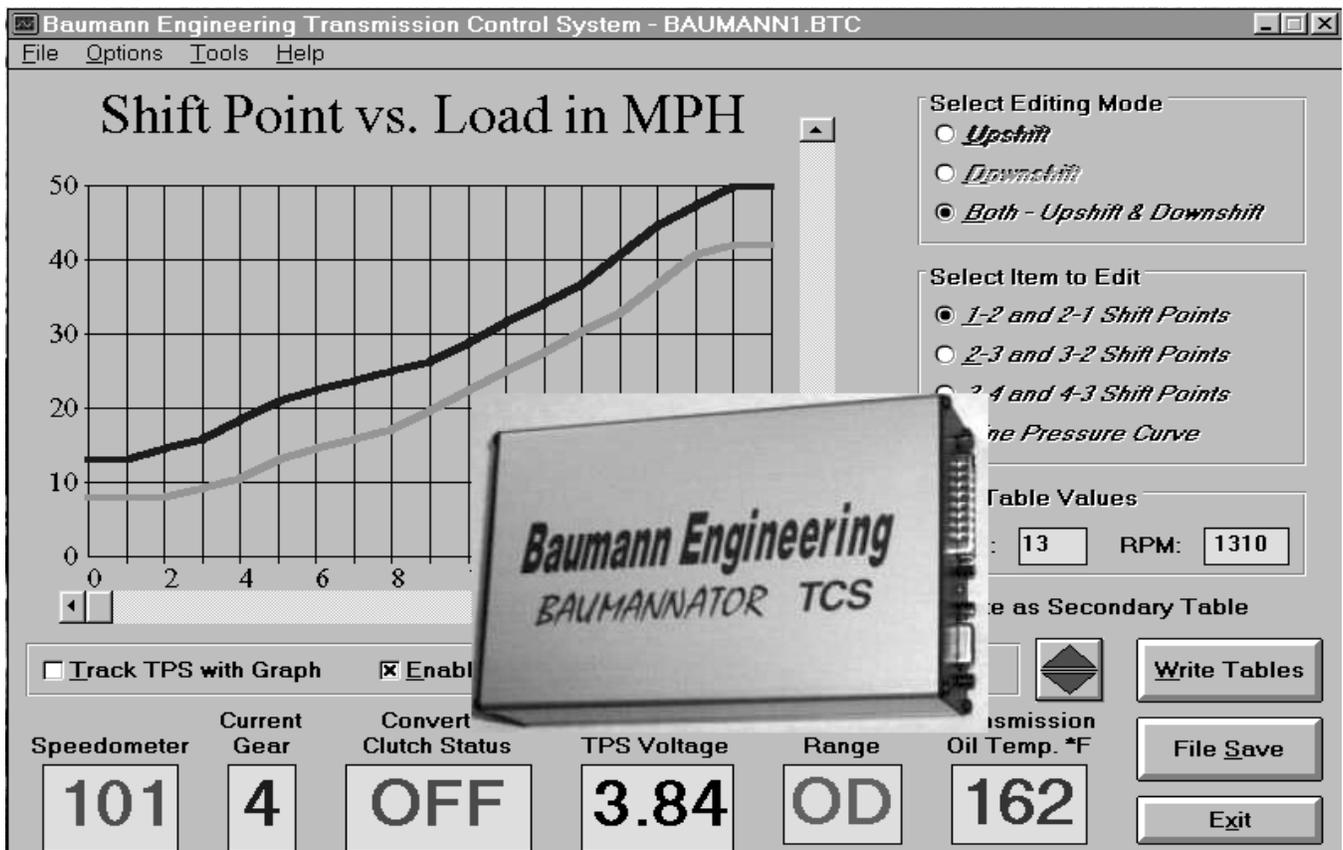


Baumann Engineering

Electromatic Performance

Baumannator ™

*T*ransmission *C*ontrol *S*ystem



Installation and Operation Manual

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Baumannator Transmission Control System instruction manual

created June 25, 1997

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WARRANTY: *Baumann Engineering is dedicated to producing the highest quality products available in the industry and is committed to customer satisfaction. Because we have no control over the circumstances under which our products are used, we can assume no more responsibility for damages (consequential or otherwise) or defects in materials and workmanship than the original purchase price of our product. Baumann Engineering will repair or replace all defective components unconditionally for a period of one year from date of sale. This Warranty does not cover damages due to abuse or improper application or connection of the device. After the Warranty period, Baumann Engineering will service this device for a nominal fee.*

Application Coverage

This system works with all Ford AOD-E, AOD-EW, 4R70, 4R70W and E4OD automatic transmissions. 4R70 is the new SAE-standardized term for AOD-E, with the “W” suffix indicating that the transmission contains a “wide-ratio” gear train, thereby giving it a 2.84-1 first gear ratio instead of the standard 2.40-1.

Preparation:

AOD-E/4R70W:

Before installing the TCS, you must make sure that the transmission has a high-impedance (about 10-ohms) torque converter clutch solenoid. If the transmission is from a 1992-1994 application, it will always contain a low-impedance (about 1-ohm) solenoid. All 1995 transmissions with the exception of LTD/Grand Marquis/Town Car applications use the low impedance solenoid as well. All 1996 and later units utilize the proper high-impedance solenoid and do not require any change. The early low-impedance solenoid will cause damage to the TCS due to excessive current draw and should never be used.

To verify which solenoid is installed in your transmission (if unsure) you may either remove the pan and look at the part number prefix stamped on the solenoid (shown in Figure 1) or measure it with an ohmmeter. The high-impedance (correct) solenoid will be marked with an “F5AP” or later prefix, while the low impedance unit will always be marked with an “F2VP” prefix. To verify with an ohmmeter, connect the transmission harness to the transmission bulkhead connector, set the ohmmeter on the 1X range and connect between the solid red wire (+12V) and the brown wire with an orange stripe (converter clutch solenoid -) at the transmission harness. (Please note that the converter clutch negative wire can also be colored purple with a yellow stripe, usually the case if the transmission harness is not from a Mustang.) The correct solenoid will register at about 10-ohms, while the incorrect piece will give a reading of about 1-ohm. If your transmission has the incorrect (low-impedance) solenoid, obtain a high-impedance part from Ford under part number F5AZ-7G136-A. Install the solenoid by removing the transmission pan and removing one 10-mm bolt and the electrical connector from the old solenoid. Reinstall the new solenoid and transmission pan in reverse order of disassembly.

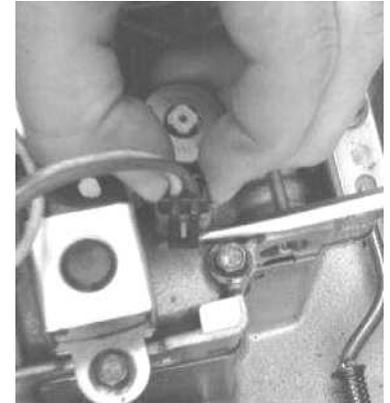


Figure 1. Solenoid

All Transmissions:

For a performance oriented or heavy-duty application, the valve body calibration must be addressed to increase transmission torque capacity. Despite the fact that they are electronically controlled, the valve bodies of these transmissions still control full-throttle shift firmness as well as the ultimate torque capacity of the transmission. Our ReCal Pro™ kits are available for these transmissions and are versatile enough, with five levels of shift firmness, to allow for precise calibration of the valve body to meet the vehicle's requirements.

Connection of the Baumannator TCS to Your Vehicle:

Retrofit Into Non AOD-E/E4OD Equipped Vehicles:

In order to connect the Baumannator TCS to your transmission, you will need an appropriate transmission harness. We recommend a 1994-1995 5.0L Mustang transmission harness (Ford part number F4ZZ-7D307-B) for this purpose. Most any other transmission harness can be adapted, such as a V6 Mustang or Mark VIII Lincoln, but other applications may contain extra connectors or could even be part of the main EEC harness. The 5.0L Mustang harness contains exactly the needed connectors (Transmission Bulkhead Connector,

Transmission Range Sensor or MLPS, Output Shaft Speed Sensor and Vehicle Speed Sensor) as well as a reasonable length of wire which terminates in a single 16-pin connector which we will remove.

Wiring in the TCS comprises four distinct steps:

- Mating the TCS stub harness that we provide to the transmission harness.
- Connecting the Neutral Safety Switch and Backup Lamp Switch to the existing wiring.
- Connecting to power, ground and the Throttle Position Sensor (TPS) at the EEC-IV system (or installing a TPS for carbureted applications).
- Connecting special functions, such as the Overdrive Cancel Switch, Table Selection Switch and ManuTronic input.

If desired, we can connect your transmission harness to the stub harness while providing the harness length that you request. Otherwise, you will need to connect the two harnesses as per the diagram in Figure 2 for AODE/4R70W transmissions or Figure 3 for E4OD transmissions. These diagrams and the TCS pin description tables which follow them indicate the colors used in the OEM Ford transmission wiring harnesses in order to simplify the process of adapting the TCS to the original Ford harness. Please note that the wiring color codes are often abbreviated in the diagrams and tables, with a “slash” separating the main wire color from the stripe color. For example, a dark green wire with a white stripe would be designated as DG/W, while an orange wire with a black stripe would be designated Or/Bk.

The Transmission Range Sensor or TRS (also known as Manual Lever Position Sensor or MLPS) is mounted on the transmission shift linkage on the driver’s side of the transmission. It serves three different functions by informing the TCS of which position the shifter is in (P, R, N, D, etc.), and also serving as the Neutral Safety Switch (allowing engine cranking in only Park and Neutral) and the Backup Lamp Switch. The Neutral Safety Switch can usually be accommodated by connecting to the original wiring, color-for-color, with a few exceptions. Earlier vehicles use the same color wire going into and out of the switch (red with a blue stripe) while the AOD-E harnesses will have a white wire with a pink stripe coming into the TRS from the “Start” terminal of the ignition switch. On an earlier vehicle, simply match the white/pink wire with the vehicle’s red/blue wire that feeds from the ignition switch. Backup lamps can be connected in a similar fashion, where the feed wire from the TRS to the lamps is black with a pink stripe and will almost always match color-for-color. The fuse panel feed to the TRS for the backup lamps will probably be purple with an orange stripe (although a Mark VIII harness will use white with light blue for this purpose) and will match many later vehicles, color-for-color. Other vehicles may require investigation to determine which wire is the “hot-in-run” feed for the backup lamps, before the connection can be made. Be extremely careful as the purple/orange color code is also used at the bulkhead connector for shift solenoid #2 and interchanging these two wires will result in improper gear selection, in addition to inoperative backup lamps.

The system utilizes two ground wires, main ground and solenoid ground. On an EEC-IV equipped application, main ground should be attached to the EEC-IV PCM at pin 40 or 60, while carbureted applications should utilize a ground location which has a relatively low resistance to the negative battery terminal. Solenoid ground

should be hooked to a separate location, to prevent noise from being conducted into the main system. In an EEC-IV equipped application, system power should be drawn from pin 37 or 57 of the PCM via a 10 AMP fuse. Otherwise, a source of 12 volt switched power (hot in run only) should be used and should be protected by a 10 AMP fuse as above.

The Throttle Position Sensor requires two connections for an EEC-IV system. The signal from the TPS connects to pin 47 on the EEC-IV PCM and can be intercepted at that point, while Vref (reference voltage) connects to pin 26 at the PCM. For a non EEC vehicle (a standalone application, such as a carburetor), a suitable TPS should be attached to the throttle linkage and connected to the TCS via three wires. The ground (signal return) wire from the standalone TPS should be connected to the main system ground as close to the TCS as possible. The signal wire connects to the TPS input of the TCS at pin 14, while the Vref (power) wire for the sensor should connect to Vref at pin 15 of the TCS.

Two types of overdrive cancel switches (ODCS) may be used, depending upon the application. A normally-open momentary push-button switch, similar to most OEM applications, may be used. In this circumstance, the TCS powers-up with overdrive enabled, and can be disabled by pressing and releasing the switch. Pushing the switch again will re-activate overdrive, essentially “toggling” overdrive on or off with each press of the switch. Another option is simply using an On-Off style switch, such as a toggle or latching push-button switch for this purpose. In this mode, the TCS simply disables overdrive when it sees 12 volts applied to the ODCS input. With either type of switch, you will need to connect one side of the switch to system power (12 volts) and the other terminal to the ODCS input of the TCS. An LED (Light Emitting Diode) or small lamp is used to indicate when overdrive is locked-out. If an LED is used, be sure to add a dropping resistor of about 1000-ohms (a ¼ or ½ Watt resistor is fine, and readily available at Radio Shack or any electronics store) in series with the LED. Also, pay attention to the polarity of the LED, the Anode should be connected to system power, while the Cathode, or negative, should connect to the ODCIL output of the TCS. Please note that an OEM Ford O/D cancel switch will have a dropping resistor built-in, if it uses an integral LED.

Adaptation to Factory-Equipped AOD-E/E4OD Vehicles:

It is possible to use the Baumannator TCS in a vehicle which was originally equipped with one of the intended transmissions. This could be done in conjunction with an engine management system upgrade (such as an F-150 Lightning mass air flow conversion or the use of a tunable after-market engine management system) that no longer supports the transmission. Use of the Baumannator for this purpose allows flexibility in choosing the engine management system, in addition to the increased control, performance and transmission durability afforded by the Baumannator TCS.

There are essentially two methods that can be employed to accomplish such a conversion. Using the wiring diagrams and pin connection tables in this manual in addition to factory wiring diagrams, it is possible to modify the factory wiring harnesses to allow use of the Baumannator with a different engine management system. We can assist this process by providing additional information or advice when available. Many people, however, prefer a more “turn-key” implementation. In such cases, we have teamed up with Pro-Flow Technologies/Best Products to provide a complete system to solve both engine and transmission control concerns in these applications.

For 1994-1995 Mustangs, Pro-Flow manufactures a complete plug-in harness which will allow the use of a 1993-level EECIV PCM to be fitted to the vehicle in conjunction with a special version of the Baumannator TCS for transmission functions. There are many advantages to using the 1993 PCM in this application, including the ability to use recalibrated MAF meters without detonation problems at full-throttle, no ignition timing retard during shifts, no engine torque reduction strategy, increased availability of after-market products, engine control strategies which are more modification tolerant and better vehicle performance. All of these advantages come in addition to the previously mentioned features and advantages of the Baumannator TCS. The Pro-Flow system can be provided complete with a 1993-level PCM and barometric pressure sensor, as needed. Tunability of the electric cooling fan is also achieved via an enhancement to the PC-based tuning interface of the Baumannator TCS, allowing low and high speed fan modes to be set for specific engine coolant temperatures.

In addition to the Mustang system, a Lightning mass air conversion kit using the Baumannator will also be available shortly. Other applications will be developed as market demand dictates. If you have a specific application for a turn-key harness that you would like to see available, please contact Baumann Engineering or Pro-Flow Technologies. For more information about these products, please inquire with Baumann Engineering or Pro-Flow Technologies.

Connection of Special Baumannator Functions:

The table selection switch should be an On-Off type switch, such as a toggle or latching push-button switch which applies 12 volts (system power) to the table select input at pin 11 when turned on. This is similar to the On-Off switch style input for ODCS as mentioned above. When the switch is turned on, the TCS will use the secondary calibration tables, allowing a completely different personality or calibration to be selected for the transmission at any time. The Table Selection input may also be connected to a nitrous oxide system to provide an alternate calibration for use when the nitrous system is engaged. Other uses for this input include a “Sport/Economy” type switch, or even a “Normal/Passenger Punishment Mode” switch. The usefulness of this input is limited only by your imagination.

The final connection is the special “Manutronic” function input. In a Ford vehicle with factory speed control (cruise control), you may use the steering-wheel-mounted speed control switches to manually select any gear at any time once you engage the ManuTronic mode. For more information concerning the operation of ManuTronic, please refer to the operation section of this manual. This mode only requires a one-wire connection to the speed control system to become operational. The ManuTronic input of the TCS (pin 18) should be connected to the light blue wire with a black stripe or dot which runs from the speed control amplifier to the steering wheel brushes at the steering column. The ManuTronic system should be disabled in the TCS configuration if not utilized. It is also possible to configure ManuTronic to work by itself in a vehicle without speed control, please call Baumann Engineering for more details.

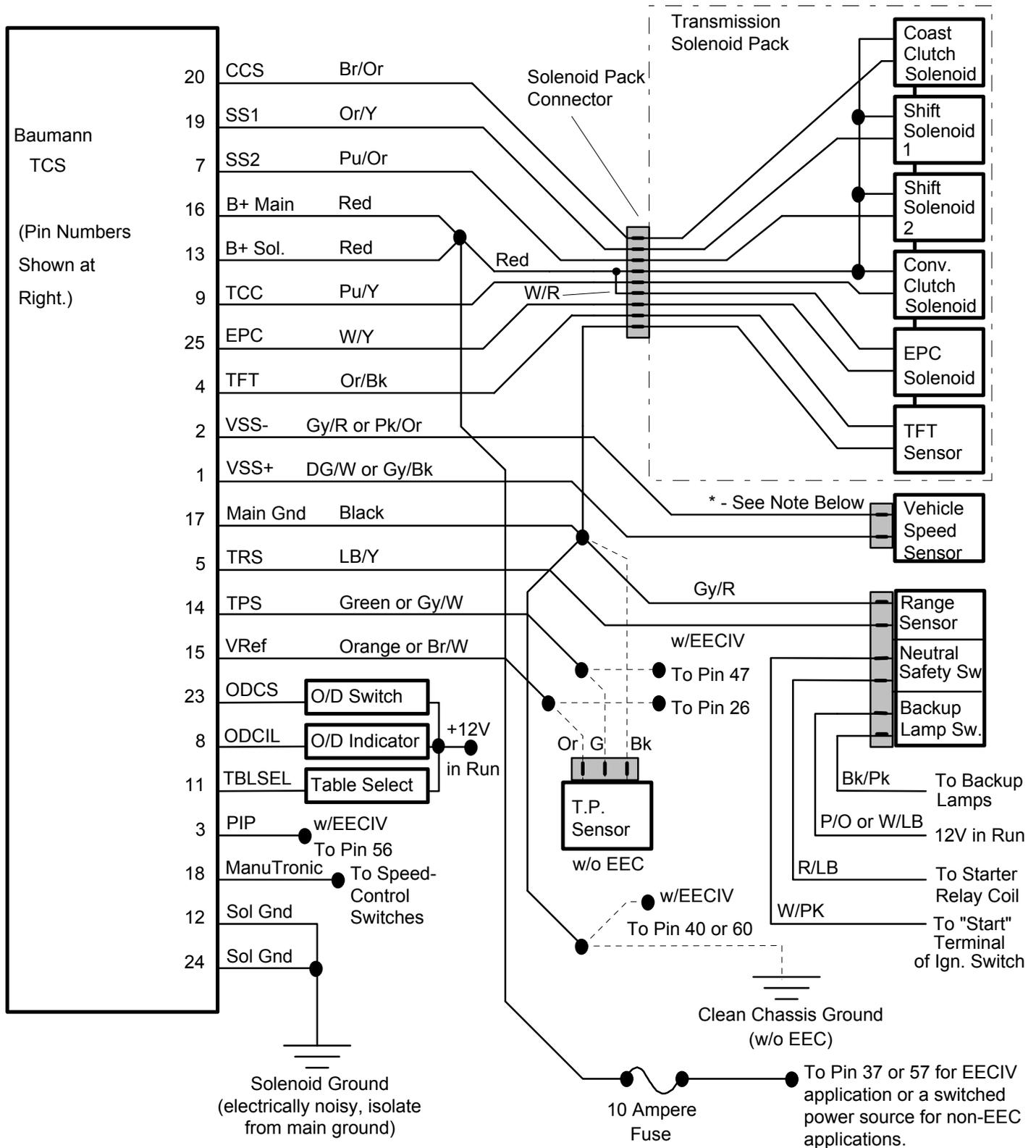


Figure 3. Connection Diagram for E4OD Transmission

TCS Module Pin Descriptions:

The following signals are shared with an existing EECIV engine management system by connecting to the appropriate pin numbers or are connected as necessary in a non-EEC application.

Signal Name	BE TCS Pin Number(s)	Function	EECIV Pin Number(s)	Non-EEC Connection	Original Ford Wiring Color
Main Ground	17	Main System Ground	40 or 60	A clean ground, best near battery	Black or Black/White
VPWR	16 and 13	Main System Power	37 or 57	A 12V source, switched with ignition	Red
VREF	15	Reference Voltage (Power) to Throttle Position Sensor	26	Orange wire at TPS	Orange or Brown/White
TPS	14	Signal from Throttle Position Sensor	47	Green wire at TPS	Green or Grey/White
PIP	3	Tach Signal	56	Leave unconnected initially	Dark Blue or Grey/Orange

The following connection needs special attention:

Solenoid Ground	Pins 12 & 24 of the Baumann TCS	This is a separate dedicated ground for the electrically noisy solenoid circuits. It should be terminated with a ring terminal to allow connection to the body sheet metal within one to two feet of the TCS. Both pins should be used to minimize voltage drop.
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The following signals allow use of enhanced features when connected:

Alternate Table Select	Pin 11 on the Baumann TCS	Allows calibration switching "on-the-fly" for "Sport/Economy" modes or special racing or nitrous calibrations. A 12 volt level on this pin enables the secondary table.
ManuTronic	Pin 18 on the Baumann TCS	When connected to the Speed Control Command input, allows manual gear selection via the Speed Control switches.

Signal Name	BE TCS Pin Number	Function	EECIV Pin Number *	Original Ford Wiring Color *
SS1	19	Shift Solenoid #1	51 - AOD-E 52 - E4OD	Orange/Yellow
SS2	7	Shift Solenoid #2	52 - AOD-E 19 - E4OD	Purple/Orange
EPC	25	Electronic Pressure Control	38	White/Yellow
TCC	9	Converter Clutch Solenoid	53	Brown/Orange (some AODE) or Purple/Yellow
TOT (TFT)	4	Transmission Oil Temp. / Transmission Fluid Temp.	49 - AOD-E 42 - E4OD	Orange/Black
MLPS (TRS)	5	Manual Lever Pos. Sensor / Transmission Range Sensor	30	Light Blue/Yellow
VSS+ (TSS)	1	Trans Speed Sensor -AODE Vehicle Speed Sensor or Speedometer Out - E4OD	5 - AOD-E 3 - E4OD	Dark Green/White - AODE/E4OD Grey/Black - some E4OD
VSS- (TSS Gnd.)	2	Ground at TCS for AODE Vehicle Speed Sensor Return or Speedometer Ground - E4OD	Ground for AOD-E 6 - E4OD	Grey/Red - AODE Black or Pink/Orange - E4OD
ODCS (TCS)	23	O/D Cancel Switch / (Trans. Control Switch)	41	Tan/White
ODCIL	8	O/D Cancel Indicator Lamp Not used for 94-95 Mustang 5.0L	55 - AOD-E 32 - E4OD	White/Light Green
CCS	20	Coast Clutch Solenoid - (E4OD Only)	55 - E4OD Only	Brown/Orange

Signal names in parenthesis are the new names based upon SAE nomenclature.

* The EECIV pin numbers and Ford wiring colors given above are generalizations based upon a few different applications and may not necessarily correspond to every application. Therefore, this information is given for guidance only and the factory wiring diagram for the vehicle in question should be consulted when adapting the Baumannator TCS to an existing AODE/E4OD installation.

General Installation Guidelines:

The Baumannator TCS should be mounted within the passenger compartment of the vehicle in a protected location. Mounting can be accomplished under the dash, behind a kick panel or under the seat, provided that the TCS and wiring are not subject to damage. Under-hood mounting is not possible with the TCS, as it is not waterproof nor is it rated for under-hood temperatures. Passenger compartment mounting is also necessary to provide easy access to the nine-pin serial port connector on the TCS, which is used to interface to a PC for programming and diagnostics. When mounting the TCS, be sure to provide ready access to the nine-pin serial connector to ease tuning and diagnostics. If you will be using the desktop programming adapter (AC adapter), install the TCS so that it may be unplugged and removed easily for transport to a desktop PC for programming.

All electrical connections should be made using 60/40 rosin core solder if possible. Cover the connection with heat-shrinkable tubing whenever possible to provide improved insulation and mechanical strength. Individual connector terminals can be connected to via a “piggy-back” method, where the terminal is removed from the plastic connector housing to allow the new wire to be soldered on to the terminal, on top of the original wire. Two wires may be connected together by twisting them together longitudinally, soldering and then covering with the appropriate size of heat-shrinkable tubing.

To connect the TCS to a host PC, simply use a standard (straight-through, not null-modem) nine-pin male to female serial cable to connect to an available COM port on the PC. If necessary, use a 9 to 25 pin adapter at the PC end of the cable to work with a 25-pin style port. Load the PC host software according to the instructions on the diskette and select the correct COM port (the one you used to connect to the TCS) from the software setup dialog box. System requirements for the host software are: 386SX-16Mhz CPU or better, Windows 3.1 or higher, at least 2MB of RAM and 3MB of free disk space. A laptop PC is preferred, in order to provide in-vehicle tunability, but a desktop machine can be used with our optional AC adapter. The tuning software has built-in documentation and help, but additional assistance can be found by calling Baumann Engineering if needed.

System Operation:

Once all connections are in-place and have been double-checked, you may power the system up. Upon power-up, you should notice the status LED illuminated. The LED should be green, indicating first gear selection. As the vehicle is driven, the LED will change to indicate the current gear commanded by the TCS. For an AODE/4R70W transmission, the LED will indicate as follows: green in first gear, yellow in second, red in third and off in fourth gear. An E4OD installation differs somewhat and will provide the following results: green in first gear, off in second, red in third and yellow in fourth gear. If the status LED does not indicate the proper color for first gear upon power-up, or if other gears are indicated improperly, a wiring or controller configuration problem is indicated. If this occurs, turn off power immediately, check the wiring connections and the controller configuration and call Baumann Engineering for troubleshooting procedures if no problem is evident.

If connected and enabled via the PC-hosted configuration software, the ManuTronic feature will allow manual selection of all forward gears by pressing the “Accel” and “Coast” buttons of the OEM Ford speed control system. This feature is activated by pressing the “Off” button briefly while holding the “Coast” button down.

This “start-up sequence” insures that the ManuTronic feature will be mutually exclusive of the speed control system, since the “Off” button is used to engage ManuTronic. Additionally, pressing either the “Off” or “On” buttons once ManuTronic has been activated will cancel ManuTronic and return to regular programmed control of shift points. With ManuTronic engaged, a brief press of the “Accel” button will upshift to the next gear, while “Coast” will downshift to the next lower gear. ManuTronic also has a safety feature which inhibits downshifting if the engine RPM after the downshift will be greater than the upshift RPM of the top table cell for the corresponding automatic upshift. This prevents inadvertent over-revving of the engine due to an improper downshift if the driver makes a mistake.

Troubleshooting:

Warning: If the transmission does not begin to operate correctly *within the first few feet of the road test*, stop immediately, check the troubleshooting guide and call Baumann Engineering if assistance is required. In some cases, just a few blocks of operation with low fluid pressure can destroy a transmission.

If you have any questions, problems or product orders, please do not hesitate to call our technical support/order line at (864) 646-8920 (Monday-Saturday 10AM-6PM EST) (Our new telephone area code is (864), replacing (803)). If no one is available, please leave a detailed message and we will reply promptly.

