



# **TELORVEK TPI WIRING INSTRUCTIONS FOR LS-60A 2000-2002 4.8 / 5.3 / 6.0 LS-1 Fuel Injection System with Drive By Wire**

Thank you for purchasing the absolute finest of wiring kits for the General Motors fuel injection. We have taken considerable time to work out the circuitry so that you, the customer will understand at least some of what this is all about. We ask that you follow our instructions closely. We recommend a high pressure (60 PSI) in-tank fuel pump. Custom installations are available from Tanks, Inc. (phone # 320-558-6882) and Rock Valley (phone #800-344-1934) .

Computers in automobiles as well as the computers we use in our home or office are getting more and more sophisticated. The auto makers have the capability now to incorporate much more computing power into a small package. In complying with federal law, auto makers have toughened the emission outputs of their engines. In the older TPI engines the computer controlled, but did not look for or set a trouble code if the emissions control devices malfunctioned or were removed. The newer engine computers (like the one you are installing) not only look (sense) for but will set a trouble code if the emission control devices malfunction or are not installed <unless you have had your ECM reprogrammed to ignore such items>.

Just for the record, by the 1990 clean air act, it is illegal to remove the emission control devices from the engine they were intended to be used on. We have found by talking to customers throughout the country that most states are not enforcing this law, but it's something to keep in mind. Unless we have reprogrammed your ECM to remove the emissions we typically supply the emissions wiring to you so that Ron Francis Wiring remains emissions compliant.

Reprogramming of your ECM is required to disable the anti-theft built into it. We can provide this service for you. Please call if you have any questions.

**NOTE: Now that the automotive manufactures have made tremendous improvements in the emission outputs of their engines, they have now turned there attention to capturing and utilizing all fuel vapors generated by gasoline moving around the fuel tank as the vehicle is being driven down the road. This is accomplished by the canister purge tank, canister vent valve and fuel pressure sensor. This system requires that the fuel tank be sealed when the gas cap is on and the use of a non-vented gas cap. The pressure/vacuum in the tank is monitored by a pressure sensor installed in the fuel tank. The PCM controls excess pressure/vacuum through the canister vent solenoid and the vapors are utilized through the canister purge tank. Failure to install these devices will cause trouble codes to set unless you have your ECM reprogrammed to remove these items. We can perform this service for you.**

**IMPORTANT: Should you eliminate a sensor a trouble code will probably set. If you are not concerned about a functional check engine light this is not a problem. If your goal is to have a functional check engine light and have removed some or all of the emissions controls the computer/ECM can be reprogrammed to remove this functionality. Ron Francis Wiring does perform this service for some applications, please call for more information.**

**Ron Francis Wiring fuel injection wire harnesses are “ALL” designed to follow the electronic circuitry of the vehicle your engine was removed from! Following this simple procedure allows our fuel injection harness customers to have their vehicles diagnosed by “ANY” GM dealer or reputable repair facility familiar with diagnosing fuel injection electronic systems.**

**Ron Francis Wiring does not re-engineer electronic circuitry that a vehicle manufacturer has spent millions of dollars on testing and designing. Our goal is to allow an “easy”, “neat”, “pain free” installation through quality installation instructions and a state of the art wiring kit.**

**If your vehicle experiences starting or runability problems, 99% of the time it is some sort of mechanical, NOT A WIRING PROBLEM. Fuel injection engines still run similar to carbureted engines, the difference being that the engine computer receives “inputs” from various sensors throughout the engine. The computer then uses this information to calibrate fuel delivery and engine timing.**

**Diagnosing a NO SPARK situation is the same on a computer controlled fuel injection engine as it is on a carbureted engine. Spark control, even though it may be done slightly different depending on engine year and make, is still essentially the same. A sensor sends a signal to the engine computer allowing spark to be provided to the plugs, similar to a carbureted engine.**

**Thank you for purchasing our products!**

## DIAGNOSTIC PROCEDURES

It would be impossible to cover all the procedures that GM requires to diagnose all possible problems a fuel injection system could have in a set of installation instructions. If this is the first time you worked with a fuel injection system, we highly recommend purchasing a shop manual from the year, make and model the engine and computer came from. The book will not only help with diagnosing problems but will also teach you about the engine you just installed.

### WARNING!

**After the kit installation is complete and it is necessary to diagnose a starting or drive ability problem, follow the procedures recommended in the shop manual. All voltage tests must be preformed using a HIGH impedance, digital voltmeter. DO NOT use a test light on this system! DAMAGE WILL BE DONE to the engine computer if a test light is used on this system.**

**POWERTRAIN CONTROL MODULE (PCM) "NEW"** (GM PART #12200411) In 1994 the prom (mem-cal) is now part of the PCM and can not be removed. GM now programs the PCM for the vehicle it is being used in. In the past you were able to purchase the PCM and then purchase a prom (mem-cal) to install in the computer which tells the PCM the type of vehicle, engine size, transmission etc. After purchasing the PCM it MUST BE programmed for the engine it is being used on. It will be necessary to provide the dealership with a "VIN" number from a Camaro in order for them to program the computer.

**NOTE: A new ECM WILL NOT function WITHOUT first being programmed.**

**POWERTRAIN CONTROL MODULE (PCM) "USED"** If you purchased the engine and computer used it must be used in a application as it was in the vehicle it was removed from. If the engine originally had a manual transmission behind it and now you want to use the 4L60-E automatic transmission, the ECM will have to be re-programmed for that application or if the ECM was originally automatic and now you want to use manual it also must be reprogrammed. A "VIN" number is required to perform this procedure.

### STARTING INSTALLATION

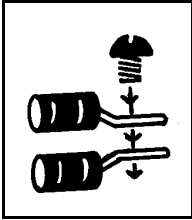
Since there are so many individual circuits to complete, we recommend that you connect them in the order that we prescribe. Disconnect the battery before starting and do not reconnect until instructed.

**TELORVEK PANEL LOCATION: (BEFORE DRILLING ANY HOLES)** The location of the TELORVEK panel and powertrain control module (PCM) can be any where you choose **INSIDE** the vehicle. They should be mounted in an accessible location, under the dash, under the seat or in the trunk are good. A lot of wires will be connected to the panel so the more accessible the panel, the easier the wire connections will go. After the Telorvek panel installation is complete, only the fuses need to be readily available.

If mounting the panel under the dash or seat, leave enough extra wire so it can be pulled down from under the dash or from under the seat after all the connections are made. The reason for this, the panel can be used as a BREAKOUT BOX for diagnosing (trouble shooting) problems in the future. Some diagnostic procedures require taking volt readings on wires to find a problem. It is a lot easier to sit in a seat then bending over a fender.

**IMPORTANT:** Check to be sure you have all the bags required for the installation. Each bag contains at least one sensor connection and approximately 20 feet of wire to reach the TELORVEK panel. We suggest opening bag #40 (mass air flow sensor) first. Plug the connector into the sensor and run the wires back to the TELORVEK panel. If they reach, then all the other sensor connections will also, because the MAF sensor is always mounted in front of the engine.

We have packaged three sizes of terminal forks. The red terminals are for the 18 gauge wires and the blue are for 16-14 gauge wires and yellow are for 10-12 gauge wires. Use the red forks when installing terminals on the wires unless other wise directed.



Always put the first terminal under a screw with the fat wire side down as in the drawing. Install any second terminals just the opposite as this will allow the screw to hold squarely and tight. The insulation from one terminal should not interfere with the one next to it.

Use a crimping tool that is designed for insulated terminals. If the tool punctures the insulation (plastic) or damages it in any way, you are using the wrong tool. The proper tool will only "flatten" the plastic and if the handles are squeezed completely, the proper crimp has been made. Get in the habit of test pulling at each terminal as you crimp it to the wire.

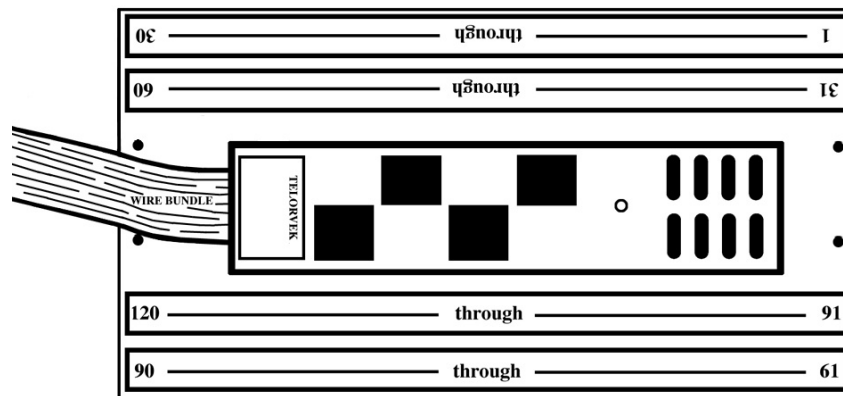
Any sensor that is difficult to hook-up should not be eliminated. All sensors are important if you desire your conversion to run as good as a factory engine. Eliminating any part of this kit WILL cause some portion of the EFI to work improperly.

**Ron Francis Wiring has made every effort to assure a quality product and can assure you that this system works well in your application. Once you have confirmed proper installation, any trouble you experience will be a defective part or seat of the pants repair. Your unit can be tested at any General Motors Dealership with no difficulty.**

**Numbered terminal block cover strip reference.**

The drawing below is for your reference on the correct positioning of the Telorvek fuel injection panel terminal block cover strips.

When connecting wires to the panel be sure the numbered terminals match the drawing below.



**Bag #40A MASS AIR FLOW SENSOR including INTAKE AIR TEMPERATURE (MAF):** On a factory installation, this sensor is mounted in the intake air duct between the air cleaner and throttle body. Plug the five gang black connector into the sensor and run the wires back to the panel. Connect the Tan wire MAF A->3 to #3, the Purple wire MAF B->2 to #2, the Black wire MAF C->30 to #30, the Pink wire MAF D->24 to #24 and the Yellow wire MAF E->1 to #1.

**Bag #41A ACCELERATOR PEDAL POSITION SENSOR:** This is the drive by wire pedal assembly. Once the Accelerator Pedal has been positioned and mounted, plug the ten gang connector into the pedal assembly and run the wires back to the panel. Connect the Gray wire ACC PED A->51 to #51, the Purple wire ACC PED B->52 to #52, the Lt Blue wire ACC PED C->53 to #53, the Tan wire ACC PED D->54 to #54, the Brown wire ACC PED E->55 to #55, the Dk Blue wire ACC PED F->81 to #81, the White wire ACC PED G->82 to #82, the Yellow wire ACC PED J->83 to #83 and the Dk Green wire ACC PED K->84 to #84.

**Bag #42A TPS AND THROTTLE ACTUATOR CONTROL (TAC):** The TPS sensor and TAC are located on the throttle body. Plug the connectors into the correct sensors (they will only fit the correct places) and run the wires back to the panel. Connect the gray wire TPS A->4 to #4, black wire TPS B->5 to #5, dark green wire TPS C->6 to #6, light blue wire TPS D->7 to #7, white wire TPS E->8 to #8, purple wire TPS F->9 to #9. Connect the brown wire TAC MOTOR A->73 to #73 and the yellow wire TAC MOTOR B->74 to #74.

**Bag #43A THROTTLE ACTUATOR CONTROL MODULE (TAC MODULE):** The TAC Module interfaces between the computer and the Throttle Actuator Control. This module should have been acquired from the donor vehicle, GM dealer or secondary parts market. Locate the module where convenient. We provide 10 feet of wire length but this module can be mounted near the Telorvek panel. Plug both connectors into the TAC Module and run the wires back to the panel. Connect the dark green TAC MOD C1 1->6 to #6, grey TAC MOD C1 2->4 to #4, black TAC MOD C1 3->5 to #5, dark blue TAC MOD C1 4->115 to #115, red TAC MOD C1 5->117 to #117, light blue TAC MOD C1 6->118 to #118, pink TAC MOD C1 7->23 to #23, brown TAC MOD C1 8->73 to #73, light blue TAC MOD C1 9->7 to #7, white TAC MOD C1 10->8 to #8, purple TAC MOD C1 11->9 to #9, orange TAC MOD C1 12->85 to #85, dark blue TAC MOD C1 13->86 to #86, gray TAC MOD C1 14->12 to #12, black TAC MOD C1 15->30 to #30, yellow TAC MOD C1 16->74 to #74. Moving on to connector two, connect gray TAC MOD C2 A->51 to #51, purple TAC MOD C2 B->52 to #52, light blue TAC MOD C2 C->53 to #53, tan TAC MOD C2 D->54 to #54, yellow TAC MOD C2 E->83 to #83, dark blue TAC MOD C2 F->81 to #81, white TAC MOD C2 G->82 to #82, brown TAC MOD C2 J->55 to #55 and dark green TAC MOD K->84 to #84.

**Bag #44 ENGINE COOLANT TEMPERATURE SENSOR:** The sensor is located in the head. Plug the connector into the sensor and run the black and yellow wires back to the panel. Connect the black wire ECT A->11 to #11 and the yellow wire ECT B->12 to #12.

**Bag #45 INJECTORS:** In 1994 GM has started to fire the injectors sequentially (one at a time) unlike in the past when the injectors were fired one bank (four) at a time. According to GM this did not improve horse power but was done for better emissions at low RPM'S. The injector wiring is in two sections, one for the left side injectors and one for the right side injectors. Note the color of wires running from the injector connectors. The left injector harness has pink, black, gray, white, red wires and the right injector harness has pink, light green, light blue, yellow and dark blue wires. Follow the paragraphs below on their connections:

**LEFT INJECTOR CONNECTIONS:** Starting from the front of the engine and working towards the fire wall, plug the injectors in as follows: injector #1 has pink & black, injector #3 has pink & gray, injector #5 has pink & white and injector #7 has pink & red wires.

**RIGHT INJECTOR CONNECTIONS:** Starting from the front of the engine and working towards the fire wall, plug the injectors in as follows: injector #2 has pink & light green, injector #4 has pink & light blue, injector #6 has pink & yellow and injector #8 has pink & dark blue.

After all the injectors are plugged in run all the wires back to the TELORVEK panel. **Note the injector harness has two pink wires.** Using the blue terminals, connect the pink wire INJ 1 B->21 to #21 and the other pink wire INJ 2 B->21 to #21. Using the red terminals, connect the rest of the injector harness wires as follows: black INJ 1 A->13 to #13, gray INJ 3 A->14 to #14, white INJ 5 A->15 to #15, red INJ 7 A->16 to #16, light green INJ 2 A->17 to #17, light blue INJ 4 A->18 to #18, yellow INJ 6 A->19 to #19 and dark blue INJ 8 A->20 to #20.

**Bag #46 EXHAUST GAS RECIRCULATION VALVE (EGR) NOTE: This wiring is not included if it has been eliminated from the ECM programming.** The EGR solenoid is mounted on the front right side of the engine. It must be connected or a trouble code will set. Plug in the connector to the EGR valve and run the wires to the panel. Connect the tan wire EGR A->31 to #31, black EGR B->32 to #32, brown EGR C->33 to #33, gray EGR D->34 to #34 and the red wire EGR E->35 to #35.

**Bag #47 CANISTER PURGE SOLENOID & CANISTER VENT SOLENOID: This wiring is not included if it has been eliminated from the ECM programming. NOTE: The connector for both solenoids is the same. Refer to the printing on the wires to ensure the correct wires are running to the correct solenoids.**

The Canister Purge solenoid is located on the left side of the manifold. This solenoid allows fuel tank vapors to be purged from the fuel tank and utilized by the engine. This connection must be completed or a trouble code will set. Refer to the vehicle shop manual for the correct plumbing of the vapor lines running from the tank to the solenoid. Plug the red connector with the pink and dark green wires into the canister purge solenoid and run the wires to the panel. Connect the pink wire CAN PURGE SOL A->23 to #23 and the dark green CAN PURGE SOL B->36 to #36.

The canister vent solenoid in a stock application is located back by the fuel tank. This valve is a pressure/vacuum relief valve which is controlled by the PCM and works in conjunction with the fuel tank pressure sensor which will be wired in later. Refer to the vehicle shop manual for the correct plumbing of this line. After plugging in the connector run the wires back to the panel. Connect the pink wire CAN VENT A->23 to #23 and the white CAN VENT B->37 to #37.

**Bag #48 COIL BANKS:** The LS-1 engine has a coil for each one of the eight cylinders. A factory harness (GM part #15320548) (not supplied) (two harnesses required, one left & one right) plug into each coil and ties all the left side coils and right side coils into separate eight gang connectors. The harnesses enclosed in this bag plug into the factory harnesses.

The left coil bank (drivers side) harness has red, dark green, brown, light blue, purple, orange and black wires. Plug the connector into the factory harness and run the wires to the Telorvek panel. Connect the red BANK 1 B->38 to #38, dark green BANK 1 C->39 to #39, brown BANK 1 E->40 to #40, light blue BANK 1 F->41 to #41 and the purple BANK 1 G->42 to #42. Using blue forks connect the orange BANK 1 H->43 to #43 and the black BANK 1 A->26 to #26.

The right coil bank harness has white, light green, tan, dark blue, purple, orange and black wires. Plug the connector into the factory harness and run the wires to the Telorvek panel. Connect the white BANK 2 B->44 to #44, light green BANK 2 C->45 to #45, tan BANK 2 E->46, dark blue BANK 2 F->47 to #47 and the purple BANK 2 G->48 to #48. Using blue forks connect the orange BANK 2 H->43 to #43 and the black BANK 2 A->26 to #26.

**Bag #49 KNOCK SENSOR WIRING (2):** These sensors will inform the computer of detonation and readjust the timing accordingly. Two knock sensors must be used and both are located under the intake manifold. A factory harness (GM #15372170) is connected to the sensors and runs out the rear of the intake. Plug the connector supplied into the factory harness and run the wires back to the panel. Connect the dark blue KNOCK A->61 to #61 and the light blue KNOCK B->62 to #62. The knock sensors detect detonation in the engine and advance and retard timing so the engine can run at maximum performance.

**Bag #50 CRANK POSITION SENSOR:** This sensor is located on the lower right rear of the engine behind the starter. Plug in the connector and run the wires to the panel. Connect the dark blue wire CRANK POS A->63 to #63, yellow wire CRANK POS B->64 to #64 and the light green wire CRANK POS C->65 to #65.

**Bag #51 CAM SHAFT POSITION SENSOR:** The cam shaft position sensor is located top center, rear of the engine. Plug the connector into the sensor and run the wires back to the panel. Connect the brown wire CAM POS A->66 to #66, pink CAM POS B->67 to #67 and the red CAM POS C->68 to #68.

**Bag #52 TACH:** The purple wire 69->TACH connects to #69 and runs to the dash mounted tach if desired. The tach will also require an ignition and ground connection. NOTE: Due to how the computer controls the tach signal you may have to adjust your tach to read on 4 cylinder mode for it to be accurate.

**Bag #53 MAP SENSOR:** The MAP sensor is located on the right rear of the engine. Plug the connector into the sensor and run the wires back to the panel. Connect the black wire MAP A->70 to #70, light green wire MAP B->71 to #71 and the gray wire MAP C->72 to #72.

**Bag #55 OXYGEN SENSORS (2):** This system originally had two rear oxygen sensors that monitored the catalytic converter function. We do not include wiring for these rear oxygen sensors. It is wise to have your ECM reprogrammed to keep codes from setting due to the absence of these two rear oxygen sensors.

Different Chevy/GMC/Cadillac models used different oxygen sensor connectors. We supplied wiring with the most common connector attached. If your oxygen sensors do not mate up with the connectors we supplied you, use Delco #AFS106 oxygen sensors.

This area of the vehicle is hot so keep the wires away from the exhaust. **Install the left and right front O2 sensors as close to the block as possible.** If you are using headers the O2 sensors should be installed in the collectors. **NOTE: The O2 sensors do not send a signal to the PCM until they reach 600 degrees. Mounting them in header collectors may take longer for them to heat up causing the PCM to stay in OPEN LOOP longer than normal. If you must install an adapter, use The Detail Zone part # OS-30.**

**LEFT FRONT O2:** The four gang connector with the purple, black, tan and pink wires running from it plugs into the left front oxygen sensor.

**RIGHT FRONT O2:** The four gang connector with the pink, black, brown and gray wires running from it plugs into the right front oxygen sensor.

Run all the wires back to the panel. Connect black wires LF FRT O2 D->29 and RT FRT O2 D->29 to #29. Connect the tan LF FRT O2 A->75 to #75, purple LF FRT O2 B->76 to #76, brown RT FRT O2 A->77 to #77 and gray RT FRT O2 B->78 to #78. Connect the pink wires LF FRT O2 C->79 and the RT FRT O2 C->79 to #79.

## Transmission Wiring

Two types of transmissions were available from the factory on the LS-1 engine. The computer controlled, electronically shifted 4L60-E automatic transmission and the computer controlled, electronically shifted 4L80-E automatic transmission. We have supplied the correct transmission wiring bags depending on the transmission type your kit was ordered for. Follow the paragraph that pertains to your transmission.

### 4L60-E Automatic Transmission Wiring

#### Wiring Bag #57

Un-coil the large harness and plug the connector into the transmission. Run the wires to the TELORVEK panel.

Connect the wires to the TELORVEK panel as follows: light green TRANS A->91 to #91, yellow TRANS B->92 to #92, red TRANS C->93 to #93, light blue TRANS D->94 to #94, black TRANS L->95 to #95, orange TRANS M->96 to #96, dark green TRANS N->97 to #97, tan TRANS P->98 to #98, dark blue TRANS R->99 to #99, gray TRANS S->100 to #100, brown TRANS T->101 to #101, and the purple TRANS U->102 to #102. Using the blue terminals connect the pink wire TRANS E->103 to #103.

### More Transmission Information

The PCM tells the 4L60-E transmission when to shift from gear to gear. The PCM is also looking for certain signals produced by the automatic as well as the manual transmission. If these signals are not received by the PCM, trouble codes WILL SET.

## 4L80E Automatic Transmission Wiring

### Wiring Bag #57A

Un-coil the large harness and plug the connector into the transmission. Run the wires to the TELORVEK panel.

Connect the wires to the TELORVEK panel as follows: light green TRANS A->91 to #91, yellow TRANS B->92 to #92, red TRANS C->93 to #93, light blue TRANS D->94 to #94, black TRANS L->95 to #95, orange TRANS M->96 to #96, dark green TRANS N->97 to #97, tan TRANS P->98 to #98, dark blue TRANS R->99 to #99, purple TRANS S->102 to #102 and the brown TRANS T->101 to #101. Using the blue terminals connect the pink wire TRANS E->103 to #103.

#### **TRANSMISSION SPEED SENSOR (4L80E ONLY):**

This sensor is located on the left side of the transmission just forward of center. Plug the connector into the sensor and run the wires back to the panel. Connect the red wire TRANS SP A->87 to #87 and the dark blue wire TRANS SP B->88 to #88.

**Bag #58 SPEED SENSOR/SPEEDOMETER:** A VSS signal input is needed on all General Motors TPI engines. If the PCM does not see that input a **CODE WILL SET**. The VSS input helps control transmission shifts, some of the EGR and IAC functions. Plug the connector into the sensor located on the right side of both the manual and automatic transmissions and run the wires to the TELORVEK panel. Connect the light green VSS A->105 to #105 and the purple VSS B->106 to #106.

**SPEEDOMETER CONNECTION:** An electric speedometer must be used in this application. Terminal #107 is the output to the dash mounted speedometer. Aftermarket gauge manufacturers will supply a chart based on the number of pulses per mile the speed sensor puts out. Terminal #107 supplies 4000 pulses per mile out of the PCM to the speedometer.

#### **Bag #59 PARK NEUTRAL POSITION SENSOR:**

This sensor is located on the shifter shaft of the transmission. Information from this sensor is given to the ECM to help determine what gear the transmission is manually in. Plug the four way connector into the sensor and run the wires back to the panel. Connect the tan wire PNP A->119 to #119, the gray wire PNP B->110 to #110, the orange wire PNP C->108 to #108 and the yellow wire PNP D->111 to #111.

#### **Bag #60 BRAKE SIGNAL (TCC CUT OUT RELAY) (AUTOMATIC TRANSMISSIONS ONLY): The**

**TCC cut out relay** is located in the Telorvek panel cover and is pre-wired. The transmission and torque converter clutch require a signal be sent to the PCM to tell it when the brakes are applied. This relay is designed to enable you to maintain the brake switch you already have in the vehicle. The purple wire 109->BRK SW connects to #109 and run to the cold side of the brake switch (hot only when the brakes are applied). This color matches our Panel wiring kit. Install a relay (Airtex part #1R1061, Standard Motor Products part #RY116 or GM part #14100455) in the connector located in the Telorvek panel.

**Bag #61 MALFUNCTION INDICATOR LAMP (MIL) and DATA LINK CONNECTOR (DLC):** The DLC is the diagnostic link for computerized testing at your local GM dealer or a hand held scanner. Please consider a very accessible location for this important part. Mount the connector in the desired location and run the wires back to the panel. Connect the black wires DLC 4->25 and DLC 5->25 to #25, red DLC 16->57 to #57 and the purple DLC 2->58 to #58.

The M.I.L. light can be any two wire un-grounded 12 volt lamp located on the dash board or where ever desired. Connect the pink 22->MIL to #22 and the brown 60->MIL to #60. Run the wires to the MIL light and make the connection. Connecting a MIL light on the dash is not necessary, the yellow L.E.D light on top of the TELORVEK panel performs the same function.

**Bag #63 FUEL PUMP:** Connect the tan wire 50->FUEL PUMP to #50 and run it to the positive terminal on the fuel pump. Connect the black wire FUEL PUMP GROUND to the negative terminal on the pump and run the other end to a good ground. Install a relay ( Airtex part #1R1061, Standard Motor Products part #RY116 or GM part #14100455) in the connector located in the Telorvek panel.



**Bag #64 (THE ALTERNATOR)** Connect the black plug into the alternator and connect the light blue wire to #113 on the panel. This is for the regulator circuit. A quality large gauge wire (not supplied with this kit) will be required to run from the large stud/battery terminal of the alternator and run to the starter solenoid or wherever your positive battery cable attaches to. We recommend at least a 6 gauge wire for this circuit.

## OTHER CONNECTIONS

The terminals listed below are the remaining factory computer connections running out of the PCM. These are not used in an aftermarket applications due to the incompatibility with aftermarket parts. If you wish to attempt to make connections to these terminals, a shop manual will be needed. The Detail Zone does not offer any wiring connections to these terminals.

#116 C2 17 Air conditioning request.

## FINISHING UP

The PCM accepts two connectors. The TELORVEK panel has two PCM connectors running from it with different color plugs. Stamped in the case of the PCM next to the two harness connections is the color harness plug that plugs in to that slot. Plug the connectors into the computer and tighten the connector bolt into the computer.

Three connections remain, battery hot, ignition and battery ground. These three wires are running out of the TELORVEK panel along with the wires to the computer. Un-coil them and wire as follows:

**BATTERY CONNECTION:** The long red wire running out of the panel connects to a battery (hot all the time) source. Run this wire to the positive battery post if the TELORVEK panel and battery are mounted in the rear of the vehicle or to the starter solenoid if the panel is mounted towards the front of the vehicle. If your vehicle is equipped with a master disconnect, connect this wire to the hot side of the switch.

**IGNITION CONNECTION:** The long orange wire is connected to a keyed ignition source (hot with the key in run and crank).

**NOTE: After you wired in the ignition connection, check it with a test light. Make sure this wire remains hot with the key in the run position and crank position.**

**BATTERY GROUND:** The black ground wire from the plug runs direct to the battery. Do not consider grounding the battery to the frame and then the engine to the frame. Run the battery ground directly to the engine.

## STARTING THE ENGINE

You have now made all of the connections necessary to TRY to start your car. If you try now, you will be disappointed since you did not hook up the battery. You can do so now. If you turn the key on but do not crank engine, you will hear the fuel pump for about 2 to 4 seconds before it stops. This will indicate the pump is ready. During normal operating it is best if you do not wait until the pump stops as this is not an indication that the pressure is up. There is no need to "pump" the throttle to start a fuel injected car.

## Telorvek Panel Fuse Designation, Size and Relay Center Layout

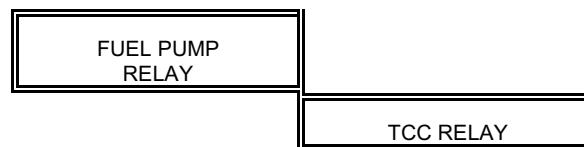
### Fuse Designation & Size

The harness has a total of eight fuses. Shown below is a diagram of what each fuse protects.

#### Top, Front View Of Fuse Blocks

Ignition Feed Fuse Row #1		Battery Feed Fuse Row #2	
Fuse Designation	Fuse Size Block #1	Fuse Designation	Fuse Size Block #2
Left & Right Injectors, M.I.L Canister Vent, Canister Purge, Mass Air Flow, PCM, relay coils	15 AMP	PCM, DLC	15 AMP
Ignition Coils	20 AMP	Accessory	30 AMP
O2 Sensors	20 AMP	Fuel Pump	15 AMP
Transmission, Skip Shift Light, Reverse inhibit	15 AMP	Accessory	30 AMP

#### Relay Center



In the cover of the TELORVEK panel are four relays the PCM uses to control fuel pump, primary & secondary cooling fans and the torque converter clutch relay. The PCM can not handle heavy load items and it requires a relay to handle the load and the PCM then controls the relay. The harness has a total of seven relays, four in the cover of the TELORVEK panel and three that are mounted remotely. All relays in the harness require GM part # 14100455.

**WARNING: All relays must be installed in the connectors. Eliminating any of them could cause damage to the engine.**

## TROUBLE CODE DEFINITION

The PCM looks for certain parameters from each sensor it controls. If it sees one out of specification it will set and store a trouble code. Not all codes will light the malfunction indicator lamp (M.I.L.). There is two types of trouble codes:

**HARD CODE:** A hard code will light the M.I.L light and in most cases (not all) put the PCM into a back-up (open loop) mode. When this happens the timing remains fixed (will not advance or retard), both cooling fans will turn on and the engine will run only taking the input from the TPS sensor. This usually causes a rich condition as well.

**SOFT CODE:** A soft code will not light the M.I.L light. This type of code will set, store and can only be read by using a scan tool. This type of code WILL NOT put the computer into a back-up mode or cause any running problems.

**NOTE:** In order to read any trouble codes it will be necessary to connect a scan tool to the DLC connector. This service can be performed at any GM dealer or repair facility in your area. You can not put 1994 and newer engines in diagnostic mode by jumping wires together in the DLC connector like could be done in the past, a scan tool must be used.

### LS-1 TROUBLE CODES

PO101 MAF SYSTEM PERFORMANCE	PO332 KNOCK SENSOR REAR
PO102 MAF SYSTEM LOW FREQUENCY	PO335 CRANK SHAFT POSITION SENSOR
PO103 MAF SENSOR HIGH FREQUENCY	PO336 CRANK SHAFT SENSOR PERFORMANCE
PO107 MAP SENSOR LOW VOLTAGE	PO341 CAM SHAFT SENSOR PERFORMANCE
PO108 MAP SENSOR HIGH VOLTAGE	PO342 CAM SHAFT SENSOR LOW VOLTAGE
PO112 IAT SENSOR LOW VOLTAGE	PO343 CAM SHAFT SENSOR HIGH VOLTAGE
PO113 IAT SENSOR HIGH VOLTAGE	PO351 IGNITION CONTROL #1 CIRCUIT
PO117 ECT SENSOR LOW VOLTAGE	PO352 IGNITION CONTROL #2 CIRCUIT
PO118 ECT SENSOR HIGH VOLTAGE	PO353 IGNITION CONTROL #3 CIRCUIT
PO121 TPS CIRCUIT INSUFFICIENT ACTIVITY	PO354 IGNITION CONTROL #4 CIRCUIT
PO122 TPS CIRCUIT LOW VOLTAGE	PO355 IGNITION CONTROL #5 CIRCUIT
PO123 TPS CIRCUIT HIGH VOLTAGE	PO356 IGNITION CONTROL #6 CIRCUIT
PO125 ECT EXCESSIVE TIME TO CLOSED LOOP	PO357 IGNITION CONTROL #7 CIRCUIT
PO131 O2 LEFT FRONT LOW VOLTAGE	PO358 IGNITION CONTROL #8 CIRCUIT
PO132 O2 LEFT FRONT HIGH VOLTAGE	PO401 EGR SYSTEM FLOW INSUFFICIENT
PO133 O2 LEFT FRONT SLOW RESPONSE	PO404 EGR SYSTEM PERFORMANCE
PO134 O2 LEFT FRONT INSUFFICIENT ACTIVITY	PO405 EGR PINTLE POSITION CIRCUIT LOW VOLTAGE
PO135 O2 LEFT FRONT HEATER CIRCUIT	PO410 AIR PUMP SYSTEM
PO137 O2 LEFT REAR LOW VOLTAGE	PO412 AIR PUMP RELAY CONTROL CIRCUIT
PO138 O2 LEFT REAR HIGH VOLTAGE	PO418 AIR PUMP RELAY CONTROL CIRCUIT
PO140 O2 LEFT REAR INSUFFICIENT ACTIVITY	PO420 LEFT CATALYTIC CONVERTER SYSTEM LOW EFFICIENCY
PO141 O2 LEFT REAR HEATER CIRCUIT	PO430 RIGHT CATALYTIC CONVERTER SYSTEM LOW EFFICIENCY
PO151 O2 RIGHT FRONT LOW VOLTAGE	PO440 EVAP SYSTEM
PO152 O2 RIGHT FRONT HIGH VOLTAGE	PO442 EVAP CONTROL SYSTEM SMALL LEAK DETECTED
PO153 O2 RIGHT FRONT SLOW RESPONSE	PO443 EVAP PURGE SOLENOID CONTROL CIRCUIT
PO154 O2 RIGHT FRONT INSUFFICIENT ACTIVITY	PO446 EVAP CANISTER VENT BLOCKED
PO155 O2 RIGHT FRONT HEATER CIRCUIT	PO449 EVAP CANISTER VENT SOLENOID VALVE CONTROL CIRCUIT
PO157 O2 RIGHT REAR LOW VOLTAGE	PO452 FUEL TANK PRESSURE SENSOR LOW VOLTAGE
PO158 O2 RIGHT REAR HIGH VOLTAGE	PO453 FUEL TANK PRESSURE SENSOR HIGH VOLTAGE
PO160 O2 RIGHT REAR INSUFFICIENT ACTIVITY	PO461 FUEL LEVEL SENSOR CIRCUIT PERFORMANCE
PO161 O2 RIGHT REAR HEATER CIRCUIT	PO462 FUEL LEVEL SENSOR CIRCUIT LOW VOLTAGE
PO171 FUEL TRIM SYSTEM LEAN LEFT SIDE	PO463 FUEL LEVEL SENSOR CIRCUIT HIGH VOLTAGE
PO172 FUEL TRIM SYSTEM RICH LEFT SIDE	PO480 PRIMARY COOLING FAN RELAY CIRCUIT
PO174 FUEL TRIM SYSTEM LEAN RIGHT SIDE	PO481 SECONDARY COOLING FAN RELAY CIRCUIT
PO175 FUEL TRIM SYSTEM RICH RIGHT SIDE	PO500 SPEED SENSOR CIRCUIT (M/T)
PO200 INJECTOR CONTROL CIRCUIT	PO502 VEHICLE SPEED SENSOR CIRCUIT LOW INPUT
PO218 TRANSMISSION FLUID OVER TEMPERATURE	PO503 VEHICLE SPEED SENSOR CIRCUIT
PO230 FUEL PUMP CONTROL CIRCUIT	
PO300 ENGINE MISFIRE DETECTED	
PO325 KNOCK SENSOR CIRCUIT	
PO327 KNOCK SENSOR FRONT	

INTERMITTENT  
 PO506 IAC SYSTEM LOW  
 PO507 IAC SYSTEM HIGH  
  
 PO530 A/C PRESSURE SENSOR CIRCUIT  
 PO562 SYSTEM VOLTAGE LOW  
 PO563 SYSTEM VOLTAGE HIGH  
 PO601 PCM MEMORY  
  
 PO602 PCM NOT PROGRAMMED  
 PO604 PCM RAM PERFORMANCE  
 PO608 VSS OUTPUT CIRCUIT  
 PO645 A/C CLUTCH RELAY CONTROL CIRCUIT  
 PO650 MIL CONTROL CIRCUIT  
  
 PO654 ENGINE SPEED OUTPUT CIRCUIT  
 PO656 FUEL GAUGE OUTPUT CIRCUIT  
 PO704 CLUTCH START SWITCH  
 PO711 TRANSMISSION TEMPERATURE RANGE/PERFORMANCE  
 PO712 TRANS FLUID TEMP LOW INPUT  
  
 PO713 TRANS FLUID TEMP HIGH INPUT  
 PO719 BRAKE SWITCH CIRCUIT LOW  
 PO724 BRAKE SWITCH CIRCUIT HIGH  
 PO740 TORQUE CONVERTER CLUTCH ELECTRICAL  
  
 PO742 TCC STUCK ON  
 PO748 PRESSURE CONTROL SOLENOID CIRCUIT ELECTRICAL  
 PO751 1-2 (A) SHIFT SOLENOID PERFORMANCE  
 PO753 1-2 (A) SHIFT SOLENOID ELECTRICAL  
  
 PO756 2-3 (B) SHIFT SOLENOID PERFORMANCE  
 PO758 2-3 (B) SHIFT SOLENOID ELECTRICAL  
 PO785 2-3 SHIFT SOLENOID CIRCUIT  
 PO801 REVERSE INHIBIT SOLENOID  
  
 PO803 SKIP SHIFT SOLENOID CONTROL CIRCUIT  
 PO804 SKIP SHIFT LAMP CONTROL CIRCUIT  
 P1111 IAT SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE  
 P1112 IAT SENSOR LOW VOLTAGE  
  
 P1114 ECT SENSOR LOW VOLTAGE  
 P1115 ECT SENSOR HIGH VOLTAGE  
 P1121 TPS HIGH VOLTAGE  
 P1122 TPS LOW VOLTAGE  
  
 P1133 LEFT FRONT O2 INSUFFICIENT SWITCHING  
 P1134 LEFT FRONT O2 TRANSITION TIME RATIO  
 P1153 RIGHT FRONT O2 INSUFFICIENT SWITCHING  
 P1154 RIGHT FRONT O2 TRANSITION TIME RATIO  
  
 P1258 ENGINE COOLANT OVER TEMPERATURE-FUEL DISABLED  
 P1336 CRANK POSITION SYSTEM VARIATION NOT LEARNED  
 P1380 ROUGH ROAD DATA UNSTABLE  
 P1404 EGR VALVE PINTLE STUCK OPEN  
  
 P1415 AIR SYSTEM LEFT SIDE  
 P1416 AIR SYSTEM RIGHT SIDE  
 P1441 EVAP SYSTEM FLOW DURING NON-PURGE  
 P1539 A/C CLUTCH STATUS HIGH VOLTAGE  
  
 P1546 A/C CLUTCH STATUS LOW VOLTAGE  
 P1626 THEFT DETERRENT SYSTEM FUEL ENABLE CIRCUIT  
 P1635 5 VOLT REFERENCE #1 CIRCUIT  
 P1637 GENERATOR "L" TERMINAL CIRCUIT.  
  
 P1639 5 VOLT REFERENCE #2 CIRCUIT  
 P1643 ENGINE SPEED OUTPUT CONTROL  
 P1652 VSS OUTPUT CIRCUIT  
 P1657 1-4 UPSHIFT SOLENOID CONTROL CIRCUIT  
  
 P1661 MIL CONTROL CIRCUIT  
 P1664 1-4 UPSHIFT LAMP CONTROL  
 P1810 TRANSMISSION FLUID PRESSURE VALVE POSITION SWITCH MALFUNCTION  
 P1860 TORQUE CONVERTER CLUTCH SOLENOID ELECTRICAL  
  
 P1870 TRANSMISSION COMPONENT SLIPPING

## Optional Accessories

	<b>GM Part #</b>	<b>Ron Francis Wiring Part #</b>
Powertrain Control Module	#12200411	
Fuel Pump Relay	14100455	FP-25
TCC Cut Out Relay	14100455	FP-25
Oxygen Sensors	25312201 or Delco AFS106	

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