



TELORVEK TPI WIRING INSTRUCTIONS FOR LS-85 98 Camaro/Firebird LS-1 Fuel Injection System

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, which in the future will be even tougher.

In the older TPI engines the computer controlled, but did not look for or set a trouble codes 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 and put the PCM into a back-up mode if the emission control devices malfunction or are not installed.

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.

NOTE: Now that the automotive manufactures have made tremendous improvements in the emission outputs of their engines, they have turned their 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 the ECM has been reprogrammed.

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 Wirng 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 differently depending on engine year and make, is still essentially the same. A rotor is turned allowing spark to be provided to the plugs, the same as in 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 have worked with a fuel injection system, we highly recommend purchasing a shop manual for 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 have 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 #16238212) 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 an 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

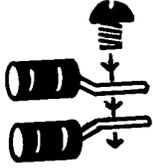
Since there are so many individual circuits to complete, we recommend that you connect them in the order that we prescribe. Disconnect the battery before starting and do not reconnect until instructed.

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 into the habit of test pulling at each terminal as you crimp it to the wire.

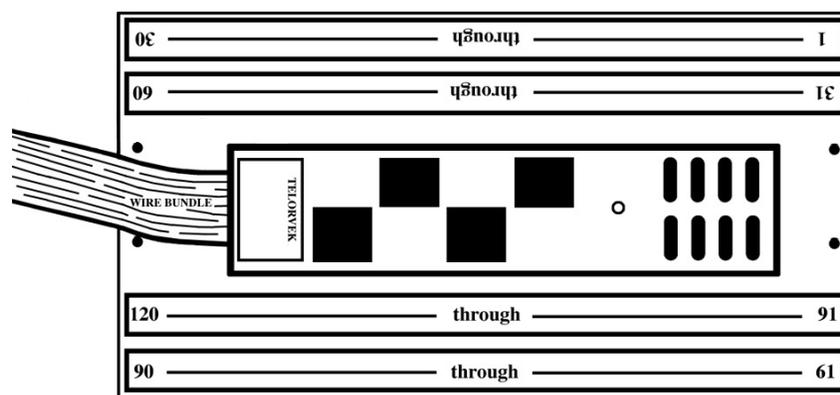
Any sensor that is difficult to hook-up should not be eliminated. All sensors are important if you desire your conversion to run as good as a factory engine. Eliminating any part of this kit WILL cause some portion of the EFI to work improperly.

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 #40 MASS AIR FLOW SENSOR (MAF): On a factory installation, this sensor is mounted in the intake air duct between the air cleaner and throttle body. Plug the three gang black connector into the sensor and run the wires back to the panel. Connect the yellow MAF A->1 to #1, black MAF B->30 to #30 and the pink wire MAF C->24 to #24.

BAG #41 INTAKE AIR TEMPERATURE SENSOR (IAT): Install this sensor in the duct work between the air cleaner and the plenum. Plug the gray connector into the sensor and run the wires back to the panel. Connect the purple wire IAT A->2 to #2 and the tan wire IAT B->3 to #3.

Bag #42 THROTTLE POSITION SENSOR (TPS): The TPS sensor is located on the left side of the throttle body. Plug the connector into the sensor and run the wires back to the panel. Connect the gray wire TPS A->4 to #4, black wire TPS B->5 to #5 and the dark blue wire TPS C->6 to #6.

Bag #43 IDLE AIR CONTROL (IAC): The IAC is located on the left side of the throttle body. Plug the four gang connector into the IAC and run the wires back to the panel. Connect the light green IAC A->7 to #7, dark green IAC B->8 to #8, light blue IAC C->9 to #9 and dark blue IAC D->10 to #10.

Bag #44 ENGINE COOLANT TEMPERATURE SENSOR: The sensor is located in the left front head behind the alternator. Plug the connector into the sensor and run the brown and yellow wires back to the panel. Connect the brown wire ECT A->11 to #11 and the yellow wire ECT B->12 to #12. **Note: A separate sensor must be installed in the engine for your dash mounted gauge.**

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 A->21 to #21 and the other pink wire INJ 2 A->21 to #21. Using the red terminals, connect the rest of the injector harness wires as follows: black INJ 1 B->13 to #13, gray INJ 3 B->14 to #14, white INJ 5 B->15 to #15, red INJ 7 B->16 to #16, light green INJ 2 B->17 to #17, light blue INJ 4 B->18 to #18, yellow INJ 6 B->19 to #19 and dark blue INJ 8 B->20 to #20.

Bag #46 EXHAUST GAS RECIRCULATION VALVE (EGR): 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 gray wire EGR SOL A->31 to #31, black EGR B->32 to #32, Brown EGR C->33 to #33, dark blue EGR D->34 to #34 and the light blue 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 #15301401) (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 #12181854) 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 yellow wire CRANK POS A->63 to #63, black 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. **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 orange wire MAP A->70 to #70, light green wire MAP B->71 to #71 and the gray wire MAP C->72 to #72.

Bag #54 OIL LEVEL SENSOR / LOW OIL INDICATOR LIGHT: The oil level sensor is located on the right side of the oil pan. Plug the connector in and run the wires back to the panel. Connect the brown wire OIL LEVEL A->73 to #73 and the black wire OIL LEVEL B->30 to #30.

LOW OIL INDICATOR LIGHT: A two wire un-grounded light must be used. Connect the pink wire 24->LOW OIL LT to #24 and the white wire 74->LOW OIL LT to #74 and run the wires to the light. If you are using a L.E.D. type light the pink wire is the ignition voltage into the light.

Bag #55 OXYGEN SENSORS (4): Starting in 1996 GM added four heated O2 sensors. You must run a dual exhaust system and install a catalytic converter in each pipe unless your ECM has been reprogrammed to remove the emissions equipment. If your ECM has been reprogrammed to remove the emissions it is necessary to run only the front 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. The right & left rear O2 sensors mount in the exhaust pipe behind the catalytic converters. 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.

RIGHT REAR O2: The four gang connector with the pink, black, dark blue and dark green wires running from it plugs into the right rear oxygen sensor.

LEFT REAR O2: The four gang connector with the pink, black, white and light green wires running from it plugs into the left rear oxygen sensor.

Run all the wires back to the panel. Connect black wires LF FRT O2 C->29 and RT FRT O2 C->29 to #29. Connect the black wires LF RR O2 C->28 and RT RR O2 C->28 to #28. 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, gray RT FRT O2 B->78 to #78, white LF RR O2 A->81 to #81, light green LF RR O2 B->82 to #82, dark green RT RR O2 A->83 to #83 and the dark blue RT RR O2 B->84 to #84. Connect the pink wires LF FRT O2 D->79 and the RT FRT O2 D->79 to #79. Connect the pink wires LF RR O2 D->80 and the RT RR O2 D->80 to #80.

Wiring for the rear oxygen sensors are not included if they have been eliminated from the ECM programming.

Bag #56 SECONDARY AIR INJECTION SYSTEM (AIR PUMP) & AIR BLEED VALVE:

This wiring is not included if it has been eliminated from the ECM programming. The air pump helps reduce some of the toxic emission output of the exhaust and the air bleed valve helps prevent a vacuum build up in the air system when the air pump is operating. When the PCM commands the pump to activate, it will lean out the exhaust gases which the PCM monitors through the O2 sensors. If the PCM does not see a lean condition when the air pump is running a trouble code will set.

In a stock application the air pump and air bleed valve are located in the right front frame rail. Refer to your shop manual for the proper plumbing of this system.

Two relay connectors are packaged in this bag. They require the installation of relays (Airtex part #1R1061, Standard Motor Products part #RY116 or GM part #14100455) in both connectors. The PCM controls the operation of the air pump and bleed valve through these relays. The relay connectors must be mounted within thirty six inches of the Telorvek panel and will side together for a compact installation. After mounting the relays connect the wires to the panel as follows. Using the blue terminals connect the red AIR RELAY 30->85 to #85, light blue AIR RELAY 87->87 to #87, red AIR SOL REL->85 to #85 and the tan AIR SOL REL->90 to #90. Now using the red terminals connect the brown AIR RELAY 86->86 to #86 and the purple AIR SOL REL->88 to #88.

Now plug the three gang connector into the air pump and the two gang connector into the bleed valve and run the wires to the panel. Using the blue terminals connect the light blue AIR PUMP A->87 to #87, AIR PUMP B->90 to #90, black AIR PUMP C->27 to #27, tan VALVE A->89 to #89 and the black VALVE B->27 to #27.

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 MM6 six speed manual 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

Uncoil 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 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.

Six Speed Manual Transmission Wiring

Wiring Bag #57A

MM6 Six Speed Manual Transmission: To ensure good fuel economy and comply with federal fuel economy standards, 2nd and 3rd gears are inhibited by use of an electrical solenoid when shifting out of first gear.

SKIP SHIFT SOLENOID: The block out solenoid is located on the left side of the transmission. Plug the connector into the solenoid and run the wires back to the panel. Connect the pink wire SKIP SHIFT B->103 to #103 and the gray wire SKIP SHIFT A->100 to #100.

REVERSE LOCKOUT SOLENOID: The lockout solenoid is located on the left side of the transmission. Plug in the connector and run the wires to the panel. Connect the light green wire REV SOL A->110 to #110 and the pink wire REV SOL B->103 to #103.

UP SHIFT INDICATOR LAMP: The remaining connection is the up shift indicator lamp. Connect the yellow wire 92->UPSHIFT LT to #92 and the pink wire 104->UPSHIFT LT to #104. Run the wires up to the location of the lamp. The lamp required must be a two wire un-grounded light. Connect the wires to the light.

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 purple VSS A->105 to #105 and the yellow 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 manufactures 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 RELAY: This system was developed to allow a regular park / neutral switch to tell the computer when the vehicle is in park, neutral or drive. Since the signals are different from normal neutral switches, we have made this small circuit that will plug into a stock GM neutral switch or splice to just about any two wire neutral switch. The signal input controls the idle air control (IAC), vehicle speed sensor diagnostics (VSS) and exhaust gas recirculation (EGR).

If you are using a Ron Francis Wire Works wiring kit, this is a simple, color coded plug-in to GM Neutral Safety Switches. The regular car wiring that normally runs to the neutral safety now plugs into the P/N relay kit with the blue and purple wires in the black connector. The plug with the blue and black wires running from the relay is connected to the original neutral safety switch. Run the black wire with the ring terminal to a good ground. The orange wire RELAY->108 is run to the TELORVEK panel and connects to #108.

NOTE: Using any other standard neutral switch requires removing the plug and splicing. Either color wire can be used on either terminal. The black plug with the Lt Blue and Black wires is connected into your neutral safety switch. If the connector on the wires doesn't fit your application, remove it and connect the wires to the neutral safety switch directly.

- ✓ The blue wire in the plug must be connected to the 12 volt supply from the ignition switch. This wire becomes hot (12 Volts) when you turn the key to crank.
- ✓ The purple wire is connected to the wire that runs to the starter solenoid.
- ✓ Run the Orange wire to the TELORVEK panel and connect it to #108.

Don't forget to install a relay (Airtex part #1R1061, Standard Motor Products part #RY116 or GM part #14100455).

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, purple DLC 2->58 to #58 and the tan DLC 9->59 to #59.

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 #62 PRIMARY & SECONDARY FAN RELAYS: Allowing the engine computer to control these fans works far better than any other control such as wired direct or with a toggle switch. Let the computer control the engine temperature as it should for best performance. **NOTE: DO NOT LOWER THE THERMOSTAT TEMPERATURE, DOING SO WILL CAUSE THE ENGINE TO RUN RICH.**

Two fans can be connected into this system. Two relays are located in the cover of the Telorvek panel which the PCM controls the fans through. The wires to the fans are labeled as primary and secondary. If you are using one fan, discard the secondary cooling fan wires. **NOTE: One cooling fan users still require installing GM relays (Airtex part #1R1061, Standard Motor Products part #RY116 or GM part #14100455) into both cooling fan relay connectors located in the cover of the Telorvek panel or a trouble code will set.**

Connect the light blue wire 111->PRIME FAN to #111 and the purple 112->2ND FAN to #112 and run both wires to the fans. Connect the light blue wire to the positive terminal of the fan you want to come on first and the purple to the positive fan terminal that will come on second. The black wires are connected to both fan negative terminals and run to a good ground.

WARNING!!

Don't forget to install relays (2) in the connectors located in the cover of the TELORVEK panel. The fan(s) WILL NOT operate unless the relays are installed. Use GM part #14100455 in the connectors.

Bag #63 FUEL TANK PRESSURE SENSOR (GM part #16257276) / FUEL LEVEL / FUEL PUMP: Some of this wiring may not be included if it has been eliminated from the ECM programming.

The fuel tank pressure sensor in a stock application is located on top of the tank in the sending unit assembly. This sensor monitors pressure/vacuum and feeds that information to the PCM to allow it to control other functions. If this sensor is not used a trouble code will set. Plug in the connector with the black, dark green and gray wires into the sensor. Run the wires to the panel and connect the black TK PRESS A->52 to #52, dark green TK PRESS B->53 to #53 and the gray TK PRESS C->54 to #54.

NOTE!!

The fuel pump relay connector is located in the cover of the TELORVEK panel and is pre-wired. The pump WILL NOT operate unless the relay is installed. Use GM part #14100455 in the connector.

FUEL LEVEL / FUEL PUMP: The PCM now requires the input of the fuel tank sending unit. This information is needed to allow it to control the canister purge and canister vent solenoids properly. The stock fuel tank sending unit is a zero to ninety ohm unit. If you are unable to use the stock sending unit, you must use one that produces the same type reading. VDO produces this type sending unit but normally must be special ordered.

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. Connect the purple wire SENDER->55 to the center post (stud) of the sending unit and connect it to #55 on the panel. The black wire SENDER GROUND connects to a sending unit mounting bolt and connects it to a good ground.

NOTE: Terminal #51 is the fuel level output to the dash mounted gauge. The gauge will also require ignition and ground connections.

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. Ron Francis Wiring does not offer any wiring connections to these terminals.

#49	C1 39	Air conditioning clutch relay control.
#115	C1 14	Air conditioning clutch status.
#116	C1 47	Air conditioning request.
#117	C1 30	Electronic brake control spark retard signal.
#118	C2 66	Air conditioning pressure sensor B.
#119	C1 63	Air conditioning pressure sensor A.
#120	C2 7	Air conditioning pressure sensor C.

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 red wire out of the plug 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 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

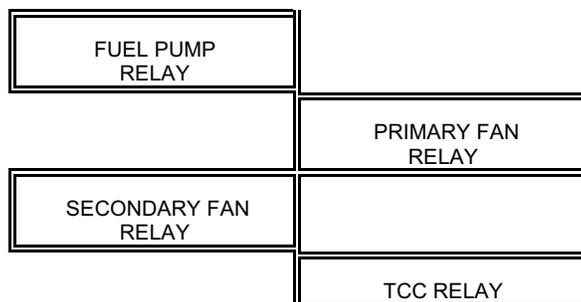
Fuse Designation & Size

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	15 AMP	PCM, DLC	15 AMP
Ignition Coils	20 AMP	Air Pump, Air Bleed Valve	30 AMP
O2 Sensors	20 AMP	Fuel Pump	15 AMP
Transmission, Skip Shift Light	15 AMP	Cooling Fans	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 Airtex part #1R1061, Standard Motor Products part #RY116 or 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.

98 Camaro 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
	PO343 CAM SHAFT SENSOR HIGH VOLTAGE
PO112 IAT SENSOR LOW VOLTAGE	PO351 IGNITION CONTROL #1 CIRCUIT
PO113 IAT SENSOR HIGH VOLTAGE	PO352 IGNITION CONTROL #2 CIRCUIT
PO117 ECT SENSOR LOW VOLTAGE	PO353 IGNITION CONTROL #3 CIRCUIT
PO118 ECT SENSOR HIGH VOLTAGE	PO354 IGNITION CONTROL #4 CIRCUIT
	PO355 IGNITION CONTROL #5 CIRCUIT
PO121 TPS CIRCUIT INSUFFICIENT ACTIVITY	PO356 IGNITION CONTROL #6 CIRCUIT
PO122 TPS CIRCUIT LOW VOLTAGE	PO357 IGNITION CONTROL #7 CIRCUIT
PO123 TPS CIRCUIT HIGH VOLTAGE	PO358 IGNITION CONTROL #8 CIRCUIT
PO125 ECT EXCESSIVE TIME TO CLOSED LOOP	
	PO401 EGR SYSTEM FLOW INSUFFICIENT
PO131 O2 LEFT FRONT LOW VOLTAGE	PO404 EGR SYSTEM PERFORMANCE
PO132 O2 LEFT FRONT HIGH VOLTAGE	PO405 EGR PINTLE POSITION CIRCUIT LOW VOLTAGE
PO133 O2 LEFT FRONT SLOW RESPONSE	PO410 AIR PUMP SYSTEM
PO134 O2 LEFT FRONT INSUFFICIENT ACTIVITY	PO412 AIR PUMP RELAY CONTROL CIRCUIT
PO135 O2 LEFT FRONT HEATER CIRCUIT	PO418 AIR PUMP RELAY CONTROL CIRCUIT
PO137 O2 LEFT REAR LOW VOLTAGE	PO420 LEFT CATALYTIC CONVERTER SYSTEM LOW EFFICIENCY
PO138 O2 LEFT REAR HIGH VOLTAGE	PO430 RIGHT CATALYTIC CONVERTER SYSTEM LOW EFFICIENCY
	PO440 EVAP SYSTEM
PO140 O2 LEFT REAR INSUFFICIENT ACTIVITY	PO442 EVAP CONTROL SYSTEM SMALL LEAK DETECTED
PO141 O2 LEFT REAR HEATER CIRCUIT	PO443 EVAP PURGE SOLENOID CONTROL CIRCUIT
	PO446 EVAP CANISTER VENT BLOCKED
PO151 O2 RIGHT FRONT LOW VOLTAGE	PO449 EVAP CANISTER VENT SOLENOID VALVE CONTROL CIRCUIT
PO152 O2 RIGHT FRONT HIGH VOLTAGE	PO452 FUEL TANK PRESSURE SENSOR LOW VOLTAGE
PO153 O2 RIGHT FRONT SLOW RESPONSE	PO453 FUEL TANK PRESSURE SENSOR HIGH VOLTAGE
PO154 O2 RIGHT FRONT INSUFFICIENT ACTIVITY	PO461 FUEL LEVEL SENSOR CIRCUIT PERFORMANCE
PO155 O2 RIGHT FRONT HEATER CIRCUIT	PO462 FUEL LEVEL SENSOR CIRCUIT LOW VOLTAGE
PO157 O2 RIGHT REAR LOW VOLTAGE	PO463 FUEL LEVEL SENSOR CIRCUIT HIGH VOLTAGE
PO158 O2 RIGHT REAR HIGH VOLTAGE	PO480 PRIMARY COOLING FAN RELAY CIRCUIT
	PO481 SECONDARY COOLING FAN RELAY CIRCUIT
PO160 O2 RIGHT REAR INSUFFICIENT ACTIVITY	
PO161 O2 RIGHT REAR HEATER CIRCUIT	PO500 SPEED SENSOR CIRCUIT (M/T)
	PO502 VEHICLE SPEED SENSOR CIRCUIT LOW INPUT
PO171 FUEL TRIM SYSTEM LEAN LEFT SIDE	PO503 VEHICLE SPEED SENSOR CIRCUIT INTERMITTENT
PO172 FUEL TRIM SYSTEM RICH LEFT SIDE	PO506 IAC SYSTEM LOW
PO174 FUEL TRIM SYSTEM LEAN RIGHT SIDE	PO507 IAC SYSTEM HIGH
PO175 FUEL TRIM SYSTEM RICH RIGHT SIDE	PO530 A/C PRESSURE SENSOR CIRCUIT
	PO562 SYSTEM VOLTAGE LOW
PO218 TRANSMISSION FLUID OVER TEMPERATURE	
PO230 FUEL PUMP CONTROL CIRCUIT	
PO300 ENGINE MISFIRE DETECTED	
PO325 KNOCK SENSOR CIRCUIT	
PO327 KNOCK SENSOR FRONT	

PO563 SYSTEM VOLTAGE HIGH
 PO601 PCM MEMORY
 PO602 PCM NOT PROGRAMMED
 PO604 PCM RAM PERFORMANCE
 PO608 VSS OUTPUT CIRCUIT
 PO650 MIL CONTROL CIRCUIT
 PO654 ENGINE SPEED OUTPUT CIRCUIT
 PO656 FUEL GAUGE OUTPUT CIRCUIT

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
 P1545 A/C CLUTCH RELAY CONTROL
 P1546 A/C CLUTCH STATUS LOW VOLTAGE

P1626 THEFT DETERRENT SYSTEM FUEL ENABLE CIRCUIT
 P1635 5 VOLT REFERENCE #1 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

GM Part

Powertrain Control Module	16238212
Fuel Pump Relay	14100455
Cooling Fan Relay (2)	14100455
Park Neutral Relay	14100455
Air Pump Relay	14100455
Air Bleed Valve	14100455
TCC Cut Out Relay	14100455

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