



# **AVENGER EFI 4 BBL TBI SYSTEMS**



- 550-400** (700 CFM – 65 lb/hr injectors) up to 400 HP
- 550-401** (900 CFM – 75 lb/hr injectors) up to 525 HP
- 550-402** (900 CFM – 85 lb/hr injectors) up to 600 HP

## **TBI HARDWARE INSTALLATION MANUAL – 199R10552**

**NOTE:** These instructions must be read and fully understood before beginning installation. If this manual is not fully understood, installation should not be attempted. Failure to follow these instructions, including the pictures may result in subsequent system failure.

**NOTE:** Fits all standard square flange intake manifolds.

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## 1.0 INTRODUCTION

Holley Performance Products has written this manual for the installation of the **AVENGER EFI** TBI fuel injection system. This manual contains the information necessary for the hardware installation. Please read all the **WARNINGS, NOTES, and TIPS**, as they contain valuable information that can save you time and money. It is our intent to provide the best possible products for our customer; products that perform properly and satisfy your expectations. Should you need information or parts assistance, please contact our technical service department at 1-270-781-9741, Monday through Friday, 8 a.m. to 5 p.m. Central Time. By using this number, you may obtain any information and/or parts assistance that you may require. Please have the part number of the product you purchased when you call.

**NOTE:** This manual is for the hardware installation of a Holley Throttle Body Fuel Injection System and instructions specific to it. Instructions on using the Avenger Handheld to set up and tune your engine are contained in the Avenger tuning manual (included with this kit).

**WARNING!** The **AVENGER EFI** systems consist of a number of sophisticated components. Failure of any one component does not constitute, nor does it justify, warranty of the complete system. Individual service items are available for replacement of components. If assistance is required or if you need further warranty clarification, you can call Holley Technical Service at the number shown above.

**WARNING!** To preserve warranty, these instructions must be read and followed thoroughly and completely before and during installation. It is important that you become familiar with the parts and the installation of the **AVENGER EFI** system before you begin. Failure to read and understand these instructions could result in damage to **AVENGER EFI** components that are not covered by the warranty and could result in serious personal injury and property damage.

**WARNING!** The oxygen sensor in this kit is recommended for use with **ONLY** unleaded fuel. Use of leaded fuels will degrade the oxygen sensor and will result in incorrect exhaust gas oxygen readings and improper fuel delivery. Failure to follow these directions does not constitute the right to a warranty claim.

**WARNING!** Failure to follow all of the above will result in an improper installation, which may lead to personal injury, including death, and/or property damage. Improper installation and/or use of this or any Holley product will void all warranties.

**WARNING!** Use of some RTV silicone sealers will destroy the oxygen sensor used with this product. Ensure the RTV silicone sealant you use is compatible with oxygen sensor vehicles. This information should be found on the RTV package.

## 2.0 CHOOSING THE RIGHT SYSTEM:

To ensure that you have purchased the correct **AVENGER EFI** kit for your application, check to be sure that the kit you purchased is listed beside your engine's horsepower.

<u>HORSEPOWER</u>	<u>KIT PART NUMBER</u>
Up to 400 hp .....	550-400 <b>AVENGER EFI TBI</b> , 700 CFM 65 lb/hr injectors
Up to 525 hp .....	550-401 <b>AVENGER EFI TBI</b> , 900 CFM 75 lb/hr injectors
Up to 600 hp .....	550-402 <b>AVENGER EFI TBI</b> , 900 CFM 85 lb/hr injectors

### 3.0 WARNINGS, NOTES, AND NOTICES

**WARNING!** For the safety and protection of you and others, only a trained mechanic having adequate fuel system experience must perform the installation, adjustment, and repair. It is particularly important to remember one of the very basic principles of safety: fuel vapors are heavier than air and tend to collect in low places where an explosive fuel/air mixture may be ignited by any spark or flame resulting in property damage, personal injury, and/or death. Extreme caution must be exercised to prevent spillage and thus eliminate the formation of such fuel vapors.

**WARNING!** This type of work **MUST** be performed in a well-ventilated area. Do not smoke or have an open flame present near gasoline vapors or an explosion may result.

### 4.0 PARTS IDENTIFICATION

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>SERVICE PART</u>
1	TBI Assembly 700 CFM 65 lb/hr Complete	1	534-172
	TBI Assembly 900 CFM 75 lb/hr Complete	1	534-187
	TBI Assembly 900 CFM 85 lb/hr Complete	1	534-173
2	Avenger EFI ECU and Handheld	1	554-116
3	Main Power Harness	1	558-308
4	Avenger EFI TBI Wiring Harness	1	558-100
5	Inline Pump	1	N/A
6	Metal Fuel Filter	1	562-1
7	Fuel Filter (WIX 33033)	1	N/A
8	Fuel Filter Clamp	1	N/A
9	Fuel Pump Block-Off Plate & Gasket	1	12-813
10	Wide Band Oxygen Sensor	1	554-101
11	MAP Sensor	1	538-24
12	Coolant Temperature Sensor	1	534-2
13	Air Cleaner Adapter	1	17-14
14	Air Cleaner Gasket	1	108-4
15	Flange Gasket	1	108-10
16	Manifold Flange Studs	4	N/A
17	Heat Insulator Gasket	1	108-12
18	Oxygen Sensor Weld Ring	1	534-49
19	40 AMP Relay (Pre-Installed in harness)	1	534-26
20	Throttle Bracket	1	N/A
21	Throttle and Cruise Control Stud	1	N/A
22	Throttle Lever Ball	1	N/A
23	Throttle Lever Bracket	1	N/A
24	Ford kick down return spring	1	N/A
25	Throttle Lever Stud	1	N/A
26	Transmission Kickdown Stud	1	N/A
27	Hose Clamp	8	N/A
28	Grommet	1	N/A
29	Cable Ties	12	N/A
30	Tube Cap	1	N/A
31	Lockwasher	2	N/A
32	1/4-28 Nut	2	N/A
33	5/16-24 Nut	4	N/A
34	5/16" Vacuum Line	1	N/A
35	Ignition Adapter	1	N/A
<b><u>TBI Service Parts:</u></b>			
	Air Charge Temperature Sensor	1	534-46
	Fuel Injector 700 CFM 65 lb/hr (requires purchase of 4)	1	522-54
	Fuel Injector 900 CFM 75 lb/hr (requires purchase of 4)	1	522-80
	Fuel Injector 900 CFM 85 lb/hr (requires purchase of 4)	1	522-43
	Fuel Pressure Regulator Diaphragm	1	512-1
	Idle Air Control (IAC) Motor	1	543-105
	Throttle Position Sensor (TPS)	1	543-29
<b><u>Optional Parts:</u></b>			
	Small Cap GM HEI Ignition Adapter	1	558-304
	Ford TFI Ignition Adapter	1	538-305



**Item 1**



**Item 2**



**Item 3**



**Item 4**



**Item 5**



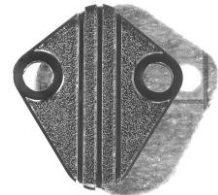
**Item 6**



**Item 7**



**Item 8**



**Item 9**



**Item 10**



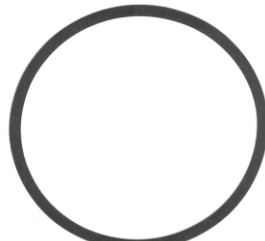
**Item 11**



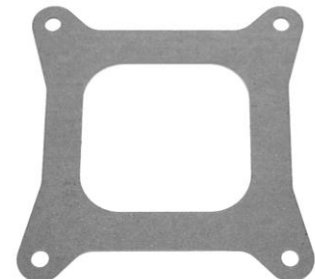
**Item 12**



**Item 13**



**Item 14**



**Item 15**



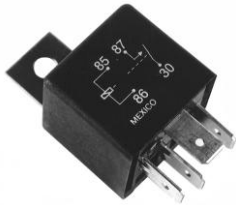
**Item 16**



**Item 17**



**Item 18**



**Item 19 (Pre-Installed in Harness)**



**Item 20**



**Item 21**



**Item 23**



**Item 24**



**Item 22**



**Item 25**



**Item 26**



**Item 27**



**Item 28**



**Item 29**



**Item 30**



**Item 31**



**Item 32**



**Item 33**



**Item 34**



**Item 35**

## 5.0 ADDITIONAL ITEMS REQUIRED FOR INSTALLATION

- 3/8" fuel hose (must meet SAE J30)
- 5/16" steel fuel line (must meet SAE J526)
- 5/16" fuel hose (must meet SAE J30)

A 0-30 psi fuel gauge and tee fitting for fuel gauge is recommended to check for proper fuel pressure. PN 554-102 is a 0-100 PSI pressure sensor that can be purchased as well that will plug into the Avenger harness to check and monitor fuel pressure. It requires a 1/8" NPT port for installation.

In addition to the above list, the engine must be equipped with a four barrel intake manifold and the vehicle must be in good operating condition.

## 6.0 TOOLS REQUIRED FOR INSTALLATION

- Standard wrench set
- Medium blade screwdriver
- Drill and assorted bit sizes
- Utility knife
- Small blade screwdriver
- #2 Phillips screwdriver
- Hole saw (2")
- Factory Service Manual for your vehicle
- 5/32" Allen wrench
- Digital Volt-Ohm meter
- Terminal crimping tool

An assistant is necessary for some installation and adjustment procedures and should be present for safety reasons.

## 7.0 COOLANT TEMPERATURE SENSOR INSTALLATION

The coolant temperature sensor (item 12) must be installed in a coolant passage in either the intake manifold or cylinder head. The sensor has 3/8" NPT threads. If only a 1/2" NPT port is available, an adapter will have to be used. It is best to drain the some of the coolant before the sensor is installed.

## 8.0 REMOVAL OF EXISTING FUEL SYSTEM

1. Disconnect the battery and remove the air cleaner.
2. Before disconnecting any vacuum hoses, it is a good idea to sketch out the vacuum hose routing. Using masking tape and a permanent marker, mark all the vacuum hoses, vacuum sources, and ports before removing the old fuel delivery system.
3. Remove and discard the fuel line that connects the fuel delivery system from the fuel pump. This will not be needed in the installation.
4. Disconnect and plug the inlet fuel line that runs from the gas tank to the fuel pump. This will prevent fuel spillage and foreign matter or dirt from entering the fuel line.

**DANGER! Before disconnecting or removing fuel lines, ensure the engine is cold. Do not smoke. Extinguish all open flames. An open flame, spark, or extreme heat near gasoline can result in a fire or explosion causing property damage, serious injury, and/or death.**

5. The fuel delivery system can now be removed. Holley recommends removing the mechanical fuel pump, if so equipped, and blocking-off the fuel pump mount using the provided fuel pump block off plate. The **AVENGER EFI** system kit includes a block-off plate that will fit small and big block Chevrolet and Chrysler engines. If the block-off plate does not fit your engine, a block-off plate may have to be purchased from a local performance parts supplier.
6. If required, replace the intake manifold at this time. Proceed to step seven if this is not required. **A 4-BARREL STOCK OR AFTERMARKET SQUARE FLANGE INTAKE MANIFOLD IS REQUIRED FOR THE INSTALLATION OF THE HOLLEY AVENGER EFI TBI system.**
7. Place clean shop towels or rags into the manifold opening to prevent dirt or debris from entering the engine. Keep exposed ends of the vacuum and fuel lines free from dirt.

**WARNING! Failure to cover the intake opening with a clean towel could result in dirt or debris entering the engine. Dirt or debris in the induction system can cause engine damage, which may necessitate in a complete engine overhaul.**

8. Remove all traces of the old gasket material from the TBI mounting flange. **DO NOT** gouge the intake manifold sealing surface during removal of old gasket material. Failure to remove all traces of the old gasket material will result in vacuum leaks that will be difficult to detect later. Sealing flanges must be clean and dry before installation.

9. Remove the shop towels from the intake and vacuum out the intake channel to ensure no dirt or debris is left in the intake system. Place a shop towel over the entire intake opening until you are ready to install the new **AVENGER EFI** TBI.

## 9.0 AVENGER EFI TBI SYSTEM INSTALLATION

### 9.1 Throttle Body

**NOTE:** A 4 barrel intake is required for the installation of the Holley **AVENGER EFI** TBI system.

**NOTE:** Some GM and Chrysler engines require the use of a manifold adapter Holley Part Number 17-6. This adapts the spread bore carburetor manifold to the Holley square flange.

1. Install the heat insulating gasket (Item 17) between the manifold and the 4 barrel throttle body injection unit. Check for sufficient thread engagement of the throttle body hold down studs and nuts. It may be necessary to purchase and install longer studs in the manifold for proper nut engagement. Gasket sealant may be used to ensure that no vacuum leaks occur.

**NOTE:** If using this heat insulating gasket, the flange gasket is not required.

**DANGER!** Check for proper clearance between engine components, such as the distributor, coil, etc., and the throttle body. If any interference is found, correct the condition before continuing. Failure to do so can result in damage to the engine components or the throttle body.

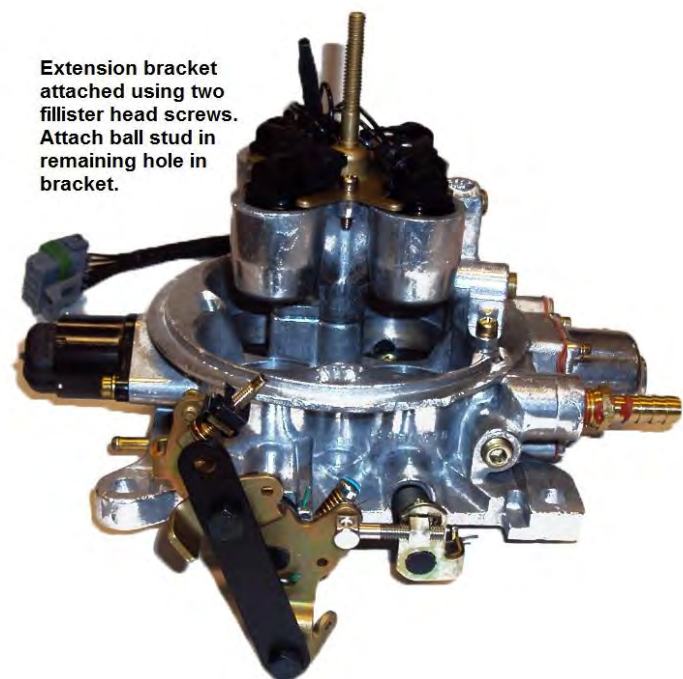
**DANGER!** Check for proper clearance between the air cleaner and the engine compartment cover hood. If any interference is found, correct the condition before continuing. Failure to do so can result in damage to the compartment cover or engine components.

2. Place the throttle body in position over the manifold flange studs with the IAC motor facing the front of the vehicle and the regulator/fuel connections towards the rear of the vehicle.
3. Tighten the throttle body down in a criss-cross pattern being careful not to over-tighten. Proper torque is 5-7 ft lbs.

**WARNING!** Over tightening the TBI manifold flange hold-down-nuts may result in a warped or cracked throttle body. The TBI hold down nuts should be tightened down progressively in a criss-cross pattern to 5-7 ft./lbs., to prevent leaks and avoid causing damage to the throttle body. A TBI that has been damaged due to negligence of the owner will void the warranty.

### 9.2 Throttle Connections

1. Measure the length of the throttle lever arm on the carburetor removed from the vehicle. Compare the length of the existing throttle lever arm with the one on the **AVENGER EFI** throttle body. If the two throttle lever arms are similar in length (within 1/2" of each other), the throttle lever arm hole on the **AVENGER EFI** throttle body can be used without the extension bracket. Use the throttle lever arm extension bracket, if the old throttle lever arm is significantly longer than the new throttle lever arm. Before installation of the bracket, check the diameter of the throttle cable stud. Some systems may use a 1/4" stud that will require drilling of the appropriate hole in the extension bracket to a 1/4" diameter. Attach the extension bracket using two fillister head screws as shown in Figure 1. The extension lever length can be adjusted using the four sets of holes.
2. Attach throttle linkage and have an assistant get in the vehicle and fully actuate the throttle controls. Make the necessary adjustments to the throttle linkage to ensure that the throttle plates are vertical when the throttle control is wide open. Work the throttle linkage back and forth several times to ensure it operates smoothly with no binding or sticking.



Extension bracket attached using two fillister head screws. Attach ball stud in remaining hole in bracket.

Figure 1



**DANGER!** Sticking throttle may result in uncontrolled engine or vehicle speed. This could cause property damage, personal injury, or death. A sticking throttle may be caused by improperly installed throttle cables, lack of clearance for any of the throttle linkage, or by a binding throttle linkage. Check all throttle cables for proper installation and alignment and actuate the throttle to check for any potential binding or clearance problems. Repair any problems before continuing.

3. Locate the 1/4-28 throttle stud from the parts provided and attach to the throttle lever with the nut provided. Connect the accelerator linkage to the throttle stud on the throttle body. If the vehicle is equipped with an automatic transmission, connect the transmission kickdown rod to the linkage on the throttle body. The transmission kickdown may have to be adjusted. Follow the vehicle manufacturer's procedure for the correct adjustment procedure.

**NOTE:** On late model GM and Ford overdrive transmissions with a lockup torque converter, make sure the lockup function is properly retained. Failure to do so will result in premature transmission failure.

**NOTE:** On Chrysler vehicles, a lever extension will be needed, Holley Part Number 20-7. Van applications may require the use of throttle lever extension Holley Part Number 20-14.

4. Attach throttle linkage and throttle return spring. Have an assistant get in the vehicle and fully depress the accelerator pedal. Make the necessary adjustments to the throttle linkage to insure that the throttle reaches wide-open position when the accelerator is depressed. Work throttle linkage back and forth several times to ensure that it operates smoothly with no binding or sticking.

**DANGER!** Failure to attach the throttle return spring or a sticking throttle may result in uncontrolled engine or vehicle speed, which could cause personal property damage, serious injury, or death.

### 9.3 MAP Sensor Installation and Vacuum Line Connections

1. The MAP sensor must be installed as close to the vacuum source it is connected to as possible. It must be connected to a "full manifold vacuum" port. This is a vacuum source below the throttle body plates. The throttle body has a full manifold port that the sensor can be connected to (see Figure 2). It is best not to "tee" multiple items into the port that supplies the MAP sensor. The sensor should be mounted such that the vacuum port on the sensor is pointed at some downward angle above the vacuum source so that moisture does not collect in the sensor itself.

**NOTE:** Make sure the MAP sensor is installed in a manner such that the vacuum hose fitting is pointing at a downward angle. Failure to do so can allow fuel and condensation to run into the sensor and cause failure. I

2. Install vacuum hoses to the appropriate port on the throttle body. Use the diagrams made during removal of the existing fuel system to locate the correct port. The vacuum ports of the throttle body are labeled in Figure 2.

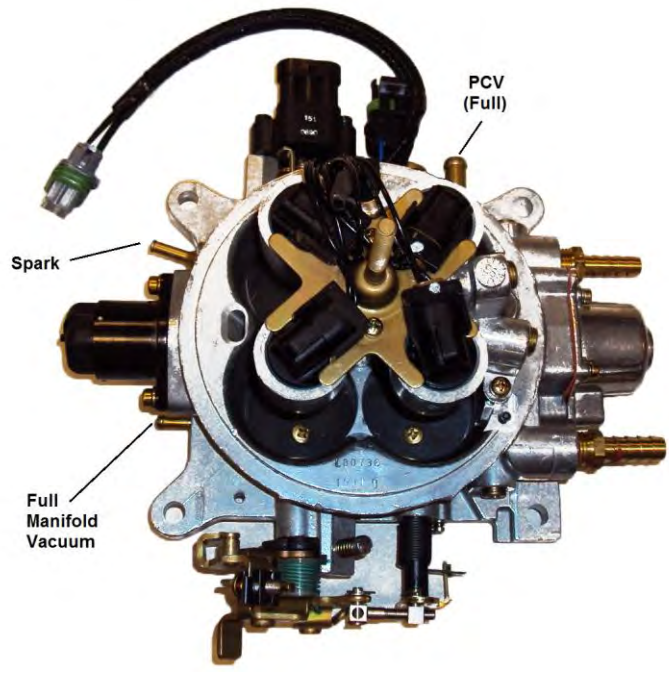


Figure 2

### 9.4 Fuel Pump, Fuel Line, and Filter Installation

**NOTE:** If you have dual fuel tanks, you must purchase Holley PN 534-38.

The following section covers the installation of an in-line pump. Holley in-line fuel pump PN 12-920 is included with this kit. Holley includes both a pre and post filter with the AVENGER TBI system. Both of these filters have "barbed" ends and are designed to connect to an EFI pressure rated rubber hose. They are not designed for "AN" style plumbing. AN style fittings are available for this pump from Holley if AN plumbing is used (PN 26-160 for -6, PN 26-180 for -8).

1. Do not mount the fuel pump higher than the lowest point of the fuel tank.
2. Make sure fuel tank is properly vented.

**DANGER!** Never get under a vehicle supported only by a jack. Serious injury or death can result from vehicles falling off of jacks. Before working underneath a vehicle, support it solidly with jack stands.

3. Mount the electric fuel pump as close to the fuel tank outlet as possible with the bracket provided. Mounting the fuel pump in this manner will insure that the pump will prime easily and purge fuel vapors in the TBI quickly to ensure faster starts.

**DANGER!** Take precautions to ensure that all fuel line routings are away from heat sources, such as the engine or exhaust pipes. A fire or explosion hazard could cause serious injury or death.

**DANGER!** Ensure that the fuel pump mounting location will not interfere with any under the vehicle components, especially at the extreme limits of the suspension travel. A fire or explosion hazard could cause serious injury or death.

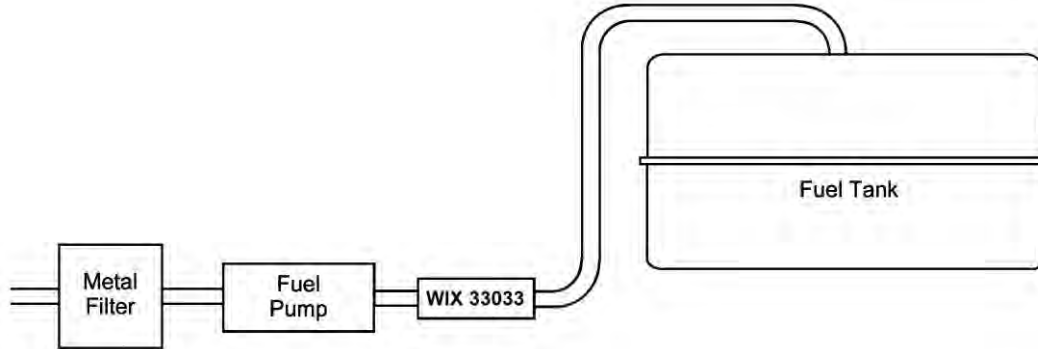


Figure 3

4. There are two metal filters included with the system. The filter marked "33033" **MUST** be installed between the fuel tank and the fuel pump inlet (unless an in-tank pump is used). The purpose of this filter is to protect the fuel pump from particles of dirt or other foreign material. The filter should be installed with the arrow on the filter pointing in the direction of the fuel flow.
5. The other metal fuel filter that is included with the **EFI** TBI system should be installed between the electric pump outlet and TBI unit. This is a 10 micron EFI filter. Position the filter, so the fuel hoses can be routed without kinks or sharp bends. The filter should be installed with the arrow on the filter pointing in the direction of the fuel flow. A clamp is provided to assist with mounting this filter in the kit.

**WARNING!** Ensure both filters are installed in the proper direction. A flow direction arrow is stamped on the side of the filter to indicate the direction of fuel flow. Failure to do so will result in a system malfunction.

**DANGER!** Take precautions to ensure all fuel line routings are away from heat sources, such as the engine or exhaust system. A fire or explosion hazard could cause property damage, serious injury, and/or death.

6. Plumbing must now be installed to connect the fuel tank to the filters, pump, and TBI unit. It is recommended to use steel hard line or stainless braided hose with AN fittings. If AN plumbing is used, the appropriate fittings must be purchased for the pump and TBI unit. Filters must have AN style fittings as well. The thread in the inlet and outlet fittings of the TBI unit is 1/4" NPT.
7. 3/8" line should be used on the feed/pressure side of the system (the filters included are designed for 3/8" line). If using steel line, rubber hose (rated for use with fuel injection) can be used to connect the steel line to the pump and filters. You should not connect a rubber hose directly to a steel line unless the end of the line has a "bead/nipple" or barb that retains the hose (similar to the ends of the fuel filters). If the steel line is just cut off, purchase a compression fitting that a barbed hose end can be installed on, or use a tool to roll a bead/nipple on the end of the steel line. Install hose clamps on all of these junctions (8 are included in the kit). All fuel hoses used must meet SAE J30 performance standards. All steel fuel line must meet SAE J526 standards.

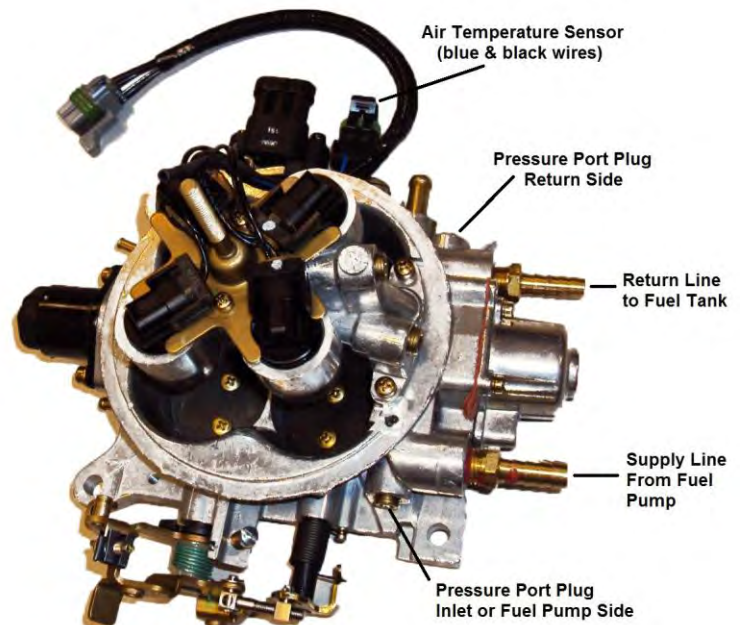


Figure 4

8. The TBI unit has an inlet and an outlet fitting. The inlet fitting is designed for a 3/8" hose and is on the drivers side (linkage side) of the throttle body. The return line (designed for a 5/16" hose) is on the passenger side (side with the TPS).
9. If you plan to install a fuel pressure gauge, do so at this time. The 4 bbl TBI systems are designed for an operating pressure of 21PSI. Although this is factory pre-set, it is ideal that it be checked. The TBI units have an 1/8 NPT plug on the drivers side that can be used to temporarily install a gauge (this location will interfere with the throttle cable on a permanent install) to set the pressure. Holley also sells a 0-100 PSI pressure transducer (PN 554-102) that plugs into the "fuel" connector on the main harness. This sensor can be installed anywhere between the fuel pump and the TBI unit. It has a 1/8" NPT male thread.
10. If using the existing fuel lines, inspect and replace any hose, clamps, or fuel line showing **ANY** sign of aging.

**DANGER!** Failure to use a fuel hose that meets SAE J30 standards could result in fuel leaks. A fuel leak may result in a fire or explosion hazard, which could cause serious injury or death.

**DANGER!** Failure to use a steel fuel line that meets SAE J526 standards could result in fuel leaks. A fuel leak may result in a fire or explosion hazard, which could cause serious injury or death.

**DANGER!** Take precautions to ensure that all fuel line routings are away from heat sources, such as the engine or exhaust pipes. A fire or explosion hazard could cause serious injury or death.

**DANGER!** Rigid fuel line tubing should be used for under vehicle runs, such as along vehicle frame rails or under floor pans. Failure to do so is a potential fire or explosion hazard, which could cause serious injury or death.

11. Anchor all fuel lines securely to solid chassis members at 1 ½ foot intervals using rubber coated steel clamps. Use of only approved steel fuel line tubing will afford maximum fuel line protection against road hazards and premature wearing due to flexing, temperature extremes, road salt, weather, etc.

## 9.5 Return Line Installation

The Holley **AVENGER EFI** TBI system requires a return fuel line to the fuel tank. Some late model vehicles that were originally equipped with a throttle body injection system may already have a return line to the fuel tank that can be utilized. If a return fuel line must be installed, a minimum size of 5/16" I.D. is recommended. The return line is on the passenger side of the TBI unit. The fitting on the TBI unit is designed for a 5/16 line. If a larger line is used, use an appropriate fitting on the throttle body. The return line must not present a pressure restriction to the return fuel flow. There should never be more than approximately 3 PSI of pressure in the return line. A line that is too small, or has restrictions will cause tuning problems with the system.

**DANGER!** Do not use the vapor canister lines as a fuel return line. Possible fuel leaks may create a fire or explosion hazard, causing serious injury or death.

**WARNING!** Use only approved steel fuel line. The return fuel line should enter the fuel tank at the "fuel level sending unit flange" or at the "filler neck". The filler neck or sending unit must be removed from the tank to perform this operation.

**DANGER!** Proper installation of the fuel return line may necessitate complete removal of the fuel tank. This work should be done by a fuel tank specialist, who regularly does this work and is familiar with safety regulations and precautions necessary to do this work. If a person attempts this work, who is not familiar with the safety regulations and precautions, an explosion hazard may result causing serious injury or death.

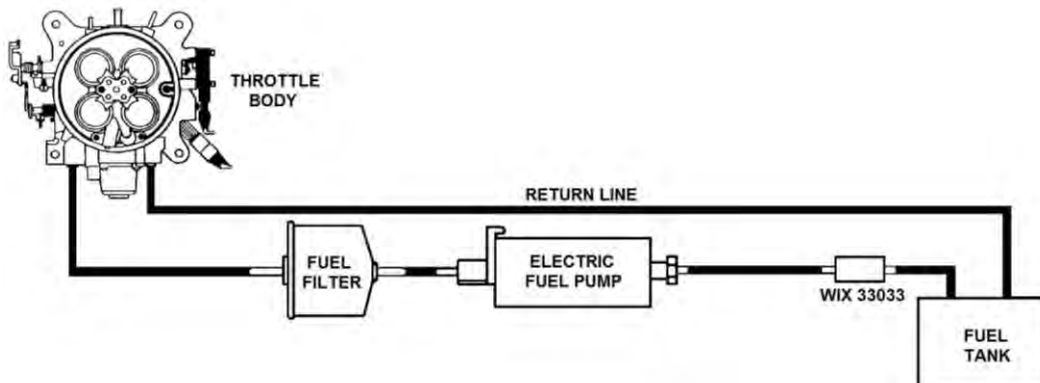


Figure 5

## 9.6 Oxygen Sensor Installation

The oxygen sensor should be mounted at a point where it can read a good average of all the cylinders on one bank. This would be slightly after all the cylinders merge. Do NOT mount the sensor far back in the exhaust as this will negatively impact closed loop operation response. If you have long tube headers, mount the sensor approximately 1-10" after the collector or in the header collector itself.

Avenger EFI systems come with a Bosch wideband oxygen sensor. Make sure your sensor looks like **Figure 6**.



Figure 6

### 9.6.1 Oxygen Sensor Mounting Procedure

**NOTE:** Never run the engine with the oxygen sensor installed if it is not plugged in and powered by the ECU, or it will be damaged. If you need to plug the hole temporarily, use an O<sub>2</sub> sensor plug or a spark plug with an 18mm thread.

**NOTE:** Someone with experience in welding exhaust systems should install the oxygen sensor boss. Any competent exhaust shop will be able to perform this task at a minimum cost.

**WARNING!** Use of leaded fuel will degrade an oxygen sensor. Prolonged use is not recommended unless periodic replacement is performed.

**WARNING!** Use of some RTV silicone sealers will destroy the oxygen sensor used with this product. Ensure the RTV silicone sealant you use is compatible with oxygen sensor vehicles. This information should be found on the RTV package.

1. Locate a position for the oxygen sensor as close to the engine as possible. If your vehicle has catalytic converters, the oxygen sensor MUST be located between the engine and the catalytic converters.

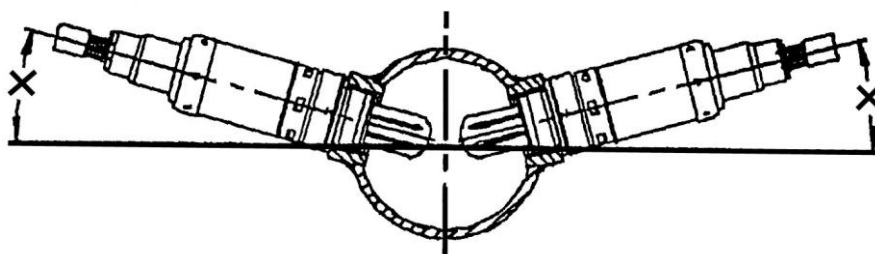


Figure 7

**NOTE:** The oxygen sensor should be mounted in such a way that the condensation in the exhaust tubing will not enter the sensor. Mount the O<sub>2</sub> sensor in the upper half of the exhaust tubing, with the angle "x", shown above, being greater than 10°. The picture above indicates that the sensor can be mounted on either side of the exhaust tubing.

2. Drill a 7/8" hole in the location picked for the sensor. Weld the threaded boss into the 7/8" hole. Weld all the way around the boss to insure a leak proof connection. Install the oxygen sensor into the threaded boss and tighten securely. It is a good idea to add anti-seize to the threads to aid in removal.
3. On vehicles equipped with an AIR pump, the oxygen sensor must be mounted before the AIR injection into the exhaust, or the AIR pump must be disconnected. Holley recommends that if the AIR is injected into both exhaust manifolds, mount the oxygen sensor into the pipe immediately after the exhaust manifold. Disconnect the AIR pump tube from the exhaust manifold and plug both ends. Check with local ordinances for the legality of this procedure in your area.

**WARNING!** Failure to disconnect the AIR pump or locating the oxygen sensor downstream from AIR injection will result in an extremely rich mixture, which could cause driveability problems and severe engine damage.

**WARNING!** It is important that the distribution ring is properly installed and fastened to the throttle body. Failure to do so will cause an inadequate seal between the throttle body and air cleaner and may be a fire hazard in the event of a backfire. Fire hazard can result in property damage, serious injury, and/or death.

## 9.6.2 ECU Mounting

The ECU can be mounted inside the passenger compartment (preferable location), or in the engine compartment. If mounted in the engine compartment, follow these guidelines:

- The ECU should be located such that it isn't being directly hit by water or road debris.
- It should also be located such that it isn't extremely close to exhaust manifolds or headers.
- It should be mounted such that it is as far away from spark plug wires, CD ignition boxes, or other "electrically noisy" devices as is reasonable possible.

The ECU comes with mounting hardware and vibration absorbers. Mount the vibration absorbers between the ECU feet and the mounting location. Do not over-tighten the mounting hardware if the ECU is not mounted on a flat surface.

## 10.0 WIRING

The following overviews how to properly install the wiring harnesses for this system.

### 10.1 Important Wiring "Do's and Don'ts"

An EFI system depends heavily on being supplied a clean and constant voltage source. The grounds of an electrical system are just as important as the power side.

Avenger ECU's contain multiple processing devices that require clean power and ground sources. The wiring harnesses for them must be installed in such a manner that they are separated from "dirty" power and ground sources.

#### DO'S

- Install the main power and ground directly to the battery.
- Keep sensor wiring away from high voltage or "noisy/dirty" components and wiring, especially secondary ignition wiring (plug wires), ignition boxes and associated wiring.
- Properly solder and heat shrink any wire connections.
- It is critical that the engine has a proper ground connection to the battery and chassis.

#### DON'TS

- NEVER run high voltage or "noisy/dirty" wires in parallel (bundle/loom together) with any EFI sensor wiring. If wires need to cross, try to do so at an angle.
- Do not use the electric fan outputs to directly power a fan. They must only trigger a relay.
- Do not use improper crimping tools.
- Don't use things like "t-taps", etc. Use solder and heat shrink.
- It is never recommended to splice/share signal wires (such as TPS, etc) between different electronic control units.

## 11.0 WIRING HARNESS INSTALLATION

### 11.1 Main Power/Battery Connection

The AVENGER ECU has a main battery power and ground connector on the right side of the ECU. The bottom position, Terminal "A" is the ground. The upper position, Terminal "B" is the positive terminal. Always use the fused power cable with the proper connectors supplied by Holley only.



Figure 8

## 12.0 PRIMARY HARNESS INSTALLATION AND SENSORS CONNECTION

These sections review the Main Harness installation and all of the sensor connections that must be completed. The Main Harness is the primary harness that supports all the primary engine sensors, fuel and ignition. There are two main connectors for this harness that plug into the ECU.

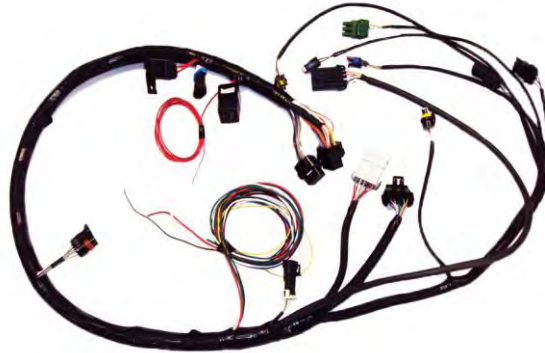


Figure 9

### 12.1 ECU Connectors

**AVENGER ECU** – The AVENGER ECU has **two** main connectors:

- **P1A** - The first connector next to the USB connector is the “P1A” connector (34 pin). This connector is primarily an “Input” connector. It contains all the sensor inputs and wide band oxygen sensor control.
- **P1B** - The second connector is the “P1B” connector (26 pin). This connector is the “output” connector. It has 8 injector outputs and outputs for other devices.

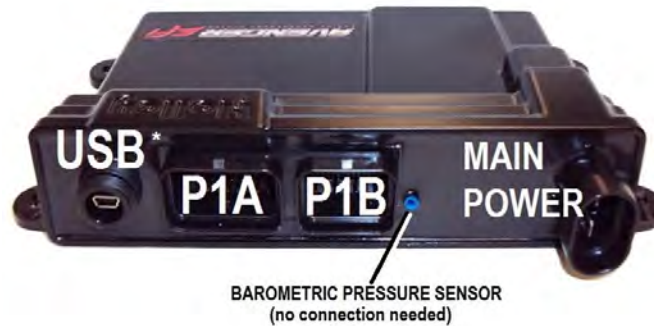


Figure 10

\*USB is not used on Avenger EFI

### 12.2 Harness Routing

If the ECU is mounted in the interior, it will have to be routed through the firewall into the engine compartment. Use a 2" hole saw to create a hole in a desired location if no other point of access is available. A grommet is supplied for a 2" hole to seal this area.

If the ECU is mounted in the engine compartment, the hand-held tuning module cable will have to be routed to the “CAN” connector on the main harness (located near the ECU connector main connector). This will require routing 1" x ½" connector somewhere through the firewall.

Connect the P1A and P1B connectors of the main harness into the ECU.

About 12" from the ECU main connectors is a 40A Relay. This powers the injectors and fuel pump.

### 12.3 Sensor Connections & Outputs

The following indicates the primary sensors that are required to be connected. Each connector on the main harness is labeled with the sensor name. The name on this label for each sensor is in parenthesis below.

### 12.3.1 Throttle Position Sensor (TPS)

Connect to the TPS which is located on the throttle body.

### 12.3.2 Manifold Air Pressure Sensor (MAP)

A 1 Bar MAP sensor is provided with all Holley EFI systems. Connect to the MAP sensor. Make sure that a vacuum line was connected to the MAP sensor in previous steps.

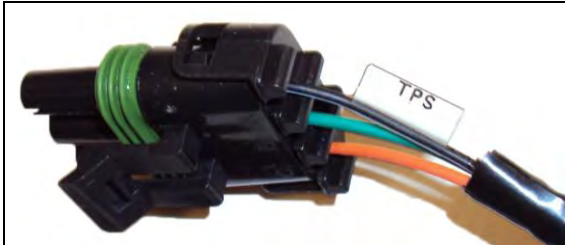


Figure 11 TPS

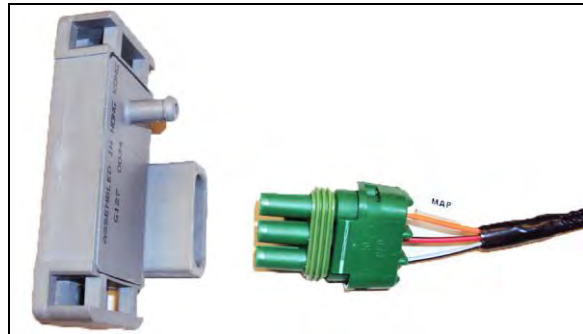


Figure 12 MAP

### 12.3.3 Coolant Temperature Sensor (CTS)

Connect to the Coolant Temperature sensor which should have been installed in an engine coolant passage.

### 12.3.4 Manifold Air Temperature Sensor (MAT)

Connect to the Air Temperature Sensor. This is located in the throttle body unit.



Figure 13 CTS



Figure 14 MAT

### 12.3.6 Wide Band Oxygen Sensor (WB02)

Connect to the oxygen sensor connector to the oxygen sensor previously installed. If you need an extension cable, one is available from Holley (P/N 534-199). The Avenger systems are intended to be used with a Bosch wide band oxygen sensor supplied by Holley. Make sure yours is the same as the picture below:

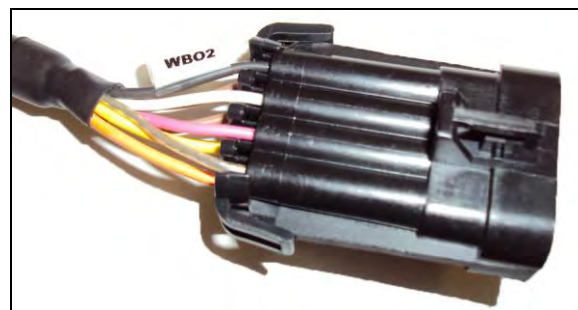


Figure 15 WB02

### 12.3.7 Fuel Pressure (Fuel)

A fuel pressure transducer connector is pre-installed in the main harness. The system is plug-and-play configured for a Holley 100 PSI pressure transducer (can be purchased under PN 554-102). If these are not connected to a pressure transducer, the Fuel and Oil Pressure will read “LEr” on the hand-held display. This will not cause any issues. Connect to the transducer (if installed).

### 12.3.8 Oil Pressure (Oil)

An oil pressure transducer connector is pre-installed in the main harness. The system is plug-and-play configured for a Holley 100 PSI pressure transducer (can be purchased under PN 554-102). If these are not connected to a pressure transducer, the Fuel and Oil Pressure will read “LEr” on the hand-held display. This will not cause any issues. Connect to the transducer (if installed).

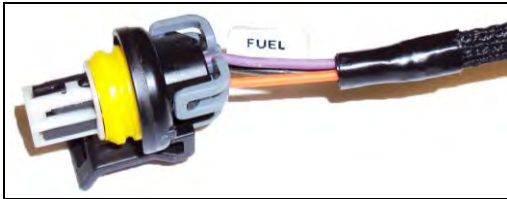


Figure 16 Fuel



Figure 17 Oil

### 12.3.9 CANbus – Handheld (CAN)

The handheld controller is used for create of an initial calibration for the system, allows for simple tuning changes to be performed, and is also used to view various information of the EFI system. It should be installed such the handheld controller can be easily used in the passenger compartment. The handheld has two loose wires and one connector with orange wires. Plug the connector into the main wiring harness into the plug marked “CAN”. This plug is located about 8 inches from the ECU connector. The handheld controller also has a white and a black wire. The black wire should be run to a sound vehicle ground. The white wire should be connected to a +12 volt source switched ignition source. The handheld does not have to be powered/installed after the vehicle is up set up and running properly.

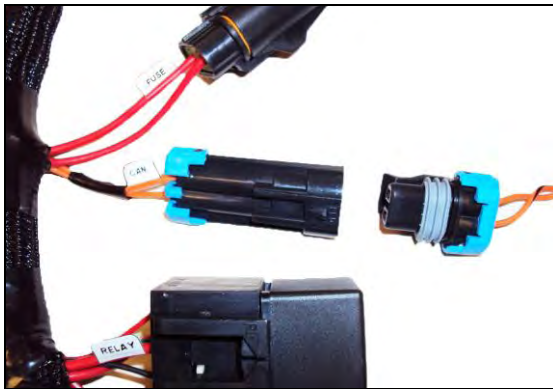


Figure 18 Harness to Handheld



Figure 19 Handheld

### 12.3.10 Knock Sensor (Knock)

The knock sensor connector is NOT used on Avenger systems.



Figure 20 Knock



### 12.3.11 Ignition (IGN)

There is a 10 pin connector marked "IGN". This is to connect to various ignition systems. This is not required for some applications. See section 16.0 below for proper ignition wiring.

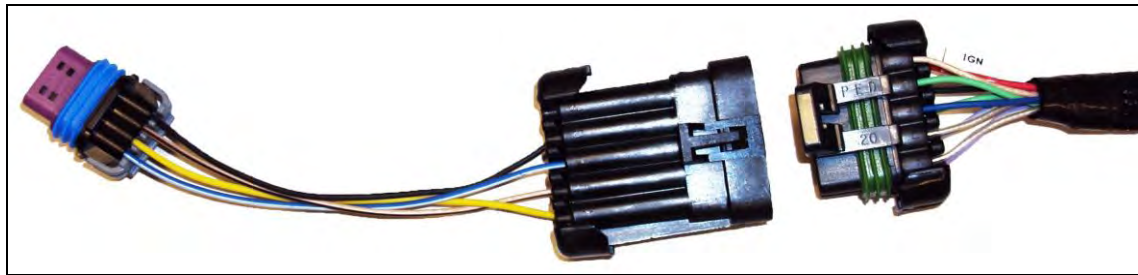


Figure 21 IGN

## 13.0 PRIMARY OUTPUTS

### 13.1 Idle Air Control (IAC)

Connect to the idle air control motor which is installed in the throttle body.

### 13.2 Fuel Injector Outputs (INJ)

Connect the fuel injector harness on the TBI unit to the injector connector on the main harness.

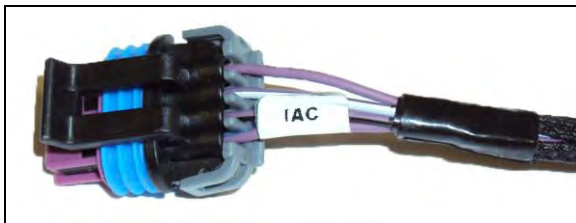


Figure 22 IAC

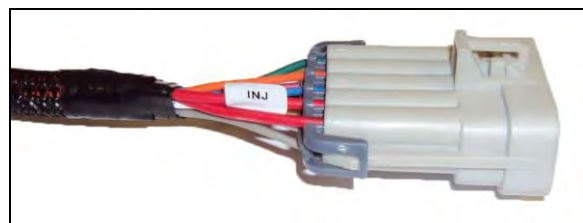


Figure 23 INJ

## 14.0 LOOSE WIRES

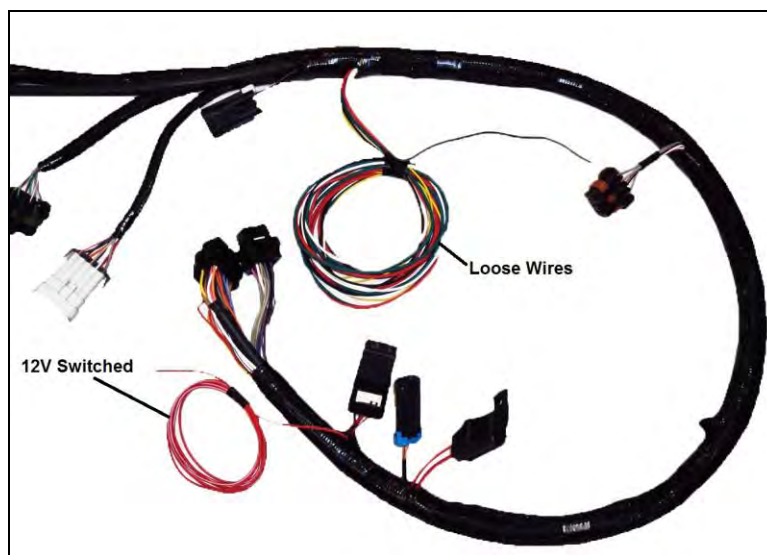


Figure 24

The following loose wires in the main wiring harness should be connected as follows on all systems. All of these wires come out of the harness about 40" from the ECU connectors except for the "12V Switched" wire.

**12V Switched – Color = Red/White** – Should be connected to a clean +12 volt power source. Power source should only be active when the ignition is on. Make sure source has power when engine is cranking as well (check with voltmeter). Not all sources apply power when the ignition switch is in “cranking” position. This wire is located approximately 7” from the ECU connectors. **Refer to Figure 24.**

**12V Battery – Color = Red** – Should be connected directly to the battery. This powers the fuel pump and fuel injectors. This wire is protected by a fuse in a sealed fuse holder. The fuse holder is located about 9” from the ECU connector. A fuse is pre-installed (20A).

**12V Fuel Pump – Color = Green** - Used to directly power a fuel pump (+12 volt). Do not use this wire to power fuel pumps that require over 10-12 Amps. For high current pumps, use this wire to trigger a separate relay and use larger gauge wire to feed the pump - 10 gauge is recommended. The pump that include with Avenger systems draws less than 10 Amps and can be powered directly by this wire.

The fuel pump also requires a ground wire. Run a wire from the negative side of the fuel pump (marked “-“ on the Holley pump in this kit). Connect it to a solid chassis/frame ground.



**Figure 25**

**Points Output – Color = White** – This wire is NOT used with the Avenger system. Tape up the end or install heat shrink in it.

**Chassis Ground – Color = Black** – Connect to a chassis ground point that has excellent connectivity with both the engine and the battery.

**“Coil – ” – Color = Yellow** – See section 15.0 below. This is an RPM input wire used for *some* applications.

## 15.0 IGNITION/ENGINE SPEED INPUT

The most important signal for the ECU is the Engine Speed input. It is critical that this is configured and wired correctly or poor performance will result.

There are 3 engine speed options on the Avenger systems. Each one is wired differently. If these are wired incorrectly, it is easily possible to permanently damage the ECU so pay close attention to proper wiring. These options are described below and wiring diagrams are supplied below the descriptions:

**OPTION 1) “Coil –“ engine speed input** – Use this if:

- You are using a stock type mechanical advance distributor with a stock inductive ignition coil. Examples of this would be any older style points distributor, a 1974-1981 GM large cap HEI.
- Do NOT use this input if you are using an aftermarket Capacitive Discharge (CD) ignition system such as a MSD, Mallory, or others. The ECU will be damaged if you connect to a capacitive discharge type ignition coil.

**NOTE:** Using this input, the EFI will NOT control the ignition timing of the engine. The timing will be based on the distributor initial, mechanical, and vacuum advance, just like it did with a carburetor.

**OPTION 2) “Tach Out” engine speed input** -

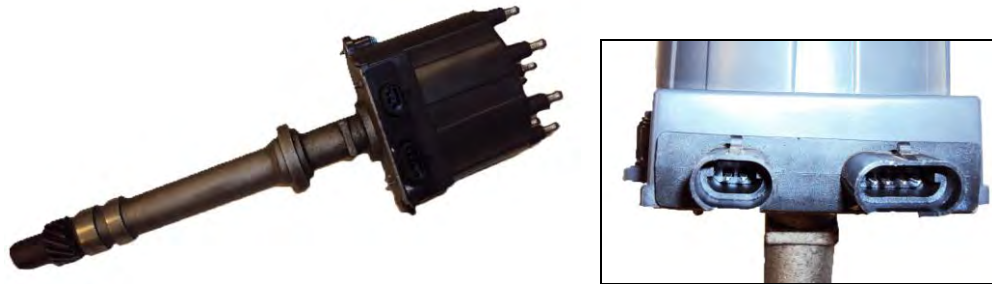
- If you are using an aftermarket Capacitive Discharge (CD) ignition system such as a MSD, Mallory, or others, you need to connect to the “Tach Out” connection or wire these systems provide. This is a 12 volt square wave output.

**CAUTION! NEVER, NEVER connect any of the EFI wires to the coil on any CD type ignition system. The ECU will be permanently damaged!**

**NOTE:** Using this input, the EFI will NOT control the ignition timing of the engine. The timing will be based on the distributor initial, mechanical, and vacuum advance, just like it did with a carburetor.

**OPTION 3) "GM Small Cap HEI" Computer Controlled Distributor –**

- Small and Big Block Chevy engines can use a small cap GM HEI computer controlled distributor that was available on factory GM vehicles from the 1980's through mid 1990's. This distributor provides an engine speed signal to the EFI, as well as allowing the EFI to control the ignition timing.



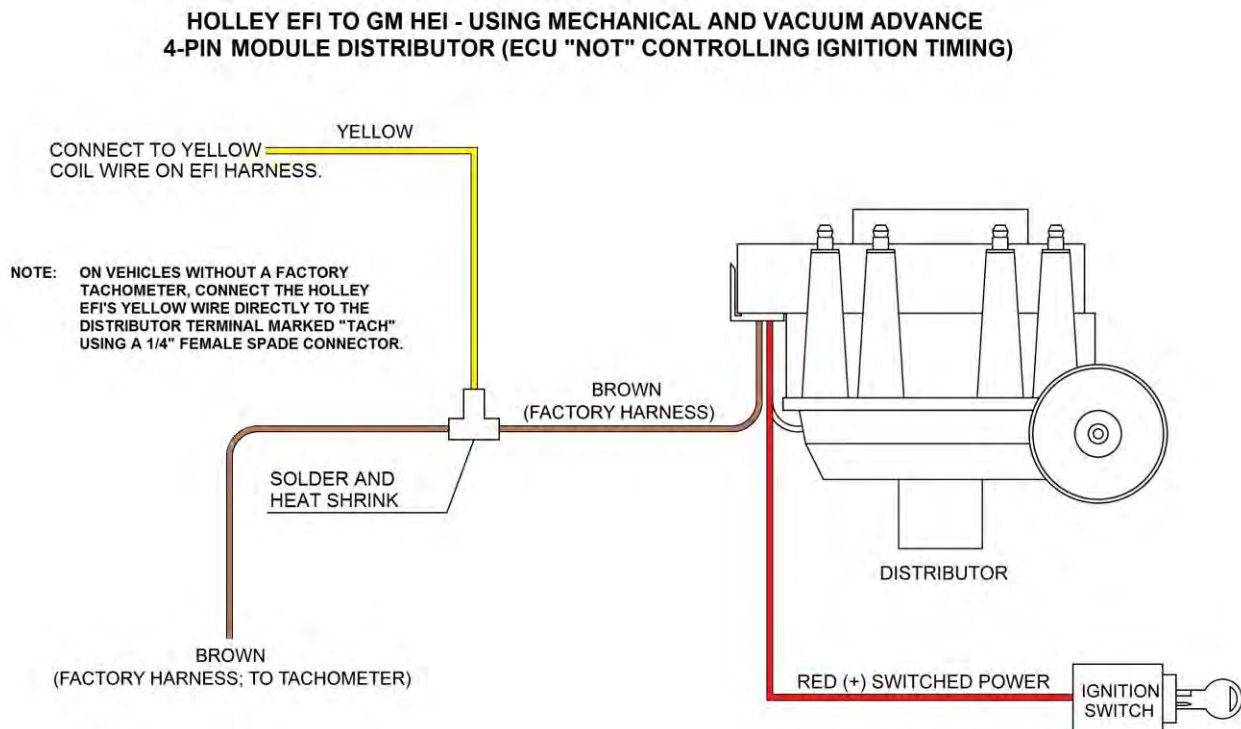
**Figure 26 Distributor and Close Up of Distributor**

## 16.0 WIRING

**OPTION 1 – "Coil –"** – Option one uses the "Yellow Wire" for engine speed input. The yellow wire is a loose wire located 40" from the ECU connectors. It is bundled with several other loose wires. The following two diagrams show how to wire to the two most common applications which are:

- 1) Any General Motors engine equipped with a factory large cap HEI distributor equipped with mechanical/vacuum advance (Figure 27).
- 2) Any engine equipped with a factory mechanical advance distributor and separate canister style coil. This would include any points style distributor (Figure 28).

**Figure 27** below shows how to connect to a large cap HEI distributor.



**Figure 27**

Figure 28 below shows how to connect to a factory style ignition with a canister style coil.

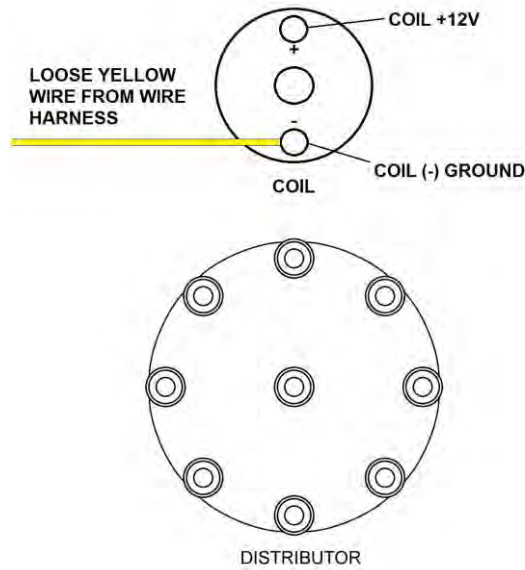


Figure 28

**OPTION 2 – “Tach Out”** – If using an aftermarket Capacitive Discharge (CD) ignition system, you need to connect to the “Tachometer Output” connection on the ignition box. To do so, you need to install the ignition adapter that comes with your kit. This adapter will have a single “yellow/black” wire (yellow wire with a black stripe) that you will connect to the tach out on the ignition box. This output usually is typically a spade type connector on the side of the box, or a wire coming out of the box. This adapter looks like this:

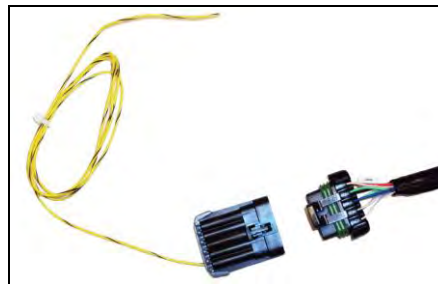


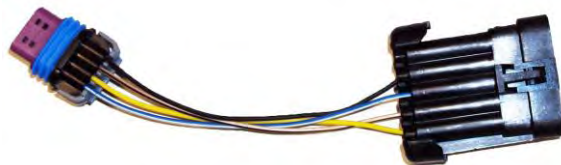
Figure 29

Connect it to the main EFI harness to the connector marked “IGN” (Ignition). Connect the yellow/black wire to the “tach out” connection on your ignition box. If you don’t know what wire this is, contact the tech service department for the ignition system you purchased.



Figure 30

**OPTION 3 - "GM Small Cap HEI" Computer Controlled Distributor** – An ignition adapter to connect to a computer controlled small cap HEI distributor is included with all Small and Big Block Chevy multi-port Avenger EFI kits. This adapter looks like:

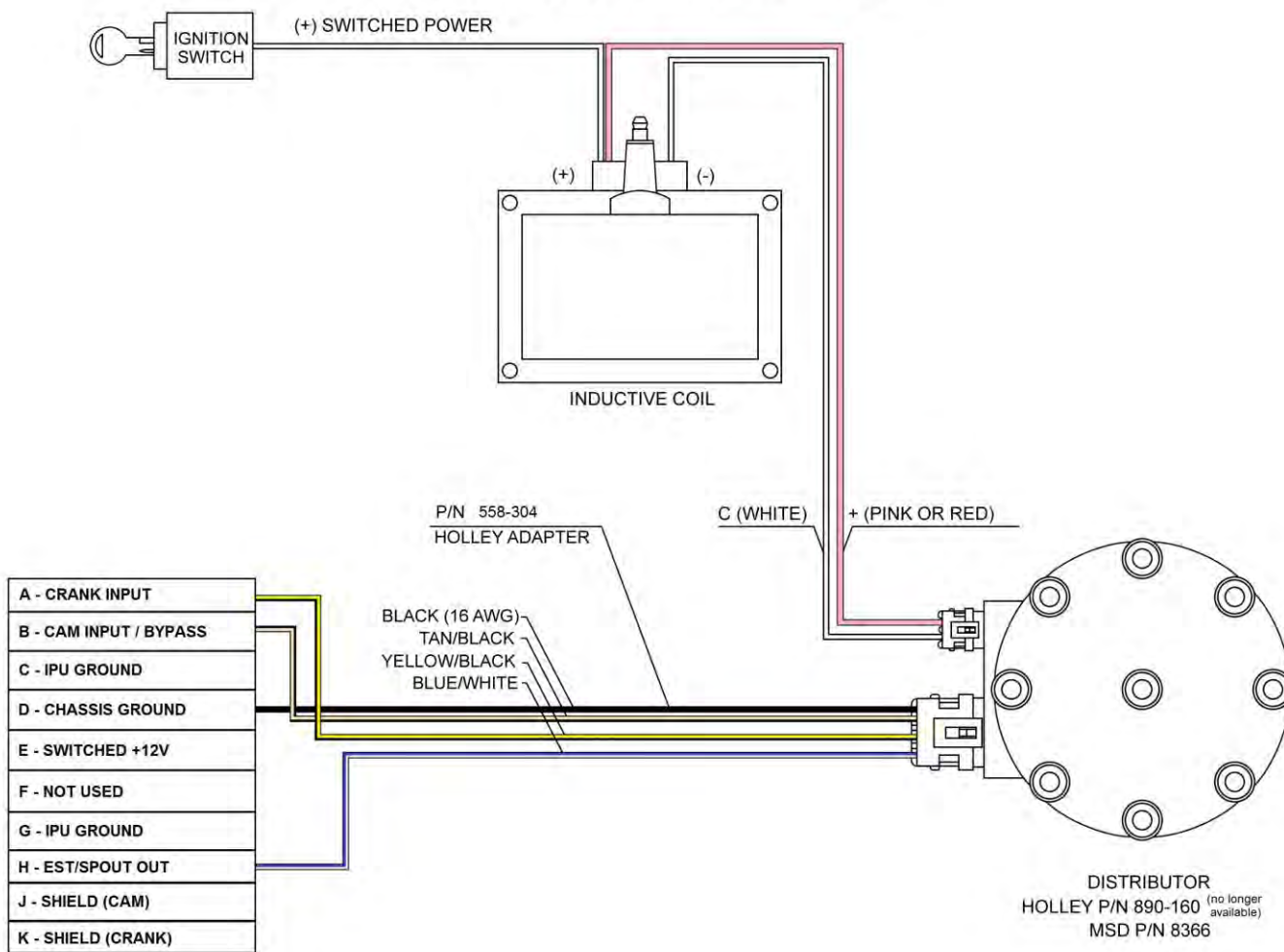


**Figure 31**

Connect this adapter to the main EFI harness to the connector marked "IGN" (Ignition). Connect the other end to the 4 pin connector on the HEI distributor. You will need to supply the wiring to connect the distributor to the coil.

**Figure 32** shows how to wire when NOT using an aftermarket CD box. **Figure 33** Shows how to wire when using an aftermarket CD box.

**HOLLEY EFI TO GM HEI IGNITION - USING COMPUTER CONTROLLED DISTRIBUTOR, EXTERNAL COIL (ECU CONTROLLING TIMING)**



**Figure 32**

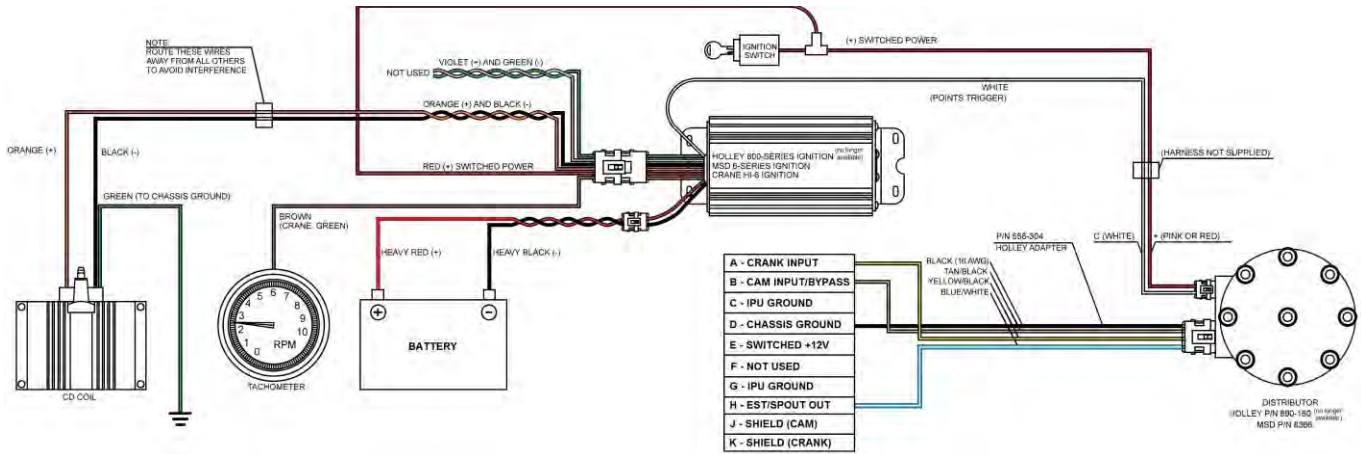


Figure 33

## 17.0 ADDITIONAL OUTPUTS

There are 3 optional outputs available on the system that can be use for the following features:

- Air Conditioning Shutdown at wide open throttle
- Electric Fan #1 output
- Electric Fan #2 output

These outputs are located in the “Input/Output” connector. This connector is located about 27 inches from the ECU connector and contains 8 pins. 3 of these are used for the features mentioned above. A harness is available to plug into this connector under Holley PN 558-400 that provides a mating plug in connector and additional harness length. If you wish to not purchase this mating harness, but want to use these options, you can remove a single wire from the main harness Input/Output connector and solder an additional length of wire on for the features you wish to use.

The following indicates proper wiring for these features.

**A/C Shutdown** – This output will provide a +12 volt output a defined throttle position. This output can be used to trigger a relay that deactivates the A/C at higher throttle positions. This may require the installation of a 5 pole relay in the existing A/C wiring. This wire is located in pin E of the 8 pin Input/Output connector and is Grey with a Yellow stripe.

**Electric Fan #1 output** – This output will provide a ground output to trigger a relay used for a cooling fan. This output should never be directly connected to a fan, but the relay that powers the fan. It should be connected to the ground trigger of the relay. This wire is located in pin G of the 8 pin Input/Output connector and is Grey with a Black stripe.

**Electric Fan #2 output** – This output will provide a ground output to trigger a relay used for a cooling fan. This output should never be directly connected to a fan, but the relay that powers the fan. It should be connected to the ground trigger of the relay. This wire is located in pin G of the 8 pin Input/Output connector and is Grey with a Green stripe.

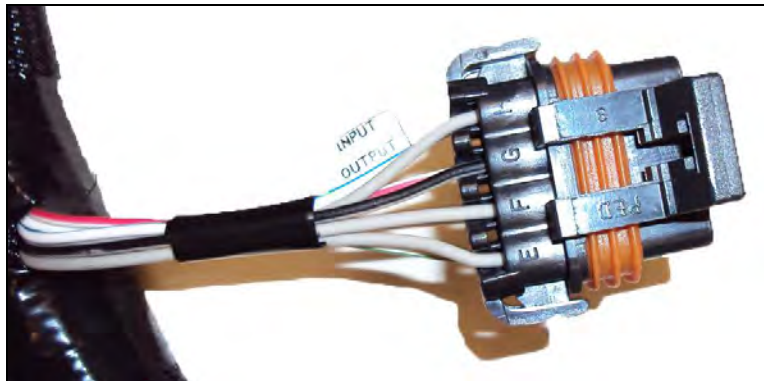


Figure 34

## APPENDIX 1.0

### Pinout

The following shows pins that are used on Avenger systems. Pins that are not used on Avenger systems, but may have wires populated in the harness, are denoted with an asterisk (\*).

<b>P1A Connector</b>	
<b>Pin</b>	<b>Function</b>
A1	Coil – Input
A2	Fuel Pump Out (+12v) (10A Max)
A3	*
A4	*
A5	TPS Input
A6	*
A7	WB1 COMPR2
A8	WB1 Shield
A9	WB HTR -
A10	Switched +12v Input
A11	Manifold Air Temp Input
A12	*
A13	*
A14	Cam/Crank Ground
A15	Gauge Digital Output
A16	WB1 COMPR1
A17	WB1 VS-/IP+
A18	Sensor Ground
A19	Engine Coolant Temp Input
A20	Oil Pressure Input
A21	*
A22	Cam Sync Input / Ignition Bypass Output
A23	Map Sensor Input
A24	CAN Lo
A25	WB1 VS+
A26	Sensor +5v
A27	NOT USED
A28	EST/Spout Output
A29	*
A30	Crank Speed Input
A31	Fuel Pressure Input
A32	CAN Hi
A33	WB1 IP+
A34	WB HTR +

<b>P1B Connector</b>	
<b>Pin</b>	<b>Function</b>
B1	IAC A Lo
B2	IAC A Hi
B3	Fan #2 Output (ground)
B4	Injector F Output
B5	Injector G Output
B6	Injector H Output
B7	Injector E Output
B8	IAC B Lo
B9	IAC B Hi
B10	Fan #1 Output (ground)
B11	*
B12	A/C Shutdown (+12v)
B13	Injector D Output
B14	*
B15	*
B16	*
B17	*
B18	*
B19	Injector A Output
B20	EST 12V Output
B21	*
B22	*
B23	*
B24	*
B25	Injector C Output
B26	Injector B Output



**Holley Performance Products  
1801 Russellville Road  
Bowling Green, KY 42101**

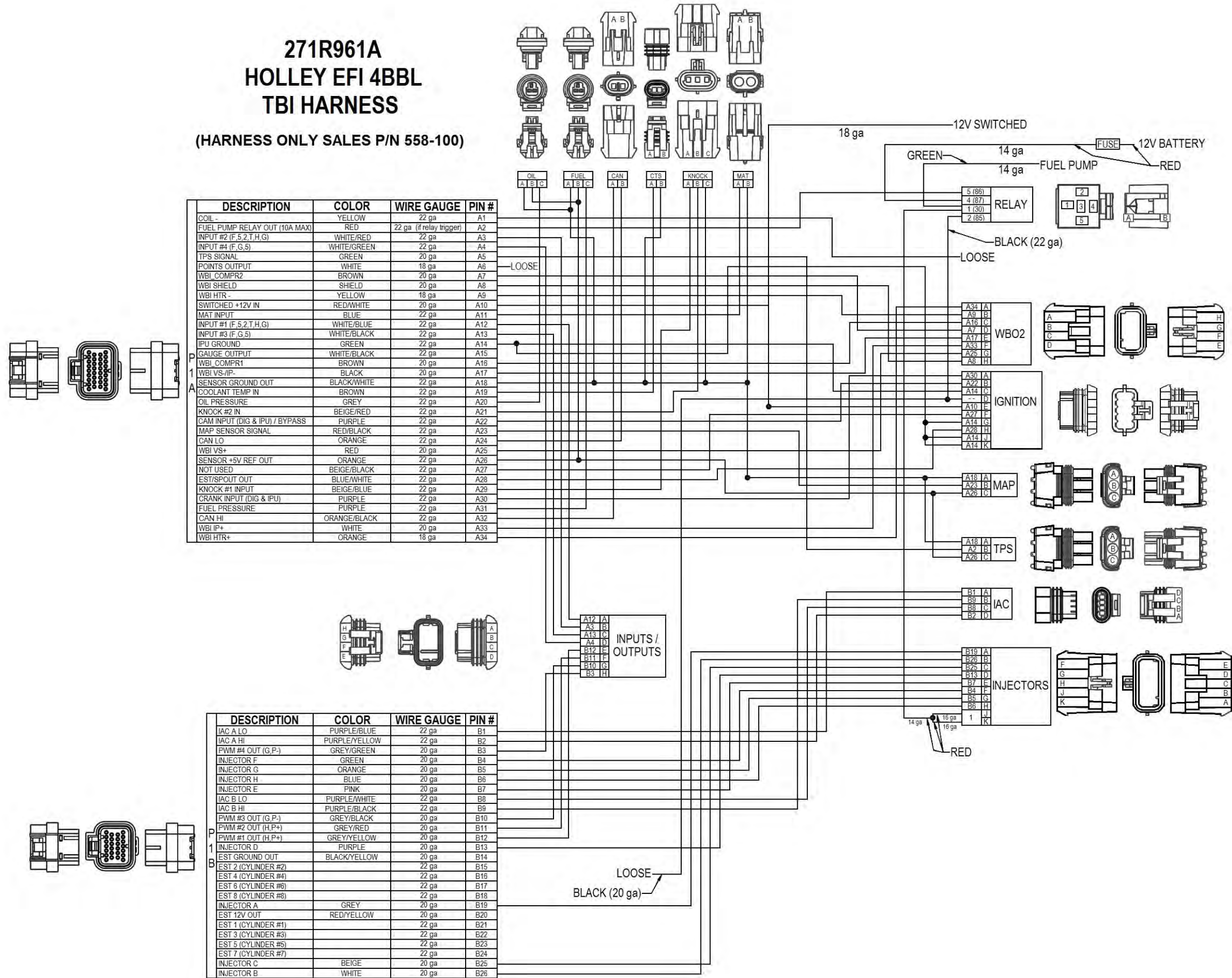
**Technical Service: 1-270-781-9741  
Fax: 1-270-781-9772**

**For online help, please refer to the Technical Information section of our website:  
[www.holley.com](http://www.holley.com)**

**199R10552 wf  
Date: 5-10-11**



**271R961A  
HOLLEY EFI 4BBL  
TBI HARNESS  
(HARNESS ONLY SALES P/N 558-100)**



DESCRIPTION	COLOR	WIRE GAUGE	PIN #
COIL -	YELLOW	22 ga	A1
FUEL PUMP RELAY OUT (10A MAX)	RED	22 ga (if relay trigger)	A2
INPUT #2 (F, 5, 2, T, H, G)	WHITE/RED	22 ga	A3
INPUT #4 (F, G, 5)	WHITE/GREEN	22 ga	A4
TPS SIGNAL	GREEN	20 ga	A5
POINTS OUTPUT	WHITE	18 ga	A6
WBI COMPR2	BROWN	20 ga	A7
WBI SHIELD	SHIELD	20 ga	A8
WBI HTR -	YELLOW	18 ga	A9
SWITCHED +12V IN	RED/WHITE	20 ga	A10
MAT INPUT	BLUE	22 ga	A11
INPUT #1 (F, 5, 2, T, H, G)	WHITE/BLUE	22 ga	A12
INPUT #3 (F, G, 5)	WHITE/BLACK	22 ga	A13
IPU GROUND	GREEN	22 ga	A14
GAUGE OUTPUT	WHITE/BLACK	22 ga	A15
WBI COMPR1	BROWN	20 ga	A16
WBI VS./IP	BLACK	20 ga	A17
SENSOR GROUND OUT	BLACK/WHITE	22 ga	A18
COOLANT TEMP IN	BROWN	22 ga	A19
OIL PRESSURE	GREY	22 ga	A20
KNOCK #2 IN	BEIGE/RED	22 ga	A21
CAM INPUT (DIG & IPU) / BYPASS	PURPLE	22 ga	A22
MAP SENSOR SIGNAL	RED/BLACK	22 ga	A23
CAN LO	ORANGE	22 ga	A24
WBI VS+	RED	20 ga	A25
SENSOR +5V REF OUT	ORANGE	22 ga	A26
NOT USED	BEIGE/BLACK	22 ga	A27
EST/SPOLT OUT	BLUE/WHITE	22 ga	A28
KNOCK #1 INPUT	BEIGE/BLUE	22 ga	A29
CRANK INPUT (DIG & IPU)	PURPLE	22 ga	A30
FUEL PRESSURE	PURPLE	22 ga	A31
CAN HI	ORANGE/BLACK	22 ga	A32
WBI IP+	WHITE	20 ga	A33
WBI HTR+	ORANGE	18 ga	A34

DESCRIPTION	COLOR	WIRE GAUGE	PIN #
IAC A LO	PURPLE/BLUE	22 ga	B1
IAC A HI	PURPLE/YELLOW	22 ga	B2
PWM #4 OUT (G.P.)	GREY/GREEN	20 ga	B3
INJECTOR F	GREEN	20 ga	B4
INJECTOR G	ORANGE	20 ga	B5
INJECTOR H	BLUE	20 ga	B6
INJECTOR E	PINK	20 ga	B7
IAC B LO	PURPLE/WHITE	22 ga	B8
IAC B HI	PURPLE/BLACK	22 ga	B9
PWM #3 OUT (G.P.)	GREY/BLACK	20 ga	B10
PWM #2 OUT (H.P+)	GREY/RED	20 ga	B11
PWM #1 OUT (H.P+)	GREY/YELLOW	20 ga	B12
INJECTOR D	PURPLE	20 ga	B13
EST GROUND OUT	BLACK/YELLOW	20 ga	B14
EST 2 (CYLINDER #2)		22 ga	B15
EST 4 (CYLINDER #4)		22 ga	B16
EST 6 (CYLINDER #6)		22 ga	B17
EST 8 (CYLINDER #8)		22 ga	B18
INJECTOR A	GREY	20 ga	B19
EST 12V OUT	RED/YELLOW	20 ga	B20
EST 1 (CYLINDER #1)		22 ga	B21
EST 3 (CYLINDER #3)		22 ga	B22
EST 5 (CYLINDER #5)		22 ga	B23
EST 7 (CYLINDER #7)		22 ga	B24
INJECTOR C	BEIGE	20 ga	B25
INJECTOR B	WHITE	20 ga	B26

**271R961A  
HOLLEY EFI 4BBL  
TBI HARNESS  
(HARNESS ONLY SALES P/N 558-100)**

