# FUEL INJECTION




# TERMS AND DEFINITIONS OF FUEL INJECTION MANAGEMENT SYSTEMS

**Throttle Body Assembly (TBA)** — The throttle body assembly (also called air valve), controls the airflow to the engine through one, two or four butterfly valves and provides valve position feedback via the throttle position sensor. Rotating the throttle lever to open or close the passage into the intake manifold controls the airflow to the engine. The accelerator pedal controls the throttle lever position. Other functions of the throttle body are idle bypass air control via the idle air control valve, coolant heat for avoiding icing conditions, vacuum signals for the ancillaries and the sensors.

**FUEL INJECTOR** — There are basically three approaches in delivering the fuel to the engine:

- Above the throttle plate as in throttle body injection
- In the intake port toward the intake valves as in multi-port injection or central multi-port injection.
- Directly into the combustion chamber as in gasoline direct injection systems (GDI).

The fuel injector is continuously supplied with pressurized fuel from the electric fuel pump. The pressure across the metering orifice of the injector is maintained constant by the fuel pressure regulator. The fuel injector is an electromagnetic valve that when driven by the ECU delivers a metered quantity of fuel into the intake manifold (or combustion chamber in the GDI system). The ECU controls the fuel flow by pulse width modulation. The time the injector is driven into an open condition is determined by the following sensor inputs:

- Engine RPM
- Throttle position (TPS)
- Manifold absolute pressure or mass air flow
- Engine coolant temperature
- Oxygen sensor feedback voltage
- Intake air charge temperature
- Battery voltage

**CENTRAL POINT INJECTION SYSTEM (CPI)** — Electronic fuel Injection system consisting on a single fuel injector mounted in the throttle body.

**DIGITAL FUEL INJECTION (DEFI OR DFI)** — Electronic fuel injection system controlled by digital microprocessors as opposed to earlier systems that were of analog design. The analog input signals to the microprocessor are converted from analog to digital before being processed.

**THROTTLE BODY INJECTION (TBI)** — In TBI systems the throttle body assembly has two major functions: regulate the airflow, and house the fuel injectors and the fuel pressure regulator. The choices of throttle bodies range from single barrel/single injector unit generally sized for less than 150 HP to four barrel/four injector unit capable of supporting fuel and air flow for 600 HP. The injectors are located in an injector pod above the throttle valves. The quantity of fuel the injector spray into the intake manifold is continuously controlled by the ECU. Most of the TBI systems use bottom fed fuel injectors.

**MULTI-POINT FUEL INJECTION (MPFI)** — In the multi point fuel injection system an injector is located in the intake manifold passage. The fuel is supplied to the injectors via a fuel rail in the case of top fed fuel injectors and via a fuel galley in the intake manifold in the case of bottom fed fuel injectors. MPFI systems provide better performance and fuel economy as compared to TBI. Most of the MPFI systems use one injector per cylinder but in certain applications up to two injectors per cylinder are used to supply the required fuel for the engine.

**CENTRAL MULTI-PORT FUEL INJECTION (CMFI)** — This is a variation of MPFI system but in this case the injectors (usually one per cylinder) are located in a plastic molded pod and the fuel is distributed to the intake ports via a polymeric hose. To avoid fuel distribution variations a fuel pressure activated poppet valve is installed at the end of the hose. The injectors are activated via the ECU in a similar fashion as in the MPFI fuel systems.

**TUNED PORT INJECTION (TPI)** — A TPI is a fuel/air management system that has a tuned induction system to optimize airflow to each cylinder. This system was developed to obtain the broadest possible torque curve. A single throttle body and one injector per cylinder are used in this configuration. The intake manifold incorporates long runners whose length is tuned to the desired torque curve. For low and mid range torque longer runners are utilized in this application.

**DIRECT FUEL INJECTION (DFI)** — In a direct fuel injection system one injector is located in the cylinder head for each cylinder. The high-pressure fuel (single fluid) or low-pressure air/fuel mixture (dual fluid) is metered directly into the combustion chamber when the electromagnetic valve is activated by the ECU. This fuel injection system offers the latest in engine management systems and offers the best in engine performance, low exhaust emissions and fuel economy.

**ELECTRONIC CONTROL UNIT (ECU)** — The function of the ECU is to "tweak" or "fine tune" the engine operation to obtain the most complete and efficient combustion process. The ECU microprocessor receives input signals from various sensors from the engine and generates specific outputs to maintain optimum engine performance. The engine operating modes controlled by the ECU is the following:

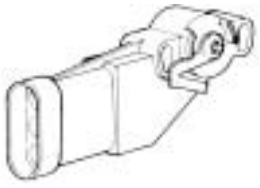
- Cold and hot start
- Acceleration enrichment
- Battery voltage compensation
- Deceleration cut/off or enleanment
- Run mode (open loop or closed loop)

**MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)** — The MAP sensor is a three-wire sensor located on or attached to the intake manifold. The function of this sensor is to measure the changes in the intake manifold air pressure and generates an electric signal that is proportional to the change of pressure. This signal is fed into the ECU and is used to:

- Adjust the fuel delivery
- Spark ignition calculations
- Barometric pressure readings upon starting the engine

**MASS AIR FLOW SENSOR (MAF)** — The mass air flow sensor is positioned in the air intake duct or manifold and measures the mass of incoming air. From this acquired data the ECU calculates the required fuel for the specific air mass flow rate. The MAF works on the hot wire or hot film concept. The hot wire/film is maintained at a constant calibrated temperature. The passing air cools down the hot wire/film and the added energy required to maintain the calibrated temperature is directly proportional to the mass of air passing by the hot wire. The MAF also compensates for humidity as humid air, denser or cooler, absorbs more heat from the sensor, requiring more current to maintain the calibration temperature.

**THROTTLE POSITION SENSOR (TPS)** — The TPS is a three-wire sensor that is mounted on the throttle body assembly and is actuated by the throttle shaft. The TPS is basically a variable resistor (potentiometer) that sends a voltage signal to the ECU that is proportional to the throttle shaft rotation. When the throttle shaft is open the sensor emits a high voltage signal and when the throttle shaft is closed it emits a low voltage signal. The voltage signal from the TPS changes between 0.45 V at idle to 4.5 to 5.0V at wide open throttle.



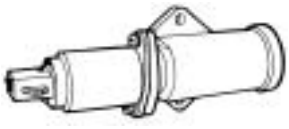
**OPEN LOOP** — Open loop defines the engine operation where the fueling level is calculated by the ECU with only the input signals from the throttle position sensor (TPS), from the coolant and/or air charge temperature, and from the manifold absolute pressure (MAP) or the mass air flow sensor (MAF).

**CLOSED LOOP** — Closed loop defines the engine operation where the fueling level is calculated and corrected by the ECU based on the voltage signal from the $O_2$ sensor. When the $O_2$ sensor emits a voltage signal above 0.45V due to a rich mixture in the exhaust manifold, the ECU reduces the fueling level by reducing the pulse width of the injector. The $O_2$ sensor voltage is the feedback that modifies the fuel control program that is based on other signals.

**IDLE AIR CONTROL VALVE (IACV OR IAC)** — The IAC is located in the throttle body of the TBI, MPFI and CMFI systems. The valve consists of a stepper motor that adjusts the position of its pintle to vary the bypass air during idle and off idle conditions. During the closed throttle condition (idle), the ECU constantly compares actual engine speed with the programmed desired engine speeds. Discrepancy between these two values result in activation of the stepper motor increasing or decreasing the bypass air around the throttle plate(s) until desired engine speed is achieved. The following input signals or conditions determine the position of the valve:

- Throttle position sensor
- Engine load (MAP/MAF, A/C compressor, power steering pressure switch, gear selection)
- Battery Voltage
- Engine coolant temperature

**THROTTLE AIR BYPASS VALVE —** The throttle air bypass valve is located on the throttle body of engine fuel management systems. This solenoid valve allows additional bypass air when the engine is subjected to certain load conditions or cold starts.



**AIR CHARGE TEMPERATURE SENSOR** — The air charge sensor is located in the engine air intake to sense the air induced into the engine manifold. The sensor consists of a thermistor, which generates a voltage signal, that is proportional to the air temperature. This voltage signal is used by the ECU to calculate the air density and using these results to adjust the fueling levels for a particular engine load. Other functions of the air temperature signal are:

- Adjust fueling during cold start
- Activation of the EGR valve
- Modify spark advance
- Regulate acceleration enrichment

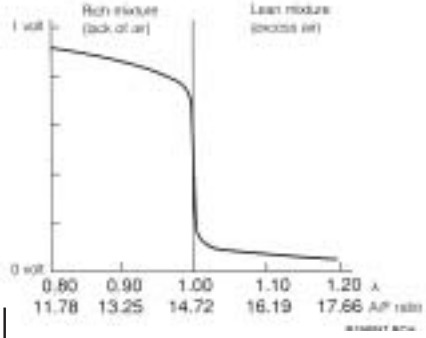



**COOLANT TEMPERATURE SENSOR** — The coolant temperature sensor is a two-wire sensor that is threaded into the engine block and is in direct contact with the coolant. The function of this sensor is to generate a signal that the ECU uses to adjust the fueling levels required for the operation of the engine and operate ancillaries. The thermistor contained in the sensor generates an electric signal that is proportional to the coolant temperature. At low temperatures the resistance is high (3800 ohms) generating a 5-volt signal in the ECU. At normal engine operating temperatures the resistance of the sensor is low (180–200 ohms) which generates 1–2 volt signal in the ECU. Other functions of the coolant temperature signal are:

- Idle speed adjustment via the IAC
- Modify spark advance
- Electric cooling fan operation
- Activation of the EGR
- Torque converter clutch application

**Oxygen Sensor** — The oxygen sensor is located in the exhaust manifold and its function is to measure the oxygen content in the exhaust gases. The sensor is an electrochemical cell, which develops a voltage signal between its two electrodes that is proportional to the oxygen content in the exhaust gases. The oxygen sensor adjusts and maintains an optimum air fuel mixture to control the exhaust emission and the fuel economy. When the oxygen content in the exhaust is high due to a lean mixture the output voltage of the sensor is close to zero. If the fuel air mixture is on the rich side, the oxygen content in the exhaust is low and the output voltage of the sensor approaches 1.0 volts. There are three types of oxygen sensors:

- One wire $O_2$ sensor (not heated)
- Three wire $O_2$ sensor (heated)
- Four wire $O_2$ sensor (heated)




**TOP-FED FUEL INJECTOR** — When the ECU activates this electromagnetic valve, the injector meters and atomizes fuel in front of the intake valve. The fuel enters the top and is discharged via the metering orifice at the bottom at high pressure. The spray geometry and cross sectional area is specific to the engine application. In general there are four major spray patterns:

- Pencil stream. Solid stream narrow angle spray.
- Split pencil stream. Two solid streams narrow angle sprays usually used in multi valve cylinder applications.
- Bend spray. Solid stream narrow angle spray being discharged in an angle with respect to the injector center axis. This application is used in engine applications where the injector package does not allow alignment of the injector axis with the spray target center axis.
- Oblong spray. This spray geometry consists of an elliptic or oblong cross-sectional area of the spray. This application is used in engine applications where the spray target requires a specific spray pattern.

**BOTTOM FED FUEL INJECTOR** — This electromagnetic valve meters fuel into the intake manifold in proportion to the air flowing into the engine. When the valve is energized the electromagnetic force generated by the solenoid lifts the pintle/ball from the seat. Fuel under pressure is then injected into the throttle body bore or the intake port. The spray configuration is application dependent. For throttle body injection a hollow conical spray is required while for port injection a narrow pencil stream is preferred to avoid wall wetting.

**HIGH IMPEDANCE INJECTORS** — Most injectors can be divided into two major categories: high impedance 12 to 16 Ohms and low impedance 1.2 to 4.0 Ohms. The high impedance injectors are used with ECUs that are designed with saturation drivers. The advantage of using saturation drivers is that the currents running through the ECU circuits and the injectors are relatively low thus generating less heat. The disadvantage of saturation drivers is that the driver has a slower response time, which could affect the full utilization of such a system at very high engine RPM.

**LOW IMPEDANCE INJECTORS** — The low impedance injectors are designed to be run with an ECU that employs peak and hold drivers (also called current sensing or current limiting drivers). The current ratio (peak to hold) is generally 4:1 and the most common drivers available are 4 A peak/1 A hold or 2 A peak/ 0.5A hold. The peak current is generated to overcome the inertia of the closed valve and once the valve is open the driver cuts down to 1/4 of the peak current to hold the injector open until the end of the metering event. Low impedance injector designs are mostly used in high flow applications.

**ELECTRIC IN-LINE FUEL PUMP** — The function of the electric fuel pump is to deliver pressurized fuel to the fuel injection system. The ECU activates the fuel pump relay to operate the fuel pump when the ignition switch is in the On or start position. The pumps are designed to match certain flow and pressure specification for the engine application. In TBI applications the fuel pump must supply enough fuel flow for the engine WOT output at 15 to 20 psi. In multi-port applications the fuel pump must be able to supply enough fuel at full engine load to maintain at least 43.5 psi at the fuel rail. At idle the fuel pressure regulator must be able to return the excess fuel to the tank and maintain the required system pressure. Most of the cars prior to 1987 use an in-line external electric fuel pump.

**ELECTRIC IN-TANK FUEL PUMP** — Almost all car applications after 1987 designed their fuel pump assembly inside the fuel tank. The advantage of having the fuel pump in the fuel tank is mainly lower noise, lower potential leakage problems, less mounting sensitivity of the pump with respect to lift of fuel from the tank is minimized. The in-tank pump went through several designs evolving from a simple "pump on a stick" to a complex in-tank fuel sending modules. The new designs combine the high-pressure electric fuel pump, noise isolation and a fuel level sensor into one compact modular package. This new design also helps reducing hydrocarbon emissions. The hot gasoline returning from the fuel system is returned to the reservoir surrounding the fuel pump. By returning the hot fuel to the reservoir heating of the bulk fuel in the fuel tank is avoided, thus reducing the evaporation of the high volatile portions in the fuel. At present all fuel tank modules are designed and serviced as a complete unit. If the pump or fuel level sensor fails the entire unit will have to be changed.

**FUEL PUMP INLET FILTER** — The function of this filter is to eliminate any impurities that might harm the fuel pump. In the in-line fuel pump type this filter is external to the fuel tank and is in a replaceable cartridge filter. In the in-tank fuel pumps the fuel filter is in the form of a sock and is directly attached to the pump in the "pump on a stick" version and attached to the fuel pump module in the module version.

**MAIN FUEL FILTER** — The function of this filter is to eliminate any contaminants after the fuel pump. These are either small enough to pass through the fuel filter of the pump inlet or are generated by the fuel pump. This fuel filter is also of the cartridge type but is designed to sustain much higher fuel pressures that the fuel pump inlet filter.

**FUEL PRESSURE REGULATOR** — Fuel system pressure is maintained by the regulator, while excess fuel is returned to the fuel tank. The regulator consists of two chambers separated by a diaphragm assembly. On the fuel side of the diaphragm a throttling valve is employed to expand or restrict fuel flow as the fuel pressure fluctuates. The other side contains a spring with an adjustment screw that is set at the factory for correct system pressure and flow. This chamber is connected to the intake manifold in MPFI systems to reference the vacuum in the manifold during engine operation. This pressure reference is required to maintain a constant differential pressure across the metering orifice of the fuel injector.




**THE ENGINE APPLICATION AND THE SELECTION OF YOUR FUEL MANAGEMENT SYSTEM COMPONENTS.**

## INJECTOR FUEL FLOW

Engine output is in direct relation with fuel supplied to the engine, however installing injectors, which are too big, will not make more power. It is therefore very important to match the fuel injector flow characteristics to specific engine applications. Matching the fuel flow characteristics of fuel injectors is as important as matching the carburetor jets for a specific engine application. The fuel flow of the injectors and the carburetor has to be matched to the air flow requirements of the engine over a broad RPM operating range.

In the carburetor the operating range is usually divided into three sub-ranges: idle, mid-range and power. Three distinct fuel circuits supply the fuels for these three ranges. In MPFI systems one single injector has to cover all three ranges for individual cylinders from 500 RPM at idle to 8000 at WOT. The operating range in fuel injectors is normally referred to as the dynamic range of the injector. An injector with a wide dynamic range is capable not only to potentially cover several engine applications but also is a very sought after metering tool for high performance applications.

The dynamic range must encompass the minute quantities of fuel required at idle conditions and the large quantities of fuel required at maximum engine output. It must also cover the required fuel amounts during transient response. The dynamic range of the fuel injector is further stressed in turbo charged applications because of the additional fuel required due to the higher engine air mass flow rates generated by the turbocharger.

The following equation sizes fuel injectors for specific engine applications.

Injector Static Flow Rate [lb/hr] = (Engine HP * BSFC)/ (Number of injectors * DC of Inj.)

Engine HP = Realistic HP output estimate of the engine

BSFC = Brake Specific Fuel Consumption [lb/HP*hr]. Good approximation 0.50

Duty Cycle of Injector = Maximum opening time of injector/cycle time.

Maximum Duty Cycle= 0.90

Example:

Engine HP = 400HP

Number of Injectors = 8

Injector Static Flow Rate [lb/hr] = (400 * 0.50)/(8 *0.90) = >27.78 b/hr

**Note:** If the application requires a static flow rate that falls in between two available injectors always use the next injector with the higher flow rate.

For the example above if only 25 lb/hr and 30 lb/hr injectors are available, choose 30lb/hr injectors.

## FUEL PRESSURE

In certain occasions matching of the injectors' fuel flow for a specific engine application cannot be done due to injector availability or the fuel flow step between the available injectors is too large. Since the fuel injector is a pressure/time-metering device, increasing the fuel pressure can increase the fueling level. Increasing the fuel pressure is limited mainly to four factors: burst pressure of the components in the fuel system, increase of opening time of the injector, reduced life expectancy of the fuel system components and limitations of the fuel pump. Most injectors are limited to a burst pressure of 125 psi. Reducing the fuel pressure to match the required fuel flow can be done but lower fuel pressures affect the atomization efficiency of the fuel injector nozzle. To project potential fueling levels by changing the fuel pressure, the following equation can be used:

$M1/M2 = \sqrt{P1} / \sqrt{P2}$

M1 = rated mass flow rate of the injector at fuel pressure P1 in lb/hr

M2 = new mass flow rate of the injector at fuel pressure P2 in lb/hr

P1 = existing fuel pressure setting in psi

P2 = new fuel pressure setting in psi

Example:

Rated mass flow rate M1 = 30 lb/hr

Existing fuel pressure P1 = 43.5 psi

Required fuel mass flow rate M2 = 35 lb/hr

$P2 = (M2/M1)^2 * P1$

$P2 = (35/30)^2 * 43.5$

P2 = 59.21psi = >60psi

To obtain a fueling level of 35 lb/hr the system pressure has to be increased to 60 psi.

After increasing the fuel pressure to obtain certain engine output, idle, off-idle and light load condition will have to be re-tested. Increasing the fueling level at the upper end, requires the fuel injector to run at smaller pulse widths at idle conditions. When running at pulse widths smaller than 1.8 ms the injector might be running in the non-n linear portion of its dynamic range. Such condition can lead to engine "hunting" during idle to hesitation during off-idle conditions.

## PROPER FUEL INJECTOR SELECTION INFORMATION

Choosing the proper fuel injector size is critical for the successful use of an electronic fuel injection system whether it be a TBI or Multi-port system. If an injector is too small, not enough fuel will be available when tuning an engine and damage can result. If an injector is selected that is much larger than is needed, the injector pulse width (time the injector is open) at idle may be too low and tuning problems at idle may occur.

**Use the following information as a guide for selecting the correct injectors for an engine:**

Formulas used to determine injector size:

$$\textbf{Injector Size} = \frac{\textbf{(Engine HP (Flywheel)) x (BSFC)}}{\textbf{(\# of injectors) x (Duty Cycle)}}$$

**Injector Size** Flow rate in lbs/hr

**Engine HP** Maximum horsepower at the flywheel

**BSFC** Brake Specific Fuel Consumption (BSFC) is the lbs. of fuel an engine consumes per HP per hour. It is simply a measure of how efficiently an engine is at converting fuel to horsepower. It is very important to use a BSFC number that is close to your actual number. If it is not, the injector will be too small or larger than is necessary.

General guidelines when choosing a BSFC number:

Low to medium performance street engines: 0.50-.55
Performance engines with good cyl. heads: 0.45-.50
Race engines with very efficient cyl. heads: 0.38 - 0.45
Supercharged and Turbocharged engines: 0.55 - 0.65

Supercharged and Turbocharged engines run at richer air/fuel ratios that raise the BSFC number. They require larger injectors for the same horsepower as a naturally aspirated engine.

Add 0.05 for marine applications, as they need to run richer than a comparable automotive application due to continuous wide open throttle use.

**Duty Cycle** The duty cycle is the maximum amount of time you want the injectors to be open at a certain horsepower and injector size. Under most circumstances you don't want an injector to be open more than 90% of the time at the most. Marine applications shouldn't exceed 80%. Injectors are rated at 100% duty cycle (static flow).

Later on if you want to increase the the engine HP, take that into account when entering the HP number.

When calculating injector size, round up to the next nearest size needed. For example if you calculate 26 lb/hr and have a 24 lb/hr and a 30 lb/hr to choose from, select the 30 lb/hr injector.

**Examples**

400 HP street engine
Number of injectors = 8

$$\text{Injector size} = \frac{\text{(400 HP) x (0.5 BSFC)}}{\text{(8 injectors) x (0.9)}} = 27.7 \text{ lb/hr}$$

600 HP Supercharged engine
Number of injectors = 8

$$\text{Injector size} = \frac{\text{(600 HP) x (0.57 BSFC)}}{\text{(8 injectors) x (0.9)}} = 47.5 \text{ lb/hr}$$

The following chart provides maximum horsepower levels based on injector size and various BSFC values. Note that this is at 100% duty cycle and 43.5 psi; raising the fuel pressure will increase the maximum horsepower.

| | Max. HP at given BSFC (100% duty cycle, 43.5 PSI) | | | | |
|---|---|---|---|---|---|
| Inj. Size | 0.4 | 0.45 | 0.5 | 0.55 | .06 |
| 14 | 280 | 250 | 225 | 203 | 186 |
| 19 | 380 | 337 | 304 | 276 | 253 |
| 24 | 480 | 426 | 384 | 349 | 320 |
| 30 | 600 | 533 | 480 | 436 | 400 |
| 36 | 720 | 640 | 576 | 523 | 480 |
| 42 | 840 | 746 | 672 | 610 | 560 |
| 50 | 1000 | 888 | 800 | 727 | 666 |
| 55 | 1100 | 977 | 880 | 800 | 733 |
| 65 | 1300 | 1155 | 1040 | 945 | 866 |
| 75 | 1500 | 1333 | 1200 | 1090 | 1000 |
| 85 | 1700 | 1511 | 1360 | 1236 | 1133 |
| 95 | 1900 | 1688 | 1520 | 1381 | 1266 |

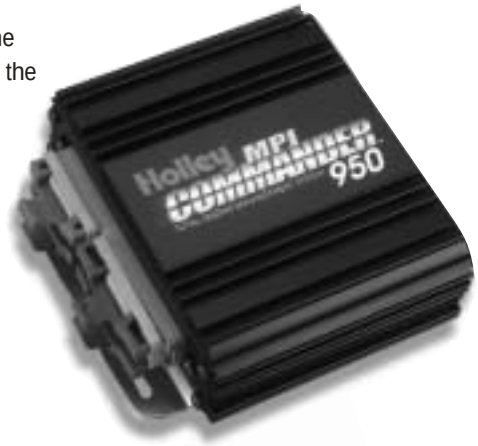



# COMMANDER 950™ PRO OVERVIEW

The Holley Commander 950 ECU provides the customer with a high level of tuning flexibility to control engines from mild to wild. From stock, naturally aspirated engines, to high horsepower supercharged engines, the Commander 950 gives you the power to precisely tune all functions of an engine.

The Commander 950 allows for real-time tuning of all parameters. The Windows-based software is simple to use for the beginner and has all the features necessary for experienced tuners.

All Commander 950 Systems come standard with the Pro Software. Pro Software comes with many features that help allow the precise tuning of any street or race engine.





## FEATURES AND ENGINE/HARDWARE COMPATIBILITY

- Compatible with 4, 6 and 8 cylinder even fire engines
- Operates as speed density or alpha-N
- Can be programmed to run alpha-N at idle only
- 16 x 16 fuel and timing maps
- Uses 1, 2 or 3 Bar MAP sensors
- Programmable load and RPM scales
- Maximum RPM of 12,750
- Controls GM and Chrysler stepper IAC valves
- Compatible with GM knock sensor
- Controls 8 high or 4 low impedance injectors
  - will control 8 low impedance injectors with P/N 534-122
- Controls TBI fuel injection with 1 to 1 or progressive linkage
- Operates in closed and open loop
- Controls narrow band and any wide band $O_2$ sensor with 0-5 volt output
  - 8 x 8 target air/fuel ratio chart
  - 8 x 8 + and - closed loop compensation limits
- Full tuning for:
  - startup and warm-up fuel enrichment
  - acceleration fuel enrichment based on MAP and TPS sensors
  - timing vs coolant temperature
  - deceleration fuel cut-off
  - fueling strategy
- Timing control feature can be achieved through the use of:
  - small cap computer controlled GM HEI (stock GM or Holley P/N 890-160)
  - large cap computer controlled GM HEI
  - Ford TFI distributor
  - magnetic crank trigger
  - hall effect crank trigger
- Integrated rev limiter
- PC and internal datalogger (logs to ECU) standard. Fully programmable operation
- Programmable inputs and outputs (timing retards, RPM activated switches, etc.)
- ECU size is 5.5” x 4.75” x 2.0”

# COMMANDER 950™ PRO SOFTWARE

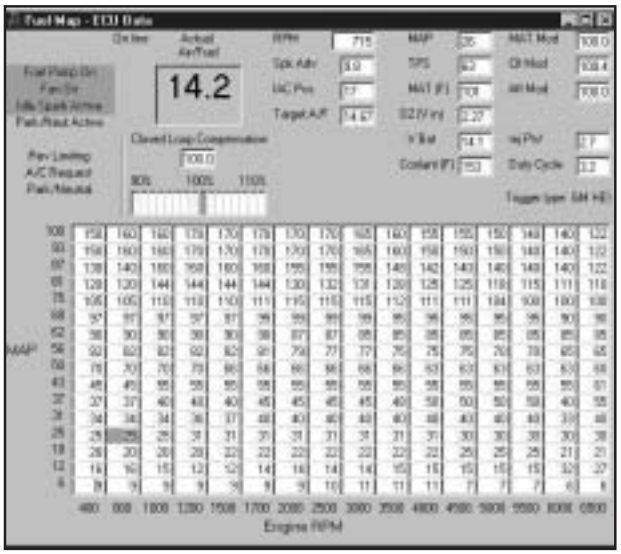
The Holley software included is Windows-based. It is designed for beginning users or expert tuners. The software is compatible with Windows 3.1, 95, 98, 2000, ME, and XP operating systems. A computer with a 9-pin serial port is required. The software allows real-time tuning whether on the dyno or tuning on the street.

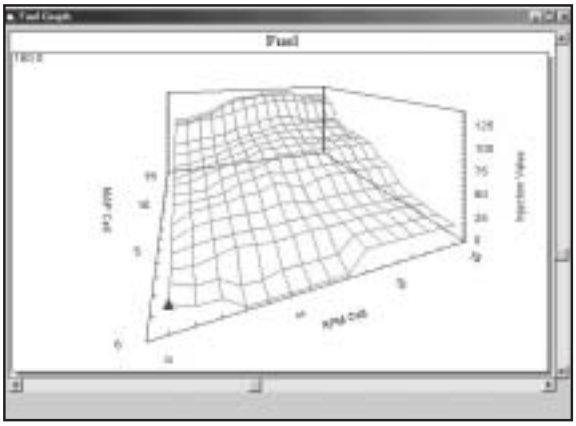
All sensor data is viewable from both the fuel and ignition timing maps which makes tuning easier. The fuel and ignition timing maps can both be viewed in graphical form, which helps to better visualize the data. Hot keys allow for quick navigation between screens. Other features such as warning the user when a fuel map number is entered that drives the injectors static makes tuning safer.

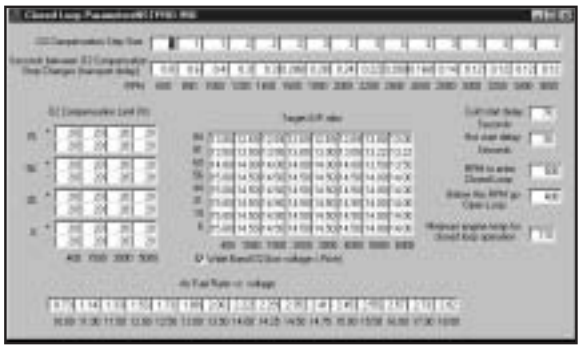
A comprehensive, step-by-step tuning manual is included, along with many base maps to get you started and assure success.

A professional level data-logger is included for evaluating on-track performance.

A copy of the comprehensive 100 page manual can be downloaded at holley.com





**NOTE:** Downloadable base fuel maps are available at www.holley.com




## COMMANDER 950™ ENGINE MANAGEMENT SYSTEM KITS

These Holley kits are intended to replace and upgrade existing fuel injection electronics or to provide a state-of-the-art electronic control module, if none is currently available. The Holley Commander 950 is the most powerful and capable ECU available on the market today. Capable of driving up to 8 high impedance and 4 low impedance injectors, the Commander 950 can provide all the power and sophistication required for any street or strip fuel injected motor. These Holley engine management system kits contain the Commander 950 ECU, wiring harness and sensors, where applicable, that you'll need to make a customized fuel injection installation.


**NOTE:** These systems are designed only for fuel and spark management. Items such as cruise control, transmission control, AC, ABS, etc are not controlled by the Commander 950.

| Application | Part # |
|---|---|
| **Holley 1D/2D Pro-Jection systems**<br>(replaces and upgrades existing Pro-Jection electronics) | **950-113** (B) |
| **Holley 4D and 4Di Pro-Jection systems**<br>(replaces and upgrades existing Pro-Jection electronics) | **950-100** (B) |
| **Holley MPI Pro-Jection II systems**<br>(replaces and upgrades existing Pro-Jection electronics) | **950-103** (B) |
| **1985-92 GM TPI (tuned port injection) engine applications** | **950-101** (B) |
| **1992-97 GM LT1/LT4 engine applications**<br>(requires a custom crank trigger installation) | **950-105** (B) |
| **1986-95 Ford 5.0L EFI V8 engine applications** | **950-106** (B) |
| **Universal V8 multi-point fuel injection** | **950-109** (B) |
| **Universal V6 multi-point fuel injection** | **950-110** (B) |
| **Universal 4cyl. & import multi-point fuel injection** | **950-104** (B) |
| **Universal engine controller kit for customized applications**<br>(includes 20' long, non-terminated harness for cut-to-length flexibility) | **950-115** (B) |

# COMMANDER 950™ ENGINE MANAGEMENT SYSTEM KITS

## SERVICE PARTS

| | Part # |
|---|---|
| **Cable, communication, laptop computer**<br>Provides ECU to laptop computer connection | **534-140** |
| **Distributor wiring harness adapter, Chevrolet HEI**<br>Small cap distributor | **534-138** |
| **Distributor wiring harness adapter, Ford TFI** | **534-139** |
| **ECU, Commander 950** (except LS1 kit) | **534-120** |
| **Relay kit, cooling fan**<br>Includes relay and wiring for cooling fan | **534-134** |
| **Sensor, knock, wiring connector kit**<br>Does not include module or sensor | **534-136** |
| **Software, Commander 950**<br>Mapping and set up | **534-144** |
| **Software, Commander 950 PRO**<br>Mapping and set up & ECU firmware upgrade | **534-191** |
| **Wiring harness, injectors** | |
| Universal 4 cyl. kit, P/N **950-104** | **534-153** |
| Ford 5.0L V8 kit, P/N **950-106** | **534-131** |
| Universal V6 kit, P/N **950-110** | **534-152** |
| Universal V8 kit, P/N **950-109** | **534-133** |
| Universal S/B V8 (over the fuel rail) | **534-129** |
| Universal B/B V8 (under the plenum) | **534-130** |
| Universal 4 cyl. | **534-182** |
| **Wiring harness, Hall Effect sensor**<br>Provides wiring for Hall Effect sensor installation | **534-177** |
| **Wiring harness, magnetic pick up**<br>Provides wiring for magnetic pick up installation | **534-135** |
| **Wiring harness, main** | |
| Used with kit, P/N **950-100** | **534-146** |
| Used with kit, P/N **950-101** | **534-128** |
| Used with kit, P/N **950-102** | **534-147** |
| Used with kit, P/N **950-103** | **534-142** |
| Used with kit, P/N **950-104** | **534-182** |
| Used with kit, P/N **950-105** | **534-148** |
| Used with kit, P/N **950-106** | **534-149** |
| Used with kit, P/N **950-109** | **534-142** |
| Used with kit, P/N **950-110** | **534-151** |
| Used with kit, P/N **950-113** | **534-158** |
| Used with kit, P/N **950-114** | **534-157** |
| Used with kit, P/N **950-115** | **534-143** |
| Used with kit, P/N **950-117** | **534-156** |

## AUXILIARY INJECTOR DRIVER KIT

Designed to work with ECUs (like the Holley Commander 950) that have four (4) "peak to hold drivers". What this module does is expand the ECU's capability to control eight (8) "peak & hold drivers", allowing the use of eight (8) low impedance injectors. With this additional capability, running either a 2x4 throttle body set-up or 8 low impedance injectors in a multi-point system is possible.


(see page 172)



(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

1 2 or 3 See page 2 for symbol explanation.




## COMMANDER 950™ MULTI-POINT FUEL INJECTION UNIVERSAL KITS

Install multi-port fuel injection on any engine!

System includes most components necessary to retrofit multi-port electronic fuel injection on nearly any vehicle. Just use your single plane manifold of choice and you have a customized EFI motor.

NEW!

| Part # | Kit Description |
|---|---|
| **534-183**(B)◆3 | 1000 CFM throttle body |
| **534-184**(B)◆3 | 2000 CFM throttle body |

### Kits include:

- Commander 950 ECU
- Pre-terminated wiring harness
- 1000 or 2000 CFM billet aluminum throttle body
- Billet aluminum fuel pressure regulator
- 8 injector bungs
- aluminum fuel rails
- MAP, coolant, air temperature, and oxygen sensors
- Software
- Comprehensive installation and tuning manuals

### Additional requirements:

- Fuel injectors sized to application
- Fuel pump and filters sized to application
- Machining of supplied fuel rails
- Machining and welding of injector bungs and fuel rail hold-downs
- Plumbing
- New throttle cable bracketry


(Manifold not included)

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

(C) Not legal for street use with a 4-barrel in California on vehicles equipped with a 2-barrel carburetor, for which there was no 4-barrel option.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.

# STEALTH RAM™ MULTI-POINT FUEL INJECTION SYSTEMS

Want to get "Oooos" and "Ahhhs" every time you open the hood? Want to feel real power every time you step on the loud pedal? Then you'd better get Holley's new STEALTH RAM™ MPFI system on your street machine. Tunnel ram design helps to build power. The plenum and runner designs promote excellent mid-range torque along with outstanding high RPM power. The available polished finish makes you look good. Commander 950™ software and electronics helps you get down the road in no time.

STEALTH RAM™ MPFI systems are complete and include a 2x58mm billet throttle body. The following are available:

| Part # | Part# with Wide Band $O_2$ NEW! | Vortec Applications NEW! | Vortec w/ $WBO_2$ Applications NEW! | Description | HP Range* |
|---|---|---|---|---|---|
| **91503201**(B) ◆3 | **91503211**(B) ◆3 | **91703201**(B) ◆3 | **91703211**(B) ◆3 | Satin w/ 24 lb/hr injectors | 300 - 385 |
| **91504201**(B) ◆3 | **91504211**(B) ◆3 | **91704201**(B) ◆3 | **91704211**(B) ◆3 | Satin w/ 30 lb/hr injectors | 385 - 480 |
| **91505201**(B) ◆3 | **91505211**(B) ◆3 | **91705201**(B) ◆3 | **91705211**(B) ◆3 | Satin w/ 36 lb/hr injectors | 480 - 575 |
| **91506201**(B) ◆3 | **91506211**(B) ◆3 | **91706201**(B) ◆3 | **91706211**(B) ◆3 | Satin w/ 42 lb/hr injectors | 575 - 670 |
| **91403201**(B) ◆3 | **91403211**(B) ◆3 | **91603201**(B) ◆3 | **91603211**(B) ◆3 | Polished w/ 24 lb/hr injectors | 300 - 385 |
| **91404201**(B) ◆3 | **91404211**(B) ◆3 | **91604201**(B) ◆3 | **91604211**(B) ◆3 | Polished w/ 30 lb/hr injectors | 385 - 480 |
| **91405201**(B) ◆3 | **91405211**(B) ◆3 | **91605201**(B) ◆3 | **91605211**(B) ◆3 | Polished w/ 36 lb/hr injectors | 480 - 575 |
| **91406201**(B) ◆3 | **91406211**(B) ◆3 | **91606201**(B) ◆3 | **91606211**(B) ◆3 | Polished w/ 42 lb/hr injectors | 575 - 670 |
| | **91500011**(B) ◆3 | | | Satin w/ no injectors or fuel pump | |

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

## System features:

- Fits early and late(**) model 23º Chevrolet cylinder heads and Vortec heads
- Computer controlled timing available using 1984-1996 GM external coil distributor (billet Holley version available under P/N 890-160).
- Base maps for various combinations to get you started
- Designed to use GM TPI throttle and transmission cables and brackets

(**) Requires angled bolt spacers, P/N 90748

## Systems include:

- Upper and lower intake manifolds
- 58mm billet throttle body
- Bright clear anodized aluminum fuel rails
- Fuel injectors
- Fuel pressure regulator
- 255 LPH fuel pump and fuel filters
- Commander 950™ ECU
- All wiring harnesses
- Software and communications cable
- TPS, MAP, coolant, air temperature and oxygen sensors
- No EGR provision
- No 9th injector port
- Detailed installation and tuning manuals

## Specifications:

- Height is 10-1/4"
- Shipping weight is approximately 45 lbs.

STEALTH RAM NEW!

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

(C) Not legal for street use with a 4-barrel in California on vehicles equipped with a 2-barrel carburetor, for which there was no 4-barrel option.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.




# COMMANDER 950™ MULTI-POINT FUEL INJECTION SYSTEMS

Commander 950 Multi-Point Fuel Injection Systems are intended for carbureted, non-emission, non-computerized Chevrolet small block and big block V8 engines. Ford small block V8 engines are not forgotten, as some very special systems are also available for them.

These are complete systems that are engineered to provide all the components and hardware needed for your custom installation. The intake manifold, billet throttle body, billet fuel rails, injectors and related miscellaneous parts are partially pre-assembled and tested prior to packaging. Holley takes this extra step in quality assurance to verify the performance, quality and integrity of the system.

With the addition of Commander 950 electronics, Holley multi-point fuel injection systems offer more in the way of features, more in the way of performance, more in the way of system capability, more in the way of outright good looks and more in the way of value! The product features, listed below, should explain this well enough.

Whether your engine is stock, crate or custom-built, a Holley Commander 950 multi-point fuel injection system can help maximize its performance characteristics and make your cruising times a lot more enjoyable.

**Ford system is shown**

## Features

- These stand-alone systems are partially pre-assembled at the factory and contain all components necessary for installation, including a detailed installation guide.
- Commander 950 ECU control functions are accessible with supplied Holley software and fully programmable with a personal laptop computer with WIN 3.1, '95, '98, NT.
- Throttle bodies available in the following styles:
  - 1000 CFM billet w/ 4-bbl square bore and 5" air horn
  - 2000 CFM billet w/ DOMINATOR flange
- Fits the following Chevrolet engines:
  - Small block w/ 23º standard port heads (early & late)
  - Small block w/ Vortec cylinder heads
  - Big block oval port heads
  - Big block rectangular port heads - including tall decks
- Fits Ford small block V8 engines.
- Sensors include: throttle position, MAP, engine and air temperature, exhaust oxygen and idle air control motor
- Wiring harness is designed for "plug-in" installation.
- Adjustable timing is available with any of the following distributors:
  - 1980-1/2 - 1990 GM 7-pin (coil-in-cap)
  - 1984 - 96 GM (external coil)
  - 1984 - later Ford 7-wire TFI
  - Aftermarket computer controlled distributors
  - (Holley P/N 890-160 - SB Chevy)

The Commander 950™ ECU's adjustable timing feature will also work with any CD ignition that does not have timing control if used with one of the above-listed distributors.

- Base fuel maps available off the Holley Web site.
- Systems available with 3-wide narrowband or wideband $O_2$ sensors

## Benefits

- Vastly improved fuel distribution and cylinder filling
- Excellent throttle response, driveability and fuel economy
- Impressive torque and horsepower gains over standard carburetion
- Superior idle, warm up and part-throttle driving characteristics

(A) Not legal for street use in California on vehicles originally equipped with 2-barrel carburetors for which there was no 4-barrel option.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

1 2 or 3 See page 2 for symbol explanation.

# COMMANDER 950™ MULTI-POINT FUEL INJECTION SYSTEMS

| HP RANGE | CFM | Throttle Body FLANGE | INJECTOR SIZE | SYSTEM PART NUMBER In-Line Fuel Pump | SYSTEM PART NUMBER w/ Wide Band $O_2$ |
|---|---|---|---|---|---|
| **Naturally Aspirated Applications:** | | Chevrolet Small Block V8; early/late cylinder heads | | | |
| 225 - 300* | 1000 | square flange | 19 lbs./hr. | **91002101** (B) ◆3 | NEW! **91002111** (B) ◆3 |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **91003101** (B) ◆3 | NEW! **91003111** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **91004101** (B) ◆3 | NEW! **91004111** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **91005201** (B) ◆3 | NEW! **91005211** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **91006201** (B) ◆3 | NEW! **91006211** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **91007201** (B) ◆3 | NEW! **91007211** (B) ◆3 |
| **Naturally Aspirated Applications:** | | Chevrolet Small Block V8; Vortec cylinder heads | | | |
| 225 - 300* | 1000 | square flange | 19 lbs./hr | **91102101** (B) ◆3 | NEW! **91102111** (B) ◆3 |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **91103101** (B) ◆3 | NEW! **91103111** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **91104101** (B) ◆3 | NEW! **91104111** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **91105201** (B) ◆3 | NEW! **91105211** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **91106201** (B) ◆3 | NEW! **91106211** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **91107201** (B) ◆3 | NEW! **91107211** (B) ◆3 |
| **Naturally Aspirated Applications:** | | Chevrolet Big Block V8; Std. Deck; Oval Port cylinder heads | | | |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **92003101** (B) ◆3 | NEW! **92003111** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **92004101** (B) ◆3 | NEW! **92004111** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **92005201** (B) ◆3 | NEW! **92005211** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **92006201** (B) ◆3 | NEW! **92006211** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **92007201** (B) ◆3 | NEW! **92007211** (B) ◆3 |
| **Naturally Aspirated Applications:** | | Chevrolet Big Block V8; Std. Deck; Rectangular Port Heads | | | |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **92103101** (B) ◆3 | NEW! **92103111** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **92104101** (B) ◆3 | NEW! **92104111** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **92105201** (B) ◆3 | NEW! **92105211** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **92106201** (B) ◆3 | NEW! **92106211** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **92107201** (B) ◆3 | NEW! **92107211** (B) ◆3 |
| 575 - 670* | 2000 | Dominator flange | 42 lbs./hr. | **92306201** (B) ◆3 | NEW! **92306211** (B) ◆3 |
| 670 - 800* | 2000 | Dominator flange | 50 lbs./hr. | **92307201** (B) ◆3 | NEW! **92307211** (B) ◆3 |

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

**NOTE:** Downloadable base fuel maps are available at www.holley.com.

(A) Not legal for street use in California on vehicles originally equipped with 2-barrel carburetors for which there was no 4-barrel option.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.




# COMMANDER 950™ MULTI-POINT FUEL INJECTION SYSTEMS

| HP RANGE | CFM | Throttle Body FLANGE | INJECTOR SIZE | SYSTEM PART NUMBER In-Line Fuel Pump | SYSTEM PART NUMBER w/ Wide Band $O_2$ |
|---|---|---|---|---|---|
| **Naturally Aspirated Applications:** | | Chevrolet Big Block V8; Tall Deck; Rectangular Port Heads | | | |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **92203101** (B) 3 | NEW! **92203111** (B) 3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **92204101** (B) 3 | NEW! **92204111** (B) 3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **92205201** (B) 3 | NEW! **92205211** (B) 3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **92206201** (B) 3 | NEW! **92206211** (B) 3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **92207201** (B) 3 | NEW! **92207211** (B) 3 |
| 575 - 670* | 2000 | Dominator flange | 42 lbs./hr. | **92406201** (B) 3 | NEW! **92406211** (B) 3 |
| 670 - 800* | 2000 | Dominator flange | 50 lbs./hr. | **92407201** (B) 3 | NEW! **92407211** (B) 3 |
| **Naturally Aspirated Applications:** | | Ford 5.0L V8 | | | |
| 300 - 385* | 70mm | Ford 5.0L EFI | 24 lbs./hr. | **94103101** (B) 3 | NEW! **94103111** (B) 3 |
| 385 - 480* | 70mm | Ford 5.0L EFI | 30 lbs./hr. | **94104101** (B) 3 | NEW! **94104111** (B) 3 |
| 480 - 575* | 70mm | Ford 5.0L EFI | 36 lbs./hr. | **94105201** (B) 3 | NEW! **94105211** (B) 3 |
| 575 - 670* | 70mm | Ford 5.0L EFI | 42 lbs./hr. | **94106201** (B) 3 | NEW! **94106211** (B) 3 |

(**) A brake specific fuel consumption (BSFC) of .6 and 90% duty cycle is used for the maximum horsepower recommendation.

**NOTE:** Downloadable base fuel maps are available at www.holley.com.

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

(A) Not legal for street use in California on vehicles originally equipped with 2-barrel carburetors for which there was no 4-barrel option.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

1 2 or 3 See page 2 for symbol explanation.

# COMMANDER 950™ RACE MPFI SYSTEMS


- Designed for BBC Bracket and Hot Street Engines
- Economically priced with all the features a racer needs
- Wide band oxygen sensor and internal datalogger make on-track tuning simple
- 42 or 50 lb/hr injectors
- Rectangular Port BBC
- Standard or Tall Deck Blocks
- 1000 (4150) or 2000 (4500) CFM Throttle Bodies
- Includes throttle body, manifold, injectors, fuel rails, wiring harness, ECU, software, NTK Wide Band sensor and controller
- Customer supplies fuel pump, fuel filters and fuel pressure regulator

| Part # | Pro Commander systems w/ wide band O2 |
|---|---|
| **92106011** | Standard Deck Big Block Chevy, 1000 CFM, 42 lb/hr w/ Wide Band Oxygen Sensor |
| **92306011** | Standard Deck Big Block Chevy, 2000 CFM, 42 lb/hr w/ Wide Band Oxygen Sensor |
| **92107011** | Standard Deck Big Block Chevy, 1000 CFM, 50 lb/hr w/ Wide Band Oxygen Sensor |
| **92307011** | Standard Deck Big Block Chevy, 2000 CFM, 50 lb/hr w/ Wide Band Oxygen Sensor |
| **92207011** | Tall Deck Big Block Chevy, 1000 CFM, 50 lb/hr w/ Wide Band Oxygen Sensor |
| **92407011** | Tall Deck Big Block Chevy, 2000 CFM, 50 lb/hr w/ Wide Band Oxygen Sensor |


## COMMANDER 950™ WIDE BAND $O_2$ UPGRADE HARDWARE Part #

**534-188**

The wideband oxygen sensor is the ultimate addition to any new or existing Commander 950 EFI system. It will plug directly into all Commander 950 harness and accurately measure any air/fuel ration between 10:1 and 20:1. This allows the engine tuner to read the air/fuel ratio in real time for extremely accurate tuning. The PRO software, that is included with the upgrade, features a 64 cell target air/fuel ratio matrix. This feature enables the tuner to program the ECU to operate the engine at any target air/fuel ratio for best power and economy. All engines will benefit from this upgrade and it is a virtual "must have" for forced induction engines.

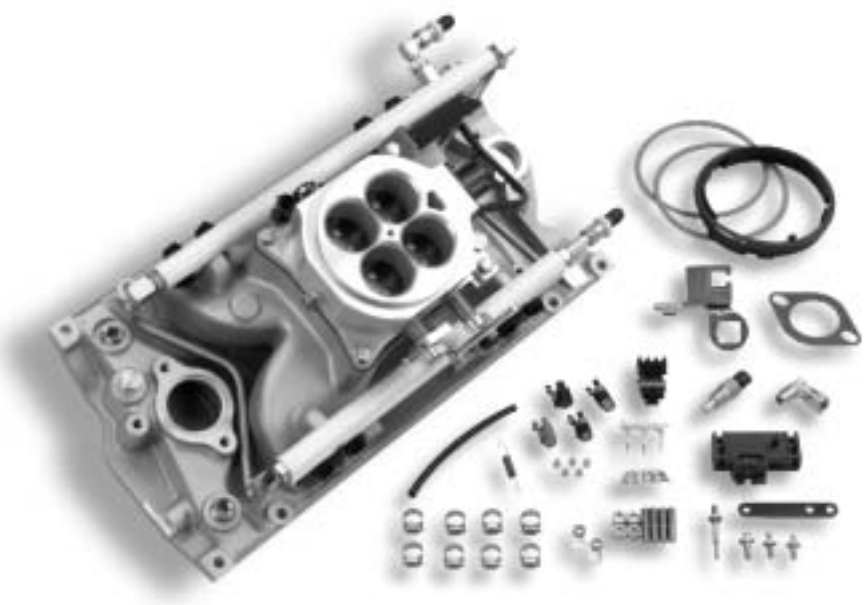
**KIT CONTAINS:**

- NTK Oxygen Sensor
- Sensor controller
- PRO software and Commander 950 ECU Firmware Upgrade Certificate
- Comprehensive manual




# MULTI-POINT FUEL INJECTION POWER PACK KITS

New Holley MPI Power Packs are partially assembled and come without an ECU, wiring harness and fuel pump. They are intended for the person who may want to use, or already has, different ECU components. These Power Pack kits can be used with other aftermarket speed-density-type ECUs that are designed for use on a multi-point system.



## Features

- Power Packs are complete multi-point systems except for ECU, wiring harness and fuel pump
- Fits Chevrolet small block 23° standard port (early and late) & Vortec cylinder heads
- Fits Chevrolet big block oval and rectangular port V8s, including tall decks
- Will work on engines with up to 1520 horsepower
- Includes billet throttle body with progressive linkage
- Includes high fuel flow capacity fuel rails and sensors
- Realize increased torque and horsepower
- Enjoy vastly improved throttle response and idle control

| HORSEPOWER RANGE | CFM | Throttle Body FLANGE | INJECTOR SIZE | PART NUMBER |
|---|---|---|---|---|
| **Naturally Aspirated Applications:** | Chevrolet Small Block V8; Early/Late Cylinder Heads | | | |
| 225 - 300* | 1000 | square flange | 19 lbs./hr. | **81002001** (B) ◆3 |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **81003001** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **81004001** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **81005001** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **81006001** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **81007001** (B) ◆3 |
| 800 - 880* | 1000 | square flange | 55 lbs./hr. | **81008001** (B) ◆3 |
| 880 - 1050* | 1000 | square flange | 65 lbs./hr. | **81009001** (B) ◆3 |

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

**NOTE:** Downloadable base fuel maps are available at www.holley.com.

(A) Not legal for street use in California on vehicles originally equipped with 2-barrel carburetors for which there was no 4-barrel option.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.

# MULTI-POINT FUEL INJECTION POWER PACK KITS

| HORSEPOWER RANGE | CFM | Throttle Body FLANGE | INJECTOR SIZE | PART NUMBER |
|---|---|---|---|---|
| **Naturally Aspirated Applications:** | Chevrolet Small Block V8; Vortec Cylinder Heads | | | |
| 225 - 300* | 1000 | square flange | 19 lbs./hr. | **81102001** (B) ◆3 |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **81103001** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **81104001** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **81105001** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **81106001** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **81107001** (B) ◆3 |
| 800 - 880* | 1000 | square flange | 55 lbs./hr. | **81108001** (B) ◆3 |
| 880 - 1050* | 1000 | square flange | 65 lbs./hr. | **81109001** (B) ◆3 |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Std. Deck; Oval Port Heads | | | |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **82003001** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **82004001** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **82005001** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **82006001** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **82007001** (B) ◆3 |
| 800 - 880* | 1000 | square flange | 55 lbs./hr. | **82008001** (B) ◆3 |
| 880 - 1050* | 1000 | square flange | 65 lbs./hr. | **82009001** (B) ◆3 |
| 1050 - 1200* | 1000 | square flange | 75 lbs./hr. | **82010001** (B) ◆3 |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Std. Deck; Rectangular Port Heads | | | |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **82103001** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **82104001** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **82105001** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **82106001** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **82107001** (B) ◆3 |
| 800 - 880* | 1000 | square flange | 55 lbs./hr. | **82108001** (B) ◆3 |
| 880 - 1050* | 1000 | square flange | 65 lbs./hr. | **82109001** (B) ◆3 |
| 1050 - 1200* | 1000 | square flange | 75 lbs./hr. | **82110001** (B) ◆3 |
| 575 - 670* | 2000 | Dominator flange | 42 lbs./hr. | **82306001** (B) ◆3 |
| 670 - 800* | 2000 | Dominator flange | 50 lbs./hr. | **82307001** (B) ◆3 |
| 800 - 880* | 2000 | Dominator flange | 55 lbs./hr. | **82308001** (B) ◆3 |
| 880 - 1050* | 2000 | Dominator flange | 65 lbs./hr. | **82309001** (B) ◆3 |
| 1050 - 1200* | 2000 | Dominator flange | 75 lbs./hr. | **82310001** (B) ◆3 |
| 1200 - 1360* | 2000 | Dominator flange | 85 lbs./hr. | **82311001** (B) ◆3 |
| 1360 - 1520* | 2000 | Dominator flange | 95 lbs./hr. | **82312001** (B) ◆3 |

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

**NOTE:** Downloadable base fuel maps are available at www.holley.com.

(A) Not legal for street use in California on vehicles originally equipped with 2-barrel carburetors for which there was no 4-barrel option.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.




# MULTI-POINT FUEL INJECTION POWER PACK KITS

| HORSEPOWER RANGE | CFM | Throttle Body FLANGE | INJECTOR SIZE | PART NUMBER |
|---|---|---|---|---|
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Tall Deck; Rectangular Port Heads | | | |
| 300 - 385* | 1000 | square flange | 24 lbs./hr. | **82203001** (B) ◆3 |
| 385 - 480* | 1000 | square flange | 30 lbs./hr. | **82204001** (B) ◆3 |
| 480 - 575* | 1000 | square flange | 36 lbs./hr. | **82205001** (B) ◆3 |
| 575 - 670* | 1000 | square flange | 42 lbs./hr. | **82206001** (B) ◆3 |
| 670 - 800* | 1000 | square flange | 50 lbs./hr. | **82207001** (B) ◆3 |
| 800 - 880* | 1000 | square flange | 55 lbs./hr. | **82208001** (B) ◆3 |
| 880 - 1050* | 1000 | square flange | 65 lbs./hr. | **82209001** (B) ◆3 |
| 1050 - 1200* | 1000 | square flange | 75 lbs./hr. | **82210001** (B) ◆3 |
| 575 - 670* | 2000 | Dominator flange | 42 lbs./hr. | **82406001** (B) ◆3 |
| 670 - 800* | 2000 | Dominator flange | 50 lbs./hr. | **82407001** (B) ◆3 |
| 800 - 880* | 2000 | Dominator flange | 55 lbs./hr. | **82408001** (B) ◆3 |
| 880 - 1050* | 2000 | Dominator flange | 65 lbs./hr. | **82409001** (B) ◆3 |
| 1050 - 1200* | 2000 | Dominator flange | 75 lbs./hr. | **82410001** (B) ◆3 |
| 1200 - 1360* | 2000 | Dominator flange | 85 lbs./hr. | **82411001** (B) ◆3 |
| 1360 - 1520* | 2000 | Dominator flange | 95 lbs./hr. | **82412001** (B) ◆3 |
| **Naturally Aspirated Applications:** | Ford 5.0L V8 | | | |
| 225 - 300* | 65mm | Ford 5.0L EFI | 19 lbs./hr. | **84002001** (B) ◆3 |
| 300 - 385* | 65mm | Ford 5.0L EFI | 24 lbs./hr. | **84003001** (B) ◆3 |
| 300 - 385* | 70mm | Ford 5.0L EFI | 24 lbs./hr. | **84103001** (B) ◆3 |
| 385 - 480* | 70mm | Ford 5.0L EFI | 30 lbs./hr. | **84104001** (B) ◆3 |
| 480 - 575* | 70mm | Ford 5.0L EFI | 36 lbs./hr. | **84105001** (B) ◆3 |
| 575 - 670* | 70mm | Ford 5.0L EFI | 42 lbs./hr. | **84106001** (B) ◆3 |
| 670 - 800* | 70mm | Ford 5.0L EFI | 50 lbs./hr. | **84107001** (B) ◆3 |
| 800 - 880* | 70mm | Ford 5.0L EFI | 55 lbs./hr. | **84108001** (B) ◆3 |
| 880 - 1050* | 70mm | Ford 5.0L EFI | 65 lbs./hr. | **84109001** (B) ◆3 |

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

**NOTE:** Downloadable base fuel maps are available at www.holley.com.

(A) Not legal for street use in California on vehicles originally equipped with 2-barrel carburetors for which there was no 4-barrel option.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.

# STEALTH RAM™ MPFI POWER PACK KITS

NEW!

This kit simplifies the task of converting a factory EFI system to a Stealth Ram. All that's needed is any factory or aftermarket ECU, wiring harness, and fuel pump. It doesn't get much easier... or more powerful.

| Part # | STEALTH RAM™ Kit Description | Horsepower Range* |
|---|---|---|
| **81503001**(B) ◈3 | Satin finish kit with 24 pph injectors | 300 - 385 |
| **81504001**(B) ◈3 | Satin finish kit with 30 pph injectors | 385 - 480 |
| **81505001**(B) ◈3 | Satin finish kit with 36 pph injectors | 480 - 575 |
| **81506001**(B) ◈3 | Satin finish kit with 42 pph injectors | 575 - 670 |
| **81403001**(B) ◈3 | Polished kit with 24 pph injectors | 300 - 385 |
| **81404001**(B) ◈3 | Polished kit with 30 pph injectors | 385 - 480 |
| **81405001**(B) ◈3 | Polished kit with 36 pph injectors | 480 - 575 |
| **81406001**(B) ◈3 | Polished kit with 42 pph injectors | 575 - 670 |

(*) A brake specific fuel consumption (BSFC) of .45 and 90% duty cycle is used for the maximum horsepower recommendation.

STEALTH RAM

## System features:

- Fits early and late(†) model 23º Chevrolet cylinder heads
- Designed to use GM TPI throttle and transmission cables and brackets

(†) Requires angled spacers, P/N 90748

## Systems include:

- Upper and lower intake manifolds
- 58mm billet throttle body
- Bright clear anodized aluminum fuel rails
- Fuel injectors
- Fuel pressure regulator
- TPS, MAP, coolant, air temperature and oxygen sensors
- No EGR provision
- Detailed installation and tuning manuals

## Specifications:

- Height is 10-1/4"
- Shipping weight is approximately 45 lbs.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

(C) Not legal for street use with a 4-barrel in California on vehicles equipped with a 2-barrel carburetor, for which there was no 4-barrel option.

◈1 ◈2 or ◈3 See page 2 for symbol explanation.




# MARINE COMMANDER 950™ MPFI SYSTEMS

## CHEVROLET APPLICATIONS - LISTED ON PAGE 125

- Small block V8 w/ 23º standard port cylinder heads (early and late)
- Small block V8 w/ Vortec/Gen 1 cylinder heads
- Big block V8 with oval port cylinder heads
- Big block V8 with rectangular port cylinder heads

### FEATURES:

- Systems are pre-assembled by Holley. Systems include all components necessary for installation, including a detailed installation guide.
- Commander 950 ECU is fully potted for superior resistance to corrosion and protection from vibration
- Intake manifold features a brass water jacket for salt water corrosion resistance
- Throttle bodies available in the following sizes:
  1000 CFM billet w/ 4 Bbl square bore flange and 5" air horn
  2000 CFM billet w/ DOMINATOR flange
- Idle air control motor included with throttle body
- Sensors include:
  Throttle position
  MAP
  Engine Temperature
  Air Temperature
  Exhaust Oxygen
- Wiring harness is designed for "plug in" installation
- Wiring harness is temperature-insulated and weather-sealed
- Adjustable timing feature is available with any of the following distributors:
  GM marine 7-pin coil-in-cap (1980 1/2 - 1990)
  GM marine external coil (1984-1996)
  Ford marine 7-wire TFI (1984 - later)
  Any marine distributor with a "locked" mechanical advance and a magnetic pick-up
  Any marine distributor that is set up to work with a crank trigger (either magnetic of hall effect)
- The Commander 950™ ECU's adjustable timing feature will also work with any CD ignition that does not have timing control if used with one of the recommended distributors
- Base fuel maps are available off the Holley web site.

### BENEFITS:

- Vastly improved fuel distribution and cylinder filling
- Excellent response from the helm's throttle control(s)
- Improved cruising economy
- Impressive power gains over standard carburetor installation
- Superior idle and warm-up characteristics


# MARINE COMMANDER 950™ MPFI SYSTEMS

| HORSEPOWER RANGE | CFM | Throttle Body FLANGE | INJECTOR SIZE | PART NUMBER |
|---|---|---|---|---|
| **Naturally Aspirated Applications:** | Chevrolet Small Block; early/late cylinder head - naturally aspirated | | | |
| 200 - 275 | 1000 | 4 Bbl/square flange | 19 lbs./hr. | **71002101** |
| 275 - 350 | 1000 | 4 Bbl/square flange | 24 lbs./hr. | **71003101** |
| 350 - 425 | 1000 | 4 Bbl/square flange | 30 lbs./hr. | **71004101** |
| 425 - 525 | 1000 | 4 Bbl/square flange | 36 lbs./hr. | **71005201** |
| 525 - 600 | 1000 | 4 Bbl/square flange | 42 lbs./hr. | **71006201** |
| 600 - 750 | 1000 | 4 Bbl/square flange | 50 lbs./hr. | **71007201** |
| **Naturally Aspirated Applications:** | Chevrolet Small Block; vortec/Gen 1 cylinder head - naturally aspirated | | | |
| 200 - 275 | 1000 | 4 Bbl/square flange | 19 lbs./hr. | **71102101** |
| 275 - 350 | 1000 | 4 Bbl/square flange | 24 lbs./hr. | **71103101** |
| 350 - 425 | 1000 | 4 Bbl/square flange | 30 lbs./hr. | **71104101** |
| 425 - 525 | 1000 | 4 Bbl/square flange | 36 lbs./hr. | **71105201** |
| 525 - 600 | 1000 | 4 Bbl/square flange | 42 lbs./hr. | **71106201** |
| 600 - 750 | 1000 | 4 Bbl/square flange | 50 lbs./hr. | **71107201** |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Std. Deck; Oval Port cylinder heads - naturally aspirated | | | |
| 275 - 350 | 1000 | 4 Bbl/square flange | 24 lbs./hr. | **72003101** |
| 350 - 425 | 1000 | 4 Bbl/square flange | 30 lbs./hr. | **72004101** |
| 425 - 525 | 1000 | 4 Bbl/square flange | 36 lbs./hr. | **72005201** |
| 525 - 600 | 1000 | 4 Bbl/square flange | 42 lbs./hr. | **72006201** |
| 600 - 750 | 1000 | 4 Bbl/square flange | 50 lbs./hr. | **72007201** |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Std. Deck; Rectangular Port cylinder heads - naturally aspirated | | | |
| 275 - 350 | 1000 | 4 Bbl/square flange | 24 lbs./hr. | **72103101** |
| 350 - 425 | 1000 | 4 Bbl/square flange | 30 lbs./hr. | **72104101** |
| 425 - 525 | 1000 | 4 Bbl/square flange | 36 lbs./hr. | **72105201** |
| 525 - 600 | 1000 | 4 Bbl/square flange | 42 lbs./hr. | **72106201** |
| 600 - 750 | 1000 | 4 Bbl/square flange | 50 lbs./hr. | **72107201** |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Std. Deck; Rectangular Port cylinder heads - naturally aspirated | | | |
| 525 - 600 | 2000 | DOMINATOR | 42 lbs./hr. | **72306201** |
| 600 - 750 | 2000 | DOMINATOR | 50 lbs./hr. | **72307201** |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Tall Deck; Rectangular Port cylinder heads - naturally aspirated | | | |
| 275 - 350 | 1000 | 4 Bbl/square flange | 24 lbs./hr. | **72203101** |
| 350 - 425 | 1000 | 4 Bbl/square flange | 30 lbs./hr. | **72204101** |
| 425 - 525 | 1000 | 4 Bbl/square flange | 36 lbs./hr. | **72205201** |
| 525 - 600 | 1000 | 4 Bbl/square flange | 42 lbs./hr. | **72206201** |
| 600 - 750 | 1000 | 4 Bbl/square flange | 50 lbs./hr. | **72207201** |
| **Naturally Aspirated Applications:** | Chevrolet Big Block V8; Tall Deck; Rectangular Port cylinder heads - naturally aspirated | | | |
| 525 - 600 | 2000 | DOMINATOR | 42 lbs./hr. | **72406201** |
| 600 - 750 | 2000 | DOMINATOR | 50 lbs./hr. | **72407201** |



# COMMANDER 950™ MPI SERVICE PARTS

Part #

## ECU- Commander 950

The most advanced fuel management / engine controller available today. See elsewhere for a complete description of features and capabilities of this remarkable unit.

**534-120** Automotive

**534-181** Marine

## Distributor

- Billet construction
- Performance pick-up
- Plug & play with Commander 950 (requires 534-138 harness and Factory GM coil connector)
- Direct replacement for 1985-up GM small cap computer controlled HEI
- Allows complete timing control using Commander 950

**890-160**

## Cable, Commander 950

Communication (ECU to laptop) **534-140**

## FUEL INJECTORS

See p.182

534-83

## FUEL INJECTOR BUNGS

| | |
|---|---|
| PKG./1 | **534-82** |
| PKG./4 | **534-83** |
| PKG./6 | **534-84** |
| PKG./8 | **534-85** |

## FUEL INJECTOR CONNECTORS AND TERMINALS

| | |
|---|---|
| 6/Pkg. (for Holley top feed injectors) | **534-111** |
| 8/Pkg. (for Holley top feed injectors) | **534-112** |

534-104

534-103

## FUEL INJECTOR O-RING AND RETAINERS

| | |
|---|---|
| Delphi/Holley fuel injector O-ring 16/Pkg. | **534-104** |
| Bosch fuel injector retainer 8/Pkg. | **534-102** |
| Delphi/Holley fuel injector retainer 8/Pkg. | **534-103** |

534-102


# COMMANDER 950™ MPI SERVICE PARTS

Part #

9900-144

9900-173

## FUEL LINES & RAILS

| | |
|---|---|
| Fuel Line, Fuel Rail Crossover – Small Block Chevrolet V-8 Fits Holley MPI Manifolds | 9900-144 |
| Fuel Line, Fuel Rail Crossover – Big Block Chevrolet V-8 Fits Holley MPI Manifolds | 9900-145 |
| Left & Right Hand Fuel Rails – Small Block Chevrolet V-8 Fits Holley MPI Manifolds | 9900-147 |
| Left & Right Hand Fuel Rails – Big Block Chevrolet V-8 Fits Holley MPI Manifolds | 9900-149 |
| Left & Right Hand Fuel Rails, Crossovers, Fittings, Hardware Small Block Chevrolet V-8 - Fits Holley MPI Manifolds | 9900-172 |
| Left & Right Hand Fuel Rails, Crossovers, Fittings, Hardware Big Block Chevrolet V-8 - Fits Holley MPI Manifolds | 9900-173 |
| STEALTH RAM™ fuel rail kit w/ non-adjustable regulator | 534-185 |
| STEALTH RAM™ fuel rail kit w/ adjustable regulator | 534-186 |
| Universal fuel rail kit - 12” length | 534-78 |
| Universal fuel rail kit - 18” length | 534-79 |
| Universal fuel rail kit - 36” length | 534-80 |

108-4

## GASKET, AIR CLEANER 108-4

## PUMP, FUEL ELECTRIC 12-920

See page 203 for specifications

12-920

## RELAY, 40 AMP. 534-26

534-26

## SENSORS

| | |
|---|---|
| Air Temp. | 9920-107 |
| Coolant Temperature | 534-10 |




## COMMANDER 950™ MPI SERVICE PARTS

Part #

538-13

### SENSOR, MAP

| | |
|---|---|
| Naturally-aspirated motors - (1 bar) | 538-24 |
| Forced induction- up to 14.7 PSI boost - (2 bar) | 538-13 |
| Forced induction- 14.7 to 29.4 PSI boost - (3 bar) | 538-23 |

43-106

534-49

### SENSOR, OXYGEN

| | |
|---|---|
| Oxygen sensor | 43-106 |
| Wide Band Oxygen sensor replacement | 534-190 |
| Sensor bung | 534-49 |

9920-104

### SENSOR, THROTTLE POSITION

| | |
|---|---|
| 1000 CFM throttle body | 9920-104 |
| 2000 CFM throttle body | 9920-110 |

534-74

### SOFTWARE

| | |
|---|---|
| Commander 950 ECU (Mapping & Set-up) | 534-144 |
| Pro-Jection MPFI w/ E-PROM | 534-117 |
| Pro-Jection (version 3.38) | 534-74 |
| Pro-Jection TBI w/ E-PROM | 534-77 |

112-538

### THROTTLE BODY ASSEMBLIES

| | |
|---|---|
| Universal 1000 CFM w/ IAC | 9900-171 |
| Universal 2000 CFM | 112-538 |

# COMMANDER 950™ MPI SERVICE PARTS

Part #

534-129

## COMMANDER 950 ECU PRIMARY WIRING HARNESS

| | |
|---|---|
| ECU-to-sensors (Holley MPI systems) | **534-142** |

## COMMANDER 950 ECU INJECTOR WIRING HARNESS

| | |
|---|---|
| Holley MPI system (over fuel rail routing) | **534-129** |
| Holley MPI system (under intake plenum routing) | **534-130** |

## COMMANDER 950 ECU ACCESSORY WIRING HARNESS

| | |
|---|---|
| Cooling fan relay | **534-134** |
| Crank trigger w/ magnetic pick up | **534-135** |
| Knock sensor | **534-136** |
| Chevrolet HEI distributor | **534-138** |
| Ford TFI distributor | **534-139** |

534-138




## COMMANDER 950™ MPI SERVICE PARTS

Part #


508-17

### Base Plate & Gasket Sealing Kit

| | |
|---|---|
| 1000 CFM throttle body | 508-17 |
| 2000 CFM throttle body | 508-18 |


112-560

### Block-off Plate, IAC

112-560

### Morse Throttle Cable Bracket - MARINE ITEM ONLY

9902-108


9902-108

### Bracket, MAP Sensor 9902-104


20-113

### TH-700R4 Transmission Bracket 20-113


562-1

### Filter, Fuel - TBI (metal) 562-1

All systems

### Filter Element, Fuel (plastic) Prefilter 562-3


562-3

### Fittings

| | |
|---|---|
| Fitting, 90° & Schrader Valve (has 1/8" NPT Tap) | 9900-163 |
| Fitting, Regulator | 9906-127 |
| Fitting, Swivel #6 to 3/8" Hose Barb | 9906-143 |
| Fitting, Swivel 90° Male to SAE 37° #6 | 9906-118 |
| Fitting, Tee 180° Male to 2x SAE 37° #6 | 9906-126 |

# COMMANDER 950™ MPI SERVICE PARTS

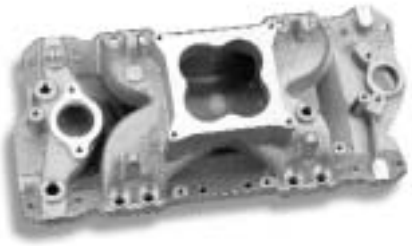
Part #

9910-101

9910-102

## GASKET, THROTTLE BODY BASE

| | |
|---|---|
| 1000 CFM throttle body | 9910-101 |
| 2000 CFM throttle body | 9910-102 |



9910-101-1

## INTAKE MANIFOLDS- SMALL BLOCK CHEVROLET V-8

**350 early & late cylinder heads**

| | |
|---|---|
| 4bbl square flange design (automotive) | 9901-101-1 |
| 4bbl square flange design (marine) | 9901-102-1 |

**STEALTH RAM™ design**

| | |
|---|---|
| Satin finish | 7540 |
| Polished finish | 7540P |

**350 Vortec/Gen 1 cylinder heads**

| | |
|---|---|
| 4 bbl square flange | 9901-107 |

## INTAKE MANIFOLDS- BIG BLOCK CHEVROLET V-8

**Oval port cylinder heads**

| | |
|---|---|
| Standard deck with square flange (automotive) | 9901-209 |

**Oval port cylinder heads**

| | |
|---|---|
| Standard deck with square flange (marine) | 9901-211 |

**Rectangular port cylinder heads**

| | |
|---|---|
| Standard deck with square flange (automotive) | 9901-201 |
| Standard deck with square flange (marine) | 9901-205 |
| Standard deck with DOMINATOR flange (automotive) | 9901-202 |
| Standard deck with DOMINATOR flange (marine) | 9901-206 |
| Tall deck with square flange (automotive) | 9901-203 |
| Tall deck with square flange (marine) | 9901-207 |
| Tall deck with DOMINATOR flange (automotive) | 9901-204 |
| Tall deck with DOMINATOR flange (marine) | 9901-208 |

9901-201

12-814

## PLATE, FUEL PUMP BLOCK-OFF

| | |
|---|---|
| Chevrolet – Small Block V8, Chevrolet – Big Block V8 | 12-814 |




# HOLLEY THROTTLE BODY FUEL INJECTION SYSTEMS

## GENERAL INFORMATION

Holley offers two barrel and four barrel universal stand-alone throttle body injection systems that will replace a carburetor on a non-computerized vehicle.

Two barrel systems are available with either the Holley digital "D" ECU or the new Commander 950 ECU. The "D" ECU does not have the ability to be programmed or mapped with a customized fuel map via lap top computer. Rather it uses a basic, pre-programmed performance fuel curve that has a wide range of adjustability. It is intended primarily for stock or very mildly modified vehicles with V8 engines that can maintain at least 15" vacuum at idle (A/T idling in gear). The Commander 950 ECU is a highly versatile and sophisticated ECU design that enables the user to program a customized fuel map for the motor, through use of a lap top computer.

Two barrel throttle body systems equipped with Commander - 950 can work on any 4 cylinder, even fire 6 cylinder or V8 engines rated not more than 275 horsepower. Special design Holley small block Chevrolet V8 manifolds are also available to accept the two barrel throttle body bolt pattern which is the same as the GM throttle body. Two barrel manifold adapter kits are available for those who wish to retain their stock two barrel intake manifold. Experience, however, has shown that the best performance results are obtained using a aftermarket dual plane intake manifold.

Four barrel systems are available only with the Commander 950 ECU. The Commander 950 ECU can program a multitude of engine parameters with the use of Windows-based software and a lap top computer. A complete explanation of the 950 Commander ECU is contained elsewhere in this section.

Holley four barrel throttle bodies utilize a square flange and are available in four sizes:

- 650 CFM for engines rated 150 - 325 horsepower
- 700 CFM for engines rated 250 - 440 horsepower
- 900 CFM for engines rated 375 - 525 horsepower
- 900 CFM for engines rated 450 - 600 horsepower

## PRO-JECTION 2D ELECTRONICS

Pro-Jection "D" electronics contain a basic performance fuel curve that has a wide range of adjustability. "D" electronics monitor engine RPM and processes a stream of information inputs from the throttle position and engine temperature sensors. From these inputs the "D" system automatically changes, adjusts and modifies the fuel delivery to maintain the fuel curve. Further refinement of the fuel curve is possible by adjusting the knobs on the ECU. The payoff for all this electronic capability is excellent start up, driveability, power and economy. "D" Pro-Jection is designed to be used on stock, or mildly modified engines with at least 15" vacuum at idle (A/T idling in gear).

## COMMANDER 950™ ELECTRONICS

The awesome power and capability of the Holley Commander 950 ECU is available with any of the Holley throttle body fuel injection systems. The advantages of the 950 are especially obvious for those who need or want a customized fuel curve. Such capability would be desirable when installing a fuel injection system on a modified motor. Stock fuel curves, in such instances, may not have enough functional variability to accommodate the fuel requirements of such an engine over its operational range. The Commander 950 ECU, however, has all the power and capability needed to accomplish this task. The software included with each Commander 950 enables the user to view the fuel map on his laptop computer and modify it, accordingly. Pre-set, downloadable, base fuel maps are available at **www.holley.com**. A true, custom fuel map is required for the ultimate in performance and driveability. Features and benefits of the Commander 950 have been detailed earlier in this section.




# COMMANDER 950™ 4-BBL THROTTLE BODY FUEL INJECTION SYSTEMS

Holley offers a complete line of 4 bbl Commander 950 TBI systems for engines from 150 to 600 horsepower*.

Throttle body fuel injection offers all of the benefits of electronic fuel injection in an easy to install and cost effective package. The Commander 950 provides complete laptop programmability of all fuel and ignition timing parameters.

The throttle body utilizes a progressive linkage for optimum off-idle driveability. The throttle body includes an adjustable regulator and high quality fuel injectors to guarantee years of trouble-free service.

Systems include most components needed for installation including ECU, wiring harness, software, throttle body, fuel pump and filters, sensors, and other misc. components.

**NOTE:** These systems are designed only for fuel and spark management. Features such as cruise control, transmission control, air conditioning, ABS, etc., are not controlled by the Commander 950.

## Features

- Commander 950 ECU
- Complete stand-alone, speed-density systems
- Square flange throttle body
- Die cast aluminum throttle body has a tumble-polished finish
- Allows infinite adjustment of the fuel map via your IBM-compatible PC
- Programmable spark curve (see system requirement)
- MAP, coolant and air temp. sensors
- Oxygen sensor
- Idle air control valve
- 45 PPH injectors used with 650 CFM throttle body
- 65 PPH injectors used with 700 CFM throttle body
- 75 PPH injectors used with 900 CFM throttle body (950-245)
- 85 PPH injectors used with 900 CFM throttle body (950-215)
- Self-priming, in-line electric gerotor fuel pump
- 5” airhorn facilitates use of performance carburetor air cleaner assembly
- Designed for bolt on, plug-in installation
- Installed height of throttle body is no greater than a carburetor
- Detailed installation/instruction booklet is included

## Benefits

- Fantastic driveability
- Unbelievable throttle response
- Increased power
- Improved engine efficiency
- Great looks

# COMMANDER 950™ 4-BBL THROTTLE BODY FUEL INJECTION SYSTEMS

| Description | CFM | Part# |
|---|---|---|
| 4 cyl., even fire 6 cyl.,V8 engine rated 150-325 horsepower* | 650 | **950-23S** (B) |
| 4 cyl., even fire 6 cyl., V8 engine rated 250-440 horsepower* | 700 | **950-22S** (B) |
| 4 cyl., even fire 6cyl., V8 engine rated 375-525 horsepower* | 900 | **950-24S** (B) |
| 4 cyl., even fire 6 cyl., V8 engine rated 450-600 horsepower* | 900 | **950-21S** (B) |

(*) A brake specific fuel consumption (BSFC) of .5 and 90% duty cycle is used for the maximum horsepower recommendation.

## System Requirements

- Four barrel (square flange) intake manifold (see Intake manifolds in this catalog)
- IBM-compatible personal laptop computer with WIN 3.1, 95, 98, NT, 2000ME, XP software
- The programmable timing feature of this system is available either by:

1. Using one of the following distributors: 1980-1/2 through 1990 GM 7-pin (coil-in-cap); 1984-96 GM (external coil); 1984 - later Ford 7-wire TFI. Use wiring harness adapter **P/N 534-47** for GM distributors and **P/N 534-48** for the Ford distributor.

2. Using a magnetic or Hall Effect crank trigger system when used in conjunction with a after market CD ignition system.

## Available Separately

- GM TH-700R4 transmission cable bracket **Part # 20-98 & 20-121**
- Holley 4-bbl intake manifold (see Intake manifolds in this catalog)
- Dual tank installation kit for light duty trucks and motor homes, **Part # 534-38**
- Performance air cleaner (a selection of Holley air cleaners is listed elsewhere in this catalog)




# COMMANDER 950™ 2-BBL THROTTLE BODY FUEL INJECTION SYSTEMS

Commander 950 two barrel throttle body fuel injection systems offer the owners with smaller engines the same opportunity of precise fuel and ignition timing control that others enjoy. Any 4, 6, or 8 cylinder even fire engine can be retrofitted with these systems. Two systems are available, a 670 CFM unit with two 85 lb/hr injectors for engines up to 275 horsepower and a 400 CFM unit with two 65 lb/hr injectors for engines up to 225 horsepower. Both units have an adjustable regulator.

These systems offer all the same features as all other Commander 950 systems such as idle air control motors, closed loop control, speed density operation, ignition timing control, and full laptop programmability.

Adapters are included for both square and spread bore intake manifolds. Other applications will require adapters.
**NOTE:** These systems are designed only for fuel and spark management. Features such as cruise control, transmission control, air conditioning, ABS, etc., are not controlled by the Commander 950.

| Description | CFM | Part# |
|---|---|---|
| 4 cyl., even fire 6 cyl.,V8 engine rated not more than 225 horsepower* | 400 | **950-19S** (B) ◆3 |
| 4 cyl., even fire 6 cyl., V8 engine rated not more than 275 horsepower* | 670 | **950-20S** (B) ◆3 |

## Available Separately

- GM TH-700R4 transmission cable bracket
  Part # **20-96** (factory 4-bbl intake manifold)
  Part # **20-97** (aftermarket performance 4-bbl intake manifold) and # **20-121** (all)
- Holley 2-bbl throttle body intake manifold adapters
  Part # **17-47** (Holley 2300/Motorcraft 2-bbl flange)
- Holley 2-bbl throttle body small block Chevrolet aluminum intake manifolds Part # **300-49** (1957-86 all and 1987-later with aluminum cylinder heads) Part # **300-66** (1987-later with cast iron cylinder heads)
- Dual tank installation kit for light-duty trucks
  Part # **534-37**

## System Requirements

- 4 cylinder, Even Fire 6 cylinder or V8
  400 CFM: not more than 225 horsepower
  670 CFM: not more than 275 horsepower
- IBM-compatible personal laptop computer with WIN 3.1, 95, 98, NT, 2000ME, and XP software
- The programmable timing feature of this system is available either by:
  1. Using one of the following distributors: 1980-1/2 through 1990 GM 7-pin (coil-in-cap); 1984-96 GM (external coil); 1984 - later Ford 7-wire TFI. Use wiring harness adapter **P/N 534-47** for GM distributors and **P/N 534-48** for the Ford distributor.
  2. Using a magnetic or Hall Effect crank trigger system when used in conjunction with a aftermarket CD ignition system.

(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

◆1 ◆2 or ◆3 See page 2 for symbol explanation.


## MARINE COMMANDER 950™ 4-BBL THROTTLE BODY FUEL INJECTION SYSTEMS


FOR TECHNICAL INFORMATION ON THIS SYSTEM , SEE PAGE 166

| 650 CFM | Part # |
|---|---|
| Any carbureted, Even-Fire V6* or V8 engine<br>Engines rated 150 - 300 horsepower | **950-53** |

| 700 CFM | Part # |
|---|---|
| Any carbureted, Even-Fire V6* or V8 engine<br>Engines rated 225 - 400 horsepower | **950-52** |

| 900 CFM | Part # |
|---|---|
| Any carbureted, Even-Fire V6* or V8 engine<br>Engines rated 350 - 500 horsepower | **950-51** |

## MARINE PRO-JECTION® 2-BBL THROTTLE BODY FUEL INJECTION

**700-21**

**All carbureted V8 engines**

- Complete stand-alone system
- Engines w/o computer control
- Engines rated up to 275 horsepower
  - At least 15" of engine vacuum at idle
- 670 CFM die cast aluminum throttle body
- Digital "2D" computer (ECU) is rugged and reliable
- ECU provides adjustments for
  - Idle, Accelerator pump
  - Main jet, High RPM jet, Choke

### Features common to both 2-bbl systems

- 85 lb./hr. injectors
- Fuel pressure regulator
  - fuel pressure is pre-set at 21 PSI
  - fuel pressure is adjustable from 12 - 25 PSI
- Gerotor-type 12-Volt electric marine fuel pump flows 300 lbs. of fuel per hour at 15 PSI
- Stainless steel flame arrestor (5 3/4" x 3") is included
- Adapters included for either spread bore or square flange 4-bbl intake manifolds
- Wiring harness is designed for "plug-in" installation
  - temperature insulated
  - weather sealed
- Includes complete and detailed installation instructions.

### System Requirements

- Adequate hatch clearance — overall height of the installed system is approximately 1" higher than the carburetor.




## COMMANDER 950™ AUXILIARY INJECTOR DRIVER KIT Part# 534-122

Looking for something unique? How about 2x4 throttle body fuel injection for a 1,000 horsepower engine, or a 600 horsepower engine? How about a multi-point fuel injection system that's capable of feeding an engine rated up to 1,520 horsepower? Look no further than Holley, the Heart and Soul of Performance to provide the hardware and electronics for your engine-building fantasies. The answer to your dreams is this Holley Auxiliary Injector Driver Module, P/N 534-122, that can control up to eight (8) low impedance fuel injectors.

This module is designed to work with ECUs (like the Holley Commander 950) that have four (4) "peak to hold drivers". What this module does is expand the ECU's capability to control eight (8) "peak to hold drivers", allowing the use of eight (8) low impedance injectors. With this additional capability, running either a 2x4 throttle body set-up or 8 low impedance injectors in a multi-point system is possible.

Dual 4-bbl TBI units can be used on street or strip engines, either naturally aspirated or supercharged. When dual 4-barrel throttle bodies with progressive throttle linkages are combined with the Commander 950 ECU, the two front injectors of each throttle body can be programmed to activate at low throttle openings. This feature alone can greatly increase around-town driveability and off-idle throttle response. It also eliminates any potential tuning problems with the idle system, as you would have with an injector pulse width that is too low at idle speeds.

With the ability to control up to eight (8) low impedance multi-point fuel injectors, the Commander 950 can control Holley injectors with flow ratings of 55, 65, 75, 85 and 95 pounds per hour. The 95 pounds per hour Holley injector can provide enough fuel to supply an engine rated up to 1,520 horsepower.

**NOTE:** Shown is the Auxiliary injector driver kit with two 4-bbl throttle bodies. Throttle bodies **NOT** included with kit.

**Note:** Multi-port installations require the purchase of two P/N 534-153 injector wiring harnesses.

Think of the possibilities!

# 670 CFM PRO-JECTION®

Part # **502-20S**(B) ③

GM, Chrysler, Ford & AMC V-8s — Shiny finish

**NO LAPTOP REQUIRED!**

## Application

- Small block V-8s up to 275 H.P.
- Big block V-8s up to 275 H.P.
- No 4 or 6 cylinders

## Features

- A complete "stand-alone" system.
- Retro-fits only carbureted, non-computerized V-8 engines.
- Die cast aluminum throttle body.
- Dual 85 lb./hour injectors.
- 12 - 22 PSI adjustable pressure regulator.
- Digital ECU is user-adjustable for:
  - Idle
  - Accelerator pump
  - Main
  - High RPM
  - Choke
- Self-priming, in-line electric gerotor fuel pump is rated at 300 lb./hr. @ 15 PSI.
- Wiring harness is designed for "plug-in" installation. It's temperature-insulated and weather-sealed.
- Adjustable fast idle solenoid.
- Installed height of TBI is no greater than standard carburetor.
- Detailed installation instruction booklet is included.

## Benefits

- Improved driveability
- Fantastic throttle response
- Greater fuel economy
- Increased power

## System Requirements

- Non-computerized V-8 engine of not more than 275 H.P.

## Available Separately

- GM TH-700R4 transmission cable bracket
  - P/N: **20-96** (factory 4-bbl. intake manifold)
  - P/N: **20-97** (aftermarket 4-bbl. intake manifold)
- Holley 2-bbl.-manifold-2 bbl.-Pro-Jection adapters
  - P/N: **17-46** (Rochester 2-bbl. flange)
  - P/N: **17-47** (Holley 2300/Motorcraft 2-bbl. flange)
- Holley 2-bbl. Pro-Jection intake manifold for small block Chevrolet V-8s
  - P/N: **300-49** (1957-86 all & 1987-later with aluminum cylinder heads)
  - P/N: **300-66** (1987-later with cast iron cylinder heads)
- Dual tank installation kit for light-duty trucks
  - P/N: **534-37**
- Closed loop kit
  - P/N: **534-54**
- Rich/Lean indicator for vehicles w/o oxygen sensor
  - P/N: **534-50**
- Rich/Lean indicator for vehicles with oxygen sensor
  - P/N: **534-51**



(B) Not legal for sale or use in California on any pollution controlled motor vehicles.

① ② or ③ See page 2 for symbol explanation.





A.


B.


C.


D.


E.


F


G.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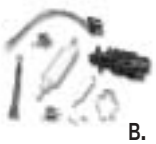
## TBI SYSTEM SERVICE PARTS

| | Part # |
|---|---|
| **A. Adapter - Air Cleaner**<br>4-bbl Pro-Jection systems | **17-14** |
| **B. Adapter - TBI (spread bore to TBI flange)**<br>2-bbl Pro-Jection | **17-41** |
| **C. Adapter - TBI (square bore to TBI flange)**<br>2-bbl Pro-Jection | **17-45** |
| **D. Adapter - TBI (square bore to spread bore flange)**<br>2-bbl Pro-Jection | **17-6** |
| **E. Adapter - TBI (2300 2-bbl flange to TBI flange)**<br>2-bbl Pro-Jection | **17-47** |
| **F. Bracket - Transmission Cable (GM TH-700R4)**<br>2-bbl Pro-Jection, P/Ns 502-1, 502-2 Chevrolet small block V-8 with original equipment 4-bbl intake manifold | **20-96** |
| **G. Bracket - Transmission Cable (GM TH-700R4)**<br>2-bbl Pro-Jection, P/Ns 502-1, 502-2 Aftermarket 4-bbl intake manifold | **20-97** |
| **H. Closed Loop Kit**<br>1-bbl, 2-bbl, 4-bbl Pro-Jection analog systems | **534-27** |
| **I. Closed Loop Kit**<br>1-bbl & 2-bbl, digital Pro-Jection | **534-54** |
| **J. Diaphragm, Fuel Pressure Regulator**<br>1-bbl, 2-bbl, 4-bbl Pro-Jection | **512-1** |
| **K. Distribution Ring, Air** | **508-10** |
| **L. Distribution Ring, Air**<br>4-bbl Pro-Jection systems | **508-12** |
| **M. Injector O Ring Kit** | **508-19** |


A.


B.


C.


D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O.

# TBI SYSTEM SERVICE PARTS

Part #

**A. Dual Tank Fuel Pump Kit**
1-bbl Pro-Jection, P/Ns 501-1, 501-2
2-bbl Pro-Jection, P/Ns 502-1, 502-2 — **534-37**

**B. Dual Tank Fuel Pump Kit**
4-bbl Pro-Jection (All), 950 MPFI/4 bbl TBI — **534-38**

**C. Electronic Control Unit (ECU)**
2-bbl Pro-Jection — **534-55**
2-bbl Pro-Jection **(MARINE)** — **534-33**

**D. Electronic Control Unit (ECU)**
1-bbl digital Pro-Jection, P/N 501-12 — **534-72**

**E. Filter, Fuel - Pump (plastic)**
All Pro-Jection systems — **562-3**

**F. Filter, Fuel - TBI (metal)**
All Pro-Jection systems — **562-1**

**G. Gasket, Air Horn**
1-bbl replacement TBIs, P/Ns 500-1, 500-2, 500-3, 500-4, 500-5
1-bbl Pro-Jection, P/Ns 501-1, 501-2 — **508-1**

**H. Gasket, Air Horn**
2-bbl replacement TBIs, P/Ns 502-3, 502-4, 502-5, 502-6, 502-7, 502-8;
2-bbl Pro-Jection, P/Ns 502-1, 502-2;
4-bbl Pro-Jection systems (all) — **108-4**

**I. Gasket, 1-bbl TBI Flange (O.E. manifold/1.68" bore)**
1-bbl replacement TBIs, P/Ns 500-1, 500-2, 500-3, 500-4, 500-5 — **508-2**

**J. Gasket, 1-bbl TBI Flange (Holley manifold/2.00" bore)**
1-bbl replacement TBIs, P/Ns 500-1, 500-2, 500-3, 500-4, 500-5 — **508-3**

**K. Gasket, 2-bbl TBI Flange (O.E. manifold/1.68" bores)**
2-bbl replacement TBI, P/N 502-3 — **508-7**

**L. Gasket, 2-bbl TBI Flange (O.E. manifold/2.00" bores)**
2-bbl replacement TBI, P/Ns 502-4, 502-5, 502-6, 502-7, 502-8 — **508-11**

**M. Gasket, Flange**
2-bbl Pro-Jection, P/N 502-1
Spread bore manifold to either P/Ns 17-41 or 517-1 adapters — **508-5**

**N. Gasket, Flange**
2-bbl Pro-Jection, P/N 502-2
Square bore manifold to P/N 17-6 adapter — **508-9**

**O. Filter, Fuel**
TBI (metal) — **562-1**





A.


B.


C.


D.


E.


F.


G.


H.


I.


J.


K.

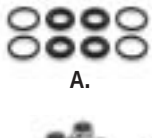

L.

## TBI SYSTEM SERVICE PARTS

| | Part # |
|---|---|
| **A. Gasket, 2-bbl TBI Flange/Adapter**<br>2-bbl Pro-Jection, P/Ns 502-1, 502-2<br>2 x 2 Pro-Jection, P/N 502-2211<br>2-bbl TBI flange to either P/Ns 17-41, 17-45 or 517-1 adapters | **508-6** |
| **B. Gasket, 4-bbl TBI Flange (1/16" thick)**<br>All 4-bbl Pro-Jection systems | **108-10** |
| **C. Gasket, 4-bbl TBI Flange (5/16" thick)**<br>All 4-bbl Pro-Jection systems | **108-12** |
| **D. Gasket, 1-bbl TBI Flange/Adapter**<br>1-bbl Pro-Jection, P/Ns 501-2, 501-12 | **508-15** |
| **E. Gasket, 2-bbl Carter BBD Flange to 1-bbl TBI Adapter**<br>1-bbl Pro-Jection, P/N 501-2 | **508-16** |
| **F. Gasket, 1-bbl TBI Air Cleaner Adapter to O.E. Air Cleaner**<br>1-bbl Pro-Jection, P/Ns 501-1, 501-2 | **508-14** |
| **G. Gasket, Idle Air Control Motor**<br>All "D" and "Di" Pro-Jection systems | **508-8** |
| **H. Idle Air Control Motor**<br>1-bbl and 2-bbl replacement TBIs | **543-2** |
| **I. Idle Air Control Motor**<br>All digital Pro-Jection systems | **543-105** |
| **J. Injector, Fuel (64 PPH)**<br>1-bbl replacement TBIs, P/Ns 500-1, 500-5 | **522-2** |
| **K. Injector, Fuel (90 PPH)**<br>1-bbl Pro-Jection, P/Ns 501-1, 501-2 | **522-40** |
| **L. Injector, fuel, performance, Commander 950 systems** | |
| 32 PPH @ 12 PSI; 45 PPH @ 21 PSI | **522-81** |
| 45 PPH @ 12 PSI; 65 PPH @ 21 PSI | **522-54** |
| 50 PPH @ 12 PSI; 72 PPH @ 21 PSI | **522-80** |
| 60 PPH @ 12 PSI; 85 PPH @ 21 PSI | **522-43** |

# TBI SYSTEM SERVICE PARTS

| | Part # |
|---|---|
| **A. Injector, O-ring kit** | |
| Commander 950 performance injector (includes O-rings for four injectors) | **534-164** |
| Commander 950 TBI new style injector | **508-19** |
| **B. Injector, retaining plate with air cleaner stud** | |
| 2-bbl throttle body, Commander 950 systems | **534-165** |
| 4-bbl throttle body, Commander 950 systems | **534-166** |
| **C. Injector, wiring harness, Commander 950 systems** | |
| 2-bbl throttle body | **534-167** |
| 4-bbl throttle body | **534-168** |
| **D. Injector pod, replacement, Commander 950 throttle body** | |
| 2-bbl throttle body | **534-162** |
| 4-bbl throttle body | **534-163** |
| (does not include injectors) | |
| **E. Injector pod upgrade kit for Pro-Jection throttle bodies** | |
| 2-bbl throttle body | **534-170** |
| 4-bbl throttle body | **534-169** |
| (upgrades "old-style" throttle body for new performance injectors; includes injector wiring harness and retaining plate) | |
| **F. Injector Caps, Replacement** | |
| 2-bbl Pro-Jection | **534-100** |
| **G. Kit, Renew** | |
| 1-bbl replacement TBIs<br>1-bbl Pro-Jection systems | **503-1** |
| **H. Kit, Renew** | |
| 2-bbl replacement TBI, P/N 502-3 | **503-2** |
| **I. Kit, Renew** | |
| 2-bbl replacement TBIs, P/Ns 502-4, 502-5, 502-6, 502-7, 502-8 | **503-5** |
| **J. Kit, Renew** | |
| 2-bbl Pro-Jection (All)<br>2 x 2 Pro-Jection | **503-3** |
| **K. Kit, Renew** | |
| 4-bbl Pro-Jection (All) | **503-6** |
| **L. Lever, Throttle Extension (Chrysler)** | |
| 2-bbl Pro-Jection (All)<br>2 x 2 Pro-Jection<br>4-bbl Pro-Jection (All) | **20-7** |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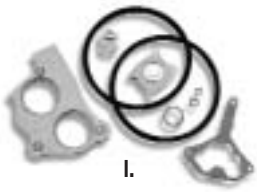
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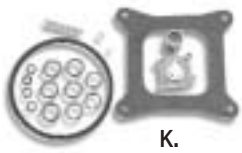
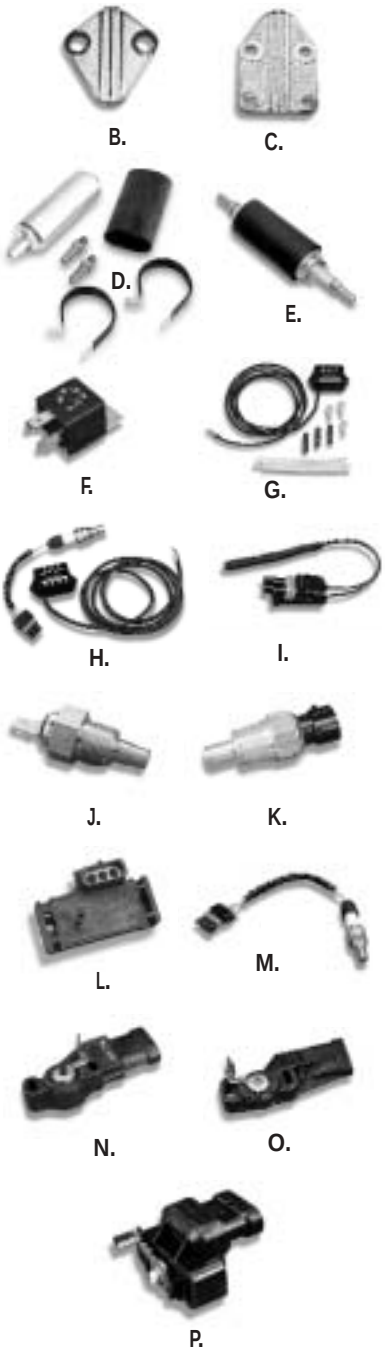

K.


L.

FUEL INJECTION




## TBI SYSTEM SERVICE PARTS

| | Part # |
|---|---|
| **A. Linkage kit, 4-bbl throttle body** | |
| **Progressive secondary action** | **534-160** |
| **1:1 secondary action** | **534-161** |
| **B. Plate, Fuel Pump Block-Off** | |
| Chrysler - Big Block V-8<br>Chrysler - Small Block V-8 | **12-813** |
| **C. Plate, Fuel Pump Block-Off** | |
| Chevrolet - Small Block V-8<br>Chevrolet - Big Block V-8 | **12-814** |
| **D. Pump, Electric Fuel (258 PPH @ 15 PSI)** | |
| All 1-bbl Pro-Jection<br>All 2-bbl Pro-Jection | **12-927** |
| **E. Pump, Electric Fuel** | |
| All 4-bbl Pro-Jection (480 PPH @ 15 PSI)<br>All MPI systems (402 PPH @ 45 PSI) | **12-920** |
| **F. Relay, 40 Amp.** | |
| All Pro-Jection systems | **534-26** |
| **G. Rich/Lean Indicator** | |
| w/o Oxygen Sensor | **534-50** |
| **H. Rich/Lean Indicator** | |
| w/ Oxygen Sensor | **534-51** |
| **I. Sensor, Air Charge** | |
| All digital Pro-Jection systems | **534-46** |
| **J. Sensor, Coolant Temperature** | |
| All 4-bbl analog Pro-Jection systems<br>P/N 502-20 digital 2-bbl Pro-Jection | **534-2** |
| **K. Sensor, Coolant Temperature** | |
| All 4-bbl digital Pro-Jection systems | **534-10** |
| **L. Sensor, MAP** | |
| All digital Pro-Jection systems - 4D & 4DI 2-bar | **538-13** |
| All Commander 950 systems - 1 bar | **538-24** |
| **M. Sensor, Oxygen** | |
| All digital Pro-Jection systems<br>Closed loop kit, P/N 534-27 | **43-106** |
| **N. Sensor, Throttle Position** | |
| 1-bbl replacement TBIs, P/Ns 500-1, 500-3, 500-5<br>1-bbl Pro-Jection, P/Ns 501-1, 501-2 | **543-1** |
| **O. Sensor, Throttle Position** | |
| 1-bbl replacement TBIs, P/Ns 500-2, 500-4<br>2-bbl Pro-Jection, P/Ns 502-1, 502-2, 502-20<br>2 x 2 Pro-Jection, P/N 502-2211 | **543-3** |
| **P. Sensor, Throttle Position** | |
| 2-bbl replacement TBIs, P/Ns 502-3, 502-4, 502-5, 502-6, 502-7, 502-8<br>4-bbl Pro-Jection, P/Ns 504-1, 504-2, 504-11, 504-12, 504-13, 504-21, 504-22, 504-23, 950-21, 950-22, 950-23 & 950-24 | **543-29** |

A.

B.

C.

2 Bbl

4 Bbl

## TBI SYSTEM SERVICE PARTS

| | Part # |
|---|---|
| **A. Software, Interactive Mapping** (3.5" IBM diskette – Windows 3.x/95 and DOS 6.0) 64 point acceleration compensation map<br>4-bbl Pro-Jection, P/Ns 504-21, 504-22, 504-23 | **534-44-1** |
| **B. Solenoid, Fast Idle**<br>All 2-bbl and 4-bbl analog Pro-Jection systems<br>1-bbl and 2-bbl Digital systems | **46-74** |
| **C. TBI Assembly (670 CFM)**<br>2-bbl Pro-Jection, P/Ns 502-1, 502-2 | **500-6S** |
| **C. TBI Assembly - Primary (670 CFM)**<br>2 x 2 Pro-Jection, P/N 502-2211 | **500-11** |
| **H. TBI Assembly (900 CFM)**<br>4-bbl Pro-Jection,<br>P/Ns 504-11, 504-21 | **500-16S** |
| **H. TBI Assembly (700 CFM)**<br>4-bbl Pro-Jection,<br>P/Ns 504-12, 504-22 | **500-17S** |
| **H. TBI Assembly (650 CFM)**<br>4-bbl Pro-Jection,<br>P/Ns 504-13, 504-23 | **500-18S** |
| **Throttle body assemblies, Commander 950 systems** | |
| 400 CFM 2-bbl w/ 65 PPH injectors | **534-174** |
| 670 CFM 2-bbl w/ 85 PPH injectors | **534-175** |
| 650 CFM 4-bbl w/ 45 PPH injectors | **534-171** |
| 700 CFM 4-bbl w/ 65 PPH injectors | **534-172** |
| 900 CFM 4-bbl w/ 75 PPH injectors | **534-187** |
| 900 CFM 4-bbl w/ 85 PPH injectors | **534-173** |
| **Throttle body assemblies, TBI systems** | |
| 670 CFM 2-bbl system P/N 700-21 | **500-13** |
| 900 CFM 4-bbl system P/N 700-51 | **500-19** |
| 700 CFM 4-bbl system P/N 700-21 | **500-20** |




## TBI SYSTEM SERVICE PARTS

Part #


A.

**A. Wiring Harness**
1-bbl Pro-Jection
2-bbl Pro-Jection — **534-25-1**


B.

**B. Wiring Harness**
4-bbl Pro-Jection 4D & 4DI, P/Ns 504-11, 504-12, 504-13, 504-21, 504-22, 504-23 — **534-43**


C.

**C. Wiring Harness Adapter**
All analog 2-bbl Pro-Jections with old-style ECU with ribbed/finned housing. Adapter allows connection either to "newer" analog or "state-of-the-art" digital ECU. — **534-23**


D.

**D. Wiring Harness Adapter**
All digital interactive (Di) Pro-Jection & 950 systems. Allows connection to GM distributor for ignition control feature. — **534-47**


E.

**E. Wiring Harness Adapter**
All digital interactive (Di) Pro-Jection & 950 systems. Allows connection to Ford distributor for ignition control feature. — **534-48**

**F. Wiring Harness, Closed Loop**
Digital 2-bbl Pro-Jection — **534-56**


F.

**G. Wiring Harness - Computer Cable DB-9**
All digital interactive (Di) Pro-Jection systems. Allows computer hookup for tuning purposes. — **534-45**


G.

**H. Wiring Terminals Package**
2-bbl Pro-Jection, P/Ns 502-1, 502-2 — **534-4**


H.

# EFI FUEL RAILS - UNIVERSAL

These Holley CNC machined aluminum fuel rails are designed for high flow, custom applications. Holley EFI fuel rails are the perfect complement to the Holley lines of high flow in-tank fuel pumps, performance fuel injectors, intake manifolds, adjustable fuel pressure regulators and high flow billet throttle bodies for your custom installation. Universal fuel rails require machining to fit your injector mounting situation.

**NOTE:** Fuel rails are sold individually.

| Application | Comments | P / N (Natural) |
|---|---|---|
| Universal | 12" length | 534-78 |
| Universal | 18" length | 534-79 |
| Universal | 36" length | 534-80 |




## PERFORMANCE FUEL INJECTOR KITS

These injector kits will enable you to upgrade the fuel delivery system of your engine. This is a definite necessity when you begin modifying a stock engine with such items as a performance fuel pump and camshaft or modifying the stock cylinder heads or upgrading to new performance cylinder heads, adding headers, high-flow throttle bodies, etc.

The fuel injectors here are all top-fed, Bosch-style with various flow ratings as shown below. The chart also equates the injector fuel flow potential to a engine horsepower rating.

**Note:** To convert lbs. per hour fuel flow to cc per minute fuel flow, multiply the lbs. per hour number by 10.5092. For example, 42 lbs. per hour is equal to 441.3 cc per minute fuel flow.

| PART # | APPLICATION / HORSEPOWER* | QTY | INJECTOR FLOW (lbs/hr) | IMPEDANCE |
|---|---|---|---|---|
| **522-1904** | Universal | 4 | 19 | High |
| **522-1906** | Universal | 6 | 19 | High |
| **522-1908** | Universal; 300 HP maximum | 8 | 19 | High |
| **522-2401** | Universal | 1 | 24 | High |
| **522-2408** | Universal; 385 HP maximum | 8 | 24 | High |
| **522-3001** | Universal | 1 | 30 | High |
| **522-3008** | Universal; 480 HP maximum | 8 | 30 | High |
| **522-3601** | Universal | 1 | 36 | High |
| **522-3608** | Universal; 575 HP maximum | 8 | 36 | High |
| **522-4201** | Universal | 1 | 42 | High |
| **522-4208** | Universal; 670 HP maximum | 8 | 42 | High |
| **522-5001** | Universal | 1 | 50 | High |
| **522-5008** | Universal; 800 HP maximum | 8 | 50 | High |
| **522-6501** | Universal | 1 | 65 | Low |
| **522-6508** | Universal; 1050 HP maximum | 8 | 65 | Low |
| **522-7501** | Universal | 1 | 75 | Low |
| **522-7508** | Universal; 1200 HP maximum | 8 | 75 | Low |
| **522-9501** | Universal | 1 | 95 | Low |
| **522-9508** | Universal; 1520 HP maximum | 8 | 95 | Low |

(*) A BSFC of 0.45 and 90% duty cycle is used for the maximum horsepower recommendation.