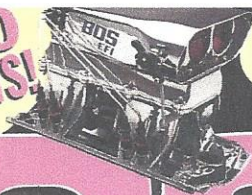
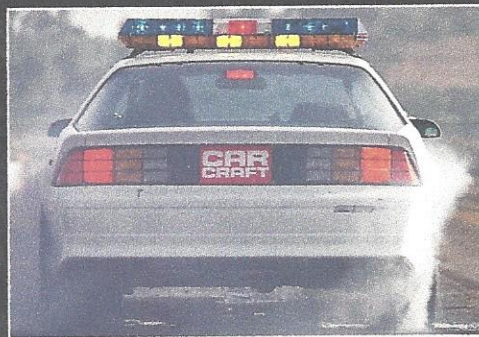


**DYNO  
RESULTS!**



**GIANT EFI TEST!**

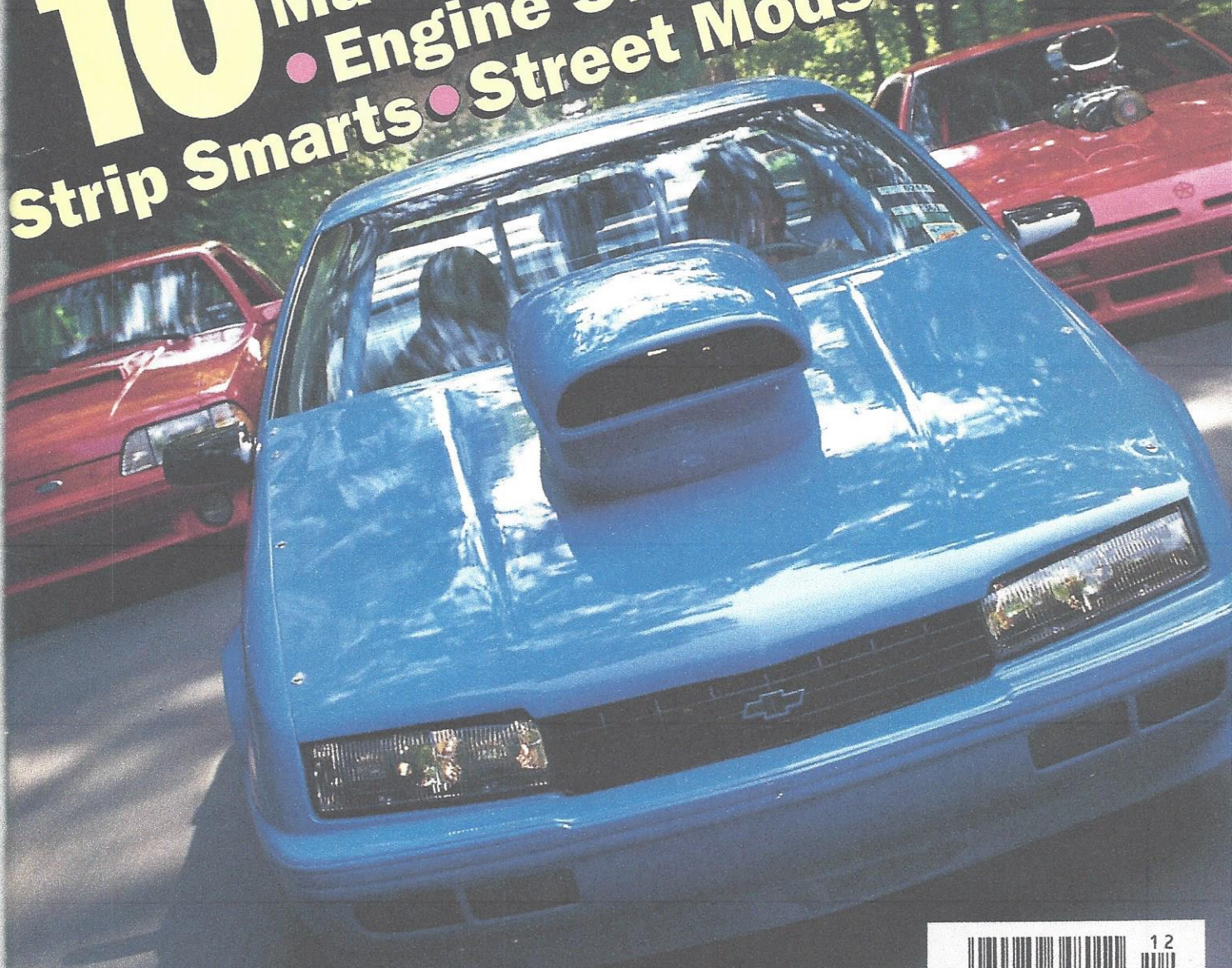
# CAR CRAFT



**COP  
CARS  
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HELL!**

**TOP  
10**

- Street Machines of '91
- Engine Swaps
- New Cars
- Strip Smarts
- Street Mods and More!



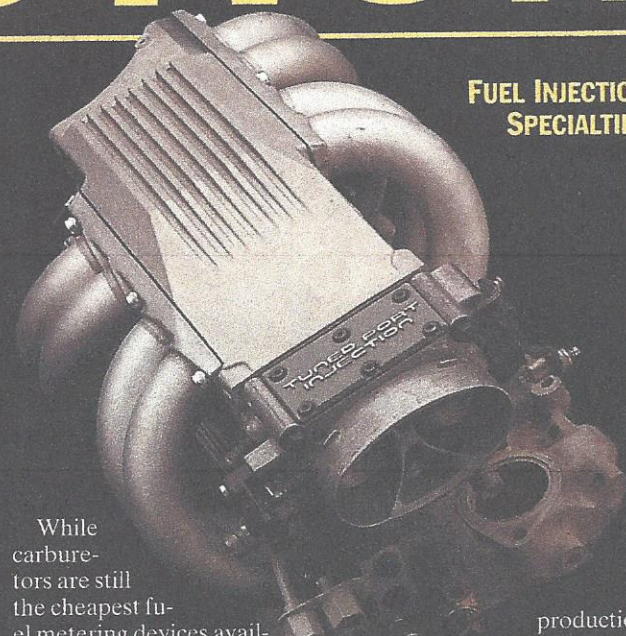
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# INJECTION

## Evaluating The Latest Electronic Fuel Injection Systems

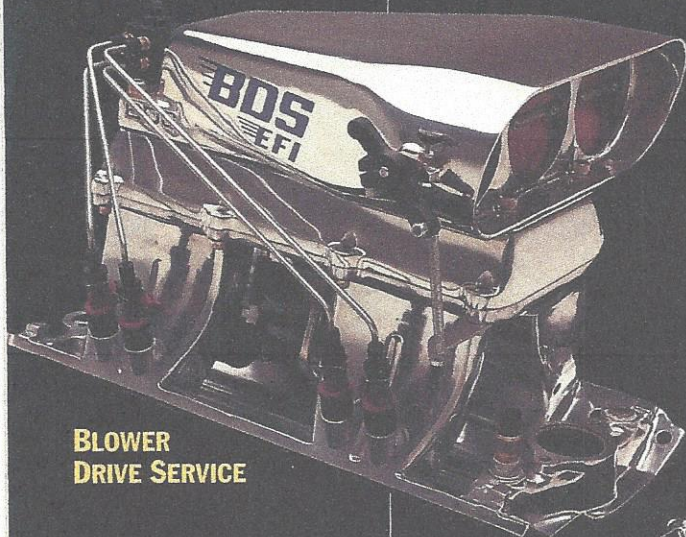
**B**OLT-ON ELECTRONIC fuel injection (EFI) systems for modern street machines still suffer from technological growing pains, but the most recent crop of electron-driven "fuelie" units offers some surprisingly mature combinations of hardware and software to tickle your engine's fancy. Still regarded as expensive and mind-boggling by most car crafters, EFI is a success in an OEM automotive market where carburetors virtually became extinct overnight.



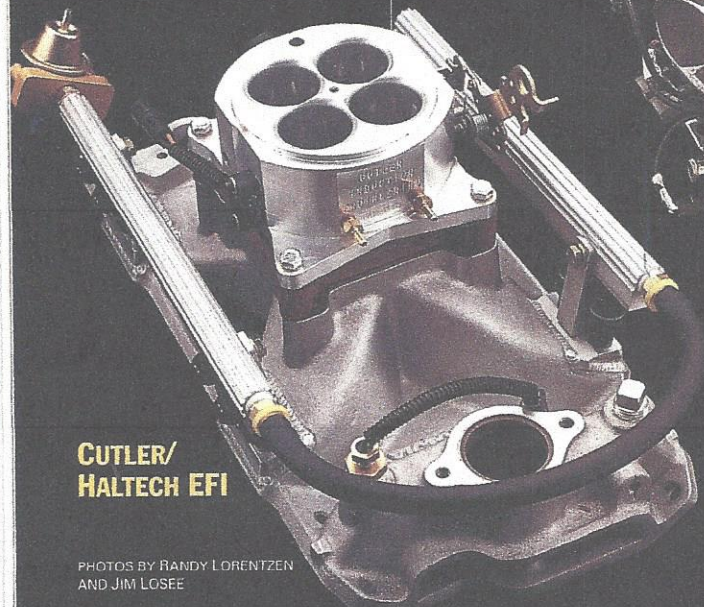
## FUEL INJECTION SPECIALTIES

While carburetors are still the cheapest fuel metering devices available, the positive effects of precisely metered fuel in modern cars can be seen in fewer emissions, reduced fuel consumption, and vastly improved driveability. Now, those benefits are increasingly available to street machiners. To help you gain some insight into the merits of aftermarket fuel injection we

production dropped alarmingly above 5250 rpm. Plus, the engine had to last through 10 full dyno sessions, each consisting of three break-in runs at 2500, 3500, and 4500 rpm to determine whether each unit was operating with safe exhaust gas tem-

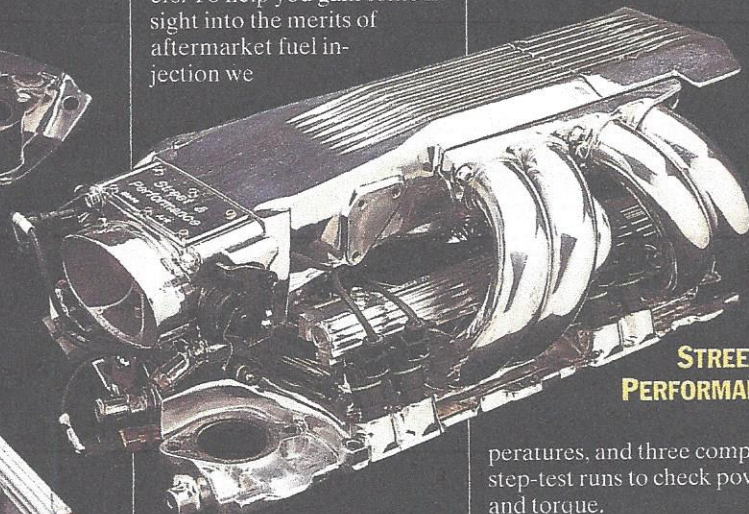


## BLOWER DRIVE SERVICE



## CUTLER/ HALTECH EFI

PHOTOS BY RANDY LORENTZEN  
AND JIM LOSEE



## STREET & PERFORMANCE

gathered together the latest EFI systems for a little informal comparison testing on a typical small-block V-8.

Testing was performed on Feuling Engineering's new Superflow SF7100 dyno with all the latest software updates. We ran the tests in 250-rpm-step increments from 2500 to 5250 rpm. The upper-end rpm limit was used because torque

peratures, and three complete step-test runs to check power and torque.

Each manufacturer was given the opportunity to bring a team of engineers to supervise the installation and the testing. But each unit had to be exactly the same as one the off-the-street customer could buy, including the electronic programming.

All of the manufacturers that utilize custom programming and chips for their units



# SELECTION

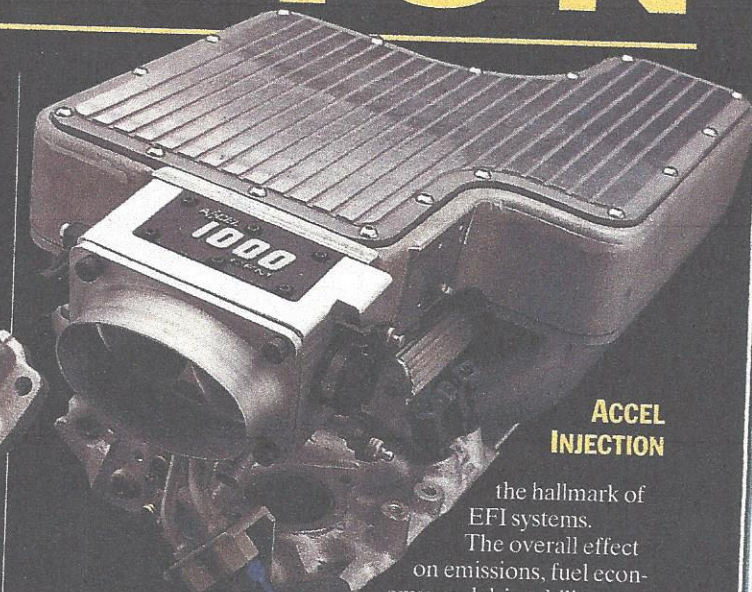
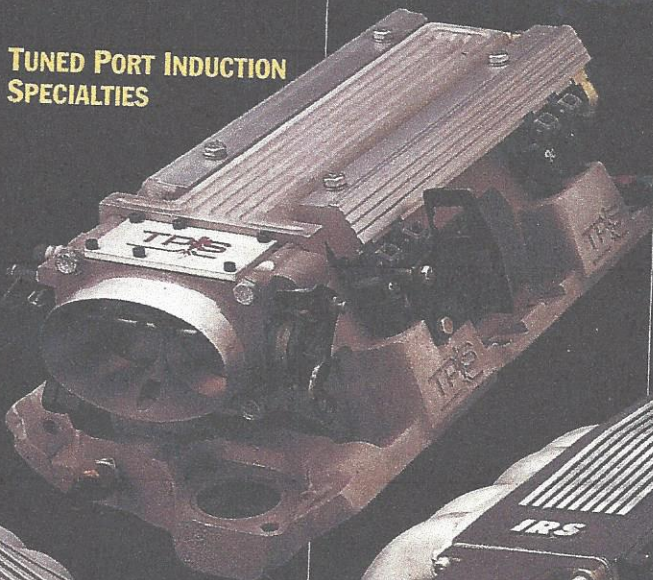


**HOLLEY  
PRO-JECTION 4**

will require you to provide your exact engine and chassis combination and they will tweak your chip to within plus or minus 5% of the optimum for the combination. This is intended to assure you a strong-running piece right out of the box.

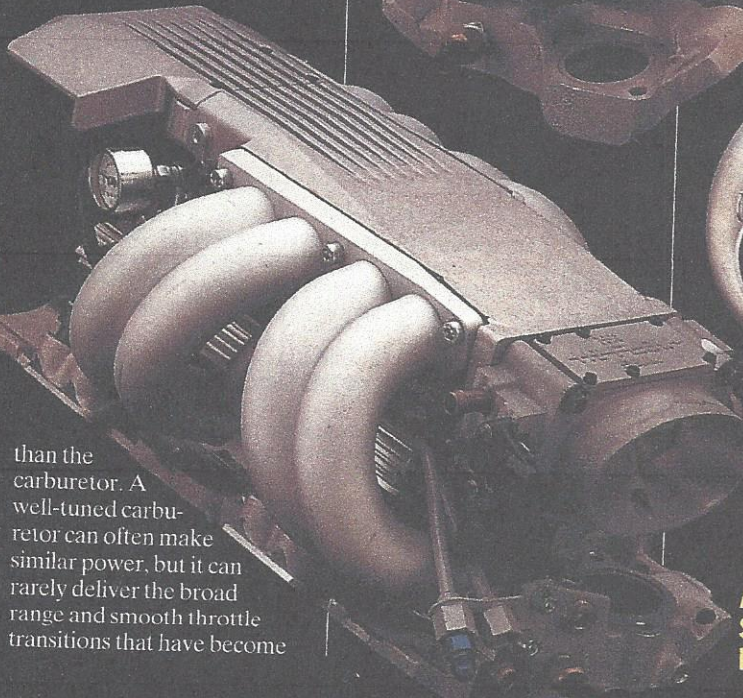
To further optimize your system, a good laptop computer that will run the manufacturer's software can be had for as little as \$600. Learning to operate the laptop and the software isn't nearly as difficult as you might expect, so don't be afraid to try it. The Arizona Speed & Marine system used in this test produced a whopping torque gain of 50 lbs-ft at a lower rpm

**TUNED PORT INDUCTION  
SPECIALTIES**



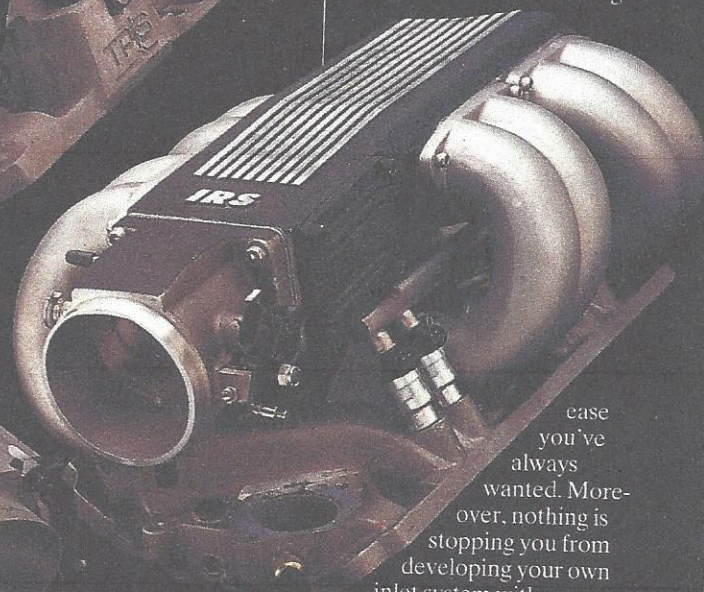
**ACCEL  
INJECTION**

the hallmark of EFI systems. The overall effect on emissions, fuel economy, and driveability aren't as easily quantified, but you can make a strong determination once you have one of these units installed on your car. Still, many enthusiasts will look at the cost and think that a carb and manifold is the way to go. That would be a pity because EFI offers the performance and tuning



**ARIZONA  
SPEED &  
MARINE TPI**

than the carburetor. A well-tuned carburetor can often make similar power, but it can rarely deliver the broad range and smooth throttle transitions that have become



**ELECTROMOTIVE**

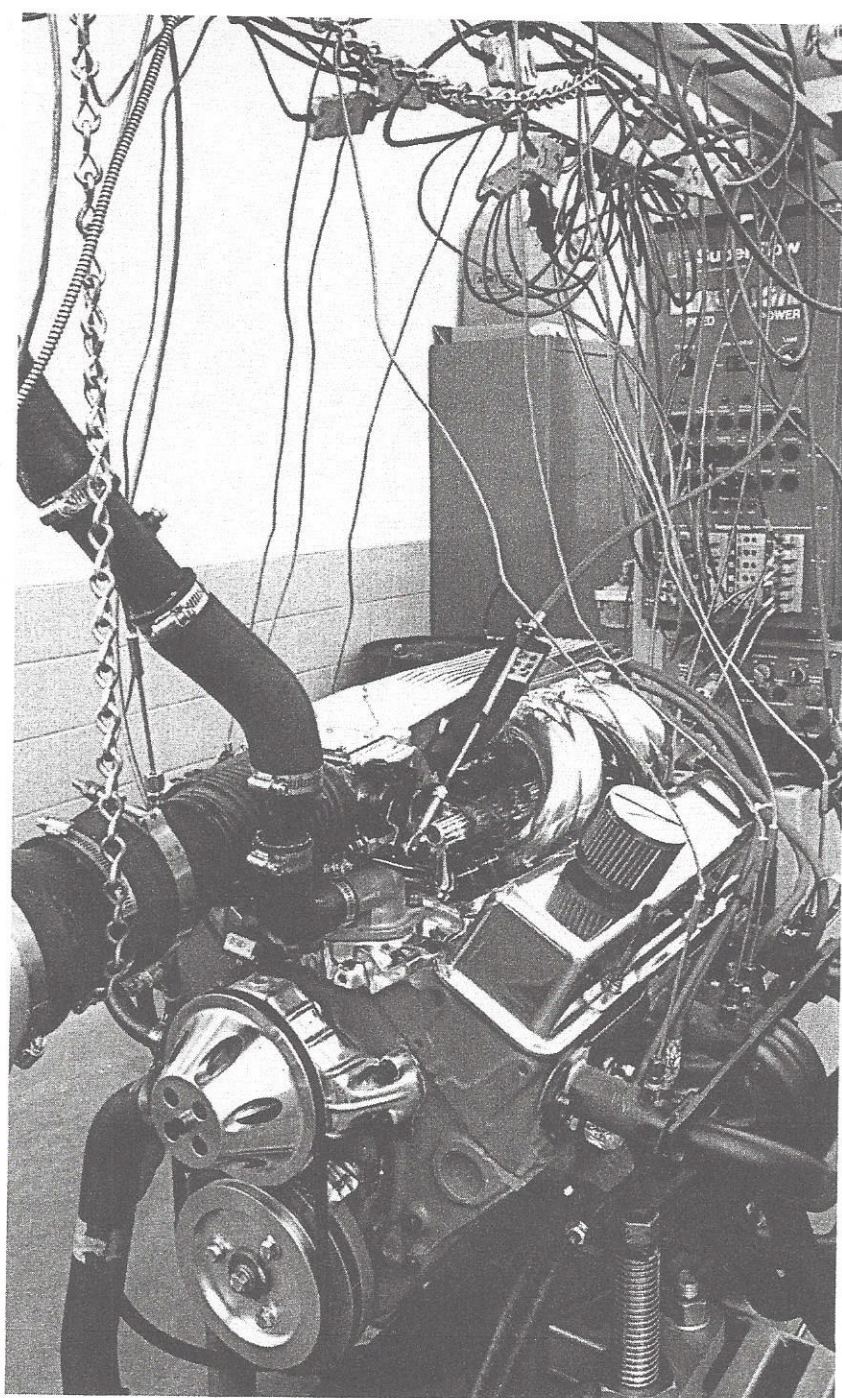
ease you've always wanted. Moreover, nothing is stopping you from developing your own inlet system with runners and plenum sized to suit your individual requirements. Once you get into this stuff, you'll quickly discover that it is a whole lot more fun than changing jets and pump cams on a four barrel.



## This Is Not A Shootout

Keep in mind that this test is an evaluation, not a shootout. Each of these systems has its own strengths and weaknesses, but they all bring something to the party. While a quick glance at the Best Power and Torque chart indicates that Arizona Speed & Marine have really done their homework, it doesn't mean that the rest of the units are terminally lame. Far from it. The low-end bolt-on factory systems are the perfect entry level set-ups to let you get your feet wet and enjoy the multiple benefits of EFI. High-end systems such as the Blower Drive Service unit and the Cutler/Haltech system offer the power and performance you want in a high-rpm application, while the Holley Pro-Jection is a great system that offers a unique compromise in terms of strong performance and reasonable cost.

The Arizona Speed & Marine system is clearly a great, moderately priced choice for street machines that require a strong, broad power band. Simply match these results to your own carefully determined requirements and you can't miss. By homing in on the specific rpm range where your car normally operates, you can pinpoint the best system for your needs. Note that terrific benefits are offered by every system, and the unique characteristics of each system allow you to select a set-up that best matches your needs. While EFI is still a pricey alternative, it does offer considerable bang for your buck.



## The Test Engine

To an engine, dynamometers are the mechanical equivalent of Murder Inc. First because most engines don't live up to the builder's expectations, and second, because they often break engines. Because we wanted a bulletproof test engine that wouldn't rearrange itself at any point in the test, we asked the advice of the Feuling Engineering dyno and engine technicians. Former NASCAR engine builder Jack Russell was put in charge of our primary engine build and he also assembled a backup engine... just in case.

What does it take to build a dyno-proof small-block? Besides quality assembly and machining, you need quality parts. Jack used Speed-Pro components, including pistons, rings, bearings, oil pump, valves, timing chain, and pushrods.

Valve operation was managed by a safe and sane Edelbrock Performer RPM cam, lifters, and valve springs. And to make certain we had absolutely no worries about the con rods, Crowder delivered two sets of their forged, high-strength-steel Sportsman rods. A Fel-Pro gasket set sealed it up tight as a drum and a pair of B&B Performance cast-aluminum, no-name valve covers dressed up the engine's appearance so it wouldn't feel out of place around all that high-tech equipment.

B&M's aluminum waterpump and pulleys circulate the coolant while MSD's best heat-shielded Heli-Core wires send the spark from the Performance Distributors' HEI unit to the Accel spark plugs. The engine parts are held firmly together with a complete engine bolt set from ARP.

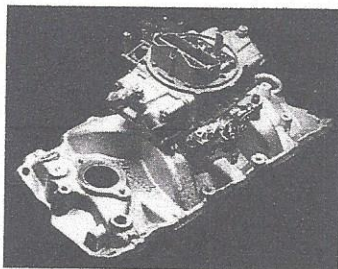
Finally, spent gases get to the dyno muffler through a set of specially made Hedman 1½-inch-diameter primary tube street headers.



## INJECTION SELECTION

### Edelbrock Performer RPM Manifold and Holley Carb

Suggested Price: \$450



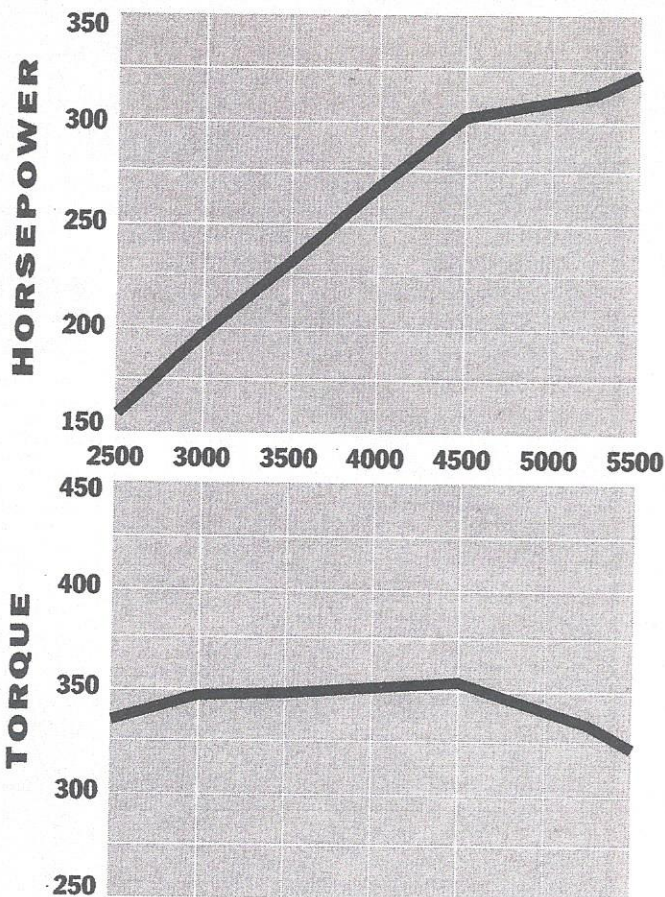
This combination represents a typical street machine induction system. It is easy to install, and with optimum jetting it delivers good strong power. Unfortunately it can't fine tune itself to correct for constantly changing conditions. The price is right, but total performance is lacking if you are judging the package based on parameters other than power. The intake manifold delivers

#### Baseline: Edelbrock Performer RPM Manifold and Holley 3310-3 750cfm, Vacuum Secondary Carb

RPM	Horsepower	Torque
2500	160.3	336.8
3000	197.2	345.2
3500	231.5	347.4
4000	267.3	350.9
4500	302.5	353.0
5000	314.9	330.8
5250	322.8	322.9

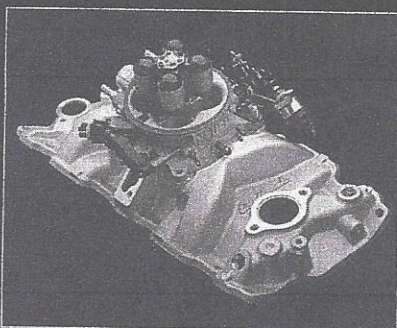
Average Horsepower: 256.4  
Average Torque: 341

great torque using a variety of four-barrel carburetors. The problem lies in the calibration of the Holley four-barrel or any other carburetor you might select. All carburetors feature numerous manual adjustments for optimizing their performance. Unfortunately you have to make the adjustments manually and they are only good as long as conditions remain the same. The contemporary intake manifold and carburetor combination provided a sound baseline from which to judge the effectiveness of the various fuel injection systems. Keep in mind however, the dyno can't show real-world improvements such as improved fuel economy, crisp driveability, and cleaner emissions.



### Holley Pro-Jection 4

Suggested Price: \$1100

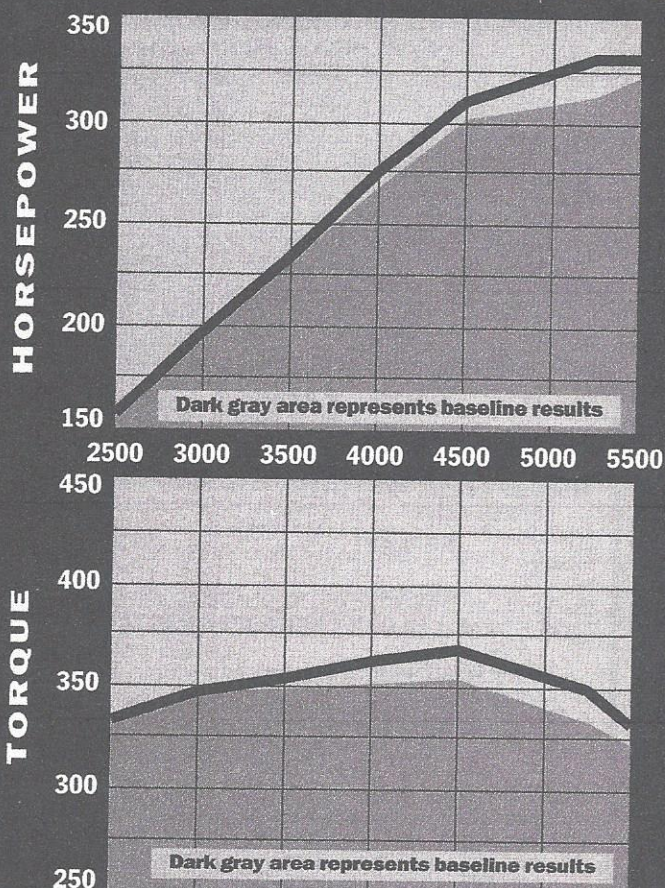


Many small-block-powered street machines run a high-rise aluminum four-barrel intake manifold and this unit readily bolts in place of a standard four-barrel carb. Indeed the unit selected for this test was installed on the same Edelbrock intake manifold used to establish the engine's baseline power curve. It is a throttle body injected (TBI) system, utilizing four injectors mounted directly on the throttle body. The Pro-Jection 4 uses the same wet-flow principal for transporting the air/fuel mixture through the manifold as does a carb, hence its performance can be adversely affected by poor manifold design, or enhanced by a good manifold. Installation is much like installing a new carburetor, but you must plumb an electric fuel pump and filter (provided in the Holley kit) into your existing fuel system. Be aware that your car's electrical system has to be in excellent condition in order to allow this system to function properly. The four externally adjustable pots on the main control unit are easy to use and quite sensitive. With a 10 horsepower gain and 15 lbs-ft right out of the box, this unit showed itself to be a capable performer.

#### Holley Pro-Jection 4

RPM	Horsepower	Torque
2500	157.8	331.5
3000	197.1	345.0
3500	236.9	355.5
4000	275.9	362.2
4500	314.4	366.9
5000	332.6	349.4
5250	332.1	332.2

Average Horsepower: 263.8  
Average Torque: 349





## Fuel Injection Specialties

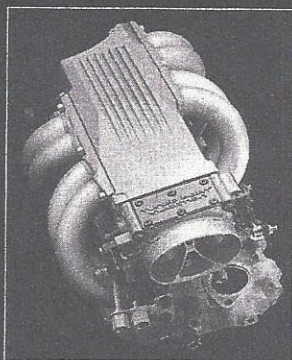
Suggested Price: \$3200

This company specializes in totally stock GM Tuned Port Injection (TPI) units. They come with a stock wiring harness, GM electronic control module (ECM), and performance chip for installation on vehicles not originally equipped with TPI. Installation of this EFI is very easy, but if you have never installed one of these units, we highly recommend that you purchase a factory service manual for the correct year of the TPI system you are using. It offers detailed explanations of the various systems and will answer any questions not covered by the installation instructions.

The Fuel Injection Specialties unit performed as expected with power peaks similar to a stock 350 TPI Camaro. This type of system is one of the safest ways to get into an EFI unit because the components are already factory matched. The unit had the lowest peak power rating in comparison with

the carbureted system, but it delivered nearly 15 lbs-ft more torque at 1000 rpm lower than the carburetor—a boost you can easily feel in the seat of your pants.

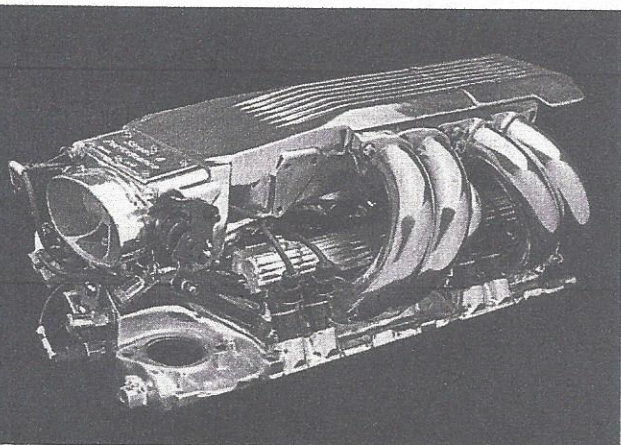
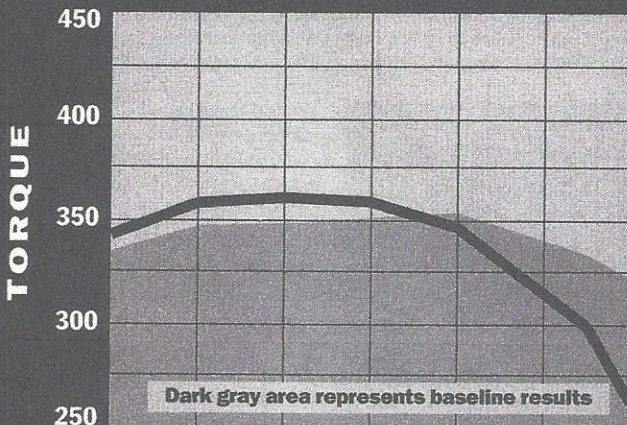
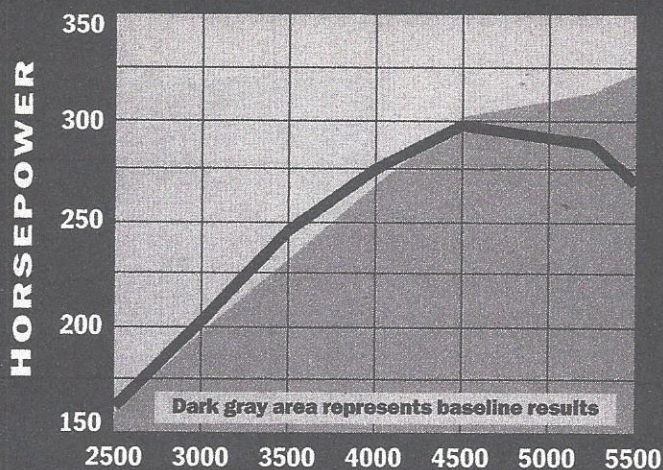
The long torque-efficient runners of the stock TPI offer the low-end punch you are looking for right out of the box, and top-end power could be easily regained using larger bolt-on runners, a modified throttle body and appropriately programmed chip. These components are all readily available as bolt-ons as your budget permits.



### Fuel Injection Specialties

RPM	Horsepower	Torque
2500	163.4	343.3
3000	206.9	362.3
3500	243.9	366.0
4000	274.6	360.5
4500	294.1	343.3
5000	285.0	299.4
5250	268.7	268.8

Average Horsepower: 248  
Average Torque: 335.6



## Street & Performance

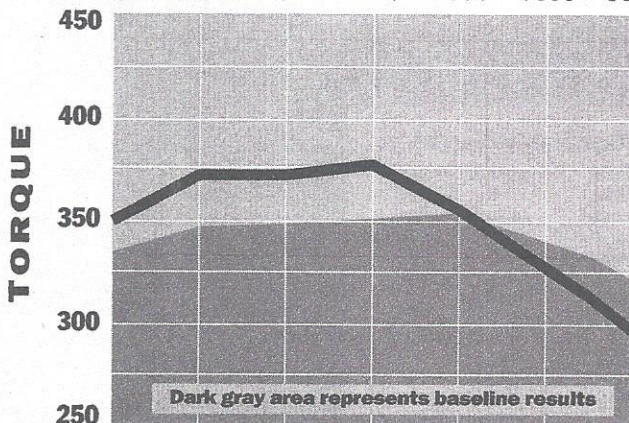
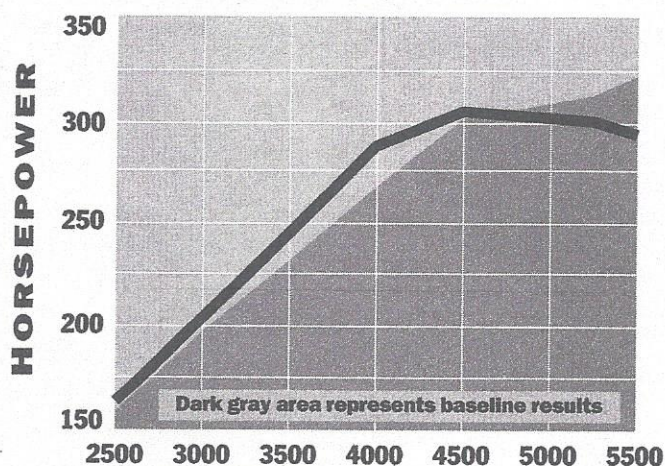
Suggested Price: \$1995

### Street & Performance

RPM	Horsepower	Torque
2500	166.8	350.4
3000	211.9	370.9
3500	245.6	368.6
4000	287.1	376.9
4500	308.6	360.2
5000	302.1	317.3
5250	294.8	294.9

Average Horsepower: 259.5  
Average Torque: 348.5

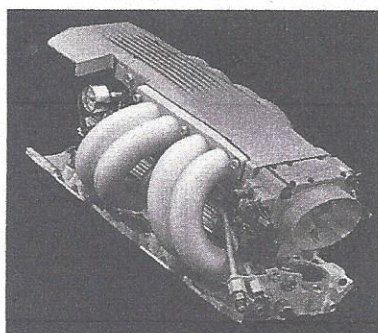
Of all the TPI units we tested, this highly polished EFI was one of the prettiest, and would look great underneath the hood of any street machine. Because this unit uses the basic GM TPI system, it's a straight bolt-on much like the Fuel Injection Specialties EFI system. Follow the instructions closely and get a copy of GM's factory service manual. Utilizing Street & Performance's number 6 chip, this unit ran quite well, producing good torque.





## Arizona Speed & Marine TPI

**Suggested Price: \$3025**



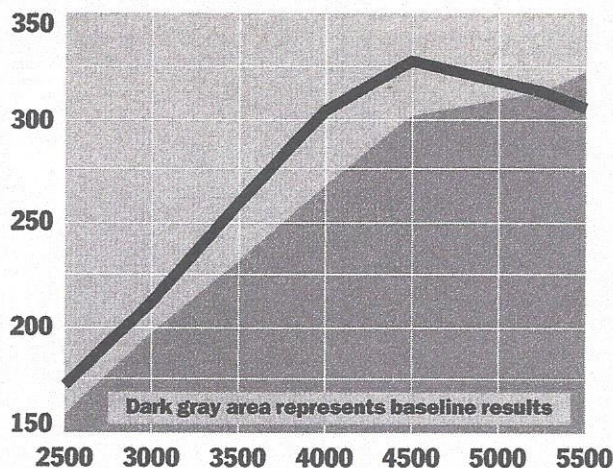
The Arizona Speed & Marine TPI is based on the GM system (including the computer) but with Arizona's custom chip programming. What sets this unit apart is the stock plenum and base manifold that has been Extrude-Honed, a process which enlarges all openings using an abrasive product that is hydraulically forced through each piece at a specific rate to remove a pre-determined amount of material. This optional feature costs more than the standard manifold and plenum, but it contributes a substantial performance gain. The runners are ASM's own mandrel-bent, large-diameter, aluminum tubes. Complementing this added air flow potential is ASM's 58-mm throttle body assembly from their big-block truck unit. Thanks to superior component matching and razor sharp electronic management, this was the only unit to exceed 400 lbs-ft, achieving a staggering 50 lbs-ft gain over the carbureted version.

### Arizona Speed & Marine

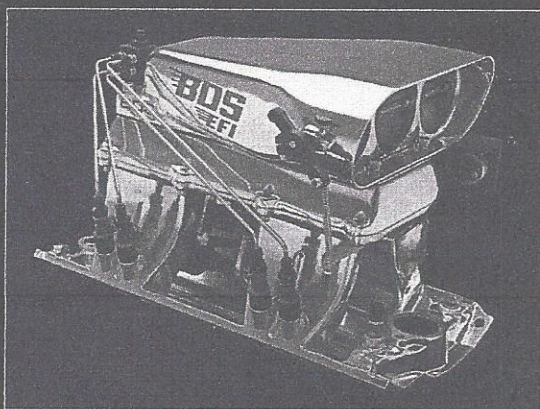
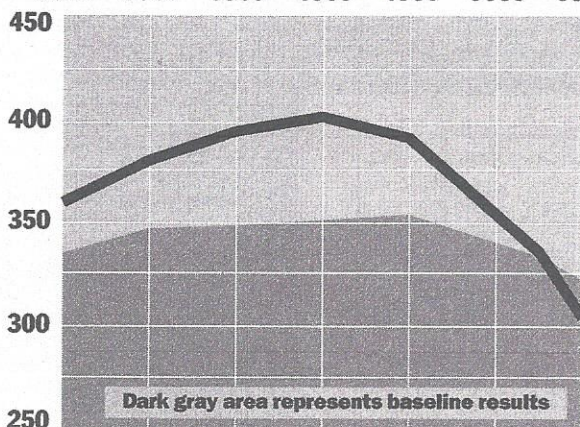
RPM	Horsepower	Torque
2500	172.8	363.0
3000	216.7	379.3
3500	261.0	391.6
4000	306.7	402.7
4500	328.3	383.2
5000	317.0	333.0
5250	310.0	310.1

Average Horsepower: 273.2  
Average Torque: 366.1

**HORSEPOWER**



**TORQUE**



## Blower Drive Service

**Suggested Price: \$3269**

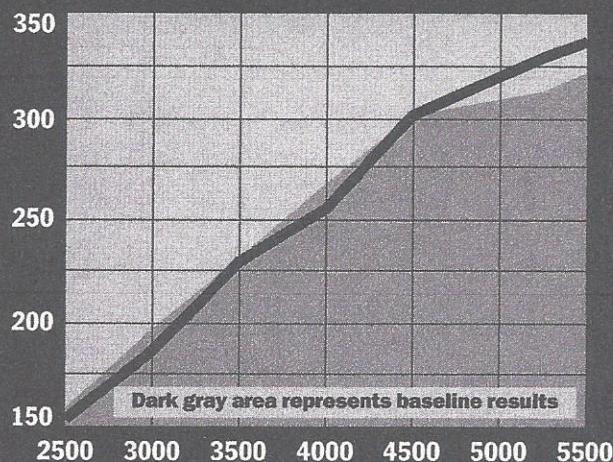
### Blower Drive Service

RPM	Horsepower	Torque
2500	154.4	324.3
3000	185.9	325.5
3500	229.0	343.6
4000	257.6	338.2
4500	303.0	353.6
5000	327.4	343.9
5250	336.5	336.4

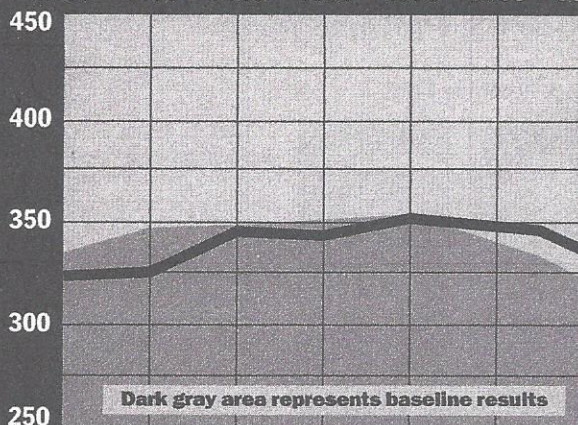
Average Horsepower: 256  
Average Torque: 337.9

If you want all the advantages of EFI and still want to retain the traditional bug catcher look for your street machine, this is your unit. Based on a tunnel ram intake manifold, BDS utilizes only the center hole of the three hole bug catcher scoop to flow over 1200 cfm. With their electronics package and an engine capable of higher rpm, this unit puts out some serious horsepower. This bolt-on is straightforward, can be done in a short time, and will give the ultimate competition look.

**HORSEPOWER**



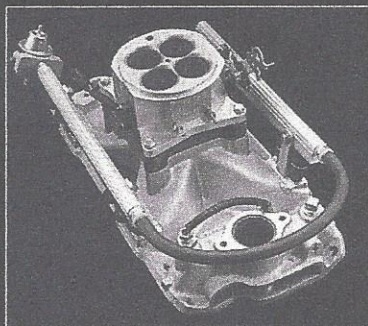
**TORQUE**





## Cutler/Haltech EFI

Suggested Price: \$2285

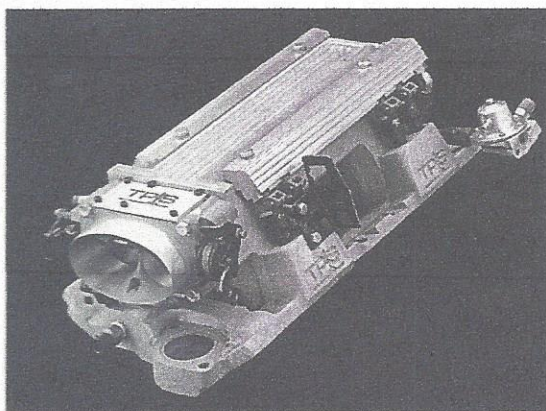
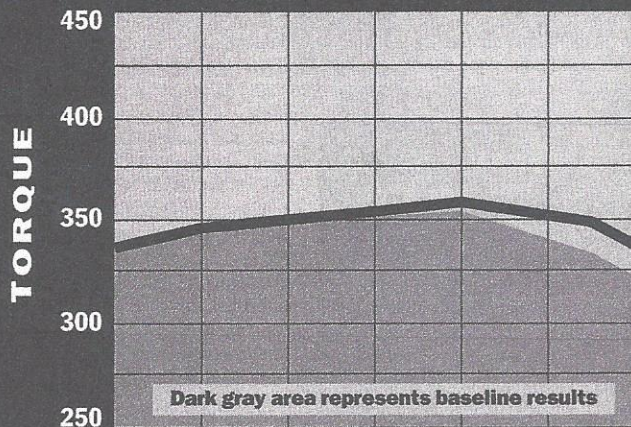
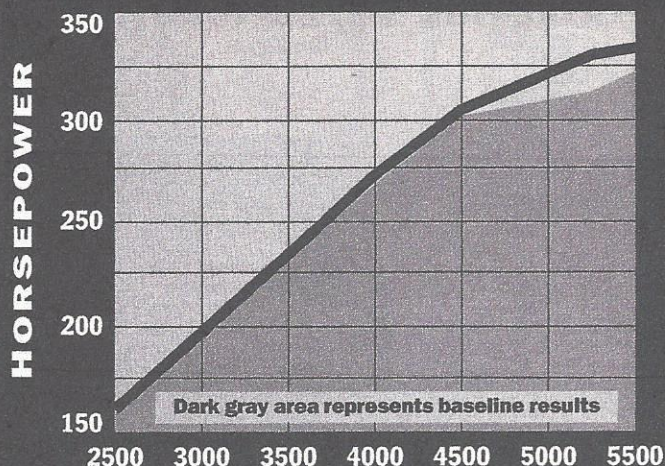


This unit differs from the others because it incorporates a throttle body for air induction only, with individual injectors at each port on a regular single-plane manifold. Installing this system is as easy as installing a conventional intake manifold. Cutler/Haltech can vary the size of the throttle body to match the air flow characteristics of your engine, and they can supply properly sized injectors for your application. Electronic fuel mixture control is established using Haltech's proven F3 management system which is easily programmable with a laptop computer. This unit will make great horsepower in a high-rpm situation. Like the BDS unit, the Cutler/Haltech system makes great power upstairs, but sacrifices considerable torque at the bottom end. Both units barely produced 5 lbs-ft more than the carbureted system and they did it at a higher rpm. This is primarily attributable to the difference in intake manifold design and much less a function of the electronic management system which tends to smooth out any large differences with superior fuel metering throughout the power band.

### Cutler/Haltech EFI

RPM	Horsepower	Torque
2500	160.7	337.6
3000	196.3	343.7
3500	233.6	350.6
4000	270.3	354.9
4500	307.0	358.3
5000	332.5	349.3
5250	336.3	336.4

Average Horsepower: 262.3  
Average Torque: 347.2



## Tuned Port Induction Specialties

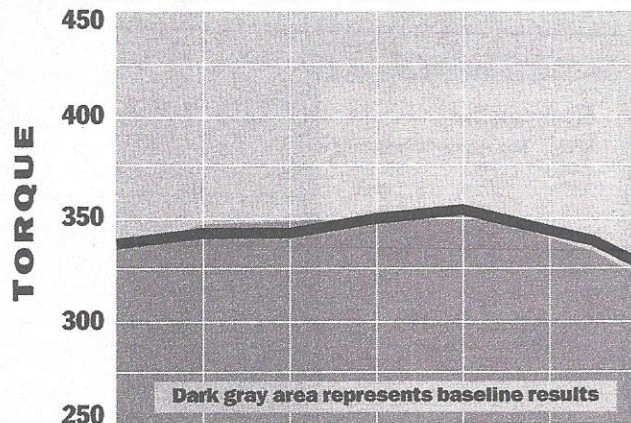
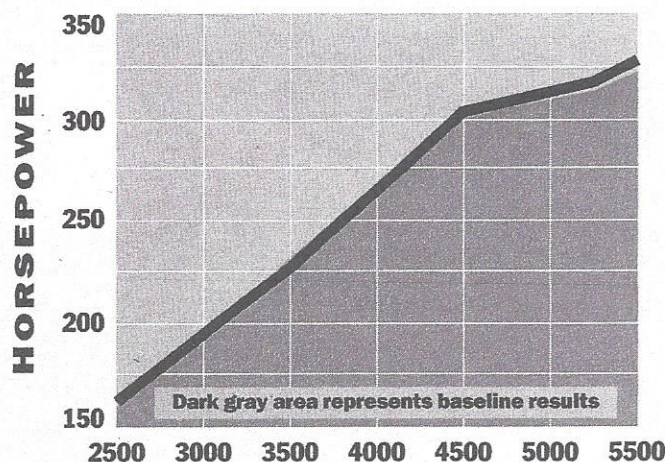
Suggested Price: \$2995

### Tuned Port Induction Specialties

RPM	Horsepower	Torque
2500	161.2	338.6
3000	194.7	340.8
3500	227.5	341.4
4000	264.4	347.1
4500	304.2	355.0
5000	320.2	336.3
5250	328.3	328.4

Average Horsepower: 257.2  
Average Torque: 341

The TPI Specialties EFI set-up is by far and away the easiest to install and the most compact of all the units tested. The design is somewhat similar to that of the new LT1 Corvette manifold with its one-piece, short-runner casting, and it makes decent power all through the rpm range using a 52-mm throttle body. Because of its one-piece design, this unit is easy to assemble and if you can't fit this injection under your hood, your car is too low to even sit in. Everything about this unit is very user friendly.





## INJECTION SELECTION

### Accel Injection

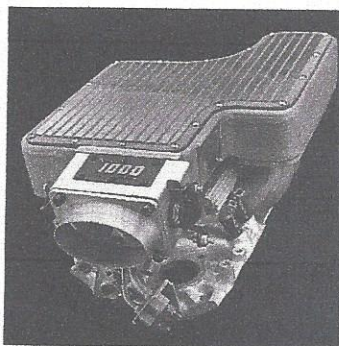
Suggested Price: \$2900

The Accel unit was the most difficult to install and came close to being the largest. Some of the hand-made fixes that were performed to ease our installation are now in production as you read this. This unit is harder to install because it uses a large plenum (and it is already packaged as small as possible). Consequently, getting at all the bolts and distributor clearance with an HEI is tight. It is very wise to read over the instructions for this unit carefully a couple of times before the install. Once everything is in place and the right calibrations are done on the injection, plenty of power is available. For those planning on doing their own EFI calibrations, we found this program the easiest to learn and the most adjustable.

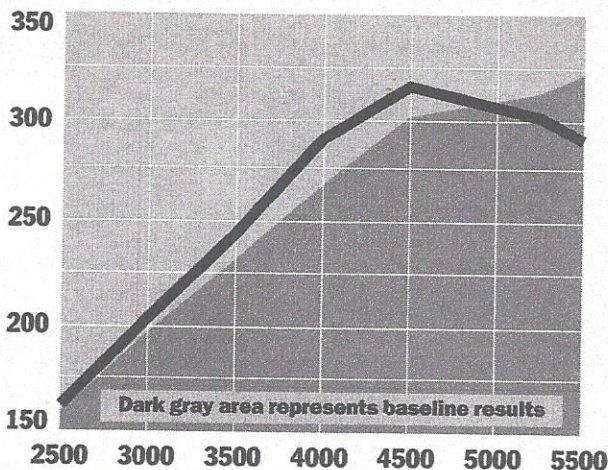
#### Accel Injection

RPM	Horsepower	Torque
2500	163.7	343.9
3000	205.7	360.1
3500	243.7	365.7
4000	288.0	378.2
4500	317.9	371.0
5000	302.9	318.2
5250	293.6	293.7

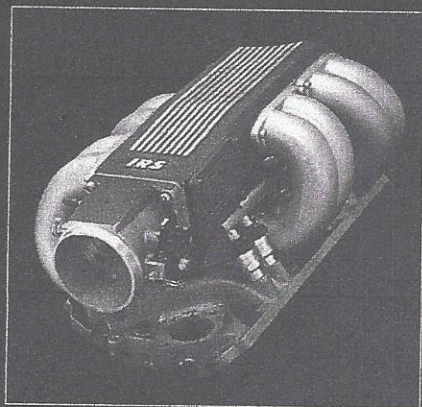
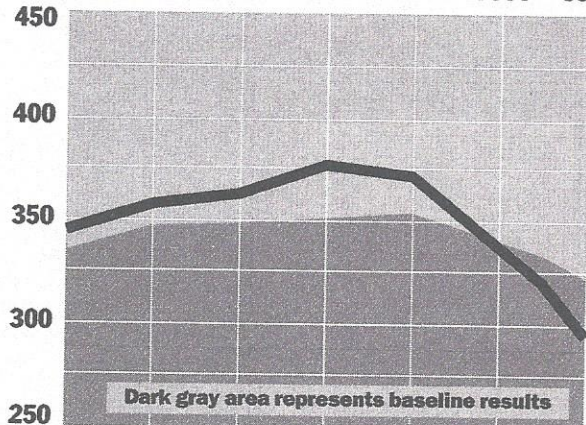
Average Horsepower: 259.3  
Average Torque: 347.2



HORSEPOWER



TORQUE



### Electromotive

Suggested Price: \$2900

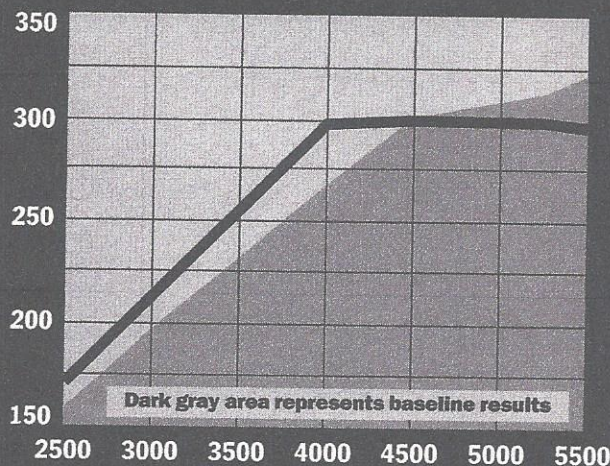
#### Electromotive

RPM	Horsepower	Torque
2500	170.8	358.9
3000	216.4	378.8
3500	257.7	386.7
4000	298.9	392.5
4500	301.6	352.0
5000	300.9	316.1
5250	297.4	297.5

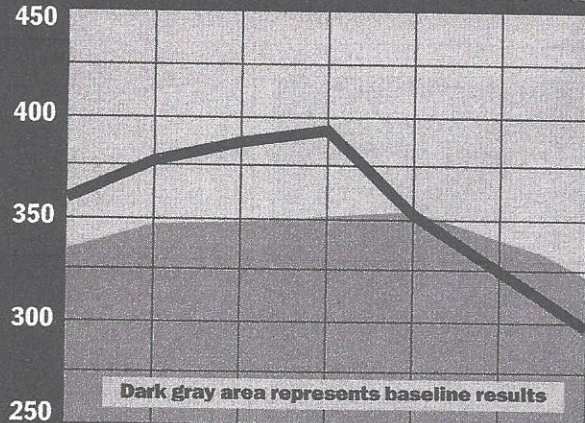
Average Horsepower: 263.3  
Average Torque: 354.6

Very similar in outward appearance to a factory GM TPI unit, the Electromotive system will make gobs of power in the right applications. The system must be assembled in the correct order so that all the wiring will fit properly, but otherwise it's a simple installation job. This was our first experience using Electromotive's coil-fired ignition system, and does it ever work! Because of the program and the variables it will allow with this injection and ignition system, any engine combination can be made to work.

HORSEPOWER



TORQUE





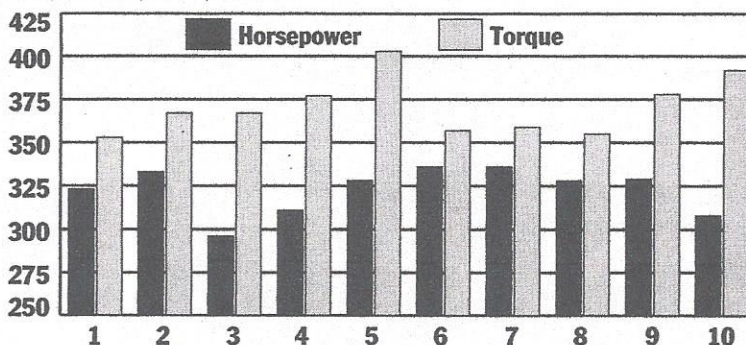
## Feuling Engineering's R&D Dyno Facility

Besides having two of the newest Super Flow SF7100 dynos, Feuling's complete R&D facility also has two state-of-the-art Digalog engine dynos and controllers, and an eddy-current dyno. Having all these dynos doesn't do any good unless you have experienced personnel to operate them properly and Feuling does. With a combined dyno experience of over 70 years, the Feuling crew can solve any dyno-related problem and usually find more power in the process. Beside the dyno crew, Feuling Engineering also maintains a full manufacturing facility, including several CNC milling machines that enable them to make almost anything, anytime. No problem is too big for these pros and we thank them heartily for their help!

## Fuel Injection Test Results

	Torque* (lbs-ft)	Horsepower*	Volumetric Efficiency
1. Baseline carb and manifold	353.1 @ 4250 rpm	322.8 @ 5250	97.8% @ 4500
2. Holley Pro-Jection 4 TBI	366.9 @ 4500 rpm	332.6 @ 5000	99.4% @ 4500
3. Fuel Injection Specialties (Stock TPI)	367.4 @ 3250 rpm	295.7 @ 4750	100.7% @ 3250
4. Street & Performance TPI	376.9 @ 4000 rpm	311.2 @ 4750	103.8% @ 4000
5. Arizona Speed & Marine	402.7 @ 4000 rpm	328.3 @ 4500	109.9% @ 4000
6. BDS Tunnel Ram	356.5 @ 4750 rpm	336.4 @ 5250	100.9% @ 5000
7. Cutler/Haltech TB/PI	358.7 @ 4750 rpm	336.3 @ 5250	100.6% @ 5250
8. TPI Specialties Short Ram	355.0 @ 4500 rpm	328.3 @ 5250	101.1% @ 5250
9. Accel TPI	378.2 @ 4000 rpm	329.2 @ 4750	105.2% @ 4000
10. Electromotive TPI	392.5 @ 4000 rpm	307.7 @ 4250	107.1% @ 4000

\*All figures atmospherically corrected



## Best Power & Torque At A Glance

RPM	Best Horsepower	Best Torque
2500	Arizona Speed & Marine	Arizona Speed & Marine
3000	Arizona Speed & Marine	Arizona Speed & Marine
3500	Arizona Speed & Marine	Arizona Speed & Marine
4000	Arizona Speed & Marine	Arizona Speed & Marine
4500	Arizona Speed & Marine	Arizona Speed & Marine
5000	Holley Pro-Jection 4	Holley Pro-Jection
5250	Blower Drive Service	Blower Drive Service/ Cutler/Haltech

## Sources

**Accel Performance**  
Dept. CC  
P.O. Box 142  
Branford, CT 06405-0142  
203/481-5771

**Arizona Speed & Marine**  
Dept. CC  
4221 E. Raymond St.  
Suite 100  
Phoenix, AZ 85040  
602/437-2510

**Automotive Racing Products**  
Dept. CC  
250 Quail Ct.  
Santa Paula, CA 93060  
805/525-5152

**B&B Performance**  
Dept. CC  
29752 Banderas  
Rancho Santa Margarita, CA 92688  
714/589-5956

**Blower Drive Service**  
Dept. CC  
12140 Washington Blvd.  
Whittier, CA 90606  
213/693-4302

**B&M Automotive Products, Inc.**  
Dept. CC  
9152 Independence Ave.  
Chatsworth, CA 91311  
818/882-6422

**Crower Cams & Equipment Co.**  
Dept. CC  
3333 Main St.  
Chula Vista, CA 92011  
619/422-1191

**Cutler/Haltech**  
Dept. CC  
17525 144th Ave., Suite B  
Spring Lake, MI 49456  
616/842-7868

**Eddings Engines**  
Dept. CC  
713-A Arroyo St.  
San Fernando, CA 91340  
818/361-0118

**Edelbrock Corp.**  
Dept. CC  
2700 California  
Torrance, CA 90503  
213/781-2222

**Electromotive, Inc.**  
Dept. CC  
14004-J Willard Rd.  
Chantilly, VA 22021  
703/378-2444

**Fel-Pro Inc.**  
Dept. CC  
7450 N. McCormick Blvd.  
Skokie, IL 60076  
708/674-7700

**Feuling Engineering, Inc.**  
Dept. CC  
2521 Palma Dr.  
Ventura, CA 93003  
805/650-6796

**Fuel Injection Specialties**  
Dept. CC  
2238 Encino Loop  
San Antonio, TX 78259  
512/494-6317

**Hedman Manufacturing**  
Dept. CC  
9599 W. Jefferson Blvd.  
Culver City, CA 90232  
213/839-7581

**Holley Replacement Parts**  
Dept. CC  
11955 E. Nine Mile Rd.  
Warren, MI 48089-2003  
313/497-4000

**MSD Ignition**  
Dept. CC  
1490 Henry Brennan Dr.  
El Paso, TX 79936  
915/857-5200

**Performance Distributors**  
Dept. CC  
2699 Barris Dr.  
Memphis, TN 38132  
901/396-5782

**Speed-Pro**  
Dept. CC  
100 Terrace Plaza  
Muskegon, MI 49443  
616/724-5011

**Street and Performance**  
Dept. CC  
Rt. 5, 1 Hot Rod Ln.  
Hwy. 375 South  
Mena, AR 71953  
501/394-5711

**Tuned Port Induction Specialties**  
Dept. CC  
4225 County Rd. 10 East  
Chaska, MN 55318  
612/448-5330