

Inject Your Horse PART 2, THE SHOPPING

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In the last issue I covered the basics on how Fords fuel injection worked, hopefully any intimidation EFI caused is now lifted. I apologize if the last article seemed a tad boring, it's now time to spend money and shine some light on this swap. By the end of this issue, each time you go shopping for fuel injection parts, I'll be right by your side. This month's goals are to inform you: what you'll need, what to watch for, how much it's worth, and how little you can pay for it. This issue is geared primarily to fuel injecting the early Bronco, but I promise there is some information that pertains to the full size Bronco crowd, as well. Everyone has options, there is no carbon copy fuel injection swap everyone has to follow, don't be afraid to think outside the box. However be warned that spending money just so you're not walking the same path as everyone else can make you look foolish. As in every project, there are a few must haves and a few options you need to stay away from for a successful swap.

Unlike most magazine articles, I'm going to try to put a fair price range on modifications I'll be discussing. I've also provided prices you can expect if you find a used alternative, such as those you would discover on eBay. All the used price ranges are U.S. Dollars averaged from eBay browsing, junk yards, and personal experience. New prices were obtained from the manufacturer; if they don't sell to the public I used an average price from Jeg's and Summit Racing. My hope is that everyone will be smarter shoppers before the start of their projects and not after, when it's too late. Also be warned that retro-fitting fuel injection into classic vehicles has come into popularity recently, and a lot of dishonest people have entered this market. It has also been my experience that prices may vary due to the availability of these items in your area.

Computers

This is usually the first thing that you need to shop for. In the past a plan was made, an engine was built; you installed a cam, intake, and carburetor, and started it up. While these are all important, now you also have to include the computer as one of the critical components that needs to be matched with the rest of the engine. Fuel injection is only as good as the programming inside the computer, pick the wrong one and you're behind the eight ball from the start. Once a known computer is found and purchased, you can build an appropriate engine. So how do we plan for this fuel injection engine build? Get a list of the available computers and their capabilities, like the one below. However, it can be difficult to identify a computer when they all look alike.

Fortunately, Ford has provided some means of identification; every computer has a sticker on the 60-pin connector that identifies the computer's part number and program code. Even though the part number holds more information, 2 computers can have the same part number but different program codes. The largest 3 - 4 digit lettering on the sticker is the program code. Always identify a computer by its program code! If the sticker is missing or is unclear, don't buy it. Below you see the computer codes 8KD, A9L, and E9C1. There is a growing list of computers on my web site www.fordfuelinjection.com. So far, I have collected the codes for over 200 identified computer programs.



- 1978 – 1983 Ford Computers
 - These computers are not for fuel injection controls. Most of them only control emissions devices and stepper motors on feedback carburetors. None of these early computers have diagnostic capabilities. When something breaks or fails, you will be playing hide and seek under the hood.
- 1984 – 1990 EFI Car Computers
 - These computers are acceptable but are not as flexible as other choices. Ford was still learning about fuel injection during these years. Most of these computers have oddball features like inferred mileage sensors and dual EGR solenoids. These computers are Speed Density controlled, which limits their capabilities in stock form.
 - These come in 2 different “flavors.” There was a “Base” version that used the old firing order (1-5-4-2-6-3-7-8) and 14lb/hr injectors; and a “High Output” (HO) version that used the HO firing order (1-3-7-2-6-5-4-8) and larger 19lb/hr injectors. These computers will run the opposite firing order, but your idle will be a little rough. Engines built to be controlled with one of these computers need to be very close to stock.
 - The most desirable computer from these years is the Mustang’s DA1. The DA1 can be mildly reprogrammed with an add-on chip, but the speed density still can’t handle large cam profiles.
 - These computers can be bought used off 5.0L Cars for \$10 - \$50. You could buy a \$550 replacement computer and MAF sensor in a conversion kit listed for these years. (Ford Racing part numbers M-9000-A51 or M-9000-B50). But, that price is an insult for the exact same 1993 Mustang computer and MAF sensor that can be bought in the \$350 kits below.
- 1989 – 1993 Mustang Computers
 - These are typically the most desirable Ford EFI computers. These computers can be identified by the following program codes; A9L, X3Z, A3M, A3M1, D3D1, S0Z, A9S, A9M, A9P, C3W, and C3W1. These are all Mass Air controlled and have an almost endless support network in the aftermarket world.
 - Almost any engine combination can be built and controlled; sometimes a \$350-\$550 programmable chip will be required for optimal results. These may not be the best EFI computers in the world, but it takes thousands of dollars to beat them. With a programmable chip like the TwEECer, even blown and stroked 460’s can be tamed for street-ability.
 - The X3Z was first used in the 93 Cobra, and is programmed for 24lb/hr injectors and a special 70mm Mass Air Flow sensor. It might sound cool, but it’s actually slower than all the other 89-93 Mustang computers. There are delay timers programmed in that slow throttle responsiveness, and top speed limiters. A used X3Z usually sells for \$100-\$150 and typically requires a custom programmable chip sooner than the other 89-93 Mustang computers. All this adds up for a less than optimal computer to purchase. However, there is a \$550 kit available that includes new MAF sensor, X3Z computer, and 24lb/hr injectors; which is an acceptable price for *new* components. (Ford Racing part number M-9000-C52.)
 - The most sought after computers from these Mustang years are the A9L and X3Z. Which is unmerited, as all the other computer program codes in this category have the exact same capabilities, don’t pay extra just for a famous A9L or X3Z. One of the problems with these computers is price wars; they are only worth \$75-\$125 used. People love to get into a bidding war on eBay and spend \$150+, which is a waste of money. You can buy these computers brand new with a MAF sensor in a \$350 kit from Ford Racing. (Part numbers M-12071-F302 or M-12071-G302.) So if you see any price over \$125 for one of these used computers, let some other sucker buy it.
- 1994 – 1995 Mustang Computers
 - These are more of a headache compared to their 89-93 brothers, and can be identified by the program codes; T4M0, J4J1, U4P0, W4H0. Ford was getting ready for OBD-II and testing out some new programming styles. These computers have more complex programming, but they actually perform slower than the 89-93 computers. All the automatic computers were controlling the 4R70W transmissions making them even more difficult to use.
 - There was a very special ZA0 computer used in 1995 for the 5.8L Cobra R. This computer sounds cooler than the X3Z but is extremely hard to even find. One of these computers will sell for over \$200 and has no special features a cheaper 89-93 or 94-95 computer can’t do. People that purchase this computer value their ego more than their bank account.
 - This computer can use a programmable chip and achieve everything the 89-93 computers can. But understand that usually the first change in programming is to convert over to the older pre-93 program. I would advise you to purchase the older 89-93 Mustang computers, to save time and money when transplanting fuel injection.
 - These computers typically sell for \$75-\$175 used, but really aren’t worth more than \$75. If you pick this computer, a \$350-\$550 programmable chip is required for performance engines. This puts the total over \$400 and out of contention for ideal fuel injection swaps.
- 1990-1993 T-Bird, Crown Vic, Mark VII Computers
 - There were some Mass Air 5.0L controlled vehicles other than the Mustang in the early 90’s. The only bad thing with these computers is their lack of popularity. Not many people know of these computers, even though they will work for a fuel injection swap.
 - These computers can control fairly modified engines just like the Mustang computers can. Getting one of these computers reprogrammed for high performance engines can be difficult but not impossible. If you have a mild small block this could be your best choice.
 - Rewiring an 89-93 Mustang harness is easily overcome in an afternoon if you pick this computer. You can also have any professional rewire a Mustang harness to match one of these computers for a small fee.
 - These computers typically sell for \$25-\$75 used, which makes them a winner for EFI swaps.

- 1986 – 1995 Speed Density Truck Computers
 - These computers are acceptable but not the best choice for 1966-77 Broncos. Early computers have the oddball features such as inferred mileage sensors, and they are all Speed Density controlled. 5.8L and 7.5L (460) engines were not universally fuel injected until 1989. All 5.0L and 5.8L trucks used 19lb/hr injectors while all 7.5L trucks used 24lb/hr injectors.
 - These truck computers can not be reprogrammed with an add-on chip. As a result any engine built and controlled with one of these computers needs to be very similar to the stock truck engines. The 5.0L and 5.8L truck computers aren't the best choice for swaps in early Broncos; they are matched to an intake which is extremely tall and difficult to cram under the hood. However, the 5.8L and 7.5L computers are very popular to be used on full-size Broncos without any complications. To swap a 5.8L into a 5.0L truck only needs a 5.8L computer, swap the engine, and the original 5.0L EFI harness can be used. We'll cover the 5.8L and 7.5L engine swaps in future Bronco Driver articles
 - You can buy a 5.0L computer for \$10 - \$25, 5.8L computers are typically \$10 - \$75, and 460 computers can sell for \$25 - \$100. You can buy a \$650 kit to convert these engines to Mass Air; but that price is offensive for a 1993 Mustang computer that sells in the above \$350 kits. (Ford Racing part numbers M-9000-T50 or M-9000-T51.) The kit does include a simple wiring harness adaptor, but it only fits 5.8L and HO firing order, 5.0L owners will need to swap cams or alter the harness.

- 1993-1995 Lightning Computers
 - All the lightning computers use the electronic E4OD transmission, and are only good options if you have that transmission. All the 1993-1995 (generation 1) Lightning's were Speed Density, which in its stock form is a big problem for performance gains. You can buy a TwEECer for \$350-\$600 and program the computer to run most engine combos. Make sure you do your homework carefully, even with the TwEECer, Speed Density can have major problems. This is typically not for early Broncos.
 - You can buy a *new* computer, MAF sensor, and injectors for \$1000 to convert these engines to Mass Air. (Ford Racing part number M-9000-L58.) This is a major waist of money! The computer has horrible programming, the MAF sensor peaks quickly, and the injectors can't be upgraded easily. The stock speed density Lightning computers with a TwEECer is the best Ford option for the E4OD. If it isn't good enough plan to spend \$3000-\$5000 on aftermarket.

- 1994 – 1995 Mass Air Truck Computers
 - They might be Mass Air controlled, but they are not the best choice for fuel injection swaps. These computers typically cost more than they are worth. You will need to have a custom harness made to match these computers, because they are nothing like the Mustang MAF computers. Most of them are linked to the electronic transmissions, without them you'll have problems. Once you pick this computer a high performance engine will tax it quicker than a Mustang computer. There are some reprogrammable options for this computer, but that's only good news for current 94-95 Truck owners. These computers can be bought for under \$100 but a harness can cost \$600+ or weeks of sweat building one. Then there is the added cost of tuning or to convert this version of Mass Air to the more tunable Mustang MAF can cost an additional \$500-\$1000, so the potential cost make this an undesirable choice.

- 1996 – 2004 Ford Computers
 - I could write a book of boring information about the EEC-V computers from 1996 and newer vehicles, but you'd all be asleep after the 4th sentence. So let's make it quick and painless, if you really want to learn more try the internet or your local book store. In 1996 every vehicle in the US went to On-Board-Diagnostics-Version 2 (OBD-II). OBD-II changed computers drastically, most of which made for cleaner emissions. None of the changes are "bad," but it makes swapping fuel injection much harder. When using an OBD-II computer you have to use ALL of the features and electronic controls or the computer will be more than just unhappy. You must use the donor steering column and dash gauge cluster.
 - Price is never cheap with these computers. They alone are rarely for sale, the harnesses are not available aftermarket, then add in the custom programming if needed. You can dump in \$1500-\$4000 and spend months fighting it. I'm not saying it can't be done, but it's a challenge for those that already experienced in fuel injection, not for simple EFI conversions.

- 2005 – Up Ford Computers
 - These computers are EEC-VI and still being researched by the aftermarket. These computers are not like any of the previous Ford models. There is NO back door port for custom programmable chips. As a result the aftermarket is hacking into the Ford programming to offer new methods of tuning. Once more information and support is available the EEC-VI might be a swap to consider.

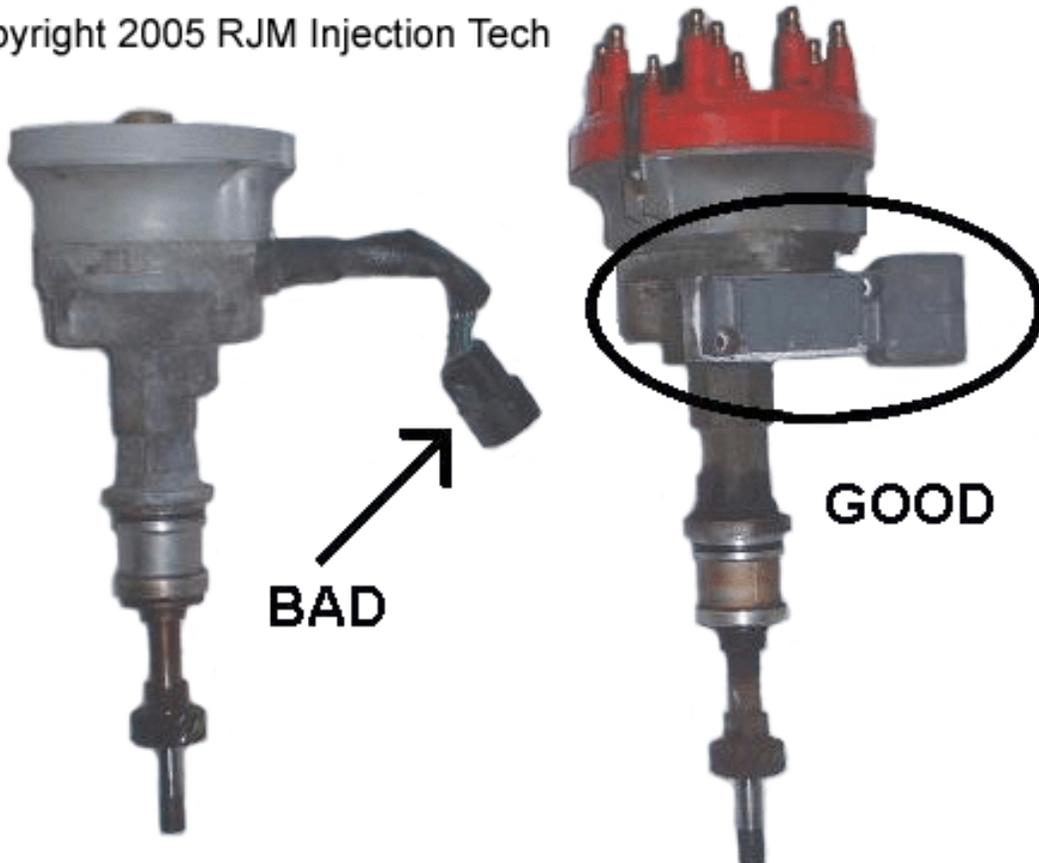
Distributor and Ignition Coil

Fuel injection isn't just about fuel controls; spark controls are more accurate and powerful than carbureted technology. A new E-Coil is what Ford used on the distributor ignition systems. 5.0L's used coil packs starting in 1996 with the new distributor-less ignition system. Coil packs can't be used in the typical fuel injection swap. Fuel injection technology created the need for higher spark energy, which means stock coils from junk yards are sufficient for 95% of swaps. High power aftermarket coils are only required if you are running higher than 10:1 compression. A new aftermarket ignition coil can cost \$50, while used coils sell for \$10-\$25



Ford used 2 different distributors with the "distributor ignition systems," which changed where the TFI module was mounted. The most commonly used distributor had the TFI module mounted directly on the side. The other distributor mounted the TFI module remotely in an aluminum heat sink on the fender or firewall, which can be identified by its wire harness pigtail. Both distributors can be used in a fuel injection transplant, but the remote mount TFI system typically costs more. The only remote-mount TFI-compatible harness on the market cost \$345 more than other models. Aftermarket distributors cost \$240-270 from MSD or Accel but are built for 10,000RPM and overkill for most Bronco EFI uses. Stock distributors can be bought used or at a local parts store for \$20-\$100, we got our coil and distributor from a junkyard for \$75.

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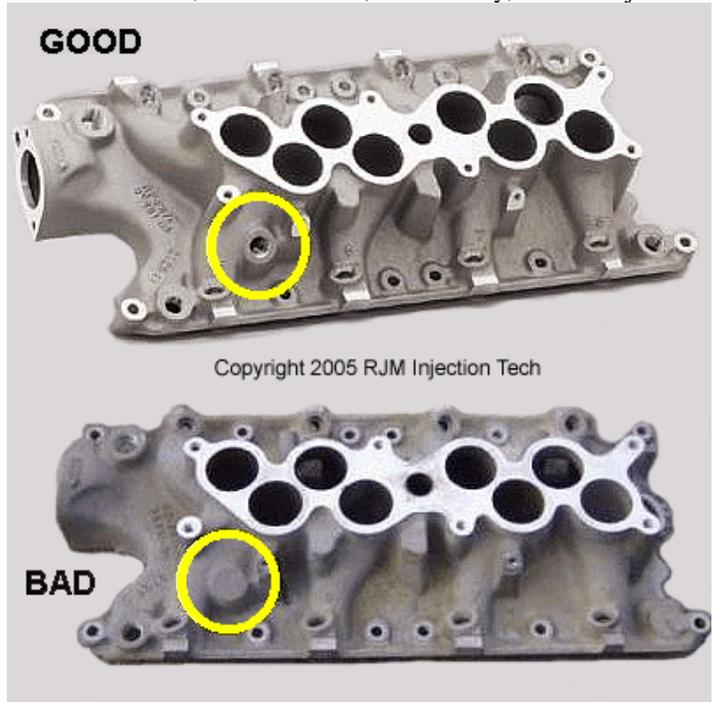
Intakes I

There are over 30 small block Ford fuel injection intake manifold combinations to choose from thanks to the Mustang crowd. This has over complicated shopping for Broncos and other large vehicle owners that are primarily concerned with engine performance below 5000RPM. This market has confused most shoppers into the wrong intake while others don't know important details to look for. When looking for an intake several other related items should be considered at the same time, such as fuel rail, throttle body, and fuel injectors.

The computer needs the most accurate Air Charge Temperature sensor reading to calculate fuel ratios. The ACT sensor needs to mount in the air stream, the closer to the combustion chamber the more accurate the reading. Most lower intake manifolds have a mounting boss on the driver's side, typically in the #5 or #6 intake runner. However if you inspect the pictures not all intakes provide an ACT mounting boss, some can be drilled and tapped. Finding an intake without ACT provisions lowers its value and is not ideal.

All of the car-style upper intakes can be flipped passenger or driver's side for your unique application. For the intake to flip 180°, the pressure regulator on the fuel rail mounted must be moved. The pressure regulator needs to be mounted on the same side as the throttle body. You can cut a fuel rail apart and modify it for your needs, but that is more work than required. Ford built vehicles with the upper intake facing both directions, so shop for a fuel rail that mounts the pressure regulator on the appropriate side. In early Broncos, most fuel injection swaps position the upper intake on the passenger side, just like the 1989-93 Mustangs. The intake can be flipped, but typically has clearance issues with the brake cylinder and booster.

Intake clearance issues can happen whenever you install a product that wasn't designed for your vehicle; take this into consideration before making a purchase. I measured all the intakes in this article from the block mating surface to the top of the intake. For early Bronco owners clearance problems happen at the hood and the master cylinder mounted on the firewall. Stay away from the 1994-95 Mustang intakes and all of the full-size truck intakes. The full-size truck 5.0L and 5.8L intakes are extremely tall, 14.5 inches to be exact. A body lift and bubble hood are not enough to stuff these giant intakes into early Broncos. I have seen it done, but it took a custom hood to clear the intake.



1994-95 Mustangs and 1991-93 Thunderbirds have the lowest intake profile at 9.5 inches, but to keep the intake runner length the intake is wider and contacts the master cylinder. Those intakes mount the throttle body at a 45° angle aimed towards the back of the headlight, so if the upper intake is flipped to the driver's side, the throttle body aims directly towards the brake master cylinder.



Throttle Body

Throttle bodies aren't too complicated to shop for. The 1985-93 on the left is the most common throttle body to acquire in a fuel injection swap. The throttle body on the right is from a 1995 Mustang, as you can see there are many changes. The largest problem is that the mounting bolt pattern is not interchangeable. All of the electronics were moved to fit the lower wider intake. The TPS sensor plug is different and does not work with most EFI harnesses.

Bigger is not always better, typically naturally aspirated 5.0L's with stock displacement won't see any gains over a 65mm throttle body. Naturally aspirated 5.8L's won't prosper from a throttle body over 75mm. Make sure the throttle body matches the intake opening. If your intake has a 70mm opening, bolting a 75mm throttle body will actually lose power unless you smooth out that step. Don't let the quarter mile crowd talk you into buying a throttle body larger than your wheels! New 65mm, 70mm, and 75mm throttle bodies sell retail \$180 to \$225 retail. Used performance throttle bodies typically sell for 50%-60% retail. Junkyard throttle bodies alone typically sell for \$20-\$50 depending on how "used" it looks.

1996-2001 Explorer 5.0L's had 65mm throttle bodies that were close to the 1985-93 style. Lars Pedersen has a technical paper that shows how to use them, it can be found on fordfuelinjection.com

Intakes II

1986-93 car intakes and 1996-2001 Explorer intakes seem to fit almost anything you could stuff a small block Ford in. The same holds true for early Broncos, even non-lifted ones. The basic intake in this category measures 11 inches tall, and the GT-40 intakes are closer to 12 inches tall. Just like the carbureted 351's Todd Henderson talked about in Issue #5; the EFI 5.8L doesn't fit under stock early Bronco hoods either. A body lift or hood scoop can easily hide a 5.8L for the sleeper look. Aftermarket intakes range from 10.5 inches to 12 inches in height, plus any heat spacer you use. Heat spacers can be a very good thing for heavy vehicle owners that need more low RPM power. Heat spacers make the intake runners longer, which adds to an engine's torque output. Heat spacers can make the Mustang-designed intakes more suitable for Broncos, but add to the possible clearance issue.

Fuel rails were changed drastically in 1999. Prior to 5/3/1999, Ford used a return style fuel system. After 5/3/1999, Ford used a returnless style fuel system. The return style fuel system brings fuel to the injectors at pressures above 50PSI, the pressure regulator shunts excess fuel and pressure back to the tank. Return style fuel systems are not governed by the computer, and modifying this system to provide more fuel for your application is easy. In a returnless fuel system, fuel is pumped to the injectors at varying pressures, controlled by the computer. There are pressure sensors and computer-controlled pumps, none of which is useable for fuel injection swaps. An intake with a returnless fuel rail lowers its value and is not ideal.

Fuel injectors are measured by how much fuel they can deliver when turned on full for an hour. Because air-fuel ratios are calculated by the mass of the two, fuel injectors are rated by weight. The typical fuel injectors used are tan 14lb/hr, orange 19lb/hr, and blue 24lb/hr, with 19lb/hr injectors being the most commonly used. Using the correct injectors with the computers program is very critical for a successful fuel injection swap. When picking the popular 1989-93 Mustang computers, 19lb/hr injectors should be used, which can feed over 310 horsepower. If you need cheap used injectors, or your intake came with the wrong ones check 5.0L truck engines. You can usually locate and buy a truck lower intake with injectors for \$25-\$50, clean up and use the injectors, then recycle the lower intake. New injectors sell for \$200 - \$250.

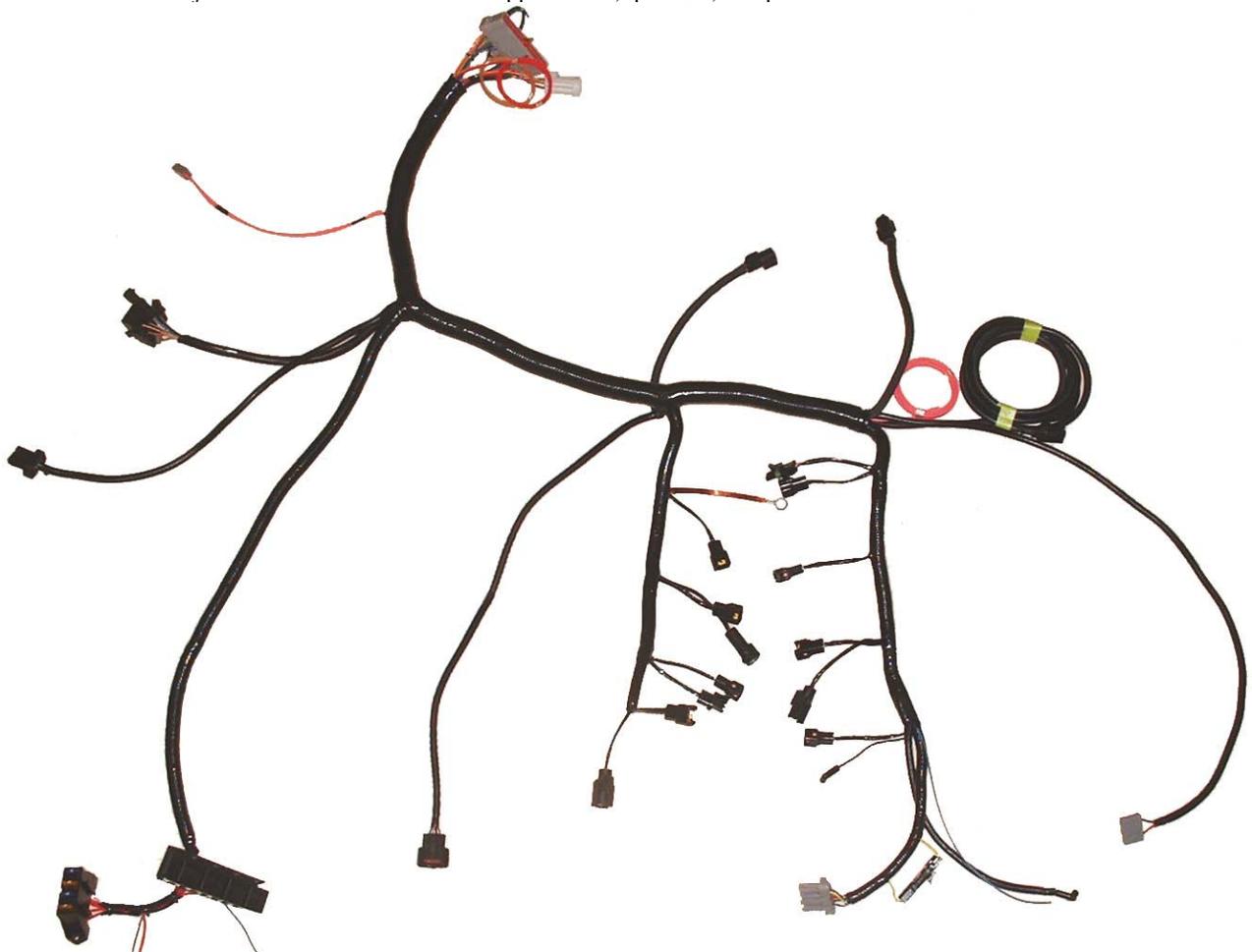
Now that you've learned all I know about intakes lets buy one! Like I said there are a zillion options out there ranging from \$50 - \$800 so let's try to narrow it down.

- Stock 5.0L intakes, which were used on Mustangs, T-Birds, Cougars, Mark VII Lincolns, Crown Victoria and Grand Marquis from 1987-1993. There is a myth that a High-Output (H.O.) intake exists, what does this mean? There is no such thing as a HO intake. HO typically refers to a firing order of 1-3-7-2-6-5-4-8 verses the old 289-302 firing order of 1-5-4-2-6-3-7-8. Firing order does not affect an intake; all non-Cobra 5.0L cars used the same intake. What does change on an intake with a HO vehicle is the injector sizes. High-Output engines used an orange 19lb/hr injector while non-HO vehicles used a grey 14lb/hr injector. These base entry intakes complete with 19lb/hr injectors, fuel rail, and throttle body typically sell for \$75-\$150.
- GT-40 intakes, which were used on the Cobras, Explorers, and could be bought aftermarket from 1993-2001. These are very popular for swaps and are usually the best bang for your buck. When shopping for a used GT40 intake don't get caught up in the Explorer vs. Cobra, Cast vs. Tubular wars. The differences between GT-40 intakes are typically within 2HP and 5ft/lbs when used on the same engine. A GT-40 intake with 65mm throttle body and 70mm MAF sensor can net gains of 15% or more power over the stock 5.0L intake. New GT-40 intakes cost \$400-\$600, which is not worth the money when compared to the rest of the intake options. The most popular GT-40 intake right now is the 5.0L Explorer intake; which can be bought used for \$200-\$300 with injectors, fuel rail, and throttle body.

- Aftermarket intakes are almost impossible to sort through, but I'll give it a quick try. I am planning a small intake shoot out article in the future pages of Bronco Driver. Edelbrock, Trick Flow, Holley, Vortech, Downs, Ron Anderson Performance, and Comp Cams all make intakes of different flavors for kids of all speed requirements. The Edelbrock Performer (not the RPM) intake seems to be the dominant intake for 5.0L usage under 5000RPM. The Edelbrock achieves rear wheel power increases of 20% over a stock 5.0L intake within reach and sells for \$490. The Trick Flow 5.0L Street intake only increases power by about 10% over the stock 5.0L intake, you have to use the Trick Flow 5.0L intakes over 4000RPM to see real advantages. Trick Flow 5.0L Street intake sells for about \$400 new. The Holley and Vortech intakes are the same as the GT-40 intakes in design and power increased under 5000RPM, and they cost over \$550. The Downs, Ron Anderson Performance, and Comp Cams intakes are designed for power in the 7000RPM range and aren't feasible in a Bronco.
- 5.8L intake options include the common GT-40 intakes, Edelbrock, and Trick Flow. It's hard to make a clear winner for the Windsor engine. Some people desire to squeeze as much torque out of the Windsor in the usable power range. While others believe that the added torque over the 5.0L allows them to play with the power range around 6000RPM. If you want to most torque you can get out of your Windsor the GT-40 is still a "best bang for the buck" winner. New GT-40 intakes can cost \$780, but can be found for under \$500 used. The Edelbrock Performer is about 5% better than the GT-40 throughout the power band, and retails for \$540 new. The Trick Flow 5.8L intakes are about 5% weaker than the GT-40 under 5000RPM, but can give you lots of power over 6000RPM if you want to go crazy. Trick Flow 5.8L intakes retail for \$550-\$600

Wiring Harness

The wire harness can make or break a fuel injection swap, and like everything else, there are a few options. The very first thing to be done is to come to terms with your own electrical skills. If you have a degree in wiring, installed your mothers car alarm, built a home computer, or are very good at reading schematics it is very possible to build your own harness. Many times you can find a junkyard EFI harness for \$20-\$50 that needs lots of attention. When I built my first EFI harness it took me about a week of full days converting a dry rotted speed density harness into a 1993 Mustang harness. My best time now is 60 hours to build a harness from scratch, and I've done it more than twice. It is also very possible to incorrectly wire a harness and have smoke pour out of the computer. There are a few books available that have some wiring diagrams, and <http://www.fordfuelinjection.com> has several diagrams and recommended books to help you build a harness. Check on the web and flip through one of the books at your local bookstore. If you feel building, repairing, and altering a harness is something you can do, try it! The biggest clue is what your Bronco looks like now. Do the headlights work? Are there 20 butt connectors on your vehicle? Do you have spaghetti of wires on the battery or under the dash? If so you might not be ready to attempt a fuel injection harness. Harness work is the most boring skill in the automobile industry, so don't feel bad if you'd rather hammer a spoon in your ear than pick up a soldering gun. There are a number of aftermarket harnesses available you can use to make the EFI transplant easier. Ford Racing, Painless Wiring, RJM Injection Technologies, Ron Morris Performance, Windsor-Fox all make Ford fuel injection harnesses for different applications, qualities, and prices.



Ford Racing Performance Parts continues to make the 1993 assembly line EFI harness for use in fuel injection swaps. As expected, the Ford harness is manufactured to exact OEM specifications in wire color, quality, and construction. The complete Ford harness consists of 4 different harnesses (part numbers: M12071C302 / M12071E302 / M12071J302) for a total of \$410 retail. The Ford harness is the cheapest harness option available. The Ford harness comes wrapped in OEM 300°F wire loom and harness wrap for a clean look. The 4 piece design uses a disconnect at the injectors to make future engine removal easier, however disconnects introduce the possibility of electrical faults in harsh environments. The biggest downfall to the Ford harness is that it is a continuation of the 1993 Mustang assembly line harnesses. This means that there are several additional connectors that do not apply to fuel injection, and the battery connection is on the driver's side. Those connectors leave 15 wires that need to be spliced to complete the harness installation. The battery connection problem, however, can be solved by re-routing the power wire to the passenger side. This harness was discontinued by Ford and hard to find.

Painless Wiring sells a Ford EFI harness which is a single stand alone harness that sells \$460. Harness does not come with any wire loom protection; it comes as a bare harness with zip ties. It also has 8 fused circuits, which tends to be overkill when Ford engineers only used 3, and makes for a larger fuse block than the other harnesses. Harness is a generic design for many applications, meaning it's not a perfect fit. This harness is also available at Summit, Jeg's and other performance speed shops.

RJM Injection Tech harness is a single stand-alone harness that sells for \$475 retail plus options like On-Board-Air and Alternator connector. RJM Injection Tech has designed a harness to specifically fit the 1966-77 early Broncos and actually plugs into the stock body harness. Only 3 wire splices are needed for a complete installation. The harness comes completed in OEM 300°F wire loom and harness wrap, with 1200°F fiberglass protection in key areas. The fuse/relay box is mounted on passenger fender and tied into the stock battery circuit. This harness was designed with a Baumann transmission controller plug to simplify electronic transmission swaps.

Ron Morris Performance and Windsor-Fox have been producing great fuel injection products for almost 10 years. Both places have EFI harness services that will custom alter the discontinued Ford Racing harness to your specifications. I'm not sure if they still sell the entire harness, or how long they will be operating. Ron Morris prices start at \$795, Windsor-Fox prices start at \$625 for a complete harness. Their harness does come wrapped in OEM 300°F wire loom and harness wrap for a clean look, On-Board-Air and Alternator connections are available. Each harness is custom built for your application which is perfect for abnormal applications, making cost the only drawback.



Complete Engine

Think a fuel injection swap translates to engine swap, engine rebuild, or donor car? Not always, it is becoming harder and harder to find complete engines and quality donors.

1989-93 Mustangs have the best computers and complete intake setup, but the newest vehicle is still 10 years old. You can risk installing a high mileage engine but for a reliable EFI swap a rebuild will quickly push the budget. Mustangs in their stock form don't have the best intake, therefore purchasing another intake with the engine makes them less appealing.

1996-2001 Explorer engines like the one pictured have the great budget performance intake, and can be found with low mileage in junkyards. Explorer engines had a distributor-less ignition and OBD-II computers, which are extremely difficult to swap, so you'll need a new computer, distributor, and ignition coil. If you are not using the Explorer serpentine belt system you'll have to change the timing cover, crank dampener, and pulley. If your Explorer motor is newer than 5/3/1999 you'll need a new fuel rail as well. All this adds up, so make the engine seller aware of this while bargaining a price. Explorer engines range from \$500 stripped to \$1500 loaded.

Whatever engine you decide to use, make sure the timing cover, crank dampener, and pulley match the crank driven accessories. Donor cars rarely have fuel systems that can be transplanted. Some people have excellent fabrication skills and can put a square peg into a round hole. A new fuel system can cost \$600, which will be covered in depth next month.

I made a few shopping lists for different budgets and styles of build ups. Your current 302 can be injected for as little as \$560 with some shopping and fabricating skills. If you must keep your 289 you'll have to use a Mass Air computer and a budget EFI conversion could cost as little as \$650. Remember the early Bronco 289 and 302 had the old firing order (1-5-4-2-6-3-7-8); for the best idle quality either swap to a HO cam firing order (1-3-7-2-6-5-4-8), or find a EFI system with the 1-5-4-2-6-3-7-8 firing order.

There you have it, fuel injection shopping. I'm extremely confident that \$550 is a close possibility for everyone that has pondered fuel injection. The popular 4WD carburetors are selling for \$350-\$550. Matching cost to fuel management capabilities fuel injections is the sure winner in this writer's play book. Don't buy into the myth that EFI costs thousands of dollars. BC Broncos was going to show us some cool fuel system products but they had a close call with the fires that plagued California recently. I recently completed a performance 351 project in a 1989 Bronco, so it might get printed sooner than I expected in Bronco Driver.

Performance Rebuild		1998 Explorer Engine	
A9L Mass Air Computer	125	Engine	1000
GT40 Intake, Fuel rail & Injectors	250	Computer	125
65mm Throttle body	100	Distributor w/ coil	75
Distributor w/ coil	75	Add Oxygen sensors Bungs	12
Add Oxygen sensors Bungs	12	Accumulator	70
Fuel pump block off	6	Low pressure pump	60
Accumulator	70	High pressure pump	110
Low pressure pump	60	Fuel Line and Fittings	40
High pressure pump	110	Total	1492
Fuel Line and Fittings	40	+ Fuel Tank	1802
Total	848	+ EFI Wiring Harness	2277
+ Fuel tank w/ Skid plate	1223		
+ EFI Wiring harness	1698		
Budget 302 Rebuild		Budget 289 Rebuild	
Speed Density computer	50	A9L Mass Air Computer	125
Stock Intake, Throttle Body, Fuel Rail & Injectors	130	Stock Intake, Throttle Body, Fuel Rail & Injectors	150
Distributor w/ coil	75	Distributor w/ coil	75
Add Oxygen sensors Bungs	12	HO Camshaft kit	175
Fuel pump block off	6	Add Oxygen sensors Bungs	12
Accumulator	70	Fuel pump block off	6
Low pressure pump	60	Accumulator	70
High pressure pump	110	Low pressure pump	60
Fuel Line and Fittings	40	High pressure pump	110
Total	553	Fuel Line and Fittings	40
+ Fuel Tank	928	Total	823
+ EFI Wiring Harness	1500	+ Fuel Tank	1198
		+ EFI Wiring Harness	1673