



PHOTOS BY TODD RYDEN
THE AUTHOR, COURTESY OF THE MANUFACTURERS, AND RACE PAGES ARCHIVES

STAGES

OF IGNITION UPGRADES

Got spark—got fuel. When you have them both, you're going to have some sort of combustion. When the spark occurs, its characteristics and the right mix of air and fuel are the main ingredients that determine the outcome of the combustion event. A weak ignition can leave fuel unburnt, resulting in a loss of power. The goal is to perfectly time the spark with the incoming gasses to produce the most efficient and best combustion possible.

That may be simplifying the process a bit as there are still even more variables including compression ratios, combustion chamber design, valve timing, fuel quality and many others that all contribute to the overall combustion event. You can have ideal fuel delivery, but if the ignition system isn't up to snuff or not set up properly, the fuel isn't going to do you much good. Conversely, a giant lightning bolt of a spark isn't going to be worth squat without proper fuel delivery, but for this story we're focused on the spark!

The ignition system is one area that can be improved and tuned to deliver more performance to your engine whether you're driving through traffic and stop lights or racing through the timing traps. When you improve other systems of the engine, such as better flowing intake or heads, or free flowing exhaust, the ignition plays a key role in helping produce the most performance possible from all of these different components. This is especially true when you introduce a shot of nitrous into the mix or start forcing the fuel mix into the cylinder. Any time the cylinder pressures are increased, the entire ignition system is taxed.



From a Flathead to a Coyote engine, a hot spark combined with timing control will result in performance improvements.

There are a lot of different products and parts that will help you improve the power of your ignition system, but where do you start? There are CD ignitions, low-resistance wires, high-output coils and much more. In fact, it can become a little overwhelming when you first start looking around at ways to up your ignition's oomph. So where do you start exactly?

First, you need to determine just what you plan to do with your car. Is it a daily driver or a boulevard bruiser that you run once in a while at the local digs or the occasional highway challenge? Are you putting together a drag car that will really only see time on the strip? Maybe you're upgrading your drag car with a serious step up on the power ladder? Also, as you're asking yourself these questions don't forget about updates that may come to fruition in the near future. To help you with your ignition upgrades, we're going to walk you through some common upgrades from street to strip with information from a number of great companies that know ignition.

STREET

Even if you keep your Ford on the street, there are a lot of benefits to be gained from improving the ignition system. A hotter spark will improve the efficiency of the combustion event resulting in improved performance that can be felt in every day driving. A smooth idle, improved throttle response and even quicker starts can all be realized with a little ignition work. Another area that can help a lot is to update or replace an old distributor. If the mechanicals of a distributor are worn out, the timing and triggering of the ignition can have adverse effects on overall performance. Following are a few suggestions to get your street car's ignition in order.

STREET • POINTLESS



The Ignitor III from Pertronix bolts into a stock Ford distributor and increases the spark energy plus delivers multiple sparks to improve starting and throttle response. It also provides an adjustable rpm limiter.

If you're running a classic muscle car with ancient breaker points firing the spark, get over it. We understand if you still want to look stock, or go the sleeper route but there are much more accurate ways to trigger the ignition and still use the stock distributor.

Points replacement kits have been around for years from the likes of Pertronix, Mallory, Crane, Accel and other manufactures. Over the years, several companies have upgraded their systems to digital technology and have been able to incorporate features such as a built-in rev limiter or increased spark through advanced dwell control.

The benefit of converting from breaker points to electronics is mainly that they are maintenance free once installed. No more setting the points or worrying about burning them up while on the road. They can even be used to trigger an aftermarket EFI system or CD ignition control.

There are a number of conversion kits available to fit any budget plus they're easy to install. Don't settle for historic breaker point technology.



Modotek offers a digital points replacement kit that is complemented with a higher output coil. Plus, it has an engine saving rev limiter that is adjustable in 200-rpm increments from 5,800 - 7,200 rpm.

STREET • DROP-IN DISTRIBUTOR



If you're not concerned with looking stock, but would prefer not to mount an ignition box under the hood of your muscle car, MSD's Ready-to-Run Distributors are a great choice. These distributors are ideal for street cruisers and provide everything you could ask for in a distributor.

As you would expect from MSD, the distributor features a high output ignition module built into the base of the billet aluminum housing. The increased spark energy will improve starting, throttle response and packs plenty of oomph up through redline rpm. To trigger the energy, a maintenance-free magnetic pickup is used and to help ease tuning, MSD moved the mechanical advance to the top of the distributor for easy adjustments. They even supply advance springs and bushing so you can custom tailor a timing curve to match your needs.

Another nice thing about these distributors is their ease of installation. There's three wires: Ground, coil-negative and 12-volt power. That's it! An optional wire is a tach output that provides a clean signal for an aftermarket tach or even to fire an aftermarket EFI system. Models are available for nearly any Ford engine from Y-blocks and FE's to big blocks with hydraulic roller cams.

FAST IGNITION • STREET



One of the newest manufacturers to the ignition side of things is FAST. We're not surprised to see a CD ignition out of the Memphis based Fuel Air Spark Technology specialists, more surprised that it took them this long! (Looks like they can replace the "Technology" with "Timing" soon!)

Their new E6 Capacitive Discharge ignition kit comes with the ignition box as well as a matched high output coil. The ignition produces full spark energy from idle to high-rpm and delivers a series of multiple sparks through 3,000 rpm. This series of sparks helps clean up the idle of overly rich carbs, improves throttle response and mid-range pull. The system is ideal for anything with a distributor and can be used with carburetors or EFI systems. To protect your engine from overrev damage from a missed shift or driveline failure, there is a rev-limiter built into the unit that is adjustable with rotary dials.

STREET

STREET • LATE-MODEL COIL PERFORMANCE

Things got a little tricky when Ford moved to coil-on-plug technology. No more CD ignition boxes nor distributor upgrades. Thanks to an innovative performance aftermarket, there are now coil upgrades available to increase the spark across the plug gap!

Ignition specialists such as MSD, Accel and Granatelli offer coil upgrades for Ford engines. These coils have been studied and reworked with better materials and tweaked turns-ratios to develop a hotter spark with longer duration than the OEM units. The upgraded coils really shine when they're added on engines with nitrous or a blower as the added spark energy and improved recovery between sparks is really put to the test.



Accel has been developing high output coil packs for several decades and that experience shows with their Super Coil for the Ford Coyote. These coils were engineered from the bobbin up with optimized windings and turns ratio to deliver a hotter spark.



Granatelli Motor Sports offers two series of coils for the Coyote engines. One, the Hot Street model is capable of handling up to 45,000 volts and bolts in place of the factory units. For more serious engines, they offer a Pro Series Extreme coil that is designed to handle increased cylinder pressures from power adders and is rated up to 65,000 volts.

STAGES OF IGNITION UPGRADES

STREET/STRIP

If your Ford is primarily used on the street, but sees some drag strip or track action now and then, the performance of the ignition system becomes even more important. Timing control, high-rpm accuracy and full-energy sparks are keys in the success of your engine's power. This could be time to consider a CD ignition that offers a few more features depending on your engine. Running a shot of nitrous? Consider using an ignition with a built-in step retard. Boost? You'll need to look for something that offers a retard based on boost in order to keep the timing in check!

STREET/STRIP • MORE THAN JUST A CDI

The team at Modotek packed a lot of great features into their Digital Capacitive Discharge Ignition Control (DCDI) to answer the calling of street performance fans. The compact unit, that is supplied as a kit with a specifically matched coil, produces a stout spark with 135mJ of spark energy and full voltage spark power through top end rpm. Good stuff, but it gets better.

The DCDI has several unique features that can be programmed through a PC from a simple rpm based advance to a 3D timing map including a boost retard. The unit also provides three different rpm limit settings and can even datalog ignition parameters with 16MB of space. There are also two outputs that can be configured for an RPM switch, nitrous activation or shift light functions. A lot of features packed into a powerful, compact unit.



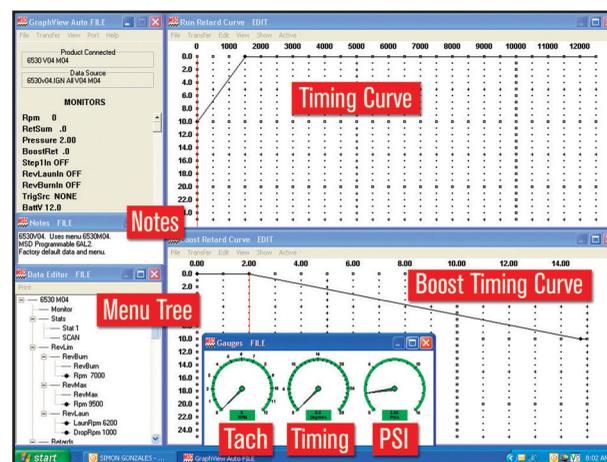
STREET/STRIP • ENTRY LEVEL PROGRAMMABLE CONTROL



MSD's 6AL is probably the most popular multiple-sparking CD ignition available, but few people know about their Programmable 6AL. This unit takes cues from their experience with NHRA Pro Stock and Outlaw racing ignition system and brings it down to a street-friendly version with just enough cool features to handle your street car.

Not only do you get the proven CD sparks, but you also open the door to advanced programming through your PC. The easy to use Pro-Data+ software allows you to map a timing curve as well as set three different rpm limits (burnout, launch and overrev). There is also a retard stage for use with nitrous and when you add a MAP sensor, you can program a timing retard based on boost! One other important feature is a time based launch retard that can help kill some power during the launch to keep the tire planted.

As far as bang for your buck, the Programmable 6AL is one of MSD's best kept secrets.



STRIP FIRST, STREET SECOND

So you've stepped up the engine with more boost and compression, the converter is high, and the suspension is less than comfortable on the road, yet you still take a stroll down to the local cruise or late night challenge. You're on the performance fence, choosing to deal with raw power over driveability or function on the street. It's time to get more serious.

At this level, if you're running an engine with a distributor, it's time to consider moving to a crank trigger. The distributor will still be used, but needs to be stripped of its mechanical advance and locked or welded solid. A crank trigger is the most accurate way to trigger the ignition and at this level of power, timing control is imperative to power and longevity of your engine.

A crank trigger is the most accurate way to trigger the ignition and at this level of power.

STRIP FIRST, STREET SECOND CPC CONTROL AND POWER

When Ford moved to the Mod Motor, the new distributorless ignition system presented quite a challenge to increasing the spark output of the ignition system. At first these engines incorporated two 4-tower coil packs with waste spark technology then moved to the coil-on-plug system that is still in use today. The skinny 'pencil' coils leave little room for enlarging or modifying the coils and with the factory ECU controlling the triggering of the coils, a CD ignition would be a wiring nightmare and costly.

However, one option is to gain control of the coils through advanced programming with a Haltech ECU such as their Platinum series. Their advanced software controls provide the opportunity to control timing and compensate for increased cylinder pressures and rev limits. If your engine requires a boost in spark energy, Haltech developed the HPI-8 Ignitor that drives more current to each coil. The HPI-8 will deliver up to 15 amps to each coil to aid in their power as well as recovery between firings. Huge power combined with the advanced ignition controls is a win-win situation for serious late model Mustang performance. The HPI module is also available for four- and six-cylinder engines.

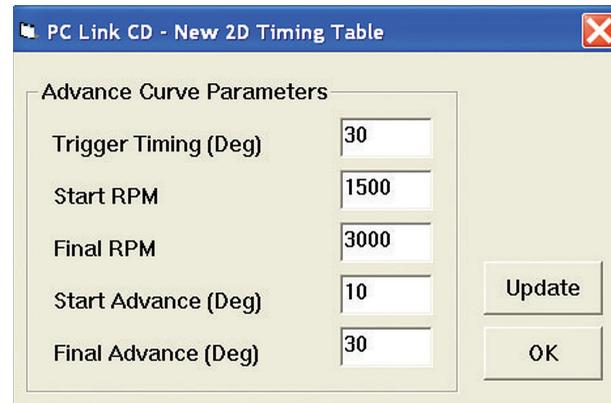


STRIP FIRST, STREET SECOND DAYTONA CD

Daytona Sensors LLC offers a couple different ignition units for traditional as well as distributorless engines. Their CD-1 CD ignition control is available for four-, six-, or eight-cylinder engines, packs a solid punch of a spark and offers a number of programmable features.

Once your laptop is connected, you'll have a variety of tuning features at your excited little fingers. There are of course the basics including rpm limits, but then you can get into timing tables based on rpm or even on rpm and manifold pressure. If running boost, they also offer an accessory that allows you to retard the timing based on boost pressure through a dash mounted control knob. Other features include a start retard and a compensation circuit for inherent retards from a mag pickup.

Once you're dialed in and hit the strip you'll also be able to data-log a run to review the ignition data in the comfort of your pits. This includes nearly anything ignition related including rpm, timing, MAP, battery voltage and more.



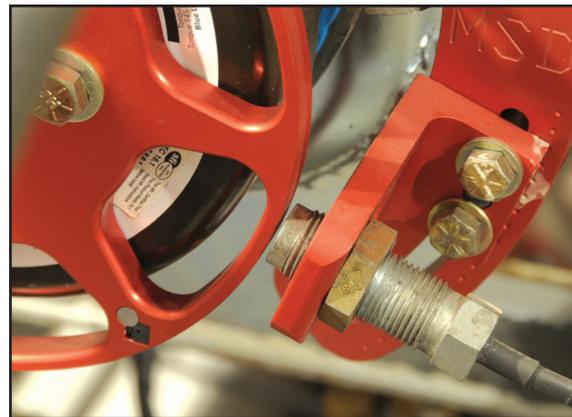
STRIP FIRST, STREET SECOND

STRIP FIRST, STREET SECOND TRIGGER FROM THE CRANK

For distributor-equipped engines running at this level, it's time to step up to a crank trigger to fire the ignition. When you're using a distributor to trigger the ignition, think about the number of mechanical components that take place; from the crank gear to the cam gear, via a chain, then through the cam gear to a distributor gear and up the shaft. Slight variances will affect the accuracy of the ignition trigger and when it comes to ignition timing combined with boost, compression or nitrous, precision is key.

A crank trigger bolts to the dampener and provides the best possible trigger signal available.

MSD offers a Flying Magnet Crank Trigger for small and big block Fords. These kits are supplied with a trigger wheel that has four magnets embedded in the wheel (hence the name). The magnets are the only way to trigger the supplied non-magnetic pickup. The pickup location is adjustable to help dial-in your desired total timing. Remember, once you go with a crank trigger, the distributor needs to be locked out and the rotor tip must be aligned with the correct terminal of the cap (called rotor phasing). This is extremely important if you're manipulating the timing for nitrous or boost pressures.



Once you go with a crank trigger, the distributor needs to be locked out and the rotor tip must be aligned with the correct terminal of the cap.

STRIP

After years of work in the shop and on the track, all of a sudden you find yourself on top of the performance mountain with the ability to make more power than the tires can hold. Obviously you need a helluva blast of fire to occur in the cylinder chamber, but what's equally as important is the ability to control all of that power. One of the best ways to control power is by manipulating the ignition and there are a number of ways to get there depending again on your application from a single coil ignition to a multiple coil set up. Either/or, you're covered.



STRIP • POWER IN PROGRAMMING

MSD first introduced PC programmable ignitions well over a decade ago with their Programmable 7-series. This group of ignitions, with the most popular being the "7531" brought about the term of "running on the dots" through advanced control of the rpm and timing. Their next generation of controller, the Power Grid, was introduced a few years ago and has taken a strong foot hold in Ford racing.

The unique thing about the Grid is that it's separated into two components; one is the brains of the system, the other the brawn with a huge spark profile. MSD split the system so the Grid brains could be used with other ignition systems, mainly their obscenely powered Pro Mag 44 (and conversely, you could wire it into a 6AL).

The Grid offers nearly anything you could want from rpm switches to timing based on time, nitrous retards, boost maps as well as data logging. Or if you prefer, you can connect your Racepak system into the Grid and record all sorts of ignition based information to review on one screen.



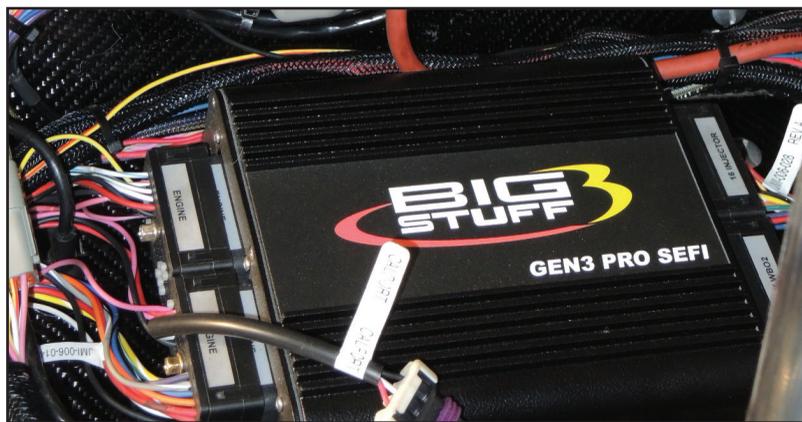
STRIP

STRIP • COMPLETE CONTROL

For those taking on late model technology with coil-per-cylinder ignition systems, chances are that you're running an aftermarket EFI controller at this stage in the game. Most systems have the capabilities to control ignition timing, unlike 10 years ago when crafty racers were fabbing distributor heads through the head in order to incorporate a programmable distributor based ignition system.

Modern EFI systems from FAST, BigStuff 3, Motec and AEM all have the ability to control the ignition side of the Coyote and Mod Motors.

Think about it. With eight coils, the ability to advance and retard the timing of each cylinder combined with dwell control or mapped timing based on rpm, engine load and power adders is all a few key strokes away. No need to be concerned with rotor phasing, caps or rotors. Combined with absolute fuel control as well. You just have got to love modern technology.



FAST offers an Ignition Module that plugs into their XFI EFI controller. The XIM unit is available for the 4V Coyote engine and features factory style connectors to ease wiring and provides access to ignition curves and programming of the complete EFI system combined with the fuel control of the XFI.



IGNITION BASICS

A lot takes place between creating a high voltage spark and getting it to fire across the spark plug gap at the right moment. There are also a variety of ignition components and upgrades available to add performance to your engine. Understanding the basics of the ignition system will help in choosing the right parts for your application so we'll start with a brief overview of a stock type inductive ignition system.

To get a better understanding of your options when it comes to ignition systems we'll start at the coil. The coil is responsible for taking in taking the high amperage with 12-14 volts from the battery and stepping it up to thousands of volts creating a spark that is capable of jumping the gap of the spark plug to ignite the air/fuel mixture. To accomplish this feat, the coil is made up of two series of windings, the primary and secondary, along with an iron core to strengthen the magnetic field that is created as the battery current flows through the primary windings. The primary windings are usually several hundred turns of a heavier wire while the secondary windings are a finer material with several thousand windings. (This gives you the turns ratio winding that you see in coil specifications such as 100:1 or 70:1, which is another story in itself.) When the switching device opens, whether it be breaker points or an electronic trigger source, it causes the current flow through the primary windings to stop forcing the magnetic field to collapse across to the secondary windings. This induces a very high voltage which is sent out of the coil through the secondary (spark plug terminal) to the distributor.

From there, the voltage is sent into the distributor cap and to the rotor.

The rotor is attached to the distributor shaft which is coupled to the spinning camshaft through the mesh of their gears. As the shaft turns the spark travels across the rotor tip and jumps to the cap terminal where the spark is delivered to the spark plug via the plug wire. This is an incredible feat in itself as it all must be timed precisely as the piston approaches Top Dead Center on its compression stroke. If that opportune moment is missed, the performance will suffer due to inefficient combustion. There are many things at work to get this all right and fortunately there are many aftermarket parts available to ensure the this process works effectively for the most performance.

SOURCES

Accel
Accel-Ignition.com
216 | 658 | 6413

Big Stuff 3
BigStuff3.com
248 | 887 | 5636

Crane Cams
CraneCams.com
386 | 252 | 1151

Daytona Sensors LLC
Daytona-Sensors.com
386 | 322 | 7390

FAST EFI
FuelAirSpark.com
901 | 260 | 3278

Granatelli Motor Sports
Granatelli.com
805 | 486 | 6644

Haltech
Haltech.com
760 | 598 | 1941

Modotek Performance Electronics
Modotek.com
440 | 352 | 0100

MSD Performance
MSDperformance.com
915 | 857 | 5200

Pertronix
Pertronix.com
800 | 827 | 3758

This screen capture illustrates the 3D timing table available in the Big Stuff 3 ECU. Fuel and complete control over the ignition is available for high performance Coyote engines.