Build Your Own Electronic Ignition

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Most all single cylinder gasoline engines use a magneto to fire their sparkplug. The magneto works OK most of the time. But when the weather is cold or the points get old, the magneto ignition gets sluggish and the engine is hard to start. Here is a very simple & inexpensive electronic ignition system that can be homebuilt built for virtually any one lung gas engine used for making electricity.

So why use a magneto?
When a manufacturer makes a small gasoline engine, he doesn't know what particular application the engine will eventually serve. The engine could be used on a pump, a rototiller, a compressor, or maybe a generator. In many of these applications, there is no source of electricity available to the static engine for ignition purposes. These small engines have no battery. So these engines commonly make their own electricity to fire the sparkplug with a magneto.

The magneto ignition system is very simple and requires no battery to start the engine. Magneto ignition operates by using at least two fixed permanent magnets on the engines flywheel. These permanent magnets rotate past a fixed coil near the flywheel. The magnetic field passing through the coil generates the electricity necessary to start the engine. The timing of the spark is controlled by a set of breaker points wired in series with the low voltage side of the coil.

The entire setup is simple enough, but has one very great drawback. It requires that the engine be spun in order to generate the electricity needed for ignition. The operator of the engine provides this initial spin by pulling on the starting rope. Hopefully, only one pull will do the job. However, if the engine is worn (low compression), the weather is cold, or if the breaker points are pitted, then the engine will be difficult to impossible to start. The reason is that the magneto's output is directly proportional to the rotational speed of the engine. The faster the engine spins, the hotter the spark. Spinning the engine by hand doesn't turn the engine very fast, hence weak spark.

So why an electronic ignition?
Well, in our case, laziness and lack of time and money. Here's the story… During issue production for Home Power #2, in the dead of winter, our Honda engine refused to start. I pulled and pulled and nothing happened. The PVs weren't putting out much due to cloudy weather and the batteries were getting low. We had mucho computer work to do and no electricity to do it with. After some 5,600 hours of trouble-free operation, our engine/generator had let us down. I started trouble shooting the engine and found no spark on the plug. I disassembled the the rope starter and removed the flywheel. An examination of the inards revealed that the coil had an open circuit in the high voltage windings. Well, there is no fix for a broken coil; it must be replaced.

It's a long way to town. I knew that the local Honda dealer wanted an arm and a leg for a new coil that he certainly didn't have in stock (usually 2 weeks minimum order time). So I started looking around for an alternative to purchasing a new coil from Honda. I was fortunate in that this engine is driving our 12 VDC alternator. This means that there is 12 Volt energy available to the motor as the alternator is wired to our large storage batteries. Such is not the case with pumps, etc. So I decided to convert the Honda engine from magneto ignition to battery/coil ignition- just like an automobile.

The battery/coil ignition has several distinct advantages over magneto ignition. The intensity of the spark in a battery powered system is very hot regardless of the rotational speed of the engine. Battery powered ignition starts the engine easily when it is cold, and produces a more intense spark.

Building an Electronic Ignition
After a few trips to the junk box and a few hours of R&D, I came up with the following circuit that worked. The circuit's schematic appears on the next page.

This circuit uses the stock ignition breaker points to switch a PNP power transistor (Q1) which in turn switches the low voltage windings of a stock automotive ignition coil. I used a new set of points as my old ones were pitted and burned. By actual, measurement the ignition points in this circuit are only passing 5.6 mA. of current. I have included R2 in the circuit for points that are corroded or pitted and not making good contact. The use of R2 increases the current through the points to about 15 mA. for greater reliability on funky points.

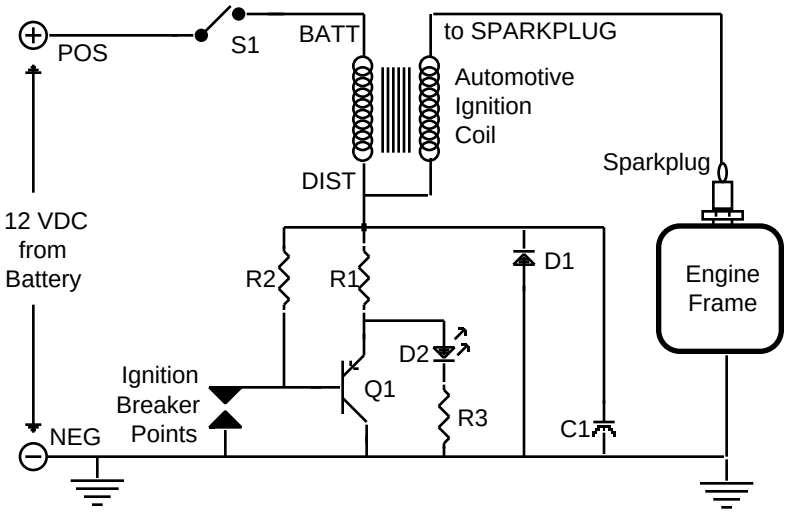
The PNP transistor I used is a 2N3789. I used this transistor because it had the required ratings and I had it in the junk box. Just about any PNP will work if it can handle at least 5 Amperes of current and has a Collector to Emitter voltage rating of at least 60 Volts. I have tried a MJE 2955 in the circuit and it works fine. The MJE 2955 is available from any Radio Shack store (RS part #276-2043) for $1.99. Those with the bucks might want to try one of the new power MOS transistors; they should work well.

The only automotive ignition coil I had handy was an old 6 Volt Chevy coil. I used it and placed a ballast resistor in series between the coil and the emitter of the PNP transistor. It took 2.3Ωs of resistance to keep the current through the coil in check. I made the 2.3Ω resistor using some nichrome wire from an old 120 vac electric hot water heater. If you have a 12

VDC coil, then use the appropriate, factory made, ballast resistor. Many modern 12 VDC ignition coils have built-in ballast resistors and require no external resistor.

The backwave diode (D1) protects the transistor from the high negative voltages generated by the collapsing magnetic field in the coil. D2 is an LED which helps timing the ignition system. When the points are open the LED is lit, and when the points are closed the LED remains dark. I used an ignition capacitor in the circuit, eventhough removing it had no appreciable effect. The capacitor is used in conventional systems to protect the ignition points from arcing & burning. In this electronic ignition system, the main switching is done by a transistor. The ignition points handle very little current, & at low voltage, so arcing is not a problem here and the capacitor is probably redundant.

Well, bottom line is that the Honda was running about 3 hours after it failed. No trip to town, no waiting or paying for new parts. This electronic ignition has been functioning for over 1,500 hours without failure. It has had some beneficial side effects. The ignition is hotter and has slightly reduced our fuel consumption. The motor now starts first pull, even on a very whimpy slow pull, every time. The sparkplug is staying cleaner due to the hotter spark. Nuff said…



Q1- PNP- 2N3789 or MJE 2955 or any 5 A., Vce 60 VDC min.
DI- 2N1202 or any five Ampere diode with 50 Volts PIV
D2- any LED
C1- Ignition capacitor (optional, see text)
R1- Ignition ballast resistor- 1 to 3Ω, 25 Watts, see text
R2- 1kΩ, 1/4 Watt, see text
R3- 1kΩ, 1/4 Watt
S1- 5 Ampere switch