



# AUTOMOTIVE IGNITION SYSTEMS

A comparison of traditional vs modern COP designs

## ABSTRACT

This report describes the differences and similarities between a 1964 Mustang traditional ignition system and that of my 2014 Jeep. To help you understand the process of delivering high voltage to spark plugs, images from the lab scope are used. You will discover that modern computer-controlled ignition systems are an extension of distributor systems to accomplish the same thing... fire spark plugs. I hope this information will assist you in evaluating and diagnosing problems with your race car.

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## Automotive Ignition Systems: Comparison of Traditional Distributor vs Coil on Plug

Here is my 1964 Mustang ignition system demo.

- Distributor which house the points and condenser (capacitor).
- One coil supplies high voltage to all spark plugs (I am only using one)
- The distributor uses both a mechanical advance and vacuum advance to change spark timing
- You can see the vacuum advance unit on the right side of the distributor. A vacuum line from the carburetor puts negative pressure on this diaphragm and it moves the plate where the points are. This advances the spark timing when we accelerate and retards it under light throttle.
- The secondary ignition pickup is measuring coil voltage and is connected to my scope so we can see what is happening during the entire firing process.
- The distributor is driven by the camshaft and rotates at  $\frac{1}{2}$  the RPM as the crankshaft.

Figure 1: My 1964 Mustang Ignition Demo



Figure 2: Close-up of the points & condenser & the 8-sided CAM that mechanically opens the points

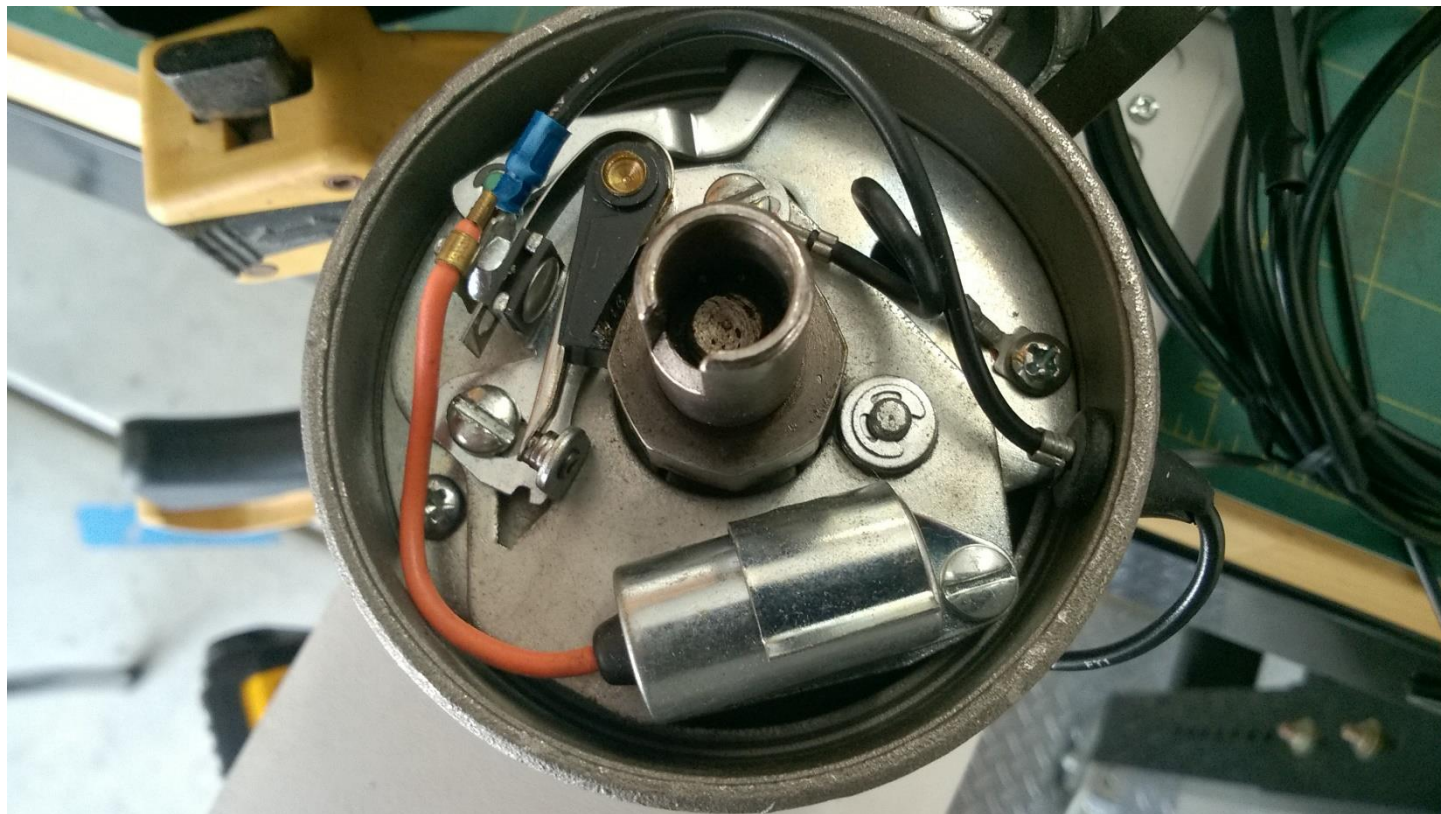
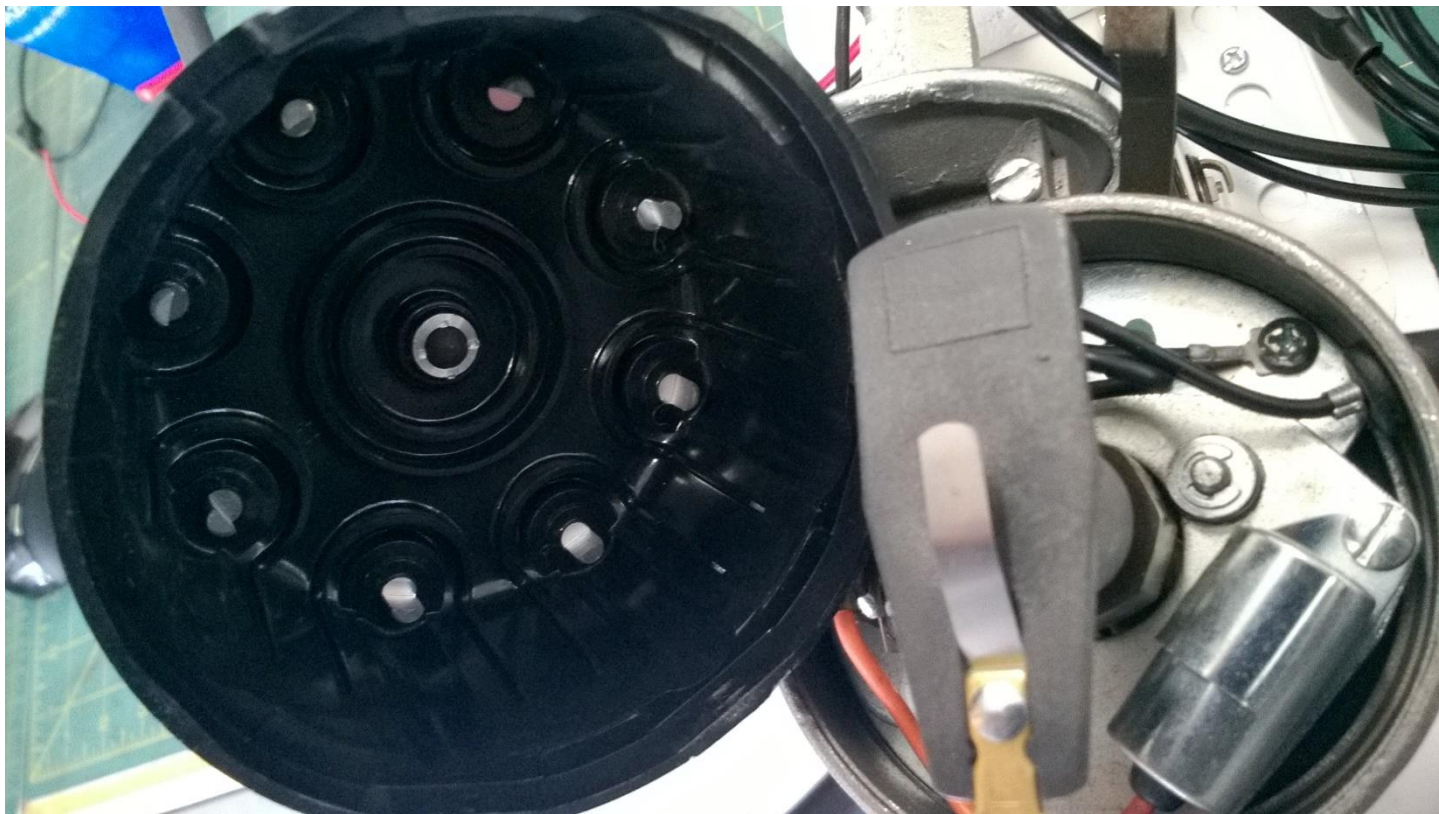


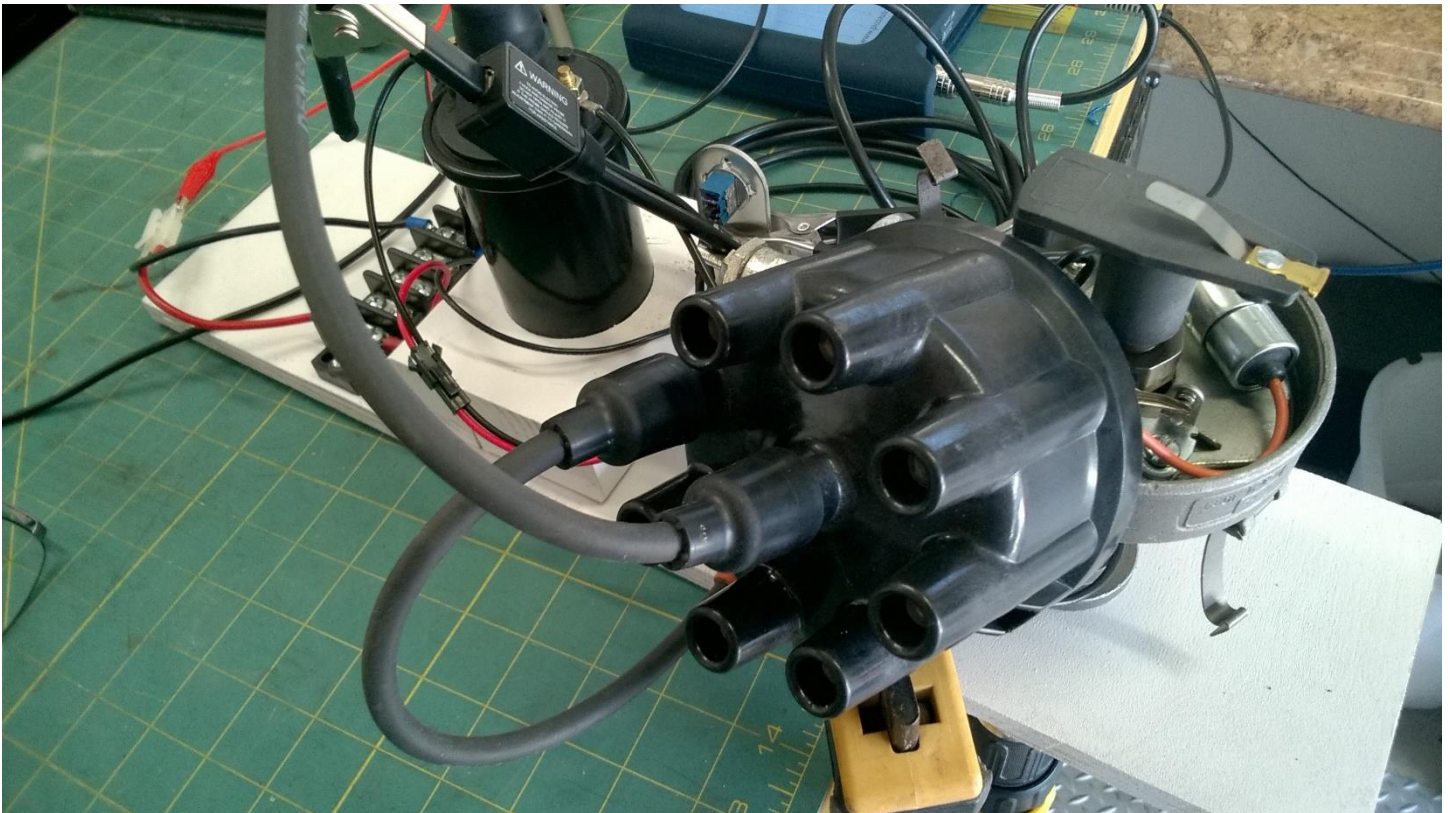
Figure 3: This shows the rotor. It takes the high voltage from the coil (center of distributor cap) and distributes it to each plug.



Notice the center electrode in the cap? It contacts the spring loaded metal piece on the rotor. As the rotor rotates, it transfers the voltage to each contact in the cap which sends the power to the plug wires.



This view shows the coil wire connected to the center electrode in the cap.



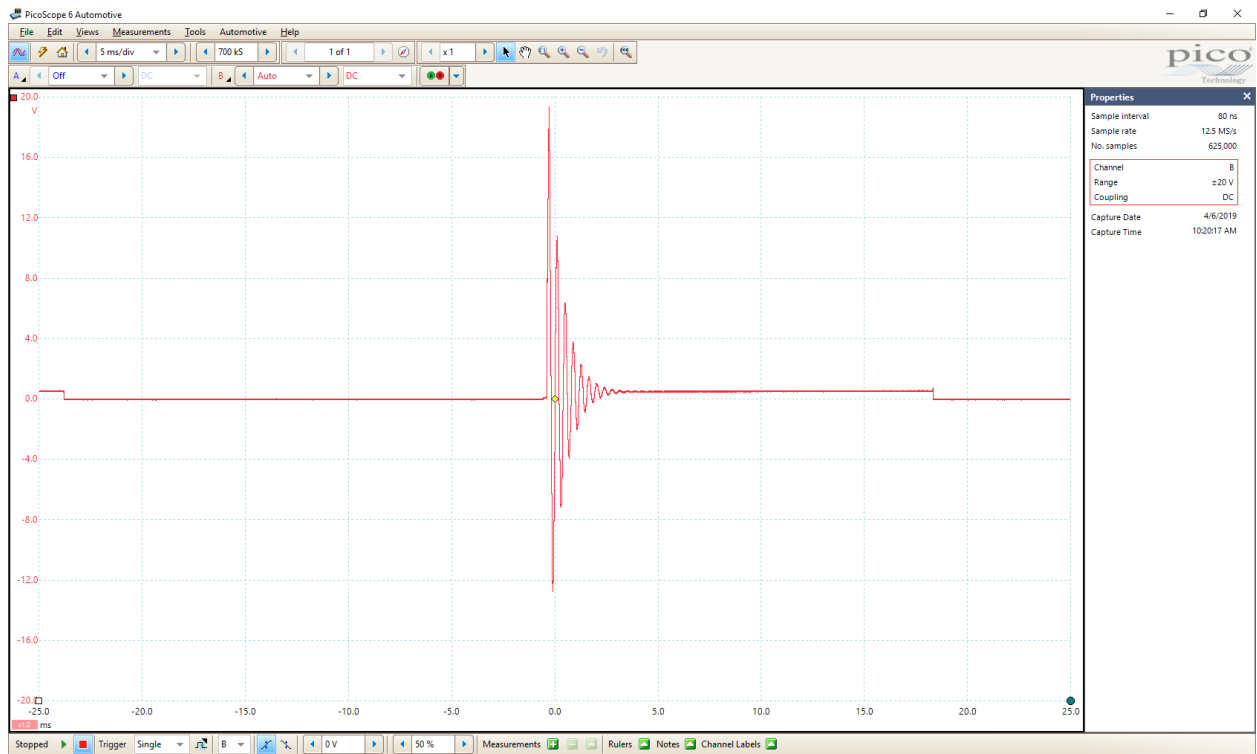
Here is what the coil on plug looks like. Notice the coil incorporates the plug wire and connects directly to the spark plug. The coil has a connector which connects to the Engine Control unit which manages the engine and transmission systems in the Jeep.



## Oscilloscope Images with Pico Automotive Scope (4225)

Traditional Ignition (64 Mustang) Points/condenser  
Primary pattern.

The scope is connected to the primary side of the coil so I can view the dwell angle and firing voltage.



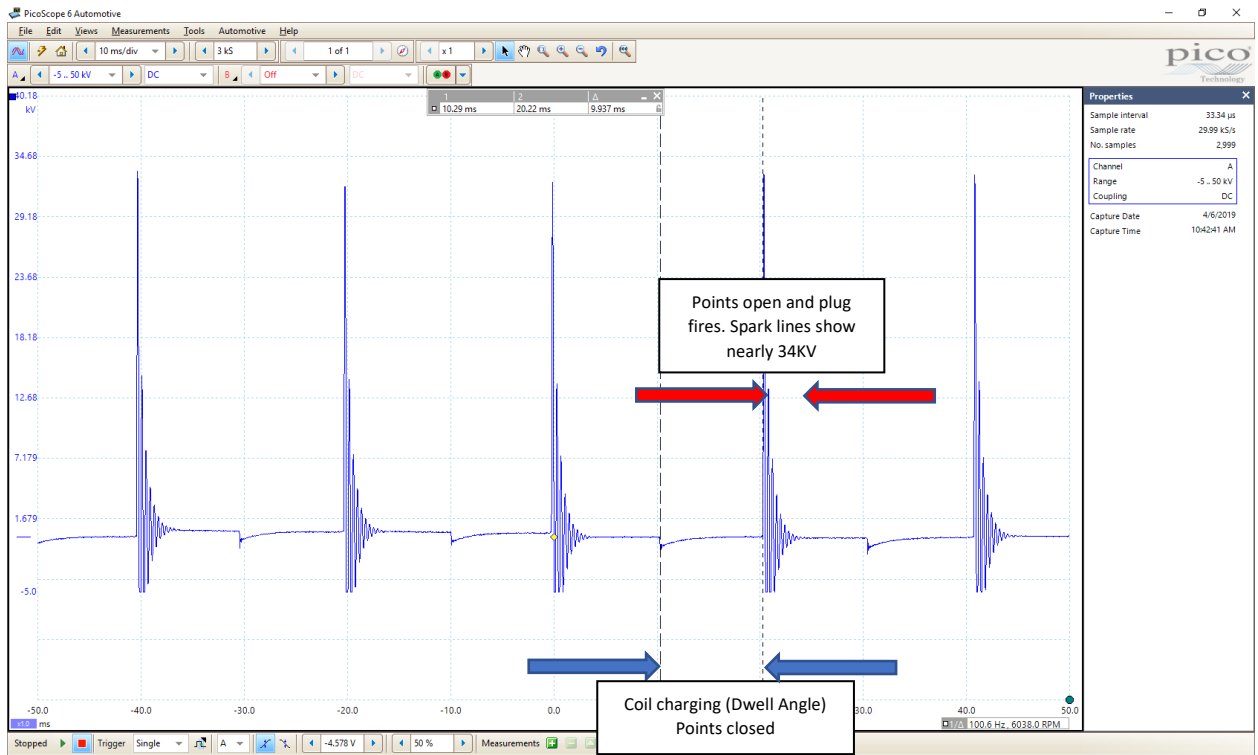
Now let's compare the Mustang ignition scope patterns to my 2014 Jeep.

### Traditional Ignition (64 Mustang) Points & condenser Secondary Pattern (Coil Pickup)

Notice the dwell angle at higher RPM is 9.9ms which is the time required to charge the coil.

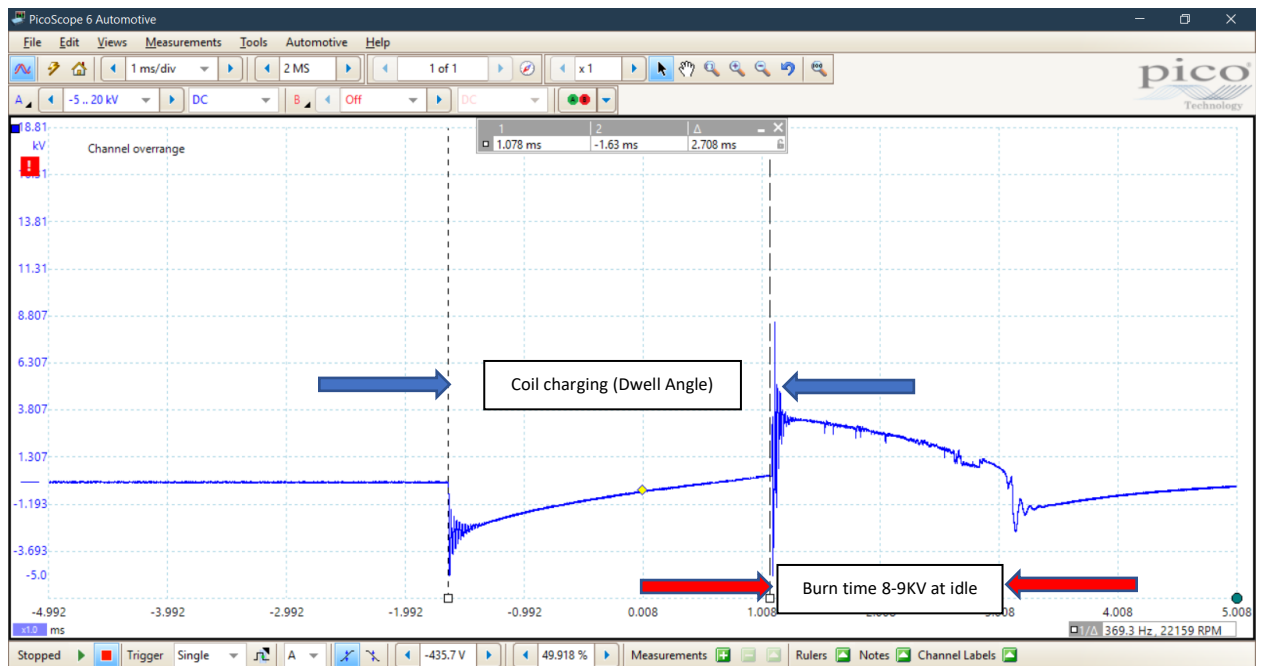
Also you can see the spark plug voltage is nearly 34,000 volts.

This is the test to determine if all plugs are firing evenly and to check for a bad plug wire.



### 2014 Jeep with Coil On Plug (COP) design taken with a “paddle probe” (see next page).

The ECU does the same things the points & condenser do. In this image you can see the actual “burn time”. It is the area just after the large voltage spike and the point where the coil energy is decaying. Notice how we can see where the coil is being charged.



This is the Pico Automotive “Coil On Plug” (COP) and Signal Probe. It is placed on top of a coil to measure the energy in the coil and to produce the scope images I showed on the previous pages. This allows easy and fast diagnosis at the track to spot ignition issues.

