Module 15
Ignition Inputs

Author: Grant Swaim

E-mail: sureseal@nr.infi.net

URL: www.tech2tech.net

Phone: (336) 632-9882

Fax: (336) 632-9688

Postal Address: Tech-2-Tech Website
PO Box 18443
Greensboro, NC 27419

Physical Address: 220-4 Swing Rd
Greensboro, NC 27409

Last Update: April 2000

IMPORTANT - READ !

Do not read or study this information unless you agree to the following conditions:

The information in this training module is the intellectual property of N. Grant Swaim and is copyrighted by Sure Seal Products Inc.

Subscribers to the Tech-2-Tech website, and persons participating in Tech-2-Tech's on-line training program are entitled to read this material on-line.

You may also click on the "save" icon on the Acrobat viewer and save a copy to your local computer. You may save a copy of this file on one computer and it must be viewed from that one computer.

You may also print one copy of this file for your viewing. If the printed copy becomes illegible, or lost, an additional copy may be printed.

Tech-2-Tech offers the following training modules in printed manual, CD-ROM, and on-line formats.

PGMFI Training Modules

- The PGMFI System Overview—Part 1
- The PGMFI System Overview—Part 2
- PGMFI Flash Type DTCs
- Inputs / Outputs—Part 1
- Inputs / Outputs—Part 2
- Engine Control Module
- Air Flow / MAP Sensor—Base Inj Pulse Width
- Fuel Delivery System
- Closed Loop Strategies—Theory
- Closed Loop Strategies—Case Studies
- Thermistor Inputs
- Throttle Position Sensor
- EGR Valve Lift Sensor
- MAP / BARO Sensor
- Ignition Inputs
- Vehicle Speed Sensor
- Oxygen Sensor
- Lean Air Fuel Sensor
- Miscellaneous Input Signals
- Fuel Injectors—Multi-Port Injection
- Fuel Injectors—Dual Point Injection
- Ignition System—Outputs
- Idle Air Control Valve

OBD-II Training Modules

- On Board Diagnostics—General Overview
- Diagnostic Trouble Codes
- MIL / Freeze Frame
- Scan Tool
- Scan Tool—Advanced
- Monitor Tests—Overview
- Comprehensive Component Monitor
- Catalyst Monitor
- EGR Monitor
- Evaporative Monitor
- Fuel System Monitor
- Misfire Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- "P" Codes

Miscellaneous Training Material

- Glossary of Terms

2000 © - All Rights Reserved Sure Seal Products Inc - Greensboro, NC

15 Ignition Inputs

15.1 General Overview

The ignition systems used by Honda over the years have gone through a lot of changes. The ignition systems on the earliest PGMFI systems controlled ignition advance mechanically and had no electrical connection to the ECM.

Image 15-1 Typical Honda Electronic Dist

In 1988 the Civic distributor went full electronic with the Accord following in 1990. These ignition systems have no mechanical advances and the ECM has total control over the ignition coil's primary current. An electronic Honda distributor is shown in Image 15-1.

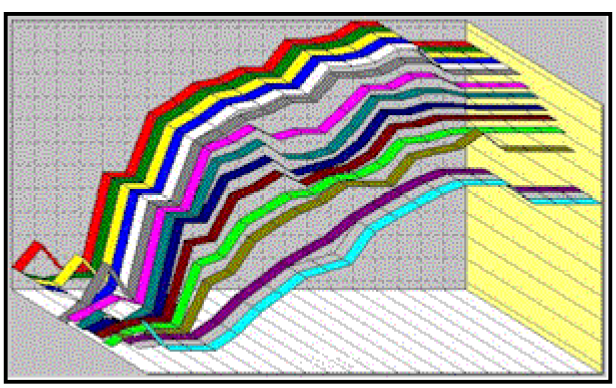
This training manual will limit its focus to the electronic distributor models.

The total ignition system is covered in two chapters. This chapter will cover ignition input signals. Chapter 22 will cover ignition outputs. For information about the PCM igniter signal, ignition igniter, ignition coil, and secondary spark, see Chapter 22.

15.2 How Does the Ignition System Work?

Honda's ignition systems are very conventional in design. It all starts with the ignition input signals. The ECM/PCM receives two input signals if it is a dual point injection system (DPI) and three input signals if it is a multi-port injection system (MPI).

Illustration 15-1 Honda Ignition Timing Map



The ECM/PCM uses this information to determine engine speed and exact crankshaft positioning. The processor looks up the proper timing advance in its internal timing tables using engine speed and MAP sensor inputs.

Illustration 15-1 is a graphical representation of a Honda Civic's ignition timing tables. You will notice 14 different tim-

© All Rights Reserved 2000 Sure Seal Products Inc

ing profiles. The ECM/PCM picks one of the 14 timing profiles based on the MAP signal.

Once the processor has determined the optimum ignition timing, it sparks the ignition by triggering the distributor mounted igniter. The igniter in turn will interrupt the ignition coil's current to cause the collapse of the primary field. This then induces a high tension voltage in the secondary ignition system which sparks the sparkplug.

15.3 Component Location

Image 15-2 DPI Distributor Base

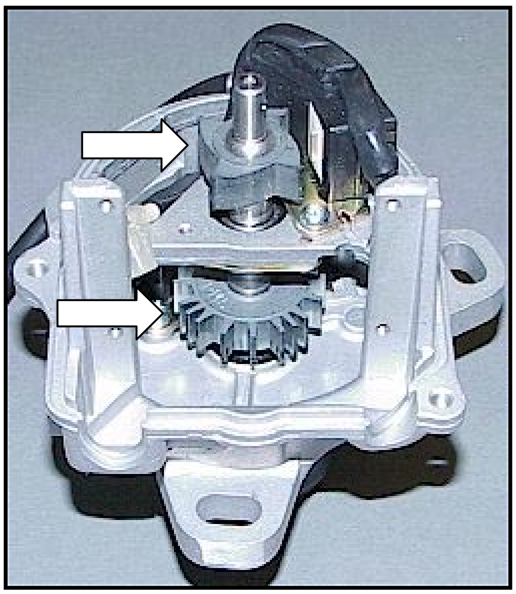
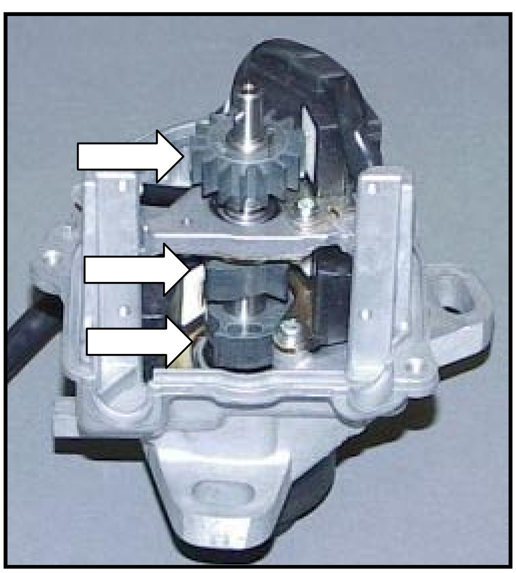


Image 15-3 MPI Distributor Base



15.3.1 Dual Point Injection Models

The DPI models only use two input signals. Since the injectors are not fired sequentially, there is no need for information about the #1 cylinder position.

In Image 15-2 the top arrow is pointing to the top dead center (TDC) sensor. The TDC sensor produces a signal each time a cylinder passes through TDC.

The bottom arrow is pointing to the crankshaft position (CKP) sensor. The CKP sensor produces a high density signal that is used for fuel control and also misfire detection.

You can see that the teeth on the DPI's CKP sensor reluctor are not spaced evenly. This will produce a CKP waveform that is not even, which is normal.

Note that the DPI system was only used on certain 1988-91 Civic models.

15.3.2 Multiple Port Injection Models

The MPI models use three input signals. In Image 15-3 the top arrow is pointing to the crankshaft position (CKP) sensor. The middle arrow is pointing to the top dead cylinder (TDC) sensor.

© All Rights Reserved 2000 Sure Seal Products Inc

Since MPI systems fire the injectors sequentially, the ECM/PCM needs to know the position of the # 1 piston. It uses the cylinder (CYL) sensor to do this. The bottom arrow in Image 16-3 is pointing to the CYL sensor.

15.3.3 Alternate Ignition Sensor Locations

Originally all ignition input sensors were located in the distributors. Over the years they have been moving some of the sensors to other locations outside the distributor. For instance on 1996 Accord 2.2 engines, the CKP and TDC are on the front of the engine, behind the timing covers. Many twin cam engines drive ignition input sensors off the back of the camshaft.

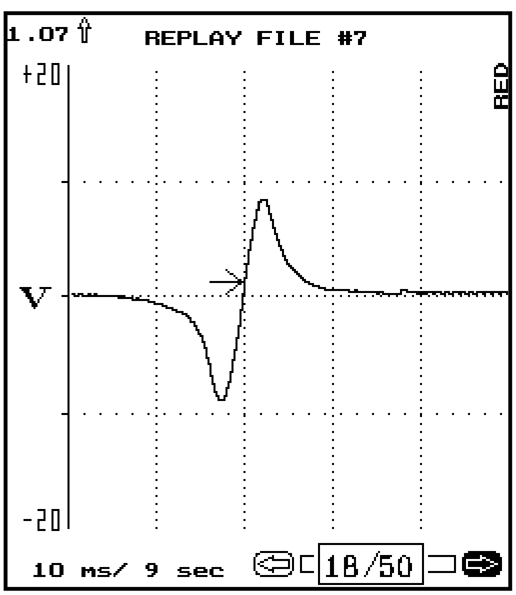
In this training manual we will not attempt to identify the location of every ignition sensor on every model. You can always consult a service manual if you need assistance in locating these sensors. Regardless of where they are located, the signals all look the same and are tested the same. In most cases you just need to verify that the signal is good.

15.4 How Do You Test Them?

The only procedure that will consistently identify bad ignition sensors is to examine the signal using a digital storage oscilloscope (DSO). Standard resistance checks on the sensor's windings will rarely identify a defective ignition sensor.

15.4.1 Analyze the Distributor Sensor Waveforms

Screen Capture 15-1



The waveforms of all the ignition sensors on a Honda look almost identical. It does not matter if the sensor is distributor mounted or "crank fired", they look the same.

Since this waveform is so common let's take a good look at a known good one. Screen Capture 15-1 is displaying a single ignition sensor waveform that is known to be good.

The signal should be close to 8 volts in strength (running at 2000 RPM), in both the positive and negative direction (this is a bi-polar – AC type signal). The leading edge should start by first going negative then positive.

© All Rights Reserved 2000 Sure Seal Products Inc

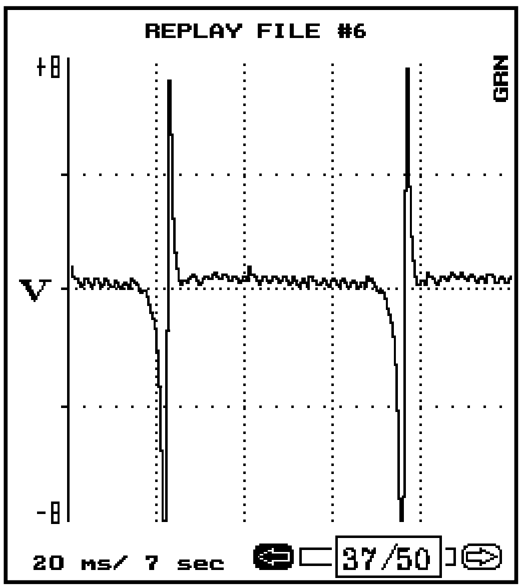
There should not be an excessive amount of “trash” on the signal and the signal strength should not vary (if the RPM is constant). There are examples of know bad signals later in this chapter.

15.4.2 Signal Strength

The strength of a distributor input signal is directly proportional to the engine’s speed. The faster the engine runs the stronger the signal, up to about a maximum of 8 volts. Let’s look at the same distributor at three different RPMs from the same car.

The following Screen Captures 15-2, 15-3, and 15-4 were all taken from a 1997 Civic,

Screen Capture 15-2

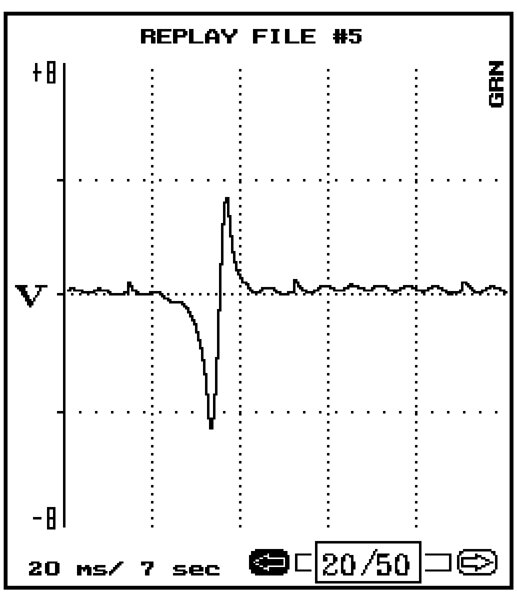


2000 RPM Reading

Screen Capture 15-2 was take while the car was running at 2000 RPM.

Notice the strength of the signal is approximately 8 volts +/-.

Screen Capture 15-3



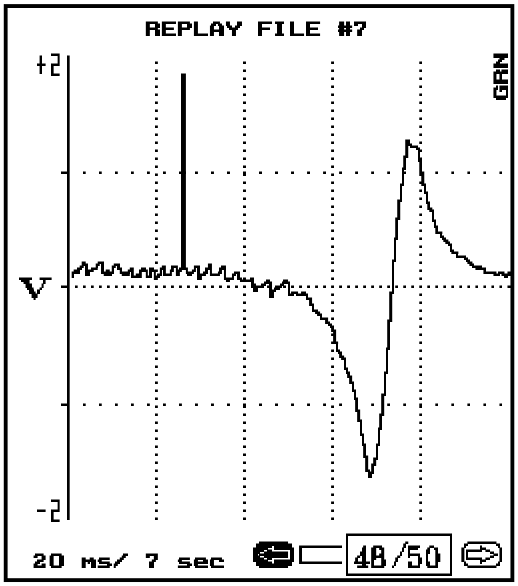
800 RPM Reading

Notice that the signal strength is one halve what it was at 2000 RPM.

The signal strength is now down to approximately 4 volts +/-.

© All Rights Reserved 2000 Sure Seal Products Inc

Screen Capture 15-4



400 RPM Reading

Screen Capture 15-4 shows how the signal drops to about 1.4 volts +/- while cranking.

Screen Captures 15-2, 15-3, and 15-4 all show how the signal strength of the distributor sensors falls off drastically during cranking RPM. This is where a distributor will first fail. With this information in mind, you should always test the signal strengths at cranking RPM.

The TDC, CYL, and CKP sensors rarely fail from their windings shorting or opening. They usually fail due to their loosing signal strength to the point that the PCM can no longer trigger off their signal.

It is the theory of many ignition experts that the type of sensors used by Honda loose their signal strength when the magnetic core of the sensor looses its strength. It is a fact that a magnet looses 10% of its strength each time it is heated up to 170^{o} F. Many sensors fail due to the increased heat caused by defective distributor base bearings.

15.4.3 Acquiring the Signals

While some techs may check ignition signals with a digital volt-ohm meter (DVOM), it should be done with a DSO.

A good DSO will allow you to see things you will never see with a DVOM. Image 15-4 is showing an Interro PDA DSO reading all three distributor signals at once. An Interro PDA unit can monitor up to four incoming signals at one time, which is a big plus.

© All Rights Reserved 2000 Sure Seal Products Inc
This manual printed 4/9/00 from the file pgmfiobd_002.

Image 15-4 Reading Ignition Inputs

You simply ground the black wire and take one channel lead at a time and back probe the distributor connector until you have found all the ignition input signals.

You will need to become comfortable and proficient in the use of a DSO. Once you have become familiar with how to set up a DSO you should be able to scope all three distributor signals in less than 5 minutes!

Image 15-5 is showing how to acquire the CKP / TDC signal off a late model Accord. The sensors are located behind the timing belt covers. The signals still look just like they did when they were located inside the distributor.

Image 15-5

When you set up your DSO use these numbers as a guideline:

Time Per Division
Try about 50ms per division. This usually gives you a full pattern. Try to adjust the time so you can see a CYL signal at the left and right edge. This way you know you are looking at all the signals.

© All Rights Reserved 2000 Sure Seal Products Inc
This manual printed 4/9/00 from the file pgmfiobd_002.

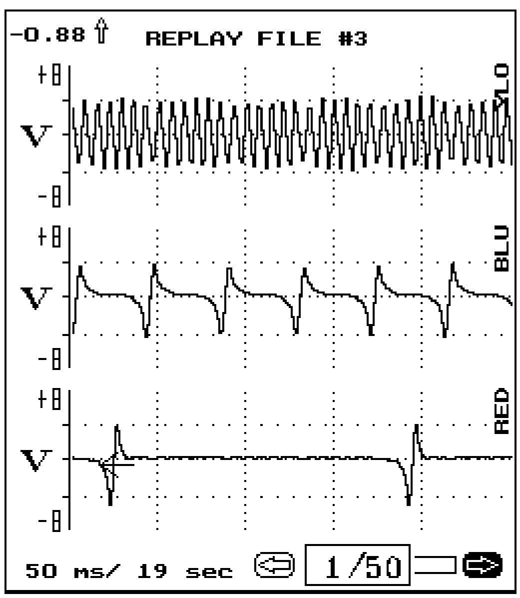
Voltage Range
A good ignition signal will be close to 2 volts while cranking. Adjust your DSO so that it is as close to 2 volts as possible, but not under 2 volts. To check the signal strength at running speeds adjust your DSO to read 8 volts or more.

Trigger
It is best to trigger just off the left side of the screen and to catch a signal as the waveform goes downward. So set up a trigger at approximately -.5 volt close to the left side of your screen and have it trigger on the downward slope.

It is also good to trigger on the CYL signal since there is only one of them for every 4 TDC signals, and about every 30 CKP signals. That way when you can see the beginning of a second CYL signal at the right of the screen, you know you are seeing all the signals.

15.5 Known Good Signals

Screen Capture 15-5



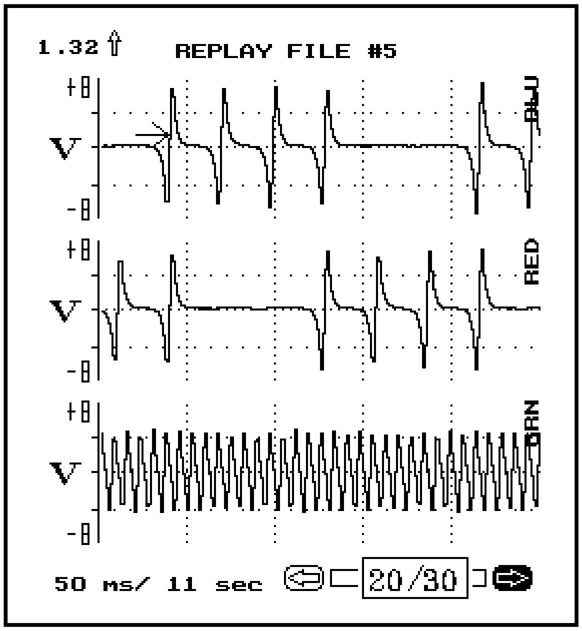
Screen Capture 15-5 is the “classic” Interro PDA test. You can grab all three at once and quickly analyze the signals for problems.

This screen capture is a known good one. Study this and get the feel for what you are looking for.

Notice that the trigger is set on the CYL signal, which is the bottom one. Since you are seeing a CYL signal at both the left and right sides of the screen, you are seeing all the signals!

© All Rights Reserved 2000 Sure Seal Products Inc
This manual printed 4/9/00 from the file pgmfiobd_002.

Screen Capture 15-6

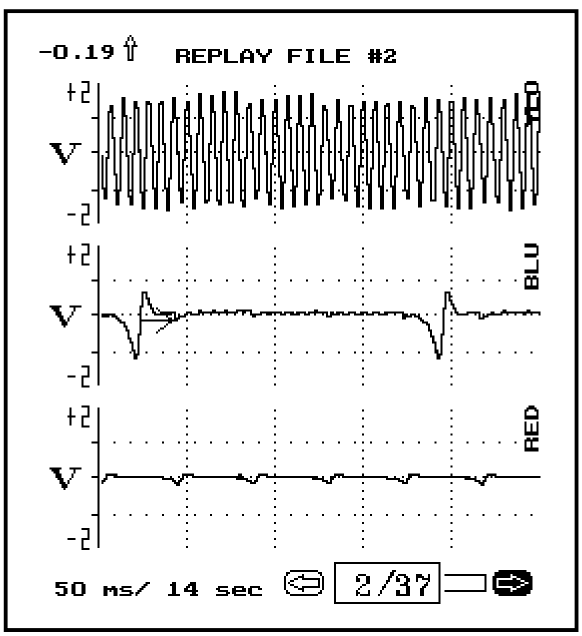


Screen Capture 15-6 is also a known good signal. It is from a V-6 Honda that uses a TDC1 / TDC2 sensor.

Notice the relationship of the top and middle patterns. This is a normal pattern

15.6 Known Bad Signals

Screen Capture 15-7

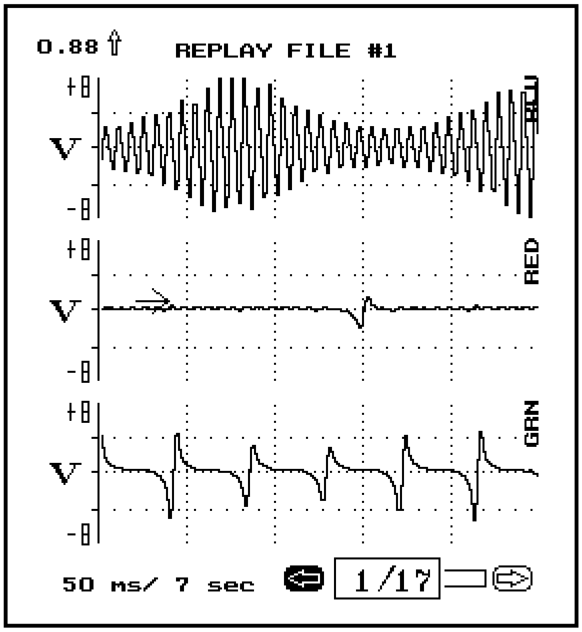


The signals in Screen Capture 15-7 came off a Honda that was still running, but barely. Notice that the signals are barely 2 volts strong, not the normal 8 volts.

The TDC sensor (bottom one) is barely measurable.

© All Rights Reserved 2000 Sure Seal Products Inc

Screen Capture 15-8



Screen Capture 15-8 is also a known bad set of signals. This was a Honda Accord with a very noisy distributor base bearing.

The drastic change in signal strength is a sign of troubles. The shaft is oscillating due to a bad base bearing.

15.7 Service Issues

15.7.1 Distributor Base Bearing Failures

It is not uncommon to have a Honda distributor base bearing failure. When a bearing fails it is usually easy to notice since the distributor will "squeal" when the engine is good and hot.

Often this is accompanied with a lot of red rust inside the distributor. Also a distributor with a bad base bearing will generate a lot of heat. In some cases enough heat to "melt" the rotor button.

Honda does not offer the base bearing or seal, however they are available in the aftermarket. The job is not easy and many opt to just change out the distributor base.

If a tech opts to "rebuild" a distributor base, the signal strength should be checked first. A noisy distributor base bearing will tend to overheat the distributor housing. This constant overheating will damage the distributor sensor's magnetic core, which affects its signal strength.

© All Rights Reserved 2000 Sure Seal Products Inc

15.7.2 Leaking Base Bearing Seal

A lesser problem than the base bearing failure is a base bearing seal failure. If this seal leaks it allows oil to get into the distributor housing. While it does not appear to cause a problem with the running of the car, it can be annoying.

© All Rights Reserved 2000 Sure Seal Products Inc