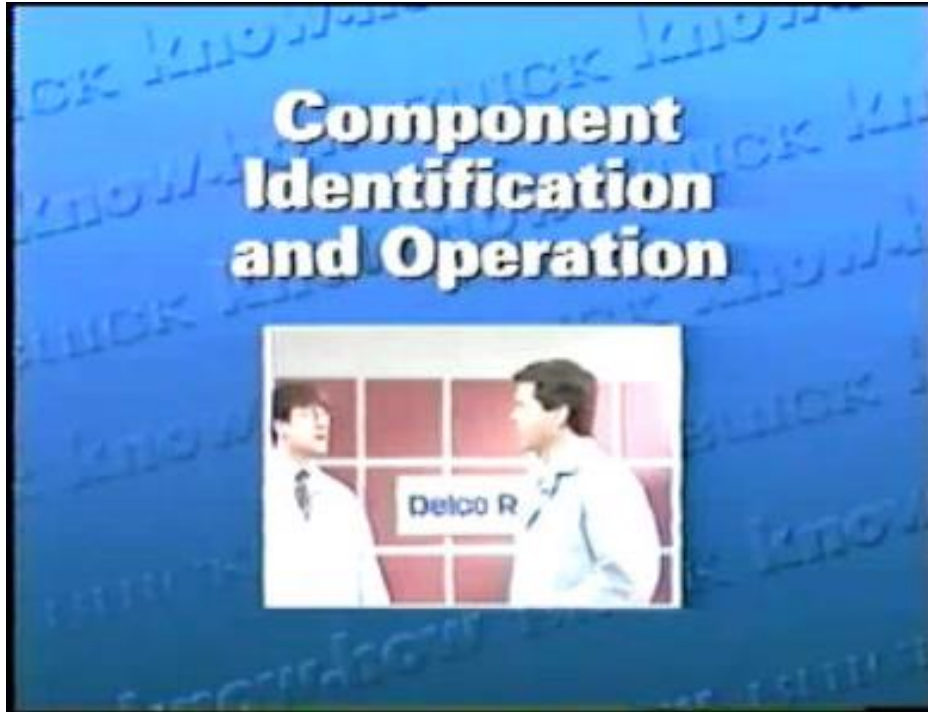


The purpose of this document is to provide very good diagnostic details with screenshots, documenting each situation.

I take NO CREDIT for the information provided, all I did was cull it down to detailed text and screen shots taken from the original video (<http://tinyurl.com/6cfcpr>)

- **LT1 Optispark (ABITS) Distributor Operation and Diagnostics**





The distributor shaft is driven by the camshaft.





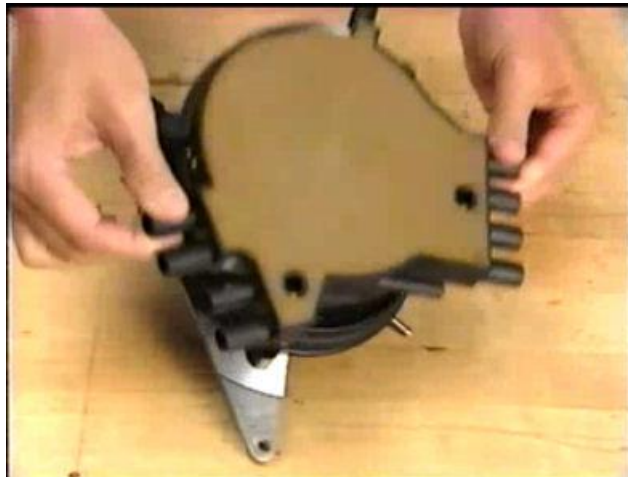
A pin in the camshaft sprocket engages a slot in the distributor.

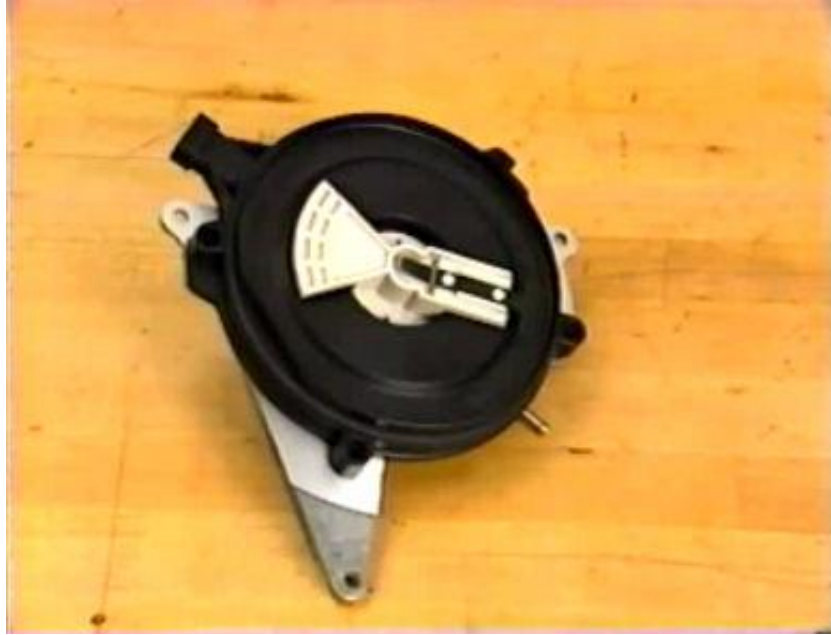


This is known as Pin Drive, and is a more robust design than spline drive distributors.

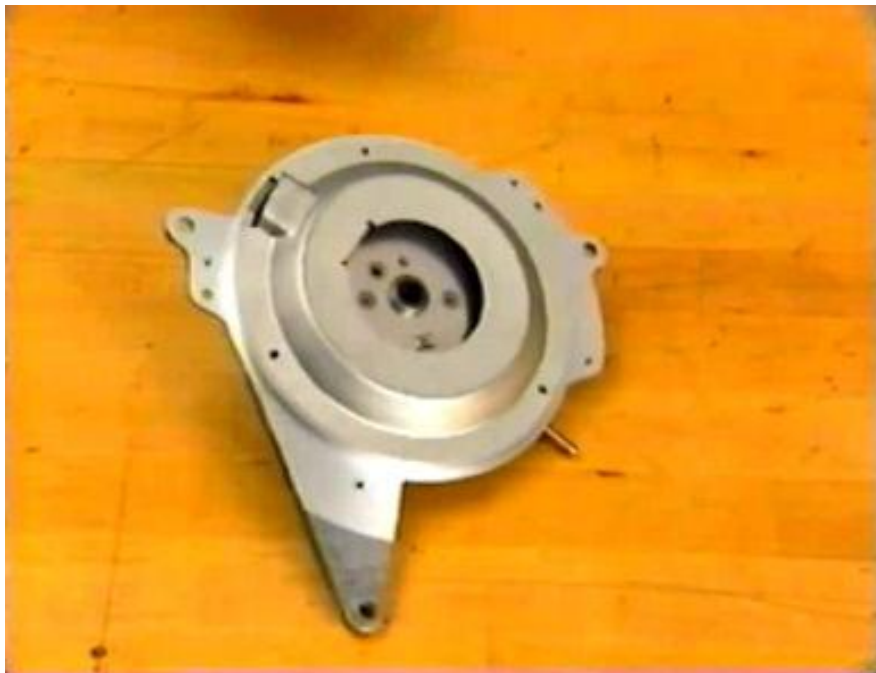


A Pin Drive unit can be identified by the Forced Air Ventilation System

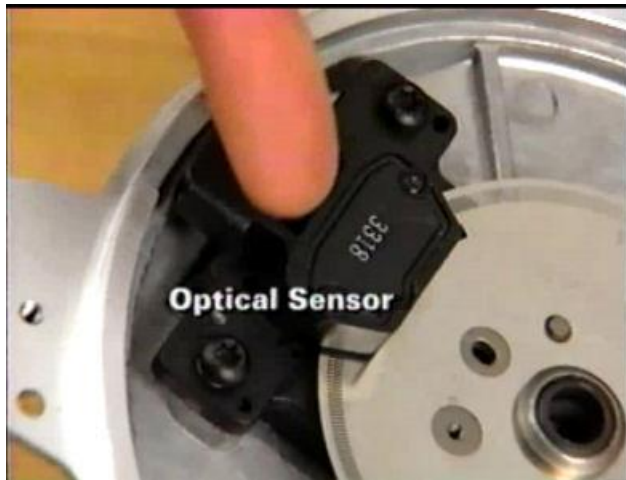




Inside the ABITS there's a rotor with a wide spark edge segment, making for a long life and reduced radio interference.



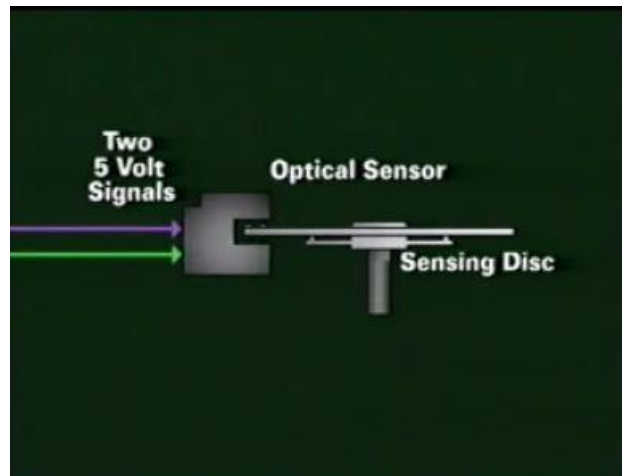
Underneath the rotor and protection shield lie the heart of the ABITS. Bolted to the pickup assembly is optical sensor.



The Optical sensor consists of two Photo LED diode pairs



The Optical sensor is mounted so a two-track signal is between the LED and the Photo Diode



The Signal disc is connected to the distributor shaft and turns with the camshaft. The PCM sends two 5Volt reference signals to the optical sensor as the signal disc turns the two rows of slots on the signal disc pass between the LED photo diode pair. This results in two pulsing signals. They are used to toggle the two 5V reference signals that are sent from the PCM to ground or ZERO volts.



The outer ring of the signal disc contains 360 slots, which provide 720 tiny edges for the PCM. This is known as the high resolution signal.

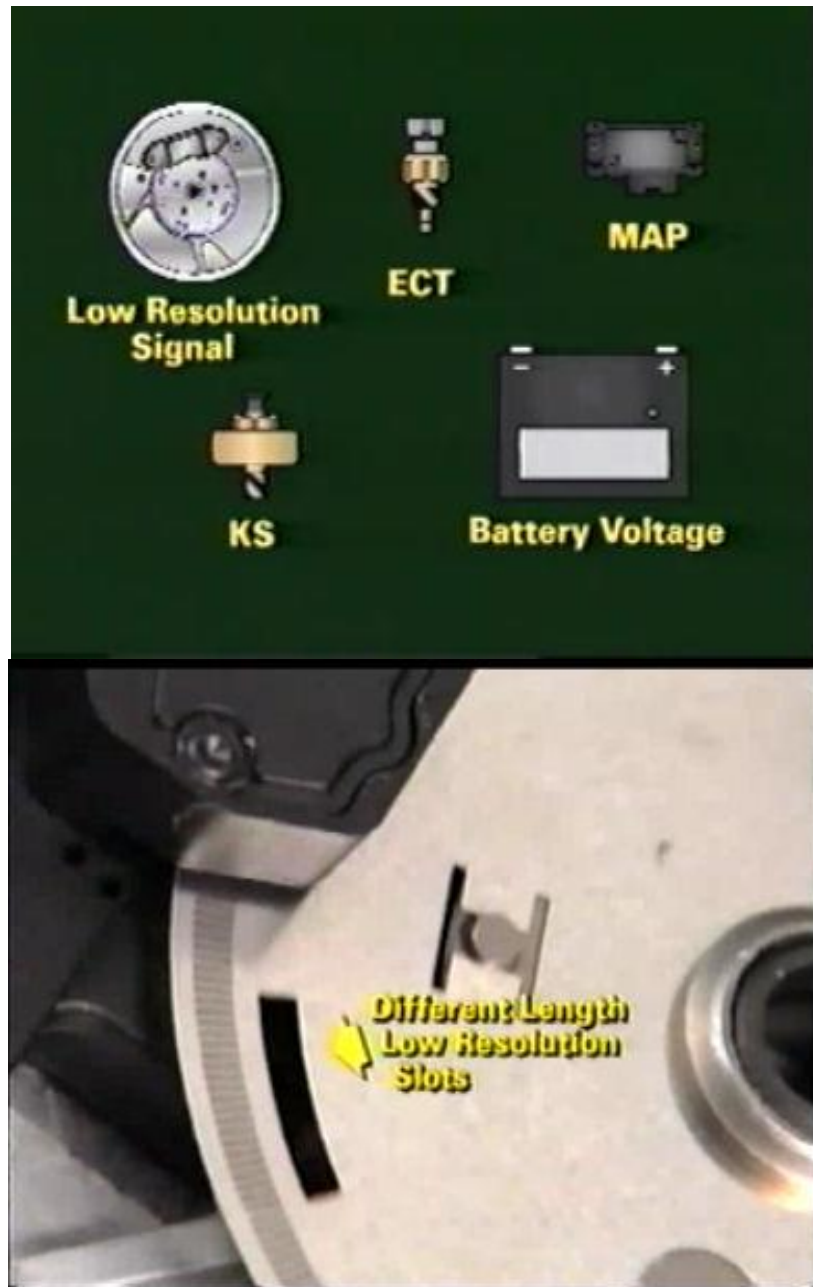


The inner ring of the disc has 8 slots, each of which have a leading edge 45 cam degrees away from the next slot. These leading edges mark TDC for each cylinder.



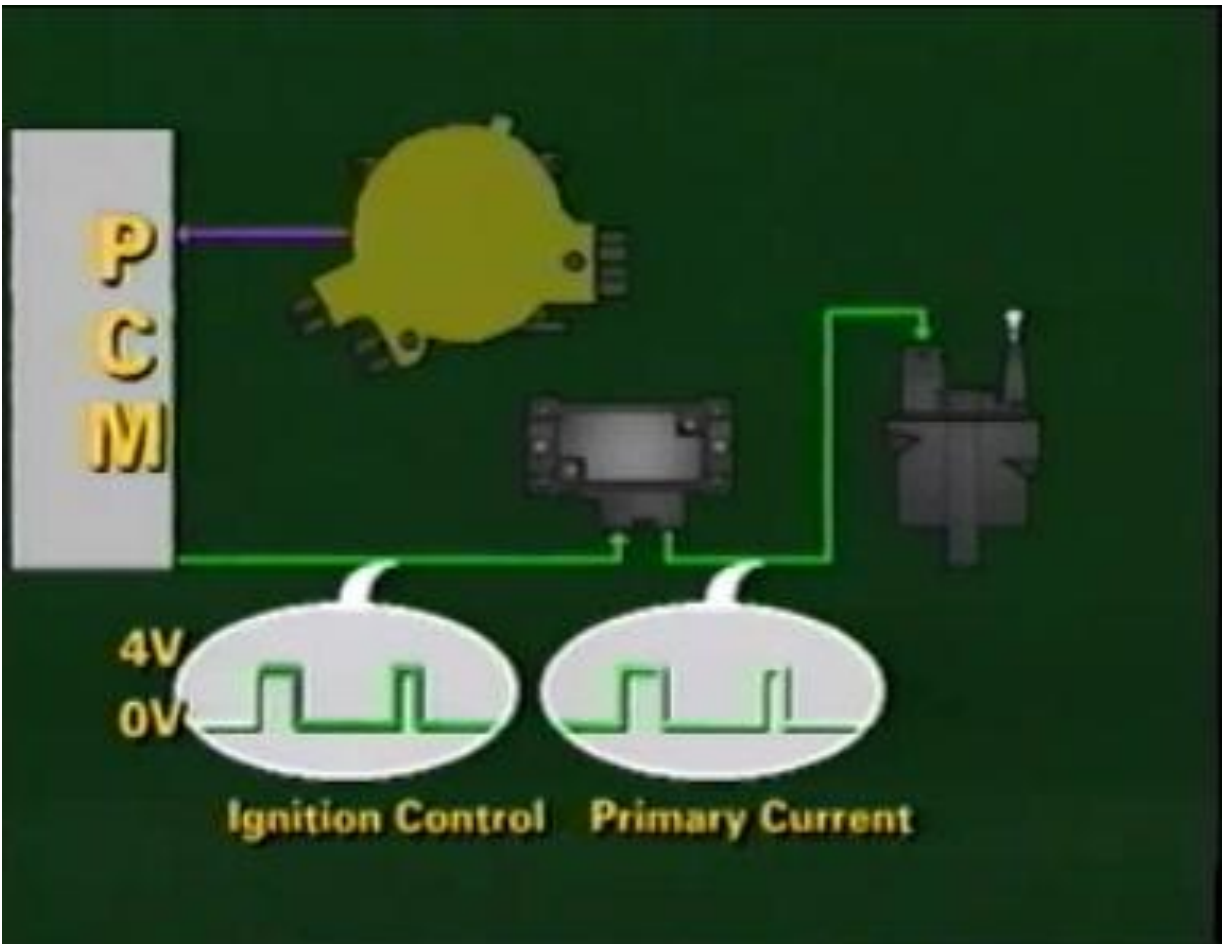
These leading edges mark TDC for each cylinder. The slots are different sizes, enabling the PCM to identify specific cylinders.

The PCM does this by counting the high resolution signal as the low resolution slots pass the optical sensor. Different length low resolution slots allow the PCM to identify the different cylinders.



Using inputs from the low resolution signal including ECT, MAP, KSs and battery voltage the PCM calculated coil dwell and spark advance.

From a low resolution signal going high the PCM starts counting high resolution signals to the beginning of coil dwell and spark advance.



The PCM then generates an electronic spark timing, for the ignition control output, for the ignition control driver module. The ignition control driver module turns on the primary current to the ignition coil when the ignition control voltage goes approximately 4Volts. When the PCM counts enough high resolution edges to reach the calculated spark advance it terminates the ignition control signal, and the ignition module turns off primary voltage to the coil.

When the ignition control signal stops the primary current in the coil switches off inducing high voltage in the coil's secondary winding. The high voltage runs from the secondary of the coil to the rotor and is distributed to the correct spark plug.

The ICM module doesn't provide a backup mode (I.E. Min function or minimim function).



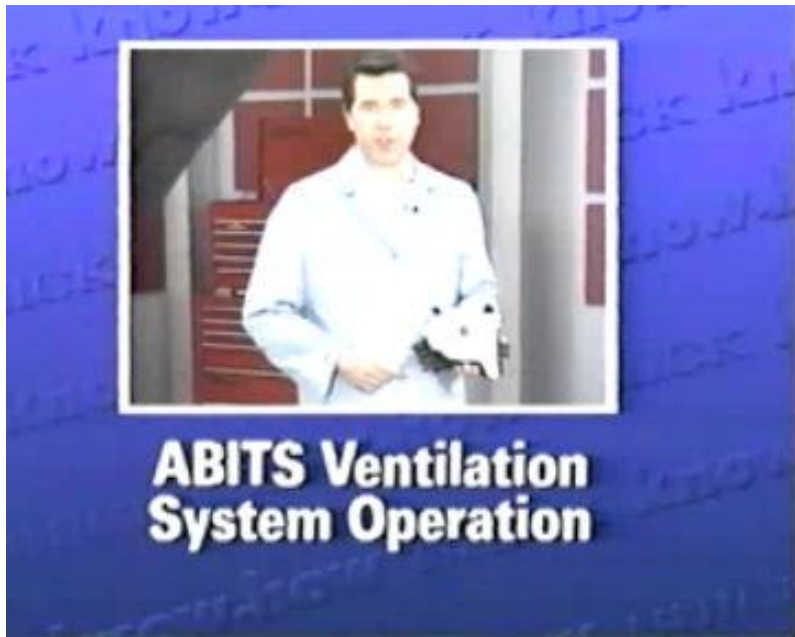
**Ignition Coil Driver
Has Built In Current
Limiting Feature**



While the Ignition control module is smaller than an HE distributor module, it is still important when installing a new module to **coat both the heat sink and module base with thermal conductive grease**. This helps the module dissipate heat. Without the grease the module can over heat and that can lead to failure.



The ABITS distributor cap introduces secondary towers on the distributor cap conductive traces connect to the spark plug by non radial paths using conductive ink. The ink traces are then encapsulated with epoxy. This routing allows 4 plugs wires on each side without causing crossfire problems.



Proper ventilation is necessary to prevent moisture buildup corrosive gasses formed by the high voltage arc.



When ABITS was first introduced in 1992 it had ventilation holes drilled across the top.

Ozone is heavier than air so it settles on the bottom of the distributor. And when it forms nitrogen and moisture in the air it forms Nitric Acid. This can create conductive paths, and cause misfires and cross fires.



The corrosive problem was solved when the vent holes were moved to the bottom of the ABITS.



The ventilation is further improved on the RoadMaster design with a forced ventilation system has a fresh air system and a vacuum line.



The fresh air inlet runs from the distributor to the air inlet duct located just after the MAF sensor. By plugging into the line just after the MAF the clean filtered air is accounted for by the PCM and doesn't affect fuel mixture.

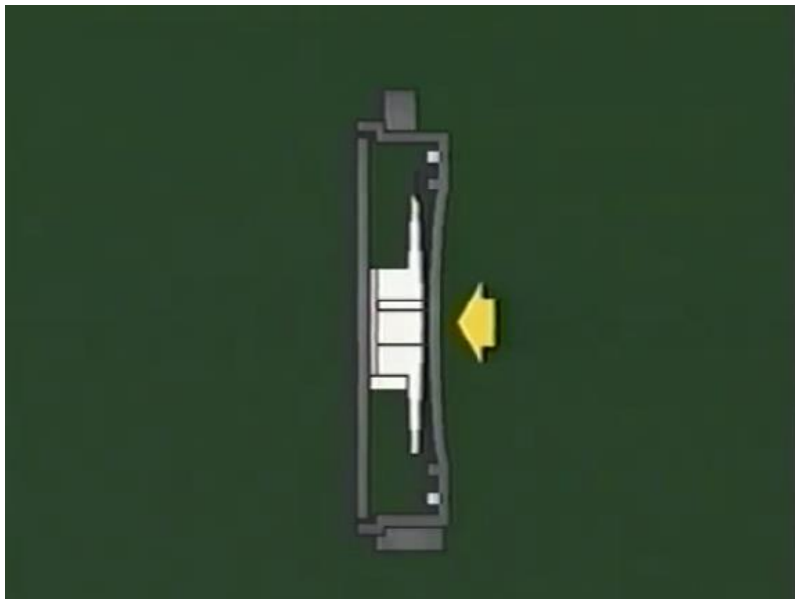
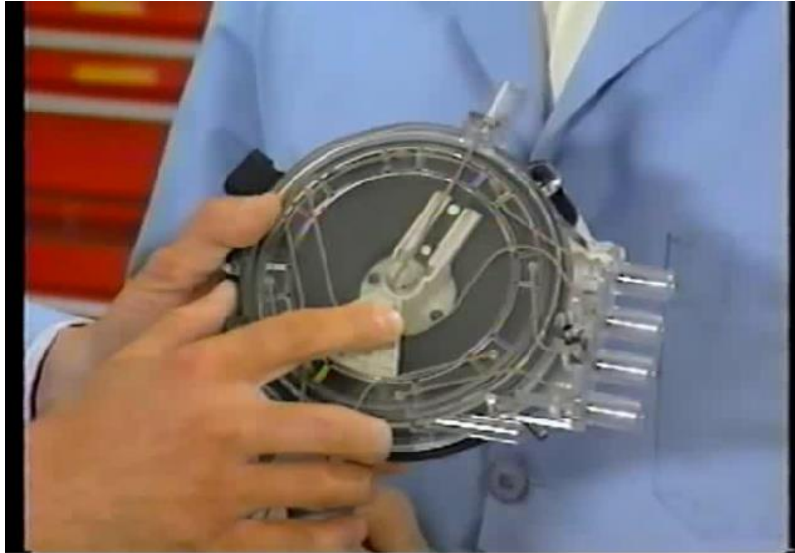


Just up from the orifice tube is a check valve. The blue side of the orifice tube faces the intake manifold. Just up from the orifice tube is a check valve. The check valve does not allow air to return to the distributor.



An inoperative ventilation line is a cause for misfire. If the fresh air inlet line becomes pinched or plugged for any reason, it will draw vacuum on the distributor. As the vacuum is created inside the distributor, the dielectric properties inside will go down, and as that happens, spark that would normally travel from the center of the distributor

cap find it much easier to go to the fastening screws on the rotor, which is a goes to GND, causing a misfire..



Other problems may result if the air inlet line is plugged. In some cases engine vacuum is strong enough to collapse the cap until it contacts the rotor. There's enough vacuum to actually bend the distributor cap!

Any tips on checking the ventilation system? Yes, but first let's start the car.

1. Unplug the air inlet of the distributor, and put your finger over it checking for a slight vacuum (Don't forget to plug the hole in the snorkel at this time).



Checking with a vacuum gauge (Mity-Vac or equivalent), Remove the air inlet from the snorkle and hook a vacuum gauge up tho the inlet line. As the engine runs the vacuum gauge should drop to very near intake manifold vacuum..

Check for pinched vacuum hoses and also check for:

- Pinched or damaged hoses
- Pinched or plugged orifice
- Plugged check valve
- Poor distribution cap seal



The harness is serviced as an assembly **ONLY**.

Upper ventilation is essential to good ABITS operation.

Fouled Plug vent systems may lead to:

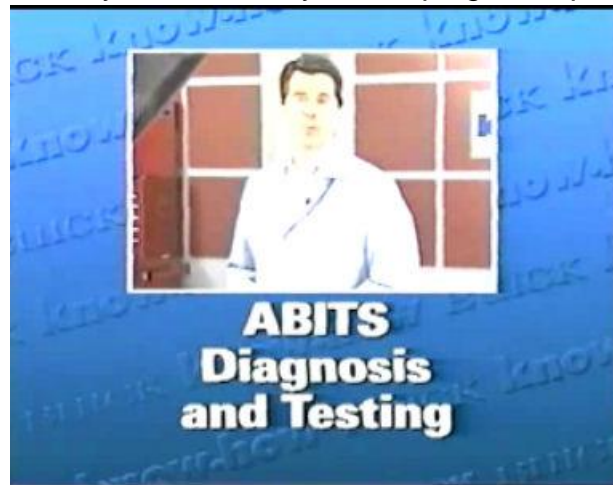
- Fouled plugs & Misfires

A misfire may be caused by a ventilation system problem.

The causes of NO spark & Intermittent complaints require additional diagnosis.



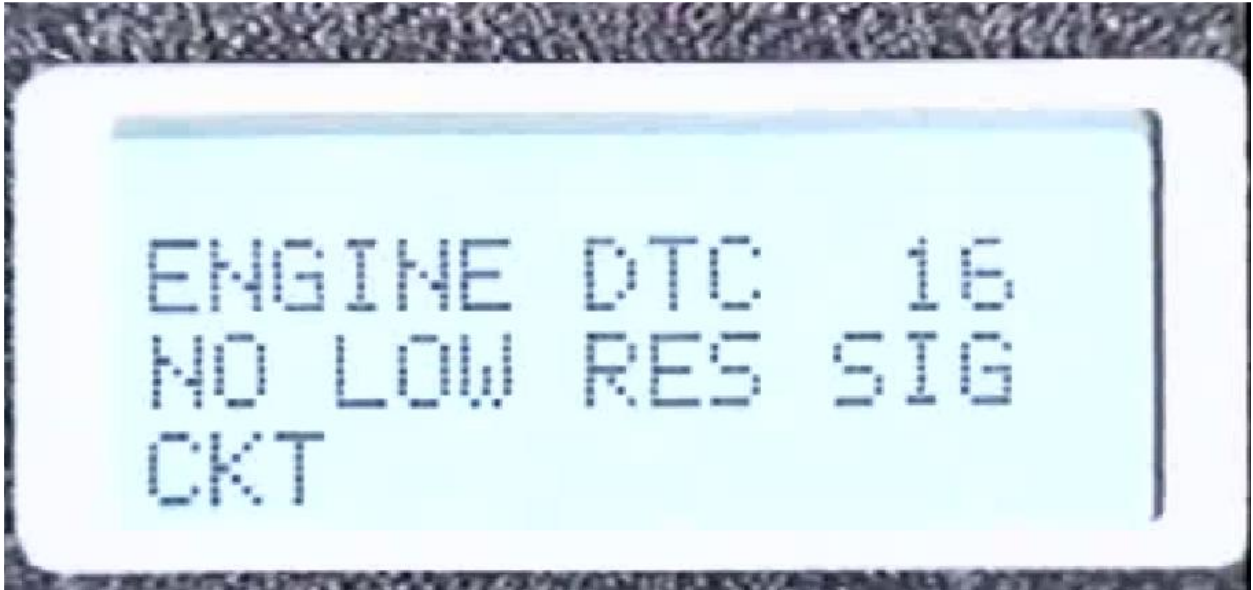
A Misfire may be caused by fouled plugs and plug wires



A Misfire may be caused by ventilation system problems. The causes of **NO** spark or intermittent complaints require additional diagnosis, Begin your system check with the ignition system check *know how technician's manual*.

The first step of this process is to check for trouble codes using the **TECH-1**. In addition to code 42, found on most ignition systems, **ABITS** has 16, 36 and 41 to aid in diagnostics of problems.

Code 16 is Set



16= Low Resolution

- If 720 high resolution signals are seen by the PCM without a low resolution signal)
- (If the camshaft turns 1 complete revolution & the ABITS doesn't provide high resolution signal for piston location, a **code 16 is set.**)
- The optical sensor diode for the high resolution signal must operate before a code 16 is set.
- A code 16 can be set by: an open, shorted, or grounded low resolution wire (Open Terminal), failed optical sensor, or a failed PCM.

- **ENGINE WITH CODE 16 WILL NOT START**



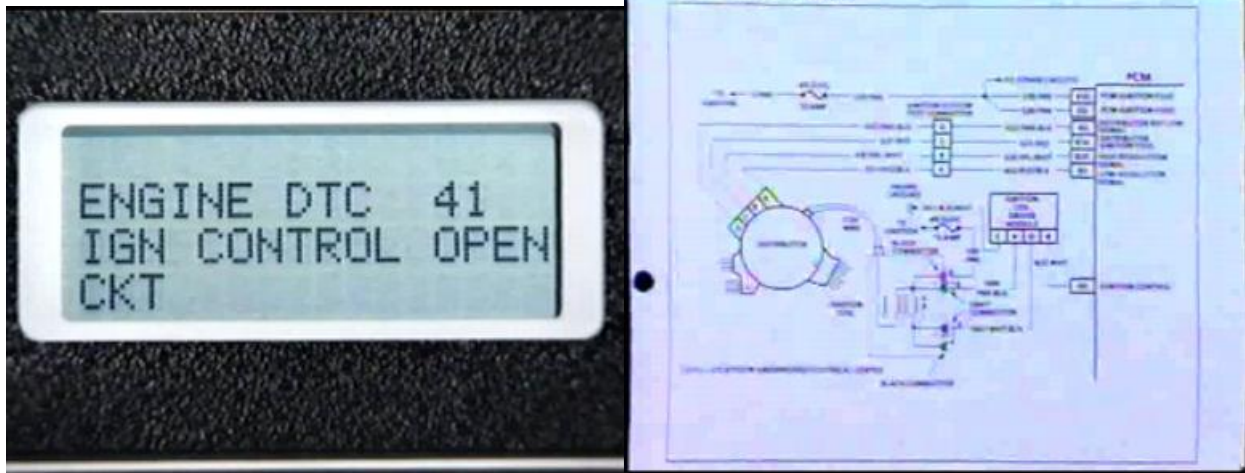
code 36 is set if

- If PCM doesn't get Hi-resolution signal for 9 consecutive low resolution signals.
 1. An open or shorted or grounded high resolution wire or open terminal.
 2. A failed optical sensor diode.
 3. Failed PCM

A code doesn't set when both optical diodes fail, but then the engine won't start either.





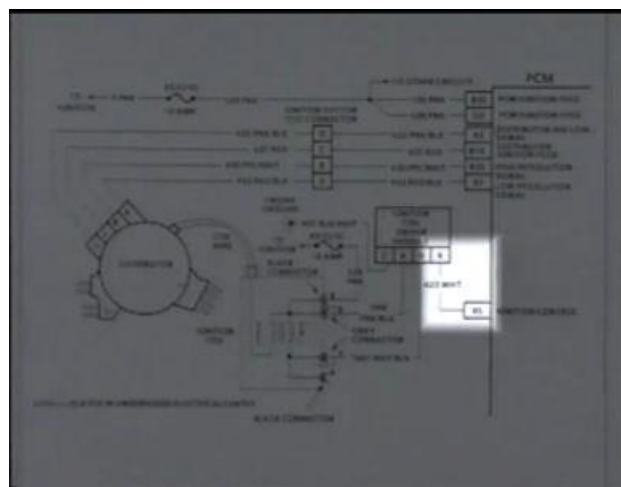


Code 41 sets

- In If an open exists in the ignition control circuit.
 - The PCM looks for voltages above 4.5 volts on the ignition control line.
- When engine speed is below 1,500 RPM, a code 41 sets if there is an open in the ignition control line (or if the ignition control line is shorted to voltage that is higher than 4.5 Volts)

Code 41 also sets if there is also an open terminal in the ignition control line.

- Code 41 sets if there is an open terminal.
 - Failed **PCM** control driver module
- Ignition system check in tech manual (Shown above)
 - Failed ICM control driver module
 - Failed **PCM** (If voltage is less than 4 volts)





A Code 42 is set

If the Ignition control line is grounded The PCM considers the control line grounded. (Less than if voltage is less than 4 volts) A code 42 is most likely caused by a grounded ignition control wire. But it could also be cause by a failed ignition driver module, or a failed PCM.

Code 41 & 42 are stored in Memory. If either are detcted the engine won't start. The PCM disbles the fuel injectors and don't turn on the MIL.

The ignition system checking chart becomes Invaluable.

It provides an organized approach to engine diagnosis

Check for voltage with an ST-125 (25K to fire this is an excellent test when checking for a misfire. The ignition system may be providing enough voltage to run the engine but not enough to fire the spark plugs under heavy load). Resulting in a misfire. Since the ST-125 requires 25,000 volts to fire it can be used to see if the ignition system is producing enough voltage to fire. If the system isn't producing adequate voltage check the voltage in the primary ignition circuit

Disconnect the ignition coil driver module, and with the ignition **ON** check the voltage from terminals **A** and **D** to **Ground**

If the coil is receiving adequate voltage both terminals should be receiving (10 volts or more)

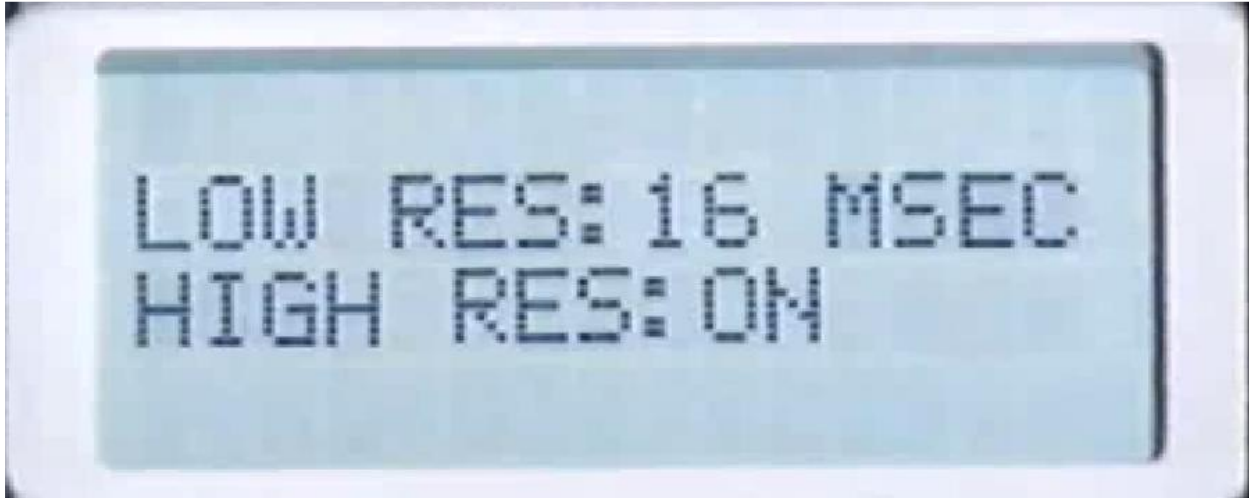


Next connect the probes to Terminal '**B**' (The ignition control line) and **GND**. And set the DVOM to the A/C scale. Crank the engine, there should be between 1 and 4 volts.



This check is the first in determining if the PCM is providing a signal to the ignition coil driver module. If the PCM isn't providing a signal to the ignition coil driver module, the problem exists between the distributor and the PCM.

If there wasn't 1-4 Volts the ignition system check examines more closely where the signal from the PCM is breaking down.



Using the Tech-1, see if there is a low resolution signal. If there isn't, turn the ignition off and disconnect the distributor electrical connector.

- Turn the ignition Back on
- Probe terminal **C** with a test light (as shown)



The light should illuminate, and if it doesn't there isn't any power going to the optical sensor.

The remaining test checks the various circuits individually to see if the proper signals are being sent and received from both the distributor and PCM.

If the light illuminated in the last test check for continuity between distributor connector **D** and **Ground**, the circuit should have continuity.

Then using a DVOM on the DC scale



Measure voltage at distributor connector "A" (Checking the low resolution signal)

Voltage should be about 5 Volts.



Repeat the measurement at distributor connector "B"

(Checking the high resolution signal). Voltage should also be about 5 volts.



In this way the ignition system check chart thoroughly tests each component of the ignition system. Many ignition system failures are intermittent in their early stages.

These are especially difficult to find. The best approach is to try and reproduce the conditions under which the problem occurs. Usually this means vibration, thermal stress. Raising engine coolant temperature or operating the engine in a specific RPM may bring out the failure.

Misfires are intermittent and appear only under load



Misfires are also due to a spark plug or secondary wire that is leaking voltage. If the engine misfires only under a load, mist the wires with a vegetable sprayer. Spark escaping from the secondary circuit can usually be seen under these conditions.

Created by Steve Reed (AKA: juniorwatson) on the ISSF & NAISSO Boards,
03/23/2011

I can be reached thru PMs on ISSF or emailed directly at:
juniorwatson@embarqmail.com

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