City of Oxnard Fleet Services

S.I.C.

Tech Tips!

"By The Techs, For The Techs"

Volume 1
Issue 1

May 2011

Top 10 Domestic Diagnostic Trouble Codes

P0300 – Random Multiple Cylinder Misfire (Ford, GM, & Chrysler)

Potential Causes; *Vacuum Leaks, EGR Leaking, Low Fuel Pressure / Volume, Restricted Fuel Sys, Spark Plugs, Incorrect Valve Lash, Weak Valve Springs.*

P0171 & P0174 – Bank 1 & Bank 2 System Too Lean (Ford)

Potential Causes; *Contaminated MAF, Vacuum Leak, Low Fuel Pressure / Volume*

P0401 – EGR System Insufficient Flow (Ford)

Potential Causes; *Faulty DPFE, Restricted EGR Valve, Plugged EGR Ports.*

P1391 – Intermittent Loss of Cam or Crank Signal (Chrysler)

Potential Causes; *Faulty CMP or CKP, Faulty Circuitry, PCM*

P1494 – Evap Pump (Chrysler)

Potential Causes; *Faulty LDP, Faulty LDP Switch Circuit, LDP Vacuum Supply Leak or Obstruction.*

P1133, P1139, & P1153 – Insufficient O2S Switching (GM)

Potential Causes; *Faulty O2S, Faulty Circuitry, PCM*

P1345 – Cam / Crank Sensor Correlation Fault (GM)

Potential Causes; *CMP & CKP out of Sync, Faulty Circuitry*

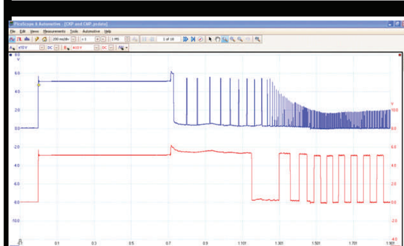
Eric Irwin

**To read the original article visit www.underhoodsevices.com*

**Orignial article written by Larry Carley, Technical editor of Underhood Services*

Tools & Equipment

Pico Scope 4223; 2 Channel Automotive Oscilloscope



Our shop recently purchased a DSO (digital storage oscilloscope) from Autonerdz, The North American Pico authority. With the power of the Pico Scope at our finger tips, our shop now has the capability to move into the next level of advanced diagnostics. With an 80Mhz ADC (analog to digital converter), 32M sample point buffer, and 12 bit resolution, the Pico Scope is capable of capturing 20 million samples on each channel; making it the most powerful scope for automotive use. Visit www.autonerdz.com and www.picoauto.com today to find out more. We also have some hands on training material available upon request for those who want to learn more.

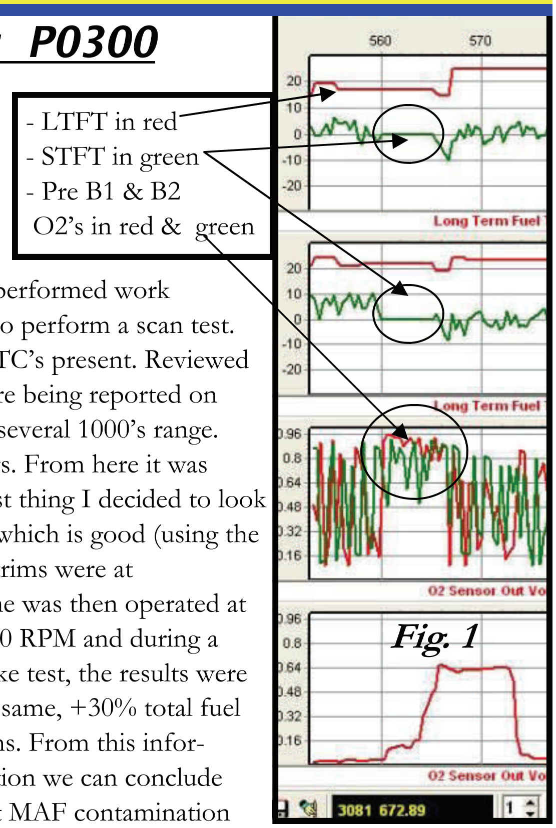
Eric Irwin

Contributions Needed!

- Tech Tips is a new quarterly publication
- Our goal is to provide up to date news and technical insight as related to vehicle repair.
- We will happily accept articles from you to be presented in this newsletter
- Help us keep the newsletter alive! Your participation is needed!

In This Issue

Case Study: 2002 Chevy Express P0300

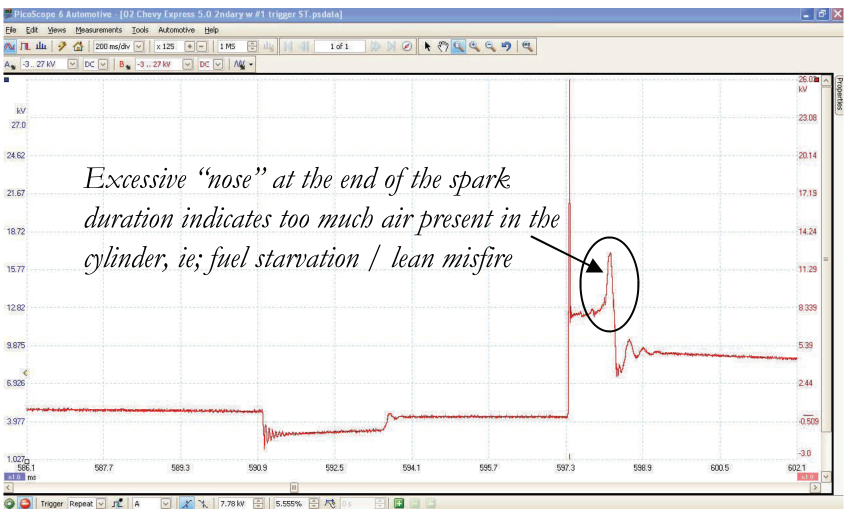


Vehicle; 2002 Chevy Express 5.0L

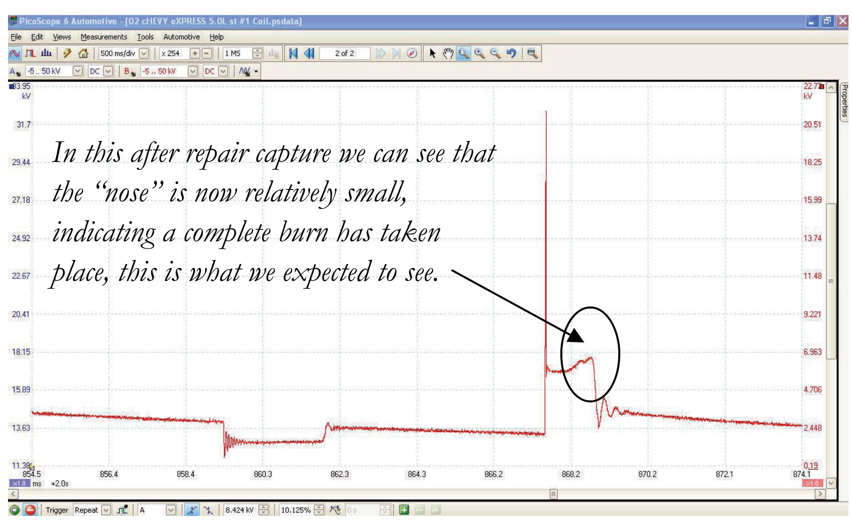
Symptoms; P0300, Class A Misfire (flashing MIL), runs rough. This vehicle came in for an intake manifold coolant leak, the lower manifold was resealed. Upon startup the vehicle exhibited a very rough idle, the engine light came on and began flashing.

Preliminary Inspection; Initial inspection revealed that all previously performed work had been performed correctly. Visual inspection was good. So the next step was to perform a scan test.

Test Results / Repair; DTC P0300 set as a current DTC. No other DTC's present. Reviewed freeze frame data and determined DTC set shortly after cold startup. Misfires were being reported on cylinders 7 and 8 during idle, the misfire history counters for 7 and 8 were in the several 1000's range. As the vehicle was brought off idle the misfire would scatter to the other cylinders. From here it was necessary to determine if the air and fuel delivery systems were a suspect. The first thing I decided to look at was the air density system (MAF). The MAF air flow reported 6.2gm/s at idle which is good (using the 1gm/s per liter analogy). Next , a review of fuel trims was performed. Total fuel trims were at approximately +30% (anything above 10% is considered out of range). The engine was then operated at 2500 RPM and during a brake test, the results were the same, +30% total fuel trims. From this information we can conclude that MAF contamination and vacuum leaks are not likely suspects (a propane enrichment leak test was still performed). Next a fuel pressure gauge was installed. Fuel pressure was at 62 psi (spec 60-66). The vehicle was then taken on a test drive to quickly determine if fuel volume was adequate. This was done by using the EASE scanner's graphing capabilities. Looking at ***Fig. 1*** we can see the relationship between fuel trims and oxygen sensors. To test for fuel volume the vehicle was operated under WOT conditions which puts the PCM into power enrichment mode (open loop). When a vehicle is in OL it defaults to run rich, so if we have adequate fuel volume the pre oxygen sensors should read rich (high O2 voltage). In ***Fig. 1*** the STFT's drop to 0 when OL occurs, when this happened the oxygen sensors responded rich indicating that fuel volume was adequate.



Next I decided to utilize the power of the Pico Scope to examine the secondary ignition waveforms. On this distributor ignition system the secondary ignition pickup lead was placed on the coil to cap HT lead which parades all of the ignition events, channel b was used as a trigger for the #1 cylinder in order to identify the cylinders. In ***Fig. 2*** we can see that cylinder #7 is running lean. The high nose at the end of the spark duration indicates too much air in the cylinder. This characteristic was present at idle on #7 and #8 and would show up at other cylinders during snap throttle testing. At this point restricted / dirty fuel injectors are the most likely culprit. All Data reveals that this vehicle has an applicable Campaign (999-9999) for a Sequential Central Port Injection replacement unit. The Campaign is covered under warranty for 10 years / 200,000mi. After the dealer performed the Campaign an after repair capture was taken ***(Fig. 3).***

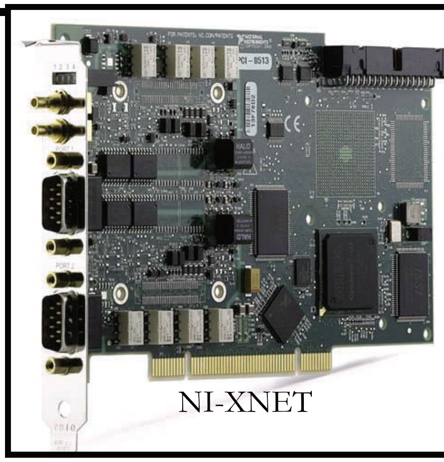


Eric Irwin

Industry News

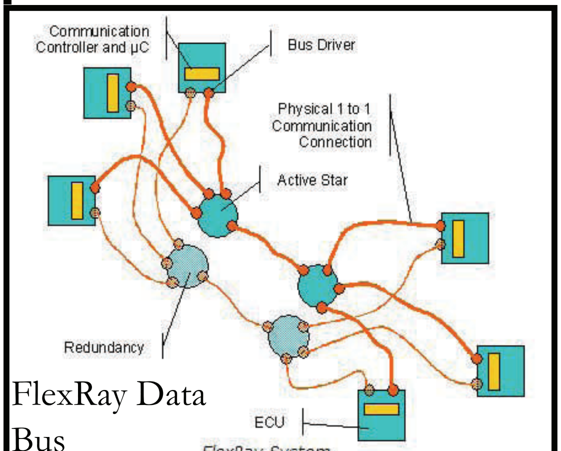
FlexRay: The Future of Automotive Network Communication Protocols

With the implementation of advanced automotive control systems there has been an increasing demand for a network communications system that is faster and more capable than CAN. Welcome to FlexRay, the future of networking communications for the automotive industry. FlexRay has been developed by the FlexRay Consortium to provide the high data transmission rates required by complex automotive control systems. The FlexRay Consortium was founded in 2000 by BMW, DaimlerChrysler, Motorola, and Phillips Semiconductor. Robert Bosch GmbH, GM, and Ford Motor Company later joined the FlexRay Consortium.



NI-XNET

Current Powertrain Control Networks are required to use the CAN communication protocol. CAN was designed to achieve up to a 1mbps data transmission rate, it is a serial data transmission protocol designed to transmit short messages in real time embedded systems. Unique identifiers are assigned to each message which determines the priority of that message. So how does FlexRay compare?



FlexRay Data Bus

FlexRay is capable of transmitting short messages at 5mbps and long messages at 10mbps, and is potentially capable of operating 20*x* faster than CAN. It is a fully digital data network system that has deterministic data transmission (guarantees message latency), flexible allocation of bandwidth to individual nodes, fault tolerant and time-triggered service implemented in hardware, fast error detection and signaling, error containment, and support for pre-existing data bus systems.

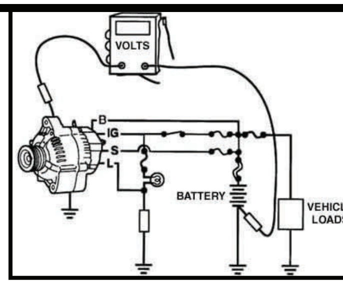
Prototype implementation chips for FlexRay were developed in 2004 for FlexRay Consortium members. Since then National Instruments has developed the NI-XNET Can and FlexRay embedded network interface. Automotive design engineers can now quickly prototype and test next generation FlexRay and CAN networks (2009). The NI-XNET allows for dual bus operation between FlexRay and CAN protocols, allowing for both systems to be implemented without rewriting code.

In 2010 NXP Semiconductors shipped it's 2 millionth FlexRay transceiver. BMW has been using the FlexRay transceiver since 2006 for the X5's active suspension. BMW's 2008 7 series uses up to 11 FlexRay transceiver nodes. FlexRay provides faster data transmission, higher bandwidths, reliability and real time capability. The point is that technicians in the automotive industry can expect to see the broad implementation of the FlexRay protocol in the very near future. ***Eric Irwin***

Resources;

1. http://johndayautomotivelectronics.com/?p=721 15, 2009 by John Day
2. **http://johndayautomotivelectronics.com/?p=3260 June 24, 2010 by John Day**
3.. **http://www.comms.engg.sussex.ac.uk/research/canflex.php** 2000 **-2011 University of Sussex Communications Research Group**
4. . Automotive Design & Production, Sept, 2002 by Lawrence S. Gould

Auto 101: Voltage Drop Testing Charging Systems



To check the alternator connections on the positive side for excessive resistance:

1. Connect the meter positive lead to the alternator output stud (B+ terminal). Connect the meter negative lead to the positive (+) battery post.

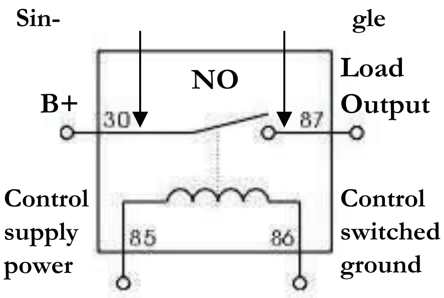
2. With the engine running at 1,800 to 2,000 rpm with all lights and accessories on, check the voltage drop reading. It should be 0.5 volts or less. If higher, the connections between the alternator output stud and battery need to be cleaned. Also, look for loose connections or undersized cables.

To check the alternator connections on the negative side for excessive resistance:

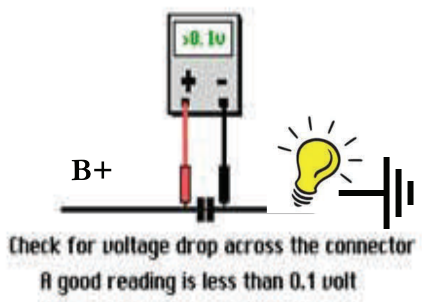
1. Connect meter negative lead to alternator case.. Connect meter positive lead to battery negative (-) post.

2. With engine running at 1,800 to 2,000 rpm with all lights and accessories on, check the voltage drop reading. On the negative side, it should be 0.2 volts or less. If excessive, the connections need cleaning or the negative cable needs to be replaced. Some alternators are mounted in rubber bushings and have a separate ground strap. If so equipped, be sure to check the voltage drop across this strap, too. ***Ray Grooms***

Common Relay



Voltage Drop Testing



Newsletter Editors
Eric Irwin
Ray Grooms
Sal Guerro

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Tech Tips!

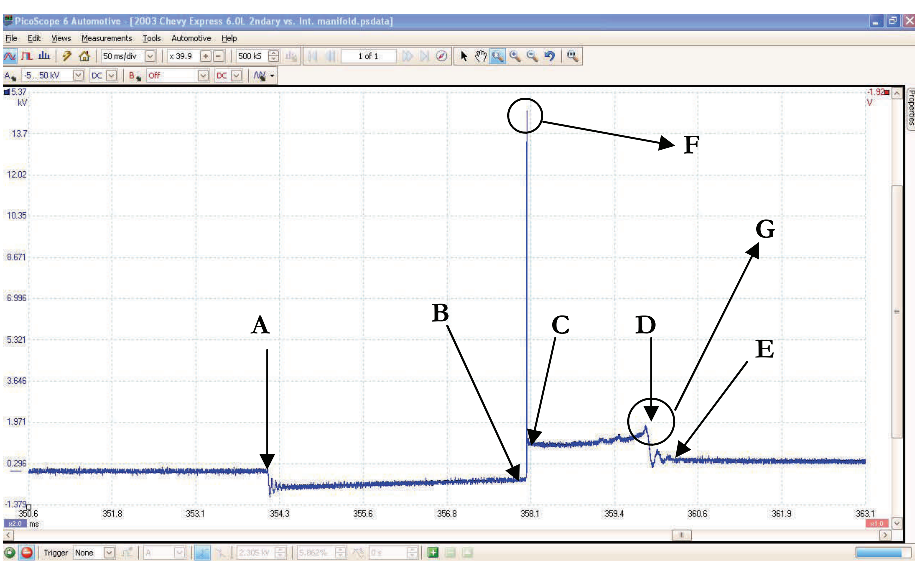
<u>**Using Ford Baro PID for MAF Contamination Diagnostics:**</u> Many Ford MAF systems use the Baro PID to assist the technician in contaminated MAF diagnostics, it is not used for fuel calculations. The Baro PID is a inferred parameter (there is no Baro sensor!) When viewing the Baro PID it should report +/- 6hz. from sea level values (approx. 159hz. in Oxnard). If the Baro reads out of this range the MAF may be contaminated. Before replacing the MAF, clean it then update the Baro PID by driving the vehicle under 3 PT to WOT conditions and see if there is an improvement. Be sure to check fuel trims too! ***- Eric***

<u>**Testing Relays:**</u> Relays are a common component used in the industry. Testing is pretty straight forward, you just need to know some basics. Most of the relays we deal with are SPST or SPDT (single pole <u>single</u>/<u>double</u> throw). The relay can be a NC or NO relay (normally <u>closed</u>/<u>open</u>). In all cases relays will have a control side and a switched load side. The control side consists of pins 85 and 86, 1 of these will have a supply voltage or ground while the other side will have the opposite (ie; switched ground or power depending upon configuration). When the control side of the relay has a ground and power, the load side of the relay will function (NO relay becomes closed). The load side consists of pins 30 and 87 (a 5-pin relay will also have 87a). The most common relay configuration is pictured to the left. - ***Sal***

<u>**Voltage Drop Testing:**</u> A voltage drop test is the only effective way to find excessive resistance in high amperage circuits. To do a voltage drop test, you create a load in the circuit that's being tested. Then you use a digital volt meter (DVM) to measure the voltage drop across the live connection while it's under load. If a connection is good, you should see little or no voltage drop. For most connections less than .4v is good, but less than .1v is ideal. High readings indicate high resistance and will need to be cleaned / repaired. The picture to the left shows a basic voltage drop test setup. - ***Ray***

Scope It!: Secondary Ignition Waveforms

<u>Scope Settings:</u> 1ms per division will give you a display of 1 ignition event (use the repeat trigger to stabilize the image and to continuously display that event). Select 1 of the secondary pickup probes, set the probe range to -3kv - 27Kv. The Pico Scope is so powerful that you can set the time base to much longer and use the windowed zoom tool to analyze the capture (This capture was taken at 1s/div then zoomed in for clarity).



<u>Key Points of the conventional 2ndary waveform:</u> (capture to the left is at idle and measurements below were made at idle). Points A to B represent the "dwell" or saturation time, 3ms is common. Points C to D are the Spark Duration (also known as Burn Time), 1.75ms is common. The Kv level of the spark duration is known as the Spark Line, which is 1.8Kv in this capture (1.5 - 3Kv is common). The Spark Line represents the amount of Kv required to maintain spark. Point E are the Coil Oscillations, traditionally there should be at least 4 "humps" which indicate a good coil, but modern electronics are so advanced that coil oscillations can be eliminated. Circle F is the Plug Kv also known as the Firing Line, this is the amount of electrical energy taken to jump the plug gap. Circle G is the Spark Duration Nose, a small nose indicates a complete burn has occurred. When capturing secondary ignition waveforms it is a good idea to perform testing during a snap throttle condition, this will load the ignition system and is a fairly accurate way of assessing how the system will perform on the road. (The case study on page 2 shows a lean cylinder condition captured during a snap throttle). ***Eric Irwin***