



1



2



## *Your Instructor For This Webinar*

### "G" Jerry Truglia

- National Trainer, ASE World Class, Master Auto, Truck, School Bus, L1, L3, CNG and...
- **ATTP Master Instructor, New York State, CT and New Jersey**
- STS (Service Technician Society) 2003 President
- **TST (Technicians Service Training) Founder and President**
- Author / Co Author/ Technical adviser on 25 plus books including OBD II and Mode 6, and Understanding and Diagnosing Hybrid Vehicles
- **Published articles for multiple newsletters, and magazines**
- Picked as one of the Top Instructors in the country by EPA & SAE
- **Numerous Radio, TV, Internet, and SAE Video appearances**
- PTEN, MotorAge and TST Webcast Instructor
- **Motor Magazine Top 20 award winner**
- Provider of OBD II Training for 14 states, Ontario Canada and the US EPA
- **Guest speaker at SAE Congress, IM Solutions and Clean Air Conference**

3



## *Your Instructor For This Webinar*

### Joshua Weaver

- Associate Degree in Applied Science for Automotive Technology
- **Collage was affiliated with General Motors and Chrysler, and I interned for Ford allowing me to learn all 3 domestic Brands**
- Worked for A Kia Dealer ship for 10 years and achieved A.S.E and Kia Master Tech Certification
- **Lead tech at dealership allowing me to see the most difficult customer concerns**
- Pennsylvania State inspection Emissions tech with waiver license
- **Holds A.S.E. L1 Advance Engine Performance**
- Holds A.S.E. L3 Light Duty Hybrid Specialist
- E.P.A. 609
- Manager of A 6 bay repair shop which also had a 6 bay body shop, allowing me to see a wide variety of electrical, drivability issue and module programing

4

## What Will Be Covered:

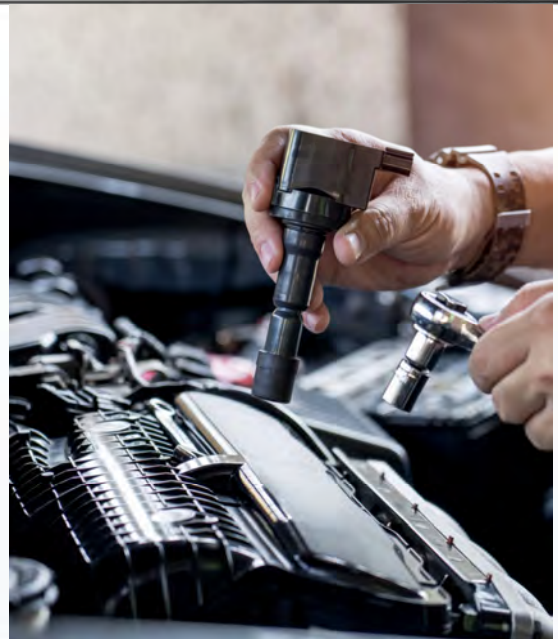
- **C.O.P. (Coil-On-Plug) ignition systems**
- Testing techniques with DVOM
- **Testing techniques with DSO**
- Case studies



5

## Coil - On - Plug (C.O.P.)

**Each cylinder gets its very own ignition system**



6

**Most common cause  
of C.O.P. coil failure**



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7

7

## **Diagnostics**

- **When it comes to diagnostics the most common diagnostic approach is to swap a COP unit with one that was still working. And there's nothing wrong with this approach.**
- **Many C.O.P. units are hidden under plenums and parts, and a few simple tests at the C.O.P. connector will usually save time and help verify the issue before bolting it all back together.**
- **Identifying the type of C.O.P. system being used is the first step in diagnostics and establishing a quick test routine for each type**

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8



## 3 Types Of C.O.P. Ignition Coils/Systems

Two wire connector

Three wire connector

Four wire connector

9

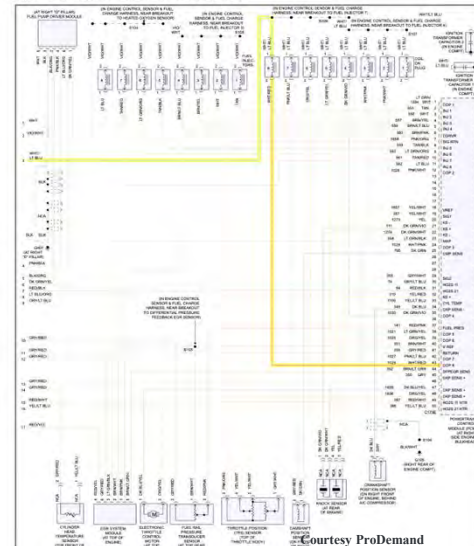
## 2 - Wire C.O.P.



YMMS: 2005 Ford Explorer  
Engine: 4.6L Eng  
VIN:

License: Nov 23, 2021  
Odometer:

Fig 4: 4.6L, Engine Performance Circuit (4 of 4)



Courtesy ProDemand

10

## No Scope?

**Check for power (12V) at the two-wire C.O.P. connector with it disconnected. On some OEMs, you may have to crank the engine to see 12V. If there isn't 12V, refer to a wiring diagram.**

**If you have 12V, test the switching signal using your test light. Connect the light to the B+ and, with the coil disconnected, insert the tip of the tool on the ground pin of the connector. You should see the light flash or at least change state when you crank the engine.**

11

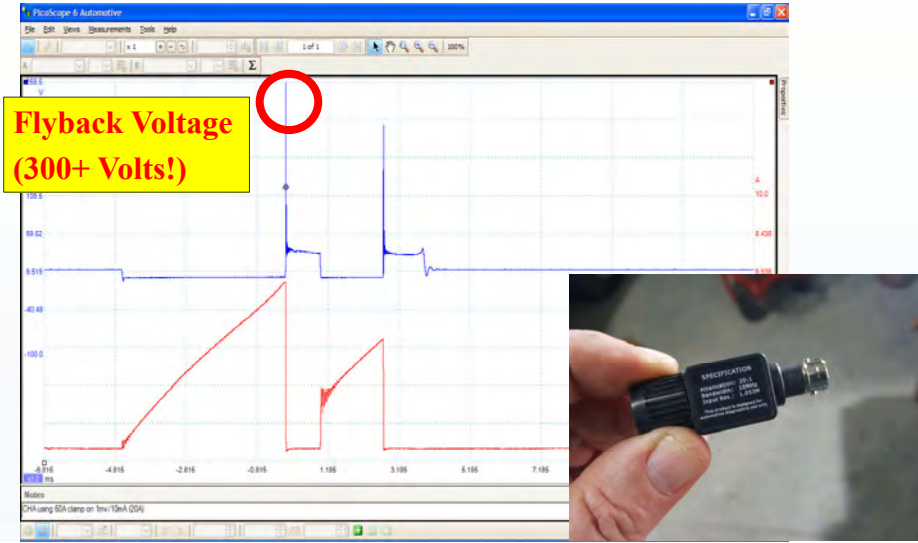
## Scope Testing 2 - Wire C.O.P. Ignitions

**Connect Channel A to the coil ground circuit.**

**Connect the low amp clamp to Channel B, select the 20 A scale and zero the clamp before attaching to the coil supply or ground circuit.**

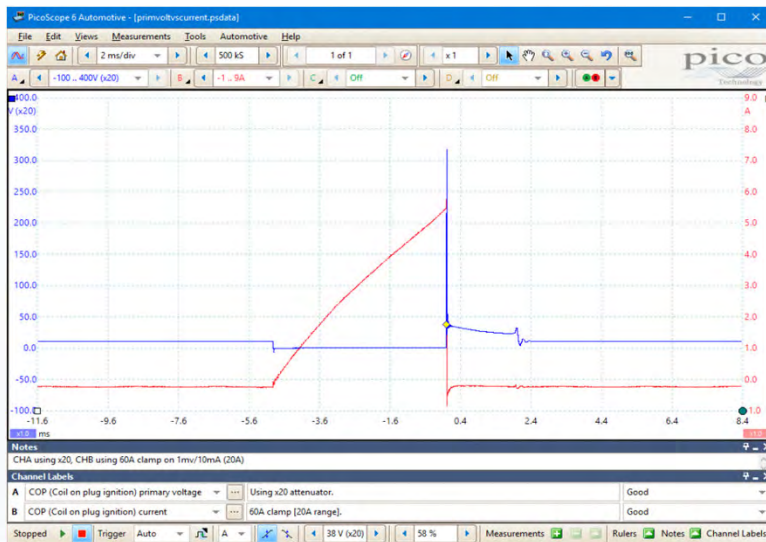
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## Don't Let Flyback Voltage Damage Your DSO!



13

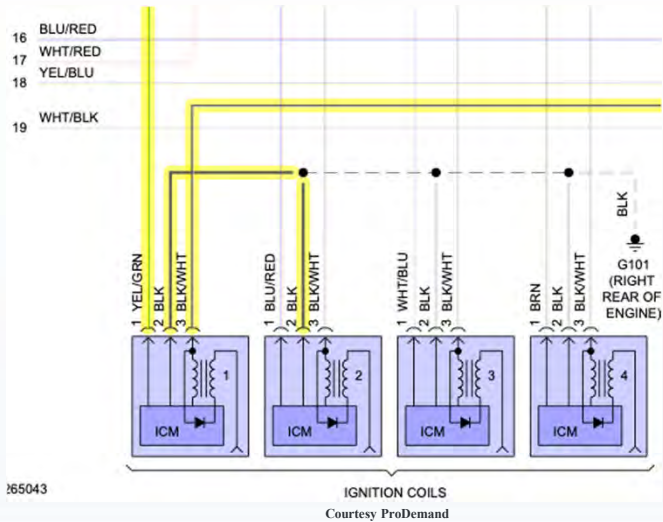
## C.O.P. Voltage & Current



Courtesy Pico Technology

14

### 3 - Wire C.O.P.



15

### Testing Without A Scope

If there is no spark, use the voltage drop testing method and a substitute load to verify a clean power supply and clean ground path.

To test the triggering circuit, reconnect the three-wire coil connector to the C.O.P. . Set the DVOM to HZ and carefully back probe the trigger wire on the C.O.P. connector. Connect the red DVOM lead to it and connect the black lead of the DVOM to battery negative then start the engine. You should see a fluctuating value.

16

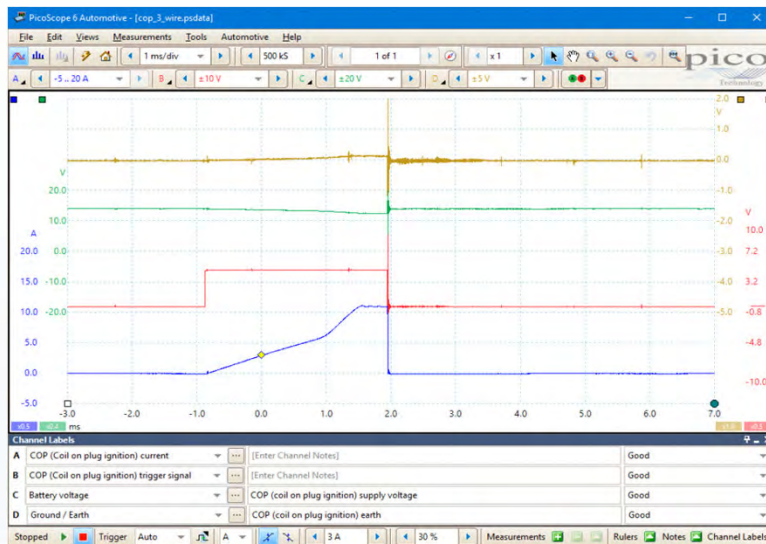


## Testing With A Scope

- **Connect the low amp clamp to Channel A, select the 20 A scale and zero the clamp before attaching to the coil voltage supply terminal.**
- **Connect Channel B to the coil signal terminal.**
- **Connect Channel C to the coil voltage supply terminal.**
- **Connect Channel D to the coil ground terminal.**

17

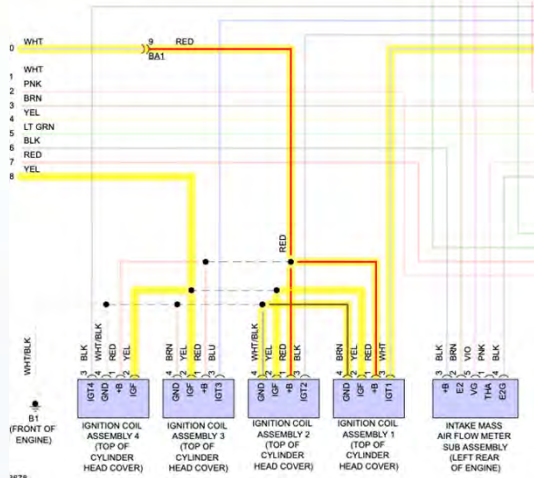
## C.O.P. Current - Trigger - Battery Voltage - Ground



Courtesy Pico Technology

18

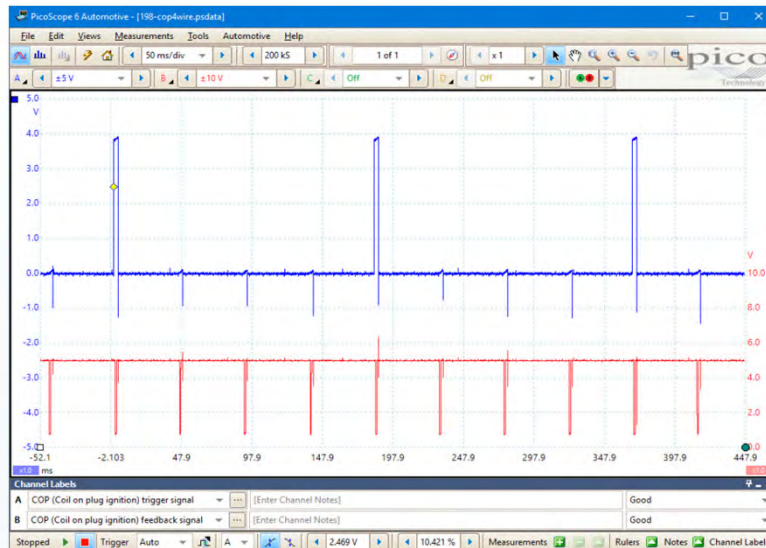
## 4 - Wire C.O.P. With Feedback



19

## Scope Testing 4 - Wire C.O.P. With Feedback

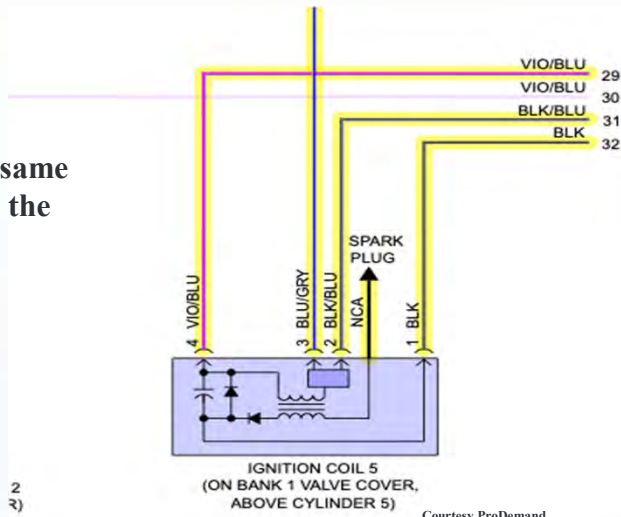
- Connect Channel A to the coil signal circuit
- Connect Channel B to the coil feedback circuit



20

## Ignition C.O.P. Wiring - 4 Wire Double Ground (GM)

Test these coils the same way you would test the 3-wire C.O.P.



21

## Secondary Ignition Testers



22

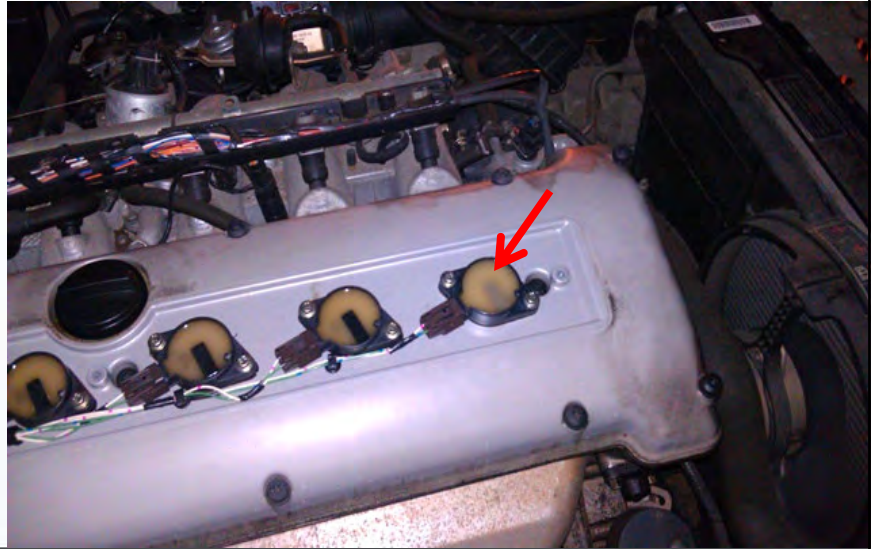
# **LIVE On Vehicle**

# **Case Study** **A Jaguar With A Night Light**

## Misfiring Jaguar C.O.P. Problem

Most important tool we have are from God...

- Brain
- Eyes
- Nose
- Ears
- Hands



## Case Study Nissan Versa P0300 & P0304



## 2009 Nissan Versa

- MIL Illuminated
- DTC P0300 & Pending P0304
- Mode 6 data shows misfires on cylinder 4

Code	Description	Test Value	Min Limit	Max Limit	Units	Count
P0300	Random/Multiple Cylinder Misfire Detected					
P0304	Cylinder 4 Misfire Detected					
\$A1: Multiple Cylinder Misfires	\$B0: Misfiring cnt @ 1000 revs of cyl 1	0.000	0.000	19.000	Count	
\$A1: Multiple Cylinder Misfires	\$B1: Misfiring cnt @ 1000 revs of cyl 2	0.000	0.000	19.000	Count	
\$A1: Multiple Cylinder Misfires	\$B2: Misfiring cnt @ 1000 revs of cyl 3	0.000	0.000	19.000	Count	
\$A1: Multiple Cylinder Misfires	\$B3: Misfiring cnt @ 1000 revs of cyl 4	100.000	0.000	19.000	Count	
\$A1: Multiple Cylinder Misfires	\$B8: Multiple cyl misfire @ 1000 revs	0.000	0.000	65534.000	Count	
\$A1: Multiple Cylinder Misfires	\$B9: Misfire @ 200 revs of cyl 1	0.000	0.000	65534.000	Count	
\$A1: Multiple Cylinder Misfires	\$B4: Misfire @ 200 revs of cyl 2	0.000	0.000	65534.000	Count	
\$A1: Multiple Cylinder Misfires	\$B5: Misfire @ 200 revs of cyl 3	0.000	0.000	65534.000	Count	
\$A1: Multiple Cylinder Misfires	\$B6: Misfire @ 200 revs of cyl 4	100.000	0.000	65534.000	Count	
\$A1: Multiple Cylinder Misfires	\$B7: Misfire @ 1000 revs of a single cyl	100.000	0.000	19.000	Count	
\$A1: Multiple Cylinder Misfires	\$B2: Misfire @ 200 revs of a single cyl	100.000	0.000	65534.000	Count	
\$A1: Multiple Cylinder Misfires	\$B3: Misfire @ 200 revs of mult. Cyls	0.000	0.000	65534.000	Count	

27

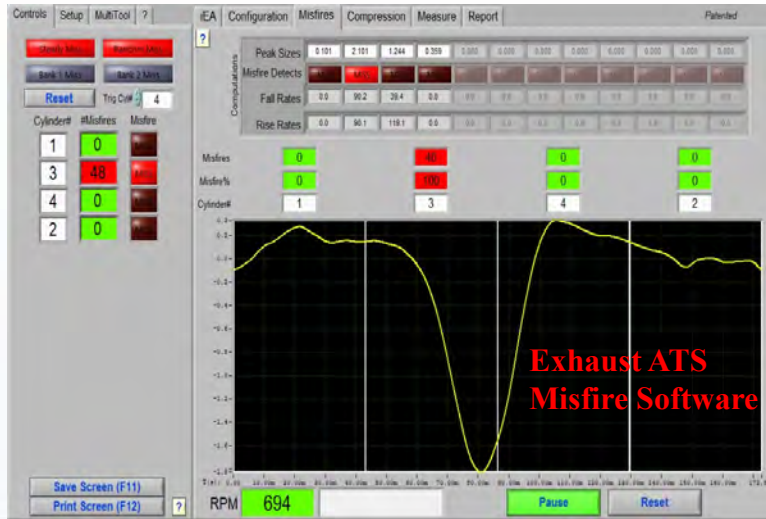
## Tip: Ford Misfire Mode \$06 (pre-CAN)

Test ID (TID)	Component ID (CID)	Test Value	Min Limit	Max Limit	Units
\$01: Front Oxygen Sensor Monitor	\$11: B1S1 Voltage Amplitude	0.856	0.552		volts
\$01: Front Oxygen Sensor Monitor	\$21: B2S1 Voltage Amplitude	0.815	0.552		volts
\$03: Front Oxygen Sensor Monitor	\$01: Upstream Switch Point Voltage	0.451	0.000		volts
\$03: Rear Oxygen Sensor Monitor	\$02: Downstream Switch Point Voltage	0.451	0.000		volts
\$04: O2 Heater Monitor	\$11: B1S1 Heater Current Maximum	1.277		3.000	amps
\$04: O2 Heater Monitor	\$12: B1S2 Heater Current Maximum	0.617		3.000	amps
\$04: O2 Heater Monitor	\$21: B2S1 Heater Current Maximum	1.191		3.000	amps
\$10: Catalyst Efficiency Monitor	\$11: Bank 1 Switch Ratio	0.000		0.796	
\$10: Catalyst Efficiency Monitor	\$21: Bank 2 Switch Ratio	0.000		0.796	
\$42: DPFE EGR System Monitor	\$12: Downstream Host Test	0.000		6.989	in H2O
\$42: DPFE EGR System Monitor	\$11: Upstream Hose Test	0.000	-6.989		in H2O
\$45: DPFE EGR System Monitor	\$20: EGR Stuck Open Test	1.054		1.640	volts
\$49: DPFE EGR System Monitor	\$30: EGR Flow Test	15.897	5.991		in H2O
\$48: DPFE EGR System Monitor	\$30: EVR Duty Cycle Flow Test	41.971		79.953	%
\$50: Misfire Monitor	\$00: Total Engine Misfire	0.315		3.931	%
\$53: Misfire Monitor Cylinder #1	\$01: Cylinder #1 Misfire Rate			0.983	%
\$53: Misfire Monitor Cylinder #2	\$02: Cylinder #2 Misfire Rate	0.000		0.983	%
\$53: Misfire Monitor Cylinder #3	\$03: Cylinder #3 Misfire Rate	0.000		0.983	%
\$53: Misfire Monitor Cylinder #4	\$04: Cylinder #4 Misfire Rate	0.000		0.983	%
\$53: Misfire Monitor Cylinder #5	\$05: Cylinder #5 Misfire Rate	0.000		0.983	%
\$53: Misfire Monitor Cylinder #6	\$06: Cylinder #6 Misfire Rate	0.000		0.983	%
\$54: Misfire Monitor	\$00: Highest Catalyst Damaging Misfire	5.551		29.490	%
\$55: Misfire Monitor	\$00: Highest Emission Threshold Misfire	0.983		0.983	%
\$56: Cylinder Events Tested	\$00: Cylinder Events Tested	3000.000		3000.000	events
\$61: EVAP System 0.040 Leak Check	\$00: Phase 0 Initial Tank Vacuum	0.000	0.000		in H2O
\$62: EVAP System 0.040 Leak Check	\$00: Phase 4 Vapor Generation Pressure	0.000	0.000		in H2O
\$63: EVAP System 0.040 Leak Check	\$00: Phase 0 Initial Gross Leak	0.000		0.000	in H2O

28

## 2009 Nissan Versa

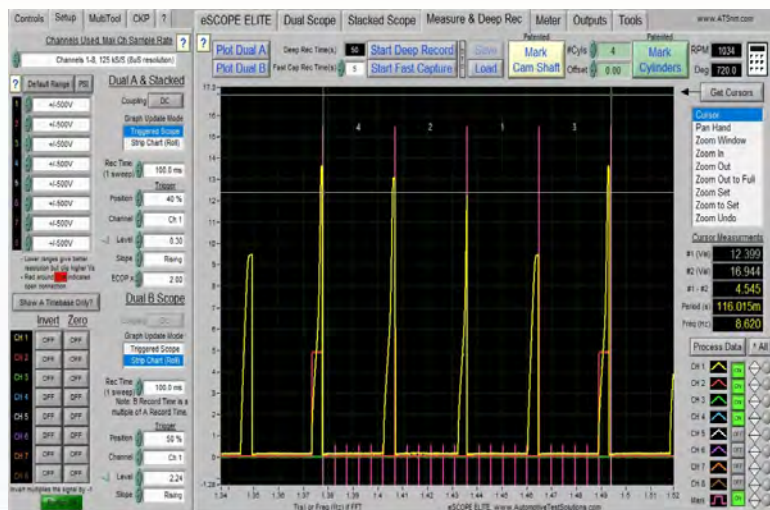
- Using ATS misfire software we found that number 4 was not the misfire, but cylinder 3 was misfiring



29

## 2009 Nissan Versa

- Now that we know the misfire is on cylinder 3 we began to look at coil current.
- An amp clamp (yellow) was placed around a fuse loop in the coil fuse. The red lead was backed probed in cylinder 4 for a sync. Found cylinder 3 had lower current.
- Number 3 coil was replaced, and misfire went away.



30

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31

31

**TST Big Event Sat April 6<sup>th</sup> 2024**

**Instructors:**

- "Understanding Internal Combustion"
- **Bernie Thompson**
- "Is the Transmission to Blame? "
- **Wayne Colonna**
- "Cracking The Case"
- **Sherwood Cook**

**Keynote Speaker:** Mark Warren

[www.tstseminars.org](http://www.tstseminars.org)

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32





## *Hands-On Electronic Class*

3 Day / 24 Hours

Dates: *Friday Jan. 19th*

*Saturday Jan. 20th*

*Sunday Jan. 21st, 2024*

Time: 8:00am to 4:30pm

*Topics covered include circuits and circuit testing, opens, shorts, voltage drops, relay testing, meter usage (DMM), Labscope / graphing meter usage, sensor, actuators, and hands-on testing to use on an array of applications such as starting, batteries, fuel delivery, ignition, sensors, computers, and more.*

*Bring your meter, scope, graphing meter amp clamp and any other electrical tools.*

Cost:

*\$1100.00*

*Includes: Electrical Book, Lunch, Snacks & all day Beverages.*

*Location: 10 Lupi Plaza, Mahopac, NY 10541*

*#845 628-1062*

*[drestucci@dormantraining.com](mailto:drestucci@dormantraining.com) or [gtruglia@dormantraining.com](mailto:gtruglia@dormantraining.com)*



33

33



34

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