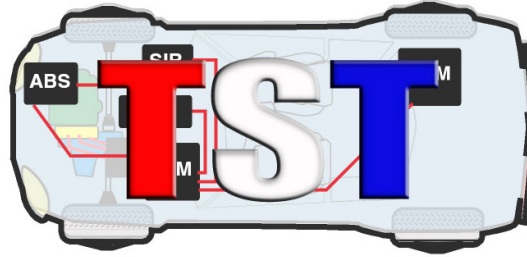


September 2013



Technicians Service Training

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"Reading a Schematic"

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Upcoming Seminars:

November 11th -14th**Donny Seyfer***What does the Code look like
-Streamlined Diagnostics***Jan 13th - 16th 2014****Bill Fulton***Diagnostic Strategies On
Broken Cars - Symptom To
System Based Diagnostics
Beyond Pattern Failures***March 22nd (Saturday) Big
Event Fishkill NY****Instructors: Scot Mann TBA
Paul "Scanner" Danner***No Start Diagnosis***May 12th -16th****Dave Hobbs***New Computerized Charging
- Battery Management***Ongoing FREE Webcasts &
our YouTube Channel**

Editor

"G" Jerry Truglia

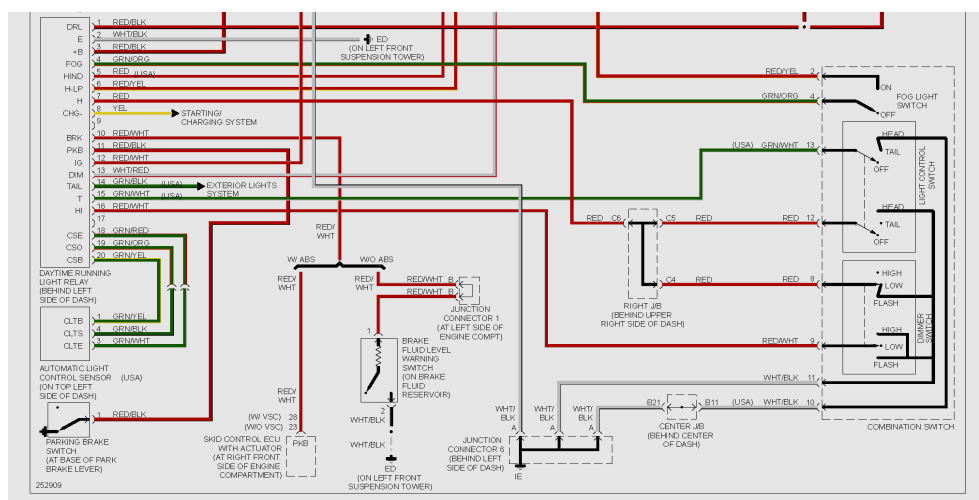
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"Reading a Schematic"

Reading an electrical map means little if you don't know how to drive!

Wiring diagrams are like road maps. You wouldn't take a cross-country trip without consulting a map or a GPS, would you? But many techs will dive blindly into an electrical diagnosis without first consulting the schematic. Unfortunately, wiring schematics don't come with a GPS navigation option. (The one neat exception I've seen is the OEM Mazda diagrams in MotoLogic. They are interactive and show current flow in the circuit under different key positions.)

No, for the most part we have to do it the way techs have been doing it for years.



(Con't on page 3)

*Technicians Service Training***11 Lupi Plaza****Mahopac, NY 10541****Phone:** (845) 628-6928**Fax:** (845) 628-9109**Email:****Info@tstseminars.org****TST on YouTube...type
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Currently there are **TST chapters in Connecticut, Massachusetts, New Jersey, New York** and membership continues to grow. For more information you can call

*Technicians Service Training***TST headquarters at:****(845) 628-6928****www.TSTseminars.org*****What is TST?***

TST is a group of dedicated technicians and instructors committed to the continuing education of our fellow technicians. We provide once a month training seminars to technicians at a reasonable price. TST brings our members nationally known instructors and state of the art training.

Our Goal & Mission Statement

- ***Keep our fellow technicians up to date with the latest technology.***
- ***Provide training seminars for a reasonable price.***
- ***Deliver information that the technician can use now.***
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- ***Increase consumer awareness of what a good technician is.***

Why join TST?

TST membership includes special pricing on weekday night seminars and the occasional full Saturday seminar. With a \$75.00 yearly membership, the monthly seminars are only \$65.00. TST classes are NOT sales or product seminars. The instructors that TST brings in are all “hands-on” industry experts with up to date, cutting edge knowledge that you can use in your shop the next day. That’s 65 dollars for a seminar in which you are able to learn something useful, for fixing those tough jobs that we all see on a regular basis. Our instructors are masters at making the complex understandable. Membership also includes a Monthly Newsletter full of real world technical articles, diagnostic case studies, and solutions to the kinds of problems you see in your bays each week.

The following are some of TST’s regular instructors:

Bernie Thompson of ATS**John Thornton** of Autotrain Inc.**Wayne Colonna** of ATSG**Jorge Menchu** the “Labscope Guru,” AES Wave**John Anello** of Auto Tech On Wheels**Mark Warren** of Motor Magazine**Bob Pattengale** of Bosch**Peter Meier** of Motor Age Magazine**Ken Zanders** of Illinois Air Team**Jerry “G” Truglia** of A.T.T.S. Inc.

“Reading a Schematic” (con’t from p. 1)

And you’ll find it isn’t all that difficult if you read through and follow all the steps. Just like reading a road map, the first place to start is with the diagram information, providing you with the position, arrangement of devices and terminals. OE diagrams are often all inclusive, that is; they show everything on one big diagram that is broken up into segments. Most aftermarket service information providers provide simpler diagrams, referred to as block diagrams that show only the components/wiring needed by an individual circuit. Most block diagrams also start with the power source at the top of the page, and follow the path to ground, ending at the bottom of the page. This is followed by a color code chart, so you’ll know what colors the diagram abbreviations are referring to. Think that too simple? Check out an OEM German schematic where all the colors are listed in Deutsch! Next is the abbreviations list that will clue you in on what the component abbreviations stand for. Last, but not least, review the symbols that will be used in the diagrams so you understand what they mean.

Diagram Legend

	ALTERNATOR		COMPONENT REFERENCE		GAUGE		SHIELD
	BATTERY		INTERNAL CONNECTOR		HEATING ELEMENT		SLIPPING
	SINGLE FILAMENT BULB		IN-LINE CONNECTOR		HEAT ACTIVATED SWITCH		SOLENOID
	DUAL FILAMENT BULB		EXTERNAL CONNECTOR		JUNCTION BOX/BLOCK/CONNECTOR		EXTERNAL SPLICE
	CAPACITOR		DIODE		LED		INTERNAL SPLICE
	VARIABLE CAPACITOR		PHOTO DIODE		MOTOR		SWITCH

(Con't on p. 7)

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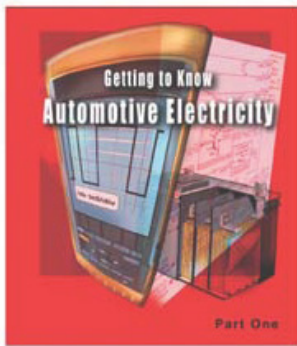
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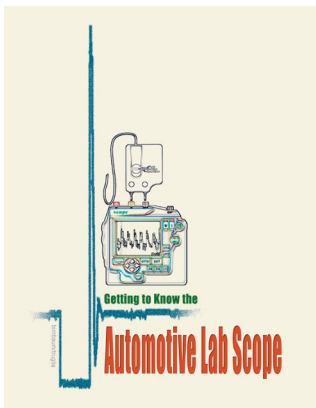
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"Reading a Schematic" (con't from p. 3)

Once you're comfortable with the basic layout of the schematic (map) you're using, it's time to locate the specific address you want to investigate. On a wiring diagram, that would be the electrical component, or load, that is giving you a problem. If that load isn't working, it's because it has an internal problem or the current flow isn't flowing the way it should. That means we need to identify the basic elements the load needs to operate: the source of power, the control(s) that determine when the load is "on", and the path that connects it all together.

If you are not as comfortable with tracing wiring diagrams as you'd like to be, I would recommend you Google "Wiring Diagram Color Coding by Jorge Menchu". Jorge has been teaching wiring diagram color-coding seminars for years and offers his resources at AESWave.com. In his seminar, he covers the basics that many have missed in our industry. Jorge explains how to color code the wiring diagram in five basic parts using red to represent power all the time, green as grounds all the time, orange as power only when the circuit (control device) is closed, yellow as ground only when the circuit (control device) is closed and blue as a variable voltage. Most electrical faults can be easily found when you know what test results to expect, and Jorge's method of color-coding helps you do just that. I'd also recommend you visit the Motor Age site and read "The Electrical System Roadmap" article in the February, 2009 issue.

Something To Get You Started

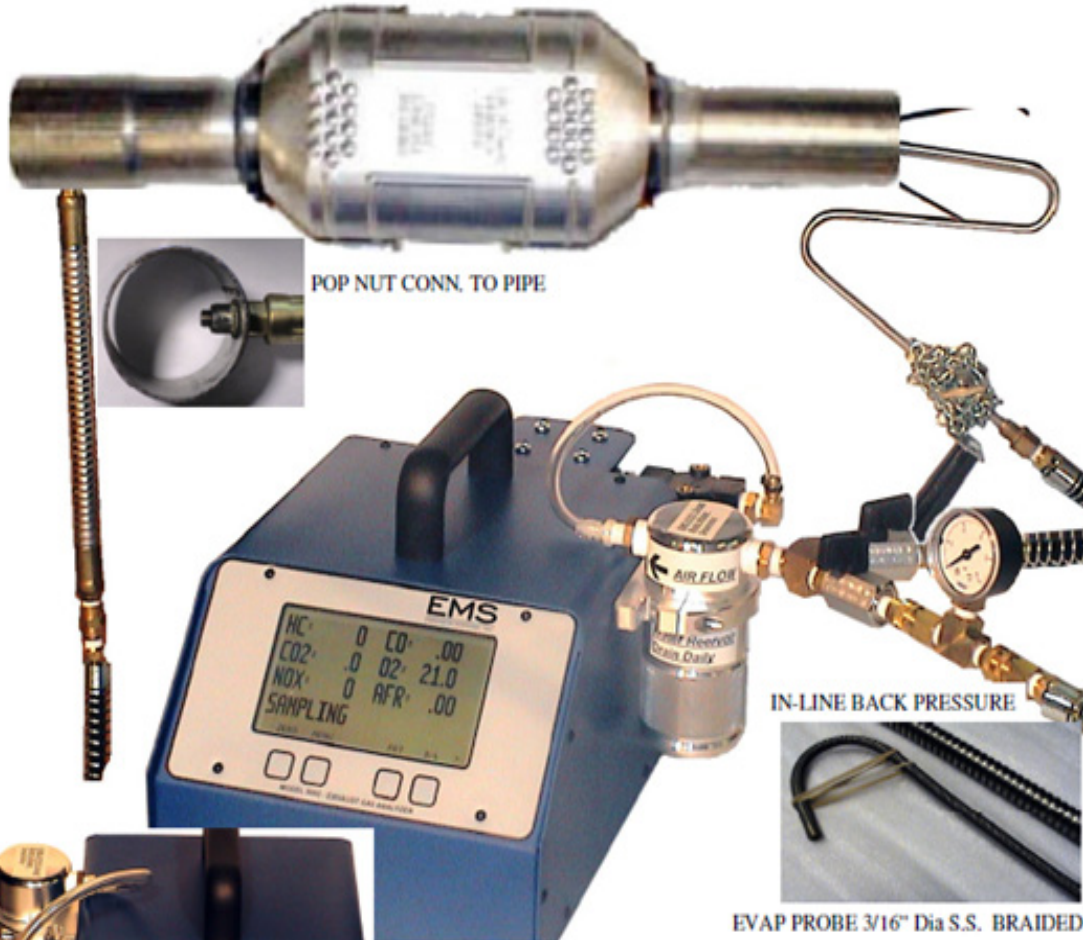
For an example of how to get started improving your wiring diagram navigational skills, I'm going to use a typical block diagram schematic of a 2007 Toyota Corolla CE headlight circuit and show how

(Con't on page 9)

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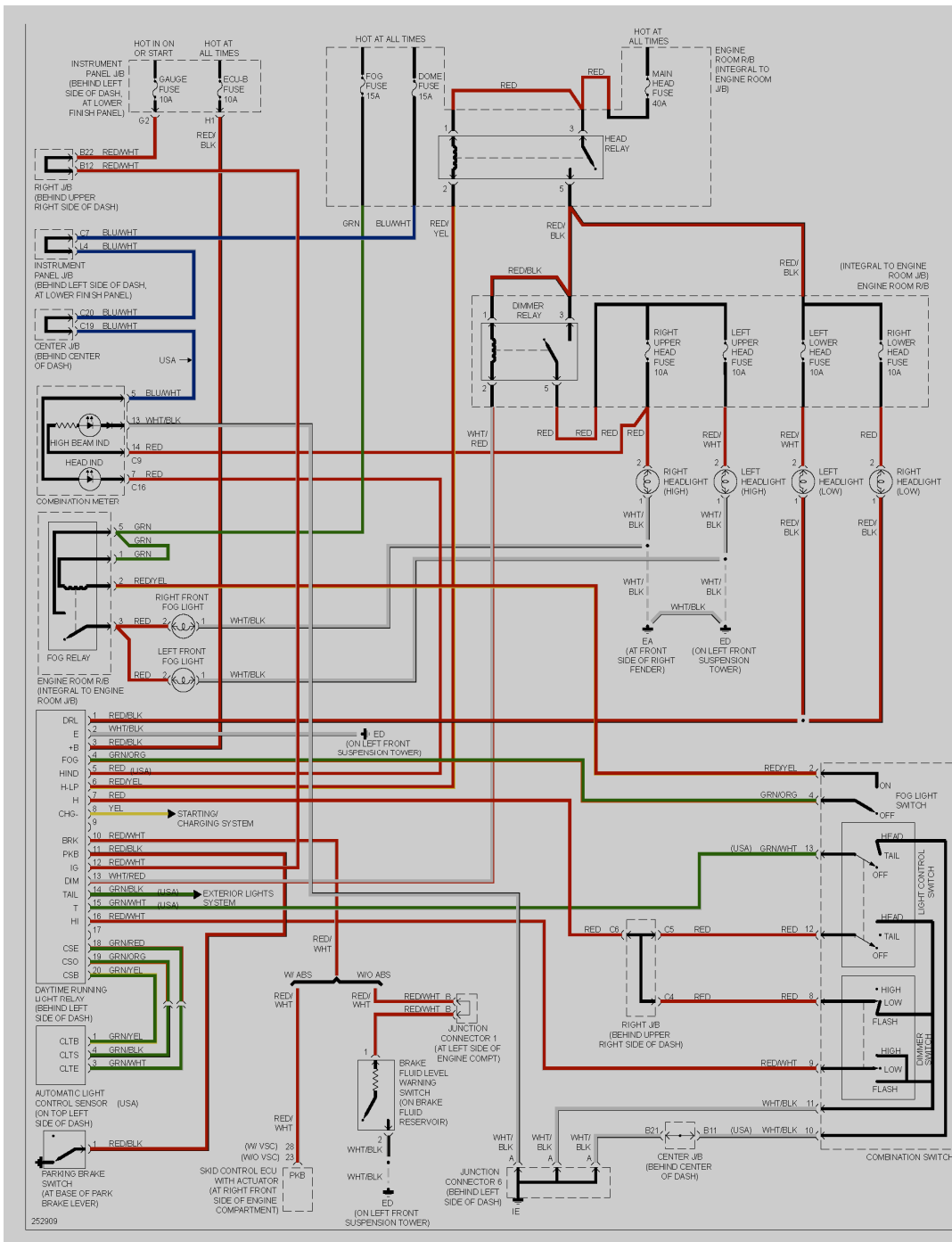
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“Reading a Schematic” (con’t from p. 7)

..... to use it to troubleshoot a missing driver’s side low beam. If you’re typical, the first thing you’d do is replace the bulb! Hey, I would have done the same thing. And most of the time we’d probably be right. But what would you do when the new bulb also fails to work?

Go make a copy of the diagram and follow along!



Lots of stuff on this diagram, isn't there? But don't freak out quite yet! You already know that every electrical circuit has to have certain basic elements in order to work. The first thing we need is a load, or component that will do the job we want the circuit to perform. What other reason would we have for wiring stuff in? In this case, it's the headlights so let's find them first and give them a little color so we can find them again easily.

(Con't on page 10)

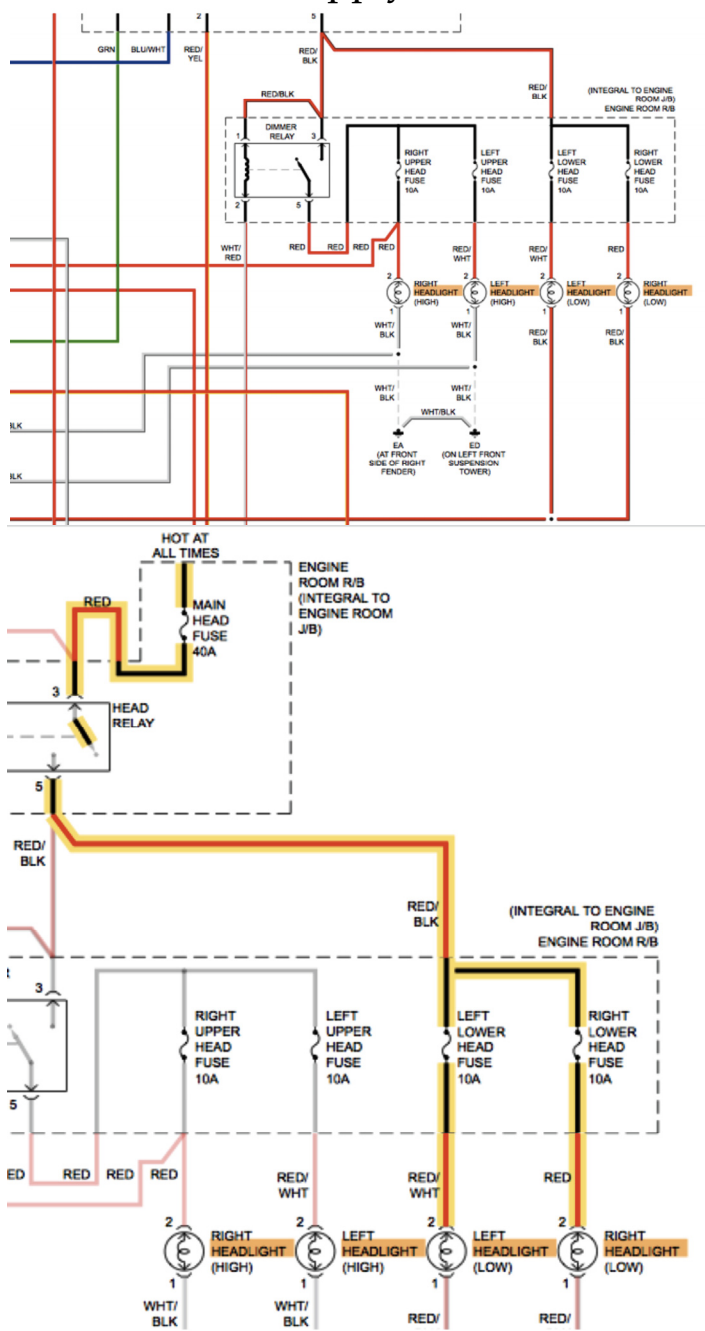
“Reading a Schematic” (con’t from p. 9)

With the load identified, it’s time to move on to what that load needs to work; power and ground. The object of the next step is to locate and identify the wires at the load that supply both. In this case, there are only two wires to choose from

so we’ve got a 50/50 shot! Seriously, though, in those cases where the load has more than two wires, just pick one and start following it to see where it goes.

I’m going to start with the one on top. In block diagrams, power wires generally head up the page while ground wires generally head down. May not always be the case, and it doesn’t really matter. Like I said, I’ve got a 50/50 shot. This red wire with a white tracer (that is, a stripe that runs the length of the wire) first enters the fuse box where a 10-amp fuse provides the protection against shorts to ground for this circuit. A fuse will only be located on the power side of the load so I know what side I’m tracing now.

It’s also easy to see that just past the fuse, the power feed to the other headlight is spliced in. The two bulbs may have separate fuses, but they share the same power source! Onward and upward!



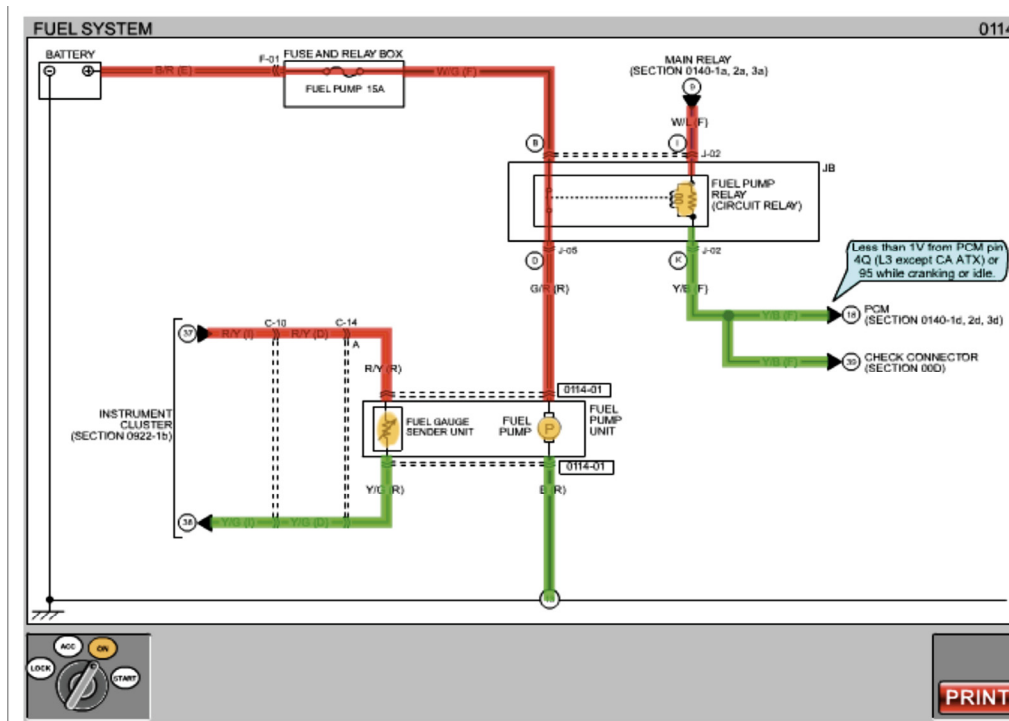
The red trail now changes from one with a white tracer to one with a black one. The path leads to the headlight relay, and by the look of the relay symbol, it’s on the switch side of the relay. What does that make the relay?

(Con’t on page 11)

"Reading a Schematic" (con't from p. 10)

Control Or Load?

A relay is an electrical component typically used by a control module to turn a high current load on or off. That means the relay can be con-



sidered a control device or a load all its own. In this case, we are on that part of the relay that acts as a switch and we would treat the

relay as such. Am I worried about the solenoid side of the relay at this point? No, not until I suspect the relay's not doing it's job as a control device. Until then, I'll stay focused on finding the power source I'm looking for.

And we're almost there. The red path now turns completely red as we exit the relay on the other side of the contacts. From there, it's a short walk to the Main Headlight 40-amp fuse, and from there it ends with a notation that reads "Hot At All Times".

What does that mean?

The "source" for the majority of automotive electrical systems is the battery.

(Con't on page 12)

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2. Do you find the seminars useful?

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**Thank you,
G Truglia**

“Reading a Schematic” (con’t from page 11)

Eventually, that’s where we want to end up. In most block diagrams, the notation “Hot At All Times” means this point in the harness is a straight line back to the battery. You can verify exactly how it gets there by referring to a diagram called the Power Distribution schematic. This shows every circuit protection device on the car, the route from the battery to the device, and all the circuits that device protects.

“Hot In Run”, “Hot In Start”, and similar phrases indicate the path back to the battery first goes through the ignition switch. You’ll find the details for these routes in the Power Distribution diagram as well.

For our purposes, though, we have succeeded in identifying the power side of the load back to the source. On to the “Dark Side”!

With one half done, let’s go back to the headlight and find out how current passing through it makes its way to ground. The only wire left to trace is...what, another red wire with black tracer? But didn’t we already trace that wire up at the relay? We can’t have two power wires going to the headlight, can we?

No, of course not. Just goes to show you that wire colors aren’t necessarily unique to the one you have your hand on.

So let’s continue. It doesn’t take long to see that both low beams come together on this path. Joined, they both continue along to the Daytime Running Light Relay (DRL). Sure are a lot of wires coming off of this thing, aren’t there?

I’m So Confused!

(Con’t on page 13)

“Reading a Schematic” (con’t from page 13)

Only one stop left, and that’s at the red/black wire that brings the power to the two low beam fuses.

What if there is power? Then we move our multimeter lead to the ground side. If we read the same voltage here as we did on the power side with the lights



turned on, there is an open circuit between the bulb and the ground splice point. If we read a perfect “0” on the meter, the bulb filament is blown or the bulb is not making good contact in the socket. No current is flowing. Any reading between the two over, say, 0.50 volts indicates excessive resistance in that short section of wiring. But if that were the case, the bulb would be lit...just dim.

And If Both Sides Worked?

You would still perform the same two tests, measuring the amount of voltage on both the power side and ground side of the bulbs as close to them as you can get. The only difference is where you’d focus your efforts on the side with the problem. Since both bulbs are not working, you’d look only at those parts of the circuit the two have in common. You may even have to do some reading on how that DRL works, but it’s a sure bet it completes ground somehow!

That’s where your skill, training, and experience come into play. Just like a good driver, you are comfortable with the idea of the basic operation of the system you’re taking on. If not, you’ll learn about that system first, won’t you?

And that’s what separates you from the amateur!

*Article by G Truglia,
ASE CMAT, CMTT, CMST, L1, CNG & TST Founder, President
Thanks to Pete Meier for the pictures*

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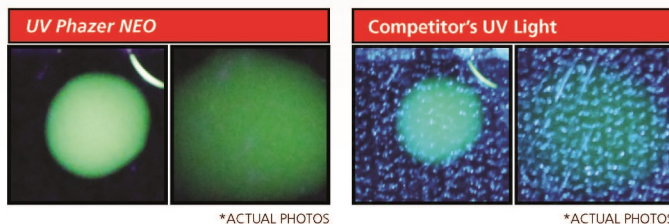
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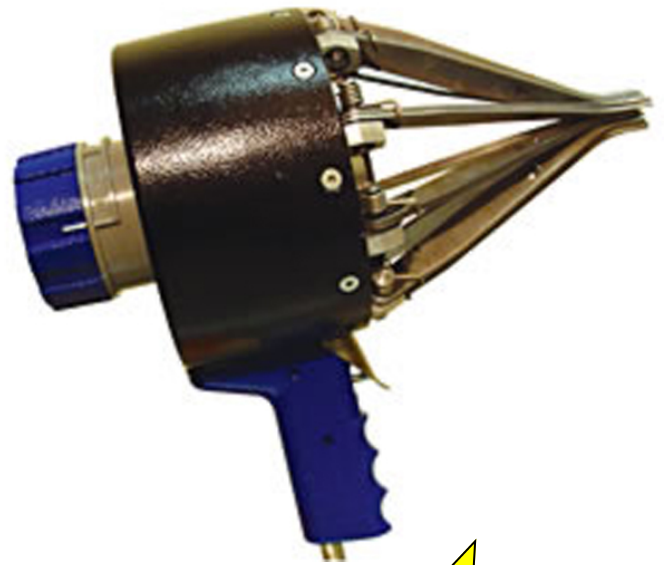
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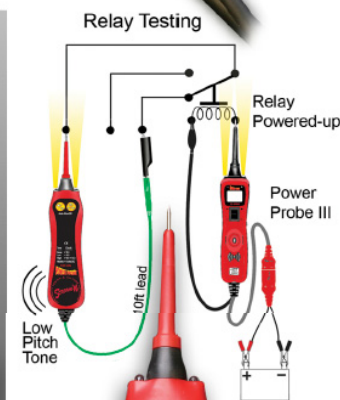


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- ➔ **GET HIRED FIRST**
- ➔ **ADVANCE FASTER**

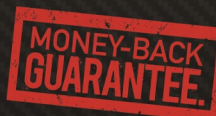


**THIS IS YOUR LAST CHANCE TO TAKE A
TRADITIONAL "PAPER AND PENCIL" TEST!**
AFTER THIS FALL, ALL TESTS WILL BE COMPUTER-BASED!



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Check out the ASE website for test dates and locations

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