

Automotive Technology 5th Edition

Chapter 42 CIRCUIT TESTERS & DIGITAL METERS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain the chapter learning objectives to the students as listed: <ol style="list-style-type: none">1. Discuss how to safely use a fused jumper wire, a test light, and a logic probe.2. Explain how to safely and properly use a digital meter to read voltage, resistance, and current, and compare the readings to factory specifications.3. Discuss diode check, pulse width, and frequency.4. Describe the prefixes used with electrical units and how to read digital meters.
Establish the Mood or Climate	Provide a WELCOME , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: This lesson plan is based on the 5th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 42: [ATE5 Chapter Images](#)

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1. SLIDE 1 CIRCUIT TESTERS & DIGITAL METERS

Check for **ADDITIONAL VIDEOS & ANIMATIONS @**
<http://www.jameshalderman.com/>
WEB SITE IS CONSTANTLY UPDATED

Videos

DEMONSTRATION: Show students how to test a circuit with a fused jumper

2. **SLIDE 2 EXPLAIN** Figure 42-1 technician-made fused jumper lead equipped with a red 10 ampere fuse. Fused jumper wire uses terminals for testing circuits at a connector instead of alligator clips.

HOST a DISCUSSION about uses of a fused jumper wire. If a device works when connected to a fused jumper wire, what is determined?

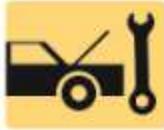
3. **SLIDE 3 EXPLAIN** Figure 42-2 12 volt test light is attached to a good ground while probing for power.

4. **SLIDE 4 EXPLAIN** Figure 42-3 Test light can be used to locate an open in a circuit. Test light is grounded at a different location than the circuit itself.

5. **SLIDE 5 EXPLAIN** Figure 42-4 Continuity light should not be used on computer circuits because applied voltage can damage delicate electronic circuits.

DEMONSTRATION: Non-powered test light will show only whether current is available. It cannot determine how much current or exact voltage available. Demonstrate a continuity test light for students & discuss when it should be used. Test lamps should not be used on any circuits connected to a PCM due to voltages used in electronic components

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6. SLIDE 6 EXPLAIN Figure 42-5 LED test light can be easily made using low cost components and an old ink pen. With the 470 ohm resistor in series with LED, this tester only draws 0.025 ampere (25 milliamperes) from circuit being tested. This low current draw helps assure technician that circuit or component being tested will not be damaged by excessive current flow.

HANDS-ON TASK: Have students use Figure 42–5 to construct an LED test lamp, and then have them use it to test a circuit or component.

[Circuit Test, Test Light \(View\) \(Download\)](#)

7. SLIDE 7 EXPLAIN Figure 42-6 logic probe connected to vehicle battery. When tip probe is connected to circuit, it can check for power, ground, or a pulse.

DEMONSTRATION: Show the students a logic probe and proper way to connect it to a power and ground source and component to be checked.

27. SLIDES 27 READ & EXPLAIN TEXT

8. SLIDE 8 EXPLAIN Figure 42-7 Typical digital multimeter. Black meter lead always is placed in the COM terminal. The red meter test lead should be in the volt-ohm terminal except when measuring current in amperes.

9. SLIDE 9 EXPLAIN Figure 42-8 Typical digital multimeter (DMM) set to read DC volts.

10. SLIDE 10 EXPLAIN Figure 42-9 (a) typical autoranging digital multimeter automatically selects the proper scale to read the voltage being tested. The scale selected is usually displayed on the meter face. Note that the display indicates “4,” meaning that this range can read up to 4 volts.

11. SLIDE 11 EXPLAIN Figure 42-9 (b) A typical autoranging digital multimeter automatically selects the proper scale to read the voltage being tested. The scale selected is usually displayed on the meter face. The range is now set to the 40 volt scale, meaning that the meter can read up to 40 volts on the scale. Any reading above this level will cause the meter to reset to a higher scale. If not set on autoranging, the meter display would indicate OL if

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a reading exceeds the limit of the scale selected.

12. SLIDE 2 EXPLAIN Figure 42-10 Using a digital multimeter set to read ohms (Ω) to test this light bulb. The meter reads the resistance of the filament.

13. SLIDE 13 EXPLAIN Figure 42-11 Many digital multimeters can have the display indicate zero to compensate for test lead resistance. (1) Connect leads in the V Ω and COM meter terminals. (2) Select the Ω scale. (3) Touch the two meter leads together. (4) Push the “zero” or “relative” button on the meter. (5) The meter display will now indicate zero ohms of resistance.

14. SLIDE 14 EXPLAIN Figure 42-12 Measuring the current flow required by a horn requires that the ammeter be connected to the circuit in series and the horn button be depressed by an assistant.

15. SLIDE 15 EXPLAIN Figure 42-13 Note the blade-type fuse holder soldered in series with one of the meter leads. A 10 ampere fuse helps protect the internal meter fuse (if equipped) and the meter itself from damage that may result from excessive current flow if accidentally used incorrectly.

16. SLIDE 16 EXPLAIN Figure 42-14 An inductive ammeter clamp is used with all starting and charging testers to measure the current flow through the battery cables.

17. SLIDE 17 EXPLAIN Figure 42-15 Typical mini clamp-on-type digital multimeter. This meter is capable of measuring alternating current (AC) & direct current (DC) without requiring that circuit be disconnected to install meter in series. Jaws are simply placed over wire and current flow through the circuit is displayed.

DEMONSTRATE proper way to connect test leads to a DMM. Point out input terminals on DMM & their functions. Tell students that reading on wrong input could destroy meter.

18. SLIDE 18 EXPLAIN Figure 42-16 Typical digital multimeter showing OL (over limit) on the readout with the ohms (Ω) unit selected. This usually means that the unit being measured is open (infinity resistance) and has no continuity.

19. SLIDE 19 EXPLAIN Figure 42-17 Always look at the meter display when a measurement is being made, especially if using an autoranging meter.

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DISCUSSION: Have students discuss various scales and settings on a DMM. What is reason that test results using a DMM are more accurate?

Discuss the Autorange features

[Bulb Test, Meter \(View\) \(Download\)](#)

[Circuit Test, Amps, Meter \(View\) \(Download\)](#)

[Circuit Test, Meter \(View\) \(Download\)](#)

[Meter Usage Measure Amps \(View\) \(Download\)](#)

[Meter Usage Measure Frequency \(View\)\(Download\)](#)

[Meter Usage Measure Ohms \(View\) \(Download\)](#)

[Meter Usage Testing Diode \(View\) \(Download\)](#)

[Test Bulb \(View\) \(Download\)](#)

[Tone Generator \(View\) \(Download\)](#)

20. SLIDE 20 EXPLAIN Figure 42-18 When reading AC voltage signals, a true RMS meter (such as a Fluke 87) provides a different reading than an average responding meter (such as a Fluke 88). The only place this difference is important is when a reading is to be compared with a specification.

21. SLIDE 21 EXPLAIN Figure 42-19 This meter display shows 052.2 AC volts. Notice that the zero beside the 5 indicates that the meter can read over 100 volts AC with a resolution of 0.1 volt.

36. SLIDES 36-58 OPTIONAL DMM DEMO EXPLAIN

NATEF Task Sheet Check electrical circuits with a test light; determine necessary action. (P-2), Page 131 Task Sheet

NATEF Task Sheet Check electrical circuits using fused jumper wires; determine necessary action. (P-2), page 132 Task Sheet

NATEF Task Sheet Demonstrate proper use of digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow, & resistance (P-1). Page 130 Task Sheet

HOMEWORK 1: Have the students complete the practice exam at the end of Chapters 42

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HOMEWORK 2: Have students use INTERNET to research digital multimeters used in the automotive repair field. Ask them to list four to five meters, their main features, and the cost of each meter. Have students determine which meter they think would be the best purchase and explain their choice and reasoning to the class.

HOMEWORK

[Crossword Puzzle \(Microsoft Word\) \(PDF\)](#)

[Word Search Puzzle \(Microsoft Word\) \(PDF\)](#)