

Introduction to Automotive Service

Chapter 22 CIRCUIT TESTERS & DIGITAL METERS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class serves as an introduction to the world of automotive service. It correlates material to task lists specified by ASE and NATEF.
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.	<p>Explain the chapter learning objectives to the students.</p> <ol style="list-style-type: none"> 1. Prepare for ASE Electrical/Electronic Systems (A6) certification test content area "A" (General Electrical/Electronic Systems Diagnosis). 2. Explain how to set up and use a digital meter to read voltage, resistance, and current. 4. Explain meter terms and readings. 5. Interpret meter readings and compare to factory specifications. 6. Discuss how to properly and safely use 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.

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Ch22 Circuit Testers & DMM

1. TITLE SLIDE 1 CIRCUIT TESTERS & DMM

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

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

2. **SLIDE 2 READ & EXPLAIN** Fused Jumper Wires

3. **SLIDE 3 EXPLAIN** Figure 22-1 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.

4. **SLIDE 4 READ & EXPLAIN** Fused Jumper Wires

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

5. **SLIDE 5 READ & EXPLAIN** TEST LIGHTS

6. **SLIDE 6 EXPLAIN** Figure 22-2 12 volt test light is attached to a good ground while probing for power.

7. **SLIDE 7 EXPLAIN** Figure 22-3 Test light can be used to locate an open in a circuit. Test light is grounded at a different location than the circuit itself

Circuit Test, Test Light
SHOW ANIMATION: Test Light

SHOW ANIMATION: Test Light or use Project Board TO simulate test light use

http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter34_Fig_34_2/index.htm

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.

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Test lamps should not be used on any circuits connected to a PCM due to voltages used in electronic components

8. SLIDE 8 **READ & EXPLAIN DMM**

9. SLIDE 9 **EXPLAIN Figure 22-4** 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

10. SLIDE 10 **EXPLAIN Chart 22-1** Common symbols & abbreviations used on DMM

11. SLIDE 11 **EXPLAIN Figure 22-5** Typical digital multimeter (DMM) set to read DC volts

12. SLIDE 12 **EXPLAIN Figure 22-6 (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. **(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 a reading exceeds the limit of the scale selected.

13. SLIDE 13 **EXPLAIN Figure 22-7** Using a digital multimeter set to read ohms (Ω) to test this light bulb. The meter reads the resistance of the filament.

Bulb Test, Meter

SHOW ANIMATION: DMM reading ohms Figure 22-7

14. SLIDE 14 **EXPLAIN Figure 22-8** 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.

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Circuit Test, Meter

SHOW ANIMATION: Measuring Voltage

15. **SLIDE 15 EXPLAIN** Digital Multimeters
16. **SLIDE 16 EXPLAIN** Figure 22-9 Measuring 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.

Circuit Test, Amps, Meter

SHOW ANIMATION: Measuring Current Figure 22-9

17. **SLIDE 17 EXPLAIN** Figure 22-10 Note blade-type fuse holder soldered in series with one of meter leads. A 10 ampere fuse helps protect internal meter fuse (if equipped) & meter itself from damage that may result from excessive current flow if accidentally used incorrectly
18. **SLIDE 18 EXPLAIN** Digital Multimeters
19. **SLIDE 19 EXPLAIN** Inductive Ammeters
20. **SLIDE 20 EXPLAIN** Figure 22-11 An inductive ammeter clamp is used with all starting and charging testers to measure current flow through battery cables.
21. **SLIDE 21 EXPLAIN** Figure 22-12 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.

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

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22. **SLIDE 22 EXPLAIN** FIGURE 22-13 Typical digital multimeter showing OL (over limit) on readout with ohms (Ω) unit selected. This usually means that unit being measured is open (infinity resistance) and has no continuity.
23. **SLIDE 23 EXPLAIN** How to Read Digital Meters
24. **SLIDE 24 EXPLAIN** Chart 22-2 Sample meter readings using manually set and auto-ranging selection on the digital meter control.

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.

25. **SLIDES 25-26 EXPLAIN** How to Read Digital Meters

ANIMATION: Interpret meter readings

http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A7_Animation/Chapter34_Fig_34_18/index.htm

ANIMATION: Labeling Exercise Meter Terms

http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A6_Animation/Chapter08_Fig_08_7/index.htm

Students complete NATEF Task Sheet A6A8 Check electrical circuits with a test light; determine necessary action. (P-2), Page 131 Task Sheet

Students complete NATEF Task Sheet A6A10 Check electrical circuits using fused jumper wires; determine necessary action. (P-2), page 132 Task Sheet

Students do NATEF Task Sheet A6A7 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 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.

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Have students determine which meter they think would be the best purchase and explain their choice and reasoning to the class.

Homework: complete Ch22 crossword puzzle:
http://www.jameshalderman.com/links/book_intro/cw/crossword_ch_22.pdf