Automotive Electrical & Engine Performance 8/E
Chapter 22 Driver Information & Navigation Systems
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Electrical & Engine Performance 8th edition provides complete coverage of automotive areas pertaining vehicle electrical systems and engine performance. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, and Animations that are listed in this Lesson Plan. This Lesson Plan also references ASEEducation (NATEF) Task Sheets available from Jim's web site.
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. 1. Discuss the diagnosis of oil pressure lamp, temperature lamp, brake warning lamp, and other analog dash instruments. 2. Discuss the operation of head-up display, night vision, and digital electronic displays. 3. Identify the meaning of dash warning symbols. 4. Explain the operation and diagnosis of Telematics systems, backup camera, backup sensor, and lane departure warning system. 5. Describe how a navigation system works. **This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "F" (Gauges, Warning Devices, and Driver Information System Diagnosis and Repair).**
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 Automotive Electrical & Engine Performance 8th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

DOWNLOAD Chapter 22 Chapter Images: From

http://www.jameshalderman.com/books_a8.html#anchor2

ICONS	Ch22 Driver Info & Navigation Systems
        	**1. SLIDE 1 CH22 DRIVER INFORMATION & NAVIGATION SYSTEMS** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Videos** **At the beginning of this class, you can download the crossword puzzle & Word Search from Jim's web site to familiarize your class with terms in this chapter & then discuss them, see below:** **HTTP://WWW.JAMESHALDERMAN.COM/BOOKS_A8.HTML#ANCHOR2** **DOWNLOAD** **CROSSWORD PUZZLE (MICROSOFT WORD) (PDF)** **WORD SEARCH PUZZLE (MICROSOFT WORD) (PDF** **Parking Brake Warning Light (View) (Download)** 2. **SLIDE 2 EXPLAIN FIGURE 22–1** Green and blue symbols are used to inform the driver what is in operation. 3. **SLIDE 3 EXPLAIN FIGURE 22–2** Amber warning symbols inform the driver of a potential concern. 4. **SLIDE 4 EXPLAIN FIGURE 22–3** Red dash symbols are used to warn the driver of a fault requiring immediate action. **HANDS-ON TASK: Provide students with common warning symbols used on vehicle dashboard cluster assemblies. Have them identify meaning of each symbol and label it on lab vehicle. Grade students on their ability to identify symbols & systems associated with them.** **DEMONSTRATION: Show methods used by various OEMs to reset maintenance reminder lights**

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	**DISCUSSION:** **Have students discuss importance of indicator, or warning, lights. What is purpose of dash warning light?**
	**DISCUSSION: discuss operation of an oil pressure gauge and sending unit. What is the voltage of output from the sensor?**
	5. **SLIDE 5 EXPLAIN FIGURE 22–4** Steering wheel controls allow the driver to select a function while keeping their hands on wheel and their eyes on road.. 6. **SLIDE 6 EXPLAIN FIGURE 22–5** Maintenance reminders are often messages displayed on the instrument panel informing the driver of needed service, such as the need to change the engine oil. 7. **SLIDE 7 EXPLAIN FIGURE 22–6** Most stepper motors use four wires that are pulsed by the computer to rotate the armature in steps. 8. **SLIDE 8 EXPLAIN FIGURE 22–7** A typical instrument display uses data from the sensors over serial data lines to the individual gauges. 9. **SLIDE 9 EXPLAIN FIGURE 22–8** A typical head-up display showing zero miles per hour, which is actually projected on the windshield from the head-up display in the dash..
	**DISCUSSION: Have students discuss advantages of head-up display. Where is HUD unit installed?**
	10. **SLIDE 10 EXPLAIN FIGURE 22–9** dash-mounted control for the head-up display on this Cadillac allows the driver to move the image up and down on the windshield for best viewing. 11. **SLIDE 11 EXPLAIN FIGURE 22–10** A typical head-up display (HUD) unit. 12. **SLIDE 12 EXPLAIN FIGURE 22–11** A night vision camera behind the grille of a Cadillac.
	13. **SLIDE 13 EXPLAIN FIGURE 22–12** (a) Symbol and line drawing of a typical light emitting diode (LED). (b) Grouped in seven segments, this array is called a seven-segment LED display with a common anode (positive connection). The dash computer toggles the cathode (negative) side of each individual segment to display

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	numbers and letters. (c) When all segments are turned on, the number 8 is displayed. 14. **SLIDE 14 EXPLAIN FIGURE 22–13** typical LCD navigation system display. 15. **SLIDE 15 EXPLAIN FIGURE 22–14** A virtual dash being used to show a navigation screen that takes up all of the center dash area. This driver selectable dash display can show almost any combination of dash instruments to meet the desires of the driver**.**
	**EXPLAIN TECH TIP:** ***Touch Screen Tip*** **Most vehicle navigation systems use a touch screen for use by the driver (or passenger) to input information or other on-screen prompts. Most touch screens use a change in capacitance at surface of screen to determine when and where some action is being performed. Do not push harder on display if unit does not respond, or display unit may be damaged. If no response is detected when lightly touching the screen, rotate finger to cause capacitance area to increase so it can be easily detected.**
	**DISCUSSION: discuss difference between analog and digital gauges. How is stepper motor used in analog dash displays?**
	**DISCUSSION: discuss diagnosis of dash electronic circuits. Why aren't dash electronic circuits shown on a wiring diagram? How would a short-to-ground in sending unit wire affect operation?**
	**DEMONSTRATION: Show students how to use an ohmmeter to check sending unit wires for opens and shorts.**
	16. **SLIDE 16 EXPLAIN FIGURE 22–15** Schematic of a capacitive touchscreen. 17. **SLIDE 17 EXPLAIN FIGURE 22–16** A vehicle speed sensor located in the extension housing of the transmission. Some vehicles use the wheel speed sensors for vehicle speed information. 18. **SLIDE 18 EXPLAIN FIGURE 22–17** (a) Some odometers are mechanical and are operated by a stepper

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	motor. (b) Many vehicles are equipped with an electronic odometer. **19. SLIDE 19 EXPLAIN FIGURE 22–18** A sending unit socket being used to remove an oil pressure sender unit. **20. SLIDE 20 EXPLAIN FIGURE 22–19** A temperature gauge showing normal operating temperature between 180°F and 215°F, depending on the specific vehicle and engine.
	**DISCUSSION: discuss electronic speedometers. What advantages does using a speed sensor have over a speedometer gear-and-cable arrangement?**
	**Vehicles equipped with electronic odometers or tripometers must be in correct mode to reset maintenance light**
	**DEMONSTRATION: Show how to test VSS (PM generator type) using soldering gun**
	**DISCUSSION: discuss how information from VSS is used by other electronic circuits. Why could a malfunction in VSS affect transmission shifting?**
	**DEMONSTRATION: Show how to remove instrument cluster & how to remove trim pieces without breaking retention clips.**
	**HANDS-ON TASK: Have students use DMM to test a vehicle speed sensor circuit.**
	**DEMONSTRATION: Show students how to use a variable resistance potentiometer like a 90 ohm gas gauge tank sender to test gauges for proper operation**
	**DISCUSS CASE STUDY: *Electronic Devices Cannot Swim:* Owner of a Dodge minivan complained that after vehicle was cleaned inside and outside, temperature gauge, fuel gauge, and speedometer stopped working. The vehicle speed sensor was checked and found**

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	**to be supplying a square wave signal that changed with vehicle speed. A scan tool indicated a speed, yet the speedometer displayed zero all the time. Finally, the service technician checked the body control module (BCM) to the right of the accelerator pedal and noticed that it had been wet, from interior cleaning. Drying BCM did not fix problem, but a replacement BCM fixed all problems. Owner discovered that electronic devices do not like water and that computers cannot swim.** **Summary:** • **Complaint—Customer complained that many gauges stopped working after the vehicle was cleaned.** • **Cause—BCM was found to be wet and had to be replaced to fix the problems.** • **• Correction—Replacing BCM was needed to fix problems.** **21. SLIDE 21 EXPLAIN FIGURE 22–20** A typical view displayed on the navigation screen from the backup camera. **22. SLIDE 22 EXPLAIN FIGURE 22–21** A typical fisheye-type backup camera usually located near center on the rear of the vehicle near license plate**.** **23. SLIDE 23 EXPLAIN FIGURE 22–22** small round buttons in the rear bumper are ultrasonic sensors used to sense distance to an object **EXPLAIN TECH TIP: *Check for Repainted Bumper*** **The ultrasonic sensors embedded in the bumper are sensitive to paint thickness because the paint covers the sensors. If the system does not seem to be responding to objects, and if the bumper has been repainted, measure the paint thickness using a nonferrous paint thickness gauge. The maximum allowable paint thickness is 6 mils (0.006 inch or 0.15 millimeter).**

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  	**HANDS-ON TASK:** Have students use DMM to test sensors/switches. Have students inspect & test gauge fuses to check power supply to gauge circuitry. Use scan tool to retrieve data that could help diagnose speedometer problems. **EXPLAIN TECH TIP:** ***Keep the Same Overall Tire Diameter.*** Whenever larger (or smaller) wheels or tires are installed, the speedometer and odometer calibration are thrown off. This can be summarized as follows: • Larger diameter tires. The speed showing on speedometer is slower than actual speed. Odometer reading shows fewer miles than actual. • Smaller diameter tires. Speed showing on speedometer is faster than actual speed. The Odometer reading shows more miles than actual. To avoid speedometer and odometer issues, select a wheel/tire combination that has same outside diameter (OD) of original wheel/tire combination. Many newer vehicles can use scan tool to change tire size (from a select group of sizes) to minimize effects of tires size change on odometer and speedometer readings. • To determine exact effects of a replacement size wheel or tire, perform an Internet search for a tire size comparison chart. **DISCUSS CASE STUDY:** ***Speedometer Works as if It Is a Tachometer:*** Owner of a Ford F-150 pickup truck complained that all of a sudden speedometer needle went up and down with engine speed, rather than vehicle speed. In fact, speedometer needle went up and down with engine speed, even though gear selector was in "park" and vehicle was not moving. After hours of troubleshooting, technician went back and started checking basics and discovered that alternator had bad diode. The

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 	technician measured over 1-volt AC and over 10-amperes AC ripple current using a clamp-on AC/DC ammeter. Replacing the alternator restored the proper operation of the speedometer. Summary: • Complaint—Customer stated that the speedometer moves in relation to engine speed and not vehicle speed. • Cause—Tests confirmed that alternator was producing excessive AC voltage due to a bad diode. • Correction—Replacing alternator restored proper operation of speedometer. 24. **SLIDE 24 EXPLAIN FIGURE 22–23** dash display on a Chevrolet pickup truck showing that an object is being detected at the front and left front of vehicle. **DISCUSS FREQUENTLY ASKED QUESTION:** ***What Is Navigation-Enhanced Climate Control?*** Some vehicles use data from navigation system to help control automatic climate control system. Data about location of vehicle includes: • Time and date. This information allows automatic climate control system to determine where sun is located. • Direction of travel. The navigation system can also help climate control system determine direction of travel. As a result of input from navigation system, automatic climate control system can control cabin temperature, in addition to various other sensors in vehicle. For example, if vehicle is traveling south in the late afternoon in July, climate control system could assume that passenger side of vehicle is warmed more by the sun than driver's side, and could increase

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	airflow to passenger side to help compensate for additional solar heating.
	**DISCUSSION: discuss how lane departure warning systems operate. How does system detect whether a vehicle is changing lanes on purpose or accidentally?**
	**25. SLIDE 25 EXPLAIN FIGURE 22–24** lane departure warning system often uses cameras to sense the road lines and warns driver if vehicle is not staying within the lane, unless the turn signal is on..
	**26. SLIDE 26 EXPLAIN FIGURE 22–25** Global positioning systems use 24 satellites in high earth orbit whose signals are picked up by navigation systems. The navigation system computer then calculates location based on the position of the satellite overhead.
	27. SLIDE 27 EXPLAIN FIGURE 22–26 typical GPS display screen showing location of vehicle.
	**28. SLIDE 28 EXPLAIN FIGURE 22–27** typical navigation display showing various options. Some systems do not allow access to these if the vehicle is in gear and/or moving.
	**29. SLIDE 29 EXPLAIN FIGURE 22–28** screen display of a navigation system that is unable to acquire usable signals from GPS satellites.
	**DISCUSSION: Have students discuss the operation of park-assist and how to use a scan tool to diagnose it.**
	**DEMONSTRATION: Show students how to locate and identify backup sensors. DEMO the backup camera.**
	**30. SLIDE 30 EXPLAIN FIGURE 22–29** three-button OnStar control is located on inside rearview mirror. The left button (telephone handset icon) is pushed if a hands-free cellular call is to be made. The center button is depressed to contact an OnStar advisor and the right emergency button is used to request that help be sent to the vehicle's location.
	**DISCUSSION: discuss different components that compose a navigation system. What is the input device for users on most navigation systems?**

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      	**DISCUSSION:** Have students discuss operation of **VOICE ACTIVATED SYSTEMS.** Can you name any of the specific OEM systems? What the term Bluetooth mean? **ASEEDUCATION TASK F1:** Inspect and test gauges and gauge sending units; determine needed action **ASEEDUCATION TASK F2:** Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine needed action. **ASEEDUCATION TASK F3**: Reset maintenance indicators as required.