

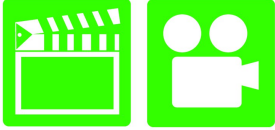
Advanced Automotive Electricity & Electronics

Chapter 17 Driver Information & Navigation Systems

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Advanced Automotive Electricity and Electronics Systems . 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. Identify the meaning of dash warning symbols.2. Explain the operation of electronic speedometers and electronic odometers.3. Describe how a navigation system works.4. Explain the operation and diagnosis of OnStar, backup camera, and backup sensor.5. Describe how to troubleshoot malfunctioning dash instruments. <p>This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "A" (General Electrical/Electronic System Diagnosis).</p>
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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.

ICONS

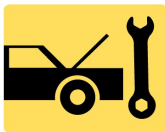


Ch17 Driver Info & Navigation Systems

1. SLIDE 1 CH17 DRIVER INFORMATION & NAVIGATION SYSTEMS

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WEB SITE IS CONSTANTLY UPDATED

2. SLIDES 2-5 **EXPLAIN** Dash Warning Symbols
6. SLIDE 6 **EXPLAIN** Figure 17-1 Engine coolant temperature is too high & **EXPLAIN** Dash Warning Symbols
7. SLIDE 7 **EXPLAIN** Figure 17-2 Engine oil pressure too low. &
8. SLIDE 8 **EXPLAIN** Figure 17-3 Water detected in fuel. Notice to drain the water from the fuel filter assembly on a vehicle equipped with a diesel engine
9. SLIDE 9 **EXPLAIN** Figure 17-4 Maintenance required. This usually means that the engine oil is scheduled to be changed or other routine service items replaced or checked
10. SLIDE 10 **EXPLAIN** Figure 17-5 Malfunction indicator lamp (MIL), also called a check engine light. The light means the engine control computer has detected a fault.
11. SLIDE 11 **EXPLAIN** Figure 17-6 Charging system fault detected.
12. SLIDE 12 **EXPLAIN** Figure 17-7 Fasten safety belt warning light
13. SLIDE 13 **EXPLAIN** Figure 17-8 Fault detected in the supplemental restraint (airbag) system.
14. SLIDE 14 **EXPLAIN** Figure 17-9 Fault detected in base brake system
15. SLIDE 15 **EXPLAIN** FIGURE 17-10 Brake light bulb failure detected
16. SLIDE 16 **EXPLAIN** Figure 17-11 Exterior light bulb failure detected
17. SLIDE 17 **EXPLAIN** Figure 17-12 Worn brake pads or linings detected.
18. SLIDE 18 **EXPLAIN** Figure 17-13 Fault detected in antilock brake system
19. SLIDE 19 **EXPLAIN** Figure 17-14 Low tire pressure

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detected

20. SLIDE 20-21 **EXPLAIN** Dash Warning Symbols
22. SLIDE 22 **EXPLAIN** Figure 17-15 Door open or ajar
23. SLIDE 23 **EXPLAIN TECH TIP**

24. SLIDE 24 **EXPLAIN** Figure 17-16 Windshield washer fluid low.
25. SLIDE 25 **EXPLAIN** Figure 17-17 Low fuel level
26. SLIDE 26 **EXPLAIN** Figure 17-18 Headlights on.
27. SLIDE 27 **EXPLAIN** Figure 17-19 Low traction detected. Traction control system is functioning to restore traction (usually flashes when actively working to restore traction)
28. SLIDE 28 **EXPLAIN** Figure 17-20 Vehicle stability control system either off or working if flashing.
29. SLIDE 29 **EXPLAIN NOTE**
30. SLIDE 30 **EXPLAIN** Figure 17-21 Traction control system has been turned off
31. SLIDE 31 **EXPLAIN** Figure 17-22 indicates cruise control is on and able to maintain vehicle speed if set. Some vehicles use a symbol that looks like a small speedometer to indicate that cruise control is on.

DISCUSSION: HAVE STUDENTS DISCUSS IMPORTANCE OF INDICATOR, OR WARNING, LIGHTS. WHAT IS PURPOSE OF DASH WARNING LIGHT?

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.

32. SLIDE 32 **EXPLAIN** OIL PRESSURE WARNING DEVICES

33. SLIDE 33 **EXPLAIN** Figure 17-23 A typical oil pressure sending unit provides a varying amount of resistance as engine oil pressure changes. The output from the sensor is a variable voltage

ICONS



QUESTION



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34. SLIDE 34 EXPLAIN REAL WORLD FIX

DISCUSSION: DISCUSS OPERATION OF AN OIL PRESSURE GAUGE AND SENDING UNIT. WHAT IS THE VOLTAGE OF OUTPUT FROM THE SENSOR?

35. SLIDE 35 **EXPLAIN** Temperature Lamp Diagnosis

36. SLIDE 36 **EXPLAIN** Figure 17-24 temperature gauge showing normal operating temperature between 180°F and 215°F, depending on specific vehicle and engine

SHOW VIDEO: TESTING DASH GAUGES
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[HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=TESTING%20AND%20DIAGNOSING%20DASH%20GAUGES&CLIP=PANDC/CHET/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/A6T9.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/STARTING_CHARGING_ELECT/XML/A6T9.XML](http://media.pearsoncmg.com/ph/chet/chet_myLABS/akamai/template/video640x480.php?title=testing%20and%20diagnosing%20dash%20gauges&clip=pandc/chet/2012/automotive/starting_charging_elect/a6t9.mov&caption=chet/chet_myLABS/akamai/2012/automotive/starting_charging_elect/xml/a6t9.xml)

37. SLIDE 37 **EXPLAIN** brake warning lamp

38. SLIDE 38 **EXPLAIN** Figure 17-25 Typical brake warning light switch located on or near the master brake cylinder.

39. SLIDE 39 **EXPLAIN** Figure 17-26 red brake warning lamp can be turned on if the brake fluid level is low.

40. SLIDE 40 **EXPLAIN** Analog Dash Instruments; Network Communication

41. SLIDE 41 **EXPLAIN** Figure 17-27 Electromagnetic fuel gauge wiring. If the sensor wire is unplugged and grounded, the needle should point to "E" (empty). If the sensor wire is unplugged and held away from ground, the needle should point to "F" (full)

DEMONSTRATION: SHOW STUDENTS HOW TO USE A VARIABLE RESISTANCE POTENTIOMETER LIKE A 90 OHM GAS GAUGE TANK SENDER TO TEST GAUGES FOR PROPER OPERATION

42. SLIDE 42 **EXPLAIN** Figure 17-28 A typical instrument display uses data from the sensors over serial data lines to the individual gauges.

43. SLID3 43 **EXPLAIN** Stepper Motor Analog Gauges

44. SLIDE 44 **EXPLAIN** Figure 17-29 Most stepper motors use four wires which are pulsed by the computer to rotate the armature in steps.

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45. **SLIDE 45 EXPLAIN Figure 17-30** The ground for the “check oil” indicator lamp is controlled by the electronic low-oil buffer. Even though this buffer is connected to an oil level sensor, the buffer also takes into consideration the amount of time the engine
46. **SLIDE 46 EXPLAIN Stepper Motor Analog Gauges**
47. **SLIDE 47 EXPLAIN NOTE**
48. **SLIDE 48 EXPLAIN HUD**
49. **SLIDE 49 EXPLAIN CAUTION**
50. **SLIDE 50 EXPLAIN Figure 17-31** typical head-up display showing zero miles per hour, which is actually projected on the windshield from the head-up display in the dash.
51. **SLIDE 51 EXPLAIN Figure 17-32** 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.
52. **SLIDE 52 EXPLAIN Figure 17-33** typical head-up display (HUD) unit.

DISCUSSION: HAVE STUDENTS DISCUSS ADVANTAGES OF HEAD-UP DISPLAY. WHERE IS HUD UNIT INSTALLED?

53. **SLIDE 53 EXPLAIN Figure 17-34** A night vision camera behind the grille of a Cadillac
54. **SLIDES 54-55 EXPLAIN** Digital Electronic Display Operation
56. **SLIDE 56 EXPLAIN CAUTION**
57. **SLIDE 57 EXPLAIN Figure 17-35** (a) Symbol and line drawing of a typical light emitting diode (LED). (b) Grouped in 7 segments, this array is called a 7-segment LED display with a common anode (positive connection). Dash computer toggles cathode (negative) side of each individual segment to display numbers and letters. (c) When all segments turned on, #8 displayed.
58. **SLIDE 58 EXPLAIN Figure 17-36** typical navigation system. This Honda/Acura system uses some of climate control functions as well as trip information on display.

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This particular unit uses a DVD unit in the trunk along with a global positioning satellite (GPS) to display a map and your exact location for the entire country.

59. **SLIDE 59 EXPLAIN** Digital Electronic Display Operation

60. **SLIDE 60 EXPLAIN** Figure 17-37 (a) View of vehicle dash with the instrument cluster removed. Sometimes the dash instruments can be serviced by removing the padded dash cover (crash pad) to gain access to the rear of the dash. (b) The front view of the electronic analog dash display. (c) The rear view of the dash display showing that there are a few bulbs that can be serviced, but otherwise unit is serviced as an assembly.



61. **SLIDE 61 EXPLAIN TECH TIP**



62. **SLIDE 62 EXPLAIN FIGURE 17-38** Typical ignition switch positions. Notice the bulb check position between “on” (run) and “start.” These inputs are often just voltage signal to the body control module and can be checked using a scan tool.

63. **SLIDE 63 EXPLAIN FIGURE 17-39** Many newer vehicles place the ignition switch on the dash and incorporate antitheft controls. Note the location of the accessory position



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.



64. **SLIDE 64 EXPLAIN** ELECTRONIC SPEEDOMETERS

ICONS



QUESTION



QUESTION

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ANIMATION: INPUT DISCREET SIGNALS

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[HTTP://PEGASUS2.PEARSONED.COM/PEGASUS/MODULES/TEACHINGPLAN/FRMCOURSEPREVIEW.ASPX?FROM=CC](http://PEGASUS2.PEARSONED.COM/PEGASUS/MODULES/TEACHINGPLAN/FRMCOURSEPREVIEW.ASPX?FROM=CC)

65. SLIDE 65 **EXPLAIN** Figure 17-40 A vehicle speed sensor located in the extension housing of the transmission. Some vehicles use the wheel speed sensors for vehicle speed information.

66. SLIDE 66 **EXPLAIN REAL WORLD FIX**

67. SLIDE 67 **EXPLAIN TECH TIP**

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.

68. SLIDE 68 **EXPLAIN** Electronic Odometers


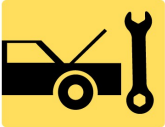










69. SLIDES 69-70 **EXPLAIN REAL WORLD FIX**









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 STUDENTS 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?

ICONS	Ch17 Driver Info & Navigation Systems
	<p>DEMONSTRATION: SHOW HOW TO REMOVE INSTRUMENT CLUSTER & HOW TO REMOVE TRIM PIECES WITHOUT BREAKING RETENTION CLIPS.</p>
	<p>HANDS-ON TASK: HAVE STUDENTS USE DMM TO TEST A VEHICLE SPEED SENSOR CIRCUIT.</p>
	<p>71. SLIDE 71 EXPLAIN Figure 17-41 (a) Some odometers are mechanical and are operated by a stepper motor. (b) Many vehicles are equipped with an electronic odometer</p>
	<p>72. SLIDE 72 EXPLAIN REAL WORLD FIX</p>
	<p>73. SLIDE 73 EXPLAIN Electronic Fuel Level Gauges 74. SLIDE 74 EXPLAIN Figure 17-42 fuel tank module assembly that contains the fuel pump and fuel level sensor in one assembly.</p>
  <p>QUESTION</p>	<p>DISCUSSION: HAVE STUDENTS DISCUSS OPERATION OF VOICE ACTIVATED SYSTEMS. CAN YOU NAME ANY OF THE SPECIFIC OEM SYSTEMS? WHAT THE TERM BLUETOOTH MEAN?</p>
	<p>75. SLIDES 75-76 EXPLAIN NAVIGATION AND GPS</p>
	<p>77. SLIDE 77 EXPLAIN Figure 17-43 Global positioning systems use 24 satellites in high earth orbit whose signals are picked up by navigation systems. The navigation system computer then calculates the location based on the position of the satellite overhead</p>
	<p>78. SLIDE 78 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p>
	<p>79. SLIDE 79 EXPLAIN Figure 17-44 typical GPS display screen showing the location of vehicle</p>
	<p>80. SLIDE 80 EXPLAIN NOTE 81. SLIDE 81 EXPLAIN Figure 17-45 typical navigation display showing various options. Some systems do not allow access to these functions if vehicle is in gear and/or moving. 82. SLIDE 82 EXPLAIN Figure 17-46 screen display of a</p>

ICONS	Ch17 Driver Info & Navigation Systems
 <p>QUESTION</p>       	<p>navigation system that is unable to acquire usable signals from GPS satellites.</p> <p>83. SLIDE 83 EXPLAIN Navigation and GPS DISCUSSION: DISCUSS DIFFERENT COMPONENTS THAT COMPOSE A NAVIGATION SYSTEM. WHAT IS THE INPUT DEVICE FOR USERS ON MOST NAVIGATION SYSTEMS?</p> <p>84. SLIDES 84-85 EXPLAIN TECH TIPS</p> <p>86. SLIDE 86 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p> <p>87. SLIDE 87-88 EXPLAIN ONSTAR</p> <p>89. SLIDE 89 EXPLAIN Backup Camera; Backup Sensors</p> <p>90. SLIDE 90 EXPLAIN Figure 17-47 The three-button OnStar control is located on the 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.</p> <p>ON-VEHICLE NATEF TASK: INSPECT AND TEST GAUGES AND GAUGE SENDING UNITS; DETERMINE NECESSARY ACTION</p> <p>91. SLIDE 91 EXPLAIN Figure 17-48 typical view displayed on the navigation screen from the backup camera.</p> <p>92. SLIDE 92 EXPLAIN Figure 17-49 typical fisheye-type backup camera usually located near the center on the rear of the vehicle near the license plate</p> <p>93. SLIDE 93 EXPLAIN Figure 17-50 A typical backup sensor display located above the rear window inside the vehicle. The warning lights are visible in the inside rearview mirror.</p> <p>94. SLIDE 94 EXPLAIN TECH TIP</p> <p>95. SLIDE 95 EXPLAIN Figure 17-51 The small round buttons in the rear bumper are ultrasonic sensors used to sense distance to an object.</p>

ICONS	Ch17 Driver Info & Navigation Systems
        	<p>DEMONSTRATION: SHOW STUDENTS HOW TO LOCATE AND IDENTIFY BACKUP SENSORS.</p> <p>96. SLIDE 96 EXPLAIN Lane Departure Warning System</p> <p>97. SLIDE 97 EXPLAIN Figure 17-52 A lane departure warning system often uses cameras to sense the road lines and warns the driver if the vehicle is not staying within the lane, unless the turn signal is on</p> <p>98. SLIDE 98 EXPLAIN Electronic Dash Instrument Diagnosis and Troubleshooting</p> <p>99. SLIDE 99 EXPLAIN TECH TIP</p> <p>100. SLIDE 100 EXPLAIN Electronic Dash Instrument Diagnosis and Troubleshooting</p> <p>101. SLIDE 101 EXPLAIN CAUTION</p> <p>102. SLIDE 102 EXPLAIN Maintenance Reminder Lamps</p> <p>DISCUSSION: DISCUSS HOW LANE DEPARTURE WARNING SYSTEMS OPERATE. HOW DOES SYSTEM DETECT WHETHER A VEHICLE IS CHANGING LANES ON PURPOSE OR ACCIDENTALLY?</p> <p>ON-VEHICLE NATEF TASK: INSPECT AND TEST CONNECTORS, WIRES, AND PRINTED CIRCUIT BOARDS OF GAUGE CIRCUITS; DETERMINE NECESSARY ACTION.</p> <p>103. SLIDES 103-114 OPTIONAL FUEL GAUGE DIAGNOSIS</p>