
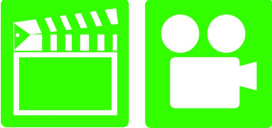
















Advanced Automotive Electricity & Electronics

Chapter 15 CAN & Network Communications

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.	Explain the chapter learning objectives to the students. <ol style="list-style-type: none">1. Describe the types of networks and serial communications used on vehicles.2. Discuss how the networks connect to the data link connector and to other modules.3. Explain how to diagnose module communication faults This chapter will help you prepare for the ASE Electrical/Electronic Systems (A6) certification test content area "A" (General Electrical/Electronic System Diagnosis).
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	Ch15 CAN & Network Communications
	<p>1. SLIDE 1 CH15 CAN & NETWORK COMMUNICATIONS</p>
	<p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p>
	<p>2. SLIDE 2 EXPLAIN MODULE COMMUNICATIONS & NETWORKS</p>
	<p>3. SLIDE 3 EXPLAIN Figure 15-1 Module communications makes controlling multiple electrical devices and accessories easier by utilizing simple low-current switches to signal another module, which does the actual switching of the current to the device</p>
	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE DIFFERENT TYPES OF COMMUNICATION BETWEEN MODULES OR NODES. WHY DO THERE NEED TO BE DIFFERENT TYPES OF COMMUNICATION?</p>
	<p>4. SLIDE 4 EXPLAIN NETWORK FUNDAMENTALS</p>
	<p>5. SLIDE 5 EXPLAIN Figure 15-2 network allows all modules to communicate with other modules</p>
	<p>DEMONSTRATION: DEMONSTRATE OR EXPLAIN TO THE STUDENTS HOW A POWER WINDOW SYSTEM WORKED 10 YEARS AGO AND HOW A MODERN POWER WINDOW SYSTEM WORKS. USE PROJECT BOARD TO DEMO CAN & NETWORK COMMUNICATION</p>
	<p>TRAINER TASK: HAVE STUDENT DO THE SETUP SHOWN IN PREVIOUS DEMONSTRATION</p>
	<p>6. SLIDE 6 EXPLAIN : MODULE COMMUNICATIONS CONFIGURATION</p>
	<p>7. SLIDE 7 EXPLAIN Figure 15-3 Ring link network reduces # of wires it takes to interconnect all of modules.</p>
	<p>8. SLIDE 8 EXPLAIN Figure 15-4 In star link network, all of the modules are connected using splice packs</p>








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	<p>9. SLIDE 9 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p> <p>10. SLIDE 10 EXPLAIN: NETWORK COMMUNICATIONS CLASSIFICATIONS</p> <p>11. SLIDE 11 EXPLAIN Figure 15-5 BUS system showing module CAN communications and twisted pairs of wire.</p> <p>12. SLIDE 12: EXPLAIN GM COMMUNICATIONS PROTOCOLS</p>
	<p>DISCUSSION: DISCUSS CAN NETWORK PICTURED IN FIGURE 15-5. DO ALL OF MODULES ON THIS BUS NEED TO BE ABLE TO TALK TO EACH OTHER?</p> <p>INTERNET TASK: SEARCH INTERNET: HAVE STUDENTS USE THE INTERNET TO RESEARCH SOCIETY OF AUTOMOTIVE ENGINEERS (SAE) STANDARDS FOR THE 3 CATEGORIES OF IN-VEHICLE NETWORK COMMUNICATIONS. DO THESE STANDARDS APPLY IN EVERY COUNTRY? ASK STUDENTS TO REPORT THEIR FINDINGS TO CLASS.</p>
	<p>13. SLIDE 13 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p> <p>14. SLIDE 14 EXPLAIN Figure 15-6 UART serial data master control module connected to DLC at pin 9</p> <p>15. SLIDE 15 EXPLAIN Figure 15-7 E & C serial data is connected to data link connector (DLC) at pin 14.</p> <p>16. SLIDE 16 EXPLAIN Figure 15-8 Class 2 serial data communication accessible at DLC at pin 2.</p> <p>17. SLIDE 17 EXPLAIN GM PROTOCOLS</p> <p>18. SLIDE 18 EXPLAIN Figure 15-9 Keyword 82 operates at a rate of 8,192 bps, similar to UART, and keyword 2000 operates at a baud rate of 10,400 bps (the same as a Class 2 communicator).</p> <p>19. SLIDE 19 EXPLAIN Figure 15-10 GMLAN uses pins at terminals 6 and 14.</p> <p>20. SLIDE 20 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p>
	<p>21. SLIDE 21 EXPLAIN Figure 15-11 twisted pair is used by several different network communications protocols to reduce interference that can be induced in the wiring from nearby electromagnetic sources.</p>








ICONS**Ch15 CAN & Network Communications**

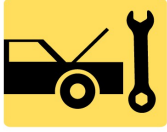
22. **SLIDE 22 EXPLAIN:** FORD NETWORK COMMUNICATIONS PROTOCOLS
23. **SLIDE 23 EXPLAIN** Figure 15-12 **CANdi** module will flash green LED rapidly if communication is detected.
24. **SLIDE 24 EXPLAIN** Figure 15-13 A Ford OBD-I diagnostic link connector showing that SCP communication uses terminals in cavities 1 (upper left) and 3 (lower left).
25. **SLIDE 25 EXPLAIN** Figure 15-14 A scan tool can be used to check communications with the SCP BUS through terminals 2 and 10 and to the other modules connected to terminal 7 of the data link connector (DLC)

26. **SLIDE 26 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE**
27. **SLIDE 27 EXPLAIN** Figure 15-15 Many Fords use UBP module communications along with CAN.
28. **SLIDE 28 EXPLAIN: CHRYSLER COMMUNICATIONS PROTOCOLS**

29. **SLIDE 29 EXPLAIN** Figure 15-16 CCD signals are labeled plus and minus and use a twisted pair of wires. Notice that terminals 3 and 11 of the data link connector are used to access the CCD BUS from a scan tool. Pin 16 is used to supply 12 volts to the scan tool.
30. **SLIDE 30 EXPLAIN** Figure 15-17 differential voltage for CCD BUS is created by using resistors in a module.
31. **SLIDE 31 EXPLAIN** Figure 15-18 Many Chrysler vehicles use both SCI & CCD for module communication
32. **SLIDE 32 EXPLAIN Chrysler Communications Protocols**
33. **SLIDE 33 EXPLAIN NOTE**
34. **SLIDE 34 EXPLAIN CONTROLLER AREA NETWORK**
35. **SLIDE 35 EXPLAIN** Figure 15-19 CAN uses a differential type of module communication where the voltage on one wire is the equal but opposite voltage on the other wire. When no communication is occurring, both wires have 2.5 volts applied. When communication is occurring, CAN H (high) goes up 1 volt to 3.5 volts and CAN L (low) goes down 1 volt to 1.5 volts.

ICONS	Ch15 CAN & Network Communications
	<p>36. SLIDE 36 EXPLAIN Figure 15-20 typical (generic) system showing how the CAN BUS is connected to various electrical accessories and systems in the vehicle</p>
	<p>37. SLIDE 37 EXPLAIN HONDA/TOYOTA</p>
	<p>38. SLIDE 38 EXPLAIN Figure 15-21 DLC from a pre-CAN Acura shows terminals in cavities 4, 5 (grounds), 7, 10, 14, and 16 (B+).</p>
	<p>39. SLIDE 39 EXPLAIN Figure 15-22 Honda scan display showing a B & 2U codes, all indicating a BUS-related problem(s).</p>
	<p>40. SLIDE 40 EXPLAIN EUROPEAN BUS COMMUNICATIONS</p>
	<p>41. SLIDE 41 EXPLAIN Figure 15-23 typical 38-cavity diagnostic connector as found on many BMW and Mercedes vehicles under the hood. The use of a breakout box (BOB) connected to this connector can often be used to gain access to module BUS information.</p>
	<p>42. SLIDE 42 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p>
	<p>43. SLIDE 43 EXPLAIN Figure 15-24 Breakout Box (BOB) used to access BUS terminals while using a scan tool to activate modules. Breakout Box is equipped with LEDs that light when circuits are active</p> <p>44. SLIDE 44 EXPLAIN EUROPEAN BUS COMMUNICATIONS</p> <p>45. SLIDE 45 EXPLAIN: NETWORK COMMUNICATIONS DIAGNOSIS</p> <p>46. SLIDE 46 EXPLAIN Figure 15-25 This Honda scan tool allows the technician to turn on individual lights and operate individual power windows and other accessories that are connected to the BUS system</p> <p>47. SLIDE 47 EXPLAIN Figure 15-26 Modules used in a GM vehicles can be “pinged” using a Tech 2 scan tool.</p> <p>48. SLIDE 48 EXPLAIN: NETWORK COMMUNICATIONS DIAGNOSIS</p> <p>49. SLIDE 49 EXPLAIN Figure 15-27 Checking terminating resistors using an ohmmeter at the DLC</p> <p>50. SLIDE 50 EXPLAIN Figure 15-28 Use front-probe terminals to access the data link connector. Always follow the specified back-probe and front-probe procedures as found in service information.</p> <p>51. SLIDE 51 EXPLAIN: NETWORK</p>

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   	<p>COMMUNICATIONS DIAGNOSIS</p> <p>52. SLIDE 52 EXPLAIN Figure 15-29 (a) Data is sent in packets, so it is normal to see activity then a flat line. (b) CAN BUS should show voltages that are opposite when there is normal communications. CAN H (high) circuit should go from 2.5 volts at rest to 3.5 volts active. CAN L (low) circuit goes from 2.5 volts at rest to 1.5 volts active between messages.</p> <p>HANDS-ON TASK: PRINT OUT STEPS FOR DIAGNOSING AND TESTING NETWORK DIAGNOSTIC CODE. ASK STUDENTS TO FOLLOW DIAGNOSTIC STEPS TO SEE REPAIR PATH.</p> <p>53. SLIDE 53 EXPLAIN: NETWORK COMMUNICATIONS DIAGNOSIS</p> <p>54. SLIDE 54 EXPLAIN TECH TIP</p> <p>55. SLIDE 55 EXPLAIN FREQUENTLY ASKED QUESTION & NOTE</p> <p>56. SLIDE 56 EXPLAIN REAL WORLD FIX</p>
  	<p>57. SLIDE 57 EXPLAIN: NETWORK COMMUNICATIONS DIAGNOSIS</p> <p>58. SLIDE 58 EXPLAIN NOTE</p> <p>59. SLIDE 59 EXPLAIN: OBD-II DATA LINK CONNECTOR</p> <p>60. SLIDE 60 EXPLAIN TECH TIP</p> <p>61. SLIDE 61 EXPLAIN Figure 15-30 16 pin OBD-II DLC with terminals identified. Scan tools use power pin (16) and ground pin (4) for power so that a separate cigarette lighter plug is not necessary on OBD-II vehicles.</p> <p>62. SLIDE 62 EXPLAIN Figure 15-31 schematic of a Chevrolet Equinox shows that the vehicle uses a GMLAN BUS (DLC pins 6 and 14), plus a Class 2 (pin 2) and UART.</p>



NATEF TASK SHEET DIAGNOSE BODY ELECTRONIC SYSTEM USING SCAN TOOL

HOMEWORK: SEARCH INTERNET: RESEARCH VEHICLE COMMUNICATION NETWORKS ON INTERNET . INCLUDE A HISTORY OF NETWORKS AND IMPROVEMENTS THAT HAVE BEEN MADE THAT ARE USED IN THE PRESENT-DAY AUTOMOBILE.