DIAGNOSTICS — FIRST STEPS

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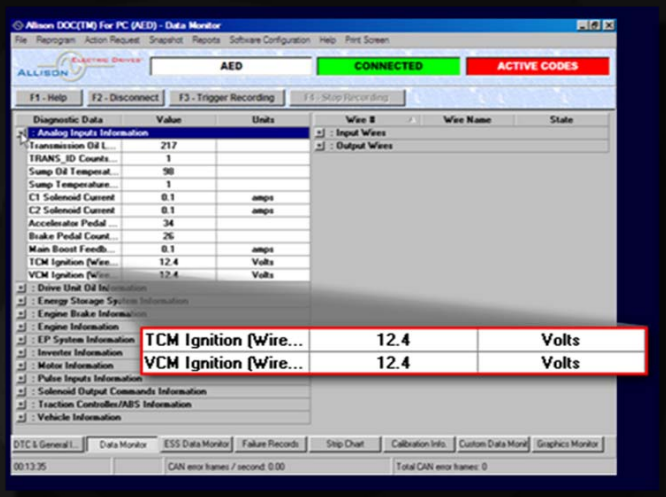
Diagnostics – First Steps

General Procedures And Inspections

- Read, understand and follow the Troubleshooting Manual's Basic Knowledge and Electrical Safety sections.
- Check the drive unit fluid level and condition.
- Visually inspect for physical damage, leaks and wiring harness and connector damage.
- Check all vehicle systems for obvious damage and problems.



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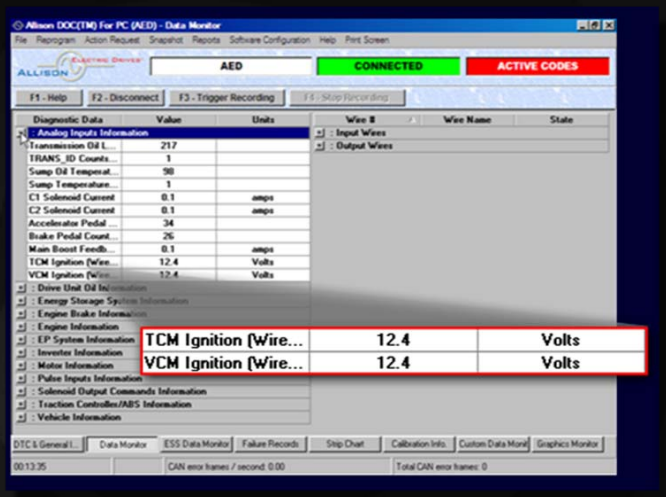
Diagnostics – First Steps

General Procedures And Inspections (cont'd)

- **Use Allison DOC™ for PC (H 40/50 EP).**
  - *Verify the TCM/VCM is receiving proper voltage.*
  - *Verify proper input, motor and output speed sensor signals.*
  - *Check for Diagnostic Trouble Codes (DTCs).*
- **Call Allison TAC (Technical Assistance Center) if necessary (800-242-5283).**



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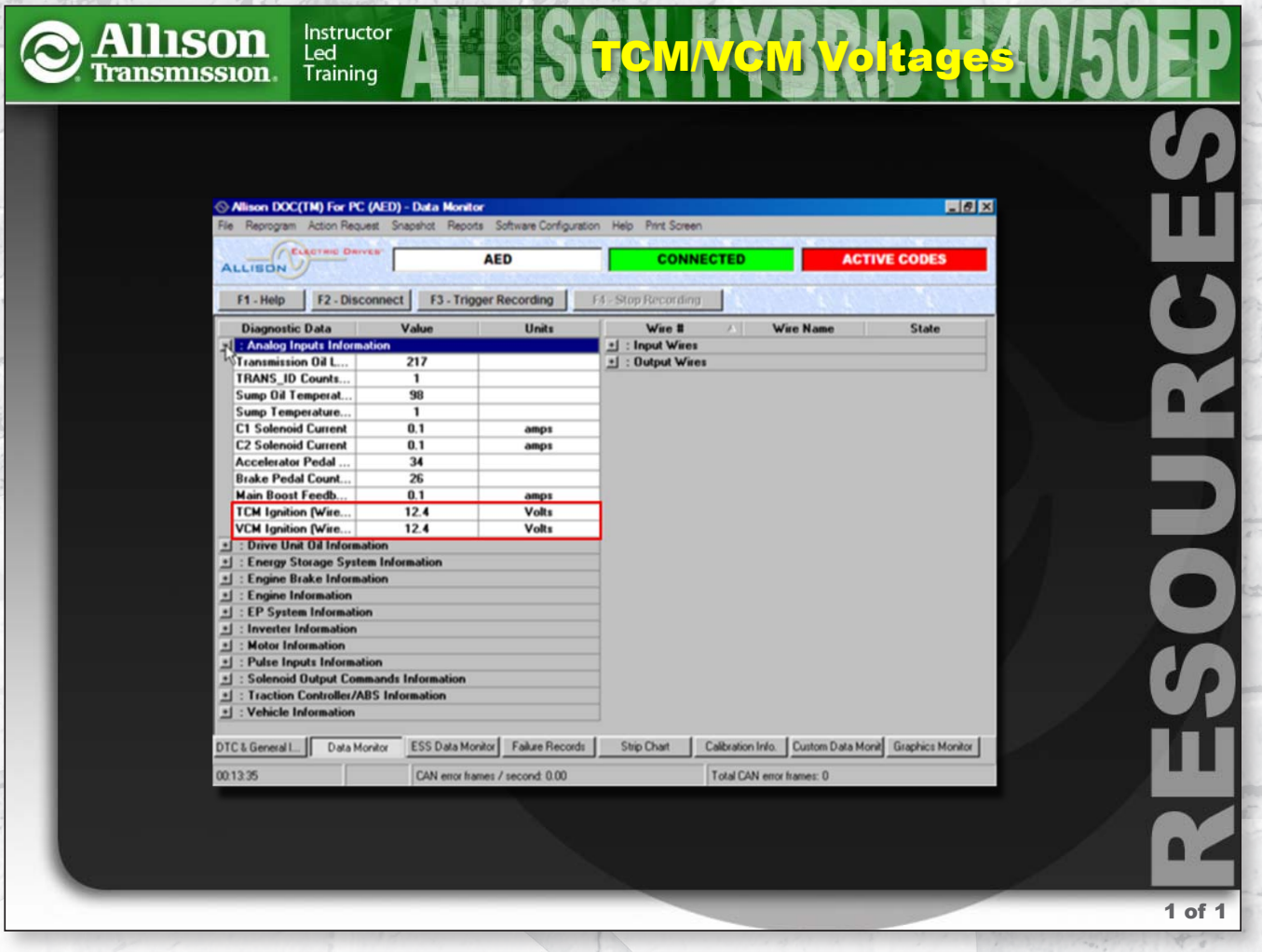
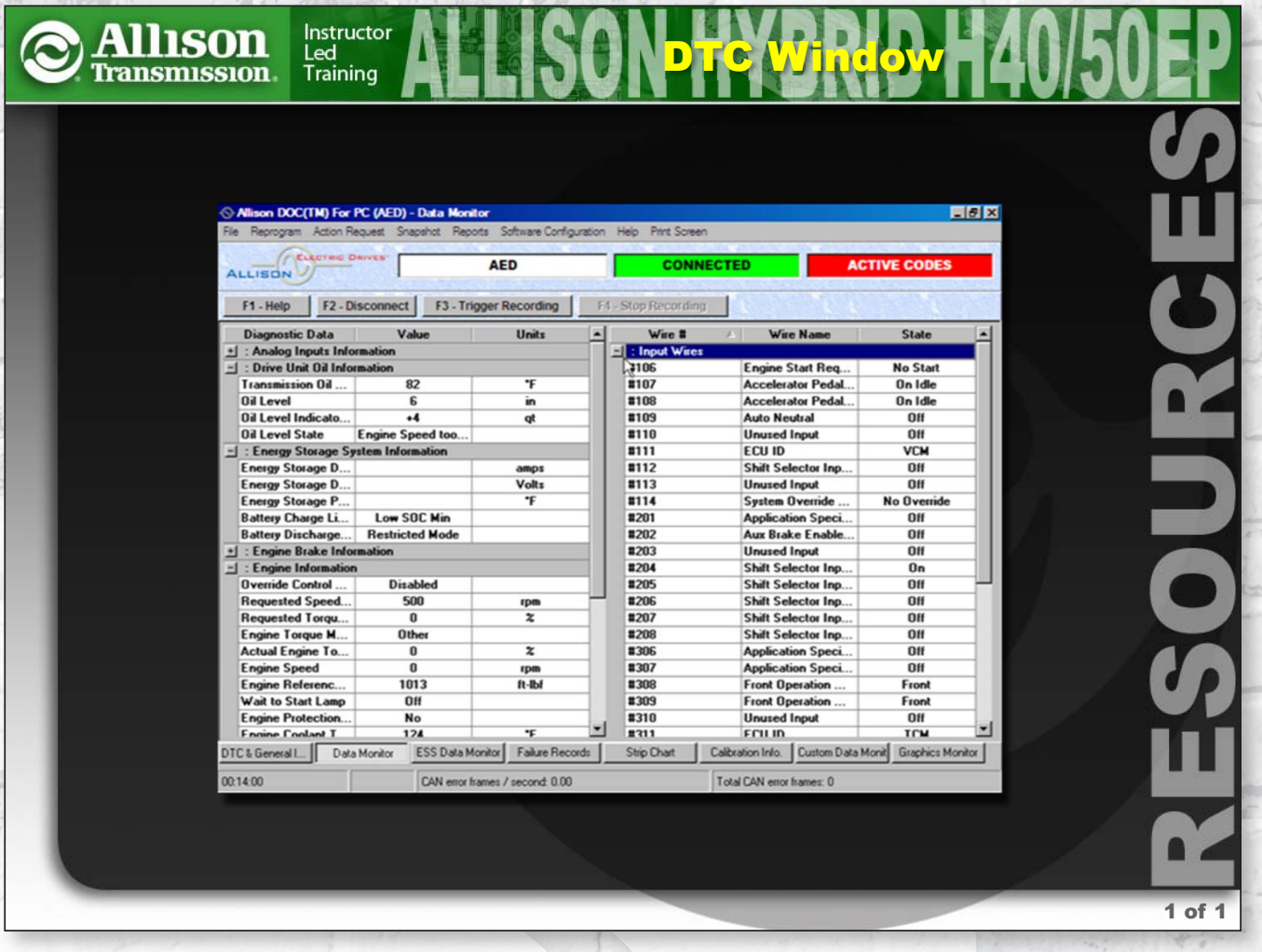
RESOURCES: TCM/VCM Voltages



1 of 1

RESOURCES: DTC Window



RESOURCES: Basic Knowledge

NOTE: This resource link has multiple pages and information changes frequently. Reference the source document for complete, current information.

E^{P} 40/50 SYSTEM™ TROUBLESHOOTING MANUAL

SECTION 3—BASIC KNOWLEDGE

3–1. BASIC KNOWLEDGE REQUIRED

To service E^{P} 40/50 System™ Electronic Controls, the technician must understand basic electrical concepts. Technicians need to know how to use a volt/ohmmeter (VOM) to make resistance and continuity checks. Most troubleshooting checks consist of checking resistance and continuity, and checking for shorts between wires and to ground. The technician should be able to use jumper wires and breakout harnesses and connectors. Technicians unsure of making the required checks should ask questions of experienced personnel or find instruction.

The technician should also have the mechanical aptitude required to connect pressure gauges or transducers to identified pressure ports used in the troubleshooting process. Pressure tap locations and pressure values are shown in Appendix B.

Input power, ground, neutral start circuitry, etc., can cause problems with electronic controls or vehicle functioning and may not generate a DTC. A working knowledge of E^{P} 40/50 System™ Electronic Controls vehicle installation is necessary in troubleshooting installation-related problems.

Refer to Section 7 for information concerning performance complaints (non-DTC) troubleshooting. A complete wiring schematic is shown in Appendix H. Refer to the Tech Data Book for information concerning electronic controls installation and the Installation Checklist. Reliable transmission operation and performance depend upon a correctly installed transmission. Review the Installation Checklist in the E^{P} 40/50 System™ Tech Data Book for proper installation.

NOTE: ***Allison Transmission is providing for service of wiring harnesses and wiring harness components as follows:***

- ***Repair parts for the internal wiring harness will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.***
- ***Repair parts for the external harnesses and external harness components must be obtained through the vehicle OEM. The OEM is responsible for warranty on these parts.***

3–2. USING THE TROUBLESHOOTING MANUAL

Use this manual as an aid to troubleshooting the E^{P} 40/50 System™ Electronic Controls. Every possible problem and its solution cannot be encompassed by any manual. However, this manual does provide a starting point from which most problems can be resolved.

Once a problem solution is discovered in the manual do not look further for other solutions. It is necessary to determine why a problem occurred. The root cause of a problem as well as the symptom must be corrected to ensure trouble free operation. For example, taping a wire that has been rubbing on a frame rail will not correct the problem unless the rubbing contact is eliminated.

NOTE: ***Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.***

3–3. IMPORTANT INFORMATION IN THE TROUBLESHOOTING PROCESS

Before beginning the troubleshooting process, read and understand the following:

- Allison recommended wire numbers (i.e. 212) are a combination of the first digit indicating the TCM connector number (i.e. J2) and the last two digits indicating the pin-out information (i.e. 12).
- Shut off the engine and ignition before any harness connectors are disconnected or connected.
- Remember to do the following when checking for shorts and opens:
  - — Minimize movement of wiring harnesses when looking for shorts. Shorts involve wire-to-wire or wire-to-ground contacts and moving the harnesses may eliminate the problem.
  - — Wiggle connectors, harnesses, and splices when looking for opens. This simulates vehicle movements which occur during actual operation.
- When disconnecting a harness connector, be sure that pulling force is applied to the connector itself and **not the wires** extending from the connector.

RESOURCES: Electrical Safety

NOTE: This resource link has multiple pages and information changes frequently. Reference the source document for complete, current information.

E^{P} 40/50 SYSTEM™ TROUBLESHOOTING MANUAL

ELECTRICAL SAFETY

WARNING!

The Allison Electric Drive E^{P} 40/50 System™ uses potentially hazardous electrical energy. All E^{P} 40/50 System™ components are identified with warning labels or symbols (see Figure 1, Figure 2, and Figure 3). DO NOT attempt to service components containing potentially hazardous electrical energy if you are not trained to do so.

All persons working with potentially hazardous electric energy should familiarize themselves with safe electrical work practices. Paragraph f in Electrical Safety section contains references to publicly available documentation that can assist a technician in developing the safe electrical work practices required to service the E^{P} 40/50 System™ electrical system.

E^{P} 40/50 System™ Normal Operating Conditions

ESS Voltage Range: 432–780VDC
DPIM Voltage Range: –350 to +350A

V10323.00.00

Figure 1. DPIM Warning Label

V10322.00.00

Figure 2. ESS Warning Label

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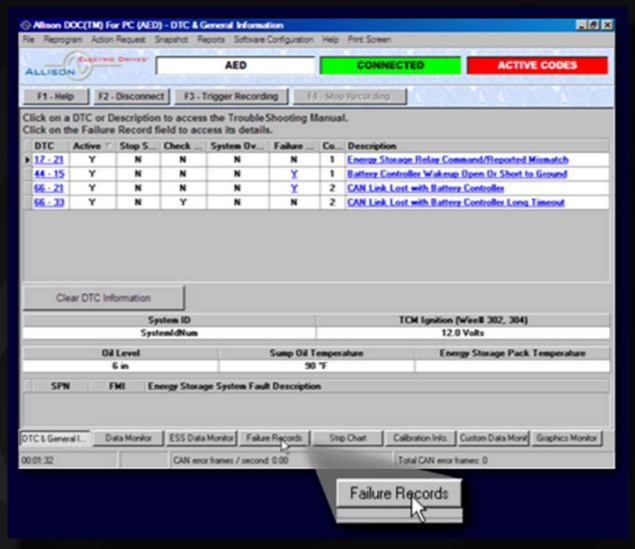
Diagnostics – First Steps

Diagnostic Trouble Codes (DTCs)

- **If DTCs are logged:**
  - *Write down the DTCs.*
  - *Save the DTC Failure Records if available.*
  - *Use the Troubleshooting Manual to diagnose DTCs.*
- **Clear the DTCs and operate the vehicle.**
  - *The presence of some DTCs may affect or limit vehicle operation.*
  - *Active DTCs are cleared at TCM/VCM power down.*
  - *Some active DTCs will clear when the condition causing the code is no longer detected.*
  - *Cleared DTCs may reset if the problem causing the code still exists.*
  - *Cleared DTCs remain logged but are termed "inactive".*



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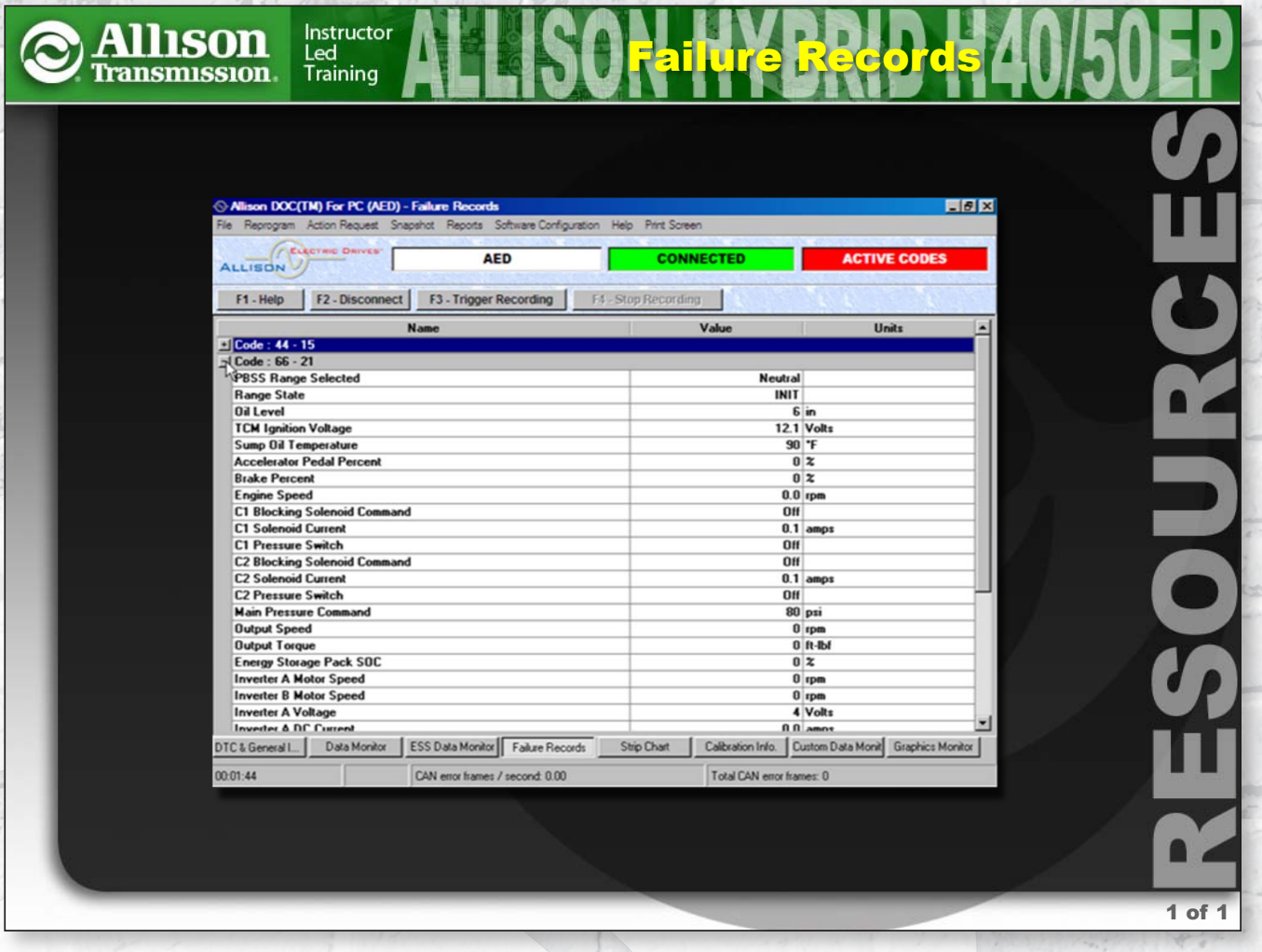
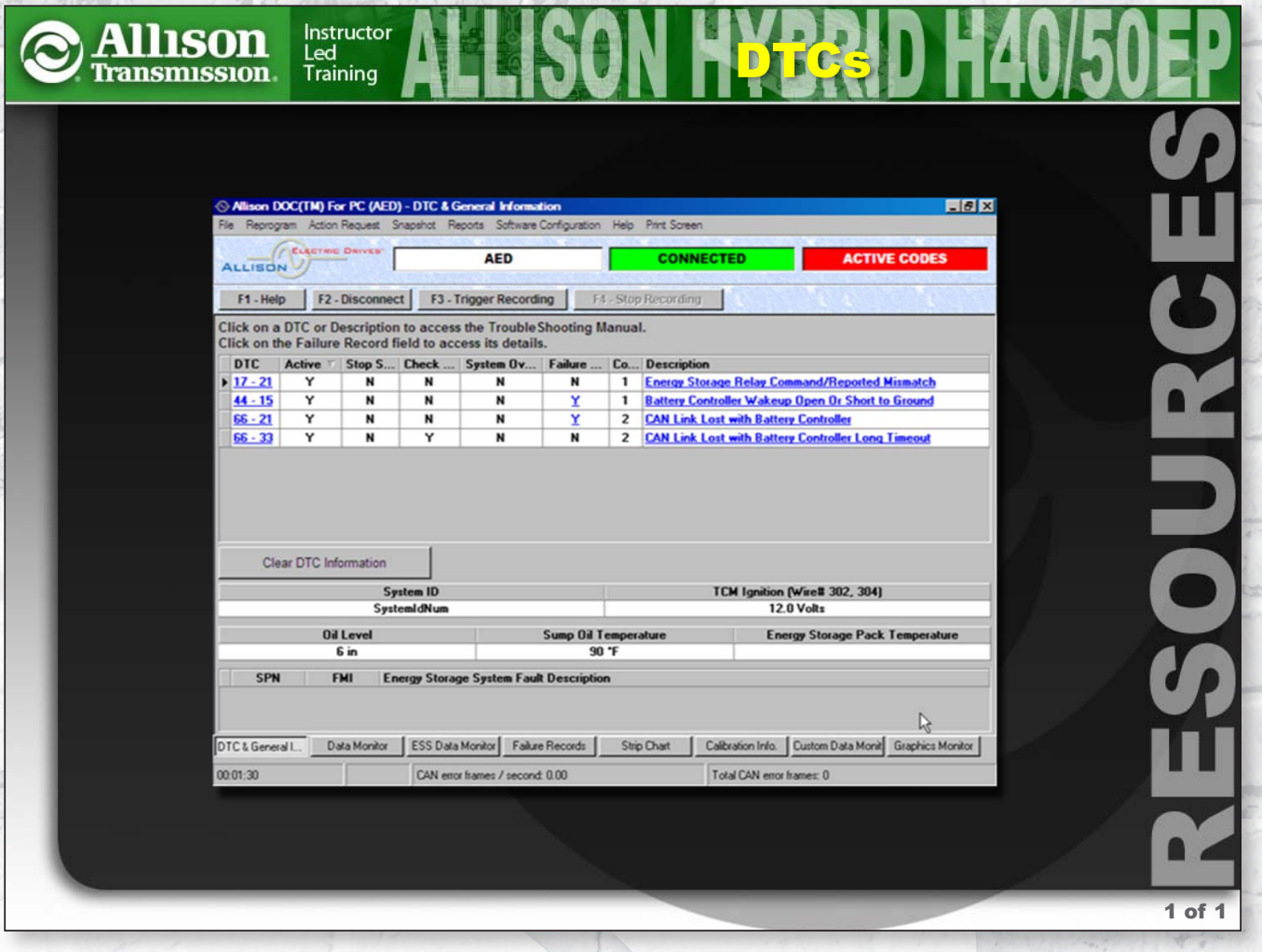
RESOURCES: Accessing Failure Records

RESOURCES: Failure Records



RESOURCES: DTCs



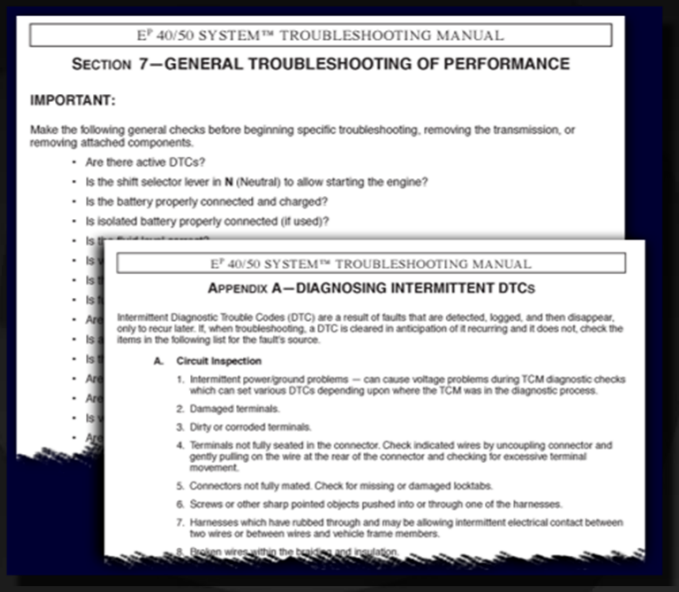
DIAGNOSTICS — FIRST STEPS

Allison Transmission. Instructor Led Training

Diagnostics – First Steps

No DTCs Present

- Use the Troubleshooting Manual's "General Troubleshooting of Performance Complaints" section.
- Use the Troubleshooting Manual's "Diagnosing Intermittent DTCs" appendix.



E^P 40/50 SYSTEM™ TROUBLESHOOTING MANUAL

SECTION 7—GENERAL TROUBLESHOOTING OF PERFORMANCE

IMPORTANT:

Make the following general checks before beginning specific troubleshooting, removing the transmission, or removing attached components.

- Are there active DTCs?
- Is the shift selector lever in **N** (Neutral) to allow starting the engine?
- Is the battery properly connected and charged?
- Is isolated battery properly connected (if used)?

E^P 40/50 SYSTEM™ TROUBLESHOOTING MANUAL

APPENDIX A—DIAGNOSING INTERMITTENT DTCs

Intermittent Diagnostic Trouble Codes (DTC) are a result of faults that are detected, logged, and then disappear, only to recur later. If, when troubleshooting, a DTC is cleared in anticipation of it recurring and it does not, check the items in the following list for the fault's source.

A. **Circuit Inspection**

1. Intermittent power/ground problems — can cause voltage problems during TCM diagnostic checks which can set various DTCs depending upon where the TCM was in the diagnostic process.
2. Damaged terminals.
3. Dirty or corroded terminals.
4. Terminals not fully seated in the connector. Check indicated wires by uncoupling connector and gently pulling on the wire at the rear of the connector and checking for excessive terminal movement.
5. Connectors not fully mated. Check for missing or damaged locktabs.
6. Screws or other sharp pointed objects pushed into or through one of the harnesses.
7. Harnesses which have rubbed through and may be allowing intermittent electrical contact between two wires or between wires and vehicle frame members.
8. Broken wires within the [illegible] and insulation.

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SECTION 7—GENERAL TROUBLESHOOTING OF PERFORMANCE

IMPORTANT:

Make the following general checks before beginning specific troubleshooting or removing the system components.

- Are there active DTCs?
- Is the shift selector lever in **N** (Neutral) to allow starting the engine?
- Is the 12/24V battery properly connected and charged?
- Is isolated battery properly connected (if used)?
- Is the fluid level correct?
- Is voltage to the TCM/VCM correct?
- Is the engine properly tuned?
- Is fuel flow to the engine correct?
- Are wheel chocks in place?
- Is air flow to the cooler and radiator unrestricted?
- Is the driveline properly connected?
- Are there signs of fluid leakage under the vehicle? What is the origination point?
- Are hydraulic connections correctly made and not leaking?
- Has the vehicle acceleration rate been changed?
- Are electrical connections correct?
- Are there any other obvious vehicle or hybrid system problems?

After making these general checks use the various sections of this manual to isolate the listed problems. The following charts address specific vehicle complaints. Some complaints involve DTCs, so all troubleshooting checks should involve first checking the system for DTCs.

Performance Complaints

A. Sluggish Vehicle Performance

Use Allison DOC™ For PC (AED) to compare the commanded versus actual engine torque—if the two values are different, check the engine for trouble codes. Check the Battery Charge Limit ID for any conditions that may limit ESS output.

B. PBSS displays a Cat-Eye

Check for loss of wake-up signal to PBSS and check the SDL wiring.

C. STOP SYSTEM light on with no codes and blank fields in DOC where TCM info should be

Possible CAN problem or power/wake-up problem with TCM. Reference the CAN Troubleshooting in Appendix of this manual.

D. CHECK SYSTEM lamp on without a fault code

Likely caused by a system override switch failing to the ON position (triggered by an open circuit or unconnected switch).

E. Rough shifts

With engine running, cycle the vehicle from **F** to **N**. The shift to Neutral cycles the shift solenoids (fully opening the armature), allowing for any possible debris to pass.

F. High engine speed at idle

Part of normal vehicle operation when the ESS SOC is low.

RESOURCES: Diagnostic Intermittent DTCs

NOTE: This resource link has multiple pages and information changes frequently. Reference the source document for complete, current information.

APPENDIX A—DIAGNOSING INTERMITTENT DTCS

Intermittent Diagnostic Trouble Codes (DTC) are a result of faults that are detected, logged, and then become inactive, only to recur later. If, when troubleshooting, a DTC is cleared in anticipation of it recurring and it does not, check the items in the following list for the fault's source.

A. Circuit Inspection

1. Intermittent power/ground problems — can cause voltage problems during TCM diagnostic checks which can set various DTCs depending upon where the TCM was in the diagnostic process.
2. Damaged terminals.
3. Dirty or corroded terminals.
4. Terminals not fully seated in the connector. Check indicated wires by uncoupling connector and gently pulling on the wire at the rear of the connector and checking for excessive terminal movement.
5. Connectors not fully mated. Check for missing or damaged locktabs.
6. Screws or other sharp pointed objects pushed into or through one of the harnesses.
7. Harnesses which have rubbed through and may be allowing intermittent electrical contact between two wires or between wires and vehicle frame members.
8. Broken wires within the braiding and insulation.

B. Finding an Intermittent Fault Condition

To find a fault, like one of those listed, examine all connectors and the external wiring harnesses. Harness routing may make it difficult to see or feel the complete harness. However, it is important to thoroughly check each harness for chafed or damaged areas. Road vibrations and bumps can damage a poorly installed harness by moving it against sharp edges and cause some of the faults. If a visual inspection does not identify a cause, move and wiggle the harness by hand until the fault is duplicated.

The next most probable cause of an intermittent DTC is an electronic part exposed to excessive vibration, heat, or moisture. Examples of this are:

1. Exposed harness wires subjected to moisture.
2. A defective connector seal allows moisture to enter the connector or part.
3. An electronic part (TCM, VCM, solenoid, or throttle sensor) affected by vibration, heat, or moisture may cause abnormal electrical conditions within the part.

When troubleshooting Item 3, eliminate all other possible causes before replacing any parts.

Another cause of intermittent DTCs is an abnormal environment. The abnormal environment will usually include excessive heat, moisture, or voltage. For example, a TCM that receives excessive voltage will generate a diagnostic code as it senses high voltage in a circuit. The DTC may not be repeated consistently because different circuits may have this condition on each check. The last step in finding an intermittent DTC is to observe if the DTC is set during sudden changes in the operating environment.

Troubleshooting an intermittent DTC requires looking for common conditions that are present whenever the DTC is diagnosed. Use the failure record information from the Allison DOC™ For PC (AED) tool to identify the conditions when the DTC was set.

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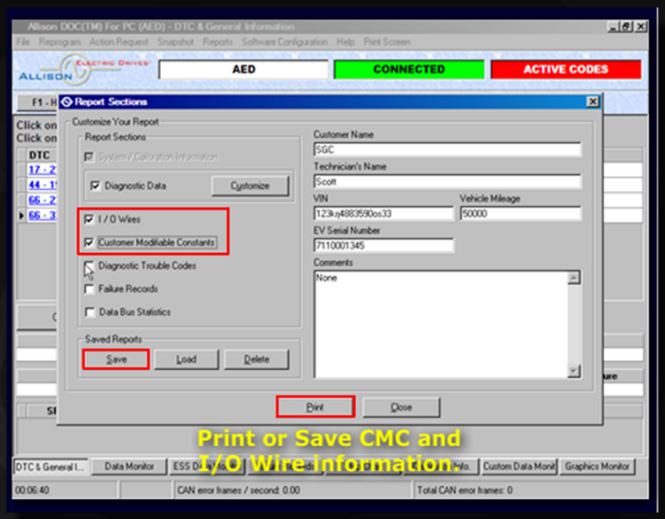
Diagnostics – First Steps

TCM/VCM Diagnostic Procedure

- Identify the current TCM/VCM Calibration Number (CIN) using Allison DOC™ for PC (H 40/50 EP).
  - *Save the Customer Modifiable Constants (CMCs) and Input/Output Wire assignments for reference.*
- Remove the TCM/VCM connectors and inspect the connector and TCM/VCM terminals for damage.
- Replace the TCM/VCM with a new or known good TCM/VCM.
- If the replacement TCM/VCM corrects the complaint, reinstall the original TCM/VCM to verify the complaint returns.



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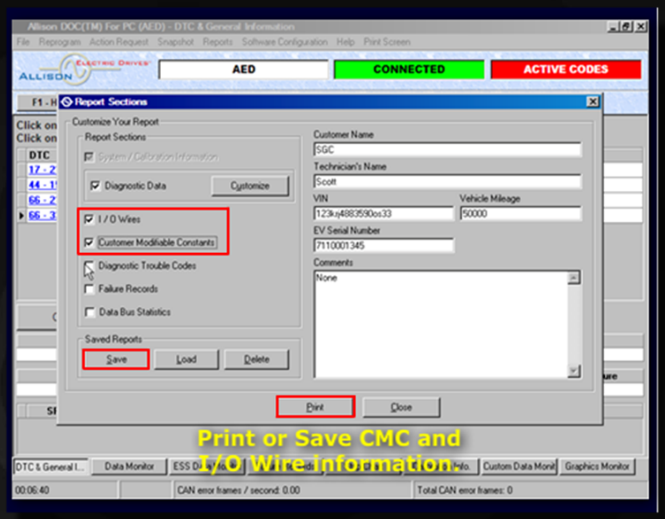
Allison Transmission. Instructor Led Training

Diagnostics – First Steps

TCM/VCM Diagnostic Procedure (cont'd)

- If the complaint does not return, leave the original TCM/VCM installed.



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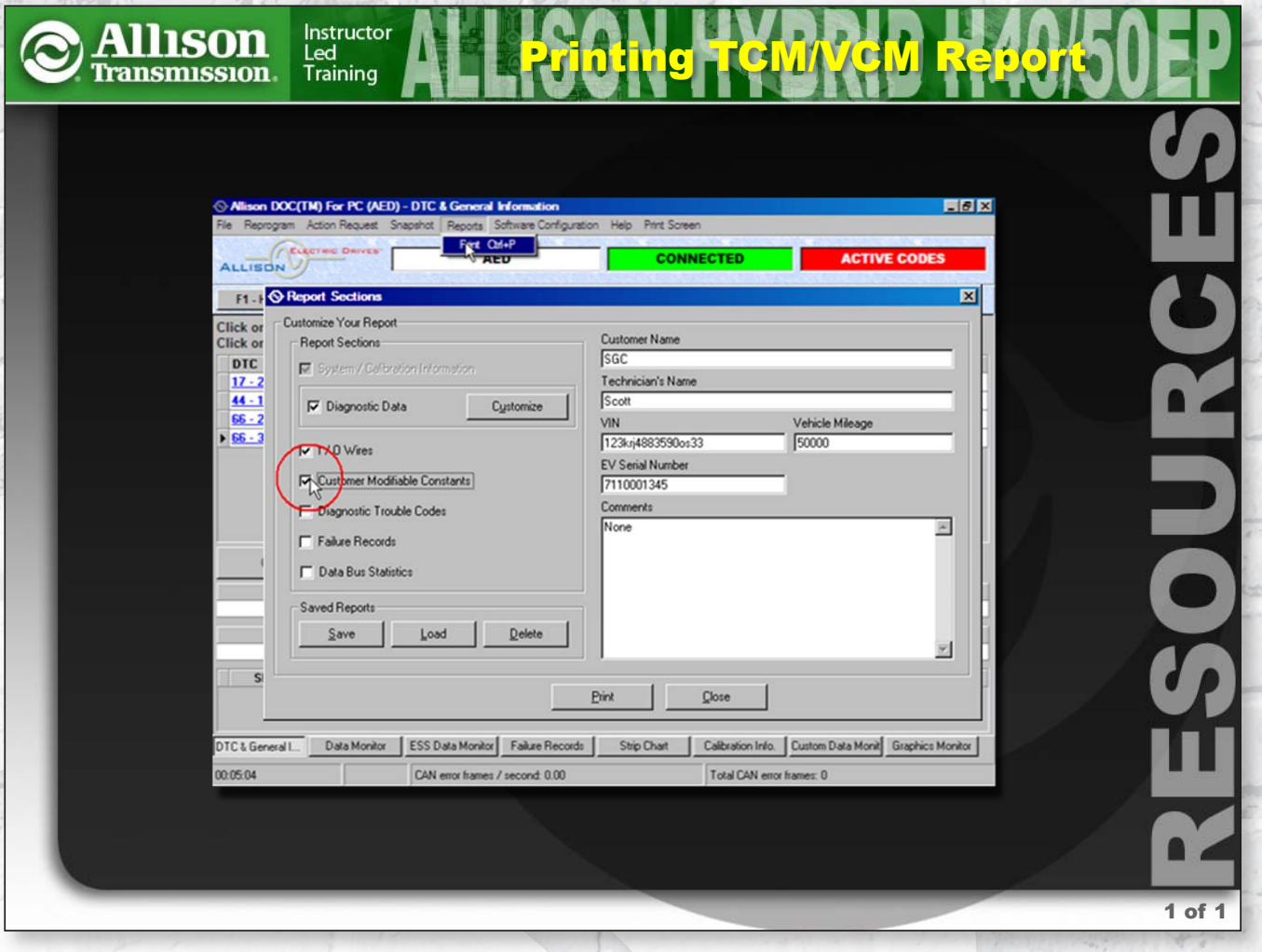
RESOURCES: Printing TCM/VCM Report



RESOURCES: Sample TCM/VCM Report

Allison Transmission Instructor Led Training

Sample TCM/VCM Report

RESOURCES

TestReport.txt - Notepad

File Edit Format View Help

```
Page [1]  Wednesday, March 29, 2006  1:31:01 PM  Customer Name:  SGC
-------------------------------------------------------------------------------

Technician's Name:  Scott
VIN:                123kr14883590os33
Vehicle Mileage:    50000
EV Serial Number:   7110001345
Comments:           None

Units are in Metric


Calibration Information
-----------------------
SID       SystemIdNum

Energy Storage System ID
------------------------
BCIM ID Design Year
BCIM ID Revision Level
BCIM ID Software Part Number

Diagnostic Data
---------------

Analog Inputs Information
-------------------------
        Transmission Oil Level Counts (Wire# 315)          131
        TRANS_ID Counts (Wire# 421)                        0
        Sump Oil Temperature Counts (Wire# 410)            147
        Sump Temperature Pull-Up Resistor                  0
        C1 Solenoid Current                                0.1             amps
        C2 Solenoid Current                                0.1             amps
        Accelerator Pedal Input Counts (Wire# 209)         28
        Brake Pedal Counts (Wire# 115)                     233
        Main Boost Feedback Current                        0.77            amps
        TCM Ignition (Wire# 302, 304)                      11.9            volts
        VCM Ignition (Wire# 102, 104)                      11.9            volts

Drive Unit Oil Information
--------------------------
        Transmission Oil Temperature                       69              °C
        Oil Level                                          99              mm
        Oil Level Indicator (+/-)                          0               L
        Oil Level State                                    Engine Speed too Low

Energy Storage System Information
---------------------------------
        Energy Storage DC Current                          0.0             amps
        Energy Storage DC Voltage                          832             volts
        Energy Storage Pack Temperature                    30              °C
```

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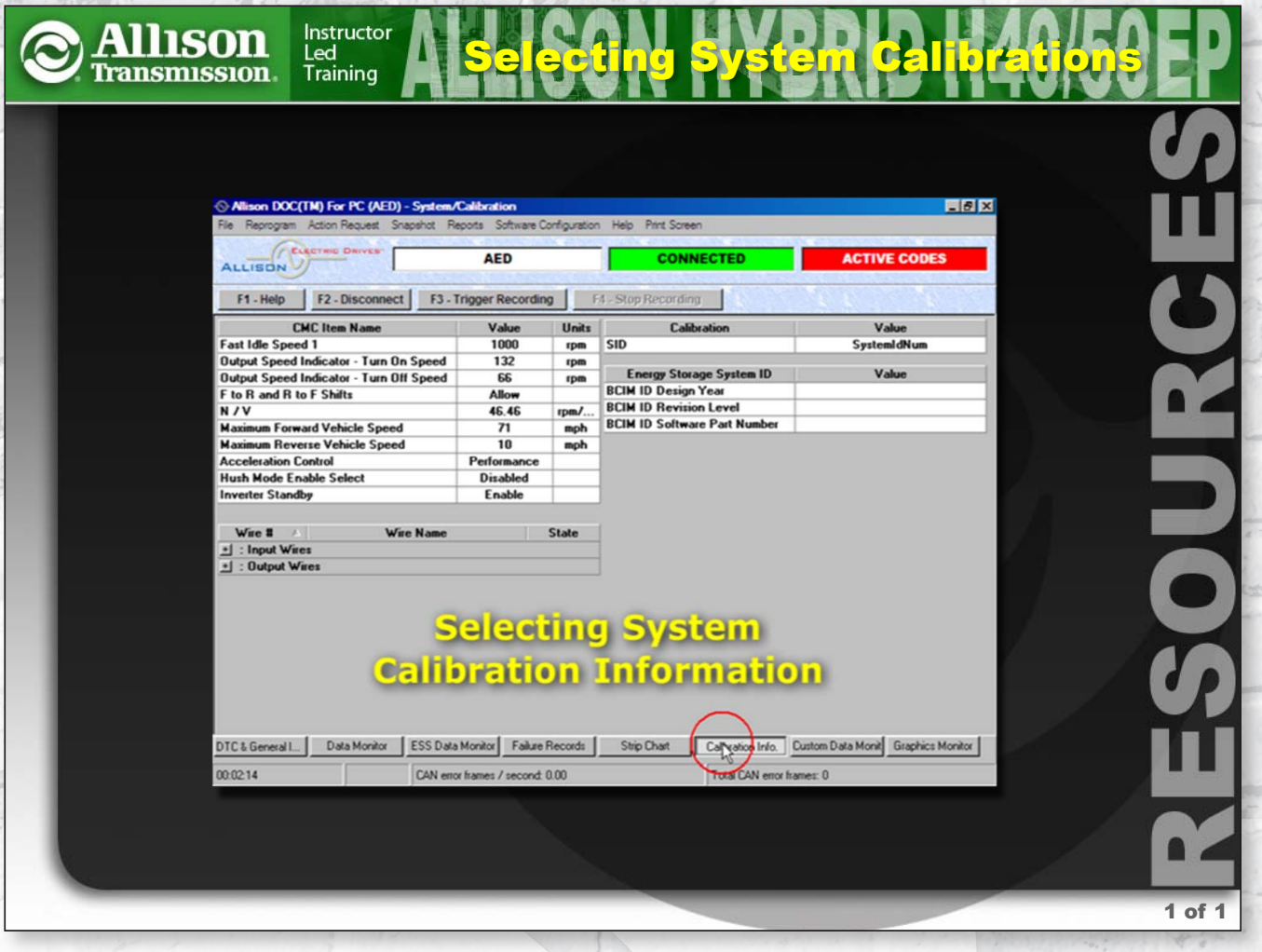
RESOURCES: Selecting System Calibrations



RESOURCES: System Calibration Screen