

ALLISON HYBRID

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.

The screenshot shows the Allison DOC (TM) For PC (AED) - Data Monitor software. The interface includes a menu bar, a status bar with 'AED' and 'CONNECTED' indicators, and a main data display area. The data display area is divided into two sections: 'Diagnostic Data' and 'Wire #'. The 'Diagnostic Data' section lists various parameters and their values. The 'Wire #' section lists input and output wires and their states. A red box highlights the 'TCM Ignition (Wire...)' and 'VCM Ignition (Wire...)' entries in the 'Wire #' section.

Diagnostic Data	Value	Units
Transmission Oil L	217	
TRANS_ID Counts	1	
Sump Oil Temperature	98	
Sump Temperature	1	
C1 Solenoid Current	0.1	amps
C2 Solenoid Current	0.1	amps
Accelerator Pedal	34	
Brake Pedal Count	26	
Main Boost Pressure	0.1	amps
TCM Ignition (Wire...)	12.4	Volts
VCM Ignition (Wire...)	12.4	Volts

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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).

Diagnostic Data	Value	Units	Wire #	Wire Name	State
Transmission Oil L	217				
TRANS_ID Counts	1				
Sump Oil Temperature	98				
Sump Temperature	1				
C1 Solenoid Current	0.1	amps			
C2 Solenoid Current	0.1	amps			
Accelerator Pedal	34				
Brake Pedal Count	26				
Main Boost Pressure	0.1	amps			
TCM Ignition (Wire...)	12.4	Volts			
VCM Ignition (Wire...)	12.4	Volts			

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RESOURCES: TCM/VCM Voltages



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ALLISON HYBRID H 40/50EP TCM/VCM Voltages

Allyson DOC(TM) For PC (AED) - Data Monitor

File Reprogram Action Request Snapshot Reports Software Configuration Help Print Screen

ALLISON ELECTRIC DRIVES

AED CONNECTED ACTIVE CODES

F1 - Help F2 - Disconnect F3 - Trigger Recording F4 - Stop Recording

Diagnostic Data	Value	Units	Wire #	Wire Name	State
Analog Inputs Information					
Transmission Oil L...	217				
TRANS_ID Counts...	1				
Sump Oil Temperat...	98				
Sump Temperature...	1				
C1 Solenoid Current	0.1	amps			
C2 Solenoid Current	0.1	amps			
Accelerator Pedal ...	34				
Brake Pedal Count...	26				
Main Boost Feedb...	0.1	amps			
TCM Ignition (Wire...	12.4	Volts			
VCM Ignition (Wire...	12.4	Volts			
Drive Unit Oil Information					
Energy Storage System Information					
Engine Brake Information					
Engine Information					
EP System Information					
Inverter Information					
Motor Information					
Pulse Inputs Information					
Solenoid Output Commands Information					
Traction Controller/ABS Information					
Vehicle Information					

DTC & General L... Data Monitor ESS Data Monitor Failure Records Strip Chart Calibration Info Custom Data Monit Graphics Monitor

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RESOURCES

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RESOURCES: DTC Window



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ALLISON HYBRID H40/50EP DTC Window

ALLISON DOC(TM) For PC (AED) - Data Monitor

File Reprogram Action Request Snapshot Reports Software Configuration Help Print Screen

ALLISON ELECTRIC DRIVES AED CONNECTED ACTIVE CODES

F1 - Help F2 - Disconnect F3 - Trigger Recording F4 - Stop Recording

Diagnostic Data	Value	Units	Wire #	Wire Name	State
: Analog Inputs Information			: Input Wires		
: Drive Unit Oil Information			#106	Engine Start Req...	No Start
Transmission Oil ...	82	°F	#107	Accelerator Pedal...	On Idle
Oil Level	6	in	#108	Accelerator Pedal...	On Idle
Oil Level Indicato...	+4	qt	#109	Auto Neutral	Off
Oil Level State	Engine Speed too...		#110	Unused Input	Off
: Energy Storage System Information			#111	ECU ID	VCM
Energy Storage D...		amps	#112	Shift Selector Inp...	Off
Energy Storage D...		Volts	#113	Unused Input	Off
Energy Storage P...		°F	#114	System Override ...	No Override
Battery Charge Li...	Low SOC Min		#201	Application Speci...	Off
Battery Discharge...	Restricted Mode		#202	Aux Brake Enable...	Off
: Engine Brake Information			#203	Unused Input	Off
: Engine Information			#204	Shift Selector Inp...	On
Override Control ...	Disabled		#205	Shift Selector Inp...	Off
Requested Speed...	500	rpm	#206	Shift Selector Inp...	Off
Requested Torqu...	0	%	#207	Shift Selector Inp...	Off
Engine Torque M...	Other	%	#208	Shift Selector Inp...	Off
Actual Engine To...	0	%	#306	Application Speci...	Off
Engine Speed	0	rpm	#307	Application Speci...	Off
Engine Referenc...	1013	Rt-lbf	#308	Front Operation ...	Front
Wait to Start Lamp	Off		#309	Front Operation ...	Front
Engine Protection...	No		#310	Unused Input	Off
Engine Coolant T	124	°F	#311	ECU ID	TTCM

DTC & General I Data Monitor ESS Data Monitor Failure Records Strip Chart Calibration Info Custom Data Monitor Graphics Monitor

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RESOURCES

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RESOURCES: Basic Knowledge



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

EP 40/50 SYSTEM™ TROUBLESHOOTING MANUAL

SECTION 3—BASIC KNOWLEDGE

3-1. BASIC KNOWLEDGE REQUIRED

To service EP 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 EP 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 EP 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 EP 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.



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RESOURCES: Electrical Safety



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

EP 40/50 SYSTEM™ TROUBLESHOOTING MANUAL

ELECTRICAL SAFETY

WARNING!

The Allison Electric Drive EP 40/50 System™ uses potentially hazardous electrical energy. All EP 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 EP 40/50 System™ electrical system.

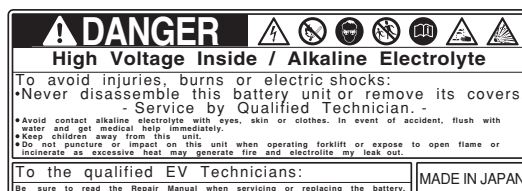
EP 40/50 System™ Normal Operating Conditions

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

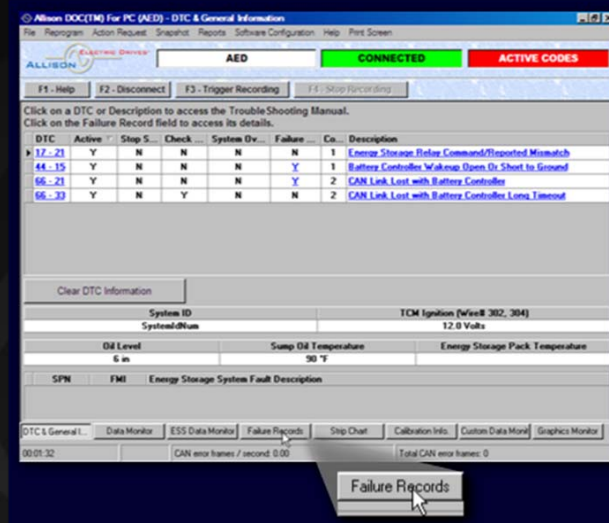


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Diagnostics – First Steps

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



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Accessing Failure Records

ALLISON DOC(TM) For PC (AED) - DTC & General Information

File Reprogram Action Request Snapshot Reports Software Configuration Help Print Screen

ALLISON ELECTRIC DRIVES AED CONNECTED ACTIVE CODES

F1 - Help F2 - Disconnect F3 - Trigger Recording F4 - Stop Recording

Click on a DTC or Description to access the Trouble Shooting Manual.
Click on the Failure Record field to access its details.

DTC	Active	Stop S...	Check ...	System Ov...	Failure ...	Co...	Description
17 - 21	Y	N	N	N	N	1	Energy Storage Relay Command/Reported Mismatch
44 - 15	Y	N	N	N	Y	1	Battery Controller Wakeup Open Or Short to Ground
66 - 21	Y	N	N	N	Y	2	CAN Link Lost with Battery Controller
66 - 33	Y	N	Y	N	N	2	CAN Link Lost with Battery Controller Long Timeout

Accessing Failure Records

Clear DTC Information

System ID TCM Ignition (Wire# 302, 304)
SystemIdNum 12.0 Volts

Oil Level Sump Oil Temperature Energy Storage Pack Temperature
6 in 90 °F

SPN FMI Energy Storage System Fault Description

DTC & General Info Data Monitor ESS Data Monitor Failure Records Trip Chart Calibration Info Custom Data Monitor Graphics Monitor

00:01:33 CAN error frames / second: 0.00 Total CAN error frames: 0

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RESOURCES: Failure Records



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ALLISON HYBRID H 40/50 EP Failure Records

ALLISON DOC(TM) For PC (AED) - Failure Records

File Reprogram Action Request Snapshot Reports Software Configuration Help Print Screen

ALLISON ELECTRIC DRIVES

AED CONNECTED ACTIVE CODES

F1 - Help F2 - Disconnect F3 - Trigger Recording F4 - Stop Recording

Name	Value	Units
Code : 44 - 15		
Code : 66 - 21		
PBSS Range Selected	Neutral	
Range State	INIT	
Oil Level	6 in	
TCM Ignition Voltage	12.1 Volts	
Sump Oil Temperature	90 °F	
Accelerator Pedal Percent	0 %	
Brake Percent	0 %	
Engine Speed	0.0 rpm	
C1 Blocking Solenoid Command	Off	
C1 Solenoid Current	0.1 amps	
C1 Pressure Switch	Off	
C2 Blocking Solenoid Command	Off	
C2 Solenoid Current	0.1 amps	
C2 Pressure Switch	Off	
Main Pressure Command	80 psi	
Output Speed	0 rpm	
Output Torque	0 ft-lbf	
Energy Storage Pack SOC	0 %	
Inverter A Motor Speed	0 rpm	
Inverter B Motor Speed	0 rpm	
Inverter A Voltage	4 Volts	
Inverter B Voltage	0.0 Volts	

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RESOURCES: DTCs



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ALLISON HYBRID H40/50EP

DTCs



Click on a DTC or Description to access the TroubleShooting Manual.
Click on the Failure Record field to access its details.

DTC	Active	Stop S...	Check ...	System Ov...	Failure ...	Co...	Description
17-21	Y	N	N	N	N	1	Energy Storage Relay Command/Reported Mismatch
44-15	Y	N	N	N	Y	1	Battery Controller Wakeup Open Or Short to Ground
66-21	Y	N	N	N	Y	2	CAN Link Lost with Battery Controller
66-33	Y	N	Y	N	N	2	CAN Link Lost with Battery Controller Long Timeout

Clear DTC Information

System ID
SystemIdNum

TCM Ignition (Wire# 302, 304)
12.0 Volts

Oil Level
6 in

Sump Oil Temperature
90 °F

Energy Storage Pack Temperature

SPN FMI Energy Storage System Fault Description

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DIAGNOSTICS — FIRST STEPS

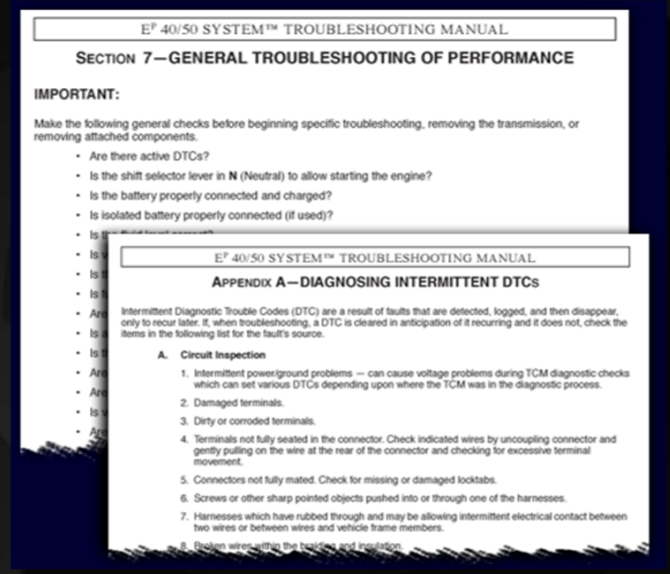


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Diagnostics – First Steps

No DTCs Present

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



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RESOURCES: General Troubleshooting

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.



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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

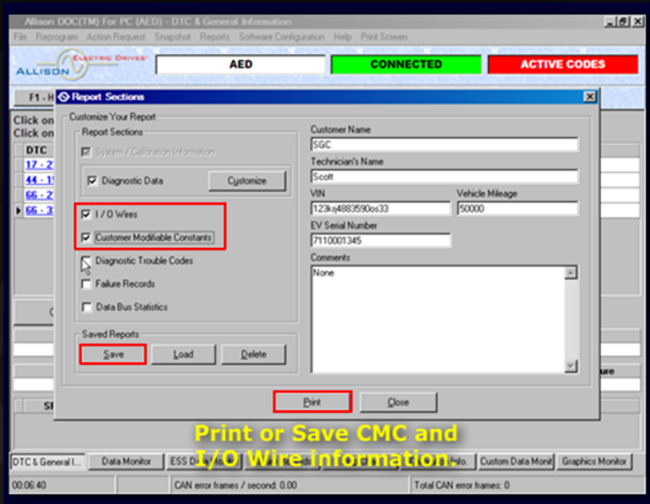


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Diagnostics — First Steps

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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DIAGNOSTICS — FIRST STEPS

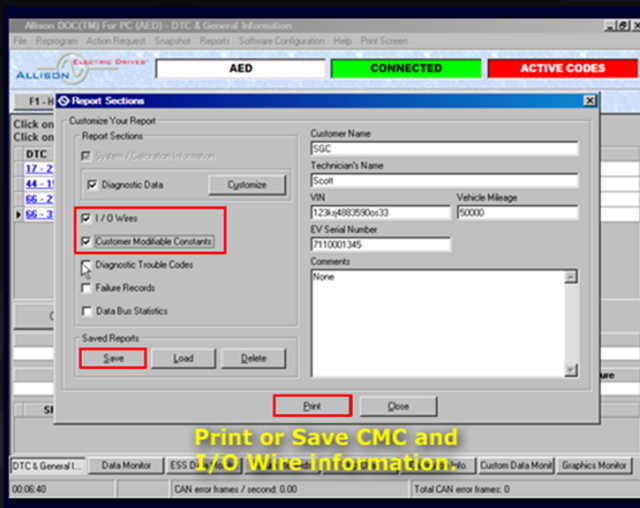


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Diagnostics – First Steps

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



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Printing TCM/VCM Report

ALLISON DOC(TM) For PC (AED) - DTC & General Information

File Reprogram Action Request Snapshot Reports Software Configuration Help Print Screen

ALLISON ELECTRIC DRIVES

Print Out-P AED

CONNECTED ACTIVE CODES

Report Sections

Customize Your Report

Report Sections:

- ☒ System / Calibration Information
- ☒ Diagnostic Data Customize
- ☒ TAD Wires
- ☒ Customer Modifiable Constants
- ☐ Diagnostic Trouble Codes
- ☐ Failure Records
- ☐ Data Bus Statistics

Saved Reports: Save Load Delete

Customer Name: SGC

Technician's Name: Scott

VIN: 123ku4883590s33 Vehicle Mileage: 50000

EV Serial Number: 7110001345

Comments: None

Print Close

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00:05:04 CAN error frames / second: 0.00 Total CAN error frames: 0

RESOURCES

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RESOURCES: Sample TCM/VCM Report



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Sample TCM/VCM Report

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: 123R148835900333
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# 302, 304)	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



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Selecting System Calibrations

Allyson DOC(TM) For PC (AED) - System/Calibration

File Reprogram Action Request Snapshot Reports Software Configuration Help Print Screen

ALLISON ELECTRIC DRIVES AED CONNECTED ACTIVE CODES

F1 - Help F2 - Disconnect F3 - Trigger Recording F4 - Stop Recording

CMC Item Name	Value	Units	Calibration	Value
Fast Idle Speed 1	1000	rpm	SID	SystemIdNum
Output Speed Indicator - Turn On Speed	132	rpm		
Output Speed Indicator - Turn Off Speed	66	rpm		
F to R and R to F Shifts	Allow			
N / V	46.46	rpm/...		
Maximum Forward Vehicle Speed	71	mph		
Maximum Reverse Vehicle Speed	10	mph		
Acceleration Control	Performance			
Hush Mode Enable Select	Disabled			
Inverter Standby	Enable			

Wire # Wire Name State

Input Wires

Output Wires

Selecting System Calibration Information


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00:02:14 CAN error frames / second: 0.00 Total CAN error frames: 0

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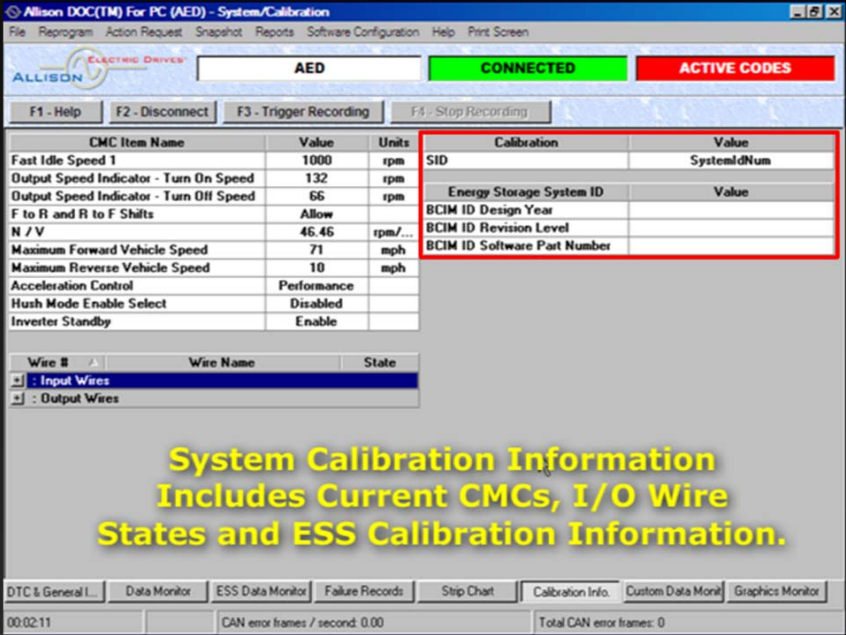


RESOURCES: System Calibration Screen



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System Calibration Screen



**System Calibration Information
Includes Current CMCs, I/O Wire
States and ESS Calibration Information.**

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