Troubleshooting Guide

Bendix™ VORAD® Collision Warning System

BW2849 (Formerly VOTS0030)

December 2011

EVT-300

General Warnings

Before starting a vehicle:

1. Sit in the driver's seat.
2. Place the vehicle in neutral.
3. Set the parking brake.
4. Disengage the clutch.

Before working on the vehicle or leaving the cab with the engine running:

1. Place the vehicle in neutral.
2. Set the parking brake.
3. Block the wheels.

Do not operate the vehicle if the alternator lamp is lit or if the gauges indicate low voltage.

Suggested Tools

NEXIQ Technologies 1-800-639-6774 www.NEXIQ.com	
Part No.	Description
104004	Pro-Link GRAPHIQ™
208040	Multi-Protocol Cartridge (MPC)
804001	MPC Eaton System Software
501003A	Data Cable
405048	6- and 9-Pin Deutsch Diagnostic Adapter
125032	USB Link™ Vehicle Link Adapter

Bendix 1-800-AIR-BRAKE www.bendix.com	
Part No.	Description
ServiceRanger 2.8	PC-based Diagnostics For EVT-300 specific ServiceRanger questions call Bendix at 1-800-AIR-BRAKE

Standard Commercial Product	
	Volt/OHM Meter (VOM)

Related Publications

For more information call 1-800-AIR-BRAKE in the U.S., Canada, and Mexico.

Section 1: Introduction

Section 2: Fault Isolation Procedures

Pretests

Component and System Codes

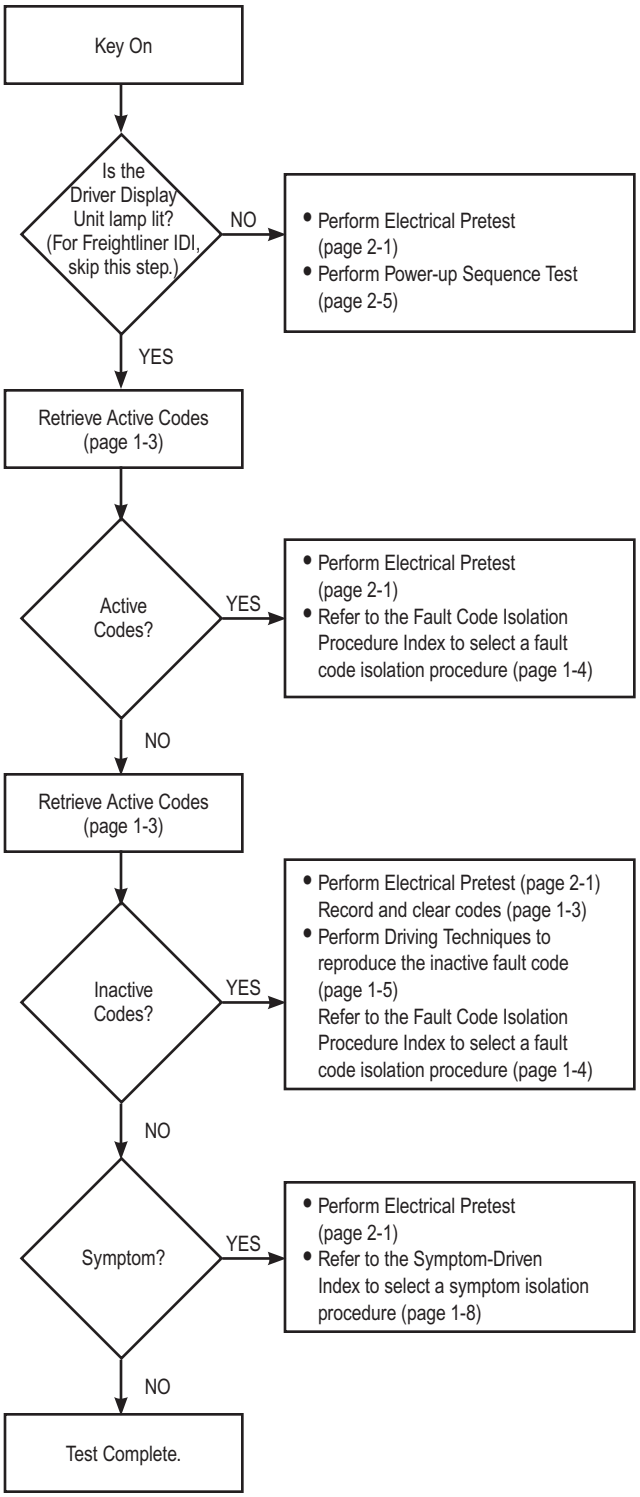
Section 3: Symptom Isolation Procedures

Symptom Tests

Appendix

Diagnostic Procedure

Follow the flowchart below for all Bendix™ VORAD® system failures. Perform tests and procedures as directed by the flowchart.



Fault Code Retrieval and Clearing

RETRIEVING FAULT CODES

Note: Retrieve Bendix™ VORAD® system fault codes by enabling the VORAD system's self-diagnostic mode.

You can also use a PC-based Service Tool, such as ServiceRanger 2.8, or a Pro-Link tool, to retrieve VORAD system fault codes.

1. Put the vehicle in neutral.
2. Set the parking brake.
3. To activate Failure Display Mode, press in and hold the Driver Display Unit "VOLUME" knob while turning the key on.

Note: For software versions 013 and higher, hold "VOLUME" knob in for 8 seconds.

4. Wait until the Driver Display Unit's red "FAIL" indicator light begins flashing two-digit fault codes and release the volume knob. If no fault codes are found, the Driver Display Unit will flash a code 41. At the conclusion of flashing the fault codes, the system will flash a code 41.
5. TO READ ACTIVE FAULT CODES: Position the Driver Display Unit "RANGE" knob to the left of center and only active codes will be sent to the "FAIL" indicator light.
6. TO READ INACTIVE FAULT CODES: Position the Driver Display Unit "RANGE" knob to the right of center and only inactive codes will be sent to the "FAIL" indicator light.
7. Observe the sequence of flashes on the indicator lamp and record the codes. A one to two second pause separates each stored code, and at the conclusion of flashing the fault codes, the system will flash a code 41. The sequence automatically repeats after all codes have been flashed.

CLEARING FAULT CODES

1. Inactive fault codes must be cleared using a PC-based Service Tool, such as ServiceRanger 2.8, or a Pro-Link tool.
2. Active fault codes change to inactive fault codes when the fault has been corrected. Clear inactive fault codes.
3. Turn key off and allow system to power down.
4. Start vehicle and verify no fault codes reoccur.

Fault Code Isolation Procedure Index

Fault Codes	Hand-Held Codes		Description	Type of Code	Page Number
	SID	FMI			
11, 12	254	4,12	Central Processing Unit	Component	2 - 19
13, 34	9	2,4,5,12	Driver Display Unit	Component	2 - 21
14, 35	1,2	2,12,14	Antenna Assembly	Component	2 - 29
15	10	2	Right Side Sensor	Component	2 - 37
16	11	2	Left Side Sensor	Component	2 - 43
21	7	2	Right Turn Signal	Component	2 - 49
22	8	2	Left Turn Signal	Component	2 - 53
23	3	2	Brake Input Signal	Component	2 - 57
24	6	2	Speed Input Signal	Component	2 - 63
25, 32	231	2,12,14	J-1939 Data Link Signal	System	2 - 67
31	250	2	J-1587 Data Link Signal	System	2 - 75
33	248	12	VBUS	Component	2 - 81
41			No Fault or End of Fault Codes		

Driving Techniques

Fault Codes	Hand-Held Codes		Description	Type of Code	Driving Technique
	SID	FMI			
11, 12	254	4,12	Central Processing Unit	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
13, 34	9	2,4,5,12	Driver Display Unit (Not applicable for Freightliner IDI.)	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
14, 35	1,2	2,12,14	Antenna	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
15	10	2	Right Side Sensor	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
16	11	2	Left Side Sensor	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.

Fault Codes	Hand-Held Codes		Description	Type of Code	Driving Technique
	SID	FMI			
21	7	2	Right Turn Signal	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
22	8	2	Left Turn Signal	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
23	3	2	Brake Input Signal	System	Key on. Apply service brake for a minimum of 8 seconds. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat and vibration.
24	6	2	Speed Input Signal	System	Select a forward gear and drive at a steady speed no slower than 10 MPH. It may be necessary to operate the vehicle for a prolonged period of time if the cause of failure is related to heat and vibration.
25, 32	231	2,12,14	J-1939 Data Link Signal	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration, and varying levels of throttle demand. It may take up to 75 seconds to set this fault.

Fault Codes	Hand-Held Codes		Description	Type of Code	Driving Technique
	SID	FMI			
31	250	2	J-1587 Data Link Signal	System	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration, and varying levels of throttle demand. It may take up to 75 seconds to set this fault.
33	248	12	VBUS	Component	Key on. If the fault is present, the system should automatically detect the problem and set the code. If the fault is not present at key on, operate the vehicle and attempt to duplicate the driving conditions that triggered the fault code. Possible triggers include heat, vibration, and varying levels of throttle demand. It may take up to 75 seconds to set this fault.
41			No Fault or End of Fault Codes		

Symptom-Driving Index

Symptom	Isolation Procedure	Page Number
Antenna Not Detecting Targets	Antenna Not Detecting Targets	3 - 1
Side Sensor Not Detecting Targets	Side Sensor Not Detecting Targets	3 - 3
Driver Card Not Reading	Driver Card Not Reading	3 - 11

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Electrical Pretest

Overview

The pretest does not relate to any specific fault code, but must be completed before performing Fault Code Isolation Table procedures. The pretest verifies the basic electrical inputs before testing individual circuits.

Detection

There is no detection process specifically for the basic electrical supply. However, failures of this type are generally detected by the Bendix™ VORAD® system or the driver as some other type of fault code or symptom.

Fallback

There is no fallback for the electrical pretest, however, it may affect other systems.

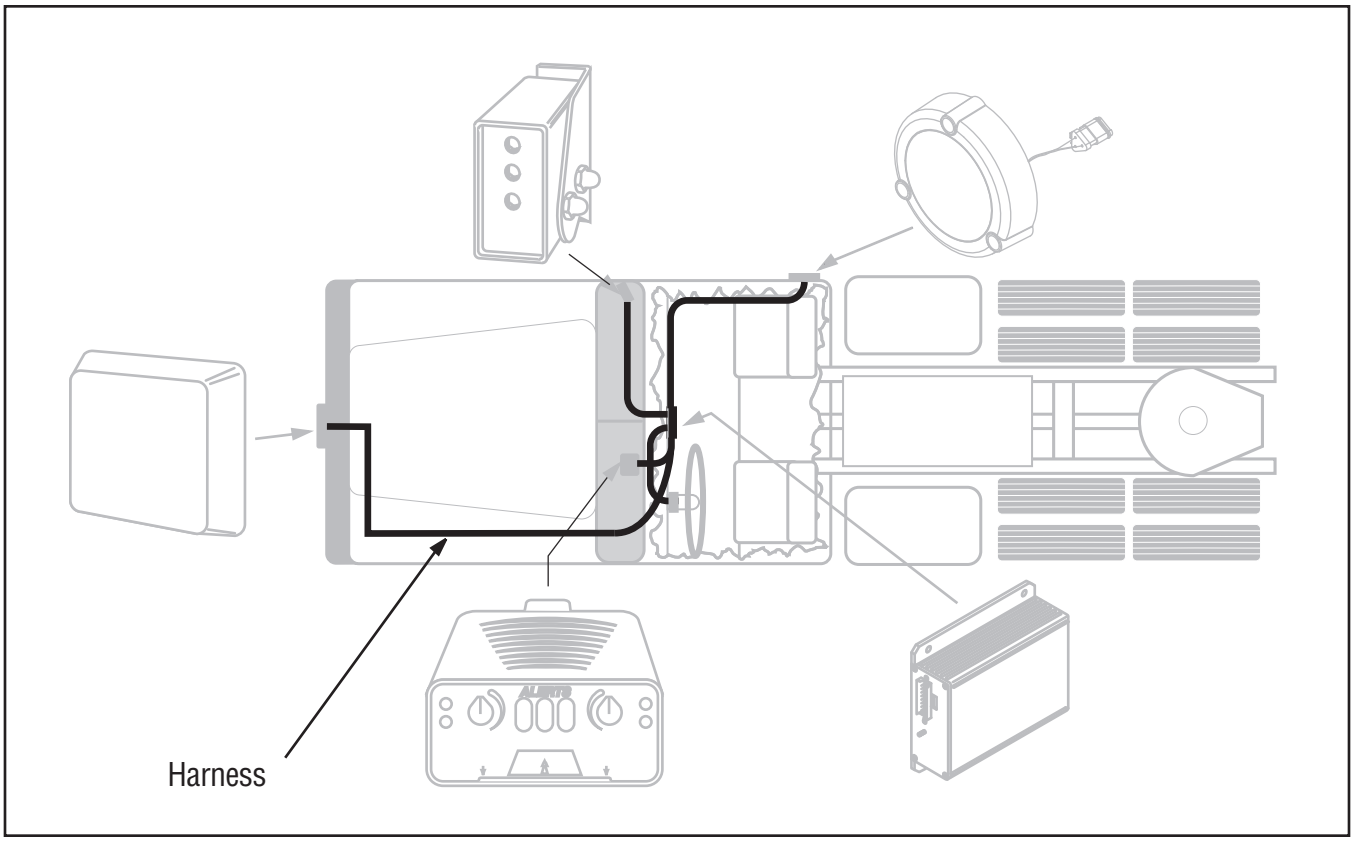
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

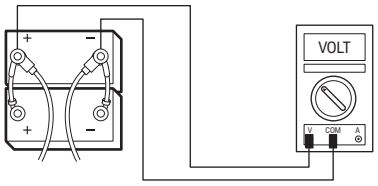
This pretest can be used for any of the following:

- Corroded Power Contacts
- Blown Fuse
- Wiring Harness
- Low Batteries



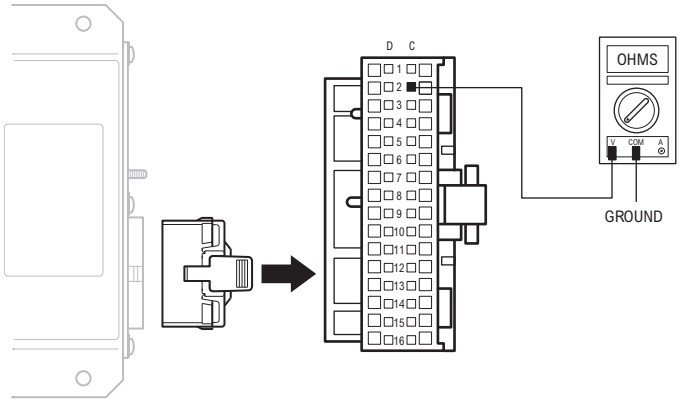
Electrical Pretest

Step A	Procedure	Condition	Action
	1. Key off. 2. Inspect starter/battery connections for integrity. 3. Measure voltage across battery.	If voltage is 11 to 13 volts on a 12 volt system or 22 to 26 on a 24 volt system	Go to **Step B**.
		If voltage is outside of range	Repair or replace batteries and charging system as required. Repeat this step.



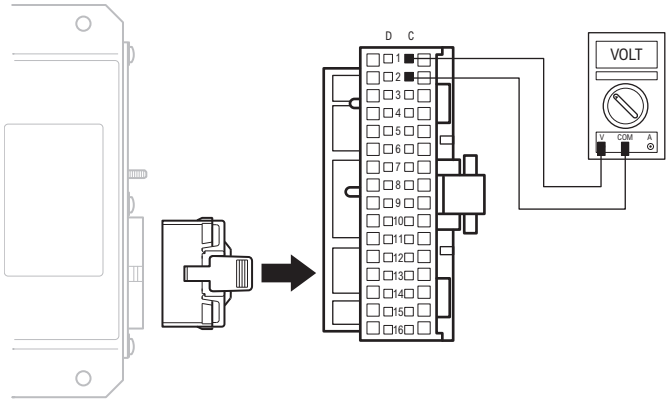
Electrical Pretest, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect negative (-) battery cable. 3. Disconnect 32-way connector from Central Processing Unit.		
	4. Measure resistance between 32-way connector pin C-2 and ground.	If resistance is 0 to .5 ohms	Go to **Step C**.
		If resistance is outside of range	Repair ground path for Bendix™ VORAD® system. Go to **Step A**.



Electrical Pretest, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Connect negative (-) battery cable. 3. Key on. 4. Measure voltage between 32-way connector pin C-1 and C-2.	If voltage is within .6 volts of battery voltage	Test complete.
		If voltage is outside of range	Repair power path for Bendix™ VORAD® system. Fuse may be blown. Reconnect all connectors. Go to **Step A**.



Power-Up Sequence Test

Overview

A failure during the power-up self-check indicates a failure of the Central Processing Unit.

Detection

The power-up self-check is performed automatically each time the key is turned on. Turn the key on and watch the Driver Display Unit. If lights on the Driver Display Unit remain on after 15 seconds, or never come on, the self-check has failed. **NOTE:** Not applicable for Freightliner IDI (Integrated Dash Interface).

Fallback

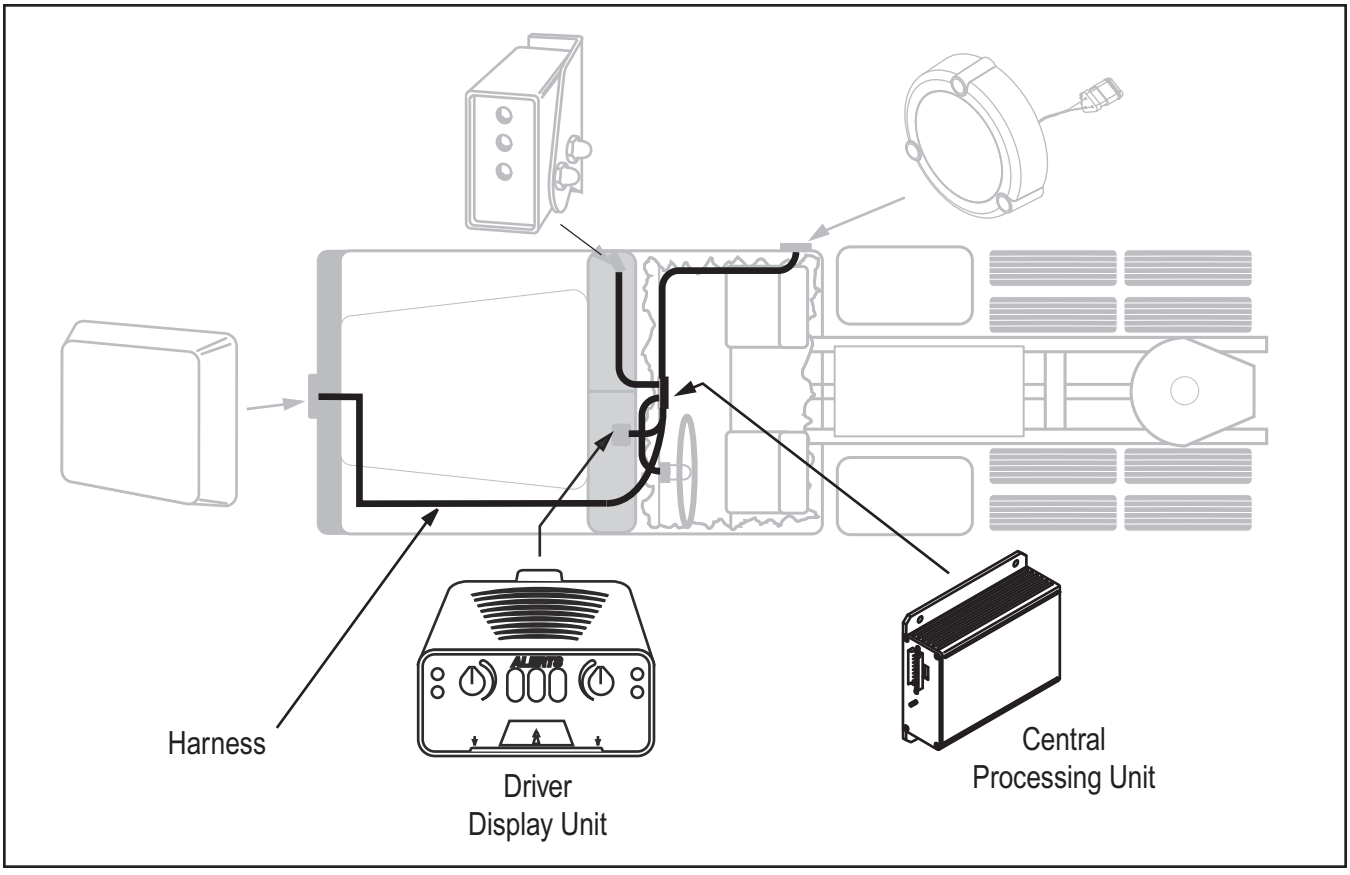
If self-check fails, the product can not perform any operations.

Required Tools

- Digital Volt/Ohm Meter

Possible Causes

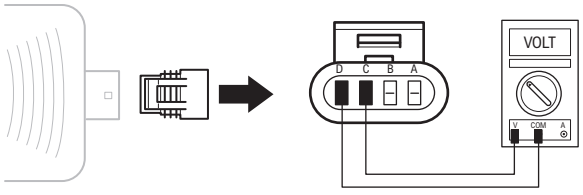
- Central Processing Unit
- Driver Display Unit
- Vehicle Harness



Power-Up Sequence Test

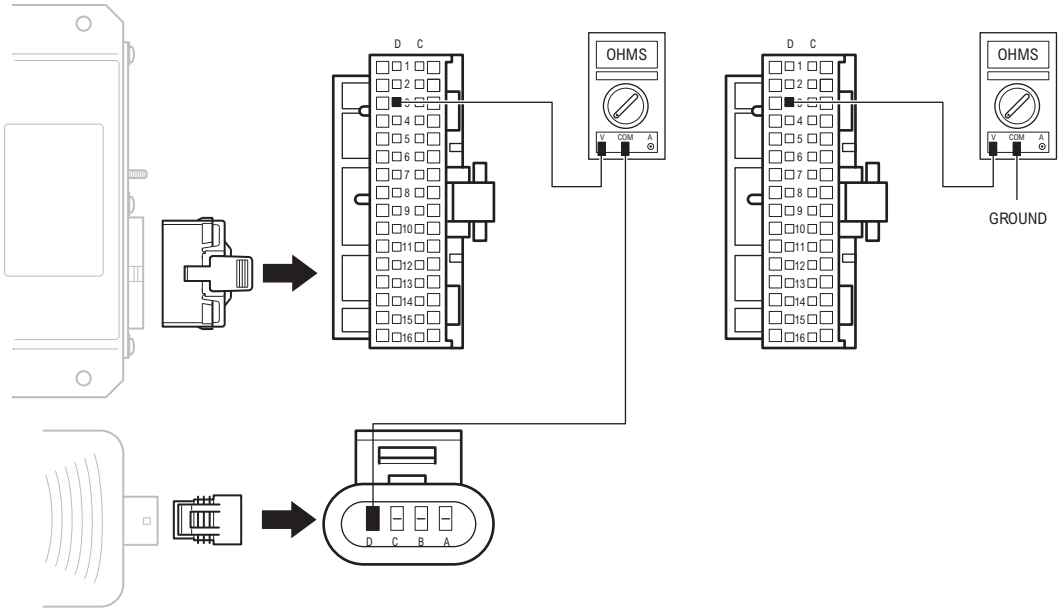
Step A	Procedure	Condition	Action
	1. Before performing this test, the Electrical Pretest must pass. 2. Key on. 3. Observe the Driver Display Unit.	If lights turn on the go off after approximately 15 seconds **Note:** Not applicable for Freightliner IDI	Test complete.
		If lights fail to turn on	Go to **Step B**.
		If lights turn on and stay on	Go to **Step C**.

Step B	Procedure	Condition	Action
	1. Key on. 2. Disconnect the 4-way connector from the Driver Display Unit. **Note:** Not applicable for Freightliner IDI. 3. Measure voltage between pins C and D on the Driver Display Unit 4-way connector.	If voltage is between 7.0 and 7.5 volts	Go to **Step C**.
		If voltage is outside of range	Go to **Step G**.



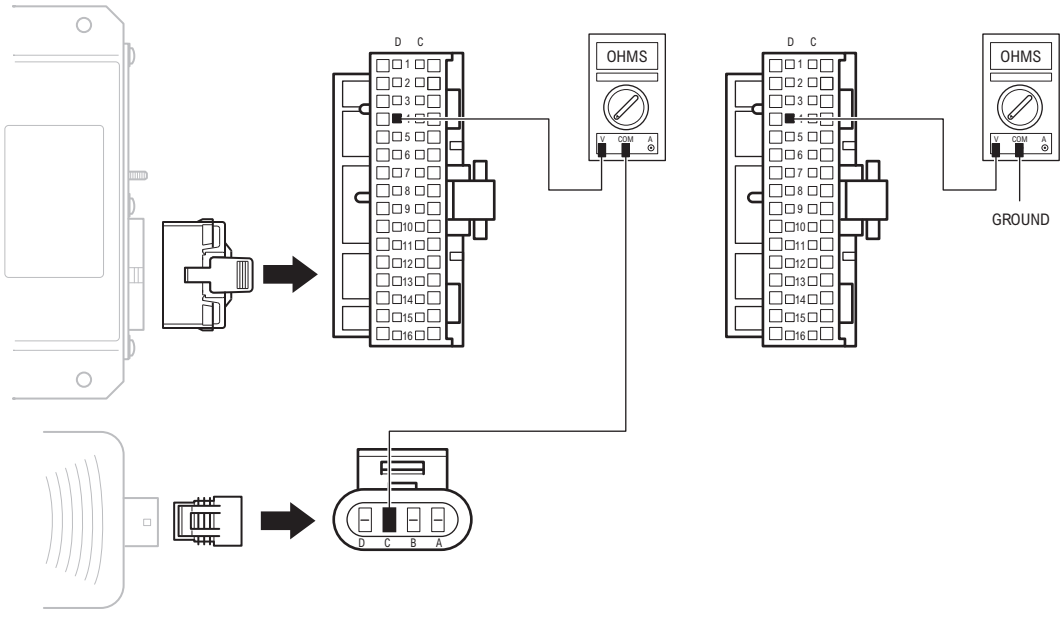
Power-Up Sequence Test, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin D3 and Driver Display 4-way connector pin D. • Central Processing Unit 32-way connector pin D3 and ground.	If resistance between D3 and pin D is 0 to .3 ohms and if resistance between pin D3 and ground is more than 10K ohms or open circuit [OL]	Go to **Step D**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



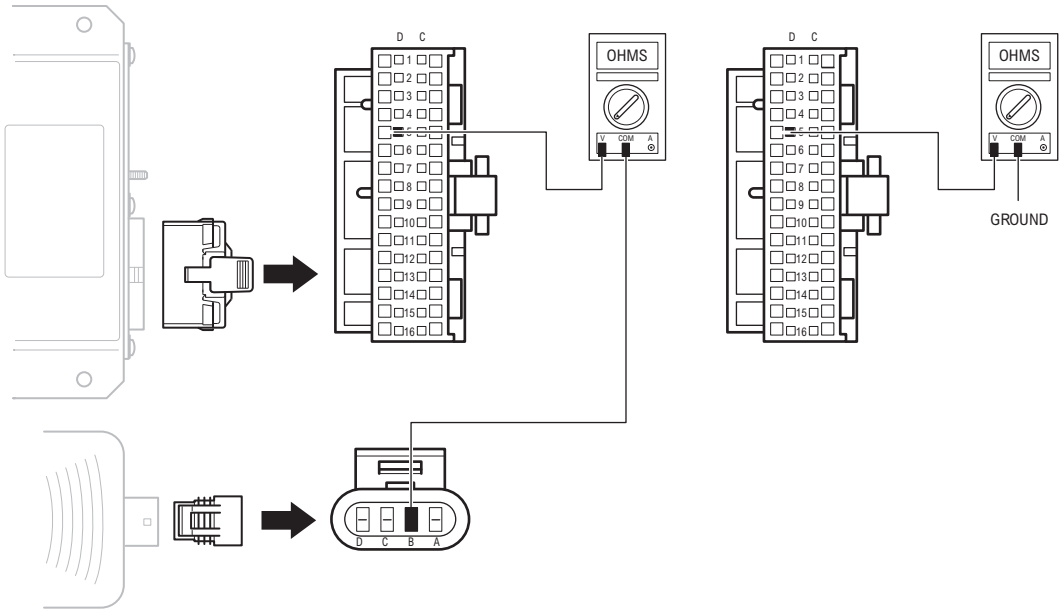
Power-Up Sequence Test, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin D4 and Driver Display 4-way connector pin C. • Central Processing Unit 32-way connector pin D4 and ground.	If resistance between pin D4 and pin C is 0 to .3 ohms and if resistance between pin D4 and ground is more than 10K ohms or open circuit [OL]	Go to **Step E**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



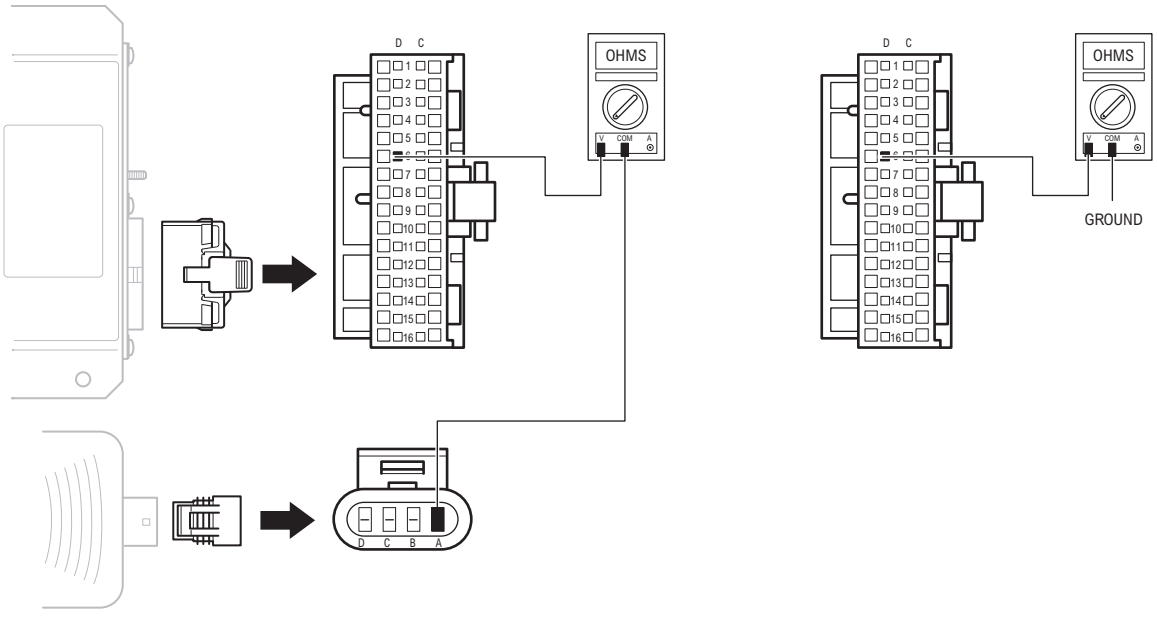
Power-Up Sequence Test, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin D5 and Driver Display 4-way connector pin B. • Central Processing Unit 32-way connector pin D5 and ground.	If resistance between pin D5 and pin B is 0 to .3 ohms and if resistance between pin D5 and ground is more than 10K ohms or open circuit [OL]	Go to **Step F**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



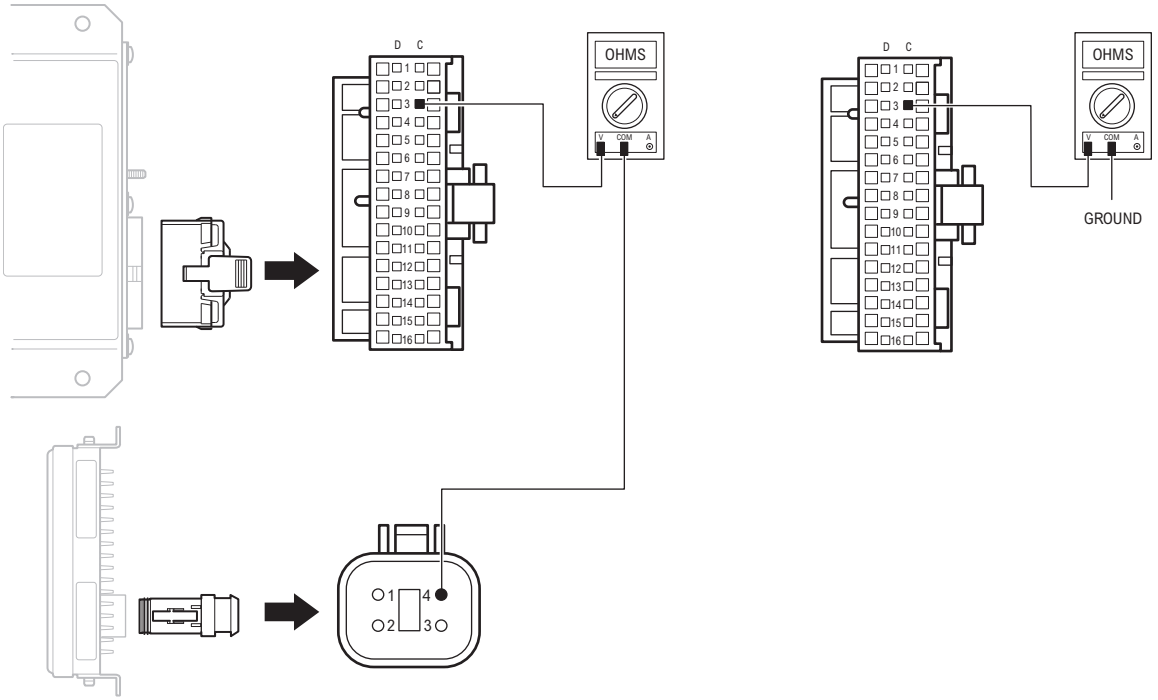
Power-Up Sequence Test, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin D6 and Driver Display 4-way connector pin A. • Central Processing Unit 32-way connector pin D6 and ground.	If resistance between pin D6 and pin A is 0 to .3 ohms and if resistance between pin D6 and ground is more than 10K ohms or open circuit [OL]	Go to **Step G**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



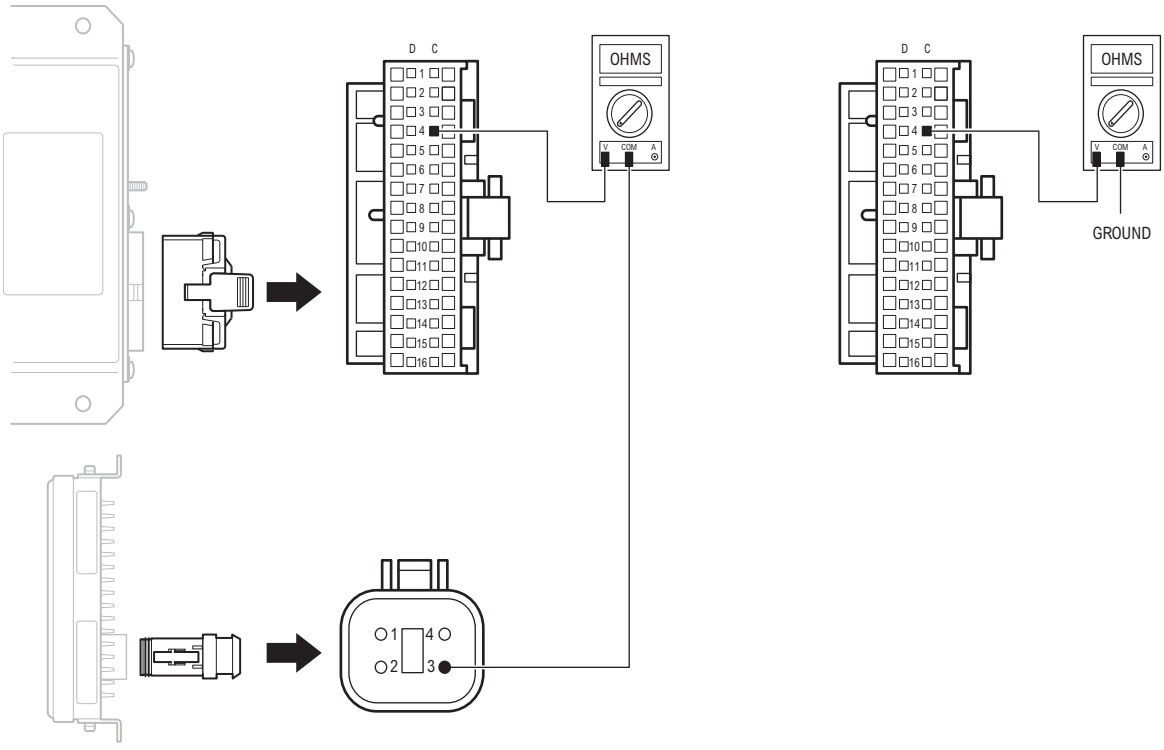
Power-Up Sequence Test, continued

Step G	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector and Front Antenna 4-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin C3 and Antenna 4-way connector pin 4. • Central Processing Unit 32-way connector pin C3 and ground.	If resistance between pin C3 and pin 4 is 0 to .3 ohms and if resistance between pin C3 and ground is more than 10K ohms or open circuit [OL]	Go to **Step H**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



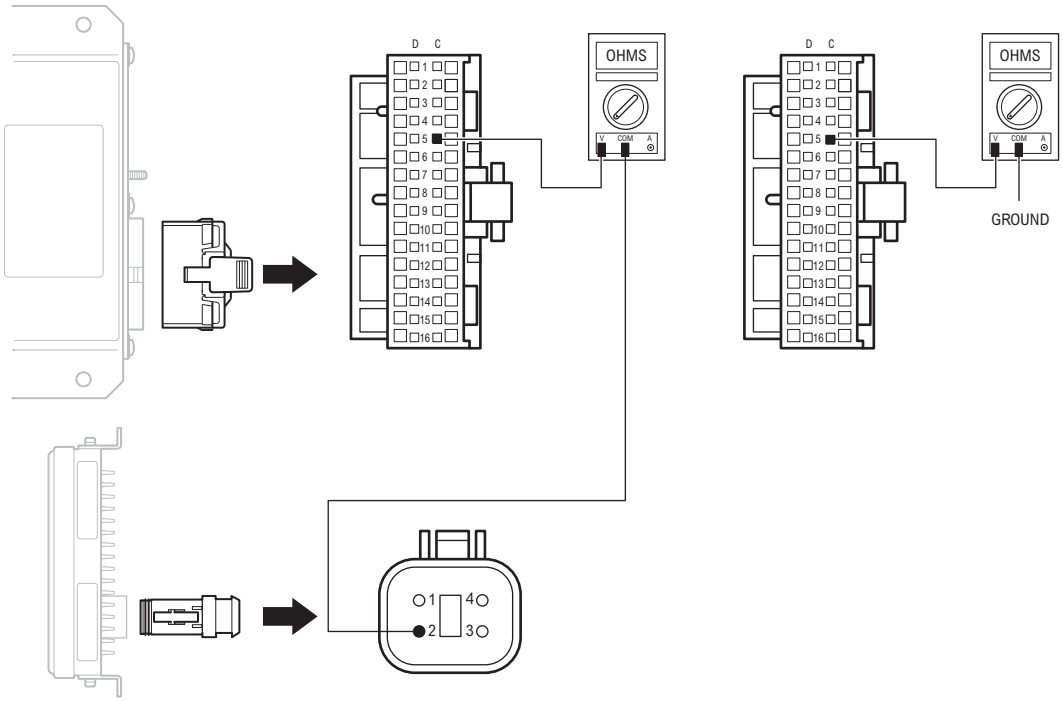
Power-Up Sequence Test, continued

Step H	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin C4 and Antenna 4-way connector pin 3. • Central Processing Unit 32-way connector and pin C4 and ground.	If resistance between pin C4 and pin 3 is 0 to .3 ohms and if resistance between pin C4 and ground is more than 10K ohms or open circuit [OL]	Go to **Step I**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



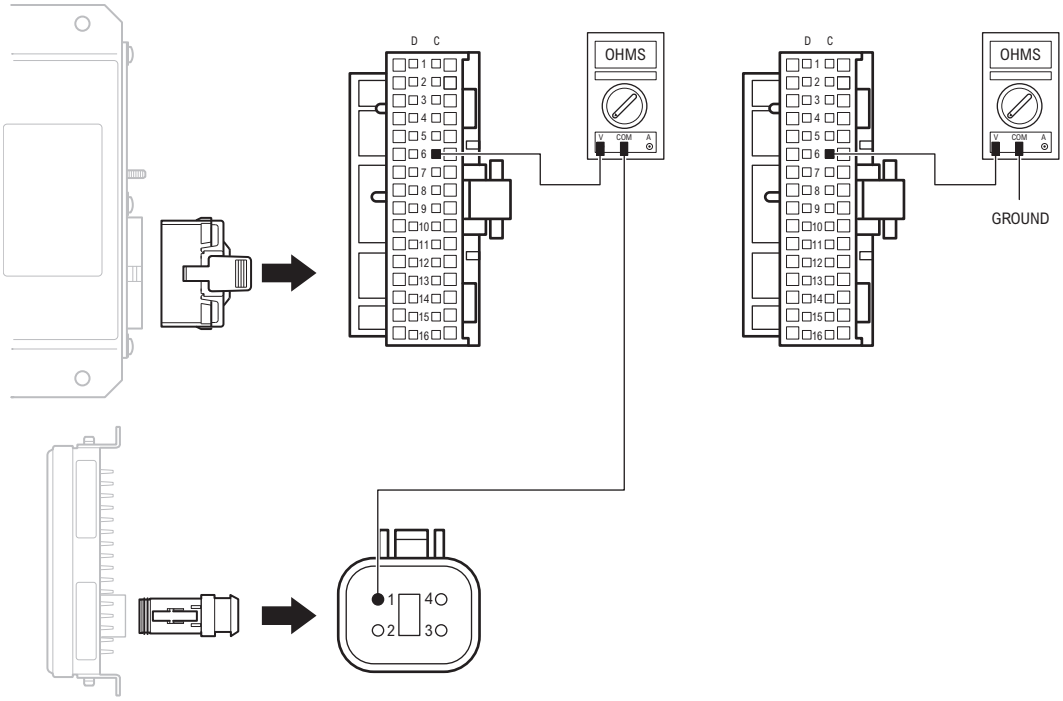
Power-Up Sequence Test, continued

Step I	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin C5 and Antenna 4-way connector pin 2. • Central Processing Unit 32-way connector pin C5 and ground.	If resistance between pin C5 and pin 2 is 0 to .3 ohms and if resistance between pin C5 and ground is more than 10K ohms or open circuit [OL]	Go to **Step J**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and the Central Processing Unit. Go to **Step V**.



Power-Up Sequence Test, continued

Step J	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin C6 and Antenna 4-way connector pin 1. • Central Processing Unit 32-way connector and pin C6 and ground.	If resistance between pin C6 and pin 1 is 0 to .3 ohms and if resistance between pin C6 and ground is more than 10K ohms or open circuit [OL]	Go to **Step K**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



Power-Up Sequence Test, continued

Step K	Procedure	Condition	Action
	1. Key off. 2. Reconnect Central Processing Unit 32-way connector. 3. Connect spare Front Antenna to 4-way connector. 4. Key on. 5. Check error codes.	If no error codes	**Replace Antenna**. Go to **Step V**.
		If error codes	**Replace Central Processing Unit**. Go to **Step L**.

Power-Up Sequence Test, continued

Step L	Procedure	Condition	Action
	1. Key off. 2. Connect spare Driver Display to 4-way connector. 3. Key on. 4. Check error codes.	If no error codes	**Replace Driver Display Unit**. Go to **Step V**.
		If error codes	Go to **Step A**. Find error in testing.

Power-Up Sequence Test, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 2. 5. Use Driving Techniques to attempt to set a code. See “Driving Techniques” on page 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 2.	If no codes	Test complete.
	Note: If problem still exists there may be a software compatibility problem. Contact your Bendix representative.	If code appears	See “Fault Code Isolation Procedure Index” on page 3.

Power-Up Sequence Test, continued

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Component Code: 11, 12 (SID 254, FMI 4, 12) Central Processing Unit (CPU)

Overview

This fault indicates an internal failure of the Central Processing Unit.

Detection

The Central Processing Unit checks the program memory every time the key is turned on. If the Central Processing Unit is able to detect a failure within its own memory, it sets these fault codes.

Fallback

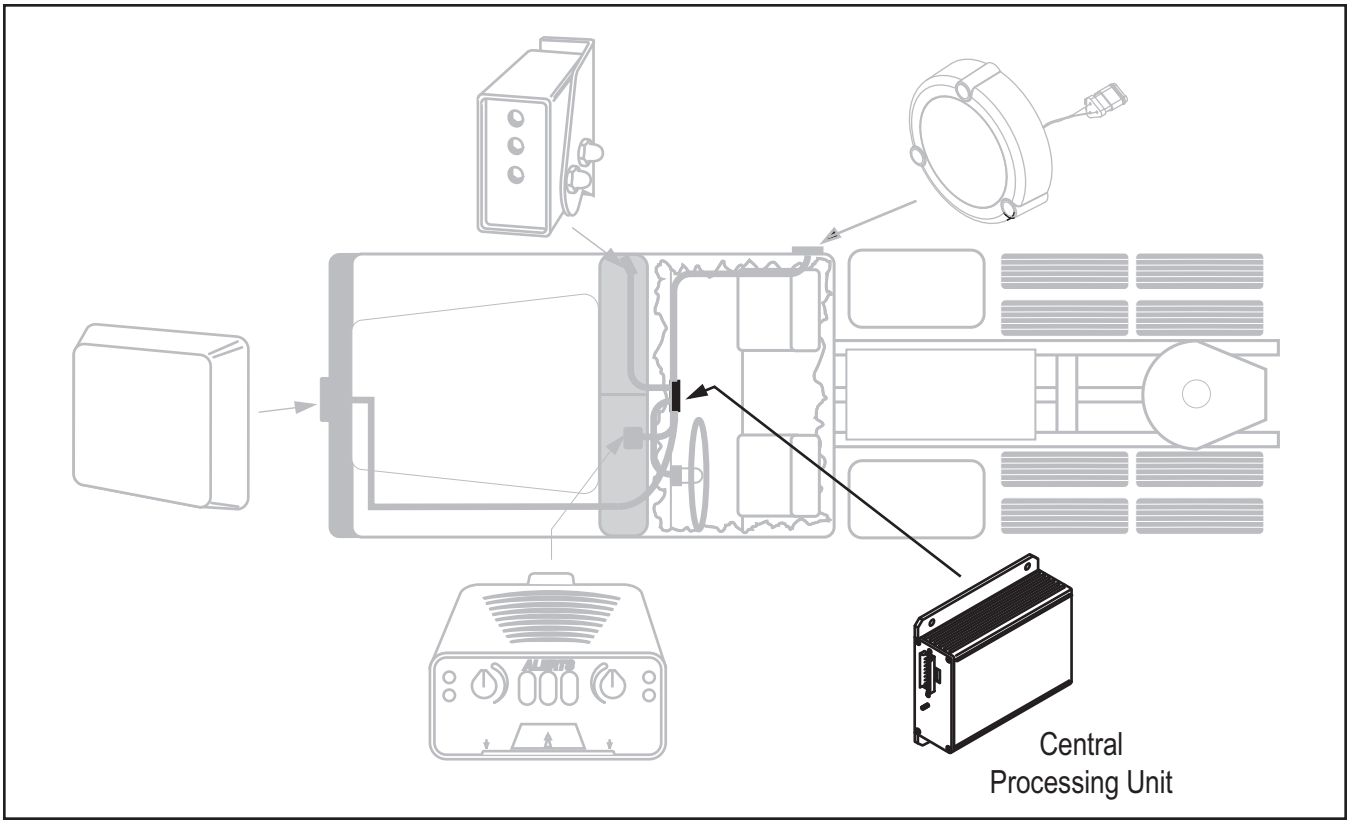
This fault causes a failure of the Bendix™ VORAD® system.

Required Tools

- Basic Hand Tools
- Troubleshooting Guide

Possible Causes

- Central Processing Unit



Code 11, 12 (SID 254, FMI 4, 12), Central Processing Unit (CPU)

Step A	Procedure	Condition	Action
	1. Key off. 2. Retrieve codes.	If code 11 is active →	**Replace Central Processing Unit.**
		If code 11 is inactive →	Test complete.

Component Code: 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit

Overview

This fault code indicates an electrical failure of the Driver Display Unit.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the communication with the Driver Display Unit. If a communication fault occurs for more than five seconds, fault code 13 is set.

Fallback

This fault causes a failure of the Bendix™ VORAD® system.

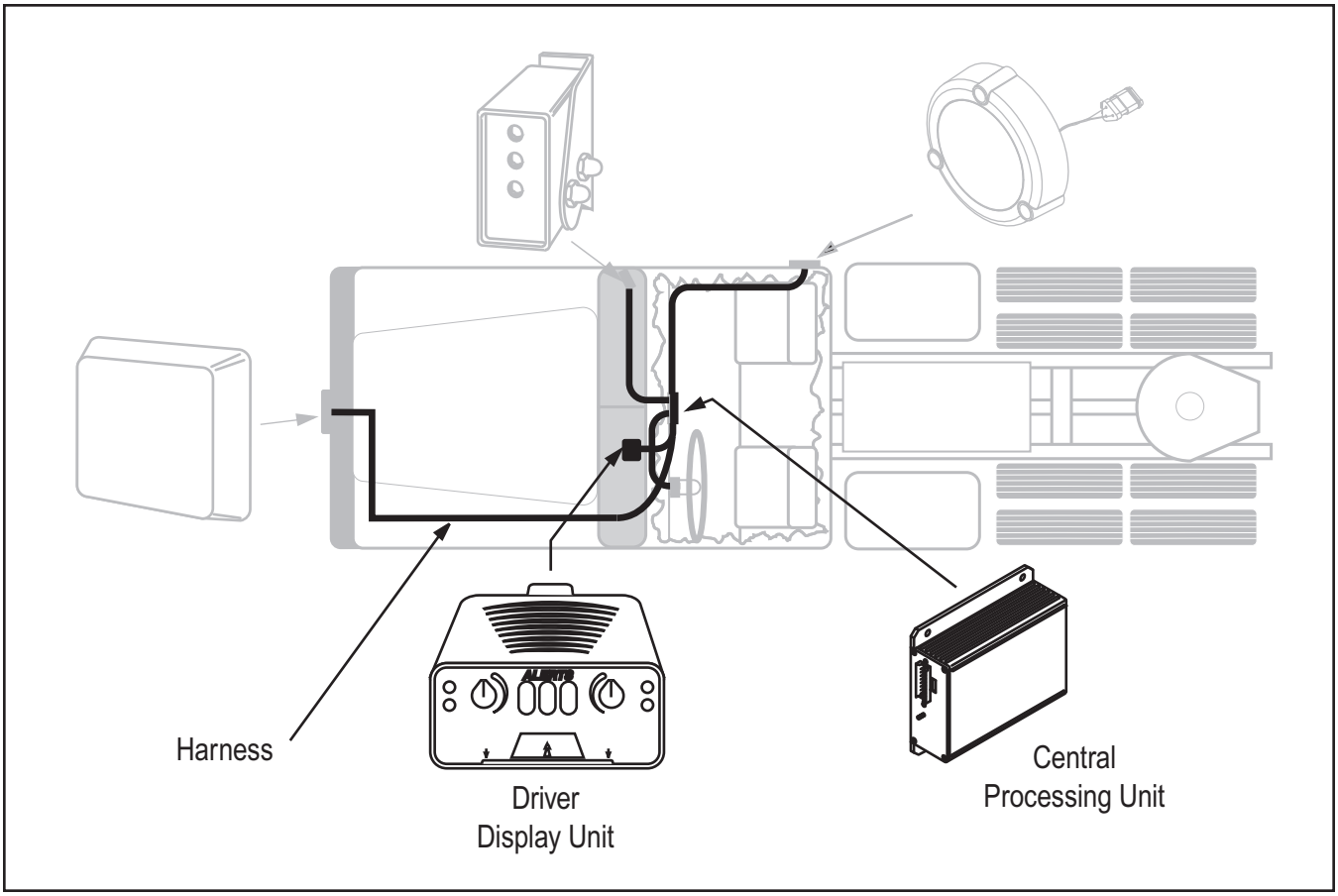
Required Tools

- Basic Hand Tools
- Troubleshooting Guide
- Digital Volt/Ohm Meter
- Data Link Tester
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

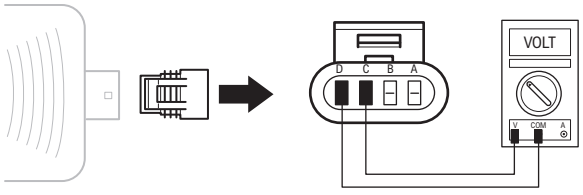
- OEM Harness
- Driver Display Unit
- Central Processing Unit



Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit

Step A	Procedure	Condition	Action
	1. Key off.		
	2. Using a PC-based or Hand-held Diagnostic Tool check for FMI (Failure Mode Identifiers) codes. →	If FMI 2, 4, or 5 exist →	Go to **Step B**.
	Note: If a diagnostic tool is not available, go to Step B.	If FMI 12 exists →	**Replace Driver Display Unit.** Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Unplug the Driver Display Unit 4-way connector.		
	3. Key on.		
	4. Measure voltage between Driver Display Unit 4-way connector pin D and pin C. →	If voltage is 7.0 to 7.5 volts →	Go to **Step E**.
		If voltage is outside of range →	Go to **Step C**.



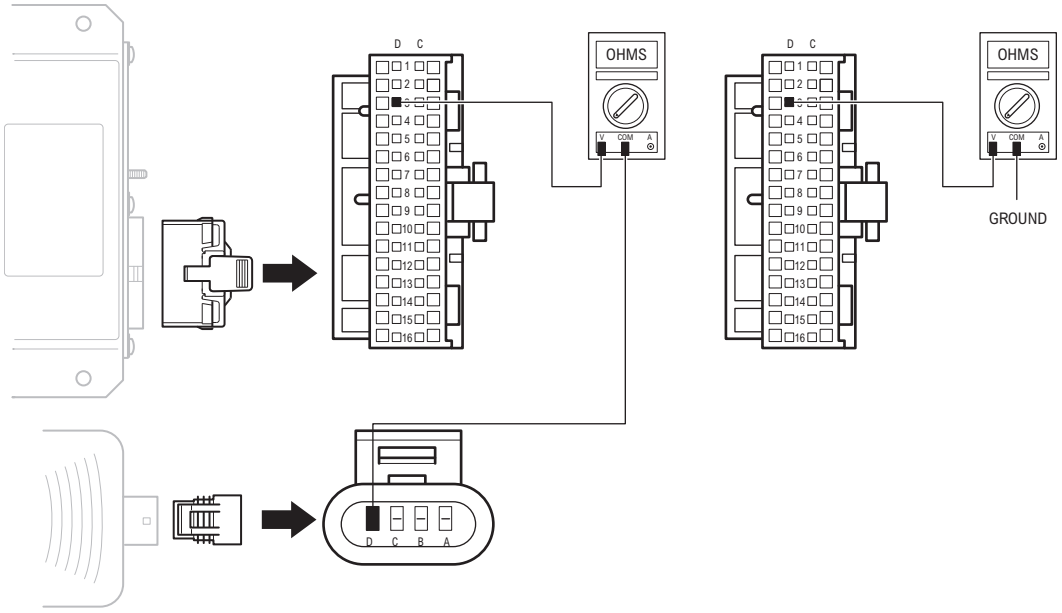
Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit, continued

Step C	Procedure	Condition	Action

1. Key off.
2. Disconnect Central Processing Unit 32-way connector.
3. Measure resistance between:
   - Central Processing Unit 32-way connector pin D3 and Driver Display 4-way connector pin D.
   - Central Processing Unit 32-way connector pin D3 and ground.

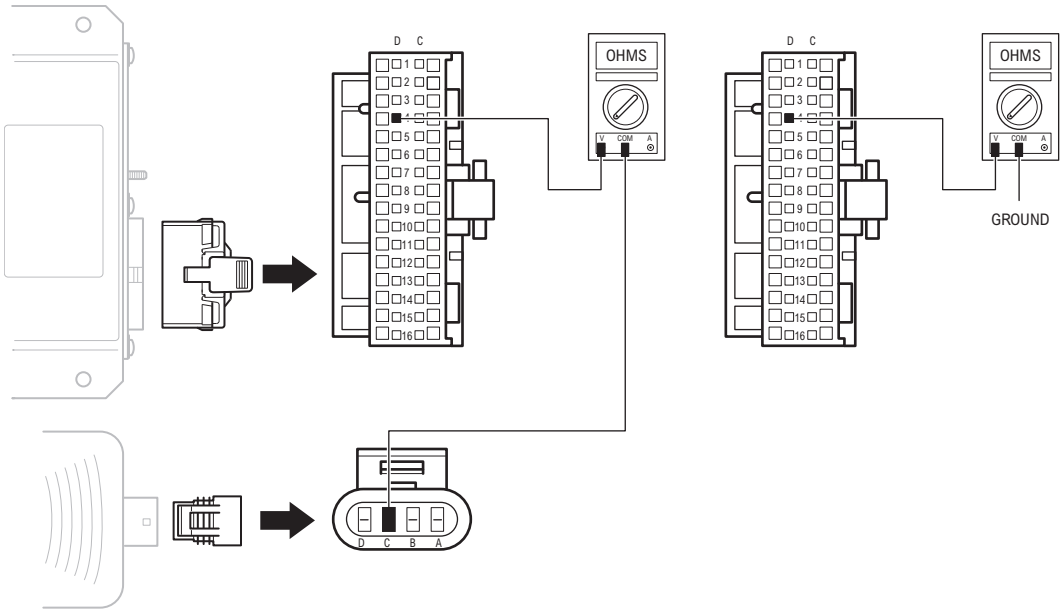
→ If resistance between D3 and D is 0 to .3 ohms and if resistance between pin D3 and ground is more than 10K ohms or open circuit [OL] → Go to **Step D**.

If any of the above conditions are not met → Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin D4 and Driver Display 4-way connector pin C. • Central Processing Unit 32-way connector pin D4 and ground.	If resistance between pin D4 and pin C is 0 to .3 ohms and if resistance between pin D4 and ground is more than 10K ohms or open circuit [OL]	**Replace Central Processing Unit.** Go to **Step V**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



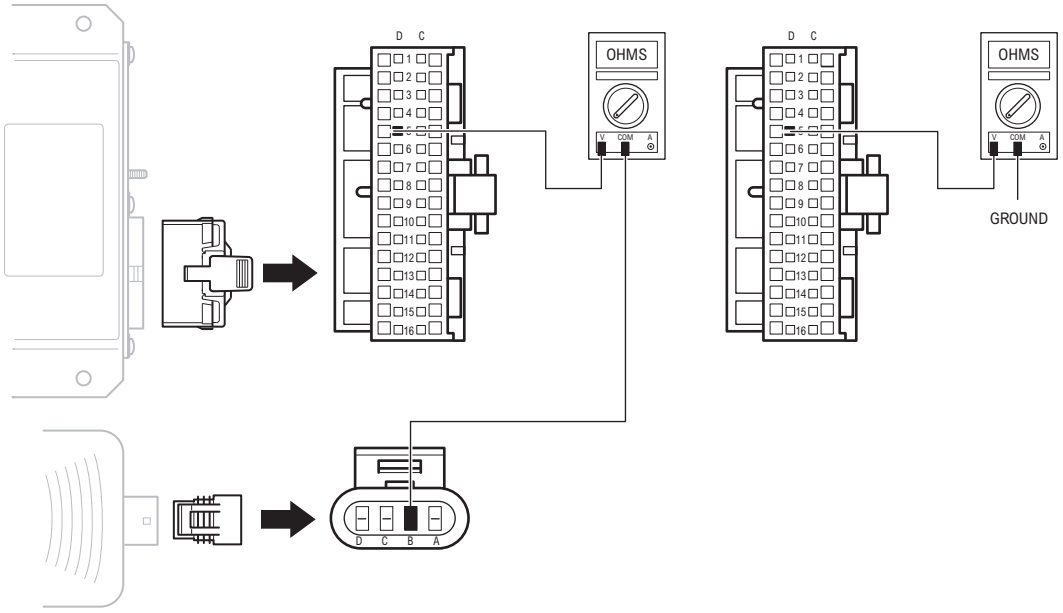
Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit, continued

Step E	Procedure	Condition	Action

1. Key off.
2. Disconnect Central Processing Unit 32-way connector.
3. Measure resistance between:
   - Central Processing Unit 32-way connector pin D5 and Driver Display 4-way connector pin B.
   - Central Processing Unit 32-way connector pin D5 and ground.

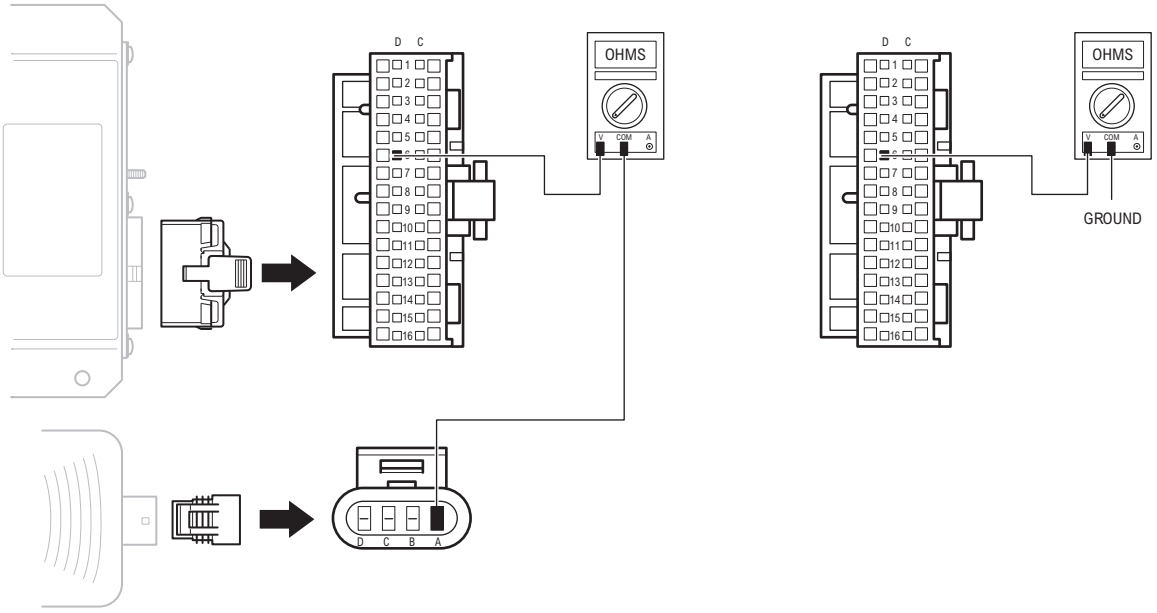
→ If resistance between pin D5 and pin B is 0 to .3 ohms and if resistance between pin D5 and ground is more than 10K ohms or open circuit [OL] → Go to **Step F**.

If any of the above conditions are not met → Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin D6 and Driver Display 4-way connector pin A. • Central Processing Unit pin D6 and ground.	If resistance between pin D6 and pin A is 0 to .3 ohms and if resistance between pin D6 and ground is more than 10K ohms or open circuit [OL]	Go to **Step G**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit, continued

Step G	Procedure	Condition	Action
	1. Key off. 2. Reconnect Central Processing Unit 32-way connector. 3. Connect spare Driver Display to 4-way connector. 4. Key on. 5. Check error codes.	If no error codes →	**Replace Driver Display Unit.** Go to **Step V**.
		If error codes →	**Replace Central Processing Unit.** Go to **Step V**.

Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
		If code 13 or 34 appears →	Return to **Step A** to find error in testing.
		If code other than 13 or 34 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna Assembly

Overview

This fault code indicates the Antenna and Central Processing Unit are unable to communicate.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the communication with the Antenna. If a communication fault occurs for more than 5 seconds, fault code 14 is set.

Fallback

This fault causes a failure of the Bendix™ VORAD® system.

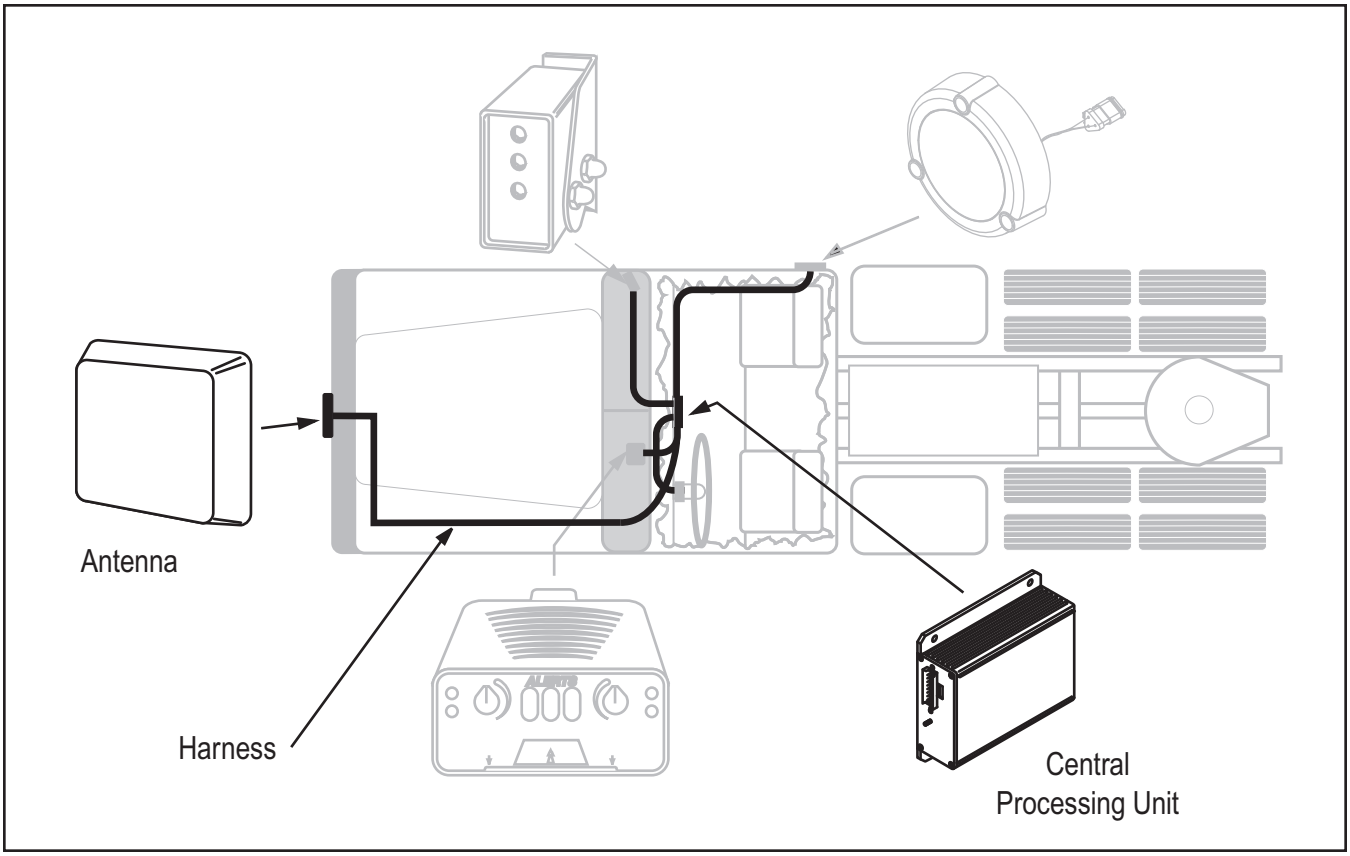
Required Tools

- Basic Hand Tools
- Troubleshooting Guide
- Digital Volt/Ohm Meter
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

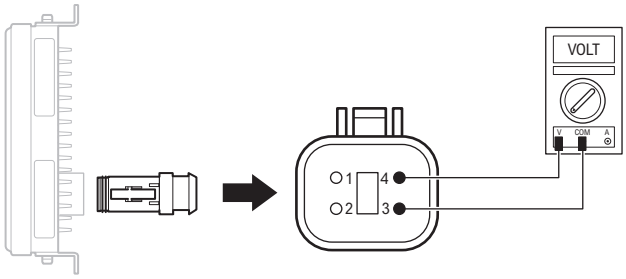
- Antenna Assembly
- OEM Harness
- Central Processing Unit
- Central Processing Unit / Antenna Software Incompatibility



Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna

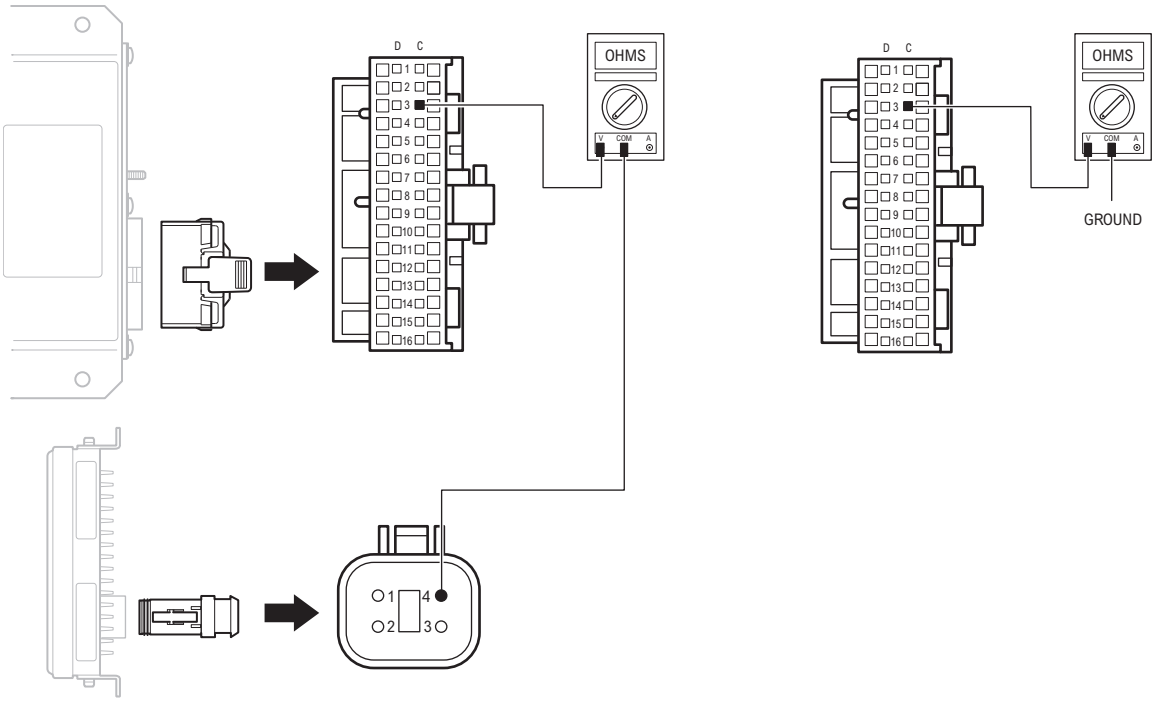
Step A	Procedure	Condition	Action
	1. Key off.		
	2. Using a PC-based or Hand-held Diagnostic Tool check for FMI (Failure Mode Identifier) codes.	If FMI 2 exists →	Go to **Step B**.
	Note: If a diagnostic tool is not available, go to Step B.	If FMI 12 exists →	Go to **Step B**.
		If FMI 14 exists	There may be a software compatibility problem. Contact your Bendix representative.

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Unplug the Antenna 4-way connector.		
	3. Key on.		
	4. Measure voltage between Antenna 4-way connector pin 3 and pin 4. →	If voltage is 7.0 to 7.5 volts →	Go to **Step E**.
		If voltage is outside of range →	Go to **Step C**.



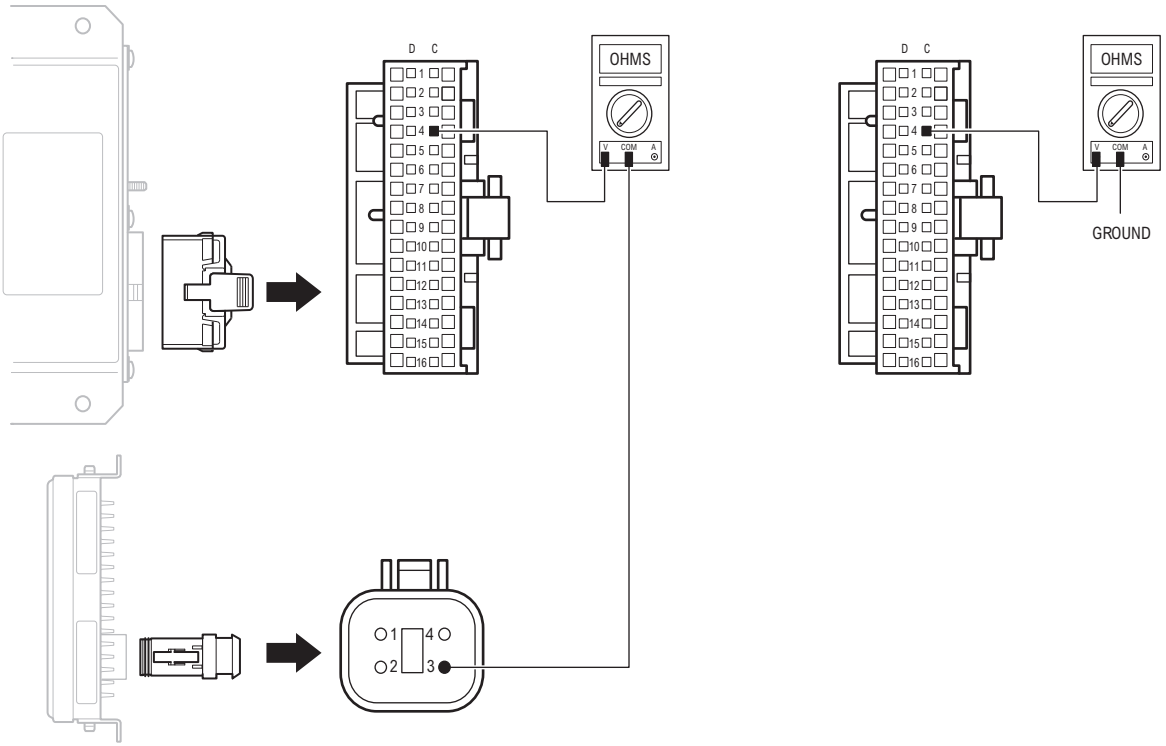
Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin C3 and Antenna 4-way connector pin 4. • Central Processing Unit 32-way connector pin C3 and ground.	If resistance between C3 and pin 4 is 0 to .3 ohms and if resistance between pin C3 and ground is more than 10K ohms or open circuit [OL]	Go to **Step D**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



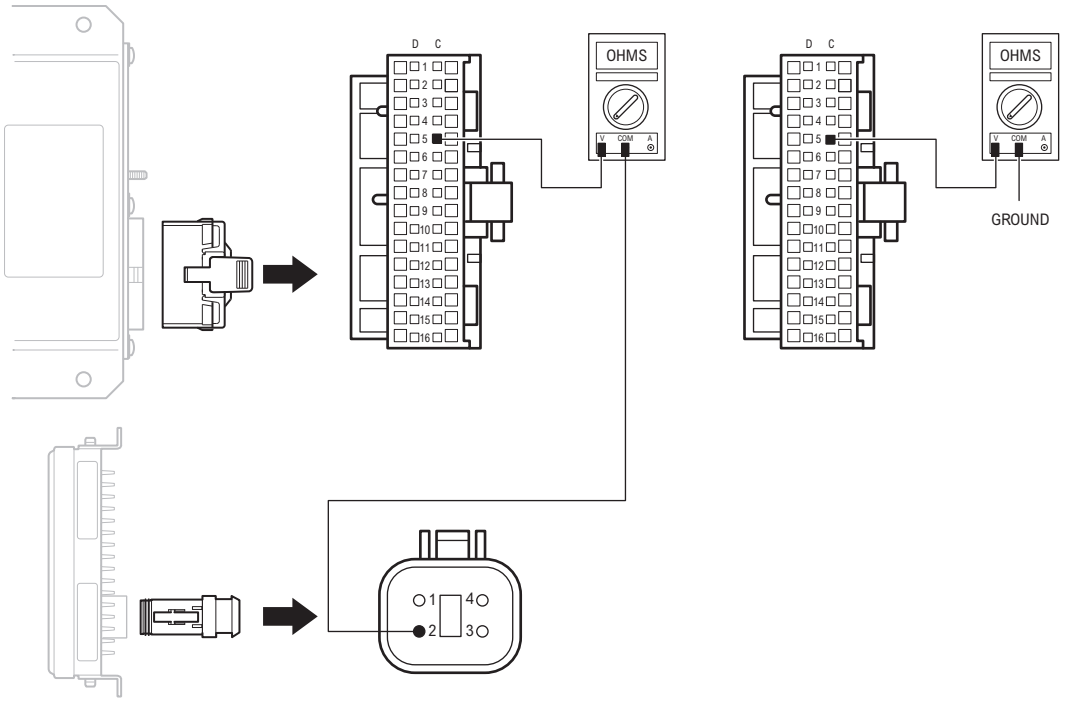
Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin C4 and Antenna 4-way connector pin 3. • Central Processing Unit 32-way connector pin C4 and ground.	If resistance between pin C4 and pin 3 is 0 to .3 ohms and if resistance between pin C4 and ground is more than 10K ohms or open circuit [OL]	**Replace Central Processing Unit.** Go to **Step V**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



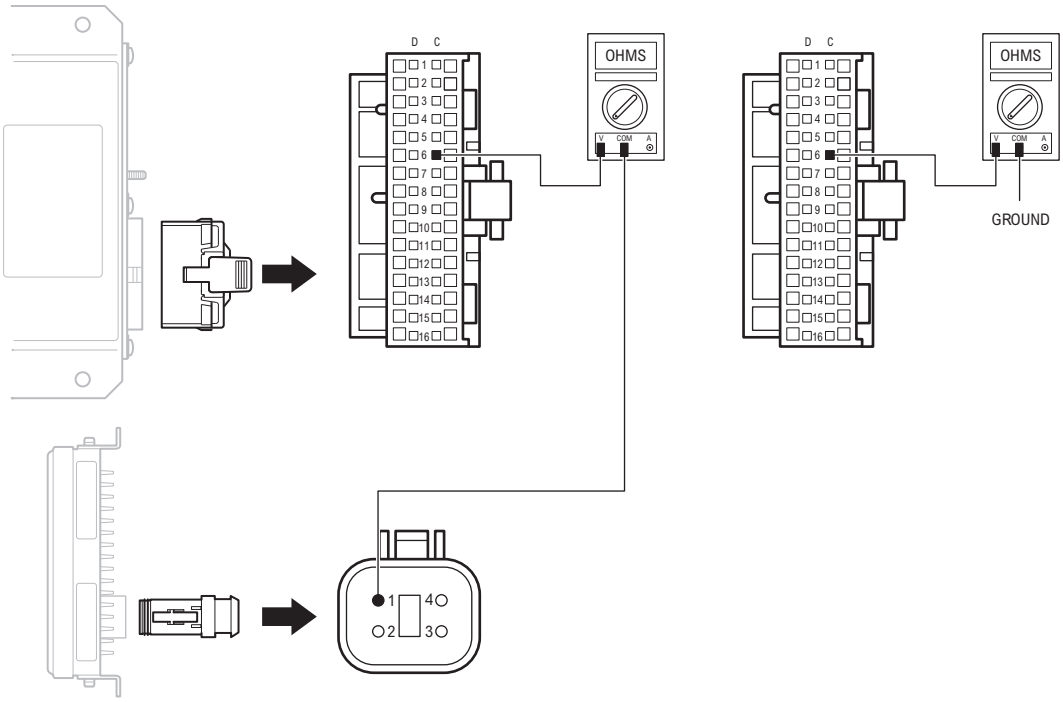
Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin C5 and Antenna 4-way connector pin 2. • Central Processing Unit 32-way connector and pin C5 and ground.	If resistance between pin C5 and pin 2 is 0 to .3 ohms and if resistance between pin C5 and ground is more than 10K ohms or open circuit [OL]	Go to **Step F**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and the Central Processing Unit. Go to **Step V**.



Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna, continued

Step F	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin C6 and Antenna 4-way connector pin 1. • Central Processing Unit 32-way connector pin C6 and ground.	If resistance between pin C6 and pin 1 is 0 to .3 ohms and if resistance between pin C6 and ground is more than 10K ohms or open circuit [OL]	Go to **Step G**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna, continued

Step G	Procedure	Condition	Action
	1. Key off. 2. Reconnect Central Processing Unit 32-way connector. 3. Connect spare Antenna to 4-way connector. 4. Key on. 5. Check error codes.	If no error codes →	**Replace Antenna.** Go to **Step V.**
		If error codes →	**Replace Central Processing Unit.** Go to **Step V.**

Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
	Note: If problem still exists there may be a software compatibility problem. Contact your Bendix representative.	If code 14 appears →	Return to **Step A** to find error in testing.
		If code other than 14 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 15 (SID 10, FMI 2) Right Side Sensor

Overview

This fault code indicates an electrical failure of the Right Side Sensor.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the feedback from the Right Side Sensor.

Fallback

This fault will not allow the Bendix™ VORAD® system to detect objects on the right side of the vehicle.

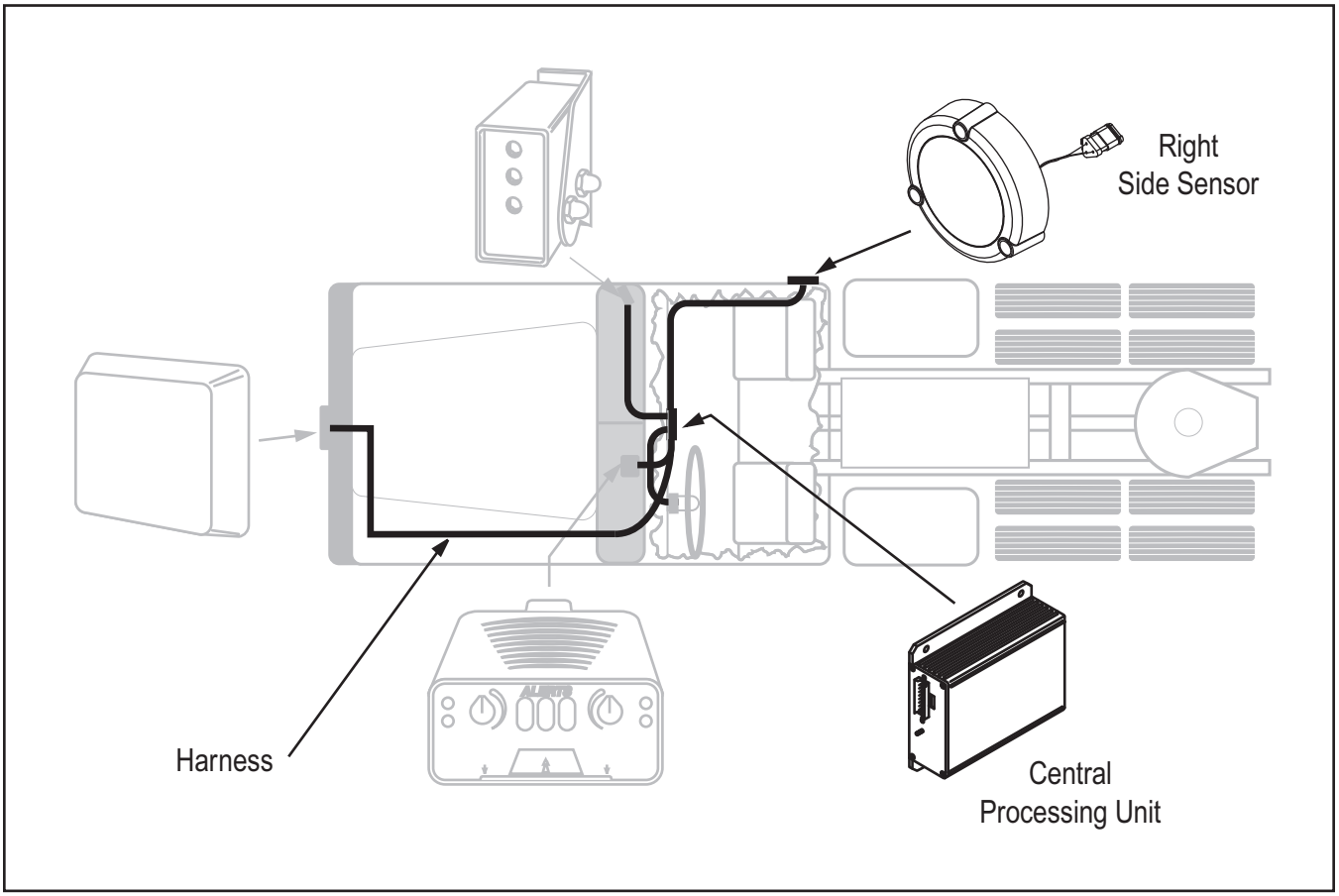
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

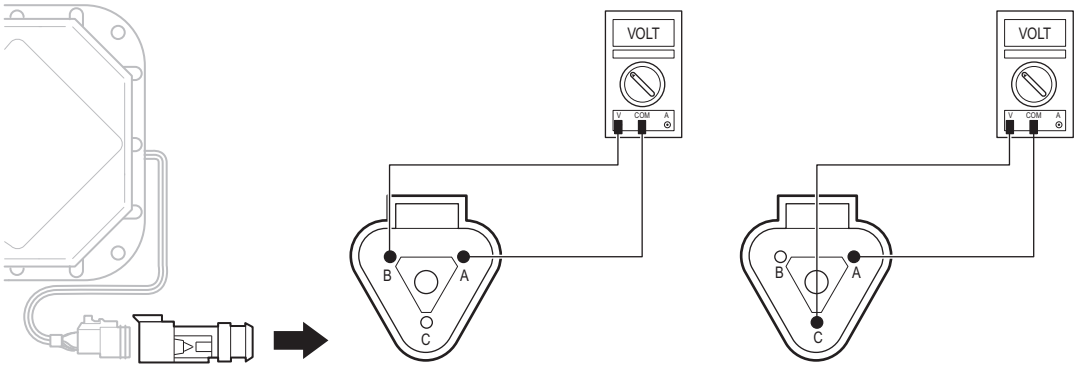
- Wiring Harness
- Right Side Sensor
- Central Processing Unit
- System Configuration



Code 15 (SID 10, FMI 2) Right Side Sensor

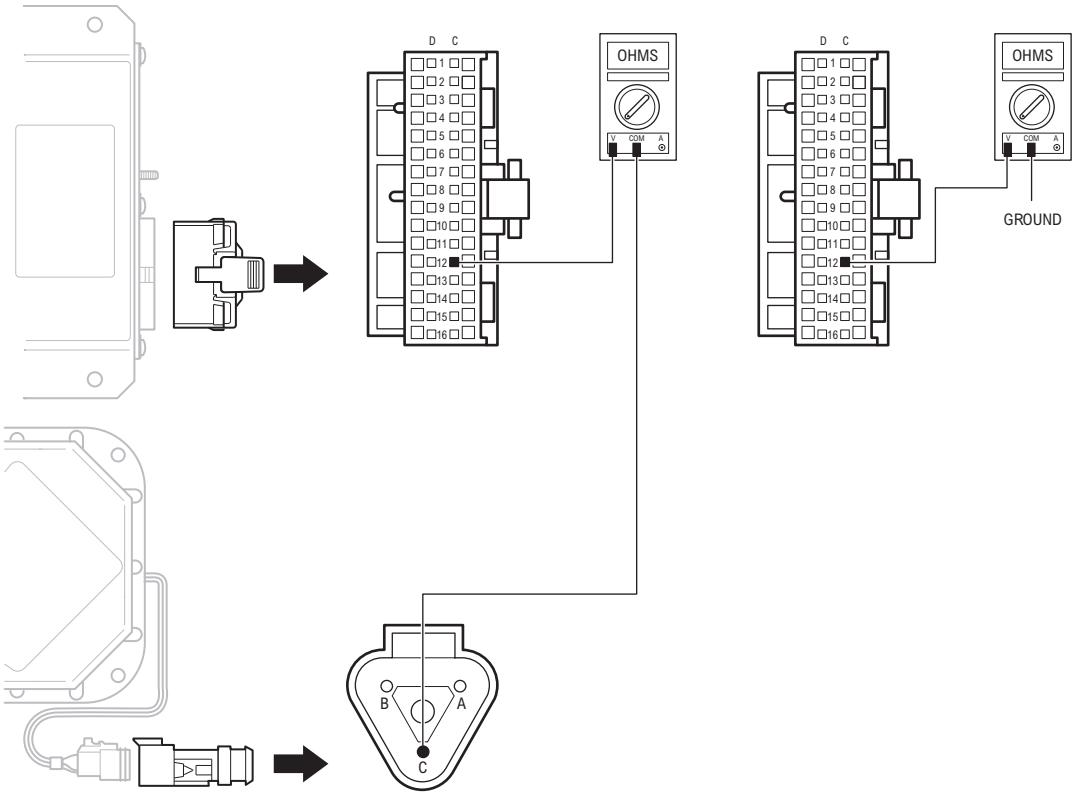
Step A	Procedure	Condition	Action
	1. Key off. 2. Is vehicle equipped with a Right Side Sensor?	If the vehicle has a Right Side Sensor →	Go to **Step B**.
		If the vehicle does not have a Right Side Sensor →	The Central Processing Unit has been programmed for a Right Side Sensor. With a PC-based or Hand-held Diagnostic Tool, place the Right Side Sensor option in "NO" position. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect 3-way stub connector at the Right Side Sensor. 3. Key on. 4. Measure voltage between: • Pins A and B. • Pins A and C.	If voltage between pins A and B is 1.8 to 2.5 volts and →	
		If voltage between pins A and C is 7.0 to 7.5 volts →	**Replace Right Side Sensor.** Go to **Step V**.
		If voltage is outside of range →	Go to **Step C**.



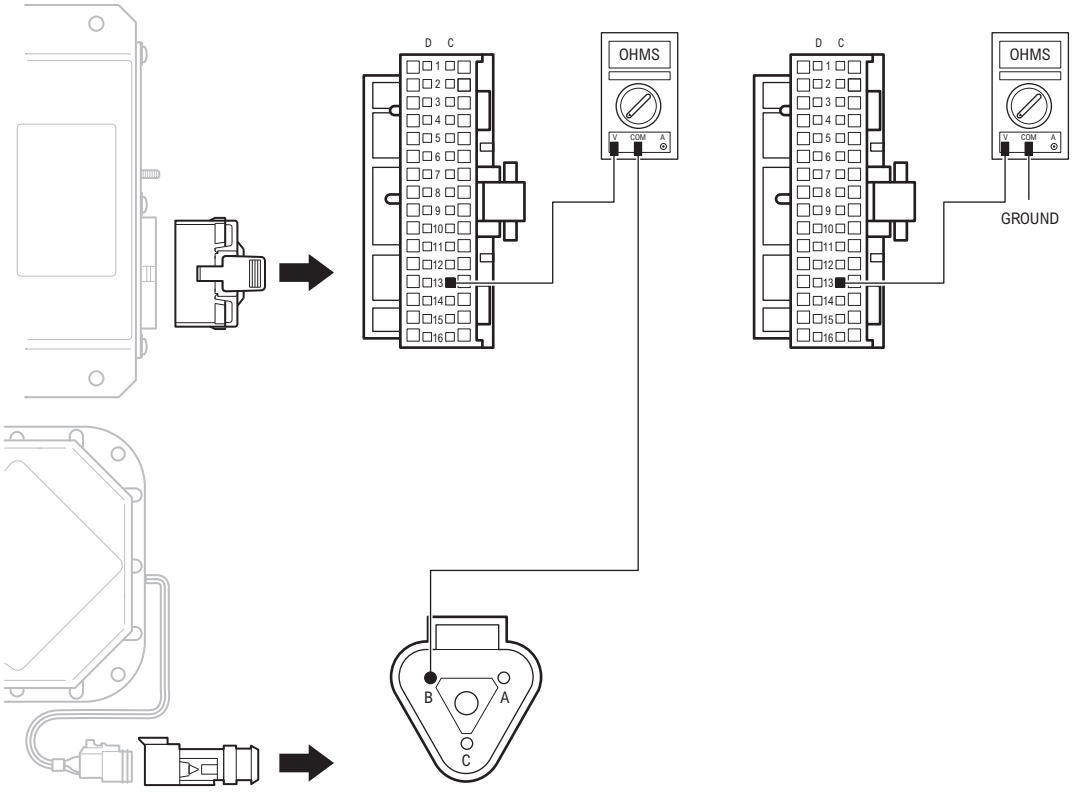
Code 15 (SID 10, FMI 2) Right Side Sensor, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin C12 and 3-way pin C. • 32-way pin C12 and ground.	If resistance between C12 and pin C is 0 to 0.3 ohms and if resistance between pin C12 and ground is more than 10K ohms or open circuit [OL]	Go to **Step D**.
		If resistance is outside of range	Repair OEM wiring harness between Right Side Sensor and Central Processing Unit. Go to **Step V**.



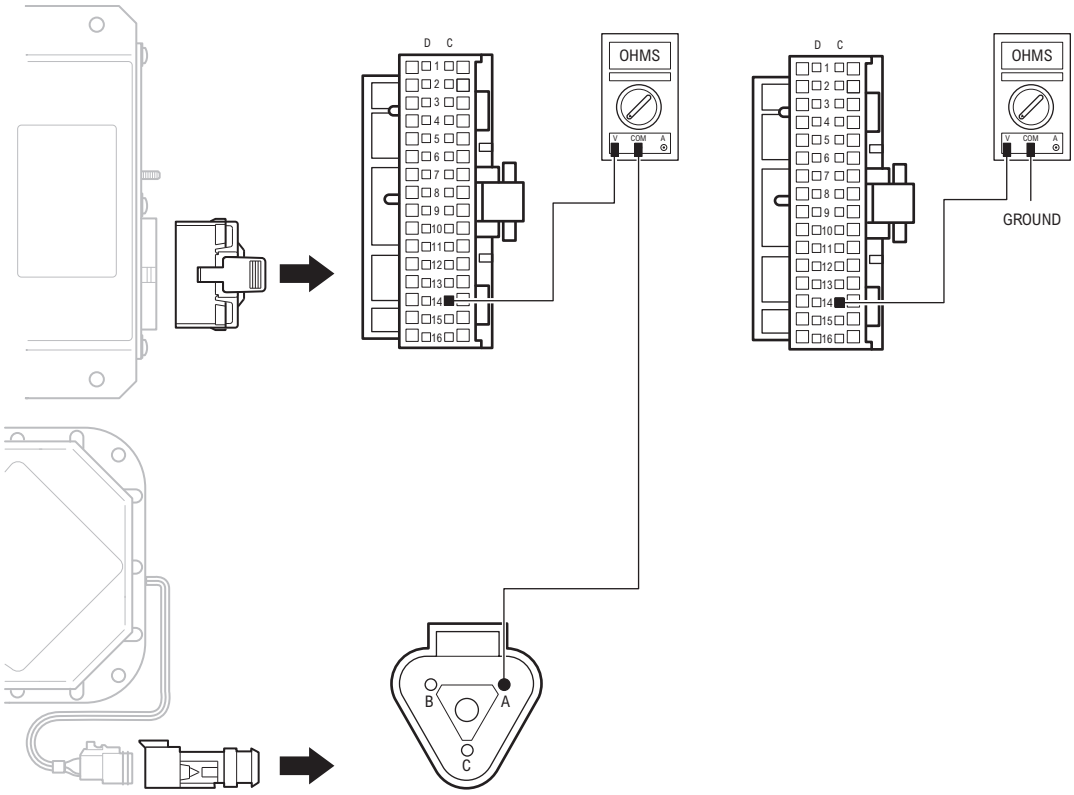
Code 15 (SID 10, FMI 2) Right Side Sensor, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin C13 and 3-way pin B. • 32-way pin C13 and ground.	If resistance between pin C13 and pin B is 0 to 0.3 ohms and if resistance between pin C13 and ground is more than 10K ohms or open circuit [OL]	Go to **Step E**.
		If resistance is outside of range	Repair OEM wiring harness between Right Side Sensor and Central Processing Unit. Go to **Step V**.



Code 15 (SID 10, FMI 2) Right Side Sensor, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin C14 and 3-way pin A. • 32-way pin C14 and ground.	If resistance between C14 and pin A is 0 to 0.3 ohms and if resistance between pin C14 and ground is more than 10K ohms or open circuit [OL]	**Replace Central processing Unit.** Go to **Step V**.
		If resistance is outside of range	Repair OEM wiring harness between Right Side Sensor and Central Processing Unit. Go to **Step V**.



Code 15 (SID 10, FMI 2) Right Side Sensor, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4. 6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
		If code 15 appears →	Return to **Step A** to find error in testing.
		If code other than 15 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 16 (SID 11, FMI 2) Left Side Sensor

Overview

This fault code indicates an electrical failure of the Left Side Sensor.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the feedback from the Left Side Sensor.

Fallback

This fault will not allow the Bendix™ VORAD® system to detect objects on the left side of the vehicle.

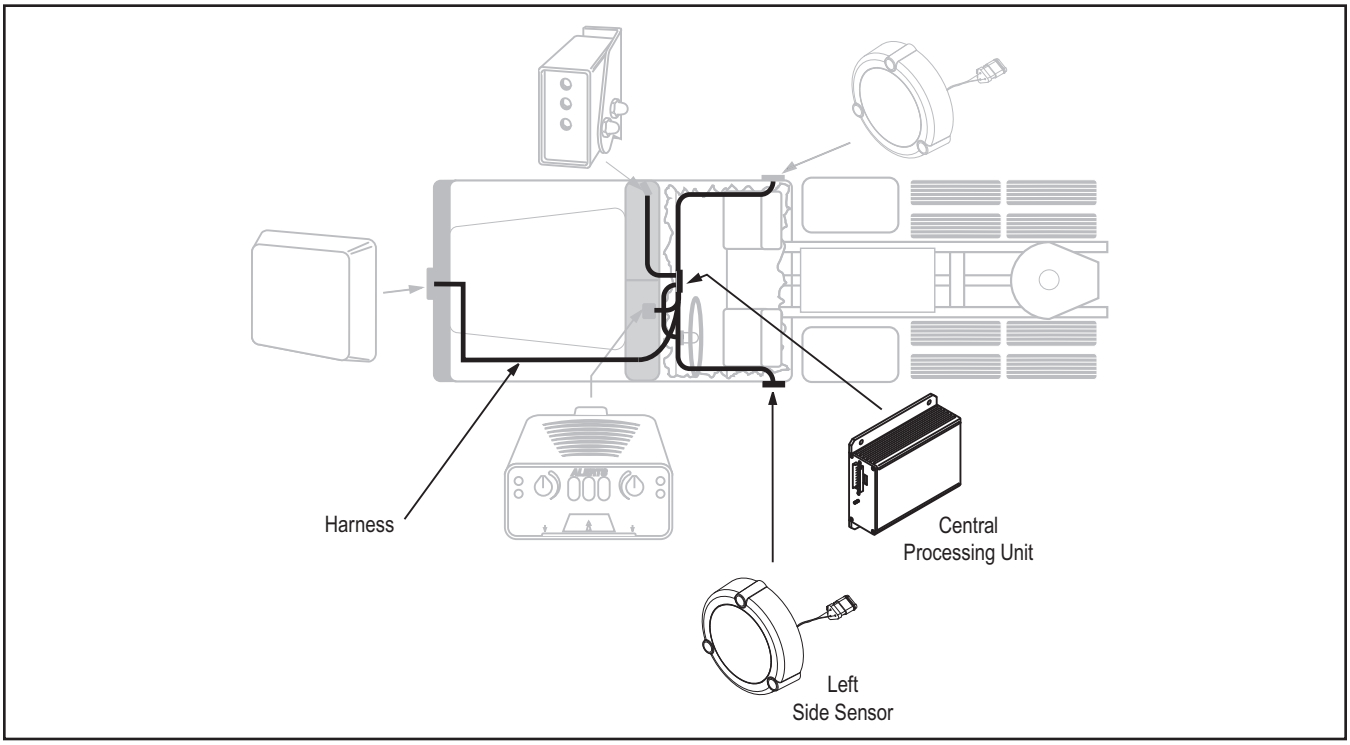
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

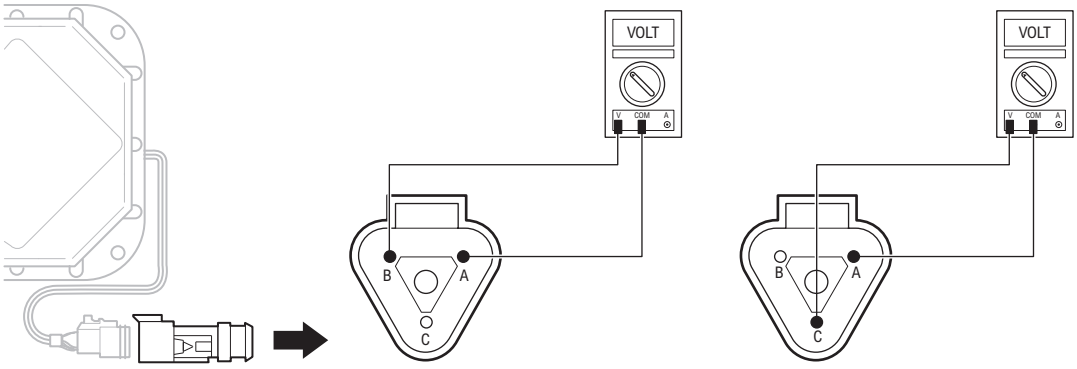
- Wiring Harness
- Left Side Sensor
- Central Processing Unit
- System Configuration



Code 16 (SID 11, FMI 2) Left Side Sensor

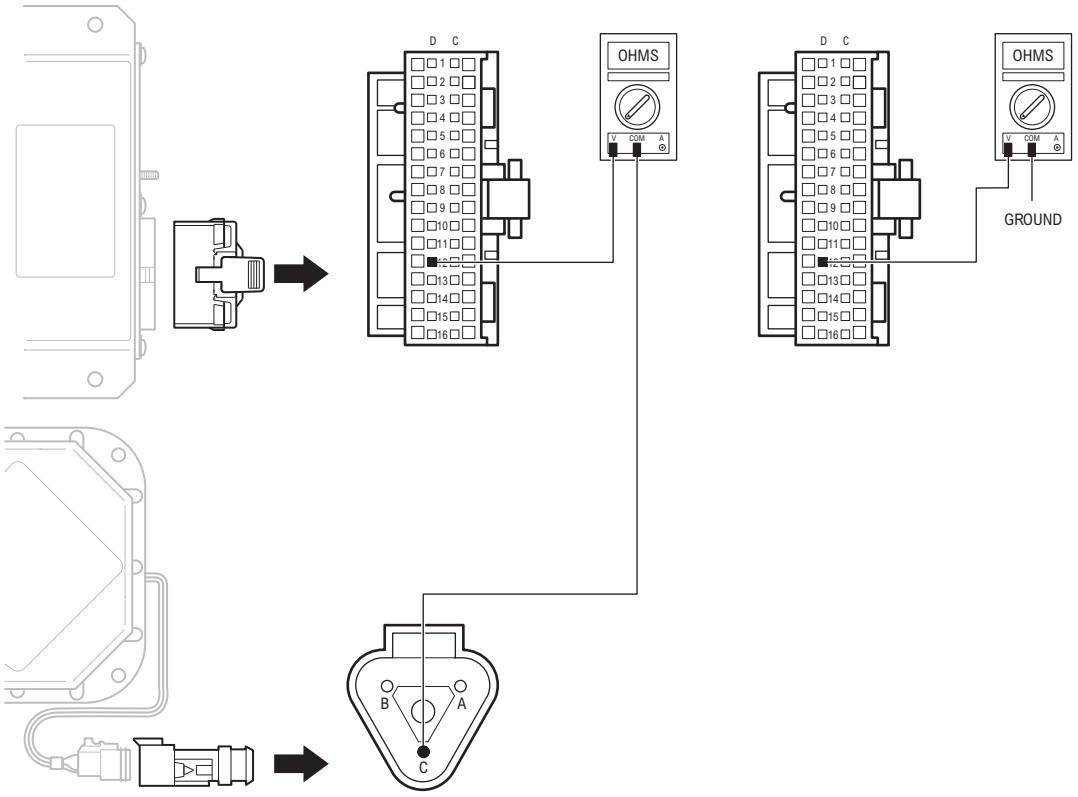
Step A	Procedure	Condition	Action
	1. Key off. 2. Is vehicle equipped with a Left Side Sensor?	If the vehicle has a Left Side Sensor →	Go to **Step B**.
		If the vehicle does not have a Left Side Sensor →	The Central Processing Unit has been programmed for a Left Side Sensor. With a PC-based or Hand-held Diagnostic Tool, place the Left Side Sensor option in "NO" position. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect 3-way stub connector at the Left Side Sensor. 3. Key on. 4. Measure voltage between: • Pins A and B. • Pins A and C.	If voltage between pins A and B is 1.8 to 2.5 volts and	
		If voltage between pins A and C is 7 to 7.5 volts →	**Replace Left Side Sensor.** Go to **Step V**.
		If voltage is outside of range →	Go to **Step C**.



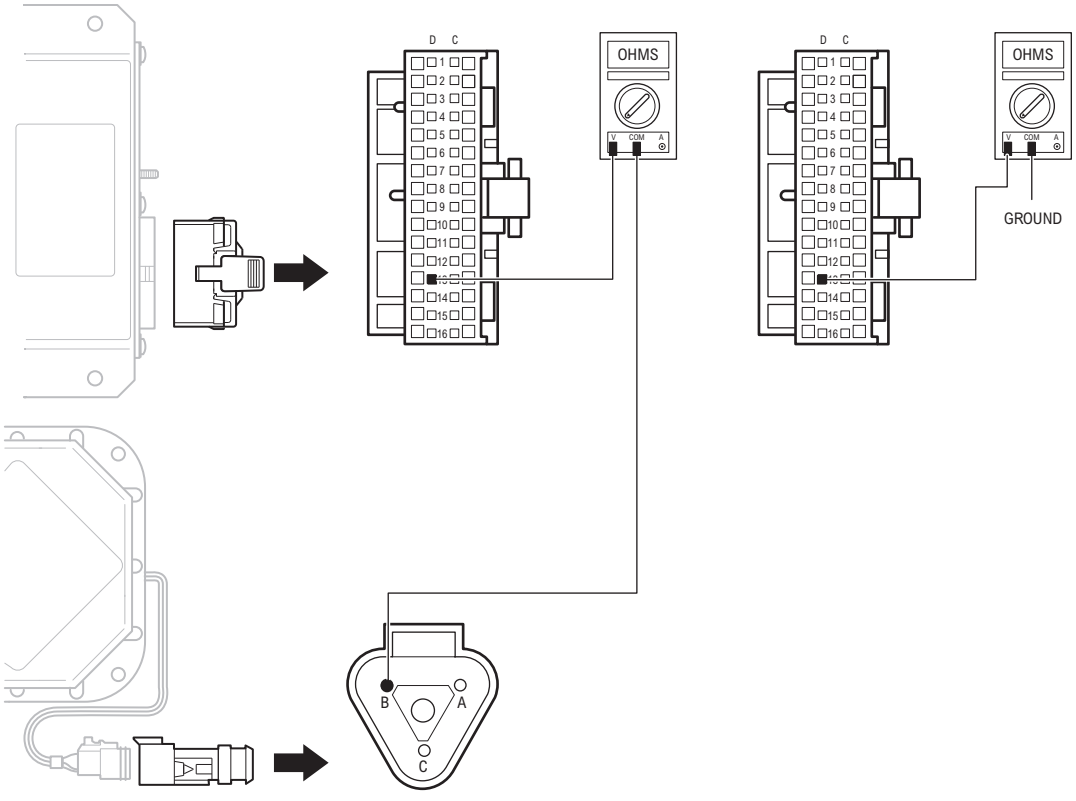
Code 16 (SID 11, FMI 2) Left Side Sensor, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin D12 and 3-way pin C. • 32-way pin D12 and ground.	If resistance between D12 and pin C is 0 to 0.3 ohms and if resistance between pin D12 and ground is more than 10K ohms or open circuit [OL]	Go to **Step D**.
		If resistance is out of range	Repair OEM wiring harness between Left Side Sensor and Central Processing Unit. Go to **Step V**.



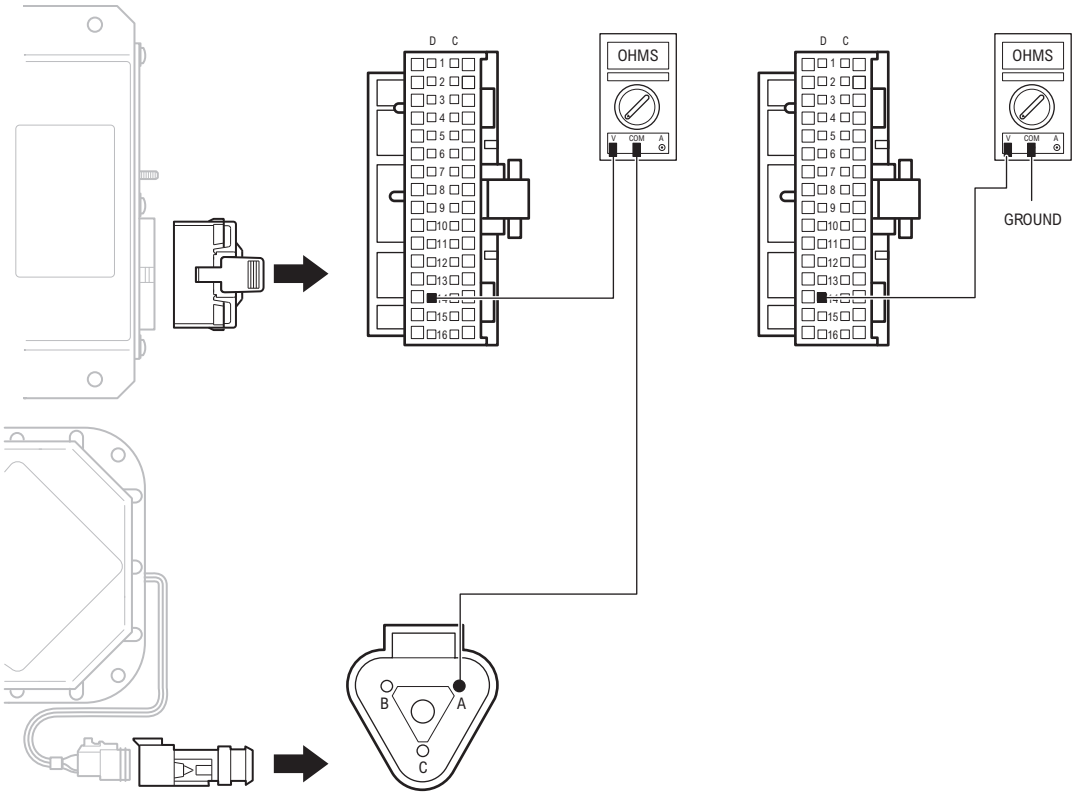
Code 16 (SID 11, FMI 2) Left Side Sensor, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin D13 and 3-way pin B. • 32-way pin D13 and ground.	If resistance between D13 and pin B is 0 to 0.3 ohms and if resistance between pin D13 and ground is more than 10K ohms or open circuit [OL]	Go to **Step E**.
		If resistance is out of range	Repair OEM wiring harness between Left Side Sensor and Central Processing Unit. Go to **Step V**.



Code 16 (SID 11, FMI 2) Left Side Sensor, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin D14 and 3-way pin A. • 32-way pin D14 and ground.	If resistance between D14 and pin A is 0 to 0.3 ohms and if resistance between pin D14 and ground is more than 10K ohms or open circuit [OL]	**Replace Central Processing Unit.** Go to **Step V**.
		If resistance is out of range	Repair OEM wiring harness between Left Side Sensor and Central Processing Unit. Go to **Step V**.



Code 16 (SID 11, FMI 2) Left Side Sensor, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4. 6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
		If code 16 appears →	Return to **Step A** to find error in testing.
		If code other than 16 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 21 (SID 7, FMI 2) Right Turn Signal

Overview

This fault code indicates an electrical problem in the right turn signal input. The input from the right turn signal did not match the current operating conditions.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the feedback from the right turn signal.

Fallback

This fault will not allow the Bendix™ VORAD® system to detect objects when the operator is making a right turn.

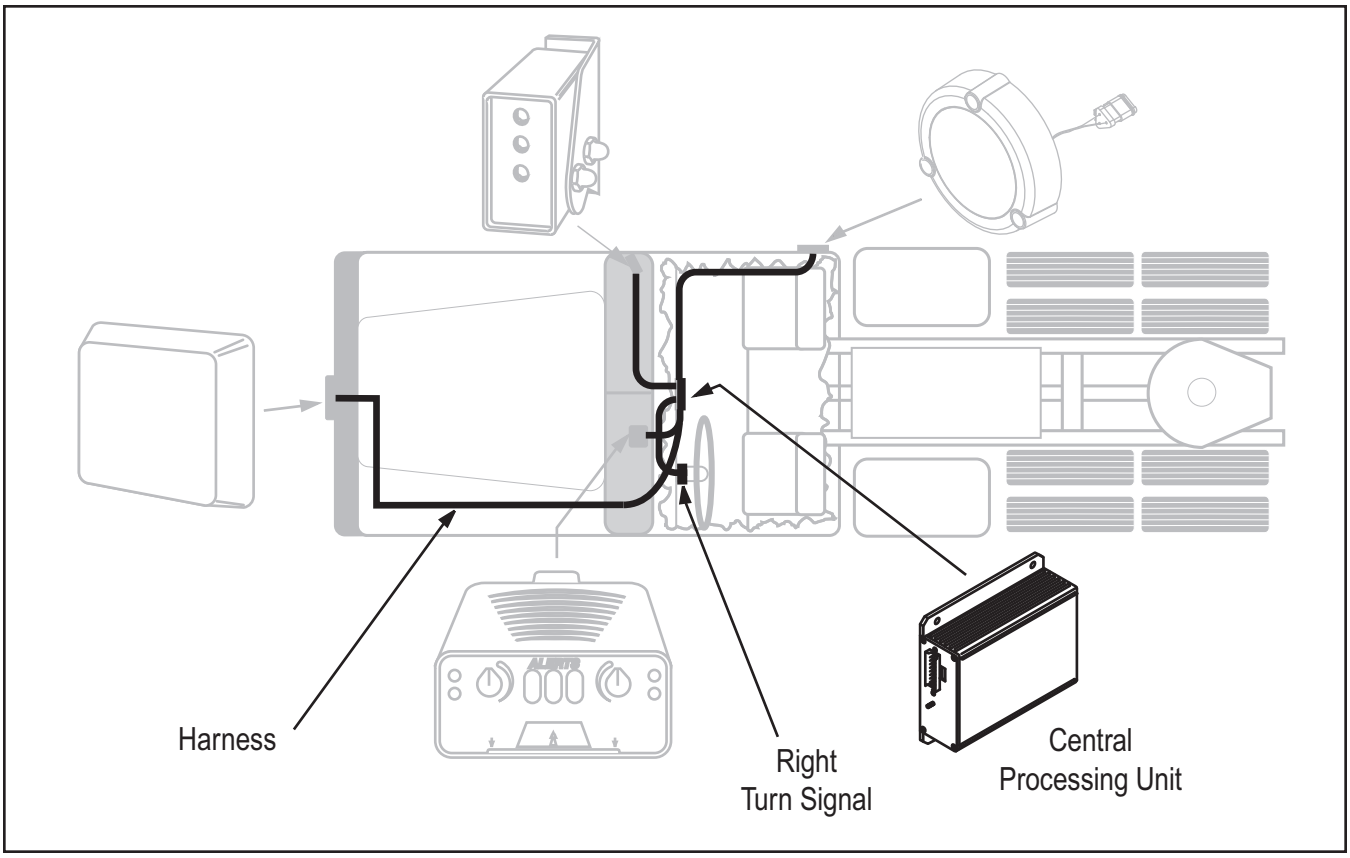
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

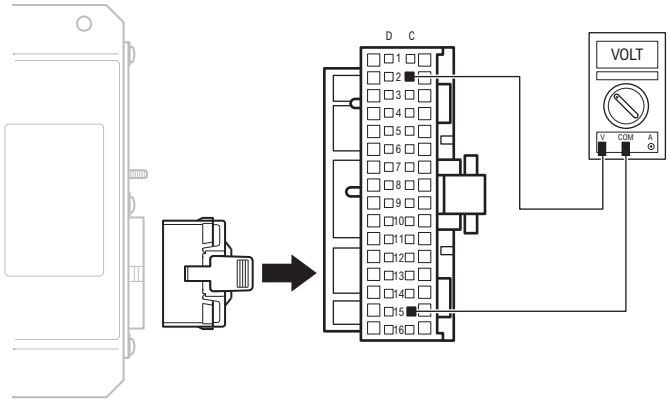
- Central Processing Unit
- OEM Harness
- Right Turn Signal



Code 21 (SID 7, FMI 2) Right Turn Signal

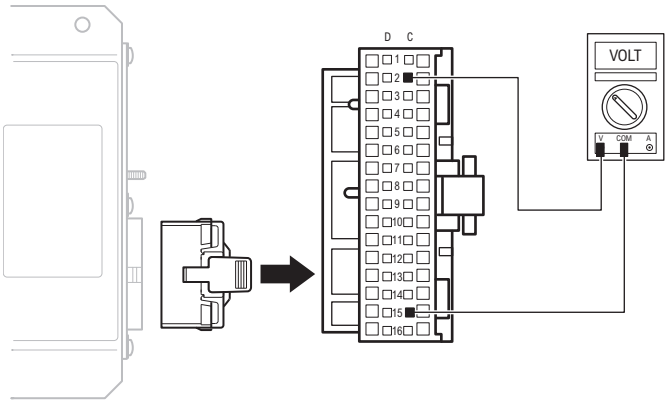
Step A	Procedure	Condition	Action
	1. Key off.		
	2. Is the vehicle equipped with a Right Side Sensor? →	If equipped with a Right Side Sensor →	Go to **Step B**.
		If not equipped with a Right Side Sensor →	The Central Processing Unit has been programmed for a Right Side Sensor. With a PC-based or Hand-held Diagnostic Tool, place the Right Side Sensor option in "NO" position. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect the 32-way Central Processing Unit connector.		
	3. Key on.		
	4. Measure voltage between Central Processing Unit 32-way connector pin C2 and C15. →	If voltage is below .5 volts →	Go to **Step C**.
	Note: Do not short pins while performing measurement.	If voltage is outside or range →	Repair OEM wiring harness as required. Go to **Step V**.



Code 21 (SID 7, FMI 2) Right Turn Signal, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Turn on right turn signal. 3. Measure voltage between Central Processing Unit 32-way connector pins C2 and C15.	If voltage flashes within 2 volts of battery voltage →	**Replace Central Processing Unit.** Go to **Step V**.
		If voltage is outside of range →	Repair OEM wiring harness as required. Go to **Step V**.



Code 21 (SID 7, FMI 2) Right Turn Signal, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
		If code 21 appears →	Return to **Step A** to find error in testing.
		If code other than 21 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 22 (SID 8, FMI 2) Left Turn Signal

Overview

This fault code indicates an electrical problem in the left turn signal input. The input from the left turn signal did not match the current operating conditions.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the feedback from the left turn signal.

Fallback

This fault will not allow the Bendix™ VORAD® system to detect objects when the operator is making a left turn.

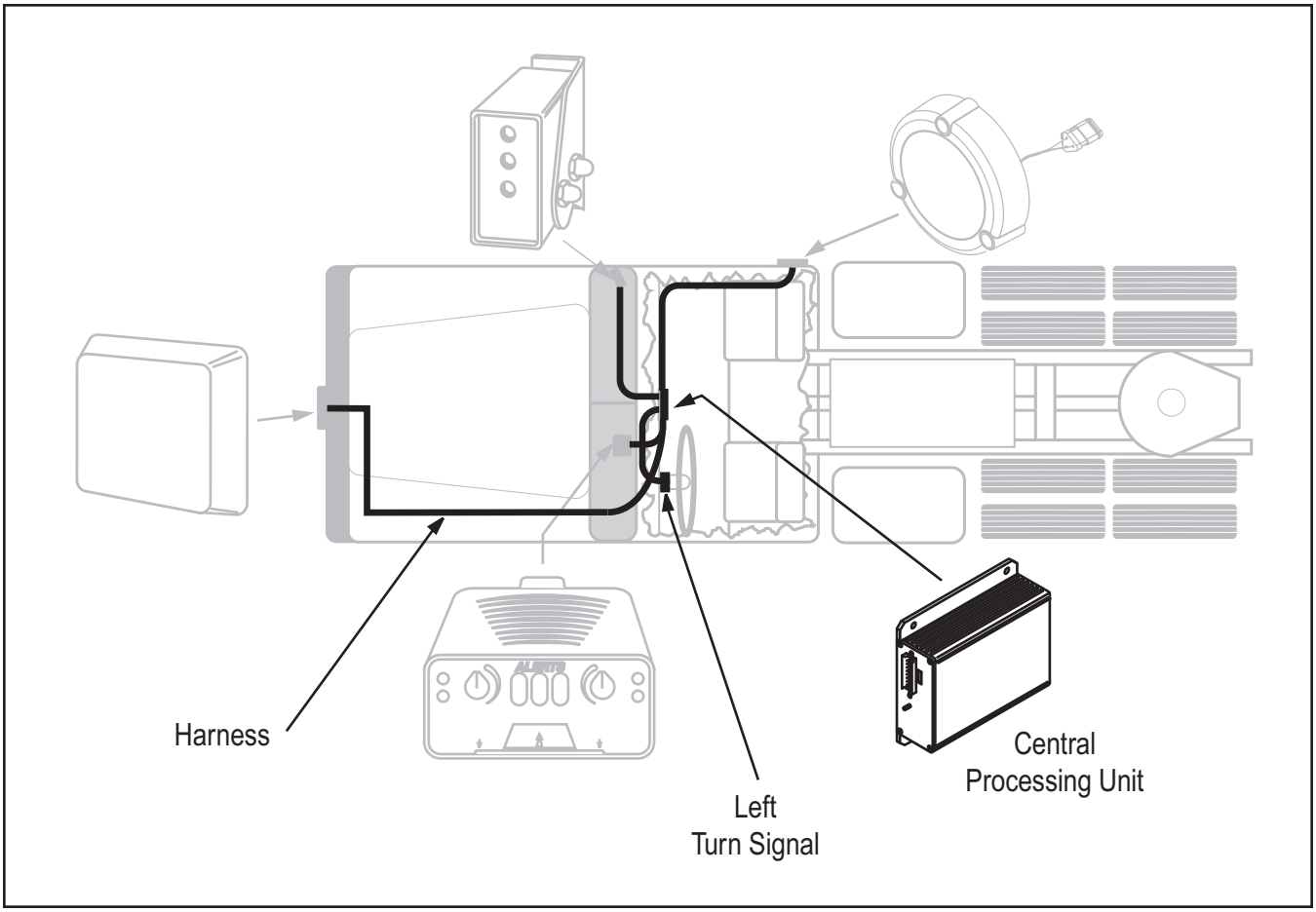
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

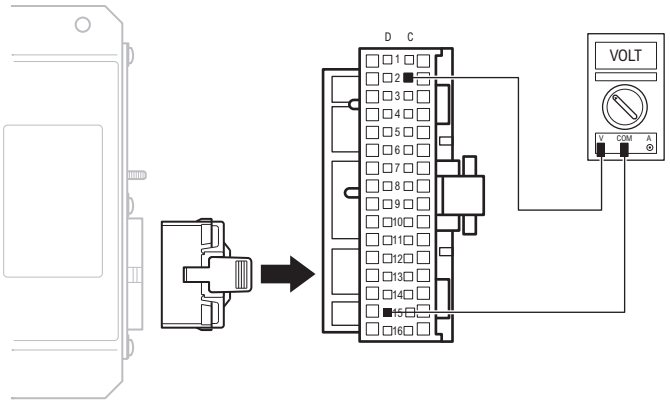
- Central Processing Unit
- OEM Harness
- Left Turn Signal



Code 22 (SID 8, FMI 2) Left Turn Signal

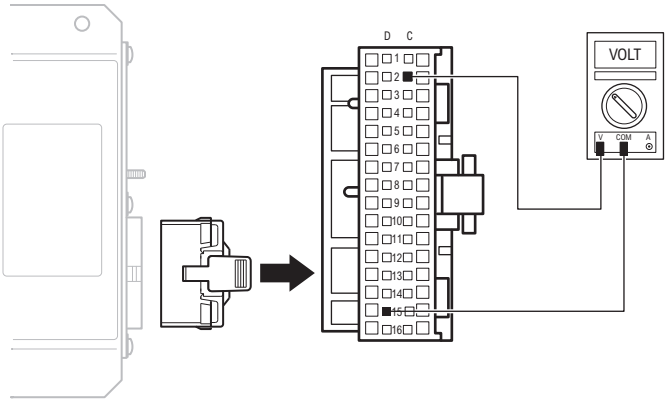
Step A	Procedure	Condition	Action
	1. Key off. 2. Is the vehicle equipped with a Left Side Sensor?	If equipped with a Left Side Sensor →	Go to **Step B**.
		If not equipped with a Left Side Sensor →	The Central Processing Unit has been programmed for a Left Side Sensor. With a PC-based or Hand-held Diagnostic Tool, place the Left Side Sensor option in "NO" position. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key off. 2. Disconnect the 32-way Central Processing Unit connector. 3. Key on. 4. Measure voltage between Central Processing Unit 32-way connector pin D15 and C2. **Note:** Do not short pins while performing measurement.	If voltage is below .5 volts →	Go to **Step C**.
		If voltage is outside of range →	Repair OEM wiring harness as required. Go to **Step V**.



Code 22 (SID 8, FMI 2) Left Turn Signal, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Turn on left turn signal. 3. Measure voltage between Central Processing Unit 32-way connector pins D15 and C2.	If voltage measures within 2 volts of battery voltage	**Replace Central Processing Unit.** Go to **Step V**.
		If voltage is outside of range	Repair OEM wiring harness as required. Go to **Step V**.



Code 22 (SID 8, FMI 2) Left Turn Signal, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4. 6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
		If code 22 appears →	Return to **Step A** to find error in testing.
		If code other than 22 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 23 (SID 3, FMI 2) Brake Input Error

Overview

This fault code indicates an electrical problem in the brake input. The signal from the bake pedal, J-1939, or J-1587 data link, did not match the current operating conditions.

Detection

Starting at key on and throughout the operation, the Bendix™ VORAD® system Central Processing Unit constantly measures this circuit. A failure mode of short to battery, short to ground, open circuit, or bad data is detected.

Fallback

This fault causes a failure of the VORAD system.

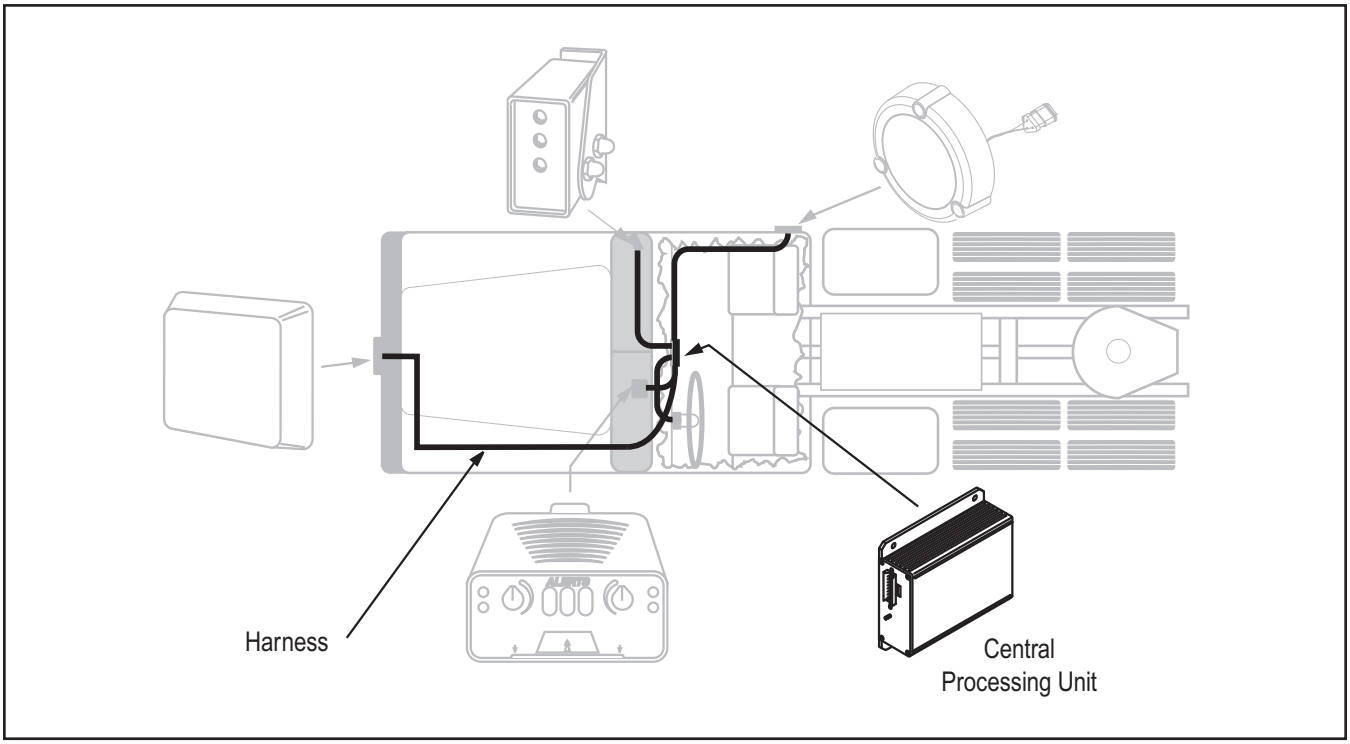
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

- Central Processing Unit
- OEM Harness
- Engine ECU



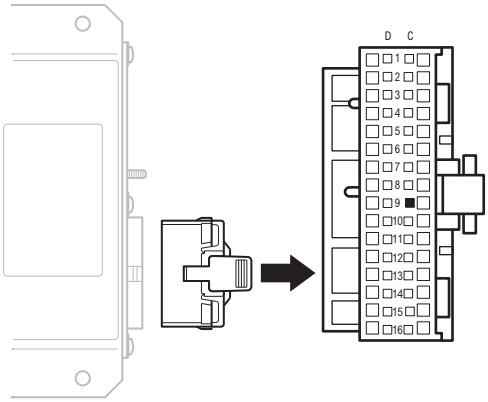
Code 23 (SID 3, FMI 2) Brake Input Error

Step A	Procedure	Condition	Action
	1. Key off. 2. Verify the vehicle brake lights are working correctly.	If the brake lights are working correctly →	Go to **Step B**.
		If the brake lights are not working correctly →	Repair vehicle brake lights. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Using a PC-based or Hand-held Diagnostic Tool verify vehicle brake configuration. →	If configuration is set to Discrete →	Go to **Step C**.
		If vehicle uses J-1939 or J-1587 configuration →	Repair OEM wiring harness J-1587 or J-1939 data link may not be connected to the VORAD system. Go to **Step V**.
		If vehicle uses LED brake lights →	Contact a Bendix representative for proper configuration. **Note:** VORAD must use either J-1939 or J-1587 to receive brake signal when LED tail lights are used on a vehicle.

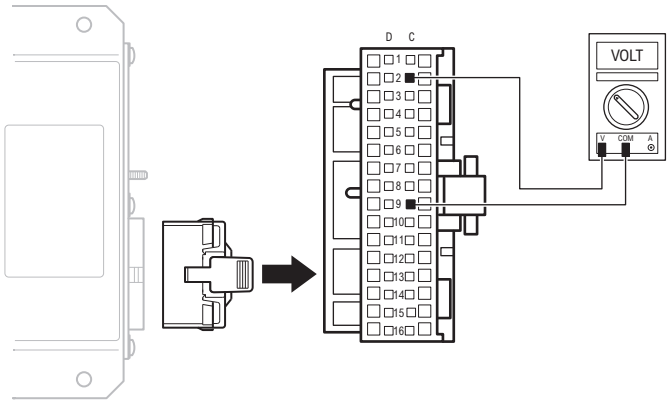
Code 23 (SID 3, FMI 2) Brake Input Error, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector.		
	3. Check pin C9 on 32-way connector.	If there is a wire in C9	Go to **Step D**.
		If there is not a wire in C9	Go to **Step E**.



Code 23 (SID 3, FMI 2) Brake Input Error, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Depress brake pedal. 3. Measure voltage between Central Processing Unit pins C9 and C2.	If voltage is within 1 volt of battery voltage	**Replace Central Processing Unit**. Go to **Step V**.
		If voltage is outside of range	Repair OEM wiring harness as necessary. Go to **Step V**.



Step E	Procedure	Condition	Action
	1. Key off. 2. Reconnect Central Processing Unit 32-way connector. 3. Connect a PC-based or Hand-held Diagnostic Tool. 4. Key on. 5. Perform brake test to verify correct signal is received when brake pedal is depressed.	If correct signal is received	**Replace Central Processing Unit**. Go to **Step V**.
		If correct signal is not received	Repair OEM wiring harness. J-1587 or J-1939 data link may not be connected to the Bendix™ VORAD® system. Go to **Step V**.

Code 23 (SID 3, FMI 2) Brake Input Error, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes appear →	Test complete.
		If code 23 appears →	Return to **Step A** to find error in testing.
		If code other than 23 appears	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Code 23 (SID 3, FMI 2) Brake Input Error, continued

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Component Code: 24 (SID 6, FMI 2) Speed Input Error

Overview

This fault code indicates an electrical problem in the speed source. The signal from the road speed source did not match the current operating conditions.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the feedback from the road speed source. If the feedback is out of range the fault code is set.

Fallback

This fault causes a failure of the Bendix™ VORAD® system.

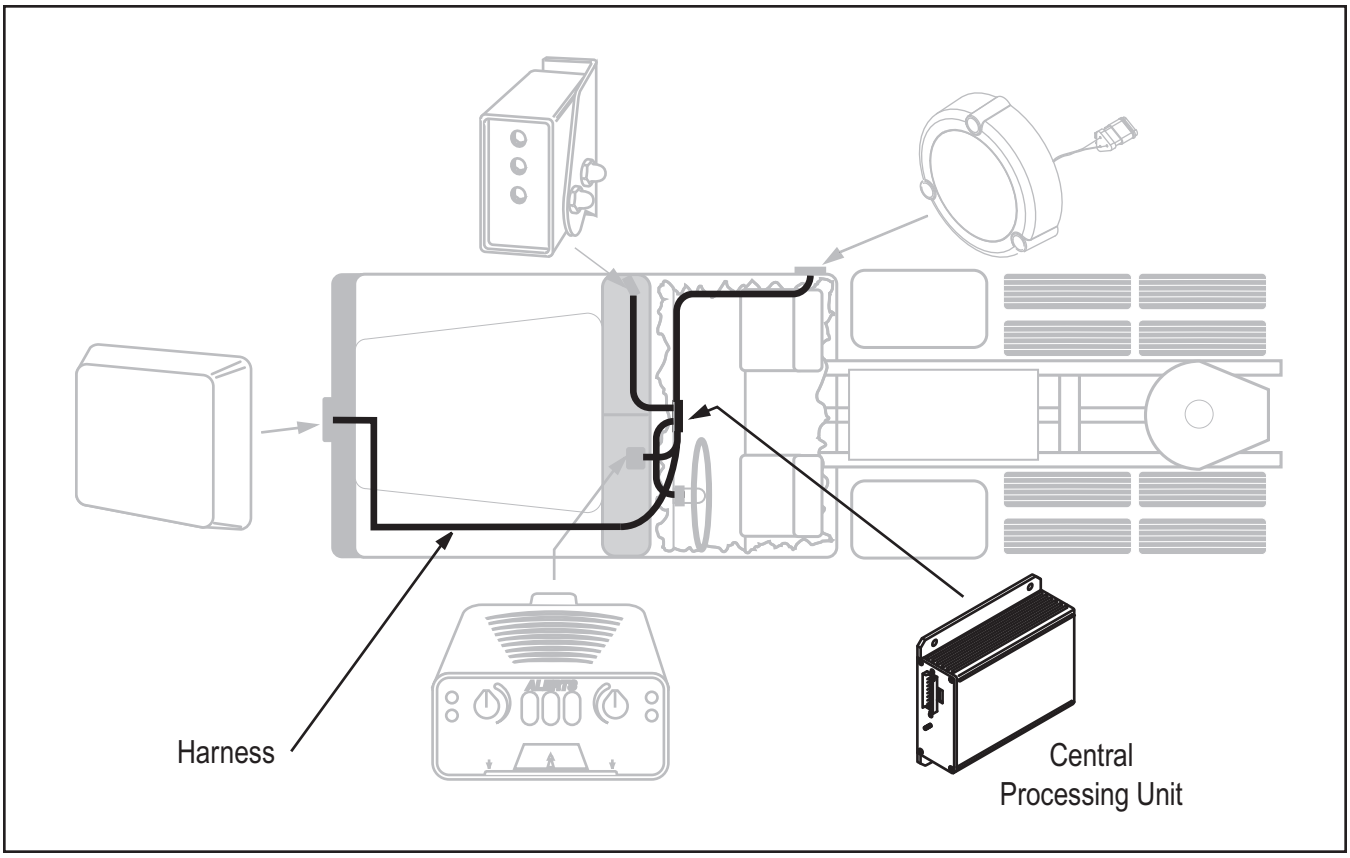
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide
- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

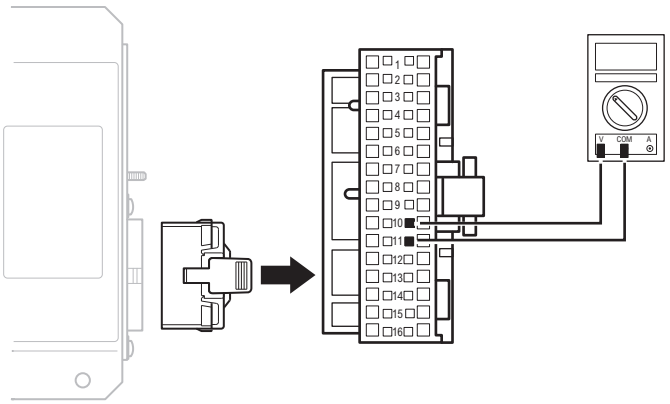
- Central Processing Unit
- OEM Harness
- Speed Sensor
- J-1939 or J-1587



Code 24 (SID 6, FMI 2) Speed Input Error

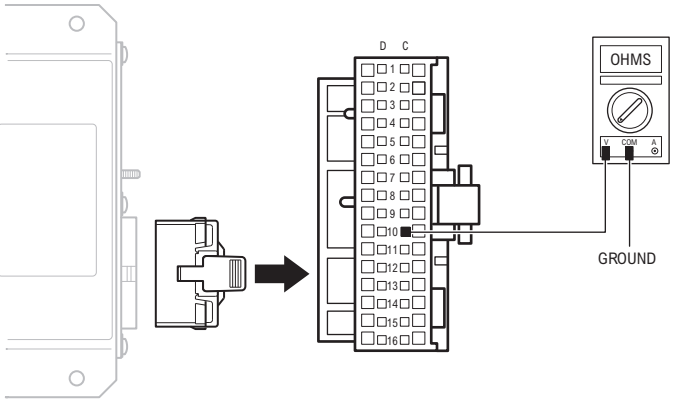
Step A	Procedure	Condition	Action
	1. Using a PC-based or Hand-held Diagnostic Tool verify vehicle speed configuration. →	If configuration is set to Discrete →	Go to **Step B**.
		If vehicle uses J-1939 or J-1587 configuration →	Repair OEM wiring harness. J-1587 or J-1939 data link may not be connected to the Bendix™ VORAD® system. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Disconnect Central Processing Unit 32-way connector.	**Note:** If 32-way connector does not have pins in C10 and C11, recheck vehicle configuration for speed source. This test is used for discrete installations only.	
	3. Measure resistance between Central Processing Unit pins C10 and C11. →	If resistance is 2 to 4K ohms →	Go to **Step C**.
		If resistance is outside of range →	Go to **Step D**.

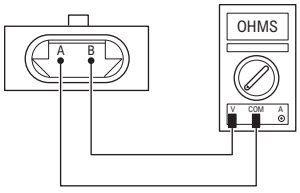


Code 24 (SID 6, FMI 2) Speed Input Error, continued

Step C	Procedure	Condition	Action
	1. Measure resistance between Central Processing Unit 32-way connector pin C10 and ground.	If resistance is more than 10K ohms or open circuit [OL]	**Replace Central Processing Unit.** Go to **Step V**.
		If resistance is less than 10K ohms	Go to **Step D**.

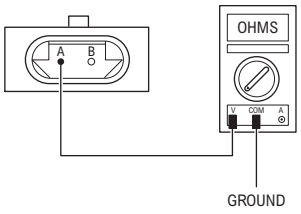


Step D	Procedure	Condition	Action
	1. Disconnect VORAD harness from speed source.		
	2. Measure resistance between speed sensor pins A and B.	If resistance is 2 to 4K ohms	Go to **Step E**.
		If resistance is outside of range	Replace speed sensor. Go to **Step V**.



Code 24 (SID 6, FMI 2) Speed Input Error, continued

Step E	Procedure	Condition	Action
	1. Measure resistance between speed sensor A and ground. →	If resistance is more than 10K ohms or open circuit [OL] →	Repair the OEM wiring harness. Go to **Step V**.
		If resistance is less than 10K ohms →	Replace speed sensor. Go to **Step V**.



Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes →	Test complete.
		If code 24 appears →	Return to **Step A** to find error in testing.
		If code other than 24 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Component Code: 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error

Overview

This fault code indicates that VORAD failed to communicate with the engine over the J-1939 data link.

Detection

Starting at key on and throughout the operation, the VORAD Central Processing Unit constantly monitors the communication with the engine ECU. If a communication fault occurs for more than 5 seconds, this fault is set.

Fallback

This fault causes a failure of the Bendix™ VORAD® system SmartCruise® option.

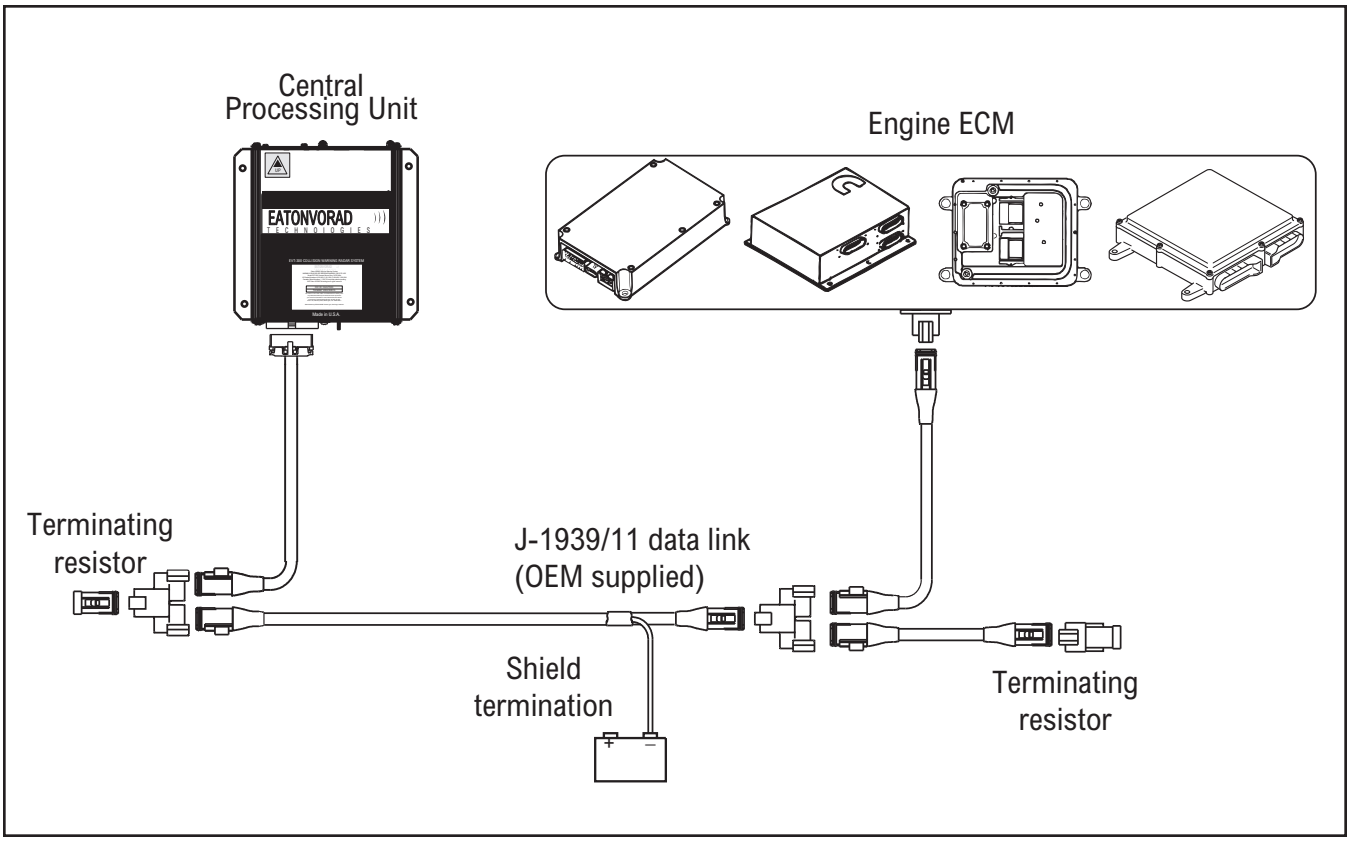
Required Tools

- Basic Hand Tools
- Data Link Tester
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

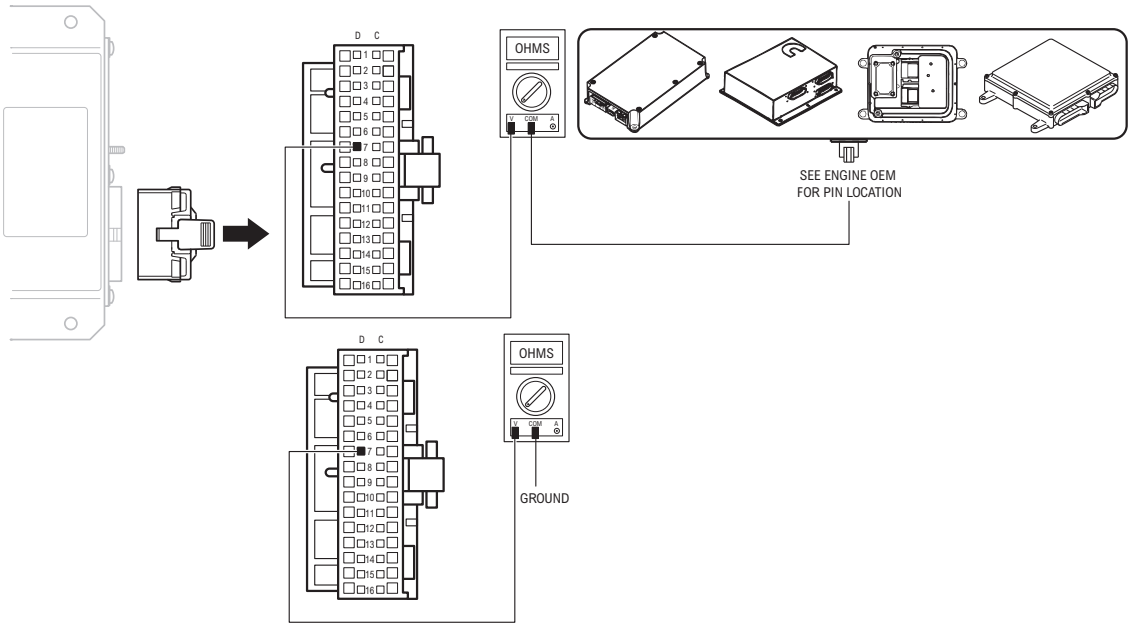
This fault code can be caused by any of the following:

- J-1939 Data Link
- Engine ECU
- Central Processing Unit



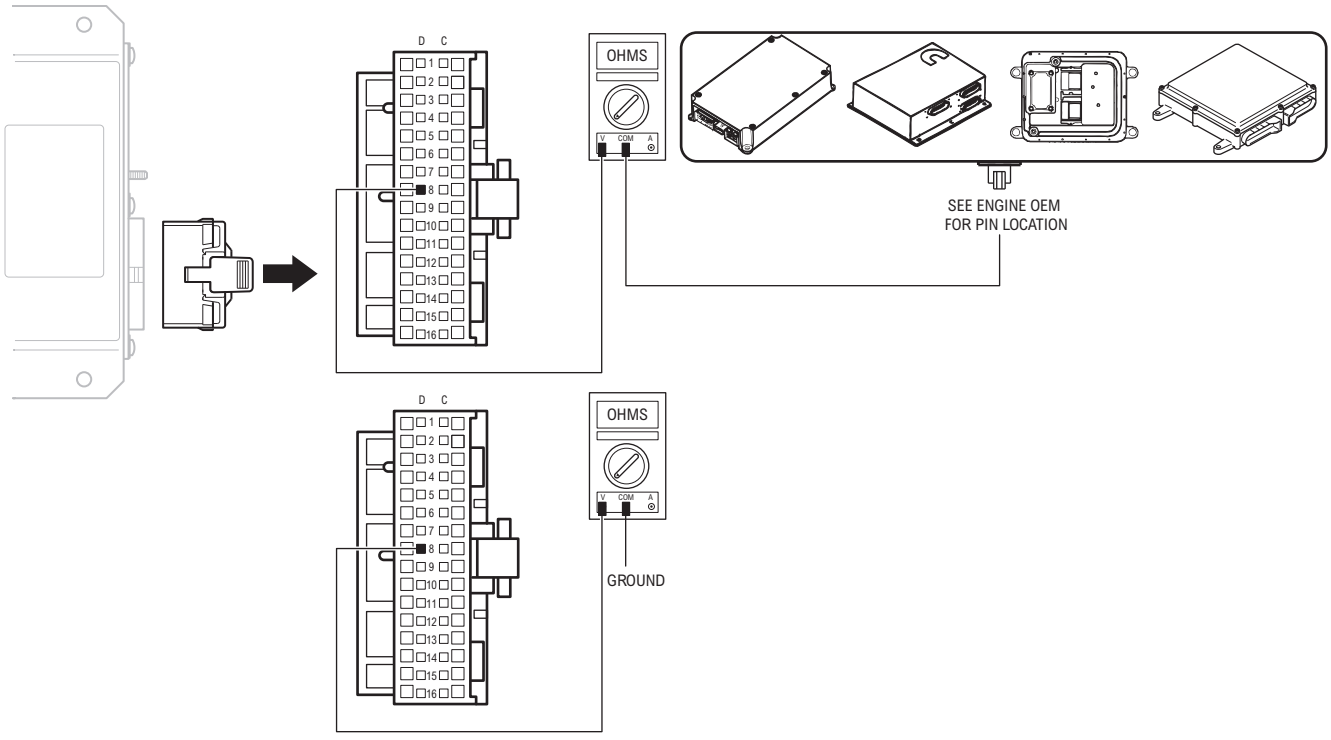
Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error

Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect the VORAD Central Processing Unit 32-way connector. 3. Disconnect engine ECU connector which contains the J-1939 data link. 4. Measure resistance between: • Bendix™ VORAD® system Central Processing Unit 32-way connector pin D7 and engine ECU pin # (see engine OEM for pin location). • VORAD system Central Processing Unit 32-way pin D7 and ground.	If resistance between pin D7 and engine ECU pin is 0 to .3 ohms and if resistance between pin D7 and ground is more than 10K ohms or open circuit [OL]	Go to **Step B**.
		If resistance is outside of range	Repair J-1939 data link wiring harness between engine ECU and VORAD system. Go to **Step V**.



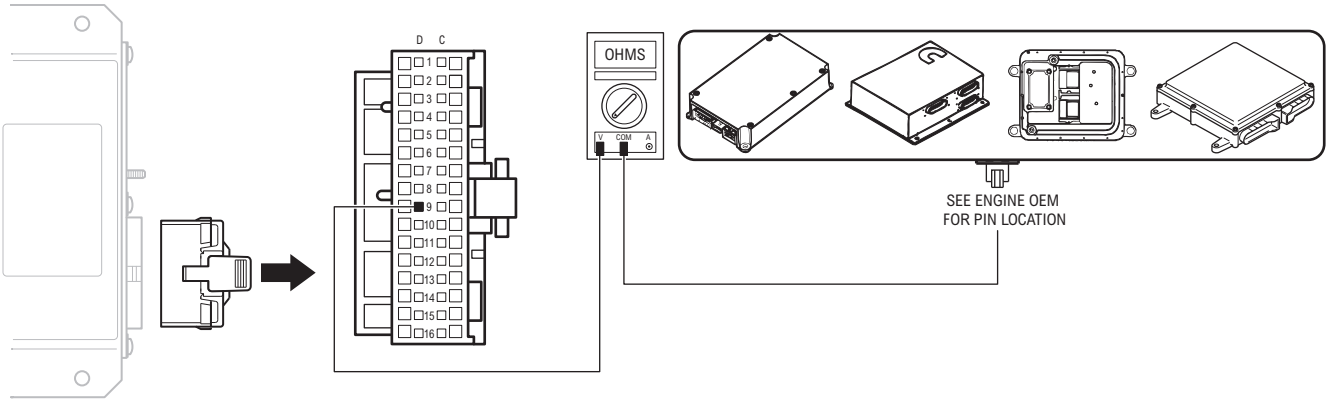
Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • The Bendix™ VORAD® system Central Processing Unit 32-way connector pin D8 and engine ECU pin # (see engine OEM for pin location). • VORAD system Central Processing Unit 32-way pin D8 and ground.	If resistance between pin D8 and engine ECU pin is 0 to .3 ohms and if resistance between pin D8 and ground is more than 10K ohms or open circuit [OL]	If equipped with J-1939-Lite, go to **Step D**. If not equipped with J-1939-Lite, go to **Step C**.
		If resistance is outside of range	Repair J-1939 data link wiring harness between engine ECU and VORAD system. Go to **Step V**.



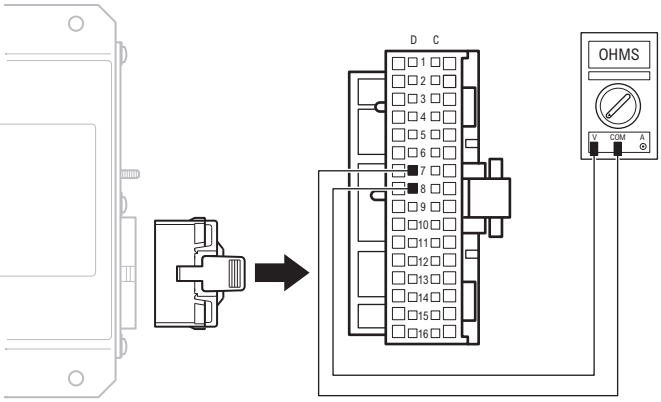
Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error, continued

Step C	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance between the Bendix™ VORAD® system Central Processing Unit 32-way connector pin D9 and engine ECU pin # (see engine OEM for pin location). →	If resistance between pin D9 and engine ECU pin is 0 to .3 ohms →	Go to **Step D**. (If working on a Mack engine, go to **Step E**.)
		If resistance is outside of range →	Repair J-1939 data link wiring harness between engine ECU and VORAD Central Processing Unit. Go to **Step V**.



Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error, continued

Step D	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance between the Bendix™ VORAD® system 32-way connector pin D7 and pin D8. **Note:** Make sure the volt/ohm meter is on the proper scale. (200 ohm scale)	If resistance between pin D7 and pin D8 is between 50 to 70 ohms	Go to **Step E**.
		If resistance is more than 70 ohms	One or both of the terminating resistors on the J-1939 data link wiring harness are either missing or out of range. Repair J-1939 data link wiring harness. Go to **Step V**.
		If resistance is less than 50 ohms	Repair the J-1939 data link between the engine ECU and VORAD system. Go to **Step V**.



Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Reconnect engine ECU connector. 3. Install spare Bendix™ VORAD® system EVT-300 CPU configured same as replaced unit.		
	4. Key on. →	If error codes →	Problem exists with the engine ECU. Repair according to manufacturer's recommendations. Go to **Step V**.
		If no error codes →	**Replace Central Processing Unit.** Go to **Step V**.

Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes appear →	Test complete.
		If code 25 appears →	Return to **Step A** to find error in testing.
		If code other than 25 appears	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Code 25, 32 (SID 231, FMI 2, 12, 14) J-1939 and Cruise Signal Error, continued

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Component Code: 31 (SID 250, FMI 2) J-1587 Data Link Error

Overview

This fault code indicates the Bendix™ VORAD® system failed to communicate with the engine over the J-1587 data link.

Detection

Starting at key on and throughout the operation, the VORAD Central Processing Unit constantly monitors the communication with the engine ECU. If a communication fault occurs for more than 2.5 seconds, this fault is set.

Fallback

This fault causes a failure of the VORAD system.

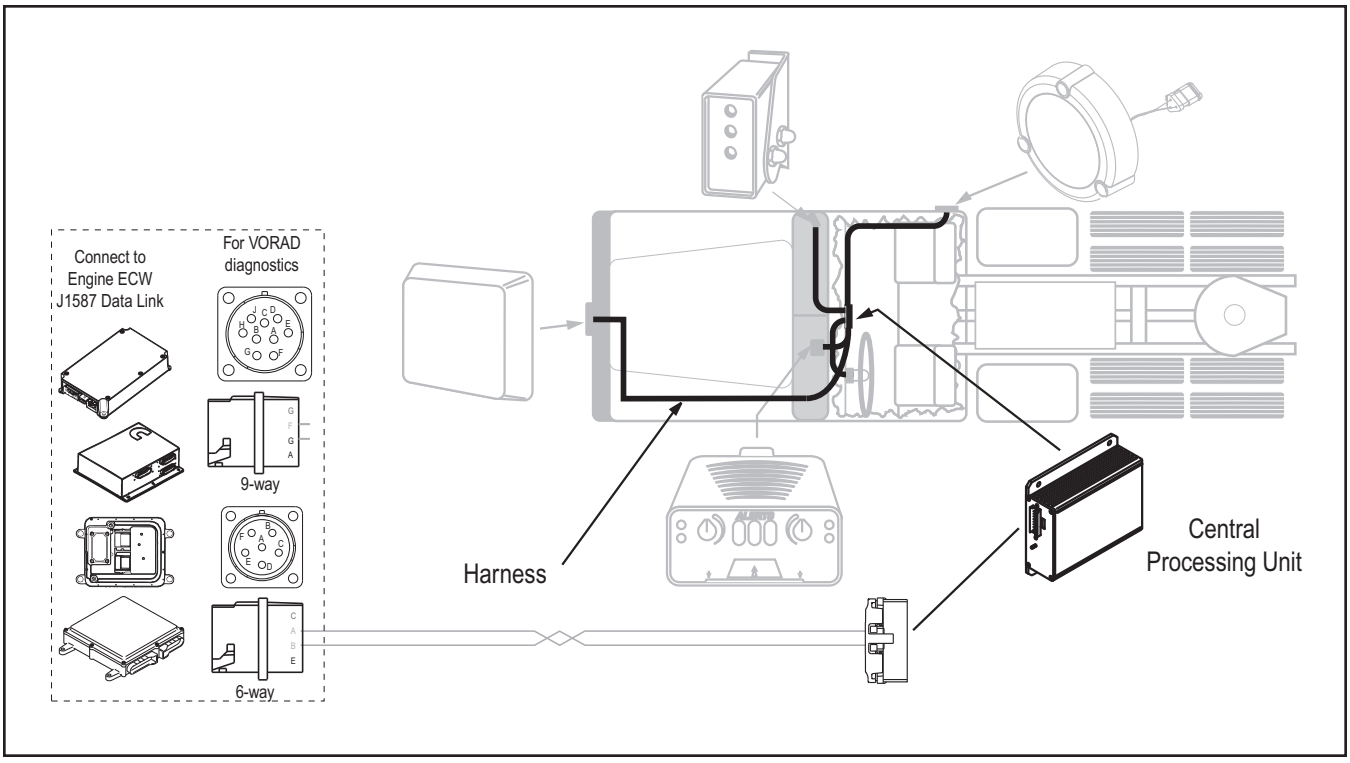
Required Tools

- Basic Hand Tools
- Digital Volt/Ohm Meter
- Troubleshooting Guide

Possible Causes

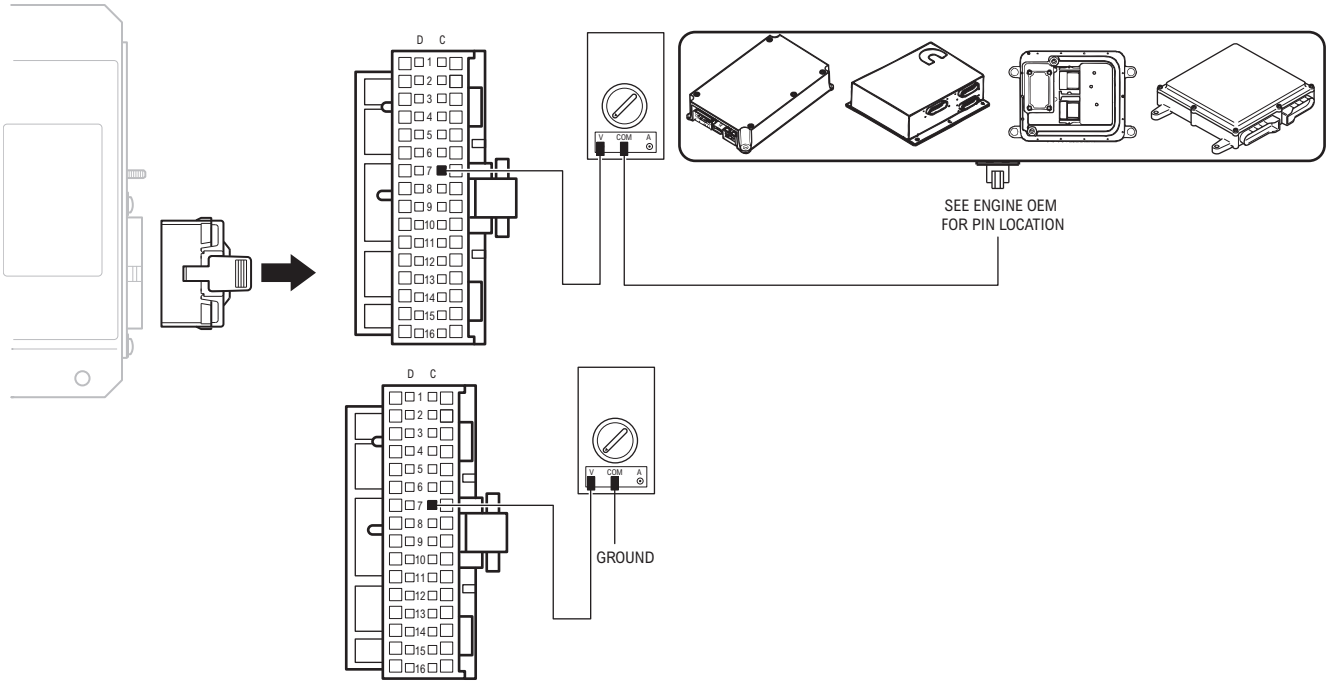
This fault code can be caused by any of the following:

- J-1587 Data Link
- Engine ECU
- Central Processing Unit



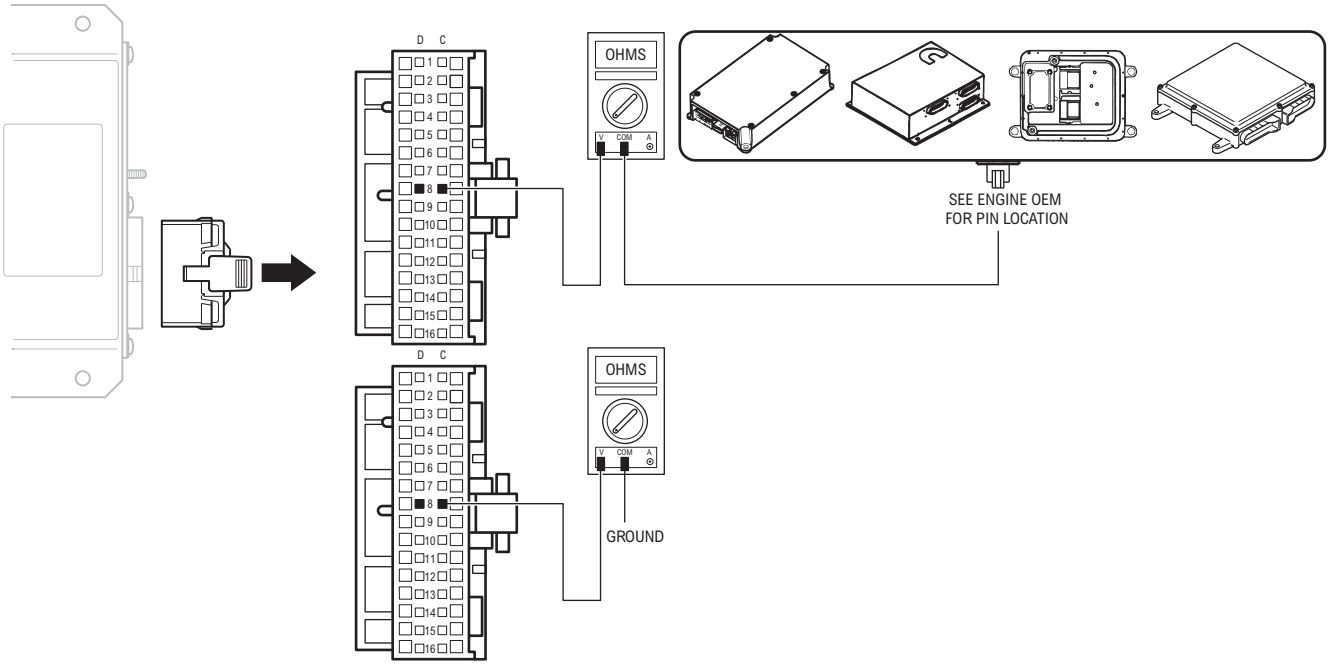
Code 31 (SID 250, FMI 2) J-1587 Data Link Error

Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Central Processing Unit 32-way connector. 3. Disconnect engine ECU connector which contains the J-1587 data link. 4. Measure resistance between: • Central Processing Unit 32-way connector pin C7 and engine ECU pin # (see engine OEM for pin location). • Central Processing Unit 32-way pin C7 and ground.	If resistance between pin C7 and engine ECU pin is 0 to .3 ohms and if resistance between pin C7 and ground is more than 10K ohms or open circuit [OL]	Go to **Step B**.
		If resistance is outside of range	Repair J-1587 data link wiring harness between engine ECU and Central Processing Unit. Go to **Step V**.



Code 31 (SID 250, FMI 2) J-1587 Data Link Error, continued

Step B	Procedure	Condition	Action
	1. Key off.		
	2. Measure resistance between: • Central Processing Unit 32-way connector pin C8 and engine ECU pin # (see engine OEM for pin location). • Central Processing Unit 32-way pin C8 and ground.	If resistance between pin C8 and engine ECU pin is 0 to .3 ohms and if resistance between pin C8 and ground is more than 10K ohms or open circuit [OL]	Go to **Step C**.
		If resistance is outside of range	Repair J-1587 data link wiring harness between engine ECU and Central Processing Unit. Go to **Step V**.



Code 31 (SID 250, FMI 2) J-1587 Data Link Error, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Reconnect Central Processing Unit 32-way connector. 3. Disconnect all data links to the vehicle diagnostic connector, leaving only the Bendix™ VORAD® system connected. 4. Connect the ServiceRanger 2 with RP1210 vehicle adapter to vehicle diagnostic connector. 5. Key on.	→ If no communication errors	→ Problem exists with one or more other vehicle components. Repair according to manufacturer's recommendations. Go to **Step V**.
		If communication errors →	Replace **Central Processing Unit**. Go to **Step V**.

Code 31 (SID 250, FMI 2) J-1587 Data Link Error, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4. 6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes appear →	Test complete.
		If code 31 appears →	Return to **Step A** to find error in testing.
		If code other than 31 appears	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Code 31 (SID 250, FMI 2) J-1587 Data Link Error, continued

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Component Code: 33 (SID 248, FMI 12) VBUS Error

Overview

This fault code indicates the Antenna, Central Processing Unit, and/or Driver Display Unit are unable to communicate.

Detection

Starting at key on and throughout the operation, the Central Processing Unit constantly monitors the communication with the Antenna and Driver Display Unit. If a communication fault occurs for more than 5 seconds, fault code 33 is set.

Fallback

This fault causes a failure of the Bendix™ VORAD® system.

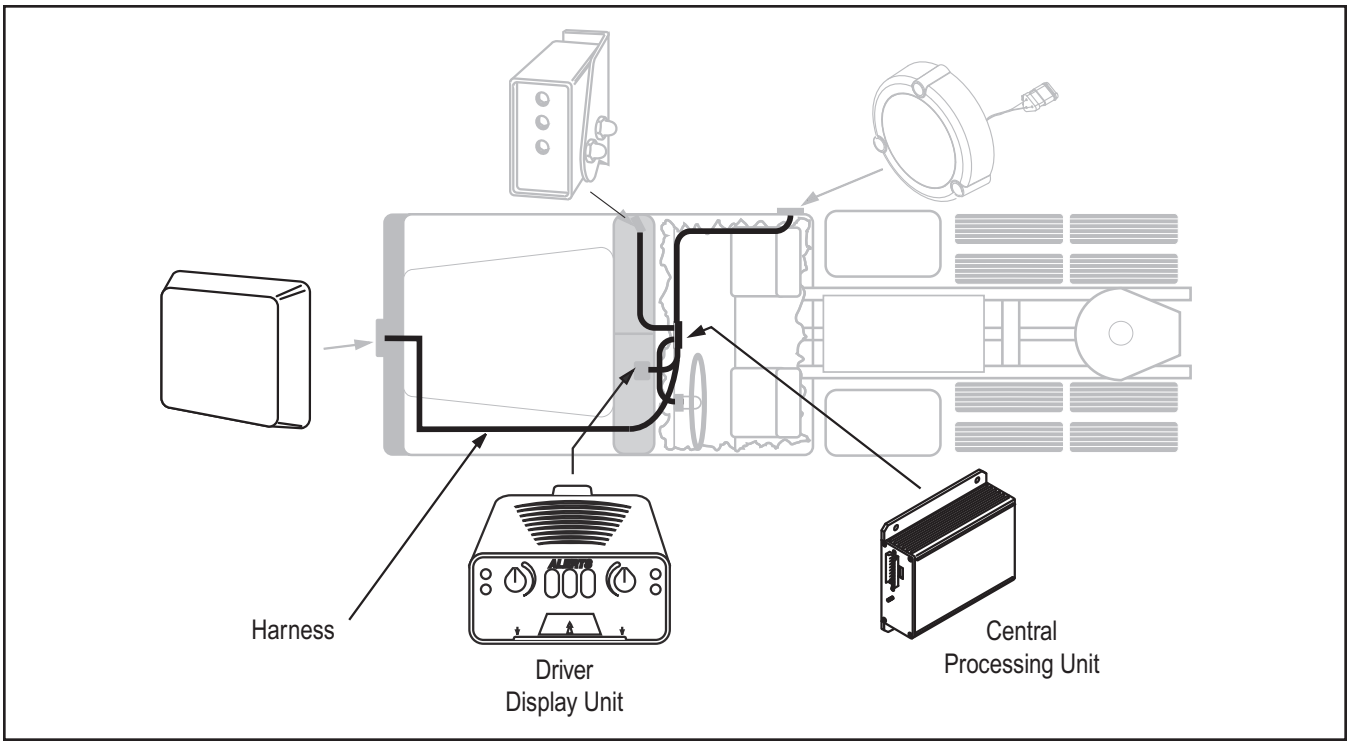
Required Tools

- Basic Hand Tools
- Troubleshooting Guide
- Digital Volt/Ohm Meter

Possible Causes

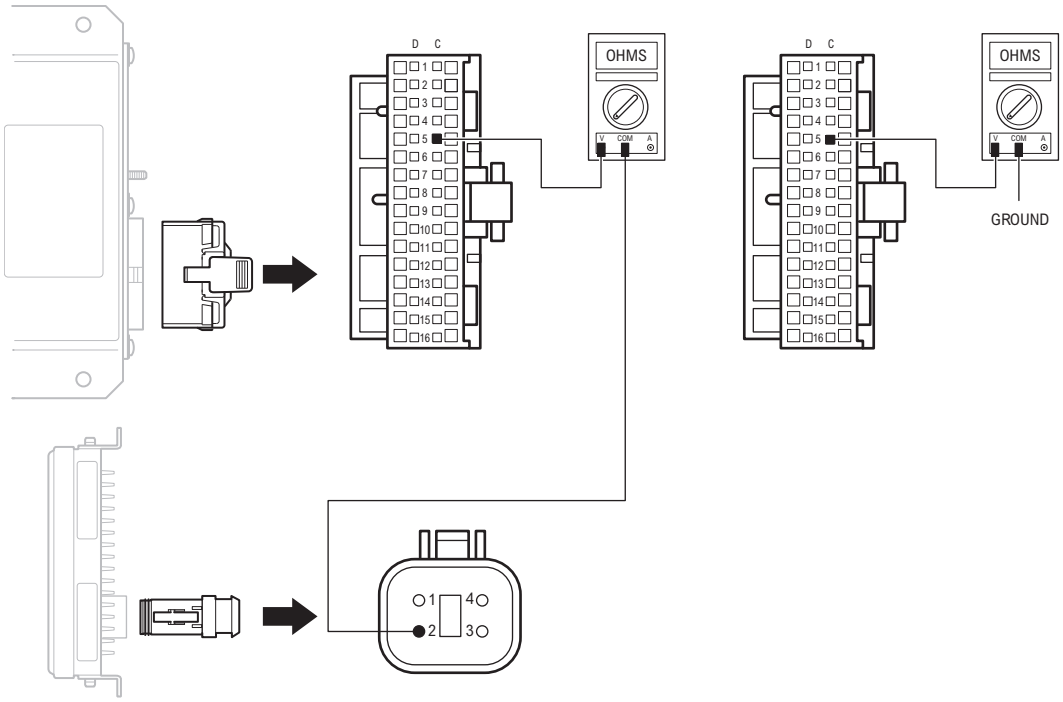
This fault code can be caused by any of the following:

- OEM Harness
- Antenna Assembly
- Central Processing Unit
- Driver Display Unit



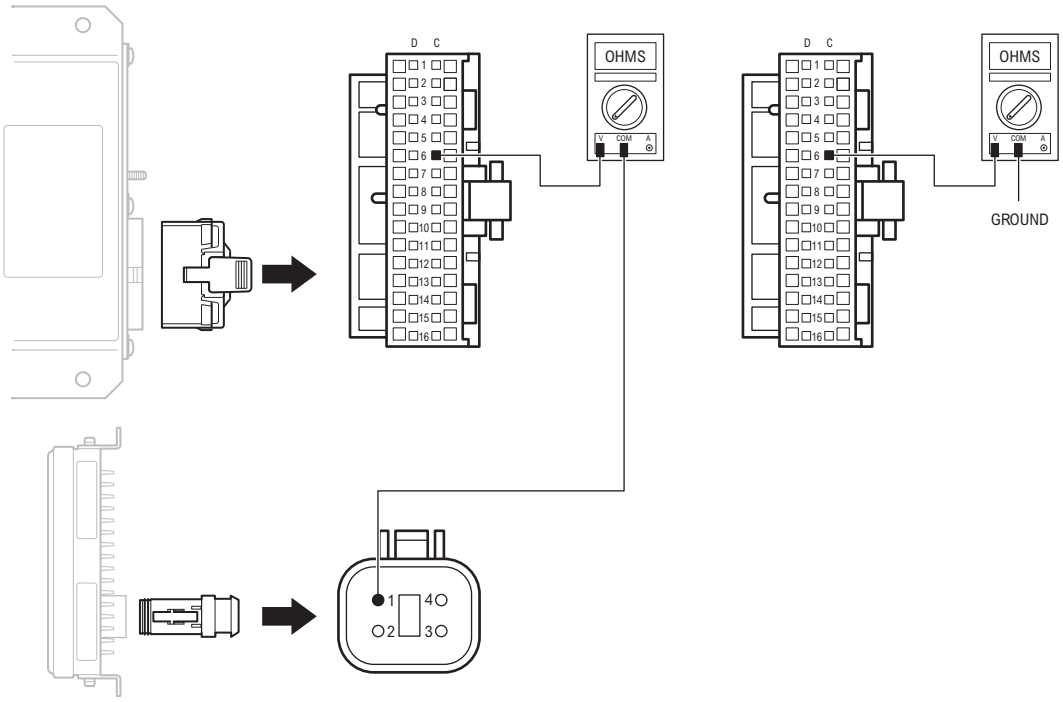
Code 33 (SID 248, FMI 12) VBUS Error

Step A	Procedure	Condition	Action
	1. Key off. 2. Disconnect the Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin C5 and Antenna 4-way connector pin 2. • Central Processing Unit 32-way connector and pin C5 and ground.	If resistance between pin C5 and pin 2 is 0 to .3 ohms and if resistance between pin C5 and ground is more than 10K ohms or open circuit [OL]	Go to **Step B**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and the Central Processing Unit. Go to **Step V**.



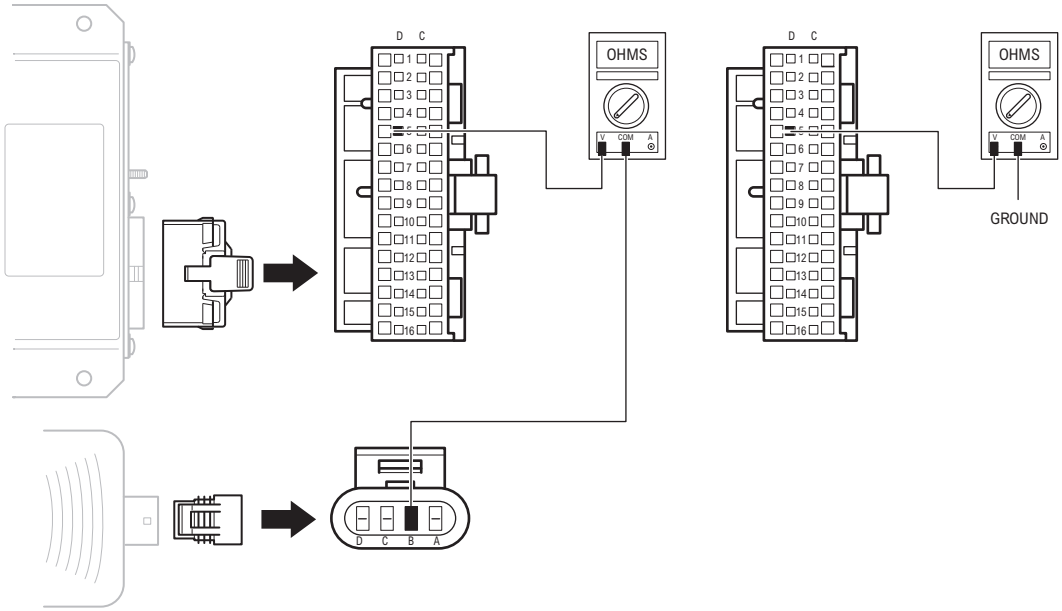
Code 33 (SID 248, FMI 12) VBUS Error, continued

Step B	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin C6 and Antenna 4-way connector pin 1. • Central Processing Unit 32-way pin C6 and ground.	If resistance between pin C6 and pin 1 is 0 to .3 and if resistance between pin C6 and ground is more than 10K ohms or open circuit [OL]	Go to **Step C**.
		If any of the above conditions are not met	Repair OEM wiring harness between Antenna and Central Processing Unit. Go to **Step V**.



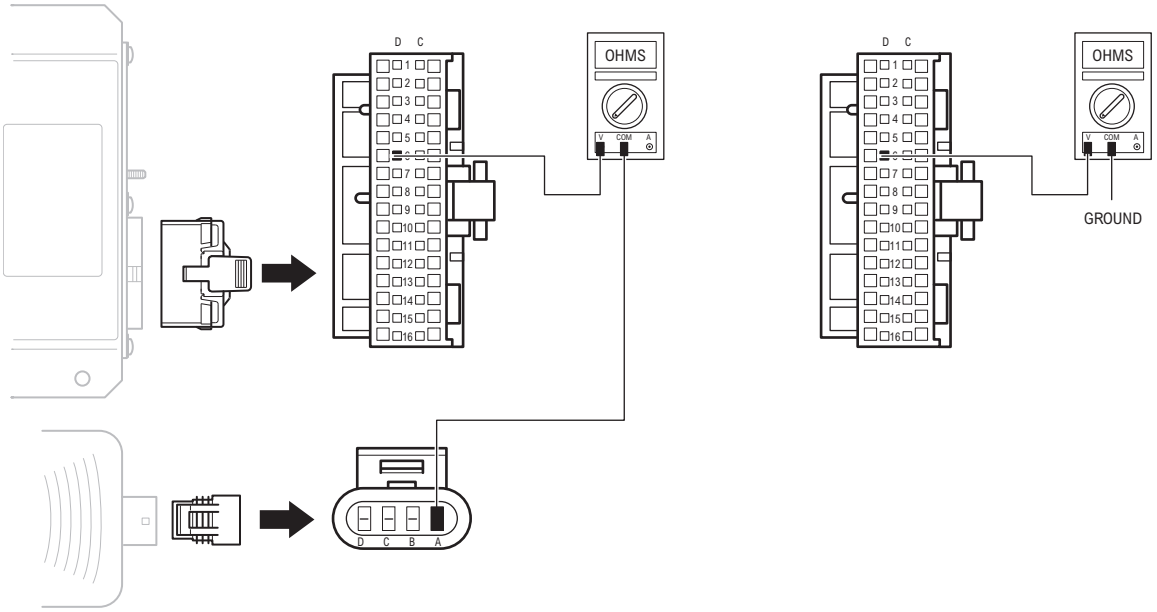
Code 33 (SID 248, FMI 12) VBUS Error, continued

Step C	Procedure	Condition	Action
	1. Key off. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • Central Processing Unit 32-way connector pin D5 and Driver Display 4-way connector pin B. • Central Processing Unit 32-way connector pin D5 and ground.	If resistance between pin D5 and pin B is 0 to .3 ohms and if resistance between pin D5 and ground is more than 10K ohms or open circuit [OL]	Go to **Step C**.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



Code 33 (SID 248, FMI 12) VBUS Error, continued

Step D	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • Central Processing Unit 32-way connector pin D6 and Driver Display 4-way connector pin A. • Central Processing Unit pin D6 and ground.	If resistance between pin D6 and pin A is 0 to .3 ohms and if resistance between pin D6 and ground is more than 10K ohms or open circuit [OL]	See “Code 13, 34 (SID 9, FMI 2, 4, 5, 12) Driver Display Unit” on page 22 and “Code 14, 35 (SID 1, 2, FMI 2, 12, 14) Antenna” on page 30 to diagnose if Antenna or Driver Display Unit is defective.
		If any of the above conditions are not met	Repair OEM wiring harness between Driver Display Unit and Central Processing Unit. Go to **Step V**.



Code 33 (SID 248, FMI 12) VBUS Error, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Key on. 4. Clear Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. 5. Use Driving Techniques to attempt to reset the code. See “Driving Techniques” on page 1 - 4.		
	6. Check for Codes. See “Fault Code Retrieval and Clearing” on page 1 - 2. →	If no codes appear →	Test complete.
	Note: If problem still exists there may be a software compatibility problem. Contact your Bendix representative.	If code 33 appears →	Return to **Step A** to find error in testing.
		If code other than 33 appears →	See “Fault Code Isolation Procedure Index” on page 1 - 3.

Antenna Not Detecting Targets

Overview

This symptom driven test is performed when the Bendix™ VORAD® system fails to detect objects properly.

Detection

The VORAD Central Processing Unit has no fault detection capability for this symptom. The symptom is observed by the driver when objects at 100 feet (30 m) or closer are not detected or no headway or detect light is observed.

Fallback

There is no fallback mode for this symptom. The Front Antenna will not operate properly.

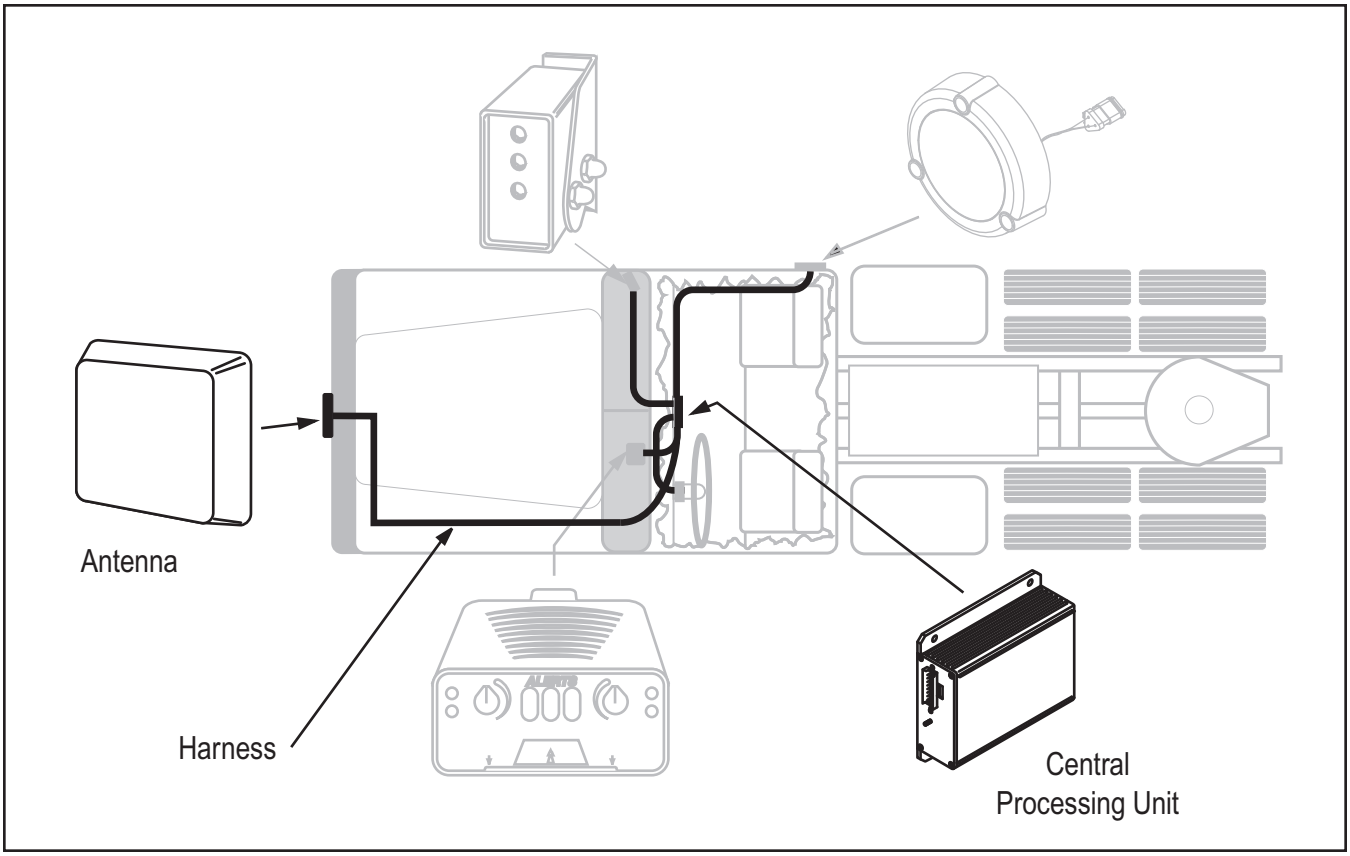
Required Tools

- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault code can be caused by any of the following:

- Front Antenna



Antenna Not Detecting Targets

Step A	Procedure	Condition	Action
	1. Align the Antenna using the Antenna Assembly Alignment Procedure in the Bendix™ VORAD® system Service Manual (BW2863). →	Antenna is aligned properly →	Go to **Step V**.
	Note: If fail light is on go to the appropriate isolation procedure.	Antenna can not be aligned properly →	**Replace Antenna.** Go to **Step A**.

Step V	Procedure	Condition	Action
	1. Key on. 2. Drive vehicle to determine whether the complaint has been repaired. →	If complaint has been repaired →	Test complete.
		If complaint has not been repaired →	Return to **Step A** to find error in testing.

Side Sensor Not Detecting Targets

Overview

This symptom driven test is performed when the Bendix™ VORAD® system fails to detect objects properly.

Detection

The VORAD Central Processing Unit has no fault detection capability for this symptom. The symptom is observed by the driver when objects at 2-10 feet (0.61-3 m) are not detected. The red light also illuminates when the side sensor has failed.

Fallback

There is no fallback mode for this symptom. The Side Sensor will not operate properly.

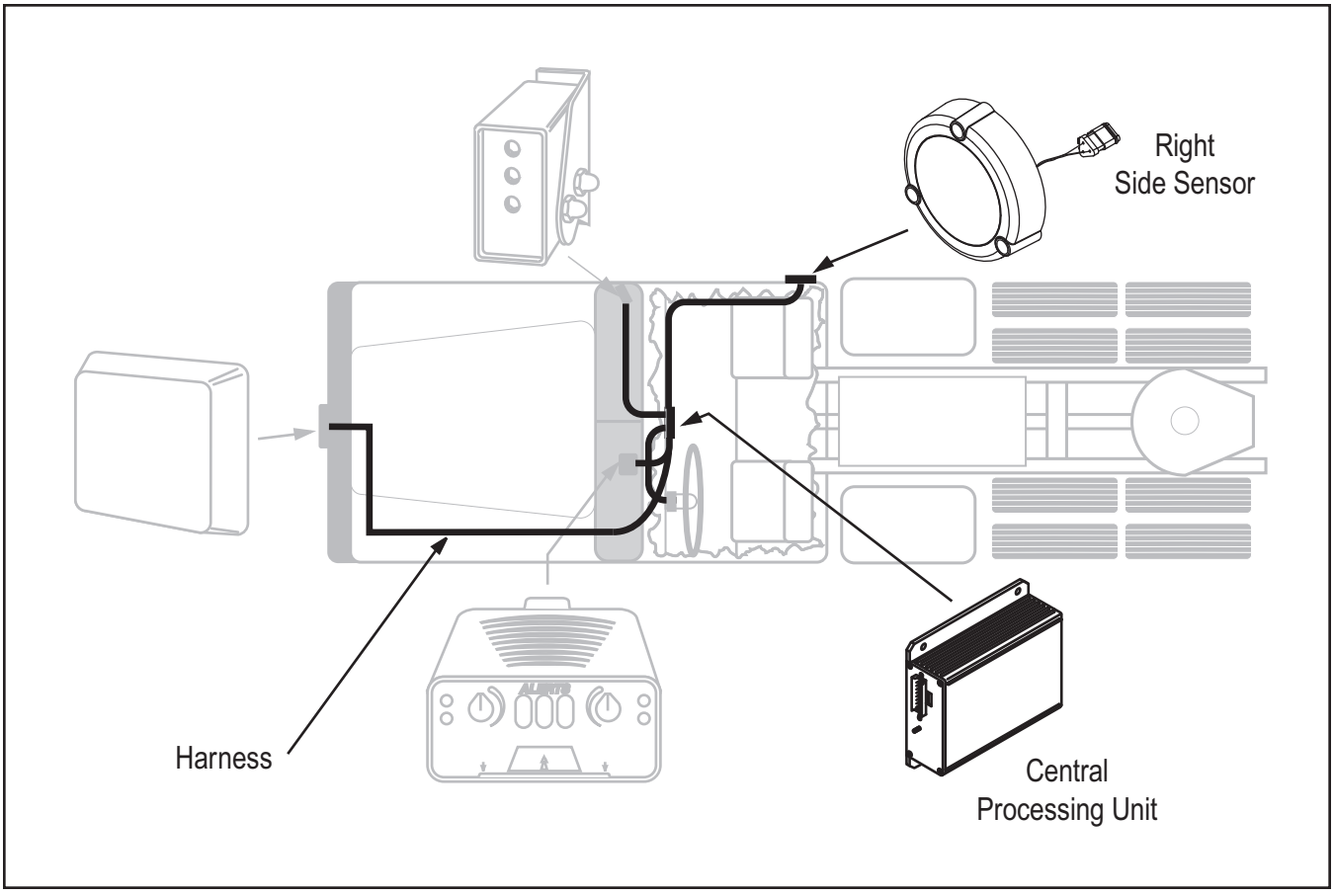
Required Tools

- PC-based or Hand-held Diagnostic Tool

Possible Causes

This fault can be caused by any of the following:

- Side Sensor
- Faulty Wiring



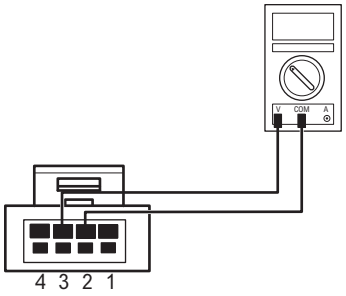
Side Sensor Not Detecting Targets

Step A	Procedure	Condition	Action
	1. Key on. 2. Using a PC-based or Hand-held Diagnostic Tool, confirm the vehicle is configured for a Left, Right, or Both Side Sensor(s).	If properly configured →	Go to **Step B**.
		If not properly configured →	Using a PC-based or Hand-held Diagnostic Tool, place the Side Sensor option(s) in the "yes" position. Go to **Step V**.

Step B	Procedure	Condition	Action
	1. Key on. 2. Place a moving target 2 to 10 feet (0.61-3 m) from but directly in front of the Side Sensor.	If the Side Sensor Display indicates that a target is detected →	Test complete.
		If the Side Sensor Display does not indicate a target is present →	Go to **Step C**.

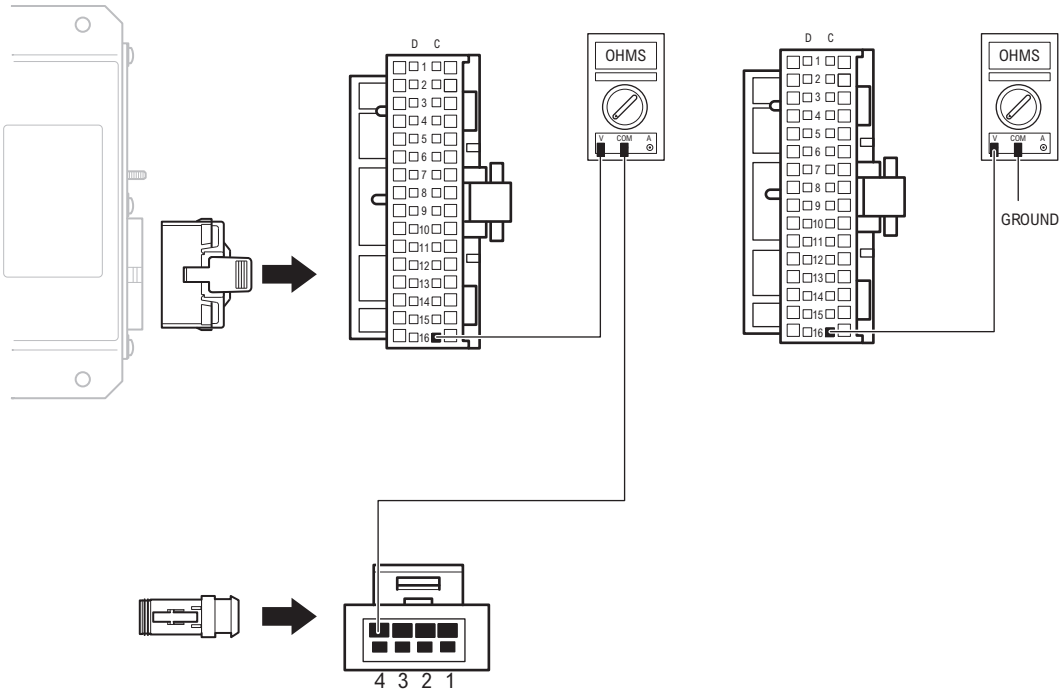
Side Sensor Not Detecting Targets, continued

Step C	Procedure	Condition	Action
	1. Key on. 2. Disconnect 4-way connector at the Side Sensor Display. 3. Key on. 4. Measure voltage between pins 2 and 3.	If voltage between pins 2 and 3 is 7.0 to 7.5 volts	Go to **Step D**.
		If voltage is outside of range	Go to **Step E**.



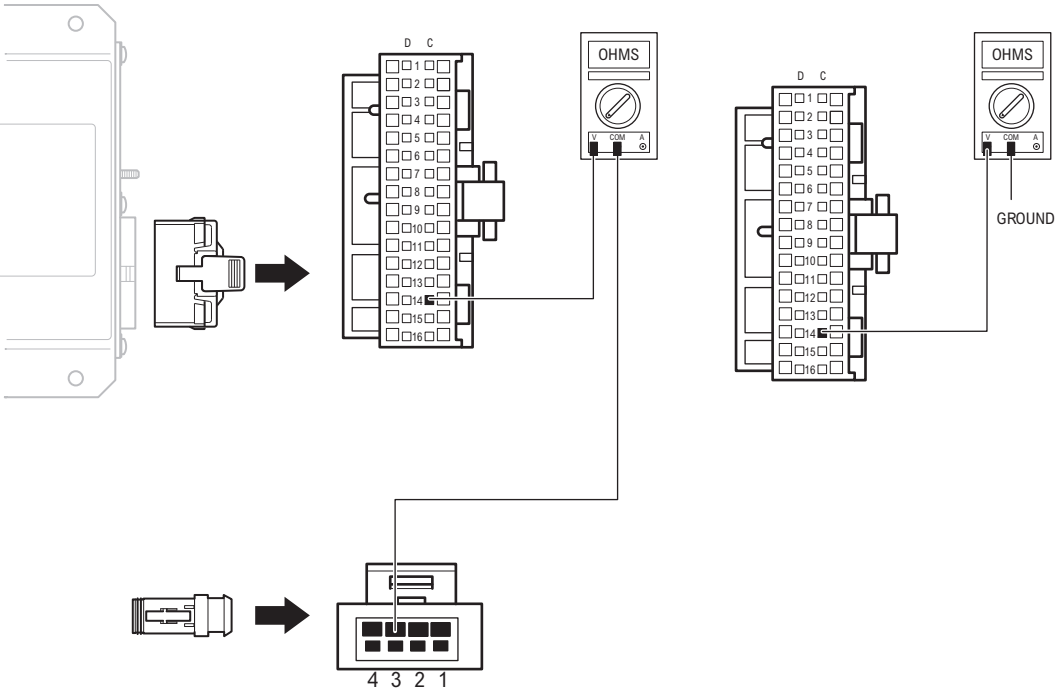
Side Sensor Not Detecting Targets, continued

Step D	Procedure	Condition	Action
	1. Key on. 2. Disconnect Central Processing Unit 32-way connector. 3. Measure resistance between: • 32-way pin C16 and 4-way pin 4. • 32-way pin C16 and ground.	If resistance between C16 and pin 4 is 0 to 0.3 ohms	Replace Side Sensor Display. Go to **Step V**.
		If resistance between C16 and ground is more than 10K ohms or open circuit [OL]	Go to **Step E**.
		If resistance is outside of range	Repair OEM harness between Side Sensor Display and Central Processing Unit. Go to **Step V**.



Side Sensor Not Detecting Targets, continued

Step E	Procedure	Condition	Action
	1. Key off. 2. Measure resistance between: • 32-way pin C14 and 4-way pin 3. • 32-way pin C14 and ground.	If resistance between C14 and pin 3 is 0 to 0.3 ohms	Go to **Step V**.
		If resistance between C14 and ground is more than 10K ohms or open circuit [OL]	Go to **Step F**.
		If resistance is outside of range	Repair OEM harness between Right Side Sensor Display and Central Processing Unit. Go to **Step V**.



Side Sensor Not Detecting Targets, continued

Step F	Procedure	Condition	Action

1. Key off.
2. Measure resistance between.
   - 32-way pin C12 and 4-way pin 2.
   - 32-way pin C12 and ground.

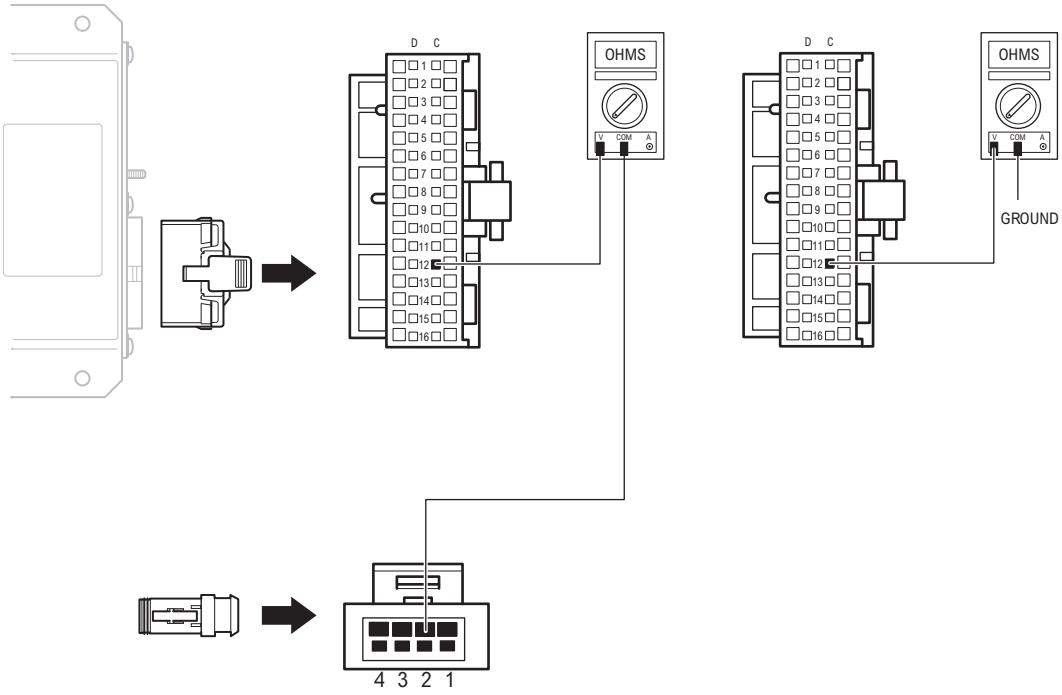
→ If resistance between C12 and pin 2 is 0 to 0.3 ohms and

→ If resistance between C12 and ground is more than 10K ohms or open circuit [OL]

→ Replace the **Central Processing Unit**. Go to **Step V**.

→ If resistance is outside of range

→ Repair OEM harness between Side Sensor Display and Central Processing Unit. Go to **Step V**.



Side Sensor Not Detecting Targets, continued

Step V	Procedure	Condition	Action
	1. Key off. 2. Reconnect all connectors. 3. Drive vehicle to determine if all complaints have been corrected.	If complaint has been repaired	Test complete.
		If complaint has not been repaired	Return to **Step A** to find error in testing.

Side Sensor Not Detecting Targets, continued

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Driver Card Not Reading

Overview

This symptom driven test is performed when the Bendix™ VORAD® system fails to detect the Driver Card in the Driver Display Unit.

Detection

The VORAD Central Processing Unit will detect the Driver Card when placed in the Driver Display Unit. The symptom is observed by the driver when no read tones are heard from the Driver Display Unit.

Fallback

There is no fallback mode for this symptom.

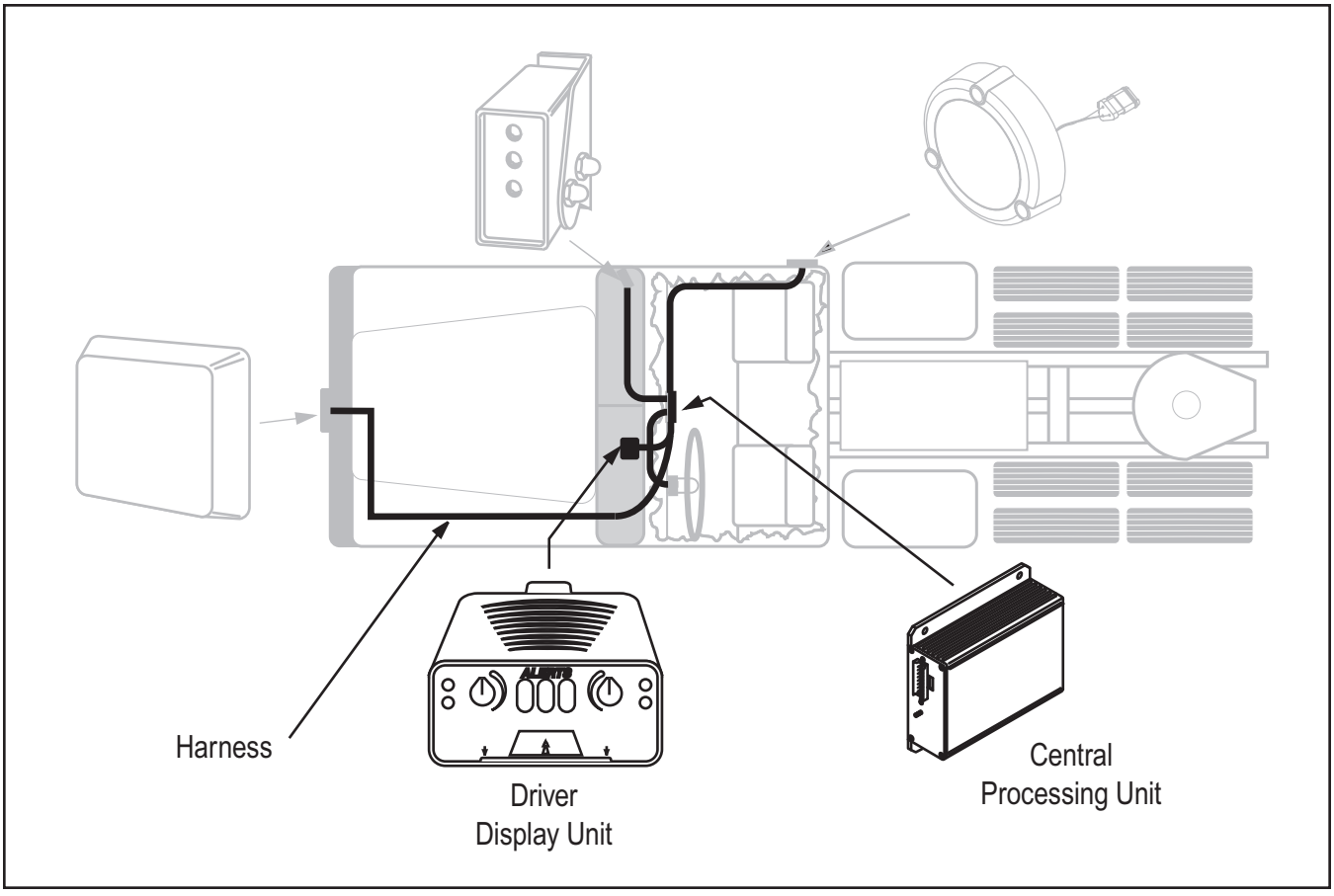
Required Tools

- New Driver Card

Possible Causes

This fault can be caused by any of the following:

- Driver Display Unit
- Faulty Card

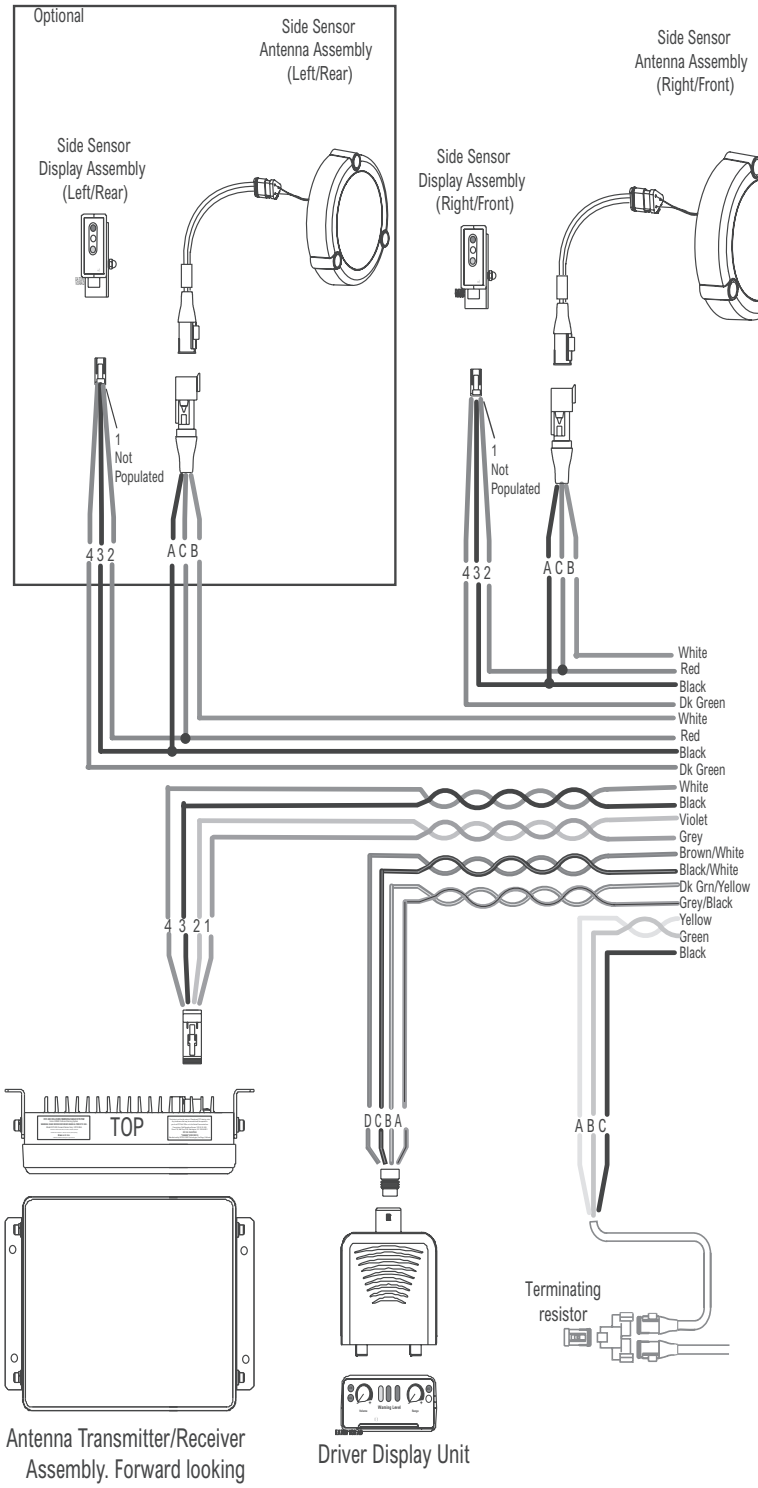


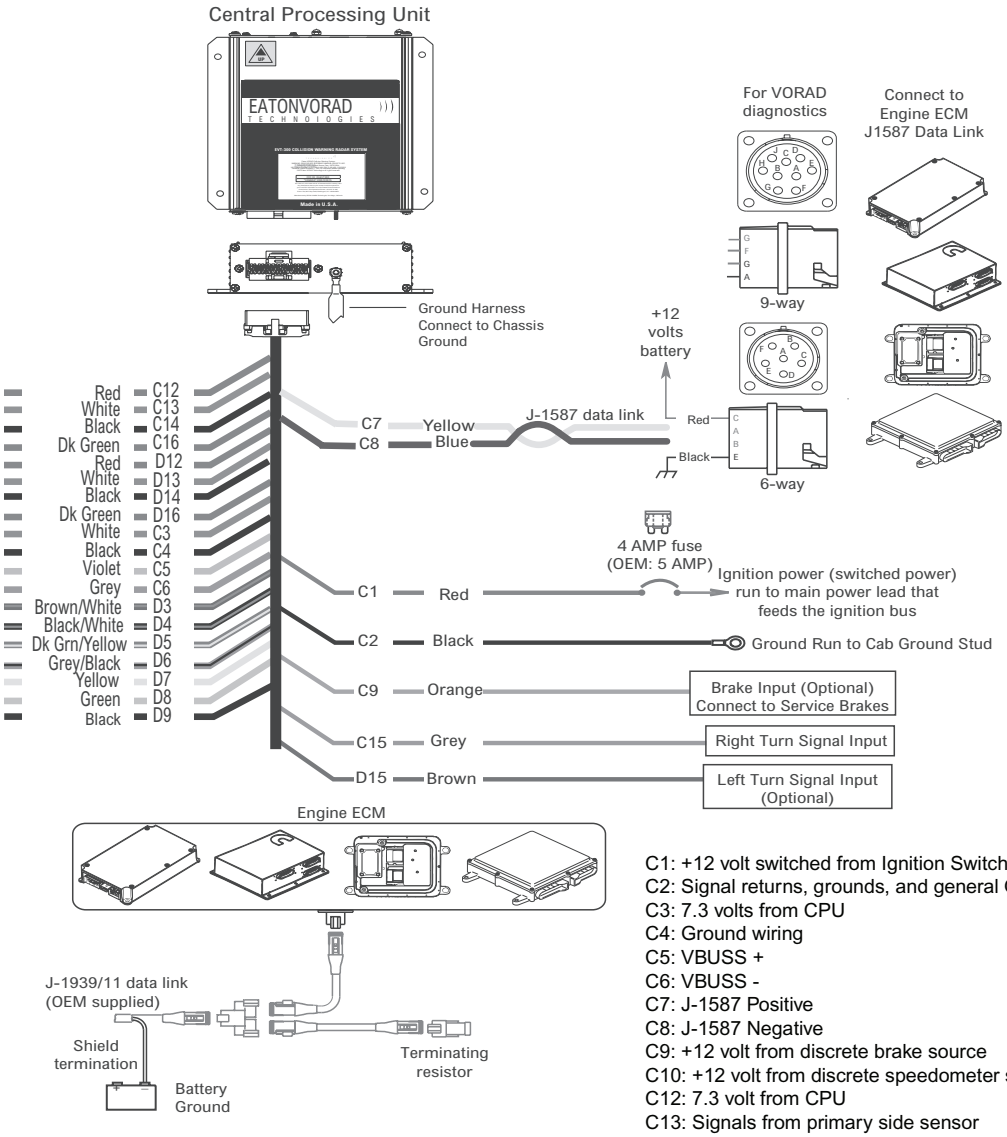
Driver Card Not Reading

Step A	Procedure	Condition	Action
	1. Insert Driver Card. 2. Was the card read by the Driver Display Unit? →	If the card was read by the Driver Display Unit →	Test complete.
		If the card was not read by the Driver Display Unit →	Go to **Step B**.

Step B	Procedure	Condition	Action
	1. Remove the existing card from the Driver Display Unit. 2. Obtain a new card and insert it into the Driver Display Unit. →	If the card was read by the Driver Display Unit →	Test complete.
		If the card was not read by the Driver Display Unit →	**Replace Driver Display Unit**.

Bendix™ VORAD® System Wiring Diagram





C1: +12 volt switched from Ignition Switch
C2: Signal returns, grounds, and general OEM wiring
C3: 7.3 volts from CPU
C4: Ground wiring
C5: VBUSS +
C6: VBUSS -
C7: J-1587 Positive
C8: J-1587 Negative
C9: +12 volt from discrete brake source
C10: +12 volt from discrete speedometer source
C12: 7.3 volt from CPU
C13: Signals from primary side sensor
C14: Ground, return
C15: +12 volt from R Turn source
C16: Primary SSD Communication from CPU
D3: 7.3 volts to front antenna
D4: Front antenna ground, return
D5: VBUSS +
D6: VBUSS -
D7: J-1939 Positive
D8: J-1939 Negative
D9: J-1939 Shield
D12: 7.3 volts from CPU
D13: Signal from secondary side sensor
D14: Ground, return
D15: +12 volt from L turn source
D16: Optional secondary SSD Communication from CPU

Update: 5/28/02

104 - 108,109,010,011 SW				012+ SW						
F/C	S /C	SID	FMI	F/C	S ID	FMI	Description	S/C Lght	Comp vs System	Notes
11	1	254	12	11, 12	254	12	CPU	Off	Comp	NVRAM
11	2	254	4			4		Off	Comp	NVRAM BATTERY
11	3	254	12			12		Off	Comp	EEPROM
11	11	254	12			12		Off	Comp	Real-Time Clock
11	12	254	12			12		Off	Comp	Gyro Turn Sensor
12	4	254	12			12		Off	Comp	Cybercard
13	25	9	2	13, 34	9	2	DDU	??	Comp	Driver Display Unit Reset Message
13	28	9	5			5		??	Comp	Driver Display Unit Volume
13	29	9	5			5		??	Comp	Driver Display Unit Range
13	30	9	5			5		??	Comp	Driver Display Unit Speaker
13	31	9	4			4		??	Comp	Driver Display Unit Speaker Driver
34	23	9	12			12		??	Comp	Driver Display Unit Power-on Message
34	24	9	2			2		??	Comp	Driver Display Unit ID Response Message
34	27	9	2			2		??	Comp	Driver Display Unit VBUS/IDI Communication Time-out
34	26	9	2			2		??	Comp	Driver Display Unit VBUS Time-out
14	34	2	2	14, 35	2	2	F/A	Off	Comp	Antenna Reset Message
14	36	2	12			12		Off	Comp	Antenna ADC Interrupt
14	38	2	12			12		Off	Comp	Antenna Transceiver Noise
14	39	1	12			12		Off	Comp	Antenna Transceiver Modulation
14	40	1	12			12		Off	Comp	Antenna Frequency Injection
14	41	2	12			12		Off	Comp	Antenna SRAM Program
14	42	2	12			12		Off	Comp	Antenna Azimuth Data
14	43	2	12			12		Off	Comp	Antenna Frequency Data
14	44	2	14			14		Off	Comp	CPU/Antenna Software Compatibility
35	32	2	12			12		Off	Comp	Antenna Power-on Message
35	33	2	2			2		Off	Comp	Antenna ID Response Message
35	35	2	2			2		Off	Comp	Antenna VBUS Time-out
15	8	10	2	15	10	2	Right SS	N/C	Comp	Right Side Sensor
16	10	11	2	16	11	2	Left SS	N/C	Comp	Left Side Sensor
21	7	7	2	21	7	2	Right TS	N/C	Comp	Right Turn Signal
22	9	8	2	22	8	2	Left TS	N/C	Comp	Left Turn Signal
23	5	3	2	23	3	2	Brake Input	Off	Comp	Brake Input
24	6	6	2	24	6	2	Speed Input	Off	Comp	Speed Input
25	19	231	14	25, 32	231	14	J-1939	Off	System	J-1939 ERC1 Message Received*
25	20	231	2			2		Off	System	J-1939 EEC1 Message Received*
--	45	--	--			14		--	--	SmartCruise/Engine Compatibility*
--	0	--	--			12		--	--	Cruise Input *
32	17	231	12			12		Off	System	J-1939 Hardware*
32	18	231	12			12		Off	System	J-1939 Address Claim*
31	15	250	2	31	250	2	J-1587	Off	System	J-1587 Receive*
31	16	250	2			2		Off	System	J-1587 Transmit*
33	14	248	12	33	248	12	VBUS	Off	Comp	VBUS Transmit
33	13	248	12			12		Off	Comp	VBUS Receive
--	22	--	--				J-1939	--	--	J-1939 CCVS Message Received
--	46	--	--				J-1587	--	--	J-1587 Queues
--	47	--	--				VBUS	--	--	VBUS Queues

* In these cases, the Freightliner dash will illuminate the fault light .

N/C = No Change