Troubleshooting Guide

Collision Warning System
SmartCruise®
Side Object Detection

VOTS0100
July 2010
Warnings

Limitations of Collision Warning Systems

The Eaton® VORAD® VS-400 system is intended solely as an aid for an alert and conscientious professional driver. It is not to be used or relied upon to operate a vehicle. The system should be used in conjunction with rear view mirrors and other instrumentation to maintain safe operation. A vehicle equipped with this system should be operated in the same safe manner as if it were not installed. The system is not a substitute for normal safe driving procedures. It will not compensate for any driver impairment such as drugs, alcohol, or fatigue.

The Eaton® VORAD® VS-400 system may provide little or no warning for some hazards, such as pedestrians, animals, oncoming vehicles, and cross-traffic.
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Recommended Tools

Service PC w\ ServiceRanger Diagnostics Software
  • ServiceRanger Version 3.0 or Later (J1939 compatible)

PC to Vehicle J1939 Link Adapter
  • Nexiq P/N 125032 or Equivalent (J1939 compatible)

Digital Volt\Ohm Meter
  • SPX\Kent-Moore P/N 5505027 or Equivalent

Test Lead Adapter Kit
  • SPX\Kent-Moore P/N J-43318

Digital Level\Protractor
  • Eaton P/N VV-KIT-03 or Equivalent

Straight Edge Rule
  • 4 to 6 Feet in Length

Other Product Literature (available at www.roadranger.com)
  • VOIG0100 - VS-400 Installation Guide
  • VODR0100 - VS-400 Driver Manual
  • VOIG0032 - Side Object Detection Installation\Users Guide
  • Service Bulletins
Before You Begin

The VORAD® VS-400 system is comprised of a Forward Looking Radar (FLR) unit and Driver Interface Unit (DIU) that utilizes the vehicle’s J1939 data link to communicate with each other, as well as the vehicle’s engine and/or chassis (cab) controller. It is recommended that the servicing technician be properly trained and familiar with the vehicle’s electrical system, J1939 data link, and electronic components before attempting any of the troubleshooting procedures in this manual.

For information on training opportunities, along with up to date service bulletins and product literature, contact your local Roadranger or visit the Roadranger website at http://www.roadranger.com/Roadranger/trainingsupport

ServiceRanger and J1939 Diagnostics

ServiceRanger is a PC-based diagnostics software used to program, configure, and, diagnose all automated Roadranger products. ServiceRanger version 3.0 and later supports J1939 diagnostics, which is required for most Roadranger products manufactured during and after 2007, including the VORAD VS-400 system.

ServiceRanger requires the use of an RP1210A compliant communications adapter that connects between the vehicle’s J1939 diagnostic port and the PC. The adapter must support both J1587 and J1939 vehicle data link communications.

Contact Roadranger Technical Assistance at 1-800-826-4357 for more information on ServiceRanger, or visit the ServiceRanger website at http://www.roadranger.com/Roadranger/trainingsupport/ServiceRanger

Additional Warnings

Some of the tests in this manual require the technician to use a test meter to measure the voltage and resistance of the vehicle’s electrical circuits. If it becomes necessary to temporarily connect the test meter leads to wire harness terminals, it is recommended to use a test lead adapter kit (P/N J-43318) or equivalent.

- Never insert test lead probes, nails, or paper clips into the vehicle harness connector terminals, as this can distort or damage the wire terminals.
- Never pierce wire insulation to test circuits, as this can result in damaged wires and wire corrosion.
- When making resistance checks on circuits, make sure the vehicle ignition is off to prevent damage to test equipment and vehicle components.
Definitions

Forward Looking Radar (FLR)

The VS-400 Forward Looking Radar is a high frequency Doppler radar unit located on the front of the vehicle that transmits a focused beam of radio frequency (RF) energy ahead of the vehicle. Energy reflected off objects is reflected back to the FLR and processed by the unit’s internal Headway Controller to determine the speed, distance, direction, and lane position of all detected objects.

Collision Warning System (CWS)

The headway controller within the FLR processes information about all objects detected by the radar and sends alert messages to the Driver Display Unit (DIU) located in the dash via the vehicle’s J1939 data link. The DIU uses a combination of visual and audible alerts to warn the driver of approaching hazards, or if following distances are too close for the current speed of the vehicle.

SmartCruise® (SC)

SmartCruise is a feature of the VS-400’s Forward Looking Radar that controls the Adaptive Cruise Control function of the engine. When enabled, SmartCruise will override the engine’s set cruise speed in order to maintain a safe following distance when approaching slower moving traffic. The vehicle’s engine must support and be enabled for adaptive cruise control in order for the VORAD® SmartCruise function to operate. Contact your vehicle OEM for information on the engine’s adaptive cruise control function.

Side Object Detection (SOD)

The VORAD Side Object Detection (SOD) is a stand-alone system that utilizes a close proximity pulse radar sensor to detect the presence of a vehicle in a lane adjacent to the host vehicle. The SOD includes its own Driver Display Unit (DDU) to report object detection and fault information to the driver. The system may be installed separately, or as an option for the VS-400 system.

J1939 (CAN) Data Link

The J1939 data link is an SAE defined high-speed Controller Area Network (CAN) used to provide a means of communication between compliant electronic devices on the vehicle. The data link consists of a twisted pair of wires running within the vehicle’s electrical harness that connects all J1939 compatible devices together in a chain.

Each end of the data link chain is terminated with a 120-ohm resistor to reduce electrical noise, or interference. The two terminating resistors also provide an easy means to test the integrity of the link by producing a combined 60-ohm link resistance that can be measured at any connection point on the link with a digital ohmmeter. Contact the vehicle OEM for information on the J1939 data link wiring and terminations.
VS-400 Pre-Test Procedures

Power-Up Pre-Test

Overview

This section shows the start up and system status display of the VS-400 system’s Driver Interface Unit.

Note: Refer to the Side Object Detection section for information on the operation and testing of the Side Object Detection system.

Power-up

With the vehicle’s ignition turned to the ON position (Engine OFF), observe the power-up sequence of the VS-400 Driver Interface Unit (DIU).

If the DIU fails to power up, proceed to the Electrical Pretest procedure to check for power to the VS-400 system components.

VS-400 DIU Lamp Test at initial power-up

System Status

After about 30 seconds from when the ignition was powered on, the DIU should display the VORAD Status screen. This screen will display which functions are enabled and if that function’s operation is OK or Failed.

If a function has failed, the orange Diagnostic Trouble Code (DTC) lamp will be illuminated indicating an Active code has been set. Proceed to the Retrieving Fault Codes section.

VORAD Status screen showing both Collision Warning System and SmartCruise® enabled but failed
Retrieving Fault Codes

Overview

This section determines if the Driver Interface Unit (DIU) and the Forward Looking Radar (FLR) are both communicating on the vehicle's J1939 data link and if either component has set any fault codes. In order for the system to operate properly, the DIU and the FLR must be able to communicate with each other, as well as other ECU’s on the vehicle’s J1939 data link.

Note: This procedure requires ServiceRanger 3.0 or later and an approved RP1210A communications adapter that supports J1939 communications.

Detecting Components

Connect the service PC to the vehicle’s 9-pin J1939 diagnostic port connector with an approved RP1210A communications adapter. Start the ServiceRanger program and verify that a connection has been established with the vehicle’s J1939 data link.

View the Vehicle Components screen in ServiceRanger and verify that the VS-400 Forward Looking Radar (source address 42) and the Driver Interface Unit (source address 140) are being detected.

<table>
<thead>
<tr>
<th>Data Link</th>
<th>Source Address</th>
<th>ECU Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1939</td>
<td>42</td>
<td>Forward Looking Radar</td>
</tr>
<tr>
<td>J1939</td>
<td>140</td>
<td>Driver Interface Unit</td>
</tr>
</tbody>
</table>

- If the DIU or the FLR are not being detected by ServiceRanger, proceed to the Electrical Pretest procedure to check for power to the VS-400 system components and that all components are properly connected the vehicle’s J1939 data link.

Viewing Fault Codes

View the Vehicle Fault Codes screen in ServiceRanger and verify if the Forward Looking Radar or the Driver Interface Unit have set any Active or Inactive codes.

- If an Active VS-400 code is present, record the vehicle fault information and proceed to Diagnostic Procedure in this manual for the Active code for more information. Do not clear any codes at this time.
- If only Inactive (historic) VS-400 codes are present, record the vehicle fault information and clear all historic fault codes. Road test the vehicle to verify proper operation of the VS-400 system.

Clearing Fault Codes

After all repairs have been made and the system is functioning normally, clear all vehicle codes before placing the vehicle back into service. To clear codes, connect the service PC to the vehicle and start ServiceRanger. View the Vehicle Fault Codes screen and select Clear All. Refresh the screen to verify all historic codes have been cleared and that no Active codes are present.
**Electrical Pre-Test**

**Overview**

This test will verify that all electrical connections to the VS-400 Forward Looking Radar (FLR) and the Driver Interface Unit (DIU) are correct for proper operation. This test should be performed before beginning any of the fault isolation procedures.

**Note:** Refer to the Side Object Detection section for information on the testing the Side Object Detection electrical connections.

![Diagram](image.png)

- Never insert test lead probes, nails, or paper clips into the vehicle harness connector terminals, as this can distort or damage the wire terminals.
- Never pierce wire insulation to test circuits, as this can result in damaged wires and wire corrosion.
- When making resistance checks on circuits, make sure the vehicle ignition is off to prevent damage to test equipment and vehicle components.

**Required Tools**

1. Digital Volt / Ohm Meter

![Diagram](image.png)
<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| A    | 1. Vehicle Ignition: Key-ON, Engine-OFF  
2. Measure and record the vehicle battery voltage at the battery terminals.  
   a. If the battery voltage measures within 2 volts of the battery-rated voltage.  
      (10 - 12 volts for a 12-volt battery)  
      i. Proceed to Step B  
   b. If the battery voltage measures less than 2 volts of the battery-rated voltage.  
      (less than 10 volts for a 12 volt battery)  
      i. Test Failed. Check batteries and charging system for proper operation, repair as required. Repeat Step. |
<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| B    | 1. Vehicle Ignition: Key-OFF, Engine-OFF  
      2. Disconnect the 8-way connector from the back of the VS-400 Driver Interface Unit (DIU).  
      3. Measure for zero voltage on pins 4 and 5 on the harness connector.  
        a. If the voltage is 0.5 volts or less.  
           i. Proceed to Step C.  
        b. If the voltage is greater than 0.5 volts, but less than battery voltage.  
           i. Test Failed. Check DIU power supply wiring for sources of stray voltage or shorts to voltage.  
        c. If the voltage is within 0.6 volts of the battery voltage measured in Step A.  
           i. Test Failed. The DIU is improperly wired to battery power. Correct the wiring by connecting the FLR to ignition power and repeat Step. |
### Pretest Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| C    | 1. Vehicle Ignition: Key-ON, Engine-OFF  
2. Measure for ignition voltage on pins 4 and 5 on the harness connector.  
   a. If the voltage is within 0.6 volts of the battery voltage measured in Step A.  
      i. Proceed to Step D.  
   b. If the voltage is less than 0.6 volts of the battery voltage measured in Step A or open.  
      i. Test Failed. Check component fuse. Troubleshoot power supply to the DIU for open/corroded connections or shorts to ground and repeat Step. |

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-4</td>
<td>V-Ignition</td>
</tr>
<tr>
<td>J1-5</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>
Pretest Procedures

Step | Procedure
--- | ---
D  | 1. Vehicle Ignition: Key-ON, Engine-OFF
   | 2. Measure for J1939 data voltage on pins 7 and 5 of the DIU harness connector.
      | (J1939 High to Ground)
      | a. If the voltage is fluctuating between 2 to 5 volts.
      | i. Proceed to Step E.
      | b. If the voltage is constant 0 volts.
      | i. Test Failed. Check for open/loose connections in the vehicle’s J1939 data link harness.
      | (See Note)

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information on the J1939 data link harness.

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-5</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>J1-7</td>
<td>J1939+</td>
</tr>
</tbody>
</table>

Driver Interface Unit

**Pin #**

**Description**

---

**DIU**

**8-pin Connector**

**Chassis Ground**

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information on the J1939 data link harness.
## Pretest Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| E    | 1. Vehicle Ignition: Key-ON, Engine-OFF.  
2. Measure for J1939 data voltage on pins 6 and 5 of the DIU harness connector. (J1939 Low to Ground)  
   a. If the voltage is fluctuating between 0 to 3 volts.  
      i. Proceed to Step F.  
   b. If the voltage is a constant 0 volts.  
      i. Test Failed. Check for open / loose connections in the vehicle’s J1939 data link harness. (See Note) |

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information of the J1939 data link harness.

### Pin # | Description
--- | ---
J1-5 | Chassis Ground
J1-6 | J1939-
Pretest Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| **F** | 1. Vehicle Ignition: Key-OFF  
2. Measure the J1939 data link resistance across pins 7 and 6 of the DIU harness connector. (J1939 High to J1939 Low)  
a. If the resistance is between 57 and 63 ohms.  
i. Proceed to Step G.  
b. If the resistance is greater than 63 ohms or open (Infinite Resistance.)  
i. Test Failed. Check for missing J1939 data link terminating resistor(s) or open / loose connections in the vehicle’s J1939 data link harness. (See Note)  
c. If the resistance is less than 57 ohms or near zero.  
i. Test Failed. Check for shorted connections in the vehicle’s J1939 data link harness.  
   Unplug all J1939 data link components from the data link to isolate a potential defective component. (See Note) |

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information of the J1939 data link harness.

---

**Pin # | Description**
---|---
J1-7 | J1939+  
J1-6 | J1939-
### Pretest Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| G    | 1. Vehicle Ignition: Key-OFF  
2. Measure the resistance across pins 7 and 5 (J1939 High to Ground.)  
3. Measure the resistance across pins 6 and 5 (J1939 Low to Ground.)  
   a. If both resistances are greater than 10K ohms or open (Infinite Resistance).  
      i. Proceed to Step H.  
   b. If either resistance is between 0 to 10K ohms.  
      i. Test Failed. Check for shorted connections in the vehicle’s J1939 data link harness.  
         Unplug all J1939 data link components from the data link to isolate a potential defective component. (See Note) |

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information of the J1939 data link harness.

---

**Driver Interface Unit**

**DIU (8-pin Connector)**

**J1939-**  
**J1939+**

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-5</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>J1-6</td>
<td>J1939-</td>
</tr>
<tr>
<td>J1-7</td>
<td>J1939+</td>
</tr>
</tbody>
</table>
## Pretest Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| H    | 1. Vehicle Ignition: Key-OFF, Engine-OFF.  
2. Disconnect the 10-way connector from the VS-400 Forward Looking Radar (FLR).  
3. Measure for zero voltage on pins 10 and 9 on the harness connector.  
   a. If the voltage is 0.5 volts or less.  
      i. Proceed to Step I.  
   b. If the voltage is greater than 0.5 volts but less than battery voltage.  
      i. Test Failed. Check FLR power supply wiring for sources of stray voltage or shorts to voltage.  
   c. If the voltage is within 0.6 volts of the vehicle battery voltage measured in Step A:  
      i. Test Failed. The FLR is improperly wired to battery power. Correct the wiring by connecting the FLR to ignition power and repeat Step. |

---

### Pin # Description

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-9</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>J1-10</td>
<td>V-Ignition</td>
</tr>
</tbody>
</table>

---

**Front View**

**FLR 10-pin Connector**

**J1**

**FLR**

**Ignition power (switched pov)**

**Chassis Ground**

---
<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| I    | 1. Vehicle Ignition: Key-ON, Engine-OFF.  
     2. Measure for ignition voltage on pins 10 and 9 on the harness connector.  
        a. If the voltage is within 0.6 volts of the battery voltage measured in Step A.  
           i. Proceed to Step J.  
        b. If the voltage is less than 0.6 volts of the battery voltage measured in Step A or open.  
           i. Test Failed. Check component fuse. Troubleshoot power supply to the FLR for open/  
              corroded connections or shorts to ground and repeat Step. |

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-9</td>
<td>Chassis Ground</td>
</tr>
<tr>
<td>J1-10</td>
<td>V-Ignition</td>
</tr>
</tbody>
</table>
**Pretest Procedures**

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| J    | 1. Vehicle Ignition: Key-ON, Engine-OFF.  
     2. Measure for J1939 data voltage on pins 4 and 9 of the FLR harness connector.  
       (J1939 High to Ground)  
       a. If the voltage is fluctuating between 2 to 5 volts.  
          i. Proceed to Step K.  
       b. If the voltage is constant 0 volts.  
          i. Test Failed. Check for open / loose connections in the vehicle’s J1939 data link harness.  
          (See Note) |

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information on the J1939 data link harness.
**Pretest Procedures**

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| K    | 1. Vehicle Ignition: Key-ON, Engine-OFF.  
      2. Measure for J1939 data voltage on pins 5 and 9 of the FLR harness connector. (J1939 Low to Ground)  
          a. If the voltage is fluctuating between 0 to 3 volts.  
             i. Proceed to Step L.  
          b. If the voltage is a constant 0 volts.  
             i. Test Failed. Check for open / loose connections in the vehicle's J1939 data link harness. (See Note) |

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information of the J1939 data link harness.

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-5</td>
<td>J1939-</td>
</tr>
<tr>
<td>J1-9</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>

**Diagram:**
- VOLTS
- FRONT VIEW FLR 10-pin Connector
- Forward Looking Radar
- FLR 10-pin Connector
- Chassis Ground
- Ignition power (switched power)
### Pretest Procedures

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| L    | 1. Vehicle Ignition: Key-OFF  
2. Measure the J1939 data link resistance across pins 4 and 5 of the FLR harness connector. (J1939 High to J1939 Low)  
   a. If the resistance is between 57 and 63 ohms.  
      i. Proceed to Step M.  
   b. If the resistance is greater than 63 ohms or open (Infinite Resistance.)  
      i. Test Failed. Check for missing J1939 data link terminating resistor(s) or open / loose connections in the vehicle’s J1939 data link harness. (See Note)  
   c. If the resistance is less than 57 ohms or near zero.  
      i. Test Failed. Check for shorted connections in the vehicle’s J1939 data link harness. Unplug all J1939 data link components from the data link to isolate a potential defective component. (See Note) |

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information of the J1939 data link harness.

---

#### Pin 10-pin Connector

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-4</td>
<td>J1939+</td>
</tr>
<tr>
<td>J1-5</td>
<td>J1939-</td>
</tr>
</tbody>
</table>

---

Forward Looking Radar

- **FLR 10-pin Connector**
- **J1939+**
- **J1939-**
- **Ignition power (switched power)**

---

**OHMS**

- **V COM A**
- **FLR 10-pin Connector**
- **J1**

---

**Chassis Ground**
### Pretest Procedures

**Step** | **Procedure**
--- | ---
M | 1. Vehicle Ignition: Key-OFF  
2. Measure the resistance across pins 4 and 9 (J1939 High to Ground).  
3. Measure the resistance across pins 5 and 9 (J1939 Low to Ground).  
   a. If the resistance is greater than 10K ohms or open (Infinite Resistance.)  
      i. Test Complete.  
   b. If the resistance is between 0 to 10K ohms.  
      i. Test Failed. Check for shorted connections in the vehicle’s J1939 data link harness.  
         Unplug all J1939 data link components from the data link to isolate a potential  
         defective component. (See Note)

**Note:** Refer to vehicle OEM repair manual or contact the OEM for more information of the J1939 data link harness.

---

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
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<tbody>
<tr>
<td>J1-4</td>
<td>J1939+</td>
</tr>
<tr>
<td>J1-5</td>
<td>J1939-</td>
</tr>
<tr>
<td>J1-9</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>

---

*Diagram showing connections and components relevant to J1939 data link harness.*
Component Code: 13  
(SA 140, SPN 893, FMI 12)  
DIU Component Fault

Overview

This code indicates that the Driver Interface Unit (DIU) has detected an internal failure.

Fault Detection

At power up and during operation, the DIU performs a self-test to verify the operation of its internal components. If the device detects an internal failure, this fault code is set.

Symptom

The VS-400 Collision Warning and SmartCruise® will fail to operate and the orange DTC light on the Driver Interface Unit will be illuminated. If SmartCruise is enabled the vehicle’s cruise control may not operate while this fault code is active.

Possible Causes

Component failure

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 13, FMI 12   | 1. Replace Driver Interface Unit (DIU)  
|                   | 2. Verify fault code has cleared.  
|                   | 3. Test Complete. |
Component Code: 14  
(SA 42, SPN 886, FMI 12)  
FLR Component Fault

Overview

This code indicates that the Forward Looking Radar (FLR) has detected an internal failure.

Fault Detection

At power up and during operation, the FLR performs a self-test to verify the operation of its internal components. If the device detects an internal failure, the fault code is set.

Symptom

The VS-400 Collision Warning and SmartCruise® will fail to operate and the orange DTC light on the Driver Interface Unit will be illuminated. If SmartCruise is enabled the vehicle’s cruise control may not operate while this fault code is active.

Possible Causes

- FLR Software
- Component failure

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 14, FMI 12   | 1. Using ServiceRanger version 3, check the “Primary” FLR software level.  
a. If the software is not current, clear the fault codes and update to the latest level.  
   i. When completed, turn the key off - powering down the system for 2 minutes.  
   ii. Key on. If fault code has cleared, test complete.  
   iii. If the fault returns, proceed to Step 2.  
b. If the software is level 13 or higher, proceed to Step 3.  
2. Replace Foward Looking Radar (FLR.)  
3. Verify fault code has cleared.  
4. Test Complete. |
Component Code: 25  
(SA 42, SPN 898, FMI 13, 14)

SmartCruise® Configuration Error

Overview

This code indicates that the VS-400 Forward Looking Radar (FLR) has detected a SmartCruise configuration or compatibility issue with the engine.

Fault Detection

At power up the FLR attempts to verify if the engine controller is SmartCruise compatible and has its Adaptive Cruise Control (ACC) setting(s) enabled. If the FLR determines that one of these conditions is false, the fault code is set.

- Code 25, FMI 13 - Engine is not configured for SmartCruise (Adaptive Cruise Control).
- Code 25, FMI 14 - Engine ID is not recognized as SmartCruise compatible.

Symptom

When this code is active, the VS-400 Collision Warning will continue to operate, but SmartCruise will not. The DIU will indicate SmartCruise is not operational and the orange DTC light will be illuminated.

Possible Causes

- FMI 13 - The engine controller setting for Adaptive Cruise Control is not enabled.
- FMI 14 - The engine does not support the Adaptive Cruise Control function or is not compatible with the VS-400 system.

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 25, FMI 13   | 1. Check engine configuration to see if Adaptive Cruise Control is enabled.  
                   2. Contact Engine OEM for more information. |
| Code 25, FMI 14   | 1. Using ServiceRanger version 3, check the “Primary” FLR software level.  
                   a. If the software level is not current, update to the latest level.  
                   i. When completed, turn the key off - powering down the system for 2 minutes.  
                   ii. Key on. If fault codes has cleared, test complete.  
                   iii. If the fault returns, proceed to Step 2.  
                   2. Contact Eaton for more information. |
Component Code: 32  
(SA 140, SPN 639, FMI 2) 
DIU J1939 Message Error

Overview

This code indicates that the Driver Interface Unit (DIU) has detected gaps or missing messages from the Forward Looking Radar (FLR) on the J1939 data link.

Fault Detection

At power up and during operation, the DIU and FLR continuously communicate with each other on the J1939 data link. If the DIU detects gaps occurring in the messages from the FLR or the FLR stops communicating, the fault code is set.

Symptom

The VS-400 Collision Warning and SmartCruise® will fail to operate and the orange DTC light on the Driver Interface Unit will be illuminated. If SmartCruise is enabled the vehicle's cruise control may not operate while this fault code is active.

Possible Causes

- Loose, corroded, or open J1939 data link connections
- Missing J1939 data link terminating resistor(s)
- Loss of power supply to the FLR
- Faulty FLR

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 32, FMI 2    | 1. Perform the “Component Power Supply Test” in the Appendix.  
                           2. Check the vehicle’s J1939 data link for poor connections or missing terminating resistors.  
                           3. Verify that all ECU’s on the data link are functional and not interfering with data link communications. **Note:** Isolate any suspect faulty ECU’s by disconnecting them from the data link.  
                           4. Perform Electrical Pretest to check data link and harness connections and harness to the VS-400 components.  
                           5. If the fault code remains active with no fault found, replace the FLR and check operation.  
                           6. Test Complete. |
Component Code: 33  
(SA 42, SPN 639, FMI 2)  
FLR J1939 Message Error

Overview

This code indicates that the Forward Looking Radar (FLR) has detected gaps or missing messages from the Driver Interface Unit (DIU) or other devices on the J1939 data link.

Fault Detection

At power up and during operation, the FLR, DIU, and other devices continuously communicate with each other on the J1939 data link. If the FLR detects gaps occurring in the messages from one of the devices or one of the devices stops communicating, the fault code is set.

Symptom

The VS-400 Collision Warning and SmartCruise® will fail to operate and the orange DTC light on the Driver Interface Unit will be illuminated. If SmartCruise is enabled the vehicle’s cruise control may not operate while this fault code is active.

Possible Causes

- Loose, corroded, or open J1939 data link connections
- Missing J1939 data link terminating resistor(s)
- Faulty device on the J1939 data link causing other ECU’s to fail communications.
- Loss of power supply to the DIU
- Fault DIU

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 33, FMI 2    | 1. Perform the “Component Power Supply Test” in the Appendix.  
2. Check the vehicle’s J1939 data link for poor connections or missing terminating resistors.  
3. Verify that all ECU’s on the data link are functional and not interfering with data link communications. Note: Isolate any suspect faulty ECU’s by disconnecting them from the data link.  
4. Perform Electrical Pretest to check data link and harness connections and harness to the VS-400 components.  
5. If the fault code remains active with no fault found, replace the DIU and check operation.  
6. Test Complete. |

Fault Isolation Procedures

Component Code: 35, 36
(SA 42, SPN 639, FMI 9)
J1939 Data Link Fault

Overview

This code indicates that the VS-400 Forward Looking Radar (FLR) or the Driver Interface Unit (DIU) has detected that there is a J1939 data link fault condition.

Fault Detection

At power up and throughout operation, the FLR, DIU, and other devices continuously communicate with each other on the J1939 data link. If there is a J1939 fault condition, such as a corrupted message, incorrect message formatting, or the complete loss of all J1939 data, the fault code is set.

- Code 35, FMI 9 - The DIU has detected a J1939 fault condition.
- Code 36, FMI 9 - The FLR has detected a J1939 fault condition.

Symptom

The VS-400 Collision Warning and SmartCruise® will fail to operate and the orange DTC light on the Driver Interface Unit will be illuminated. If SmartCruise is enabled the vehicle's cruise control may not operate while this fault code is active.

Possible Causes

- Loose, corroded, or open J1939 data link connections
- Faulty device on the J1939 data link causing other ECU's to fail communications.

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code 36, FMI 9</td>
<td>2. Check the vehicle's J1939 data link for poor connections, opens or short circuits.</td>
</tr>
<tr>
<td></td>
<td>3. Verify that all ECU's on the data link are functional and broadcasting data per the manufacturer’s specifications. Note: Isolate any suspect faulty ECU's by disconnecting them from the data link.</td>
</tr>
<tr>
<td></td>
<td>4. Perform Electrical Pretest to check data link connections to the VS-400 components.</td>
</tr>
<tr>
<td></td>
<td>5. Test Complete.</td>
</tr>
</tbody>
</table>
Component Code: 39  
(SA 42, SPN 158, FMI 3, 4)  
FLR Supply Voltage Out of Range

Overview

This code indicates that the Forward Looking Radar (FLR) has determined that the supply voltage is, or was, out of range.

Fault Detection

At power up and during operation, the FLR monitors supply voltage. If the supply voltage fails outside the normal operating range (+9 to 16Vdc) the fault code will set and the FLR will power down to prevent damage. In some cases the FLR may power down before the fault is set. This fault may also trigger Driver Interface faults 32 and 35 for loss of J1939 messages. In this case correcting this condition should clear the other faults.

Symptom

The VS-400 Collision Warning and SmartCruise® will fail to operate and the orange DTC light on the Driver Interface Unit will be illuminated. If SmartCruise is enabled the vehicle's cruise control may not operate while this fault code is active.

Possible Causes

- FMI 3 - Supply voltage to the FLR is too low.
- FMI 4 - Supply voltage to the FLR is too high.

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 39, FMI 3, 4 | 1. Repair supply voltage to FLR. The FLR voltage should be 12Vdc ignition power.  
|                   | 2. Verify fault condition has been cleared.  
|                   | 3. Test Complete. |
Fault Isolation Procedures

System Code: 41, 42
(SPN 1703, 1704, FMI 4, 5)
Driver Interface Unit External Speaker Fault

Overview

Most vehicles use the DIU as a source of audio alerts, however, the chassis manufacturer has the option to install an external chassis speaker system. For systems with external speaker systems, this code indicates that the VS-400 Driver Interface Unit (DIU) has detected that the external speaker circuit has an open circuit or short to ground.

Fault Detection

If the DIU is enabled for external speakers and the speaker circuit becomes open or shorted to ground this code is set active.

- Code 41, FMI 4 - RH Speaker circuit is shorted to ground
- Code 41, FMI 5 - RH Speaker circuit is open
- Code 42, FMI 4 - LH Speaker circuit is shorted to ground
- Code 42, FMI 5 - LH Speaker circuit is open

Symptom

When this code is active, the VS-400 system will not operate and the orange DTC fail light on the DIU will be illuminated. If SmartCruise® is enabled and the engine is enabled for adaptive cruise, the vehicle's cruise control may not operate.

Possible Causes

1. Loose, corroded, or open external speaker connections
2. Pinched wire or shorted external speaker
3. External Speaker configuration enabled without external speaker connected

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Steps to Perform</th>
</tr>
</thead>
</table>
| Code 41, FMI 4    | 1. Check for a short to ground by measuring the resistance between Pin-1 and Pin-5 of the DIU harness connector.  
|                   | a. If value is less than 2 ohms, test failed. Check external speaker and harness for short to ground. Repair as needed.  
|                   | b. If value is 2 to 5 ohms, continue to next step.  
|                   | 2. Replace DIU and verify fault condition has cleared.  
|                   | 3. Test Complete |
|                   | 2. Replace DIU and verify fault condition has cleared.  
|                   | 3. Test Complete |
Fault Isolation Procedures

**Code 41, FMI 5**

1. Check to see if Pin-1 of the DIU harness connector is populated.
   a. If no, test complete. The DIU does not utilize a RH external speaker.
      Disable the RH external speaker output using ServiceRanger.
   b. If yes, continue to next step.
2. Check for an open circuit in the external speaker by measuring the resistance between Pin-1 and Pin-5 of the DIU harness connector.
   a. If value is greater than 5 ohms, test failed. Check external speaker and harness for open. Repair as needed.
   b. If value is 2 to 5 ohms, continue to next step.
3. Replace DIU and verify fault condition has cleared.
4. Test Complete.

**Code 42, FMI 4**

1. Check for a short to ground by measuring the resistance between Pin-2 and Pin-5 of the DIU harness connector.
   a. If value is less than 3 ohms, test failed. Check external speaker and harness for short to ground. Repair as needed.
   b. If value is 2 to 5 ohms, continue to next step.
2. Replace DIU and verify fault condition has cleared.
3. Test Complete.

**Code 42, FMI 5**

1. Check to see if Pin-2 of the DIU harness connector is populated
   a. If no, test complete. The DIU does not utilize a LH external speaker.
      Disable the LH external speaker output using ServiceRanger.
   b. If yes, continue to next step.
2. Check for an open circuit in the external speaker by measuring the resistance between Pin-1 and Pin-5 of the DIU harness connector.
   a. If value is greater than 5 ohms, test failed. Check external speaker and harness for open. Repair as needed.
   b. If value is 2 to 5 ohms, continue to next step.
3. Replace DIU and verify fault condition has cleared.
4. Test Complete.

---

**Driver Interface Unit**

**DIU 8-pin Connector**

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-1</td>
<td>RH SPKR Out</td>
</tr>
<tr>
<td>J1-2</td>
<td>LH SPKR Out</td>
</tr>
<tr>
<td>J1-5</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>
Component Code: 91  
(SA 42, SPN 886, FMI 7)  
Forward Looking Radar Out of Alignment

Overview
This code indicates that the Forward Looking Radar (FLR) has determined that the radar is misaligned.

Fault Detection
When the vehicle is in motion, the FLR will calculate the vehicle’s center thrust axis and compare this to the radar’s physical horizontal alignment to determine if the radar is aligned properly. The radar software can compensate for a very slight misalignment (+/- 1°). When the FLR has determined that the position is off by more than what it can correct for, the fault code is set.

Symptom
The VS-400 Collision Warning and SmartCruise® will continue to operate, however, the radar’s ability to detect objects at an angle will be compromised. The Driver Interface unit (DIU) will display a message indicating the fault condition.

Possible Causes
- Loose or Misaligned Radar

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code 91, FMI 7</td>
<td>1. Perform the Forward Looking Radar Alignment procedure located in the Appendix.</td>
</tr>
<tr>
<td></td>
<td>2. Road test vehicle and make sure the fault condition has cleared.</td>
</tr>
<tr>
<td></td>
<td>3. Test Complete.</td>
</tr>
</tbody>
</table>
Component Code: 92  
(SA 42, SPN 886, FMI 14)
Forward Looking Radar Not Detecting Objects or Radar Blocked

Overview

This code indicates that the Forward Looking Radar (FLR) has not detected a target in an excessive amount of time or has become blocked.

Fault Detection

When the FLR has gone a period of time without receiving any reflected radar signals this fault is set. This may simply indicate that the vehicle has been in an extremely desolate area without any vehicles or objects to reflect its radar signals. Non-vehicular objects such as road signs, highway overpasses and background trees should provide enough radar signals to prevent this fault from being set. This fault may also indicate that the FLR has become blocked by mud, snow, ice, or other debris.

Symptom

The VS-400 Collision Warning and SmartCruise will fail to operate, however, the driver will have access to conventional cruise control. The Driver Interface Unit (DIU) will illuminate an orange DTC light and display a message indicating the fault condition. If the VS-400 system once again begins to detect objects the condition will clear and the system will resume normal operation.

Possible Causes

- Obstructed Radar View
- Correct Operation, but with a lengthy time since the last radar object was detected

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Action</th>
</tr>
</thead>
</table>
| Code 92, FMI 14         | 1. Check the Forward Looking Radar for debris buildup (snow, mud, etc.) or if the radar’s view is being obstructed.  
|                         |   **Note:** This fault is automatically set inactive after each power cycle.  
|                         | 2. Road test vehicle and make sure the fault condition has cleared.  
|                         | 3. Test Complete.                                                     |
Component Code: 95  
(SA 42, SPN 171, FMI 0, 1)  
Forward Looking Radar Ambient Temperature Out of Range

Overview

This code indicates that the Forward Looking Radar (FLR) has determined that the ambient temperature it is operating in is outside the component’s operating range.

Fault Detection

At power up and throughout operation, the FLR monitors the outside air temperature. When the temperature reaches the limits of the FLR’s functional ability to operate, this fault code will set.

Symptom

When this code is active, the VS-400 system will not operate and the orange DTC fail light will be illuminated. If SmartCruise is enabled and the engine is enabled for adaptive cruise, the vehicle’s cruise control may not operate.

Possible Causes

- FMI 0 - Ambient air temperature too low for FLR operation.
- FMI 1 - Ambient air temperature too high for FLR operation.

Repair Procedure

<table>
<thead>
<tr>
<th>Active Fault Code</th>
<th>Action</th>
</tr>
</thead>
</table>
| Code 92, FMI 0, 1 | 1. As long as the FLR temperature remains outside of the product specifications, this code will remain active. You may wish to bring the truck into a controlled temperature environment, such as a garage, for a period of time. Cycle the ignition and attempt to duplicate the fault.  
2. If the fault continues to be active in another temperature environment, contact Eaton for more information. |
Side Object Detection (SOD)

System Operation

Overview

This section covers the operation of the Side Object Detection System (SOD). The Side Object Detection system is a stand-alone system which can be installed as an all-on feature for the VS-400 Forward Looking system. It is powered independently from the forward looking system and utilizes its own Driver Display Unit which is typically located on the windshield pillar.

System Power up

When the vehicle’s ignition is turned to the ON position, the SOD display will power up by initially illuminating both the red and yellow lamps, indicating the system is performing its self test. Once the self test is complete and no objects are within a 15 foot radius of the sensor, the red lamp turns off while the yellow lamp remains illuminated, indicating the system is operational.
Normal Operation

When an object is detected within the sensor’s detection zone, the driver display illuminates the red detect lamp. During normal operation, the display will toggle between illuminating either the yellow or the red lamps, but never both at the same time (See SOD Failure Diagnostic Procedure).

Alert Tone

If the turn signal is active when an object is detected, the Driver Display Unit will sound an alert tone. An alert tone is heard only once each time the turn signal is activated. The sensor is wired to the turn signal on the same side of the vehicle in which the sensor is mounted (ie: RH Turn Signal causes a RH mounted SOD display to tone).
Fault Isolation Procedures
System Fault (Both Red and Yellow Lamps ON)

Overview
The Side Object Detection (SOD) Driver Display Unit illuminates both the red and yellow lamps to indicate a system fault.

Fault Detection
Whenever the SOD Driver Display looses communications with the side sensor, or if the sensor reports an internal failure, the display will illuminate both the red and yellow lamps.

Symptom
The Side Object Detection system will fail to detect objects in its detection zone.

Possible Causes
- Broken or shorted wire between the SOD display and the SOD sensor
- Faulty Side Sensor

Repair Procedure

<table>
<thead>
<tr>
<th>Condition</th>
<th>Action</th>
</tr>
</thead>
</table>
| Red and Yellow ON | 1. Disconnect the Driver Display and the Side Sensor from the interconnect harness.  
                          2. Test the resistance between Pin-3 of the Driver Display harness connector and chassis ground.  
                              a. If greater than 100K ohms, continue to next step.  
                              b. If less than 100K ohms, test failed. Repair harness.  
                          3. Test resistance between Pin-3 of the Driver Display harness connector and Pin-3 of the Side Sensor harness connector.  
                              a. If less then 0.9 ohms, continue to next step.  
                              b. If greater than 0.9 ohms, test failed. Repair harness.  
Forward Looking Radar Alignment

Proper alignment of the Forward Looking Radar (FLR) is critical to the correct operation of the VS-400 system. Improper alignment degrades the systems ability to detect objects in the vehicles path and will cause the system to fault.

Alignment

Alignment of the FLR involves both a physical alignment procedure and calibration. These procedures are used primarily when the FLR has been removed or replaced.

Note: If the FLR alignment becomes slightly off center along the horizontal axis during operation, the FLR will attempt to calibrate itself to find the true centerline of the vehicle. However if the FLR alignment is off of tru center by more than ±1°, the FLR will set a fault code 91 - Radar Out of Alignment. The FLR cannot compensate for vertical misalignment.

Physical Alignment

Tools Required:
- Digital level/protractor
- Straight edge
- Tape measure
- 5/32” Allen wrench

The vehicle must be parked on a level surface. If the vehicle is on a grade compensations for level must be made to ensure proper alignment.

Note: This physical alignment procedure is based on a typical VORAD standard mounting bracket. If a different type of bracket was used, contact the OEM or system installer for the proper alignment procedure.

Vertical Alignment

The steps for vertical alignment are as follows:

1. Hold a digital level against the flat surface of the mounting bracket.
2. Use a 5/32” Allen wrench to loosen the locking screws.
   Note: Failure to loosen both locking screws will result in damage to the alignment bracket.
3. Adjust the alignment screws until the digital level reads down 0° ± .2°.
4. Once aligned, tighten the locking screws.
**Horizontal Alignment**

The Forward Looking Radar must be facing straight ahead (azimuth) of the vehicle in order to optimally detect objects in the vehicle path.

1. Select two truck reference points that are identical and symmetrical about the truck centerline. Ensure the reference points are equally aligned. Items such as fenders and headlights should not be damaged or distorted; otherwise the alignment will be inaccurate.

2. Center a 4'-6' (1-2m) straight edge across a flat surface of the Forward Looking Radar bracket.

3. Measure the distance between the reference points and the face of the straight edge.

4. Use a 5/32” Allen wrench to loosen the locking screws.

   **Note:** Failure to loosen both locking screws will result in damage to the alignment bracket.

5. Adjust the alignment screw until the two measurement points are equal within +/- 0.1” (2.54mm).

6. Once the measurements are equal for both of the reference points, tighten the locking screws.

7. Check both the vertical and horizontal alignment:
   - Re-measure the reference points to ensure they are equal
   - Use the digital level to verify the vertical alignment is still face down 0° from vertical ± .2°.

**Note:** The illustration below shows a typical mounting and mounting bracket. The design may vary.
The Forward Looking Radar (FLR) calibration procedure is performed using the ServiceRanger 3 diagnostic software on a mobile computer in the cab while the vehicle is in motion. For this reason this procedure requires two people to perform. The driver should not attempt to perform the calibration procedure alone while driving the vehicle. Doing so may result in the loss of vehicle control and potential risk of an accident.

**Calibration Reset**

This procedure clears all previously stored alignment calibration values in the FLR.

- The reset procedure is performed with the engine idling and the vehicle stopped.
- From the ServiceRanger 3 main screen, select the “Advanced Product Functions” button.
- Select “VORAD VS-400 FLR” in the menu tree.

- Select and launch “VORAD VS-400 Alignment Test”.

![ServiceRanger 3.2.0](image)
• Read and acknowledge the “Caution” statement

The following function screen will appear:

• Review test description and select “Next” to continue.

**Note:** If the FLR physical alignment has already been performed and/or no adjustments were made to the mounting bracket during part replacement, use the “Next” button to precede past the Physical Alignment procedures to the Calibration Reset screen.
The reset procedure is performed with the engine idling and the vehicle stopped.

- Select “Reset Calibration”. The Driver Interface Unit will tone indicating the calibration was successful.

**Note:** Resetting the calibration values will also clear all previously stored fault codes.

- Select “Next” to continue.

**Azimuth Monitoring**

**WARNING**

This procedure requires two people to perform. The following steps in the calibration procedure require the vehicle to be in motion.
The vehicle must be traveling on a straight road at a speed above 30 mph.

Position the vehicle 200 - 300 feet behind a target vehicle traveling in the same lane. If the Vorad system is SmartCruise equipped place the vehicle in SmartCruise and use the range display on the Driver Interface Unit to approximate a 2-3 second following distance behind the target vehicle.

Click “Start” to begin monitoring the FLR azimuth value.

Continue to drive the vehicle for 2-5 minutes while monitoring the azimuth.

**Note:** Avoid minor steering adjustments while tracking the vehicle ahead as this may cause a +/- 0.3° drift. Objects detected in adjacent lanes may also cause the reading to fluctuate and should not be interpreted as being out of the acceptable range. The reading should be steady when tracking the target vehicle ahead only.

### Alignment Pass/Fail Criteria

- If the azimuth value remained between -0.5 and 0.5 degrees (green range) the radar is properly aligned and needs no further adjustment, test is complete.

- If the azimuth value remained between -0.5 and -0.9 degrees or +0.5 and +0.9 degrees (yellow range), the FLR will calibrate itself to find the true centerline of the vehicle. No further adjustment is necessary, test is complete.

**Note:** If you prefer to re-check the horizontal alignment, proceed to the Fine-Tuning Horizontal Alignment procedure in next section.

- If the FLR azimuth remained less than -1.0 or greater than 1.0 degree (red range) outside of the specification proceed to the Fine-Tuning Horizontal Alignment procedure in next section.
Select “Finish” when test is complete.
Fine-Tuning the Horizontal Alignment

If the alignment function in ServiceRanger continuously shows an azimuth value greater than 0.5° or less than -0.5°, then the FLR needs to be physically adjusted in the horizontal direction beyond that already completed.

**Center FLR Azimuth Position (FLR aligned correctly)**

If the alignment function consistently shows an azimuth value of 0° +/- 5° when tracking a vehicle in the same lane, then the FLR is properly centered. In this case, the FLR does not need to be further aligned and the procedure is complete.
Negative Azimuth Adjustment (FLR too far to the left)

If the alignment function shows a positive value, then the FLR is adjusted too far to the left, when looked at from the driver’s seat. The radar needs to be adjusted to the driver’s right. To accommodate this, adjust the horizontal alignment screw, by turning it in a clockwise direction, when viewed from the front of the vehicle. Each full rotation of the alignment screw adjusts for approximately 0.2° of azimuth position from the alignment function. For example, if the azimuth position was 0.5°, then the alignment screw should be adjusted 2 ½ turns clockwise.

After adjustment of the FLR, perform the calibration procedure again to verify proper alignment.
Positive Azimuth Adjustment (FLR too far to the Right)

If the alignment function shows a negative value, then the FLR is adjusted too far to the right, when looked at from the driver’s seat. The radar needs to be adjusted to the driver’s left. To accommodate this, adjust the horizontal alignment screw, by turning it in a counter-clockwise direction, when viewed from the front of the vehicle. Each full rotation of the alignment screw adjusts for approximately 0.2° of azimuth position from the alignment function. For example, if the azimuth position was -0.5°, then the alignment screw should be adjusted 2 ½ turns counter-clockwise.

After adjustment of the FLR, perform the calibration procedure again to verify proper alignment.
Component Power Supply Test

Overview

The base VS-400 system consists of two components, the FLR and DIU. Both should be powered by the main ignition power supply (12Vdc). If one of these components is incorrectly connected to constant battery power or a secondary ignition source other than the main ignition power supply bus there is the potential for J1939 communication fault between the FLR and DIU. These include but are not limited to fault codes 32 and 33. If these faults appear after the installation of a new VS-400 system or if the system is suspected of having this problem, perform this test to verify proper ignition power source to the FLR and DIU.

Verifying Ignition Power to DIU

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| A    | 1. Vehicle Ignition: Key-OFF, Engine-OFF  
2. Disconnect the 8-way connector from the back of the VS-400 Driver Interface Unit (DIU).  
3. Measure for zero voltage on pins 4 and 5 on the harness connector.  
   a. If the voltage is 0.5 volts or less.  
      i. Proceed to Step B.  
   b. If the voltage is greater than 0.5 volts but less than battery voltage.  
      i. Test Failed. Check DIU power supply wiring for sources of stray voltage or shorts to voltage.  
   c. If the voltage is within 0.6 volts of the battery voltage measured in Step A.  
      i. Test Failed. The DIU is improperly wired or shorted to a battery power source. Correct the wiring by connecting the DIU to the main ignition power supply bus and repeat Step. |

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1-4</td>
<td>V-Ignition</td>
</tr>
<tr>
<td>J1-5</td>
<td>Chassis Ground</td>
</tr>
</tbody>
</table>
### Appendix

#### Step B

1. Vehicle Ignition: Key-ON, Engine-OFF
2. Measure for ignition voltage on pins 4 and 5 on the harness connector.
   a. If the voltage is within 0.6 volts of the battery voltage measured in Step A.
      i. Proceed to Step C.
   b. If the voltage is less than 0.6 volts of the battery voltage measured in Step A or open.
      i. Test Failed. Check component fuse. Troubleshoot power supply to the DIU for open / corroded connections or shorts to ground and repeat Step.

#### Step C

1. Vehicle Ignition: Key-OFF, Engine-OFF
2. Disconnect the 10-way connector from the VS-400 Forward Looking Radar (FLR).
3. Measure for zero voltage on pins 10 and 9 on the harness connector.
   a. If the voltage is 0.5 volts or less.
      i. Proceed to Step D.
   b. If the voltage is greater than 0.5 volts but less than battery voltage.
      i. Test Failed. Check FLR power supply wiring for sources of stray voltage or shorts to voltage.
   c. If the voltage is within 0.6 volts of the battery voltage measured in Step A.
      i. Test Failed. The FLR is improperly wired or shorted to a battery power source. Correct the wiring by connecting the FLR to main ignition power supply bus and repeat Step.

---

**Pin #** | **Description**
---|---
J1-9 | Chassis Ground
J1-10 | V-Ignition

---

**Diagram of FLR 10-pin Connector**

- **VOLTS**
- **J1-9**
- **J1-10**
- **FLR 10-pin Connector**
- **Chassis Ground**
- **Ignition power (switched power)**
- **Forward Looking Radar**

---

Appendix
Verifying Component Power Up Timing

Verify the DIU and FLR are wired to the same ignition source. If either component is wired to a secondary ignition source with a delay, one of the components may fault as a result of the other(s) delayed power cycle.

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| D    | 1. Vehicle Ignition: Key-ON, Engine-OFF  
2. Measure for ignition voltage on pins 10 and 9 on the harness connector.  
   a. If the voltage is within 0.6 volts of the battery voltage measured in Step A.  
     i. Proceed to Step E.  
   b. If the voltage is less than 0.6 volts of the battery voltage measured in Step A or open.  
     i. Test Failed. Check component fuse. Troubleshoot power supply to the FLR for open / corroded connections or shorts to ground and repeat Step. |

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| E    | 1. Key-OFF. Let the truck sit for two minutes to allow time for the ECU's to completely power down.  
2. Disconnect the 10-way connector from the back of the FLR and add a test lamp to ignition power pin 10. If the test lamp requires a ground pin, use pin 9 or chassis ground.  
3. Disconnect the 8-way connector from the back of the DIU and add a test lamp to power pin 4. If the test lamp requires a ground pin, use pin 5 or ground the lamp to chassis ground.  
4. While viewing both test lamps, turn the ignition key on and verify that both lamps light at the same time.  
   a. If there is a noticeable delay before one lamp lights, the power source for the delayed light could be a secondary delayed ignition supply.  
     i. Correct the wiring by connecting the appropriate component to the main ignition power supply bus.  
   b. If the lamps light simultaneously.  
     i. Test Passed.  
5. Test Complete. |

CAUTION

Be careful not to spread pins on the FLR harness connector while performing this test.

Be careful not to spread pins on the DIU harness connector while performing this test.
Wiring Diagrams

Collision Warning System with Side Object Detection
# Connector Pin Descriptions

## Forward Looking Radar

### 10-pin TRW Connector

<table>
<thead>
<tr>
<th>PIN #</th>
<th>SIGNAL NAME</th>
<th>TYPE</th>
<th>INTERFACE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NO_CONNECTION</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>NO_CONNECTION</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>3</td>
<td>J1939_SHIELD</td>
<td>TRUCK J1939 LINK</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>CAN_HI</td>
<td>--</td>
<td>TRUCK J1939 LINK</td>
</tr>
<tr>
<td>5</td>
<td>CAN_LO</td>
<td>--</td>
<td>TRUCK J1939 LINK</td>
</tr>
<tr>
<td>6</td>
<td>NO_CONNECTION</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7</td>
<td>NO_CONNECTION</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>8</td>
<td>NO_CONNECTION</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>9</td>
<td>GROUND</td>
<td>POWER</td>
<td>CHASSIS GROUND</td>
</tr>
<tr>
<td>10</td>
<td>IGNITION</td>
<td>POWER</td>
<td>+12V SWITCHED</td>
</tr>
</tbody>
</table>

## Driver Interface Unit

### 8-Pin Molex Connector

<table>
<thead>
<tr>
<th>PIN #</th>
<th>SIGNAL NAME</th>
<th>TYPE</th>
<th>INTERFACE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RIGHT_SPEAKER</td>
<td>O</td>
<td>SPEAKER DRIVER 4 OHM / 1 WATT</td>
</tr>
<tr>
<td>2</td>
<td>LEFT_SPEAKER</td>
<td>O</td>
<td>SPEAKER DRIVER 4 OHM / 1 WATT</td>
</tr>
<tr>
<td>3</td>
<td>BLACKOUT_INPUT / SPARE</td>
<td>I</td>
<td>TRI-STATE INPUT</td>
</tr>
<tr>
<td>4</td>
<td>IGNITION</td>
<td>POWER</td>
<td>+9-32VDC SWITCHED</td>
</tr>
<tr>
<td>5</td>
<td>GROUND</td>
<td>POWER</td>
<td>CHASSIS GROUND</td>
</tr>
<tr>
<td>6</td>
<td>CAN_LO</td>
<td>TRUCK J1939 LINK</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>CAN_HI</td>
<td>TRUCK J1939 LINK</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>SPARE_ANALOG</td>
<td>I</td>
<td>TRI-STATE INPUT</td>
</tr>
</tbody>
</table>
## Side Sensor Display Unit

### 4-pin Deutsch Connector

<table>
<thead>
<tr>
<th>PIN #</th>
<th>SIGNAL NAME</th>
<th>TYPE</th>
<th>INTERFACE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>POWER</td>
<td>I</td>
<td>+12V FROM SENSOR</td>
</tr>
<tr>
<td>2</td>
<td>GROUND</td>
<td>POWER</td>
<td>CHASSIS GROUND</td>
</tr>
<tr>
<td>3</td>
<td>COMMUNICATION</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>TURN_SIGNAL</td>
<td>I</td>
<td>+12V</td>
</tr>
</tbody>
</table>

## Side Sensor

### 6-pin Deutsch Connector

<table>
<thead>
<tr>
<th>PIN #</th>
<th>SIGNAL NAME</th>
<th>TYPE</th>
<th>INTERFACE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IGNITION</td>
<td>POWER</td>
<td>+12V SWITCHED</td>
</tr>
<tr>
<td>2</td>
<td>GROUND</td>
<td>POWER</td>
<td>CHASSIS GROUND</td>
</tr>
<tr>
<td>3</td>
<td>COMMUNICATION</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>POWER</td>
<td>O</td>
<td>+12V</td>
</tr>
<tr>
<td>5</td>
<td>SODDU_GROUND</td>
<td>POWER</td>
<td>GROUND</td>
</tr>
<tr>
<td>6</td>
<td>NO CONNECTION</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Vendor Contact Information

**AMP/Tyco**
Harrisburg, PA
Tel: 800-522-6752
http://www.tycoelectronics.com/

**Champlain Cable Corporation**
175 Hercules Drive
Colchester, Vermont 05446
Tel: 800.451.5162
http://www.champcable.com/

**Deutsch**
LADD Industries
4849 Hempstead Station Dr.
Kettering, OH 45429
Tel: 800.223.1236
http://www.laddinc.com

**FEP**
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http://www.fepz.de/en/e_index.html

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Fax: 847.391.0894
http://www.littelfuse.com

**Molex**
2222 Wellington Court
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http://www.molex.com

**Packard**
Delphi Connection Systems
5725 Delphi Drive
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http://www.powerandsignal.com