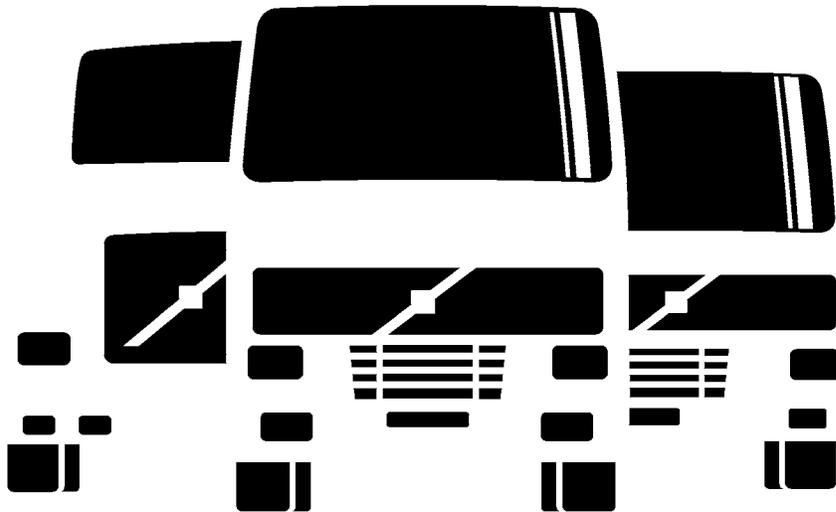


Service Manual Trucks

Group **36**

Eaton VORAD Collision Warning System

VN



Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to November 2000.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is believed to have a significant bearing on this manual, supplementary service bulletins will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to an S.R.T. (Standard Repair Time).

Service procedures which do not include an operation number in the title are for general information and no reference is made to an S.R.T.

The following levels of observations, cautions and warnings are used in this Service Documentation:

Note: Indicates a procedure, practice, or condition that must be followed in order to have the vehicle or component function in the manner intended.

Caution: Indicates an unsafe practice where damage to the product could occur.

Warning: Indicates an unsafe practice where personal injury or severe damage to the product could occur.

Danger: Indicates an unsafe practice where serious personal injury or death could occur.

Volvo Trucks North America, Inc.
Greensboro, NC USA

Order number: PV776-TSP132687

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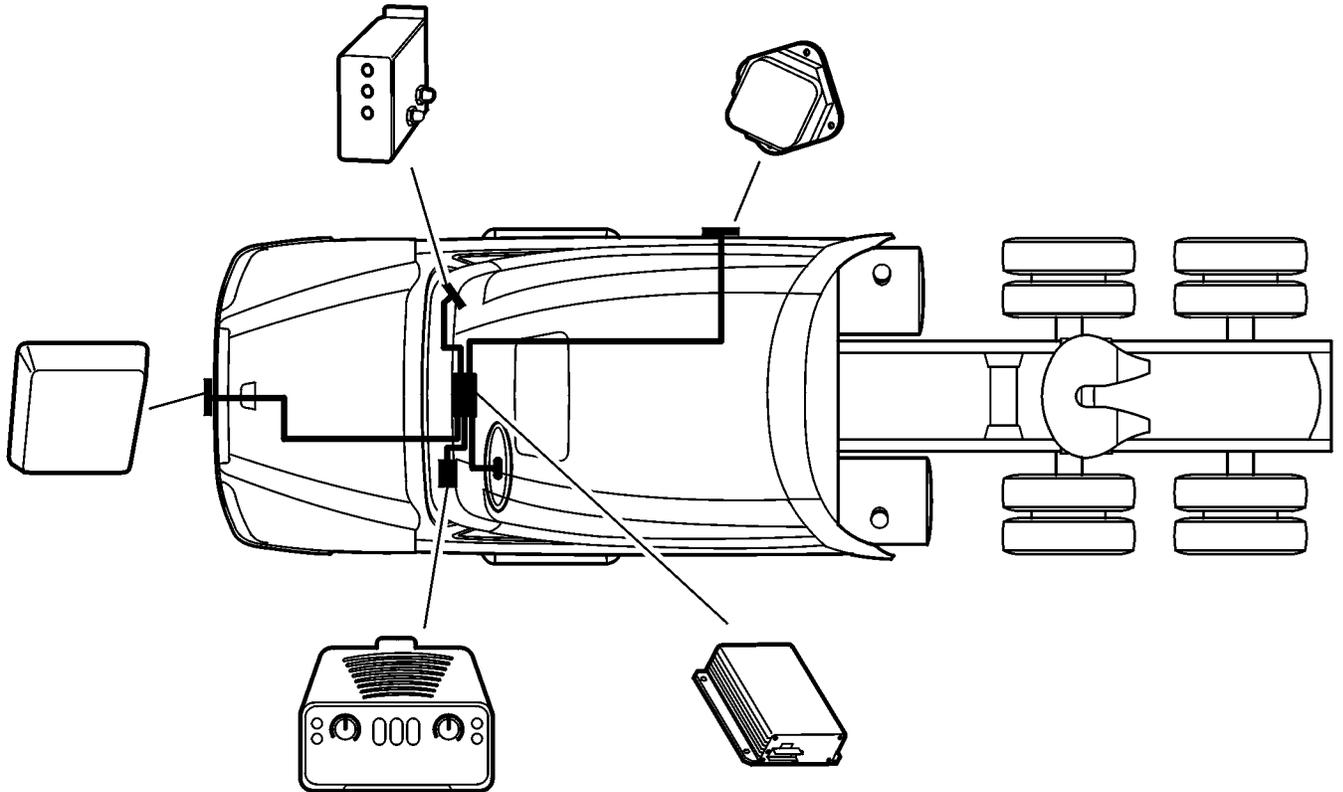
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General

Collision Warning System



W3004178

Eaton's VORAD Collision Warning System and SmartCruise®¹ are factory-installed options on Volvo's VN models. SmartCruise can never be installed as an aftermarket add-on; it is only available from the factory.

¹SmartCruise is a registered trademark of Eaton Corp.

Specifications

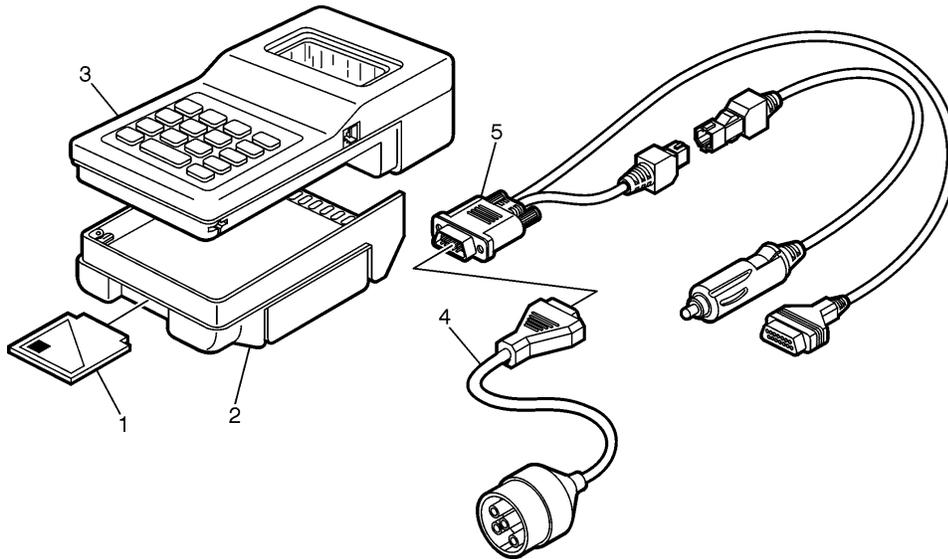
Collision Warning System

The table provides specifications for the EVT-300 Collision Warning System.

Description	Value
Vehicle Closing Rate	0.4-160 km/h (0.25-100 mph)
Operating Range	0.9-110 m (3-350 ft.) (typical)
Host Vehicle Speed	0.8-190 km/h (0.5-120 mph)
Power Requirements	12 to 24 Vdc, 20 watts (nominal)
Operating Frequency, Antenna Assembly	24.725 GHz
Operating Frequency, Side Sensor	24.725 GHz
Transmitted RF Power	3.0 milliwatts (typical)
Temperature Range	-40 to +85 °C -40 to + 185 °F

Tools

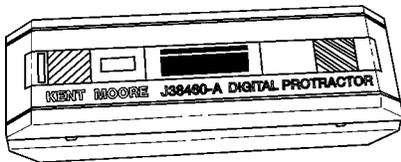
Special Equipment



W0001969

Pro-Link 9000 with Eaton Applications Card
Available from Volvo

- 1 MPI 809001
- 2 MPI 208040
- 3 MPI 108004
- 4 KEMJ-44012
- 5 MPI 501002



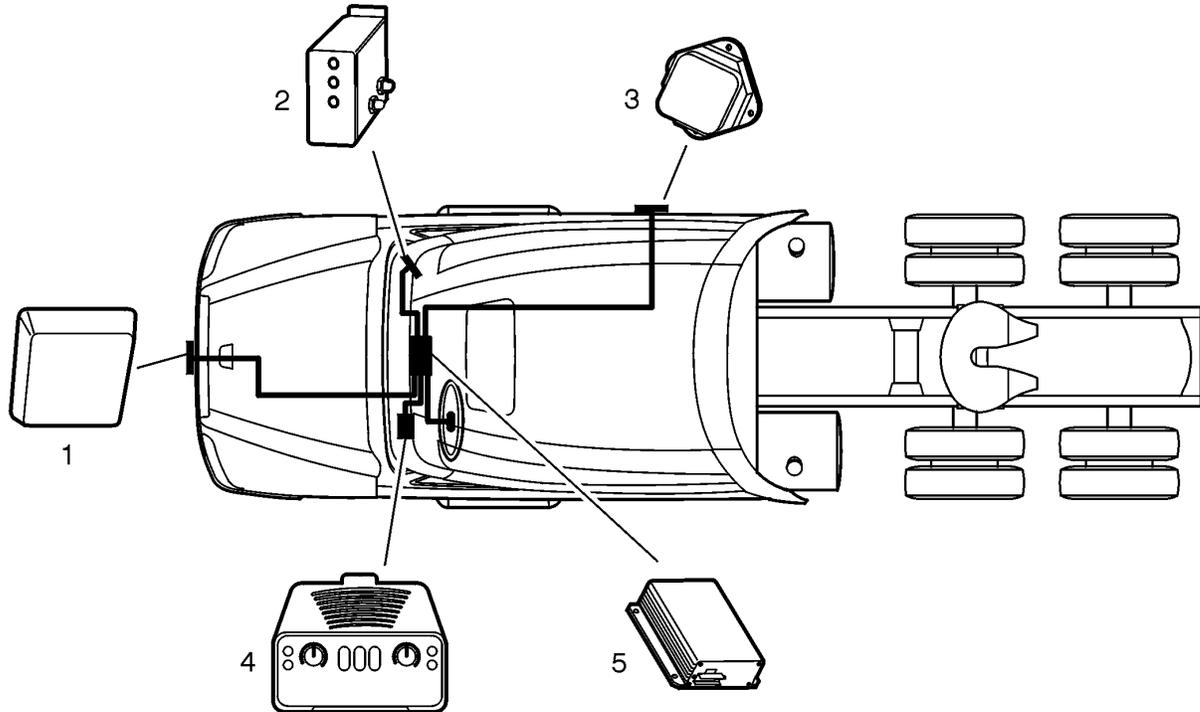
W7000708

J-38460 Digital Protractor
Available from Kent-Moore(1-800-328-6657)

Design and Function

Collision Warning System

VORAD EVT-300, General Description



- 1 Antenna Assembly
- 2 Side Sensor Display (SSD)
- 3 Side Sensor (SS)
- 4 Driver Display Unit (DDU)
- 5 Electronic Control Unit (ECU)

W3004298

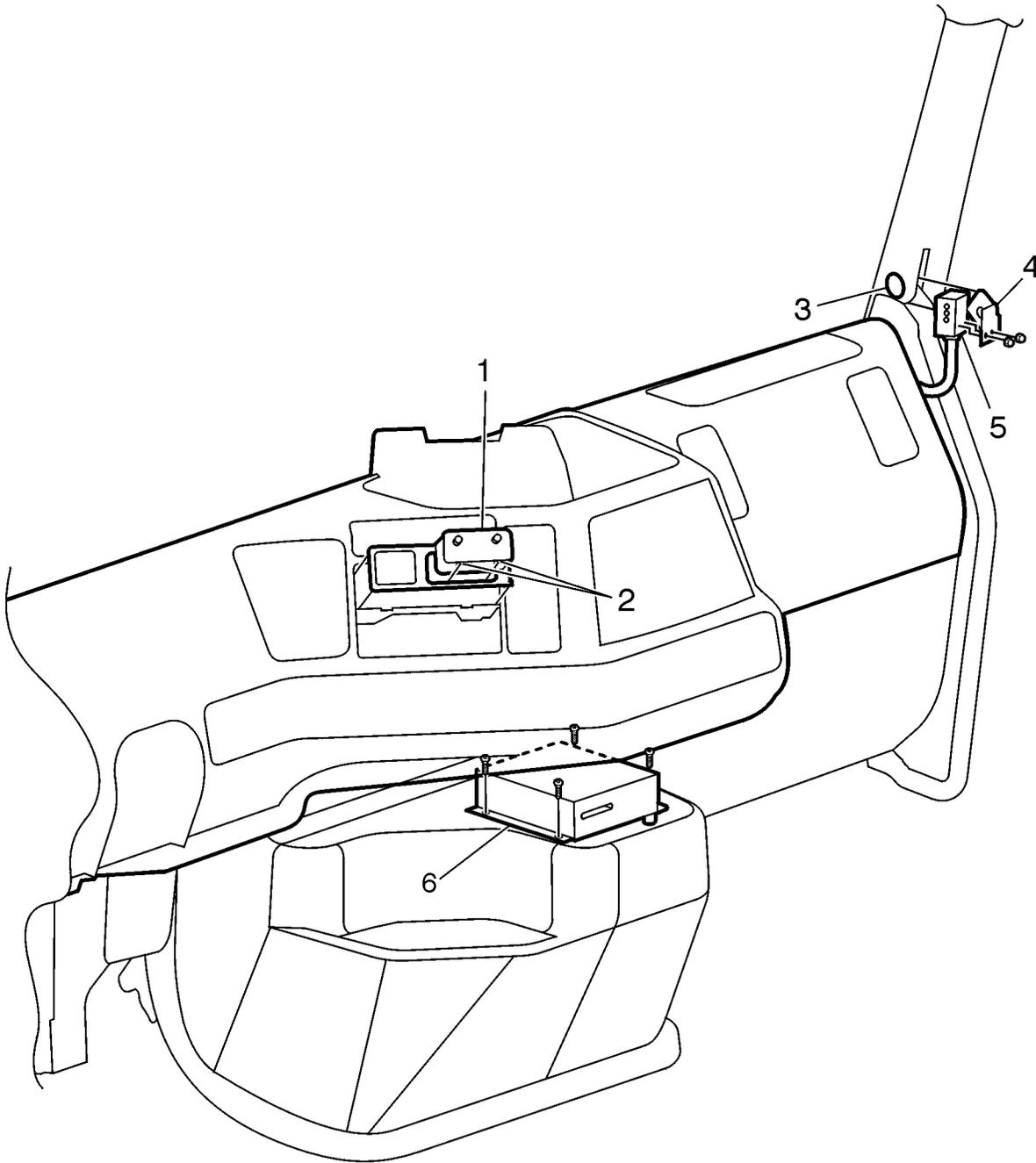
The EVT-300 collision warning system provides object detection in front of a vehicle and on the right side of a vehicle. The forward looking radar system transmits and receives signals for determining the distance, azimuth and relative velocity of vehicles in front of the truck. (Azimuth is the angle, positive for right, negative for left, of the vehicle in front.) The EVT-300 ECU (or CPU) contains a yaw rate sensor has an internal gyro to provide the turn rate of the vehicle which is being driven. The yaw rate and azimuth data are combined to provide object detection when going around curves.

The optional side sensor is a radar transmitter and receiver that is mounted on the side of the truck. It detects objects from two to ten feet from the side of the truck. The side sensor can detect vehicles and objects, moving or stationary, alongside the truck.

The EVT-300 collision warning system consists of the following components:

- Antenna Assembly
- Side Sensor Display (SSD)
- Side Sensor (SS)
- Driver Display Unit (DDU)
- Electronic Control Unit (ECU), with or without SmartCruise®

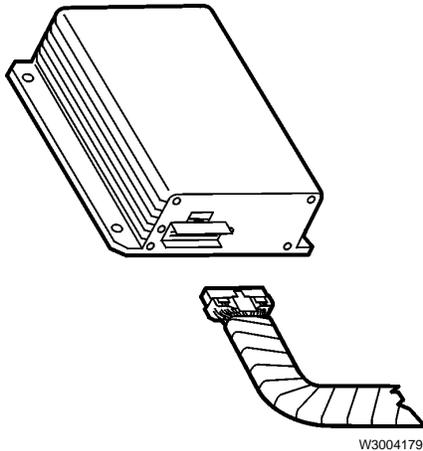
Component Locations in Cab



- 1 Driver Display Unit
- 2 Mounting Clips
- 3 Mounting for Side Sensor Display
- 4 Mounting Bracket
- 5 Side Sensor Display
- 6 VORAD ECU

W3004177

Electronic Control Unit (ECU)



The ECU is the brain of the EVT-300 system. The ECU has a card slot used for programming and downloading data. The ECU processes information from the antenna assembly, engine ECU, Vehicle ECU, speedometer, optional side sensor, brake and turn signal circuits to provide audible and visual warnings. It is mounted under the center of the dash. The VORAD ECU may also be referred to as the Central Processing Unit (CPU) in this or other publications.

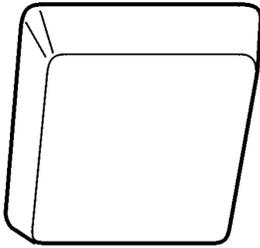
For a replacement procedure, see “Collision Warning ECU, Replacement” page 25. For set-up information see “Collision Warning System Set Up Using a Pro-Link” page 31.

Accident reconstruction is an optional function which records truck data into ECU memory. It can be used to reconstruct the last several minutes prior to an accident. To retrieve and analyze the data, the ECU must be returned to Eaton VORAD. For more information on accident reconstruction, see “Accident Reconstruction” page 16.

ECU Pinout			
	Pin	Circuit Number	Function
<p>Diagram of the ECU connector showing pin locations 1 through 16. The connector is shown from the wire insertion side. Labels 'D' and 'C' are positioned above the connector. The pin numbers 1 through 16 are listed to the right of the connector diagram. The diagram is labeled W3004545.</p>	C1	592V	Ignition Signal
	C2	0CG-B	Ground
	C3	V196A	Power
	C4	V0A	DC Return
	C5	V406A	VBUS Positive (+)
	C6	V407A	VBUS Negative (-)
	C7	400-K	J1587 Information Datalink (+)
	C8	401-K	J1587 Information Datalink (-)
	C12	V196C	Side Sensor Display Power
	C13	V197C	Side Sensor Signal
	C14	V0C	Ground, Side Sensor
	C15	V113	Right Turn Signal
	C16	V197D	Side Sensor Display Signal
	D3	V196B	Driver Display Unit Power
	D4	V0B	Ground
	D5	V406B	VBUS Positive (+)
D6	V407B	VBUS Negative (-)	
D7	406V	J1939 Control Datalink High (+)	
D8	407V	J1939 Control Datalink Low (-)	
D9	408V	J1939 Control Datalink Shield	

Note: Connector is shown from wire insertion side.

Antenna Assembly



The Antenna Assembly located on the front of the truck transmits and receives low power, high frequency radar signals. The transmitted radar signals are reflected off objects in front of the truck and received back at the antenna assembly. The antenna assembly compares the difference between the transmitted and received signals, converts this information into a digital format, and transmits it to the ECU for additional processing. The antenna assembly will simultaneously monitor up to 20 objects within a range of 110 m (350 ft.), whether moving or stationary.

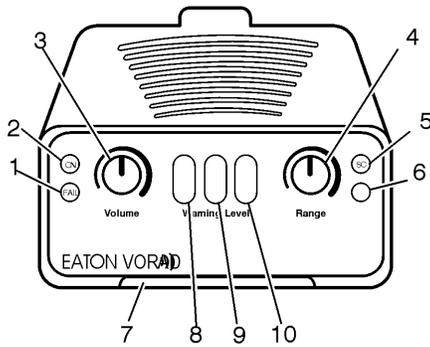
The antenna assembly is mounted in the center of the bumper. This mounting location ensures that the radar beam is aimed directly in front of the truck. For replacement and alignment procedures, see “Antenna Assembly, Replacement” page 20 and “Antenna, Alignment” page 21.

W3004181

Front Antenna Connector Pinout			
	Pin	Circuit Number	Description
<p>W3004546</p>	1	V407A	VBUS Negative (-)
	2	V406A	VBUS Positive (+)
	3	V0A	Ground
	4	V196A	Power

Note: Connector is shown from wire insertion side.

Driver Display Unit (DDU)



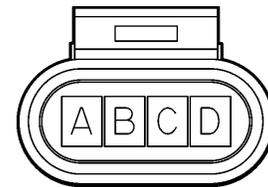
W3004180

- 1 System Failure Light (Red)
- 2 Power On and Driver ID Card Status Light (Green)
- 3 Volume Control, On/Off
- 4 Range/Threshold Adjustment
- 5 Smart Cruise On Indicator Light (Green)
- 6 Light Sensor
- 7 Driver ID Card Slot
- 8 Yellow Warning Light
- 9 Orange Warning Light
- 10 Red Warning Light

The Driver Display Unit contains controls and indicators related to system operation. The DDU controls system power-up, speaker volume, range for vehicle warnings and headway thresholds for SmartCruise®. A slot is also provided at the front bottom edge of the DDU to insert the optional Driver Identification Card (described later). DDU indicator lights illuminate to indicate system power, system failure, absence of the Driver's Identification Card, SmartCruise enabled, and multiple stages of warning levels.

A light sensor in the face of the DDU adjusts the indicators' brightness with changes in ambient light. The DDU also contains a small speaker that provides audible alert tones. The alert tones are sounded when the truck is closing in on an object, and if an object is detected by the Side Sensor and the right turn signal is on. Additionally, the speaker provides informational tones such as volume level, system failure, and the Driver Identification Card tones. For a replacement procedure, see "Driver Display Unit, Replacement" page 28.

DDU Connector Pinout

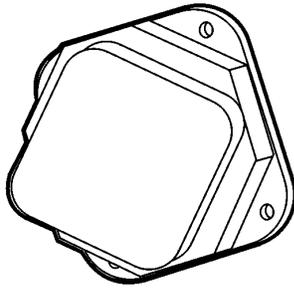


W3004550

Pin	Circuit Number	Description
A	V407B	VBUS Negative (-)
B	V406B	VBUS Positive (+)
C	V0B	DC Return
D	V196B	Power

Note: Connector is shown from wire insertion side.

Side Sensor (SS)



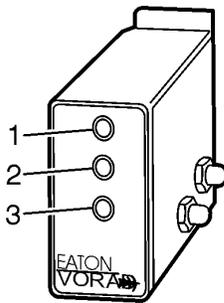
W3004183

The side sensor is also a radar device that senses objects from 0.6–3 m (2–10 ft) from the right side of the truck, close to the blind spot area. This information is provided to the ECU for processing, lighting of indicator lamps and sounding of alarms. The side sensor is mounted on the right side of the truck, behind the cab entry steps. For a replacement procedure, see “Side Sensor, Replacement” page 27.

Side Sensor Connector Pinout		
Pin	Circuit Number	Description
A	V0C-A	Ground
B	V197C	Signal
C	V196C-A	Power

Note: Connector is shown from wire insertion side.

Side Sensor Display (SSD)



W3004182

- 1 Red, Vehicle Detected Indicator Light
- 2 Light Sensor
- 3 Yellow, No Vehicle Detected Indicator Light

The side sensor display contains red and yellow indicator lights that indicate whether or not the side sensor is detecting an object. The yellow indicator light is on when there is no object within the side sensor detection zone. When the side sensor detects an object, the red indicator light illuminates and the yellow light goes off. The red light also illuminates if the side sensor fails. When there is heavy rain and both the red and yellow lights illuminate, the side sensor will not detect objects until the heavy rain condition has ended. A light sensor in the side sensor display adjusts indicator brightness with changes in ambient light.

The side sensor display is mounted on the right side A-pillar. For a replacement procedure, see “Side Sensor Display, Replacement” page 28.

Side Sensor Display Connector Pinout		
Pin	Circuit Number	Description
1		N/C
2	V196C-B	Power
3	V0C-B	Ground
4	V197D	Signal

Note: Connector is shown from wire insertion side.

SmartCruise®

SmartCruise² is an optional enhancement to the VORAD system, and is only available factory-installed. SmartCruise is activated whenever the vehicle's standard cruise control system is activated. When SmartCruise is active, the green S/C light in the upper right corner of the Driver Display Unit will illuminate.

The "Range" control knob on the Driver Display Unit adjusts the SmartCruise "following interval". The SmartCruise system will either maintain the selected following interval between the truck and a vehicle ahead, or the set cruise control speed.

Listed below are the most common situations encountered while using SmartCruise:

- **Normal Cruise Control used:**

If no vehicle is present in front of the truck (or if the vehicle is out of range of the EVT-300 system). If there is a SmartCruise failure, the vehicle will revert to normal cruise control if the cruise switch is activated **twice within 10 seconds**. The red System Failure light will remain on. The collision warning function of the system will continue as normal.

- **SmartCruise following interval is used:**

The driver can adjust the SmartCruise following interval from 2.25 to 3.25 seconds. The following descriptions outline SmartCruise operation.

- 1 Normal Operation

As the truck approaches a vehicle in the same lane, the truck will slow to the speed of the other vehicle and maintain the set following interval. The speed reduction may be accomplished by the engine ECU or Vehicle ECU issuing a command to reduce fuel and engaging the engine retarder (both via J1939). If the truck speed and other vehicle speed are very different, the driver may need to apply the service brakes to maintain a safe distance.

- 2 Cut In and Out

If another vehicle in an adjacent lane cuts in front and continues to the opposite adjacent lane, SmartCruise may respond. If the speed of the other vehicle is faster than that of the truck, the truck will maintain its speed. But if the speed of the vehicle is less than the truck's speed, the engine ECU will issue a command to reduce fuel and may also engage the engine brake (both via J1939). Once the other vehicle moves out of the truck's lane, the truck will reestablish the cruise control speed or resume the following interval if another vehicle is in the

lane. Again, the driver may need to apply the service brakes to maintain a safe distance.

- 3 Cut In and Stay

If another vehicle in an adjacent lane cuts in front of the truck and remains there, the system will respond by slowing the truck to reestablish the set following interval to the other vehicle. The engine ECU will reduce fuel and may also engage the engine brake (both via J1939). Again, the driver may need to apply the service brakes to maintain a safe distance.

- 4 Vehicle Ahead Changes Lane

When maintaining a following interval to a vehicle in front, and that vehicle moves into an adjacent lane, the system will respond. If there is no other vehicle ahead (or within range), the truck will accelerate to the set cruise speed. If there is another vehicle ahead, the truck will reestablish the following interval to that vehicle. Again, the driver may need to apply the service brakes to maintain a safe distance.

- 5 SmartCruise and AutoShift™ Transmissions³

Under any situation that causes the system to slow the truck, and the engine RPM reaches a preset minimum, the AutoShift will automatically downshift. Similarly, any situation that causes the truck to accelerate and a preset maximum engine RPM is reached, the AutoShift will upshift. This is due to engine/transmission response to the changing road speed and is not directly controlled by the VORAD ECU program.

- 6 SmartCruise and Manual Transmissions

Under any situation that causes the system to slow the truck, and the engine RPM reaches a preset minimum, the engine ECU will disengage cruise control and the driver may need to manually downshift the transmission. If this happens, the truck cruise control will need to be reengaged before SmartCruise will be operational again.

- 7 Road Curves and SmartCruise

SmartCruise will continue to maintain a set following interval in a gentle curve. In a sharp curve, the system may lose track of the vehicle in front. If this happens, the truck will maintain its current speed. When the vehicle in front is again in view, the system will reestablish the set following interval.

The previous paragraphs do not address all possible driving situations that the truck and driver may encounter.

²SmartCruise is a registered trademark of Eaton Corp.

³AutoShift is a registered trademark of Eaton Corporation.

Vehicle Information Management System (VIMS)

The VIMS (Vehicle Information Management System) Office Information Kit is a comprehensive PC data base program which supplements the Collision Warning System.

VIMS software can be used by fleet maintenance and safety departments to manage driver operations in a variety of ways. Safety Departments use the software program to follow driver habits and can take corrective action when their fleet benchmarks are being exceeded. Maintenance Departments use VIMS to verify that operational parameters are being met: for instance, idle time within fleet acceptable limits, engine not driven to governed limits, or cool down times are being followed.

Data is downloaded from the VORAD ECU onto a cyber-card so that the information can be loaded onto a PC.

Accident Reconstruction

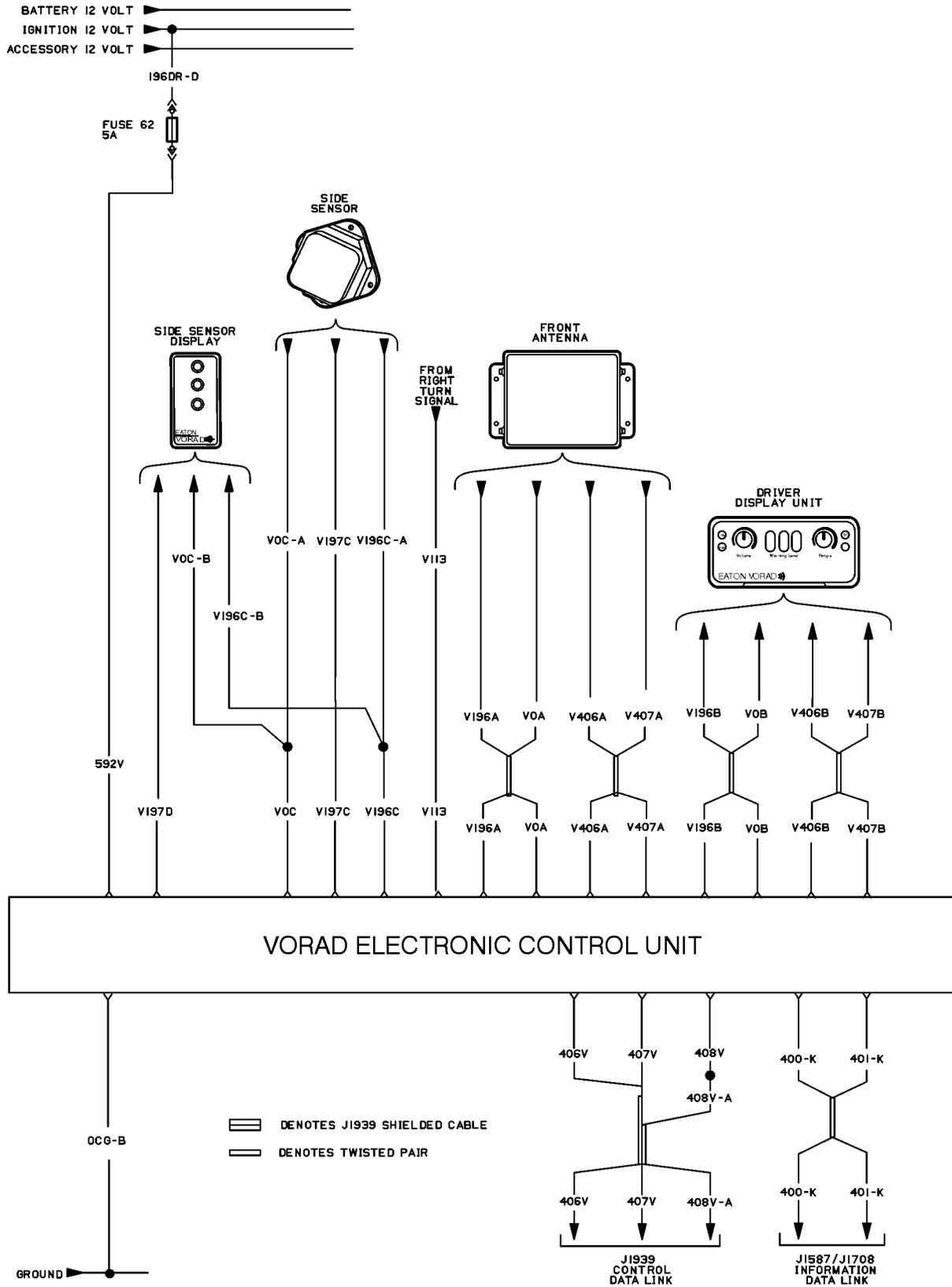
Accident reconstruction is an optional function which records truck data into ECU memory. It works like an airplane's "black box" by recording vital information for reconstructing events leading up to an accident.

Such information includes a second-by-second (up to 10 minutes) recounting of the trucks's proximity to other vehicles, speeds of the vehicles involved in the accident, brake actuation, steering wheel position, alerts the driver received, and much more.

Accident reconstruction is used as follows: in the event of an accident, there are two possible segments of ECU memory that can store data. By pressing and holding the "Range" knob for 5 seconds, the last 10 minutes of data stored in memory are frozen and two segments are created. The first segment remains frozen while the second segment cannot be frozen and will continue to record data.

To retrieve and analyze the data, the ECU must be returned to Eaton VORAD.

VORAD System Schematic



W3004549

Service Procedures

General Work Practices

Repairs should only be attempted by qualified and trained technicians. Do not attempt repairs without the use of a Pro-Link 9000® diagnostic tool equipped with an Eaton VORAD cartridge or Eaton applications PCMCIA card.

The Prolink 9000 diagnostic tool is used for establishing a variety of system options, confirming operation, and for clearing the fault codes. It is important to note that some repairs will require a test drive using the Prolink to verify correct system operation. Refer to the Prolink section in this guide ("Collision Warning System Set Up Using a Pro-Link" page 31) for specific operation.

Alternatively, the Driver Display Unit (DDU) is capable of providing flash codes when placed in Failure Display Mode. To initialize and use the Failure Display Mode of the DDU, do one of the following:

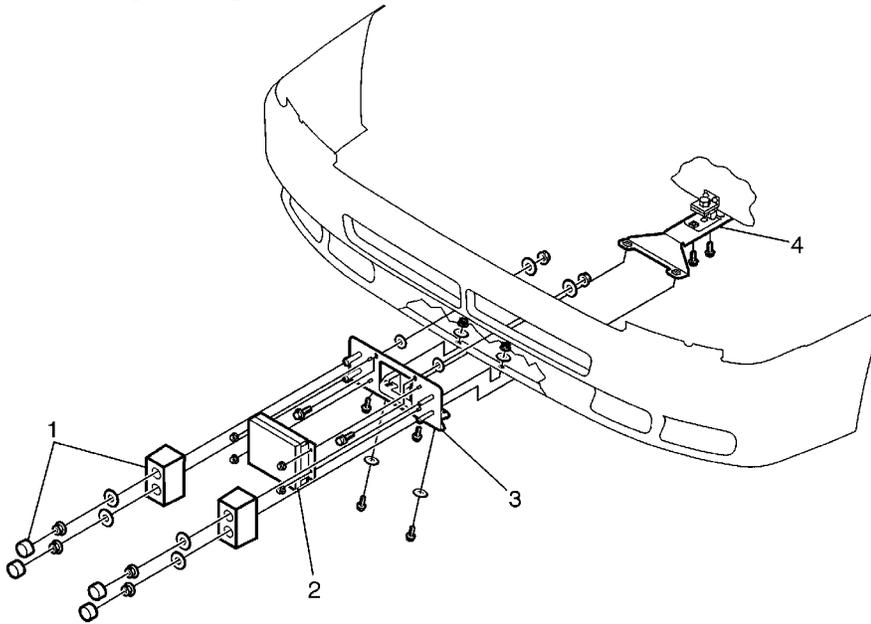
- With the ignition off, press and hold the DDU's Volume Control/Power On/Off knob. Turn the ignition key on, while continuing to hold the knob for five seconds, then release. Fault codes will blink on the display.
- Or, if the unit has On/Off capability (most do not), press and hold the Volume Control/Power On/Off knob for five seconds, then release. Fault codes will blink on the display.

The section, "System Check", describes the system set up using the Prolink diagnostic tool. The Prolink is currently the only tool which allows technicians access to the EVT-300 operational parameters. These parameters should be checked prior to repair to ensure specific customer options remain unchanged if repaired and/or replaced. In some instances, it may be necessary to add or remove options to the EVT-300, which will require the Prolink (see "Collision Warning System Set Up Using a Pro-Link" page 31).

Eaton's Service Ranger (version 1.25 or higher) can be used to read fault codes in addition to the Pro-Link tool.

3665-03-02-04

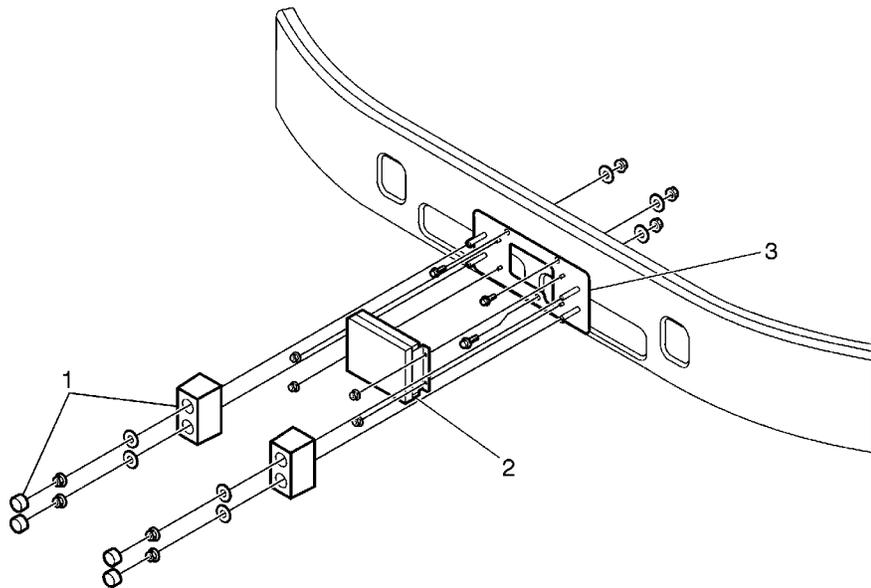
Antenna Assembly, Replacement



W3004184

Exploded view, antenna assembly and mounting hardware (Metton bumper)

- 1 Protective Bumpers
- 2 VORAD Antenna
- 3 Mounting Plate
- 4 Mounting Bracket



W3004186

Exploded view, antenna assembly and mounting hardware (metal bumper)

- 1 Protective Bumpers
- 2 VORAD Antenna
- 3 Mounting Plate

1


DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Make sure that vehicle ignition is OFF.

2


CAUTION

Failure to disconnect the ECU may cause antenna damage.

Remove the 4 VORAD ECU mounting screws to access the electrical connector and disconnect.

3

Cut the tie straps securing the antenna harness.

4

Remove the 4 mounting nuts. Disconnect the antenna connector and remove the antenna (with L-brackets attached).

5

Install the connector to the replacement antenna. Install the antenna (with L-brackets attached) and secure.

6

Secure the antenna harness with tie straps.

7

Connect the connector to the VORAD ECU and install.

8

Align antenna as shown in "Antenna, Alignment" page 21.

9

Verify the function of the antenna by performing the test shown in "Collision Warning System, Test Drive" page 23.

3665-05-02-01 Antenna, Alignment

Note: Alignment of the antenna assembly is a repetitive process of adjusting the vertical and horizontal axes. Slots in the antenna assembly "L" brackets allow for adjustment to take place.

Note: This procedure assumes that the tow eye mounting holes are identical, symmetrical and undamaged. If the tow eye mounting holes have been damaged or distorted, the alignment may be incorrect.

Note: The antenna must be aligned with the vehicle level. Be sure air suspension system is fully inflated and that the vehicle is parked on a level surface. Use the digital protactor J-38460A on the vehicle frame rail to check that the vehicle is within 0.5° of level before beginning antenna alignment procedure.

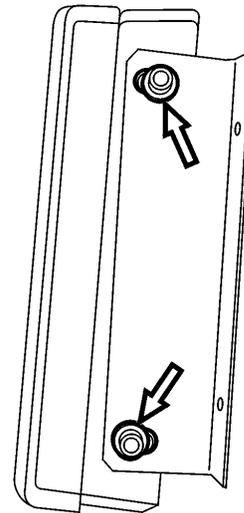
1


DANGER

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Make sure that vehicle ignition is OFF.

2

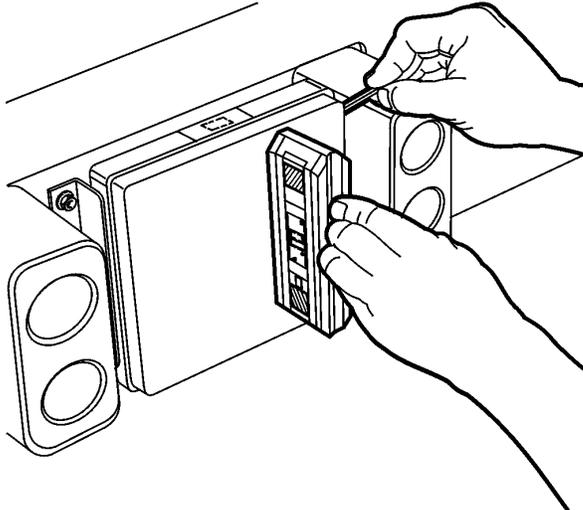


W3004534

Loosen the 4 adjusting screws enough to move the antenna for adjustment, but still hold after repositioning.

3

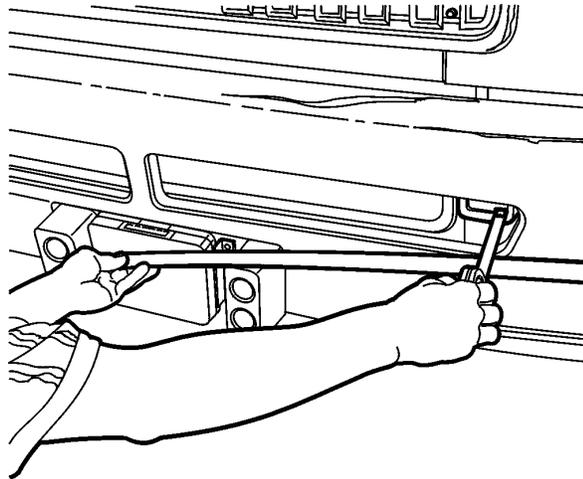
Push the antenna back to the end of its travel within the mounting bracket. Tighten the 2 bottom adjusting screws enough to hold the bottom in position but still allow the top of the antenna to be pivoted down.

4

W3004533

J-38460A

To adjust the vertical alignment, hold the J-38460A digital protractor against the face of the antenna assembly. Pivot the top of the antenna assembly down until the digital protractor reads 0.5 degree down (-0.5°) for metal bumpers or straight ahead (0°) for SMC bumpers. Tighten the 2 top adjusting screws enough to hold the antenna in position.

5

W3004535

To adjust the horizontal alignment, place a rigid straightedge flat against the face of the antenna so that it crosses over one tow eye mounting hole. Measure the distance from the straightedge to the tow eye mounting hole edge (see figure). Repeat the measurement on the opposite side. Adjust the antenna assembly as needed until the measurements are equal ± 2.5 mm (± 0.1 in.). Tighten the adjusting screws enough to hold the antenna in position.

6

Recheck the vertical and horizontal alignment and adjust until both specifications are met. Tighten the 4 adjusting screws when correct.

7

Perform a test drive. See "Collision Warning System, Test Drive" page 23.

3665-08-02-01 Collision Warning System, Test Drive

1


DANGER

When operating the vehicle on streets and highways during data collecting procedures, it is mandatory to have a second person drive while a technician collects the data. Failure to do so may cause a collision, which can result in serious injury or death.

To perform the test drive, select a straight, flat road with light traffic that will allow the test vehicle to be driven straight ahead while following another vehicle centered in your lane. A highway with multiple lanes, such as an interstate highway, is ideal for test drives.

2


DANGER

Only attempt the test drive where at least two lanes are available and traffic is light. Failure to do so could result in the loss of control of the vehicle and serious personal injury or death.

Perform the test drive after the initial antenna adjustments have been completed, as in “Antenna, Alignment” page 21.

Note: Range displayed on the Pro-Link is for diagnostic purposes only and does not represent the actual distance used by the system.

3

Connect the Pro-Link 9000 tool with the Eaton application card to the diagnostic connector with adapter J-44012 (for 9-pin diagnostic connectors).

4

Start the engine. Proceed to the test drive location.

5

From the Pro-Link initial screen select EATON VORAD – DIAGNOSTICS — CHECK OUT. From the CHECK OUT menu, select the following tests:

Gyro Test

6

During the test drive select CHECK-OUT MENU, then GYRO TEST. The following will display on the Pro-Link screen. BIAS V is a voltage (read in hexadecimal numbers) which represents the centerpoint of the gyro at rest. If the preset limits are exceeded, a failure will be issued. TURN RATE is a reading of degrees per second that changes from 0.0 when going straight ahead, to a plus or minus value when turning right or left, respectively.

BIAS V	200
TURN RATE	0.0

7

Observe that the TURN RATE will change when negotiating turns. A positive TURN RATE will be shown when turning to the right, and a negative value will be shown when turning left.

8

If the readings are erratic, verify the ECU is mounted in the correct position indicated by the UP arrow sticker and is securely fastened.

9

Press FUNC to exit the GYRO TEST and return to the CHECK OUT MENU.

Speedometer Test

10

This test must be performed with the vehicle operating at highway speed while following another vehicle centered in your lane. Select SPEEDO TEST from the CHECK OUT MENU in the Pro-Link. The following screen will display:

SPEED	0.0
RADAR	0.0
PPM	30000
SPEED MODE	J1939
ENGINE RPM	0

11

Check that the SPEED MODE source is J1939. If not, change it to J1939.

12

Check the SPEED value. The road speed value of the J1939 control data link source is displayed on the first line of the screen.

13

Check the RADAR value. RADAR is the speed differential between the truck and the vehicle in front. If the vehicle is pulling away from the truck the radar speed will be a negative value and conversely will be positive when closing on the vehicle.

14

PPM is used to calculate vehicle speed when the discrete speed input is used. Since all VN series vehicles use J1939 for the speed source, the PPM does not need to be checked or changed.

15

SPEED MODE is where the ECU is informed of the speed source information. See previous steps.

16

ENGINE RPM is an output from the engine electronic control unit which is displayed when the engine is running.

17

Press FUNC to exit the SPEEDO TEST and return to the CHECK OUT MENU.

Antenna Assembly Test

18

The Antenna Assembly must be in alignment to the truck's forward centerline. To verify proper Antenna Azimuth alignment, the DDU should only display following distance information on a vehicle traveling directly in front of you, and not on the vehicles in the left or right side lanes while driving in a straight line.

Note: Range, rate and azimuth will show "NO TARGET" if there is no vehicle within 350 feet of the host vehicle. Select ANT TEST from the CHECK OUT menu on the Pro-Link. The following will display:

RANGE	0
RATE	0.0
AZIMUTH	0.0

The RANGE indication is the distance to the target vehicle sensed in front of the antenna assembly, and is displayed in feet. Rate is the relative speed difference (in MPH), between the host vehicle and the target vehicle. Azimuth is the angle, positive for right, negative for left, of the movement of the target vehicle compared to the host vehicle.

19

Perform the ANT TEST on a straight road with light traffic that will allow the test vehicle to be driven straight ahead while following another vehicle centered in your lane.

20

From the CHECK OUT menu select ANT TEST.

21

Confirm that the antenna is monitoring the vehicle directly ahead only. The antenna should not pick up vehicles in other lanes. Note the RANGE and RATE information.

22

When properly aligned, the Pro-Link display should report AZIMUTH as 0.0 when tracking the vehicle directly ahead. The AZIMUTH reading will probably "bounce" ± 0.4 due to normal side-to-side movement of the vehicle ahead. Note: If the AZIMUTH reading is consistently positive, the antenna assembly should be aligned more to the right. If it is consistently negative, align it more to the left.

23

Press FUNC to exit the ANT TEST and return to the CHECK OUT MENU.

Side Sensor Test**24**

The side sensor verifies that vehicles in the right lane adjacent to the host vehicle are detected by the side sensor, when in the sensor's field of view. The SS TEST should be performed with the vehicle operating at highway speed in the left lane of a divided multi-lane highway. Another vehicle must be in the side sensor's field of view ("blind spot" area) on the right side of the vehicle.

25

From the CHECK OUT menu of the Pro-Link select SS TEST. The following will display.

RH SS	OFF
LH SS	N/A

26

The RH SS should read OFF until a vehicle is detected by the side sensor. When a vehicle is detected, the RH SS display should change to ON.

Note: Displayed message will read OPEN if the electrical connection to the SS is removed or broken and OFF if the SS is faulty.

27

Press FUNC to exit the SS TEST and return to the CHECK OUT MENU.

3665-03-02-01**Collision Warning ECU, Replacement****EVT-300**

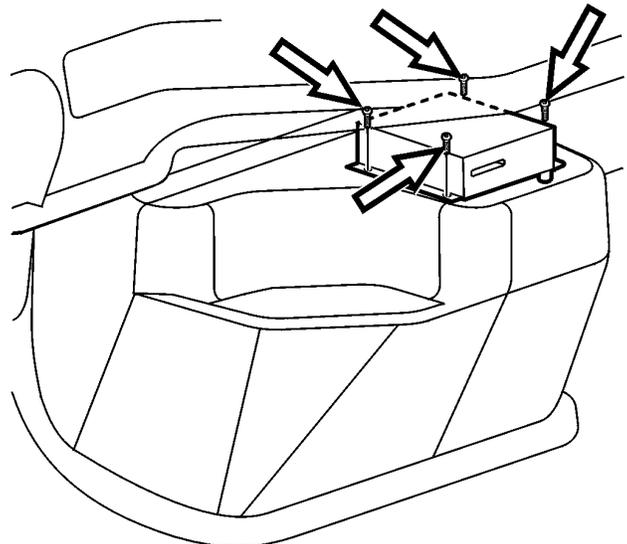
1



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Make sure that vehicle ignition is OFF.

2



W3004538

Remove the 4 ECU mounting screws.

3

Disconnect the connector from the rear of the ECU.

4

Remove the ground wire from the rear of the unit and remove the ECU.

5

Install the ground wire on the replacement ECU.

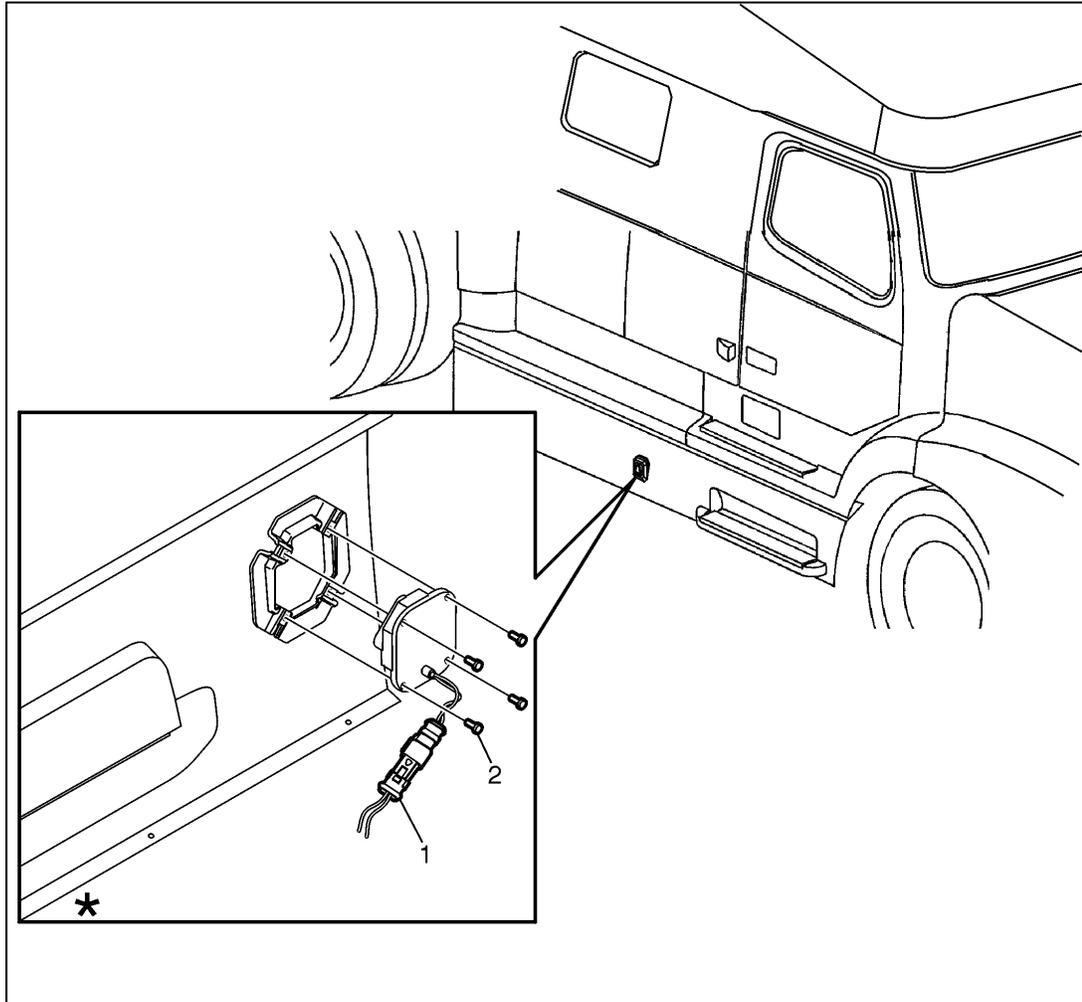
6

Connect the connector on the rear of the ECU. Then install the 4 mounting screws.

7

Program unit to original customer specifications. See "Collision Warning System Set Up Using a Pro-Link" page 31.

3665-03-02-05 Side Sensor, Replacement



W3004193

- 1 Side Sensor Connector
- 2 Mounting Bolts
- * View from inside fairing

1

**DANGER**

Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Make sure that vehicle ignition is OFF.

2

Disconnect the side sensor harness connector (1).

3

Remove the 4 mounting bolts (2) and remove the side sensor from the vehicle.

4

Install the replacement side sensor with the mounting bolts and secure.

5

Connect the side sensor harness connector.

3665-03-02-02 Side Sensor Display, Replacement

1



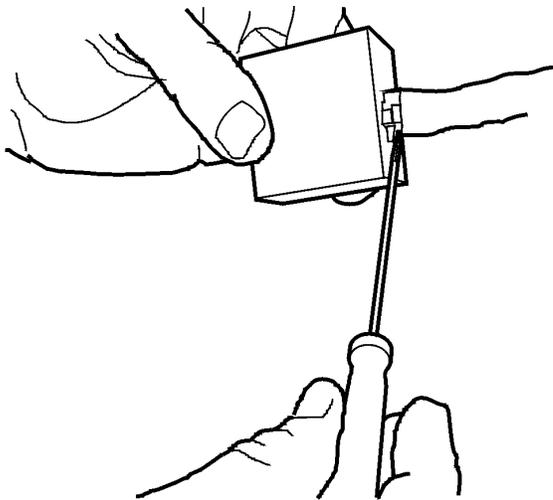
Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Make sure that vehicle ignition is OFF.

2

Remove the side sensor display from its mounting bracket.

3



W3004314

Disconnect the connector and remove the display from the vehicle.

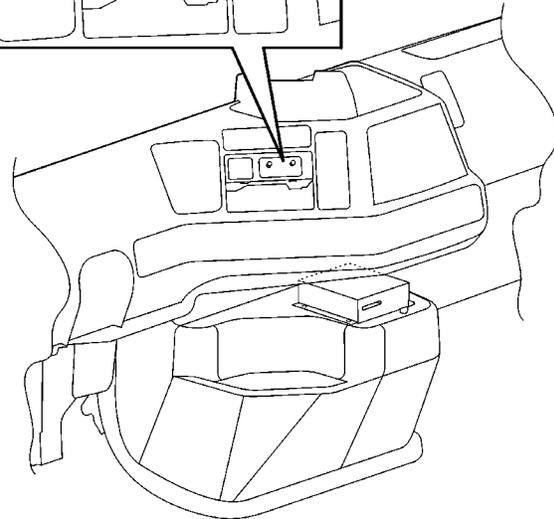
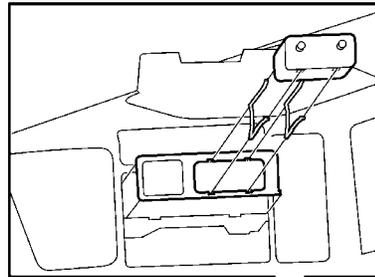
4

Connect the connector for the new display.

5

Install the display in its mounting bracket.

3665-03-02-03 Driver Display Unit, Replacement



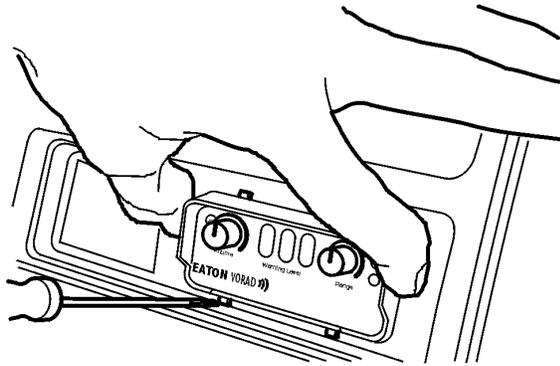
W3004192

1



Before working on a vehicle, set the parking brakes, place the transmission in neutral, and block the wheels. Failure to do so can result in unexpected vehicle movement and can cause serious personal injury or death.

Make sure that vehicle ignition is OFF.

2

W3004313

Use a small slotted screwdriver to release the lower mounting clips.

3

Slide the driver display unit (DDU) out of the dash.

4

Disconnect the connector and remove the DDU from the vehicle.

5

Connect the new DDU into the connector in the dash.

6

Be sure the mounting clips are properly positioned and slide the DDU into its mounting location.

System Check

Collision Warning System Set Up Using a Pro-Link

After completing the installation of EVT-300 components, it is necessary to configure and test the system. An MPSI Pro-Link 9000® diagnostic tool equipped with an Eaton PCMCIA card is necessary.

A Test Drive (described later) must be performed after all the system parameters have been established in the SET UP menu to verify the installed components are correctly configured for the system and the truck.

Insert the ignition key and turn it to the run position. The EVT-300 system will power-up. Connect the Pro-Link cable to the truck diagnostic connector and the other end to the Pro-Link. Select the Eaton VORAD CWS or Eaton VORAD EVT-200 sub-menu, whichever is shown. The EVT-200 and EVT-300 Pro-Link sub-menu will work on either system.

When the Pro-Link has completed reading the diagnostic menu the following display will appear on the Pro-Link screen.

```

EVT-300 MENU
  VER xx

  SET UP
  CHECK OUT
  ERROR LOG
  
```

The SET UP menu is used for changing or setting a variety of system parameters.

The CHECK OUT menu is then used for conducting the EVT-300 tests. The EVT-300 ECU continuously performs internal tests for the entire system. The results of these tests are saved in the ECU in the form of fault codes for future reference.

The ERROR LOG provides a listing of the fault codes and sub-codes encountered during system self diagnostics. Selecting H/W Configuration, S/W Configuration or TRIP PARAMS will display sub-menus.

SET UP MENU

The SET UP menu is for configuring the initial system data for the date, time, and vehicle ID number. The SET UP menu also shows the date of the last system configuration change, and contains selections to enter three (3) sub-menus and one informational menu.

Note: To enter or change the vehicle ID, the Vehicle Information Management System (VIMS) data must be empty, either uploaded or erased by selecting DEL TRIP DATA in the PERFORMANCE OPTIONS menu.

Position the selection arrow next to the item you want to change by pressing the up or down arrow on the Pro-Link. Press the ENTER key to select. To return to the previous menu press the FUNC key.

```

DATE                0 2/1 7/9 9
TIME                0 9 : 0 5 : 3 0
CHANGED             0 2 - 1 7 - 9 9
VEH ID              XXXXXX
H/W CONFIG
S/W CONFIG
TRIP PARAMS
SPECIAL
  
```

H/W (Hardware) CONFIGURATION MENU

The H/ W CONFIG menu is for configuring the ECU, informing the ECU that a Side Sensor, R.SS? or L.SS? is installed by selecting YES. When a turn signal wire is connected to the system you must select either R. TURN SIG? or L. TURN SIG?, YES. The 2 SS, 1 SSD must be selected YES when two Side Sensors are installed on the right side of the truck with one Side Sensor Display.

Note: Volvo VN series vehicles are currently configured with 1 right side sensor.

Position the selection arrow next to the item you want to change and press the ENTER key to select between YES or NO.

R SS ?	YES
L SS ?	NO
2 SS, 1 SSD	NO
R TURN SIG ?	YES
L TURN SIG ?	NO
BRAKE BIST	YES
TURN SIG BIST	YES

Once all the items are configured correctly, press the FUNC key to return to the SETUP menu.

S/W (Software) CONFIGURATION MENU

This menu is used for selecting the correct system operating parameters for the installed system. J1587 ENABLE is selected YES for all VN models equipped with an electronically controlled engine. BRAKE MODE selects whether the input is discrete (a wired connection) or electronic J1587 or J1939 input. All VN models should use J1939 for BRAKE MODE. HI BRK LOGIC is only used if the BRAKE MODE is discrete, so does not apply to VN models.

SPEED MODE permits the selection of the speed source e.g., J1587, J1939 or DISCRETE. SPEEDO BIT is set to YES so the ECU can verify a speed source. PROXIMITY ALERT, when selected YES, will detect when the truck is rolling towards or away from an object, (the object needs to be less than 4.5 m (15 ft) away, with either vehicle or detected object moving at a rate of more than 1 km/h (0.5 mph), but less than 3 km/h (2 mph)). 2 SEC AUDIO when selected YES provides an audio alert when the truck is within 2 seconds of the vehicle in front.

Position the selection arrow next to the item you want to change and press the ENTER key to change the selection.

BRAKE MODE	J1939
HI BRK LOGIC	YES
SPEED MODE	J1939
SPEEDO BIST	YES
PROXIMITY ALERT	YES
2 SEC AUDIO	YES
PERFORMANCE OPTIONS	
PRODUCT OPTIONS	

PERFORMANCE OPTIONS MENU

The selections in the Performance Options Menu are password protected.

The selection, SYS OFF ENABLE, will allow or prevent the driver from turning the system off. Selecting YES for 1/2 SEC ALERT will provide a continuous warning until increasing the following distance. The MIN VOL selection sets the minimum level that the volume can be changed, by the volume control knob. RANGE ENABLE allows or prevents the driver from changing the radar detection range. DEL TRIP DATA when selected and enabled with the password, will erase the data stored for VIMS. Position the selection arrow next to the item you want to change and press the ENTER key to change the selection.

Position the selection arrow next to the item you want to change and press the ENTER key to change the selection.

SYS OFF ENABLE	YES
1/2 SEC ALERT	YES
MIN VOL	100
RANGE ENABLE	YES
DEL TRIP DATA	
PASSWORD	

Once all values are entered correctly, press the FUNC key to return to the S/W CONFIG MENU.

PRODUCT OPTIONS MENU

This section is used to enable optional features purchased with the system and is only accessible by the factory.

The selections in the Product Options Menu are password protected. The Password must be entered by the service repair technician to change the configuration setting.

TRIP REC ENABLE enables or disables VIMS data collection. AR DATA enables or disables accident reconstruction data availability. SMARTCRUISE is activated or disabled when the system is available. SATCOM ENABLE enables or disables operation of VIMS data transmission via a satellite communications system when installed (this feature is not available). BLACKOUT enables or disables blackout mode (only available on military vehicles.) DISPLAY TYPE enables the system to use the VORAD Driver Display Unit or another type display unit.

TRIP REC ENABLE	YES
A R DATA ENABLE	YES
SMARTCRUISE	YES
SATCOM ENABLE	NO
BLACK OUT	NO
DISPLAY TYPE	DDU

Once all values are entered correctly, press the FUNC key to return to the S/W CONFIG MENU.

TRIP PARAMS

TRIP PARAMS is a menu to enter parameters for the collection of optional VIMS data. SPEED/RPM BANDS is a sub-menu where reporting limits for speed and rpm are set for VIMS data collection. DIST TO START selects the mile in tenths that VIMS data starts to be collected and the start of one of the hundred-ninety available trips. MINS TO END selects the time after the truck ignition has been off to end a trip. The ODOMETER setting can only be changed when the trip data file is empty. CARD ALARM is the parameter that sets the alarm when there is a Driver Identification Card missing, when one is required. When TONE is selected and the required Driver Identification Card is missing, the tone will be activated after the truck has passed the DIST TO START set value.

SPEED/RPM BANDS	
DIST TO START	5
MINS TO END	5
ODOMETER	0
CARD ALARM	LIGHT

SPEED/RPM BANDS

TRIP PARAMS contains selections for setting up Vehicle Information Management System (VIMS) parameters. Refer to the RPM/ SPEED Summary Report section of the VIMS manual to determine if changes in this menu are necessary.

SPD	1	3 4
SPD	2	5 4
SPD	3	6 4
SPD	4	6 9
SPD	5	7 5
RPM	1	6 9 9
RPM	2	11 9 9
RPM	3	16 9 9
RPM	4	20 9 9

Place the blinking cursor where the new value should be entered. Enter the new value for the parameter you want to change. When the value is entered, press the ENTER key to store the new value and return to the TRIP PARAMS menu.

SPECIAL

The SPECIAL menu provides system configuration information. The SOFT BT selection is the only menu item that has an action, and that is to activate a soft reboot of the system.

CPU S/N	0 0 0 0 0 1 0 0
BT V E R	4 0 7 2 9 - 1 0 1
BT DATE	FEB 17, 2000
FLSH VER	40736-xxx
FLSH DATE	06/24/98
FLSH CRC	8B06
FE S/N	00000021
FE BT	40690 -101
FE CODE	40899 - xxx
FE DATE	02/17/00
SOFT BT	

CHECK OUT MENU

The CHECK OUT menu is used to test selected components of the system. The MPSI Pro-Link® 9000 diagnostic tool with an Eaton VORAD cartridge/PCMCIA card is used to test the selected component. Some tests require an assistant. The CHECK OUT menu is selected from the EVT-300 MENU and is displayed as follows:

SSD TEST
 SS TEST
 SPKR TEST
 ANT TEST
 GYRO TEST
 DDU TEST
 TURN SIG TEST
 BRAKE TEST
 SPEEDO TEST

SSD TEST (Side Sensor Display Test)

When the SSD TEST is selected from the CHECK OUT MENU the state of the right and/or left SSD indicator lights appear. If the system is configured for only one SSD (see H/W CONFIGURATION MENU), N/A appears to indicate that the SSD is Not Available.

RH SSD	YEL
LH SSD	N/A

Perform SSD Test as follows:

- 1 Position the display selection arrow next to SSD TEST and press ENTER.
- 2 Move the pointer to the appropriate SSD to be tested, Press ENTER.
- 3 Observe that the indicator light for the selected SSD matches the red or yellow message selection shown on the Pro-Link 9000 display.
- 4 Press FUNC to exit the SSD TEST and return to the CHECK OUT MENU.

SS TEST (Side Sensor Test)

When the SS TEST is selected from the CHECK OUT MENU the state of the right and left Side Sensor(s) appear. If the system is configured for only one SS (see H/W CONFIGURATION MENU), N/A appears to indicate that the SS is Not Available. See "Collision Warning System, Test Drive" page 23 for the test drive procedure, or see below for a test that can be performed without moving the vehicle.

Perform the SS TEST as follows: From the CHECK OUT menu of the Pro-Link select SS TEST. The following will display.

RH SS	OFF
LH SS	N/A

- 1 Position the display selection arrow next to the SS to be tested and press ENTER.
- 2 Move an object back and forth in front of the SS being tested, at a distance greater than 0.6 m (2 ft) from the front of the SS.
- 3 The message displayed on the Pro-Link 9000 for the selected SS should change from OFF to ON as the object is moved in front of the SS.
- 4 Press FUNC to exit the SS TEST and return to the CHECK OUT MENU.

Note: Displayed message will read OPEN if the electrical connection to the SS is removed or broken and OFF if the SS is faulty.

SPKR TEST (Speaker Test)

When SPKR TEST is selected from the CHECK OUT MENU seven unique sound patterns can be played on the system speaker.

PROXIMITY ALERT
WARNING 1
WARNING 2
VOLUME CHANGE
BIT FAIL
ID READ PASS
ID READ FAIL

Perform SPKR TEST as follows:

- 1 Position the display selection arrow next to the sound pattern to be tested, press ENTER.
Note: Volume of sound can be changed by the DDU VOL control.
- 2 Observe that the specific sound pattern can be heard from the DDU speaker.
- 3 Repeat the tests for each of the seven (7) sound patterns.
- 4 Press FUNC to exit the SPKR Test and return to the CHECK OUT MENU.

ANT TEST (Antenna Assembly Test)

When the ANT TEST is selected from the CHECK OUT menu, the RANGE indication on the object sensed in front of the antenna appears on the Pro-Link 9000 display. Distance is displayed in units of feet. Rate is the speed (mph), whether closing or opening, on the vehicle immediately in front. Azimuth is the angle, positive for right, negative for left, of the vehicle in front. Rate and Azimuth should be viewed while doing the test drive. See "Collision Warning System, Test Drive" page 23 for the complete procedure.

GYRO TEST

The GYRO TEST should be conducted during the test drive. See "Collision Warning System, Test Drive" page 23 for the complete procedure.

DDU TEST (Driver Display Unit Test)

When performing the DDU TEST the gain of the VOL and RANGE knobs are tested as well as the, yellow, orange and red Warning Level indicator lights.

LH KNOB	55%
RH KNOB	1.4%
LAMP TEST	YEL, ORG, RED

Perform DDU Test as follows:

- 1 Observe that each of the three DDU Warning Level lights come on sequentially from left to right while in the test mode.
- 2 Rotate the DDU Volume control (LH KNOB) through its full range and note that the percentage for Volume on the Pro-Link display changes from 0 to 100 percent.
- 3 Rotate the DDU Range control (RH KNOB) through its full range and note that the percentage for Range on the Pro-Link display changes from 0 to 100 percent.
- 4 Press and hold the range knob until the Pro-Link display reads "PUSH".
- 5 Press FUNC to exit the DDU TEST and return to the CHECK OUT MENU.

TURN SIG TEST

When the TURN SIG TEST is selected the state of the right and left signals appear. If the system is configured for only one Side Sensor, and therefore only one turn signal (see H/W CONFIG menu), N/A appears as the value for the turn signal that is Not Applicable.

RH SIGNAL	OFF
LH SIGNAL	N/A

Perform the TURN SIG TEST as follows:

- 1 Position the display selection arrow next to either RH SIGNAL or LH SIGNAL.
- 2 Move vehicle turn signal in the direction selected.
- 3 The message displayed on the Pro-Link for the selected turn signal should change from OFF to ON.
- 4 Press FUNC to exit the TURN SIG TEST and return to the CHECK OUT MENU.

Note: The displayed message will read OPEN if the electrical connection to the turn signal circuit is disconnected.

BRAKE TEST

When the BRAKE TEST is selected the state of the vehicle brake (OFF or ON) appears.

BRAKE	OFF
MODE	J1939

Perform the BRAKE TEST as follows:

- 1 Press the brake pedal, observe that BRAKE message on the Pro-Link display changes from OFF to ON.

Note: If a ground signal is received when the brakes are applied, the HI BRK Logic setting in the S/ W CONFIG menu must be set to NO.

Note: If the mode selected is J1587 or J1939 and the truck parking brakes are on, the brake message will read ON.

SPEEDO TEST

The SPEEDO TEST needs to be performed during the test drive. See "Speedometer Test" page 24 for the complete procedure.

Test Drive



When operating the vehicle on streets and highways during data collecting procedures, it is mandatory to have a second person drive while a technician collects the data. Failure to do so may cause a collision, which can result in serious injury or death.

A road test must be performed after the system parameters in the SET UP MENU are established to confirm installed components are configured correctly. See "Collision Warning System, Test Drive" page 23 for the test drive procedure.

ERROR LOG MENU

ERROR LOG

There are two menus where logged faults can be viewed. The first is the ERROR LOG. The Error Log menu can be accessed from the EVT-300 MENU by scrolling either up or down in the menu. The second area where fault codes can be viewed is in the MPSI Pro-Link Selection Menu. See “Active and Inactive Fault Log” page 40 for more information.

The ERROR LOG is selected from the EVT-300 MENU. The ERROR LOG display provides a listing of all fault codes that the system has detected. Every 15 seconds the system ECU performs a self diagnostic test of its internal processes and of the other system components. Faults that occur are logged into the system memory as a fault code. A complete listing of these fault codes along with their associated SID and FMI numbers are provided in table page 40. The SUB number shown is for Eaton’s internal use, and will be used if calling for technical support.

For each fault code selected, the ERROR LOG displays the count /duration of each fault, the date and time of the first and last occurrence of each fault. The ERROR LOG display appears as follows:

CODE 34	INACTIVE
	CRUISE (SUB 21)
CLR CT/MIN	3/15
1ST	15:35 08/14/99
LAST	15:35 08/14/99

Viewing the ERROR LOG

The CODE line of the ERROR LOG displays the current fault code number and indicates whether it is an active or inactive fault. The next line lists the fault name for the current fault code and sub-code selected. The CLR CT/MIN line of the display shows the number of occurrences of the current fault code and the number of minutes it has been continuous.

Note: Each time a fault reoccurs, the count window increments whether active or inactive, and time continues to lapse.

Note: The system stores information for up to 255 counts for each fault and 999 minutes per count.

The fourth line of the display provides the time and date of the first occurrence of the current displayed fault code while the LAST line of the display provides the time and date of the last occurrence of the current displayed fault code. To view ERROR LOG information for the different fault codes stored in the system memory, proceed as follows:

- 1 Position display selection arrow next to CODE (first line of display). The first fault code in the error log is listed.

Note: All information in the ERROR LOG display pertains to the current fault code listed.

- 2 Press ENTER to display ERROR LOG information for next logged fault.
- 3 Each successive pressing of ENTER steps through each of the logged fault codes.

Clearing the Count

For any particular fault code, the count and duration of the current count can be cleared or reset. This may be useful for determining the effect a maintenance action has on removing a fault. Clear the count on a specific fault as follows:

- 1 Select the fault code for which you want to clear the count (see above).
- 2 Position display selection arrow on CLR CT/MIN line of display.
- 3 Press ENTER key to clear count of current fault.

Active and Inactive Fault Log

To access this area press the FUNC key until the EATON VORAD menu or the menu below appears. If at the EATON VORAD menu selection press ENTER and the menu below will appear. See the following Fault Code Table for list of Displayed Fault Name, MID number, SID number, FMI number, and fault description.

DIAGNOSTICS
ACTIVE FAULTS
INACTIVE FAULTS
CLEAR FAULT CODES

Fault Code Table				
Displayed Fault	Code (note 1)	SID	FMI	Description
Controller	11	254	12	ECU or Central Processor Unit (CPU)
Controller	12	254	12	Cyber Card
Control Display Unit	13	9	12	Driver Display Unit
Forward Antenna	14	1	12	Antenna Assembly
Right Side Sensor	15	10	2	Right Side Sensor
Right Turn Signal	21	7	2	Right Turn Signal
Brake	23	254	2	Brake Input
Speed Monitor	24	6	2	Speedometer Input
Controller	25	254	12	Cruise Control
Controller	31	254	12	J1587 Communications
Controller	32	254	12	J1939 Communications
Controller	33	254	12	VBUS Communications
Control Display Unit	34	9	12	DDU Communications
Forward Antenna	35	1	12	Antenna Assembly Communications
	41			No Fault or End of Fault Codes

Note 1: The codes listed in this column correspond to the blink codes that can be displayed on the DDU by pressing and holding the volume control knob for five seconds. They are displayed with these same numbers in the Pro-Link. (They are not the same as the VORAD system MID, which is 219.)

Fault Codes

These codes are similar to the Error Log except for the format. Each fault will have the name of the fault, the FMI code associated with the fault and the number of occurrences (count).

FMI — Failure Mode Identifiers

FMI numbers describe the type of failure detected in the system identified by the SID. SID numbers are used to identify a section of the control system. See the following table for FMI descriptions.

Failure Mode Identifier (FMI) Descriptions			
J1587 FMI Descriptors		Pro-Link FMI Descriptors	
0	Data valid but above normal operating range (example: engine overheating)	0	High
1	Data valid but below normal operating range	1	Low
2	Data erratic, intermittent or incorrect	2	Intermittent
3	Voltage above normal or shorted high	3	Voltage high
4	Voltage below normal or shorted low	4	Voltage low
5	Current below normal or open circuit	5	Current low
6	Current above normal or grounded circuit	6	Current high
7	Mechanical system not responding properly	7	Mechanical fault
8	Abnormal frequency, pulse width or period	8	Abnormal freq, PW
9	Abnormal update rate	9	Abnormal update rate
10	Abnormal rate of change	10	Bad rate of change
11	Failure mode not identifiable	11	Can't identify FMI
12	Bad intelligent device or component	12	Bad device/comp
13	Out of calibration	13	Out of calibration
14	Special instructions	14	Special instructions

ACTIVE FAULTS

ACTIVE FAULTS displays the name of each fault, its FMI code and the count for each fault code logged.

```
LOGGED
ACTIVE FAULTS
(Name of Fault)
FMI: __, count: __
```

To view the prior active fault, press the up or down arrow keys. To view the next active fault, press the up or down arrow keys.

INACTIVE FAULTS

INACTIVE FAULTS are faults which used to be active but are no longer occurring. Inactive Faults displays the name of each inactive fault, its FMI code and the count for each inactive fault code logged.

```
LOGGED
INACTIVE FAULTS
(Name of Inactive Fault)
FMI: __, count: __
```

To view the prior active fault press the up or down arrow keys. To view the next active fault, press the up or down arrow keys.

CLEAR ALL FAULT CODES

CLEAR ALL FAULT CODES allows you to clear all fault codes stored in memory.

```
CLEAR ALL
FAULT CODES
[FUNC] NO
[ENTER] YES
```

Important: Be sure that you want to clear all fault codes before doing so.

- 1 Press FUNC key to return to DIAGNOSTIC menu.
- 2 Press ENTER key to return to the main EVT-300 menu.

Operation Numbers

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3665-03-02-03	Driver Display Unit, Replacement	28
3665-03-02-04	Antenna Assembly, Replacement	20
3665-03-02-05	Side Sensor, Replacement	27
3665-05-02-01	Antenna, Alignment	21
3665-08-02-01	Collision Warning System, Test Drive	23

VOLVO

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