

# OnGuard<sup>®</sup>, OnGuardALERT<sup>™</sup> AND OnGuardACTIVE<sup>®</sup>

## MAINTENANCE MANUAL



MM1306

**WABCO**



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You will find the current edition at: <https://zf.com/cvliterature>

## General Information

# 1 General Information

## 1.1 Symbols Used in this Document

### **DANGER**

Description of an immediate situation which will result in irreversible injury or death if the warning is ignored.

### **WARNING**

Description of a possible situation which may result in irreversible injury or death if the warning is ignored.

### **CAUTION**

Description of a possible situation which may result in irreversible injury if the warning is ignored.

### **NOTICE**

Description of a possible situation which may result in material damage if the warning is ignored.

 Important information, notices and/or tips

 Reference to information on the Internet

Descriptive text

– Action step

1. Action step 1 (in ascending order)

2. Action step 2 (in ascending order)

⇒ Result of an action

• Listing

 Indicating the use of a tool / WABCO tool

## General Information

### 1.2 How to Obtain Additional Maintenance, Service and Product Information

If you have any questions about the material covered in this publication, or for more information about the WABCO product line, please contact WABCO Customer Care Center at 855-228-3203, by email at [wabconacustomercenter@zf.com](mailto:wabconacustomercenter@zf.com), or visit our website: [www.zf.com/cv](http://www.zf.com/cv).

Refer to the Society of Automotive Engineers (SAE) website to find all current SAE documents and standards applicable to WABCO products (such as SAE J447 and SAE J908 at [www.sae.org](http://www.sae.org)).

Refer to the National Highway Traffic Safety Administration (NHTSA) website to find all current documents referenced in the manual at [www.nhtsa.gov](http://www.nhtsa.gov).

### 1.3 How to Obtain Parts and Kits

Contact the WABCO Customer Care Center at 855-228-3203 (United States and Canada); 800-953-0248 (Mexico). Email: [wabconacustomercenter@zf.com](mailto:wabconacustomercenter@zf.com).

### 1.4 WABCO TOOLBOX PLUS™ Software

TOOLBOX PLUS™ Software provides PC diagnostic for WABCO products and can be purchased and downloaded from <https://wabco.snapon.com>.

The software User Guide, MM19047 can be obtained by visiting our Literature Center.



Purchase and Download TOOLBOX PLUS™

<https://wabco.snapon.com>



ZF Commercial Vehicle Literature Center

<https://zf.com/cvliterature>

### 1.5 WABCO Academy



[www.wabco-academy.com](http://www.wabco-academy.com)

### 1.6 WABCO Online Product Catalog



[www.wabco-customercenter.com](http://www.wabco-customercenter.com)



## General Information

### 1.7 Your Direct Contact to ZF CVS

#### **ZF CV Systems North America LLC**

1220 Pacific Drive  
Auburn Hills, MI 48326

Customer Care Center: (855) 228-3203

[www.zf.com/cv](http://www.zf.com/cv)

[wabconacustomer@zf.com](mailto:wabconacustomer@zf.com)

## Safety Information

# 2 Safety Information

## 2.1 Provisions for a safe work environment

- Only experienced, trained and qualified automotive technicians may carry out work on the vehicle.
- Read this publication carefully.
- Follow all warnings, notices and instructions to avoid personal injury and property damage.
- Always abide by the vehicle's Original Equipment Manufacturer (OEM) specifications and instructions.
- Observe all accident regulations of the repair facility as well as regional and national regulations.
- The workplace should be dry, sufficiently lit and ventilated.
- Use personal protective equipment if required (safety shoes, protective goggles, respiratory protection and ear protectors).

Read and observe all Danger, Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

### **WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

### **WARNING**

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

### **WARNING**

This product can expose you to chemicals including Nickel, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information, go to [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

# The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

## 3 The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

\*The OnGuard Family refers to second-generation OnGuard and OnGuardACTIVE (Collision Mitigation Systems) and OnGuardALERT (Forward Collision Warning).

### 3.1 Driver-Related Information

#### **WARNING**

The OnGuard Collision Mitigation System (CMS) and Forward Collision Warning (FCW) System are driver aids only. They are designed to assist the vehicle operator in maintaining a safe following distance and, if needed, provide limited initial braking to reduce the severity of a possible collision. It is not an auto-pilot system for operating the vehicle.

The OnGuard CMS and FCW are no substitute for the most important factor in vehicle safety, which is a safe, conscientious driver. Use of OnGuard CMS and FCW cannot compensate for a driver that is distracted, inattentive or impaired by fatigue, drugs or alcohol.

As always, it is the driver's responsibility to:

- Use safe driving techniques
- Exercise proper judgment for the traffic, road and weather conditions
- Maintain a safe distance between vehicles
- Apply the brakes when needed to maintain control of the vehicle

Whether OnGuard CMS or FCW are in use or not, the driver is responsible for the vehicle's speed, distance between other vehicles and braking the vehicle, if necessary, to avoid a collision. Never wait for an OnGuard CMS or FCW warning before applying the brakes. Failure to do so can result in serious personal injury or death, and/or severe property damage.

#### **WARNING**

The driver is responsible for understanding the operation and limitations of the OnGuard CMS or FCW before operating the vehicle. Failure to do so can result in serious personal injury or death, and/or severe property damage.

#### **WARNING**

OnGuard Family is designed to create high vehicle deceleration (*without driver intervention*) in certain situations. To reduce the risk of injuries caused during OnGuard®-activated vehicle deceleration, all vehicle occupants should be correctly seated and properly belted or restrained during vehicle operation. All loose items should be secured so that they will not fly forward and cause injury during a deceleration event. The use of OnGuard Family in vehicles not equipped with seat belts may expose non-belted passengers to injuries due to system initiated sudden vehicle deceleration, despite vehicle compliance with applicable safety standards.

# The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

## 3.2 Environment-Related Information

### **WARNING**

The driver should consider the benefit/risk of using OnGuard CMS or FCW under the following conditions.

- Weather such as rain, sleet, snow, ice, heavy fog, as well as smoke or dust. These conditions can make roads slippery which can cause a spinout, or block or limit the radar's distance sensing ability.
- Construction zones, off road, dirt roads or muddy roads with loose surface. These conditions can cause the wheels to lose traction and limit OnGuard's ability to provide appropriate warning and adequate braking. Curvy or winding roads, roads with sharp turns.
- Curvy roads can make it difficult for the OnGuard CMS or FCW radar to track vehicles in its path. While in a sharp turn or if the preceding vehicle is in a sharp turn, OnGuard may no longer track a vehicle in front of you. Your vehicle could then unexpectedly accelerate to the previously selected speed.
- Heavy or complicated traffic, entry and exit ramps, downhill, cross traffic and intersections. OnGuard CMS and FCW are not capable of taking into account these complex traffic situations and respond to each scenario. It cannot track traffic and objects traveling perpendicular to its path.

Driving in these conditions with OnGuard CMS or FCW active can produce false warnings, unexpected braking or no response at all. Serious personal injury or death, and/or severe property damage can result.

### **WARNING**

The OnGuard Family is designed to monitor only the distance between your vehicle and the vehicle moving in the same direction directly ahead of it. It may not identify a vehicle moving TOWARDS it or stationary objects in the road, such as a vehicle that is stopped in traffic or disabled. As such, the OnGuard Family will not provide engine torque control or braking. The driver must always be aware of the objects in front of his vehicle and be ready to apply the brakes, if required. Failure to apply the brakes when needed can result in an accident.

OnGuard Family is designed to detect and track common size automobiles and trucks with metal surfaces. It is not designed to detect smaller objects such as pedestrians, narrow vehicles, motorcycles, mopeds, bicycles, or similar sized items. It also cannot detect vehicles of unusual shape or with limited metal surfaces, such as recreational vehicles, horse-drawn buggies, or logging trailers. The OnGuard Family may provide little or no warning of these objects in the vehicle's path. It is the driver's responsibility to be aware of these objects and apply the brakes as necessary to avoid an accident.

It is always the driver's responsibility to apply the brakes, if needed, to avoid an accident. Never wait for an OnGuard Family warning before applying the brakes. Failure to apply the brakes when needed can result in serious personal injury, or death, and/or severe property damage.

# The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

## 3.3 System-Function Information

### **WARNING**

Once the driver applies the brake, the OnGuard CMS or FCW will be disabled and no longer provide braking intervention. It is the driver's responsibility to maintain a safe speed and distance from other vehicles and brake as necessary to maintain vehicle control. Failure to apply the brakes when necessary can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

OnGuard Family is designed to create high vehicle deceleration (without driver intervention) in certain situations. To reduce the risk of injuries caused during OnGuard Family-activated vehicle deceleration, all vehicle occupants should be correctly seated and properly belted or restrained during vehicle operation. All loose items should be secured so that they will not fly forward and cause injury during a deceleration event. The use of OnGuard Family in vehicles not equipped with seat belts may expose non-belted passengers to injuries due to system initiated sudden vehicle deceleration, despite vehicle compliance with applicable safety standards.

### **WARNING**

The driver is responsible for selecting a safe and legal speed setting that is appropriate for the traffic, road surface and weather conditions. Adjust the speed setting as necessary when driving in reduced visibility or potentially slick conditions. Driving with the OnGuard CMS or FCW at a speed that is inappropriate for following a vehicle safely can lead to an accident. Serious personal injury or death, and/or severe property damage can result.

### **WARNING**

While the OnGuard CMS or FCW are in System/Radar Alignment mode, the system will not track vehicles or operate. Make sure that the Service Alignment procedure is completed before releasing the vehicle from service. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

If a potential collision is developing and the driver does not take action to decelerate the vehicle, the OnGuard CMS or FCW sounds an alert, automatically de-throttles the engine, and sends a message to the ABS ECU requesting foundation brake application to provide up to 0.35g or up to 0.6g (depending on software version) of braking power. (For information about the ABS system, refer to the latest ABS maintenance manual available from the ZF Commercial Vehicle Literature Center at <https://zf.com/cvliterature>.) The driver must still apply the brakes to provide additional braking force to help avoid an accident. Failure to apply the brakes when necessary can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

Do not allow the installation of bumpers, cattle guards or other such items in front of the radar area. If the radar is blocked, the OnGuard CMS or FCW will have limited or no functionality, which can lead to an accident. Serious personal injury or death, and/or severe property damage can result.

## The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

### **WARNING**

Depending on the software version, OnGuard CMS or FCW automatically becomes active once the vehicle reaches a speed of 15 mph (24 kph) or 9 mph (15 kph). It does not provide warning and braking functionality below 15 mph (24 kph) or 9 mph (15 kph) depending on software version. It is the driver's responsibility, at all times, to use safe driving techniques, be alert, maintain a proper distance between vehicles and brake the vehicle, if needed, to avoid a collision. Never wait for OnGuard CMS or FCW to provide a warning or braking before applying the brakes. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

OnGuard CMS or FCW may initiate forward collision warnings or in seldom cases unwanted or inappropriate acceleration or deceleration. In such cases, the driver has to either deactivate or override the system as necessary to maintain proper vehicle control. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

If the driver accelerates to a faster speed than the one set to overtake a vehicle, OnGuard CMS or FCW will return to the last stored speed once the driver removes his/her foot from the accelerator pedal. The driver must be aware of the last stored speed to make sure that the vehicle can remain in control or deactivate the system. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

OnGuard CMS or FCW may take a few moments to adjust to the selected speed. Adjust the speed as necessary to accommodate the current road, traffic and weather conditions. Use care to avoid dramatic acceleration or deceleration of the vehicle which can lead to a loss of control. Serious personal injury or death, and/or severe property damage can result.

### **WARNING**

Using the "Resume" option will return the vehicle to the last stored set speed. It is the driver's responsibility to be aware of what the last stored speed is and ensure it is safe and legal for the current road, traffic and weather conditions. Failure to do so can result in serious personal injury or death, and/or severe property damage.

## 3.4 System Functions and Miscellaneous Information

### **WARNING**

Always keep the path of the radar clear of obstructions. Snowy and muddy conditions can cause the radar to become blocked or debris to get between the fascia and radar. Always remove snow, mud or other debris from the front of the fascia and between the fascia and radar immediately to ensure proper radar operation. Do not allow the installation of bumpers, shields, deflectors, guards or other such items in front of the radar area. Do not allow items to block the radar or the OnGuard CMS or FCW will have limited or no functionality, which can lead to an accident. Serious personal injury or death, and/or severe property damage can result.

# The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

## **WARNING**

The OnGuard CMS or FCW requires time to recognize an object or potential obstacle. An object moving at a speed of approximately 20 mph or more may not be recognized in enough time to produce a warning or brake the vehicle. Never wait for the OnGuard CMS or FCW to intervene when a potentially hazardous situation arises. The driver must always monitor traffic and apply the brakes, if needed, to avoid a crash. Failure to do so can result in serious personal injury or death, and/or severe property damage.

## 3.5 System Malfunction Information

### **WARNING**

Do not allow the fascia to become blocked by any foreign matter (dirt, snow, ice, stickers etc.), otherwise a system fault will occur and the OnGuard CMS or FCW will be disabled. If the system becomes disabled, immediately inspect the OnGuard CMS or FCW fascia for a blockage and correct it as necessary. Whether or not the radar is working correctly, it is the driver's responsibility to apply the brakes when necessary to maintain vehicle control. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

If the OnGuard CMS or FCW is not correctly tracking vehicles that are in your lane or is tracking vehicles that are not in your lane, this may be due to radar operational issues. Typically, these are radar operational issues that can result from the following problems:

- Debris (dirt, snow, ice) on the radar fascia or between the fascia and the radar sensor. This must be removed.
- A loose radar sensor or one that is not tightly secured on the mounting bracket.
- The radar sensor may be too close to or actually contacting the bumper as mounted. There should be at least 1/4 inch of clearance between the fascia, radar sensor or bracket and the bumper.
- Radar interference from other radar sources or strong radar reflections.

If OnGuard CMS or FCW is not functioning correctly or as expected, immediately have the OnGuard CMS or FCW inspected to correct the issue. Whether or not the radar is working correctly, it is the driver's responsibility to apply the brakes when necessary to maintain vehicle control. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

When active Diagnostic Trouble Codes (DTCs) are present, the OnGuard CMS or FCW may be partially or fully disabled depending on whether the DTC(s) is associated with the Adaptive Cruise Control (ACC) functions or the CMS or FCW functions. If OnGuard CMS or FCW is not functioning correctly or as expected, have the OnGuard CMS or FCW inspected immediately to correct the issue. Whether or not the radar is working correctly, it is the driver's responsibility to apply the brakes when necessary to maintain vehicle control. Failure to do so can result in serious personal injury or death, and/or severe property damage.

## The OnGuard Family\*: Warnings, Cautions and Operating Guidelines

### **WARNING**

If the OnGuard CMS or FCW are not correctly tracking vehicles that are in your lane or is tracking vehicles that are not in your lane, the radar may not be aligned correctly. If this occurs, immediately have the OnGuard CMS or FCW radar inspected and corrected as needed. Refer to the Radar Sensor Service Alignment procedure. Whether or not the radar is working correctly, it is the driver's responsibility to be aware of vehicles in front of the driver's vehicle and apply the brakes when necessary to maintain vehicle control. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

If OnGuard CMS or FCW are not providing alerts as expected, immediately have the OnGuard CMS or FCW inspected to correct the issue. Whether or not the radar is working correctly, it is the driver's responsibility to apply the brakes when necessary to maintain vehicle control. Failure to do so can result in serious personal injury or death, and/or severe property damage.

### **WARNING**

In order to reduce the potential danger of injuries caused during OnGuard activated vehicle decelerations, the driver and front passenger must always be correctly seated and with seat belts correctly fastened when operating the vehicle. Additionally, the driver should secure all loose items in the cab so that they will not fly forward during a full brake application.

## Introduction

# 4 Introduction

## 4.1 Overview

### 4.1.1 The OnGuard® Family

OnGuard and OnGuardACTIVE are Collision Mitigation Systems (jointly referred herein as “CMS”) that offer Following Distance Alert (FDA) and Adaptive Cruise Control (ACC) with active braking, if equipped. These systems are currently available for pneumatically braked vehicles.

OnGuardALERT is a Forward Collision Warning (referred herein as “FCW”) System that is a radar-based active safety system that offers Following Distance Alert (FDA), Forward Collision Warning and Braking Integration. This system is currently available on SmarTrac® Hydraulic-equipped vehicles.

Second generation radar OnGuard	Collision Mitigation System (CMS) that provides warning and braking on moving and stopped objects and provides warning only on stationary objects.	Available on pneumatically-braked vehicles.
OnGuardACTIVE	Collision Mitigation System (CMS) that provides warning and braking on moving, stopped and stationary objects.	Available on pneumatically-braked vehicles.
OnGuardALERT	Forward Collision Warning (FCW) system that provides warning and braking integration* on moving, stopped and stationary objects.	Available on SmarTrac® Hydraulic-equipped vehicles.

\*Braking Integration: the OnGuardAlert system provides some braking assistance with a reduced braking performance as compared to OnGuard and OnGuardACTIVE collision mitigation systems.

For Frequently Asked Questions (FAQs) and more information about OnGuard, OnGuardALERT and OnGuardACTIVE, refer to the following:

- FAQ publication, SP14119
- OnGuard Driver's Tips, TP1320
- OnGuardACTIVE Driver's Tips, SP1658
- OnGuardALERT Driver's Tips, SP19121
- Driver's Training DVD, T1399

## 4.2 How the OnGuard Family Works

The OnGuard Family systems detect objects ahead and measures the vehicle's position and speed in relation to others on the road to warn the driver of a possible rear-end collision by providing audible, visual and haptic warnings.

When appropriate, CMS will apply the brakes to help mitigate a rear-end collision. When appropriate, FCW reduces engine torque and provides some brake assistance through its integration. The system monitors the road and provides warnings and active braking even when cruise control is or is not set. The system also warns on stationary objects, such as cars, to alert the driver of potential obstructions in their lane.

The CMS or FCW is not intended to replace driver control of the vehicle at any time. You, as the driver, remain in control of your vehicle and ultimately determine the actions that are necessary for safe operation.

# Introduction

## 4.2.1 CMS

### **WARNING**

OnGuard® is designed to create high vehicle deceleration (without driver intervention) in certain situations. To reduce the risk of injuries caused during OnGuard®-activated vehicle deceleration, all vehicle occupants should be correctly seated and properly belted or restrained during vehicle operation. All loose items should be secured so that they will not fly forward and cause injury during a deceleration event. The use of OnGuard® in vehicles not equipped with seat belts may expose non-belted passengers to injuries due to system initiated sudden vehicle deceleration, despite vehicle compliance with applicable safety standards.

The OnGuard Family assists the driver in recognizing and responding to potentially dangerous driving scenarios that could lead to a rear end collision. The system responds by sending warnings, automatically reducing engine torque and applying foundation brakes.

The CMS and FCW will both provide visual and audible alerts through an in-cab dash display when the vehicle's following interval could result in a rear-end collision. If a potential rear-end collision is developing and the driver does not take action to decelerate the vehicle, the CMS or FCW active braking feature issues a haptic warning (short brake pulse) and automatically de-throttles the engine.

If a potential rear-end collision still exists, and the driver has not taken the appropriate action, the CMS will request application of the foundation brakes to provide up to 50% or full braking depending on software version. The FCW will provide some brake assistance with its integration. When the CMS or FCW requests application of the vehicle's brakes, the brake lights will come on.

The active braking application is intended to assist the driver to avoid or reduce the severity of a collision. The driver must take the appropriate corrective action in response to the collision warning. OnGuard Family warnings will not be issued below a vehicle speed of 15 mph or 9 mph depending on software version.

## 4.2.2 FDA

FDA will generate an audible and visible alert when the vehicle's following distance may result in a collision. FDA provides only a warning and will not control vehicle speed unless ACC is engaged, or a collision mitigation event is detected. The FDA is enabled automatically above a certain host vehicle speed threshold dependent upon software level. It will start monitoring the following distance then. It automatically becomes disabled if the host vehicle speeds fall below the disabling speed threshold.

## 4.2.3 ACC (If Equipped)

ACC adjusts the speed of your vehicle while in cruise control and attempts to maintain a set following interval defaulted at 3.6 seconds when there is a vehicle ahead driving at a lower speed than your vehicle.

ACC works in conjunction with conventional cruise control to maintain the set cruise speed when the lane ahead is clear and will automatically adjust the vehicle's speed to maintain the set following interval when a vehicle ahead is detected. The CMS or FCW achieves the set following interval by controlling engine torque, engine and foundation brakes without driver intervention.



Cruise control is the standard OEM system that maintains a vehicle speed set by the driver. If your vehicle does not have cruise control, ACC functionality does not apply.

## Introduction

### 4.2.4 In-Cab Dash Display

The in-cab dash display has five different screen background colors.

**Blue:** General operating mode with no target vehicle detected

**Green:** Target vehicle detected ahead

**Yellow:** Following distance alert, System capability warning

**Red:** Collision warning, Stationary object warning

**Amber:** Diagnostic Trouble Code (DTC) screen

## 4.3 Operating Modes

### 4.3.1 Adaptive Cruise Control Not Set

If equipped, the vehicle operates as usual when the ACC speed is not set. The system will still emit audible and visual warnings when it detects a possible rear-end collision. The OnGuard CMS is active above 9 or 15 mph, depending on software version, and will request brake application if deemed necessary. The OnGuardACTIVE or OnGuardALERT are active from 9 or 15mph and up to-77 mph, depending on software version, and will request brake application if deemed necessary.

Once the vehicle is traveling faster than 15 mph or 9 mph depending on software version, the following screens will be displayed.



### 4.3.2 Adaptive Cruise Control Set

When the ACC speed is set, the set cruise speed appears on the display. When a slower vehicle is detected in front of the vehicle, ACC will attempt to reduce the speed to the speed of the lead vehicle. This speed adjustment may momentarily drop lower than the lead vehicle in order to maintain a 3.6 seconds following interval between the vehicle and the vehicle ahead when appropriate. While ACC is on, the display will emit visual and audible collision warnings, and the system will control throttle and apply engine and service brakes if needed while attempting to maintain a set following interval.

## Introduction



### 4.3.3 Following Distance Alert: Adaptive Cruise Control Not Set

The Following-Distance Alert will provide an audible alert and the in-cab dash display screen will turn yellow if the vehicle is following another vehicle too closely at a 1.5 seconds following interval (tailgating). This alert will end when the following distance is increased to a safe level or if the speed drops below the lead vehicle speed.



### 4.3.4 Following Distance Alert: Adaptive Cruise Control Set

When the vehicle is in cruise control mode, the Following-Distance Alert will provide an audible alert and the in-cab dash display screen will turn yellow if the driver uses the accelerator pedal to override the ACC and approaches a vehicle too closely. The OnGuard Following-Distance Alert will not provide warnings when the vehicle speed is below 15 mph. The OnGuardACTIVE Following-Distance Alert will not provide warnings when the vehicle speed is below 15 mph or over 77 mph.



## Introduction

### 4.3.5 Collision Warning and Mitigation or Forward Collision Warning

When an unforeseen event occurs, such as another vehicle enters the vehicle's lane traveling slower than the vehicle, or the gap between the vehicles becomes too close, the CMS or FCW will provide an audible alert and the display will turn red with a collision warning symbol. If the system determines that a rear-end collision is imminent, it will automatically apply the brakes to reduce the vehicle's speed. The driver may also feel a haptic warning (short brake pulse) to warn of collision danger. The driver must also take the appropriate corrective action to avoid dangerous driving situations.

The OnGuard Family will not be active when the vehicle's speed is below 15 mph or 9 mph depending on software version. If the OnGuard Family detects a stationary object in the vehicle's lane (such as a disabled car) it will provide an audible alert and the display will turn red showing a stationary object symbol. **The OnGuard CMS will not apply the brakes or reduce the vehicle's speed when it detects a stationary object.**

The OnGuard Family will not be active when the vehicle's speed is below 15 mph or 9 mph or over 77 mph, depending on software version. If the OnGuard Family detects a stationary object (such as a disabled car) it will provide an audible alert, followed by a haptic warning and then a brake application to reduce the vehicle's speed.



## 4.4 System Limitations

The CMS and FCW only brake for objects located directly in front of your vehicle. The OnGuard Family will not be active when the vehicle's speed is below 15 mph or 9 mph or over 77 mph depending on software version. OnGuard will alert but not actively brake on stationary objects. Accordingly, the OnGuard Family systems:

- Will not react and alert the driver to objects crossing in front of the vehicle or oncoming traffic.
- Should not be relied on to track lead vehicles when traveling through a severe curve in the road. Because of this, ACC is not recommended for use on winding (curving) roads.
- Should not be relied upon to track smaller objects (e.g. motorcycles, mopeds, bicycles, pedestrians, etc.).
- Should not be relied on to alert drivers to vehicles in an adjacent lane.
- OnGuardALERT Forward Collision Warning with Brake Integration is installed on vehicles with SmartTrac® Hydraulic Anti-Lock Braking System and has significantly reduced performance in braking capabilities as compared to OnGuardACTIVE collision mitigation system installed on vehicles with pneumatic anti-lock braking systems.

## Introduction

### 4.5 System Components

#### 4.5.1 Radar Sensor

The radar sensor is used to detect vehicles and obstacles for the OnGuard Family. It is mounted in the front of the vehicle near the center of the bumper and recessed in the bumper in most applications. The sensor has an electrical connector that provides power, ground and communication to the SAE J1939 network which is required for correct operation.

The mounting orientation is determined by the 3 hole bolt pattern of the bracket. The radar sensor generally is mounted with the connector on the driver's side of the vehicle. The sensor connector is protected by a rubber boot. This boot should fully cover the connector upon completion of the sensor installation or repair.



#### 4.5.2 Fascia

The fascia is a protective cover for the radar sensor and is assembled to the same bracket on which the radar sensor is mounted. Some vehicle manufacturer's use other fascia designs.

Only original equipment fascias supplied by ZF and the vehicle manufacturer may be used to protect the radar sensor.

The fascia should not be blocked by any foreign matter (dirt, snow, ice, stickers, etc.), otherwise a system fault will occur and the OnGuard Family will be disabled.



#### 4.5.3 Display

The OnGuard Family display provides the interface for the driver. Audible and visual warnings, as well as verification of correct system operation and faults, are communicated to the driver. The driver is able to monitor the status of lead vehicles that the OnGuard Family system are tracking. The functions of the OnGuard Family display may be integrated into a vehicle's instrument panel. If the vehicle has an integrated display, please refer to your vehicle owner's manual for correct operation.

## Introduction



### 4.5.4 SAE J1939 Network

The SAE J1939 Serial Control and Communications Heavy-Duty Vehicle Network allows various electronic controllers on the vehicle to interact efficiently and in coordination with each other. The interactions between controllers include sharing sensor data, calculated information, subsystem operating state and configuration. This communication allows subsystems to influence each other's operation.

## Diagnostics, Troubleshooting and Testing

# 5 Diagnostics, Troubleshooting and Testing

## 5.1 General Information

### 5.1.1 Radar Sensor and Display Software Levels

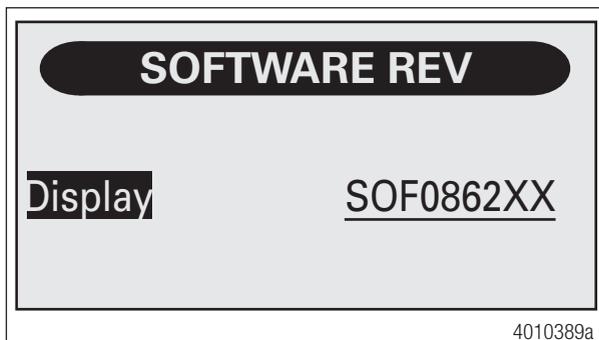
Many diagnostic and troubleshooting procedures will require knowledge of the software version of the radar sensor and display.



The radar sensor software version is determined using TOOLBOX PLUS™ Software 12.2 or higher.

The display software revision level is determined using the following display operating procedure.

1. Turn the ignition key ON and wait for the display to power up.
2. Press the “Mode” key on the display several times until the screen labeled “Software Rev” shown below appears.



Take note of the software version of each component for reference during maintenance procedures and repairs.

### 5.1.2 Error Screens and Diagnostic Trouble Codes

If the system is not operating correctly, an error screen or a screen containing Diagnostic Trouble Codes (DTCs) may be shown on the display. Only currently active DTCs are displayed.



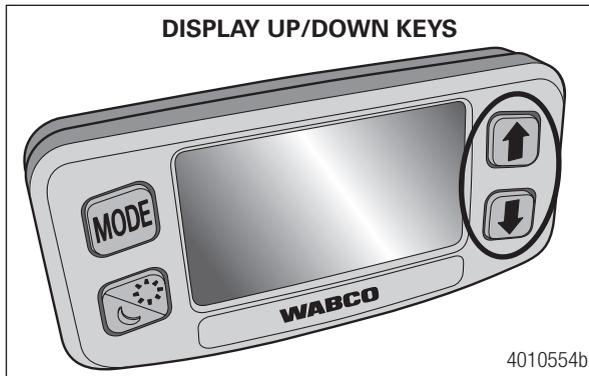
It is important to document any DTC that is displayed because stored DTCs are not displayed and are only retrievable with TOOLBOX PLUS™ Software.



When active DTCs are present, the system may be partially or fully disabled depending on whether the DTC(s) is associated with the ACC functions or the CMS functions or FCW and Brake Integration functions.

## Diagnostics, Troubleshooting and Testing

Multiple DTCs may be active simultaneously. If a DTC is shown on the display, use the UP and DOWN keys on the display to scroll through each code. Record each DTC for future reference.



DTCs may become active during service procedures on other electrical system components (e.g., engine, transmission, ABS, etc.). If there are other vehicle systems with faults, they should be repaired first. After completion of service on the other vehicle system components, cycle the ignition OFF for at least two minutes and then turn the ignition back ON. Start the engine and run it at idle speed for at least two minutes. This frequently clears the DTCs.

### 5.1.3 Required Maintenance

A service alignment is required after completion of any adjustments, repairs, replacement or maintenance affecting tires, chassis, or front body components. For information about service alignment, refer to the Radar Sensor Service Alignment Procedure in this section.



Failure to complete the required service alignment may result in driveability concerns. The system performance may be affected.

The following, although not all-inclusive, is a list of service, maintenance, and repair operations requiring a service alignment:

- Chassis parts replacement
- Steering or suspension parts replacement, adjustment, or alignment
- Tire inflation or size change, and/or tire replacement
- Front body parts replacement or adjustment

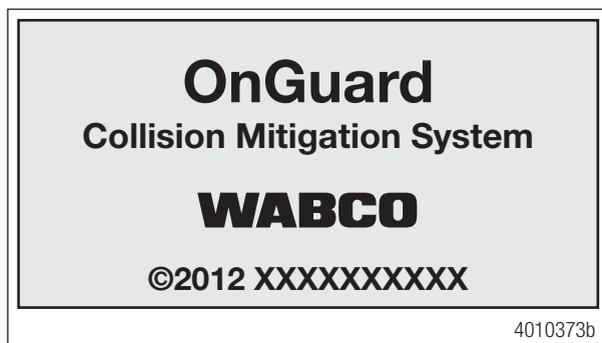


Use of non-OEM bumpers, hoods, and brush guards may result in driveability concerns and affect system performance, and in the worst case, result in DTCs or the disabling of the CMS, if equipped.

# Diagnostics, Troubleshooting and Testing

## 5.2 Troubleshooting Guide

When ignition power is switched on, a screen similar to the one shown below, will be displayed for several seconds.



If the display does not light up when the ignition is on, check the power and ground connections. This can be caused by problems in the electrical harness or a faulty display. Refer to Display Harness Electrical Checks in the Electrical System and Harness Troubleshooting Section.

If the display lights up but is hard to read, adjust the brightness and contrast settings.

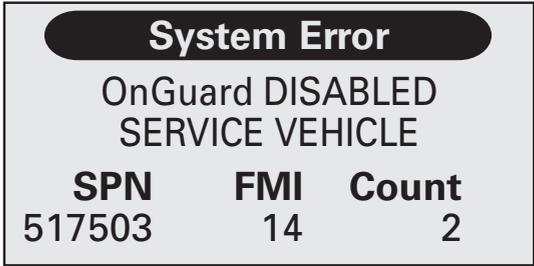
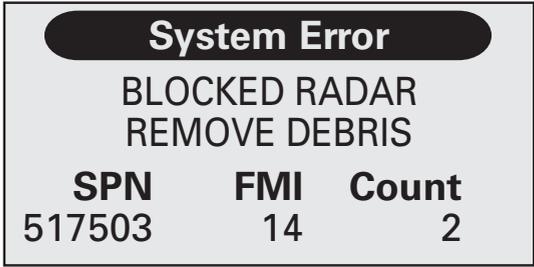
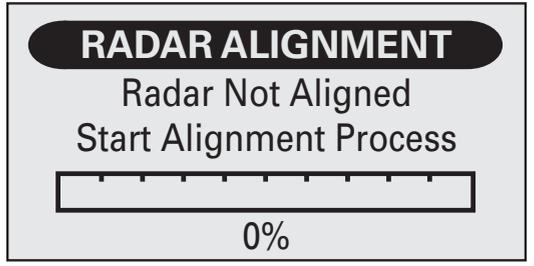
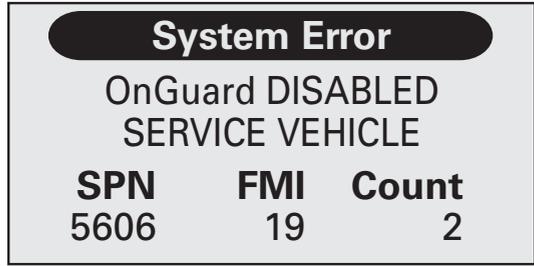
If the display shows an amber error screen, use the following Error/System Failure Screen Repair Table to determine the correct repair action.



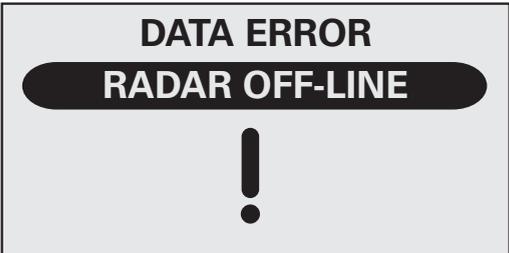
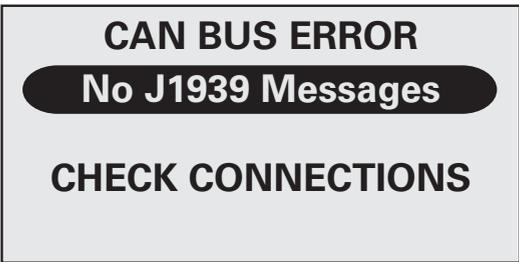
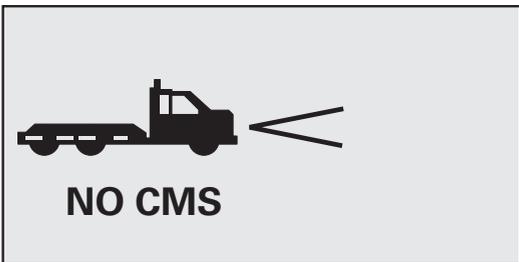
The system is sensitive to faults in other vehicle systems and will set a DTC as a reaction. As such, it is recommended that all faults in any other vehicle ECUs are diagnosed and repaired prior to diagnosing OnGuard and OnGuardACTIVE DTCs.

# Diagnostics, Troubleshooting and Testing

Table A: System Error Screen Repair Action

Display Message	Repair Action	Troubleshooting Section
 <p>4010632a</p>	Remove snow, mud, etc. from fascia or between radar and fascia	Blocked
 <p>4010633a</p>		
 <p>4010385a</p>	Radar not aligned. Perform Radar Sensor Service Alignment using TOOLBOX PLUS™ Software. Ignition cycle may be required to clear the fault and restore system function.	Radar Sensor Alignment
 <p>4011863a</p>	Diagnose with TOOLBOX PLUS™ Software and Diagnostic Trouble Code Table to determine system error.	TOOLBOX PLUS™ Software and Diagnostic Trouble Code Table
 <p>4010406a</p>	Diagnose with TOOLBOX PLUS™ Software and Diagnostic Trouble Code Table to determine reason for disabled CMS.	TOOLBOX PLUS™ Software and Diagnostic Trouble Code Table

## Diagnostics, Troubleshooting and Testing

Display Message	Repair Action	Troubleshooting Section
 <p>4010390a</p>	<p>Communication between the radar and display is interrupted. Troubleshoot harnesses between radar and display. Diagnose J1939 wiring harness, power and ground.</p>	<p>Display Harness Electrical Checks and Radar Harness Electrical Checks</p>
 <p>4010391a</p>	<p>Diagnose J1939 wiring harness.</p>	<p>Electrical System and Harness Troubleshooting</p>
 <p>4011864a</p>	<p>“NO ACC” indicates that ACC is not available due to an error. CMS is still active. Cruise control is disabled.</p> <p>Diagnose with TOOLBOX PLUS™ Software and Diagnostic Trouble Code Table to determine reason for disabled ACC.</p>	<p>TOOLBOX PLUS™ Software and Diagnostic Trouble Code Table</p>

OnGuard and OnGuardACTIVE DTCs may be generated and displayed during service procedures on other electrical system components (i.e., engine, transmission, ABS, etc.). If the display screen turns amber with error screens or DTCs visible after the vehicle has been serviced for other vehicle system issues, cycle the ignition OFF for at least two minutes, turn the ignition back ON, start the engine and run at idle speed for one minute. OnGuard and OnGuardACTIVE DTCs caused by other systems that have been repaired should be cleared. If active DTCs remain, continue troubleshooting.

If the radar is not correctly tracking vehicles that are in your lane or is tracking vehicles that are not in your lane, this may be due to radar operational issues.

Typically these are radar operational issues that can result from the following problems:

- Debris (dirt, snow, ice) on the radar fascia or between the fascia and the radar sensor. This must be removed.
- The radar sensor may be loose or not tightly secured on the mounting bracket.
- The radar sensor may be too close to or actually contacting the bumper as mounted, which will affect the radar signal. There should be at least 1/4 inch of clearance between the fascia, radar sensor or bracket and the bumper. Contact your vehicle manufacturer representative on adjustments to the bumper for radar sensor clearance.
- The radar may not be aligned correctly. Refer to the Radar Sensor Service Alignment procedure.

## Diagnostics, Troubleshooting and Testing

If the vehicle's standard cruise control is working and the OnGuard or OnGuardACTIVE ACC is not working, consult your dealer or engine supplier. This can occur if the engine controller has been re-programmed or the engine parameter that activates ACC has been turned off. Consult with your dealer or engine supplier for engine software and parameter adjustments.

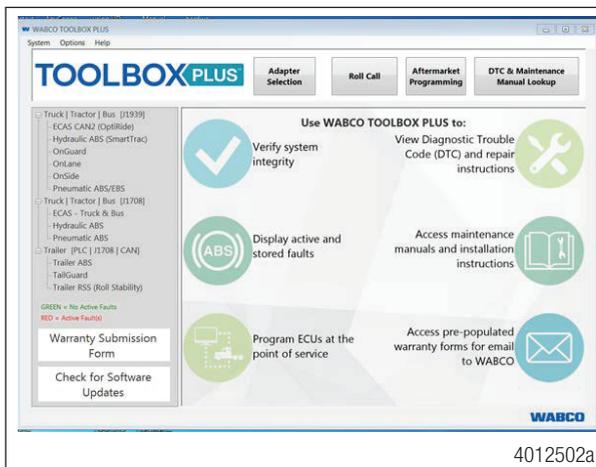
### 5.3 TOOLBOX PLUS™ Software

**i** To download TOOLBOX PLUS™ Software, visit <https://wabco.snapon.com/>.

To access the WABCO TOOLBOX PLUS™ Software from the desktop screen, double-click on the WABCO TOOLBOX™ icon.



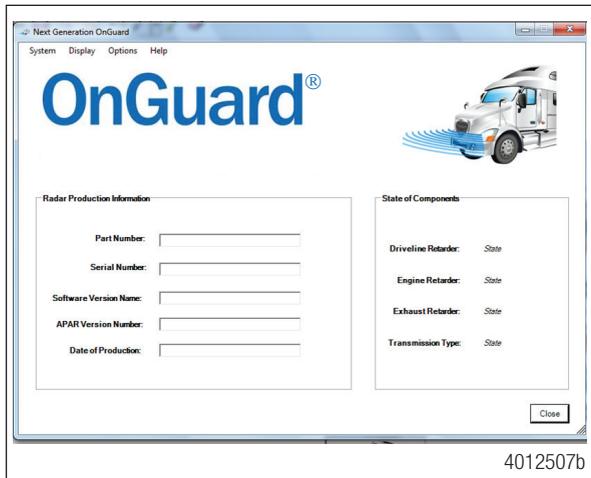
From the message box that appears, click on the OnGuard Radar Diagnostics button. For TOOLBOX PLUS™, select OnGuard from the left menu.



**i** OnGuard and OnGuardACTIVE will only communicate on J1939. Verify that the correct device and protocol are selected under “Adapter selection” in “Utilities” or by clicking the Adapter Button on TOOLBOX PLUS Main Screen. If the protocol was changed, you will need to cycle the key.

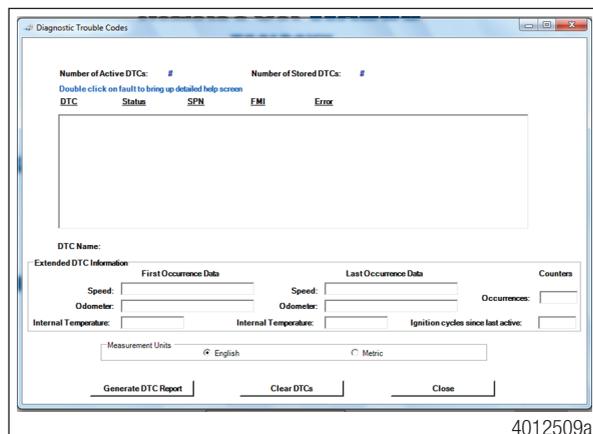
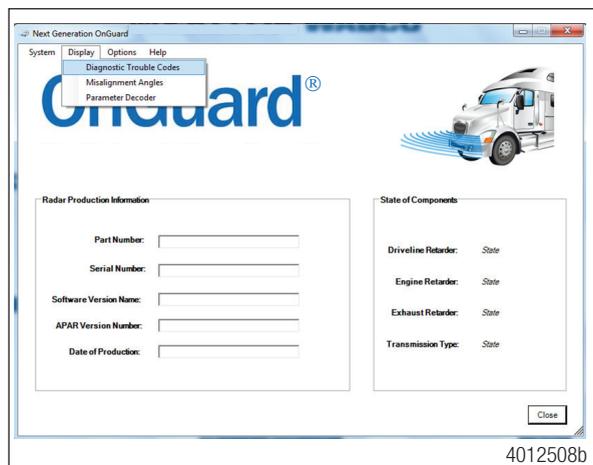
# Diagnostics, Troubleshooting and Testing

This will display the radar sensor part number and radar software version, as well as other important information.



## Retrieving DTCs:

1. To display radar sensor DTCs, select the "Display" option from the menu.
2. From the pull-down menu, select "Diagnostic Trouble Codes". A description of the DTC, the number of times the DTC occurred, the suspect parameter number (SPN) and the failure mode identifier (FMI) are all displayed in the Diagnostic Trouble Codes window.



## Diagnostics, Troubleshooting and Testing

- When you click on one of the DTCs in the window, the “Extended DTC Information” will populate below.

The following data is shown for the First and Last Occurrence of the DTC:

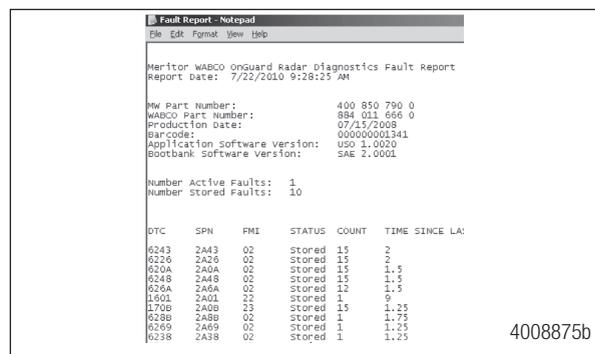
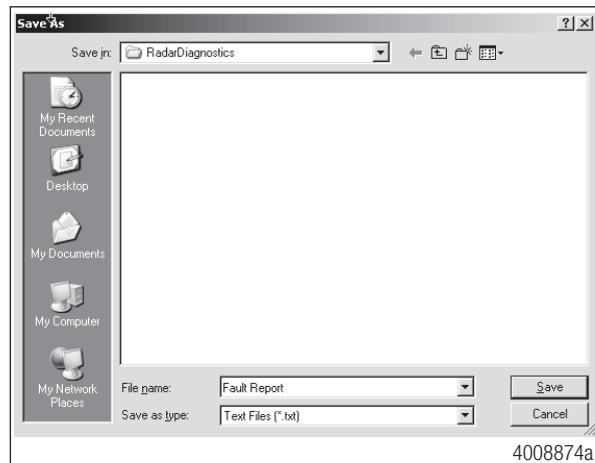
- Vehicle speed
- Odometer reading
- Radar internal temperature

Under “Counters”, you will find the following data:

- Number of times the DTC was reported
- Number of ignition cycles since the last time the code was active

After making the necessary repairs, use the “Clear DTCs” to reset the radar.

- A DTC report can also be generated by selecting the “Generate DTC Report” button, while in the “Diagnostic Trouble Codes” screen. A “Save As” screen will then come up asking you to name the file and select where it will be saved. The “DTC Report” includes the extended DTC information.

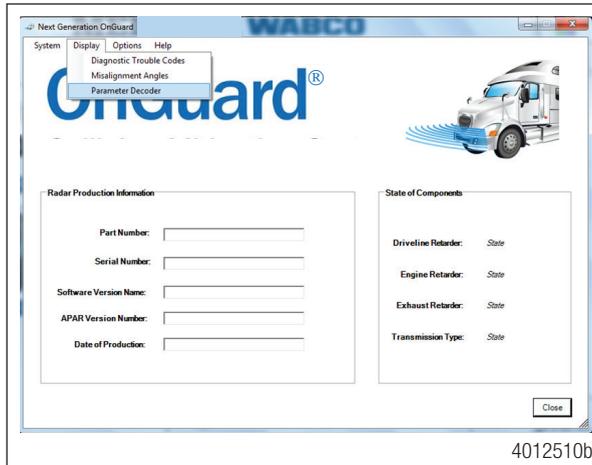


DTCs can be cleared after generating a fault report. Only stored DTCs will clear.

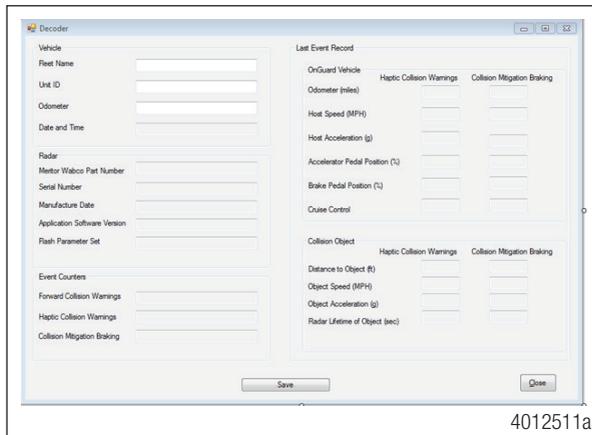
# Diagnostics, Troubleshooting and Testing

## Displaying Parameter Decoder Information:

1. To display Parameter Decoder information, select the “Display” option from the menu.
2. From the pull-down menu, select “Parameter Decoder”.



3. Critical event information from the radar will be displayed on screen.



## Diagnostics, Troubleshooting and Testing

### 5.4 OnGuard and OnGuardACTIVE Radar Diagnostic Trouble Code Table

The following table provides repair instructions and the corresponding Troubleshooting Sections in this manual for SPN/FMI DTCs that are readable using TOOLBOX PLUS™ Software. If the display shows a code not listed in the table, contact the WABCO Customer Care Center at 855-228-3203 for assistance.

**Table B: Diagnostic Trouble Code Table**

SPN	FMI	Cause/Description	Action/Repair Instructions
70	19	Incorrect J1939 Parking Brake Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>Verify operation of the Parking Brake Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>Verify the correct radar part number is installed on the vehicle.</li> </ul>
84	19	Incorrect J1939 Wheel-Based Vehicle Speed data received in CCVS1 message (usually from engine ECM)	<ul style="list-style-type: none"> <li>Verify the correct radar part number is installed on the vehicle.</li> <li>Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
86	19	Incorrect J1939 Cruise Control Set Speed data received in CCVS1 message (usually from engine ECM)	<ul style="list-style-type: none"> <li>Verify the correct radar part number is installed on the vehicle.</li> <li>Cycle the ignition to clear DTCs after engine servicing.</li> <li>Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
91	19	Incorrect J1939 Accelerator Pedal Position 1 data received in EEC2 message (usually from engine ECM, also possible in body, cab or chassis controller)	<ul style="list-style-type: none"> <li>Verify the Accelerator Pedal is operating correctly and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>Verify the correct radar part number is used on the vehicle.</li> </ul>
188	9	J1939 Engine Configuration 1 (EC1) message not received or intermittent	<ul style="list-style-type: none"> <li>Cycle the ignition to clear DTCs after engine servicing.</li> <li>Verify engine ECM is functional and has correct software and parameters.</li> </ul>
188	19	Incorrect J1939 Engine Speed At Idle data received in EC1 message from engine	<ul style="list-style-type: none"> <li>Cycle the ignition to clear DTCs after engine servicing.</li> <li>Verify engine ECM is functional and has correct software and parameters.</li> </ul>
190	19	Incorrect J1939 Engine Speed data received in EEC1 message from engine	<ul style="list-style-type: none"> <li>Cycle the ignition to clear DTCs after engine servicing.</li> <li>Verify engine ECM is functional and has correct software and parameters.</li> </ul>
191	19	Incorrect J1939 Transmission Output Shaft Speed data received in ETC1 message from transmission	<ul style="list-style-type: none"> <li>Verify the correct radar part number is installed on the vehicle.</li> <li>Cycle the ignition to clear DTCs after transmission servicing.</li> <li>Verify the transmission ECU is functional and has correct software and parameters.</li> </ul>
512	19	Incorrect J1939 Driver's Demand Engine - Percent Torque data received in EEC1 message from engine	<ul style="list-style-type: none"> <li>Cycle the ignition to clear DTCs after engine servicing.</li> <li>Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
513	9	J1939 Electronic Engine Controller 1 (EEC1) message not received or intermittent	<ul style="list-style-type: none"> <li>Cycle the ignition to clear DTCs after engine servicing.</li> <li>Verify the engine ECM is functional and has correct software and parameters.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
513	19	Incorrect J1939 Actual Engine - Percent Torque data received in EEC1 message from engine	<ul style="list-style-type: none"> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
520	9	J1939 Electronic Retarder Controller 1 (ERC1) message not received or intermittent	<ul style="list-style-type: none"> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
520	19	Incorrect J1939 Actual Retarder - Percentage Torque data received in ERC1 message from engine retarder	<ul style="list-style-type: none"> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
521	19	Incorrect J1939 Brake Pedal Position data received in EBC1 message from ABS	<ul style="list-style-type: none"> <li>■ Use WABCO TOOLBOX PLUS™ Software PC Diagnostics to test the ABS Brake Pedal Pressure Sensor.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify the correct ABS ECU part number is used on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after ABS servicing.</li> </ul>
523	9	J1939 Electronic Transmission Controller 2 (ETC2) message not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after transmission servicing.</li> <li>■ Verify transmission ECU is functional and has correct software and parameters.</li> </ul>
523	19	Incorrect J1939 Transmission Current Gear data received in ETC2 message from transmission	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after transmission servicing.</li> <li>■ Verify transmission ECU is functional and has correct software and 527 parameters.</li> </ul>
527	9	J1939 Cruise Control/Vehicle Speed 1 (CCVS1) message from the primary source (usually the engine) not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify engine ECU is functional and has correct software and parameters.</li> </ul>
527	19	Incorrect J1939 Cruise Control States data received in CCVS1 message (usually from engine, also possible from body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM (or body, cab or chassis controller) is functional and has correct software and parameters.</li> </ul>
544	19	Incorrect J1939 Engine Reference Torque data in EC1 message received from engine	<ul style="list-style-type: none"> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM is functional and has correct software and parameters.</li> </ul>
559	9	J1939 Electronic Engine Controller 2 (EEC2) message not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify engine ECU is functional and has correct software and parameters.</li> </ul>
560	9	J1939 Electronic Transmission Controller 1 (ETC1) message not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after transmission servicing.</li> <li>■ Verify transmission ECU is functional and has correct software and parameters.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
560	19	Incorrect J1939 Transmission Driveline Engaged data received in ETC1 message from transmission	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle. Cycle the ignition to clear DTCs after transmission servicing.</li> <li>■ Verify transmission ECU is functional and has correct software and parameters.</li> </ul>
563	19	Incorrect J1939 Anti-Lock Braking Active data received in EBC1 message from ABS	<ul style="list-style-type: none"> <li>■ Verify the correct ABS ECU part number is used on this vehicle.</li> <li>■ Cycle the ignition to clear the DTCs after ABS servicing.</li> </ul>
574	19	Incorrect J1939 Transmission Shift In Process data received in ETC1 message from transmission	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after transmission servicing.</li> <li>■ Verify the transmission ECU is functional and has correct software and parameters.</li> </ul>
596	19	Incorrect J1939 Cruise Control Enable Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify operation of the Cruise Control Enable Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> </ul>
597	19	Incorrect J1939 Brake Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify operation of the Brake Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> </ul>
598	19	Incorrect J1939 Clutch Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify operation of the Clutch Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> </ul>
599	19	Incorrect J1939 Cruise Control Set Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify operation of the Cruise Control Set Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> </ul>
601	19	Incorrect J1939 Cruise Control Resume Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify operation of the Cruise Control Resume Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> </ul>
770	19	Bootloader error usually caused when there is an issue during a radar software update	<ul style="list-style-type: none"> <li>■ Run the software update again.</li> <li>■ Is usually seen in TOOLBOX PLUS™ Software with SPN 197120 FMI 31 on the display.</li> </ul>
904	9	J1939-Wheel Speed Information (EBC2) message from the ABS not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the ABS ECU is connected to the J1939 network and is functional.</li> <li>■ Verify correct ABS part number is used.</li> <li>■ Cycle ignition to clear DTCs after ABS servicing.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
904	19	CAN Out of Range for signal EBC2_FRNT_AXLE_SPD. See ABS ECU.	<ul style="list-style-type: none"> <li>■ Verify the ABS ECU is connected to the J1939 network and is functional.</li> <li>■ Verify correct radar part number is installed on the vehicle.</li> <li>■ Verify wheel speed sensor signal per ABS ECU diagnostics.</li> <li>■ Cycle ignition to clear DTCs after ABS servicing.</li> </ul>
905	19	CAN Out of Range for signal EBC2_RELSPD_FRNTAXLE_LW	<ul style="list-style-type: none"> <li>■ Check ABS ECU for proper function and active faults.</li> <li>■ Verify correct ABS ECU is installed.</li> </ul>
906	19	CAN Out of Range for signal EBC2_RELSPD_FRNTAXLE_RW	<ul style="list-style-type: none"> <li>■ Check ABS ECU for proper function and active faults.</li> <li>■ Verify correct ABS ECU is installed.</li> </ul>
907	19	CAN Out of Range for signal EBC2_RELSPD_REARAXLE_LW	<ul style="list-style-type: none"> <li>■ Check ABS ECU for proper function and active faults.</li> <li>■ Verify correct ABS ECU is installed.</li> </ul>
908	19	CAN Out of Range for signal EBC2_RELSPD_REARAXLE_RW	<ul style="list-style-type: none"> <li>■ Check ABS ECU for proper function and active faults.</li> <li>■ Verify correct ABS ECU is installed.</li> </ul>
1121	9	J1939 Electronic Brake Controller 1 (EBC1) message from the ABS not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the ABS ECU is connected to the J1939 network and is functional.</li> <li>■ Verify correct ABS part number is used.</li> <li>■ Cycle ignition to clear DTCs after ABS servicing.</li> </ul>
1121	19	Incorrect J1939 EBS Brake Switch data received in EBC1 message from ABS	<ul style="list-style-type: none"> <li>■ Use WABCO TOOLBOX PLUS™ Software PC Diagnostics to test the ABS Brake Pedal Pressure Sensor.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify the correct ABS ECU part number is used on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after ABS servicing.</li> </ul>
1243	19	Incorrect J1939 ABS Fully Operational data received in EBC1 message from ABS	<ul style="list-style-type: none"> <li>■ Use WABCO TOOLBOX PLUS™ Software PC Diagnostics to test the Anti-Lock Braking System.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify the correct ABS ECU part number is used on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after ABS servicing.</li> </ul>
1590	9	J1939 Adaptive Cruise Control 1 (ACC1) message from the engine not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM has the Adaptive Cruise Control parameter enabled.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
1590	19	Incorrect J1939 ACC Mode data in ACC1 message received from engine. This code may indicate the engine has recognized a radar malfunction (e.g. blocked radar) and has disabled Cruise Control. This code may also indicate the engine is not configured for operation with an Adaptive Cruise Control system.	<ul style="list-style-type: none"> <li>■ Check for multiple active DTCs in the radar.</li> <li>■ If there is more than one active code, repair all other codes, then cycle the ignition to clear the error recognition in the engine.</li> <li>■ If this is the only active DTC, verify the engine ECM has the Adaptive Cruise Control parameter enabled.</li> </ul>
1633	19	Incorrect J1939 Cruise Control Pause Switch data received in CCVS1 message (from engine ECM, body, cab or chassis controller)	<ul style="list-style-type: none"> <li>■ Verify operation of the Cruise Control Pause Switch and the ECU broadcasting this information on the J1939 network (engine ECM, body, cab or chassis controller) is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> </ul>
2919	9	J1939 Electronic Brake Controller 5 (EBC5) message from ABS not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the ABS ECU is connected to the J1939 network and is functional.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify correct ABS part number is used.</li> <li>■ Cycle ignition to clear DTCs after ABS servicing.</li> </ul>
5023	9	J1939 Adaptive Cruise Control 2 (ACC2) message from the display (or instrument cluster) not received or intermittent	<ul style="list-style-type: none"> <li>■ Intermittent power or J1939 network connection to display or instrument cluster.</li> <li>■ Verify harness is correct.</li> <li>■ Verify correct software version in display or instrument cluster.</li> </ul>
5606	9	J1939 Cruise Control/Vehicle Speed 3 (CCVS3) message (usually from the engine) not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM has the Adaptive Cruise Control parameter enabled.</li> </ul>
5606	19	Incorrect J1939 Adaptive Cruise Control Readiness Status data received in CCVS3 message from engine. This code may indicate the engine has recognized a radar malfunction (e.g. blocked radar) and has disabled Cruise Control. This code may also indicate the engine is not configured for operation with an Adaptive Cruise Control system.	<ul style="list-style-type: none"> <li>■ Verify the fault is active at all times by cycling the key off for 2 to 3 minutes and powering it back up to see if the fault code is still active.</li> <li>■ Verify there are no faults in any system on the vehicle and repair all other faults before diagnosing the system.</li> <li>■ Check for multiple active DTCs in the radar.</li> <li>■ If there is more than one active code, repair all other codes, then cycle the ignition to clear the error recognition in the engine.</li> <li>■ If this is the only active DTC, instruct the dealer to verify with the engine manufacturer that the engine parameters are set correctly.</li> <li>■ Check any optional components that are connected to the J1939 network that may cause a message issue.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
5681	9	J1939 Advanced Emergency Braking System 2 (AEBS2) message from the display (or instrument cluster) not received or intermittent	<ul style="list-style-type: none"> <li>■ Intermittent power or J1939 network connection to display or instrument cluster.</li> <li>■ Verify harness is correct.</li> <li>■ Verify correct software version in display or instrument cluster.</li> </ul>
5681	19	Incorrect J1939 Driver activation demand for Advanced Emergency Braking System data received in AEBS2 message from display (or instrument cluster)	<ul style="list-style-type: none"> <li>■ Intermittent power or J1939 network connection to display (or instrument cluster).</li> <li>■ Verify harness is correct.</li> <li>■ Verify correct software version in display (or instrument cluster).</li> </ul>
5682	19	Incorrect J1939 AEBS2 Message Counter data received in AEBS2 message from display (or instrument cluster)	<ul style="list-style-type: none"> <li>■ Intermittent power or J1939 network connection to display (or instrument cluster).</li> <li>■ Verify harness is correct.</li> <li>■ Verify correct software version in display (or instrument cluster).</li> </ul>
5683	19	Incorrect J1939 AEBS2 Message Checksum data received in AEBS2 message from display (or instrument cluster)	<ul style="list-style-type: none"> <li>■ Intermittent power or J1939 network connection to display (or instrument cluster).</li> <li>■ Verify harness is correct.</li> <li>■ Verify correct software version in display (or instrument cluster).</li> </ul>
197120	31	Bootloader error usually caused when there is an issue during a radar software update.	<ul style="list-style-type: none"> <li>■ Run the software update again.</li> <li>■ Is usually seen in WABCO TOOLBOX PLUS™ Software PC Diagnostics with SPN 197120 FMI 31 on the display.</li> </ul>
516096	9	J1939 Cruise Control/Vehicle Speed 1 (CCVS1) message from second source (usually the body controller or chassis controller) not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify the body/chassis ECU is functional and has correct software and parameters.</li> <li>■ Cycle the ignition to clear DTCs after servicing body/chassis ECU.</li> <li>■ If SPN 516097 FMI 9 is also active in conjunction with this code, there may be an issue with the Central Gateway Module, review with the OEM.</li> </ul>
516097	9	J1939 Cruise Control/Vehicle Speed 1 (CCVS1) message from third source (usually the body controller or chassis controller) not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify the body/chassis ECU is functional and has correct software and parameters.</li> <li>■ Cycle the ignition to clear DTCs after servicing body/chassis ECU.</li> <li>■ If SPN 516096 FMI 9 is also active in conjunction with this code, there may be an issue with the Central Gateway Module, review with the OEM.</li> </ul>
516108	9	J1939 Retarder Configuration (RC) message from the engine retarder not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
516108	19	Incorrect J1939 Reference Retarder Torque data received in RC message from engine retarder	<ul style="list-style-type: none"> <li>■ Verify engine-retarder-ECU is functional and has correct parameters and software downloaded from database.</li> <li>■ Verify the correct engine-retarder-ECU part number is installed on this vehicle.</li> <li>■ Cycle the ignition to clear DTCs after retarder servicing.</li> </ul>
516211	5	CAN 1 Bus Off	<ul style="list-style-type: none"> <li>■ Check CAN wiring at other ECUs.</li> </ul>
516215	9	J1939 network messages not received or intermittent	<ul style="list-style-type: none"> <li>■ Verify J1939 network backbone, stub connections to each ECU and terminating resistors are correct.</li> <li>■ Verify engine, ABS and display are operational and communicating on J1939 network.</li> </ul>
516219	8	Excessive automatic braking is used to maintain safe following interval while driving down hill	<ul style="list-style-type: none"> <li>■ Stored Fault: Driver must reduce speed and use a lower gear while driving down hill.</li> </ul>
516497	12	Extended plausibility check for signal	<ul style="list-style-type: none"> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after engine servicing.</li> <li>■ Verify the engine ECM has the Adaptive Cruise Control parameter enabled.</li> </ul>
516499	12	Malfunction in the Anti-Lock Braking System caused the system to be temporarily disabled	<ul style="list-style-type: none"> <li>■ Use WABCO TOOLBOX PLUS™ PC Diagnostics to test the Anti-Lock Braking System.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Verify the correct ABS ECU part number is used on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after ABS servicing.</li> </ul>
516500	12	Malfunction in the Anti-Lock Braking System caused to be temporarily disabled	<ul style="list-style-type: none"> <li>■ Verify the correct ABS ECU part number is used on the vehicle.</li> <li>■ Use WABCO TOOLBOX PLUS™ Software PC Diagnostics to test the Anti-Lock Braking System.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after ABS servicing.</li> </ul>
516501	12	Extended Plausibility check for Signal Brake System accepts AEBS XBR	<ul style="list-style-type: none"> <li>■ Verify the correct ABS ECU part number is used on the vehicle.</li> <li>■ Use WABCO TOOLBOX PLUS™ Software PC Diagnostics to test the Anti-Lock Braking System.</li> <li>■ Verify the correct radar part number is installed on the vehicle.</li> <li>■ Cycle the ignition to clear DTCs after ABS servicing.</li> </ul>
516503	13	Radar sensor is not aligned	<ul style="list-style-type: none"> <li>■ Perform Service Alignment.</li> <li>■ Cycle ignition and determine if issue is resolved.</li> </ul>
516507	12	Cruise Control States and Adaptive Cruise Control Mode are Mismatched	<ul style="list-style-type: none"> <li>■ Driver must cycle Brake Switch and Clutch Switch prior to activating Cruise Control.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
516528	2	Yaw Rate bias plausibility check failed	<ul style="list-style-type: none"> <li>Verify the Radar is mounted correctly and is not damaged.</li> <li>If the radar is damaged, it would indicate the radar has failed.</li> <li>If the radar is mounted incorrectly, properly install and perform a service alignment.</li> <li>If the radar is mounted correctly and there is no sign of damage, and the DTC persists, a failed radar is indicated.</li> </ul>
516529	2	Yaw Rate scaling plausibility check failed	<ul style="list-style-type: none"> <li>Verify the Radar is mounted correctly and is not damaged.</li> <li>If the radar is damaged, it would indicate the radar has failed.</li> <li>If the radar is mounted incorrectly, properly install and perform a service alignment.</li> <li>If the radar is mounted correctly and there is no sign of damage, and the DTC persists, a failed radar is indicated.</li> </ul>
516530	2	Yaw Rate mounting plausibility check failed	<ul style="list-style-type: none"> <li>Verify the Radar is mounted correctly and is not damaged.</li> <li>If the radar is damaged, it would indicate the radar has failed.</li> <li>If the radar is mounted incorrectly, properly install and perform a service alignment.</li> <li>If the radar is mounted correctly and there is no sign of damage, and the DTC persists, a failed radar is indicated.</li> </ul>
516531	12	Vehicle velocity spike detection exceeded	<ul style="list-style-type: none"> <li>Vehicle speed signal is implausible.</li> <li>Check Vehicle CAN and speed signal sending ECU.</li> <li>Road conditions, icy spots or loose gravel.</li> <li>Check vehicle speed signal source, possible tone ring or sensor issues.</li> </ul>
516998	12	WABCO Production Data could not be read from EEPROM during startup	<ul style="list-style-type: none"> <li>Cycle the ignition to clear DTCs.</li> </ul>
517503	14	Radar Sensor blocked by ice, mud or debris while driving. Reflected signal from other vehicles is too weak	<ul style="list-style-type: none"> <li>Park the vehicle in a safe location, set the Parking Brake and turn ignition OFF.</li> <li>Inspect and clean the radar fascia.</li> <li>The DTC will be cleared when ignition is switched ON.</li> <li>Drive the vehicle in traffic about 5 minutes at speeds above 20 mph to confirm the blockage is cleared.</li> </ul>
517504	14	Radar Sensor blocked. No objects observed within 2 minutes while driving	<ul style="list-style-type: none"> <li>Park the vehicle in a safe location, set the Parking Brake and turn ignition OFF.</li> <li>Inspect and clean the radar fascia.</li> <li>Re-start the engine. DTC should clear as the vehicle begins driving above 15 mph.</li> <li>If the Blocked Radar DTC causes a secondary engine DTC, an additional ignition OFF cycle may be required to clear the secondary DTC.</li> </ul>
517505	13	VDY velocity correction factor is Out of Range	<ul style="list-style-type: none"> <li>Check speed signal parameters in engine, braking system, and tachograph.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
517525	13	Unknown error during alignment. Software did not respond on time	<ul style="list-style-type: none"> <li>■ Perform Service Alignment.</li> </ul>
517527	13	Alignment monitoring failed in azimuth - Radar sensor is looking too far to the right. This code may indicate the radar installation was damaged by impact (frame cross-member, bumper, radar bracket, etc.). This code may also indicate a Radar Service Alignment was not completed following axle alignment.	<ul style="list-style-type: none"> <li>■ Check for damage to radar sensor, bracket and fascia.</li> <li>■ Perform Service Alignment.</li> </ul>
517528	13	Alignment monitoring failed in azimuth - Radar sensor is looking too far to the left. This code may indicate the radar installation was damaged by impact (frame cross-member, bumper, radar bracket, etc.). This code may also indicate a Radar Service Alignment was not completed following axle alignment.	<ul style="list-style-type: none"> <li>■ Check for damage to radar sensor, bracket and fascia.</li> <li>■ Perform Service Alignment.</li> </ul>
517529	13	Alignment monitoring failed in azimuth - Radar sensor is looking too low. This code may indicate the radar installation was damaged by impact (frame cross-member, bumper, radar bracket, etc.). This code may also indicate a Radar Service Alignment was not completed following axle alignment.	<ul style="list-style-type: none"> <li>■ Check for damage to radar sensor, bracket and fascia.</li> <li>■ Perform Service Alignment.</li> </ul>
517530	13	Alignment monitoring failed in azimuth - Radar sensor is looking too high. This code may indicate the radar installation was damaged by impact (frame cross-member, bumper, radar bracket, etc.). This code may also indicate a Radar Service Alignment was not completed following axle alignment.	<ul style="list-style-type: none"> <li>■ Check for damage to radar sensor, bracket and fascia.</li> <li>■ Perform Service Alignment.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
517558	4	Electrical supply voltage too low	<ul style="list-style-type: none"> <li>■ Verify that the voltage at the radar sensor connector is greater than 6 VDC with a 1 amp load (e.g. tail light or marker light bulb).</li> <li>■ Inspect the radar connector for corrosion.</li> <li>■ Inspect each of the power connections between the ignition switch and the radar to determine where loss of power may be occurring.</li> </ul>
517559	3	Electrical supply voltage too high	<ul style="list-style-type: none"> <li>■ Monitor the battery voltage to determine if the battery is providing voltage between 10 and 16 VDC.</li> <li>■ If the voltage is too high, troubleshoot the voltage regulator and alternator system.</li> <li>■ Determine if a jump start or battery charging has occurred that could cause a vehicle overvoltage condition.</li> </ul>
517648	12	Shutdown by OSEK	<ul style="list-style-type: none"> <li>■ Cycle ignition power off for 2 to 3 minutes.</li> <li>■ Verify fault does not return.</li> </ul>
517652	7	Motor azimuth: Blockage detected	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>
517653	7	Motor azimuth: Blockage detected	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>
517654	7	Motor azimuth: crosscheck between light barrier and bemf speed	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>
517655	7	Motor Azimuth: drum runs in a wrong direction	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>
517656	7	Motor Azimuth: light barrier speed is out of range for more than 5 minutes	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>

## Diagnostics, Troubleshooting and Testing

SPN	FMI	Cause/Description	Action/Repair Instructions
517657	7	Motor Azimuth: bemf speed is out of range for more than 5 minutes	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>
517658	7	Motor elevation: plate is blocked or not available	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>
517659	7	Motor elevation: Fault while setting back the original plate position occurred	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ Place the vehicle back in service and the code will become stored after driving above 10 mph for one minute.</li> </ul>
517996	7	Bootloader: invalid Bootloader and application interface	<ul style="list-style-type: none"> <li>■ Verify no visible/physical damage to radar.</li> <li>■ Check power ground and load test at the radar harness connector.</li> <li>■ If fault persists after completing previous checks and repairs, this may indicate the radar has failed.</li> </ul>

### 5.5 Radar Inspection and Preventive Maintenance

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

#### **WARNING**

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

#### **WARNING**

Release all air from the air systems before you remove any components. Pressurized air can cause serious personal injury. Refer to the vehicle manufacturer's service manual for instructions.

1. Remove the fascia and inspect the bumper positioning. Verify the bumper is not physically touching the radar sensor, fascia or mounting bracket at any point.  
If the bumper is touching the fascia: Reposition the bumper so there is a minimum of 1/4-inch (6.35 mm) clearance between it and the fascia at all points.
2. Visually inspect the radar connector and housing for any damage. Inspect the edge of the fascia for any signs of wear or prior contact with the bumper. Also, inspect the routing of the radar sensor harness to ensure it is not pinched in the bumper or damaged at any point. The rubber boot on the radar harness connector must fully cover the connector.
3. Verify the radar sensor and mounting hardware is secure.
4. If the radar passes all of these inspections, reinstall the fascia.

# Diagnostics, Troubleshooting and Testing

## 5.6 Radar System Troubleshooting

**i** Before troubleshooting the OnGuard and OnGuardACTIVE CMS or OnGuardALERT FCW DTCs or concerns, check for DTCs in all other vehicle systems communicating on the J-1939 network.

Many vehicle stability systems apply the service brakes, as well as engine retarder and/or de-rate the engine to accomplish their designed function. The following, although not all-inclusive, is a list of such systems. For information about non-WABCO systems, refer to the system manufacturer's documentation:

- Cruise Control
- Electronic Stability Control (ESC)
- Automatic Traction Control (ATC)
- Roll Stability Control (RSC)
- Trailer Roll Stability Support (RSS)
- OnGuard, OnGuardACTIVE and OnGuardALERT

The CMS and FCW monitors and utilizes other system messages on the J-1939 network allowing it to function without interfering with vehicle stability systems, and engine/transmission/speed parameters.

The CMS and FCW sets a DTC whenever messages from the other control modules on the J-1939 network are incomplete, not plausible, or not received.

If the J-1939 network is unstable or overloaded by vehicle telematics messages, interruptions result.

**i** Per SP1375, damage or system concerns related to malfunctions and failure codes caused by other electronic sub-system failures (data bus, engine, transmission, dashboard, etc.) are excluded from WABCO warranty coverage.

Refer to the Diagnostic Trouble Code Table for further information. The following sections and sub-sections are referenced in the last column of the Diagnostic Trouble Code Table.

**i** Unintended braking events or other driveability concerns may occur without active or stored DTCs. Ensure all service alignments as prescribed in the Required Maintenance section have been completed.

If driveability concerns persist with no DTCs or assignable cause, contact WABCO Customer Care Center at 855-228-3203 for further assistance.

**i** Before calling the WABCO Customer Care Center, please download the system DTC report and the parameter (par) file or Fleet Data Report using TOOLBOX PLUS™ Software. Email the files to the WABCO Customer Care Center at [wabconacustomer@zf.com](mailto:wabconacustomer@zf.com) with the case number (if known) and DTC Report in the subject line.

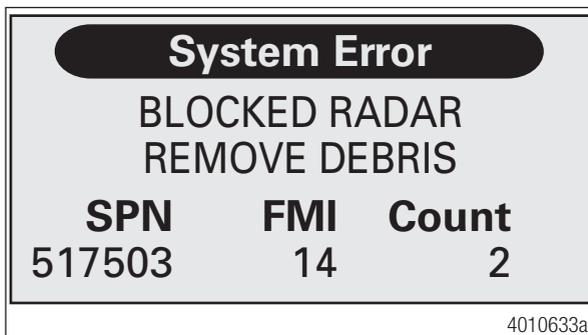
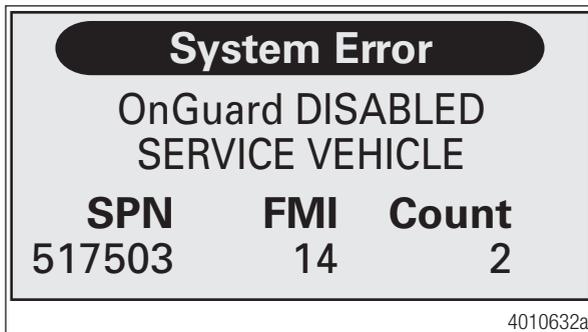
### 5.6.1 Radar Sensor Connector Corrosion

Radar sensor connector corrosion results when the radar sensor connector or protective rubber boot have been incorrectly installed following service. When the connector is not fully seated during installation or repair activities, water, corrosive road salts or other contaminants can enter the radar sensor connector. Ensure the radar connector and harness are secured and correctly connected and the environmental seal is intact to prevent water intrusion and corrosion.

## Diagnostics, Troubleshooting and Testing

### 5.6.1.1 Blocked Radar

The radar sensor is protected by a fascia. The fascia and the radar sensor must not be blocked in any manner. The radar sensor can become blocked by snow, ice, dirt or other foreign matter. If this occurs, the radar sensor will have limited or no functionality. If a “Blocked Radar” error occurs, the next two screens will be presented on the display:



If this occurs, perform the following procedure:

1. Determine if the radar sensor is blocked by snow, ice, dirt or anything else.
2. Clean the surface of the fascia and between the fascia and the radar sensor. Remove any foreign debris that may form in this area. Removal of the fascia may be necessary to completely clean the radar sensor and the inside of the fascia. Do not remove the radar.
3. Verify the fascia is correctly installed.
4. Cycle the ignition OFF for at least two minutes to clear the fault. The vehicle must be driven to determine if the fault has been corrected.

### 5.6.2 Radar Sensor Service Alignment

The following, although not all-inclusive, is a list of service, maintenance, and repair operations requiring system Service Alignment:

- Chassis parts replacement
- Steering or suspension parts replacement, adjustment, or alignment
- Tire inflation or size change, and/or tire replacement
- Front body parts replacement or adjustment

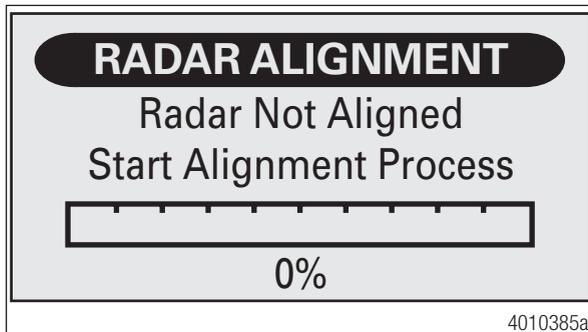


Use of non-OEM bumpers, hoods, and brush guards not verified to work with the system on a particular vehicle may result in driveability concerns and affect system performance with worst case result in DTCs or disabled CMS.

## Diagnostics, Troubleshooting and Testing

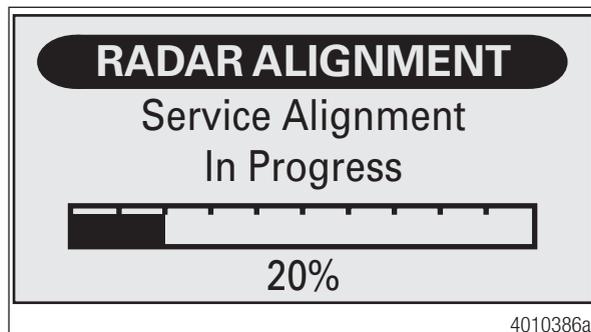
If the radar sensor needs to be aligned, the radar sensor mounting system has become damaged or has loosened, or new radar sensor software has been installed, a Radar Sensor Service Alignment will need to be performed.

If a Radar Sensor Service Alignment is required, the Radar Not Aligned Screen may be displayed as shown below.



While the system is in Service Alignment mode, the system does not track vehicles or operate until the Service Alignment procedure is completed.

1. Before starting the alignment procedure, verify the radar is mounted securely and the bracket is not bent or damaged. Refer to Radar Inspection and Preventive Maintenance in this section.
2. Using TOOLBOX PLUS™ Software, select Options and Perform Service Alignment. When the Start Service Alignment box appears, click Yes. While in this mode, the display will show the progress of the alignment process as shown below.



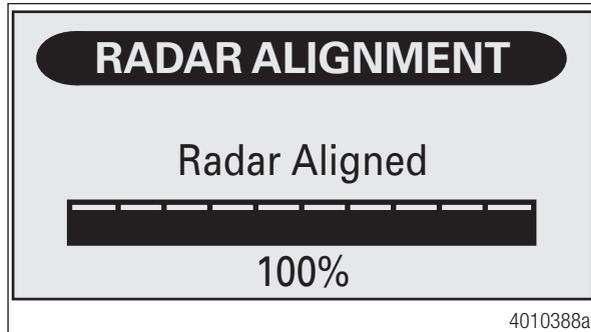
If the Radar Service Alignment will not initiate, perform the following procedure:

- a. Turn off the ignition for at least two minutes.
  - b. Start the vehicle and drive above 10 mph.
  - c. Pull to the side of the road, come to a complete stop and leave the key on.
  - d. With the TOOLBOX PLUS™ Software connected, initiate the service alignment to begin the alignment process.
3. Drive the vehicle on a straight road above 30 mph (48 kph). The road should have telephone poles, signposts or other non-moving objects along the roadside. There must be other traffic on the road, either oncoming or lead vehicles at distances greater than 150 ft.

## Diagnostics, Troubleshooting and Testing

**i** Stopping the vehicle during alignment is acceptable, but alignment will not progress while the vehicle is at low speeds or stopped.

4. Drive until the Radar Aligned screen below appears in the display. This typically takes less than 10 miles to complete.



5. After completing the Service Alignment procedure, the system returns to one of the normal operating screens.

**i** After the Radar Sensor Service Alignment is complete, you may have a system fault screen. If this occurs, cycle the ignition off for at least two minutes.

If this occurs, review the radar sensor installation, determine if the radar sensor needs to be repositioned (or in some way serviced) and then repeat the Radar Sensor Service Alignment procedure. Contact the WABCO Customer Care Center at 855-228-3203 if the radar service alignment fault cannot be resolved.

**i** Before calling the WABCO Customer Care Center, please download the system DTC report and the parameter (par) file or Fleet Data Report using TOOLBOX PLUS™ software. Email the files to the WABCO Customer Care Center at [wabconacustomer@zf.com](mailto:wabconacustomer@zf.com) with the case number (if known) and DTC Report in the subject line.

As the vehicle is driven following the Radar Sensor Service Alignment, the system performs continuous adjustments to the radar sensor alignment. Further service alignments are generally not necessary unless the radar sensor mounting assembly is disturbed, becomes loose, or the radar sensor requires replacement.

## 5.7 Electrical System Troubleshooting

Refer to the Diagnostic Trouble Code Table for further information.

The following are the troubleshooting sections and sub-sections referenced in the last column of the Diagnostic Trouble Code Table.

The following procedures require a multi-meter.

### **⚠ CAUTION**

Use care to avoid damaging the connector pins when performing electrical checks.

## Diagnostics, Troubleshooting and Testing

### 5.7.1 Harness Routing and Associated Wire Fatigue or Abrasion

Wire fatigue will occur at any harness location where sufficient harness motion allows bending of the wiring. When this occurs, individual harness wires become weakened and can break. The harness can have intermittent or permanent open circuit failures causing the system to malfunction.

Harness abrasion will occur at any harness location where sufficient harness motion allows rubbing of the harness against adjacent vehicle components. When this occurs, the outer harness jacket and the individual wire insulation can wear, causing short circuits between each of the exposed wires or to the vehicle chassis causing the system to malfunction. The harness is especially susceptible to wear when the harness rubs against a sharp edge.

Both wire fatigue and harness abrasion can be prevented by correctly attaching the harness to the chassis at closely spaced intervals while avoiding contact with sharp edges. The harness should be secured with tie wraps every two feet or less in areas where damage may occur. Tie wraps should be tightened with a tie wrap gun set to the appropriate setting to correctly secure the harness without allowing a loose mounting but also not causing the harness to be over-tightened. Over-tightening the tie wrap to the harness can crush the harness jacket and conductors causing harness damage and system failures.

#### 5.7.1.1 Radar Connector Pinout

The radar harness is connected to the radar sensor using an eight-pin connector.

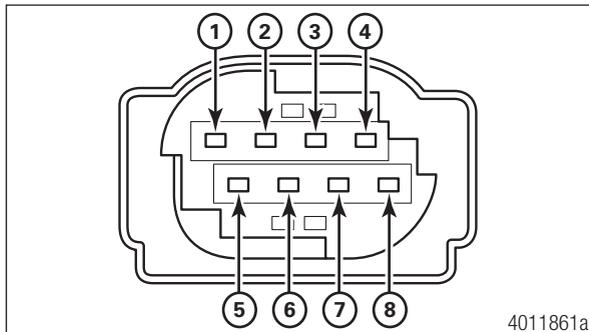


Table C: Radar Harness Connector Pinouts

Pin	Circuit
1	+12V (or ignition)
2	Ignition
3	J1939 High
4	No Connection
5	No Connection
6	J1939 Low
7	No Connection
8	Ground

## Diagnostics, Troubleshooting and Testing

### 5.7.1.2 Display Connector Pinouts

The display harness is connected to the display mounted in the dashboard. Remove the dash to access the back of the display and harness connector.

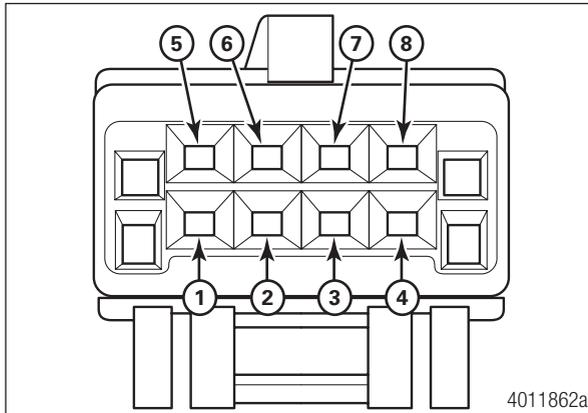


Table D: Display Harness Connector Pins

Pin	Circuit
1	No Connection
2	No Connection
3	No Connection
4	Ignition
5	Ground
6	J1939 Low
7	J1939 High
8	No Connection

### 5.7.1.3 Radar and Display Circuit Testing

The following radar and display harness check should be performed when various DTCs occur. Refer to the Troubleshooting Guide and the Diagnostic Trouble Code Table for further information.

#### Power and Ground Checks

- Verify vehicle batteries, charging system and fuses are in good working condition.
- Load test battery and ignition circuits to ground at the ECU harness using a 2-4 amp sealed lamp and verify lamp does not flicker and it is on steady.
- Take measurements at the radar and display harness pins.

# Diagnostics, Troubleshooting and Testing

Measurements should read as follows:

Location	Measurement
Across J1939 High and Low	Approximately 60 ohms
J1939 Low Voltage	0.1V-2.4V
J1939 High Voltage	2.5-5.0V
J1939 High or J1939 Low to Ground or Power	No continuity

## 5.7.2 Component Message Fault Troubleshooting

Refer to the Diagnostic Trouble Code Table for further information.

The following are the troubleshooting sections and sub-sections referenced in the last column of the Diagnostic Trouble Code Table.

### Message Timeout

Occasionally the system will generate Message Timeout DTCs due to data not being received from the ECUs connected on the SAE J1939 network. This can occur if the cruise control, engine, transmission, ABS, engine retarder or driveline retarder ECUs have been re-flashed with new software that is incorrect, was not downloaded correctly or has the incorrect parameter set. This information may reside in the vehicle OEM ECU database. It is also possible that various ECUs are not operating correctly on the SAE J1939 network or DTCs have occurred during diagnostic procedures. Perform the following procedure if a Message Timeout DTC is present:



Certain diagnostic software programs, other than TOOLBOX PLUS™ Software, can generate Timeout DTCs. Verify code is Active on the display without any diagnostic software connected to the vehicle.

1. Determine if the software or parameter set from to appropriate ECU has recently been modified. Install the correct software and parameter set if required.
2. Verify that the SAE J1939 network is functioning correctly. Use the Radar Harness Electrical Checks procedure to repair any SAE J1939 network issues.
3. After any ECU servicing has been completed, cycle the ignition OFF for one minute and then back ON for one minute with the engine idling to clear the system DTC. Verify that the DTC has been cleared.

### Message Data Error

Occasionally the system will generate Message Data Error DTCs from ECUs connected on the SAE J1939 network. This can occur if an ECU has been re-flashed with new software that is incorrect, was not downloaded correctly or has the wrong parameter set. This information resides in the OEM ECU database. It is also possible that the problem ECU was replaced with the wrong ECU. Perform the following procedure if a Message Data Error DTC is present:

1. Determine if the appropriate ECU has been recently replaced. Verify that the correct ECU part number has been installed. Install the correct ECU if required.
2. Determine if the ECU software or parameter set have recently been modified. Install the correct software and parameter set if required
3. Use the display to determine if the various functions (i.e., set, resume, accel, coast, etc.) are functioning correctly. Consult the display operating instructions for more information.

## Diagnostics, Troubleshooting and Testing

4. After ECU servicing has been completed, cycle the ignition OFF for one minute and then back ON for one minute with the engine idling to clear the system DTC. Verify that the DTC has been cleared.

### 5.7.3 Cruise Control System Troubleshooting

Refer to the Diagnostic Trouble Code Table for further information.

The following are the troubleshooting sections and sub-sections referenced in the last column of the Diagnostic Trouble Code Table.

The Engine Ignores ACC Control DTC may be generated due to other vehicle system DTCs or issues. Check for multiple system DTCs using the TOOLBOX PLUS™ Software. If multiple DTCs are present, the DTC is most likely a secondary DTC. Take corrective action for the primary DTC first and cycle the ignition. Document all DTCs present. If the other DTCs are corrected and the Engine Ignores ACC DTC is still present, then the Engine Ignores ACC Control DTC becomes the primary DTC. There is a communication issue with the other vehicle systems. Verify the Engine and Gateway ECU software is up-to-date and cycle the ignition.

#### Programming DTCs

1. Verify with the OEM or engine manufacturer that the correct engine parameters are programmed to accept TSC1 messages from the ACC.
2. Reprogram the engine parameters if not correct. Refer to the vehicle manufacturer's service manual for further instruction.
3. Check for multiple DTCs using the display. If there are multiple DTCs, this is a secondary DTC caused by other DTCs.
4. Correct the other DTCs and cycle ignition to clear this DTC. If it is a single DTC, update the Engine and Vehicle Gateway software.

## Component Replacement Procedures

# 6 Component Replacement Procedures

## 6.1 Hazard Alert Messages

Read and observe all Warning and Caution hazard alert messages in this publication. They provide information that can help prevent serious personal injury, damage to components, or both.

### **WARNING**

To prevent serious eye injury, always wear safety eye protection when you perform vehicle maintenance or service.

### **WARNING**

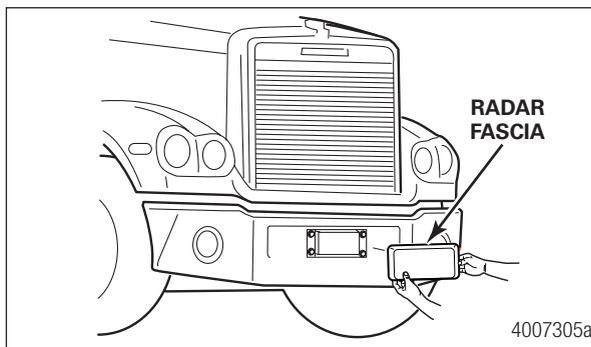
Release all air from the air systems before you remove any components. Pressurized air can cause serious personal injury. Refer to the vehicle manufacturer's service manual for instructions.

## 6.2 Radar Sensor Replacement

### **WARNING**

Park the vehicle on a level surface. Block the wheels to prevent the vehicle from moving. Support the vehicle with safety stands. Do not work under a vehicle supported only by jacks. Jacks can slip or fall over. Serious personal injury and damage to components can result.

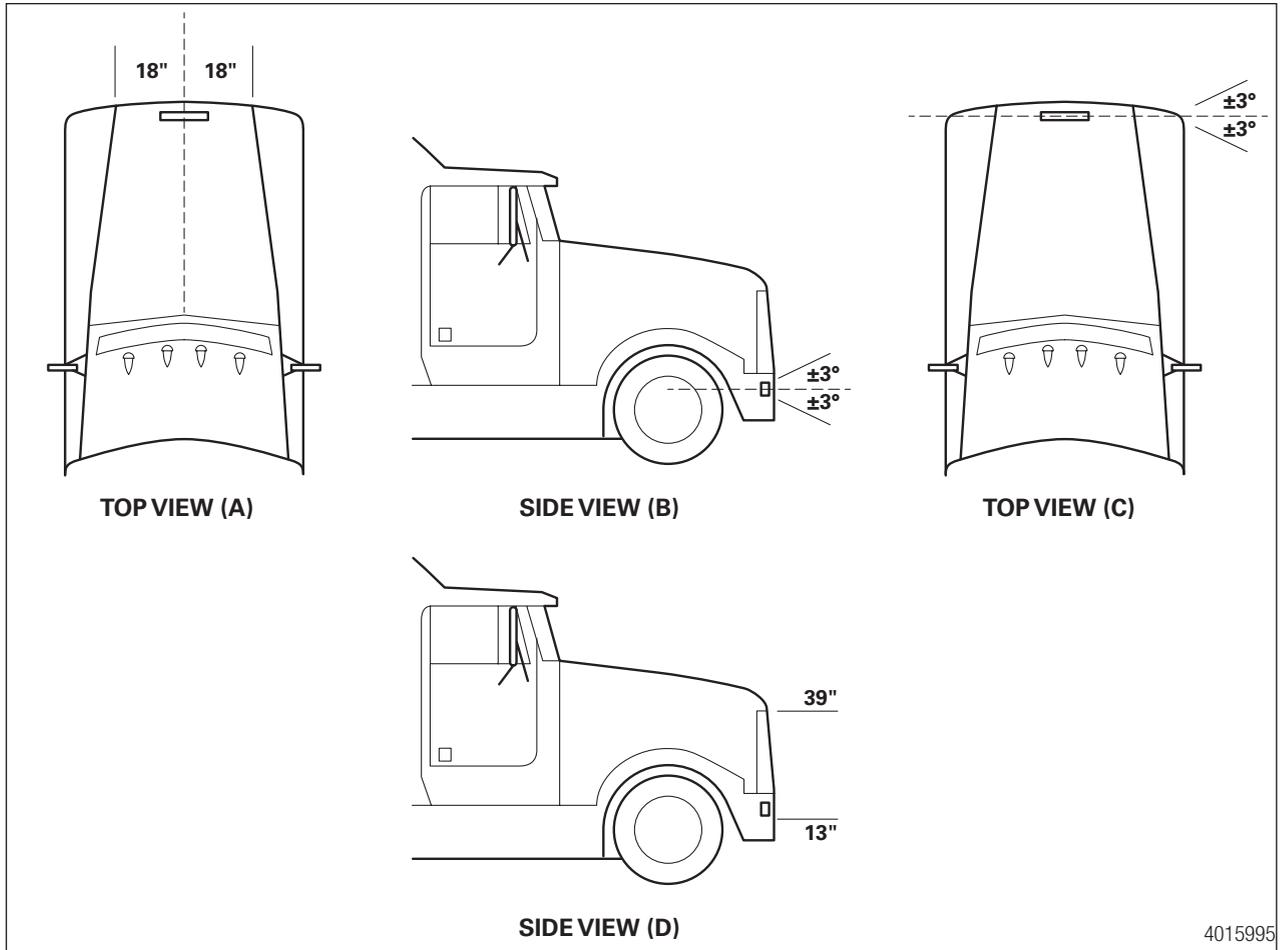
1. Turn the ignition switch to the OFF position.
2. Place blocks under the rear tires to prevent the vehicle from moving. Apply the parking brake.
3. Remove the three fascia mounting hardware and remove the fascia from the radar sensor.



4. Pull back the rubber boot from the radar connector. Disconnect the radar sensor connector by depressing the lock tabs on both sides of the radar connector.
5. Remove the radar sensor from the radar sensor bracket by removing the three nuts on the rear of the radar sensor bracket.
6. Verify that the mounting bracket is correctly mounted with mounting bolts tightly secured. Replace the bracket if damaged. The bracket cannot be moved from its original OEM installation location. Using the center point of the radar assembly as reference, ensure the bracket meets 4 conditions.

## Component Replacement Procedures

- a. The center point of the bracket must be mounted within 18" (450 mm) of the tractor center point.
- b. The face of the bracket must be mounted perpendicular (90 degrees  $\pm 3$  degrees) to the level road surface.
- c. The face of the bracket must be mounted parallel to the front of the vehicle ( $\pm 3$  degrees).
- d. The bracket may not be closer than 13" (330 mm) and no more than 39" (1000 mm) to the road surface.



The bracket with mounted radar and cover cannot extend beyond the front of the bumper as a precaution from unintended impact damage.



Care should be taken to verify the correct part number radar is being installed on the vehicle as all CMS and FCW radars look alike.

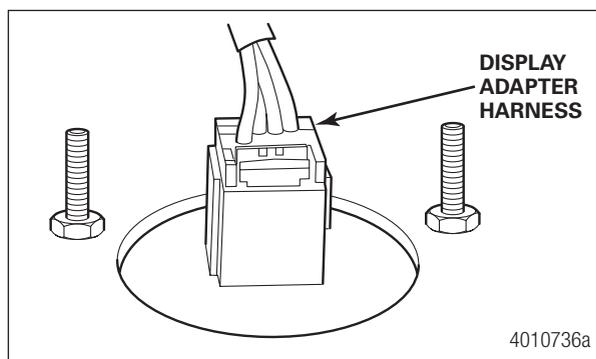
7. Mount the replacement radar sensor to the bracket. Tighten the mounting nuts to 61-75 in-lb (6.9-8.4 Nm).
8. Verify that there is at least 1/4-inch gap, between the radar sensor and the bumper. If there is not a 1/4-inch gap, contact the manufacturer for assistance in adjusting the bumper. This gap is critical to the correct operation of the system.

## Component Replacement Procedures

9. Reconnect the sensor connector by pushing on the connector until it snaps into the radar sensor. Slide the rubber boot over the connector until the connector is completely covered by the boot.
10. Replace the fascia using the fasteners and washers that were removed or recommended hardware per OEM requirements. Dry tighten the bolts to OEM specifications.
11. Perform the Radar Sensor Service Alignment procedure in Section 5.

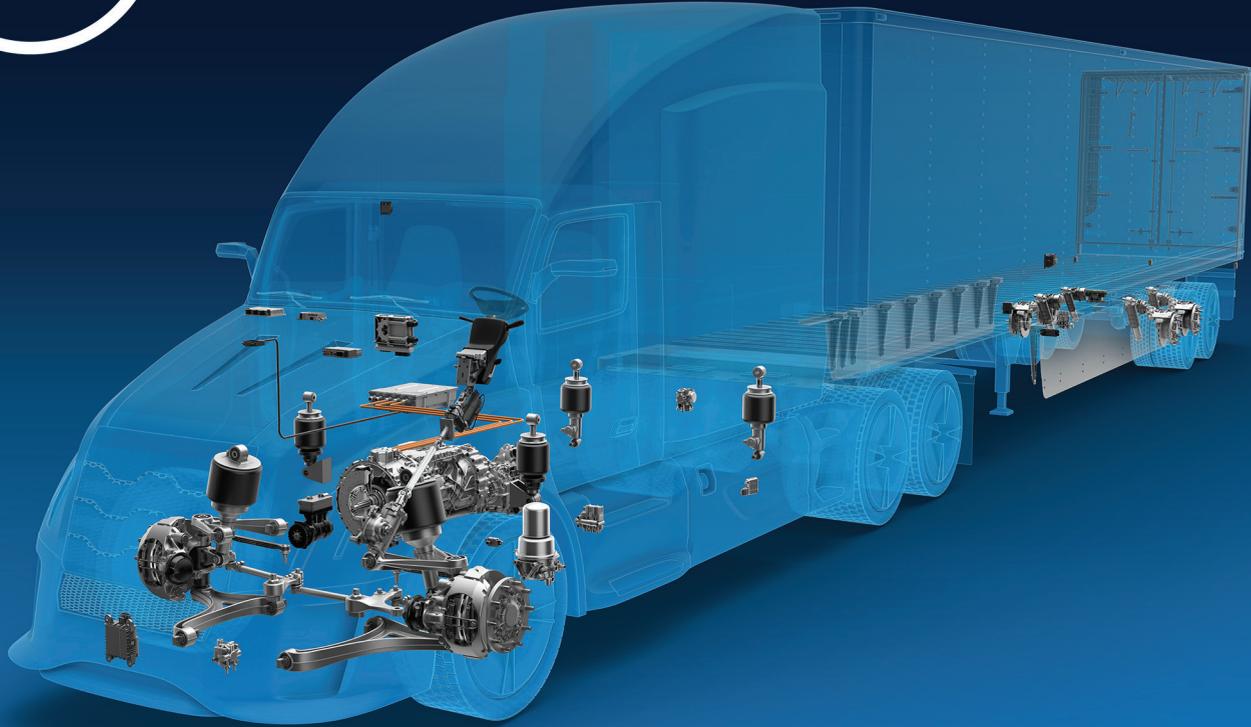
### 6.3 Display Replacement

1. Remove the necessary instrument cluster paneling to gain access to the back of the display. Refer to the OEM instructions for correct procedures.
2. Make sure the ignition is in the OFF position. Disconnect the wiring connector from the display.



3. Remove the display. Save the hardware for installation of the new display.
4. Reinstall the new display.
5. Connect the wiring connector to the new display.
6. Reassemble the instrument cluster paneling according to the OEM procedures.





**For further details, contact the  
WABCO Customer Care Center at 855-228-3203.**

### **About CVS Division**

ZF's Commercial Vehicle Solutions (CVS) division is helping shape the future of commercial transportation ecosystems. Our mission is to be the preferred global technology partner to the commercial vehicle industry. Powerfully combining ZF's commercial vehicle systems expertise, extensive technology portfolio and global operations, the division serves the full commercial vehicle industry value chain. As the automotive industry progresses towards an increasingly autonomous, connected, and electrified (ACE) future, ZF's CVS division innovates, integrates and supplies components and advanced control systems that help make commercial vehicles and fleets operate more safely and sustainably. CVS unites ZF's former Commercial Vehicle Technology and Commercial Vehicle Control Systems divisions, the latter being formed following ZF's acquisition of WABCO in Spring 2020.

For more information, visit: [www.zf.com/cv](http://www.zf.com/cv)

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