Bendix®

Service Data

SD-61-4963

Bendix® Wingman® Fusion™ FLR-21™ Radar Sensor

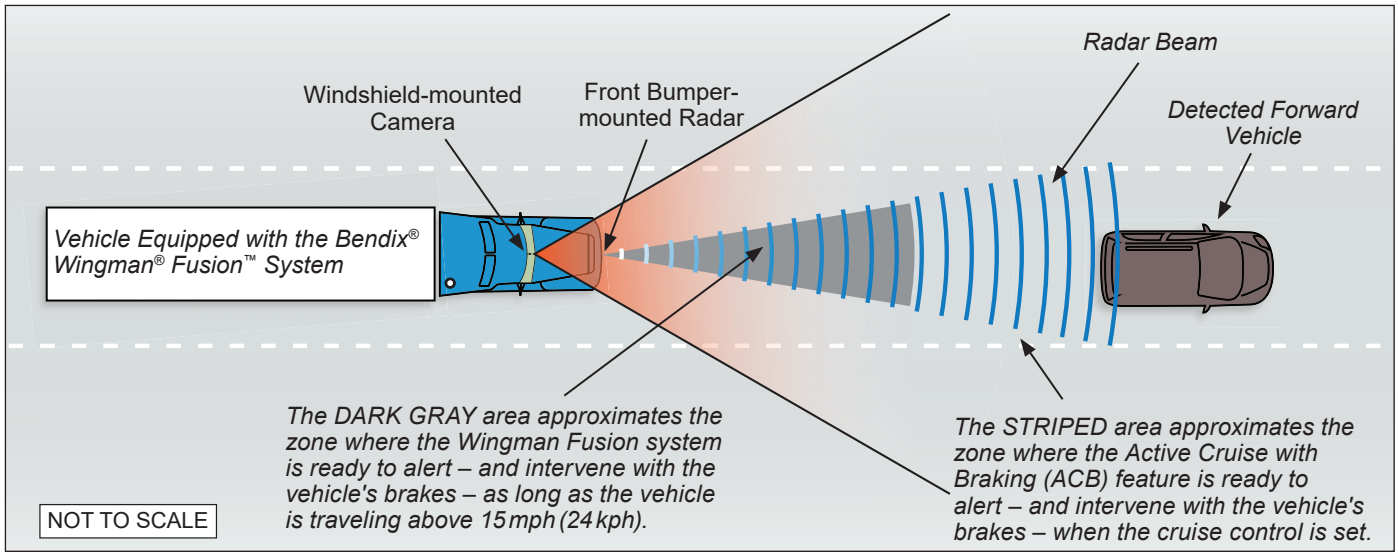


Figure 1 – Bendix® Wingman® Fusion™ System

IMPORTANT

Bendix®-brand Electronic Control Units (ECUs) are not designed to store data for purposes of accident reconstruction, and Bendix® ACom® PRO™ Diagnostic Software is not intended to retrieve data for purposes of accident reconstruction. Bendix makes no representations as to the accuracy of data or video retrieved and interpreted from ECUs for purposes of accident reconstruction. Bendix does not offer accident reconstruction services or interpretation of stored data. Bendix ECUs are not protected from fire, loss of power, impact damage, or other conditions that may be sustained in a crash situation and may cause data to be unavailable or irretrievable.

The Bendix™ FLR-21™ radar sensor is part of the Bendix® Wingman® Fusion™ system, which integrates a camera, radar, and brakes. The Wingman Fusion system provides the following alerts and actions:

- Stationary Vehicle Braking (SVB)
- Enhanced Collision Mitigation Braking (CMB)
- Active Cruise with Braking (ACB)
- Overspeed Alert and Action (OAA)
- Lane Departure Warnings (LDW)
- Stationary Object Alerts (SOA)
- Alert Prioritization

NOTE: Depending on configuration, the system may record data and video of certain events and, when integrated with a telematics provider, can transmit this information for viewing on the SafetyDirect® by Bendix CVS web portal. Currently, the system does not integrate alerts from Bendix™ BlindSpotter® or SmarTire® Tire Pressure Monitoring System (TPMS) by Bendix CVS.

SD Sheet Index

Appendices

GENERAL SAFETY GUIDELINES

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following guidelines should be observed AT ALL TIMES:

- ▲ Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear personal protection equipment.
- ▲ Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated, or electrically charged components.
- ▲ Do not attempt to install, remove, disassemble, or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
- ▲ If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, a Bendix® AD-9si®, AD-HF®, or AD-HFi™ air dryer, be sure to drain the purge reservoir.
- ▲ Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- ▲ Never exceed manufacturer's recommended pressures.
- ▲ Never connect or disconnect a hose or line containing pressure; it may whip and/or cause hazardous airborne dust and dirt particles. Wear eye protection. Slowly open connections with care, and verify that no pressure is present. Never remove a component or plug unless you are certain all system pressure has been depleted.
- ▲ Use only genuine Bendix® brand replacement parts, components, and kits. Replacement hardware, tubing, hose, fittings, wiring, etc. must be of equivalent size, type, and strength as original equipment and be designed specifically for such applications and systems.
- ▲ Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.
- ▲ Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
- ▲ For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.
- ▲ The power MUST be temporarily disconnected from the radar sensor whenever any tests USING A DYNAMOMETER are conducted on a vehicle equipped with a Bendix® Wingman® system.
- ▲ You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.

⚠ WARNING

Improper use of the Bendix® Wingman® Fusion™ Driver Assistance System can result in a collision causing property damage, serious injuries, or death. Be sure to read, understand, and carefully follow the instructions in the Operator's Manual (BW2681) on b2bendix.com.

⚠ WARNING

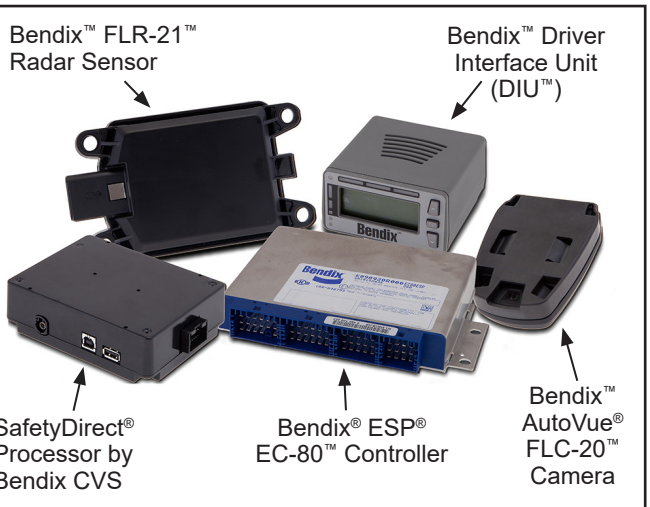
Due to the inherent limitations of image recognition technology, camera-based safety technology — on rare occasions — may not be able to detect or may misinterpret lane markings. At these times, alerts may not occur, or erroneous alerts may occur.

⚠ WARNING

Bendix safety technologies complement safe driving practices. No commercial vehicle safety technology replaces a skilled, alert driver exercising safe driving techniques and proactive, comprehensive driver training. Responsibility for the safe operation of the vehicle remains with the driver at all times.

⚠ IMPORTANT

It is the responsibility of the driver to remain vigilant and change driving practices depending on traffic and road conditions.



For more information, refer to the following Service Data Sheets on b2bendix.com:

- *SD-64-20124, Bendix™ AutoVue® FLC-20™ Camera*
- *SD-13-4986, Bendix® ESP® EC-80™ Controller*
- *SD-65-21025, SafetyDirect® By Bendix CVS Processor*

Figure 2 – Major Bendix® Wingman® Fusion™ System Components

The major components that are used in the Bendix® Wingman® Fusion™ Driver Assistance System are the Bendix® ESP® EC-80™ Controller, the Bendix™ FLR-21™ Radar Sensor, the Bendix™ AutoVue® FLC-20™ Camera (powered by the Mobileye® System-on-Chip EyeQ processor with state-of-the-art vision algorithms), the Bendix™ Driver Interface Unit (DIU™) or OEM dash display, the SafetyDirect® processor by Bendix CVS, and the vehicle's telematics system. *See Figure 2.*

FEATURES OF THE BENDIX WINGMAN FUSION SYSTEM

ACTIVE CRUISE CONTROL WITH BRAKING

The Active Cruise with Braking (ACB) feature is an additional upgrade of ordinary cruise control. When using cruise control, the Wingman Fusion system will maintain the set speed, and will also intervene – as needed – to help maintain a set following distance behind a detected forward vehicle.

Using the FLR-21 radar sensor mounted to the front of the vehicle – with a range of approximately 500 ft (152 m) – the Fusion system reacts to detected forward vehicles in the same lane, traveling in the same direction. *See Figure 1.*

The active cruise control with braking feature is designed to help maintain a set following distance between the vehicle and a detected forward vehicle when cruise control is set. *See the striped "Radar Beam" area in Figure 1.*

Once cruise control is set and the system is maintaining a set following distance between the vehicle and the forward detected vehicle, if the forward detected vehicle slows down below the cruise control's set speed, the Fusion system will intervene as necessary in this order in an attempt to maintain the set following distance behind the vehicle ahead:

(a) Reduce the engine throttle; then

(b) Apply the engine retarder; then

(c) Apply the foundation brakes.

NOTE: If during the intervention it is necessary to apply the foundation brakes, or the vehicle speed falls below the minimum cruise speed allowed, the vehicle will *not* automatically resume the cruise control set speed.

EXCEPTION: It is possible that some Fusion system applications allow the cruise control to automatically resume after the Fusion system applies the foundation brakes during cruise control. The driver is able to override the auto resume feature by manually activating the brake pedal.

If the vehicle ahead slows below the cruise control's set speed, but then accelerates away – and the Fusion system did not need to use the foundation brakes – the system will automatically accelerate back to the original cruise control set speed and maintain a set following distance behind any detected forward vehicles.

Because the Wingman Fusion system operates along with normal cruise control, all the typical features built into cruise control work as usual. For example, limits imposed by factory-set road speed governors, etc. are fully supported by the Fusion system.

ALERTS

The Wingman Fusion system assists by giving audible and visual alerts, whether or not cruise control is on. *Refer to Appendix E and Appendix K for more information on the types of alerts the driver may hear and/or see.*

COLLISION MITIGATION TECHNOLOGY

See the striped area in Figure 1. The Fusion system's collision mitigation technology is designed to be ready to alert the driver to detectable objects in front of the vehicle (whether or not cruise control is set) and react to the presence of stationary/moving vehicles in the lane ahead. Collision mitigation interventions provide the driver with an alert before an intervention occurs. The driver must immediately act to potentially avoid – or lessen the severity of – a collision.

OVERSPEED ALERT AND ACTION (OAA)

The Bendix® Wingman® Fusion™ Driver Assistance System has the ability to assist the driver by recognizing U.S. and Canadian speed limit signs. This allows the system to display the current posted speed limit and alert the driver when overspeed thresholds are detected. When changing between regions which post speeds in miles and those which post in kilometers, the speed limit sign recognition feature will not function until the correct U.S./metric selection has been made.

LANE DEPARTURE WARNING (LDW)

The Wingman Fusion system will monitor the visible lane markings on the road, and when an unexpected lane change – a lane change without an activated turn signal – takes place, the system will alert the driver to make a correction. Tired, distracted, or inattentive drivers are alerted and can take remedial actions.

SAFETY DATA RECORDING AND TRANSMISSION

Many Fusion-equipped vehicles use the SafetyDirect® by Bendix CVS processor and the vehicle's telematics processor to record vehicle and driver safety data after safety system events. Data collected includes signals on the vehicle communication network, images, video from the Bendix™ AutoVue® FLC-20™ camera, and internally generated data. Telematics devices transmit this data and video to the SafetyDirect web portal.

1.0 INTRODUCTION TO TROUBLESHOOTING

This section introduces three (3) initial steps to accurately troubleshoot the Bendix® Wingman® Fusion™ Driver Assistance System.

Read this introductory section – as well as the *Troubleshooting/Diagnostics Section (2.0)* – before performing any troubleshooting.

When diagnosing the Fusion system, a current version of Bendix® ACom® PRO™ Diagnostic Software is required. This software is available as a download at b2bendix.com.

NOTE: Prior to troubleshooting, all aftermarket-installed components should be removed from the vehicle and the vehicle must be returned to factory specifications. Once the vehicle is returned to factory specifications, the fault should be recreated prior to performing troubleshooting steps.

1.1 TROUBLESHOOTING BASICS

Refer to SD-64-20124, Bendix® AutoVue® FLC-20™ Camera, on b2bendix.com for camera diagnostics.

Troubleshooting Basics (1.1)	
Questions/Instructions	**Next Steps**
1. Have the driver run the Power-up Self-test.	**Power-up Self-test** This is a self-diagnostic check to determine if the system operation is normal. 1. Park the vehicle. Power off. 2. Put the key into the ignition and turn to the “ignition power” position. 3. Toggle the cruise control switch at least once, and leave it in the “on” position. 4. Start the vehicle, but do not drive away. 5. **Note that if the cruise control is in the “off” position, or if the vehicle is moving, this test will not run.** The self-test will start after 15 seconds, and takes approximately 5 seconds to complete. (Note that other vehicle system self-tests [i.e. the ABS “chuff” test] may run during the initial 15 seconds after ignition “on.”) As the Bendix Wingman Fusion system self-test runs, the driver should hear a short set of beeps. The test checks the engine, transmission, and brake systems to make sure they are communicating. In addition, depending on the vehicle, the test may briefly display a Following Distance Alert (FDA) alert message and/or cause the Forward Vehicle Detected icon in the instrument cluster to illuminate; this is normal.
2. Does the driver hear a long warning beep?	If no problem is found and the test is passed, no additional beeps/lamps will be displayed nor will a Diagnostic Trouble Code (DTC) be set. If the system has found an issue that will prevent it from functioning properly, **a long warning beep will sound** to alert the driver, and a DTC will be logged in the system (typically with a status indicator/dash icon illuminated). For descriptions of all DTCs, *refer to Section 2.5: Diagnostic Trouble Codes.*
3. Have the driver describe the system behavior that they believe shows it is not working properly.	When diagnosing the system, especially in cases where there are no DTCs logged, find out which part of the system behavior appears to be operating improperly. **NOTE:** False brake applications are often misdiagnosed and are, in fact, *not* brake applications, but rather loss of engine throttle caused by a J1939 communication failure on the vehicle. This is frequently caused by aftermarket components installed in the vehicle CAN line (i.e. electronic drivers logs [EDLs], GPS, or telematics systems).
4. Fill out the Troubleshooting Checklist *(pages 7–8)* and create a DTC report *(Appendix F).*	*The Checklist and DTC Report will clarify the problem and be necessary if a call to the Bendix Tech Team is needed.* *Refer to Section 1.2: Narrowing Down the Problem.*
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.	

Table 1 – Troubleshooting Basics

Troubleshooting Checklist	
WARNING: The Troubleshooting Checklist should not be completed while the vehicle is in motion and while the driver is completing the scenarios and tests.	
Detailed Scenarios and Tests	**Record Driver's Answers for Follow-up with Bendix**
Are there any active faults or lamps illuminated on the dash?	Yes ☐ No ☐ _____
Are there any aftermarket components installed on the vehicle?	Yes ☐ No ☐ _____
Does the vehicle maintain its set speed when the cruise control is switched on and set?	Yes ☐ No ☐ _____
Is the cruise control "set" icon displayed?	Yes ☐ No ☐ _____
While following a forward vehicle within radar range and the cruise control is switched on and set, record your response to the following:	
Is the "forward vehicle detected" icon displayed?	Yes ☐ No ☐ _____
What color is the icon?	Icon Color_____
When the forward vehicle slows down, does the truck also slow down to maintain the set distance?	Yes ☐ No ☐ _____
With engine cruise "off" and a forward vehicle present, does the audible alert become faster as the truck moves closer to the forward vehicle?	Yes ☐ No ☐ _____
With cruise control switched on and set, when the forward vehicle slows moderately or cuts in front of the truck and slows, did the driver observe any of the following conditions?	
Are there Diagnostic Trouble Codes (DTCs) logged?	Yes ☐ No ☐ _____
Does the vehicle slow and the Bendix® Wingman® Fusion™ system maintain the following distance?	Yes ☐ No ☐ _____
Is the engine throttle reduced?	Yes ☐ No ☐ _____
Is the engine retarder applied?	Yes ☐ No ☐ _____
Are foundation brakes applied?	Yes ☐ No ☐ _____
Does the truck proceed toward the forward vehicle without a following distance alert or braking intervention?	Yes ☐ No ☐ _____
With cruise engaged, when your vehicle passes a slower vehicle on the left or right on a straight road:	
Does the Bendix® Wingman® Fusion™ system ignore the vehicle you are overtaking?	Yes ☐ No ☐ _____
Does it give a following distance alert?	Yes ☐ No ☐ _____
With cruise engaged, if a faster vehicle passes your vehicle on the left or right on a straight road:	
Does it give a Following Distance Alert (FDA)?	Yes ☐ No ☐ _____

Troubleshooting Checklist	
WARNING: The Troubleshooting Checklist should not be completed while the vehicle is in motion and while the driver is completing the scenarios and tests.	
Detailed Scenarios and Tests	**Record Driver's Answers for Follow-up with Bendix**
With cruise control engaged, if the vehicle ahead slows moderately or cuts in front of your truck and slows down:	
Does your vehicle slow and the Bendix® Wingman® Fusion™ System maintain the following distance?	Yes ☐ No ☐ _____
Is the engine throttle reduced?	Yes ☐ No ☐ _____
Is the engine retarder applied?	Yes ☐ No ☐ _____
Are the foundation brakes applied?	Yes ☐ No ☐ _____
Does your truck proceed toward the forward vehicle without a Following Distance Alert (FDA) or braking intervention?	Yes ☐ No ☐ _____

1.2 NARROWING DOWN THE PROBLEM

Use this table to help assess if the Bendix® Wingman® Fusion™ System is not performing correctly. Be sure to have a thorough understanding of the system's normal behavior; this will reduce the troubleshooting time. This table provides a guide to basic troubleshooting questions and possible corrective actions. Items *in italics* cross-reference to the service procedures in this manual to repair the condition described.

Narrowing Down the Problem (1.2)	
Questions	**Next Steps**
Blocked Radar Sensor Issues	
Is mud, ice, or snow covering the radar sensor? Is anything blocking the view of the radar sensor?	Clean the radar sensor front surface immediately. Remove anything blocking the radar sensor then power cycle and read any remaining Diagnostic Trouble Codes (DTCs). *Refer to Section 2.5: Diagnostic Trouble Codes.* *Refer to Appendix A3: Bendix™ FLR-21™ Radar Sensor Mounting Clearance.* If the radar sensor is blocked by ice, snow, mud, tampering, etc. so that it cannot "see" a forward vehicle, the Wingman Fusion system will notify the driver by an audible and/or visual alert. After the blockage is removed, the audible and/or visual alert will be removed. Drivers should visually check the radar sensor for blockage during the pre-trip inspection.
Potential False Warnings	
Do false warnings seem to happen in construction zones?	Several road scenarios have a tendency to cause false warnings, including construction zones and bridges. Unless these false warnings are frequent, the system is likely reacting normally. The driver should not set the cruise control in construction zones. If driver complaints persist, continue asking questions to more narrowly define the driving condition presenting the problems. Review proper operating conditions in the operator's manual.
Mounting Problems	
Is the radar sensor mounting location (bumper or cross-member) damaged? Does the system seem to not "see" as far as it "used to," or warn on many more overhead bridges/signs than previously?	Re-align the radar sensor vertically and laterally. Use the following procedures: • Inspect the radar mounting. A solid mounting surface is necessary in order to hold the alignment. If the bumper or mounting cross-member is damaged, replace it first, then align the radar sensor. • *Refer to Appendix B1 and follow the actions directed in the procedure(s) and align the radar.* • *Refer to Appendix B4 to* check the vertical alignment and use Bendix® ACom® PRO™ Diagnostic Software to adjust if needed.
Does the mounting bracket look damaged or tampered with?	Other than expected surface scratches or some discoloration over time, there should be no visible damage to the radar sensor bracket assembly or the bumper. If no visible damage is found, realign the radar sensor vertically and laterally. • *Refer to Appendix B4* to check the vertical alignment and adjust if needed. • *Refer to Appendix B2 and B3* to check the lateral alignment and use ACom PRO Diagnostic Software to adjust if needed.. The radar sensor needs a solid mounting surface in order to hold the alignment. If the radar sensor alignment cannot be held in place, the bracket assembly must be replaced, and/or if the bumper or mounting cross-member is damaged, replace it as needed. When replacing either or both of these, align the radar sensor using the procedure shown in *Appendix C.*

Table 2 – Narrowing Down the Problem

Narrowing Down the Problem (1.2)	
Questions	**Next Steps**
Has the system worked without problems in the past but is not working as expected now?	This is a good indication that something has changed – such as misalignment of the radar sensor. Review the following questions with the driver to further diagnose the problem.
Has the radar sensor been changed recently?	If so, the new radar sensor may be incompatible with the vehicle. In addition, check any system Diagnostic Trouble Codes (DTCs) with Bendix® ACom® PRO™ Diagnostic Software. *Refer to Section 2.5: Diagnostic Trouble Codes.* Check the radar sensor baud rate. Confirm the part number (located on the back of the radar sensor) is the correct part number per the vehicle's VIN. Confirm the radar sensor is not installed backwards (the mirror and connector tab on the radar sensor are good references [**NOTE:** all label stickers should face the rear of the vehicle]).
Did the radar sensor currently on the vehicle come from another vehicle?	The radar sensor may be incompatible with the new vehicle. Follow Section K1.15: *Radar Sensor Interchangeability* procedure and check system DTCs with Bendix ACom PRO diagnostic software. *Refer to Section 2.5: Diagnostic Trouble Codes.*
With cruise control set, does the system consistently apply the foundation brakes when a forward vehicle slows?	This is normal operation. If the radar system interventions are not typical, the radar sensor may be misaligned. • Inspect the radar mounting. A solid mounting surface is necessary in order to hold the alignment. If the bumper or mounting cross-member is damaged, replace it first, then align the radar sensor. • *Refer to Appendix B1 and use the flowchart to find out the procedure needed. Follow the actions directed in the procedure and align the radar.* • *Refer to Appendix B2 and B3.* The service technician will need to check trouble codes as well. *Read Section 2.5: Diagnostic Trouble Codes.*
Does a DTC seem to occur when driving through the desert or in barren areas (no road signs, trees, or vehicles)?	In normal operation, the active cruise control with braking feature of the Bendix Wingman Fusion system may indicate a DTC if it hasn't detected a metallic object after a pre-determined period. This is rare, but most likely to occur when driving in deserts or barren areas. If the system does set a DTC, the Bendix Wingman Fusion system provides a visible warning to the driver. In addition, the vehicle will also drop out of cruise mode, providing an audible and/or visual warning to the driver as well. The driver must pull off the road and cycle the ignition before the vehicle's cruise control can be used.
Does the system seem to disengage after an automatic braking event?	This is normal operation. The driver must set or "resume" the cruise control once again to regain the following distance function.
Does cruise control disengage sometimes when the brakes come on and not at other times?	This is normal operation. When traveling with lightly loaded trailers, or "bobtail", the active cruise control with braking feature of the Bendix Wingman Fusion system may continue to function even after an automatic brake application. No driver input is needed.
Does the connector or wiring appear damaged?	Wires can become corroded if the radar sensor is not plugged in properly. Clean the connectors on the wire harness, as well as the radar sensor, and reattach. If wires are chafed, replace the wire harness. Also, check for trouble codes. *Refer to Section 2.5: Diagnostic Trouble Codes and Section 2.12: Troubleshooting Wiring Harnesses.*
Does the system generate a DTC going down a grade when using ACB (Active Cruise-control with Braking) to slow the vehicle, but the code goes away later?	This is normal operation. The active cruise control with braking feature of the Bendix Wingman Fusion system is not intended to be used on grades. Verify there are no DTCs. Proper downgrade driving techniques should be used. *Refer to Section 2.5: Diagnostic Trouble Codes*.
Does the radar sensor have noticeable damage beyond normal discoloration or surface scratches?	The radar sensor and bracket are very durable. However, if the radar sensor housing or cover is cracked or broken, immediately look for trouble codes via Bendix ACom PRO diagnostic software and replace the damaged radar sensor. *Refer to Section 2.5: Diagnostic Trouble Codes and Appendix A3: Radar Sensor Mounting Clearance.*

Table 2 – Narrowing Down the Problem

1.3 OVERVIEW OF POSSIBLE ISSUES

Some customer issues are actually misunderstandings of how the Bendix® Wingman® Fusion™ system performs normally. Use Table 3 below to learn the causes of potential issues if the Fusion system is not performing correctly. Some issues can be investigated by a visual inspection. Others may cause a Diagnostic Trouble Code (DTC) to be logged: *Refer to Section 2.5: Diagnostic Trouble Codes*.

Overview of Possible Issues (1.3)	
Issue	**Description**
Vehicle Diagnostic Trouble Codes (DTCs)	**The Bendix Wingman Fusion system will not operate and will set a DTC if any of the following vehicle systems also show a DTC: engine, engine cruise, instrument cluster, Bendix® ABS, Bendix® ATC, Bendix® ESP®, or transmission. These components must be repaired and cleared of DTCs before troubleshooting the Wingman Fusion system. (*NOTE: Clearing the vehicle DTCs may be the only step needed to reestablish full Fusion system functionality. Refer to Section 2.6: Clearing Diagnostic Trouble Codes (DTCs).***
System familiarity	Verify the system functionality. Is it operating normally or not? Drivers who are unfamiliar with the system may report dissatisfaction over the way it beeps or how it activates the brakes. *Refer to Section 1.0: Introduction to Troubleshooting, Section 1.1: Troubleshooting Basics, and Section 2.5: Diagnostic Trouble Codes to verify if the system is functioning normally;* then continue.
DTCs caused by temporary operating conditions	Some DTCs indicate a temporary condition and will clear when that condition is no longer present. If these persist, further investigation is warranted. *Refer to Section 1.1: Troubleshooting Basics*.
Radar sensor blocked	If the system doesn't seem to work at all, the radar sensor may possibly be blocked. If the radar is blocked, an alert should be issued to the driver to indicate this condition. Visually inspect the area around the radar, clear the blockage, turn the ignition on and run through a power cycle. *Refer to Appendix A3 for more information about radar mounting and clearances.*
Damaged radar sensor or bracket	If the vehicle has been in an accident, it is likely the radar sensor will need to be re-aligned or replaced. Inspect the radar sensor and housing for damage. Radar sensor discoloration or small scratches may be acceptable. Significant damage (such as cracks or broken pieces) will require radar sensor replacement. Regardless of the exterior condition, *check for DTCs outlined in the Section 2.5: Diagnostic Trouble Codes (DTCs) to determine if radar sensor replacement is necessary.*
Damaged connector or wiring	Visually inspect the connector and wire harness for corrosion or chafing. *Refer to Sections 2.7: Troubleshooting Diagnostic Trouble Codes: Power Supply and 2.8 Serial Data (J1939) Communications Link of this document for additional troubleshooting.*
Radar sensor misalignment	Inspect the front of the vehicle. If a) it has been damaged; or b) the vehicle does not track straight, either of these conditions must be repaired before troubleshooting the Bendix Wingman Fusion system. If there is a DTC set or if the system does not function, the radar sensor may be severely misaligned and the Wingman Fusion system will not operate until this is corrected. *Refer to Appendix B - Radar Alignment*.
J1939 network problems	**If the entire system is non-functional, it may be a J1939 network problem. *Follow the instructions in Section 2.8: Serial Data (J1939) Communications Link.***
Power to radar sensor problems	If the entire system is non-functional, another likely cause may be a lack of power to the radar sensor. *Follow the instructions in Section 2.7: Troubleshooting Diagnostic Trouble Codes: Power Supply.*

Table 3 – Overview of Possible Issues

1.4 IMPORTANT NOTE ON TELEMATICS WIRING

Where a vehicle does not have an On Board Computer/ Telematics (OBC/T) system – in order to prevent interference to the SafetyDirect® by Bendix CVS Web Portal Processor – disconnect the OBC/T harness (any wiring harness provisionally installed in the vehicle for potential use for Telematics) from the main vehicle harness. Re-connect the harness only when an OBC/T system is installed. (*Refer to Appendix K, Figure K6*).

2.0 TROUBLESHOOTING/ DIAGNOSTICS SECTION

IMPORTANT

All vehicle Diagnostic Trouble Codes (DTCs) related to the engine, transmission, instrument cluster, engine cruise control, and Bendix® ABS, ATC, or ESP® systems must first be resolved – with no trouble codes present during the vehicle operation while in cruise control – before attempting to diagnose Bendix® Wingman® Fusion™ system DTCs.

Important examples are VDC2 and EBC DTCs which are typically related to the brake controller. The hierarchy of Electronic Control Units (ECUs) determines that any DTCs on the brake controller must be resolved before attempting to troubleshoot the Wingman Fusion system.

2.1 BENDIX® ACOM® PRO™ DIAGNOSTIC SOFTWARE

Bendix® ACom® PRO™ Diagnostic Software is a PC-based software program available to purchase from bendix.com. This software provides the technician with access to all the available Electronic Control Unit (ECU) diagnostic information and configuration capability. For controller-specific system diagnostics, use a current version of the ACom PRO Diagnostic Software.

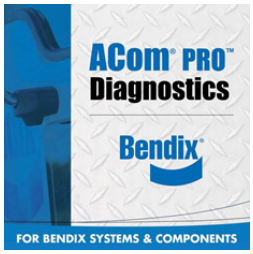


Figure 4 – Bendix ACom PRO Diagnostic Software

STARTING BENDIX ACOM PRO DIAGNOSTIC SOFTWARE

The ACom PRO Diagnostic Software can be started from the desktop shortcut. To begin, the technician should select “Connect” from the main toolbar, then “Heavy Duty” connection type. The “Heavy Duty” button connects to the vehicle BUS using all vehicle protocols. This process could take approximately two (2) minutes. After the connection is complete, the roll call will show the ECU and its active and inactive DTCs. The connection depends on a compatible RP1210C adapter. For assistance with the ACom PRO Diagnostic Software, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725, option 2, option 2).

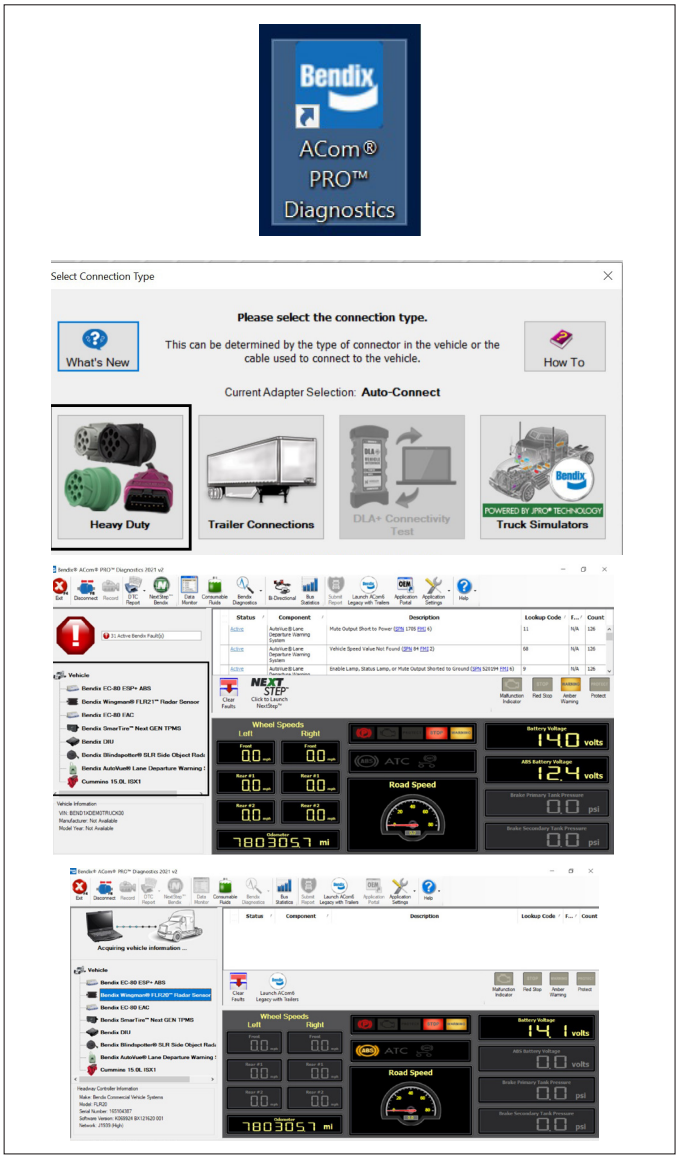


Figure 5 - Starting Bendix ACom PRO Diagnostic Software

2.2 READING DIAGNOSTIC TROUBLE CODES (DTCS)

1. Connect a current version of the Bendix® ACom® PRO™ Diagnostic Software to the vehicle.
2. Once the roll call is complete, you can view active and inactive DTCs and clear DTCs from all vehicle components or solely from a selected Bendix controller.
3. To read and clear DTCs from all vehicle components at the same time, select the vehicle on the roll call and clear the DTCs by selecting “Clear Faults.”
4. To read and clear DTCs from a specific Bendix Electronic Control Unit (ECU), select the Bendix ECU on the roll call select “Clear Faults.”

For assistance with ACom PRO Diagnostic Software, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725, option 2, option 2).

2.3 READING THE SYSTEM SOFTWARE VERSION

Connect a current version of Bendix® ACom® PRO™ Diagnostic Software to the vehicle. View the software version by selecting the appropriate vehicle.

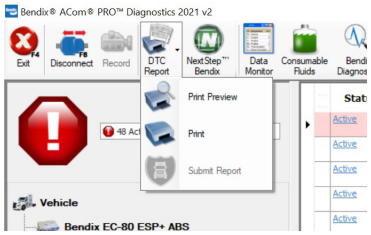
Figure 6 – Bendix® ACom® PRO™ Diagnostic Software Starter Screen Showing Software Version

2.4 HOW TO GENERATE A BENDIX WINGMAN FUSION SYSTEM DIAGNOSTIC TROUBLE CODE (DTC) REPORT

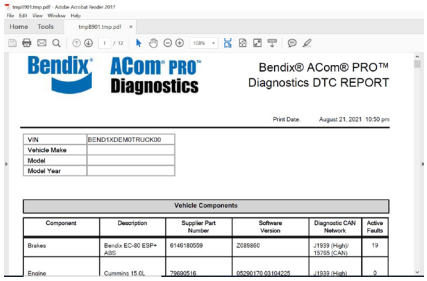
1. Connect a current version of the Bendix® ACom® PRO™ Diagnostic Software with the vehicle.

2. Once the roll call is complete, you can select the DTC Report icon on the top menu.

3. The DTC report drop-down gives you the following options:
   - Print DTC Report
   - Print Preview of the DTC Report
   - Submit DTC Report



4. Select “Print Preview” to generate and save the report



ADDITIONAL SUPPORT AT BENDIX.COM / 1-800-AIR-BRAKE (1-800-247-2725), OPTION 2

For the latest information, and for downloads of the Bendix® ACom® PRO™ Diagnostic Software, visit b2bendix.com.

You will also find a current list of compatible RP1210 data link adapters for ABS and the Bendix® Wingman® ACB system.

For direct telephone technical support, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available Monday through Thursday, 8:00 a.m. – 6:00 p.m., and Friday, 8:00 a.m. – 5:00 p.m. ET. For assistance, follow the instructions in the recorded message. Be sure to have a filled-out Troubleshooting Checklist *(pages 7–8)* and a Bendix ACom PRO Diagnostic Software Diagnostic Trouble Code (DTC) report *(Section 2.4)* before calling.

You can also reach the Bendix Tech Team by email at techteam@bendix.com.

2.5 TABLE OF BENDIX® WINGMAN® FUSION™ FLR-21™ RADAR SENSOR DIAGNOSTIC TROUBLE CODES (DTCs)

IMPORTANT

Review the preliminary steps prior to referencing the Diagnostic Trouble Code (DTC) and Service Action Code tables (Table 4A and Table 4B).

1. Check Bendix® ACom® PRO™ Diagnostic Software for the Diagnostic Trouble Codes (DTCs) that indicate an inoperable radar. If one of these DTCs is active and displayed on ACom PRO ***and the Bendix® Wingman® Fusion™ System is still under warranty***, you can submit for a warranty evaluation.

2. Faults referencing *J1939 Signal Missing* are faults indicating that the Bendix® FLR-21™ Radar Sensor did not receive a required message from the component listed in the fault description (*refer to the acronym table below*). *Refer to the associated Service Action Code list in Table 4B.*

Acronym	Description
ABS	Antilock Braking System
ACC	Adaptive Cruise Control
AEBS	Autonomous Emergency Brake System
ASR	Anti-slip Reduction
CC	Cruise Control
CCVS	Cruise Control Vehicle Speed
CMT	Collision Mitigation Technology
CVW	Combined Vehicle Weight
DTC	Diagnostic Trouble Code
DM	Diagnostic Message
EBC	Electronic Brake Control
EC	Electronic Control
ECM	Electronic Control Module
EEC	Electronic Engine Control
ERC	Electronic Retarder Control
FLC	Forward-looking Camera
GCVW	Gross Combined Vehicle Speed
HDB	Highway Departure Braking
OEL	Operator's External Light
RC	Retarder Control
ROP	Rollover Prevention
TC	Torque Control
TSC	Torque/Speed Control
TSR	Traffic Sign Recognition
VDC	Vehicle Dynamic Controller
XBR	External Brake Request

NOTE: Bendix™ FLR-10™ radar sensors use a different set of DTCs.
Refer to SD-61-4962 on b2bendix.com.

For DTC(s), refer to Table 4A. Alternately, refer to Appendix M for a table sorted by SPN (Suspect Parameter Number) and FMI (Failure Mode Identifier) code combinations.

In Table 4A, find the DTC(s) found in column one and determine the Service Action Code(s) to look up in Table 4B.

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
1–2	Internal radar sensor error	886	12	A
3	Antenna is dirty or partially blocked	886	17	B
4	Battery voltage too low	886	4	C
5	Battery voltage too high	886	3	
6–10	Internal radar sensor error	630	12	A
11	J1939 Error Frame limit reached: J1939 wiring error	639	19	Y
12	Radar detects intermittent loss of J1939 messages from vehicle components	639	9	
13–14	Not used	#N/A	#N/A	Not Used
15	Internal radar sensor error	886	12	A
16	Antenna is dirty or partially blocked	886	1	B
17–18	Internal radar sensor error	630	12	A
19	Not used	#N/A	#N/A	Not Used
20	Internal radar sensor error	630	12	A
21	Not used	#N/A	#N/A	Not Used
22	Internal radar sensor error	886	14	A
23–27	Internal radar sensor error	886	12	
28	Internal radar sensor error	1799	14	D
29	J1939 signal: Missing AEBS2 message	5681	14	
30	J1939 signal: Missing CCVS1 message	527	14	D
31	J1939 signal: Missing CVW message	1760	14	D
32	J1939 signal: Missing EBC1 message	1243	14	
33	J1939 signal: Missing EBC2 message	904	14	
34	J1939 signal: Missing EBC5 message	2919	14	
35	J1939 signal: Missing EEC1 message	190	14	
36	J1939 signal: Missing EEC2 message	91	14	
37	J1939 signal: Missing ERC1_DR message	520	9	
38	J1939 signal: Missing ERC1_XR message	520	14	
39	Not used	#N/A	#N/A	Not Used
40	J1939 signal: Missing OEL message	2876	14	D
41	Not used	#N/A	#N/A	Not Used
42	J1939 signal: Missing VDC2 message	1807	14	D
43	Not used	#N/A	#N/A	Not Used
44	J1939 signal: Missing EBC3 message	1091	14	D
45	Not used	#N/A	#N/A	Not Used
46	Radar sensor is misaligned	886	7	G
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
47	Internal radar sensor error	886	12	A
48	Internal radar sensor error	630	14	A
49–53	Not used	#N/A	#N/A	Not Used
54	Internal radar sensor error	630	12	A
55–58	Not used	#N/A	#N/A	Not Used
59	Internal radar sensor error	886	31	A
60	Internal radar sensor error	886	12	
61	Internal radar sensor error	886	14	
62	Not used	#N/A	#N/A	Not Used
63	Internal radar sensor error	886	12	A
64–65	Not used	#N/A	#N/A	Not Used
66	Internal radar sensor error	886	12	A
67	Internal radar sensor error	886	8	
68–77	Internal radar sensor error	886	12	
78	Bendix® ABS J1939 proprietary message signal missing or error state	2551	14	H
79–81	Internal radar sensor error	886	12	A
82	Active Cruise Control braking overuse	3839	0	J
83	J1939 signal: ACC1 Engine not properly configured for Bendix® Wingman®	5606	13	K
84–85	Internal radar sensor error	630	12	A
86	CMT Configuration mismatch between brake controller and radar sensor	886	13	L
87	J1939 signal: Missing VDC1 message	1814	14	D
88	CMT braking overuse	2920	0	M
89–91	Not used	#N/A	#N/A	Not Used
92	J1939 signal: Invalid CCVS2 wheel speed	84	2	N
93	J1939 signal: Error in CCVS1 wheel speed	84	19	N
94	J1939 signal: Not available CCVS1 wheel speed	84	9	N
95	J1939 signal: Invalid CCVS1 CC speed	86	2	N
96	J1939 signal: Error in CCVS1 CC speed	86	19	N
97	J1939 signal: Not available CCVS1 CC speed	86	9	N
98	J1939 signal: Error CCVS1 CC active	595	19	N
99	J1939 signal: Not available CCVS1 CC active	595	9	N
100	J1939 signal: Error in CCVS1 CC enable	596	19	N
101	J1939 signal: Not available CCVS1 CC enable	596	9	N
102–103	Not used	#N/A	#N/A	Not Used
104	J1939 signal: Invalid CVW GCVW	1760	2	N
105	J1939 signal: Error in CVW gross combination vehicle weight (GCVW)	1760	19	N
106	J1939 signal: Not available CVW GCVW	1760	9	N
107	J1939 signal: Error in EBC1 brake switch	1121	19	N
108	J1939 signal: Not available EBC1 brake switch	1121	9	N
109	J1939 signal: Error in EBC1 ABS fully operational	1243	19	N
110	J1939 Signal: Not available EBC1 ABS Operate	1243	9	N
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
111	J1939 signal: Invalid EBC2 front axle	904	2	N
112	J1939 signal: Error in EBC2 front axle	904	19	N
113	J1939 signal: Not available EBC2 front axle	904	9	N
114	J1939 signal: Invalid EBC2 LF wheel	905	2	N
115	J1939 signal: Error in EBC2 LF wheel	905	19	N
116	J1939 signal: Not available EBC2 LF wheel	905	9	N
117	J1939 signal: Invalid EBC2 RF wheel	906	2	N
118	J1939 signal: Error in EBC2 RF wheel	906	19	N
119	J1939 signal: Not available EBC2 RF wheel	906	9	N
120	J1939 signal: Invalid EBC2 LR1 wheel	907	2	N
121	J1939 signal: Error in EBC2 LR1 wheel	907	19	N
122	J1939 signal: Not available EBC2 LR1 wheel	907	9	N
123	J1939 signal: Invalid EBC2 RR1 wheel	908	2	N
124	J1939 signal: Error in EBC2 RR1 wheel	908	19	N
125	J1939 signal: Not available EBC2 RR1 wheel	908	9	N
126	J1939 signal: Invalid EBC5 XBR state	2917	2	N
127	J1939 signal: Error in EBC5 XBR state	2917	19	N
128	J1939 signal: Not available EBC5 XBR state	2917	9	N
129	J1939 signal: Error in EBC5 brake use	2919	19	N
130	J1939 signal: Not available EBC5 brake use	2919	9	N
131	J1939 signal: Invalid EBC5 XBR limit	2921	2	N
132	J1939 signal: Error in EBC5 XBR limit	2921	19	N
133	J1939 signal: Not available EBC5 XBR limit	2921	9	N
134	J1939 signal: Error in EBC5 brake temp	3839	19	N
135	J1939 signal: Not available EBC5 brake temp	3839	9	N
136	J1939 signal: Invalid EC1 engine reference torque	544	2	N
137	J1939 signal: Error in EC1 engine reference torque	544	19	N
138	J1939 signal: Not available EC1 engine reference torque	544	9	N
139	J1939 signal: Invalid EEC1 engine speed	190	2	N
140	J1939 signal: Error in EEC1 engine speed	190	19	N
141	J1939 signal: Not available EEC1 engine speed	190	9	N
142	J1939 signal: Invalid EEC1 driver torque	512	2	N
143	J1939 signal: Error in EEC1 driver torque	512	19	N
144	J1939 signal: Not available EEC1 driver torque	512	9	N
145	J1939 signal: Invalid EEC1 actual torque	513	2	N
146	J1939 signal: Error in EEC1 actual torque	513	19	N
147	J1939 signal: Not available EEC1 actual torque	513	9	N
148	J1939 signal: Invalid EEC2 accelerator pedal position	91	2	N
149	J1939 signal: Error in EEC2 accelerator pedal position	91	19	N
150	J1939 signal: Not available EEC2 accelerator pedal position	91	9	N
151–154	Not used	#N/A	#N/A	Not Used
155	J1939 signal: Invalid OEL turn signal	2876	2	N
156	J1939 signal: Error in OEL turn signal	2876	19	N
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
157	J1939 signal: Not available OEL turn signal	2876	9	N
158	J1939 signal: Error in VDC1 ROP brake control	1818	19	N
159	J1939 signal: Not available VDC1 ROP brake control	1818	9	N
160	J1939 signal: Error in VDC1 ROP engine control	1816	19	N
161	J1939 signal: Not available VDC1 ROP engine control	1816	9	N
162	J1939 signal: Error in VDC1 YC brake control	1819	19	N
163	J1939 signal: Not available VDC1 YC brake control	1819	9	N
164	J1939 signal: Error in VDC1 YC engine control	1817	19	N
165	J1939 signal: Not available VDC1 YC engine control	1817	9	N
166	J1939 signal: Invalid VDC2 steer angle	1807	2	N
167	J1939 signal: Error in VDC2 steer angle sensor	1807	19	N
168	J1939 signal: Not available VDC2 steer angle	1807	9	N
169	J1939 signal: Invalid VDC2 yaw rate	1808	2	N
170	J1939 signal: Error in VDC2 yaw rate	1808	19	N
171	J1939 signal: Not available VDC2 yaw rate	1808	9	N
172–174	Not used	#N/A	#N/A	Not Used
175	J1939 signal: Invalid TSC1 requested torque limit	518	2	N
176	J1939 signal: Error in TSC1 requested torque limit	518	19	N
177	J1939 signal: Not available TSC1 requested torque limit	518	9	N
178	Antenna is dirty or partially blocked	886	17	B
179	Vehicle Cruise Control and ACC out of sync	886	14	S
180	Radar mounting offset is out of range	886	2	T
181	J1939 signal: EBC1 ABS not fully operational	1243	2	U
182	J1939 signal: VDC1 VDC not fully operational	1814	2	H
183	J1939 signal: Error in VDC1 VDC fully operational	1814	19	N
184	J1939 signal: Not available VDC1 VDC fully operational	1814	9	N
185	ABS tire size needs recalibration	1069	13	V
186	Internal radar sensor error	630	12	A
187	J1939 signal: Error in ACC1 ACC mode	5606	2	N
188	J1939 signal: Not available ACC1 ACC mode	5606	19	N
189	J1939 signal CCVS3: Engine not properly configured for Bendix Wingman	5606	13	K
190	Internal radar sensor error	5676	14	A
191	Internal radar sensor error	2921	12	A
192–193	Internal radar sensor error	630	12	A
194	Proprietary CAN: Message counter error	625	19	X
195	Proprietary CAN: Message timeout	625	9	X
196	Proprietary CAN: Message inconsistent	625	2	X
197	Not used	#N/A	#N/A	Not Used
198	J1939 signal: Missing EC1 message	188	14	D
199	J1939 signal: Error in AEBS2 driver activation demand	5681	19	N
200	J1939 signal: Not available AEBS2 driver activation	5681	9	N
201	J1939 signal: Error in AEBS2 message checksum	5683	19	N
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
202–204	Not used	#N/A	#N/A	Not Used
205	J1939 signal: Invalid ACC2 requested ACC distance mode	1799	2	N
206	J1939 signal: Error in ACC2 requested ACC distance mode	1799	19	N
207	J1939 signal: Not available ACC2 distance mode	1799	9	N
208	J1939 signal: Error in ACC2 ACC usage demand	5023	19	N
209	J1939 signal: Not available ACC2 ACC usage	5023	9	N
210	J1939 signal: Error in AUXIO1 trailer ABS operational	707	19	N
211	J1939 signal: Not available AUXIO trailer ABS operational	707	9	N
212	J1939 signal: Error in AUXIO1 trailer ABS detected	706	19	N
213	J1939 signal: Not available AUXIO trailer ABS detected	706	9	N
214	J1939 signal: Error in AUXIO1 trailer connected	705	19	N
215	J1939 signal: Not available AUXIO trailer connected	705	9	N
216	J1939 signal: Error in CCVS1 parking brake switch	70	19	N
217	J1939 signal: Not available CCVS1 parking brake switch	70	9	N
218	J1939 signal: Error in CCVS1 Cruise Control set switch	599	19	N
219	J1939 signal: Not available CCVS1 set switch	599	9	N
220	J1939 signal: Error in CCVS1 Cruise Control coast switch	600	19	N
221	J1939 signal: Not available CCVS1 coast switch	600	9	N
222	J1939 signal: Error in CCVS1 Cruise Control resume switch	601	19	N
223	J1939 signal: Not available CCVS1 resume switch	601	9	N
224	J1939 signal: Error in CCVS1 Cruise Control accelerate switch	602	19	N
225	J1939 signal: Not available CCVS1 ACCL switch	602	9	N
226	J1939 signal: Error in CCVS1 Cruise Control pause switch	1633	19	N
227	J1939 signal: Not available CCVS1 pause switch	1633	9	N
228	J1939 signal: Invalid EBC1 brake pedal position	521	2	N
229	J1939 signal: Error in EBC1 brake pedal position	521	19	N
230	J1939 signal: Not available EBC1 brake pedal position	521	9	N
231	J1939 signal: Error in EBC1 anti-lock braking active	563	19	N
232	J1939 signal: Not available EBC1 ABS active	563	9	N
233	J1939 signal: Error in EBC1 ASR engine control active	561	19	N
234	J1939 signal: Not available EBC1 ASR engine control active	561	9	N
235	J1939 signal: Error in EBC1 ASR brake control active	562	2	N
236	J1939 signal: Not available EBC1 ASR brake control active	562	19	N
237	J1939 signal: Error in EBC1 source address of controlling device	1481	2	N
238	J1939 signal: Not available EBC1 source address of controlling device	1481	19	N
239	J1939 signal: Invalid EBC5 XBR active control mode	2918	2	N
240	J1939 signal: Error in EBC5 XBR active control mode	2918	19	N
241	J1939 signal: Not available EBC5 XBR active control mode	2918	9	N
242–245	Not used	#N/A	#N/A	Not Used
246	J1939 signal: Invalid EC1 engine speed at idle point 1	188	2	N
247	J1939 signal: Error in EC1 engine speed at idle point 1	188	19	N
248	J1939 signal: Not available EC1 engine speed at idle point 1	188	9	N
249	J1939 signal: Invalid EEC3 nominal friction percent torque	514	2	N
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
250	J1939 signal: Error in EEC3 nominal friction percent torque	514	19	N
251	J1939 signal: Not available EEC3 nominal friction percent torque	514	9	N
252	J1939 signal: Error in ETC1 transmission driveline engaged	560	19	N
253	J1939 signal: Not available ETC1 transmission driveline engaged	560	9	N
254	J1939 signal: Invalid ETC2 transmission selected gear	524	2	N
255	J1939 signal: Error in ETC2 transmission selected gear	524	19	N
256	J1939 signal: Not available ETC2 transmission selected gear	524	9	N
257	J1939 signal: Invalid ETC2 transmission actual gear ratio	526	2	N
258	J1939 signal: Error in ETC2 transmission actual gear ratio	526	19	N
259	J1939 signal: Not available ETC2 transmission actual gear ratio	526	9	N
260	J1939 signal: Invalid ETC2 transmission current gear	523	2	N
261	J1939 signal: Error in ETC2 transmission current gear	523	19	N
262	J1939 signal: Not available ETC2 transmission current gear	523	9	N
263	J1939 signal: Error in TC1 transmission requested gear	525	19	N
264	J1939 signal: Not available TC1 transmission requested gear	525	9	N
265	J1939 signal: Missing AUXIO message	701	14	D
266	J1939 signal: Missing DM1 message	1214	14	D
267	J1939 signal: Missing EEC3 message	514	14	D
268	J1939 signal: Missing ETC1 message	560	14	D
269	J1939 signal: Missing ETC2 message	524	14	D
270	J1939 signal: Missing TC1 message	525	14	D
271	J1939 signal: Missing FLC message	1705	14	D
272	J1939 signal: AUXIO trailer ABS not fully operational	707	2	H
273	Proprietary CAN: Message counter increment error	625	10	X
274	Fusion configuration mismatch between brake controller and radar sensor	630	19	L
275	J1939 signal: Missing ETC5 message	767	14	D
276	J1939 signal: Error in ETC5 reverse switch	767	19	N
277	J1939 signal: Not available ETC5 reverse switch	767	9	N
278	J1939 signal: Error in CCVS1 brake switch	597	19	N
279	J1939 signal: Not available CCVS1 brake switch	597	9	N
280	XBR is locked out	1196	19	A
281	Internal radar sensor error	630	12	A
282	Automatic braking system was activated too many times	2920	0	M
283	Internal radar sensor error	886	12	A
284	Fusion configuration mismatch between brake controller and radar sensor	625	13	L
285	AEBS deactivated because of factory mode	5681	13	B
286	System detected an error requiring a radar shutdown	886	18	A
287	System detected engine not properly responding to control messages	513	13	FF
290	J1939: Engine Controller Signal Invalid - ERC1 Actual Engine Torque	1717	2	Z
291	J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque	1717	19	Z
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Table 4A: Diagnostic Trouble Codes (DTCs), Descriptions, and Service Action Codes				Go to the Service Action Code List in Table 4B *(Pages 22-30)*
DTC	**Description**	**SPN**	**FMI**	
292	J1939: Retarder Controller Signal Not Available - Retarder ERC1 Actual Max Torque	1717	9	Z
293	J1939: Retarder Controller Signal Invalid - RC Reference Torque	556	2	Z
294	J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque	556	19	Z
295	J1939: Retarder Controller Signal Not Available - Retarder RC Reference Torque	556	9	Z
296	J1939: Retarder Controller Signal Timeout - Engine RC Message	901	9	Z
297	J1939: Retarder Controller Signal Timeout - Driveline RC Message	901	14	Z
298	Radar mismatch with Engine ACC Control Type	517000	14	EE
299	Radar mismatch with ABS configuration for Highway Departure Braking	517001	14	L
300	Radar mismatch with ABS configuration for Multi-Lane Automatic Emergency Braking	517002	14	L
301	Radar mismatch with ABS configuration for Adaptive Cruise Control Type	517003	14	L
302	Fusion Configuration – Highway Departure Braking – mismatch between camera sensor and radar sensor	517004	14	CC
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.				

Table 4A – DTC Code to Service Action Code (Pages 15 – 21)

Service Action Codes and the Recommended Service to Perform

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
A	**This Diagnostic Trouble Code (DTC) *is* a failure of the FLR-21 radar sensor. *Replace the FLR-21 radar sensor.*** **Prior to replacing the FLR-21 radar sensor, perform the following:** • Clear the Bendix® Wingman® Fusion™ system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. • If the error returns, replace the FLR-21 radar sensor.
B	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • These DTCs may arise from infrequent conditions that could occur normally. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check for proper installation of the FLR-21 radar sensor. This DTC is commonly caused by the FLR-21 radar sensor being installed backwards. • Check for FLR-21 radar sensor obstruction. Clean dirt – or packed snow or ice – from the FLR-21 radar sensor if present. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
C	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • These DTCs result from incorrect ignition, battery supply voltage, or wiring harness issues as measured at the FLR-21 radar sensor. **Review the following sections:** • 2.7: *Ignition Voltage Too Low* • 2.7: *Ignition Voltage Too High* • 2.7: *Power Supply Tests* • 2.12: *Troubleshooting Wiring Harnesses* **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Verify the ignition supply voltage to the FLR-21 radar sensor is between 9 to 16 VDC. • Visually check for damaged or corroded connectors. • Visually check for damaged wiring. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
D	**This Diagnostic Trouble Code (DTC) *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor.** **Possible causes:** • The Bendix® Wingman® Fusion™ system is indicating a J1939 communication error. • The FLR-21 radar sensor is not receiving/missing messages from the other system components. • There is aftermarket component interference. • This DTC could be accompanied by other active DTCs. **Review the following sections:** • K1.15: *FLR-21 Radar Sensor Interchangeability* • 2.10: *J1939 Engine Communications Test Procedure* **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).* If the error persists, continue to the next step. • Remove all aftermarket components from the J1939 CAN line and retest vehicle communications. • Check the source of the J1939 message to identify why the signal has invalid data in the J1939 message. • Check the engine, engine retarder, and Antilock Braking System (ABS) for DTCs using the manufacturer's diagnostic procedures. Either the engine, engine retarder, or the ABS are the source of the J1939 message. The component that broadcasts the signal must be investigated first. Some examples are gross vehicle weight and various engine torque signals. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
G	**This DTC *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor.** **Possible cause:** • The FLR-21 radar sensor is out of alignment. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Physically check that the FLR-21 radar sensor is securely mounted in its original mounting location with OE-specified hardware. • Refer to *Appendix B1* and use the flowchart to find out the procedure needed. Follow the actions directed in the procedure and align the FLR-21 radar sensor. • Use Bendix® ACom® PRO™ Diagnostic Software to reset the alignment value. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
H	**This Diagnostic Trouble Code (DTC) *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • The Bendix® Wingman® Fusion™ system is indicating a required J1939 message from the Antilock Braking System (ABS) controller is missing or the ABS controller is sending a message indicating an ABS fault. • This DTC could be accompanied by other active DTCs. **Review the following sections:** • K1.15: *FLR-21 Radar Sensor Interchangeability* **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • If there are no DTCs present in the ABS controller, clear all faults. • If the DTC returns after driving the vehicle, check the ABS controller's DTC events to see if an intermittent fault is occurring. • Check the ABS controller for DTCs using the Bendix's diagnostic procedures. Some examples are incorrect ABS ECU software version, incorrect parameter settings, or failure of a component in the ABS or ESP systems. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
J	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • The system was used improperly (i.e. using the system on downhill grades). **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check any engine or engine retarder DTCs.
K	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • The engine has a configuration setting enabling it to perform the torque and retarder control for the Bendix® Wingman® Adaptive Cruise Control (ACC). • The FLR-21 radar sensor is not compatible with the current configuration of the engine. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Contact the engine manufacturer for proper engine Electronic Control Module (ECM) configuration settings. • If the error returns, contact the engine manufacturer for assistance.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
L	**This Diagnostic Trouble Code (DTC) *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • The controller is recognizing that there are components installed that have part numbers incompatible with the current system configuration. (For example, when a technician attempts to install a more recent FLR-21 radar sensor onto a vehicle with an earlier Bendix® Wingman® Fusion™ system or ACB [Active Cruise Control with Braking] system.) **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Contact the vehicle OEM for assistance.
M	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • The Collision Mitigation System (CMS) applied the brakes more than three (3) times in a power cycle and the system was used improperly. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. • Review the operation of the Bendix® Wingman® Fusion™ system with the driver.
N	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • The source of the J1939 message is producing a value that is out of range, in error, or not supported. **Review the following sections:** • K1.15: *FLR-21 Radar Sensor Interchangeability* • 2.10: *J1939 Engine Communications Test Procedure* **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the source of the J1939 message to identify why it has invalid or missing data. • Check the engine, engine retarder, and Antilock Braking System (ABS) for DTCs using the manufacturer's diagnostic procedures. Either the engine, engine retarder, or the ABS are the source of the signal. The controller that broadcasts the J1939 message must be investigated first. Some examples are gross vehicle weight and various engine torque signals. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
S	**This Diagnostic Trouble Code (DTC) *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** • Some system, signal, or component caused the Bendix® Wingman® Fusion™ system to be disabled. Adaptive Cruise Control (ACC) is unavailable and should not operate when the Wingman Fusion system is disabled. **Possible causes:** • Check the engine and engine retarder DTCs. Inspect and troubleshoot the ACC system wiring, switches, etc. for proper operation. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. • Start the engine.
T	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible cause:** • Mounting offset incorrect. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the mounting offset of the FLR-21 radar sensor in Bendix® ACom® PRO™ Diagnostic Software by selecting the *Bi-directional Test*, then the *Wingman FLR configuration screen*. The offset value should not exceed 500 mm. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
U	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the radar FLR-21 radar sensor.** **Possible causes:** • A fault occurred in the ABS controller causing the radar to not receive a proper message from the ABS controller. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Repair the ABS fault(s). • Check the ABS fault history for reoccurring intermittent faults. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
V	**This DTC *is not* a failure of the FLR-21 radar sensor. *Do not* replace the FLR-21 radar sensor.** **Possible causes:** • This is an indicator of an ABS fault. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the ABS controller and repair if necessary. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
X	**This Diagnostic Trouble Code (DTC) *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor.** **Possible causes:** • The Bendix® Wingman® Fusion™ system is indicating an error in the messages on the proprietary CAN bus. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the proprietary CAN connections at the Bendix® FLC-20™ Camera and FLR-21 radar sensor. • Check for the presence of the FLC-20 camera on the vehicle J1939 CAN line using the roll call feature in Bendix® ACom® PRO™ Diagnostic Software (left side of the home screen). If the FLC-20 camera is not found, *refer to SD-64-20124, Bendix® AutoVue® FLC-20™ Camera Service Data Sheet, on b2bendix.com for proper camera diagnostics.* • Check that the resistance between the Proprietary CAN+ and CAN- is between 50 and 70 ohms with the power off, and that both the radar sensor and camera are properly connected. If removing the connector from the radar sensor, the resistance should be 120 ohms. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Y	**This DTC *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor.** **Possible causes:** • This is an indicator of an intermittent CAN failure. Refer to CAN line diagnostics for further troubleshooting steps. • The Wingman Fusion system is indicating an error in the messages on the public/vehicle CAN bus. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the public/vehicle CAN connections at the camera and the FLR-21 radar sensor. • Check that the resistance between the public/vehicle CAN+ and CAN- is between 50 and 70 ohms with the power off. • If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Z	**This DTC *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor.** **Possible causes:** • The Wingman Fusion system is indicating a required signal within a J1939 message is not being sent from the retarder controller. • The FLR-21 radar sensor is missing proper engine configuration messages. This DTC could be accompanied by other active DTCs. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the source of the J1939 message to identify why it has invalid data. • Check the engine and the engine retarder for DTCs using the manufacturer's diagnostic procedures. Either the engine or engine retarder is the source of the signal. The controller that broadcasts the J1939 message must be investigated first. • Contact the engine manufacturer for proper engine Electronic Control Module (ECM) configuration.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

Service Action Code *(From Table 4A or Appendix. M)*	**Table 4B: Service Action Codes and the Recommended Service to Perform** **Recommended Service** ***(Bendix™ FLR-21™ Radar Sensors Only)***
CC	**This DTC *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor** **Possible causes:** • The Wingman Fusion system is indicating that the Bendix™ FLC-20™ camera sensor is not compatible with Highway Departure Braking (HDB). The configuration of the FLC-20 camera sensor needs to be changed to match the intended vehicle functionality. **Review the following sections:** • K1.15: *FLR-21 Radar Sensor Interchangeability* **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Confirm the proper FLR-21 radar sensor is installed. • Confirm the proper FLC-20 camera sensor is installed. • For FLC-20 camera sensor software updates, *refer to TCH-29-002 on b2bendix.com.*
EE	**This DTC *<u>is not</u>* a failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor** **Possible causes:** • The Wingman Fusion system is indicating that the engine setting is not compatible with the Adaptive Cruise Control (ACC). Either the configuration of the FLR-21 radar sensor or the engine needs to be changed to match the intended vehicle functionality. **Review the following sections:** • K1.15: *FLR-21 Radar Sensor Interchangeability* • 2.10: *J1939 Engine Communications Test Procedure* **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the engine and ABS for DTCs using the manufacturer's diagnostic procedures. • Contact the engine manufacturer for proper engine Electronic Control Module (ECM) configuration.
FF	**This DTC *<u>is not</u>* failure of the FLR-21 radar sensor. *<u>Do not</u>* replace the FLR-21 radar sensor** **Possible causes:** • The Wingman Fusion system is indicating the engine is not responding correctly to the FLR-21 radar sensor control signals on the J1939 CAN bus. **Perform the following:** • Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. If the error persists, continue to the next step. • Check the engine, engine retarder, and the ABS for DTCs using the manufacturer's diagnostic procedures. • Contact the engine manufacturer for proper engine ECM configuration.
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.	

Table 4B – Service Action Codes (Pages 22–30)

2.6 CLEARING DIAGNOSTIC TROUBLE CODES (DTCS)

1. Connect a current version of the Bendix® ACom® PRO™ Diagnostic Software to the vehicle.
2. Once the roll call is complete, you can view active and inactive Diagnostic Trouble Codes (DTCs) and clear DTCs from all vehicle components or solely from a selected Bendix controller.
3. To read and clear DTCs from all vehicle components at the same time, select the vehicle on the roll call and clear the DTCs by selecting “Clear Faults.”
4. To read and clear DTCs from a specific Bendix Electronic Control Unit (ECU), select the Bendix ECU on the roll call select “Clear Faults.”

For assistance with ACom PRO Diagnostic Software, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725, option 2, option 2).

2.7 TROUBLESHOOTING DIAGNOSTIC TROUBLE CODES: POWER SUPPLY

IGNITION VOLTAGE TOO LOW

Measure the ignition voltage under load. Ensure that the ignition voltage is greater than 10 VDC (Volts DC). Check the vehicle battery and associated components. Inspect for damaged wiring, damaged or corroded connectors, and loose connections. Check the condition of the fuse.

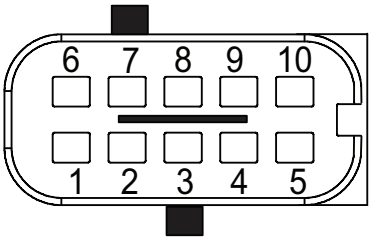
IGNITION VOLTAGE TOO HIGH

Measure the ignition voltage. Ensure that ignition voltage is not greater than 16 VDC. Check the vehicle battery and associated components. Inspect for damaged wiring, damaged or corroded connectors, and loose connections.

POWER SUPPLY TESTS

1. Take all measurements at the radar sensor harness connector.
2. Place a load (i.e. 1157 stop lamp) across the supply voltage and ground connection. Measure the voltage with the load. The supply voltage on pin 8 to ground should measure between 10 to 16 VDC.
3. Check for damaged wiring, damaged or corroded connectors, and loose connections.
4. Check the condition of the vehicle battery and associated components. Ensure the connection to ground is secure and tight.
5. Using the procedures described by the vehicle manufacturer, check the alternator output for excessive noise.

Power Supply Pin Codes (4.5)



(Looking into the Front of the Harness Connector)

Pin #	Description
1	J1939 High
2	Private Communications High
3	Not Used
4	Not Used
5	Radar Sensor Ground GND (-)
6	J1939 Low
7	Private Communications Low
8	Supply Voltage IGN (+)
9	Not Used
10	Not Used

Table 5 – Harness Connector Pins

2.8 SERIAL DATA (J1939) COMMUNICATIONS LINK

Check for a loss of communications between the Bendix® Wingman® Fusion™ system radar sensor, the Antilock Braking System (ABS) controller, the engine ECU, and other devices connected to the J1939 link. Check for damaged or reversed J1939 wiring. Check for corroded or damaged connectors and loose connections. Using procedures described by the vehicle manufacturer, verify the presence of the engine ECU and the ABS controller on the J1939 link.

Verify the engine ECU configuration. Check for other devices inhibiting J1939 communications.

Note: The Wingman Fusion system will not report newly active J1939 DTCs until the engine has been running for 15 seconds. Do not attempt to diagnose FLR J1939 DTCs without the engine running.

2.9 PRIVATE COMMUNICATIONS NETWORK TEST PROCEDURE

The Fusion system requires private network messages to and from the other devices in the system. If these messages are not present, or if there is a problem with the private communications system, a DTC will be set.

2.10 ENGINE COMMUNICATIONS (J1939) TEST PROCEDURE

NOTE: Remove all non-factory-equipped components – such as Electronic Drivers' Logs (EDLs), GPS, and telematic systems – prior to testing communications.

The Bendix® Wingman® Fusion™ system requires several J1939 messages from the engine Electronic Control Unit (ECU) to control the engine and retarder torque for distance control and braking. The Fusion system will set a Diagnostic Trouble Code (DTC) if one of these messages is not present.

Use the engine manufacturer's diagnostic test procedures to verify that there are no errors present in the engine that may prevent the Wingman Fusion system from controlling the engine or retarder torque.

NOTE: The Fusion system will not report newly active J1939 DTCs until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.

2.11 J1939 TROUBLESHOOTING PROCEDURE

1. Take all measurements at the harness connector unless otherwise indicated.

⚠ CAUTION

Do not insert probes into the back of the connector as this will damage the seal around the wire.

⚠ CAUTION

Do not insert any probe into the pin on the mating connector of the radar sensor that is greater than the dimension of the mating connector. Damaged connector pins will require the replacement of the harness.

NOTE: The Fusion system will not report newly active J1939 DTCs until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.

2. Check for damaged or reversed J1939 wiring.

   If the J1939 HIGH or J1939 LOW wiring circuits are damaged, such as shorting together, the entire J1939 link will be lost. The problem may be intermittent, enabling the J1939 link to sometimes operate normally. If this occurs, multiple DTCs will be logged in multiple engine and vehicle controllers.

   If the J1939 HIGH and J1939 LOW wiring circuits are reversed, communication over the entire J1939 link will not be lost. Only those devices that are outside of the problem point from other devices will not receive, or be able to transmit, data messages.

3. Check for corroded or damaged wiring connector problems such as opens or shorts to voltage or ground.

   If the connector terminals are corroded, this may be an indication of water intrusion into the wiring system and possibly into the radar sensor. Replacement of the entire harness is recommended. If the terminals of the radar sensor are corroded, replacement of the radar sensor is recommended.

4. Check for other J1939 devices which may be inhibiting J1939 communication. The service technician should consult the vehicle manufacturer's procedures for other J1939 troubleshooting procedures. The device's power should be removed and measurements made at the ECU pins for shorts to ground and power pins and resistance between the J1939 HIGH or J1939 LOW input circuits.

5. Unplug the radar sensor. With the ignition switch off, measure the resistance (ohms) using a multimeter between harness pins 1 and 6. The reading should be approximately 60 ohms. If it is not, the vehicle wiring should be investigated using procedures described by the manufacturer.

2.12 TROUBLESHOOTING WIRING HARNESSES

All wire harness connectors must be properly seated to maintain environmental seals. Push the mating connector until it seals with a click. When replacing a Fusion radar sensor, check that the wire harness connector is free of corrosion before plugging it into a new radar sensor. Check for corroded or damaged wiring connector problems such as opens or shorts to voltage or ground.

If the connector terminals are corroded, this may be an indication of water intrusion into the wiring system and possibly into the radar sensor. Replacement of the entire harness is recommended. If the terminals of the radar sensor are corroded, replacement of the radar sensor is recommended.

3.0 OTHER SYSTEM FEATURES

3.1 READING BENDIX® WINGMAN® FUSION™ SYSTEM KEY INDICATORS

1. Connect a current version of Bendix® ACom® PRO™ Diagnostic Software key system indicators from the roll call. Key Electronic Control Unit (ECU) indicators will be shown at the bottom left of the screen below the roll call. Some information shown in this includes the make, model, serial number, software version, etc.
2. Additional ECU indicators can be found by selecting “Bi-Directional” from the main menu. Select the Bendix controller and the controller-specific configuration option in the populated menu.

For assistance with the ACom PRO Diagnostic Software, contact the Bendix Tech team at 1-800-AIR-BRAKE (1-800-247-2725, option 2, option 2).

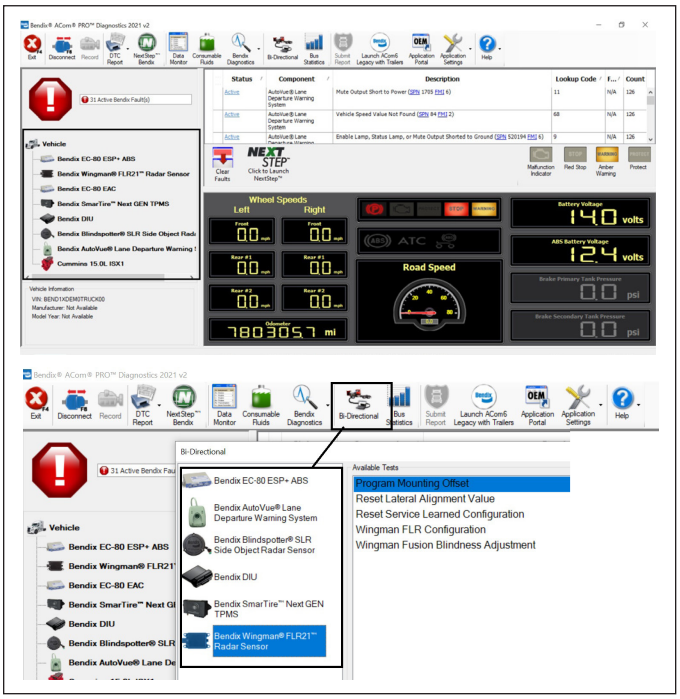


Figure 7 – Bendix® ACom® PRO Screen Showing the Configuration Number

3.2 BENDIX WINGMAN FUSION SYSTEM DIAGNOSTIC TROUBLE CODE (DTC) SELF-CLEARING

1. Connect a current version of the ACom PRO Diagnostic Software to the vehicle.
2. Once the roll call is complete, you can view active and inactive DTCs and clear DTCs from all vehicle components or solely from a selected Bendix controller.
3. To read and clear DTCs from all vehicle components at the same time, select the vehicle on the roll call and clear the DTCs by selecting “Clear Faults.”
4. To read and clear DTCs from a specific Bendix Electronic Control Unit (ECU), select the Bendix ECU on the roll call select “Clear Faults.”

3.3 FOLLOWING DISTANCE ADJUSTMENT SWITCH (OPTIONAL)

If the vehicle is equipped with the following distance adjustment switch and the following distance does not change after an adjustment is made, the switch, wiring, or a controller on the vehicle should be checked using the diagnostic procedures described by the vehicle manufacturer. The radar sensor receives the driver’s desired following distance on the J1939 data communication link from a controller on the vehicle. No DTC will be set if the vehicle is not equipped with a following distance adjustment switch.

3.4 CONFIGURING BENDIX WINGMAN FUSION SYSTEM FOLLOWING DISTANCE ALERTS

Multiple alert and distance setting strategies, known as Following Distance Alert (FDA) configurations, can be chosen using the ACom PRO Diagnostic Software. In current versions of the ACom PRO Diagnostic Software, the service technician will find a selection box called “Following Distance Alert Table” which gives the service technician the choices shown in Figure 8 and in Table 6. *Refer to Appendix H for information about how to change the FDA settings and enable momentary beeping. To view key system indicators, refer to Appendix G.*

Configuring Bendix® Wingman® Fusion™ System Following Distance Alerts (FDA) (3.4)								
FDA Config. No.	**Vehicle Speed Range**	**Slow Audible Alert (sec.)**	**Medium Speed Audible Alert (sec.)**	**Fast Audible Alert (sec.)**	**Following Distance (Mode 1)**	**Following Distance (Mode 2) Default**	**Following Distance (Mode 3)**	**Following Distance (Mode 4)**
1	0 - 37 MPH	-----	-----	0.5	3.5	**2.8**	2.3	1.7
	38 - 52 MPH	1.125	0.875	0.5				
	> 52 MPH	1.5	1.0	0.5				
2	0 - 37 MPH	-----	-----	0.5	3.5	**3.5**	2.8	2.3
	38 - 52 MPH	1.125	0.875	0.5				
	> 52 MPH	1.5	1.0	0.5				
3	0 - 37 MPH	-----	1.5	1.0	3.5	**2.8**	2.3	2.3
	38 - 52 MPH	2.0	1.5	1.0				
	> 52 MPH	2.0	1.5	1.0				
4	0 - 37 MPH	-----	1.5	1.0	3.5	**3.5**	2.8	2.3
	38 - 52 MPH	2.0	1.5	1.0				
	> 52 MPH	2.0	1.5	1.0				
5	0 - 37 MPH	-----	1.5	1.0	3.5	**3.5**	3.5	3.5
	38 - 52 MPH	3.0	2.0	1.0				
	> 52 MPH	3.0	2.0	1.0				
6	0 - 37 MPH	3.0	1.5	1.0	3.5	**3.5**	3.5	3.5
	38 - 52 MPH	3.0	2.0	1.0				
	> 52 MPH	3.0	2.0	1.0				
7	0 - 37 MPH	-----	-----	0.2	3.5	**2.8**	2.3	1.7
	38 - 52 MPH	-----	-----	0.2				
	> 52 MPH	-----	-----	0.2				
8	0 - 37 MPH	-----	-----	0.5	2.3	**1.7**	1.7	1.7
	38 - 52 MPH	1.125	0.875	0.5				
	> 52 MPH	1.5	1.0	0.5				
9	0 - 37 MPH	-----	-----	0.5	2.3	**2.3**	1.7	1.7
	38 - 52 MPH	1.125	0.875	0.5				
	> 52 MPH	1.5	1.0	0.5				

Table 6 – Configuring Following Distance Alerts (FDAs)

Changing configuration allows the fleet to adjust both the following distance alerts and the following distance behind a detected forward vehicle. *See Figure 8.*

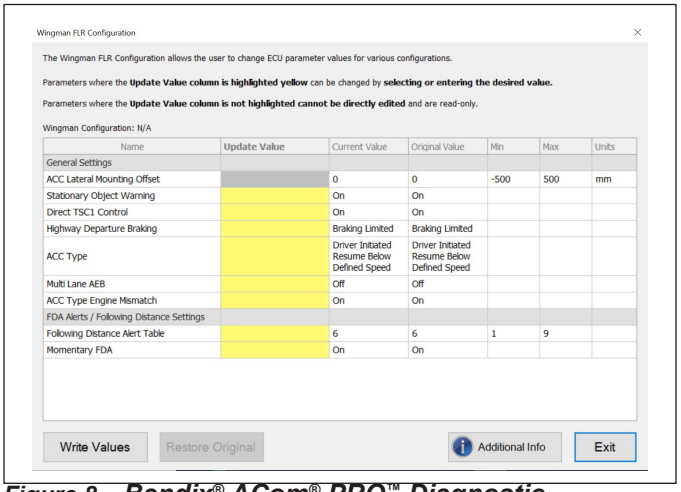


Figure 8 – Bendix® ACom® PRO™ Diagnostic Software – Following Distance Alert (FDA) and Following Distance

APPENDIX A - RADAR MOUNTING AND INSTALLATION

Appendix A

Mounting the Bendix™ FLR-21™ Radar Sensor

GENERAL

⚠ WARNING

Improper use of the Bendix® Wingman® Fusion™ system can result in a collision causing property damage, serious injuries, or death.

⚠ WARNING

Under no circumstances should the radar be removed or repositioned from the original production line installation. The assembly should always be mounted in the original OEM location.

⚠ CAUTION

Vehicle equipment, including bumpers, deer guards, etc., must not infringe upon the zone used by the radar sensor to emit and receive radar waves. *Refer to Appendix A.3.* Failure to comply with this requirement will impair the function of the radar. Only vehicle OEM-approved covers and/or cover panels may be installed in front of the radar.

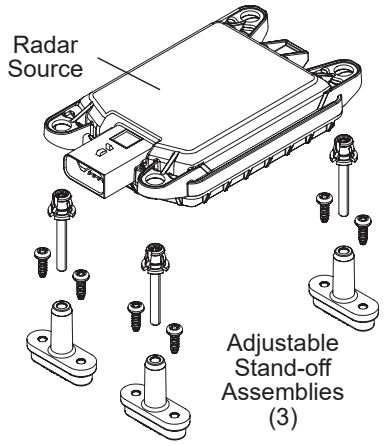
The radar sensor assembly is mounted to the front of the vehicle using an adjustable bracket. This adjustable bracket allows for the radar sensor to be properly aimed laterally and vertically to maximize Wingman Fusion system performance. When mounting a radar sensor, the wire harness connector should always point towards the passenger side of the vehicle.

A.1 Vehicle Applications

The radar sensor can be mounted and installed only on vehicles that have the Bendix Wingman Fusion system already installed.

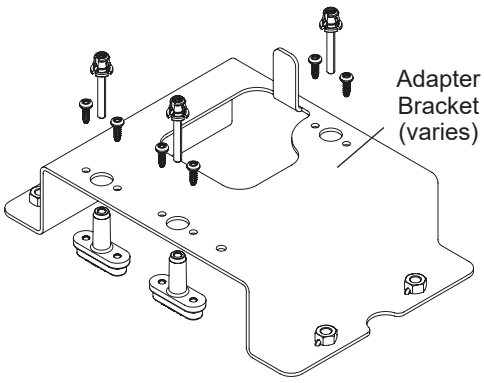
A.2 Replacement Parts

Replacement parts exist for all components shown below. Parts are available from any Bendix authorized parts supplier.



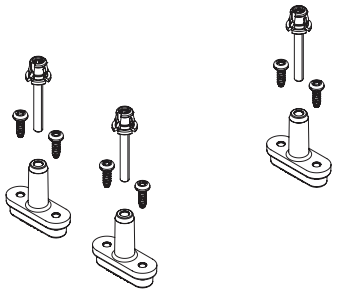
Radar Sensor with Stand-off Assemblies

- Kit K071772 includes a specifically programmed Bendix™ FLR-21™ Radar Sensor, three (3) stand-off adjuster assemblies, and six (6) mounting screws.



Bracket (Varies) and Stand-off Assemblies

- Provide the bracket part number *(see label)* when ordering replacements. Kits include three (3) stand-off adjuster assemblies and six (6) mounting screws.



Stand-off Assemblies Only

- Kit K073199 includes three (3) stand-off adjuster assemblies and six (6) mounting screws.

Bendix™ FLR-21™ Radar Mounting Clearance

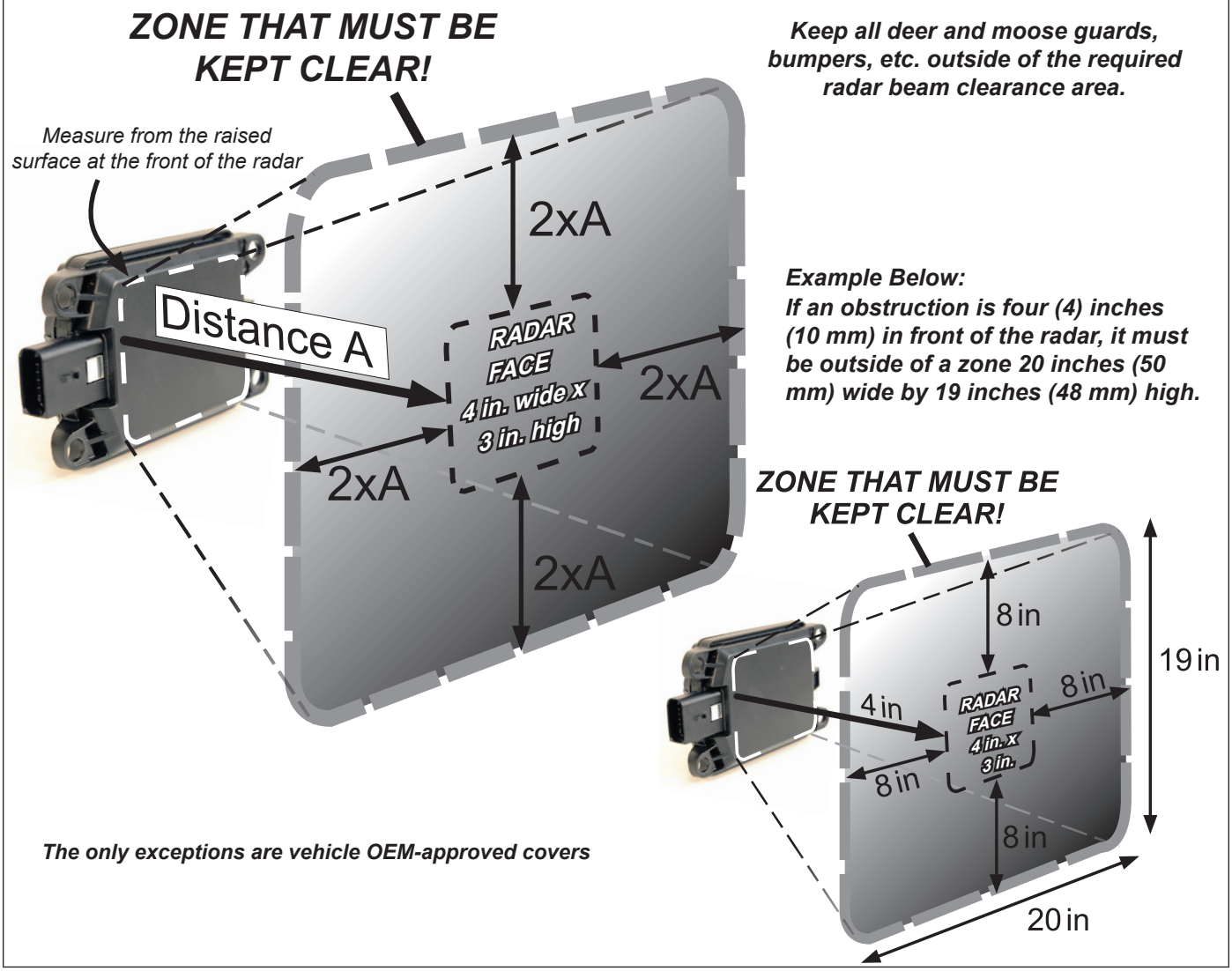
A.3 Bendix™ FLR-21™ Radar Sensor Mounting Clearance

⚠ CAUTION: Vehicle equipment, including bumpers, deer guards, etc., must not infringe upon the zone used by the radar sensor to emit and receive radar waves. Failure to comply with this requirement will impair the function of the radar. Only vehicle OEM-approved covers and/or cover panels may be installed directly in front of the radar.

For proper operation of the Bendix® Wingman® Fusion™ system, adhere to the following guidelines:

- The radar sensor assembly should be OEM-installed on the vehicle following all OEM specifications.
- The radar's field of view must NOT have interference from any other vehicle components such as bumpers, cow-catcher bumpers, engine blankets, seasonal decorations, or any other commonly mounted front-of-vehicle components. The radar signal is emitted from the front of the sensor with a spreading beam. In order to ensure that no adverse interference is experienced from bumpers or other nearby vehicle equipment, a suitable clearance must be maintained around the radar. This clearance must be maintained regardless if the vehicle is stationary or in motion. *Refer to the diagram below for a general guide and an example of how to calculate the zone required.*

NOTE: Bendix does not certify nor offer warranty on Bendix® Wingman® systems where system performance is affected by beam obstructions of any kind or unapproved post-production covers. This document gives general guidelines that will work for most vehicles; exceptions may exist.



APPENDIX B - RADAR ALIGNMENT

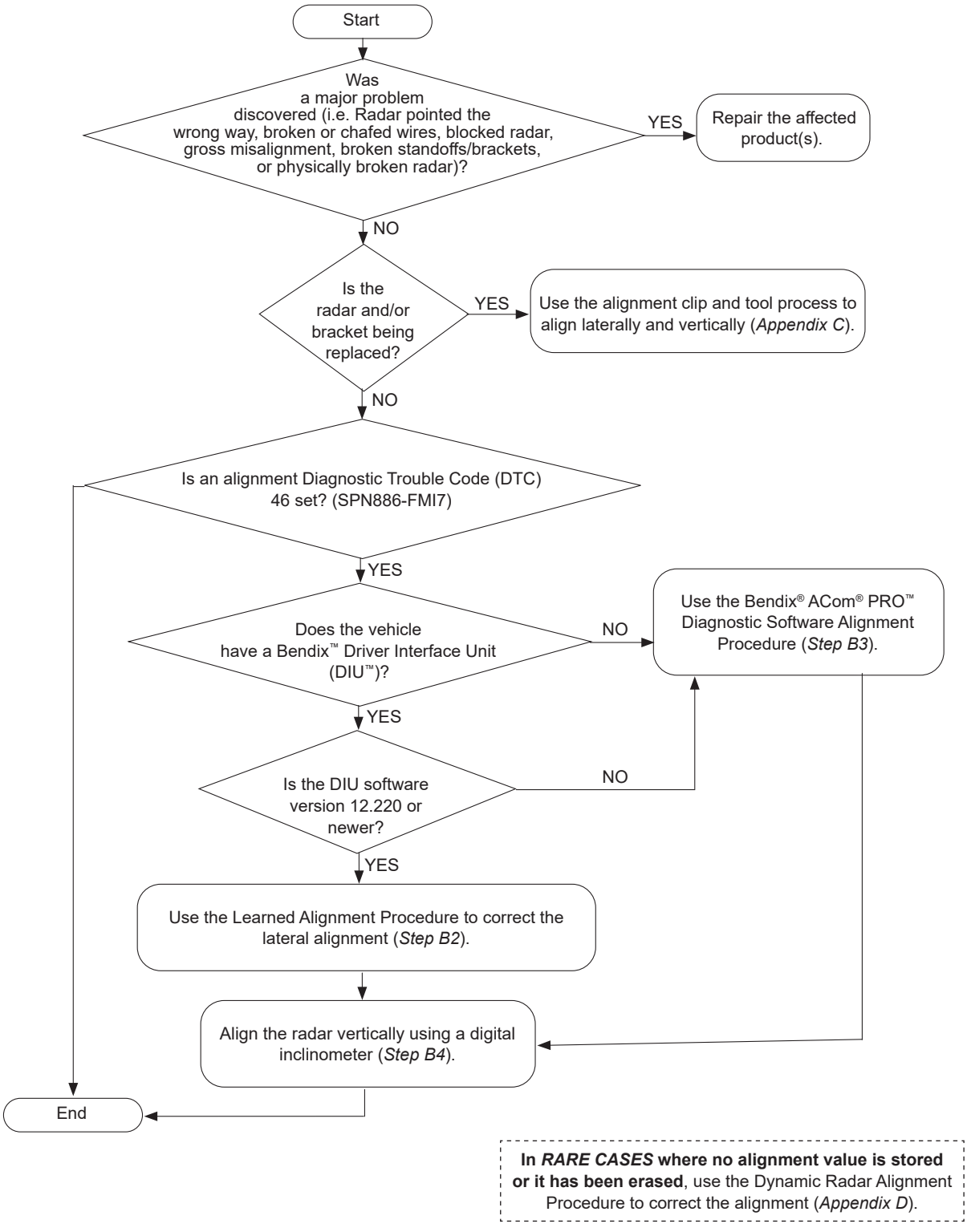
Appendix B

Bendix™ FLR-21™ Radar Sensor Alignment

B1.0 Radar Alignment Flowchart

For Bendix™ FLR-10™ radar sensors, refer to SD-61-4962 on b2bendix.com.

Use this flowchart to find which section(s) of this Appendix to use.



Appendix B

Bendix™ FLR-21™ Radar Alignment

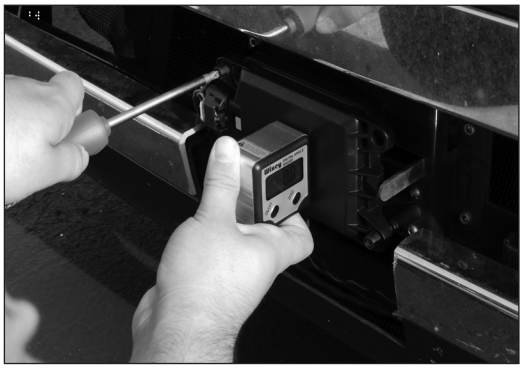
B1.1 General Information About Adjusting The Alignment

Accurate vertical and lateral alignment of the radar sensor is critical for proper operation of the Bendix® Wingman® Fusion™ FLR-21™ Radar Sensor. If the alignment is outside a certain range, it could cause false warnings, missed warnings, and/or a Diagnostic Trouble Code (DTC) in the system.

The radar sensor is mounted to the front of the vehicle using a bracket with three (3) stand-offs, two (2) of which are used when making adjustments, if necessary.

It is important to use the correct stand-off when making any alignment adjustments.

Adjusting the lateral alignment stand-off.



Adjusting the vertical alignment stand-off.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725) option 2, for troubleshooting assistance.

Appendix B

Bendix™ FLR-21™ Radar Sensor Alignment

B2 Lateral Alignment Using The Learned Alignment Screen

This is the preferred and recommended method for lateral alignments

This method is for vehicles with Bendix™ Driver Interface Unit (DIU™) displays that use software whose version is 12.220 and above. To verify the DIU's software version, go to the *Volume* screen. The software version is displayed in the top right-hand corner.

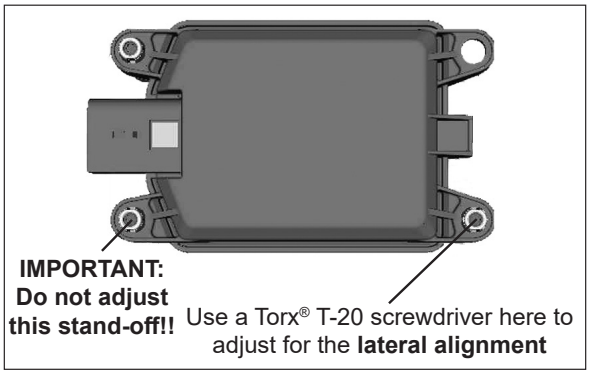
If the radar's lateral alignment is not correct, the system calculates – over the course of many hours of driving – an alignment adjustment value. The DIU displays the learned alignment value, shows the technician the direction to turn, and shows the technician the number of turns to make to the lateral alignment adjustment screw.

B2.1 Tools needed: DIU (with software version 12.220 or above) and a Torx® T-20 screwdriver.

B2.2 Enter the DIU menu item titled "Radar" and select "Alignment Check."

B2.3 Upon selecting the "Alignment Check" menu item, the following screen will be displayed:

Bendix DIU Screen Showing Learned Alignment Value



The example above shows a correction value of five (5) full turns counterclockwise is needed. The correction count and arrow direction displayed shows that in order to adjust the radar to be correctly aligned with the travel of the vehicle, the lateral adjustment screw (lower right screw when facing the front of the vehicle) should be turned.

B2.4 Make the adjustment shown on the Bendix DIU.

IMPORTANT: Make necessary adjustments to the alignment stand-off *prior* to resetting the alignment value.

B2.5 Select "Reset" and then "Exit" on the Bendix DIU screen to return to the default screen.

B2.6 Cycle the ignition power.

B2.7 **IMPORTANT: Before returning the vehicle to service, *go to Appendix B4* and check the vertical alignment.**

NOTE: The alignment process is complete after the vertical alignment has been checked (and adjusted, if necessary.) Test driving the vehicle <u>is not</u> necessary.

Appendix B

Bendix™ FLR-21™ Radar Sensor Alignment

B3 Lateral Alignment Using Bendix® ACom® PRO™ Diagnostic Software

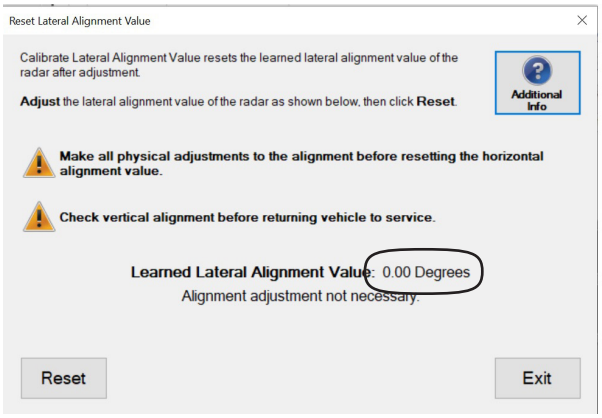
Use this method to align the Bendix™ FLR-21™ radar laterally – when the vehicle does not have a Bendix™ Driver Interface Unit (DIU™), or has a DIU (but its software version is prior to 12.220).

B3.1 Tools needed: Bendix ACom PRO Diagnostic Software and a Torx® T-20 screwdriver.

B3.2 Connect the vehicle to a laptop computer with the current release of the ACom PRO Diagnostic Software.

B3.3 *See the "Alignment Value" shown on the Reset Lateral Alignment Value test in available Bi-directional tests for the Bendix™ FLR-21™ Radar Sensor.*

If the alignment value shown by Bendix ACom PRO Diagnostic Software is between -1.1° and 1.1°, this is acceptable and the system should operate normally. A value outside that range means the radar sensor should be adjusted.



The Bendix® ACom® PRO™ Diagnostic Software Screen Showing the Alignment Value

Alignment Value Range (Degrees)	Service Action	Number of Full Turns of the Lateral Alignment Adjustment Screw
-2.0 to -1.8	***Adjustment Required***	6 clockwise
-1.7 to -1.6		5 clockwise
-1.5 to -1.2		4 clockwise
-1.1 to -0.8	***No Adjustment Needed***	3 clockwise *(optional)*
-0.7 to -0.5		2 clockwise *(optional)*
-0.4 to -0.3		1 clockwise *(optional)*
-0.2 to 0.2		
0.3 to 0.4		1 counterclockwise *(optional)*
0.5 to 0.7		2 counterclockwise *(optional)*
0.8 to 1.1		3 counterclockwise *(optional)*
1.2 to 1.5	***Adjustment Required***	4 counterclockwise
1.6 to 1.7		5 counterclockwise
1.8 to 2.0		6 counterclockwise

ADJUSTMENT SCREW ROTATION REQUIRED

NOTE: The maximum Alignment Value shown by the ACom PRO Diagnostic Software is ± 2°.

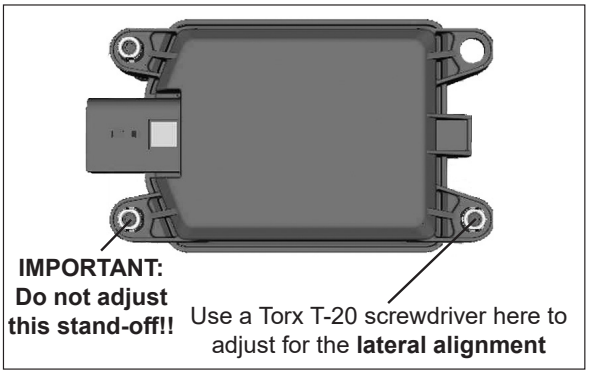
Appendix B

Bendix™ FLR-21™ Radar Sensor Alignment

B3 Lateral Alignment Using Bendix® ACom® PRO™ Diagnostic Software (Continued)

B3.4 *See the image below to see the lateral alignment adjustment screw location.*

Use the table in B3.3 on the prior page to find the number of full turns of the stand-off adjustment screw required to bring the radar sensor back into alignment. A Torx® T-20 screwdriver with a mark or other indicator may help track the number of turns.

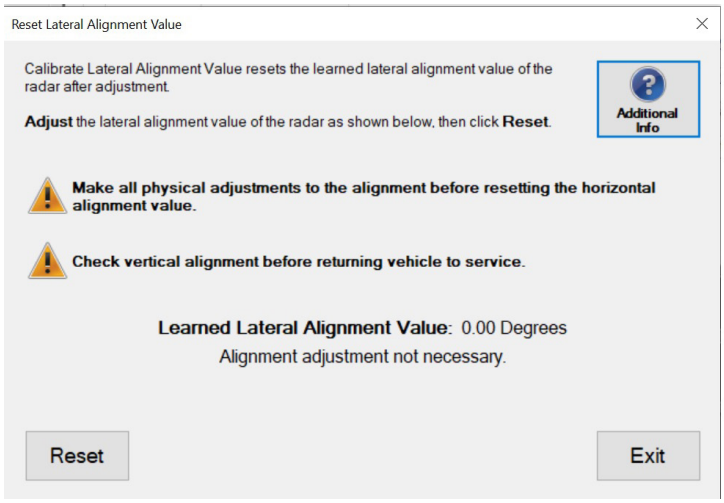


B3.5 After making the adjustment, clear the Bendix® Wingman® Fusion™ system Diagnostic Trouble Code (DTC) using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.

B3.6 Follow steps B3.7–11 to reset the alignment value stored in the system.

B3.7 **Procedure to Reset the Alignment Value.** From the available Bi-directional Tests for the Bendix™ FLR-21™ Radar Sensor in ACom PRO Diagnostic Software, select the *Reset Lateral Alignment Value* test.

B3.8 Review the test instructions and select *Reset* in the *Reset Lateral Alignment Value* test. *(Refer to Appendix H for more details.)*



B3.9 Close the ACom PRO Diagnostic Software program and any open windows.

B3.10 Cycle the vehicle ignition.

B3.11 After the vehicle has been driven at least 20 miles at above 35 mph (56 kph) in multi-lane urban traffic, re-check the alignment value using the ACom PRO Diagnostic Software.

Appendix B

Bendix™ FLR-21™ Radar Sensor Alignment

B4 Vertical Alignment Using An Inclinometer

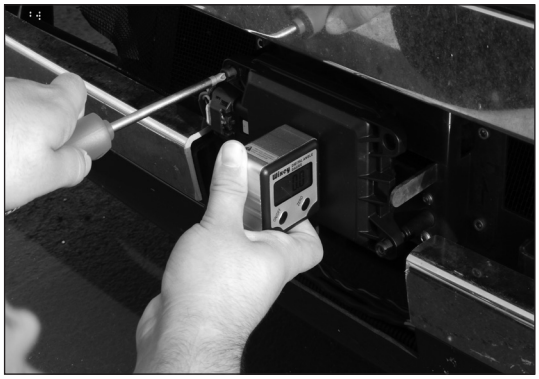
B4.1 Tools Needed: A digital inclinometer, Torx® T-20 screwdriver. (If a clip from the Bendix Alignment Tool kit is available, the clip may be placed over the front of the radar sensor during this process.)

B4.2 Park the vehicle on a level floor. Air suspensions must be charged and stable.

B4.3 Calibrate (or "zero") the inclinometer to the level surface the vehicle is parked on. Follow the manufacturer's instructions (typically digital inclinometers have a "SET" button for this purpose).

Calibrate (or *"zero"*) the Digital Inclinometer

B4.4 Place the calibrated digital inclinometer against the front surface of the radar ***so that the tool is held in the same direction as it was when calibrating.*** **With the digital inclinometer resting as shown below, verify that the display shows 0° (±1.0°) from vertical**, when measured by and inclinometer calibrated to the level surface the vehicle is parked on. **If the display does not show 0° (±1.0°) from vertical, *proceed to step B4.5 to complete a vertical adjustment.***



Use a Torx T-20 screwdriver here to adjust for the **vertical alignment**

IMPORTANT: Do not adjust this stand-off!!

Appendix B

Bendix™ FLR-21™ Radar Sensor Alignment

NOTE: Complete the steps below **only** if a vertical adjustment is necessary.

B4.5 Use the Torx® T-20 screwdriver to turn (by hand) the top-left adjustment stand-off. During the adjustment, observe the digital display on the inclinometer and turn the vertical alignment screw clockwise or counterclockwise depending on the vertical direction (up or down) needed, until the reading is 0°.

B4.6 **The radar is aligned vertically when the display is between -1.0° and 1.0°; however, to achieve a more precise alignment, adjust the vertical alignment screw until the digital alignment value is near 0°.**

NOTE: The alignment process shown here is for Bendix® alignment brackets. For other brackets, similar alignment steps will be needed; consult the vehicle manual for full instructions.

Pitch		
Alignment Value Range (Degrees)	**Service Action**	**Number of Full Turns of the Vertical Alignment Adjustment Screw**
5.3	Adjustment Required	8 clockwise
4.6		7 clockwise
4		6 clockwise
3.3		5 clockwise
2.7		4 clockwise
2		3 clockwise
1.4		2 clockwise
0.6	No Adjustment Needed	1 clockwise (optional)
0		0
-0.6		1 counterclockwise (optional)
-1.4	Adjustment Required	2 counterclockwise
-2		3 counterclockwise
-2.6		4 counterclockwise
-3.2		5 counterclockwise
-4		6 counterclockwise
-4.6		7 counterclockwise
-5.3		8 counterclockwise

B4.7 If used, be sure to remove the clip before returning the vehicle to service.

APPENDIX C - RADAR ALIGNMENT USING A BENDIX® ALIGNMENT CLIP AND TOOL

Appendix C

Bendix™ FLR-21™ Radar Sensor Alignment

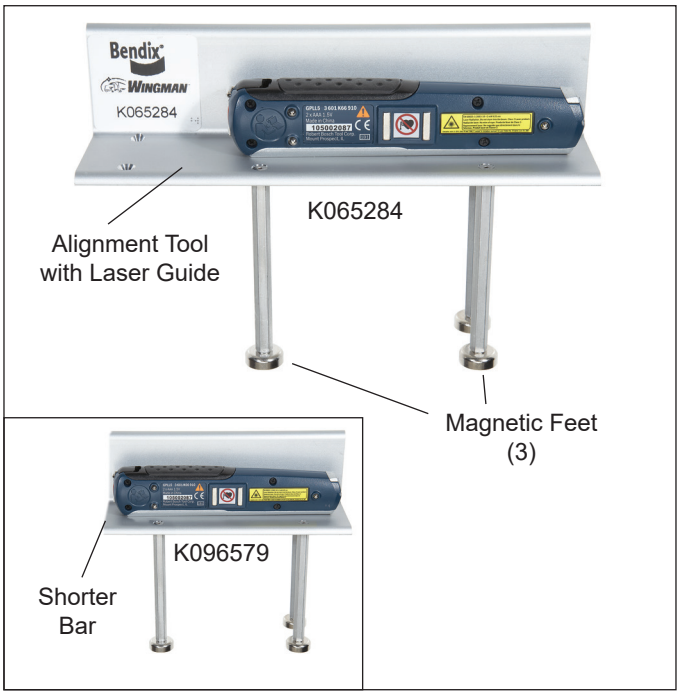
C1 Lateral Alignment Using the Bendix® Alignment Clip and Tool

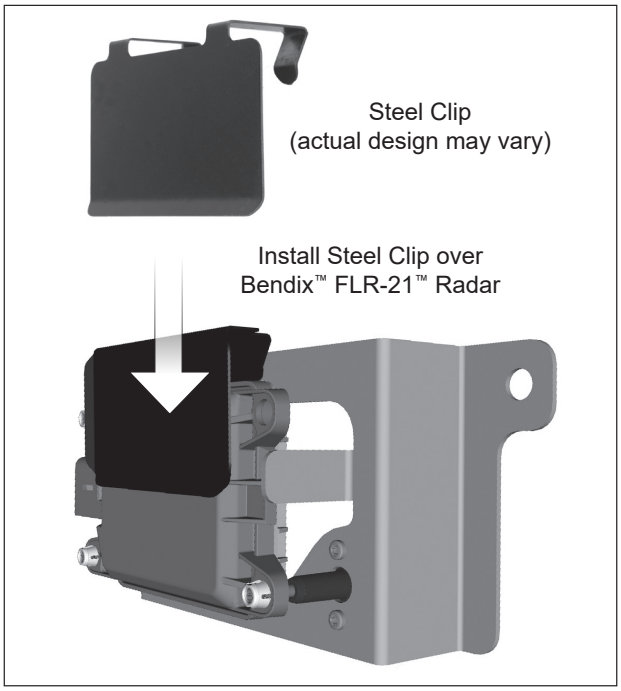
This is the method to use for lateral alignment when a radar and/or bracket is replaced.

Tools needed: Bendix® alignment kit, steel clip, Torx® T-20 screwdriver, and a tape measure.

- One of the Bendix® Alignment Tools (Bendix part numbers K065284 and K096579—available from Bendix parts outlets) are used.

The alignment procedure also requires a steel clip (Bendix part number K073087).

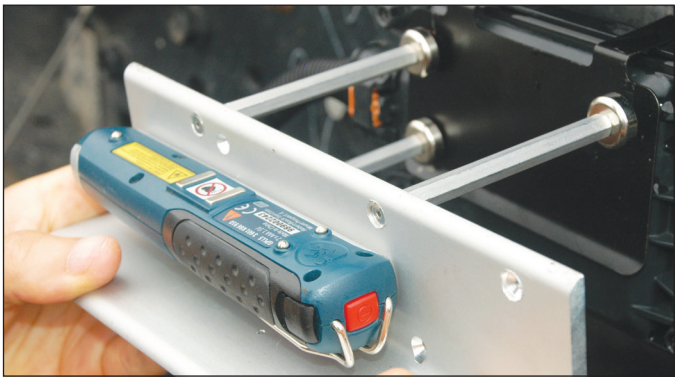




ALIGNMENT TOOLS AVAILABLE

C1.1 Park the vehicle on a level floor. Air suspensions must be charged and stable. Install the steel clip supplied over the radar sensor.

C1.2 Attach the alignment tool onto the clip using its magnetic feet. Inspect to make sure that the alignment tool is approximately horizontal width-wise.



C1.3 Activate the lateral alignment laser light “on” switch. Place the tool into position for the first measurement. (The tool will be reversed when the second measurement is made.)

Appendix C

Bendix™ FLR-21™ Radar Sensor Alignment

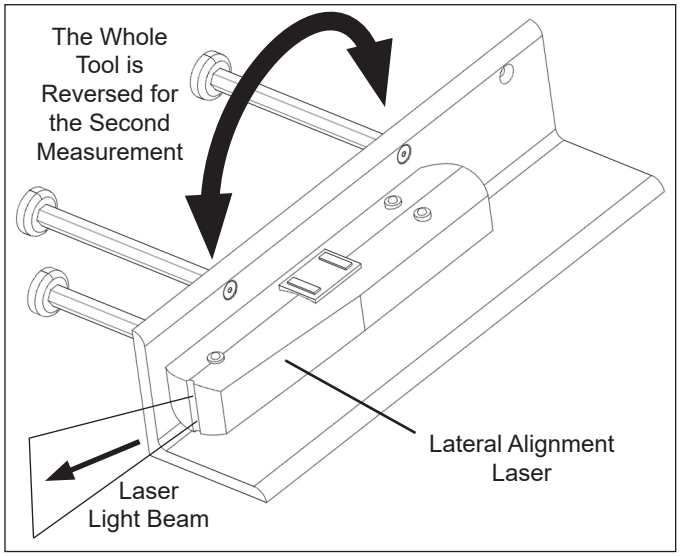
C1 Lateral Alignment Using the Bendix® Alignment Clip and Tool (continued)

C1.4 Locate symmetrical points on the front of the vehicle that are at least 12 in. (30 mm) from the vehicle's center line (such as the tow hooks). Using a ruler or tape measure, record the distance from each side to the laser light line.

LATERAL ALIGNMENT LEFT MEASUREMENT

NOTE: The technician must be careful during the laser positioning process to double check the values measured on each side of the truck. Be sure to check back and forth for each side of the radar sensor several times to ensure accuracy.

C1.5 Repeat the process for the opposite side, reversing the tool, so that the laser light points to the other side of the vehicle.



C1.6 Compare the left and right distance measurements. A properly aligned radar sensor will have the same measurement from each side. If these two dimensions are within 1/8 in. (3 mm), no alignment is necessary and *the technician can proceed to Step C1.10 to check the vertical alignment. If an adjustment is needed, follow the instructions in C1.7–C1.9 on page 46.*

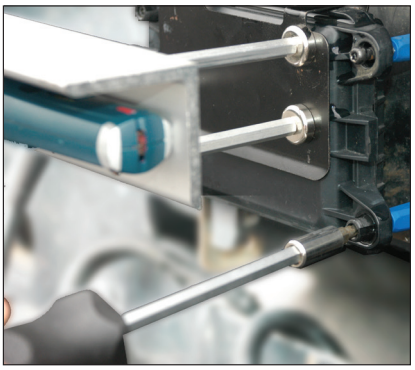
Appendix C

Bendix™ FLR-21™ Radar Sensor Alignment

C1 Lateral Alignment Using the Bendix® Alignment Clip and Tool (continued)

NOTE: Complete these steps only if a lateral adjustment is necessary.

C1.7 With the Bendix® alignment tool still in place, use the Torx® T-20 screwdriver to turn by hand the driver-side stand-off adjustment screw until the desired alignment is reached.



C1.8 Re-measure the distances from symmetrical points located at least 12 in. (30.48 cm) (from the center line of the vehicle. Reverse the tool for each measurement, until the values are the same [within 1/8 in. (3 mm)].

C1.9 After the lateral alignment procedure is complete, if there is an active misalignment Diagnostic Trouble Code (DTC) (codes 55, 56, or 57), *clear the Bendix® Wingman® Fusion™ system DTC using the procedure in Section 2.6: Clearing Diagnostic Trouble Codes (DTCs) and reset the alignment value by connecting the vehicle to a PC with Bendix® ACom® PRO™ Diagnostic Software and follow steps B4.4–20 to reset the alignment value. (Refer to Appendix H.)*

C1.10 **IMPORTANT: Before returning the vehicle to service, check the vertical alignment using the procedure outlined below.**

C1.11 The steel clip and alignment tool should already be in place. *Refer to steps C1.1–2.*

Appendix C

Bendix™ FLR-21™ Radar Sensor Alignment

C1.12 Calibrate (or "zero") the inclinometer to the level surface the vehicle is parked on. Follow the manufacturer's instructions (typically digital inclinometers have a "SET" button for this purpose). Calibrate (or "zero") the digital inclinometer on the level surface the vehicle is parked on in the direction the vehicle travels.

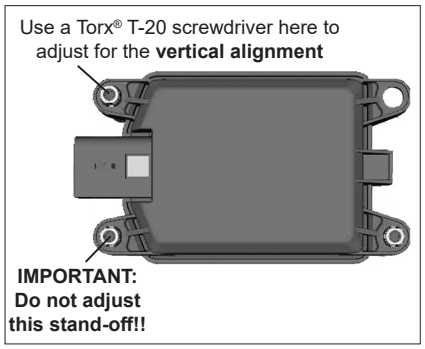
Place the calibrated digital inclinometer onto the surface of the tool, ***so that the tool is in the same direction as it was during calibration.*** **Verify that the display shows 0° (±1.0°) from vertical**. **If the display does not show 0° (±1.0°) from vertical,** ***go on to step C1.13 to complete a vertical adjustment.***

NOTE: Complete these steps ***only*** *if a vertical adjustment is necessary.*

C1.13 With the Bendix alignment tool still in place, use the screwdriver to turn by hand the top-left adjustment stand-off. *Refer to the diagram on the right.* During the adjustment, observe the digital display on the inclinometer and turn the vertical alignment screw clockwise or counterclockwise depending on the vertical direction (up or down) needed, until the reading is near is 0°.

C1.14 **The radar is aligned vertically when the display is near zero (0°).**

NOTE: The alignment process shown here is for Bendix® alignment brackets. For other brackets, similar alignment steps will be needed; consult the vehicle manual for full instructions.



NOTE: The alignment process is complete after the vertical alignment has been checked (and adjusted, if necessary.)

APPENDIX D - DYNAMIC RADAR ALIGNMENT

Appendix D

Bendix™ FLR-21™ Radar Sensor Dynamic Alignment Method

This procedure may be used in rare cases where the stored alignment value is not available. The vehicle must have a Bendix™ Driver Interface Unit (DIU™) with a software version 12.220 or above.

D1 Lateral Alignment Using the Dynamic Alignment Method

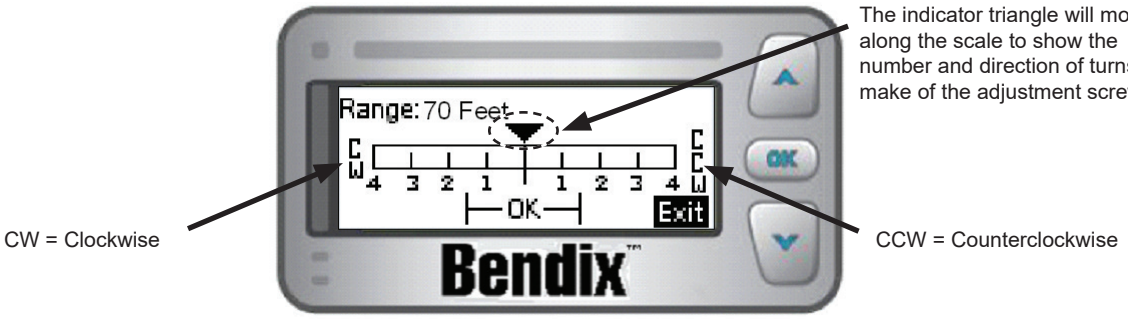
Use the flowchart B1.0 – page 36 of this document – to ensure the correct alignment procedure is used. This procedure is used in the rare cases where a learned alignment value is not available. For example, in cases where a technician erroneously resets the alignment value before recording the Learned Alignment correction value and direction.

D1.1 Tools needed: DIU (with software version 12.220 or above), and a Torx® T-20 screwdriver. The assistance of another vehicle will be necessary, plus an assistant in the cab of the vehicle with the driver.

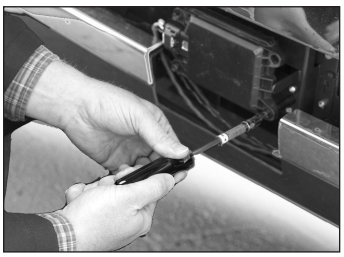
The DIU's software version can be seen in the top right-hand corner of the Volume screen. The Bendix DIU's Dynamic Alignment Screen is used to show a dynamic calculation of the alignment of the radar.

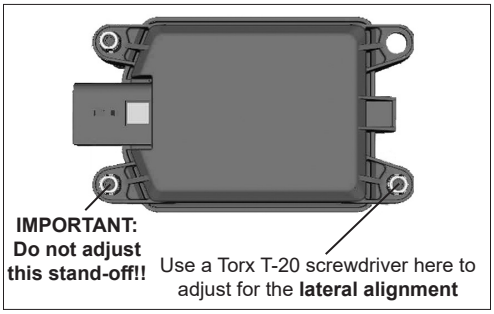
D1.2 To perform the inspection, the vehicle must be traveling behind a cooperative vehicle on a straight, level length of highway where the speed limit is >35 mph. Obeying all traffic laws, follow the vehicle in the same lane at a speed greater than 35 mph / 56 kph. For the most accurate results, the distance between the vehicles must be between 50 and 300 feet (15 to 91 meters), so the observed distance figure – displayed in the top left-hand corner of the display – helps the driver maintain the correct range. Verify that both vehicles remain in the middle of the lane during the test. The radar determines the distance and alignment to the vehicle ahead, and, if needed, calculates an alignment correction value, displayed on the screen.

D1.3 During the test, an assistant in the vehicle should observe where on the scale the triangle indicator shows the alignment correction value. Because this is a dynamic measurement, the arrow will typically move through a range of positions. Note the average position where the triangle points over a length of time. This value gives the number of turns of the lateral adjust screw clockwise (CW) or counterclockwise (CCW), in order to correct any misalignment present. *See Figure below.* The number of turns may require less than a full screw turn, e.g. halfway between 2 and 3 is 2.5 turns. The scale to the left of center shows when a clockwise (CW) adjustment is needed, and numbers to the right are for counterclockwise (CCW) adjustments.



Dynamic Alignment Screen





D1.4 Alignment values less than 1.1 from the center are acceptable and do not necessarily require adjustment. *(See the "OK" zone shown on the scale for this range.)*

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

APPENDIX E - DRIVER INTERFACE UNIT (DIU™): DISPLAYS AND ALERTS

Appendix E

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

E1 Operator Interface

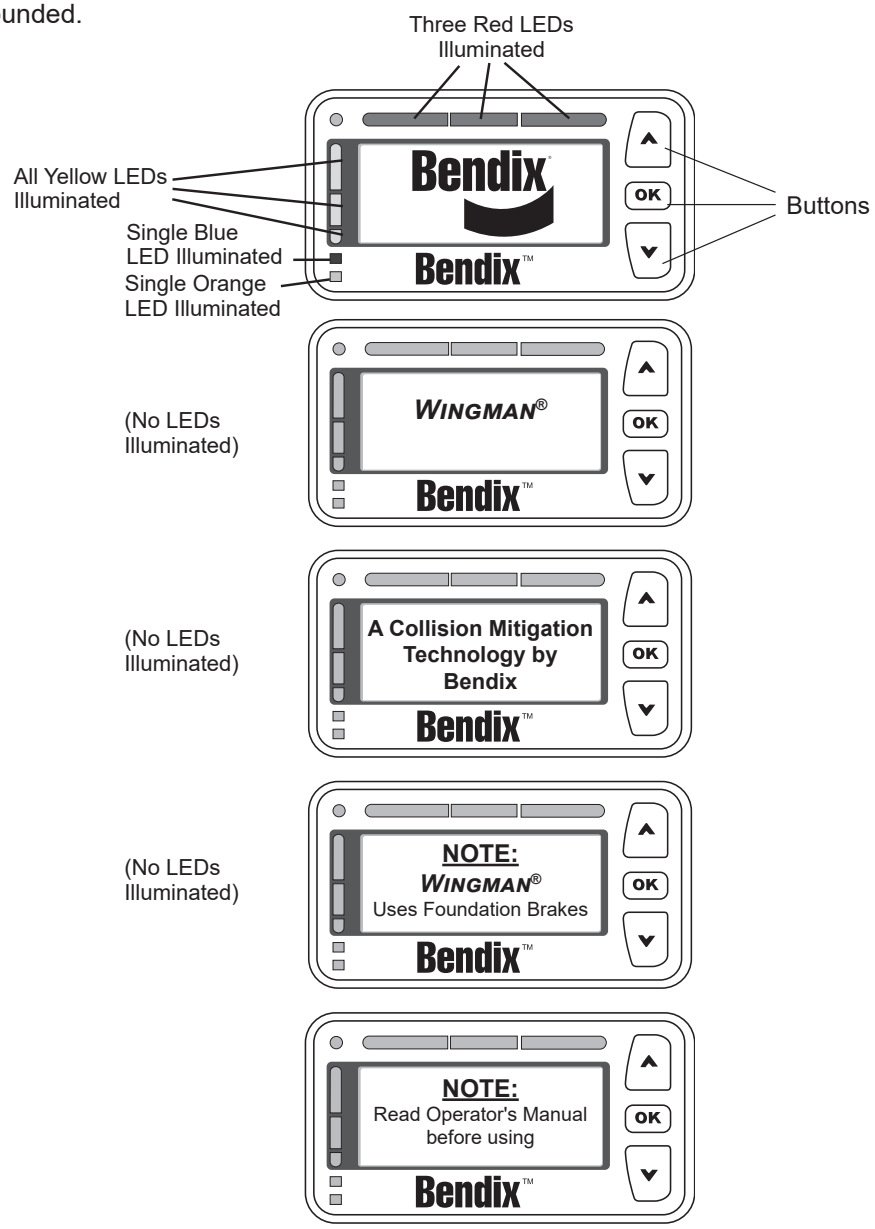
The Bendix® Wingman® Fusion™ system is either integrated into the vehicle's dash or console, or uses the Bendix™ Driver Interface Unit (DIU™) to communicate with the driver. *(For integrated systems, refer to the vehicle operator's manual for more information.)*

This Section describes the functions of the DIU. The DIU mounts in, or on, the vehicle dash and provides the interface between the driver and the Fusion system. The DIU provides visual and audio warnings to the driver and accepts input from the driver through the "Up", "Down" and "OK" buttons.

The DIU contains an internal speaker to provide audible warnings, two (2) LED arrays (one each in yellow and red), a single orange and blue LED and an LCD screen for visual warnings, and a light radar sensor to distinguish between day and night conditions.

E1.1 Start-Up Mode

At initialization, the DIU executes self-test routines during which the following screens are displayed and all LEDs are activated (power-on bulb check) for approximately three (3) seconds. If configured, a power-up tone is also sounded.

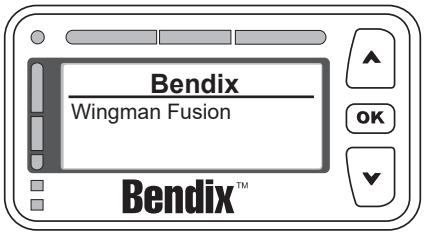


Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts (continued)

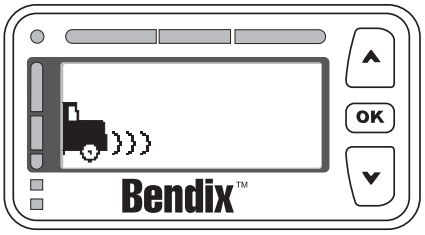
When the initialization sequence is complete, the following screen is displayed for approximately three (3) seconds to indicate the features available to the driver.

(No LEDs Illuminated)



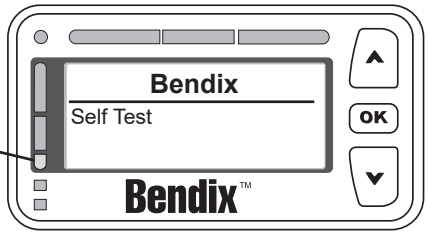
Next, the DIU will enter normal operation. Under normal operation, the screen is:

(No LEDs Illuminated)

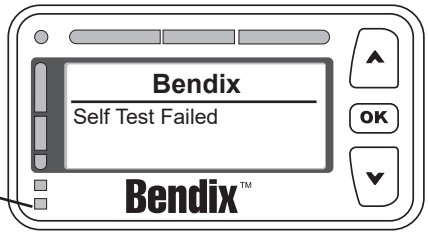


If the Bendix® Wingman® Fusion™ system goes into the self-test mode, the DIU may briefly display the "Bendix Self-Test" screen. Also, the audible distance alerts will activate, followed by a screen indicating that the self-test has run. *Below left* is the screen that will be briefly displayed if the self-test runs and passes. *Below right* is the screen that will be briefly displayed if the self-test runs and fails. If the self-test fails, a Diagnostic Trouble Code (DTC) will be set. The driver should turn off the vehicle, wait 15 seconds and then turn it back on again. If the problem persists, a qualified technician will be necessary for troubleshooting. *Refer to the "Power-Up Self-Test" in this Service Data Sheet Section 1.1: Troubleshooting Basics for further information.*

Single Yellow LED Illuminated



(Followed by a Single Orange LED Illuminated)



E1.2 Menu Operation

Pressing the "OK" button at any time will enter the "Menu Operation Mode". The following selections will appear in a scrollable window. Some items may not appear if the feature is not configured or not allowed as shown below.

- Volume
- Dist. Setting (Distance Setting)
- Dist. Units (Distance Units)
- U.S./Metric
- Brightness
- System Status
- Diag. Display (Diagnostic Display)
- Demo (Demonstration. NOTE: Demo is available only when vehicle is not moving)

The desired menu item is highlighted using the up (▲) or down (▼) arrow buttons and selected with the "OK" button. The following sections describe each menu item.

⚠ WARNING

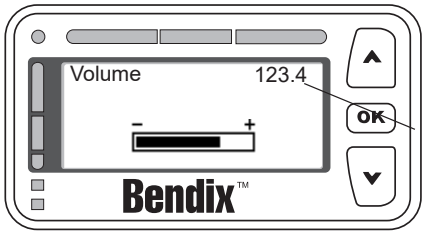
Settings should only be changed when the vehicle is stationary.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

E1.3 Volume

Selecting “Volume” from the main menu displays the following screen:

(No LEDs Illuminated)



Software Version

Use the up (▲)/down (▼) arrow buttons to change the volume. Pressing the “OK” button exits this menu item.

The modified volume setting will be retained through ignition cycles unless configured not to do so. If not configured, the volume setting will default to 100% on each new ignition cycle.

NOTE: The DIU can be configured to limit the minimum volume setting that the driver can select. The bar shown above always represents the adjustable range based on minimum and maximum values. For example, if the minimum value is set to 50% (midpoint between lowest (70 ± 3dB) and highest (89 ± 3dB) audio levels, the bar represents an adjustable range from 50% (approx. 80dB) to 100% (approx. 89dB). Once the minimum (or maximum) has been reached, a message will be shown indicating that further adjustment is not allowed (e.g. “Minimum volume reached”). The step change per button press is approximately 2dB.

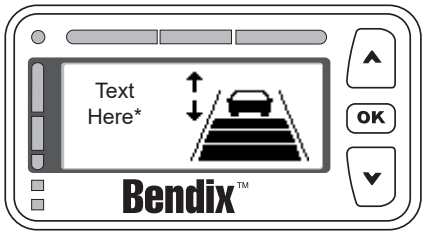
E1.4 Distance Setting (Dist. Setting)

On systems where changes are permitted, the “Distance Setting” option from the main menu will adjust the following distance that the Bendix® Wingman® Advanced™ system will attempt to maintain while in the following distance mode. Distance Settings 1, 2, 3, and 4 will have different meanings based on the configuration chosen by the user in Bendix® ACom® PRO™ Diagnostic Software. Generally, 4 relates to the farthest distance setting available and 1 relates to the closest distance setting available. In many of the Advanced configurations available in ACom PRO, two or more distance settings may be made equivalent to one another.

For more information on user configurations available through the Bendix ACom PRO diagnostic software, *refer to Section 3.4: Configuring Bendix Wingman Fusion System Following Distance Alerts* for further information.

Selecting “Dist. Setting” from the main menu displays the following screen:

(No LEDs Illuminated)



** Text may vary depending on the system installed*

E1.5 Distance Units (Dist. Units) *(Refer to Appendix E1.6 for metric units)*

From the “Dist. Units” menu item, the driver may choose to have the following distance from the forward vehicle displayed in either seconds or feet. By default, this item is set to seconds. If the driver selects feet, the DIU will display the approximate distance from the bumper to the selected forward vehicle in feet. If the driver selects seconds, the DIU will display the approximate distance from the bumper to the selected forward vehicle in seconds.

NOTE: Following distance in seconds is calculated based on the current speed of the Fusion system-equipped truck, and the distance, in feet, away from the selected forward vehicle. For instance, if the selected forward vehicle is 88 feet (27 m) from the bumper of the Wingman Fusion system-equipped truck, and the Fusion system-equipped truck is traveling 60 mph/97 kph, then the following distance in seconds would be 1.0 seconds because a truck traveling 60 mph/97 kph can travel 88 feet (27 m) in one (1) second.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

E1.6 U.S./Metric

From this menu item, the driver may select whether English (U.S.) or Metric units are displayed. For instance in “Metric” mode, the following distance is shown in meters. In “U.S.” mode, the following distance is shown in feet.

E1.7 Brightness

Selecting Brightness from the main menu displays the following screen:

(No LEDs Illuminated)

The driver uses the up ( ) down ( ) arrow buttons to change the LCD backlighting, LED brightness and button backlighting. Pressing the OK button exits this menu item.

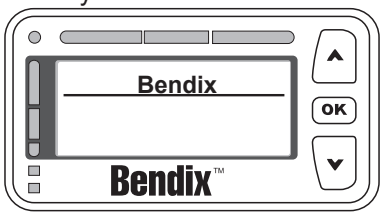
The light sensor reading determines whether the current cab lighting mode is bright (day) or dark (night). When the light mode is bright, any brightness adjustment made by the driver is applied to only the bright mode setting. Likewise, when the light radar sensor sets the light mode to dark, any brightness adjustment made by the driver is applied to only the dark mode setting. This functionality allows the driver to adjust the brightness setting for the two cab lighting conditions after which the DIU will automatically toggle between the two settings based on the light radar sensor’s input. Both the bright mode setting and the dark mode setting are stored across power cycles.

NOTES: The DIU does not allow the brightness control to completely shut off the LEDs.
DIU units without a light sensor will use signals from the vehicle's J1939 CAN bus to determine and configure the day and night setting.

E1.8 System Status

This screen shows the configured features of the system and their current operational status (i.e., “Failed” or “OK”). The failed status means that some system malfunction is preventing the feature from properly operating and that the feature is not available for use by the driver at this time. Pressing “OK” exits this menu item.

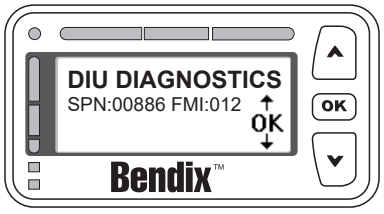
(No LEDs Illuminated)



E1.9 Diagnostics

Selecting Diagnostics from the main menu displays any active Bendix® Wingman® Fusion™ system Diagnostic Trouble Code (DTC) conditions – including SAE standard diagnostic codes called J1939 SPNs (Suspect Parameter Numbers) and J1939 FMIs (Failure Mode Identifiers) – that may be present in the DIU and radar sensor. The following is a typical screen displayed in this mode when an active DTC is present:

(No LEDs Illuminated)



Note: The Forward Looking Radar (FLR) will not report newly active J1939 DTCs until the engine has been running for 15 seconds. Do not attempt to diagnose FLR J1939 DTCs without the engine running.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Appendix E

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

E2.0 Driver Demonstration Mode

Selecting Demo from the main menu starts a demonstration mode that shows the various lights, display screens, and sounds produced by the DIU – along with a brief explanation of their meaning – for the configured features. Pressing the down ( ) arrow button advances through the screens. The up ( ) arrow button has no functionality in this mode. Demonstration mode may be exited at any time by pressing the OK button.

NOTE: This mode can only be entered while the vehicle is not moving. Also, while in the demonstration mode, if the vehicle begins to move, the demonstration mode terminates.

If a screen is associated only with a configurable feature, and that feature is not configured, then that screen will not be shown in the demonstration mode.

The screens presented to the driver in the demonstration mode are shown with the following text: “Error! Reference source not found.”

E3.0 Following Distance Alerts (FDAs)

One of the features of the Bendix® Wingman® Fusion™ system is the Following Distance Alert (FDA). A proprietary system combining vehicle speed, forward vehicle speed, distance, and driving scenario, FDAs are used to provide the driver with distance alerts which are intelligent, in that they will give appropriate distance alerts for the given situation. They alert the driver to objects far ahead in highway and country road driving situations, while not over-alerting in dense city traffic. They are available when the vehicle is traveling at speeds above 5 mph / 8 kph.

The radar sensor uses the DIU to communicate the FDA alerts to the driver. This system can be configured through a current version of Bendix® ACom® PRO™ Diagnostic Software, for use by a fleet as a driver training tool with or without coordinating the data made available by the Bendix Wingman Advanced System. In addition to being a reminder of when a driver may be dangerously close to the vehicle ahead, the following distance alerts may also be configured to reinforce safe following distance habits taught by the fleet.

The FDA is based on the following interval between the host vehicle and the object ahead. In other words, this is the time required by the host vehicle to travel forward and reach the object’s current location. With the exception of the volume, the FDA may not be adjusted by the driver through the DIU. A qualified technician must connect to the vehicle through the diagnostic port and run ACom PRO diagnostic software, in order to change the configuration. The volume cannot be turned all the way down, but other adjustments may be made by the fleet. *Refer to Section E1.3 for more details on volume adjustment.*

The FDA system is intended only to alert the driver about following distance. For more information on alerts for forward objects with high relative velocities and sudden decelerations, *refer to Section E4.0: Impact Alert.*

Only objects detected in the vehicle's lane, traveling in the same direction, are considered valid objects for the FDA. For more information on stationary objects, *refer to Section B5.0: Stationary Object Alert and Appendix E.*

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

⚠ WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix Wingman Fusion system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

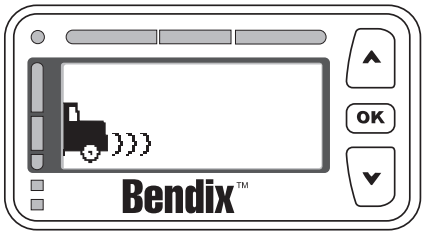
Appendix E

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

E3.1 Object Detected

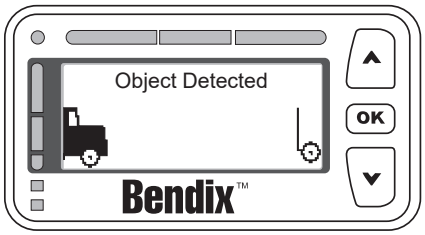
When there is no valid object detected and no other high priority alert is displayed, the DIU will stand by with the following screen:

(No LEDs Illuminated)



When a valid object is detected, and is outside the range of the first level of alert, and no other higher priority alert is displayed, the DIU will display the image shown below and no audio tones will be issued. The distance to the object will be displayed in large characters in the white space at the center of the screen (not shown) in seconds, feet, or meters, depending on the menu-selected preferences. By default, seconds will be displayed.

(No LEDs Illuminated)

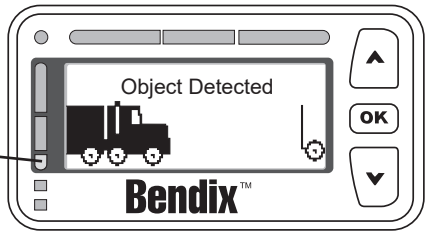


E3.2 Following Distance Alert (FDA) Level 3 *(Slow audible two-tone alert/single LED illuminated)*

When FDA Level 3 is issued, the following distance to the object/vehicle ahead has been reduced to the distance determined in the current configuration for FDA Level 3. The DIU will begin to give the driver audio and visual alerts for as long as the forward vehicle is in this zone and traveling at the same speed or slower.

The DIU will not display following distance units while in an FDA Level. For FDA Level 3, the audible alert will be a single repeating tone, and the visual alert is a single yellow LED and a screen with the vehicles slightly closer as shown below.

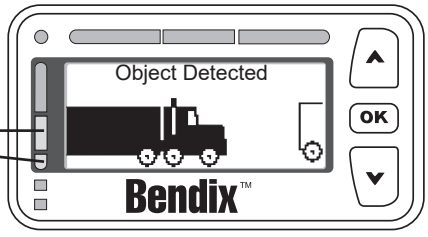
Single Yellow LED Illuminated



E3.3 Following Distance Alert (FDA) Level 2 *(Medium audible two-tone alert/two LED's illuminated)*

The DIU will give the driver audio and visual alerts for as long as the object/vehicle ahead is in this zone and traveling at the same speed or slower. The DIU will not display following distance while in an FDA Level. For FDA Level 2, the audible alert will be a repeating double tone, and the visual alert is two (2) yellow LEDs and a screen with the vehicles closer as shown below.

Two Yellow LEDs Illuminated

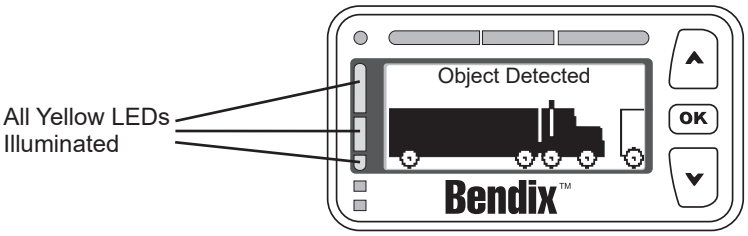


Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

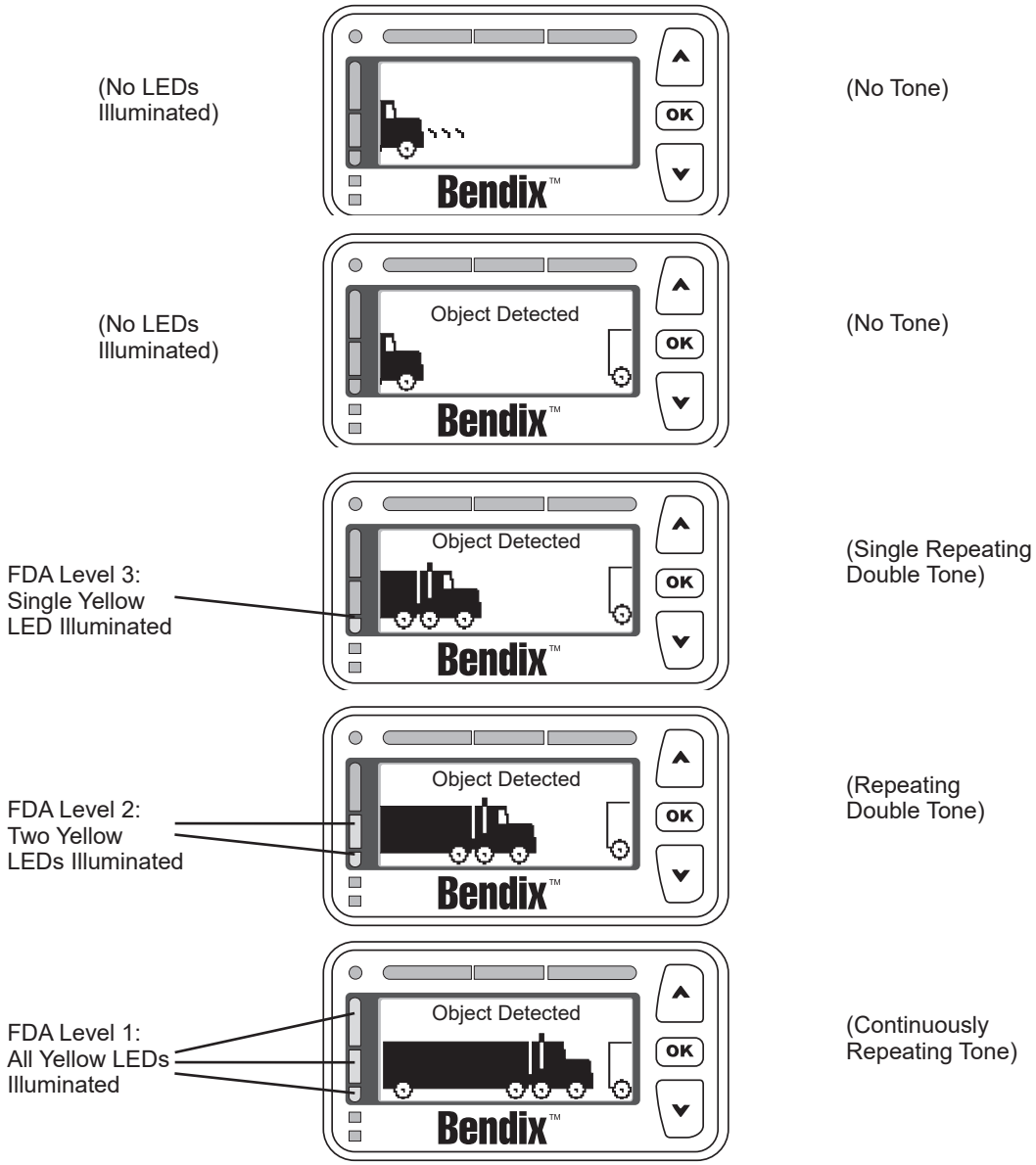
E3.4 Following Distance Alert (FDA) Level 1 *(Fast audible two-tone alert/three yellow LEDs illuminated)*

The DIU provides the driver with audio and visual alerts for as long as the vehicle ahead is in this zone and traveling at the same speed or slower. This is the closest and most urgent Following Distance Alert.

The DIU will not display following distance while in an FDA Level. For FDA Level 1, the audible alert will be a continuously repeating tone, and the visual alert is three (3) yellow LEDs and a screen with the vehicles close as shown below:



All five states of the FDA system can be seen together below.



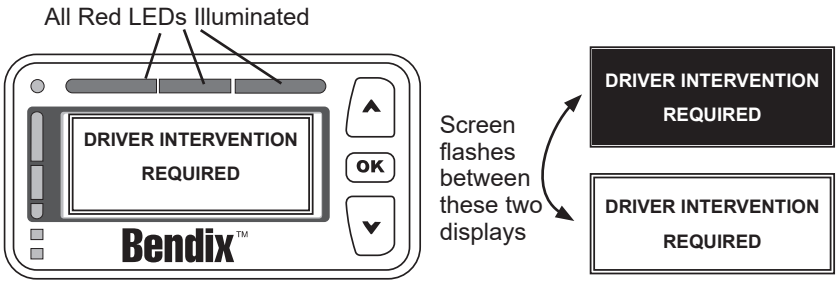
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Appendix E

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

E4.0 Impact Alert (IA)

The “Impact Alert” uses a combination of distance to the vehicle ahead, plus high relative velocity, to decide when to issue a loud solid tone, as well as a visual indicator to the driver. The red LED bar across the top of the DIU will illuminate and “DRIVER INTERVENTION REQUIRED” will flash using the two screens below:



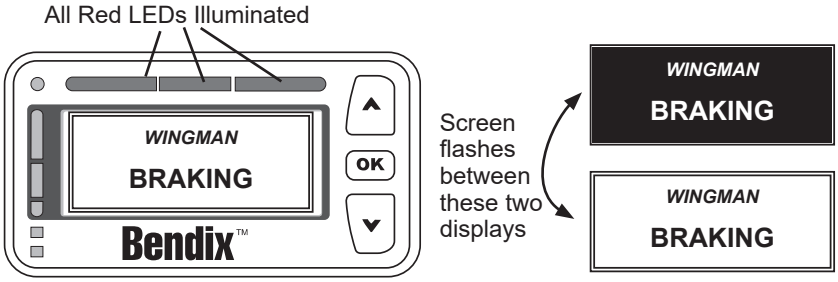
When the IA activates, the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

The impact alert cannot be configured or turned off.

NOTE: At most, the active cruise control with braking feature of Bendix® Wingman® Fusion™ system will apply the vehicle’s brakes. The driver must apply additional braking, when necessary, in order to maintain a safe distance from the vehicle ahead.

E4.1 Collision Mitigation Braking (CMB)

If a collision is likely to occur, and the collision mitigation feature activates the foundation brakes, the tone of the alert will typically change and the display will be as shown below. The driver must immediately act to potentially avoid, or lessen the severity of, a collision.



NOTE: The collision mitigation feature of the Bendix Wingman Fusion system will apply the vehicle’s brakes.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Appendix E

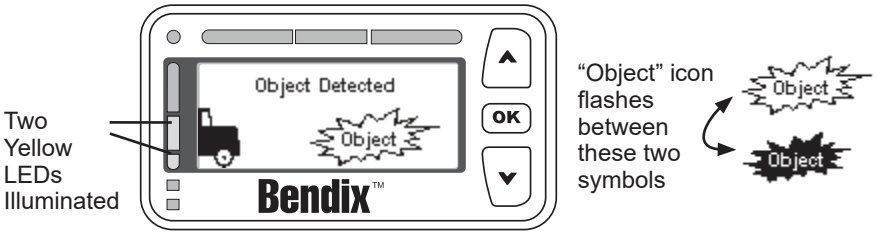
Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

E5.0 Stationary Object Alert (SOA)

Stationary Object Alert (SOA) is an alert given to the driver when the radar detects a sizeable, non-moving metallic object in the vehicle's path of travel. To reduce the number of false detections, such as bridges and overhead signs, a set of filters are put in place so the SOA will not warn on every stationary object. Typically the SOA is ready to alert the driver whenever the vehicle is moving above ten (10) mph / 16 kph, but some OEs/ fleets may select higher minimum speeds.

The SOA can be configured to be on or off through the display.

If a SOA is issued – up to three (3) seconds before a potential impact – the DIU will very briefly send out an alert identical to a very brief FDA Level 2: continuous tone and two (2) yellow LEDs, with the display image switching between the two shown below.



E6.0 Stationary Vehicle Braking (SVB) Alert

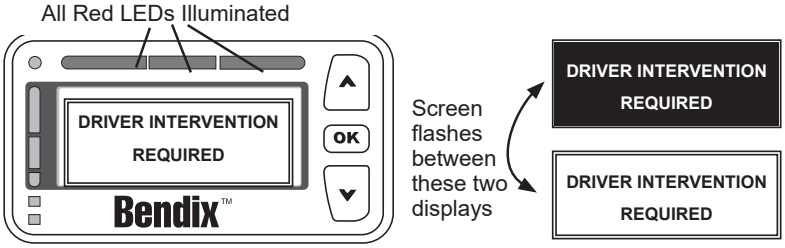
⚠ WARNING

When a large, stationary, metallic object in a vehicle's lane of travel is definitively identified as a vehicle, the driver is notified up to 3.5 seconds before impact.

***If the driver does not take action to address the potential impact that caused the alert*, Wingman Fusion can automatically engage the brakes to assist the driver in reducing the severity of or potentially avoiding a collision with that stationary vehicle. *If the system cannot definitively identify the stationary object as a vehicle* – for example, if the vehicle is not a licensed motorized vehicle, or certain types of trailers – the driver will get up to 3.0 seconds of alert to address the situation ahead; no automatic braking will be applied. Stationary Vehicle Braking is most useful when approaching a line of stopped traffic or a stalled vehicle that is not immediately recognized by the driver.**

⚠ CAUTION

The SVB is ready to alert the driver whenever the vehicle is moving above 15 mph / 24 kph, but although that figure is typical, some OEs/fleets may select higher minimum speeds. The driver should be especially careful when approaching certain types of vehicles or objects. The Bendix® Wingman® Fusion™ system radar may not be able to detect vehicles with limited metal surfaces (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.). *NOTE: Entering a curve may reduce the alert time.*



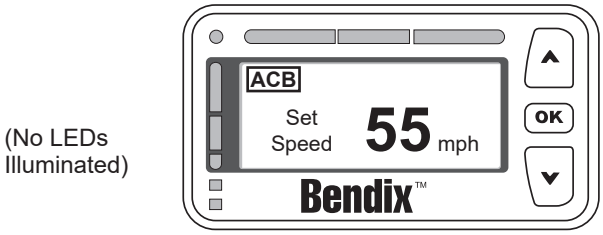
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

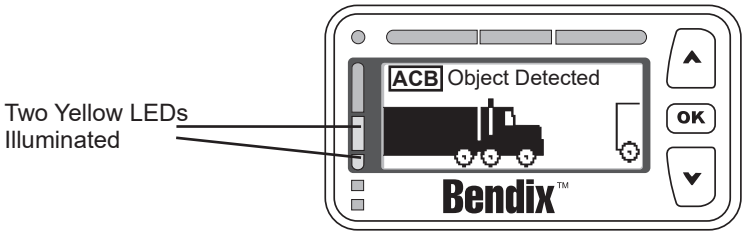
E7.0 ACB (Active Cruise Control with Braking) Icon

The ACB icon appears in the upper left-hand corner of the DIU's screen to indicate to the driver that the active cruise control with braking feature of the Bendix® Wingman® Fusion™ system is ready and able to intervene.

Once the driver sets cruise, the DIU will display the set speed and the ACB icon as shown below.



When a forward vehicle is detected and either the distance to the vehicle or a following distance alert is shown, the ACB icon should remain on the screen if the active cruise control feature of the Wingman Fusion system is still engaged and ready to intervene.



⚠ WARNING

If the ACB icon is not displayed on the screen, the driver must assume that the active cruise control with braking feature of the Bendix Wingman Fusion system is not ready, or able, to intervene!

E8.0 Brake Overuse Alert

⚠ WARNING

The Bendix Wingman Fusion system provides a warning when the system is intervening and using the foundation brakes excessively. Overuse of the foundation brakes can lead to the brakes overheating and a potential loss of braking performance caused by brake fade. Using cruise control on downhill runs will cause this alert to be activated.

⚠ WARNING

Grades should be approached normally, with the appropriate gear selected and at a safe speed. Cruise control should *NOT* be used on downhill grades.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

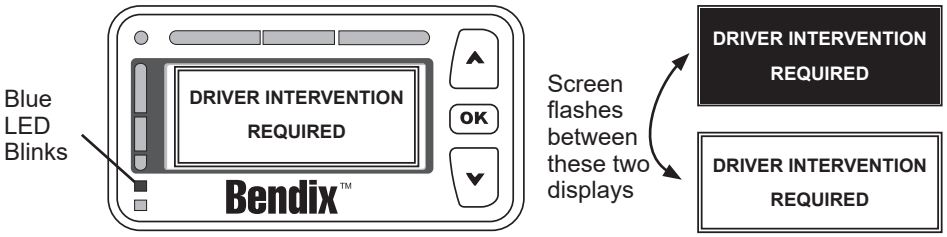
Appendix E

Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

⚠ WARNING

Cruise Control should *NOT* be used on downhill grades. Grades should be approached normally, with the appropriate gear selected and at a safe speed.

To guard against foundation brake overuse by the active cruise control with braking feature of the Bendix® Wingman® Fusion™ system, the frequency of foundation brake interventions is monitored. If the system detects a situation where the brakes are being applied too frequently by the system in a given time period, the brake overuse alert will activate. This is designed to help prevent overheating of the brakes, which may lead to brake fade and reduced vehicle braking capability. In this situation, the Brake Overuse Alert (BOA) will flash a message requesting driver intervention. Also, an audible alert will sound and a blue LED will blink on the Bendix Driver Interface Unit (DIU™), as illustrated below:

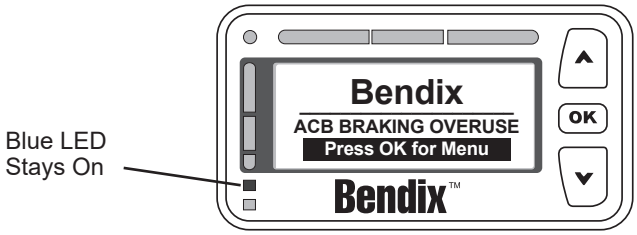


This alert will continue for 15 seconds, during which time the driver should step on the brake or turn off cruise control using the cruise control on/off switch.

If the system detects that the driver has intervened within 15 seconds after a brake overuse alert

(Typically by applying the brakes, or cancelling cruise control)

- The intervention cancels cruise control.
- **WARNING**: ***After a BOA, for a period of time (typically 20 minutes), the Wingman Fusion system will not use the foundation brakes when intervening.*** The system will be limited to de-throttling the engine and applying the engine retarder. **NOTE: In all cases, the driver still has the ability to apply the foundation brakes if necessary. The driver should take care since overheated brakes may reduce the vehicle's braking capability.**
- The time period for this mode is measured from the time the BOA was activated and lasts approximately 20 minutes.
- NOTE: The driver will continue to receive all three alerts (Following Distance, Impact, and Stationary Object).
- Additionally, the DIU message will change to "ACB Braking Overuse" and the blue LED will remain lit, as shown below:



At the end of the "cooling-off" period, the "ACB Braking Overuse" message and the blue LED will turn off.

If the system does not detect an intervention by the driver within 15 seconds after a brake overuse alert

- **The system will shut itself off, and set a Diagnostic Trouble Code (DTC).**
- **WARNING: *All intervention features of the Fusion system will be disabled until the next ignition cycle.***
- NOTE: The driver will continue to receive all three alerts (Following Distance, Impact, and Stationary Object).
- **NOTE: In all cases, the driver still has the ability to apply the foundation brakes if necessary. The driver should take care since overheated brakes may reduce the vehicle's braking capability.**

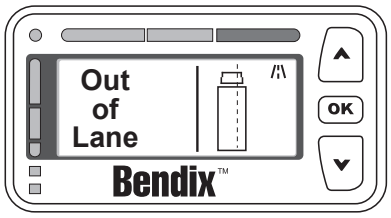
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

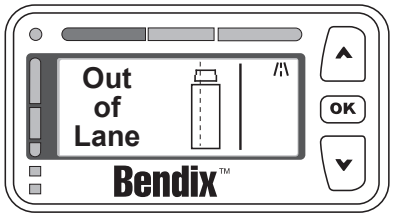
E9.0 Lane Departure Warning (LDW) Alert

⚠ WARNING

The Bendix® Wingman® Fusion™ system has the ability to warn the driver if the vehicle is not tracking in the intended roadway path. In most vehicle applications the LDW system is enabled above 37 mph / 59 kph. The driver should immediately correct the vehicle tracking and maintain the correct position in the lane.

Red LED illuminated indicates
the direction of departure



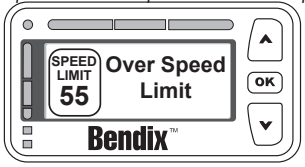


E10.0 Overspeed Alert (OA)

⚠ WARNING

The Bendix Wingman Fusion system has the ability to warn the driver if the vehicle's speed exceeds the posted legal limits. The Overspeed Alert is enabled when the vehicle is traveling greater than 5 mph/8 kph from the posted limit. The driver should immediately reduce the vehicle's speed to the posted legal limit. Note that the system does not activate overspeed alerts where the posted speed limit is 20 mph/32 kph or less.

Example of Overspeed Alert Display



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

APPENDIX F - HOW TO GENERATE, READ, AND RESET THE BENDIX® WINGMAN® SYSTEM DIAGNOSTIC TROUBLE CODES (DTCs) USING BENDIX® ACOM® PRO™ DIAGNOSTIC SOFTWARE

Appendix F

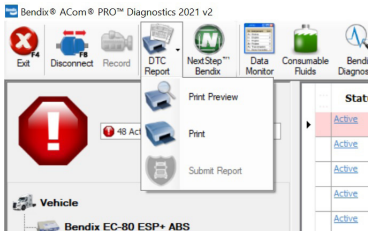
F1: How to Generate a DTC Report with Bendix® ACom® PRO™ Diagnostic Software

1. Connect a current version of the Bendix® ACom® PRO™ Diagnostic Software with the vehicle.

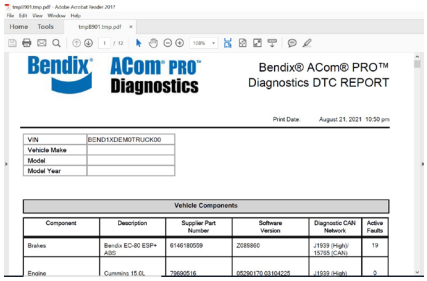
2. Once the roll call is complete, you can select the DTC Report icon on the top menu.

3. The DTC report drop-down gives you the following options:

- Print DTC Report
- Print Preview of the DTC Report
- Submit DTC Report



4. Select “Print Preview” to generate and save the report.



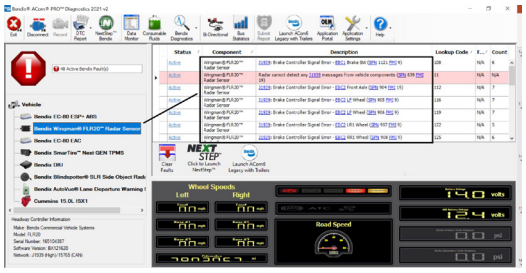
F2: How to Read the Bendix® Wingman® Advanced™ System Diagnostic Trouble Code (DTC) Reports with Bendix® ACom® PRO™ Diagnostic Software

1. Connect a current version of the Bendix® ACom® PRO™ Diagnostic Software with the vehicle.

2. Once the roll call is complete, you can view active and inactive DTCs and clear DTCs from all vehicle components or only from a selected Bendix controller.

3. To read and clear DTCs from all vehicle components at the same time, select the vehicle on the roll call and click “‘Clear Faults.”

4. To read and clear DTCs from a specific Bendix Electronic Control Unit (ECU), select the Bendix ECU on the roll call and click “Clear Faults.”



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

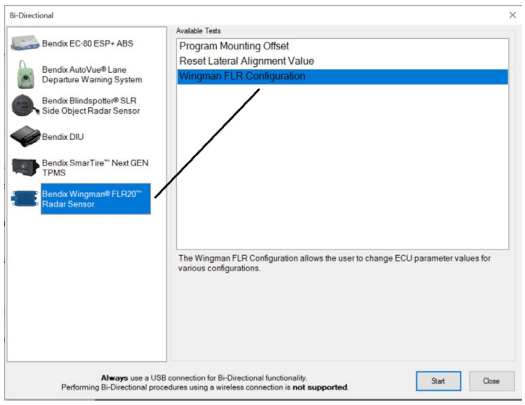
APPENDIX G - HOW TO READ KEY SYSTEM INDICATORS AND RESET ALIGNMENT VALUES

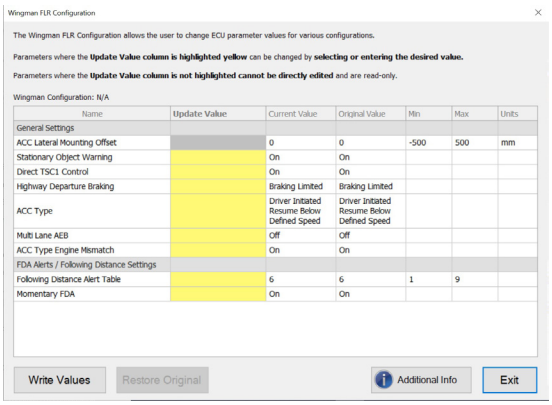
Appendix G

How to Read Key System Indicators and Reset Alignment Values

Read System Key Indicators (Configuration)

1. Connect to a current version of the Bendix® ACom® PRO™ Diagnostic Software and select “Bi-Directional” from the main menu.
2. Select the FLR20 controller from the menu.
3. Select the “Wingman FLR Configuration” from the available tests, which will display all the FLR-21 configuration parameters.

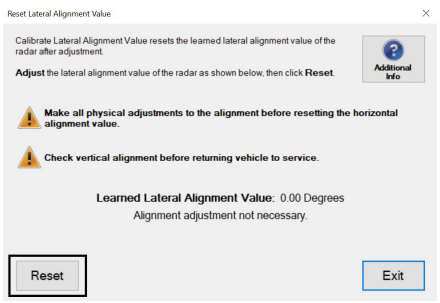




System Key Indicators		
Attribute	**Description**	**Refer to Section:**
ACC Lateral Mounting Offset	This value should equal 0 if the radar sensor is mounted on the center line of the vehicle. If the service technician believes the radar sensor should be mounted offset from center, call 1-800-AIR-BRAKE (1-800-247-2725), option 2.	Appendix A
Stationary Object Warning Indicator	This is a status indicator for the function of stationary object warning. Available for use in Bendix® Wingman® Advanced™ system versions since 2010.	1.8
Following Distance Alert (FDA) Table	This indicates the distance setting and FDA that are configured for the vehicle. *Refer to Table 7* for setting information.	Appendix J

How To Reset The “Alignment Value”

1. In the “Bi-Directional” menu, select the FLR20 controller.
2. Select the “Reset Lateral Alignment Value” from the available tests.
3. Follow the instructions on the window and click “Reset.”
4. Cycle the vehicle ignition power to complete the process.



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

APPENDIX H- HOW TO CHANGE THE FOLLOWING DISTANCE ALERT (FDA) SETTINGS AND ENABLE MOMENTARY BEEPING

Appendix H

How to Change the Following Distance Alert (FDA) Settings and Enable Momentary Beeping

Read Key System Indicators (Configuration)

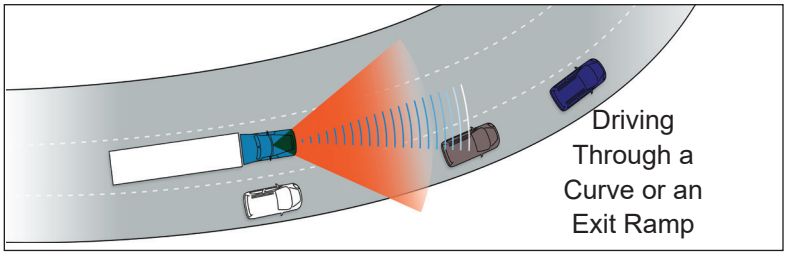
1. Connect a current version of Bendix® ACom® PRO™ Diagnostic Software and select “Bi-Directional” from the main menu.
2. Select the FLR20 controller from the menu.
3. Select the “Wingman FLR Configuration” from the available tests, which will display all the FLR20 configuration parameters.
4. To update the FDA settings, enter the desired value in “Update Value” and select “Write Values.”
5. Turn the “Momentary FDA” on or off as needed and select “Write Values.”

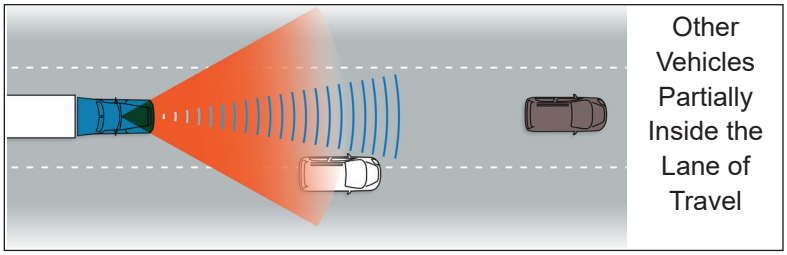
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

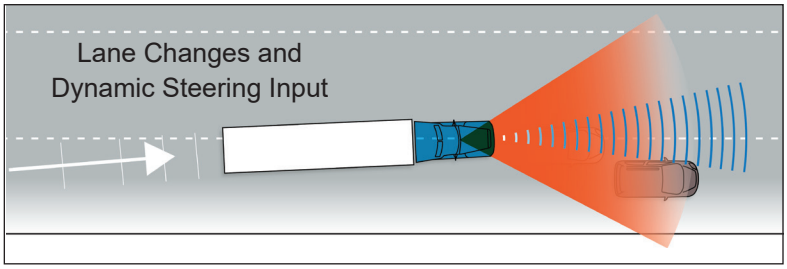
APPENDIX J - SITUATIONS THAT MAY CAUSE FALSE ALERTS BY THE BENDIX® WINGMAN® FUSION™ SYSTEM

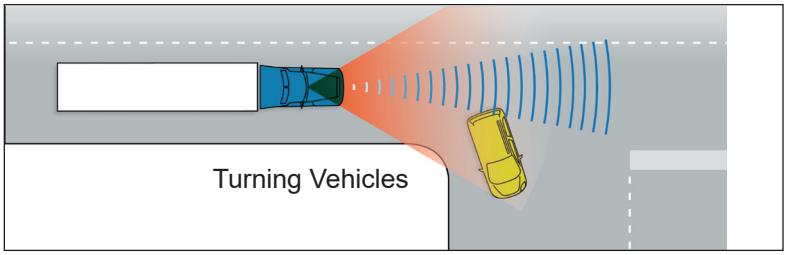
Appendix J

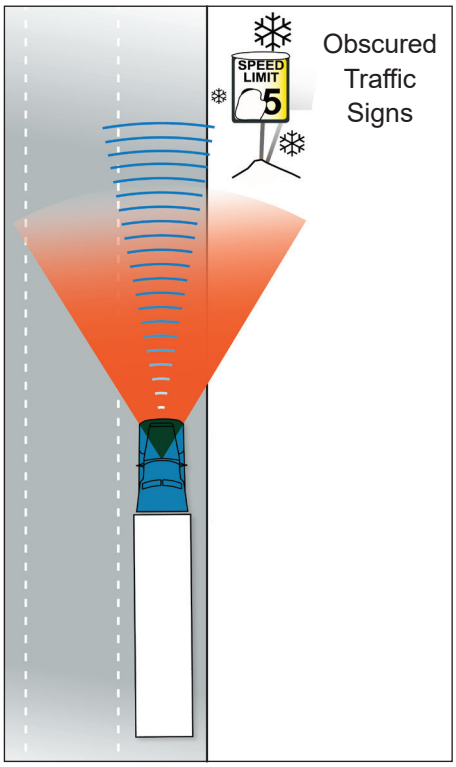
The following charts illustrate situations that may cause false alerts. The Bendix® Wingman® Fusion™ system may unexpectedly issue warnings, apply braking, or not respond.

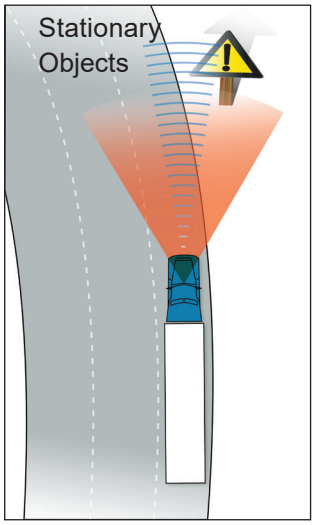












Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725) option 2, for troubleshooting assistance.

APPENDIX K - SYSTEM OPERATION

K1.0 OPERATION SECTION

K1.1 IMPORTANT SAFETY INFORMATION

Read and follow the General Safety Guidelines shown on page two of this document.

⚠ WARNING

Bendix safety technologies complement safe driving practices. No commercial vehicle safety technology replaces a skilled, alert driver exercising safe driving techniques and proactive, comprehensive driver training. Responsibility for the safe operation of the vehicle remains with the driver at all times.

This vehicle's cruise control must be used only in the same conditions that are normally recommended for ordinary cruise control.

Vehicle manufacturers may use alerts, messages, and dash arrangements that vary from the examples shown here. Consult the vehicle operator's manual for applicable details regarding use and operation.

K1.2 WHEN NOT TO USE THE BENDIX® WINGMAN® FUSION™ SYSTEM ACTIVE CRUISE CONTROL WITH BRAKING

The active cruise control with braking feature in the Bendix® Wingman® Fusion™ system is automatically ready when normal cruise control is set.

⚠ WARNING

This vehicle's cruise control must be used only in the same conditions that are normally recommended for ordinary cruise control. As noted below, there are certain situations when cruise control should *NOT* be used.

• **Inclement Weather/Low Visibility Situations** – Do not use cruise control in inclement weather or low visibility conditions such as rain, snow, smoke, fog, ice or other severe weather conditions that may affect the performance of the Bendix Wingman Fusion system.	
• **Dense Traffic** – Do not use cruise control in heavy traffic.	
• **Sharp Curves and Winding Roads** – Do not use cruise control when traveling sharply curved or winding roadways. CAUTION: Road curvature may impact the radar's ability to track vehicles ahead in the same lane.	
• **Entrance or Exit Ramps** – Do not use cruise control when entering or exiting roadways.	
• **Downhill Grades** – Do not use cruise control on downhill grades.	
• **Construction Zones** – Do not use cruise control in construction zones.	
• **Off-Road** – Do not use cruise control in off-road conditions.	
• **Smaller Forward Vehicles** – Smaller vehicles, such as motorcycles or certain types of trailers, may be difficult for the radar to identify. It is the driver's responsibility to be aware of these types of vehicles and to slow down if necessary.	

Visit the Wingman Fusion web page – under the Products tab of bendix.com – for more information, along with any updates to these limitations and restrictions.

K1.3 AUTOMATIC FOUNDATION BRAKE APPLICATIONS

The vehicle automatically manages foundation brake priorities among the various vehicle systems that use the foundation brakes, such as the Bendix® Wingman® Fusion™ system, Bendix® ESP® Electronic Stability Program, Bendix® ATC (Automatic Traction Control) and Bendix® ABS (Antilock Braking System).

NOTE: Cruise Control will automatically cancel whenever the Wingman Fusion system applies the foundation brakes. The driver can verify that the cruise control is disengaged by observing that the cruise-enabled icon is no longer illuminated. The driver must resume or set cruise control in order to regain normal cruise control functionality and to reengage the active cruise control with braking feature of the Fusion system.

Additional information, and complete troubleshooting procedures for the Bendix® ESP® EC-80™ Controller, can be found in the *Bendix Service Data Sheet SD-13-4986*.

K1.4 SYSTEM COMPONENTS

The Bendix Wingman Fusion system. *(See Figure 2)* has five major components, plus indicator switches and lamps.

1. A Bendix™ FLR-21™ radar is located at the front of the vehicle – either on the bumper or just behind it on a cross-member. *See Figure K1*.

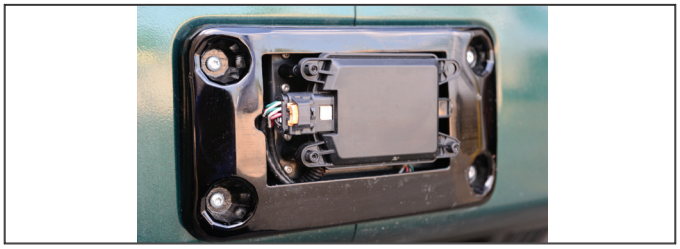


Figure K1 – Component: Radar Sensor

The radar sensor is pre-aligned at the factory and no adjustment should be needed. If the radar sensor becomes misaligned (or a Diagnostic Trouble Code [DTC] is issued), either a message – or light on the dash, depending on the vehicle – lets the driver know that service is needed.

2. A Bendix™ AutoVue® FLC-20™ Camera is a visible-light spectrum camera mounted near the top and center of the windshield of the vehicle. *See Figure K2*.

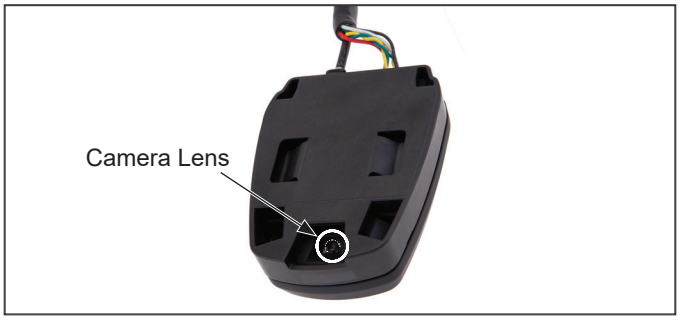


Figure K2 – Component: Camera

The Bendix AutoVue system supplies feedback to the driver during Lane Departure Warning (LDW) incidents using audible alerts and/or seat vibrations. In the Bendix Fusion system, the camera supplies supplemental visual data that – along with the radar sensor – helps the system generate data about the traffic and environment around the vehicle.

3. A Bendix ESP EC-80 Controller – located in the cab of the vehicle – controls the antilock braking and full stability functions for the vehicle, using a set of wheel-speed, yaw, steering-angle and load sensors. In the Bendix Wingman Fusion system, the Controller also manages any actions requested by the Fusion system. *See Figure K3.*

Figure K3 – Component: Bendix ESP EC-80 Controller

4. A SafetyDirect® by Bendix CVS processor – located close to the camera in the cab of the vehicle – typically in an over the windshield compartment. *See Figure K4*.

Figure K4 – Component: SafetyDirect Processor

The processor communicates data to the vehicle's telematics system for relay to the web servers.

5. An interface to communicate between the driver and the Bendix Wingman Fusion system. Depending on the OEM, the Bendix™ Driver Interface Unit (DIU™) is used, or system messages are displayed via the vehicle dashboard. *See Figure K5*.

Figure K5 – Bendix Driver Interface Unit (DIU™)

A set of visual, text, and audible indicators and alerts will be provided by the Bendix DIU or OEM dash display. *For more about the Bendix DIU, refer to Appendix B*.

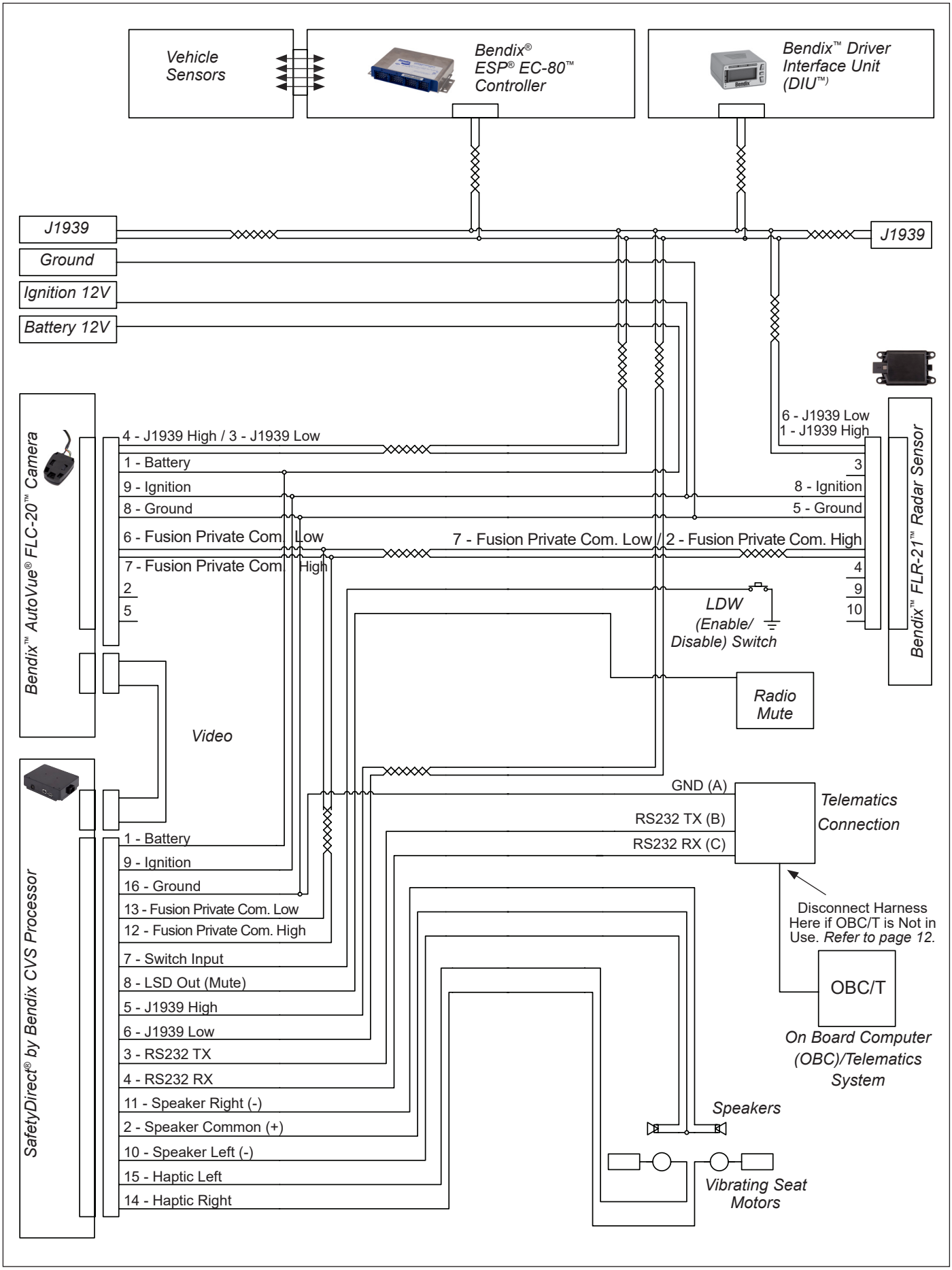


Figure K6 – Main Bendix® Wingman® Fusion™ System Component Schematic

Also refer to the Indications and Alerts section of Appendix K for more detailed information about the alerts.

K1.5 DASH SWITCHES AND LAMPS

Each OEM typically has a different arrangement to display the system status and to allow the driver to temporarily disable the Lane Departure Warning (LDW) system. Refer to the OEM Operator's Manual for any system indicator lamp(s). *See Figure K7 for some examples of OEM icons used at the time this document was published.*

Dash/Switch Icon. (The design will vary by vehicle OEM. In some cases, the switch and lamps may be separate.)	International®	Kenworth®
		
Mack®	Peterbilt®	Volvo®
		
* All trademarks shown here are the property of their respective owners and are used for reference only.		

Figure K7 – Dash Switch Icons

K1.6 TEMPORARILY DISABLE THE LANE DEPARTURE WARNING (LDW)

To avoid erroneous LDW warnings in areas such as work zones – where the road markings present might cause false alerts – Bendix® Wingman® Fusion™ systems feature an enable/disable switch, either the Bendix design shown below or a similar OEM switch. Applying the switch will suppress alerts for fifteen minutes; the system auto-resets afterwards.

The design will vary by vehicle OEM. The switch and lamps may be separate.

Figure K8 – Example of an LDW Enable/Disable Switch

Additionally, the system self-monitors and will set a Diagnostic Trouble Code (DTC) that will typically alert the driver using a similar icon on the dash display or by a status lamp.

Refer to Section 2, "Troubleshooting," for more information**.** *See Figure K6 for a wiring schematic showing the connections between the various system components.*

K1.7 ACTIVATE THE BENDIX WINGMAN FUSION SYSTEM ACTIVE CRUISE CONTROL

To have the benefits of the active cruise control feature of the Fusion system, the vehicle's regular cruise control must be switched on. *See Figure K9 for examples of switches that may be used.*

Figure K9 – Examples of Cruise Control Switches

When the vehicle reaches the desired cruise speed, the driver presses the cruise control set switch to activate the system. The Wingman Fusion system will then engage and help the driver maintain a set following distance behind the vehicle traveling in front.

Once the cruise control speed is set, a cruise-enabled icon (or similar) will illuminate on the instrument panel. If the cruise-enabled or set (or similar) icon does not illuminate, the Fusion system may not function normally. Refer to the vehicle operator's manual to double-check the location of the icon, and for further troubleshooting information. There will typically be a bulb-check for the icon at vehicle start-up.

The driver can switch off the Bendix Wingman Fusion active cruise control system manually by either stepping on the brake pedal or switching off the cruise control.

NOTE: It is possible that some Wingman Fusion applications allow the cruise control to automatically resume after the Wingman Fusion system applies the foundation brakes during adaptive cruise. The driver is able to override the auto resume feature by manually activating the brake pedal.

K1.8 WHAT TO EXPECT WHEN USING THE BENDIX® WINGMAN® FUSION™ SYSTEM

Table K1, parts 1–2, illustrate what to expect from the Bendix® Wingman® Fusion™ system in various driving situations. Typical system indications and actions to expect from the system are illustrated.

Part 1: All Driving Scenarios (Cruise Control is either "on" or "off")		
What to Expect		
Situation	**Typical System Indication/Alerts**	**Typical System Actions/Cautions**
Stationary objects/vehicles ahead in the lane of travel		
A stationary – non-vehicle – object is detected ahead in the lane in which the truck is traveling.	A Stationary Object Alert (SOA) may be issued up to three (3) seconds prior to impact.	None. **⚠ WARNING** **The driver must immediately act to potentially avoid, or lessen the severity of, a collision.**
A stationary motor vehicle is detected ahead in the lane in which the truck is traveling. ***NOTE: Factors that can potentially affect the system's ability to identify a stationary vehicle include: environmental factors (sun glare, dim/ dark lighting conditions, precipitation, fog, etc.); if the vehicle is not a licensed motorized vehicle; or certain types of trailers.***	If the vehicle is traveling above 10 mph / 16 kph, a Stationary Vehicle Alert (SVA) may be issued up to three-and-a-half (3.5) seconds prior to impact.	**⚠ WARNING** **The driver must immediately act to potentially avoid, or lessen the severity of, a collision.** If the Wingman Fusion system detects that a collision is likely to occur, the system may provide a warning and/or apply the vehicle's brakes, to lessen the severity of, or potentially prevent impact.
Moving objects/vehicles ahead in the lane of travel		
The vehicle comes up fast behind a slower-moving detected forward vehicle.	The Following Distance Alert (FDA) will sound and a visual message/icon typically appears on the dash screen or Bendix™ Driver Interface Unit (DIU™) display. Depending on how close the vehicle approaches, the system may initiate an Impact Alert (IA) warning.	None. **The driver must respond as needed.**
The detected forward vehicle slows rapidly.	The Following Distance Alert (FDA), or Impact Alert (IA) warning (continuous tone) will sound and a visual message/ icon typically appears on the dash screen or DIU display.	None. **The driver must respond as needed.** If a collision is likely to occur, the collision mitigation feature will apply the vehicle's brakes.
A pedestrian, deer, or dog runs in front of the truck.	None.	None. **The driver must respond as needed.**
Another vehicle crosses the road perpendicular to the vehicle's path of travel – such as at an intersection.	None.	None. **The driver must respond as needed.**
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.		

Table K1 – Part 1 - Operational Scenarios with the Bendix Wingman Fusion System

Part 1: All Driving Scenarios (Cruise Control is either "on" or "off")		
What to Expect		
Situation	**Typical System Indication/Alerts**	**Typical System Actions/Cautions**
Lane Departure System Active (Lane detection icons being displayed)		
The vehicle signals a lane-change and crosses a lane-marking.	None.	None.
Traveling below 37 mph / 59 kph, the vehicle crosses a lane-marker (without the corresponding turn signal activated).	None.	None. **The driver must respond as needed.**
Traveling above 37 mph / 59 kph, the vehicle crosses a lane-marker (without the corresponding turn signal activated).	A "rumble strip" audible/ vibration/visual alert is initiated.	None. **The driver must respond as needed.** (The driver must use the turn signal when changing lanes and/or keep the vehicle within the lane markings.)
Overspeed Alert & Action (OAA) International travel: When changing between regions which post speeds in miles and those which post in kilometers, the speed limit sign recognition feature will not function until the correct U.S./Metric selection has been made.		
The vehicle passes a U.S. or Canadian speed limit sign.	The DIU will display the posted speed limit.	None.
The vehicle exceeds the posted speed limit by 5 to 9 mph (8 to 14 kph).	An overspeed alert will be issued and the posted speed limit will be visually presented to the driver.	None. **The driver must respond as needed.**
The vehicle exceeds the posted speed limit by more than 10 mph / 16 kph.	An audible overspeed alert and the posted speed limit will be visually presented to the driver, to signal that the vehicle should slow down.	**If cruise control is NOT ON:** A one-second de-throttle of the engine will occur. **The driver must respond as needed.**
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.		

Table K1 – Part 1 - Operational Scenarios with the Bendix Wingman Fusion System

NOTE: The system indicators/alerts above are typical, but may vary from the descriptions shown here by vehicle manufacturer, or earlier versions of the Fusion system.

NOTE: These are examples of situations and typical Wingman Fusion system responses. However, this chart does not attempt to cover all possible situations.

⚠ Due to the inherent limitations of radar and camera technology, the enhanced Collision Mitigation Technology – on rare occasions – *may not* detect moving vehicles or stationary vehicles in the vehicle's lane of travel. Alerts, warnings, or brake interventions may not occur.

⚠ Due to the inherent limitations of radar and camera technology, the enhanced Collision Mitigation Technology – on rare occasions – *may react* to moving vehicles not in the vehicle's lane of travel. Alerts, warnings, or brake interventions may occur.

What to Expect (K1.8)		
Part 2: Cruise Control "on" and speed "set"		
Situation	**Typical System Indication/Alerts**	**Typical System Actions/Cautions**
Interactions with forward vehicles in the same lane of travel		
With no detected forward vehicle.	None.	The vehicle maintains the set speed.
With a detected forward vehicle.	The cruise control ON indicator is illuminated and the detected forward vehicle icon is illuminated.	The active cruise control with braking feature will maintain the set speed and following distance.
The detected forward vehicle slows **moderately**.	The Following Distance Alert (FDA) will sound and a visual message/icon typically appears on the dash screen or Bendix™ Driver Interface Unit (DIU™) display.	**The driver must respond as needed.** If the system intervenes, the vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order. ***NOTE:** When the foundation brakes are applied, cruise control is cancelled.*
The detected forward vehicle slows **rapidly**.	The Impact Alert (IA) warning (continuous tone) will sound and a visual message/icon typically appears on the dash screen or DIU display. The FDA may also be heard.	**The driver must respond as needed.** If the system intervenes, the vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order. ***NOTE:** When the foundation brakes are applied, cruise control is cancelled.*
The detected forward vehicle cuts in front of the vehicle **but then speeds away.**	Following Distance Alerts may be given to the driver, depending on the exact system configuration set for the vehicle, and how close the vehicle cuts in front.	Vehicle maintains set speed. **The driver must respond as needed.**
Downhill grades		
Going down a grade with a detected forward vehicle. Cruise control should ***NOT*** be used on downhill grades - *refer to page 78.* *(Refer to the CDL manual instructions on proper gear usage for downhill grades.)*	DO NOT USE cruise control on downhill grades.	*DO NOT USE cruise control on downhill grades.*

Table K1 – Part 2 - Operational Scenarios with the Bendix® Wingman® Fusion™ System

NOTE: The system indicators/alerts above are typical, but may vary from the descriptions shown here by vehicle manufacturer, or earlier versions of the Fusion system.

It is possible that some Wingman Fusion applications allow the cruise control to automatically resume after the Wingman Fusion system applies the foundation brakes during adaptive cruise. The driver is able to override the auto resume feature by manually activating the brake pedal.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

K1.9 HOW A DRIVER INTERACTS WITH THE BENDIX® WINGMAN® FUSION™ SYSTEM

Table K2 illustrates how the Bendix® Wingman® Fusion™ system will respond to various actions a driver may take when using the Fusion system on the road.

⚠ WARNING

The driver is always responsible for the control and safe operation of the vehicle at all times. The Bendix Wingman Fusion system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

How a Driver Interacts with the Bendix Wingman Fusion System (1.4)	
If the driver does this:	**Expect the Wingman Fusion system to do this:**
Steps on the brake. (During a collision mitigation event.)	The driver is always in control and is able to apply full braking power.
Steps aggressively on the accelerator. (During a collision mitigation event.)	The driver is always in control. His/her actions override any Fusion system actions. Note: If cruise control is engaged, it will be overridden until the accelerator is released; then cruise control will resume the original set speed automatically.
Steps on the brake. (When in cruise.)	Cruise control will be cancelled.
Steps on the accelerator. (When in cruise.)	Cruise control will be overridden until the accelerator is released; then cruise control will resume the original set speed automatically.
Switches on the cruise control.	Nothing. The active cruise control with braking feature will not engage until the driver sets the cruise control speed.
Switches off the cruise control.	The active cruise control with braking feature will turn off; the collision mitigation feature remains active and ready to intervene. The driver will continue to hear all alerts as needed.
Sets the cruise control speed.	The active cruise control with braking feature is automatically activated. The vehicle maintains a set speed and following distance behind the vehicle ahead.
Covers or blocks the radar.	The Bendix Wingman Fusion system performance will be diminished or even disabled when the radar is blocked. An audible and/or visual alert will notify the driver of this condition. The driver should remove the radar blockage and the Wingman system performance will return to normal.
Uses normal cruise control “+/-” switch.	Vehicle speed increased (+) or reduced (-) to achieve the new set speed while actively maintaining following distance with the vehicle ahead, if one is present within 500 feet (152 m).
Presses the Lane Departure Warning (LDW) enable/disable switch.	The LDW system alerts will be suppressed for 15 minutes.
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.	

Table K2 – How a Driver Interacts with the Bendix Wingman Fusion System

NOTE: The system responses above are typical, but may vary from the descriptions shown here by vehicle manufacturer, or earlier versions of the Fusion system. These are examples of driver actions and typical Wingman Fusion system responses, however, this chart does not attempt to cover all possible situations.

THE FORWARD VEHICLE DETECTED ICON

When cruise control is switched on and set, and a vehicle ahead is detected by the radar, the detected forward vehicle icon – or similar – will illuminate on the vehicle dashboard.

This is an indication to the driver that the Bendix Wingman® Fusion™ system is actively managing the distance between the driver and the forward vehicle, and may intervene automatically, if needed.

See Figure K10 for examples.

Figure K10 - Forward Vehicle Detected Icons

ADJUSTING THE CRUISE CONTROL SPEED

The vehicles' cruise control speed can be set using the switch(es) provided by the vehicle manufacturer. When adjusted, the set speed will typically be indicated on the vehicle dash, message center, or speedometer.

K1.10 FOLLOWING DISTANCE

Following distance refers to the time gap, measured in seconds, between the driver and the vehicle ahead. The actual physical distance between the two will vary based on the speeds of both vehicles; however, the set gap will remain the same for all set cruise speeds.

FOLLOWING DISTANCE ADJUSTMENT SWITCH

This Wingman Fusion system feature has an option that allows the driver to adjust the following-distance or time-gap. Feature availability is determined by the vehicle manufacturer. The switch has an increase or decrease function. Pressing increase (+) will provide a larger following distance, measured in seconds. Pressing decrease (-) will provide a shorter following distance.

K1.11 LANE DEPARTURE WARNING DIU STATUS SCREEN ICONS

See Figure K11. In the case of vehicles that use a Bendix™ Driver Interface Unit (DIU™), the top right corner of the display is used to show an icon. For other OEM displays, refer to the vehicle manual to find the method used to show the system status.

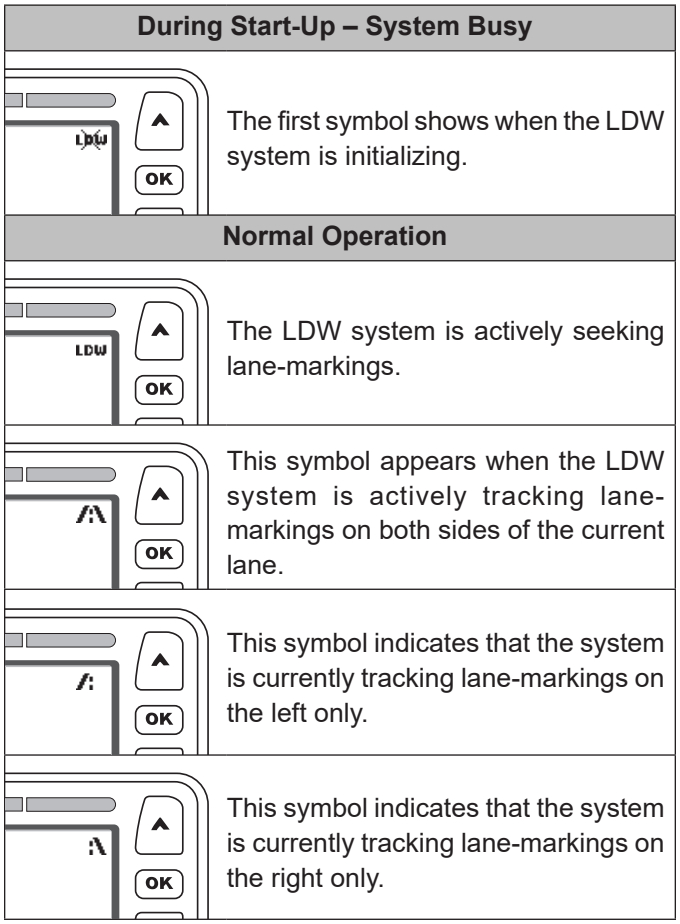


Figure K11 - Normal Bendix DIU Screens Showing LDW System Status

If none of the LDW status icons shown in Figure K11 appear on the DIU screen – and the driver has not pressed the LDW disable switch (*refer to Section 2.3*) – this indicates that the system using the Bendix™ AutoVue® FLC-20™ camera has detected a DTC and the system should be serviced at the earliest opportunity. *See Figure K12.*

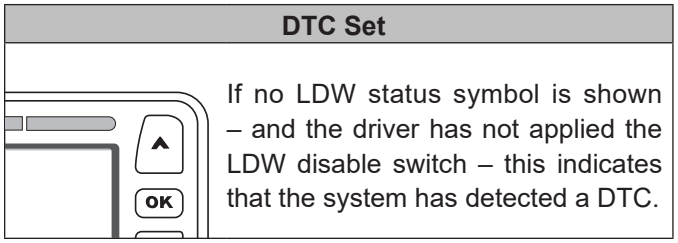


Figure K12 – Bendix DIU Screen Showing LDW System Status

In these cases, the OE vehicle dash display will also alert the operator that there is a DTC present.

K1.12 BENDIX® WINGMAN® FUSION™ SYSTEM COLLISION MITIGATION FEATURE OPERATION

Whenever the vehicle is traveling above 15 mph / 24 kph, the Bendix® Wingman® Fusion™ system collision mitigation feature is ready to intervene, if needed. It does not require cruise control to be set. The collision mitigation feature of the Wingman Fusion system will alert the driver automatically, and apply the vehicle's brakes if a collision with the detected forward vehicle is likely to occur. The driver must immediately act to potentially avoid, or lessen the severity of, a collision.

Collision mitigation is ready to intervene as long as no DTCs are active in either the brake system, the Fusion system, or any other contributing vehicle system.

AUTOMATIC FOUNDATION BRAKE APPLICATIONS

The vehicle automatically manages foundation braking priorities among the various vehicle systems that use the foundation brakes, such as the Bendix Wingman Fusion system, Bendix® ESP® (Electronic Stability Program), Bendix® ATC (Automatic Traction Control), and Bendix® ABS (Antilock Braking System).

K1.13 ALERTS AND WARNINGS

The Fusion system operates differently compared to other cruise control/forward collision warning systems. It is important that the driver fully understands the system's features, especially the alerts and warnings.

Three important warnings provided by the Bendix Wingman Fusion system are the Following Distance Alert (FDA), Impact Alert (IA), and Stationary Object Alert (SOA). The driver will be alerted by any of the three warnings, whether or not the cruise control is activated.

Refer to Appendix B, Sections 3.0–5.0, for more information about how DIUs communicate alerts.

⚠ WARNING

Any audible and/or visual alert by the system means that the vehicle is too close to the vehicle or object ahead, and the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

IMPACT ALERT (IA)/ COLLISION MITIGATION BRAKING (CMB)

⚠ WARNING

The Impact Alert (IA)/Collision Mitigation Braking (CMB) is the most severe warning issued by the Bendix Wingman Fusion system. This alert indicates that a collision with the detected forward vehicle is likely and the driver must immediately act to potentially mitigate, or lessen the severity of, a collision.

The IA/CMB is ready to alert the driver whenever the vehicle is moving above 15 mph / 24 kph.

When activated, the IA/CMB will sound and a visual message/icon typically appears on the dash screen or Bendix™ Driver Interface Unit (DIU™) display. The actual sound/display method varies by vehicle manufacturer.

NOTE: The IA/CMB is typically accompanied by automatic brake interventions. The Fusion system will apply the vehicle's brakes. The driver must apply additional braking, when necessary, to maintain a safe distance from the vehicle ahead.

See Figure K13 for an example of an Impact Alert Icon.

Figure K13 – Example of Impact Alert Icon

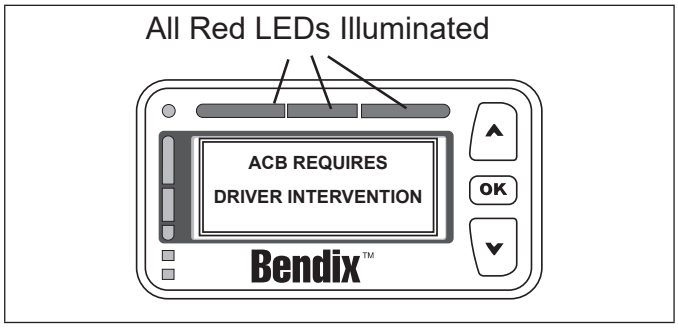


Figure K14 – Impact Alert Text and Light Pattern as Seen on the Bendix DIU

FOLLOWING DISTANCE ALERT (FDA)

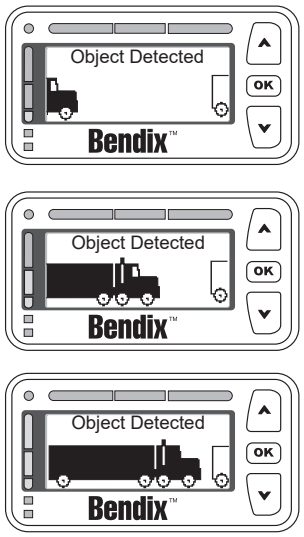
WARNING

The FDA is ready to alert the driver whenever the time between the vehicle and the detected forward vehicle is less than one-and-a-half (1.5) seconds* and decreasing. Once the audible alert is given, the driver should increase the distance between his/her vehicle and the vehicle ahead until the audible alert stops.

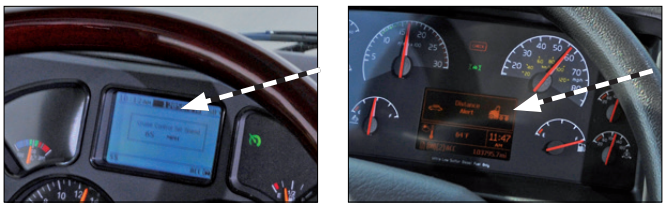
The FDA is ready to alert the driver whenever the vehicle is moving above 5 mph / 8 kph.

If the following distance continues to decrease, the driver will hear more rapid audible alerts. When the FDA reaches its highest level, typically a red LED also illuminates on the instrument cluster. The FDA may be accompanied by a visual alert.

***ONE-AND-A-HALF (1.5) SECONDS IS THE SYSTEM DEFAULT AND MAY VARY BY FLEET/OEM.**



Driver Interface Unit (DIU™) Showing Examples of Following Distance Alerts with Progressively Faster Audible Alerts.



Above: Examples of other vehicle manufacturer's displays.

Figure K15 – Following Distance Alert

STATIONARY OBJECT ALERT (SOA)

WARNING

Stationary Object Alert (SOA) – The Bendix® Wingman® Fusion™ system will give up to a three (3) second alert to the driver when approaching a detected, sizable, metallic (radar-reflective), stationary object in the same lane of travel. This alert indicates that a collision with a stationary object is likely and the driver must immediately act to potentially avoid, or lessen the severity of, a collision.

CAUTION

The SOA is ready to alert the driver whenever the vehicle is moving above 10 mph / 16 kph. The driver should be especially careful when approaching certain types of vehicles or objects. The Fusion system radar may not be able to detect objects with limited metal surfaces (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.). *NOTE: Entering a curve may reduce the alert time to less than three (3) seconds.*

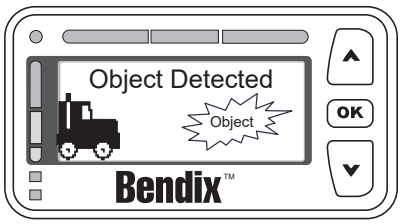


Figure K16 – Stationary Object Alert Displayed

STATIONARY VEHICLE BRAKING (SVB)

⚠ WARNING

Stationary Vehicle Braking (SVB) – When a large, stationary, metallic object in a vehicle's lane of travel is definitively identified as a vehicle, the driver is notified up to 3.5 seconds before impact. If the driver does not take action to address the potential impact that caused the alert, the Bendix® Wingman® Fusion™ system can automatically engage the brakes to assist the driver in reducing the severity of or potentially avoiding a collision with that stationary vehicle. If the system cannot definitively identify the stationary object as a vehicle — for example, if the vehicle is not a licensed motorized vehicle, or certain types of trailers — the driver will get up to 3.0 seconds of alert to address the situation ahead, but no automatic braking will be applied. Stationary Vehicle Braking is most useful when approaching a line of stopped traffic or a stalled vehicle that is not immediately recognized by the driver.

⚠ CAUTION

The SVB is ready to alert the driver whenever the vehicle is moving above 15 mph/24 kph. The driver should be especially careful when approaching certain types of vehicles or objects. The Fusion system radar may not be able to detect vehicles with limited metal surfaces (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.). *NOTE: Entering a curve may reduce the alert time.*

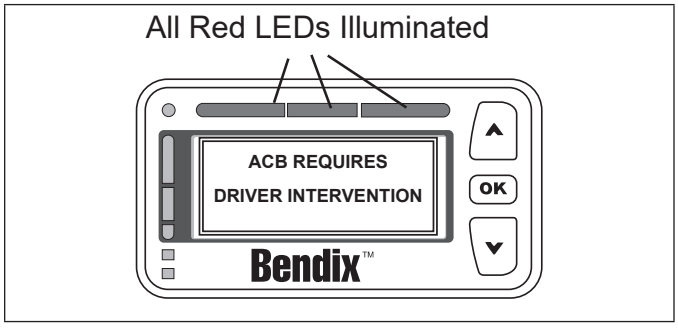


Figure K17 – Stationary Vehicle Braking (SVB) Alert Displayed

BRAKE OVERUSE ALERT

⚠ WARNING

The Bendix Wingman Fusion system provides a warning when the system is intervening and using the foundation brakes excessively. Overuse of the foundation brakes can lead to the brakes overheating and a potential loss of braking performance caused by brake fade. Using cruise control on downhill runs will cause this alert to be activated.

⚠ WARNING

Grades should be approached normally, with the appropriate gear selected and at a safe speed. Cruise control should *NOT* be used on downhill grades.

When the system detects brake overuse, depending on the vehicle manufacturer, a text message will be displayed on the dashboard and an audible alert will be activated. The driver should intervene immediately.

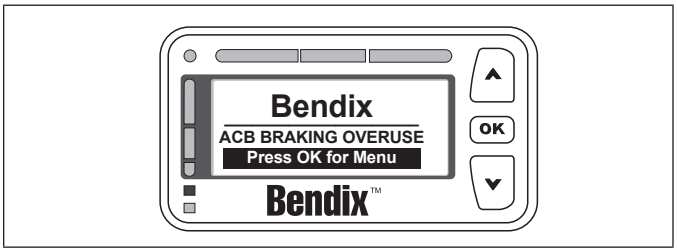


Figure K18 – Brake Overuse Warning

- Once the brake overuse alert is activated, certain driver interventions that cancel cruise control – like stepping on the brake pedal or switching off cruise – will discontinue the alert. Following an overuse alert, the driver should not reset cruise control for at least 20 minutes. This gives the brakes time to cool down.

⚠ WARNING

If the driver chooses to reset cruise control during that 20 minute period, Fusion system interventions will be limited to de-throttling and engine retarder only. The system will automatically disable all Wingman Fusion system foundation brake applications for at least 20 minutes. If the system does not detect a driver intervention within 15 seconds after the brake overuse alert sounds, it will shut itself off and set a Diagnostic Trouble Code (DTC). The driver will continue to receive alerts, but all Wingman Fusion system interventions (de-throttling, engine retarder or brake applications) will be disabled until the next ignition cycle.

NOTE: In all cases, the driver still has the ability to apply the foundation brakes if necessary. The driver should take care since overheated brakes may reduce the vehicle's braking capability. *(Refer to Appendix B7.0).*

LANE DEPARTURE WARNING (LDW) ALERT

⚠ WARNING

The Bendix® Wingman® Fusion™ system has the ability to warn the driver if the vehicle is not tracking in the intended roadway path. In most vehicle applications the LDW system is enabled above 37 mph. The driver should immediately correct the vehicle tracking and maintain the correct position in the lane.

Red LED illuminated indicates the direction of departure

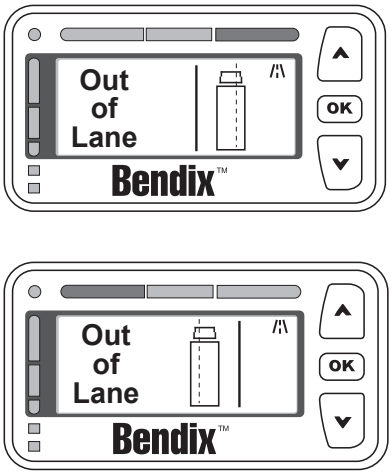


Figure K19 – Lane Departure Warning

OVERSPEED ALERT & ACTION (OAA)

⚠ WARNING

The Bendix Wingman Fusion system has the ability to warn the driver if the vehicle's speed exceeds the posted legal limits. The Overspeed Alert & Action is enabled when the vehicle is traveling greater than 5 mph / 8 kph from the posted limit. The driver should immediately reduce speed to the posted legal limit.

When the vehicle exceeds the posted speed limit by 5 mph / 8 kph, an audible alert will sound to alert the driver. If the vehicle speed exceeds 10 mph/16 kph over the posted speed limit, an audible alert signals the driver to slow down and a one-second de-throttle of the engine will occur.

International travel: When changing between regions which post speeds in miles and those which post in kilometers, the speed limit sign recognition feature will not function until the correct U.S./Metric selection has been made.

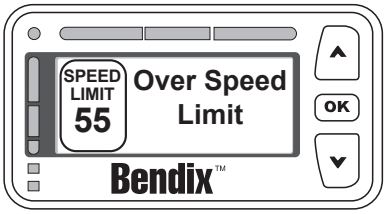


Figure K20 – Over Speed Limit Warning

K1.14 BENDIX® WINGMAN® FUSION™ SYSTEM DIAGNOSTIC TROUBLE CODES

The Bendix® Wingman® Fusion™ system is monitored and if any malfunction is detected, a Diagnostic Trouble Code (DTC) will be set and the driver will be alerted. The exact alert given depends on the vehicle manufacturer: refer to the vehicle operator's manual and Sections 3 and 4.

K1.15 RADAR SENSOR INTERCHANGEABILITY

Many variables must be considered when determining whether or not the radar sensor can be relocated from one vehicle to another vehicle. They include, but are not limited to, the version of the Bendix® ESP® stability system used on the vehicle, the instrument cluster, the vehicle Electronic Control Unit (ECU), the engine and the transmission. Contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, to determine if this is a viable option.

⚠ WARNING

Do not interchange radar sensors without contacting Bendix first.

K1.16 ALERT VOLUME

For Bendix Wingman Fusion systems installed on vehicles with alerts that come directly through the instrument cluster, audible alert levels are pre-set at the factory and cannot be turned off, but the volume may be adjustable, depending on the OE. (However, where the Bendix™ Driver Interface Unit (DIU™) is used, volume adjustment is permitted.)

K1.17 POTENTIAL FALSE ALERTS

Drivers should take into account the road conditions, and any other factors they are encountering, as they choose how to react to any alerts they receive from the Bendix Wingman Fusion system. *(Refer to Appendix J.)*

K1.171 POTENTIAL STATIONARY OBJECT FALSE ALERTS

In certain unusual traffic or roadway conditions, the Fusion system may issue a false alert. While eliminating all false alerts is not possible, if false alerts occur too frequently (more than twice a day), service the system at the earliest opportunity.

K1.172 POTENTIAL FALSE - OR MISSING - SPEED SIGN ALERTS

Some road speed signs may not be able to be recognized – or be recognized incorrectly – by the system.

APPENDIX L - MAINTENANCE SECTION

L1.1 GENERAL SAFETY GUIDELINES

Refer to Page 2 of this Service Data Sheet for the General Safety Guidelines.

L1.2 SYSTEM PREVENTIVE MAINTENANCE

The Bendix® Wingman® Fusion™ system is relatively maintenance free. The key items to keep the system functioning properly include:

1. Keep the radar front – and windshield – clean and free of obstructions.
2. Inspect for any damage to the bumper, radar, or camera to ensure that the alignment has not been compromised. **Never use the radar unit as a step.** *NOTE: If the radar sensor was originally installed behind a panel, check the panel for damage, etc. that may impact the radar's performance before reinstalling. Replace the panel, if necessary, with an original OEM supplied panel. Do not paint over the panel.*
3. Perform appropriate inspections of the braking system as required by the manufacturer to ensure brakes are in proper working order.
4. Ensure that the tires are properly inflated and that adequate tread is present.

⚠ CAUTION

Inspections – The driver should inspect the radar and camera mounting brackets regularly and keep the windshield and bumper locations clear of any mud, snow, ice build-up, or other obstructions. The installation of aftermarket deer guards, bumper guards, snow plows, or similar potential obstructions is not recommended, and could impair the operation of the radar.

⚠ CAUTION

Damage/Tampering – In cases where the bumper, radar and/or windshield have sustained any damage, are misaligned, or if the device is suspect for tampering, do not use the active cruise control until the vehicle has been repaired and the radar re-aligned. In addition, an indicator on the dash typically will illuminate if the system detects any of these conditions. Consult the vehicle's operator's manual or contact Bendix for more information.

NOTE: Any vehicle trouble code that disables vehicle cruise control will also cause a DTC in the Bendix Wingman Fusion system.

ADDITIONAL SUPPORT AT BENDIX.COM / 1-800-AIR-BRAKE (1-800-247-2725), OPTION 2

For the latest information, and for downloads of the Bendix® ACom® PRO™ diagnostic software and its User Guide, visit the Bendix website at: bendix.com.

You will also find a current list of compatible RP1210 data link adapters for ABS and the Bendix® Wingman® ACB system.

For direct telephone technical support, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available Monday through Thursday 8:00 a.m. – 6:00 p.m. and Friday 8:00 a.m. – 5:00 p.m. ET. For assistance, follow the instructions in the recorded message. Be sure to have a filled-out Troubleshooting Checklist *(pages 7–8)* and a Bendix ACom PRO diagnostic software DTC report *(Section 2.4)* ready before calling.

You can also reach the Bendix Tech Team by email at: techteam@bendix.com.

APPENDIX M - SPN AND FMI CODES, DESCRIPTIONS AND SERVICE ACTIONS

For Diagnostic Trouble Codes (DTCs), refer to Table 4A on pages 15 - 21.

Table M: SPN and FMI Codes, Descriptions and Service Actions			Go to the Service Action Code List in Table 4B *(Pages 22-30)*
SPN	**FMI**	**Description**	
70	9	J1939 signal: Not available CCVS1 parking brake switch	N
	19	J1939 signal: Error in CCVS1 parking brake switch	N
84	2	J1939 signal: Invalid CCVS2 wheel speed	N
	9	J1939 signal: Not available CCVS1 wheel speed	N
	19	J1939 signal: Error in CCVS1 wheel speed	N
86	2	J1939 signal: Invalid CCVS1 CC speed	N
	9	J1939 signal: Not available CCVS1 CC speed	N
	19	J1939 signal: Error in CCVS1 CC speed	N
91	2	J1939 signal: Invalid EEC2 accelerator pedal position	N
	9	J1939 signal: Not available EEC2 accelerator pedal position	N
	14	J1939 signal: Missing EEC2 message	D
	19	J1939 signal: Error in EEC2 accelerator pedal position	N
188	2	J1939 signal: Invalid EC1 engine speed at idle point 1	N
	9	J1939 signal: Not available EC1 engine speed at idle point 1	N
	14	J1939 signal: Missing EC1 message	D
	19	J1939 signal: Error in EC1 engine speed at idle point 1	N
190	2	J1939 signal: Invalid EEC1 engine speed	N
	9	J1939 signal: Not available EEC1 engine speed	N
	14	J1939 signal: Missing EEC1 message	D
	19	J1939 signal: Error in EEC1 engine speed	N
512	2	J1939 signal: Invalid EEC1 Driver Torque	N
	9	J1939 Signal: Not available EEC1 driver torque	N
	19	J1939 signal: Error in EEC1 driver torque	N
513	2	J1939 signal: Invalid EEC1 actual torque	N
	9	J1939 signal: Not available EEC1 actual torque	N
	13	System detected engine not properly responding to control messages	D
	19	J1939 signal: Error in EEC1 actual torque	N
514	2	J1939 signal: Invalid EEC3 nominal friction percent torque	N
	9	J1939 signal: Not available EEC3 nominal friction percent torque	N
	14	J1939 signal: Missing EEC3 message	D
	19	J1939 signal: Error in EEC3 nominal friction percent torque	N
518	2	J1939 signal: Invalid TSC1 requested torque limit	N
	9	J1939 signal: Not available TSC1 requested torque limit	N
	19	J1939 signal: Error in TSC1 requested torque limit	N
520	9	J1939 signal: Missing ERC1_DR message	D
	14	J1939 signal: Missing ERC1_XR message	D

Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.

Table M – SPN and FMI Codes and their Service Action Code

Table M: SPN and FMI Codes, Descriptions and Service Actions			Go to the Service Action Code List in Table 4B *(Pages 22-30)*
SPN	**FMI**	**Description**	
521	2	J1939 signal: Invalid EBC1 brake pedal position	N
	9	J1939 signal: Not available EBC1 brake pedal position	N
	19	J1939 signal: Error in EBC1 brake pedal position	N
523	2	J1939 signal: Invalid ETC2 transmission current gear	N
	9	J1939 signal: Not available ETC2 transmission current gear	N
	19	J1939 signal: Error in ETC2 transmission current gear	N
524	2	J1939 signal: Invalid ETC2 transmission selected gear	N
	9	J1939 signal: Not available ETC2 transmission selected gear	N
	14	J1939 signal: Missing ETC2 message	D
	19	J1939 signal: Error in ETC2 transmission selected gear	N
525	9	J1939 signal: Not available TC1 transmission requested gear	N
	14	J1939 signal: Missing TC1 message	D
	19	J1939 signal: Error in TC1 transmission requested gear	N
526	2	J1939 signal: Invalid ETC2 transmission actual gear ratio	N
	9	J1939 signal: Not available ETC2 transmission actual gear ratio	N
	19	J1939 signal: Error in ETC2 transmission actual gear ratio	N
527	14	J1939 signal: Missing CCVS1 message	D
544	2	J1939 signal: Invalid EC1 engine reference torque	N
	9	J1939 signal: Not available EC1 engine reference torque	N
	19	J1939 signal: Error in EC1 engine reference torque	N
556	2	J1939: Retarder Controller Signal Invalid - RC Reference Torque	Z
	9	J1939: Retarder Controller Signal Not Available - Retarder RC Reference Torque	Z
	19	J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque	Z
560	9	J1939 signal: Not available ETC1 transmission driveline engaged	N
	14	J1939 signal: Missing ETC1 message	D
	19	J1939 signal: Error in ETC1 transmission driveline engaged	N
561	9	J1939 signal: Not available EBC1 ASR engine control active	N
	19	J1939 signal: Error in EBC1 ASR engine control active	N
562	2	J1939 signal: Error in EBC1 ASR brake control active	N
	19	J1939 signal: Not available EBC1 ASR brake control active	N
563	9	J1939 signal: Not available EBC1 ABS active	N
	19	J1939 signal: Error in EBC1 anti-lock braking active	N
595	9	J1939 signal: Not available CCVS1 CC active	N
	19	J1939 signal: Error CCVS1 CC active	N
596	9	J1939 signal: Not available CCVS1 CC enable	N
	19	J1939 signal: Error in CCVS1 CC enable	N
597	9	J1939 signal: Not available CCVS1 brake switch	N
	19	J1939 signal: Error in CCVS1 brake switch	N
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running. Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.			

Table M – SPN and FMI Codes and their Service Action Code

Table M: SPN and FMI Codes, Descriptions and Service Actions			Go to the Service Action Code List in Table 4B *(Pages 22-30)*
SPN	**FMI**	**Description**	
599	9	J1939 signal: Not available CCVS1 set switch	N
	19	J1939 signal: Error in CCVS1 cruise control set switch	N
600	9	J1939 signal: Not available CCVS1 coast switch	N
	19	J1939 signal: Error in CCVS1 cruise control coast switch	N
601	9	J1939 signal: Not available CCVS1 resume switch	N
	19	J1939 signal: Error in CCVS1 cruise control resume switch	N
602	9	J1939 signal: Not available CCVS1 accelerate switch	N
	19	J1939 signal: Error in CCVS1 cruise control accelerate switch	N
625	2	Proprietary CAN: Message inconsistent	X
	9	Proprietary CAN: Message timeout	X
	10	Proprietary CAN: Message counter increment error	X
	13	Fusion Configuration mismatch between brake controller and radar sensor	L
	19	Proprietary CAN: Message counter error	X
630	12	Internal radar sensor error	A
	14	Internal radar sensor error	
	19	Fusion configuration mismatch between brake controller and radar sensor	L
639	9	Radar detects intermittent loss of J1939 messages from vehicle components	
	19	Radar cannot detect any J1939 messages from vehicle components	
701	14	J1939 signal: Missing AUXIO message	D
705	9	J1939 signal: Not available AUXIO trailer connected	N
	19	J1939 signal: Error in AUXIO1 trailer connected	N
706	9	J1939 signal: Not available AUXIO trailer ABS detect	N
	19	J1939 signal: Error in AUXIO1 trailer ABS detected	N
707	2	J1939 signal: AUXIO trailer ABS not fully operational	H
	9	J1939 signal: Not available AUXIO trailer ABS operational	N
	19	J1939 signal: Error in AUXIO1 trailer ABS operational	N
767	9	J1939 signal: Not available ETC5 reverse switch	N
	14	J1939 signal: Missing ETC5 message	D
	19	J1939 signal: Error in ETC5 reverse switch	N

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Table M – SPN and FMI Codes and their Service Action Code

Table M: SPN and FMI Codes, Descriptions and Service Actions			Go to the Service Action Code List in Table 4B *(Pages 22-30)*
SPN	**FMI**	**Description**	
886	1	Antenna is dirty or partially blocked	D
	2	Radar mounting offset is out of range	T
	3	Battery voltage too high	C
	4	Battery voltage too low	C
	7	Radar sensor is misaligned	G
	8	Internal radar sensor error	A
	12	Internal radar sensor error	
	13	CMT Configuration mismatch between brake controller and radar sensor	L
	14	Internal radar sensor error	A
	14	Vehicle cruise control and ACC out of sync	S
	17	Antenna is dirty or partially blocked	B
	18	System detected an error requiring a radar shutdown	S
	31	Internal radar sensor error	A
901	9	J1939: Retarder Controller Signal Timeout - Engine RC Message	Z
	14	J1939: Retarder Controller Signal Timeout - Driveline RC Message	Z
904	2	J1939 signal: Invalid EBC2 front axle	N
	9	J1939 signal: Not available EBC2 front axle	N
	14	J1939 signal: Missing EBC2 message	D
	19	J1939 signal: Error in EBC2 front axle	N
905	2	J1939 signal: Invalid EBC2 LF wheel	N
	9	J1939 signal: Not available EBC2 LF wheel	N
	19	J1939 signal: Error in EBC2 LF wheel	N
906	2	J1939 signal: Invalid EBC2 RF wheel	N
	9	J1939 signal: Not available EBC2 RF wheel	N
	19	J1939 signal: Error in EBC2 RF wheel	N
907	2	J1939 signal: Invalid EBC2 LR1 wheel	N
	9	J1939 signal: Not available EBC2 LR1 wheel	N
	19	J1939 signal: Error in EBC2 LR1 wheel	N
908	2	J1939 signal: Invalid EBC2 RR1 wheel	N
	9	J1939 signal: Not available EBC2 RR1 wheel	N
	19	J1939 signal: Error in EBC2 RR1 wheel	N
1069	13	ABS tire size needs recalibration	V
1091	14	J1939 signal: Missing EBC3 message	D
1196	19	XBR is locked-out	S
1121	9	J1939 signal: Not available EBC1 brake switch	N
	19	J1939 signal: Error in EBC1 brake switch	N
1214	14	J1939 signal: Missing DM1 message	D

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Table M – SPN and FMI Codes and their Service Action Code

Table M: SPN and FMI Codes, Descriptions and Service Actions			Go to the Service Action Code List in Table 4B *(Pages 22-30)*
SPN	**FMI**	**Description**	
1243	2	J1939 signal: EBC1 ABS not fully operational	U
	9	J1939 signal: Not available EBC1 ABS operate	N
	14	J1939 signal: Missing EBC1 message	D
	19	J1939 signal: Error in EBC1 ABS fully operational	N
1481	2	J1939 signal: Error in EBC1 source address of controlling device	N
	19	J1939 signal: Not available EBC1 source address of controlling device	N
1633	9	J1939 signal: Not available CCVS1 pause switch	N
	19	J1939 signal: Error in CCVS1 cruise control pause switch	N
1705	14	J1939 signal: Missing FLC message	D
1717	2	J1939: Engine Controller Signal Invalid - ERC1 Actual Engine Torque	Z
	9	J1939: Retarder Controller Signal Not Available - Retarder ERC1 Actual Max Torque	Z
	19	J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque	Z
1760	2	J1939 signal: Invalid CVW GCVW	N
	9	J1939 signal: Not available CVW GCVW	N
	14	J1939 signal: Missing CVW message	D
	19	J1939 signal: Error in CVW gross combination vehicle weight	N
1799	2	J1939 signal: Invalid ACC2 requested ACC distance mode	N
	9	J1939 signal: Not available ACC2 distance mode	N
	14	Internal radar sensor error	D
	19	J1939 signal: Error in ACC2 requested ACC distance mode	N
1807	2	J1939 signal: Invalid VDC2 steer angle	N
	9	J1939 signal: Not available VDC2 steer angle	N
	14	J1939 signal: Missing VDC2 message	D
	19	J1939 signal: Error in VDC2 steer angle sensor	N
1808	2	J1939 signal: Invalid VDC2 yaw rate	N
	9	J1939 signal: Not available VDC2 yaw rate	N
	19	J1939 signal: Error in VDC2 yaw rate	N
1814	2	J1939 signal: VDC1 VDC not fully operational	H
	9	J1939 signal: Not available VDC1 VDC fully operational	N
	14	J1939 signal: Missing VDC1 message	D
	19	J1939 signal: Error in VDC1 VDC fully operational	N
1816	9	J1939 signal: Not available VDC1 ROP engine control	N
	19	J1939 signal: Error in VDC1 ROP engine control	N
1817	9	J1939 signal: Not available VDC1 YC engine control	N
	19	J1939 signal: Error in VDC1 YC engine control	N
1818	9	J1939 signal: Not available VDC1 ROP brake control	N
	19	J1939 signal: Error in VDC1 ROP brake control	N
Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running. Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.			

Table M – SPN and FMI Codes and their Service Action Code

Table M: SPN and FMI Codes, Descriptions and Service Actions			Go to the Service Action Code List in Table 4B *(Pages 22-30)*
SPN	**FMI**	**Description**	
1819	9	J1939 signal: Not available VDC1 YC brake control	N
	19	J1939 signal: Error in VDC1 YC brake control	N
2551	14	Bendix ABS J1939 Proprietary message signal missing or error state	H
2876	2	J1939 signal: Invalid OEL turn signal	N
	9	J1939 signal: Not available OEL turn signal	N
	14	J1939 signal: Missing OEL message	D
	19	J1939 signal: Error in OEL turn signal	N
2917	2	J1939 signal: Invalid EBC5 XBR state	N
	9	J1939 signal: Not available EBC5 XBR state	N
	19	J1939 signal: Error in EBC5 XBR state	N
2918	2	J1939 signal: Invalid EBC5 XBR active control mode	N
	9	J1939 signal: Not available EBC5 XBR active control mode	N
	19	J1939 signal: Error in EBC5 XBR active control mode	N
2919	9	J1939 signal: Not available EBC5 brake use	N
	14	J1939 signal: Missing EBC5 message	D
	19	J1939 signal: Error in EBC5 brake use	N
2920	0	CMT braking overuse	M
2921	2	J1939 signal: Invalid EBC5 XBR limit	N
	9	J1939 signal: Not available EBC5 XBR limit	N
	12	Internal radar sensor error	A
	19	J1939 signal: Error in EBC5 XBR limit	N
3839	0	Active cruise control braking overuse	J
	9	J1939 signal: Not available EBC5 brake temp	N
	19	J1939 signal: Error in EBC5 brake temp	N
5023	9	J1939 signal: Not available ACC2 ACC usage	N
	19	J1939 signal: Error in ACC2 ACC usage demand	N
5606	2	J1939 signal: Error in ACC1 ACC mode	N
	13	J1939 signal: ACC1 or CCVS3: engine not properly configured for Bendix Wingman	K
	19	J1939 signal: Not available ACC1 ACC mode	N
5676	14	Internal radar sensor error	A
5681	9	J1939 signal: Not available AEBS2 driver activation	N
	13	Fusion Configuration mismatch between brake controller and radar sensor	S
	14	J1939 signal: Missing AEBS2 message	D
	19	J1939 signal: Error in AEBS2 message checksum or driver activation demand	P
5683	19	J1939 signal: Error in AEBS2 message checksum	
517000	14	Radar mismatch with Engine ACC Control Type	EE
517001	14	Radar mismatch with ABS configuration for Highway Departure Braking	CC
517002	14	Radar mismatch with ABS configuration for Multi-Lane Automatic Emergency Braking	DD
517003	14	Radar mismatch with ABS configuration for Adaptive Cruise Control Type	L

Note: The system will not report newly active J1939 Diagnostic Trouble Codes (DTCs) until the engine has been running for 15 seconds. Do not attempt to diagnose J1939 DTCs without the engine running.

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Table M – SPN and FMI Codes and their Service Action Code