# The Bendix® Wingman® Fusion™ Driver Assistance System

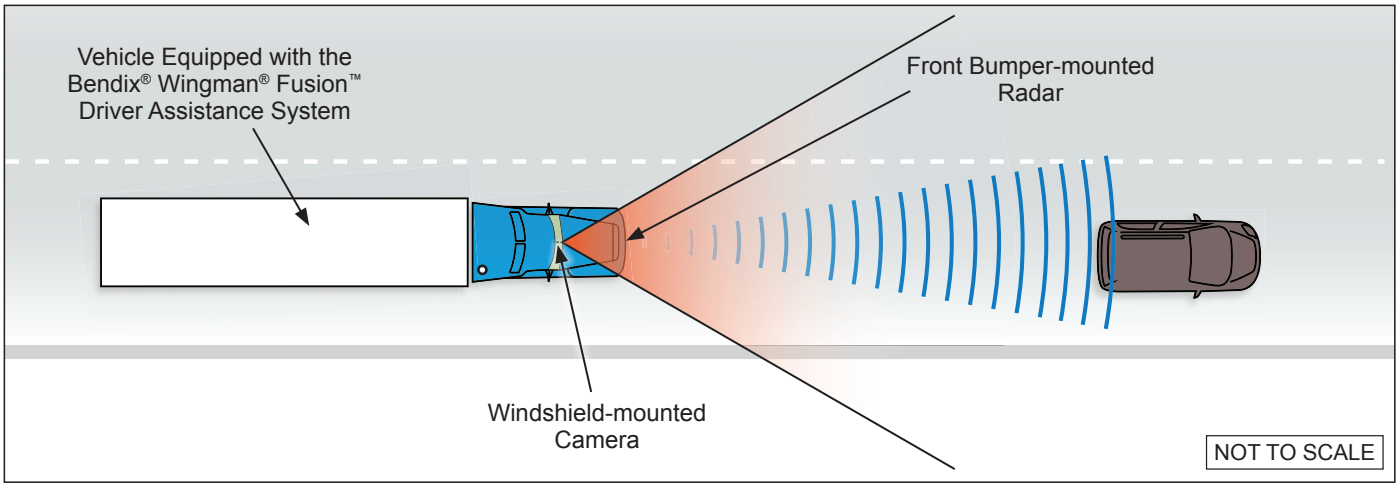



***Figure 1 – The System Uses a Camera and Radar***

**⚠ 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.**

Integrating camera, radar, and brakes, the Bendix® Wingman® Fusion™ Driver Assistance System (Fusion) 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); and
- Alert Prioritization.

Note: The system, depending on configuration, 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.

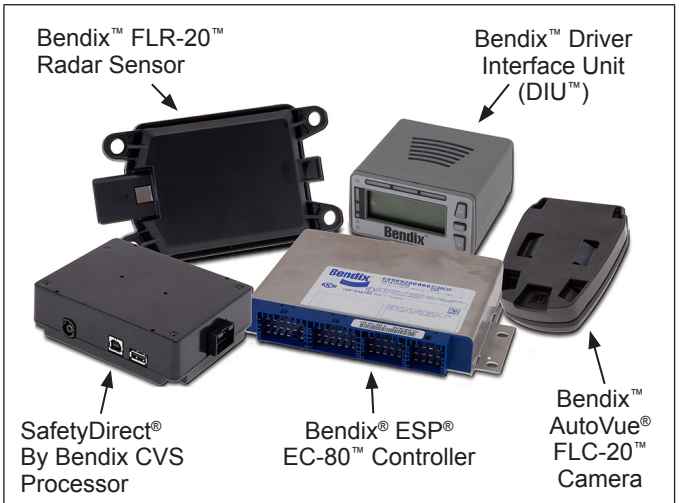



***Figure 2 – Major Bendix Wingman Fusion System Components***

The major components that are used in the Fusion system are the Bendix® ESP® EC-80™ Controller, the Bendix™ FLR-20™ Radar, 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, and the vehicle's telematics system. *See Figure 2.*

# 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, or a Bendix® AD-9si® 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).**

**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.

# SD Sheet Index



**Appendices**

## Features of the Bendix® Wingman® Fusion™ Driver Assistance System (Fusion)

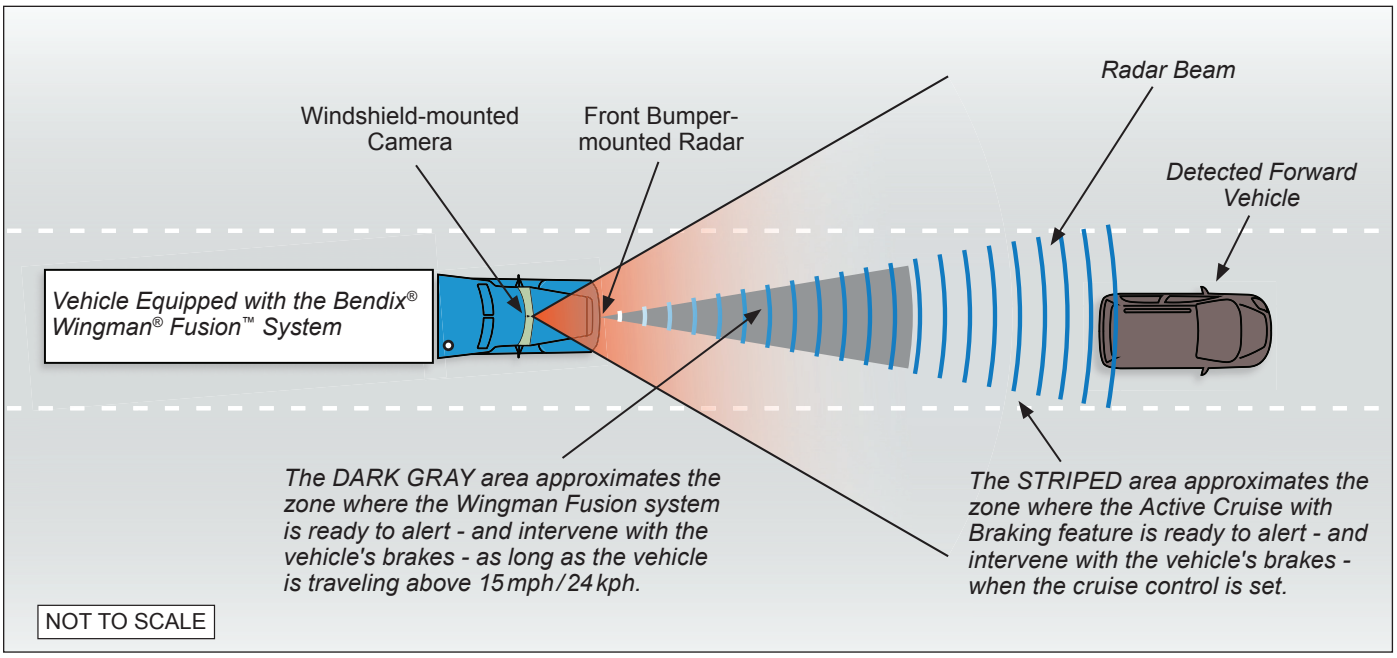



***Figure 3 – Bendix® Wingman® Fusion™ Driver Assistance System Intervention Zone***

### PART ONE: ACTIVE CRUISE CONTROL WITH BRAKING

The active cruise control with braking feature is an additional upgrade of ordinary cruise control. When using cruise control, the Bendix® Wingman® Fusion™ Driver Assistance System (Fusion) will maintain the set speed, and will also intervene – as needed – to help maintain a set following distance behind a detected forward vehicle.

Using a radar sensor mounted to the front of the vehicle – with a range of approximately 500 feet (152 m) – Fusion reacts to detected forward vehicles in the same lane, traveling in the same direction. *See Figure 3.*

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 3.*

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, Fusion will intervene and, as necessary, in this order:

(a) reduce the engine throttle; then

(b) apply the engine retarder; then

(c) apply the foundation brakes

in an attempt to maintain the set following distance behind the vehicle ahead. 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 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.

If the vehicle ahead slows below the cruise control's set speed, but then accelerates away – and the Bendix Wingman 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 Fusion 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 Bendix® Wingman® Fusion™ system.

## PART TWO: ALERTS

Fusion also assists by giving audible and visual alerts, whether or not cruise control is on. *See Figure 4 and also Appendix K for more information on the types of alerts the driver may hear and/or see displayed.*

## PART THREE: COLLISION MITIGATION TECHNOLOGY

*See the striped area in Figure 3.* The Wingman Fusion Driver Assistance 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.

## PART FOUR: OVERSPEED ALERT & ACTION (OAA)

The Fusion System has the ability to assist the driver by recognizing US 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.

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.

## PART FIVE: LANE DEPARTURE WARNING

Bendix Wingman Fusion 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.

## PART SIX: 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, and 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 SECTION

This section introduces three initial steps to accurately troubleshoot the Bendix® Wingman® Fusion™ system.

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

When diagnosing the Bendix Wingman Fusion system, a current version of Bendix® ACom® Diagnostic Software (version 6.9 or higher) is required. This software is available as a download from bendix.com.

## 1.1 TROUBLESHOOTING BASICS

| Troubleshooting Basics (1.1) | |
|---|---|
| **Questions** | **Next Steps** |
| 1. Have the driver run the Power-Up Self-Test. | **Power-Up Self-Test**<br>This is a self-diagnostic check to determine if the system operation is normal.<br>1. Park the vehicle. Power off.<br>2. Put the key into the ignition and turn to the "ignition power" position.<br>3. Toggle the cruise control switch at least once, and leave it in the "on" position.<br>4. Start the vehicle, but do not drive away.<br>5. **Note that if the cruise control is in the "off" position, or if the vehicle is moving, this test will not run.**<br>The self-test will start after 15 seconds, and takes approximately five (5) seconds to complete.<br>(Note that other vehicle system self-tests, e.g. the ABS "chuff" test, may run during the initial 15 seconds after ignition "on.")<br>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 distance 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 trouble code be set.<br>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 Diagnostic Trouble Code (DTC) will be logged in the system (typically with a status indicator/dash icon illuminated). For descriptions of all DTCs, *see 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. |
| 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.*<br>*Also See 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 *(Pages 7–8)* | |
|---|---|
| **Detailed Scenarios and Tests** | **Record Driver's Answers for Follow-up with Bendix** |
| 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? | |
| 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 ☐ _____ |
| Are there Diagnostic Trouble Codes (DTCs) logged? | Yes ☐ No ☐ _____ |
| Does the truck proceed toward the forward vehicle without a following distance alert or braking intervention? | Yes ☐ No ☐ _____ |
| With cruise control engaged, and while following a vehicle ahead in gentle curves (assuming a 3 to 3.5 second following distance): | |
| Does the Bendix Wingman Fusion System continue to follow the vehicle through the curves at a constant distance? | 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 or slightly curvy road: | |
| Does the Bendix Wingman Fusion system ignore the vehicle you are overtaking? | Yes ☐ No ☐ _____ |
| Does it give a following distance alert? | Yes ☐ No ☐ _____ |

| Troubleshooting Checklist *(Pages 7–8)* | |
|---|---|
| **Detailed Scenarios and Tests** | **Record Driver's Answers for Follow-up with Bendix** |
| With cruise engaged, if a faster vehicle passes your vehicle on the left or right on a straight or slightly curvy road: | |
| Does your vehicle throttle up and try to keep pace with the faster moving vehicle? | Yes ☐ No ☐ _____ |
| Does it give a following distance alert? | Yes ☐ No ☐ _____ |
| 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 Bendix® Wingman® Fusion™ 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 ☐ _____ |
| Are there Diagnostic Trouble Codes (DTCs) logged? | Yes ☐ No ☐ _____ |
| Does your truck proceed toward the forward vehicle without a following distance alert or braking intervention? | Yes ☐ No ☐ _____ |
| What version of Bendix® ABS and Bendix Wingman Fusion system is installed on the vehicle? *See Section 2.3: Reading the System Software Version.* | _____ |
| What are the key system indicators? *See Section 3.1: Reading Bendix Wingman Fusion System Key Indicators.* | _____<br>_____<br>_____<br>_____<br>_____ |

## 1.2 NARROWING DOWN THE PROBLEM

Use the questions found in Table 2 below 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. The 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.

If Bendix Tech Team assistance is needed, prior to calling us at 1-800-AIR-BRAKE (1-800-247-2725), option 2, complete the *Troubleshooting Checklist* (*See Appendix A*), to help reduce the time needed to troubleshoot the system.

| Narrowing Down the Problem (1.2) | |
|---|---|
| **Questions** | **Next Steps** |
| **Blocked Radar Sensor Issues** | |
| Is mud, ice, or snow covering the radar sensor?<br>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 trouble codes.<br>*Read Section 2.5: Diagnostic Trouble Codes.*<br>*Read Appendix A3: Bendix™ FLR-20™ Radar Sensor Mounting Clearance.*<br>If the radar sensor is blocked by ice, snow, mud, tampering, etc. so that it cannot "see" a forward vehicle, the Bendix 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 alerts seem to happen in construction zones or going under bridges? | 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?<br>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:<br>• 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.<br>• Appendix B1 - Go to Appendix B1 and use the flowchart to find out the procedure(s) needed. Follow the actions directed in the procedure(s) and align the radar.<br>• Appendix B4 - Check the vertical alignment and 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.<br>• Check the Vertical Alignment (Appendix B4) and adjust if needed.<br>• Check the Lateral Alignment (Appendix B2 & B3) and adjust if needed.<br>The radar sensor needs a solid mounting surface in order to hold the alignment. If the radar sensor alignment can not 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. Where replacing either or both of these, align the radar sensor using the procedure shown in Appendix C. |
| Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

***Table 2 – Narrowing Down the Problem (Pages 9–10)***

| 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® Diagnostic Software. Read Section 2.5: *Diagnostic Trouble Codes.* |
| 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 Diagnostic Software. Read 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. Continue asking the driver questions to determine if the radar system interventions are not the expected Bendix® Wingman® Fusion™ system behavior. If the radar system interventions are not typical, the radar sensor may be misaligned.<br>• 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.<br>• Appendix B1 - Go to Appendix B1 and use the flowchart to find out the procedure needed. Follow the actions directed in the procedure and align the radar.<br>• Appendix B4 - Check the vertical alignment and adjust if needed.<br>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 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.<br>Read Section 2.5: *Diagnostic Trouble Codes,* and<br>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 Bendix Wingman Fusion system is not intended to be used on grades. Verify there are no DTCs. Proper downgrade driving techniques should be used.<br>Read 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 Diagnostic Software (version 6.9 or higher) and replace the damaged radar sensor. Read Section 2.5: *Diagnostic Trouble Codes*, and Appendix A3: *Radar Sensor Mounting Clearance*. |
| Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

***Table 2 – Narrowing Down the Problem (Pages 9–10)***

## 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: *See 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. See 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. Use Section 1.0: *Introduction to Troubleshooting*, Section 2.5: *Diagnostic Trouble Codes*, and Section 1.1: *Troubleshooting Basics* 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.<br>*See 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. *See 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.<br>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. *See 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.* |
| Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

***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. (*See Appendix K, Figure K6*).

## 2.0 TROUBLESHOOTING/ DIAGNOSTICS SECTION

***IMPORTANT NOTE: 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® DIAGNOSTIC SOFTWARE

Bendix® ACom® Diagnostic Software is a PC-based software program available as a download from the Bendix web site (bendix.com). This software provides the technician with access to all the available ECU diagnostic information and configuration capability. For Wingman Fusion system diagnostics, use ACom Diagnostic Software version 6.9 or higher.

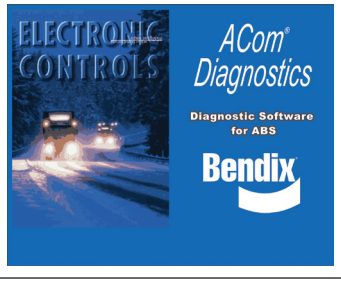



***Figure 4 – Bendix ACom Diagnostic Software***

## STARTING BENDIX ACOM DIAGNOSTIC SOFTWARE

The Bendix ACom Diagnostic Software can be started from the desktop shortcut, or from the main Windows® screen with "Start...Programs...Bendix...ACom Diagnostic Software." *See Figure 5 plus* ***Appendices F and G***. To begin, the technician selects "Wingman" from the Starter screen, then "Start with ECU" from the Diagnostic Control panel.

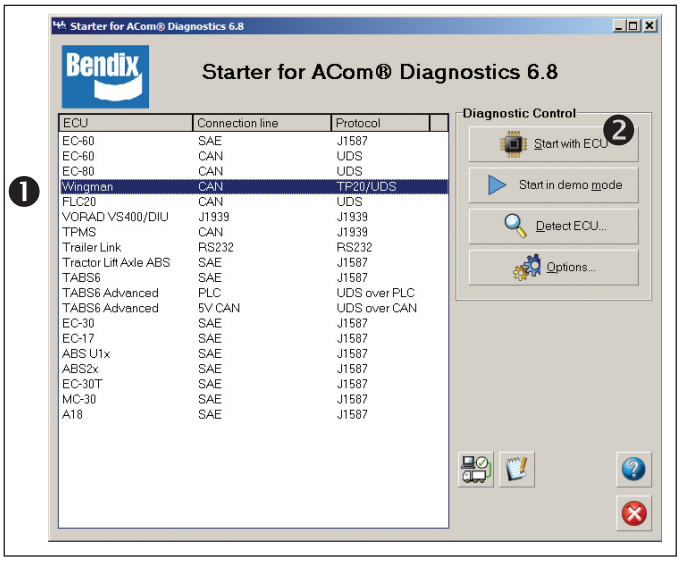



***Figure 5 – Starting Bendix ACom Diagnostic Software***

*NOTE: When using ACom Diagnostic Software for the first time, the service technician will be asked to select the communication adapter for both the Bendix Wingman Fusion system and Bendix ABS and stability controllers. While both controllers will use the same physical adapter, the technician will need to indicate which communication protocol to use for each. Once a successful connection has been made, these steps will no longer be necessary.*

The *Bendix ACom Diagnostic Software for ABS User Guide* is available for download at bendix.com and should be used as a reference to all functions of the ACom service tool.

## 2.2 READING DIAGNOSTIC TROUBLE CODES (DTCS)

If the system generates a Diagnostic Trouble Code (DTC), where a lamp or icon is illuminated on the instrument cluster, then a current version of Bendix® ACom® Diagnostic Software is required. Select “Wingman®” from the starter screen, then “Start with ECU”. Click “DTC” to show the DTCs. ***See Appendix C for screen shots.*** *See Section 2.5 for a complete table showing DTCs and troubleshooting information.*

## 2.3 READING THE SYSTEM SOFTWARE VERSION

If during troubleshooting you are asked for the Bendix® Wingman® Fusion™ system software version, the number is found on the “Wingman Fusion System Status” tab. *See Figure 6. Also, see Section 3.1 for other system indicators.*

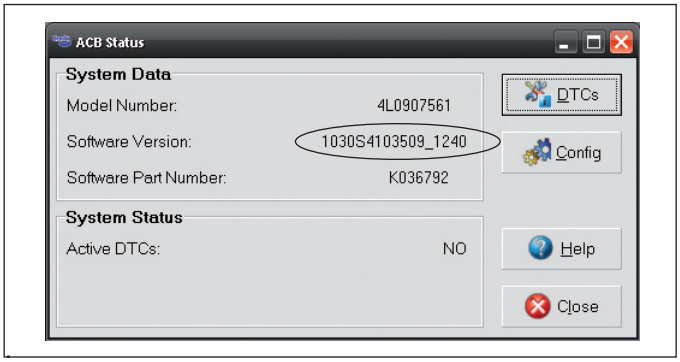
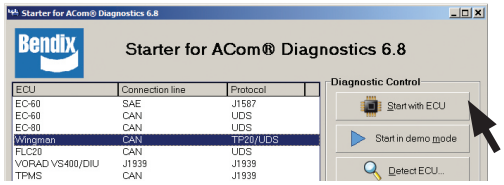



***Figure 6 – Bendix® ACom® Diagnostic Software Starter Screen Showing Software Version***

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

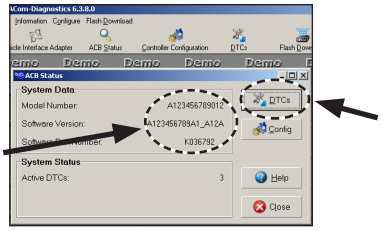
1. Click the Bendix ACom Diagnostic Software desktop icon.


2. Select “Wingman” from the starter screen.
   Click “start with ECU”.



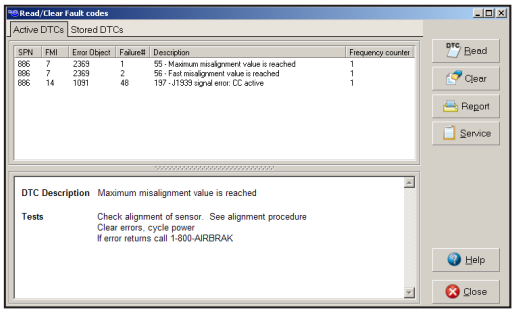

3. Read the Bendix Wingman Fusion system status screen.

A. Take Note of: Model #, Software Version, Software P/N, Active DTCs

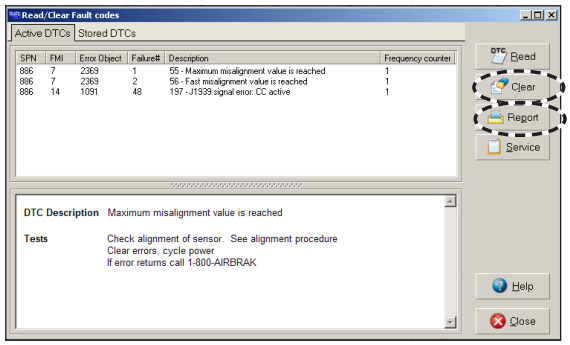



B. Click DTCs

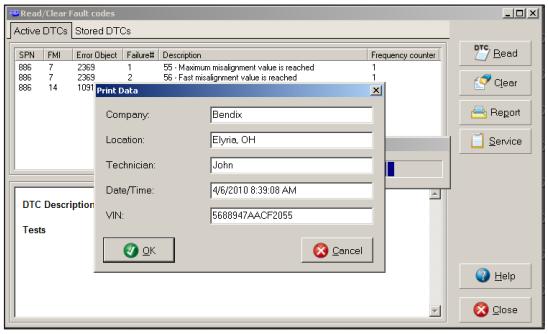
4. Click “Read”. Active DTCs are shown along with descriptions of the codes and tests that can be run to troubleshoot the code. You can also select “stored DTCs” to show inactive DTCs.



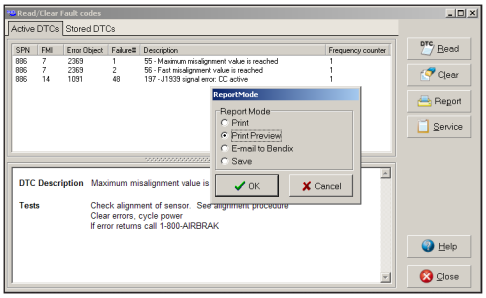
5. Click “Clear” to clear all active DTCs. Click “Report” to get the Bendix® ACom® Diagnostic Software report.



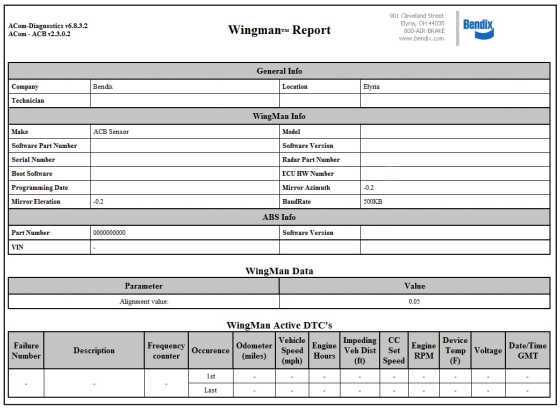

6. Fill in the requested information: Company, location, technician, date/time, VIN, and click “OK”.




7. Select how you want the report displayed or printed. Then click “OK”.




8. Finally, the event report is generated. This can be saved if desired.




9. The shortcut menu at the top of the screen can be used to select: Wingman Status; DTCs; and Controller Configuration.

## 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 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 Diagnostic Software DTC report *(Section 2.4)* ready before calling.

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

## 2.5 TABLE OF BENDIX® WINGMAN® FUSION™ DIAGNOSTIC TROUBLE CODES (DTCs)

***NOTE: Bendix™ FLR-10™ radar sensors use a different set of DTCs – see SD-61-4962.***

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

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 | E |
| 31 | J1939 signal: Missing CVW message | 1760 | 14 | F |
| 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 | F |
| 41 | Not used | #N/A | #N/A | Not Used |
| 42 | J1939 signal: Missing VDC2 message | 1807 | 14 | F |
| 43 | Not used | #N/A | #N/A | Not Used |
| 44 | J1939 signal: Missing EBC3 message | 1091 | 14 | F |
| 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | | | | |

***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 | E |
| 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 | P |
| 94 | J1939 signal: Not available CCVS1 wheel speed | 84 | 9 | R |
| 95 | J1939 signal: Invalid CCVS1 CC speed | 86 | 2 | N |
| 96 | J1939 signal: Error in CCVS1 CC speed | 86 | 19 | P |
| 97 | J1939 signal: Not available CCVS1 CC speed | 86 | 9 | R |
| 98 | J1939 signal: Error CCVS1 CC active | 595 | 19 | P |
| 99 | J1939 signal: Not available CCVS1 CC active | 595 | 9 | R |
| 100 | J1939 signal: Error in CCVS1 CC enable | 596 | 19 | P |
| 101 | J1939 signal: Not available CCVS1 CC enable | 596 | 9 | R |
| 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 | P |
| 106 | J1939 signal: Not available CVW GCVW | 1760 | 9 | R |
| 107 | J1939 signal: Error in EBC1 brake switch | 1121 | 19 | P |
| 108 | J1939 signal: Not available EBC1 brake switch | 1121 | 9 | R |
| 109 | J1939 signal: Error in EBC1 ABS fully operational | 1243 | 19 | P |
| 110 | J1939 Signal: Not available EBC1 ABS Operate | 1243 | 9 | R |

*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 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 | P |
| 113 | J1939 signal: Not available EBC2 front axle | 904 | 9 | R |
| 114 | J1939 signal: Invalid EBC2 LF wheel | 905 | 2 | N |
| 115 | J1939 signal: Error in EBC2 LF wheel | 905 | 19 | P |
| 116 | J1939 signal: Not available EBC2 LF wheel | 905 | 9 | R |
| 117 | J1939 signal: Invalid EBC2 RF wheel | 906 | 2 | N |
| 118 | J1939 signal: Error in EBC2 RF wheel | 906 | 19 | P |
| 119 | J1939 signal: Not available EBC2 RF wheel | 906 | 9 | R |
| 120 | J1939 signal: Invalid EBC2 LR1 wheel | 907 | 2 | N |
| 121 | J1939 signal: Error in EBC2 LR1 wheel | 907 | 19 | P |
| 122 | J1939 signal: Not available EBC2 LR1 wheel | 907 | 9 | R |
| 123 | J1939 signal: Invalid EBC2 RR1 wheel | 908 | 2 | N |
| 124 | J1939 signal: Error in EBC2 RR1 wheel | 908 | 19 | P |
| 125 | J1939 signal: Not available EBC2 RR1 wheel | 908 | 9 | R |
| 126 | J1939 signal: Invalid EBC5 XBR state | 2917 | 2 | N |
| 127 | J1939 signal: Error in EBC5 XBR state | 2917 | 19 | P |
| 128 | J1939 signal: Not available EBC5 XBR state | 2917 | 9 | R |
| 129 | J1939 signal: Error in EBC5 brake use | 2919 | 19 | P |
| 130 | J1939 signal: Not available EBC5 brake use | 2919 | 9 | R |
| 131 | J1939 signal: Invalid EBC5 XBR limit | 2921 | 2 | N |
| 132 | J1939 signal: Error in EBC5 XBR limit | 2921 | 19 | P |
| 133 | J1939 signal: Not available EBC5 XBR limit | 2921 | 9 | R |
| 134 | J1939 signal: Error in EBC5 brake temp | 3839 | 19 | P |
| 135 | J1939 signal: Not available EBC5 brake temp | 3839 | 9 | R |
| 136 | J1939 signal: Invalid EC1 engine reference torque | 544 | 2 | N |
| 137 | J1939 signal: Error in EC1 engine reference torque | 544 | 19 | P |
| 138 | J1939 signal: Not available EC1 engine reference torque | 544 | 9 | R |
| 139 | J1939 signal: Invalid EEC1 engine speed | 190 | 2 | N |
| 140 | J1939 signal: Error in EEC1 engine speed | 190 | 19 | P |
| 141 | J1939 signal: Not available EEC1 engine speed | 190 | 9 | R |
| 142 | J1939 signal: Invalid EEC1 driver torque | 512 | 2 | N |
| 143 | J1939 signal: Error in EEC1 driver torque | 512 | 19 | P |
| 144 | J1939 signal: Not available EEC1 driver torque | 512 | 9 | R |
| 145 | J1939 signal: Invalid EEC1 actual torque | 513 | 2 | N |
| 146 | J1939 signal: Error in EEC1 actual torque | 513 | 19 | P |
| 147 | J1939 signal: Not available EEC1 actual torque | 513 | 9 | R |
| 148 | J1939 signal: Invalid EEC2 accelerator pedal position | 91 | 2 | N |
| 149 | J1939 signal: Error in EEC2 accelerator pedal position | 91 | 19 | P |
| 150 | J1939 signal: Not available EEC2 accelerator pedal position | 91 | 9 | R |
| 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 | P |

*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 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 | R |
| 158 | J1939 signal: Error in VDC1 ROP brake control | 1818 | 19 | P |
| 159 | J1939 signal: Not available VDC1 ROP brake control | 1818 | 9 | R |
| 160 | J1939 signal: Error in VDC1 ROP engine control | 1816 | 19 | P |
| 161 | J1939 signal: Not available VDC1 ROP engine control | 1816 | 9 | R |
| 162 | J1939 signal: Error in VDC1 YC brake control | 1819 | 19 | P |
| 163 | J1939 signal: Not available VDC1 YC brake control | 1819 | 9 | R |
| 164 | J1939 signal: Error in VDC1 YC engine control | 1817 | 19 | P |
| 165 | J1939 signal: Not available VDC1 YC engine control | 1817 | 9 | R |
| 166 | J1939 signal: Invalid VDC2 steer angle | 1807 | 2 | N |
| 167 | J1939 signal: Error in VDC2 steer angle sensor | 1807 | 19 | P |
| 168 | J1939 signal: Not available VDC2 steer angle | 1807 | 9 | R |
| 169 | J1939 signal: Invalid VDC2 yaw rate | 1808 | 2 | N |
| 170 | J1939 signal: Error in VDC2 yaw rate | 1808 | 19 | P |
| 171 | J1939 signal: Not available VDC2 yaw rate | 1808 | 9 | R |
| 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 | P |
| 177 | J1939 signal: Not available TSC1 requested torque limit | 518 | 9 | R |
| 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 | P |
| 184 | J1939 signal: Not available VDC1 VDC fully operational | 1814 | 9 | R |
| 185 | ABS tire size needs recalibration | 1069 | 13 | W |
| 186 | Internal radar sensor error | 630 | 12 | A |
| 187 | J1939 signal: Error in ACC1 ACC mode | 5606 | 2 | P |
| 188 | J1939 signal: Not available ACC1 ACC mode | 5606 | 19 | R |
| 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 | F |
| 199 | J1939 signal: Error in AEBS2 driver activation demand | 5681 | 19 | P |
| 200 | J1939 signal: Not available AEBS2 driver activation | 5681 | 9 | R |
| 201 | J1939 signal: Error in AEBS2 message checksum | 5683 | 19 | P |

*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 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 | P |
| 207 | J1939 signal: Not available ACC2 distance mode | 1799 | 9 | R |
| 208 | J1939 signal: Error in ACC2 ACC usage demand | 5023 | 19 | P |
| 209 | J1939 signal: Not available ACC2 ACC usage | 5023 | 9 | R |
| 210 | J1939 signal: Error in AUXIO1 trailer ABS operational | 707 | 19 | P |
| 211 | J1939 signal: Not available AUXIO trailer ABS operational | 707 | 9 | R |
| 212 | J1939 signal: Error in AUXIO1 trailer ABS detected | 706 | 19 | P |
| 213 | J1939 signal: Not available AUXIO trailer ABS detect | 706 | 9 | R |
| 214 | J1939 signal: Error in AUXIO1 trailer connected | 705 | 19 | P |
| 215 | J1939 signal: Not available AUXIO trailer connected | 705 | 9 | R |
| 216 | J1939 signal: Error in CCVS1 parking brake switch | 70 | 19 | P |
| 217 | J1939 signal: Not available CCVS1 parking brake switch | 70 | 9 | R |
| 218 | J1939 signal: Error in CCVS1 Cruise Control set switch | 599 | 19 | P |
| 219 | J1939 signal: Not available CCVS1 set switch | 599 | 9 | R |
| 220 | J1939 signal: Error in CCVS1 Cruise Control coast switch | 600 | 19 | P |
| 221 | J1939 signal: Not available CCVS1 coast switch | 600 | 9 | R |
| 222 | J1939 signal: Error in CCVS1 Cruise Control resume switch | 601 | 19 | P |
| 223 | J1939 signal: Not available CCVS1 resume switch | 601 | 9 | R |
| 224 | J1939 signal: Error in CCVS1 Cruise Control accelerate switch | 602 | 19 | P |
| 225 | J1939 signal: Not available CCVS1 ACCL switch | 602 | 9 | R |
| 226 | J1939 signal: Error in CCVS1 Cruise Control pause switch | 1633 | 19 | P |
| 227 | J1939 signal: Not available CCVS1 pause switch | 1633 | 9 | R |
| 228 | J1939 signal: Invalid EBC1 brake pedal position | 521 | 2 | N |
| 229 | J1939 signal: Error in EBC1 brake pedal position | 521 | 19 | P |
| 230 | J1939 signal: Not available EBC1 brake pedal position | 521 | 9 | R |
| 231 | J1939 signal: Error in EBC1 anti-lock braking active | 563 | 19 | P |
| 232 | J1939 signal: Not available EBC1 ABS active | 563 | 9 | R |
| 233 | J1939 signal: Error in EBC1 ASR engine control active | 561 | 19 | P |
| 234 | J1939 signal: Not available EBC1 ASR engine control active | 561 | 9 | R |
| 235 | J1939 signal: Error in EBC1 ASR brake control active | 562 | 2 | P |
| 236 | J1939 signal: Not available EBC1 ASR brake control active | 562 | 19 | R |
| 237 | J1939 signal: Error in EBC1 source address of controlling device | 1481 | 2 | P |
| 238 | J1939 signal: Not available EBC1 source address of controlling device | 1481 | 19 | R |
| 239 | J1939 signal: Invalid EBC5 XBR active control mode | 2918 | 2 | N |
| 240 | J1939 signal: Error in EBC5 XBR active control mode | 2918 | 19 | P |
| 241 | J1939 signal: Not available EBC5 XBR active control mode | 2918 | 9 | R |
| 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 | P |
| 248 | J1939 signal: Not available EC1 engine speed at idle point 1 | 188 | 9 | R |
| 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

***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 | P |
| 251 | J1939 signal: Not available EEC3 nominal friction percent torque | 514 | 9 | R |
| 252 | J1939 signal: Error in ETC1 transmission driveline engaged | 560 | 19 | P |
| 253 | J1939 signal: Not available ETC1 transmission driveline engaged | 560 | 9 | R |
| 254 | J1939 signal: Invalid ETC2 transmission selected gear | 524 | 2 | N |
| 255 | J1939 signal: Error in ETC2 transmission selected gear | 524 | 19 | P |
| 256 | J1939 signal: Not available ETC2 transmission selected gear | 524 | 9 | R |
| 257 | J1939 signal: Invalid ETC2 transmission actual gear ratio | 526 | 2 | N |
| 258 | J1939 signal: Error in ETC2 transmission actual gear ratio | 526 | 19 | P |
| 259 | J1939 signal: Not available ETC2 transmission actual gear ratio | 526 | 9 | R |
| 260 | J1939 signal: Invalid ETC2 transmission current gear | 523 | 2 | N |
| 261 | J1939 signal: Error in ETC2 transmission current gear | 523 | 19 | P |
| 262 | J1939 signal: Not available ETC2 transmission current gear | 523 | 9 | R |
| 263 | J1939 signal: Error in TC1 transmission requested gear | 525 | 19 | P |
| 264 | J1939 signal: Not available TC1 transmission requested gear | 525 | 9 | R |
| 265 | J1939 signal: Missing AUXIO message | 701 | 14 | F |
| 266 | J1939 signal: Missing DM1 message | 1214 | 14 | F |
| 267 | J1939 signal: Missing EEC3 message | 514 | 14 | F |
| 268 | J1939 signal: Missing ETC1 message | 560 | 14 | F |
| 269 | J1939 signal: Missing ETC2 message | 524 | 14 | F |
| 270 | J1939 signal: Missing TC1 message | 525 | 14 | F |
| 271 | J1939 signal: Missing FLC message | 1705 | 14 | F |
| 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 | F |
| 276 | J1939 signal: Error in ETC5 reverse switch | 767 | 19 | P |
| 277 | J1939 signal: Not available ETC5 reverse switch | 767 | 9 | R |
| 278 | J1939 signal: Error in CCVS1 brake switch | 597 | 19 | P |
| 279 | J1939 signal: Not available CCVS1 brake switch | 597 | 9 | R |
| 280 | XBR is locked-out | 1196 | 19 | S |
| 281 | Internal radar sensor error | 630 | 12 | |
| 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 | |
| 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 | AA |

*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 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 | AA |
| 293 | J1939: Retarder Controller Signal Invalid - RC Reference Torque | 556 | 2 | Z |
| 294 | J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque | 556 | 19 | AA |
| 295 | J1939: Retarder Controller Signal Not Available - Retarder RC Reference Torque | 556 | 9 | AA |
| 296 | J1939: Retarder Controller Signal Timeout - Engine RC Message | 901 | 9 | AA |
| 297 | J1939: Retarder Controller Signal Timeout - Driveline RC Message | 901 | 14 | AA |
| 298 | Radar mismatch with Engine ACC Control Type | 517000 | 14 | EE |
| 299 | Radar mismatch with ABS configuration for Highway Departure Braking | 517001 | 14 | CC |
| 300 | Radar mismatch with ABS configuration for Multilane Automatic Emegency Braking | 517002 | 14 | DD |
| 301 | Radar mismatch with ABS configuration for Adaptive Cruise Control Type | 517003 | 14 | BB |
| 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | | | | |

***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 A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| A | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• Some error conditions may occur at extreme high or low temperatures. These trouble codes must be diagnosed with the ambient temperature above 32°F (0°C) and below 100°F (38°C).<br>**Perform the following:**<br>• Clear the Bendix® Wingman® Fusion™ system trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| B | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• These trouble codes may arise from infrequent conditions that could occur normally.<br>**Perform the following:**<br>• Check for sensor obstruction. Clean dirt – or packed snow or ice – from the sensor if present.<br>• Clear the Wingman Fusion system trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• 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 an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• These trouble codes result from incorrect ignition, battery supply voltage, or wiring harness issues as measured at the radar sensor.<br>**Review the following sections:**<br>• 2.7: *Ignition Voltage Too Low*<br>• 2.7: *Ignition Voltage Too High*<br>• 2.7: *Power Supply Tests* 2.12: *Troubleshooting Wiring Harnesses*<br>**Perform the following:**<br>• Verify ignition supply voltage to the radar sensor is between 9 to 16 VDC<br>• Visually check for damaged or corroded connectors<br>• Visually check for damaged wiring<br>• Clear the Wingman Fusion system trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*. 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| D | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Bendix® Wingman® Fusion™ system is indicating a required signal within a J1939 PGN message is not being sent from one or more sources. This could be accompanied by other active DTCs from the same source.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>• 2.10: *J1939 Engine Communications Test Procedure*<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine, engine retarder, and ABS for trouble codes 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 signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals.<br>• Clear the Bendix Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| E | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Wingman Fusion system is indicating a required signal within a J1939 PGN message is not being sent from one or more sources. This could be accompanied by other active DTCs from the same source.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>• 2.10: *J1939 Engine Communications Test Procedure*<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine, engine retarder, and ABS for trouble codes 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 signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals.<br>• Clear the Wingman Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| F | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Bendix® Wingman® Fusion™ system is indicating a required signal within a J1939 PGN message is not being sent from one or more sources. This could be accompanied by other active DTCs from the same source.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>• 2.10: *J1939 Engine Communications Test Procedure*<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine, engine retarder, and ABS for trouble codes 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 signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals.<br>• Clear the Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| G | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• Radar sensor OUT OF ALIGNMENT<br>**Perform the following:**<br>• Go to *Appendix B1* and use the flowchart to find out the procedure needed. Follow the actions directed in the procedure and align the radar.<br>• Clear the Bendix Wingman Fusion system trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| H | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Wingman Fusion system is indicating a required signal from the ABS controller is missing or the ABS is sending a message indicating an error. This DTC could be accompanied by other active DTCs.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>**Perform the following:**<br>• Check the ABS for trouble codes 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.<br>• Clear the Fusion system trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• 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 an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The system was used improperly, such as use of the system on downhill grades.<br>**Perform the following:**<br>• Check any engine, or engine retarder trouble codes.<br>• Clear the Fusion system trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| K | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>• The engine has a calibration setting enabling it to perform the torque and retarder control for the Bendix® Wingman® Active Cruise Control (ACC).<br>**Possible causes:**<br>• The "ACC-enable" setting in the engine software calibration is not set.<br>• The engine is not equipped with an engine retarder, or does not support the engine CC option.<br>**Perform the following:**<br>• Check the vehicle and engine manufacturers engine configuration for an engine CC feature.<br>• Check the engine for an engine retarder feature.<br>• Check engine configuration for enabling the ACC function.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| L | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• 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 radar sensor onto a vehicle with an earlier Bendix® Wingman® Fusion™ system or ACB (Active Cruise-control with Braking) system.] Contact the dealer or call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for the correct part number to use, or the re-programming steps to take for the newer part number to be accepted:<br>**After addressing the possible causes, perform the following:**<br>• Clear the Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| M | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Collision Mitigation System (CMS) applied the brakes more than three times in a power cycle and system was used improperly:<br>**After addressing the possible causes, perform the following:**<br>• Clear the Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• Review the operation of Bendix Wingman Fusion system with the driver.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| N | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• J1939 source of the signal is indicating a signal is producing a value that is out-of-range.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>• 2.10: *J1939 Engine Communications Test Procedure*<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine, engine retarder, and 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 signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals.<br>• Clear the Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| P | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• J1939 source of the signal is indicating an error in the signal.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>• 2.10: *J1939 Engine Communications Test Procedure*<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has an error.<br>• Check the engine, engine retarder, and ABS for trouble codes 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 signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals.<br>• Clear the Bendix® Wingman® Fusion™ system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| R | **This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Bendix Wingman Fusion system is indicating the required data within a J1939 signal is not supported from one or more sources.<br>**Review the following sections:**<br>• K1.15: *Radar Sensor Interchangeability*<br>• 2.10: *J1939 Engine Communications Test Procedure*<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine, engine retarder, and ABS for trouble codes 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 signal must be investigated first, but the origin of the signal could be another component. Some examples are gross vehicle weight and various engine torque signals.<br>• Clear the Fusion system DTCs using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| S | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>• Some system, signal or component caused the Fusion system to be disabled. Engine cruise control is unavailable and should not operate when the Fusion system is disabled.<br>**Possible causes:**<br>• Check the engine, and engine retarder trouble codes. Inspect and troubleshoot the cruise control system wiring, switches, etc. for proper operation.<br>**After addressing the possible causes, perform the following:**<br>• Clear the Bendix Wingman Fusion system DTCs by cycling the power. Start the engine.<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform** |
|---|---|
| | **Recommended Service** *(Bendix™ FLR-20™ Radar Sensors Only)* |
| T | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• Mounting offset incorrect.<br>**Perform the following:**<br>• Check the mounting offset of the radar sensor in Bendix® ACom® Diagnostic Software Configuration screen. The offset value should not exceed 500 mm.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| U | **This is not a failure of the radar sensor. Do not replace the radar sensor.**<br>**Possible causes:**<br>• The Bendix® Wingman® Fusion™ system is indicating a required signal that indicates whether the ABS is fully operational or whether its functionality is reduced by a permanent or temporary (e.g. low voltage) defect, or not configured or not yet fully initialized, or loss of input sensors.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| V | **This is not a failure of the radar sensor. Do not replace the radar sensor.**<br>**Possible causes:**<br>• The Fusion system is indicating that the ABS tire sizes are out of calibration.<br>**Perform the following:**<br>• Using ACom Diagnostic Software, connect to the ABS. Select the Controller Configuration menu and select Modify. Enter the correct tire sizes in the Tire Size [rpm] table for each axle of the vehicle.<br>• Clear the Bendix Wingman Fusion system Diagnostic Trouble Codes (DTCs) using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| W | **This is not a failure of the radar sensor. Do not replace the radar sensor.**<br>**Possible causes:**<br>• The Bendix Wingman Fusion system is indicating that the ABS tire sizes are out of calibration.<br>**Perform the following:**<br>• Using ACom Diagnostic Software, connect to the ABS. Select the Controller Configuration menu and select Modify. Enter the correct tire sizes in the Tire Size [rpm] table for each axle of the vehicle.<br>• Clear the Bendix Wingman Fusion system Diagnostic Trouble Codes (DTCs) using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| X | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Bendix Wingman system is indicating an error in the messages on the Proprietary CAN bus.<br>• Check the Proprietary CAN connections at the Camera and Radar.<br>• Check that the resistance between Proprietary CAN+ and CAN- is between 50 and 70 ohms with the power off.<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| Y | **This DTC is not an indicator of a malfunctioning sensor. Do not replace the sensor.**<br>**Possible causes:**<br>• The Bendix Wingman system is indicating an error in the messages on the public/vehicle CAN bus.<br>• Check the public/vehicle CAN connections at the Camera and Radar.<br>• Check that the resistance between public/vehicle CAN+ and CAN- is between 50 and 70 ohms with the power off.<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| Z | **There is not a failure of the radar sensor. Do not replace radar sensor.**<br>**Possible causes:**<br>• The Bendix® Wingman® Fusion™ system is indicating a required signal within a J1939 PGN message is not being sent from the retarder controller. This could be accompanied by other active DTCs from the same source.<br>**Perform the following:**<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine and the engine retarder for trouble codes using the manufacturer's diagnostic procedures. Either the engine or engine retarder is the source of the signal. The controller that broadcasts the signal must be investigated first.<br>• Clear the Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| AA | **There is not a failure of the radar sensor. Do not replace radar sensor.**<br>**Possible causes:**<br>• The Wingman system is indicating a required signal within a J1939 PGN message is not being sent from the retarder controller. This could be accompanied by other active DTCs from the same source.<br>**Perform the following**:<br>• Check the source of the signal to identify why the signal has invalid data in the J1939 message.<br>• Check the engine and engine retarder for trouble codes using the manufacturer's diagnostic procedures. Either the engine or engine retarder is the source of the signal. The controller that broadcasts the signal must be investigated first.<br>• Clear the Bendix Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| BB | **There is not a failure of the radar sensor. Do not replace radar sensor.**<br>**Possible causes:**<br>• The Wingman system is indicating that the ABS setting is not compatible with adaptive cruise control type. Either the configuration of the radar or ABS needs to be changed to match the intended vehicle functionality.<br>**Review the following sections:**<br>• K1.15: Radar Sensor Interchangeability<br>• 2.10: J1939 Engine Communications Test Procedure<br>**Perform the following:**<br>• Check the Radar and ABS for trouble codes using the manufacturer's diagnostic procedures.<br>• Clear the Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform**<br>**Recommended Service**<br>***(Bendix™ FLR-20™ Radar Sensors Only)*** |
|---|---|
| CC | **There is not a failure of the radar sensor. Do not replace radar sensor**.<br>**Possible causes:**<br>• The Bendix® Wingman® Fusion™ system is indicating that the ABS setting is not compatible with Highway Departure Braking. Either the configuration of the Radar or ABS needs to be changed to match the intended vehicle functionality.<br>**Review the following sections:**<br>• K1.15: Radar Sensor Interchangeability<br>• 2.10: J1939 Engine Communications Test Procedure<br>**Perform the following:**<br>• Check the Radar and ABS for trouble codes using the manufacturer's diagnostic procedures.<br>• Clear the Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| DD | **There is not a failure of the radar sensor. Do not replace radar sensor.**<br>**Possible causes:**<br>• The Wingman system is indicating that the ABS setting is not compatible with Multilane Automatic Emergency Braking. Either the configuration of the Radar or ABS needs to be changed to match the intended vehicle functionality.<br>**Review the following sections:**<br>• K1.15: Radar Sensor Interchangeability<br>• 2.10: J1939 Engine Communications Test Procedure<br>**Perform the following:**<br>• Check the Radar and ABS for trouble codes using the manufacturer's diagnostic procedures.<br>• Clear the Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. |
| EE | **There is not a failure of the radar sensor. Do not replace radar sensor**.<br>**Possible causes:**<br>• The Bendix Wingman system is indicating that the Engine setting is not compatible with the Adaptive Cruise Control Type. Either the configuration of the Radar or Engine needs to be changed to match the intended vehicle functionality.<br>**Review the following sections:**<br>• K1.15: Radar Sensor Interchangeability<br>• 2.10: J1939 Engine Communications Test Procedure<br>**Perform the following:**<br>• Check the engine and ABS for trouble codes using the manufacturer's diagnostic procedures.<br>• Clear the Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

| Service Action Code *(From Table A or Appx. M)* | **Table 4B: Service Action Codes and the Recommended Service to Perform** |
|---|---|
| | **Recommended Service** *(Bendix™ FLR-20™ Radar Sensors Only)* |
| FF | **There is not a failure of the radar sensor. Do not replace radar sensor.**<br>**Possible causes:**<br>• The Bendix® Wingman® system is indicating the engine is not responding correctly to the radar control signals on the J1939 CAN bus.<br>**Perform the following:**<br>• Check the engine, engine retarder, and the ABS for trouble codes using the manufacturer's diagnostic procedures.<br>• Clear the Wingman system diagnostic trouble codes using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs).*<br>• 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.* Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance. | |

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

## 2.6 CLEARING DIAGNOSTIC TROUBLE CODES (DTCS)

Diagnostic Trouble Codes (DTCs) may be cleared using the Bendix® ACom® Diagnostic Software (version 6.9 and higher) service tool or by cycling the ignition power. In the ACom program, click the "Clear" button located on the "Read / Clear Fault Codes" screen. Alternately, power-off the vehicle for at least one (1) minute, then start the engine and run it at idle for at least 15 seconds.

Drive the vehicle and, on a test track or suitable section of roadway, verify proper operation.

If the error returns, call Bendix at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for assistance.

## 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.

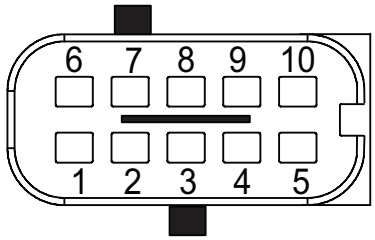
### IGNITION VOLTAGE TOO HIGH

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 (e.g. 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 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

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

To check the Bendix® Wingman® Fusion™ system key indicators such as software version number, use Bendix® ACom® Diagnostic Software version 6.9 or higher. From the ACom software main menu, the technician highlights Advanced, then clicks "Start with ECU". The Fusion Status screen will appear. Clicking "Config" will display the key system indicators. *See Section 4.21 for an example of reading the software version. See Figure 7 for an example of ACom software configuration information. See Appendix G.*

*NOTE: ACom Diagnostic Software is also used for troubleshooting Bendix® ESP®, ATC, and ABS systems.*

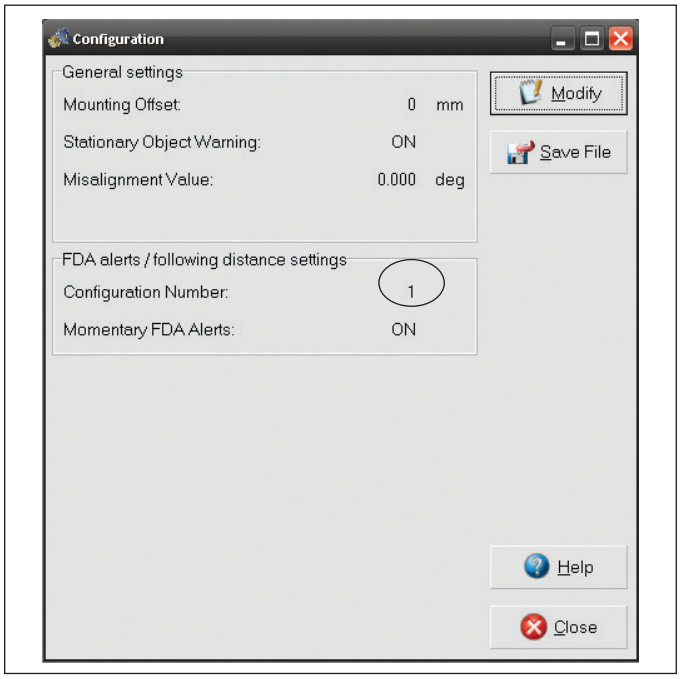



***Figure 7 – Bendix® ACom® Screen Showing the Configuration Number***

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

Many of the Diagnostic Trouble Codes (DTCs) will automatically clear when the cause of the problem is corrected. When the technician troubleshoots a DTC, it is recommended that Bendix ACom Diagnostic Software (version 6.9 or higher) be used to clear the DTCs as directed by the repair procedure.

Some codes will clear immediately and the functionality will resume. Some codes will clear after powering off the ignition for about 15 seconds and then turning it back on. Other codes will clear after the engine runs for about 15 seconds.

If the vehicle's cruise control can be engaged, that indicates all Fusion system trouble codes have been cleared.

### 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 Bendix ACom Diagnostic Software (version 6.9 or higher). In current versions of the ACom software, the service technician will find a selection box called "Configuration Number" which gives the service technician the choices shown in Figure 8 and in Table 6.

*See Appendix B for an example of following distance alerts for systems where a Bendix™ Driver Interface Unit (DIU™) is used. See Appendix F for information about how to change the FDA settings and enable momentary beeping.*

| Configuring Bendix® Wingman® Fusion™ System Following Distance Alerts (FDA) (5.4) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 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 | ----- | ----- | ----- | 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)***

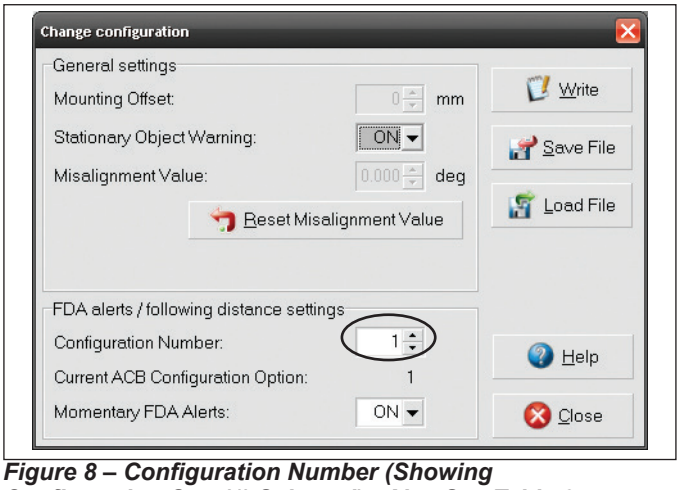



***Figure 8 – Configuration Number (Showing Configuration One (1) Selected) - Also See Table 6***

Changing configuration allows the fleet to adjust both the following distance alerts and the following distance behind a detected forward vehicle. *See Figure 9.*

## 3.5 BENDIX® WINGMAN® FUSION™ SYSTEM DATA

NOTE: A license key is required from Bendix in order to engage the data collection ability of the system. Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for more information. Note this feature may not be available on newer FLR systems.

### 3.5.1 DATA AVAILABILITY

Data will not be stored by the system until the "Clear Resettable Data Log" (*see Figure 9*) is selected and the proper Bendix® ACom® Diagnostic Software license key is present. Contact Bendix at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for the ACom software license key and the set-up procedure.

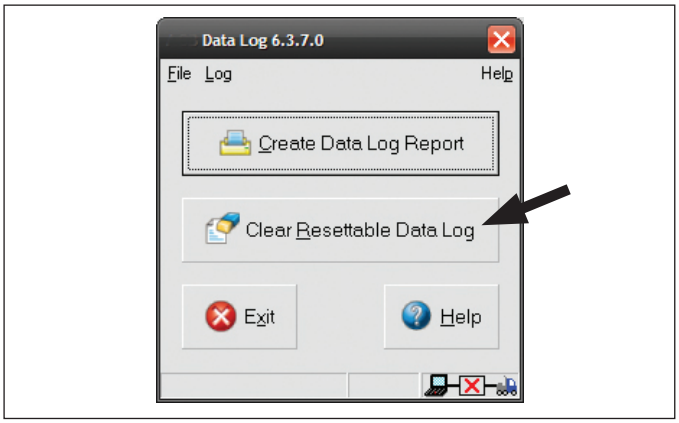



***Figure 9 – Clearing the Resettable Data Log***

### 3.5.2 DATA OVERVIEW

At the fleet's discretion, the Fusion system makes data available (*see Figure 10*) in an ACB (Active Cruise-control with Braking) data log, regardless of whether or not Fusion is used. The log can be reset–using ACom Diagnostic Software–as often as needed.

### 3.5.3 EXTRACTING DATA AND SAVING A REPORT

The Bendix ACom Diagnostic Software and *User Guide* is available online at "ABS Software" link under "Services and Support" on the Bendix website (bendix.com). Use the *User Guide* for specific instructions on extracting data from the Wingman Fusion system.

After a successful connection, the service technician will be presented with the window shown in Figure 10.

Select "Start ACB Data Log". The service technician will be asked to enter the vehicle ID and mileage. This data will be stored in the report. *See Figure 10.*

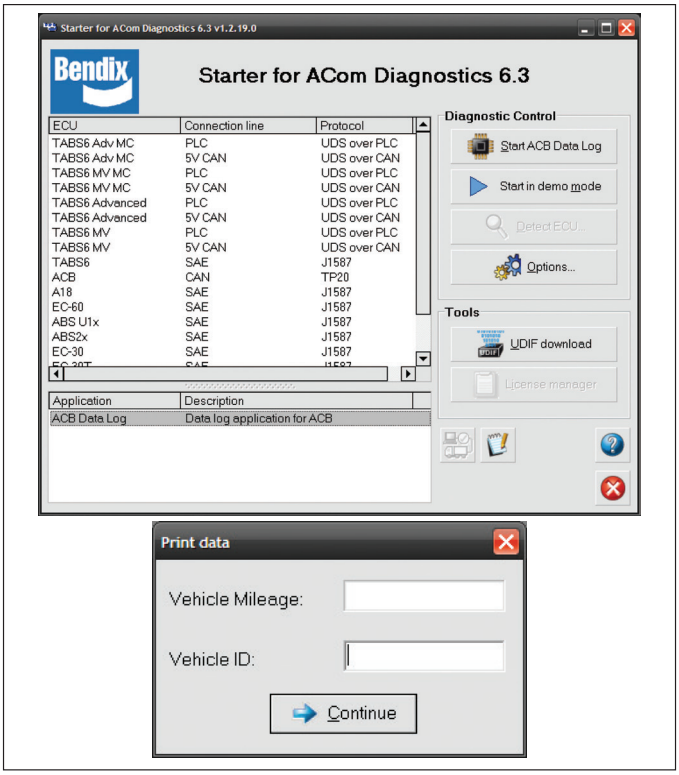



***Figure 10 – Vehicle Data***

The service technician can choose whether to "Print", "Print Preview", "E-mail", or "Save" the report to disk. *See Figure 11.* The data can be saved as a comma delimited file or an HTML web page file. *See Figure 12 on next page for a sample report.*

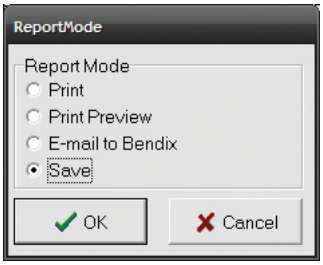
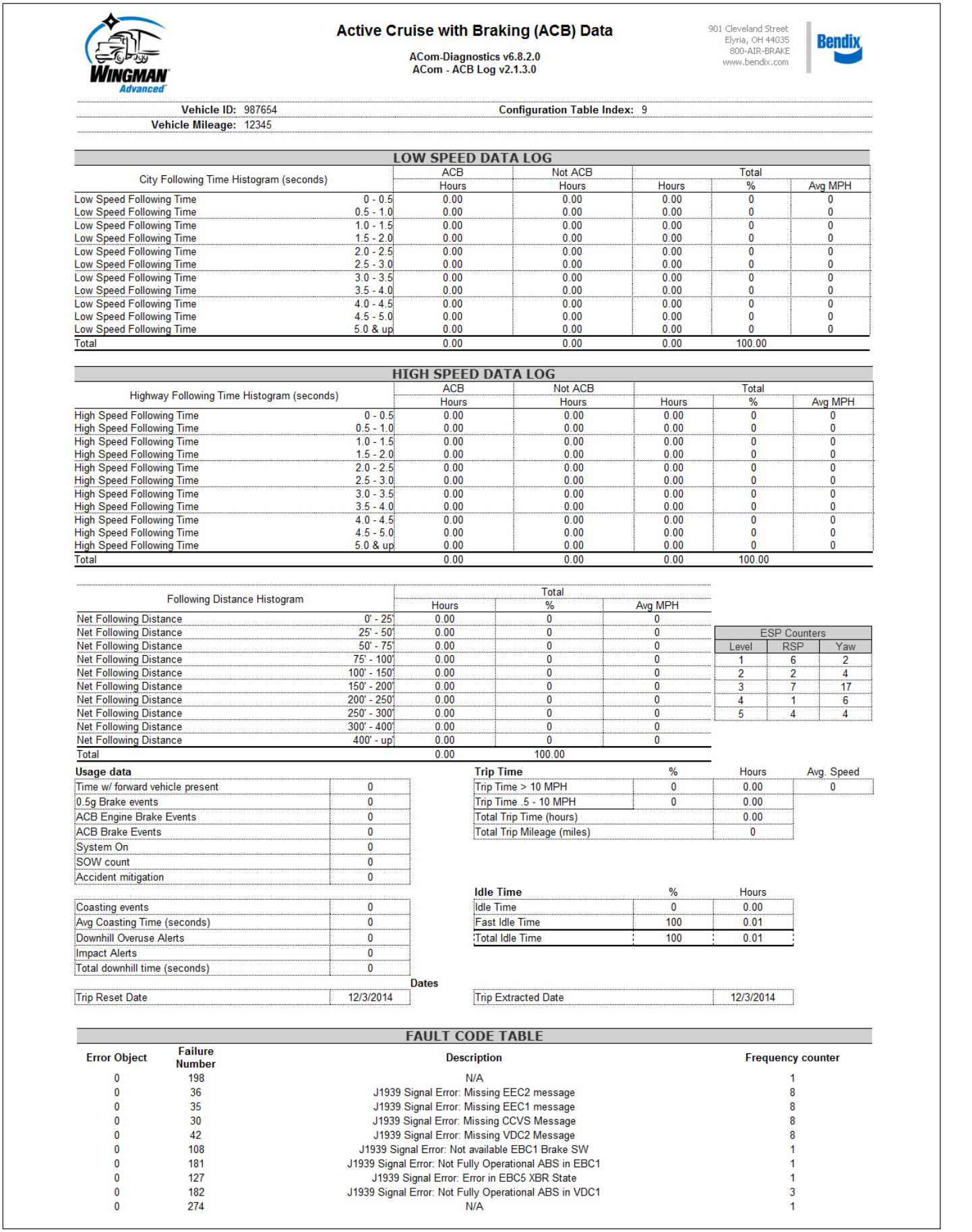



***Figure 11 – Report Mode***



## Active Cruise with Braking (ACB) Data

ACom-Diagnostics v6.8.2.0
ACom - ACB Log v2.1.3.0

901 Cleveland Street
Elyria, OH 44035
800-AIR-BRAKE
www.bendix.com

**Vehicle ID:** 987654 **Configuration Table Index:** 9
**Vehicle Mileage:** 12345

### LOW SPEED DATA LOG

| City Following Time Histogram (seconds) | | ACB Hours | Not ACB Hours | Total Hours | Total % | Total Avg MPH |
|---|---|---|---|---|---|---|
| Low Speed Following Time | 0 - 0.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 0.5 - 1.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 1.0 - 1.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 1.5 - 2.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 2.0 - 2.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 2.5 - 3.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 3.0 - 3.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 3.5 - 4.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 4.0 - 4.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 4.5 - 5.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Low Speed Following Time | 5.0 & up | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Total | | 0.00 | 0.00 | 0.00 | 100.00 | |

### HIGH SPEED DATA LOG

| Highway Following Time Histogram (seconds) | | ACB Hours | Not ACB Hours | Total Hours | Total % | Total Avg MPH |
|---|---|---|---|---|---|---|
| High Speed Following Time | 0 - 0.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 0.5 - 1.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 1.0 - 1.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 1.5 - 2.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 2.0 - 2.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 2.5 - 3.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 3.0 - 3.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 3.5 - 4.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 4.0 - 4.5 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 4.5 - 5.0 | 0.00 | 0.00 | 0.00 | 0 | 0 |
| High Speed Following Time | 5.0 & up | 0.00 | 0.00 | 0.00 | 0 | 0 |
| Total | | 0.00 | 0.00 | 0.00 | 100.00 | |

| Following Distance Histogram | | Total Hours | Total % | Total Avg MPH |
|---|---|---|---|---|
| Net Following Distance | 0' - 25' | 0.00 | 0 | 0 |
| Net Following Distance | 25' - 50' | 0.00 | 0 | 0 |
| Net Following Distance | 50' - 75' | 0.00 | 0 | 0 |
| Net Following Distance | 75' - 100' | 0.00 | 0 | 0 |
| Net Following Distance | 100' - 150' | 0.00 | 0 | 0 |
| Net Following Distance | 150' - 200' | 0.00 | 0 | 0 |
| Net Following Distance | 200' - 250' | 0.00 | 0 | 0 |
| Net Following Distance | 250' - 300' | 0.00 | 0 | 0 |
| Net Following Distance | 300' - 400' | 0.00 | 0 | 0 |
| Net Following Distance | 400' - up | 0.00 | 0 | 0 |
| Total | | 0.00 | 100.00 | |

| ESP Counters | | |
|---|---|---|
| Level | RSP | Yaw |
| 1 | 6 | 2 |
| 2 | 2 | 4 |
| 3 | 7 | 17 |
| 4 | 1 | 6 |
| 5 | 4 | 4 |

| Usage data | |
|---|---|
| Time w/ forward vehicle present | 0 |
| 0.5g Brake events | 0 |
| ACB Engine Brake Events | 0 |
| ACB Brake Events | 0 |
| System On | 0 |
| SOW count | 0 |
| Accident mitigation | 0 |

| Trip Time | % | Hours | Avg. Speed |
|---|---|---|---|
| Trip Time > 10 MPH | 0 | 0.00 | 0 |
| Trip Time .5 - 10 MPH | 0 | 0.00 | |
| Total Trip Time (hours) | | 0.00 | |
| Total Trip Mileage (miles) | | 0 | |

| | |
|---|---|
| Coasting events | 0 |
| Avg Coasting Time (seconds) | 0 |
| Downhill Overuse Alerts | 0 |
| Impact Alerts | 0 |
| Total downhill time (seconds) | 0 |

| Idle Time | % | Hours |
|---|---|---|
| Idle Time | 0 | 0.00 |
| Fast Idle Time | 100 | 0.01 |
| Total Idle Time | 100 | 0.01 |

**Dates**

| | |
|---|---|
| Trip Reset Date | 12/3/2014 |
| Trip Extracted Date | 12/3/2014 |

### FAULT CODE TABLE

| Error Object | Failure Number | Description | Frequency counter |
|---|---|---|---|
| 0 | 198 | N/A | 1 |
| 0 | 36 | J1939 Signal Error: Missing EEC2 message | 8 |
| 0 | 35 | J1939 Signal Error: Missing EEC1 message | 8 |
| 0 | 30 | J1939 Signal Error: Missing CCVS Message | 8 |
| 0 | 42 | J1939 Signal Error: Missing VDC2 Message | 8 |
| 0 | 108 | J1939 Signal Error: Not available EBC1 Brake SW | 1 |
| 0 | 181 | J1939 Signal Error: Not Fully Operational ABS in EBC1 | 1 |
| 0 | 127 | J1939 Signal Error: Error in EBC5 XBR State | 1 |
| 0 | 182 | J1939 Signal Error: Not Fully Operational ABS in VDC1 | 3 |
| 0 | 274 | N/A | 1 |

*Figure 12 – Sample Bendix® Wingman® Fusion™ System Vehicle Report*

# APPENDIX A - RADAR MOUNTING AND INSTALLATION

## Appendix A

## Mounting the Bendix™ FLR-20™ Radar

## 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. If this location is not in the center of the vehicle, the mounting offset will need to be programmed through Bendix® ACom® Diagnostic Software.**

**⚠ 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. See 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.**

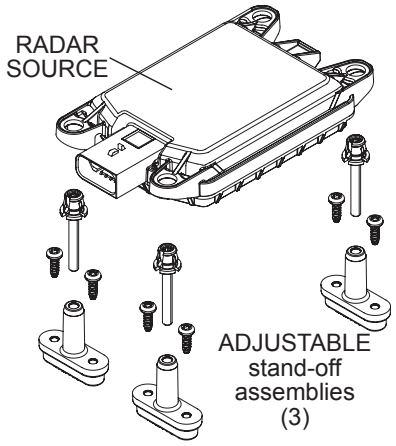
The radar sensor assembly is mounted to the front of the vehicle using an adjustable bracket. This adjustable bracket allows for the radar sensor to be properly aimed laterally and vertically to maximize Wingman Fusion system performance. When mounting a radar sensor, the wire harness connector should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

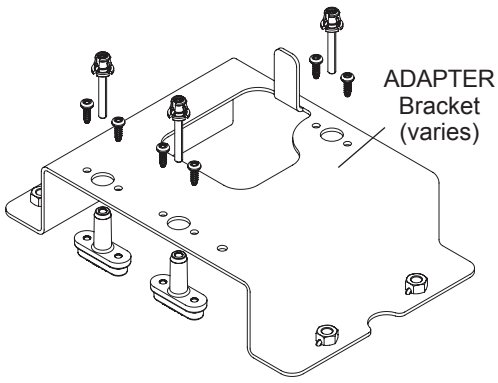
### A.2 Replacement Parts

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



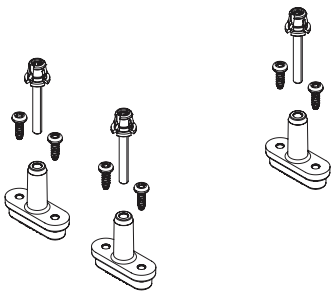

**Radar Sensor with Stand-off Assemblies**

- Kit K071772 includes a specifically-programmed Bendix™ FLR-20™ radar sensor, three stand-off adjuster assemblies, and six mounting screws.




**Bracket (Varies) and Stand-off Assemblies**

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



**Stand-off Assemblies Only**

- Kit K073199 includes three stand-off adjuster assemblies, and six mounting screws.

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

## Bendix™ FLR-20™ Radar Mounting Clearance

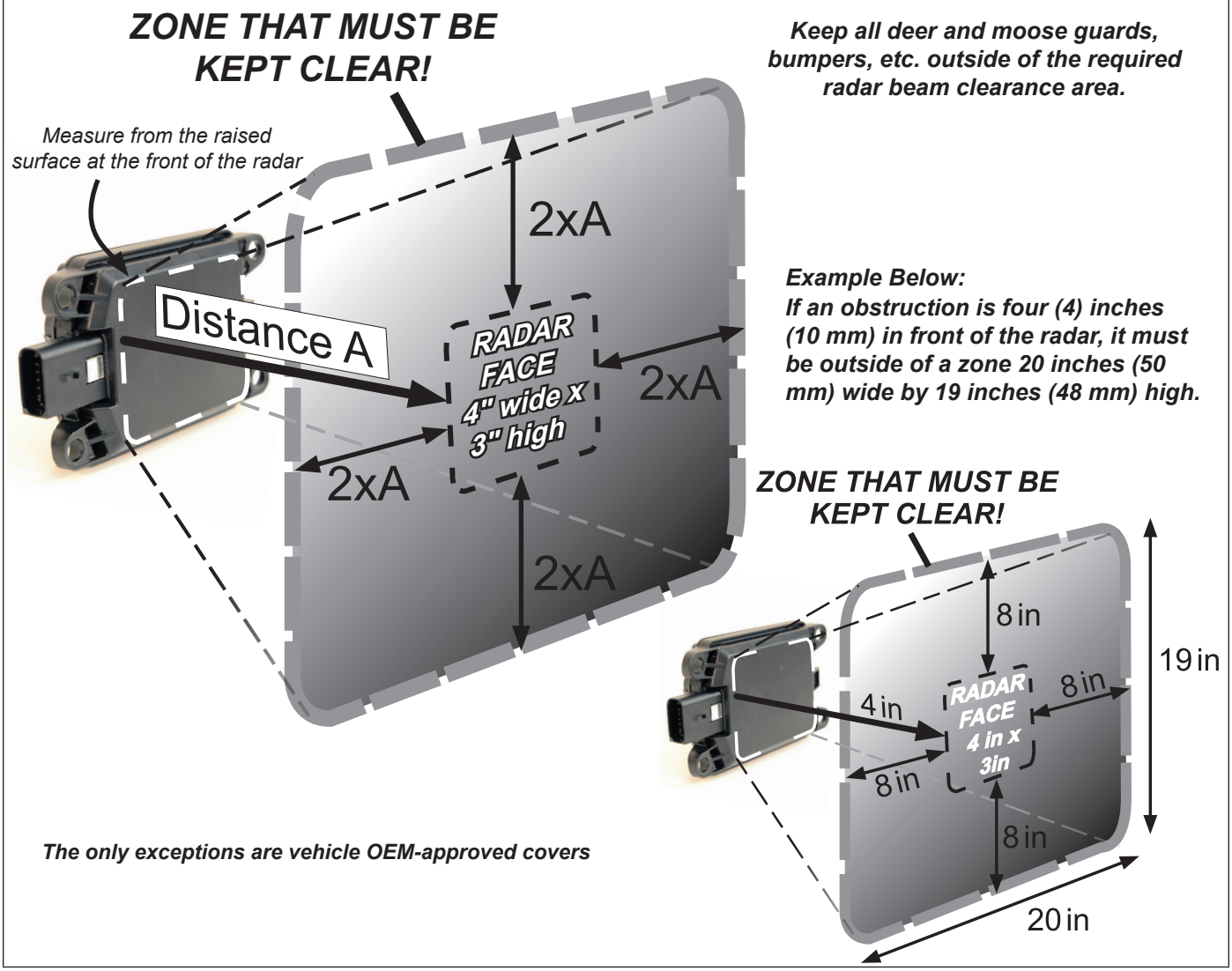
### A.3 Bendix™ FLR-20™ Radar Sensor Mounting Clearance

**⚠ 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. See 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

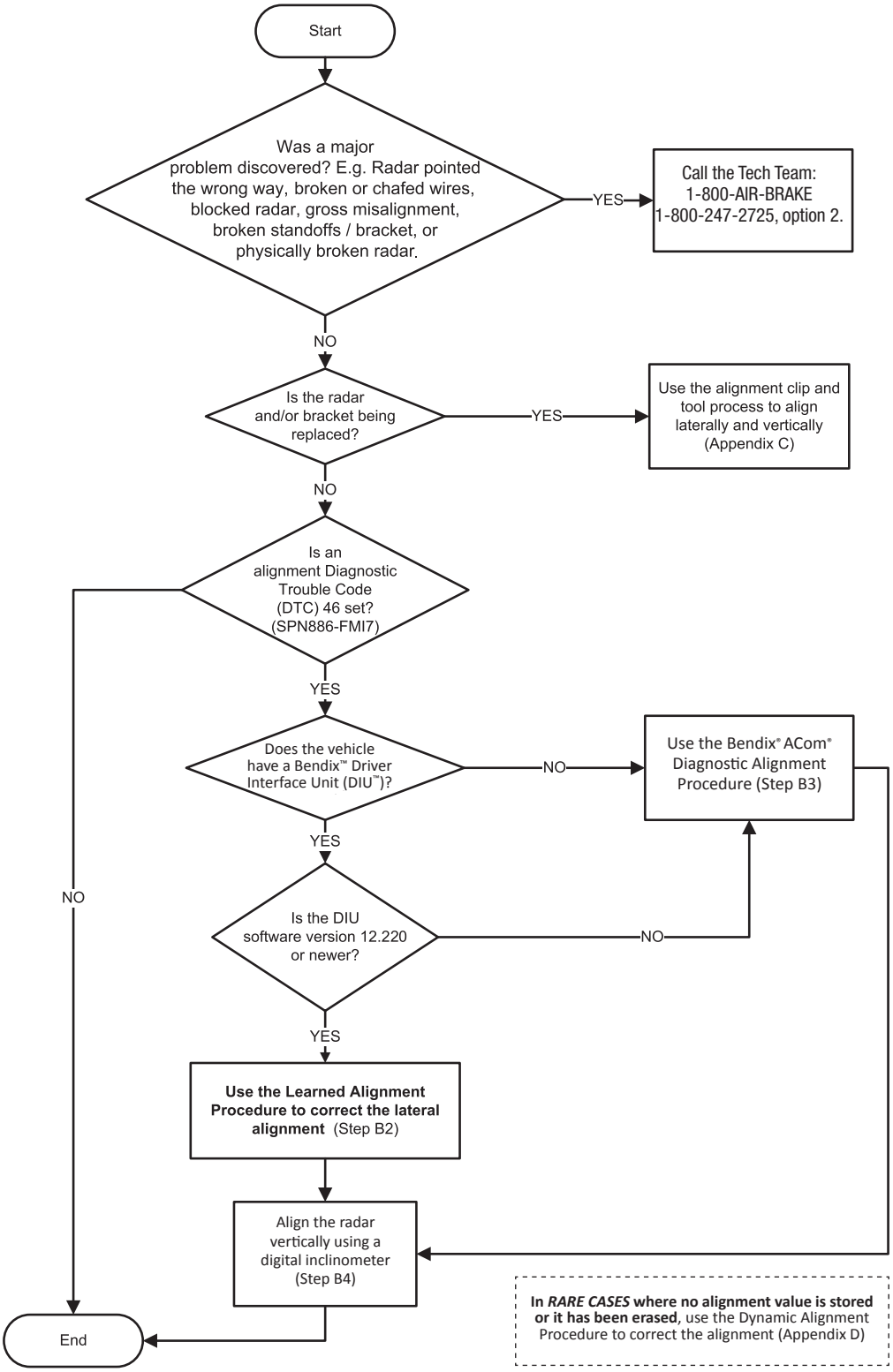
## Appendix B

## Bendix™ FLR-20™ Radar Sensor Alignment

### B1.0 Radar Alignment Flowchart

*For Bendix™ FLR-10™ radar sensors, see Bendix® Service Data Sheet (SD-61-4962).*

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




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

## Appendix B

## Bendix™ FLR-20™ Radar Alignment

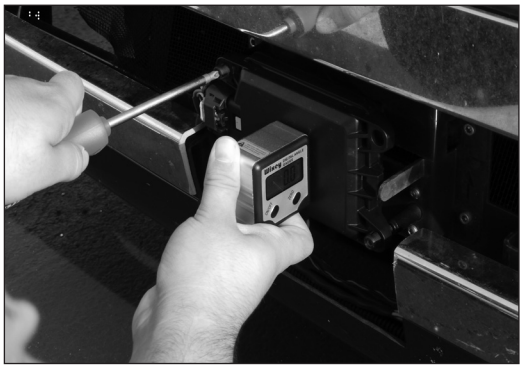
### B1.1 General Information About Adjusting The Alignment

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

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

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


***A technician makes an adjustment to the lateral alignment standoff.***



***The vertical alignment standoff is adjusted.***

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

## Appendix B

### Bendix™ FLR-20™ Radar 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.

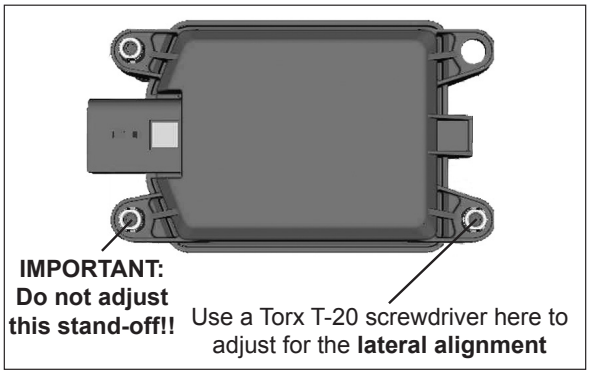
If the radar's lateral alignment is not correct, the system calculates – over the course of many hours of driving – an alignment adjustment value. The DIU displays the learned alignment value, and also shows the technician the direction to turn, and number of turns to make to the lateral alignment adjustment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

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

## Appendix B

## Bendix™ FLR-20™ Radar Alignment

### B3 Lateral Alignment Using Bendix® ACom® Diagnostic Software

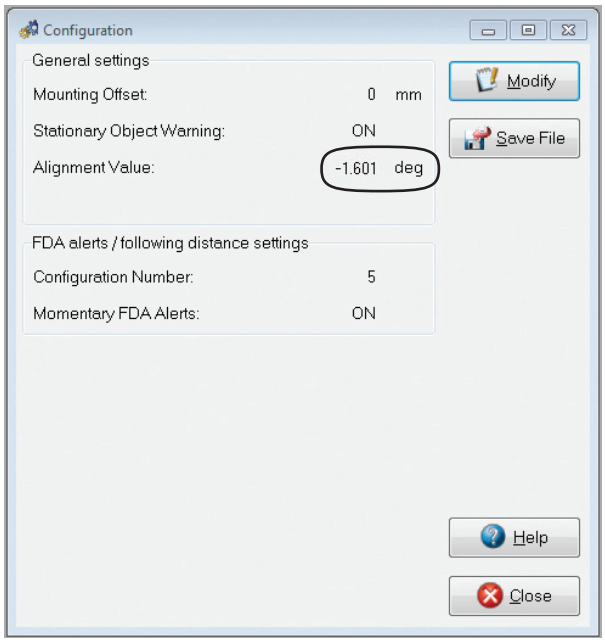
***Use this method to align the Bendix™ FLR-20™ radar laterally – when the vehicle does not have a Bendix DIU™, or has a DIU (but its software version is prior to 12.220).***

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

B3.2 Connect the vehicle to a laptop computer with the current release of the ACom software.

B3.3 *See the "Alignment Value" shown on the Configuration screen.*

If the alignment value shown by ACom is between -1.5° and 1.5°, this is acceptable and the system should operate normally. A value outside that range means the radar sensor should be adjusted.




***The Bendix ACom Diagnostic Software Screen Showing the (Lateral) 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 software is two degrees (plus or minus).*

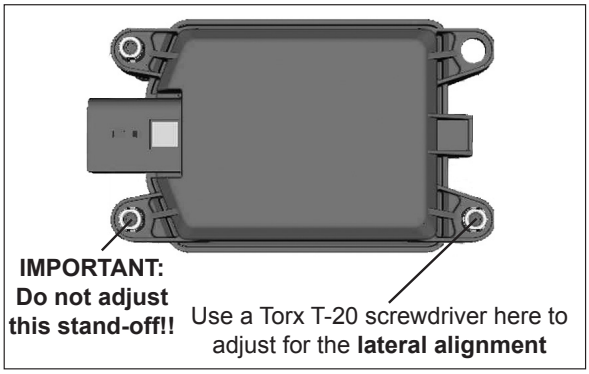
## Appendix B

### Bendix™ FLR-20™ Radar Alignment

### B3 Lateral Alignment Using Bendix® ACom® Diagnostic software (Continued)

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

Use 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.

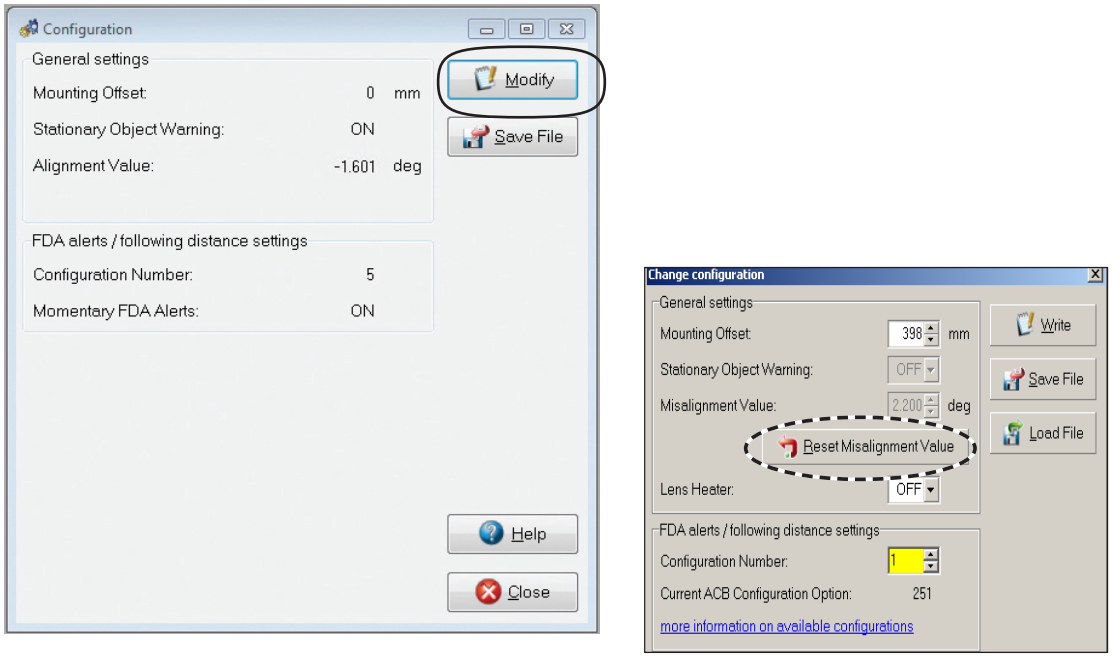



B3.5 After making the adjustment, clear the Bendix® Wingman® Fusion™ system Diagnostic Trouble Code (DTC) using the procedure in Section 2.6: *Clearing Diagnostic Trouble Codes (DTCs)*.

B3.6 Then follow steps B3.7–12 to reset the alignment value stored in the system.

B3.7 **Procedure to Reset the Alignment Value.** Select Wingman Fusion system on the starter screen, and then select “Start with ECU.” Select “Config” on the Wingman Fusion system Status window.

B3.8 Select “Modify” on the Configuration Status window.




***Bendix® ACom® Diagnostic Software: configuration and change configuration screens***

B3.9 Select “Reset Alignment Value” in the Change Configuration box. *(See Appendix H for more details.)*

B3.10 Close the Bendix ACom Diagnostic Software program and any open windows.

B3.11 Cycle the vehicle ignition.

B3.12 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 software.

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

## Appendix B

### Bendix™ FLR-20™ Radar Alignment

### B4 Vertical Alignment Using An Inclinometer

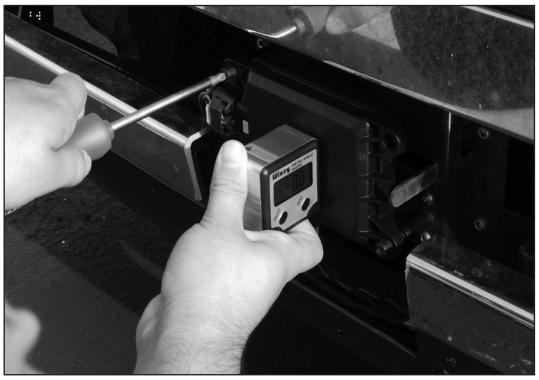
B4.1 Tools Needed: A digital inclinometer, Torx® T-20 screwdriver. (If a clip from the Bendix Alignment Tool kit is available, the clip may be placed over the front of the radar sensor during this process.)

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

B4.3 Calibrate (or "zero") the inclinometer on a horizontal section of the frame rail. Follow the manufacturer's instructions (typically digital inclinometers have a "SET" button for this purpose)**.**


Calibrate (or *"zero"*) the Digital Inclinometer on a cab frame rail in the direction that the vehicle travels.

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 on the rail.*** **With the digital inclinometer resting as shown below, verify that the display shows 0° (±1.5°) from vertical**, when measured by an inclinometer set to zero on the vehicle's frame.



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

**IMPORTANT: Do not adjust this stand-off!!**

*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 zero degrees.

B4.6 **The radar is aligned vertically when the display is between -1.5° and 1.5°, however to achieve a more precise alignment, adjust the vertical alignment screw until the digital alignment value 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.

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

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

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

## Appendix C

## Bendix™ FLR-20™ Radar Alignment

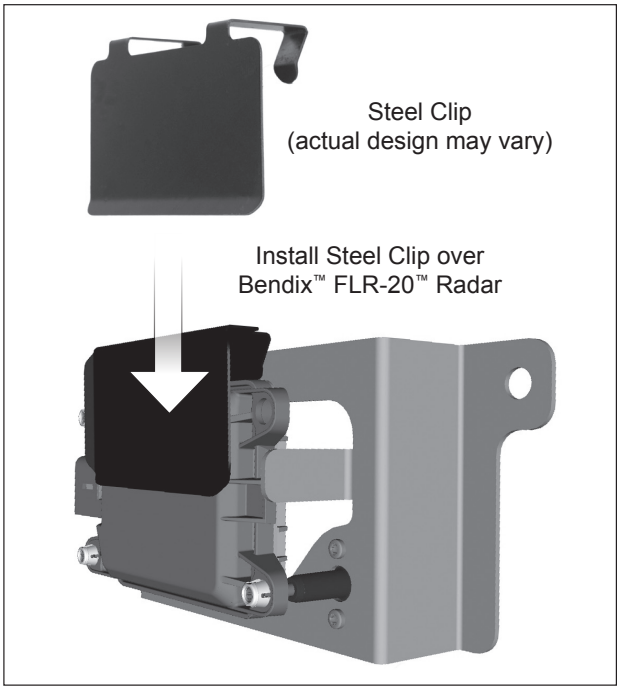
## C1 Lateral Alignment Using The Bendix® Alignment Clip And Tool

***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 part no: K065284 and K096579—available from Bendix parts outlets—are used.

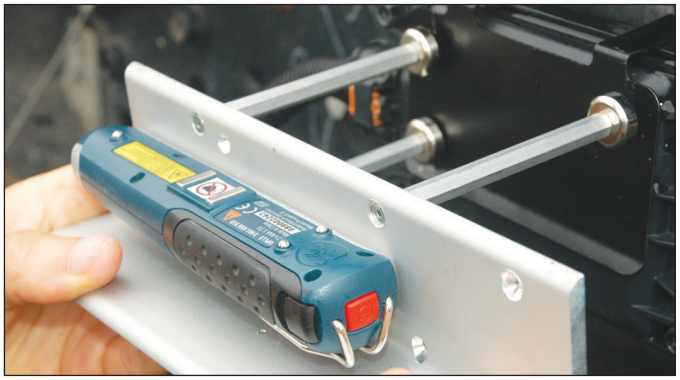
The alignment procedure also requires a steel clip, Bendix part number K073087.


***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.)

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

## Appendix C

### Bendix™ FLR-20™ Radar Alignment

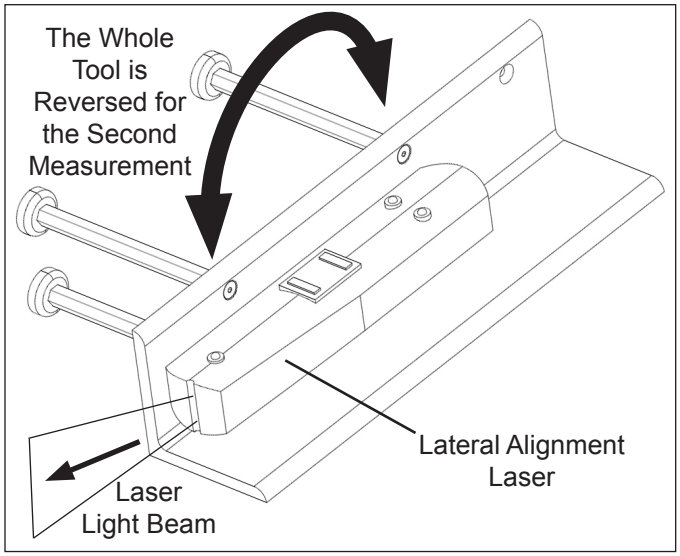
### C1 Lateral Alignment Using The Bendix® Alignment Clip And Tool (continued)

C1.4 Locate symmetrical points on the front of the vehicle that are at least 12 inches (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" (3 mm), no alignment is necessary and the technician can go to Step C1.10 to check the vertical alignment. If an adjustment is needed, follow the instructions in C1.7–C1.9 on page 47.

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

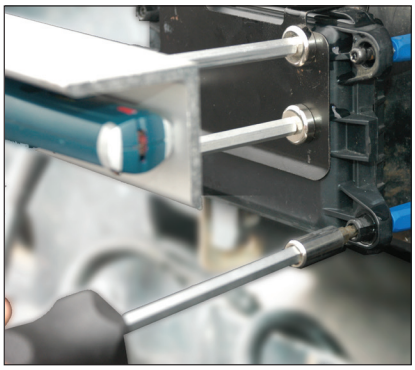
## Appendix C

### Bendix™ FLR-20™ Radar 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" from the center line of the vehicle. Reverse the tool for each measurement, until the values are the same [within 1/8" (3 mm)].

C1.9 After the lateral alignment procedure is complete, if there is an active misalignment DTC (codes 55, 56, or 57), clear the Bendix® Wingman® Fusion™ system Diagnostic Trouble Code (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® Diagnostic Software and follow steps B4.4–20 to reset the alignment value. (*Also, see 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. *See C1.1–2.*]

C1.12 Calibrate (or "zero") the inclinometer on a horizontal section of the frame rail. Follow the manufacturer's instructions (typically digital inclinometers have a "SET" button for this purpose).


Calibrate (or *"zero"*) the Digital Inclinometer on a cab frame rail in the direction that the vehicle travels.

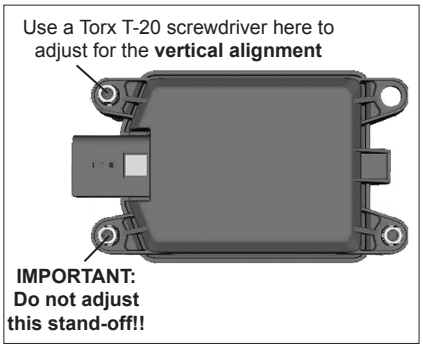
Place the calibrated digital inclinometer onto the surface of the tool, ***so that the tool is in the same direction as it was on the rail.*** **Verify that the display shows 0° (±1.5°) from vertical**.


*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. *See 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 zero degrees.

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.) Test-driving the vehicle is not necessary.***

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

# APPENDIX D - DYNAMIC RADAR ALIGNMENT

## Appendix D

### Bendix™ FLR-20™ Radar 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

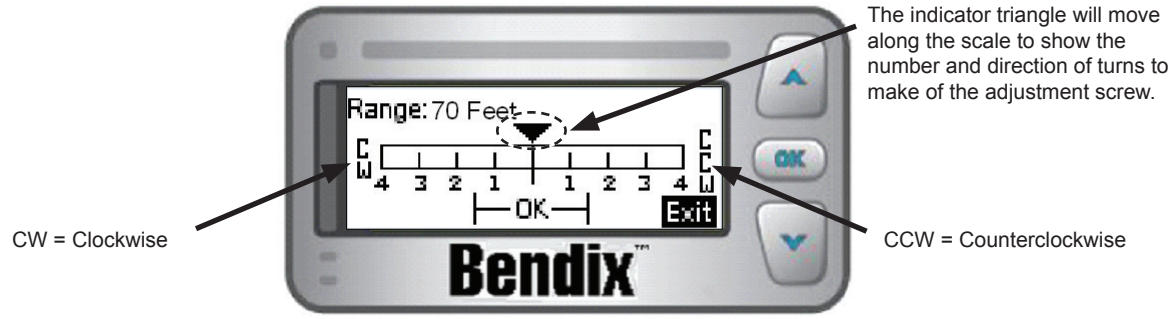
**Use the flowchart B1.0 – page 39 of this document – to ensure the correct alignment procedure is used. This procedure is used in the rare cases where a learned alignment value is not available. For example, in cases where a technician erroneously resets the alignment value before recording the Learned 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.

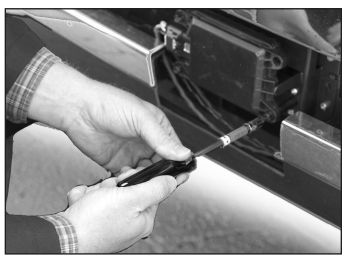
The DIU's software version can be seen in the top right-hand corner of the Volume screen. The Bendix DIU's Dynamic Alignment Screen is used to show a dynamic calculation of the alignment of the radar.

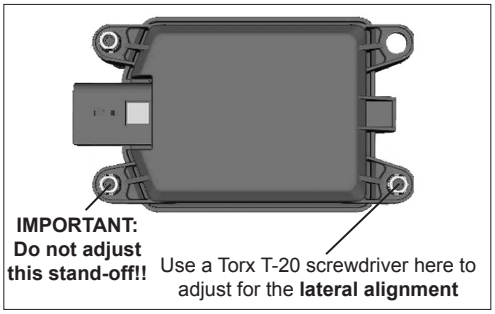
D1.2 To perform the inspection, the vehicle must be traveling behind a cooperative vehicle on a straight, level length of highway. Obeying all traffic laws, follow the vehicle in the same lane at a speed greater than 35 mph / 56 kph. For the most accurate results, the distance between the vehicles must 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

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

### E1 Operator Interface

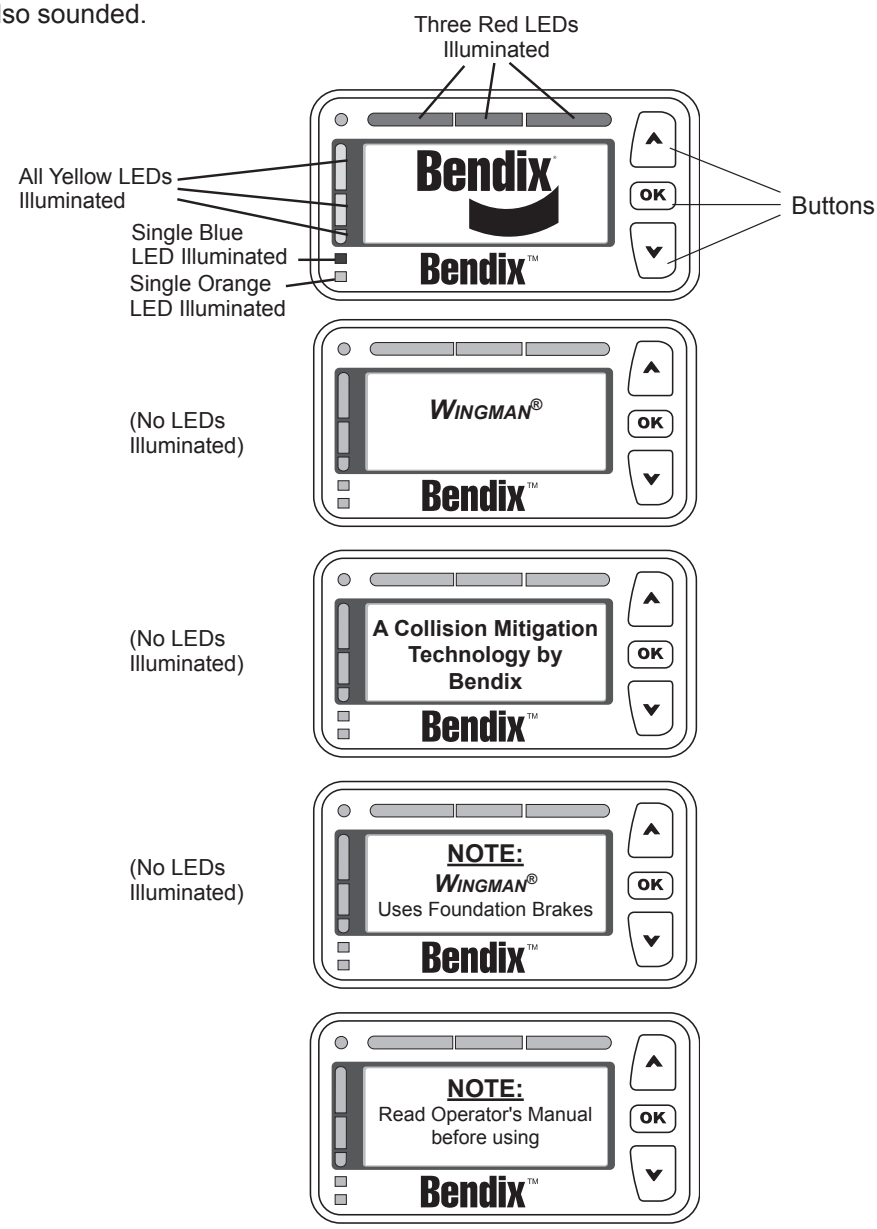
The Bendix® Wingman® Fusion™ system is either integrated into the vehicle's dash or console, or uses the Bendix™ Driver Interface Unit (DIU™) to communicate with the driver. *(For integrated systems, see the vehicle operator's manual for more information.)*

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.

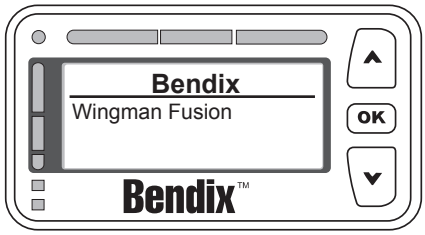



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

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

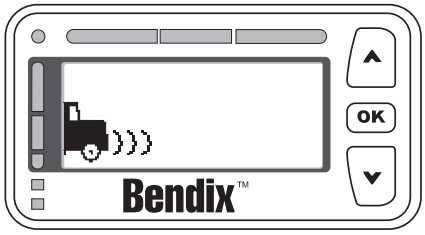
When the initialization sequence is complete, the following screen is displayed for approximately three (3) seconds to indicate the features available to the driver.

(No LEDs Illuminated)



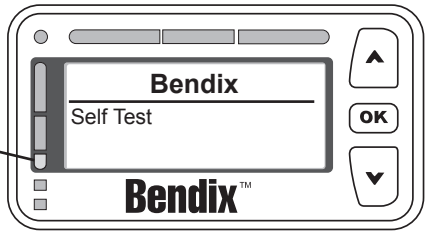

Next, the DIU will enter normal operation. Under normal operation, the screen is:

(No LEDs Illuminated)

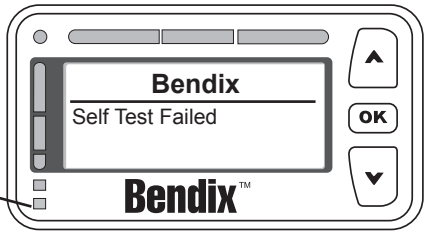



If the Bendix® Wingman® Fusion™ system goes into the self-test mode, the DIU may briefly display the "Bendix Self-Test" screen. Also, the audible distance alerts will activate, followed by a screen indicating that the self-test has run. *Below left* is the screen that will be briefly displayed if the 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. *See the "Power-Up Self-Test" in this Service Data Sheet Section 3.1: 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)
- US/Metric
- Brightness
- System Status
- Diag. Display (Diagnostic Display)
- Demo (Demonstration. NOTE: Demo is available only when vehicle is not moving)

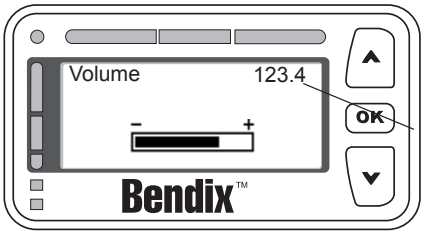
The desired menu item is highlighted using the up ( ▲ ) or down ( ▼ ) arrow buttons and selected with the "OK" button. The following sections describe each menu item.

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.*

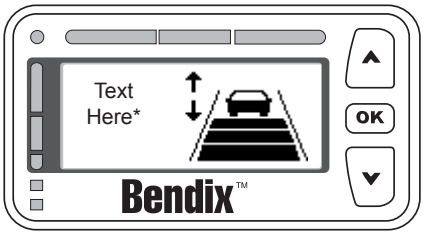
## E1.4 Distance Setting (Dist. Setting)

On systems where changes are permitted, the "Distance Setting" option from the main menu will adjust the following distance that the Bendix® Wingman® Fusion™ 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 driver in Bendix® ACom® Diagnostic Software (version 6.9 or higher). Generally, 4 relates to the farthest distance setting available and 1 relates to the closest distance setting available. In many of the Fusion system configurations available in ACom, two or more distance settings may be made equivalent to one another.

For more information on user configurations available through the Bendix ACom Diagnostic Software, *see Section 5.4: Configuring Bendix Wingman Fusion System Following Distance Alerts* in this Service Data Sheet 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) *(See also 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.

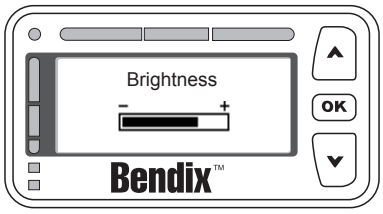
## E1.6 US/Metric

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.

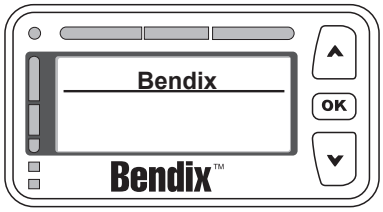
The light sensor reading determines whether the current cab lighting mode is bright (day) or dark (night). When the light mode is bright, any brightness adjustment made by the driver is applied to only the bright mode setting. Likewise, when the light radar sensor sets the light mode to dark, any brightness 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.* ***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.

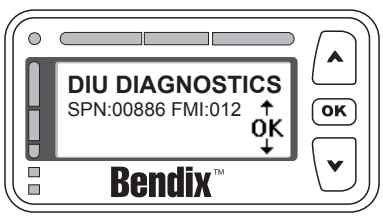
(No LEDs Illuminated)




## 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 FDAs to the driver. This system can be configured through Bendix® ACom® Diagnostic Software (version 6.9 or higher), for use by a fleet as a driver training tool with or without coordinating the data made available by Bendix Wingman Fusion 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 Diagnostic Software, in order to change the configuration. The volume can not be turned all the way down, but other adjustments may be made by the fleet. *See Section B1.3* 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, *see Section B4.0: 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, *see Section B5.0: Stationary Object Alert.*

*See Section 5.4: Configuring Bendix Wingman Fusion system Following Distance Alerts.*

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.**

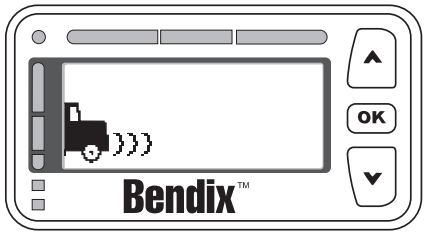
## Appendix E

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

### E3.1 Object Detected

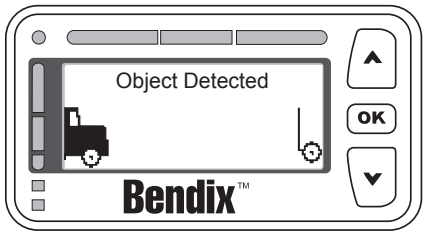
When there is no valid object detected and no other high priority alert is displayed, the DIU will stand by with the following screen:

(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)

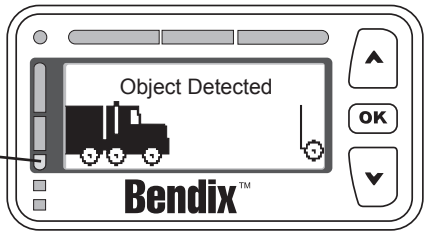



### E3.2 Following Distance Alert (FDA) Level 3 *(Slow audible two-tone alert/single LED illuminated)*

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.

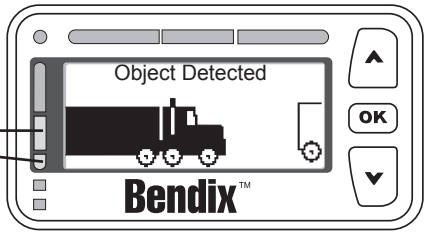
Single Yellow LED Illuminated




### 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

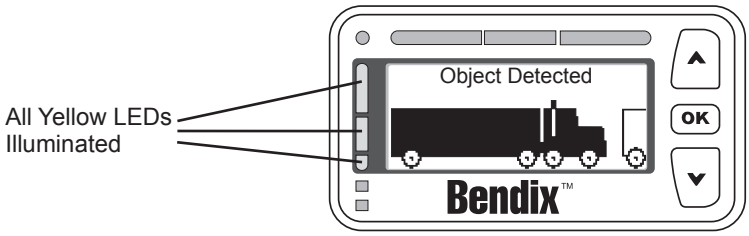



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

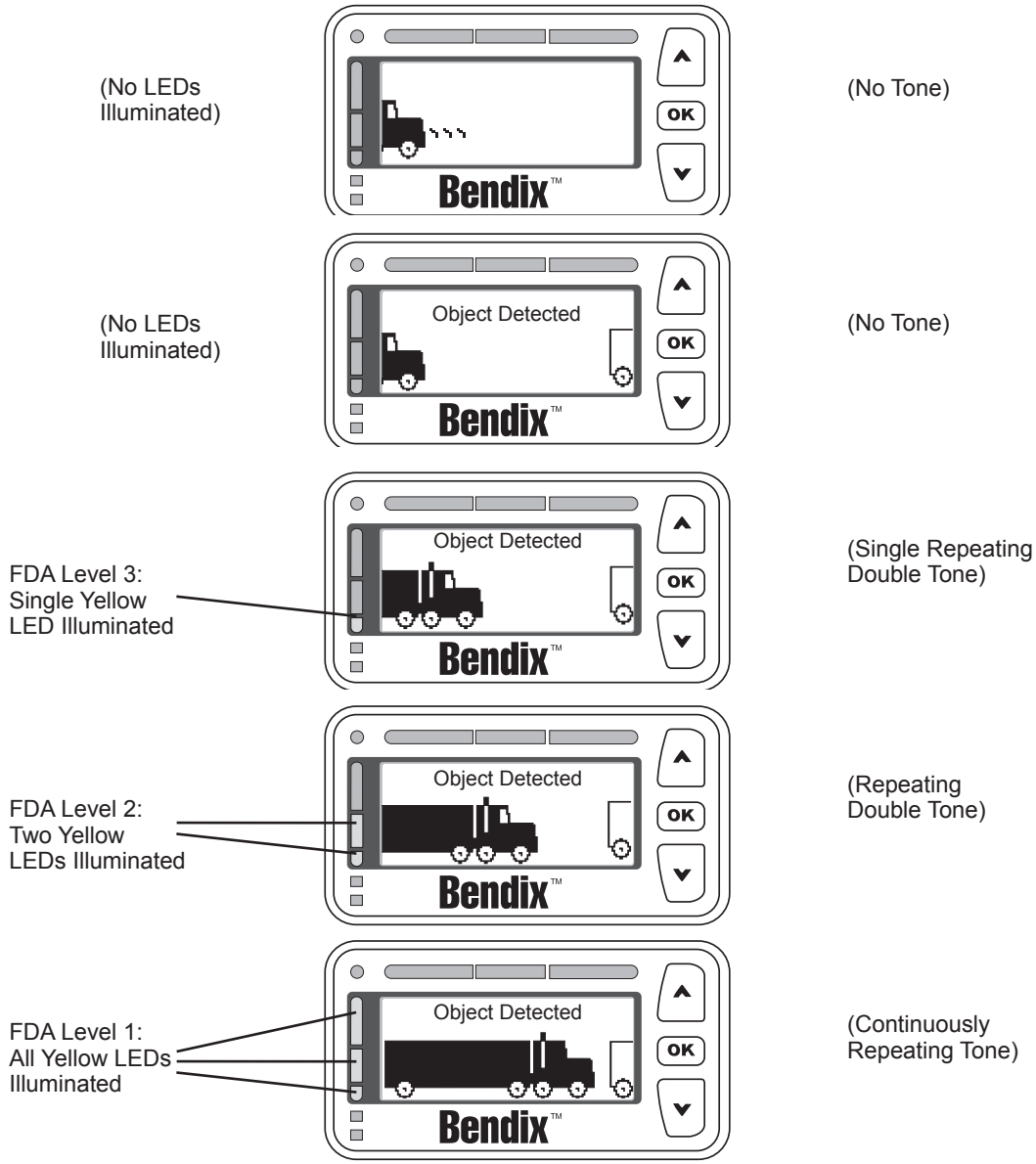
## E3.4 Following Distance Alert (FDA) Level 1 *(Fast audible two-tone alert/three yellow LEDs illuminated)*

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:



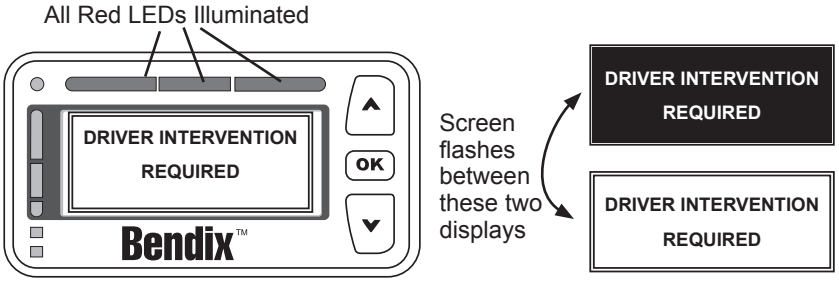

**All five states of the FDA system can be seen together below.**




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

## 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:



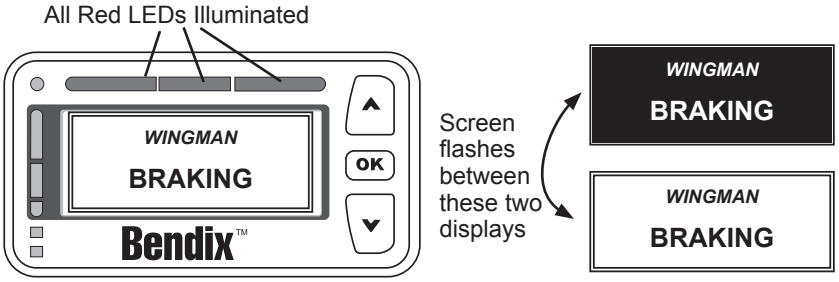

**When the IA activates, the driver must immediately act to potentially avoid, or lessen the severity of, a collision.**

The impact alert can not 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.

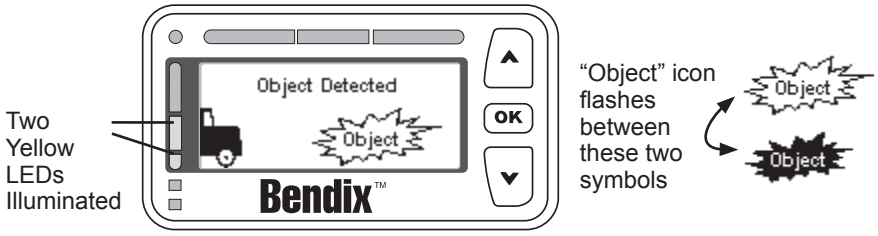
## Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

### 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

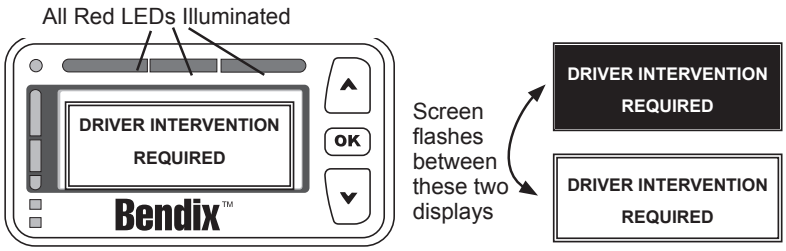
**⚠ WARNING**

**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. Without the automatic alert and braking, it may be too late to avoid impact.**

**⚠ 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.

## Appendix E

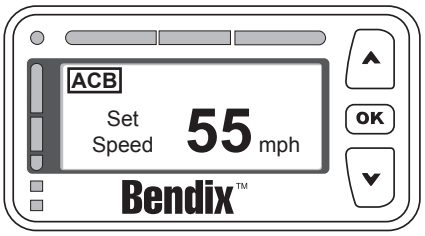
## Bendix™ Driver Interface Unit (DIU™): Displays & Alerts

### 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.

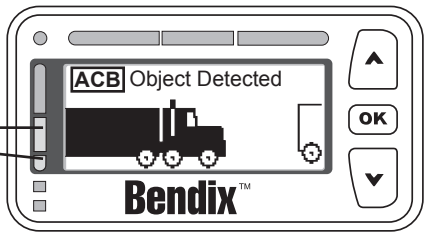
Once the driver sets cruise, the DIU will display the set speed and the ACB icon as shown below.

(No LEDs Illuminated)




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.

Two Yellow LEDs Illuminated




*NOTE: 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.

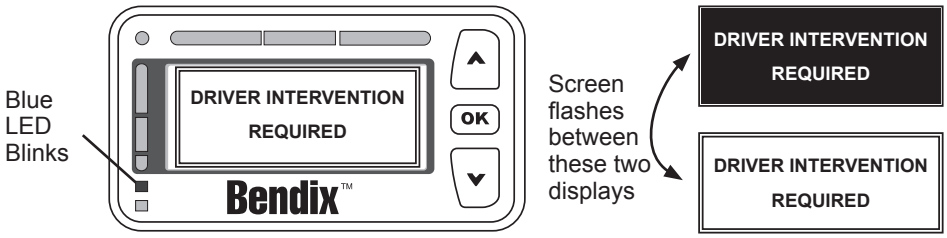
## Appendix E

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

**⚠ CAUTION**

**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.
- 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).**
- **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.**

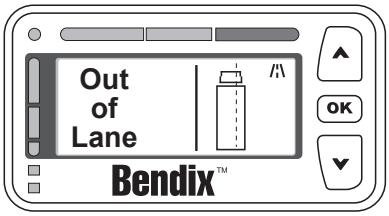
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

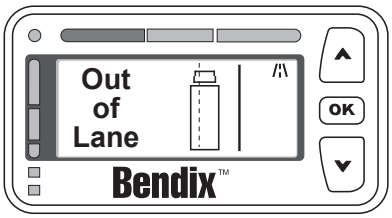
## E9.0 Lane Departure Warning (LDW) Alert

**⚠ 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 / 60 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



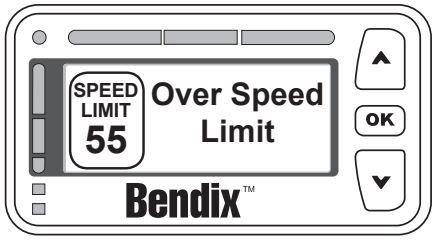




## E10.0 Overspeed Alert (OA)

**⚠ 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*



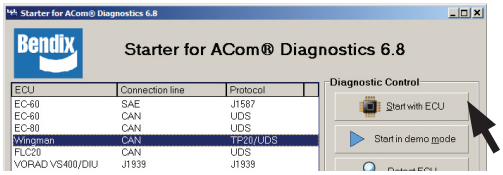
# APPENDIX F - HOW TO GENERATE, READ, AND RESET THE BENDIX® WINGMAN® SYSTEM DIAGNOSTIC TROUBLE CODES (DTCs) USING BENDIX® ACOM® DIAGNOSTIC SOFTWARE

## Appendix F

### F1: How to Generate a DTC Report with Bendix ACom Diagnostic Software

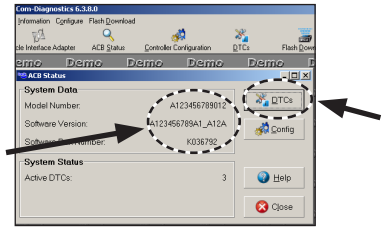
1. Select the Bendix® ACom® Diagnostic Software desktop icon.


2. Select “Wingman” from the starter screen. Click “Start with ECU”.



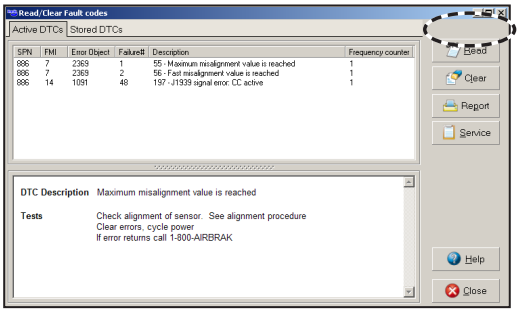

3. Read Bendix® Wingman® Fusion™ system status screen.

A. Take Note of: Model #, Software Version, Software P/N, Active DTCs

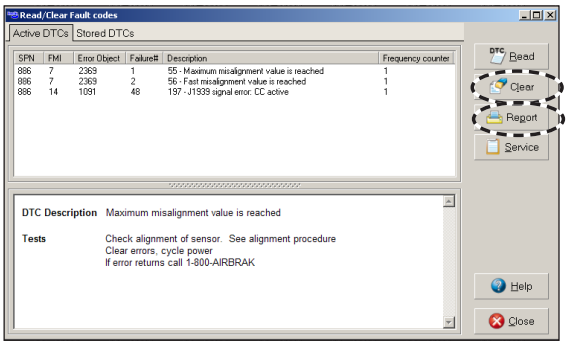



B. Click DTCs

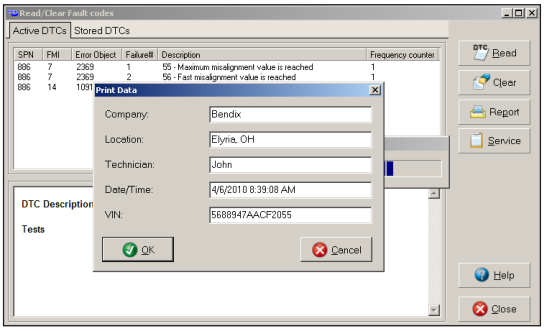
4. Select "Read". Active DTCs are shown along with descriptions of the codes and tests that can be run to troubleshoot the code. “Stored DTCs” can be selected to show inactive DTCs.



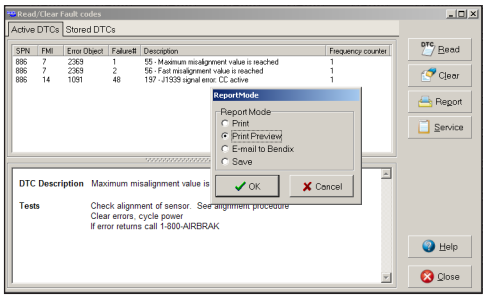

5. Click “Clear” to clear all active DTCs. Click “Report” to get the ACom report.



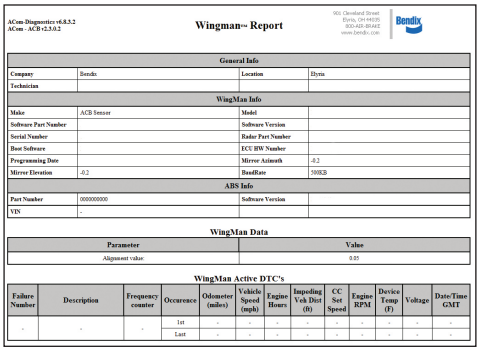

6. Fill in the requested information: Company, location, technician, date/time, VIN, and click “OK”.




7. Select how the report should be displayed or printed. Then click “OK”.




8. The event report is generated. This can be saved if desired.




9. The shortcut menu at the top of the screen can be used to select: Fusion status; DTCs; and Controller Configuration.

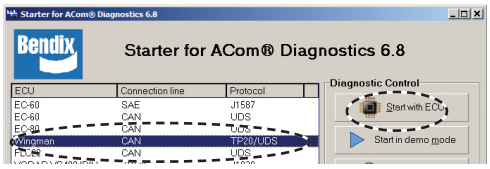
Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

# Appendix F

## F2: Reading Bendix® Wingman® Fusion™ System Diagnostic Trouble Code (DTC) Reports with Bendix® ACom® Diagnostic Software

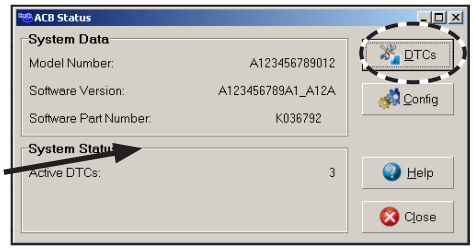
1. Select the Bendix® ACom® Diagnostic Software desktop icon.


2. Select “Wingman” from the starter screen. Click “Start with ECU”.

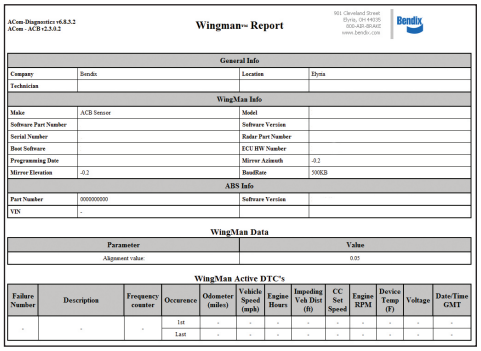



3. Select “DTC”.

For reference




4. Select "Read". Active DTCs are shown along with descriptions of the codes and tests that can be run to troubleshoot the code. “Stored DTCs” can be selected to show inactive DTCs.



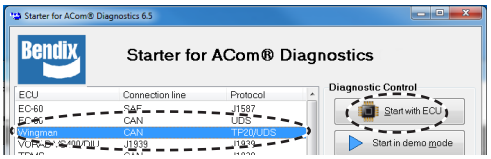

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

# Appendix F

## F3: Clearing Bendix® Wingman® Fusion™ System Diagnostic Trouble Codes (DTCs) with Bendix® ACom® Diagnostic Software

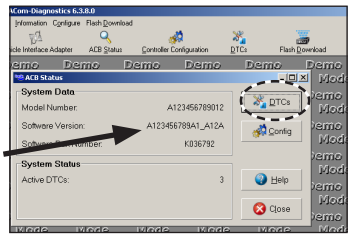
1. Select the Bendix® ACom® Diagnostic Software desktop icon.


2. Select “Wingman” from the starter screen. Click “Start with ECU”.

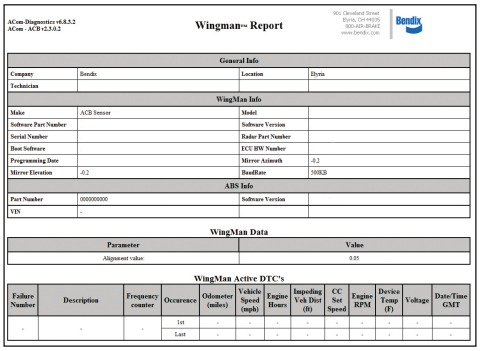



3. Select “DTC”.

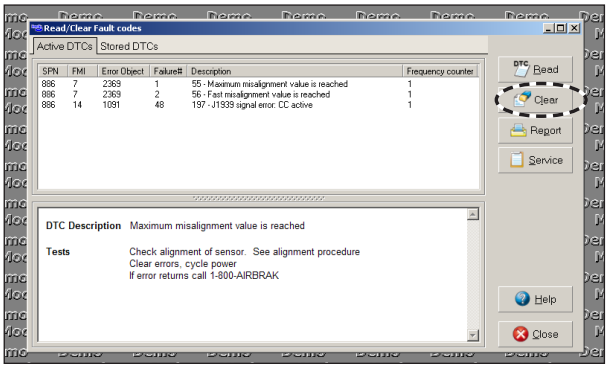
For reference




4. Select "Read". Active DTCs are shown along with descriptions of the codes and tests that can be run to troubleshoot the code. “Stored DTCs” can be selected to show inactive DTCs.




5. Select “Clear” to clear all active DTCs.




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

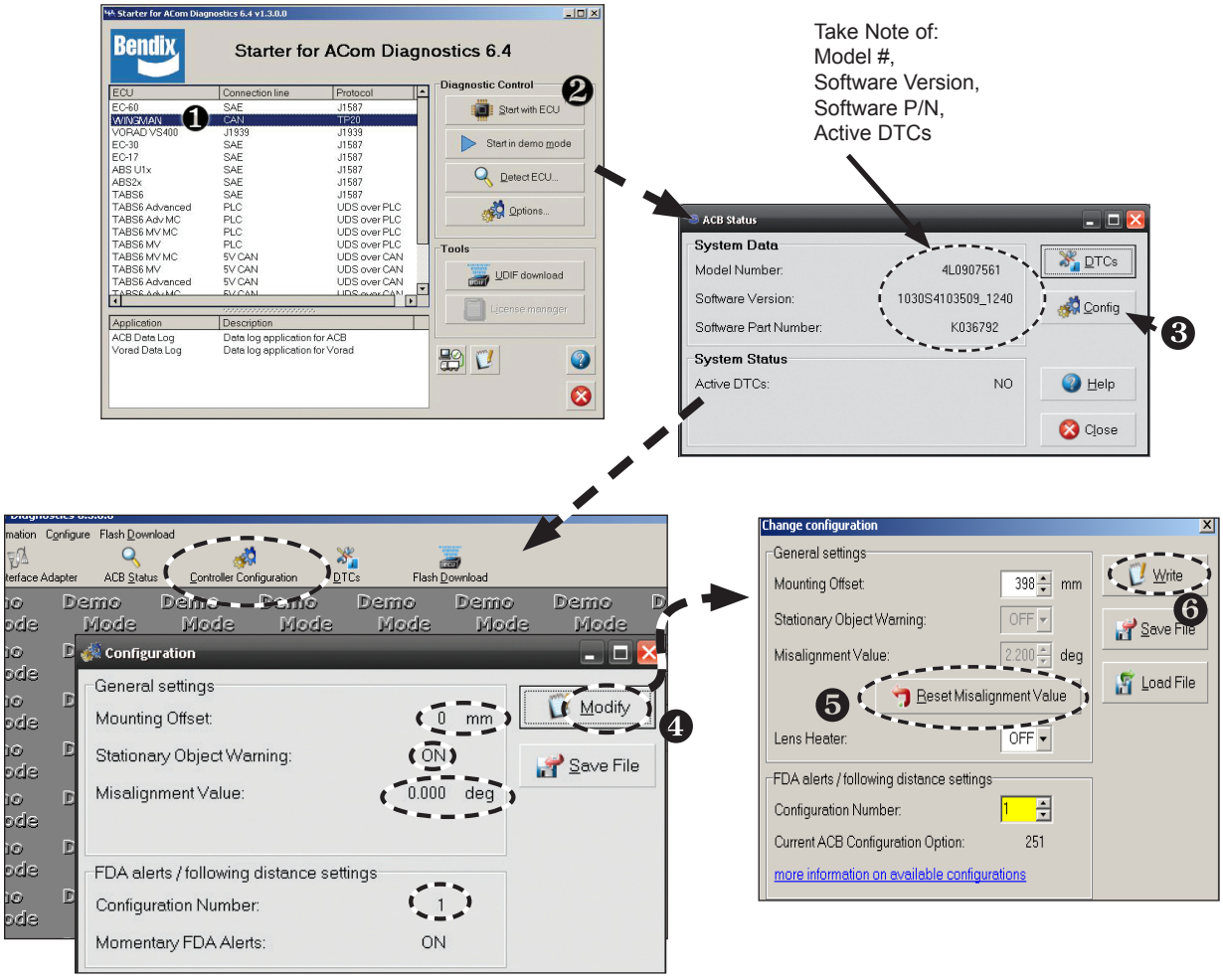
# APPENDIX G - HOW TO READ KEY SYSTEM INDICATORS AND RESET ALIGNMENT VALUES

## Appendix G

### How to Read Key System Indicators and Reset the Alignment Value

## Read System Key Indicators (Configuration)

1. Start the Bendix® ACom® Diagnostic Software and connect the computer to the vehicle.
2. Select “Advanced” and Click “Start with ECU” to display the “Fusion Status” window.
3. Click “Config” to display the indicators.




### System Key Indicators

| Attribute | Description | | | | | See Section: |
|---|---|---|---|---|---|---|
| **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® Fusion™ system versions since 2010. | | | | | 1.8 |
| **Alignment Value** | Trouble code will be set if value is -1.3º or less | Abnormal operation: -0.8º | Normal operation: normal | Abnormal operation: 0.8º | Trouble code will be set if value is 1.3º or more | *(Appendix B, Sections B2 & B3)* |
| **Configuration Number** | This indicates the distance setting and following distance alert that are configured for the vehicle. *Refer to Table 7 for setting information*. | | | | | *Appendix J* |

## How To Reset The “Alignment Value”

4. From the configuration window shown above, click “Modify.”
5. From the Change Configuration window, select “Reset Alignment Value.”
6. Click “Write.”
7. 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

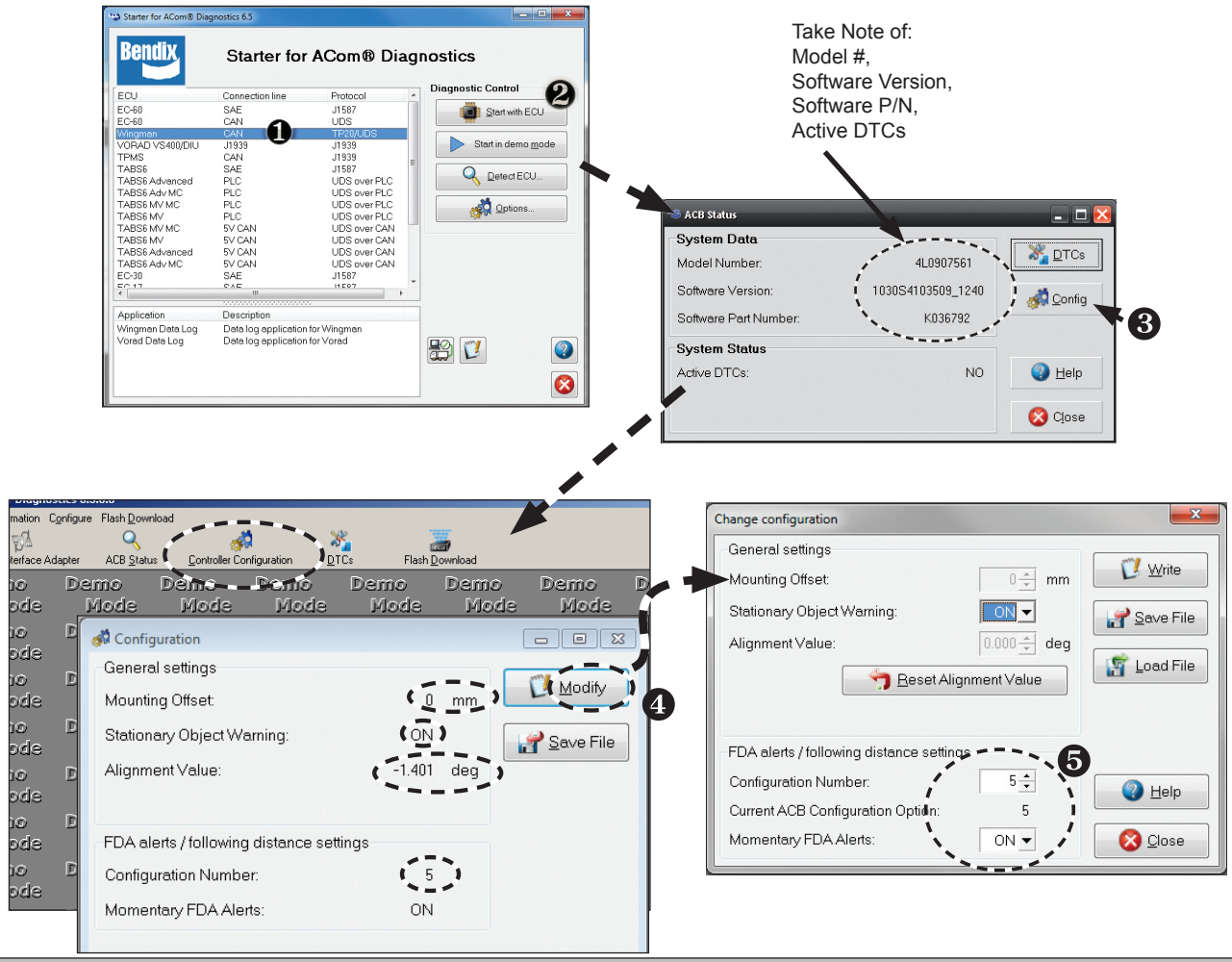
**Steps to Display the Indicators**

1. Start Bendix® ACom® Diagnostic Software and connect to vehicle.
2. Select “Advanced” and Click “Start with ECU” to display the “Fusion Status” window.
3. Select “Config” to display the indicators.

**Steps to CHANGE the indicators**

**Important: The correct Bendix ACom Diagnostic Software license key is required to complete this action. If the license key is not available, a key can be requested from the Bendix Tech Team by calling 1-800-AIR-BRAKE (1-800-247-2725), option 2.**

4. Select “Modify”.
5. Modify the configuration number to change the FDA settings and also enable or disable momentary FDAs as needed.

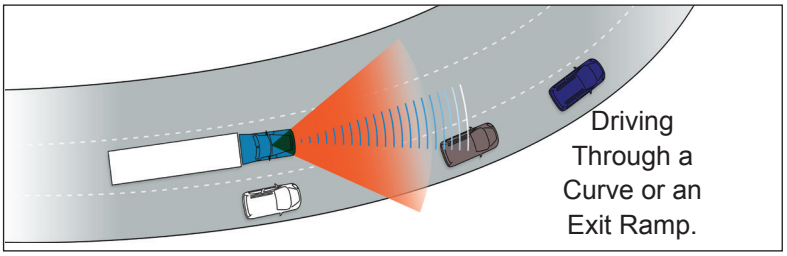


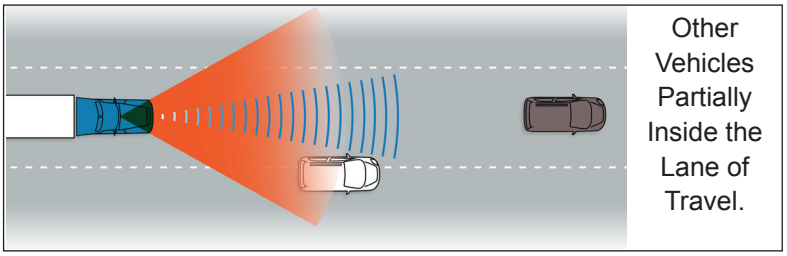

Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2 for troubleshooting assistance.

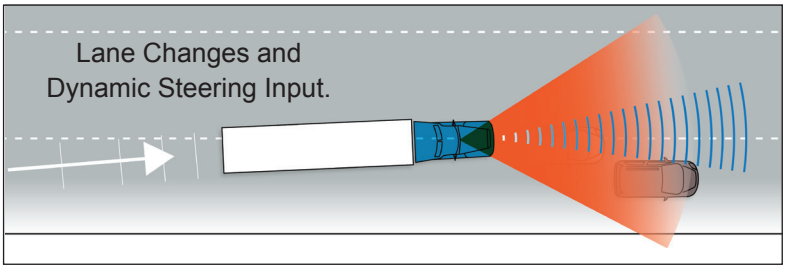
# APPENDIX J - SITUATIONS THAT MAY CAUSE FALSE ALERTS BY THE BENDIX® WINGMAN® FUSION™ SYSTEM

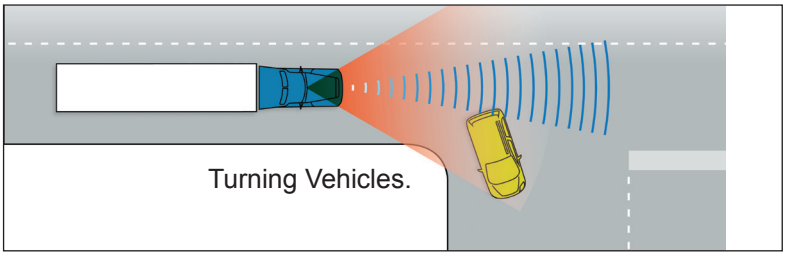
## Appendix J

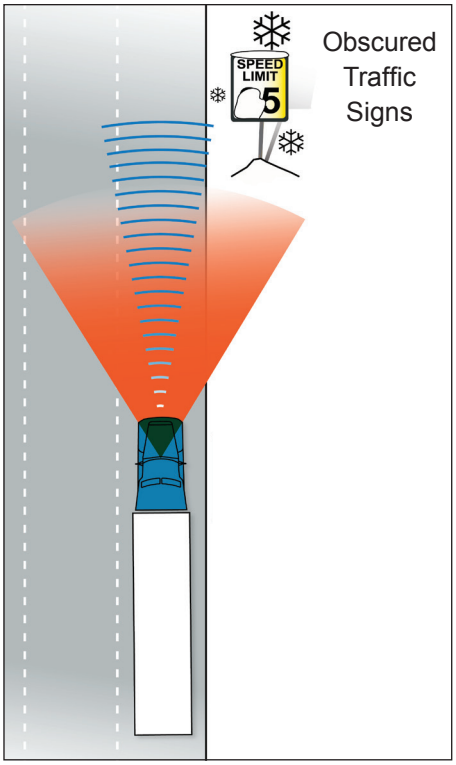
**The following charts illustrate situations that may cause false alerts. The Bendix® Wingman® Fusion™ system may unexpectedly issue warnings, apply braking, or not respond.**

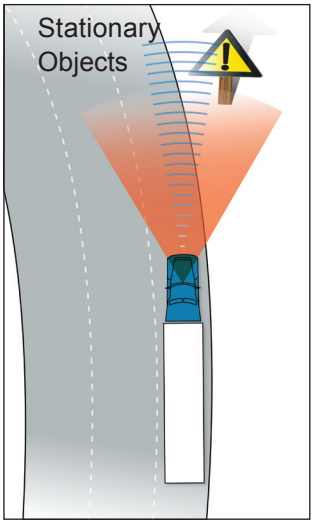



Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725) option 2, for troubleshooting assistance.

# 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.**

**⚠ CAUTION**

**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-20™ radar is located at the front of the vehicle – either on the bumper or just behind it on a cross-member. *See Figure K1*.

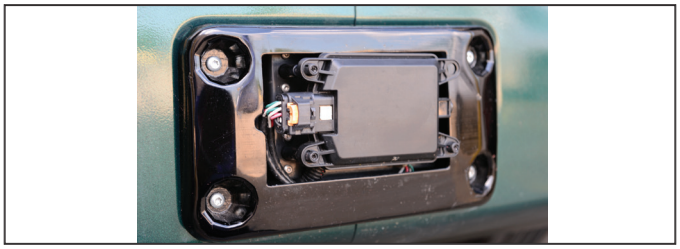


***Figure K1 – Component: Radar Sensor***

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*.

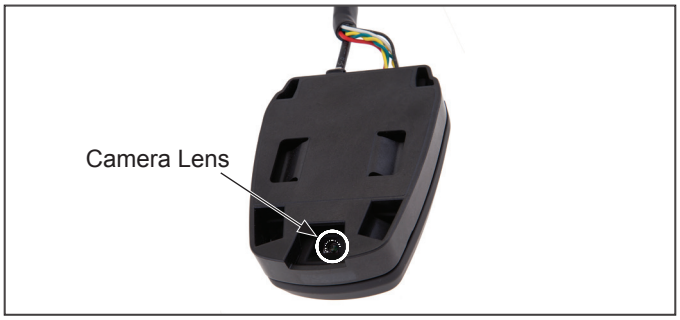



***Figure K2 – Component: Camera***

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, see Appendix B*.

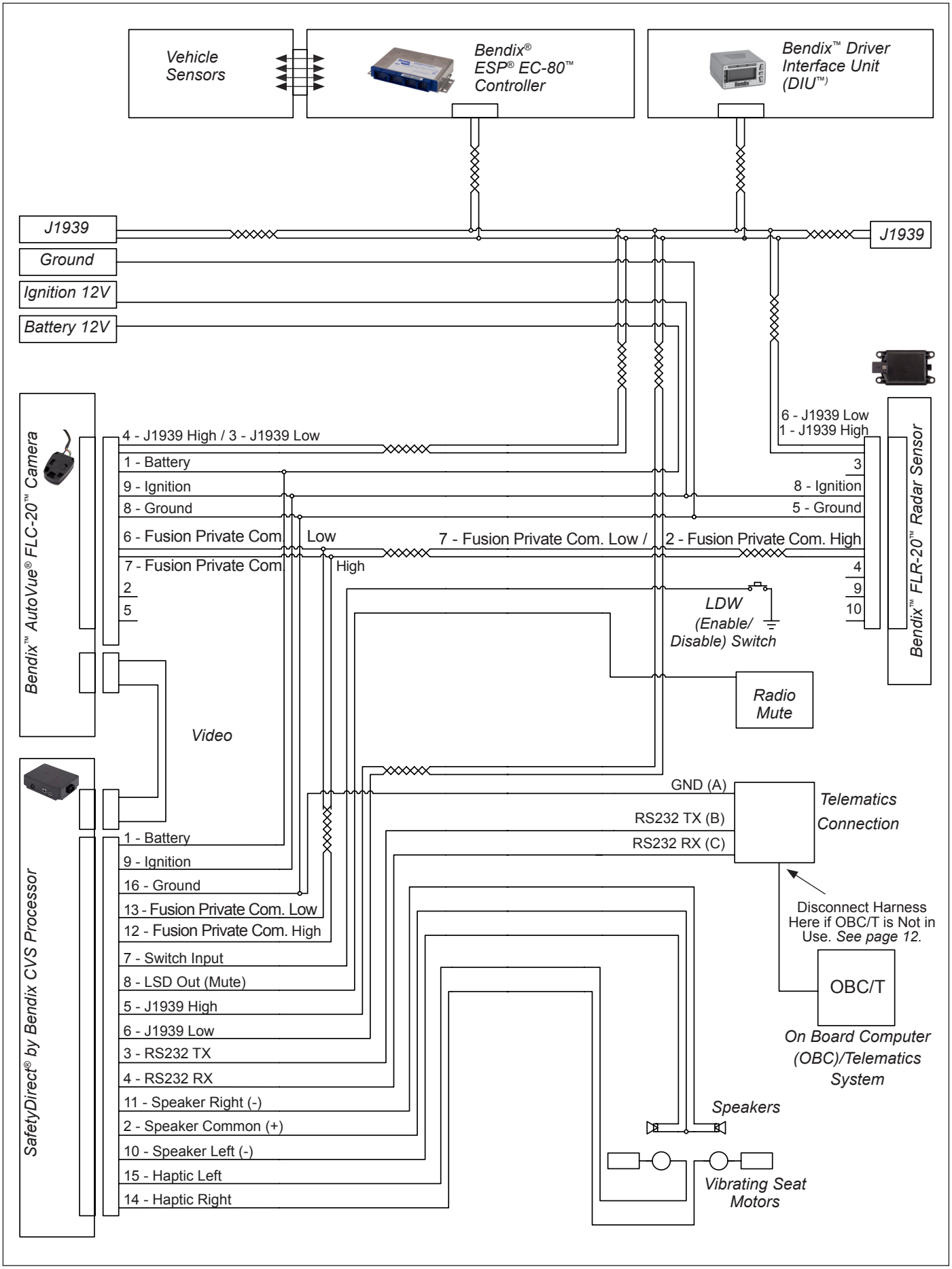



***Figure K6 – Main Bendix® Wingman® Fusion™ System Component Schematic***

*Also see 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.

*See 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.

*IMPORTANT NOTE: Cruise control will automatically cancel whenever the Bendix Wingman Fusion system applies the foundation brakes.*

## 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.<br>**⚠ WARNING**<br>**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.<br>***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**<br>**The driver must immediately act to potentially avoid, or lessen the severity of, a collision.**<br>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 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.<br>**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.<br>**The driver must respond as needed.**<br>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.<br>**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.<br>**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 / 60 kph, the vehicle crosses a lane-marker (without the corresponding turn signal activated). | None. | None.<br>**The driver must respond as needed.** |
| Traveling above 37 mph / 60 kph, the vehicle crosses a lane-marker (without the corresponding turn signal activated). | A "rumble strip" audible/ vibration/visual alert is initiated. | None.<br>**The driver must respond as needed.**<br>(The driver must use the turn signal when changing lanes and/or keep the vehicle within the lane markings.) |
| ***Overspeed Alert & Action (OAA)***<br>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 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. |
| 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.**<br>If the system intervenes, the vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order.<br>***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.**<br>If the system intervenes, the vehicle throttle will be reduced; the engine retarder engaged; and the foundation brakes applied, in that order.<br>***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. |
| ***Downhill grades*** | | |
| Going down a grade with a detected forward vehicle.<br>Cruise control should ***NOT*** be used on downhill grades - *see page 78.* | DO NOT USE cruise control on downhill grades. | *DO NOT USE cruise control on downhill grades.* |
| *(See the CDL manual instructions on proper gear usage for 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.

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.*

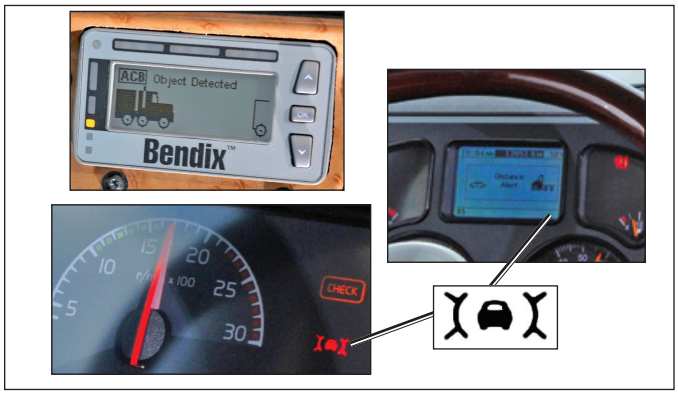



***Figure K10 - Forward Vehicle Detected Icons***

## 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, see the vehicle manual to find the method used to show the system status.

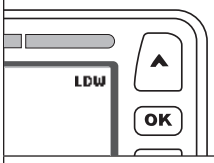
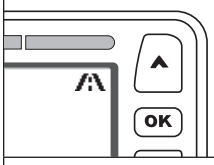
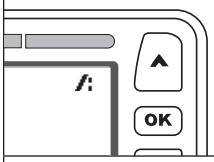
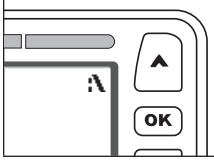
| During Start-Up – System Busy | |
|---|---|
|  | The first symbol shows when the LDW system is initializing. |
| **Normal Operation** | |
|  | The LDW system is actively seeking lane-markings. |
|  | This symbol appears when the LDW system is actively tracking lane-markings on both sides of the current lane. |
|  | This symbol indicates that the system is currently tracking lane-markings on the left only. |
|  | This symbol indicates that the system is currently tracking lane-markings on the right only. |

***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 (*see 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.*

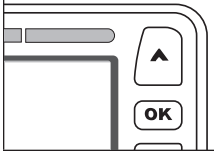
| DTC Set | |
|---|---|
|  | If no LDW status symbol is shown – and the driver has not applied the LDW disable switch – this indicates that the system has detected a DTC. |

***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.

*See 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 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***

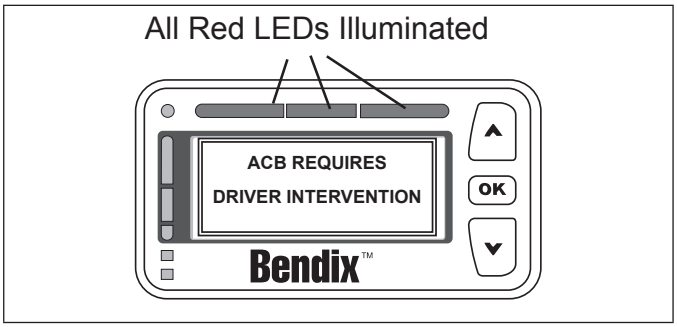



***Figure K14 – Impact Alert Text and Light Pattern as Seen on the Bendix DIU***

## FOLLOWING DISTANCE ALERT (FDA)

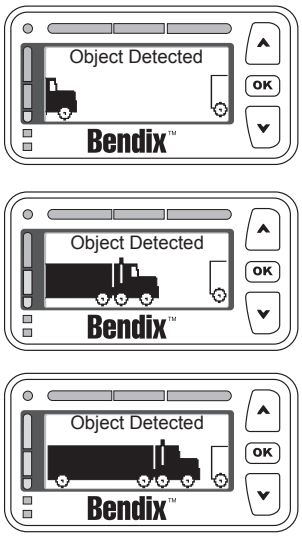
**WARNING**

**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.**

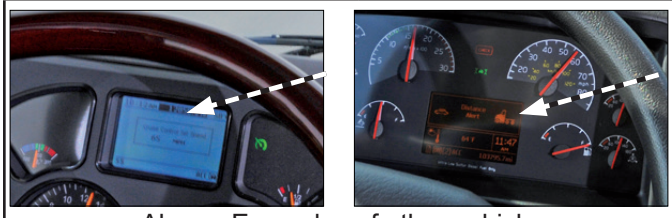
**The FDA is ready to alert the driver whenever the vehicle is moving above 5 mph / 8 kph.**

**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.*

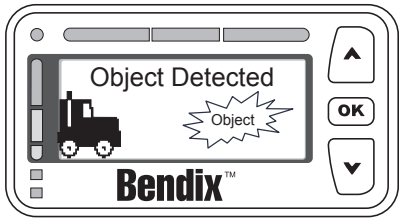



***Figure K16 – Stationary Object Alert Displayed***

## 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. Without the automatic alert and braking, it may be too late to avoid impact.**

**⚠ 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.*

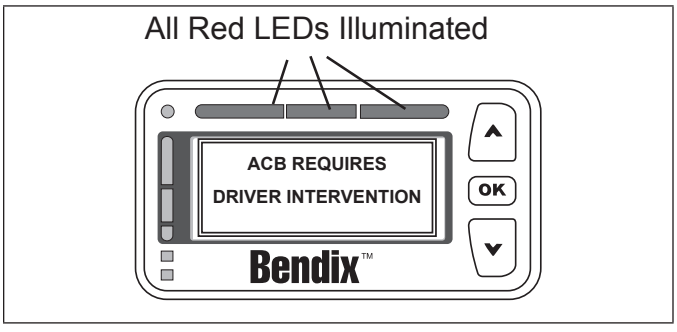



***Figure K17 – Stationary Vehicle Braking (SVB) Alert Displayed***

## 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. 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.** *(See 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

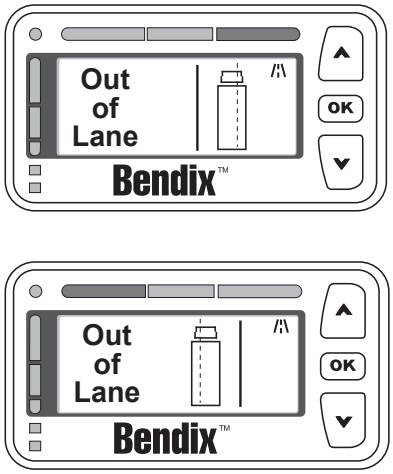



*Figure K19 – Lane Departure Warning*

## 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 US/Metric selection has been made.**

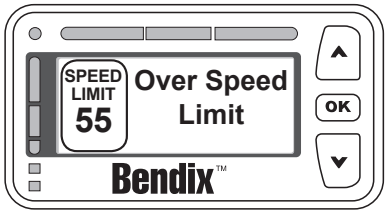



*Figure K20 – Over Speed Limit Warning*

## 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 can not 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. *(See also 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 potentially not be able to be recognized – or be recognized incorrectly – by the system.

# APPENDIX L - MAINTENANCE SECTION

## L1.1 GENERAL SAFETY GUIDELINES

*See 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 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 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 | R |
| | 19 | J1939 signal: Error in CCVS1 parking brake switch | P |
| 84 | 2 | J1939 signal: Invalid CCVS2 wheel speed | N |
| | 9 | J1939 signal: Not available CCVS1 wheel speed | R |
| | 19 | J1939 signal: Error in CCVS1 wheel speed | P |
| 86 | 2 | J1939 signal: Invalid CCVS1 CC speed | N |
| | 9 | J1939 signal: Not available CCVS1 CC speed | R |
| | 19 | J1939 signal: Error in CCVS1 CC speed | P |
| 91 | 2 | J1939 signal: Invalid EEC2 accelerator pedal position | N |
| | 9 | J1939 signal: Not available EEC2 accelerator pedal position | R |
| | 14 | J1939 signal: Missing EEC2 message | F |
| | 19 | J1939 signal: Error in EEC2 accelerator pedal position | P |
| 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 | R |
| | 14 | J1939 signal: Missing EC1 message | F |
| | 19 | J1939 signal: Error in EC1 engine speed at idle point 1 | P |
| 190 | 2 | J1939 signal: Invalid EEC1 engine speed | N |
| | 9 | J1939 signal: Not available EEC1 engine speed | R |
| | 14 | J1939 signal: Missing EEC1 message | F |
| | 19 | J1939 signal: Error in EEC1 engine speed | P |
| 512 | 2 | J1939 signal: Invalid EEC1 Driver Torque | N |
| | 9 | J1939 Signal: Not available EEC1 driver torque | R |
| | 19 | J1939 signal: Error in EEC1 driver torque | P |
| 513 | 2 | J1939 signal: Invalid EEC1 actual torque | N |
| | 9 | J1939 signal: Not available EEC1 actual torque | R |
| | 13 | System detected engine not properly responding to control messages | FF |
| | 19 | J1939 signal: Error in EEC1 actual torque | P |
| 514 | 2 | J1939 signal: Invalid EEC3 nominal friction percent torque | N |
| | 9 | J1939 signal: Not available EEC3 nominal friction percent torque | R |
| | 14 | J1939 signal: Missing EEC3 message | F |
| | 19 | J1939 signal: Error in EEC3 nominal friction percent torque | P |
| 518 | 2 | J1939 signal: Invalid TSC1 requested torque Limit | N |
| | 9 | J1939 signal: Not available TSC1 requested torque Limit | R |
| | 19 | J1939 signal: Error in TSC1 requested torque Limit | P |
| 520 | 9 | J1939 signal: Missing ERC1_DR message | F |
| | 14 | J1939 signal: Missing ERC1_XR message | F |

*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***

| 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 | R |
| | 19 | J1939 signal: Error in EBC1 brake pedal position | P |
| 523 | 2 | J1939 signal: Invalid ETC2 transmission current gear | N |
| | 9 | J1939 signal: Not available ETC2 transmission current gear | R |
| | 19 | J1939 signal: Error in ETC2 transmission current gear | P |
| 524 | 2 | J1939 signal: Invalid ETC2 transmission selected gear | N |
| | 9 | J1939 signal: Not available ETC2 transmission selected gear | R |
| | 14 | J1939 signal: Missing ETC2 message | F |
| | 19 | J1939 signal: Error in ETC2 transmission selected gear | P |
| 525 | 9 | J1939 signal: Not available TC1 transmission requested gear | R |
| | 14 | J1939 signal: Missing TC1 message | F |
| | 19 | J1939 signal: Error in TC1 transmission requested gear | P |
| 526 | 2 | J1939 signal: Invalid ETC2 transmission actual gear ratio | N |
| | 9 | J1939 signal: Not available ETC2 transmission actual gear ratio | R |
| | 19 | J1939 signal: Error in ETC2 transmission actual gear ratio | P |
| 527 | 14 | J1939 signal: Missing CCVS1 message | E |
| 544 | 2 | J1939 signal: Invalid EC1 engine reference torque | N |
| | 9 | J1939 signal: Not available EC1 engine reference torque | R |
| | 19 | J1939 signal: Error in EC1 engine reference torque | P |
| 556 | 2 | J1939: Retarder Controller Signal Invalid - RC Reference Torque | Z |
| | 9 | J1939: Retarder Controller Signal Not Available - Retarder RC Reference Torque | AA |
| | 19 | J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque | AA |
| 560 | 9 | J1939 signal: Not available ETC1 transmission driveline engaged | R |
| | 14 | J1939 signal: Missing ETC1 message | F |
| | 19 | J1939 signal: Error in ETC1 transmission driveline engaged | P |
| 561 | 9 | J1939 signal: Not available EBC1 ASR engine control active | R |
| | 19 | J1939 signal: Error in EBC1 ASR engine control active | P |
| 562 | 2 | J1939 signal: Error in EBC1 ASR brake control active | P |
| | 19 | J1939 signal: Not available EBC1 ASR brake control active | R |
| 563 | 9 | J1939 signal: Not available EBC1 ABS active | R |
| | 19 | J1939 signal: Error in EBC1 anti-lock braking active | P |
| 595 | 9 | J1939 signal: Not available CCVS1 CC active | R |
| | 19 | J1939 signal: Error CCVS1 CC active | P |
| 596 | 9 | J1939 signal: Not available CCVS1 CC enable | R |
| | 19 | J1939 signal: Error in CCVS1 CC enable | P |
| 597 | 9 | J1939 signal: Not available CCVS1 brake switch | R |
| | 19 | J1939 signal: Error in CCVS1 brake switch | P |

*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 | R |
| | 19 | J1939 signal: Error in CCVS1 cruise control set switch | P |
| 600 | 9 | J1939 signal: Not available CCVS1 coast switch | R |
| | 19 | J1939 signal: Error in CCVS1 cruise control coast switch | P |
| 601 | 9 | J1939 signal: Not available CCVS1 resume switch | R |
| | 19 | J1939 signal: Error in CCVS1 cruise control resume switch | P |
| 602 | 9 | J1939 signal: Not available CCVS1 accelerate switch | R |
| | 19 | J1939 signal: Error in CCVS1 cruise control accelerate switch | P |
| 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 | |
| | 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 | F |
| 705 | 9 | J1939 signal: Not available AUXIO trailer connected | R |
| | 19 | J1939 signal: Error in AUXIO1 trailer connected | P |
| 706 | 9 | J1939 signal: Not available AUXIO trailer ABS detect | R |
| | 19 | J1939 signal: Error in AUXIO1 trailer ABS detected | P |
| 707 | 2 | J1939 signal: AUXIO trailer ABS not fully operational | V |
| | 9 | J1939 signal: Not available AUXIO trailer ABS operational | R |
| | 19 | J1939 signal: Error in AUXIO1 trailer ABS operational | P |
| 767 | 9 | J1939 signal: Not available ETC5 reverse switch | R |
| | 14 | J1939 signal: Missing ETC5 message | F |
| | 19 | J1939 signal: Error in ETC5 reverse switch | P |
| *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** | |
| 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 | AA |
| | 14 | J1939: Retarder Controller Signal Timeout - Driveline RC Message | AA |
| 904 | 2 | J1939 signal: Invalid EBC2 front axle | N |
| | 9 | J1939 signal: Not available EBC2 front axle | R |
| | 14 | J1939 signal: Missing EBC2 message | F |
| | 19 | J1939 signal: Error in EBC2 front axle | P |
| 905 | 2 | J1939 signal: Invalid EBC2 LF wheel | N |
| | 9 | J1939 signal: Not available EBC2 LF wheel | R |
| | 19 | J1939 signal: Error in EBC2 LF wheel | P |
| 906 | 2 | J1939 signal: Invalid EBC2 RF wheel | N |
| | 9 | J1939 signal: Not available EBC2 RF wheel | R |
| | 19 | J1939 signal: Error in EBC2 RF wheel | P |
| 907 | 2 | J1939 signal: Invalid EBC2 LR1 wheel | N |
| | 9 | J1939 signal: Not available EBC2 LR1 wheel | R |
| | 19 | J1939 signal: Error in EBC2 LR1 wheel | P |
| 908 | 2 | J1939 signal: Invalid EBC2 RR1 wheel | N |
| | 9 | J1939 signal: Not available EBC2 RR1 wheel | R |
| | 19 | J1939 signal: Error in EBC2 RR1 wheel | P |
| 1069 | 13 | ABS tire size needs recalibration | W |
| 1091 | 14 | J1939 signal: Missing EBC3 message | F |
| 1196 | 19 | XBR is locked-out | S |
| 1121 | 9 | J1939 signal: Not available EBC1 brake switch | R |
| | 19 | J1939 signal: Error in EBC1 brake switch | P |
| 1214 | 14 | J1939 signal: Missing DM1 message | F |
| *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** | |
| 1243 | 2 | J1939 signal: EBC1 ABS not fully operational | U |
| | 9 | J1939 signal: Not available EBC1 ABS operate | R |
| | 14 | J1939 signal: Missing EBC1 message | F |
| | 19 | J1939 signal: Error in EBC1 ABS fully operational | P |
| 1481 | 2 | J1939 signal: Error in EBC1 source address of controlling device | P |
| | 19 | J1939 signal: Not available EBC1 source address of controlling device | R |
| 1633 | 9 | J1939 signal: Not available CCVS1 pause switch | R |
| | 19 | J1939 signal: Error in CCVS1 cruise control pause switch | P |
| 1705 | 14 | J1939 signal: Missing FLC message | F |
| 1717 | 2 | J1939: Engine Controller Signal Invalid - ERC1 Actual Engine Torque | Z |
| | 9 | J1939: Retarder Controller Signal Not Available - Retarder ERC1 Actual Max Torque | AA |
| | 19 | J1939: Retarder Controller Signal Error - ERC1 Actual Max Torque | AA |
| 1760 | 2 | J1939 signal: Invalid CVW GCVW | N |
| | 9 | J1939 signal: Not available CVW GCVW | R |
| | 14 | J1939 signal: Missing CVW message | F |
| | 19 | J1939 signal: Error in CVW gross combination vehicle weight | P |
| 1799 | 2 | J1939 signal: Invalid ACC2 requested ACC distance mode | N |
| | 9 | J1939 signal: Not available ACC2 distance mode | R |
| | 14 | Internal radar sensor error | D |
| | 19 | J1939 signal: Error in ACC2 requested ACC distance mode | P |
| 1807 | 2 | J1939 signal: Invalid VDC2 steer angle | N |
| | 9 | J1939 signal: Not available VDC2 steer angle | R |
| | 14 | J1939 signal: Missing VDC2 message | F |
| | 19 | J1939 signal: Error in VDC2 steer angle sensor | P |
| 1808 | 2 | J1939 signal: Invalid VDC2 yaw rate | N |
| | 9 | J1939 signal: Not available VDC2 yaw rate | R |
| | 19 | J1939 signal: Error in VDC2 yaw rate | P |
| 1814 | 2 | J1939 signal: VDC1 VDC not fully operational | V |
| | 9 | J1939 signal: Not available VDC1 VDC fully operational | R |
| | 14 | J1939 signal: Missing VDC1 message | E |
| | 19 | J1939 signal: Error in VDC1 VDC fully operational | P |
| 1816 | 9 | J1939 signal: Not available VDC1 ROP engine control | R |
| | 19 | J1939 signal: Error in VDC1 ROP engine control | P |
| 1817 | 9 | J1939 signal: Not available VDC1 YC engine control | R |
| | 19 | J1939 signal: Error in VDC1 YC engine control | P |
| 1818 | 9 | J1939 signal: Not available VDC1 ROP brake control | R |
| | 19 | J1939 signal: Error in VDC1 ROP brake control | P |
| *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 | R |
| | 19 | J1939 signal: Error in VDC1 YC brake control | P |
| 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 | R |
| | 14 | J1939 signal: Missing OEL message | F |
| | 19 | J1939 signal: Error in OEL turn signal | P |
| 2917 | 2 | J1939 signal: Invalid EBC5 XBR state | N |
| | 9 | J1939 signal: Not available EBC5 XBR state | R |
| | 19 | J1939 signal: Error in EBC5 XBR state | P |
| 2918 | 2 | J1939 signal: Invalid EBC5 XBR active control mode | N |
| | 9 | J1939 signal: Not available EBC5 XBR active control mode | R |
| | 19 | J1939 signal: Error in EBC5 XBR active control mode | P |
| 2919 | 9 | J1939 signal: Not available EBC5 brake use | R |
| | 14 | J1939 signal: Missing EBC5 message | F |
| | 19 | J1939 signal: Error in EBC5 brake use | P |
| 2920 | 0 | CMT braking overuse | M |
| 2921 | 2 | J1939 signal: Invalid EBC5 XBR limit | N |
| | 9 | J1939 signal: Not available EBC5 XBR limit | R |
| | 12 | Internal radar sensor error | A |
| | 19 | J1939 signal: Error in EBC5 XBR limit | P |
| 3839 | 0 | Active cruise control braking overuse | J |
| | 9 | J1939 signal: Not available EBC5 brake temp | R |
| | 19 | J1939 signal: Error in EBC5 brake temp | P |
| 5023 | 9 | J1939 signal: Not available ACC2 ACC usage | R |
| | 19 | J1939 signal: Error in ACC2 ACC usage demand | P |
| 5606 | 2 | J1939 signal: Error in ACC1 ACC mode | P |
| | 13 | J1939 signal: ACC1 or CCVS3: engine not properly configured for Bendix Wingman | K |
| | 19 | J1939 signal: Not available ACC1 ACC mode | R |
| 5676 | 14 | Internal radar sensor error | A |
| 5681 | 9 | J1939 signal: Not available AEBS2 driver activation | R |
| | 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 Multilane Automatic Emergency Braking | DD |
| 517003 | 14 | Radar mismatch with ABS configuration for Adaptive Cruise Control Type | BB |

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

**Reference Documents:**

- The Bendix™ AutoVue® FLC-20™ Camera (SD-64-20124)
- The Bendix® ESP® EC-80™ Controller (SD-13-4986)
- The SafetyDirect® by Bendix CVS Processor (SD-65-21025)



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