

## Bendix™ AutoVue® FLC-20™ Camera

### 1.0 DESCRIPTION

The Bendix™ AutoVue® FLC-20™ camera is a component used in many Bendix safety systems, including:

- The AutoVue® Lane Departure Warning (LDW) System by Bendix CVS; and
- The Bendix® Wingman® Fusion™ Active Safety System.

For more information about the Bendix Wingman Fusion System, refer to SD-61-4963, *Bendix® Wingman® Fusion™ FLR-21™ Radar Sensor*, on [b2bendix.com](http://b2bendix.com).

This document covers installation, troubleshooting, and replacement for this camera.

#### **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.

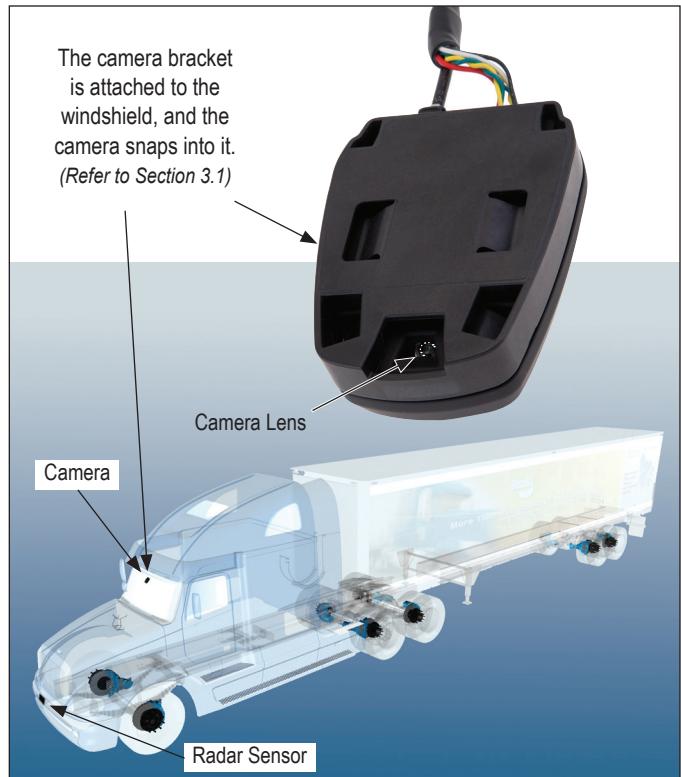


Figure 1 – Bendix™ AutoVue® FLC-20™ Camera

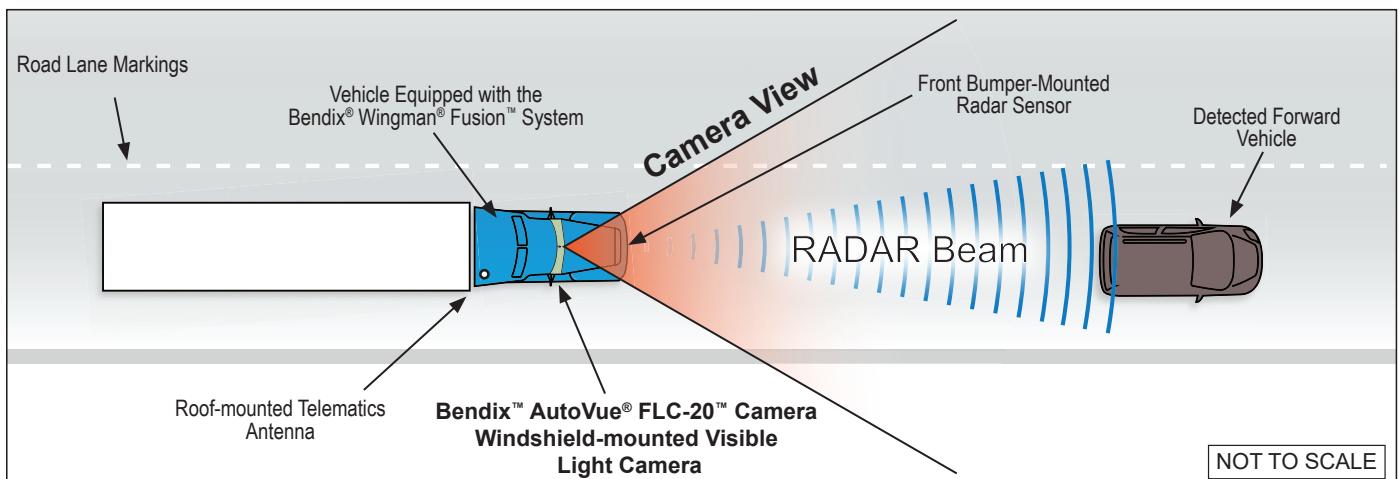


Figure 2 – Operational View

## 1.1 GENERAL SAFETY GUIDELINES

### ! WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS !

#### TO AVOID PERSONAL INJURY OR DEATH:

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

- ▲ Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear personal protection equipment.
- ▲ Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated, or electrically charged components.
- ▲ Do not attempt to install, remove, disassemble, or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
- ▲ If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, a Bendix® AD-9si®, AD-HF®, or AD-HFi™ air dryer, be sure to drain the purge reservoir.
- ▲ Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- ▲ Never exceed manufacturer's recommended pressures.
- ▲ You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.
- ▲ 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.

#### ! WARNING

Improper use and/or maintenance of the Bendix® Wingman® Fusion™ Active Safety 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.

#### ! IMPORTANT

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

## How to identify if the vehicle has the Bendix® Wingman® Fusion™ Active Safety System:



Look for the Bendix® brand logo on the camera label. (Refer to Section 3.1 for how to remove the camera from the bracket to view the label.)

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## 2.0 TROUBLESHOOTING

### 2.1 SAFETY GUIDELINES

Read and follow the General Safety Guidelines shown in this document.

#### **IMPORTANT**

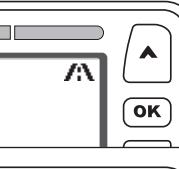
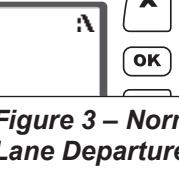
All vehicle Diagnostic Trouble Codes (DTCs) related to the engine, transmission, instrument cluster, engine cruise control, and Bendix® ABS, ATC, or ESP® systems must first be resolved, with no DTCs present during the vehicle operation while in cruise control, before trying to resolve camera DTCs.

#### **IMPORTANT**

If a problem with the Bendix™ AutoVue® FLC-20™ camera is detected, it should be serviced as soon as possible to restore full functionality.

### 2.2 BENDIX™ DRIVER INTERFACE UNIT (DIU™) LANE DEPARTURE WARNING SYSTEM ICONS

See *Figure 3* and *Figure 4*. 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 Lane Departure Warning (LDW) system is initializing.
Camera Impaired	
	If the system experiences problems detecting objects (for example, due to sun-glare, a dirty windshield, obstructions, etc.), a full DIU screen message will briefly be displayed.
Normal Operation	
	The screen will revert to displaying the icon shown, until the problem is resolved.
	The LDW system is actively seeking lane-markings.
	The LDW system is actively tracking lane-markings on both sides of the current lane.
	The system is actively tracking only lane-markings on the left.
	The system is actively tracking only lane-markings on the right.

**Figure 3 – Normal Bendix DIU Screens Showing Lane Departure Warning (LDW) System Status**

Diagnostic Trouble Code (DTC) Set	
	If no LDW status is shown – and the driver has not applied the LDW disable switch – this indicates that the system has detected a DTC.

**Figure 4 – Bendix DIU Screen Showing LDW System Status**

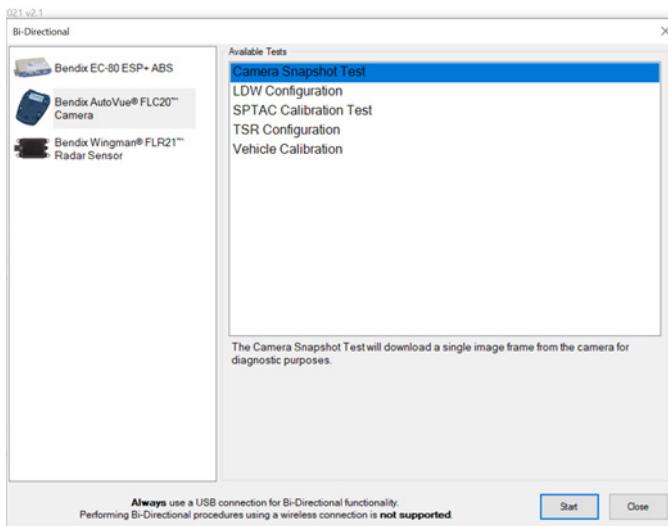
In these cases, the OE vehicle dash display will also alert the operator that there is a DTC present.

## 2.3 CAMERA TEST IMAGE

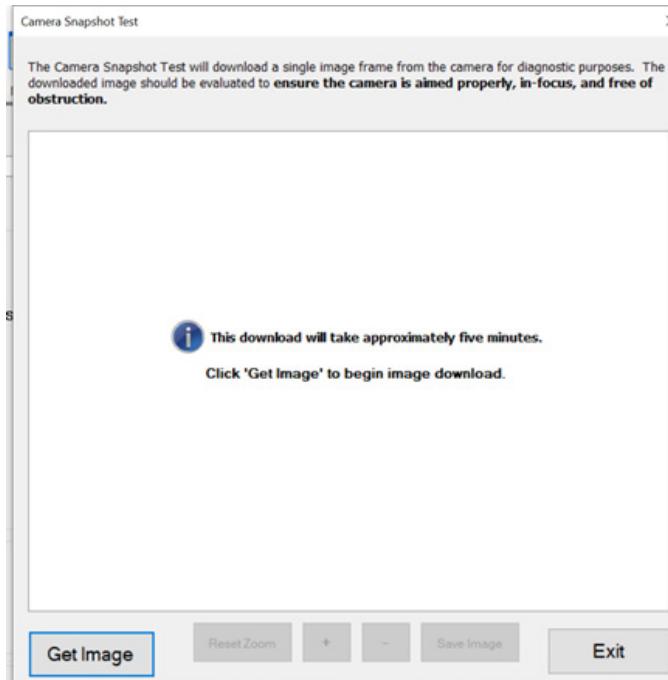
Take a Test Image Using the Latest Version of Bendix® ACom® PRO™ Diagnostic Software

Troubleshooting a camera may be assisted by viewing a test image from the camera to ensure it is not blocked, or has another problem.

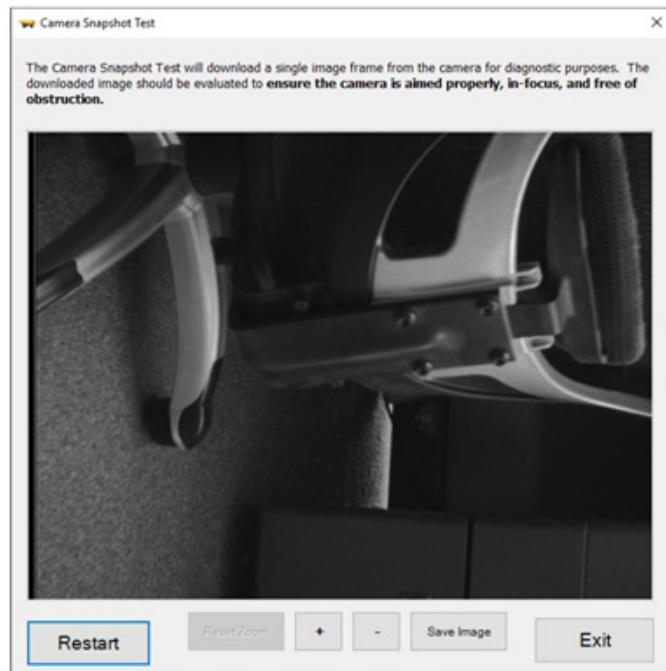
- Connect a current version of Bendix® ACom® PRO™ Diagnostic Software, select 'Bi-Directional' from the main menu, then select the FLC-20 controller from the list.
- Select the 'Camera Snapshot Test' from the list of available FLC-20 tests and click 'Start'.



1. Click 'Get Image' to initiate camera snapshot.



2. Inspect the image. You may use the pan/zoom controls to examine the details of the image.



3. Save if needed by clicking on 'Save Image'.

## 2.4 TEMPORARILY DISABLE THE LANE DEPARTURE WARNING (LDW)

To avoid erroneous LDW warnings in areas such as construction zones – where the non-standard or overlapping road markings present might cause false alerts – the Bendix® Wingman® Fusion™ Active Safety System (Fusion) has an enable/disable switch. The Bendix switch design or a similar OEM switch may be used. See *Figure 5*.



**Figure 5 – Example of an LDW Enable/Disable Switch**

For vehicles that have the LDW switch hard-wired to the SafetyDirect® by Bendix CVS Web Portal Processor, and a functioning On Board Computer (OBC)/Telematics system: The enable/disable switch used by the Lane Departure Warning (LDW) system also functions – when depressed for six (6) seconds – to activate a manual request to transmit the last five seconds and next five seconds of buffered video data.

## 2.5 SETTING DIAGNOSTIC TROUBLE CODES (DTCs)

If, during operation, the Bendix Wingman Fusion system detects a problem with the Bendix™ AutoVue® FLC-20™ camera, a Diagnostic Trouble Code (DTC) will be set and – depending on the OEM – the driver will be alerted on the dash display with an icon or similar method. In these cases, some features of the Fusion system will not be available.

If, for an extended period of time, the system detects that the camera is blocked by dirt, snow, ice, etc., a Diagnostic Trouble Code (DTC) will typically be set.

## 2.6 BENDIX® ACOM® PRO™ DIAGNOSTIC SOFTWARE

Bendix® ACom® PRO™ Diagnostic Software is a PC-based software program available to purchase from [bendix.com](http://bendix.com). This software provides the technician with access to all the available Electronic Control Unit (ECU) diagnostic information and configuration capability. For Fusion system diagnostics, use the current version of Bendix ACom PRO Diagnostic Software. See *Figure 6*.



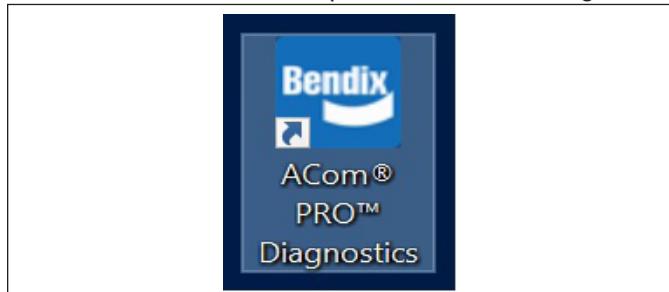
**Figure 6 – Bendix® ACom® PRO™ Diagnostic Software**

### **! IMPORTANT**

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

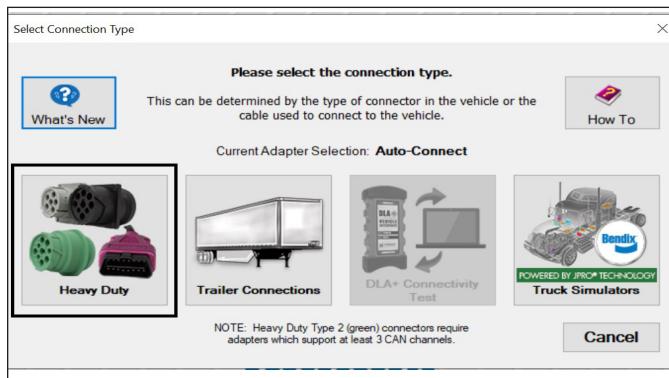
## 2.7 STARTING BENDIX® ACOM® PRO™ DIAGNOSTIC SOFTWARE

The Bendix® ACom® PRO™ Diagnostic Software can be started from the desktop shortcut. See *Figure 7*.



**Figure 7 – Starting Bendix® ACom® PRO™ Diagnostic Software**

To begin, the technician should select ‘Connect’ from the main toolbar, then ‘Heavy Duty’ connection type. See *Figure 8*.



**Figure 8 – Bendix ACom PRO Diagnostic Software – Hardware Interface Screen**

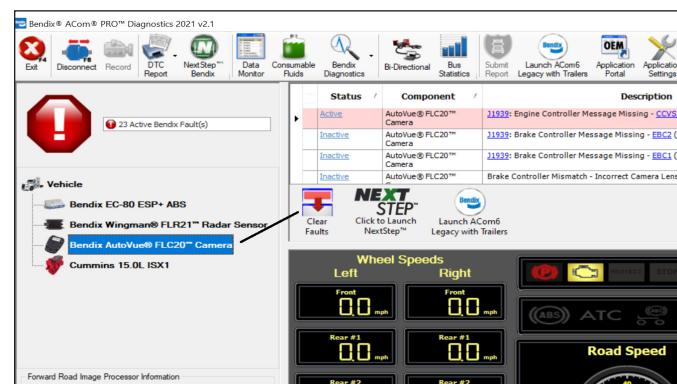
The Heavy Duty button connects to the vehicle BUS using all vehicle protocols. This process could take approximately two minutes. After the connection is complete, the roll call will show the ECU, and its active and inactive Diagnostic Trouble Codes (DTCs). Connection depends on a compatible RP1210C adapter. For assistance with Bendix ACom PRO Diagnostic Software, call 1-800-AIR-BRAKE (1-800-247-2725, option 2, option 2).



## 2.8 READING DIAGNOSTIC TROUBLE CODES (DTCs)

1. Connect a current version of the Bendix ACom PRO Diagnostic Software to the vehicle.
2. Once the roll call is complete, you can view active and inactive DTCs and clear DTCs from all vehicle components or the FLC-20 controller.
3. To read and clear DTCs from all vehicle components at the same time, select vehicle on the roll call and clear faults by clicking on ‘clear faults’.
4. To read and clear DTCs from a specific Bendix ECU, select the FLC-20 on the roll call and clear faults by clicking on ‘clear faults’.

For assistance with Bendix ACom PRO Diagnostic Software, call 1-800-AIR-BRAKE (1-800-247-2725, option 2, option 2).



## 2.9 DIAGNOSTIC TROUBLE CODES

Use a J1939 detection software to find the DTC(s) and use the Table in Section 2.10 to find the service action code to use. The service actions to take may then be found in the Table shown in Section 2.11.

If the troubleshooting devices available to the technician provide Suspect Parameter Number (SPN) and Failure Mode Identifier (FMI) code combinations, refer to Appendix A.

## 2.10 TABLE OF DIAGNOSTIC TROUBLE CODES (DTCs) AND SERVICE ACTION CODES

Look in the left column below for the DTC and find the Service Action Code to follow in *Table 2 (Section 2.11)*.

Diagnostic Trouble Codes (DTCs), Descriptions and Service Action Codes		Go to the Service Action Code List in Table 2 (Pages 11-14)
DTC	Description	
1	High Battery Voltage	B
2	Low Battery Voltage	
3-12	Internal Error	A
13	Internal Error	B
14-16	Internal Error	A
17	Internal Error	Q
18	J1939 Bus Fault	M
19	Calibration not complete	Q
20	Internal Error	
21-35	Internal Error	A
36	Image Processor software version error	I
37-42	Internal Error	A
43	Calibration data corrupt	Q
44-46	Internal Error	A
47	SPC Calibration not complete	Q
48-49	Internal Error	A
50	Dynamic Calibration out of range	Q
51	Dynamic Calibration not complete	
52-57	Internal Error	A
58	Internal Error	
59	Vehicle Calibration not complete	Q
60	Image Processor Calibration error	
61	Internal Error	A
62	J1939: Vehicle controller message missing - LD	
63	J1939: Brake controller message missing - VDC2	
64	J1939: Engine controller message missing - C CVS1	
65	J1939: Vehicle controller message missing - OEL	M
66	J1939: Vehicle controller signal error - OEL Turn Signal	
67	J1939: Vehicle controller signal error - LD Right Turn	
68	J1939: Vehicle controller signal error - LD Left Turn	
69	J1939: Brake controller signal error - VDC2 Steering Wheel	N
70	J1939: Brake controller signal error - VDC2 Yaw Rate	
71	J1939: Brake controller signal error - Lateral Accell	
72	Private CAN: Error frame threshold exceeded	V
73	J1939: Brake controller signal error - EBC2 Wheel Speed	
74	J1939: Brake controller signal error - EBC1 Brake Switch	
75	J1939: Vehicle controller signal error - LCMD Right Turn	N
76	J1939: Vehicle controller signal error - LCMD Left Turn	
77	Internal Error	A

*NOTE: The 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.*

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

**Table 1 – DTC Code to Service Action Code (Pages 8–10)**

Diagnostic Trouble Codes (DTCs), Descriptions and Service Action Codes		Go to the Service Action Code List in Table 2 (Pages 11-14)
DTC	Description	
78	J1939: Vehicle controller message missing - VDHR	
79	J1939: Vehicle controller message missing - LCMD	M
80	J1939: Vehicle controller signal error - OEL Hazard Switch	N
81-86, 128-129	Internal Error	A
130	J1939: Vehicle controller message missing - TCO1	
131	J1939: Brake controller message missing - EBC2	M
132	J1939: Brake controller message missing - EBC1	
133	Brake Controller Mismatch - Incorrect Camera Lens Angle	Q
134	J1939: Vehicle controller message missing - FLIC	M
139	J1939: Brake controller message missing - Prop FLC Status	M
140	Incompatible software version - Image Processor	I
141-145	Internal Error	A
146	Camera lens blocked	C
147	Camera temperature too high	A
148	J1939: Vehicle controller signal error - LDW Enable Switch	
149	J1939: Engine controller signal error - CCVS1 Parking Brake	
150	J1939: Brake controller signal error - EBC1 Brake Switch	
151	J1939: Brake controller signal error - EBC2 Vehicle Speed	
152	J1939: Engine controller signal error - EEC1 Engine Speed	
153	J1939: Vehicle controller signal error - FLIC LDW Enable Command	
154	J1939: LDW Speaker controller signal error - FLIC Prop Speaker	
155	J1939: Vehicle controller signal error - LCMD Low Beam Headlamp	
156	J1939: Vehicle controller signal error - LCMD High Beam Headlamp	
157	J1939: Vehicle controller signal error - LD Low Beam Headlamp	
158	J1939: Vehicle controller signal error - LD High Beam Headlamp	
159	J1939: Vehicle controller signal error - OEL Turn Signal Switch	
160	J1939: Vehicle controller signal error - OEL High-Low Beam Switch	
161	J1939: Vehicle controller signal error - OEL High Beam Status	
162	J1939: Vehicle controller signal error - OEL Wiper	
163	J1939: Vehicle controller signal error - TCO1 Vehicle Speed	
164	J1939: Vehicle controller signal error - VP37 Left Turn Signal	
165	J1939: Vehicle controller signal error - VP37 Right Turn Signal	
166	J1939: Vehicle controller signal error - VP37 High Headlamp	
167	J1939: Vehicle controller signal error - VP37 Hazard Lamp	
168	J1939: Vehicle controller signal error - VP37 Wiper Status	
172	J1939: Engine controller signal invalid - EEC1 Engine Speed	
173	J1939: Vehicle controller signal invalid - FLIC LDW Enable Command	
174	J1939: Speaker controller signal invalid - FLIC Prop Speaker	
176	J1939: Brake controller signal invalid - VDC2 Steering Angle Sensor	M
<p><i>NOTE: The 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.</i></p> <p>Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.</p>		

**Table 1 – DTC Code to Service Action Code (Pages 8–10)**

Diagnostic Trouble Codes (DTCs), Descriptions and Service Action Codes		Go to the Service Action Code List in Table 2 (Pages 11-14)
DTC	Description	
178	J1939: Brake controller signal error - EBC2 Front Axle Speed	P
179	J1939: Engine controller signal invalid - Engine Speed	
180	J1939: Vehicle controller signal invalid - OEL Turn Signal Switch	
181	J1939: Vehicle controller signal invalid - TCO1Tachograph Vehicle Speed	
182	J1939: Brake controller signal invalid - VDC2 Steering Wheel Angle	
183	J1939: Vehicle controller signal invalid - OEL High Beam Headlamp	
184	J1939: Vehicle controller signal invalid - Left Turn Signal	
185	J1939: Vehicle controller signal invalid - Right Turn Signal	M
186	J1939: Vehicle controller signal invalid - Windshield Wiper	
187	J1939: Vehicle controller signal error - OWW Wiper	
188	J1939: Vehicle controller signal error - OEL High Beam	
189	J1939: Brake controller signal invalid - VDC2 Yaw Rate	
190	J1939: Brake controller signal invalid - VDC2 Yaw Rate	
191	J1939: Brake controller signal invalid - VDC2 Lateral Accl	
192	J1939: Brake controller signal missing - VDC2 Lateral Accl	M
193	J1939: Vehicle controller signal invalid - FLIC Prop Speaker	
194	J1939: Vehicle controller signal invalid - OEL Hazard Switch	
195	J1939: Vehicle controller signal invalid - OEL Turn Signal	
196	J1939: Brake controller signal invalid - EBC1 Brake Switch	
197	J1939: Vehicle controller signal invalid - TCO1 Vehicle Speed	
198	Brake controller mismatch - Fusion™	
199	J1939: Vehicle controller message missing - OWW	I
200	J1939: CCVS1 Vehicle Speed signal invalid	M
201	J1939: CCVS1 Vehicle Speed signal missing	P

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

**Table 1 – DTC Code to Service Action Code (Pages 8–10)**

## 2.11 TABLE OF SERVICE ACTION CODES

Recommended service actions for the Diagnostic Trouble Code(s) (DTC) found. *For Suspect Parameter Number (SPN) and Failure Mode Identifier (FMI) code combinations, see Appendix B.*

Service Action Code	Recommended Service
A	<p><b>This DTC is not an indicator of a malfunctioning camera. <u>Do not</u> replace the camera.</b></p> <p><b>Possible Causes:</b></p> <ul style="list-style-type: none"> <li>Some error conditions may occur at extreme high or low temperatures. These DTCs must be diagnosed with the ambient temperature above 32°F (0°C) and below 100°F (38°C).</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>. If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</li> </ul>
B	<p><b>This DTC is not an indicator of a malfunctioning camera. <u>Do not</u> replace the camera.</b></p> <p><b>Possible Causes:</b></p> <p>These DTCs result from incorrect ignition, battery supply voltage, or wiring harness issues as measured at the camera.</p> <p>Review the following Sections:</p> <ul style="list-style-type: none"> <li>2.12 <i>Troubleshooting Diagnostic Trouble Codes: Power Supply; Ignition Voltage Too Low; Ignition Voltage Too High; Power Supply Tests</i>.</li> <li>2.17 <i>Troubleshooting Wiring Harnesses</i>.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>Verify ignition supply voltage to the camera is between 9 to 32 Volts DC (VDC);</li> <li>Visually check for damaged or poorly crimped connectors;</li> <li>Visually check for damaged wiring; and</li> <li>Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>. If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</li> </ul>
C	<p><b>This DTC is not an indicator of a malfunctioning camera. <u>Do not</u> replace the camera.</b></p> <p><b>Possible Causes:</b></p> <ul style="list-style-type: none"> <li>These DTCs may arise from infrequent conditions that could occur normally.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>Check for lens obstruction. Clean dirt, packed snow, or ice from the lens, if present. See <i>Appendix A to take a test image with the camera to help check that the view is clear</i>.</li> <li>Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes (DTCs)</i>.</li> </ul> <p>If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</p>

*NOTE: The 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.*

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

**Table 2 – Service Action Codes to Recommended Service (Pages 11-14)**

Service Action Code	Recommended Service
E	<p><b>This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning camera. <u>Do not</u> replace the camera.</b></p> <p><b>Possible causes:</b></p> <ul style="list-style-type: none"> <li>• Camera mounting is improper.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>• Go to Section 3.0, measure and see if the camera was mounted properly on the windshield. If an improper mounting arrangement is discovered, follow the instructions included in this document to remove the camera. The adhesive cannot be re-used, but order the approved bracket with adhesive (Bendix® part number K109285) to install and re-mount the camera onto the windshield.</li> <li>• Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>.</li> </ul> <p>If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</p>
I	<p><b>This DTC is not an indicator of a malfunctioning camera. <u>Do not</u> replace the camera.</b></p> <p><b>Possible Causes:</b></p> <ul style="list-style-type: none"> <li>• The system using the camera has either the incorrect/updated software version, or wasn't updated properly during a firmware upgrade.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>• Attempt an update of the software using a PC with Bendix® ACom® PRO™ Diagnostic Software installed to facilitate the update. Make sure that the updated program reports a successful download.</li> <li>• Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>.</li> </ul> <p>If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</p>
M	<p><b>This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning camera. <u>Do not</u> replace the camera.</b></p> <p><b>Possible Causes:</b></p> <ul style="list-style-type: none"> <li>• The system using the camera has not found the J1939 signal(s) it is expecting from one or more sources. This could be accompanied by other active DTCs from the same source.</li> </ul> <p>Review the following Section:</p> <ul style="list-style-type: none"> <li>• 2.13 <i>Serial Data (J1939) Troubleshooting Procedure</i>.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>• Check the expected source(s) of the signal to identify why the signals have invalid data. A communication link may be disconnected, the power fuse disconnected or blown, or a change was made to the controller that was incorrect.</li> <li>• Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>.</li> </ul> <p>If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</p>

*NOTE: The 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.*

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

**Table 2 – Service Action Codes to Recommended Service (Pages 11-14)**

Service Action Code	Recommended Service
N	<p><b>This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning camera. <u>Do not replace the camera.</u></b></p> <p><b>Possible causes:</b></p> <ul style="list-style-type: none"> <li>The system using the camera has found J1939 signal(s) it is expecting, however the values indicate that there is a malfunctioning component and/or wiring error.</li> <li>Some examples of components, cameras, or switches that produce J1939 signals are: brake pressure switches; steering angle sensors; lighting indicators (high/low beam lights, turn signals); windshield wiper status; various engine torque signals; Bendix® Wingman® Fusion™ Active Safety System components; and wheel speed sensors.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>Check the engine, cab/body controller, Bendix Wingman Fusion components, or ABS for DTCs using the manufacturer's diagnostic procedures. The controller that broadcasts the error signal must be investigated first; however, the origin of the signal could potentially be another source.</li> </ul> <p>After addressing the possible causes, perform the following:</p> <ul style="list-style-type: none"> <li>Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>. If the error returns, refer to SD-61-4963, <i>Bendix® Wingman® Fusion™ FLR-21™ Radar Sensor</i>, on <a href="http://b2bendix.com">b2bendix.com</a> for more troubleshooting information, or call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</li> </ul>
P	<p><b>This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning camera. <u>Do not replace the camera.</u></b></p> <p><b>Possible causes:</b></p> <ul style="list-style-type: none"> <li>The Bendix™ AutoVue® FLC-20™ camera finds an expected J1939 source, but the signal's value is out of the normal operating range.</li> </ul> <p>Review the following Sections:</p> <ul style="list-style-type: none"> <li>3.6 <i>Camera Interchangeability</i>.</li> <li>2.13 <i>Serial Data (J1939) Troubleshooting Procedure</i>.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>Check the engine, cab/body controller, or ABS for DTCs using the manufacturer's diagnostic procedures. The controller that broadcasts the signal indicates that a camera or switch input is producing a value that is out of the normal operating range.</li> <li>After addressing the possible causes, perform the following:</li> <li>Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>. If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</li> </ul>

*NOTE: The 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.*

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

**Table 2 – Service Action Codes to Recommended Service (Pages 11-14)**

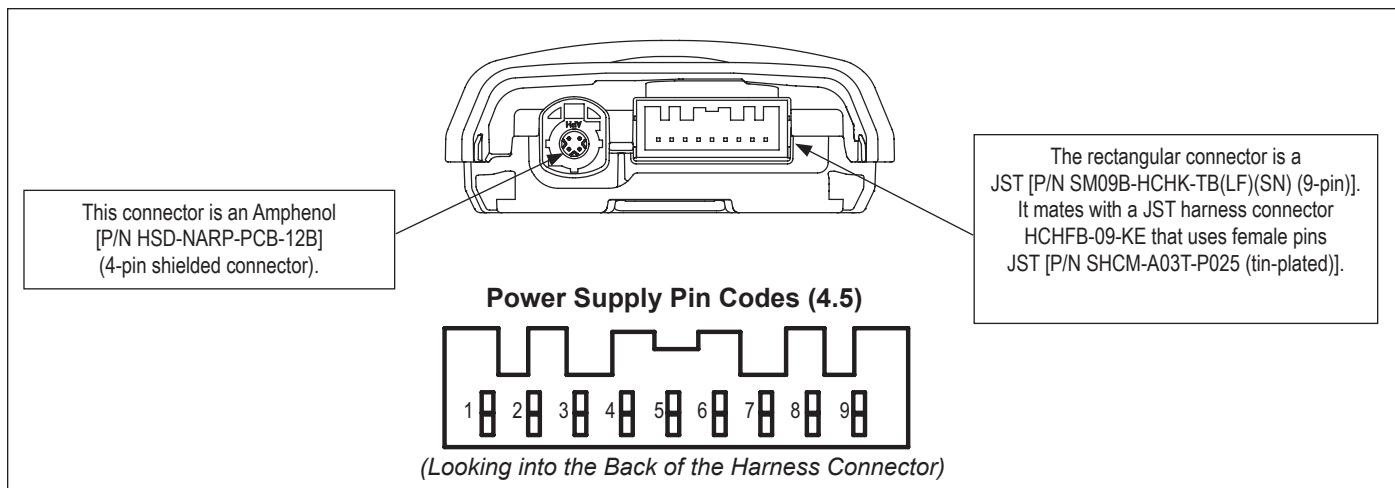
Service Action Code	Recommended Service
Q	<p><b>This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning camera. <u>Do not replace the camera.</u></b></p> <p><b>Possible Causes:</b></p> <ul style="list-style-type: none"> <li>• The camera is indicating that it is either not calibrated or an error has occurred.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>• The ABS controller may be disconnected or configuration from the ABS controller may be sending invalid information.</li> <li>• <i>Go to Section 3.0</i>, measure and see if the camera was mounted properly on the windshield. If an improper mounting arrangement is discovered, follow the instructions included in this document to remove the camera. The adhesive cannot be re-used. Order the approved bracket with adhesive (Bendix® part number K109285) to install and re-mount the camera onto the windshield.</li> </ul> <p>After addressing the possible causes, perform the following:</p> <ul style="list-style-type: none"> <li>• Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>.</li> </ul> <p>If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</p>
V	<p><b>This Diagnostic Trouble Code (DTC) is not an indicator of a malfunctioning camera. <u>Do not replace the camera.</u></b></p> <p><b>Possible Causes:</b></p> <ul style="list-style-type: none"> <li>• The system using the camera has not found the signal(s) it is expecting from the private communications link. This could be accompanied by other active DTCs from the same source.</li> </ul> <p>Review the following Section:</p> <ul style="list-style-type: none"> <li>• <i>2.16 Private Communications Network Test Procedure</i>.</li> </ul> <p><b>Perform the following:</b></p> <ul style="list-style-type: none"> <li>• Check the expected source(s) of the signal to identify why the signals have invalid data. The private communications link may be disconnected, have improper terminations, power fuse disconnected or blown, or a change was made to the controller that was incorrect.</li> <li>• Clear the camera's DTCs using the procedure in Section 2.18 <i>Clearing Diagnostic Trouble Codes</i>.</li> </ul> <p>If the error returns, call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2. Representatives are available 8:00 a.m.-6:00 p.m. ET, Monday - Thursday, and 8:00 a.m.-5:00 p.m. on Friday.</p>

*NOTE: The 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.*

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

**Table 2 – Service Action Codes to Recommended Service (Pages 11-14)**



**Figure 9 – Camera and Harness Connector Views**

Pin #	Description	Nominal Voltage	Nominal Current
1	Module Power	14V/28V (9~32V)	200mA/100mA
2	Not Used	—	—
3	J1939 Low	5V	85mA
4	J1939 High	5V	85mA
5	Not Used	—	—
6	Private Communications Low	5V	85mA
7	Private Communications High	5V	85mA
8	Ground GND (-)	0.000V	200mA/100mA
9	Ignition Wake-Up	14V/28V (7~32V)	20mA/10mA

**Table 3 – Harness Connector Pins**

## 2.12 TROUBLESHOOTING DIAGNOSTIC TROUBLE CODES: POWER SUPPLY

### IGNITION VOLTAGE TOO LOW

Measure the ignition voltage under load. Ensure that the ignition voltage is greater than 9 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.

### CONNECTOR PIN-OUT & POWER REQUIREMENTS

The camera has two connectors. See *Figure 3*.

### POWER SUPPLY TESTS

1. Take all measurements at the camera's 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 1 to ground should measure between 10 to 16 VDC (Volts DC).
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.

## 2.13 SERIAL DATA (PRIVATE COMMUNICATIONS) TROUBLESHOOTING PROCEDURE

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



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

2. Check for damaged or reversed Private Communications wiring.

If the Private Communications HIGH, **or** Private Communications LOW, wiring circuits are damaged, such as shorting together, the entire Private Communications link will be lost. The problem may be intermittent, enabling the Private Communications link to operate normally sometimes. In this event, multiple diagnostic trouble codes may be logged in the camera and radar.

If the Private Communications HIGH, **and** Private Communications LOW, wiring circuits are reversed, communication over the entire Private Communications link will be lost. Devices that use the affected network will not be able to transmit or receive messages on that network.

3. Check for corroded or damaged wiring connector problems such as opens or shorts to voltage or ground.
4. If the connector terminals are corroded, this may be an indication of water intrusion into the wiring system and possibly the camera sensor. Replacement of the entire harness is recommended. If the terminals of the camera sensor are corroded, replacement of the sensor is recommended.
5. Check for other Private Communications devices which may be inhibiting communication. The service technician should consult the procedures for Private Communications troubleshooting. The device's power should be removed and measurements made at the Electronic Control Unit (ECU) pins for shorts to ground and power pins and resistance between the Private Communications HIGH or Private Communications LOW input circuits.
6. Unplug the camera harness. With the ignition switch off, measure the resistance (ohms) using a multimeter between harness pins 6 and 7. The reading should be approximately 120 ohms. If it is not, the vehicle wiring should be investigated.

## 2.14 POWER TROUBLESHOOTING PROCEDURES

1. Unplug the camera. With the ignition switch ON, using a multimeter, measure the voltage between harness pin 9 and ground. The measurement should indicate 10 to 16 VDC (Volts DC). If this is not the case, the vehicle wiring should be investigated using procedures described by the manufacturer.
2. Unplug the camera. With the camera ignition switch OFF, using a multimeter, measure the voltage between harness pin 9 and ground. The measurement should indicate zero VDC. If this is not the case, the vehicle wiring should be investigated using procedures described by the manufacturer.
3. Unplug the camera. With the ignition switch OFF, using a multimeter, measure the voltage between harness pin 1 and ground. The measurement should indicate 10 to 16 VDC. If this is not the case, the vehicle wiring should be investigated using procedures described by the manufacturer.

## 2.15 COMMUNICATIONS (J1939) TEST AND TROUBLESHOOTING PROCEDURES

The Bendix™ AutoVue® FLC-20™ camera requires several J1939 messages from various Electronic Control Units (ECUs). The camera will set a Diagnostic Trouble Code (DTC) if one of the messages from one of the expected ECUs is not present. Go to the Service Data Sheet listed below for the particular ECU for full troubleshooting information.

### Reference Documents:

- *Bendix® Wingman® Fusion™ FLR-21™ Radar Sensor (SD-61-4963)*
- *Bendix® ESP® EC-80™ Controller (SD-13-4986)*
- *SafetyDirect® by Bendix CVS Web Portal Processor (SD-65-21025)*

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



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

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 operate normally sometimes. If this occurs, multiple diagnostic trouble codes will be logged in multiple engine and vehicle controllers.

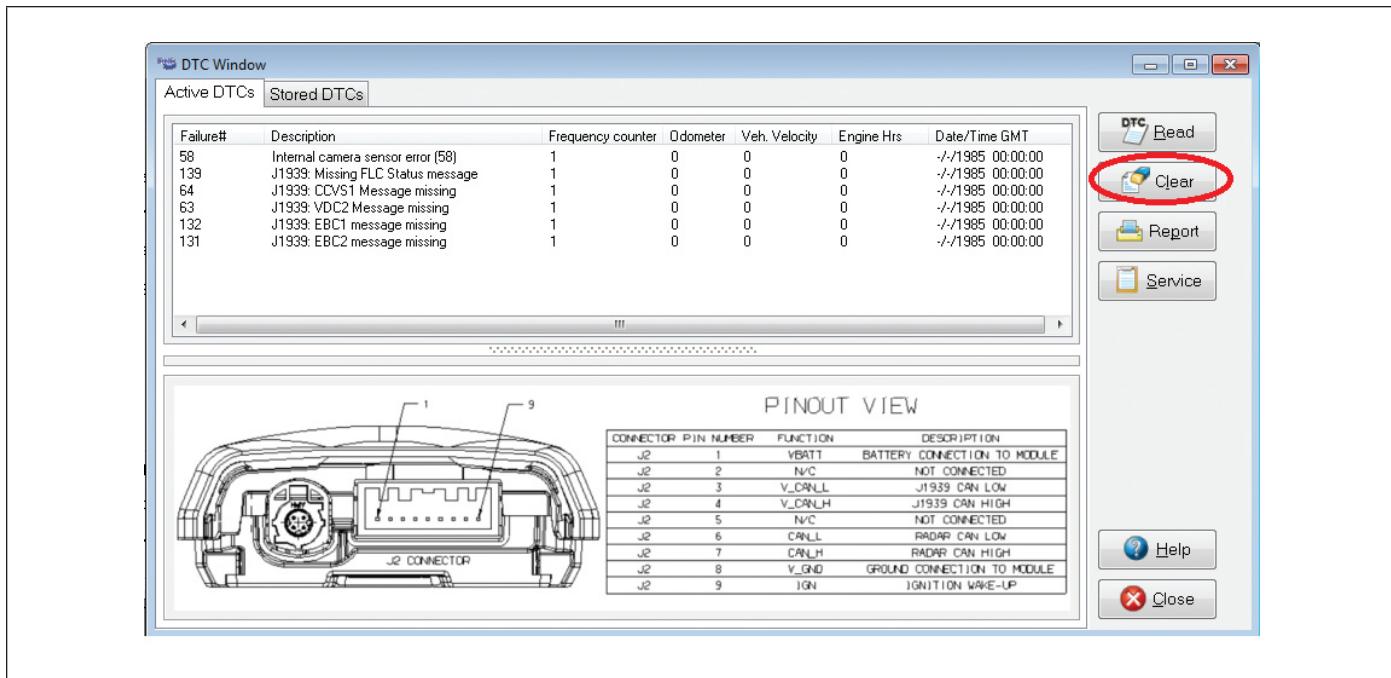


Figure 10 – Clear Diagnostic Trouble Codes (DTC[s]) Button

If the J1939 HIGH, **and** J1939 LOW, wiring circuits are reversed, communication over the entire J1939 link will be lost. Devices that use the affected network will not be able to transmit or receive messages on that network.

3. Check for poorly-crimped, corroded, contaminated, or damaged wiring connector problems such as opens or shorts to voltage or ground.

If the connector terminals are corroded or damaged, this may be an indication of water intrusion into the wiring system and possibly into the sensor. Replacement of the entire harness is recommended. If the terminals of the sensor are corroded, replacement of the 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 camera harness. With the camera ignition OFF, measure the resistance (ohms) using a multimeter between harness pins 3 and 4. The reading should be approximately 60 ohms. If this is not the case, the vehicle wiring should be investigated.

## 2.16 PRIVATE COMMUNICATIONS NETWORK TEST PROCEDURE

The Bendix™ AutoVue® FLC-20™ camera requires private network messages to and from the Bendix® Wingman® Fusion™ system. The camera will set a Diagnostic Trouble Code (DTC) if these messages are not present, or if there is a problem with the private communications system. *Refer to SD-61-4963, Bendix® Wingman® Fusion™ FLC-21™ Radar Sensor, on b2bendix.com for full troubleshooting information.*

## 2.17 TROUBLESHOOTING WIRING HARNESES

All wire harness connectors must be properly seated to maintain electrical connectivity. Push the mating connectors until they click. When replacing a Bendix Fusion FLC-20 camera, check that the wire harness connectors are free of damage, including corrosion, before plugging into a new camera. 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 camera (presumably from a cracked windshield). Replacement of the entire harness is recommended. If the terminals of the camera are corroded, replacement of the camera is recommended.

## 2.18 CLEARING DIAGNOSTIC TROUBLE CODES (DTCs)

Cycle the ignition power, or use the Bendix® ACom® PRO™ Diagnostic Software to clear DTCs after troubleshooting – and correcting – any problem with the system. *See Figure 10.*

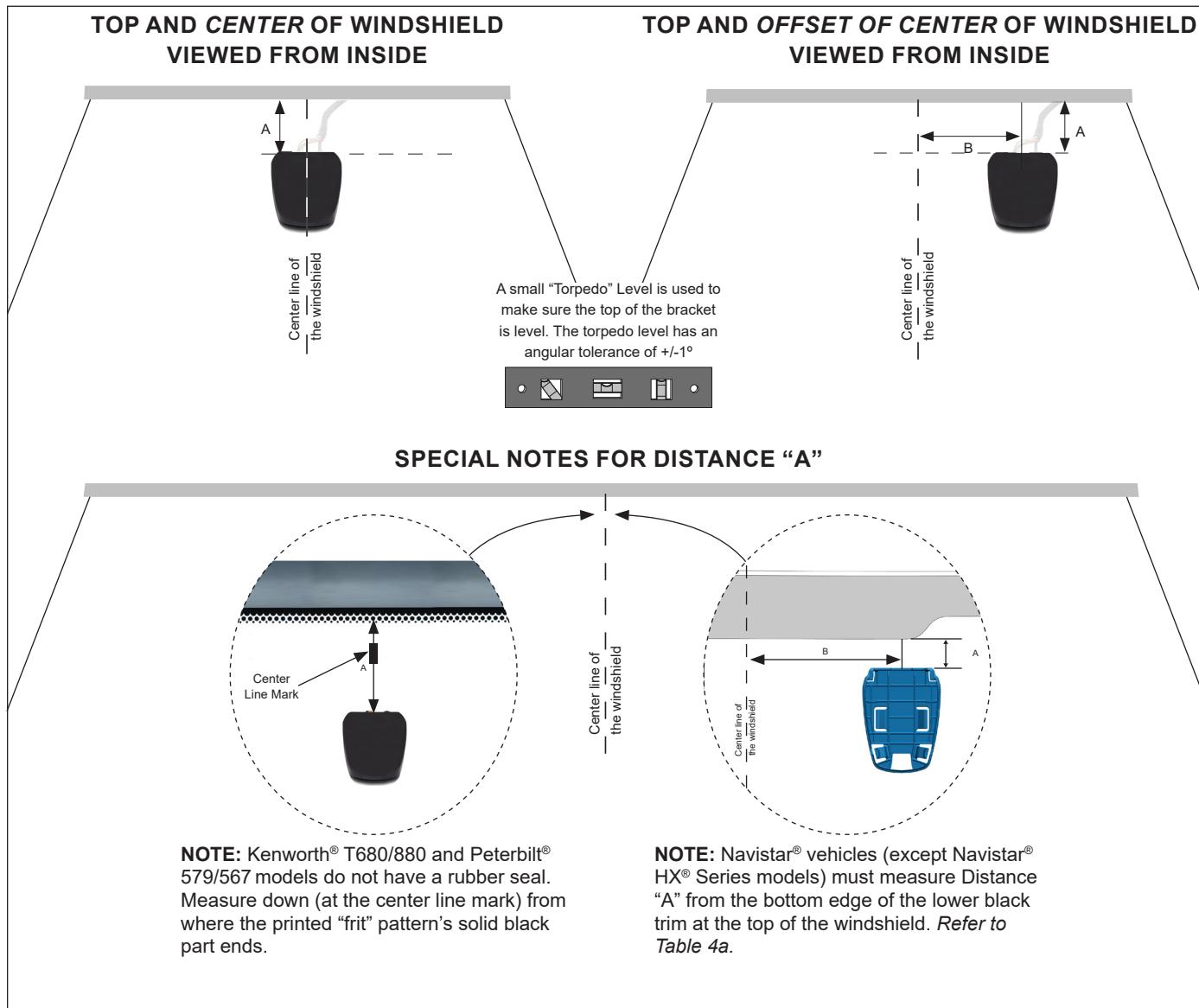
### 3.0 TYPICAL INSTALLATION

The Bendix™ AutoVue® FLC-20™ camera is installed on the windshield at a position determined by Bendix engineering and the OEM. See *Figure 11a* and refer to *Table 4a* for cameras mounted from the top of the windshield. See *Figure 11b* and refer to *Table 4b* for cameras mounted from the bottom of the windshield.

**NOTE:** When replacing a camera bracket, temporarily mark the location of the top of the original bracket to help position the replacement.

#### **IMPORTANT**

Use only Bendix-approved windshield adhesive when re-mounting a camera bracket (included with the bracket kit).



**Figure 11a – Bracket Installation Coordinates from Top of Windshield**

Camera Mounting from the Top of the Windshield				
Vehicle OEM*	Vehicle Model	Distance "A"	Distance "B"	Comments
Kenworth®	T280, T380, T480, T680, T880, W990	1.4 in. $\pm \frac{1}{8}$ in. (35 mm $\pm$ 3 mm)	0	Windshields have a mark at the center line. The camera bracket is located <i>Distance "A"</i> downward from the lower edge of the printed border.
	T370	2.38 in. $\pm \frac{1}{8}$ in. (60.3 mm $\pm$ 3 mm)	6 in. $\pm \frac{1}{8}$ in. (152 mm $\pm$ 3 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "B"</i> from the center of the windshield. The camera bracket is located <i>Distance "A"</i> downward from the interior seal of the windscreens.
Mack®	CHU/CXU	2 in. $\pm \frac{1}{8}$ in. (51 mm $\pm$ 3 mm)	6 in. $\pm \frac{1}{8}$ in. (152 mm $\pm$ 3 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "B"</i> from the center. The camera bracket is located <i>Distance "A"</i> downward from the lower edge of the rubber seal.
Navistar® International®	HX® Series	1.97 in. $\pm \frac{3}{16}$ in. (50 mm $\pm$ 5 mm)	5.9 in. $\pm \frac{3}{16}$ in. (150 mm $\pm$ 5 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "B"</i> from the center of the windshield. The camera bracket is located <i>Distance "A"</i> downward from the bottom edge of the inner black trim at the top of the windshield.
	ProStar®, LT® Series, RH™ Series	1.26 in. $\pm \frac{3}{8}$ in. (32 $\pm$ 10 mm)	5.9 in. $\pm \frac{3}{16}$ in. (150 mm $\pm$ 5 mm)	
	LoneStar®, DuraStar®	2.165 in. $\pm \frac{3}{8}$ in (55 mm $\pm$ 10 mm)	5.9 in. $\pm \frac{3}{16}$ in. (150 mm $\pm$ 5 mm)	
Navistar® IC Bus™	CE Series	7.125 in. $\pm \frac{1}{8}$ in. (180 mm $\pm$ 3 mm)	6 in. $\pm \frac{1}{8}$ in. (152 mm $\pm$ 3 mm)	
Peterbilt®	536, 537, 548, 579, 567	1.4 in. $\pm \frac{1}{8}$ in. (35 mm $\pm$ 3 mm)	0	Windshields have a mark at the center line. The vertical location is between the bracket's uppermost surface and the nearest surface of the windscreens seal. The camera bracket is located <i>Distance "A"</i> downward from the lower edge of the printed border.
	337, 348	1.18 in. $\pm \frac{1}{8}$ in. (30 mm $\pm$ 3 mm)	0	The camera bracket is located <i>Distance "A"</i> downward from the bottom of the windscreens seal.
	520	8.625 in. $\pm \frac{1}{8}$ in. (219 mm $\pm$ 3 mm)	6 in. $\pm \frac{1}{8}$ in. (152 mm $\pm$ 3 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "B"</i> from the center of the windshield. The camera bracket is located at <i>Distance "A"</i> from the interior upper seal of the windscreens.
Volvo	VNM / VNL	1.3 in. $\pm \frac{1}{8}$ in. (34 mm $\pm$ 3 mm)	0	The camera bracket is located <i>Distance "A"</i> downward from the lower edge of the rubber seal.

\* All trademarks shown here are the property of their respective owners and are used for reference only.

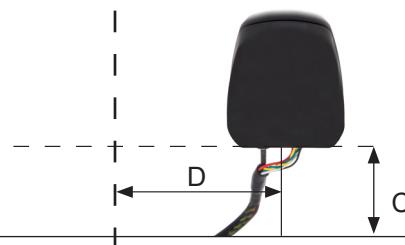
**Table 4a – Camera Mounting from Top of Windshield Specifications**

## BOTTOM AND CENTER OF WINDSHIELD - VIEWED FROM INSIDE

A small "Torpedo" Level is used to make sure the top of the bracket is level. The torpedo level has an angular tolerance of  $\pm 1^\circ$



Center line of  
the windshield



**Figure 11b – Bracket Installation Coordinates from Bottom of Windshield**

Camera Mounting from the Bottom of the Windshield				
Vehicle OEM*	Vehicle Model	Distance "C" $\pm \frac{1}{8}$ in. (3 mm)	Distance "D" $\pm \frac{1}{8}$ in. (3 mm)	Comments
Prevost®	H3-45	3.15 in. (80.0 mm)	5.12 in. (130 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "D"</i> from the center of the windshield. The camera bracket is located <i>Distance "C"</i> upward from the inner seal surface.
Mack®	TE	7.125 in (181 mm)	6 in. (152 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "D"</i> from the center of the windshield. <b>Distance C is taken from the horizontal edge of the seal.</b>
	LR	5.125 in (130 mm)	6 in. (152 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "D"</i> from the center of the windshield. The camera bracket is located <i>Distance "C"</i> upward from the lower seal edge.
Temsa™	TS35	6.75 in. (171 mm)	6 in. (152 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "D"</i> from the center of the windshield. The camera bracket is located <i>Distance "C"</i> upward from the external rubber seal.
	TS45	7.375 in. (187 mm)	6 in. (152 mm)	The camera bracket is offset to the passenger's side of the vehicle by <i>Distance "D"</i> from the center of the windshield. The camera bracket is located <i>Distance "C"</i> upward from the external rubber seal.

\*NOTE: All measurements are along the surface of the windscreen

**Table 4b – Camera Mounting from Bottom of Windshield Specifications**

### **WARNING**

**Whenever re-installing or replacing a camera – for example, after a windshield is replaced – the recommended position for the vehicle must be used. Failure to install the camera in the correct position can result in system Diagnostic Trouble Codes being set, system performance degradation, and/or a collision causing property damage, serious injuries, or death.**

The ambient temperature must be in the range of 50-100° F (10-38° C). Thoroughly clean the area of the windshield where the camera will be installed with a lint-free cloth and a 50-50 water/isopropyl alcohol solution. Make certain that there is no grease or contamination present and that the windshield is completely dry before installing the bracket.

Use removable tape or a non-permanent marker to indicate where the top of the bracket will be installed. Remove the protective film from the tape covering the adhesive on the bracket and, using a small "torpedo" level to be sure that it is level, install the bracket on the glass, holding firmly [a minimum of 62 lb. (28.1 kg.) pressure] in place for ten (10) seconds. Wait at least twenty minutes before installing the camera, at which point a 50% bond strength is created. The full bond between the bracket and windshield is achieved after 72 hours.

1. Engage the top of the camera into the bracket	2. Rotate the camera into the bracket	3. Listen for the click as the bracket engages the camera	<b>IMPORTANT: Double-check that the camera is fully engaged into the bracket.</b>
			

**Figure 12 – Camera Installation**

To install the camera into the bracket, See *Figure 12*.

1. Engage the top of the camera into the bracket. There are two channels in the camera that need to line up with the bracket housing, so check to be sure that both sides engage into the bracket.
2. While maintaining the engagement at the top of the camera, rotate the rest of the camera body towards the bracket.
3. When the camera and bracket meet, there are retaining clips built into the bracket that will snap into place, holding the camera in position.

**IMPORTANT**

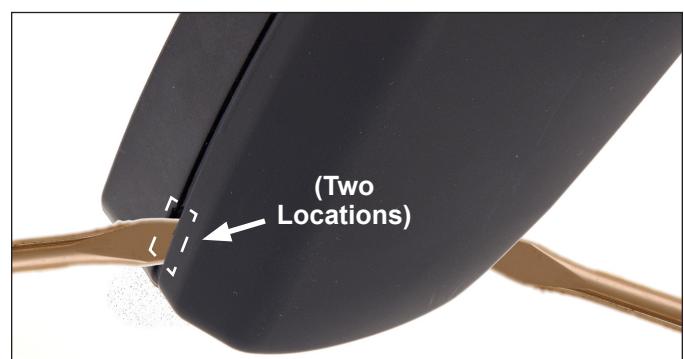
Double-check that the camera is fully engaged into the bracket by verifying that the channel between them has the same gap all the way around. Pull gently on the camera to check that the tabs at the top and bottom are engaged and that there is no play. See *Figure 12*.

4. Remove any tape, or temporary marks made, during the installation.

### 3.1 CAMERA REMOVAL

**CAUTION**

**Do not use a twisting action when releasing the tabs. Insert the screwdrivers and pry by moving the handles towards each other a small amount. Never twist the screwdrivers as the tabs may break! Replace the bracket if the tab is broken.**



**Figure 13 – Camera Release**

See *Figure 13*. If a camera needs to be removed, locate the two locations at the lower corners where the camera and bracket meet.

1. Insert two medium-sized flat-blade screwdrivers into the slots, fully seating them.
2. *Then – gently prying by moving the screwdriver handles away from the windshield a small amount – push against the retaining clips to release the camera.*

## 3.2 BRACKET REMOVAL

The camera must be removed prior to this procedure. The preferred method for removing a bracket ideally requires two technicians. Using a heat-gun, one of the technicians gradually applies heat to the outside of the windshield at the location of the adhesive, while the other gently applies a prying force to the bracket while being careful not to damage the windshield.

As soon as the ideal temperature is reached, the bracket will release. Allow the windshield to completely cool down before cleaning the glass and installing a replacement bracket.

When replacing brackets, use only replacements with the same part number or a direct superceding replacement number supplied by Bendix or the OEM. If you have questions, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.

**NOTE:** Some OEMs may offer the windshield with the bracket pre-installed. Contact the dealer for more information.

## 3.3 DASH SWITCHES AND LAMPS

Each OEM has their own method for displaying the system status to the driver, and typically there will be a switch on the dash board to allow the driver to temporarily disable the system. Refer to the OEM Operator's Manual for system indicator lamp(s) used for the Bendix™ AutoVue® FLC-20™ camera, and whether there is a bulb-check illumination at vehicle power-up. See *Figure 14* 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 14 – Dash Switch Icons**

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 2.0, Troubleshooting*, for more information.

## 3.4 MAINTENANCE

In normal use, the Bendix AutoVue FLC-20 camera needs only a clean, properly maintained windshield to ensure a clear view of the road ahead. Protect the camera lens whenever the inside of the windshield is cleaned. You may check that the camera's view is clear by taking a test image (See *Appendix A*).

## 3.5 CAMERA INTERCHANGEABILITY

When replacing cameras only, use replacements with the same part number (or a direct superceding replacement number supplied by Bendix). After replacing the camera, run the engine for two (2) minutes and verify no faults are present. Once confirmed no faults are shown with the engine running, drive the vehicle for 5 – 20 miles (8 – 32 km) or until a speed sign is displayed by the system.



**WARNING**

**Cameras of different vehicle models and model years must not be interchanged. The use of an incorrect camera can lead to Diagnostic Trouble Codes (DTCs) being set, and performance degradation – including unnecessary system interventions and the potential for situations where interventions do not occur when they would normally.**

Cameras are designed specifically for a particular vehicle and model. DTCs caused by relocating cameras to an incorrect vehicle may result in the vehicle system using the camera to be partially or fully unavailable.

If you have questions, contact the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2.

Bendix AutoVue FLC-20 cameras are powered by the Mobileye® System-on-Chip EyeQ® processor with state-of-the-art-vision algorithms.

## APPENDIX A - SUSPECT PARAMETER NUMBER (SPN) AND FAILURE MODE IDENTIFIER (FMI) CODES TO SERVICE ACTION CODES

Look up the SPN/FMI code found and see the Service Action Code to use. *Table 2 in Section 2.11* (pages 11-14) explains the service actions to take.

For an equivalent table sorted by Diagnostic Trouble Codes (DTCs) to service action codes, see *Table 1 in Section 2.10* (pages 8-10).

Appendix A				
SPN/FMI Codes to Service Action Codes				
SPN	FMI	DTC	Diagnostic Trouble Codes (DTC) Description	Service Action Code (See 2.11)
70	9	64	J1939: Engine controller message missing - CCVS1	M
	19	149	J1939: Engine controller signal error - CCVS1 Parking Brake	N
84	2	200	J1939: Engine controller signal invalid - CCVS1 Vehicle Speed	P
	9	64	J1939: Engine controller message missing - CCVS1	M
		201	J1939: Engine controller signal missing - CCVS1 Vehicle Speed	
	19	64	J1939: Engine controller message missing - CCVS1	M
		73	J1939: Brake controller signal error - EBC2 Wheel Speed	N
190	2	179	J1939: Engine controller signal invalid - Engine Speed	P
	9	172	J1939: Engine controller signal invalid - EEC1 Engine Speed	M
	19	152	J1939: Engine controller signal error - EEC1 Engine Speed	N
234	12	142	Internal Error	A
597	2	74	J1939: Brake controller signal error - EBC1 Brake Switch	N
	19			
625	9	72	Private CAN: Error frame threshold exceeded	V
628	2	11	Internal Error	A
		36	Image Processor software version error	I
630	2	19	Calibration not complete	Q
		47	SPC Calibration not complete	
		50	Dynamic Calibration out of range	
		51	Dynamic Calibration not complete	
		59	Vehicle Calibration not complete	
	19	198	Brake controller mismatch - Fusion™	I
639	9	18	J1939 Bus Fault	M
879	9	184	J1939: Vehicle controller signal invalid - Left Turn Signal	
881	9	185	J1939: Vehicle controller signal invalid - Right Turn Signal	
904	2	178	J1939: Brake controller signal error - EBC2 Front Axle Speed	P
	9	131	J1939: Brake controller message missing - EBC2	M
	19	151	J1939: Brake controller signal error - EBC2 Vehicle Speed	N
<p><i>Note: The 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.</i></p> <p>Call the Bendix Tech Team at 1-800-AIR-BRAKE (1-800-247-2725), option 2, for troubleshooting assistance.</p>				

## Appendix A

### SPN/FMI Codes to Service Action Codes

SPN	FMI	DTC	Diagnostic Trouble Codes (DTC) Description	Service Action Code (See 2.11)
917	9	78	J1939: Vehicle controller message missing - VDHR	M
1121	9	132	J1939: Brake controller message missing - EBC1	
		196	J1939: Brake controller signal invalid - EBC1 Brake Switch	
1624	19	150	J1939: Brake controller signal error - EBC1 Brake Switch	N
	2	181	J1939: Vehicle controller signal invalid - TCO1 Tachograph Vehicle Speed	P
	9	130	J1939: Vehicle controller message missing - TCO1	M
		197	J1939: Vehicle controller signal invalid - TCO1 Vehicle Speed	
	19	163	J1939: Vehicle controller signal error - TCO1 Vehicle Speed	N
1705	3	1	High Battery Voltage	B
	4	2	Low Battery Voltage	
	7	146	Camera lens blocked	C
1705	11	133	Brake Controller Mismatch - Incorrect Camera Lens Angle	Q
1705	3, 4, 7-10, 12, 14-16, 21-35, 37-42	13	Internal Error	A
		17, 20	Internal Error	B
		43	Calibration data corrupt	Q
		44-46, 48, 49, 52-57	Internal Error	A
	12	60	Image Processor Calibration error	Q
		61, 77, 81-86, 128, 129	Internal Error	A
		140	Incompatible software version - Image Processor	I
		141, 143-145	Internal Error	A
		19	Calibration not complete	Q
1705	13	47	SPC Calibration not complete	
		50	Dynamic Calibration out of range	
		51	Dynamic Calibration not complete	
		58	Internal Error	
		59	Vehicle Calibration not complete	
		11	Internal Error	A
14	14	36	Image Processor software version error	I
		147	Camera temperature too high	A

*Note: The 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.*

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

## Appendix A

### SPN/FMI Codes to Service Action Codes

SPN	FMI	DTC	Diagnostic Trouble Codes (DTC) Description	Service Action Code (See 2.11)
1705	31	3, 4, 7-10, 12	Internal Error	A
		13	Internal Error	B
		14-16	Internal Error	A
		17, 20	Internal Error	Q
		21-35, 37-42	Internal Error	A
		43	Calibration data corrupt	Q
		44-46, 48, 49, 52-57	Internal Error	A
		58	Internal Error	Q
		60	Image Processor Calibration error	
		61, 77, 81-86, 128-129	Internal Error	A
		140	Incompatible software version - Image Processor	I
		141, 143-145	Internal Error	A
		147	Camera temperature too high	
1807	2	182	J1939: Brake controller signal invalid - VDC2 Steering Wheel Angle	P
	9	176	J1939: Brake controller signal invalid - VDC2 Steering Angle Sensor	M
	19	69	J1939: Brake controller signal error - VDC2 Steering Wheel	N
1808	2	189	J1939: Brake controller signal invalid - VDC2 Yaw Rate	P
	9	63	J1939: Brake controller message missing - VDC2	M
		190	J1939: Brake controller signal invalid - VDC2 Yaw Rate	
	19	70	J1939: Brake controller signal error - VDC2 Yaw Rate	N
1809	2	191	J1939: Vehicle controller signal invalid - VDC2 Lateral Accel	P
	9	192	J1939: Brake controller signal missing - VDC2 Lateral Accel	M
	19	71	J1939: Brake controller signal error - Lateral Accell	N
2347	19	156	J1939: Vehicle controller signal error - LCMD High Beam Headlamp	
2348	19	158	J1939: Vehicle controller signal error - LD High Beam Headlamp	
2349	19	155	J1939: Vehicle controller signal error - LCMD Low Beam Headlamp	
2350	19	157	J1939: Vehicle controller signal error - LD Low Beam Headlamp	
2367	19	76	J1939: Vehicle controller signal error - LCMD Left Turn	
2368	2	164	J1939: Vehicle controller signal error - VP37 Left Turn Signal	
	19	68	J1939: Vehicle controller signal error - LD Left Turn	
2369	9	79	J1939: Vehicle controller message missing - LCMD	M
	19	75	J1939: Vehicle controller signal error - LCMD Right Turn	N

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

## Appendix A

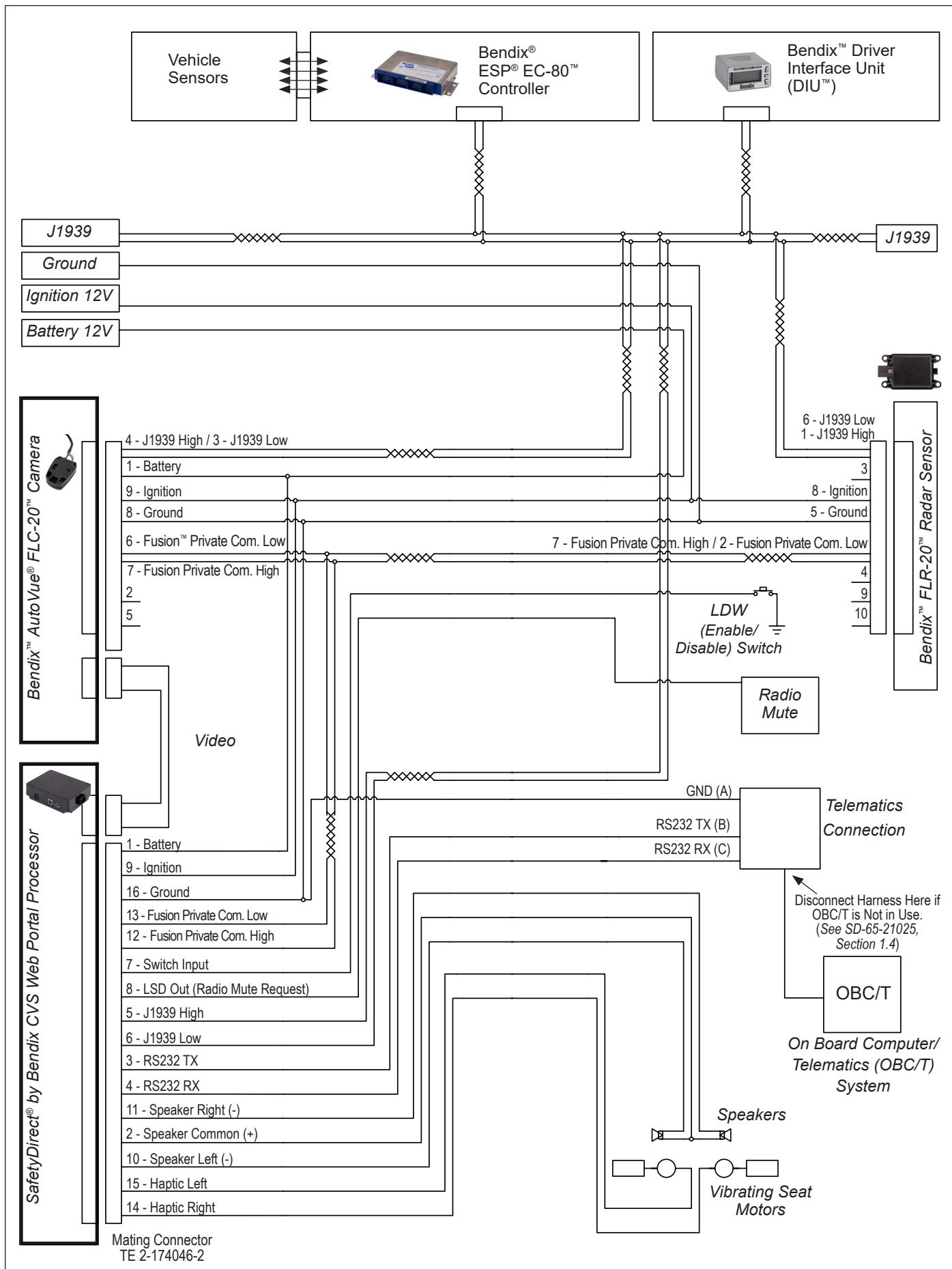
### SPN/FMI Codes to Service Action Codes

SPN	FMI	DTC	Diagnostic Trouble Codes (DTC) Description	Service Action Code (See 2.11)
2370	2	165	J1939: Vehicle controller signal error - VP37 Right Turn Signal	N
	9	62	J1939: Vehicle controller message missing - LD	M
	19	67	J1939: Vehicle controller signal error - LD Right Turn	N
2550	9	139	J1939: Brake controller message missing - Prop FLC Status	M
2863	14	199	J1939: Vehicle controller message missing - OWW	
	19	187	J1939: Vehicle controller signal error - OWW Wiper	N
2874	19	160	J1939: Vehicle controller signal error - OEL High-Low Beam Switch	
2875	9	194	J1939: Brake controller signal invalid - OEL Hazard Switch	M
	19	80	J1939: Vehicle controller signal error - OEL Hazard Switch	N
2876	2	180	J1939: Vehicle controller signal invalid - OEL Turn Signal Switch	P
	9	65	J1939: Vehicle controller message missing - OEL	M
		195	J1939: Vehicle controller signal invalid - OEL Turn Signal	
	19	66	J1939: Vehicle controller signal error - OEL Turn Signal	N
3564	4	153	J1939: Vehicle controller signal error - FLIC LDW Enable Command	N
	9	173	J1939: Vehicle controller signal invalid - FLIC LDW Enable Command	M
	14	134	J1939: Vehicle controller message missing - FLIC	
	19	153	J1939: Vehicle controller signal error - FLIC LDW Enable Command	N
4011	9	183	J1939: Vehicle controller signal invalid - OEL High Beam Headlamp	M
516096	19	148	J1939: Vehicle controller signal error - LDW Enable Switch	N
516097	2	193	J1939: Vehicle controller signal invalid - FLIC Prop Speaker	P
	9	174	J1939: Speaker controller signal invalid - FLIC Prop Speaker	M
	18	193	J1939: Vehicle controller signal invalid - FLIC Prop Speaker	P
	19	154	J1939: LDW Speaker controller signal error - FLIC Prop Speaker	N
516098	2	188	J1939: Vehicle controller signal error - OEL High Beam	N
	19	161	J1939: Vehicle controller signal error - OEL High Beam Status	
516099	9	186	J1939: Vehicle controller signal invalid - Windshield Wiper	M
	19	162	J1939: Vehicle controller signal error - OEL Wiper	N
516100	19	164	J1939: Vehicle controller signal error - VP37 Left Turn Signal	N
516101	19	165	J1939: Vehicle controller signal error - VP37 Right Turn Signal	
516102	19	166	J1939: Vehicle controller signal error - VP37 High Headlamp	
516103	19	167	J1939: Vehicle controller signal error - VP37 Hazard Lamp	
516104	19	168	J1939: Vehicle controller signal error - VP37 Wiper Status	

*Note: The 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.*

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

## APPENDIX B - BENDIX® WINGMAN® FUSION™ SYSTEM COMPONENT SCHEMATIC



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