Installation Instructions

AutoVue® Lane Departure Warning (LDW) System (3G) by Bendix CVS

PREPARATION

The vehicle must be parked on level ground. Switch off the ignition and disconnect the battery.

Read and understand this document before beginning work. *See the General Safety Guidelines on Page 2.* Familiarize yourself with the kit contents; kits may feature speakers OR vibrating seat motors.

Inspect the windshield area where the camera will be mounted for damage/cracks to be sure there will be a clear view.

In some cases, it may be necessary to consult the vehicle's electrical schematic diagram(s) to plan access to the power supply and the turn-signal wiring.

REQUIRED TOOLS

3¼ inch hole saw; wire strippers; wire crimpers; small "torpedo"-style level; test light or multimeter; and wire-pulling aids. Depending on the installation, *see a list of optional tools on the final page*.

INSTALLATION OVERVIEW

Plan the entire installation before beginning work. Some key points to bear in mind when planning the installation are:

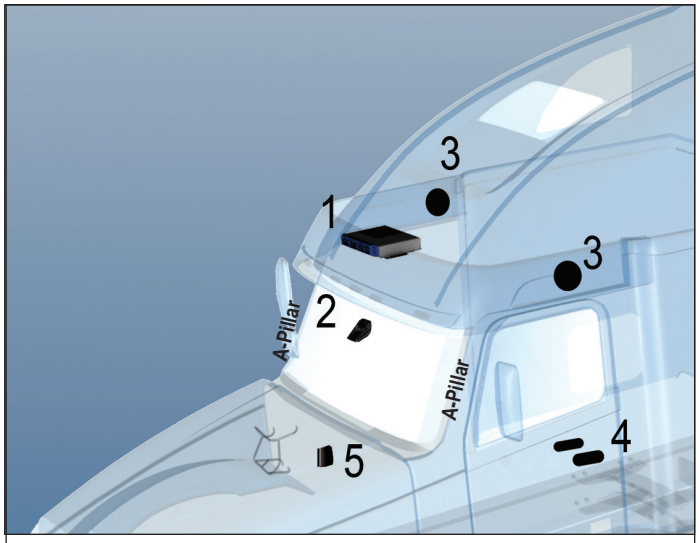
- Camera and processor placement - note that the length of the camera cord is approximately 22 in. (550 mm) long.
- Wiring harness routing.
- Access to the turn-signal wiring.
- Dash switch location and wiring.
- Speaker (or seat motor) locations and wiring.

Where you are installing Autovue® LDW system on multiple vehicles, standardize the best installation for the model; this will assist when troubleshooting.

CAMERA MOUNTING

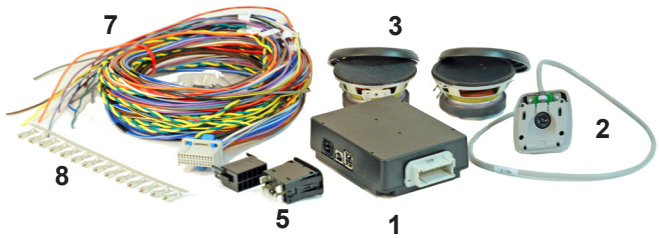
IMPORTANT: Before mounting the camera, verify that the vehicle is level.

1. Clean and inspect the inside of the windshield where the windshield bracket will be mounted. Use a denatured alcohol-based (or similar) cleaner. Cracks/distortion/damage that would interfere with the camera operation are not acceptable. Clean and dry the windshield; the presence of grease or dirt will affect the adhesive used to hold the camera bracket in place.



Kit Contents

Key	Description	Qty
1.	Lane Departure Warning processor	1
2.	Camera with windshield bracket	1
3.	Two 3½-inch speakers with covers (optional)	2
4.	Vibrating seat motors (optional)	2
5.	Enable/Disable switch	1
6.	Driver information sticker (not shown)	1
7.	Wiring harness (16 wire, color-coded; 20 foot)	1
8.	Connectors	14
9.	120 Ohm resistors (not typically needed)	2
10.	Other wiring harnesses	(varies by kit)



(Sticker, vibrating seat motors, extra harnesses, and windshield bracket not shown)

FIGURE 1 - *INSTALLATION KIT*

GENERAL SAFETY GUIDELINES

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

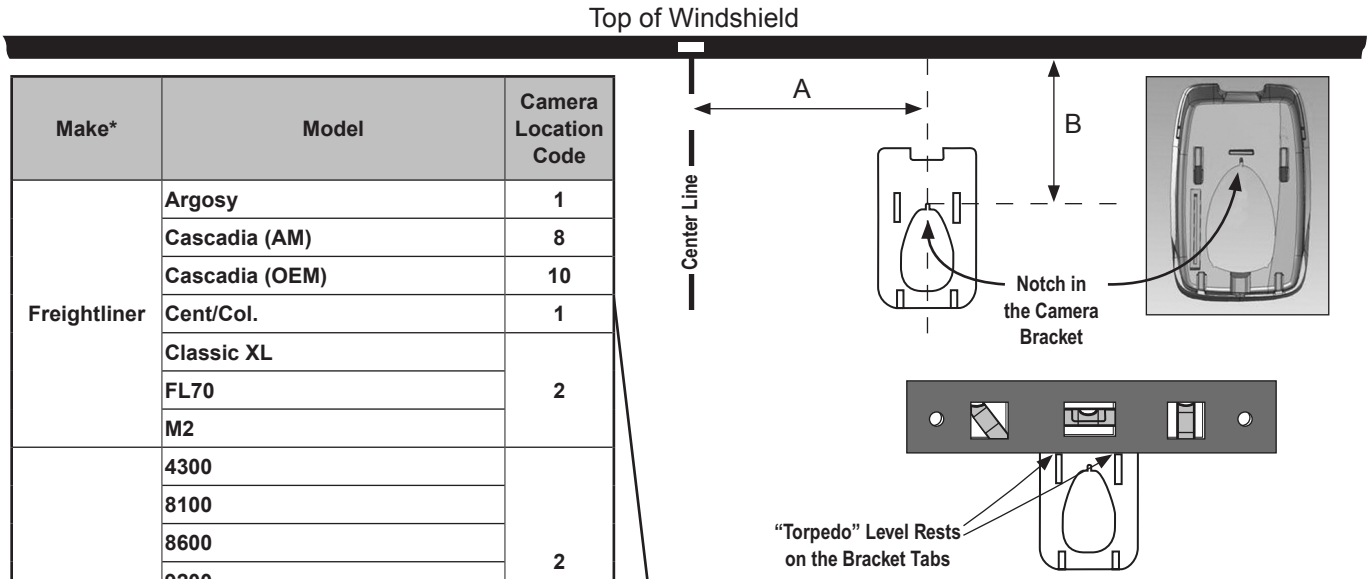
When working on or around a vehicle, the following general precautions should be observed at all times:

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.**
2. **Stop the engine and remove 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.**
3. **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.**
4. **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 or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **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.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **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.**

2. The precise location to install the camera bracket varies based on the vehicle make/model. *See Figure 2.* Find the horizontal offset "A", and vertical offset "B" for the vehicle. The intersection of "A" and "B" will line up with a notch in the windshield bracket during installation. When measuring for the window bracket placement, measure from the center of the windshield and from the solid black area at the top. For vehicles with split-windshields, measure from the middle of the center divider. For one-piece windshields, typically there is a graphical indicator to show the middle point.
3. Use a measuring tape and fine-tipped pen to mark on the windshield the installation point for the bracket.
4. *See Figure 2* Remove the plastic film from the adhesive on the windshield bracket. Place a small level on the leveling tabs. Touching only the top edge of the bracket to the glass at first, align your mark with the notch in the bracket. Adjust the angle of the bracket until it is level, then carefully bring the rest of the bracket into contact with the glass, making sure that the notch remains lined up with the point marked on the glass. While it is lightly seated, verify again that the bracket is level — at this point some adjustment is still possible. Once you have confirmed that the bracket is completely level, press it firmly to the windshield for 10 seconds to ensure a good bond.
5. Install the camera onto the mounting bracket and route the harness to the compartment above.

PROCESSOR PLACEMENT

1. The processor will typically be mounted on the passenger side of the vehicle in a front overhead compartment. When selecting the ideal location, be sure to consider that there must be no pinching or binding of the camera cable, and that there should be easy access to all of the unit's connections.
2. It is recommended to position the processor unit so that the large connector is oriented to the passenger side of the vehicle. A good practice is to leave 12 in. (or more) of excess harness on the connector side for a service loop. The processor should be mounted flat, using the hook-and-loop-fastener pad to attach it to the vehicle.



Make*	Model	Camera Location Code
Freightliner	Argosy	1
	Cascadia (AM)	8
	Cascadia (OEM)	10
	Cent/Col.	1
	Classic XL	2
	FL70	
	M2	
International	4300	2
	8100	
	8600	
	9200	
	9400	
	9900	
	Lonestar	9
	Pro Star	2
	Workstar/7000 Series	
Kenworth	T200	2
	T600/800	3
	T600/800 Flt Wndshld	7
	T660	3
	T680	2
	T700	
Mack	Pinnacle	2
	Vision	
Peterbilt	378	2
	379	
	385	
	386	
	389	
	340 Car Hauler	
	379 Car Hauler	
	384/386 with video	
	384/386 with Curved Windshield	
	387 (AM)	
	387 (OEM)	
	579	9
Sterling	A-Line	2
	A-Line Car Hauler	
Volvo	NonVolvo Engine	2
	Volvo Engine	
Western Star	4900	2

To determine the correct point on the windshield to line up to the notch in the camera bracket, use the Make/Model columns of the table (left) to find the Camera Location Code. The second table (below) shows the correct vertical and horizontal offset to use for each Code.

Camera Location Code	Horizontal Offset "A"	Vertical Offset "B"
1	9 ± 0.25 in.	2 ± 0.5 in.
2	6 ± 0.25 in.	2 ± 0.5 in.
3	9 ± 0.25 in.	3 ± 0.5 in.
7	7 ± 0.25 in.	3 ± 0.5 in.
8	7 ± 0.25 in.	2 ± 0.5 in.
9	6 ± 0.25 in.	2.5 ± 0.5 in.
10	8 ± 0.25 in.	2 ± 0.5 in.

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

FIGURE 2 - ***LOCATING THE CORRECT POINT TO MOUNT THE CAMERA BRACKET***

Retain All Harnesses

NOTE: Store all the wiring harnesses supplied in the kit — including any not used in this installation — with the processor in the overhead compartment. Additional systems that interact with the Autovue® LDW system, may require these harnesses.

WIRING HARNESS ROUTING

See Figure 1. The 20 foot wiring harness can be routed via either, or both, A-pillars. Routing may depend on where the dash Enable/Disable switch will be located, and whether speakers or seat-motors are to be used to alert the driver.

TURN SIGNAL CONNECTIONS

1. Test the turn signal system to verify that it is functioning correctly.
2. Refer to the wiring diagram for the vehicle to find wire numbers for the left and right turn signals.
3. As necessary, remove the vehicle trim/panels to gain access to the wiring looms where the left and right turn signal wires are located.

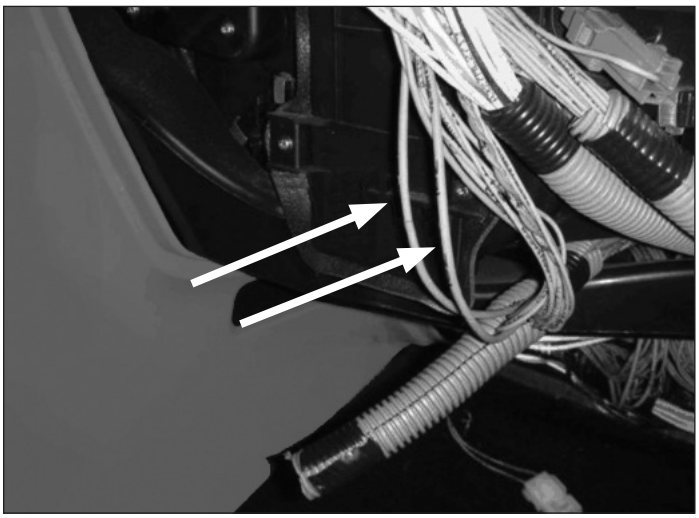


FIGURE 3 - *LOCATING THE TURN SIGNAL POSITIVE WIRES*

4. Connect a test lamp, Voltmeter or Multimeter to each of the turn signal positive wires and use the following tests to confirm you have the correct wires.

   Verify that you find (for both the left ***and*** right wiring):

   - When the turn signal is off, the test lamp should be off (or 0v);
   - When the turn signal is operating, the test lamp should blink (or pulse 12v);
   - When the service brake pedal is applied (with the turn signal off), the lamp should be off (or 0v);
   - When the parking brake pedal is engaged or disengaged, (with the turn signal off), the lamp should be off (or 0v); and
   - When the headlights are switched on, (with the turn signal off), the lamp should be off (or 0v).

   Having confirmed each wire for function, be sure to mark each wire clearly for the next step.

5. Run the wiring harness to the location where the connection will be made. Refer to the tags on the wires and connect, by soldering or splicing, to their respective (left or right) turn signal positive wires.

IGNITION, GROUND, AND BATTERY CONNECTIONS

Three power connections must be made:

1. **Ignition (Pin A9).** Ignition power is required for the processor, the Enable/Disable switch, and for kits including seat motors, to the seat connector. Obtain ignition power at a good 12 Volt accessory location: typically at the fuse panel; or at the ignition switch.

CAUTION: The Ignition power MUST come from a suitable vehicle circuit that is:

- Switched on and off by the ignition switch; and,
- Is protected by a fuse or circuit breaker with an electrical current rating of no greater than 15 Amps and no less than 5 Amps.

Connect Ignition power to both the harness red wire marked IGNITION, and also to Pins 10 and 12 the Enable/Disable switch. Use 18 gauge wire as needed.

2. **Ground (Pin B9).** Locate a suitable location on the vehicle to make a good connection to chassis ground. Potential locations are: the fuse box; the vehicle's chassis; or the firewall near the steering column. If you select the chassis or firewall — and in making the ground, need to drill a hole — take care not damage, or interfere with other vehicle components.

- Connect ground to the harness black wire marked GROUND, and also to Pin 2 of the Enable/Disable switch. Use 18 gauge wire as needed.

3. **To the Battery (Pin A11).** The battery connection must be made at a location where 12 Volt battery voltage is constantly present, regardless of the ignition state. This is essential for full functionality of the optional data recording features.

   Make sure that the battery connection is stable by confirming that the voltage level is (nominally) 12 Volts at the battery connection regardless of the ignition switch position.

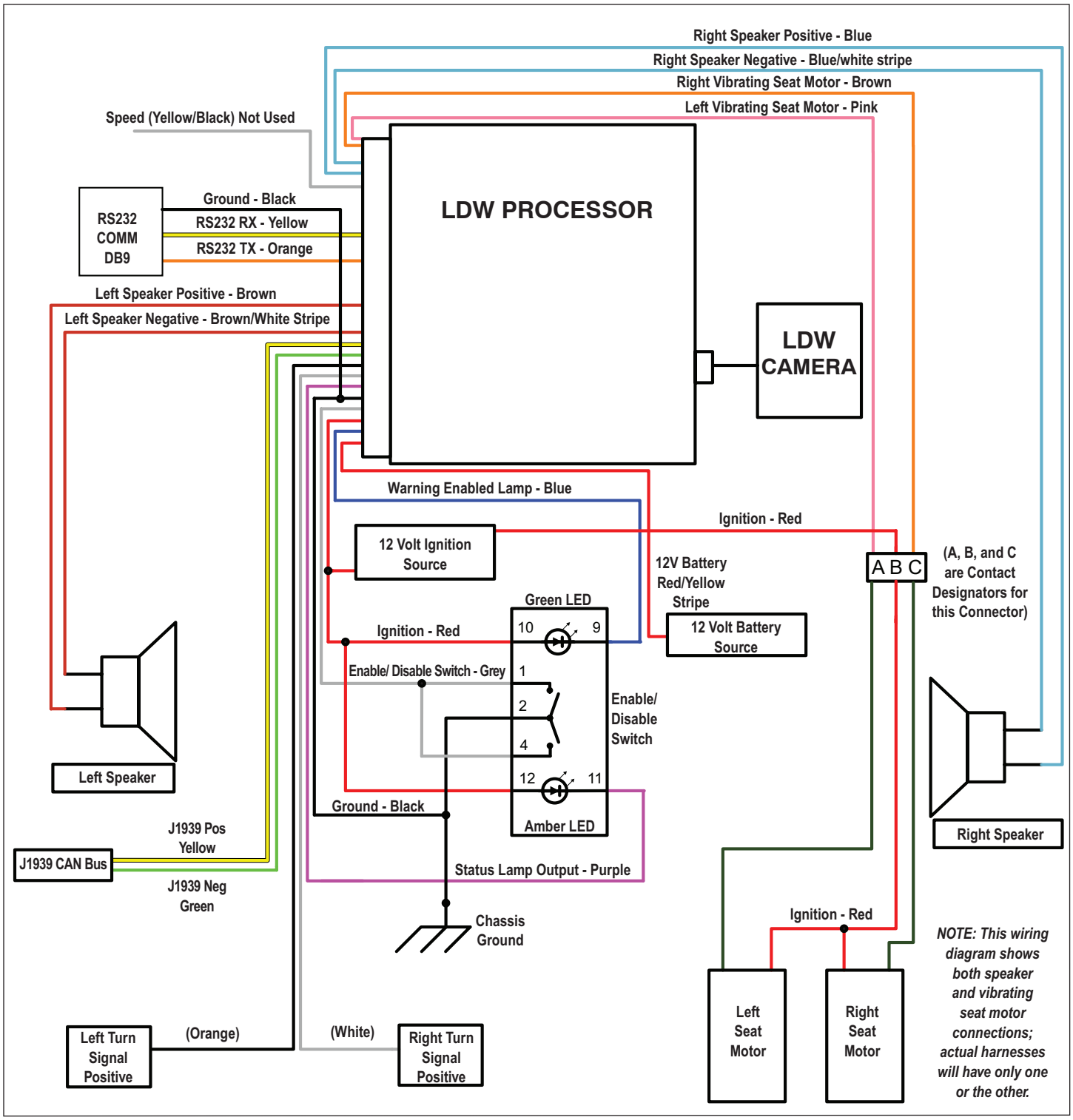


FIGURE 4 - *AUTOVUE® LDW SYSTEM WIRING DIAGRAM*

J1939 CAN BUS CONNECTION

The J1939 CAN (Controller Area Network) Bus is a communications standard designed to permit vehicle devices to communicate with each other. To enable the full range of the Autovue® LDW system by Bendix CVS features, the designated wires in the harness need to be connected to the J1939 CAN Bus.

NOTE: For vehicles built since 2005, the J1939 CAN Bus is almost always activated. In rare cases where J1939 CAN Bus is not found, see the *Troubleshooting* section.

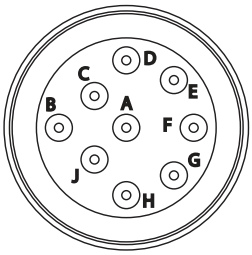
Most vehicles have a 6- or 9-pin diagnostic connector, near the driver-side door, typically low down on — or under — the dash. *See Figures 4 and 5.* This connector is used by PC Diagnostics to examine engine performance data and Diagnostic Trouble Codes (DTCs), and is an ideal point to connect the AutoVue LDW system harness.

Gain access to the wires behind the connector. A yellow and green twisted pair of wires is the Standard for J1939 CAN Bus wiring; see the AutoVue LDW system harness

wires used for this purpose as an example of what to look for. Generally, it is best to splice in the new wires as close to the data connector as possible.

For Vehicles with 9-pin Diagnostic Connectors

Pin Location	Signal	Description
C	CAN_H	CAN Bus, High
D	CAN_L	CAN Bus, Low
E	CAN_GND	CAN Ground
H & J	This is a different CAN Bus - DO NOT USE!	



View Looking Into the Connector

FIGURE 5 - *9-PIN DEUTSCH CONNECTOR: J1939 CAN BUS TERMINALS*

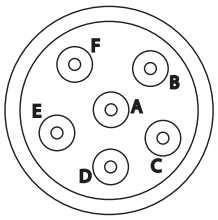
On vehicles with 9-pin connectors, splice the yellow wire of the harness to the yellow J1939 CAN Bus High (+) connected to pin C, and the green wire of the harness to the green J1939 CAN Bus Low (-) connected to pin D.

Some vehicles with 9-pin connectors may be connected to two sets of twisted pair yellow and green wires. Only connect to the green and yellow wires at pins C AND D (J1939 CAN Bus).

CAUTION: If a second set of yellow and green wires is presently connected to Pins H and J be aware that this is a different CAN Bus - DO NOT USE THIS BUS for this kit. INCORRECT CONNECTION MAY CAUSE UNEXPECTED VEHICLE PERFORMANCE PROBLEMS.

For Vehicles with 6-pin Diagnostic Connectors

Pin Location	Signal	Description
D	CAN_H	CAN Bus, High
F	CAN_L	CAN Bus, Low



View Looking Into the Connector

FIGURE 6 - *6-PIN DEUTSCH CONNECTOR: J1939 CAN BUS TERMINALS*

On vehicles with 6-pin connectors, splice the yellow wire of the harness to the yellow J1939 CAN Bus High (+, connected to pin D), and the green wire of the harness to the green J1939 CAN Bus Low (-, connected to pin F).

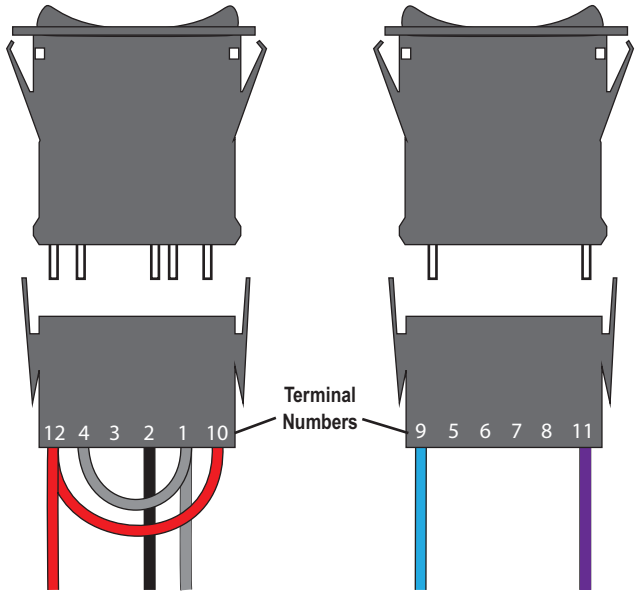
ALERT: With either connector, IF FOUND, do not attempt to use sets of orange and green wires; these are J1708 Bus wires and this kit is not designed to use the J1708 Bus.

ENABLE/DISABLE SWITCH

Select a suitable location for the Enable/Disable switch, keeping in mind how much room will be needed for the switch and access to its wiring connections. A typical site is next to existing switches of the same size; use a spare switch location if available. Otherwise, use hand tools and/or a dashboard-punch to make the hole. Most dashboard materials are relatively easy to cut through, but be sure to avoid any damage to wiring or equipment behind the selected location.

FIGURE 7 - *EXAMPLE ENABLE/DISABLE SWITCH INSTALLATION*

See Figure 8 for the wiring connections. As you attach the wiring, since the terminals are not in numeric order, be sure to verify the exact location number for each wire as you assemble the connector for the back of the switch.



Pin	Color	Description
1	Grey	AutoVue Harness, Also Connects to Pin 4
2	Black	Ground
4	Grey	AutoVue® Harness, Also Connects to Pin 1
9	Blue	Warning Lamp Enabled
10	Red	Ignition, Also Connects to Pin 12
11	Purple	Status Lamp Output
12	Red	Ignition, Also Connects to Pin 10

FIGURE 8 - *ENABLE/DISABLE SWITCH CONNECTIONS*

DRIVER ALERT SYSTEMS - AUDIBLE OR VIBRATION

Kits will either contain a speaker-based alert system, or use vibrating seat motors in the driver's seat to provide feedback.

AUDIBLE ALERT SYSTEM

The standard location to install the speakers is above and/or close behind, the head of the driver (and passenger). Check that the location selected has both room behind the panel for the speakers to fit, and in front for the speaker grills. A 3¼ inch hole saw can be used to cut the holes for the speakers. Select the correct set of speaker wires and pull each pair of wires to the respective side, through the hole into the cab.

Harness Speaker Wire Color	Where Used
Brown / Brown and White	Left (Driver Side)
Dark Blue / Dark Blue and White	Right (Passenger Side)

Use the terminals supplied, or use solder, to connect the speakers to the harness. Install the u-nuts at the sides of the holes cut. With the speaker and grill aligned, install the screws supplied. *See the speaker image in Figure 9.*

When the installation is complete, at vehicle start-up, the speakers will "chirp" in sequence (left then right) to confirm that they are functioning.

VIBRATING SEAT MOTOR ALERT SYSTEM

See Figure 9 (NOTE: The exact kit components may vary from the items shown.)

Instead of speakers, selected kits use vibrating seat motors to signal to the driver. For these kits, route the pink and brown harness wires to the floor at the back of the seat. The red wire that comes already installed to the smaller section of the connector needs to be run back to the ignition power (*see the Ignition, Ground, and Battery Connections section.*)

Remove the bottom seat cushion from the driver's seat and take the cover off to reveal the foam. The motors will be installed so that they are under the driver's thighs. Plan the locations and then cut the foam as shown in Figure 9, including a center pocket for the vibrating seat motor assembly. As shown, leave a flap of foam to cover the motor.

Run the wires from the motors to the back of the seat by cutting a slit part-way into the foam and routing the wires through it.

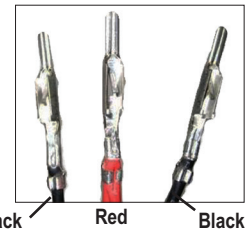
A connector with two detachable halves is used to join the motor harnesses and the wiring from the system and ignition.

Before cutting any excess from the wires, plan the location of the connector, making sure that there will be sufficient slack to allow the seat to move freely through its full range of motion. Verify also that the wiring will not be pinched when the seat is moved.

Typical Speaker Location

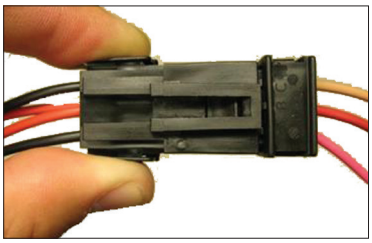
Kit Harness Featuring Vibrating Seat Motors

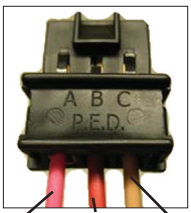
Preparing and Installing the Vibrating Seat Motors: Routing the Wiring



Black Red (Combined) Black

Preparing and Installing the Seat Connector Wiring Using the Delphi PED connector





Pink Red (Factory Installed) Brown

FIGURE 9 - ***DRIVER ALERT SYSTEMS***

Connections from the Vibrating Seat Motor Side

Using Delphi connectors, install the vibrating seat motor wires into the smaller section of the connector. The black wire from the right motor goes into slot C, the black wire from the left motor goes into slot A, and the two red wires from the motors are joined together and go into slot B of the Delphi connector that is supplied with the kit.

The seat cushion can now be replaced. Use wire loom protectors for any exposed wiring.

Connections From the Harness Side

This connector supplied has a red wire already installed into slot B; this wire must connect to a good 12 Volt ignition source protected by a fuse or circuit breaker with a current rating between 5 (five) and 15 Amps.

Using Delphi connectors, install the pink wire into slot A and the brown wire into slot C. The pink wire is used to control the left vibrating seat motor and the brown wire controls the right motor by supplying the motor with a ground. Join the two halves of the connector together. Use wire loom protectors for any exposed wiring.

FINAL STEPS AND SYSTEM TESTING

Install the Driver Information Sticker in a suitable location on the vehicle, visible to the driver.

Return all vehicle panels and wiring looms to their installed positions.

Restore the battery connections.

When the vehicle power is switched on the Autovue® LDW system by Bendix CVS will go through a self test:

- If equipped with speakers, you will hear a chirp from the left and right speakers respectively, in that order.
- If equipped with vibrating seat motors, you will feel a short pulse from the left and right motors respectively, in that order.

Both the green and yellow indicator lights on the Enable/Disable switch should remain on. Both the green and yellow lights should remain on until you reach 38 to 40 mph (61 to 64 km/h), at which point the system is active.

Test drive the vehicle (both day and night where practical).

Enable/Disable Switch Lamp Behavior:

Situation	Warning Enabled Lamp (Green)	Status Lamp (Yellow)	Warnings Ready
Vehicle Speed < 37 mph (60 km/h)	ON	ON	No
Can't Find Lane Markings	ON	ON	No
Vehicle Speed > 37 mph (60 km/h) AND Lane Markings Found	ON	OFF	Yes
Driver Presses Switch to Disable Warnings	OFF	OFF	No
System Diagnostic Trouble Code (DTC) Set	OFF	ON	No

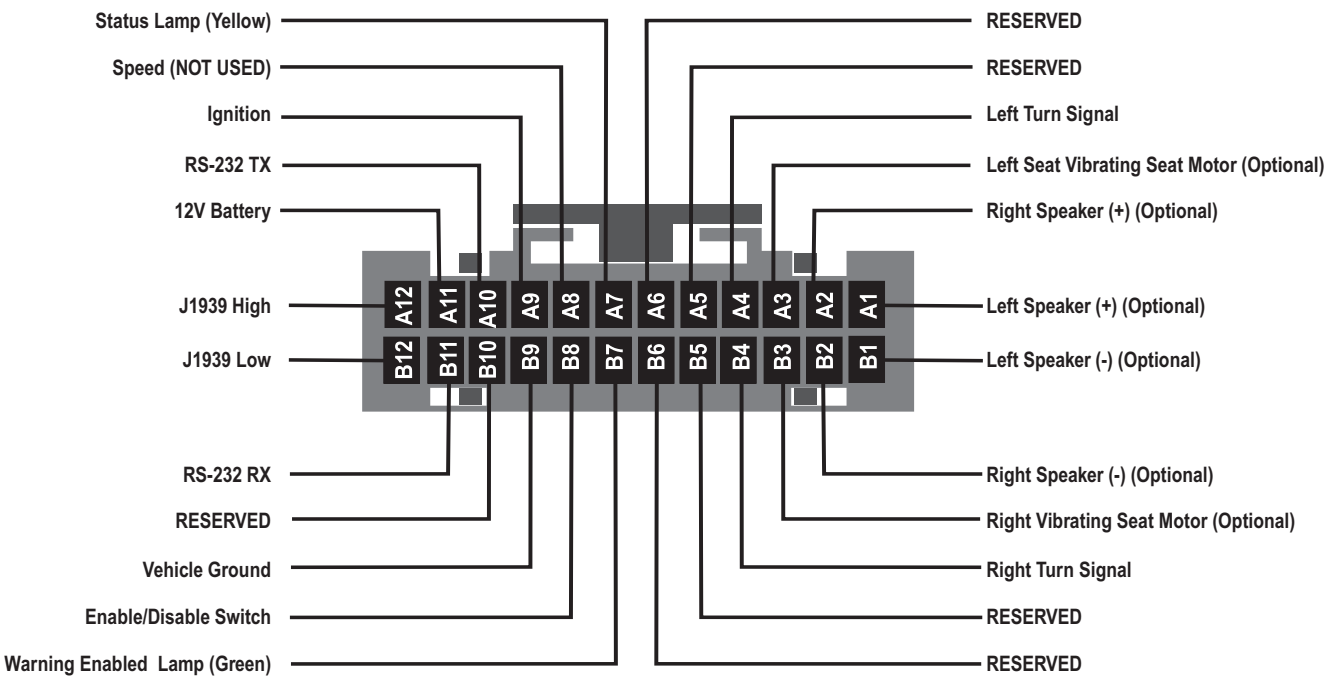
TROUBLESHOOTING:

At start-up, if the green light on the Enable/Disable switch illuminates and then goes out after a few seconds, this typically indicates that the system is not finding the J1939 CAN Bus data link. If so, test the following:

1. Check for loose connections to the data link wiring.
2. Use PC diagnostics to check the J1939 CAN Bus.

Two much more rare possibilities are:

3. The J1939 CAN Bus is not activated. Typically the J1939 CAN Bus can be activated via the engine diagnostic port using a laptop, or diagnostic computer.
4. The vehicle does not have the J1939 Bus wiring run from the engine ECM connector or Vehicle Control Unit. Consult the OEM documentation for the correct procedure to permit J1939 communications. Where this is necessary, the two 120 Ohm resistors are supplied in the kit to be used— if necessary — to assist with obtaining the 60 Ohms required across the yellow and green wires, so that the ECM recognizes that the J1939 Bus is in use.



Connector Diagram (viewed from wiring side of harness connector):
RESERVED = Reserved for future use.

Pin	Term	Input/ Output	Wire Color	Connection	Function
A1	Left Speaker (+) (Optional)	O	Brown	8 Ohm, 25 W speaker (between A1 and B1)	Generates audio warning during left side lane departure.
A2	Right Speaker (+) (Optional)	O	Blue	8 Ohm, 25 W speaker (between A2 and B2)	Generates audio warning during right side lane departure.
A3	Left Vibrating Seat Motor (Optional)	O	Pink	Vibrating seat motor (+) lead	Generates seat signal during left side lane departure.
A4	Left Turn Signal	I	Orange	Vehicle left turn signal line	Disable all warnings when turned on.
A7	Status Lamp (Yellow)	O	Purple	Low side of yellow LED	Indicates to driver that the system is not ready to give warnings.
A9	Ignition Voltage	I	Red	Vehicle ignition switch	Provides system power.
A10	RS-232 TX	O	Orange	Connects to RS-232 port, data receive input	Used for communication with other computer devices.
A11	Battery Voltage	I	Red/Yellow	Vehicle battery feed	Allows unit to store data during power down sequence after ignition has been turned off.
A12	J1939 High	I/O	Yellow	Vehicle J1939 Bus (high side)	CAN Bus; Source of vehicle speed.
B1	Left Speaker (-) (Optional)	O	Brown/White Stripe	8 Ohm, 25 W speaker (between A1 and B1)	Generates audio warning during left side lane departure.
B2	Right Speaker (-) (Optional)	O	Blue/White Stripe	8 Ohm, 25 W speaker (between A2 and B2)	Generates audio warning during right side lane departure.
B3	Right Vibrating Seat Motor (Optional)	O	Brown	Vibrating seat motor (+) lead	Generates seat signal during right side lane departure.
B4	Right Turn Signal	I	White	Vehicle right turn signal line	Disable all warnings when turned on.
B7	System Enabled Lamp (Green)	O	Blue	Low side of green LED	Indicates to driver that system is enabled.
B8	Enable/Disable Switch	I	Grey	Normally open, momentary switch connected to chassis ground	Allows the driver to temporarily disable warnings in confusing situations (e.g. construction zones with multiple sets of lane markings.)
B9	Vehicle Ground	I	Black	Vehicle chassis ground	System power return.
B11	RS-232 RX	I	Yellow	Connects to RS-232 port, data transmit output	Used for communication with other computer devices.
B12	J1939 Low	I/O	Green	Vehicle J1939 Bus (low side)	CAN Bus; Source of vehicle speed.

FIGURE 10 - *WIRING REFERENCE CHART*

NOTES

NOTES

Bendix Technical Assistance Team

For direct telephone technical support, call the Bendix Tech Team at: 1-800-AIR-BRAKE (1-800-247-2725). Tech Team members are available Monday through Friday, 8:00 A.M. to 6:00 P.M. ET.

Or, if you prefer, e-mail us at: techteam@bendix.com. Please have the following information ready when you contact the Bendix Tech Team: Bendix product model number; part number and configuration; vehicle make and model.

Tools

Some installers have found the following items useful:

- Delphi Crimper (part number 06285847) for switch contacts.
- Panel Punch (part number DIN-132) for making the hole for the Enable/Disable switch. (www.panelpunches.com)

Miscellaneous Supplies

- Wire Loom Protectors (for the vibrating seat motor installation.)