



Operator's Manual for UPS Package Car Drivers

Bendix™ VORAD® VS-500™
Forward Collision Warning System

Bendix™ AutoVue® 5G
Lane Departure Warning System

SafetyDirect® by Bendix CVS
Video and Data System



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



This booklet contains important operational and safety information that benefits you and subsequent drivers.

Introduction

This operator's manual explains the features and functions of the Bendix™ VORAD® VS-500™ Forward Collision Warning System, the AutoVue® 5G Lane Departure Warning System, and the SafetyDirect® by Bendix CVS Video and Data Capture System.

Read this manual thoroughly before operating the system. Be familiar with the controls, system alerts, and what to expect when the system is on. Keep this manual in the vehicle as a reference for the system, its operation, and performance characteristics.

Additional Information About Bendix® Systems

For additional information about Bendix® systems, contact the Bendix Tech Team at techteam@bendix.com or call 1-800-AIR-BRAKE (1-800-247-2725). Visit bendix.com for more information and for any updates to this document.

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-HF^{ci} 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.

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IMPORTANT SAFETY INFORMATION

THE DRIVER IS ALWAYS RESPONSIBLE FOR THE CONTROL AND SAFE OPERATION OF THE VEHICLE AT ALL TIMES. THE BENDIX™ VORAD® VS-500™ SYSTEM DOES NOT REPLACE THE NEED FOR A SKILLED, ALERT, PROFESSIONAL DRIVER, REACTING IN A TIMELY MANNER, AND USING SAFE DRIVING PRACTICES.

BEFORE DRIVING WITH THE VS-500 SYSTEM, THE DRIVER MUST FULLY UNDERSTAND ALL AUDIBLE ALERTS AND VISUAL INDICATORS.

THE VS-500 SYSTEM REACTS ONLY TO VEHICLES MOVING IN THE SAME DIRECTION AS YOUR VEHICLE. THE SYSTEM DOES NOT RECOGNIZE SIDE-TO-SIDE MOVING TRAFFIC, OR ONCOMING TRAFFIC. THE SYSTEM WILL NOT PROVIDE AN ALERT WHEN APPROACHING VEHICLES IN THESE CIRCUMSTANCES.

THE VS-500 SYSTEM WILL NOT WARN OR REACT TO PEDESTRIANS, ANIMALS, AND NON-METALLIC OBJECTS. THE SYSTEM MAY NOT WARN OR REACT TO LIMITED-METALLIC OBJECTS (SUCH AS RECREATIONAL VEHICLES, HORSE-DRAWN BUGGIES, MOTORCYCLES, LOGGING TRAILERS, ETC.).

DUE TO THE INHERENT LIMITATIONS OF THE IMAGE RECOGNITION TECHNOLOGY USED IN THE BENDIX™ AUTOVUE® 5G LANE DEPARTURE WARNING SYSTEM, 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.

IT IS IMPORTANT TO REMEMBER THAT THE BENDIX™ SAFETYDIRECT® PROCESSOR MAY NOT CAPTURE ALL EVENTS, OR ALL VIDEO AND DATA ASSOCIATED WITH EVENTS, ESPECIALLY WHEN POWER MAY BE CUT OFF BEFORE DATA CAN BE CAPTURED, OR IF CRASH DAMAGE IS EXTENSIVE OR FIRE IS INVOLVED.

METALLIC OBJECTS THAT THE RADAR MAY DETECT IN, OR CLOSE TO, THE VEHICLE'S PATH (SUCH AS CRASH BARRIERS, GUARD RAILS, CONSTRUCTION ZONE BARRICADES, TUNNEL ENTRANCES, ETC.) MAY DECREASE THE FUNCTION OF THE RADAR.

INSPECT THE RADAR AND MOUNTING BRACKET REGULARLY AND REMOVE ANY MUD, SNOW, ICE BUILD-UP, OR OTHER OBSTRUCTIONS. INSTALLING AFTERMARKET DEER GUARDS IS NOT RECOMMENDED, AND COULD IMPAIR THE OPERATION OF THE RADAR.

IF THE BUMPER AND/OR RADAR ARE DAMAGED OR MISALIGNED, OR IF THE RADAR WAS TAMPERED WITH, THE SYSTEM WILL NOT DELIVER ALERTS PROPERLY UNTIL THE VEHICLE IS REPAIRED AND THE RADAR RE-ALIGNED.

IF A PROBLEM IS DETECTED WITH THE VS-500 SYSTEM, THERE IS AN AUDIBLE ALERT, AND/OR ICON ON THE BENDIX™ DRIVER INTERFACE UNIT (DIU™).

SMALLER FORWARD VEHICLES, SUCH AS MOTORCYCLES, MAY BE DIFFICULT FOR THE RADAR TO IDENTIFY. IT IS THE DRIVER'S RESPONSIBILITY TO BE AWARE OF THIS TYPE OF VEHICLE AND TO BE CAUTIOUS.

INSPECT THE CAMERA AND MOUNTING BRACKET REGULARLY. MAKE SURE THE WINDSHIELD, ESPECIALLY AROUND THE CAMERA, IS FREE OF SNOW, ICE BUILD-UP, IS CLEAN AND FREE OF DEBRIS OR OTHER OBSTRUCTIONS. ALSO, MAKE SURE THE WINDSHIELD WIPERS ARE IN GOOD CONDITION AND NOT LEAVING STREAKS WHICH MAY IMPAIR CAMERA FUNCTION. DO NOT COVER OR BLOCK THE CAMERA AS THIS COULD IMPAIR THE OPERATION OF THE SYSTEM.

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FCC Part 15

This device complies with part 15 of the FCC rules with the limits for a Class B digital device and with RSS-210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; and (2) this device must accept any interference received, including interference that may cause undesired operation.

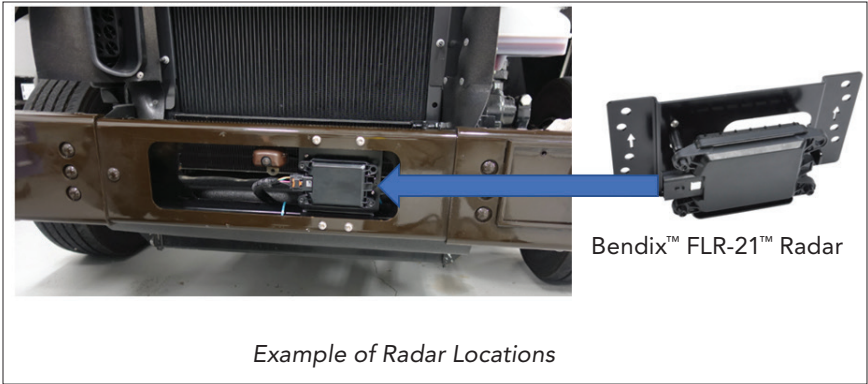
Bendix™ VORAD® VS-500™ Forward Collision Warning System Components

The Bendix™ VORAD® VS-500™ system includes a Bendix™ Driver Interface Unit (DIU™) display connected to a forward-looking radar sensor. The DIU display is located on the dash. It provides audible and visual alerts to the driver. Information about the forward monitored vehicle displayed on the DIU display is sent from the radar.

The forward-looking radar sensor locates and tracks moving vehicles in the same lane, and traveling in the same direction, ahead of the monitoring vehicle. The radar is located at the front of the vehicle either on the bumper or behind it on a cross-member.

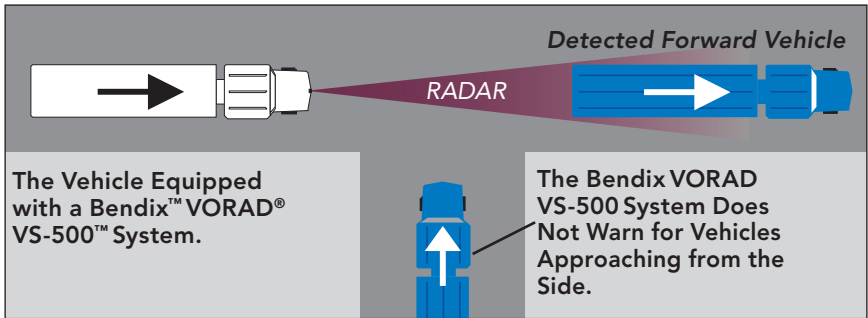


Bendix Driver Interface Unit



System Features

The Bendix™ VORAD® VS-500™ forward collision warning system delivers three types of visual and audible alerts. **NOTE:** The system **DOES NOT** deliver active interventions (such as braking or throttle reduction) – it is the responsibility of the driver to take all necessary action based on the alerts given and the situation encountered.



Following Distance

Following distance refers to the time gap, measured in seconds, between the vehicle with a VORAD VS-500 system and the vehicle ahead. Time is used, as opposed to distance, because the actual physical distance between the two vehicles changes based on the speed of each vehicle. Following Distance Alerts (FDA) are provided by the system when certain time thresholds, based on the systems parameters, are reached.

Alerts and Warnings

Visual and audible alerts and warnings are displayed on the Bendix™ DIU™. The three alerts provided by the system are the Following Distance Alert (FDA); the Impact Alert (IA); and the Stationary Object Alert (SOA).

Following Distance Alert (FDA) - Highway Mode

Above 37 mph/59 kph, the system operates in “highway mode” and will typically deliver three (3) alerts; a close alert, a closer alert, and a closest alert. The following sections provide more details.

Close Alert

The first following distance alert received in highway mode is the close alert. This alert is delivered when the distance between your vehicle and the vehicle in front of you is less than 3.0 seconds and the distance is decreasing. The system will deliver a single repeating audible tone and a single LED light on the DIU. The display on the DIU will also change as noted in the illustration.



Close Alert

Closer Alert

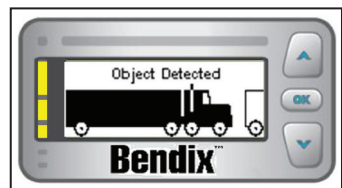
If the following distance continues to decrease, the second following distance alert—the closer alert—is activated. The system will deliver a double repeating audible tone and will light two LEDs on the DIU. The display on the DIU will also change as noted in the illustration.



Closer Alert

Closest Alert

When the following distance gap between your vehicle and the forward vehicle has closed to within 1.0 seconds, the third following distance alert—the closest alert—is activated. A continuously repeating audible tone, along with lighting three (3) LEDs on the DIU. The display on the DIU will also change, as noted in the illustration.



Closest Alert

Following Distance Alert - City Mode

At 37 mph/59 kph and below, the system operates in “city mode” and will typically deliver two (2) alerts – a closer alert and a closest alert.

The **closer alert** is delivered at 1.5 seconds from the forward vehicle. This is a double repeating audible tone, along with two (2) lit LEDs on the DIU. The display on the DIU also changes, as noted in the “closer alert” illustration on page 6.

The **closest alert** is delivered at 1.0 seconds from the forward vehicle. This is a continuously repeating audible tone and three (3) lit LEDs on the DIU. The display on the DIU also changes, as noted in the “closest alert” illustration on page 6.

Avoiding Following Distance Alerts

Once the audible alert starts, increase the distance between your vehicle and the vehicle ahead until the alerts stop. Keeping a greater than 3.0 second following distance when traveling at speeds above 37 mph/59 kph, or greater than a 1.5 seconds following distance at speeds of 37 mph/59 kph and below, will keep following distance alerts from activating.

Impact Alert (IA)

The Impact Alert (IA) is the most severe warning issued by the system. The IA indicates that a collision with the detected forward vehicle is likely and the driver must immediately act to avoid a collision.



Impact Alert - Forward Collision Warning (FCW)

Stationary Object Alert (SOA)

The Stationary Object Alert (SOA) provides up to three (3) seconds alert time when approaching a detected, stationary object with sufficient metallic (radar-reflective) surfaces in your lane. The SOA indicates that a collision with a stationary object is likely, with a single audible tone—a two (2) lit LED visual alerts—and an icon on the DIU display. The SOA is ready to alert the driver even when the vehicle is moving at low speeds.



Stationary Object Alert

The driver is responsible for taking immediate action to avoid a collision. Be especially careful when approaching certain types of vehicles and objects. The radar may not be able to detect objects with limited metal surfaces (such as recreational vehicles, horse-drawn buggies, motorcycles, logging trailers, etc.). Entering a curve may reduce the alert time to less than three (3) seconds.

At lower speeds you may get an earlier alert on stationary objects in your lane of travel than at higher speeds.

Using the Bendix™ VORAD® VS-500™ System

This chart lists the system reactions to specific situations.

What to Expect		
Situation	System Alerts	System Actions
A detected forward vehicle is in your lane.	The detected forward vehicle icon is illuminated.	None.
The detected forward vehicle slows <u>moderately</u> .	The Following Distance Alert (FDA) will be displayed.	None.
The detected forward vehicle slows <u>rapidly</u> .	The FDA, or Impact Alert (IA) (continuous tone) will sound and an icon appears.	None. The driver may need to act to avoid impact.
A detected forward vehicle cuts in front of your vehicle <u>and speeds away</u> .	The FDA may be given, depending on how close the vehicle cuts in front.	None. The driver may need to act to avoid impact.
If your vehicle comes up fast behind a slower detected forward vehicle.	The FDA will sound and an icon appears. Depending on how close your vehicle approaches, the system may initiate an IA.	None. The driver may need to act to avoid a collision.
A stationary vehicle is in your lane.	A Stationary Object Alert (SOA) may be issued up to three (3) seconds prior to impact.	None. The driver must act to avoid impact.

NOTE: These are examples of situations and typical system responses. This chart does not attempt to cover all possibilities.

System Responses

This chart lists the system response to specific driver actions.

If You Do This:	The System Responses Are:
Step on the brake any time.	The driver is always able to apply full braking force (assuming a properly maintained vehicle).
Pass a vehicle or change lanes.	The vehicle in front, still in the lane being exited, is no longer detected by the radar.
Cover or block the radar.	The system performance is diminished or disabled. A Diagnostic Trouble Code (DTC) is set.

NOTE: These are examples of driver actions and typical system responses. The chart does not attempt to cover all possible situations.

System Maintenance and Troubleshooting

Potential False Alerts

Radar technology is not perfect and false alerts occasionally occur. Radar misalignment may increase false alerts. Take into account road conditions and other factors when choosing how to react to system alerts.

System Warnings and Trouble Codes

The system monitors itself. If a malfunction is detected, a Diagnostic Trouble Code (DTC) is set and the driver is alerted. Service the system as soon as possible.

Bendix® ACom® Diagnostic Software **MUST** be used to properly diagnose and troubleshoot the system if an active DTC is present.

Preventive Maintenance

The Bendix™ VORAD® VS-500™ system is relatively maintenance free. The key items to keep the system functioning properly include:

- Keep the radar clean and free of obstructions.
- **NOTE:** Installing aftermarket deer guards is not recommended and could impair the operation of the radar.
- Inspect the radar to ensure it is free from any visual damage.
- Never use the radar unit as a step.
- Check to ensure the wiring is properly connected to the radar. Watch for salty snow build-up around the connection which may lead to corrosion.

Bendix™ AutoVue® 5G Lane Departure Warning (LDW) System Components

The AutoVue® 5G Lane Departure Warning (LDW) System by Bendix CVS helps drivers combat lane drift related to: drowsiness/fatigue, distractions, and adverse/unfavorable weather conditions.

The system components include a digital camera mounted near the middle of the windshield inside the cab, and a central processing unit in the overhead console. There are two speakers mounted right and left in the overhead console which provide the lane departure warning alerts. A combined GPS and cellular antenna is mounted on the windshield which provides connectivity to the system. Lastly, an ENABLE/DISABLE switch mounted on the dash enables a temporary (15 minute) system shutdown by the driver in cases where lane markings may not be clear – such as in work zones. The LEDs on the switch let the driver know if the system is available.



System Features

The AutoVue 5G lane departure system—using a camera that tracks visible lane markings including both solid and dashed shoulder lines, center lines, and lines between lanes—detects when a vehicle begins to drift toward an unintended lane change, and provides an audible alert to the driver when the vehicle crosses over a visible lane marking by 6” or more.

The AutoVue 5G LDW system is optimized to reduce false alerts; however the driver may temporarily use the ENABLE/DISABLE switch to silence the alerts if the current road conditions are causing multiple false alerts.

The AutoVue 5G Lane Departure Warning (LDW) system is not meant for use in city traffic, in construction zones, or in heavy highway traffic.

System Features (continued)

The system does not provide warnings for planned lane departures indicated by an activated turn signal and disables warnings when driving below 37 mph/59 kph.

Alerts and Warnings - What to Expect

- At start up, the system will provide a lane departure warning alert through the left- and right-mounted speakers.
- If the system is operating normally, the ENABLE/DISABLE switch LED will glow green. If not, it will glow orange.
- If you cross a line by 6" or more without using your turn signal, you will get a rumble strip alert through either the right or left speaker, depending on which direction you departed your current lane of travel.
- By maintaining good lane positioning and using your turn signal when appropriate, you should not experience excessive lane departure warning alerts.

System Responses

- When an unexpected lane change takes place—lane changes without an activated turn signal in the direction the vehicle is headed—the system alerts the driver to make a correction.
- Optimized to reduce false alarms, the system automatically emits a distinctive “rumble strip” warning through speakers mounted left and right overhead, alerting the driver to make a correction.
- **NOTE:** The system does **NOT** provide an audible or visual alert through the Bendix™ Driver Interface Unit (DIU™) mounted in the vehicle.
- **NOTE:** The system is a warning system **ONLY** and does not provide active interventions to keep you in your lane of travel.

System Maintenance and Troubleshooting

Under normal road conditions (when driving above 37 mph/59 kph), if the amber LANE SEARCHING lamp illuminates on consecutive trips for more than 30 minutes at time and the green ENABLED lamp remains off despite depressing the ENABLE/DISABLE switch, the system requires calibration service at a dealer or authorized service facility.

Examples of conditions that can illuminate the amber lamp:

- If the vehicle speed is less than 37 mph/59 kph;
- When lane markings are undetectable;
- If a dirty windshield (or a similar problem) is obscuring the camera; and/or
- When a system Diagnostic Trouble Code (DTC) is detected.

While the system is capable of detecting many different types of lane markers, its performance may be diminished by certain conditions, including:

- Road surfaces that are broken or obscured by dirt, sand, salt, gravel, or skid marks;
- Weather conditions—such as rain, snow, ice, mud, or fog—diminish the visibility of the road surface;
- Lane markings that are damaged, worn, or faded;
- Poor lighting, such as heavy glare or if the vehicle has an inoperable headlight; or
- A windshield that is cracked, dirty, or streaked.



CAREFULLY READ THE INFORMATION PROVIDED. THE AUTOVUE® 5G LDW SYSTEM IS INTENDED ONLY AS AN AID FOR A CONSCIENTIOUS AND ALERT DRIVER. IT MAY NOT PROVIDE ANY WARNING OF UNINTENDED LANE DEPARTURES UNDER CERTAIN CONDITIONS. DO NOT RELY SOLELY ON THE SYSTEM TO SAFELY OPERATE THE VEHICLE. IT DOES NOT WARN OF ALL POSSIBLE HAZARDS. FOR EXAMPLE, THE SYSTEM CANNOT HELP ASSIST IN THE PREVENTION OF AN ACCIDENT IF THE DRIVER IS IMPAIRED OR NOT DRIVING SAFELY. IT IS ALWAYS THE RESPONSIBILITY OF THE DRIVER TO RECOGNIZE TRAFFIC PATTERNS AND CONDITIONS AND ALTER HIS OR HER DRIVING STYLE ACCORDINGLY.

SafetyDirect® by Bendix CVS Video and Data Capture System Components

The SafetyDirect® system has three major components:

- The Bendix™ AutoVue® 5G front facing camera (mounted on the inside of the windshield);
- The SDP5 processor (mounted inside a compartment near the camera); and
- The SDP5 GPS/cellular antenna (mounted on the inside of the windshield.)

Together they collect complex safety data and video which is transferred to the SafetyDirect web portal for review.

What to Expect

- When an event occurs that triggers recording, SafetyDirect automatically records five (5) seconds of video and data before and after the event for a total of 10 seconds of information.
- If the lane departure warning enable/disable switch is pressed and held until three (3) beeps are heard (about 7 seconds), the SafetyDirect system will capture up to 80 seconds of video immediately preceding the switch activation and 10 seconds of video after.
- The SDP5 processor is equipped with a DVR (digital video recorder) that continually records video while the vehicle is running. This video can be requested via the SafetyDirect website or through the SafetyDirect mobile application.

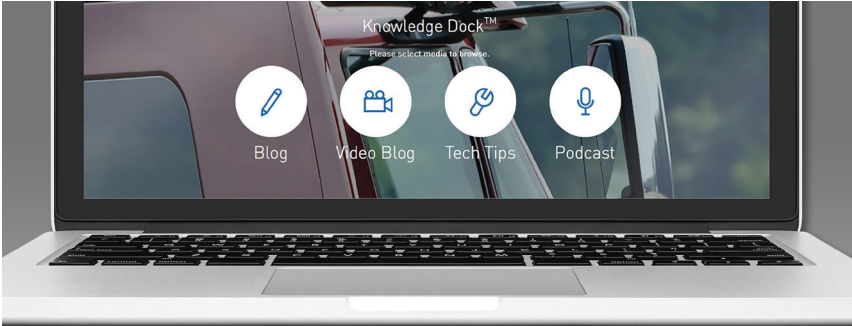
System Responses

The system will provide a beep when an event is triggered. Events may be triggered by the following situations:

Event	Situation
Lane Departure Warning	Crossing a lane marking without using a turn signal, and going back into the original lane.
Excessive Lane Departure	Crossing a lane marking without using a turn signal and continuing past a second limit, currently set at 12 inches past the inside of the lane marking.
Lane Change w/o Turn Signal	Crossing a lane marking without using a turn signal, and continuing to the adjacent lane.
Loss of Video Tracking	The unit has not been able to track for a period of ten minutes. For example, this can be caused by tampering or the lens being covered.
LDW System Disabled	System disabled by driver.
Distance Alert	An audible and visual warning, alerting the driver that the distance between the truck and the vehicle ahead is two (2) seconds or less for a duration of two (2) minutes.
Forward Collision Warning	An urgent audible and visual warning of an impending collision.
Excessive Braking	Braking with a longitudinal deceleration in excess of 0.4g, while at speeds greater than 20 mph.
Excessive Curve Speed	High speed going through a curve. Limit for event log is a lateral acceleration of 0.4g.
Manual Trigger	Driver has initiated a Manual Trigger.
For vehicles that are equipped with traction control or stability control and ABS	
ATC	An event where engine braking and/or foundation braking occurs to prevent loss of traction at the wheels of the vehicle.
ESP	An event where engine braking and/or foundation braking occurs to prevent vehicle directional instability in order to keep the vehicle traveling on its intended path.
RSP	An event where engine braking and/or foundation braking occurs to stabilize the vehicle during a possible roll-over situation.
ABS	A driver initiated brake event when the ABS system is activated.



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.



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