Operator's Manual

SmarTire® Tire Pressure Monitoring System (TPMS) by Bendix CVS

⚠ WARNING

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

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

General Safety Guidelines

Warning! Please read and follow these instructions to avoid personal injury or death.

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

- Park the vehicle on a level surface, apply the parking brakes and always block the wheels. Always wear personal protection equipment.
- Stop the engine and remove the ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically-charged components.
- Do not attempt to install, remove, disassemble or assemble a component until you have read, and thoroughly understand, the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.
- If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system, a Bendix® DRM™ dryer reservoir module, or a Bendix® AD-9si® air dryer, be sure to drain the purge reservoir.
- Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.
- Never exceed manufacturer's recommended pressures.
- Never connect or disconnect a hose or line containing pressure; it may whip and/or cause hazardous airborne dust and dirt particles. Wear eye protection. Slowly open connections with care, and verify that no pressure is present. Never remove a component or plug unless you are certain all system pressure has been depleted.
- Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, wiring, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.
- Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.

- Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.
- For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.
- The power MUST be temporarily disconnected from the radar sensor whenever any tests USING A DYNAMOMETER are conducted on a vehicle equipped with a Bendix® Wingman® system.
- You should consult the vehicle manufacturer's operating and service manuals, and any related literature, in conjunction with the Guidelines above.

Important Notice: Please Read

To prevent sensor damage, when mounting and dismounting tires that have SmarTire® TPMS tire sensors, be sure that the maintenance facility is aware that a tire pressure monitoring system is installed.

If any rims are relocated or replaced, be sure to follow the SmarTire by Bendix CVS system guidelines to permit the system to re-learn the tire sensor positions.

To monitor your trailer tires with your existing SmarTire by Bendix CVS tractor mounted Electronic Control Unit (ECU), you must ensure that the SmarTire Trailer-Link™ enable function is set to ON in the SmarTire TPMS system tractor-mounted ECU (part number 200.0216).

Additionally, for tractors equipped with ECU part number 200.0184, in order for the ECU to be able to communicate with the SmarTire Trailer-Link ECU, the ECU firmware MUST BE updated to new firmware. For instructions on performing this update, please contact your Bendix account manager or call 1-800-AIR-BRAKE (1-800-247-2725), option 2.

Disclaimer

This system is used for monitoring tire pressure and temperature only and does not warn of physical defects in the tires.

SmarTire® Tire Pressure Monitoring System by Bendix CVS

This vehicle is equipped with a SmarTire Tire Pressure Monitoring System (TPMS) which constantly monitors the pressure and temperature of each tire on your vehicle in order to provide real-time, on-demand, tire status information and to warn of a tire pressure related issue before it becomes dangerous.

Key Features of the SmarTire System

- Alerts are temperature-compensated, allowing you to know when your tires are at pressure and/or temperature risk no matter how long you have been driving or how hot your tires are.
- Real-time tire information displayed on the dash.
- Alerts provide immediate visual and optional audible notifications of a tire problem.
- Alerts and icons:


First Level Low/High Pressure Alert


Second Level Critical Low Pressure Alert


High Temperature Alert

Importance of Tire Maintenance

Proper tire maintenance is critically important for keeping tires rolling smoothly. When properly maintained and inflated, tires will help provide shorter stopping distances, better vehicle handling in emergency situations, better fuel economy, and longer life.

Maintenance Tips for Long Tire Life:

- Keep tires properly inflated at all times.
- Visually inspect tires for injuries prior to each trip.
- Match dual tires for size and ensure tire pressures are within 5 psi of one another.
- Re-tread tires before wear causes excessive belt damage or fatigue.

Important Safety Information about SmarTire® Tire Pressure Monitoring System by Bendix CVS

Section 1: General – You are always responsible for the control and safe operation of the vehicle at all times. The SmarTire system does not replace the need for a skilled, alert professional driver, reacting appropriately and in a timely manner, and using safe driving practices.

Variations from this manual: vehicle manufacturers – and some previous models of the SmarTire system – may use alerts, messages, and dash arrangements that vary from the examples shown here. Consult the vehicle operator's manual(s) for applicable details regarding use and operation.

Section 2: Driver Alerts & Warnings – Before driving with SmarTire TPMS you should fully understand all the alerts and visual indicators that the system provides. This booklet will assist in explaining what each of them means. The SmarTire system provides two inflation alerts and one high temperature alert. It is important that you, the driver respond to these alerts as appropriate and as soon as possible to ensure continued safe operation of the vehicle. Alerts will be maintained until corrective action is undertaken.

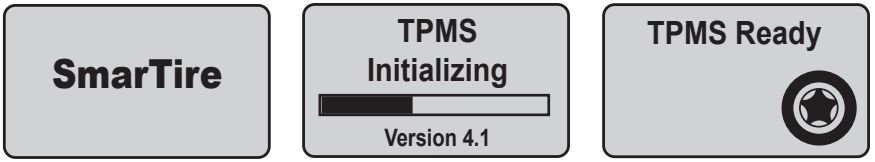
Section 3: Equipment Maintenance – System Problems: if a problem with the SmarTire system is detected, depending on the vehicle manufacturer, typically there will be an indication on the display. The system should be serviced as soon as possible to restore full SmarTire system functionality.

Using SmarTire® TPMS by Bendix CVS

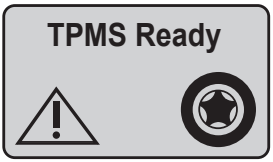
NOTE: It is normal for the TPMS system to take up to 5 minutes for all tire sensor data to be received and displayed to the driver (as the sensors transmit data every 3-5 minutes). In some instances the tire could be in a position where the sensor signal may be blocked and not seen by the receiver. In this case, after 35 minutes of not seeing a sensor, the system will issue a Sensor Fault Alert for that location. If a Sensor Fault Alert occurs and does not clear after the vehicle is driven, please report this condition to your maintenance personnel as it may indicate a problem with the system.

Getting Started

When the vehicle's ignition switch is turned on, the SmarTire system will power up and the display will indicate that the system is initializing. After a short period, the display will show the "TPMS Ready" screen indicating that the system is ready to receive tire data from the sensors.



If an Alert icon (*triangle with an exclamation point*) is displayed and the LED light is illuminated when the TPMS Ready screen is shown, this is an indication that an active alert has been detected and should be investigated/ corrected before the vehicle is driven. **NOTE:** *It is normal for the TPMS system to take up to 5 minutes for all tire sensor data to be received and displayed to the driver* (*as the sensors transmit data every 3-5 minutes*).



Bendix recommends that tire pressure and temperature alerts always be investigated and corrected before a vehicle is driven to ensure the safety of the driver, vehicle and cargo.

Federal Communications Commission (FCC) Notice

This device complies with part 15 of the FCC rules. 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. This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and–if not installed and used in accordance with the instructions–may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

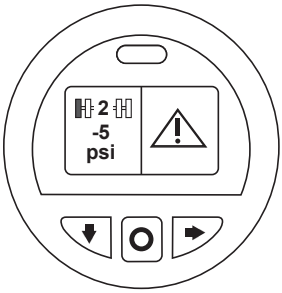
   If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

   - Reorient or relocate the receiving antenna;
   - Increase the separation between the equipment and the receiver;
   - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected; and/or
   - Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this device without the express written approval of Bendix may void the user's authority to use this device and any product warranty.

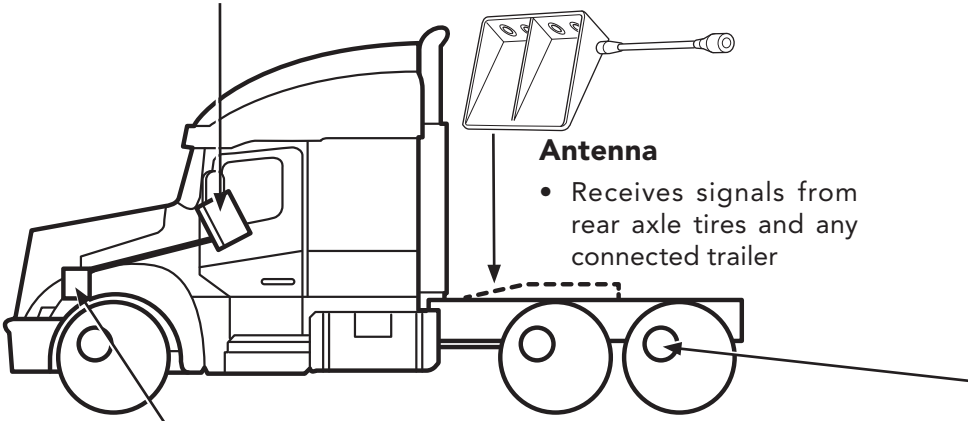
System Overview and Components

Tire sensors mounted on each wheel measure tire pressure and temperature every 12 seconds and transmit tire data every 3 to 5 minutes. If a sensor detects a pressure change of +/- 3 psi, the sensor will transmit the data immediately. The display shows real-time tire pressure and temperature information. If the tractor is connected to a trailer equipped with SmarTire® Trailer-Link™ TPMS by Bendix CVS, trailer tires are also displayed.



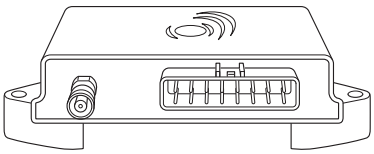
SmarTire Display

- Reports real-time tire and pressure information
- Signals alerts of tire pressure or temperature problems
- Reports system faults
- For OEM installations, display may be different



Antenna

- Receives signals from rear axle tires and any connected trailer



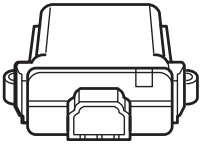
Wireless Receiver/ECU

- Captures data transmitted from tire sensors mounted on each wheel
- Analyzes data against programmed user-defined settings
- Triggers an alert of a pressure or temperature problem

System Overview and Components

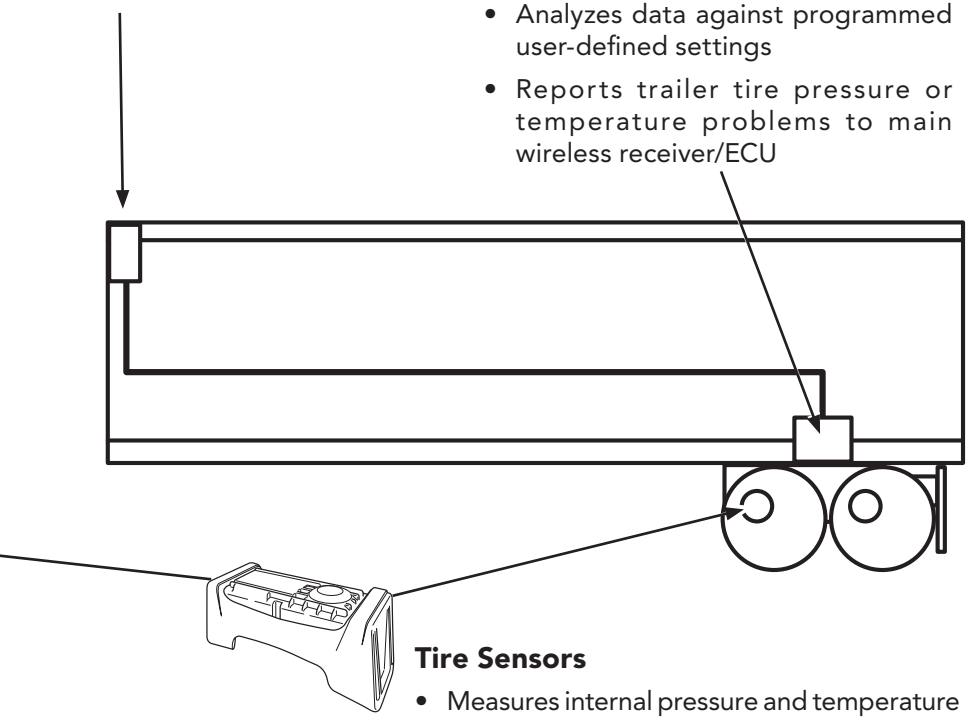
Optional Trailer Warning Lamp

- Indicates a tire problem on a connected trailer



SmarTire® Trailer-Link™ ECU by Bendix CVS

- Captures data from tire sensors mounted on each trailer wheel
- Analyzes data against programmed user-defined settings
- Reports trailer tire pressure or temperature problems to main wireless receiver/ECU



Tire Sensors

- Measures internal pressure and temperature every 12 seconds
- Transmits normal data every 3 to 5 minutes
- Transmits abnormal data immediately
- Mounted on a breakaway cradle allowing reuse of the core sensor in case of tire damage

The Pressure/Temperature Relationship

In a closed vessel such as a tire, temperature and pressure are directly related. As temperature increases, pressure will also increase proportionally. As a tire heats up, its pressure will naturally increase; as the tire cools down, pressure will decrease.

For proper truck operation, it is important to maintain the recommended tire pressure, neither too high or too low. By monitoring both temperature and pressure, the SmarTire® TPMS system by Bendix CVS compensates for temperature changes and reports the compensated pressure.

The typical tire industry recommended tire pressure is based upon a "cold" temperature of 65° F. Pressure readings at 65° F are considered "Cold Inflation Pressures" (CIP). The chart below shows inflation values for a series of cold inflation pressures at various temperatures.

Example: for a CIP of 105 psi at an ambient tire temperature of 125° F, a proper pressure reading is 119 psi.

Pressure / Temperature Correlation Chart
High Pressure Range

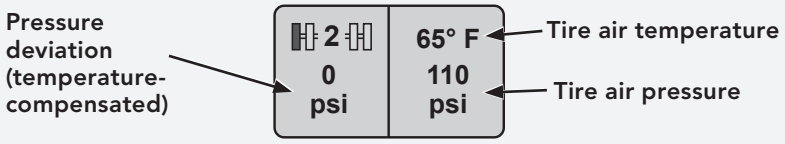
AMBIENT / TIRE TEMPERATURE		RECOMMENDED COLD INFLATION PRESSURE (PSI)											
		85	90	95	100	105	110	115	120	125	130	135	140
7	45	81	86	91	96	100	105	110	115	120	125	129	134
13	55	83	88	93	98	103	108	113	118	123	127	132	137
18	65	85	90	95	100	105	110	115	120	125	130	135	140
24	75	87	92	97	102	107	113	118	123	128	133	138	143
30	85	89	94	100	105	110	115	120	126	131	136	141	146
35	95	91	96	101	107	112	117	123	128	133	138	144	149
40	105	93	98	103	109	114	119	125	130	136	141	147	152
46	115	95	100	106	111	117	122	127	133	138	144	149	155
52	125	97	102	108	113	119	125	130	136	141	147	152	158
57	135	98	104	110	115	121	127	132	138	144	149	155	161
62	145	100	106	112	117	123	129	135	140	146	152	158	164
68	155	102	108	114	120	126	131	137	143	149	155	161	167
74	165	104	110	116	122	128	134	140	146	152	158	164	170

SmarTire TPMS Temperature Compensation

TPMS tire sensors measure both temperature and pressure. The system calculates the temperature/pressure relationship and reports temperature-compensated pressure values. The TPMS temperature compensation is especially valuable in the event of a slow leak in a hot tire. In this case, a standard pressure gauge may report a proper reading when the tire is actually underinflated and operating well above its temperature capacity. The tire could become so hot that its structure could degrade and fail in the form of a blow-out and/or tire fire.

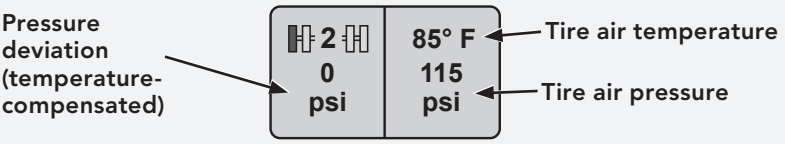
Here are several examples showing the operating benefits of TPMS temperature compensation.

Example: Tire at "Cold" Temperature and at Proper Pressure



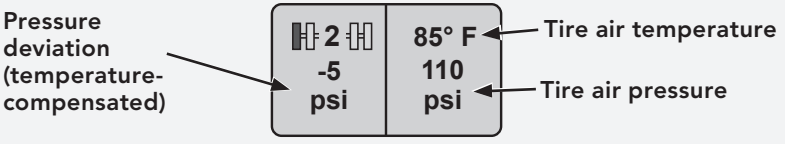
Required Action: None

Example: Hot Tire at Proper Pressure



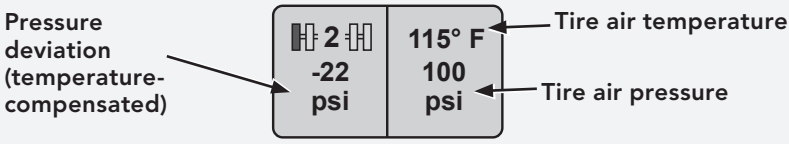
Required Action: None

Example: Hot Tire With Slightly Low Tire Pressure



Required Action: Add air to bring tire pressure up to 115 psi

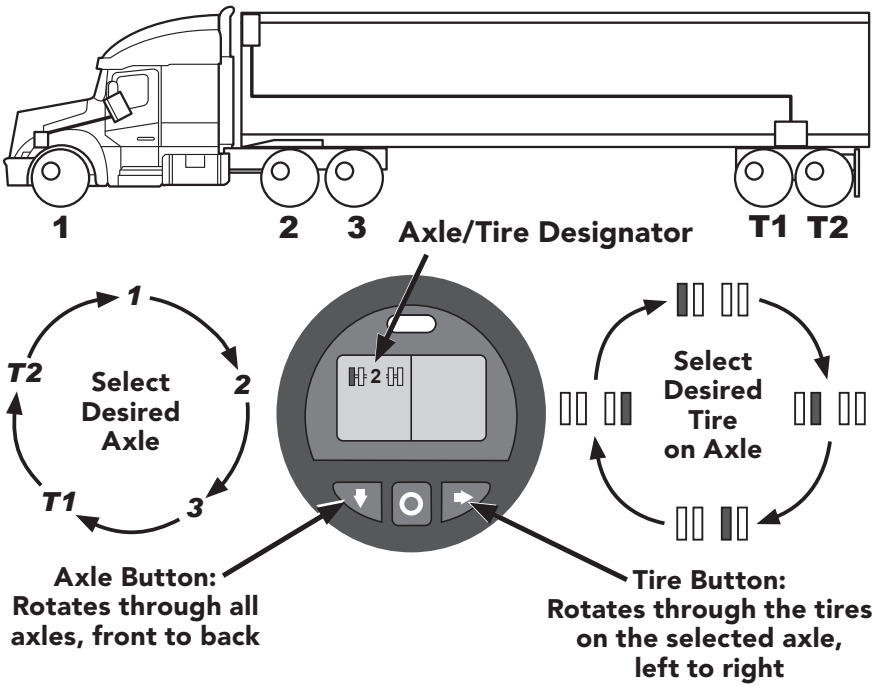
Example: Hot Tire, Significantly Low Tire Pressure



Required Action: Add air to bring tire pressure up to 122 psi

SmarTire® TPMS by Bendix CVS Display

Note: *The following directions apply if this vehicle is equipped with a SmarTire display. For OEM installations, please refer to the vehicle manual for further instructions.*

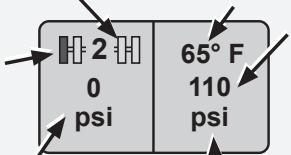


Screen Overview

Tire Icon–The axle's tire configuration. One box on each side indicate single tires, two boxes on each side indicate dual tires.

Selected Tire Icon–Which tire is selected and which tire data is actively displayed on the screen (Pressure, Temperature and Deviation Value).

Pressure Deviation Value–Amount of under- or over-inflation. + 5, means 5 psi of air should be removed, - 5, means 5 psi of air should be added.



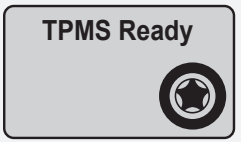
Tire Air Temperature–The current internal air temperature for the selected tire. May be shown in degrees F or C.

Tire Air Pressure–The current pressure value for the selected tire (actual pressure value, not temperature-compensated).

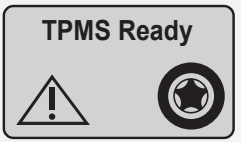
Units of Measure–Units the pressure value is displayed in; may be set to psi, BAR, or kPa.

Screen Icons

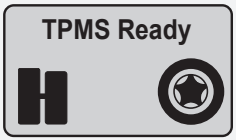
Ready Screen Icons



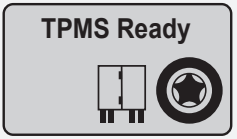
Wheel Icon–Appears on the TPMS Ready Screen and indicates the system is ready and active.



Triangle–Indicates an active alert is present when shown on the TPMS Ready Screen.

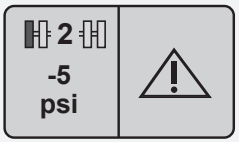


Dual Tire–Appears on the TPMS Ready Screen and indicates an active dual tire imbalance is present. Also shown on the individual axle screen and indicates the wheel-end where the imbalance is present.

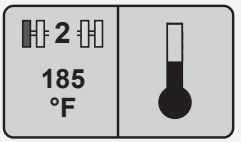


Trailer–Indicates a Trailer-Link™ TPMS system by Bendix CVS is wirelessly connected to the tractor ECU and trailer data is available.

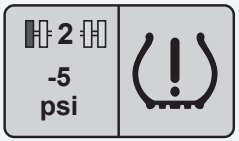
Alert Icons



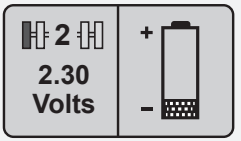
Triangle–Shown on the individual axle screen and indicates a First Level Alert (FLA) is active.



Thermometer–Shown on the individual axle screen and indicates a High Temperature Alert is active.



Tire with Exclamation Point–Shown on the individual axle screen and indicates a Second Level Alert (SLA) for critical low pressure is active.

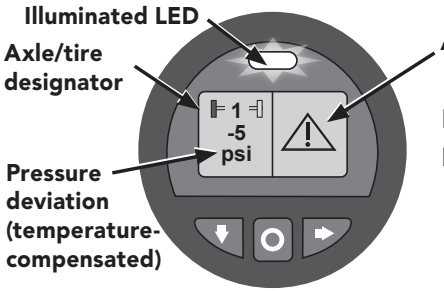


Low Battery–Shown on the individual axle screen and indicates a sensor with a low battery.

Alerts and Warnings

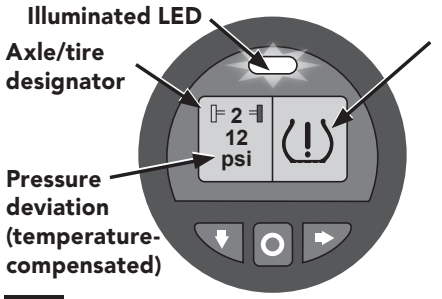
TPMS alerts and warnings indicate unsafe conditions and must be corrected as soon as possible. The LED flashes upon first indication of an alert or warning. After driver acknowledgment, the LED is constantly illuminated. Upon correction, the alert will turn off. For OEM installations, the display may look different.

First Level Alert: Pressure Deviation



Required Action: Add or reduce pressure by the amount of deviation.

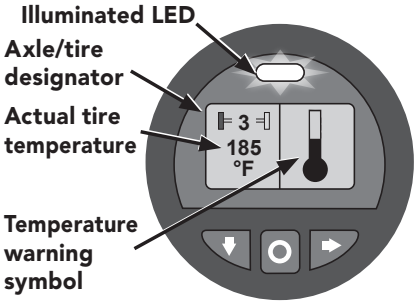
Second Level Alert: Critical Pressure Deviation



Required Action: Stop vehicle. Add or reduce pressure by the amount of deviation.

Important: Tire is Critically Underinflated. Correct Immediately.

High Temperature Alert



Cause: Possible causes include under inflation, a dragging brake, or a bearing failure. Usually–in case of under inflation–the system will trigger a pressure alert in advance of the temperature alert.

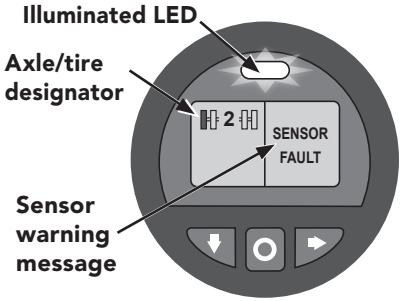
Required Action: Investigate the cause and correct.

Important: Tire is Critically Hot. Correct Immediately.

Alerts and Warnings *Continued*

TPMS alerts and warnings indicate unsafe conditions and must be corrected as soon as possible. Upon correction, the alert will turn off.

Sensor Fault Alert

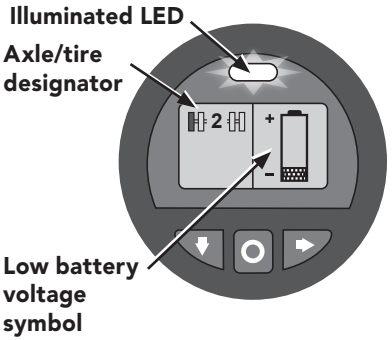


Cause: ECU has not recently received data from a sensor. Fault could be triggered when the vehicle is stopped or idling.

Corrective Action: Drive the vehicle. If the fault does not clear, the sensor is damaged or missing and cannot provide pressure and temperature alerts. Take necessary maintenance steps to repair or replace the sensor.

Caution: Tire with active sensor faults cannot monitor pressure and temperature.

Low Sensor Battery Alert



Cause: Battery voltage is 2.3 Volts or lower.

Corrective Action: Replace the sensor as soon as possible before the battery dies and stops transmitting.

No Tires Programmed Alert

If this alert appears after the start-up sequence, the system is not functioning and no pressure or temperature alerts will be displayed.

Take necessary maintenance steps to investigate and correct.

Quick Troubleshooting Table

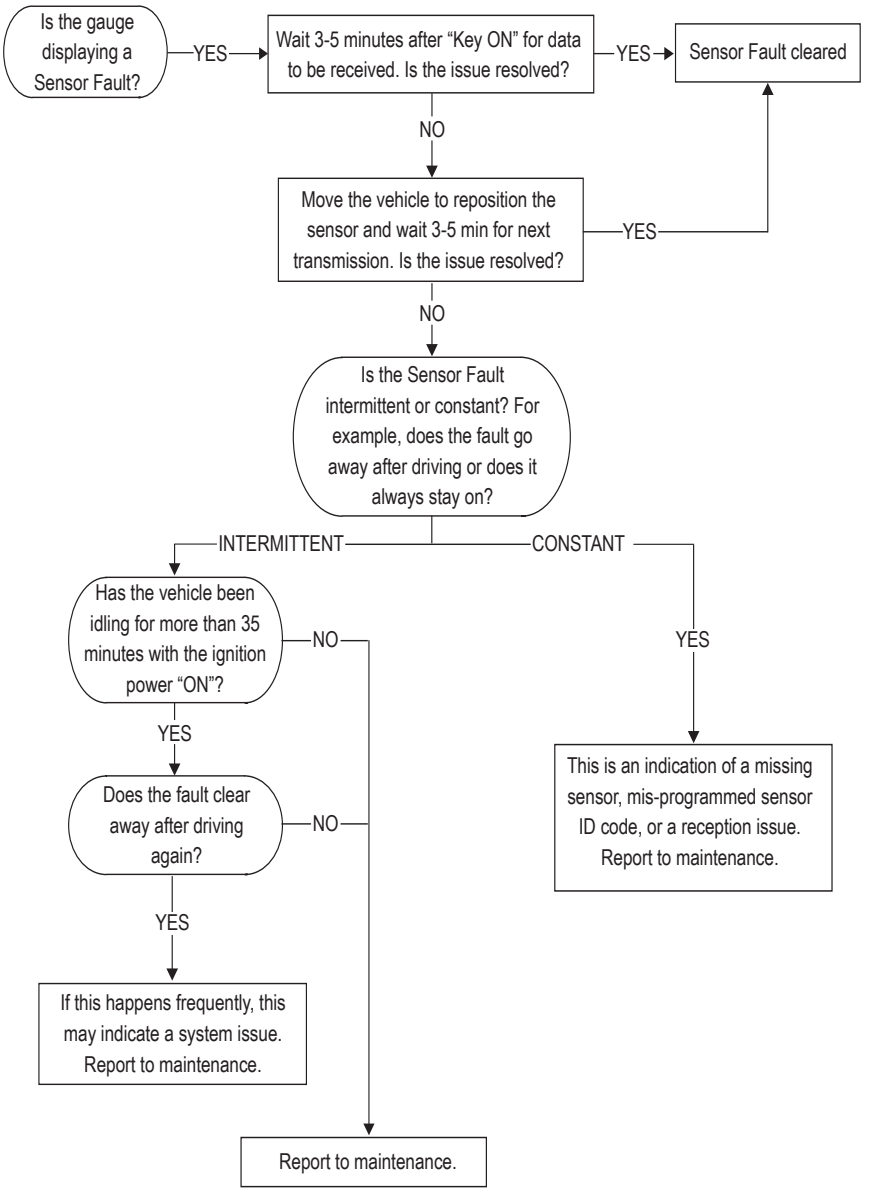
Order of Troubleshooting

Actions to be taken	Problem						
	Gauge is not initializing	Dashes displayed on gauge	Gauge shows a pressure or temperature alert	Tire pressure is not being updated after pressure correction (greater than 3 psi)	Tire pressure value is decreasing over time	Gauge shows sensor fault alert	Several tires are reporting sensor Diagnostic Trouble Codes (DTCs)
Turn the ignition OFF and ON.	x						
Wait 5 minutes after "Key ON" for the data to be received.		x				x	x
Move the vehicle to reposition the sensor as the sensor signal may not be received.		x		x		x	x
Go to the "Pressure and Temperature Alerts & Warnings" section (Page 14) and follow the indications for the specific alert.			x				x
Inspect the tire for damage or leaks as the tire is losing air.					x		
Follow the indications on "Sensor Fault Troubleshooting" (Page 17)						x	
Report to your maintenance team	x	x		x	x	x	x

Note: If the problem continues, report any problem to your maintenance team.

Sensor Fault Troubleshooting Flow Chart

Driver Sensor Fault Troubleshooting



Sources Of Additional Information About the SmarTire® Tire Pressure Monitoring System (TPMS) by Bendix CVS

Consult the vehicle manufacturer's documentation.

Visit www.bendix.com for free downloads of these publications from the Literature Center.

- BW2799 SmarTire Tire Pressure Monitoring System (TPMS) Operator's Manual
- BW2809 SmarTire TPMS Hand Tool Manual
- BW2820 SmarTire Low Frequency (LF) Tool Users Manual
- BW2822 SmarTire TPMS Walk Around Card

Contact the Bendix Tech Team via email at techteam@bendix.com or call 1-800-AIR-BRAKE (1-800-247-2725), option 2.
Representatives are available
Mon.–Thur. 8:00 a.m. to 6:00 p.m. ET.
Fri. 8:00 a.m. to 5:00 p.m. ET.

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