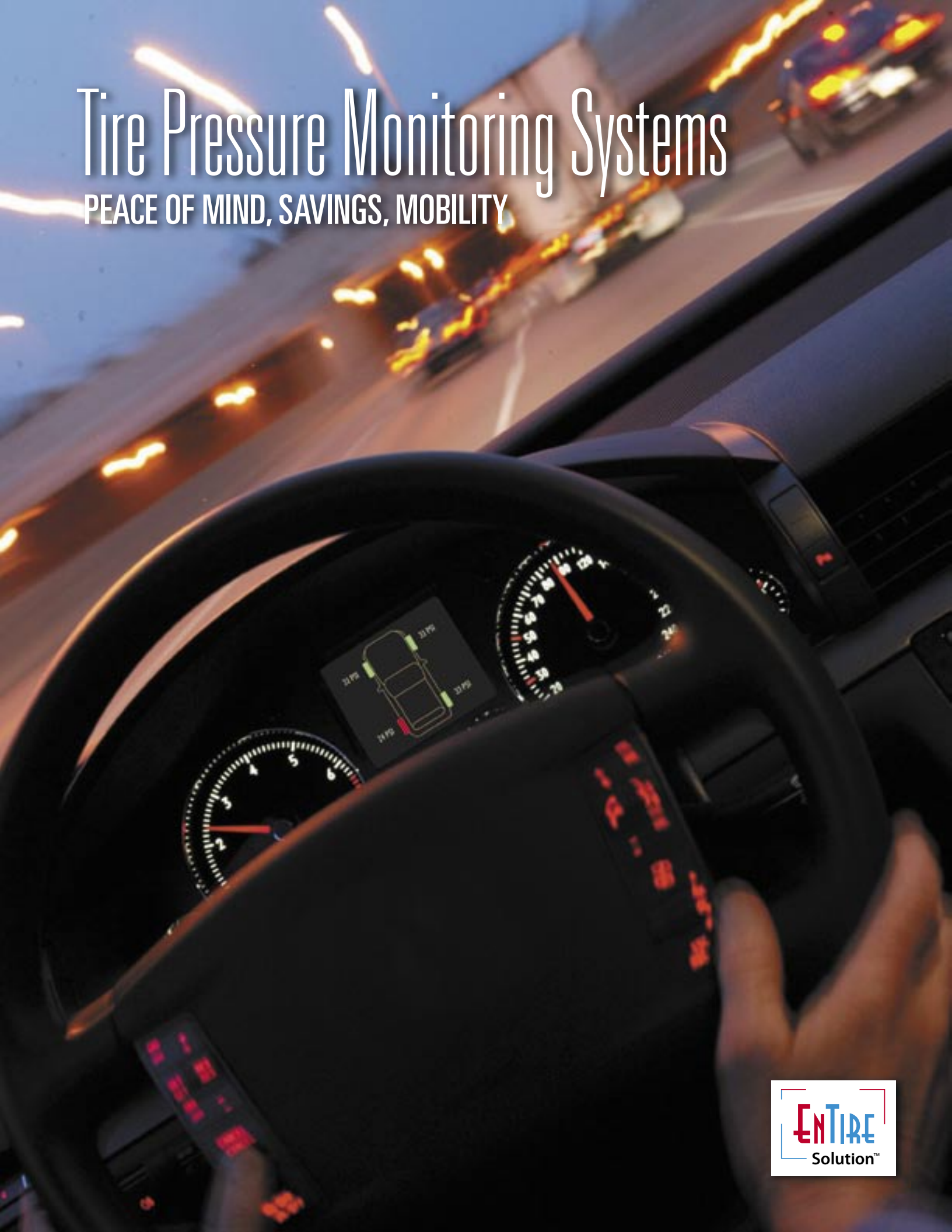


Tire Pressure Monitoring Systems

PEACE OF MIND, SAVINGS, MOBILITY



What are tire pressure monitoring systems?

Tire pressure monitoring (TPM) systems continually monitor a vehicle's tire pressure. Using *leading-edge technology*, some TPM systems almost immediately detect tire pressure loss or other abnormal tire pressure conditions. Many systems can detect natural air leaks, which is important when you consider this is the leading cause of underinflated tires.

Not all TPM systems are the same. Accurate and reliable information on the status of each individual tire is best achieved with systems using direct pressure measurement devices (pressure sensing transmitters) mounted inside each tire. These systems include:

- a central receiver (ECU) to collect the pressure data sent from each tire,
- sophisticated logic to analyze the data and decide whether an alert about incorrect tire pressure is warranted,
- and a dashboard display to indicate tire pressure status.

There are other systems installed on cars that use the vehicle's anti-lock braking (ABS) system to measure the rotation speed of the tire (a tire at a different pressure than the others will rotate at a different speed). These *indirect* measurement systems are not as accurate as direct pressure systems that measure pressure in one or more tires.

High-performance *direct* measurement TPM systems provide accurate warnings in as little as 20 seconds – giving drivers ample time to detect problems before they become serious. Information from these TPM systems allows drivers to maintain a vehicle's tires at optimum inflation pressure, thereby improving driving comfort, vehicle handling, tire life and fuel economy – real benefits.

The TPM industry is rapidly progressing in the areas of research, innovation and expertise. For example, TPM suppliers are supporting efforts to integrate tire pressure information with vehicle control systems, thereby improving ride and handling.

In the early 1990s, some automakers began installing TPM systems on select vehicles. As time goes by, more and more automakers are adding TPM systems to their vehicles. TPM systems are key to improving driver peace of mind and mobility, and analysts predict consumer demand for the product will increase.

Drivers are encouraged to read the owner's manual or consult with dealerships about proper usage and service of their TPM systems.

It is very important to understand that a TPM system does not take the place of the driver's responsibility to properly maintain the air pressure in the tires. TPM systems can only give an indication of a tire pressure condition that needs attention.

How do tire pressure monitoring systems work?

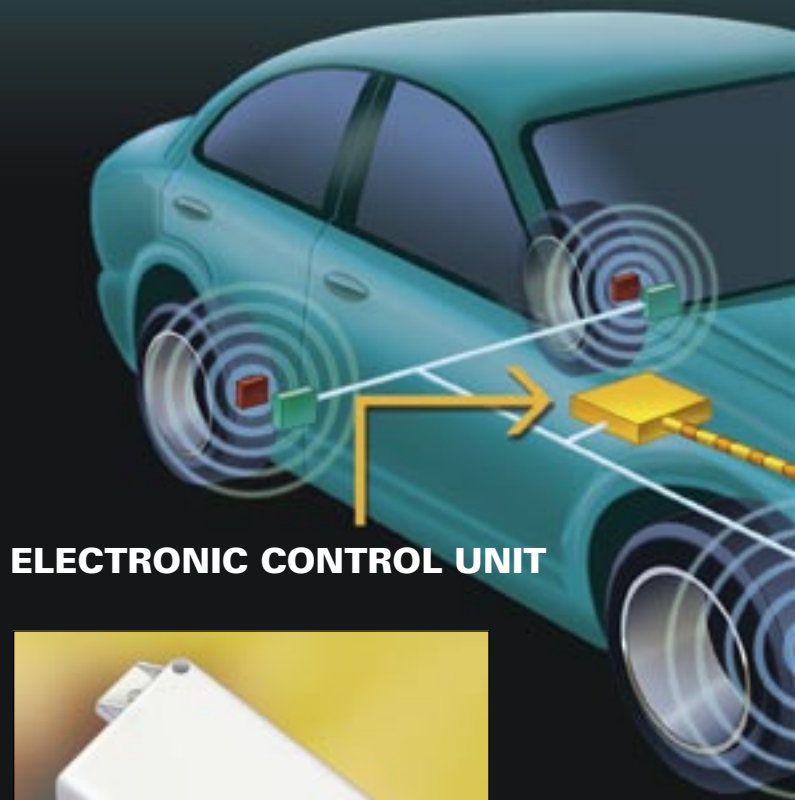
Direct measurement tire pressure monitoring (TPM) systems use wheel-mounted sensors to monitor the temperature and internal pressure of each tire. Transmitters send this data and diagnostic information to a control unit located in the vehicle interior. The control unit analyzes the data by running specialized warning software cali-

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Maintaining correct tire pressure leads to greater fuel economy and longer tire life. It also helps a vehicle brake in the shortest possible distance.

Step 1: Sensors installed in each wheel measure temperature and pressure at regular intervals.

Step 2: Sensors transfer information by radio frequency signal to an **electronic control unit** located inside vehicle.



Step 3: Electronic control unit interrogates sensors and to ensure that a

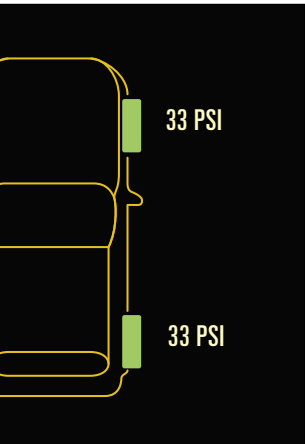
33 PSI

24 PSI

systems work?

Naturally occurring leaks cause tires to slowly lose air pressure. However, rapid air loss can lead to a significant reduction in vehicle control.

brated by vehicle and tire type. TPM systems warn drivers of pressure loss in each individual tire – under all environmental conditions – *in as little as 20 seconds*. In addition to the control unit and transmitters, some TPM systems are activated when the car is started. TPM systems monitor pressure during all driving activities, including acceleration, braking and steering.



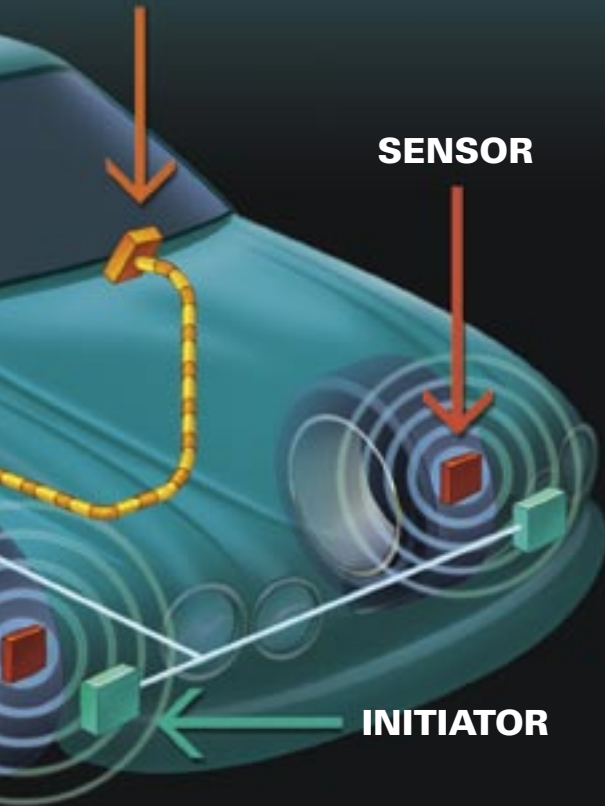
Step 4: Via an existing dashboard display, the driver is warned in real time of any critical deviations from normal conditions.

What are the benefits of tire pressure monitoring systems?

TPM systems monitor vehicle tire pressure. Maintaining the correct tire pressure is paramount to ensuring the best possible tire performance. Proper tire pressure also improves vehicle ride and handling, increases fuel economy and promotes longer tire life. Conversely, underinflated tires diminish vehicle handling, tire life and fuel economy.

Direct measurement tire pressure monitoring (TPM) systems offer constant surveillance of a vehicle's tire pressure, and almost immediately alert drivers of tire pressure loss or other abnormal tire conditions. Because some TPM systems provide warnings in as little as 20 seconds, *drivers have ample time to detect problems before they become serious*. Early detection is convenient, too. It allows drivers to determine how and when to remedy the situation.

DISPLAY



SENSOR

INITIATOR



Underinflated tires, which are difficult to detect, affect vehicle handling and can lead to higher fuel consumption.

Control unit analyzes data it receives. Initiators as needed to rapidly confirm possible warnings accurate information is sent to driver.



Keep your tires in the best possible condition!

Consider this information:

- If every vehicle in the United States had properly inflated tires, we'd realize a savings of 4 million gallons of gasoline per day, every day. (Source: U.S. Department of Transportation)
- An estimated 9% of passenger cars on U.S. roadways are driven with at least one worn tire. (Source: National Highway Traffic Safety Administration 61-01, Nov. 2001)
- Approximately 27% of passenger cars and 33% of light trucks on U.S. roadways are driven with one or more substantially underinflated tires. (Source: NHTSA research survey of U.S. passenger vehicles, Aug. 2001)
- An estimated 23,000 accidents and 535 fatal accidents annually involve blowouts or flat tires. Theory and limited testing show that low tire pressure had a significant impact on all of these. (Source: NHTSA 49 CFR Part 571)
- 20% tire underinflation reduces tire life by 20% and reduces fuel economy 2% to 3%. (Source: Michelin)
- Any pressure imbalance between tires on the same axle leads to understeer. (Source: Michelin)
- 40% tire underinflation increases braking distance by 10%. (Source: Michelin)
- About 14% of gas stations in the U.S. are either not equipped with air pumps, or have malfunctioning pumps. (Source: NHTSA 61-01, Nov. 2001)
- In the U.S., only 49% of gas stations that are equipped with air pumps provide tire pressure gauges. (Source: NHTSA 61-01, Nov. 2001)

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