



Questions and Answers Regarding TPI

General

Q: What is TPI?

A: TPI is an indirect tire pressure monitoring system (TPMS).

Q: What are the benefits of a TPMS like TPI?

A: With a TPMS the driver can get an early warning if one more or tires loses air, which increases safety, reduces tire wear and saves fuel. With TPI the driver can be alerted of pressure drops in one, two, three, and four tires simultaneously and he/she can also get information which tire is faulty or which tires are faulty.

Q: What is the operating principle of TPI?

A: TPI is a software-based, indirect TPMS, which means it doesn't measure the pressures inside the tires directly using wheel mounted pressure sensors. Instead TPI uses signals from the brake system and other systems in the vehicle and calculates different pressure-related parameters that the system in a second processing step uses to detect under-inflation.

Q: When is TPI active?

A: TPI is active for vehicle speeds between 10 km/h and 250 km/h.

Q: What is the performance of TPI?

A: TPI can detect pressure drops of 25% in one, two, three, or four tires simultaneously and can point out the faulty tire(s). TPI meets the requirements for FMVSS 138 applicable to all vehicles sold in USA from September 1, 2007.

Q: Can TPI detect diffusion?

A: TPI detects both fast pressure drops due to punctures, rim damages etc. and slow pressure drops due to diffusion (air molecules leaking out through the rubber), leaking valves etc.

Q: How fast and at what pressure level can TPI detect a puncture?

A: With TPI punctures are typically detected within five to ten minutes, faster if the problem is severe. The detection level is typically between 20-25% under-inflation.

Q: Can TPI tell me what the pressures in the individual tires are?

A: No, TPI is an indirect TPMS and does not measure the absolute pressures in the tires only deviations from the normal pressure level.

Q: Will TPI be available as an aftermarket product?

A: No, this is not foreseen. TPI is designed to be and marketed as an OEM solution exclusively.



Usage

Q: How do I operate TPI?

A: TPI is always on when the engine is running and is fully automatic and requires no driver intervention or service in normal operation mode. When the driver has made any changes to the tires or the tire pressures he/she needs to reset the system to allow it to learn the characteristic parameters it needs to be able to detect under-inflation for the current tire set/tire pressure(s). The reset is done via a reset button on the dashboard or through a menu option in the vehicle's onboard computer, depending on the human-machine interface design of the actual vehicle. After the driver has reset the system it runs automatically and requires no further driver intervention.

Q: What is calibration and how does it work with TPI?

A: Calibration is the initial phase when the system learns the normal values of the parameters it uses to detect under-inflation associated with the current tire set and the current tire pressure(s). In normal operation mode, when the calibration has been completed, the system compares the current values of the same parameters to the ones learnt during the calibration phase and issues an alarm if the deviations are larger than a pre-set threshold. Calibration is activated by the driver when he/she resets the system after a tire or pressure change.

Q: With TPI, do I as a driver need to drive in a special way to get the system to calibrate in a correct way?

A: No, TPI learns the calibration values during normal driving in different speeds and does not require any special driving maneuvers or similar to complete calibration.

Q: How long time does it take to complete calibration with TPI?

A: TPI becomes active and can detect punctures within a few minutes of driving after the system has been reset. The system performance improves as the calibration progresses and after 20 minutes driving in low and moderate speeds the system is able to detect pressure drops of 25% in up to all four tires. In order to reach full performance the system continues to calibrate until enough data has been collected in all different speed ranges which can take up to two hours depending on the speed variation and other factors.

Q: What happens if I get a puncture before the calibration of TPI is complete?

A: If you get a puncture during calibration TPI will detect this thanks to a special component in the software and issue a warning before the situation becomes dangerous.

Q: What happens if I stop and turn off the vehicle before the calibration of TPI is complete?

A: During the calibration phase the system continuously updates the normal parameter values. When the engine is turned off the current parameter values are stored in a non-volatile memory. When the engine is turned on again the system reads the stored parameter values from the memory and continues to update their values based on the new data it receives when the vehicle is driven again. This ensures that no calibration data is lost and that the calibration will be completed regardless of how the vehicle is used the first hours after a reset.

Q: How do I activate the calibration with TPI?

A: To activate calibration with TPI the driver has to reset the system, as described above. No further actions from his or her side are necessary.



Q: With TPI, when do I have to re-calibrate the system?

A: The driver should reset and re-calibrate the system whenever he or she has made a change to the tires or wheels or to the tire pressures to allow it to learn the correct parameters for the current tires and tire pressures.

Q: How do I know when the calibration has been completed?

A: In most vehicles, depending on the vehicle manufacturer's human-machine interface strategy, the driver will get an audiovisual confirmation that the system has been reset (and the calibration activated). After this there is no signal to the driver concerning the state of the system unless an under-inflated tire or a fault has been detected.

Q: Will TPI issue a warning when I load up my vehicle e.g. before a weekend trip with the family?

A: No, TPI is designed to be robust against changes in the load of the vehicle up to the maximally allowed load for the vehicle in question.

Q: Does TPI require any special service or maintenance operations to continue to work as my car gets older?

A: No, since TPI is a software-based system it does not rely on any wheel-mounted and battery-powered pressure sensors that need to be serviced or replaced. The only manual operation required to operate the system is to reset it when the tires or the tire pressures have been changed.

External factors

Q: Can TPI be used with run-flat tires?

A: Yes, TPI is designed to work both with standard radial tires and different types of run-flat or extended mobility tires.

Q: Can I use TPI with aftermarket tires and rims?

A: Yes, TPI is a software solution that follows the vehicle not the tire or the rims. As long as the system is allowed to learn (calibrate) the normal parameter values for the new tires and/or wheels it will work with almost all aftermarket tires and rims.

Q: What is the effect of different chassis settings on the performance of TPI?

A: TPI is designed to be robust against variations in the chassis settings and to achieve the same level of performance regardless of these factors.

Q: What vehicle design parameters affect the performance of TPI, engine type, transmission type, body style, physical dimensions etc.?

A: Since TPI is an indirect TPMS and therefore can be said to use the tires themselves to monitor the tire pressures, the tires are the most important critical components on the vehicle for the system. This is the reason why it is instrumental that the driver resets the system whenever he or she changes the tires or the tire pressures to allow it to learn the correct nominal parameter values. Other design parameters that affect the system's performance, but to a lesser degree, are the type of transmission used (e.g. 2WD or 4WD) and what type of chassis and suspension the vehicle has (e.g. steel or air suspension).

Q: How do temperature and weather changes affect TPI?



A: All pneumatic tires are filled with air (or sometime mixtures of air and other gases) which expands when the temperature increases and contracts when the temperature decreases. This naturally affects TPI and the parameter it uses to detect under-inflation but thanks to specially designed components in the system the temperature effects can be isolated and accounted for in the decisions whether to issue a low-pressure alarm or not. Other weather conditions have no measureable effect on TPI.

Q: How does the road condition affect the performance of TPI?

A: TPI is designed to be active and have full performance on all normal paved roads. If the road surface is very rough that adaptation rate of the system is decreased to avoid false warnings, which deteriorate the drivers' trust in the system and hence should be avoided as far as possible.

Q: Does the performance of TPI depend on how I drive?

A: TPI is active between 10 and 250 km/h and in almost all normal driving scenarios. In high dynamic driving scenarios, like when driving on a race track and accelerating and braking very hard and taking corners at very high speeds, the system will either slow down the adaptation rate, as described above, or become temporarily inactive to avoid problems with false under-inflation warnings.