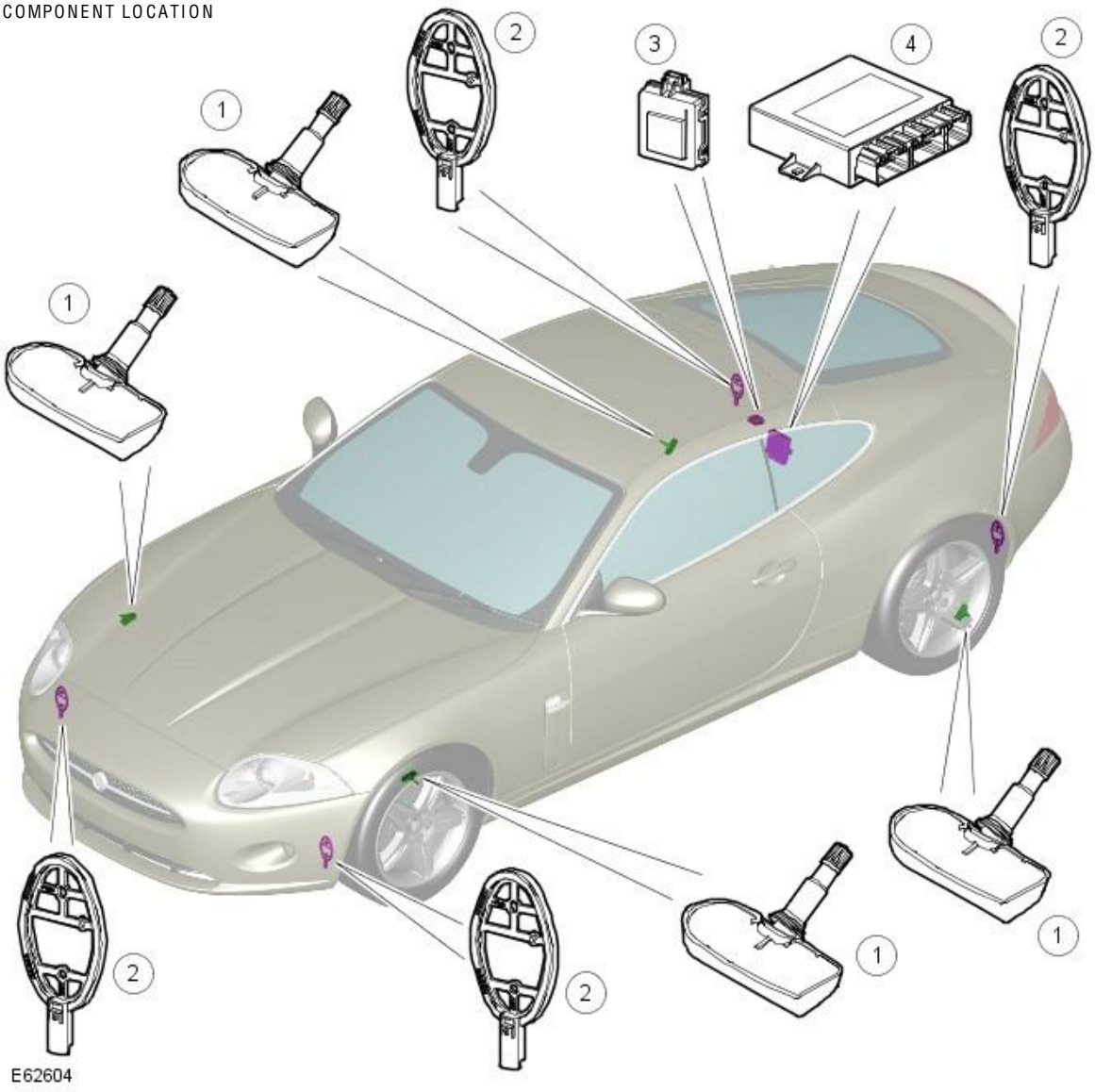
TIRE PRESSURE MONITORING SYSTEM (TPMS)

COMPONENT LOCATION



Item	Part Number	Description
1	-	Tire pressure sensor (4 off)
2	-	Initiator (4 off)
3	-	Tire Pressure Monitoring System (TPMS) receiver
4	-	TPMS module

OVERVIEW

The TPMS is a driver assistance system which assists the driver to maintain the tire pressures at the optimum level. The TPMS is a standard fitment on North American Specification (NAS) vehicles and an optional fitment in other markets. The TPMS system has the following benefits:

- Improve fuel consumption
- Maintain ride and handling characteristics
- Reduce the risk of rapid tire deflation - which may be caused by under inflated tires
- Comply with legislation requirements in relevant markets.

CAUTION: The TPMS is not intended as a replacement for regular tire pressure and tire condition checks and should be considered as additional to good tire maintenance practices.

The TPMS measures the pressure in each of the tires on the vehicle (the space saver spare wheel is not monitored) and issues warnings to the driver if any of the pressures deviate from defined tolerances.

NOTE: During a 'blow-out' a very rapid reduction in pressure is experienced. The system is not intended to warn the driver of a 'blow-out', since it is not possible to give the driver sufficient warning that such an event is occurring, due to its short duration. The design of the TPMS is to assist the driver in keeping the tires at the correct pressure, which will assist to reduce the likelihood of a tire 'blow-out' occurring.

The controlling software for the TPMS is located within a TPMS module. The software detects the following:

- the tire pressure is below the recommended low pressure value - under inflated tire
- the position of the tire on the vehicle.

The system comprises a TPMS module, a Radio Frequency (RF) receiver, 4 initiators and 4 tire pressure sensors (the space saver spare wheel is not fitted with a sensor).

The TPMS module is located behind the Left Hand (LH) rear passenger seat, behind the Auxiliary Junction Box (AJB) and the TPMS RF receiver is located on the AJB mounting bracket. The front initiators are positioned at the front of the wheel arches, behind the fender splash shields. The rear initiators are positioned at the rear of the rear wheel arches, behind the fender splash shields.

The 4 initiators are hard wired to the TPMS module. The initiators transmit 125 KHz Low Frequency (LF) signals to the tire pressure sensors which respond by modifying the mode status within the RF transmission. The 315 or 433 MHz RF signals are detected by the RF receiver which is connected directly to the TPMS module. The received RF signals from the tire pressure sensors are passed to the TPMS module and contain identification, pressure, temperature and acceleration information for each wheel and tire.

The TPMS module communicates with the instrument cluster via the medium speed CAN bus to provide the driver with appropriate warnings. The TPMS module also indicates status or failure of the TPMS or components.

Tire Location and Identification

The TPMS can identify the position of the wheels on the vehicle and assign a received tire pressure sensor identification to a specific position on the vehicle, for example FL (front left), FR (front right), RL (rear left) and RR (rear right). This feature is required because of the different pressure targets and threshold between the front and rear tires.

The wheel location is performed automatically by the TPMS module using an 'auto-location' function. This function is fully automatic and requires no input from the driver. The TPMS module automatically re-learns the position of the wheels on the vehicle if the tire pressure sensors are replaced or the wheel positions on the vehicle are changed.

The TPMS software can automatically detect, under all operating conditions, the following:

- one or more new tire pressure sensors have been fitted
- one or more tire pressure sensors have stopped transmitting
- TPMS module can reject identifications from tire pressure sensors which do not belong to the vehicle
- two 'running' wheels on the vehicle have changed positions.

If a new tire pressure sensor is fitted on any 'running' wheel, the module can learn the new sensor identification automatically when the vehicle is driven for more than 15 minutes at a speed of more than 20 km/h (12.5 mph).

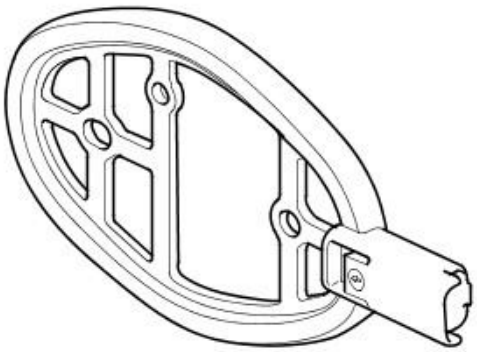
The tire learn and location process is ready to commence when the vehicle has been stationary or travelling at less than 12 mph (20 km/h) for 15 minutes. This is known as 'parking mode'. The learn/locate process requires the vehicle to be driven at speeds of more than 12 mph (20 km/h) for 15 minutes. If the vehicle speed reduces to below 12 mph (20 km/h), the learn process timer is suspended until the vehicle speed increases to more than 12 mph (20 km/h), after which time the timer is resumed. If the vehicle speed remains below 12 mph (20 km/h) for more than 15 minutes, the timer is set to zero and process starts again.

If the tire pressure sensors fitted to the running wheels vehicle are changed, the module can learn the new sensor identifications automatically. The learn function requires no manual intervention by the driver.

Spare Tire Identification

Tire pressure sensors are not fitted to the space saver spare wheel and therefore the spare wheel is not monitored.

Initiators



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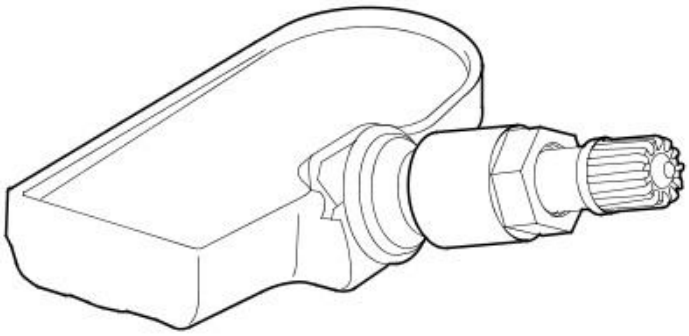
Four initiators are fitted to the vehicle. The front initiators are located near the front of the front wheel arches, behind the fender splash shields. The rear initiators are located at the rear of the rear wheel arches, behind the fender splash shields. Each initiator has a connector which connects to the vehicle body harness.

The initiator is a passive, LF transmitter. The initiators transmit their signals which are received by the tire pressure sensors, prompting them to modify their mode status.

The TPMS module energises each initiator in turn using LF drivers. The corresponding tire pressure sensor detects the LF signal and responds by modifying the mode status within the RF transmission.

Tire Pressure Sensor



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The TPMS uses active tire pressure sensors which are located on each wheel, inside the tire cavity. The sensor incorporates the tire valve and is secured in the wheel by a nut on the outside of the wheel. The sensor contains a Printed Circuit Board (PCB) which houses a Positive Temperature Co-efficient (PTC) sensor, a Piezo pressure sensor. a radio receiver and transmitter and a lithium battery.

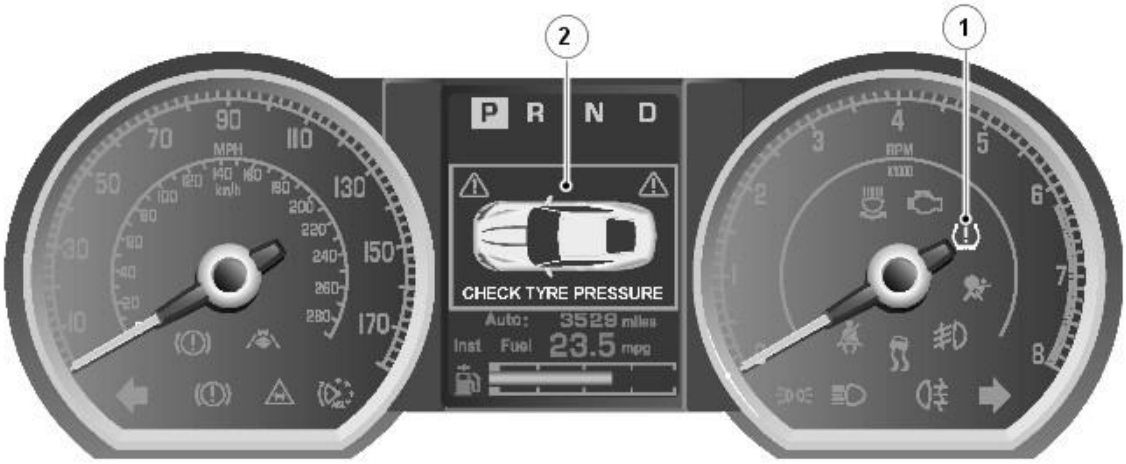
The tire pressure sensors use the PTC sensor and the Piezo sensor to periodically measure the pressure and temperature of the air inside the tire. The data is transmitted by RF data signals at either 315 MHz or 433 MHz dependant on market requirements.

The RF transmission from the sensor contains a unique identification code in its transmission data. This allows the TPMS to identify the wheel on the vehicle. If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt when the vehicle is driven at speed of more than 20 km/h (12.5 mph) for 15 minutes.

The tire pressure sensor can also detect when the wheel is rotating. In order to preserve battery power, the sensor uses different transmission rates when the wheel is stationary or moving.

The care points detailed in 'Tire Changing' earlier in this section must be followed to avoid damage to the sensor. If a new sensor is fitted, a new nut, seal and washer must also be fitted and the sensor nut tightened to the correct torque as given in the Service Repair Manual.

Instrument Cluster Indications



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Item	Part Number	Description
1	-	Low tire pressure warning indicator
2	-	Message centre

The warning indications to the driver are common on all vehicles fitted with TPMS. The driver is alerted to system warnings by a low tire pressure warning indicator in the instrument cluster and an applicable text message in the message centre.

The TPMS module passes system status information to the instrument cluster on the medium speed CAN bus. The instrument cluster then converts this data into illumination of the warning indicator and display of an appropriate message.

When the ignition is switched on, the warning indicator is illuminated for 3 seconds for a bulb check.

NOTE: If the vehicle is not fitted with the TPMS, the warning indicator will not illuminate.

The instrument cluster checks, within the 3 second bulb check period, for a CAN bus message from the TPMS. During this time the TPMS performs internal tests and CAN bus initialisation. The warning indicator will be extinguished if the TPMS module does not issue a fault message or tire pressure warning message.

If a TPMS fault warning message is detected by the instrument cluster at ignition on, the warning indicator will illuminate on vehicles up to 2007.25MY and will flash on vehicles from 2007.25MY for 72 seconds after the 3 second bulb check period and then remain permanently illuminated.

If a tire pressure warning message is detected by the instrument cluster at ignition on, the warning indicator will extinguish briefly after the 3 second bulb check period, before re-illuminating to indicate a tire pressure warning.

The following table shows the warning indicator functionality for given events:

Event	Instrument Cluster Indications
Low pressure warning limit reached in one wheel	Warning indicator illuminated. 'CHECK TYRE PRESSURE' message displayed and applicable tire highlighted on display.
Low pressure warning limit reached in one or more wheels in low speed mode (only if programmed or learning)	Warning indicator illuminated. 'CHECK ALL TYRE PRESSURES' message displayed.
TPMS fault	On vehicles up to 2007.25MY - Warning indicator permanently illuminated. On vehicles from 2007.25MY - Warning indicator flashes for 72 seconds and is then permanently illuminated. 'TYRE PRESSURE SYSTEM FAULT' message displayed.
No transmission from a specific tire pressure sensor or Specific tyre pressure	Warning indicator illuminated. 'TYRE NOT MONITORED' message displayed and Amber LED flashes for 72 seconds. Amber LED illuminated at next and

sensor fault	subsequent ignition on cycle.
No transmission from more than one tyre pressure sensor or More than one tyre pressure sensor fault	Warning indicator illuminated. 'TYRE PRESSURE SYSTEM FAULT' message displayed and Amber LED flashes for 72 seconds. Amber LED illuminated at next and subsequent ignition on cycle.
CAN signals missing	On vehicles up to 2007.25MY - Warning indicator permanently illuminated. On vehicles from 2007.25MY - Warning indicator flashes for 72 seconds and is then permanently illuminated. 'TYRE PRESSURE SYSTEM FAULT' message displayed.