

Tire Pressure Monitoring Systems Operation

Binder – 4 – Chassis

Vehicle Type: **All with tire pressure monitoring system**

Model Year: **2003 - present**

Information: This bulletin will outline the Tire Pressure Monitoring systems Porsche has used since their introduction. There are four system hardware configurations that have been used since the introduction of tire pressure monitoring.

A simple block diagram will illustrate each hardware configuration. A vehicle application chart outlining the versions for that hardware configuration will accompany the diagram.

The following note is applicable for the four system configurations.

NOTE: In the actual values of the tester, the battery life of the wheel electronics can be seen. Checking this information when a vehicle is being serviced can help you alert the customer when the batteries are low and avoid a return visit.

The two summary points below are included here to make it easy to find, and compare, for all systems.

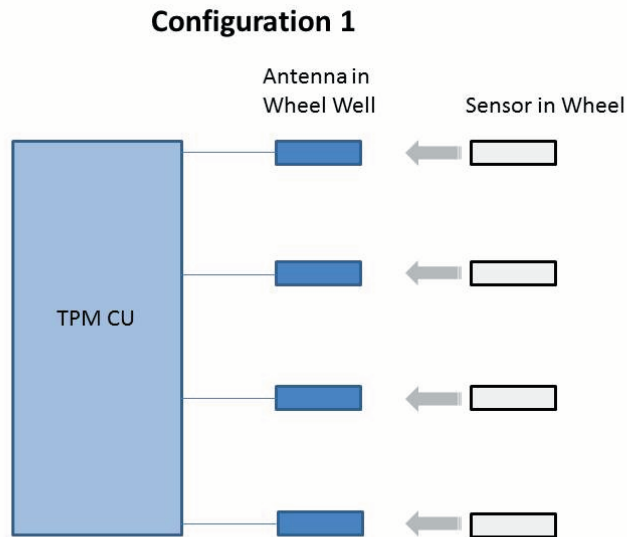
Whether or not TPMS goes into learning mode is determined by the control unit only, for all generations of systems.

- Learning mode is only active while driving above 25kph (15 mph)
- Below these vehicle speeds the system is locked. This is done for robustness, to avoid mutual interference with other vehicles or to avoid learning in parking lots where there is a lot of steel and unpredictable signal reflections.
- Stop and go traffic will not work for learning. The vehicle needs to keep moving at a speed higher than the minimums given above, until learning has completed.

The wheel electronics of:

- Generation 1.x always transmit whether driving or standing.
- Generation 2.x transmit based on request by the trigger module.
- Generation 3.x transmit when wheel rotation is detected (latest at a speed above 25kph / 15mph). After 5 Minutes “standstill”, the TPMS wheel electronic will go to sleep.

1.) TPMS – Generation “1.0” & “1.5” (permanent transmit):



TPMS - Generation “1” Systems		
Production Date	From December 2001	From April 2004
System Version	RDK 1.0 Beru	RDK 1.5 Beru
Vehicle Type	Cayenne E1	9X7 997 Turbo, GT2, GT3 (from April 2006) <u>Carrera GT</u>
Control Unit	7L5.907.273B 433 MHz	997.618.103.06 <u>980.618.103.00 Carrera GT</u>
Antenna	4D0.907.277 433 MHz	997.606.101.00 433MHz
Trigger Module	No Trigger	No Trigger
Wheel Sensor	7L0.907.275.D 433 MHz	997.606.021.02 433 MHz

Tire Pressure Monitoring Generation “1.0” & “1.5”

• Function

- Wheel sensors transmit data at regular intervals via an HF radio frequency signal to each antenna in the respective wheel well.
- The signal is received by the antenna and sent to the control unit for processing.
- The control unit displays the relevant information in the instrument cluster

• Sensor operation

- The wheel electronics unit is comprised of the following components:
 - Pressure sensor
 - Temperature sensor
 - Battery
 - Transmitter, measuring and control electronics
- There are two frequencies for the transmitters.
 - 433 MHz is used in the U.S.
 - 315 MHz is for areas such as Asia.
- The following information is transmitted by the wheel sensor:
 - Individual ID number of sensor (also printed on the sensor body)
 - Current tire inflation pressure (absolute pressure)
 - Current temperature of air in the tire
 - Status of integral battery
 - Message information necessary for proper data transmission
- Sensor transmission modes
- During normal driving the sensor takes measurements every 3 seconds and transmits every 54 seconds.
- With a pressure loss of over 2.9 psi (0.2 bar) per minute, the sensor immediately goes into high-speed transmission mode, measuring and transmitting every 0.8 seconds.
- After the vehicle is parked and a specified run-on time, sleep mode is entered.

• Antenna Operation

- The antenna receives the HF radio signals for the TPM control unit.
- In the Cayenne model line the antenna receives the signals for the control unit and does not process the high frequency signal (the control unit does it).
- In the 997 the antenna receives the signal and processes the high frequency signal into a digital message that is sent to the control unit.

- **NOTE:** Refer to the application chart to see which Cayennes and 997 vehicles are equipped with the 1.0 and 1.5 TPM systems

• **Learning Parameters**

- Learning occurs only while driving
- The learning process is divided into three phases
 - Recognition of own wheels (which wheels belong to this vehicle)
 - Takes approximately 6 minutes of driving
 - Can be initiated by selecting a new set of tires in the instrument cluster
 - “No monitoring, system is identifying” message is displayed
 - TPM warning light is on
 - Warning light goes out when the own wheels are recognized
 - A loss of pressure and a warning can be displayed at this point
 - No specific wheel position is available at this point
 - Assigning wheel position (what corner is each wheel located at)
 - Can take a maximum of 30 minutes driving
 - Determining wheel location allows system to then display pressures in the instrument cluster
 - Differential pressure (temperature compensated) will also be displayed at this point in time.
 - Confirmation phase (has anything changed)
 - This phase is primarily for determining if a wheel/tire or sensor change has occurred without it being selected in the instrument cluster menu.
- **NOTE: When a wheel/tire or sensor has been changed, it is necessary to reselect the tire size in the instrument cluster. The system will relearn with the new change and it will avoid false warnings.**
- Operation and display:
 - TPM menu navigation is not possible while driving.
 - Once sensors have been learned, it only takes about 2 minutes for tire pressures to be displayed when the vehicle is started.
 - The actual pressure display shows the actual pressure that is in the tire. It is not compensated for temperature changes.



- The pressure deviation or filling display shows the temperature compensated pressure deviation (only visible when vehicle is stationary).
- **Only use this screen as a reference when adjusting the pressure in the tire.**
- A negative value ("-") is too low and needs more air pressure.
- A positive value is too high and needs to be reduced.



- The gentle warning screen is used if the pressure has dropped more than 2.9 psi (0.2 bar), but not more than 5.8 psi (0.4 bar).
 - This warning is displayed for 10 seconds after the ignition is switched off and every time the vehicle is started.
 - Air pressure should be corrected at next opportunity.

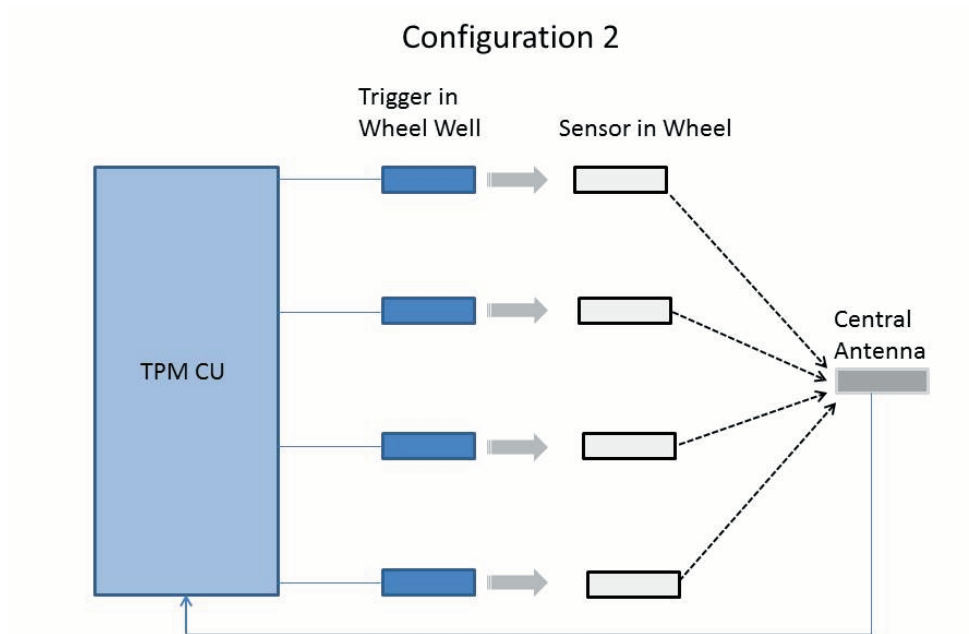


- The “stern” warning in red text is displayed if the pressure has dropped by more than 5.8 psi (0.4 bar) or by more than 2.9 psi (0.2 bar) per minute.
 - The display appears as soon as the condition exists.
 - The driver should stop to inspect the tire in question.

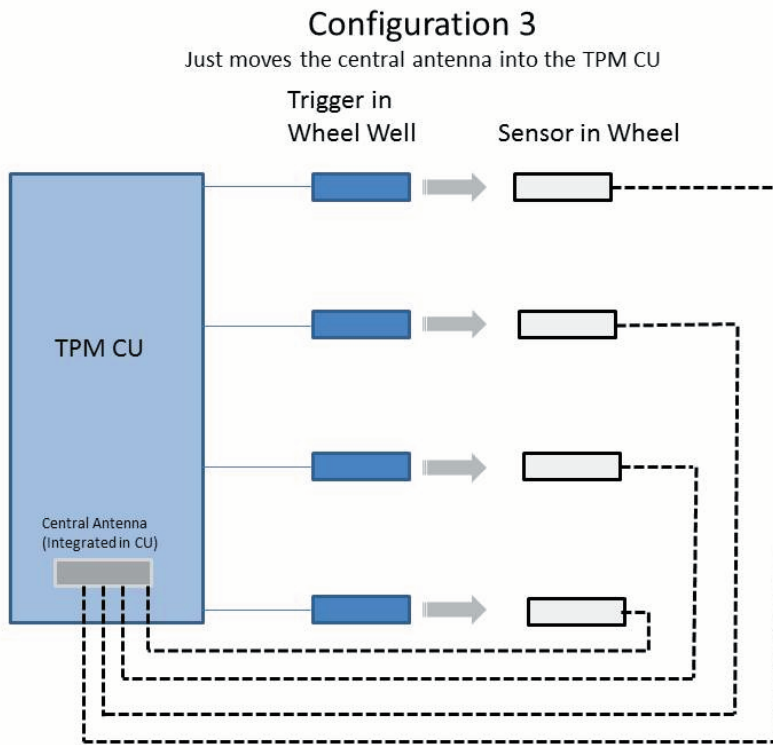


- A speed warning not to exceed 50 mph (80 km/h) in the event of a puncture is also available.
 - Selecting the run-flat system in the TPM menu is necessary for this warning to work.
 - This is a helpful warning in the event of a puncture, since adherence to it will help preserve the remaining life of the tire on the wheel.

2.) TPMS – Generation “2” (trigger based):



TPMS - Generation "2": Configuration 2			
Production Date	From December 2006	From April 2008	From April 2009
System Version	RDK 2.2 Beru	RDK 2.3 Beru	RDK 2.4 Beru
Vehicle Type	Cayenne E1 II	9X7 II 997 II GT3 (from April 2009) 997 II GT2 RS (from Oct. 2010)	Panamera 970 9X7 II (from August 2009) 997 II Turbo (from Sept 2009)
Control Unit	7L5.907.273.E	997.618.103.23	970.618.103.05 (970) 997.618.191.02 (9x7FL)
Antenna	955.606.101.00 433 MHz	955.606.101.00 433 MHz	955.606.101.00 433 MHz
Trigger Module	955.618.113.00	955.618.113.00	7PP.907.283
Wheel Sensor	7PP.907.275.F 433 MHz	7PP.907.275.F 433 MHz	7PP.907.275.F 433 MHz



TPMS - Generation "2": Configuration 3		
Production Date	From January 2010	From July 2011
System Version	RDK 2.5 Beru	RDK 2.6 Huf
Vehicle Type	Cayenne E2	9X1 <u>918/GT3</u>
Control Unit	7P5.907.273.D 433 MHz	991.618.104.02 <u>918.618.104.01</u>
Antenna	Integrated into Cont. Unit	Integrated into Cont. Unit
Trigger Module	7PP.907.283	7PP.907.283
Wheel Sensor	7PP.907.275.F 433 MHz	7PP.907.275.F 433 MHz

Tire Pressure Monitoring Versions “2.2” – “2.6”

(Hardware configurations 2 & 3)

NOTE: U.S. Law does not allow the system to be turned off.

• Function

- The radio messages from the wheel electronics units are requested by the control unit, as required, via the trigger units.
- The system detects the vehicle’s own wheels, and the installation position of own wheels, by evaluating the trigger location and performing a statistical evaluation of the wheel electronics information received.

• Sensor operation

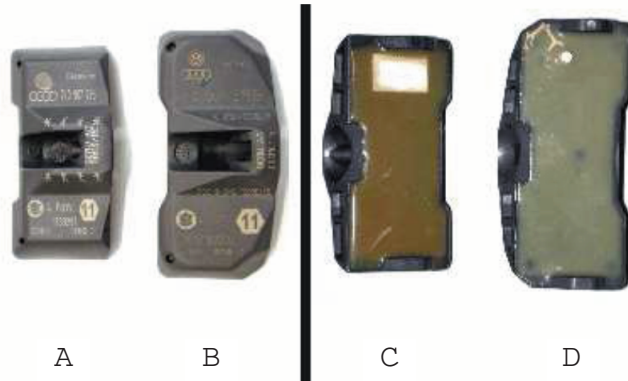
- The wheel electronics unit is comprised of the following components:
 - Pressure sensor
 - Temperature sensor
 - Roll switch
 - Battery
 - Receiver, transmitter, measuring, and control electronics
- Higher transmission power in the wheel sensor is necessary due to the longer radio link to the central antenna.
- The roll switch detects whether the wheel is stationary or turning.
 - This information is used either to start a triggered learning process for a moving wheel or to switch off the wheel electronics unit when the wheel has been stationary for a long time.
- To avoid confusion with 1st generation wheel electronics, the new wheel electronic unit can be identified by the modified shape of the housing and the small air filter.
- A modified data protocol ensures that the wheel electronics unit will not be detected if installed incorrectly and this is stored as a fault in the fault memory.

4

4434

All
1604

Advanced Technical Information



A-1st generation (original), B- 2nd generation (original)

NOTE: The newest Gen.1 – wheel electronic replacement from 2015 has the housing of the Generation “3” wheel electronic! (In photos below)



7L0.907.275.D



997.606.021.02



- **The Photo above is the 2nd generation sensor presently available (7PP.907.275.F)**

- **Trigger Units**

- The four triggers, which are located under the wheel housing liners in each of the four wheel housings, send a 125 kHz signal directly to the wheel electronic units.
- After a wheel sensor is triggered it will transmit the desired information to a central antenna immediately.
- This means that **the antenna always receives only one data protocol** and this comes from the wheel electronics unit that received the request to send.
- This gives the system added protection against cross-talk affecting other antennas.

- **Central Antenna**

- Configuration 2
 - The digital central antenna (reception frequency 315 or 433 MHz) is mounted on the underbody of the driver's side of the vehicle about halfway between the front and rear.
 - The signals received from the wheel electronics are digitalized in the antenna and forwarded to the control unit via LIN bus.
 - The antenna has a self-diagnosis capability.
 - Detected faults will be communicated to the control unit and the fault code will be stored there for retrieval by the tester.
- Configuration 3
 - The central antenna has been moved into the TPM control unit.
 - All processing functions of the received signal are now internal to the TPM control unit.

• **Learning Parameters**

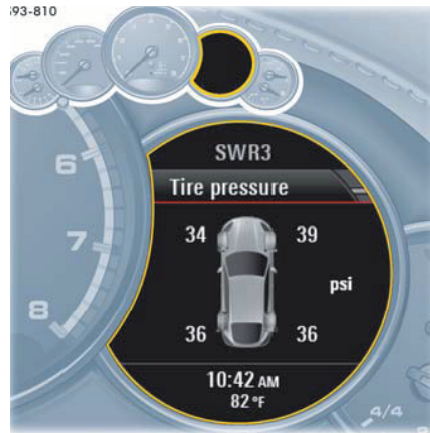
- Learning can be initiated by selecting a new set of tires in the instrument cluster.
- The system must recognize its own wheels and assign the corresponding positions. The learning process is only active during the drive.
 - When the vehicle is unlocked, the control unit initiates the first 125 kHz signal for each trigger in the four wheel housings one after the other, starting at the left front in clockwise direction.
 - Then, the wheel electronic units are only triggered approx. every 54 **seconds** while the vehicle is moving at a speed above 25 kph (15mph).
- Since the range of the trigger units is limited to the relevant wheel housing, any possibility of cross-talk affecting other wheels is almost totally eliminated.
 - Depending on many and varied influences from the immediate environment, such as:
 - reflections (wet roads, metallic floors, guide rails, etc.), external interference (external transmitters)
 - Bad positioning of the wheel electronics units with respect to the trigger and/or central antenna, a trigger signal can fail to reach the related wheel sensor or the feedback data protocol can get lost on its way to the central antenna.
 - The control unit responds immediately by re-triggering the trigger - repeatedly if necessary - at the wheel position at which the expected protocol has failed to materialize as soon as the initiated trigger cycle from front left to rear right is completed.
 - This concept reduces system interference and the wheel electronics units are detected much faster.

• **Learning After a Tire Change**

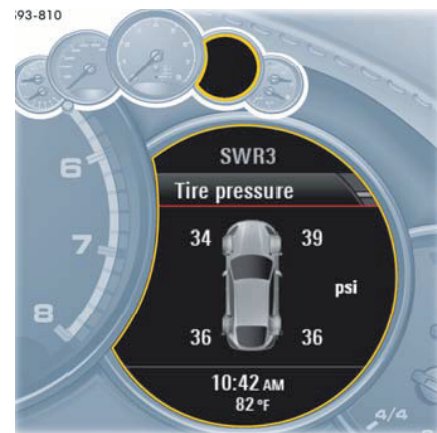
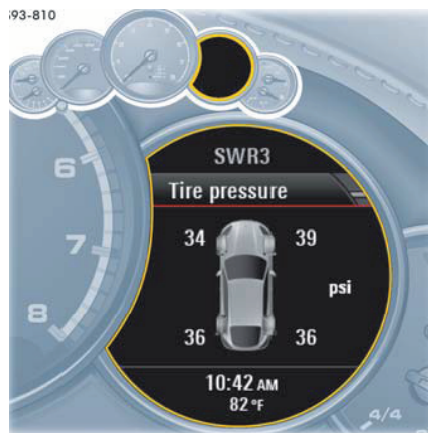
- The wheel sensors of a newly mounted set of tires are assigned within one minute – often even within a few seconds – of selecting the set of tires in the “Tire Pressure” menu and the pressure values are displayed.
- If a set of tires is not selected in the “Tire Pressure” menu after a tire change, the system will detect this within a maximum of 3 minutes and the message “Wheel Change?” will appear in the cluster display.
 - Selecting the correct tires in the menu at this point will insure the system is configured with the correct pressures for the tires.

• **Operation and display**

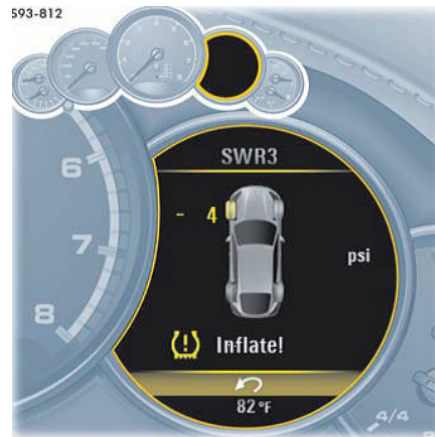
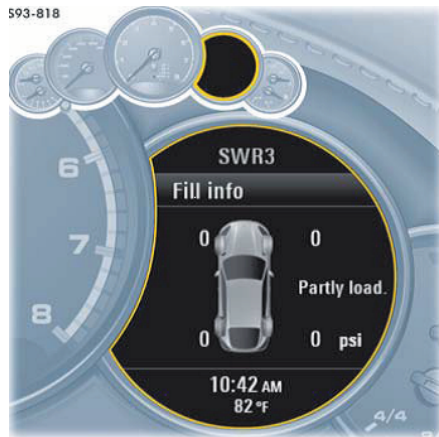
- The TPM CU knows which tire set is mounted on the vehicle once the teaching process is complete.
- The tire pressure values are available as soon as the vehicle is started since the trigger cycle starts immediately, once the door is opened, and the wheel electronics units have sent the latest data to the control unit.
- The tire pressure main menu screen displays the current pressures.



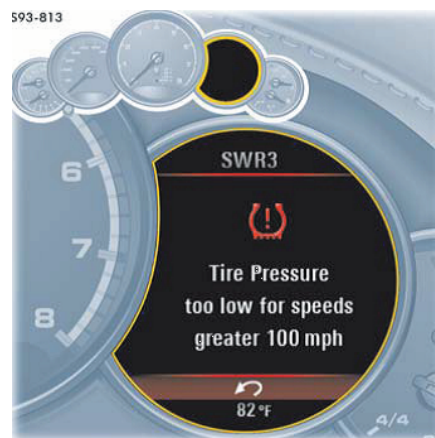
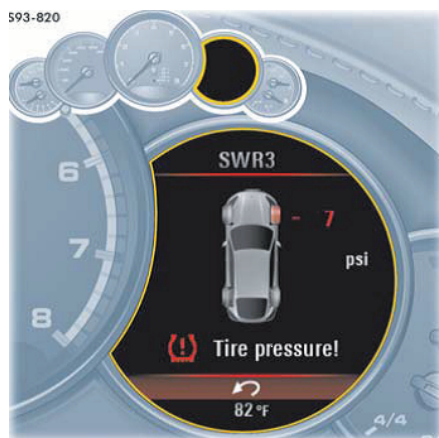
- If a spare tire without a wheel sensor is mounted (such as a collapsible spare) the remaining wheel sensors are still detected and displayed.
- If one or two sensors fail, the remaining sensors are still displayed.
- If a spare tire is mounted with a sensor in it, selecting “Spare Wheel” in the menu will incorporate that wheel into the monitoring, after a brief learning phase.



- The differential pressure display (temperature compensated) is available when the vehicle is stationary for filling the tires.
 - As soon as the information is called up, a fast pressure update is generated over a time span of 15 minutes (maximum).
 - This display updates the current information every 10 seconds during the filling process.
 - The soft yellow warning alerts the driver to add air to a tire.

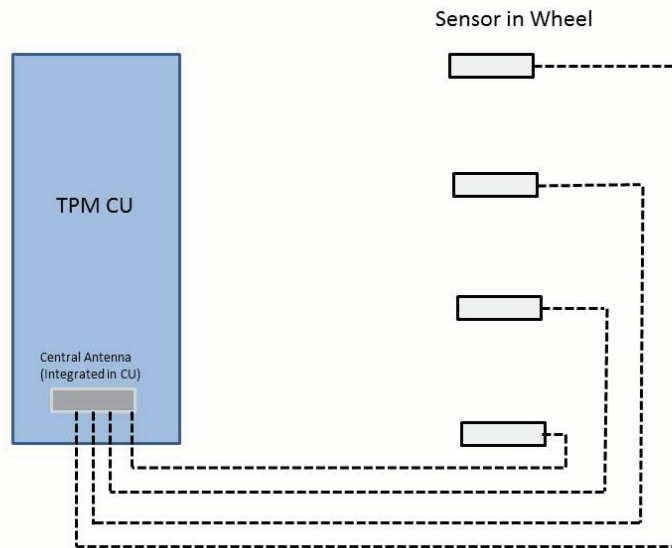


- If the pressure in the tires is reduced for additional traction (for mud or sand) a flat tire message will appear continuously in the display.
- The hard red warning can be acknowledged by the driver.
 - This clears the display so that any other messages and/or information can be shown.
 - The TPM light in the instrument cluster remains illuminated until the tire pressure is once again increased to a normal level.
 - Each time the ignition is switched off and on again, the hard warning re-appears as a reminder and can be acknowledged again by the driver.
 - If the pressure in the tires is reduced for additional traction (for mud or sand) a flat tire message will appear continuously in the display.



3.) TPMS – Generation “3”:

Configuration 4



TPMS - Generation “3”: Configuration 4	
Production Date	From April 2013
System Version	RDK 3 Huf
Vehicle Type	970 II Cayenne E2 II 991 II & 982 Macan
Control Unit	7PP.907.273.H 433 MHz 7PP.907.273.M 433MHz 991II/982 ab 22/2016
Antenna	Integrated into Cont. Unit
Trigger Module	No Trigger
Wheel Sensor	50Q.907.275.B 433 MHz

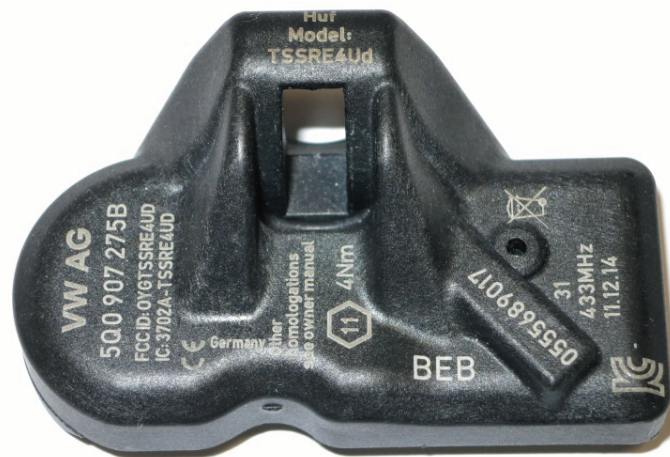
Tire Pressure Monitoring “Generation 3.x”

• Function

- TPM-valves with mounted wheel electronics (similar to the TPM Gen 2.6 in 991)
- Wireless data transmission at fixed intervals from the wheel electronics provides the following data:
 - Wheel ID
 - Measured tire pressure
 - Tire air temperature
 - Remaining battery life
- The wheel positions are learned automatically by determining side and axle position.
 - For determining which side of the vehicle a wheel is located on -
 - Accelerations sensors in the wheel electronics are used to determine rotation directions of the individual wheels.
 - For determining the axle position -
 - Signal strength is used to determine which axle is closer, and which is farther, from the antenna.
 - The antenna is mounted close to one axle (high signal strength).

• Sensor operation

- The burst mode consists of 25 transmissions @ 2 second interval -> It lasts from the moment the sensor detects rotation, so get the vehicle above 15 mph (25 kph) quickly, and keep it there, until learning is complete.
- For a sensor to fall back into "standby mode" (as a precondition for the burst to reoccur when driving), the car needs to be parked for approx. 5 minutes.
- After the burst mode, there is only one transmission every 30 second, with only one out of 3 transmissions containing the rotational direction. This explains why learning takes longer if the burst mode was missed originally.



- In the photo above is the generation 3 sensor (5Q0.907.275.B).

- **Learning Parameters**

- Vehicle is stationary for at least 5 minutes and clear of other TPM equipped vehicles
- Select the tire type from the TPM menu
- Message “System is learning from 25kph.”
- Drive vehicle continuously above a speed of 25kph (15mph). until pressures display
- Learning time should be less than 2 minutes (ideally).
- (Note: The system learns the wheel electronics only while driving. Periods of time where the vehicle is standing can increase the learning time considerably.)

- **Important differences between TPM Generations 2 & 3**

- About 5 minutes after the vehicle has stopped driving, the wheel electronics go into power saving mode. No new data is sent once this happens.
- The wheel electronics will come out of power saving mode -
 - If the vehicle starts moving again.
 - If a change in pressure of more than 1.5 psi (0.1 bar) is detected.
 - The wheel electronics will begin to send data after about 2 minutes.
- If the vehicle starts driving again within about 10 minutes of turning off the ignition, all tire pressures still appear.

- **Operation and display:**
 - Communication with the display instrument via MMI CAN.
 - The previous Porsche TPM-control and display concept has been retained as far as possible.
 - The instrument cluster displays monitored pressures in the main menu screen.



- For all approved tires the following pressure information is stored in the cluster
 - Load (full/partial),
 - Mode (comfort/standard)
- It is possible to add tires (Tequipment) in the free position of tire type menu, including pressures, by using the PIWIS Tester
- Instrument Cluster Menus (2 levels)
 - The first level menu shows the tire selection along with boxes to be selected for “Full Load” and “Comfort” pressure settings
 - “Partial Load” is the default, checking the box changes the setting to “Full Load”.
 - “Standard” pressure is the default, checking the box changes the setting to “Comfort”.
 - The tire pressure main menu screen displays the current pressures.





- There are two menus on the second level
 - The first one allows the tire type to be selected.
 - The next one has the filling information screen. This is a temperature compensated target value. Always fill using this screen.

Dealership	Service Manager _____	Service Specialist _____	_____	_____	_____	_____	_____	_____	_____
Distribution	Asst. Manager _____	Service Specialist _____	_____	_____	_____	_____	_____	_____	_____
Routing									

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