TSS 2. Generation
Tire Safety System TSS 2nd. Generation

Dept. BEE

Systembeschreibung TSS **System description TSS**	Dokument Nr.: *Document no.:*	Änderungsstand: *Status of modification:*	Index: *Index:*
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b	**00**	**315MHz components included**	**Saric 03/09/06**	**Saric 03/09/06**	**Saric 03/09/06**
a	**00**	**First version**	**Saric/ 8/26/05**	**Birringer/ 8/26/05**	**Saric/ 8/31/05**

Section 15.19: Labelling requirements
This device complies with Part15 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.

Section 15.21: Information to the user
The user manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

IC statement according to RSS210
5.11 User Manual
Operation is subject to the following two conditions:
(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device

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Contents:

1 SYSTEM AND FUNCTIONAL DESCRIPTION 5
1.1 SYSTEM DESCRIPTION 5
2 FUNCTIONAL DESCRIPTION 6
3 WARNING ALGORITHM 8
3.1 WARNING LIMIT "MINIMUM PRESSURE" 8
3.2 WARNING LIMIT "NOMINAL PRESSURE MINUS RELATIVE DEVIATION" (NOMINAL PRESSURE – X %) 8
4 SYSTEM COMPONENTS 8
4.1 CONTROL UNIT 8
4.1.1 Installation area 9
4.1.2 Temperature range 9
4.1.3 Voltage Range 9
4.1.4 Current consumption 9
4.1.5 Occupancy of the CAN control unit: 9
4.1.6 Occupancy of the K bus control unit: 10
4.1.7 CAN bus connection 10
4.1.8 K bus connection 10
4.2 WHEEL ELECTRONIC 10
4.2.1 Installation area 11
4.2.2 Versions 11
4.2.3 Temperature 11
4.2.4 Pressure 12
4.2.5 Service Life 12
4.2.6 Environmental requirements 12
4.2.7 Mechanical specification 13
4.2.8 Measurement specification 13
4.2.9 Specification for HF transmitter 13
• *Transmitting power 14*
4.2.10 Block diagram wheel electronics 14
4.3 DIGITAL ANTENNA 15
4.3.1 Installation Area 15
4.3.2 General Dimensions and Values 15
4.3.3 Temperature ranges 15
4.3.4 Voltage supply 15
4.3.5 Current consumption 15
4.3.6 Environmental conditions 15
4.3.7 TSS BUS communication with TSS control unit 16
4.3.8 Connection occupancy, sleeve strip 16
4.3.9 Block diagram 16
4.3.10 Assembly 17
4.4 TRIGGER TRANSMITTERS 18
4.4.1 Temperatur / temperature 18
4.4.2 Mechanische Anforderungen / mechanical requirements 18
4.4.3 Voltage Range 18
4.4.4 CurrentConsumption 18

4.4.5 Frequenz / frequency 18
4.4.6 Modulation / modulation 18
4.4.7 Physikalische Schnittstelle / physical link 19
4.4.8 Protokoll / protocol 19
4.4.9 Diagnose / diagnosis 19
4.4.10 Stecker / connector 19
4.4.11 Environmental Qualification 19
4.4.12 Schematic Representation of the Trigger Transmitters 20

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1 System and functional description

1.1 System description

The Tire Safety System (TSS) controls and monitors tire pressures.
The system comprises the following components:

1 TSS control unit
4 sets of wheel electronics including valve
1 digital antenna
4 trigger transmitters

The wheel electronics mounted inside the tire measures tire pressure and temperature at regular intervals and transfers the values telemetrically via a HF transmission line to a reception antenna. The current pressure and temperature values can be requested specifically via the trigger function. In the receiver antenna, the radio data telegram is decoded and transferred to the control unit as a digital signal. The control unit evaluates the received data and forwards the information to the driver as required. This provides the driver with information on the necessary tire pressure or tire tension adjustments.

The benefits offered by the tire pressure control system are:

- Safety
  An early warning in case of fast pressure loss is given.
  "Blow-outs" caused by excessive flexing and driving too fast on inadequate tire pressure are avoided.
  The driver is prompted to adjust the tire pressure where necessary.

- Comfort
  Tire handing is made simple. Using the filling equipment at the fuel station and removing the valve cap is only necessary for correcting the tire pressure.

- New tire developments
  Tires with limp-home features avoid having to change a wheel immediately and render the spare wheel superfluous. They do, however, require permanent monitoring of the tire pressure.

- Service life and economy
  Tire wear is minimized through correct air pressure.

2 Functional description

The wheel electronics are mounted within the tires and measure tire pressure, temperature and wheel electronics. The measured data is sent from the wheel via a transmitter in the wheel electronics. A system with relatively seldom measured data transfer is adequate for tire pressure monitoring provided it features the additional option of detecting sudden pressure loss. This enables the electronics in the wheel to be designed for minimum power draw and battery operation.

All wheel electronics have their own code (ID) that is forwarded with the data at each transfer. The HF transfer occurs in the 433 MHz range or, referred to as the ISM range and/or in some countries in the 315 MHz range. The trigger functionality is achieved by a 125kHz LF channel.

The control unit calls up the wheel electronics via the trigger transmitters every 54 s (a random generator with a jitter of 25ms to 175ms ensures that no periodic signal is generated) to send data messages. Tire pressure and wheel electronics temperature are also measured every 3 seconds. When a pressure loss > 0.2 bar on the last sent pressure value is detected, the wheel electronics switch immediately to fast-send mode. In this situation, the wheel electronics measure and send every 0.8 seconds.

The TSS measures and transfers considerably more data than is necessary to ensure reliable basic function. It can therefore use a data transfer path that is not assigned for the error-free transfer of each individual data protocol. Using the trigger function, an implausible and/or non-received data message can be requested again from the corresponding wheel electronics.

The data sent by the wheel electronics is received via the digital antenna and is decoded. The decoded data is transferred onwards to the control unit via a digital interface.
The control unit evaluates the received data and forwards the information to the driver information system as required. This provides the driver with information on the necessary tire pressure or tire tension adjustments.

The main functional characteristics of the control unit are:
- A central warning algorithm and an algorithm for the wheel manager
- The vehicle-specific connection for the power supply system and manufacturer-specific operation and display philosophy

The essential feature of wheel management is the self-learning system with automatic individual wheel detection and the detection of the corresponding installed positions (wheel position detection).
Thanks to fast triggering of the wheel electronics when Ignition is ON, the system detects a flat tire well before the start of a journey.

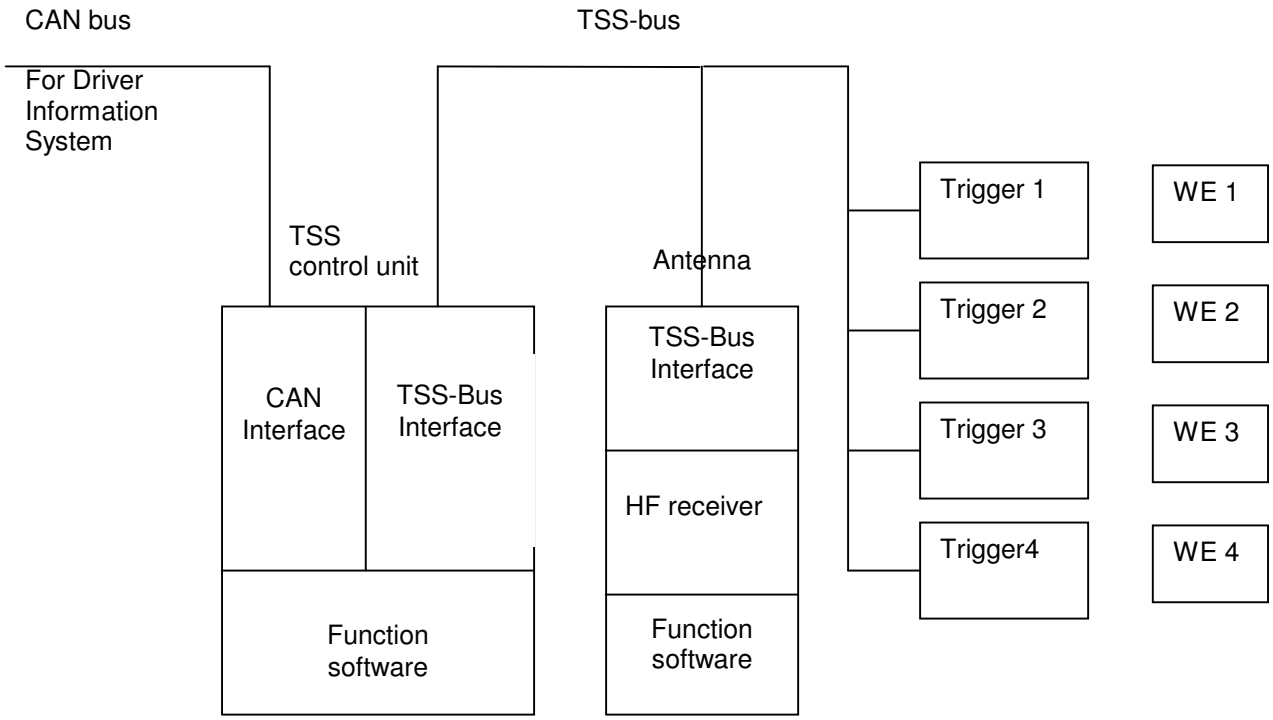

Figure 1: Block diagram, TSS system of the second generation

3 Warning algorithm

The system monitors a nominal pressure, which is set by the operator, and a fixed set minimum warning pressure. The higher value in each case is used to generate the breakdown warning.

The driver instructs the system to accept the current pressure values as the nominal pressure by using the "Reset". The reset is triggered by pressing a key or selecting a menu item.

3.1 Warning limit "Minimum pressure"

At this warning limit, a check is made against the minimum warning pressure $P_{Warning\_MinimumPressure}$, which is programmed into the system as a fixed value.
The minimum warning pressure amounts to 2.6bar abs plus an accuracy reserve of 0.1bar.

The corresponding warning bit is set, if the measured pressure lies below this threshold twice in succession.

3.2 Warning limit "Nominal pressure minus relative deviation" (Nominal pressure – x %)

This warning limit is calculated from the nominal pressure less a relative deviation of 25% of the nominal pressure. The nominal pressure is specified by the driver.
Again here an accuracy reserve of 0.1 bar is added to the warning limit.

The corresponding warning bit is set, if the measured pressure lies below this threshold twice in succession.