

OptiTire

Tire Pressure Monitoring
for Commercial Vehicles

Draft

WABCO

OptiTire

Tire Pressure Monitoring for Commercial Vehicles System Description

Edition 7

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1 Important instructions

1.1 Information and Disclaimer

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1.2 Symbols used

DANGER

Imminent hazard situation which can cause serious personal injury or death if the safety instruction is not observed.

WARNING

Potential hazard situation which can cause death or serious personal injury if the safety instruction is not observed.

CAUTION

Potential hazard situations that can cause minor or moderate to severe injury, or material loss, if the safety instruction is not observed.



Important instructions, information, or tips that you should always observe.



Reference to information and publications on the Internet

- List
- Step
- ➔ Consequence of an action

1.3 General information

This publication is directed at trained service technicians employed at workshops for commercial vehicles.

Proper use

The OPTITIRE system is designed exclusively for monitoring the tire pressure in commercial vehicles.



Carefully read all the safety instructions as well as all the repair and maintenance instructions in this document before you start maintenance work, repairs or replacing parts.

These instructions must be observed to avoid personal injury or material damage. WABCO only guarantees the reliability and performance of its products and systems if all instructions, notes and safety instructions are observed.

1.4 General safety instructions

Before you perform any work on the vehicle (repair, maintenance, replacing parts, etc.), you must ensure the following:

WARNING



Severe damage to property and injuries to health may result due to improper assembly or repair work.

- Only trained and qualified personnel may perform repairs on the vehicle.
- Always follow the specifications and instructions of the vehicle manufacturer.
- Always comply with the Company and national accident prevention guidelines and Health and Safety regulations.
- Wear suitable protective clothing as the situation requires.
- Ensure that the workplace is dry and provided with sufficient lighting.

2 Introduction

This chapter gives you an overview of the benefits OPTITIRE provides.

2.1 OPTITIRE prevents tire blow-outs

OPTITIRE stands for Integrated Vehicle Tire Pressure Monitoring. The system is continuously monitoring tire pressure on all wheels by means of sensors. In the event of a critical pressure drop, a display in the driver cabin of the towing vehicle warns the driver in time. Since around 85% of all punctures are caused by driving with wrong air pressure or creeping pressure loss while in motion, risk of tire burst can be reduced down to 15% thanks to OPTITIRE.

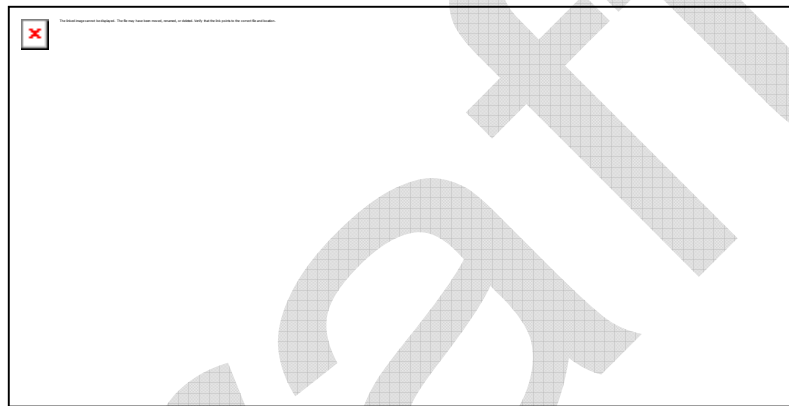


fig. 2-1: Root causes for roadside emergencies (source: ADAC 2011)

- A Tires 31.6%
- B Electrics 29.2%
- C Engine 20.7%
- D Others 18.5%

2.2 OPTITIRE reduces cost

By selecting the correct tires and having them properly maintained, substantial savings can be achieved per vehicle and year. Maintaining correct inflation pressure for instance: In practice, about every second tire is run at an air pressure falling below 10 percent of the specified one. Also 20% under nominal pressure is not rarely observed and this will reduce tire mileage by as much as 20%. This will push up fuel consumption in each case.

Full tire pressure checks usually take around 30 minutes per vehicle, OPTITIRE can help reduce or even eliminate this extra work.

So OPTITIRE minimises cost and makes a great contribution to safety on our roads.

OPTITIRE allows employment of Super Singles instead of twin wheels.

OPTITIRE can be easily retrofitted.

Return of Investment Calculator



Using our Return of Investment Calculator on our website <http://www.OptiTire.com> or <http://www.wabco-auto.com>, you are able to calculate use your OPTITIRE offers within a few stages.

You can either enter your individual application data or use standard profiles for determining which savings you are able to achieve using the OPTITIRE.

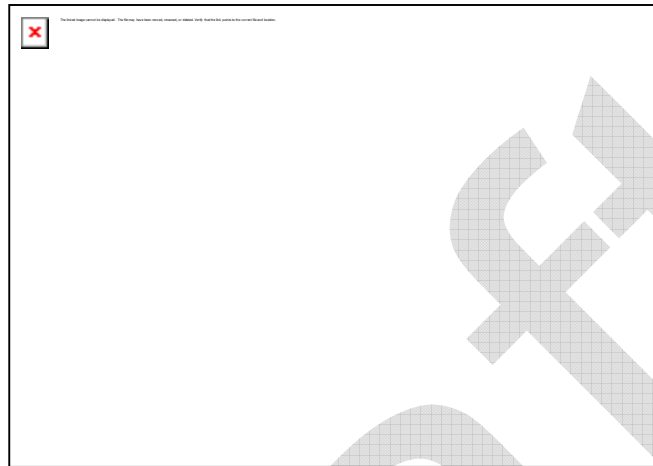


fig. 2-2: Dependence of tire service life from air pressure

- A Tire pressure
- B Service life reduction
- C Tire pressure too low
- D Tire pressure too high

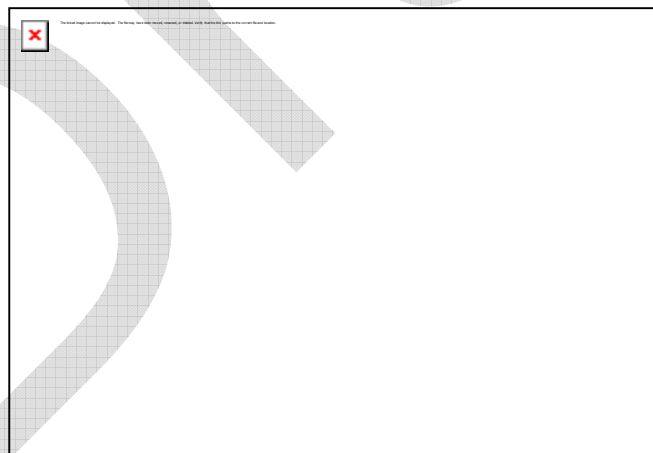


fig. 2-3: Consumption vs. air pressure dependency

- A Tire pressure
- B Fuel consumption
- C Tire pressure too low
- D Tire pressure too high

3 System Description

This chapter describes the mode of operation of the OPTITIRE system. Furthermore, you will also obtain information concerning technical reports for installing and retrofitting.

3.1 OPTITIRE Basic Functions

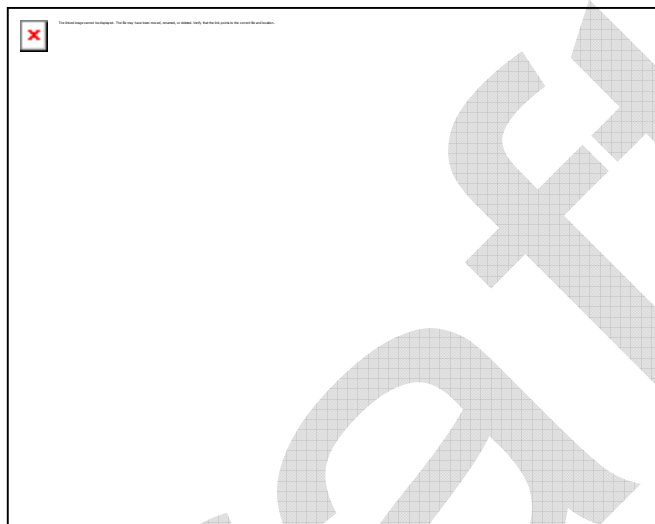


fig. 3-1: Solo system

- A** Electronic Control Unit (ECU)
- B** Wheel module
- C** Display

Each wheel continuously transmits actual tire pressure to a central electronic control unit (ECU). The signals of all wheels are evaluated there and the information is conveyed to a display in the driver's cab.

Measuring

Wheel modules measure the air pressures on the conventional valves every 15 minutes (WM2) or 1 min (WIS) and transmit them to the ECU. If the pressure changes critically then the wheel module would send the values in shorter periods.

Evaluating

Evaluation is far more than just comparing a current pressure value with an allowed one and sending a warning message on falling below. The ECU discriminates a real problem situation from usual pressure fluctuations during vehicle operation also on bad road conditions or uneven load.

In the event that an irregularity occurs then this fact would not only be reported on the display but the wheel in question would be exactly indicated too.

An OPTITIRE ECU can receive and process data from up to 20 wheel modules each and further ECUs. Dual tires will each be fitted with individual sensors. Sensor pressure range is between 2 and 14 bar corresponding to nominal pressure values from 3 to 10.5 bar.

Displays

WABCO is offers a driver's display for indicating warning messages and tire pressure checking.

For certain vehicles the data can also be transmitted to an integrated display as an alternative. Detailed description of display functionality is given in chapter "Operation" (see chapter 5, page 28).



OPTITIRE, and therefore TPI, cannot announce sudden, extreme tire damage caused by external effects.

3.2 OPTITIRE at trailer-towing operation

Operating mode

Initially, the OPTITIRE system on the trailers will work self-sufficiently if there is a power supply. In order to display tire pressure and trailer warnings to the driver during driving, however, it is necessary to install OPTITIRE to both parts of vehicle, which means one control unit to the trailer and one unit to the towing vehicle.

Any towing vehicle equipped with OPTITIRE could be connected to any trailer equipped with OPTITIRE.

Variants

The OPTITIRE for trailer vehicles can be operated using the WABCO SmartBoard as well as for stand-alone versions.

Tire pressure values, in connection with WABCO TCE or EBS, can be transferred to the towing vehicle's CAN bus via standard CAN data connection according to ISO 11992 (only in connection with appropriately prepared towing vehicle).

Automatic trailer recognition

Control unit of towing vehicle identifies control unit of trailer automatically: The stop light is enabled on towing vehicle and trailer when hitting the brake. The trailer ECU radios a signal with this voltage pulse that is expected by the towing vehicle's ECU that instant. The towing vehicle thus clearly detects that the trailer belongs to the tractor/trailer combination and subsequently transmits trailer ECU messages to the display.

As trailers are usually not permanently powered, it is possible that due to the frequency of wheel modules transmission the tire pressure data for all the wheels of the trailer is not available in the display for up to 15 minutes after starting the drive.

3.3 Configuration for bus and towing vehicle

In this chapter, you will learn which components you require for your vehicle.

Selection of OPTITIRE components depends on vehicle type, type and number of wheels and type of systems connected to OPTITIRE but not on the vehicle system voltage.

ECU

Trucks, buses or articulated buses are equipped with the ECU 446 220 100 0.

Display

IVTM display 446 221 000 0 is used for the retrofitting of the display and operation devices. Original equipment, however, will often address a central computer via CAN with the latter controlling indication of the integrated dashboard-mounted display.

Wheel modules

Select wheel modules and counterweights according to their axle configuration. The table contains components for three vehicle type examples. Further information in chapter "Components", see chapter 4, page 18.

Order Number	Component	Comment	4x2	6x2	Articulated bus 6x2
446 220 100 0	ECU	Communication with trailer ECU / warning lamps	1	1	1
446 221 000 0	Display		1	1	1
894 607 390 0	Wiring harness	Cable set, 7-pin optional 894 607 295 0 (5-pin, no trailer-towing operation)	1	1	1
960 731 051 0	L shape wheel module	for the front axle, rim 22.5", 10 holes	2	4	2
960 731 031 0	Wheel module	for rear axle, rim 22.5", 10 holes	4	4	8
960 730 822 2	Counterweight	Balance weight for front axle wheel module	2	4	2
960 731 802 0	PA tube	for front axle wheel module, L-shape	2	4	2
960 731 822 2	PA tube	for rear axle wheel module, outside	2	2	4
960 731 804 0	PA tube	for rear axle wheel module, inside	2	2	4
960 731 801 0	PA tube	Super Single	2	2	4

Table: 3-1: Components for bus / towing vehicle

Operation via CAN bus

Provided the trailer is equipped appropriately, data exchange can also be made via CAN bus besides wireless connection between towing vehicle and trailer. Towing vehicle ECU needs to be connected to vehicular CAN Bus for this purpose too.

Circuit diagrams



Detailed circuit diagrams are – as are the outline drawings of the components – available on the Online Product Catalogue INFORM at <http://www.wabco-auto.com>.

Enter wiring diagram product number for opening the file:

- 841 801 970 0: Solobus
- 841 801 971 0: Articulated bus
- 841 801 972 0: Articulated truck / truck

3.4 Configuration for trailers

Transmission types

Trailer and towing vehicle must be equipped with OPTITIRE for displaying trailer OPTITIRE data in the driver's cab.

Alternatively, trailer data can display in towing vehicle only then when it is equipped with an integrated display. When the trailer is also equipped with TCE or TEBS then data transfer can be made to the towing vehicle central computer via CAN. The following illustration compares both transmission types, wireless connection and CAN bus, with each other.

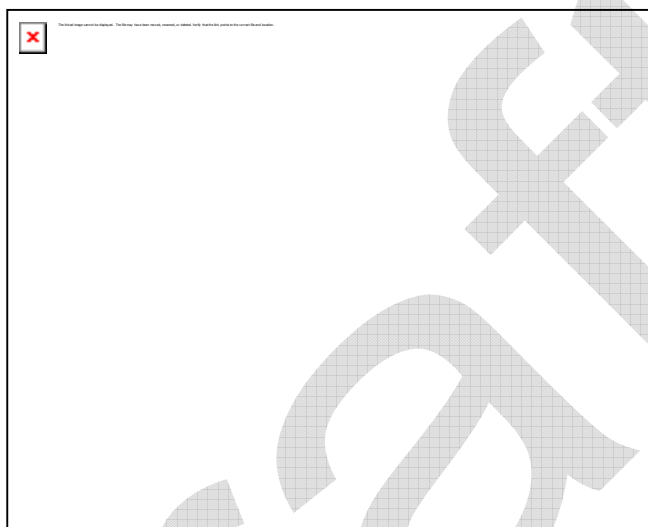


fig. 3-2: Data transfer wireless connection (top) and CAN

- A IVTM display
- B Wheel modules
- C OPTITIRE-ECU
- D Wireless connection
- E OPTITIRE Trailer ECU
- F Integrated display
- G Central computer
- H TEBS/TCE

Stand-alone trailer towing operation

If the trailer should be independently equipped with OPTITIRE, then the pressure release can be carried out via telemetry or the vehicles own display. When using the OPTITIRE display, it requires a special box for splash protection or another protected attachment location. The WABCO SmartBoard can be installed as an alternative.

The driver cannot receive fault messages without OPTITIRE support while the towing vehicle is in motion.

OPTITIRE with several trailers

Equipment of tractor/trailer combinations with more than one trailer is possible. Tractor/trailer combinations with two trailers can still be made with wireless connections; roadtrains need CAN bus connection with special ECUs.

Please contact your WABCO partner for more information.

OPTITIRE with TEBS D, TEBS E or TCE

Installation in a vehicle with TEBS D, TEBS E or TCE is simple because this merely has to be plugged into pre-assembled cables. Other systems would require open wiring that needs to be enclosed by protective housing.



Observe the current installation instructions for the control unit of the ABS / EBS in the WABCO product database INFORM <http://www.wabco-auto.com> and / or those of the vehicle manufacturer.

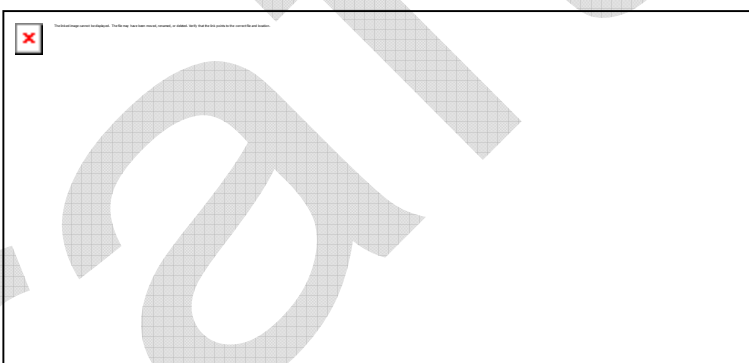
The circuit diagrams illustrated in the following table in excerpt form can be retrieved from INFORM.

Wiring diagrams for trailers

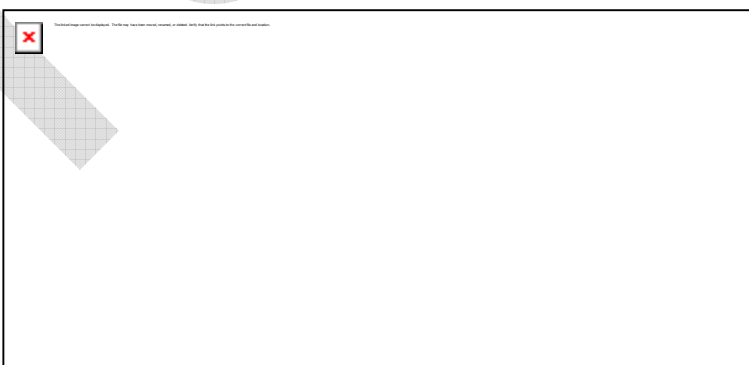
The circuit diagrams shown in excerpt form below can be retrieved from the WABCO online product database NFORM at <http://www.wabco-auto.com>. To retrieve them, enter the desired circuit diagram number in the "Product number" input field.

Wiring diagram 841 801 943 0:**Trailer ABS VCS**

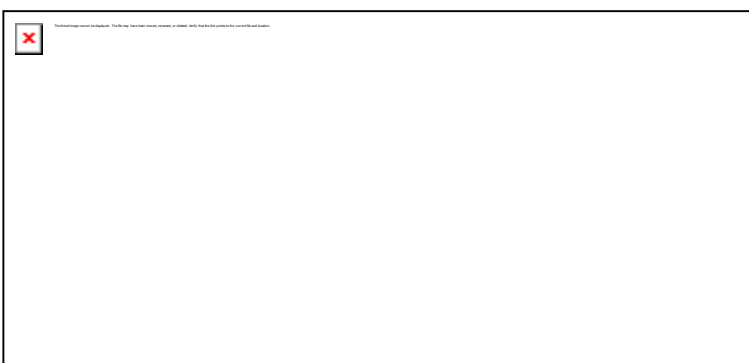
Cable position 8 (449 314 ...) is opened and connected to cable position 3 (449 674 273 0) and a line to the stop light in a wiring box.

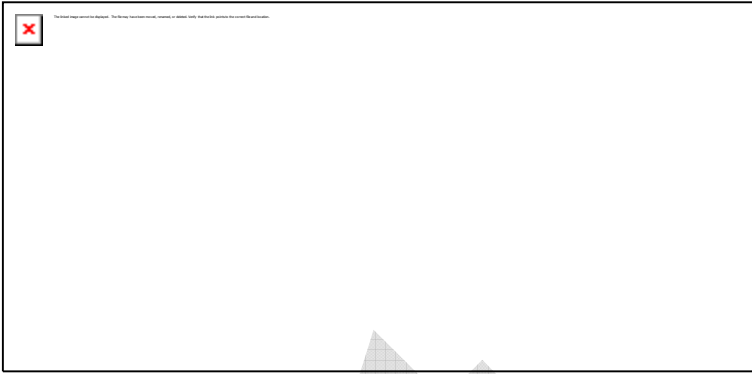
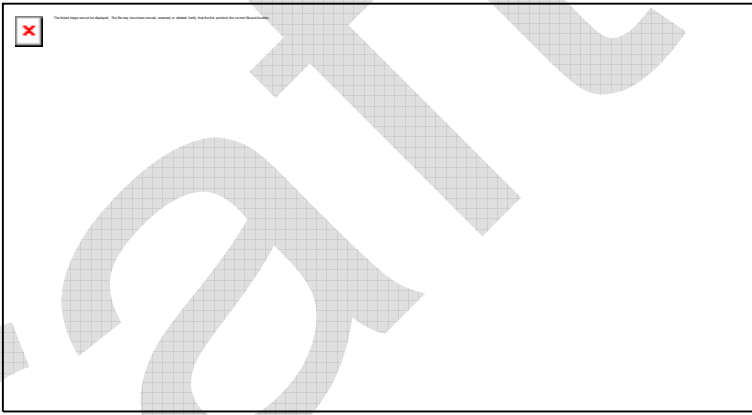
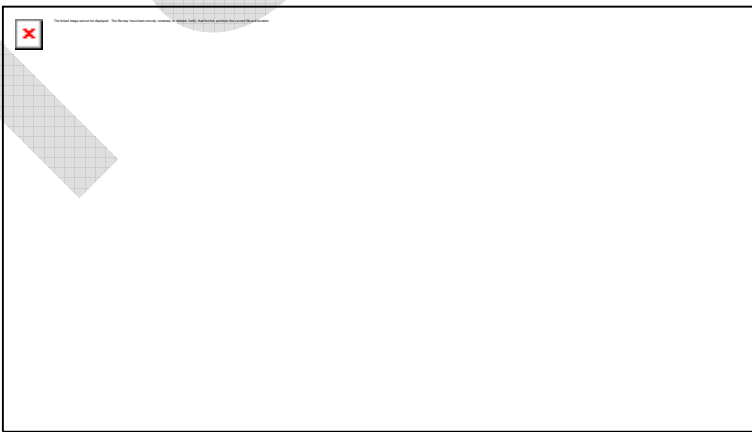
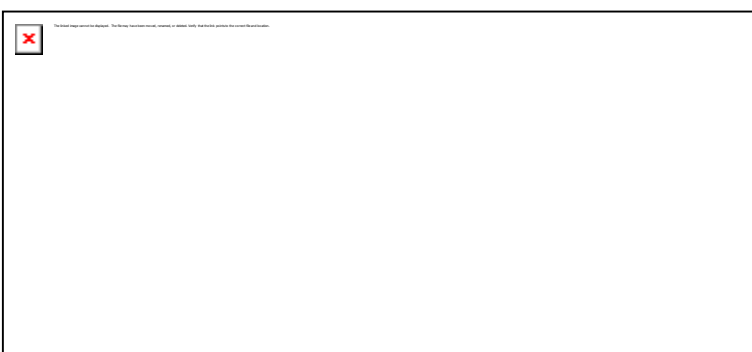
**Wiring diagram 841 801 946 0:****Trailer ABS VCS II**

Cable position 8 (449 336 ...) is opened and connected to cable position 3 (449 674 273 0), cable position 11 (449 621 ...) and a line to the stop light in a wiring box.

**Wiring diagram 841 801 941 0:****Trailer EBS with CAN connection**

Cable position 8 (449 614 ...) is opened and connected to cable position 3 (449 674 273 0) and a line to the stop light in a wiring box. The ISS output must not be used and needs to be set to 0 km/h.



Wiring diagram 841 801 945 0: Trailer EBS D with CAN Connection is made with cable position 3 (449 377 ... 0 / 449 378 ... 0). The ISS output must not be used and needs to be set to 0 km/h. OPTITIRE diagnosis through diagnostic cable 446 300 329 2 via TEBS diagnostic port.	
Trailer TCE Connection like on Trailer EBS D with CAN but with cable 449 302 ... 0.	Wiring like 841 801 945 0
Wiring diagram 841 801 940 0: Trailer ECAS Cable position 3 (449 674 273 0) is introduced into bottom box of ECAS-ECU and connected there. One cable to stop light (position 7) is installed additionally. You need screwed cable glands (PG 11: 894 130 312 2) for two cables.	
Wiring diagram 841 801 944 0: Vario-C Cable position 3 (449 674 273 0) is introduced into bottom box of ABS-ECU and connected there. One cable to stop light (position 7) is installed additionally. You need screwed cable glands (PG 11: 894 130 312 2) for two cables.	
Wiring diagram 841 801 942 0: Trailer EBS and ELM Cable position 8 (449 344) is opened and connected to cable position 3 (449 674 273 0) and a line to the stop light in a wiring box.	

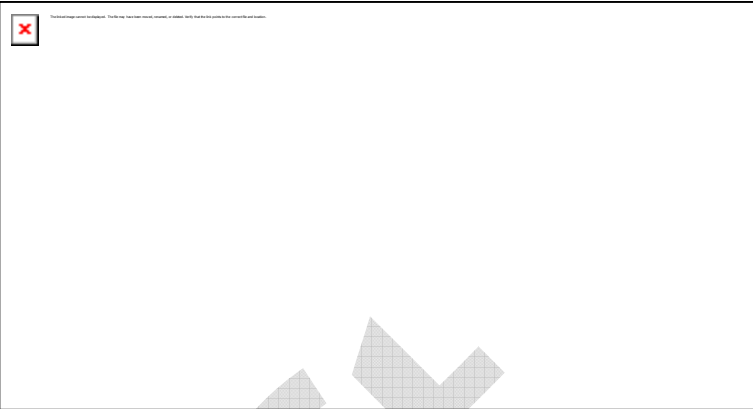
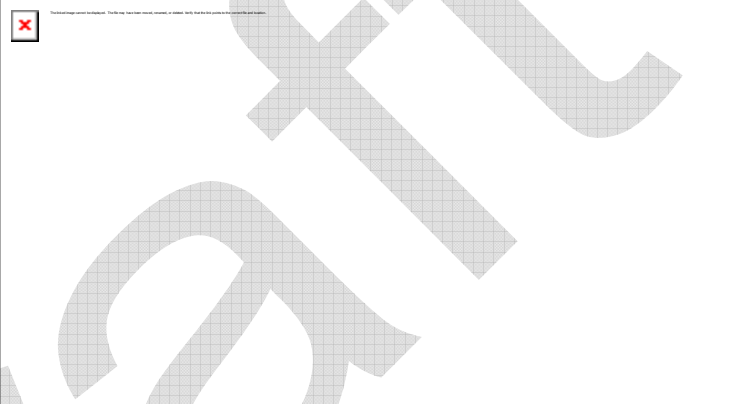
Wiring diagram 841 801 913 0: Trailer EBS D and SmartBoard (from year of manufacture 2004) The SmartBoard and OPTITIRE are connected to the Trailer EBS D modulator on port IN/OUT2. CAN 2 must be activated (activation via diagnostic software). 1 Trailer EBS D Modulator 480 102 014 0 2 Cable family 449 377 ... 0 3 SmartBoard 446 192 110. 0 4 OPTITIRE 5 Distributor housing	
Wiring diagram 841 802 155 0 Trailer EBS-E OPTITIRE is connected to sub-systems using cable (449 911 ...).	
Wiring diagram 841 802 155 0 TEBS E with SmartBoard OPTITIRE and SmartBoard are connected to sub-systems using cable (449 916 ...).	

Table: 3-2: Components for trailers

3.5 Certificates

Certificates for mounting and additional mounting of OPTITIRE are available, which significantly facilitate approval of vehicle registration papers.



The certificates are not part of this document but can be retrieved from the WABCO online product database INFORM at <http://www.wabco-auto.com>. To retrieve them, enter the search term in the "Index" input field.

Following certificates are stored there:

- Expertise TÜH ATC TB 2002-108.00
- Part certificate of TÜH ATC - TB 2003-023.00
- Type approval 94/9/EG CE 0032, TÜV03 ATEXxxxx

-
- Operating range: ex II 2G EEx ib IIC T4
-

OptiTire FCC Declaration for FCC ID: SA4-OPTITIRE and SA4-WM731:

„This device complies with Part 15 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“

OptiTire IC Declaration for model: IC: 6970A-OPTITIRE and 6970A-WM731:

„This device complies with Industry Canada's licence-exempt RSSs. 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.“

„Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- 1) l'appareil ne doit pas produire de brouillage;
- 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.“

For operation in the USA following statement has to be considered:

„. CAUTION TO USERS: “Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.”

4 Components

This component description details the properties of basic components.



Other details, such as dimensions, can be accessed via the WABCO online product database NFORM at <http://www.wabco-auto.com>. To retrieve them, enter the desired product number in the "Product number" input field.

4.1 Wheel module WM2

CAUTION



Risk due to incorrect handling

- Do not unscrew or remove the module from the bracket.
- Any changes of manipulation to the wheel module of any type, especially attempts made to change the battery will destroy the device and may lead to injuries.

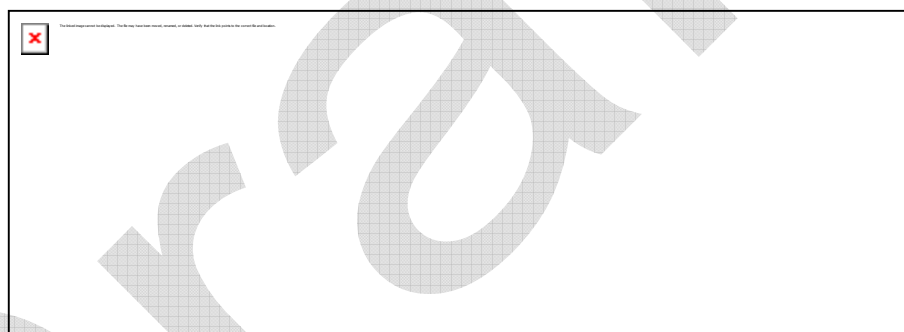


fig. 4-1: Wheel module with connecting hose

The wheel module consists of a compound-filled plastic unit comprising a pressure sensor, an evaluation circuit, a radio transmitter and a lithium battery.

Battery life under normal operating conditions is minimum 6.5 years. If the battery is dead the module would not transmit any longer and needs to be replaced with a new one.

The wheel module is mounted to the rim by the standard lug nuts and is connected to valve via a PA tube. The result is an easy installation. You will not need to remove the tire from the rim when retrofitting.

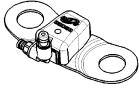
Data transfer

Wireless transmission is made by 433 MHz signal. If pressure is constant, measured values are transmitted every 18 minutes (9 minutes with versions that do not have acceleration sensor), if pressure is changing, frequency of data transfers is faster.



OPTITIRE can be interrupted in its function if other devices or systems in the vicinity are also transmitting in the area of 433 MHz. These can be radio sets, radio remote controls (e.g. for door actuation, cranes, fork lift), insufficiently shielded electrical drives with high power or other radio transmitters. When OPTITIRE system is removed from the influencing area, the function is guaranteed again.

Depending on rim crank, use of the normal module according to Figure 4-1 or the so-called L-shape or T-shape version is recommended. For details see Table 4-1 and also the chapter on configuration (see chapter 3.3, page 11 and see chapter 3.3, page 11).

Application	WABCO number	Hole, wheel bolt	Bolt circle Ø	Angle	Figure
Trailer: Independent wheel (no Super-Single)	960 731 011 0	26 mm	335 mm	0°	
Trailer: Independent wheel (no Super-Single), 20° for special purposes (e.g. Iveco)	960 731 013 0	23 mm	335 mm	0°	
Trailer: Independent wheel (no Super-Single), 23 mm pitch circle diameter	960 731 017 0	23 mm	335 mm	0°	
Trailer: Independent wheel (no Super-Single)	960 731 021 0	32 mm	335 mm	0°	
Twin tires, Super-Single	960 731 031 0	26 mm	335 mm	70°	
Twin tires, Super-Single	960 731 041 0	32 mm	335 mm	70°	
Towing vehicle: Front axle, load axle	960 731 051 0	26 mm	335 mm	60°	
Towing vehicle: Front axle, load axle	960 731 053 0	32 mm	335 mm	0°	
Towing vehicle: Front axle, load axle	960 731 055 0	26 mm	335 mm	60°	

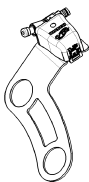
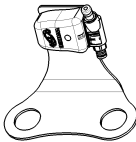
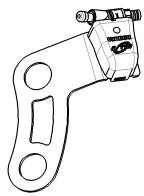
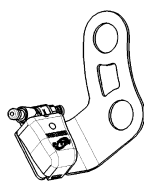
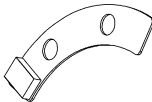
Application	WABCO number	Hole, wheel bolt	Bolt circle Ø	Angle	Figure
Towing vehicle: Front axle, load axle	960 731 061 0	32 mm	335 mm	33°	
Twin tires, Super-Single	960 731 073 0	26 mm	285,75 mm	70°	
Towing vehicle: Front axle, load axle	960 731 075 0	26 mm	285,75 mm	33°	
Twin tires, Super-Single	960 731 081 0	26 mm	225 mm	70°	
Counterweight for L-shape wheel module	960 730 822 2 960 730 828 2	26 mm 32 mm	335 mm	0°	
Counterweight independent wheels	960 730 820 4 960 730 825 4	26 mm 32 mm	335 mm	0°	

Table: 4-1: Wheel modules and counterweights



With twin wheels and Super Single rims, problems may occur with the radio transmission due to the immersion depth. To ensure the quality of the reception, wheel modules with the T-shape should be used (960 731 031 0 or 960 731 041 0).

Counter weight

To prevent the wheel module causing an imbalance on the wheel, a counterweight is mounted on the opposite side, see figure 4-2 "Module with counterweight", page 21.

Axles with twin tires do not need counterweight. In this case, the wheel module of one wheel serves as counterweight for the wheel module of the other wheel. They are mounted opposite to one another, see figure 4-3 "Module for twin wheels", page 21.



fig. 4-2: Module with counterweight

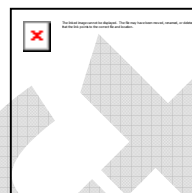


fig. 4-3: Module for twin wheels

ID code

Special identification code of each wheel module allows unique assignment of modules to particular wheels. The wheel module will "report" to ECU using this code. This will exclude pressure signals from other vehicles to be assigned to own system. Code is determined when module is manufactured and cannot be changed. This number is imprinted on the wheel module when commissioning.

! Assignment between wheel and wheel module must be absolutely maintained tire-change procedure. If tires were confused, OPTITIRE could not set off required alarm when a wheel with low pressure has been wrongly assigned to an axle on which this pressure is still permissible.

Identification code assignment to a wheel is determined during initial start-up of the diagnostic software on commissioning, see chapter 6.6 "Start-up", page 42.

4.2 Wheel Internal Sensor (WIS)

The wheel internal sensor WIS 960 732 000 0 consists of a compound-filled plastic unit comprising a pressure sensor, an evaluation circuit, a radio transmitter and a lithium battery.

Battery life under normal operating conditions is minimum 10 years. If the battery is dead the module would not transmit any longer and needs to be replaced with a new one.

The wheel module is mounted on the rim on the backside of a specific filling valve. Therefore it will be assembled inside the tire and is able to measure pressure and temperature. Data transfer

Wireless transmission is made by 433 MHz signal. If pressure is constant, measured values are transmitted every 1 minute, if pressure is changing, additional messages will be transmitted.

4.3 Electronic Control Unit (ECU)



fig. 4-4: ECU

Mode of function

The ECU immediately recognises all changes from programmed nominal tire pressure values by combined comparison with threshold pressure values and pressure changes.

Incorrect values of tire pressures are already displayed before departure (if ECU is permanently powered).

The system may be extended up to 20 wheel modules per ECU.

After system installation, commissioning by PC diagnostic software must be performed.

Any faults occurring during operation are stored in the electronic unit for diagnostic purposes.

Design

Three standard versions of the electronic control unit (ECU) are employed:

- Towing vehicle and bus: 446 220 100 0
- Trailer: 446 220 110 0
- Trailer Train: 446 220 110 0 (by parameter adaptation, can be cascaded up to 5 times with 20 modules each)

ECUs essentially differ by radio communication signal structure and CAN bus (ID) connection. External distinguishing mark by type label only.

Further ECU types are tailored to specific customer requests and have other pin assignments.

All ECUs are suitable for 12 or 24 volt operation and can be mounted on the vehicle frame.

Software change

ECUs produced after calendar week 43/07 already have new software installed.

The setting range for the reference pressure has been extended downward to between 3 and 10.5 bar. The software change allows the reference pressure to be set within certain tolerances on-board. Furthermore, it is also possible to measure the signal quality of the radio contact to the wheel modules and to display them using the diagnostic software. The new software allows different reference pressures to be set per axle.

Radio transmission

The ECU is mounted to chassis in central part of vehicle, so that perfect radio contact with all wheel modules and connection between trailer ECU and towing vehicle ECU is ensured. You should use special brackets for good radio contact.



fig. 4-5: Bracket 960 901 050 4

Radio contact is provided by antenna integrated in the control unit housing that guarantees pressure signal reception from all wheel modules even under most difficult operating conditions.

4.4 The display

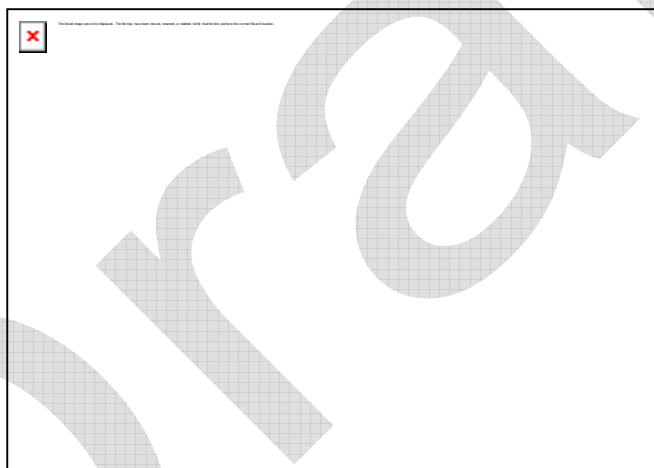


fig. 4-6: Display 446 221 000 0

The display serves for showing and checking all necessary information on the OPTITIRE system. It is connected to ECU via CAN bus. Supply voltage may be 12 or 24 volt.

All tire pressures can be queried by push of a button (Manometer button). Manual checks of the tire pressure are superfluous. Faulty tire pressures should be corrected directly via tire inflation valve.

Since warnings are also signalled acoustically the display does not need to be installed within driver's direct field of vision. Optical warning messages display by integrated lights: red (stop immediately) and amber (drive slowly).

For other instructions of operating the display, see chapter 5 "Operation", page 28.

The display is available in the standard version 446 221 000 0 and under 446 221 100 0 as special version for Portal lifting wagons.

4.5 Connecting cable

Connection OPTITIRE to vehicle wiring on towing vehicle / bus performed in two sections:

The first section comprises the connection of the ECU to the distribution element in the vicinity of the driver's workplace. This section is splash-proof allowing external installation on vehicle.

The second section is a cable set designed for interior installation only and distribution to display, diagnosis interface and, using the free cable ends, to the terminals of vehicle wiring from coupling of first cable is made from here.

Basic wiring principle for towing vehicle / bus is displayed in the following illustration. As cable are based on IVTM connector a suitable cable adapter 894 600 001 2 must be included.

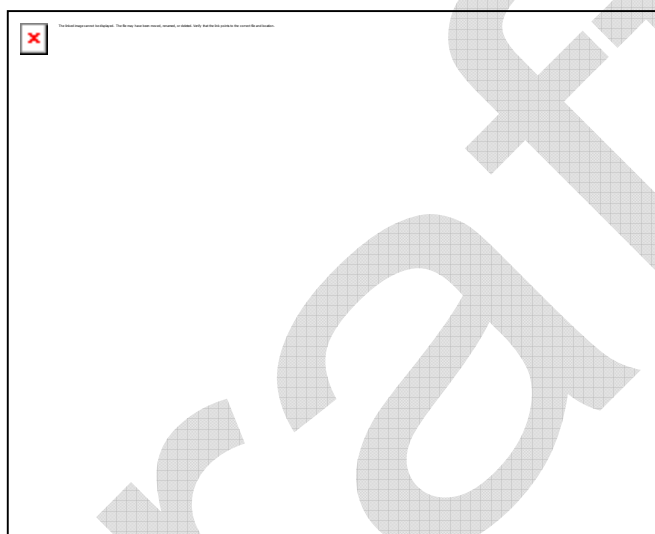


fig. 4-7: Wiring of towing vehicle

- A** Display
- B** Diagnosis
- C** Vehicle electric system
- D** ECU
- E** external
- F** inside

Pin No.	Connector pin assignment	Cable colour 5-pin	Cable colour 7-pin
2	CAN High		
1	CAN Low		
8	GND	blue	blue
7	+24 V or 12 V	red	red
6	Ignition	amber & grey	grey
4	Stop light / warning lamp 2		amber

Pin No.	Connector pin assignment	Cable colour 5-pin	Cable colour 7-pin
3	Warning lamp 1		green

Table: 4-2: Cable set assignment

! Connection to +12 V/24 V and ignition to be fused through 5 ampere fuses. Since OPTITIRE has low current consumption an existing fused circuit can be used.

Draft

Cable set towing vehicle, 7-pin

The 7-pin wiring is implemented to match cable set 894 607 390 0, see figure 4-7 "Wiring of towing vehicle", page 24. Pin assignment on the connecting plugs corresponds to the 5-pin variant. In addition, either connection to stop light (for synchronising with trailer ECU) and warning lamp or connection of two warning lamps is possible.

Cable set towing vehicle, 5-pin

Simpler wiring is intended as 5-pin variant for bus retrofitting: 894 607 295 0. Employment of this wiring allows driving of warning lamps inside display or via CAN respectively but not separate warning lamps on dashboard.

Cable set, trailer

Information about the different interconnections with CAN-enables systems (with TEBS or TCE), see chapter 3.3 "Configuration for bus and towing vehicle", page 11 and see chapter 3.4 "Configuration for trailers ", page 13.

Cable set 449 674 273 0 should be used if data transmission is made through wireless connection only, see figure 4-8 "Trailer wiring", page 26.

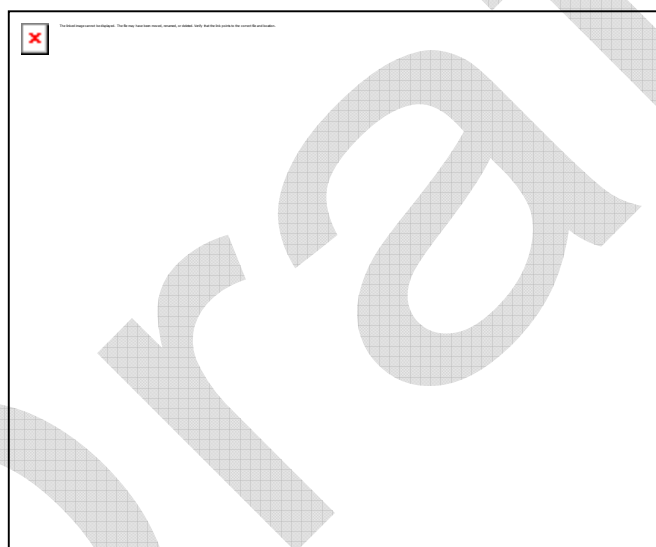


fig. 4-8: Trailer wiring

- A** ECU
- B** Brown: Ground
- C** Red: +12 V/24 V
- D** White: Stop light
- E** Diagnosis

Diagnostic cable

Cable 446 300 348 0 connects diagnostic connector on vehicle with Diagnostic Interface during diagnosis. More information on the subject of "Diagnosis" see chapter 7.1 "Diagnosis", page 45.

4.6 Connecting tube

The wheel modules WM2 must be continuously connected to tires for sensing tire pressures. Use WABCO pre-assembled PA tubes for this purpose. The connection does not have to be disconnected for inflating the tires as valves for inflating the tire are located on the wheel modules.

Depending on wear situation, a replacement of the PA tube is recommended after 1,000,000 km.

Various types of PA tubes are illustrated in the chart:

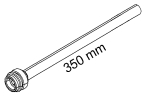
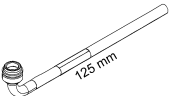
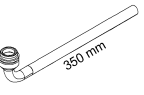
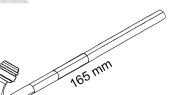
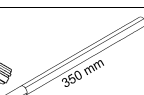
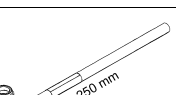
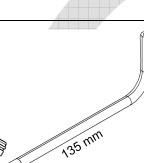
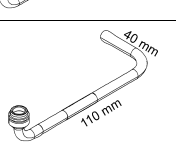
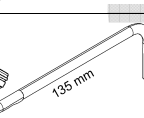
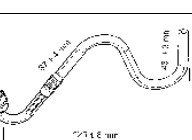
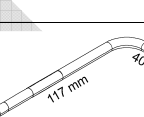
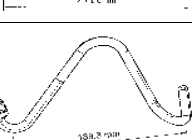
Order Number	Figure	Order Number	Figure
960 731 800 0		960 731 810 0	
960 731 801 0		960 731 811 0	
960 731 802 0		960 731 812 0	
960 731 803 0		960 731 816 0	
960 731 804 0		960 731 822 0	
960 731 808 0		960 731 827 0	

Table: 4-3: Connecting tube

- ! Check PA tubes frequently for damages and replace them if necessary.
Replace defective hose connections with PA tubes. At the same time, install a new wheel module type II, see chapter 7.5 "Replacing wheel module I with wheel module II", page 48.

! Vehicles with OE equipment

- ! Rubber hoses can be fitted in vehicles installed with OE equipment. Before replacing the hoses, observe the release notes of the manufacturer.

Valve extension

! Do not use valve extensions made of plastic

- ! Do not use plastic valve extensions. These will not remain tight under permanently existing pressure.

5 Operation

In this chapter, the handling of the OPTITIRE system is described by means of the WABCO display.

Additionally installed warning lamp indicates the same warning like the display.

Please refer to manufacturer's operating instructions when operating by means of an integrated display.

5.1 Warning signals

Different alarm levels are indicated. The colour of the signal lam and the type of audio signal indicate the severity of the fault:

- A **red warning lamp (STOP)** and audio warnings at one minute intervals indicate a severe fault and the vehicle must be stopped immediately (potential danger for persons and vehicle).
- A **yellow warning lamp (turtle)** and audio warning signals at 10 minute intervals indicate a more minor fault; the vehicle speed should be reduced and the tire pressure corrected at the first opportunity.

The faults detected by OPTITIRE are saved in the ECU for diagnostic purposes.

5.2 Switch on of ignition

After ignition is switched on, system performs an internal check procedure where all internal functions are tested. All symbols are displayed for one second, all pilot lights and audio signals are enabled. This procedure is repeated twice.

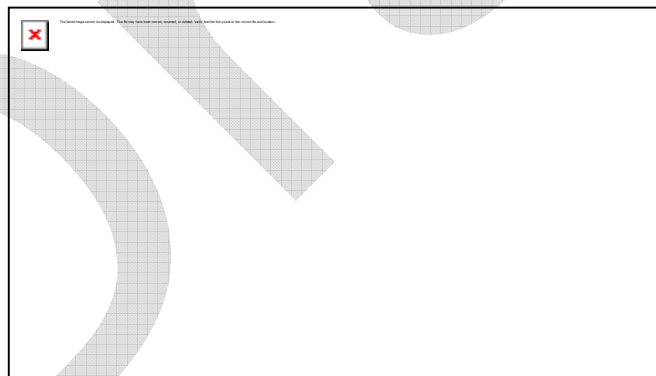


fig. 5-1: Initialisation

After initialisation, if tire pressures are within specified values, the following picture will show for a few seconds:

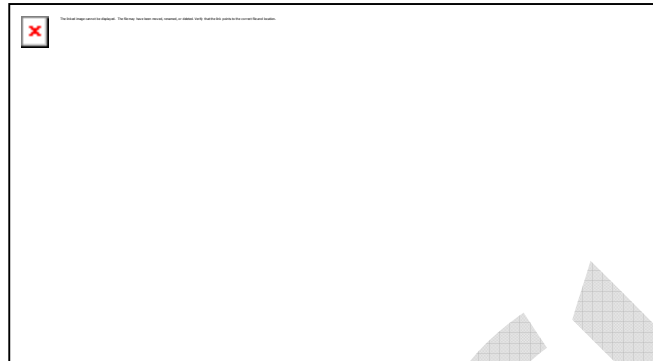


fig. 5-2: System check

The display will change to normal mode if all pressures are correct.

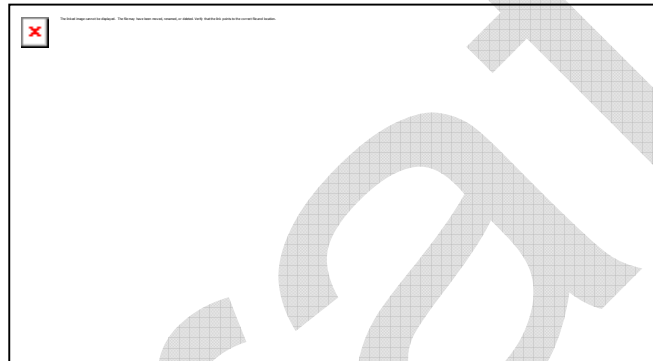


fig. 5-3: Normal mode

5.3 Checking pressure values

Proceed as follows to display the pressure values of the individual tires:

- Push left button.
 - ➔ The axle of which the pressures are displayed, is marked on the display.
- Left pressure value on the display corresponds to left tire in driving direction.

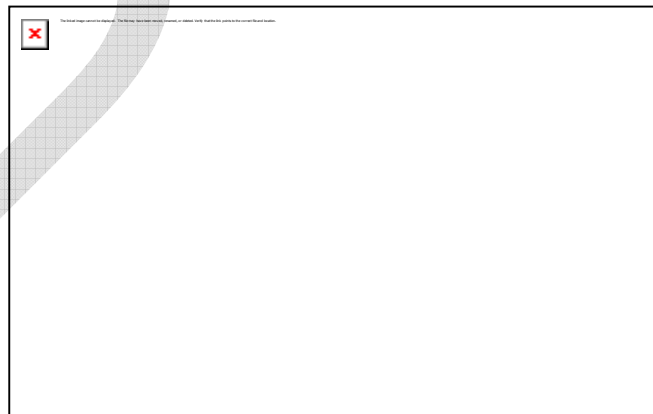


fig. 5-4: Requesting the pressure values

- Repeatedly push left button to display pressure values of further axles.
 - ➔ Axles with twin tires have their wheels represented outside and inside one after the other.

- Repeatedly push left button to display the axles of the towing vehicle as well the axles of the towed vehicle.



The display will switch back to normal mode if no button has been pushed for a period of 20 seconds.

5.4 Display of faults

When the OPTITIRE detects a fault, an amber or red warning lamp illuminates. Proceed as follows to display the type of fault on the vehicle:

- Push right button after lighting up of amber or red warning lamp.
 - ➔ The pressure value of the affected wheel will be indicated and the position on the vehicle is indicated by a flashing wheel icon.
- If no current defect is found the system does not react to pressing right button.



fig. 5-5: Display of faults



If the system warns about several tires then the tire with the most serious fault is indicated first.

Repeated pressing of right button will show further faults.



fig. 5-6: Creeping pressure loss

The individual fault types are shown in the following:

Error	Displayed			Action
1. Extremely low pressure				– Stop the vehicle immediately. – Look for the cause. – If necessary, also change the tire.
2. Low pressure				– Reduce your driving speed. – Adjust air pressure at the next opportunity.
3. Creeping pressure loss				– Reduce your driving speed. – Stop the vehicle at the next opportunity. – Look for the cause of the pressure loss. – If necessary, also change the tire.
4. High pressure				– Reduce your speed for preventing the tire from bursting. – Stop the vehicle at the next opportunity. – Search for the cause of excess pressure (e.g. defective, overheated brake). – Correct the tire pressure in the event of overpressure when the tire is cold.

Table: 5-1: Fault type overview

5.5 Adjusting tire pressures

Proceed as follows to adjust the tire pressures on the vehicle:

! Do not adjust tire pressure with the ignition switch on - this may cause faulty warning messages on display.

- Turn off the ignition.
- Adjust air pressure.
- Switch on ignition again.
- ➔ If leakage warning has been active, reset on display and stored on diagnostic memory of the ECU.

5.6 Display of System Errors

If "OPTITIRE" is represented crossed out then there are one or more system faults.

! System should be checked in the workshop.

No reception

Marked wheel has not transmitted pressure value for over one hour. OPTITIRE has stopped sending warning messages for this wheel, driver needs to check tire pressures on the wheel manually.

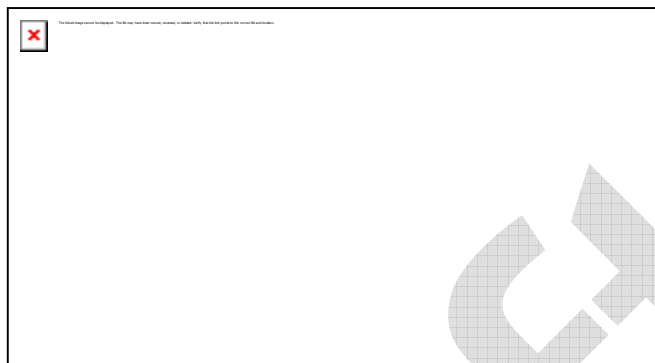


fig. 5-7: No reception

Repair note

With an older system, the wheel module battery is exhausted. The wheel module must be replaced.

- Replace the wheel module.
- Start operating the new wheel module using diagnostic software by setting a new ID in the parameters.

If it is a newer system, the radio connection between the wheel module and the ECU is disturbed.

- Remove any possible dirt.
- Select a better attachment location for the ECU.

Additional information see chapter 7 "Workshop instructions", page 44.

System failure

System faults are given if display shows crossed-out "OPTITIRE" only.

OPTITIRE does not signal warning messages for any wheel. The driver must check the tire pressures manually on the wheel.



fig. 5-8: System error

Repair note

- Check the supply voltage of the ground line.
- Check the cable connections.
- Carry out a system diagnosis.

5.7 Operation via SmartBoard

OPTITIRE can be controlled via the WABCO SmartBoard. The SmartBoard can be used to operate OPTITIRE as a stand-alone variant for trailers.

- On the SmartBoard select the functional group "Tire pressure monitoring".

The pressures for the individual tires, the nominal tire pressure value and the configuration are displayed in this functional group.



The key <Arrow right> is used to switch between the different tires.

The tire symbol flashes if the tire pressure is too low.

If the tire has a fault, the warning LED and the menu item for this functional group flashes in the main menu.

Notation	Description	Note
Nominal pressure value	The nominal pressure value is set in the parameters of the OPTITIRE electronic control unit.	The value applies to a cold tire.
	Currently saved pressure for the selected tire.	

6 Installation

In this chapter, you will learn how the OPTITIRE is installed your vehicle.

Observe all safety instructions when carrying out assembly work on the vehicle.

WARNING**Regulations / Instructions**

- Observe the occupational health and safety regulations of the respective country, the workshop as well as the vehicle manufacturer's instructions.

WARNING**Rolling away of the vehicle**

Vehicles not secured may roll away during the assembly. This might lead to severe injuries or even death.

- Secure the vehicle against rolling away before carrying out work on the vehicle.

WARNING**Danger to health due to dust**

Dust that are dangerous to health are generated when the rim is cleaned using compressed air.

- For this purpose, do not clean the rims using compressed air.

WARNING**Loose wheel nuts**

Loose wheel nuts may lead to accidents when driving on roads.

- Wheel nuts must be tightened with torque specified by vehicle manufacturer.
- Check the tightness of the wheel nuts after 500 km.

6.1 Mounting the wheel modules – WM2



The vehicle does not need to be jacked up when only four wheel nuts are removed.

Assembly preparation

- Read the following chapter, see chapter 4.1 "Wheel module", page 18 and see chapter 4.5 "Connecting tube", page 27.
- If necessary, also remove the rim protecting ring.

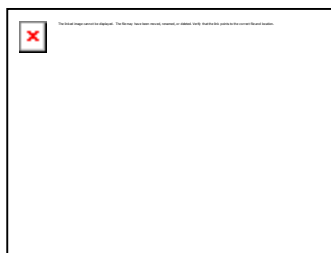


fig. 6-1: Front wheel with protective ring

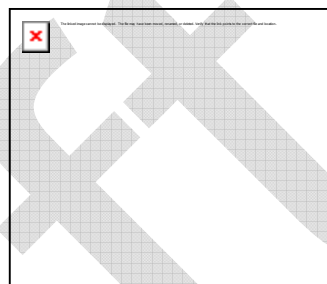


fig. 6-2: Front wheel with counterweight

Mounting the wheel module

- Loosen and remove two wheel nuts positioned next to each other near to the valve.
- Check if the position of the wheel module is suitable for connecting to the PA tube wheel module and the valve.
The PA tube should be able to be guided to the tire valve without stretching, upsetting deformation or twisting.
- Screw the wheel nuts back on.
- Remove the white protective cap from the pressure connection.

Mounting the counter weights

- Loosen and remove two wheel nuts that are exactly opposite from each other (180°).
- Position the counterweight on the wheel bolts.
- Screw the wheel nuts back on.

Mounting the PA tube

CAUTION



Increased wear due to incorrect installation

With tubes that rest on the edge of enclosures, there is an increased wear due to vibrations. This might lead to leakages.

- PA tubes need to be installed such that they neither exercise tensile or compressive stress on connections nor rest on the rim.

- Hold the PA tube with the connection to the tire valve.
- Hold the other end of the PA tube to the wheel module.
- Mark the position on the tube where the PA tube meets with the edge of the wheel module (e.g. using adhesive tape).
- Cut the PA tube (960 731 800 0 to 960 731 802 0) to the required length when necessary.

Also consider that the PA tube disappears to 20 mm in the connection. For this purpose, the PA tube should be cut 20 mm after the marking.

Use a suitable right-angled cutting tool, such as those that are also used for shortening plastic brake lines (see illustrations below).



fig. 6-3: Tube cutting tool for $\varnothing$ 4 to $\varnothing$ 12

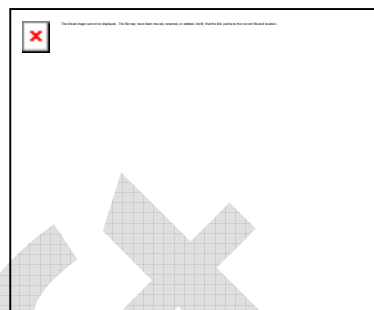


fig. 6-4: Tube cutting tool for $\varnothing$ 4 to $\varnothing$ 22

- Mount the connecting tube to wheel module by inserting the end of the PA tube into the wheel module opening.
After pressing with force, the PA tube is locked in position and can then only be removed again after unscrewing the brass screw connection (V203).
- Using the marking, check if the PA tube has been pushed in until the stop.
- Pull on the PA tube to check if the PA tube has been inserted with a tight connection (approx. 20 N).
- Connect the PA tube to the tire valve.
- Tighten union nuts on the tire valve hand tight.
- Check that the connection is tight using a leakage indicating spray.

Make the wheel module ready for operation

- Tighten wheel nuts crosswise as per vehicle manufacturer's instructions.
- Re-tighten the rim protective ring if necessary.



Correct assignment of wheel module ID vs. connected wheel is essential for later commissioning.

- Note position of installed wheel modules on a sheet of paper. Affix stickers with wheel module ID codes next to the respective wheel module.
- Adjust tires to correct operating pressure according to vehicle manufacturer's instructions.
- Note pertinent nominal pressure values per axle for later nominal pressure parameterisation through diagnostic.
- Check wheel nuts for tightness after 500 km.

WARNING



Risk of accidents due to loosening the fastening screws of the wheel module

The safe fixing of the wheel module is only possible when the wheel module housing has a tight fit to the bracket.

- Never loosen the fastening screws fixing the wheel module housing on the bracket.

Valve extension



Do not use valve extensions made of plastic

Do not use plastic valve extensions. These will not remain tight under permanently existing pressure.

Use flexible valve extensions with tightening clamps (e.g. alligator) or WABCO valve extensions 960 731 805 0 instead.



fig. 6-5: Twin wheels (outer wheel)

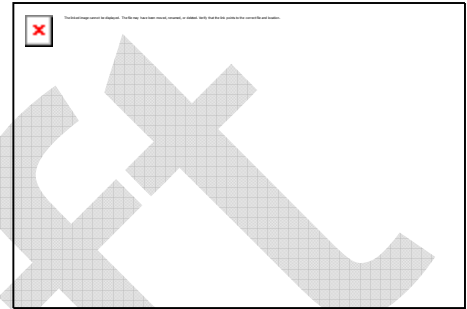


fig. 6-6: Twin wheels (inner wheel)

6.2 Mounting the wheel modules – WIS



For Tire assembly the vehicle must be secured properly.

Assembly preparation

- Read the following chapter, see chapter 4.2 "Wheel module", page 17
- If necessary, also remove the rim protecting ring.

Mounting the wheel module

- Loosen and remove the tire
- remove original filling valve
- identify suitable filling valve for WIS sensors and place it into the hole
- fix nut with 9..12Nm
- screw in the WIS by applying the hollow screw included in set
- apply torque of 4 Nm

Make the wheel module ready for operation

- Fix the wheel on the vehicle
- Tighten wheel nuts crosswise as per vehicle manufacturer's instructions.
- Re-tighten the rim protective ring if necessary.



Correct assignment of wheel module ID vs. connected wheel is essential for later commissioning.

- Note position of installed wheel modules on a sheet of paper. Affix stickers with wheel module ID codes next to the respective wheel module.
- or readout ID with a suitable tool (e.g. Ateq VT36)
- or follow sequential allocation with OptiTire diagnostic SW

- Adjust tires to correct operating pressure according to vehicle manufacturer's instructions.
- Note pertinent nominal pressure values per axle for later nominal pressure parameterisation through diagnostic.
- Check wheel nuts for tightness after 500 km.

WARNING**Risk of accidents due to loosening the fastening screws of the wheel module**

The safe fixing of the wheel module is only possible when the wheel module housing has a tight fit to the bracket.

- Never loosen the fastening screws fixing the wheel module housing on the bracket.

9.3 Mounting the ECU in bus / towing vehicle

ECU position on vehicle

Towing vehicle

The ECU plug must point to side (to the right or left) but not up or down.

- Choose a fitting position according to the following illustration.
- If the vehicle is equipped with a low lying coupling for central axle trailer, install the ECU on the right side of the vehicle, so that the wireless connection to the trailer is not shielded of by the coupling.

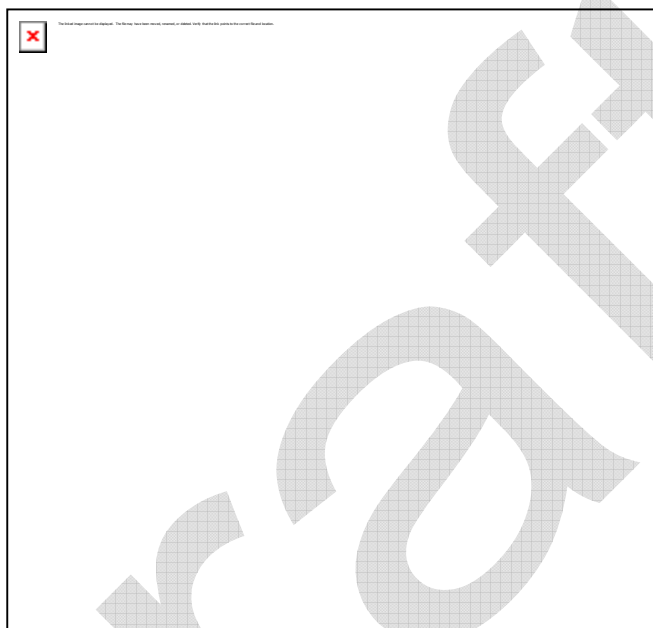


fig. 6-7: Assembly at longitudinal beam

Bus

The ECU plug must show up.

- Use threaded rods for hanging assembly at the roof frame in the cabin.
- Position ECU in solo bus in the vehicle's centre, on articulated bus in driving direction in front of the swivel joint.

Further possible installation positions are:

- in the roof rounding opposite to the entrances
- in the roof lining
- with articulated buses, in the rear area of the front section (in the geometric centre of all axles)
- with touring coaches, also in the ceiling of the luggage compartment

Mounting the ECU

- Read the chapter, see chapter 4.2 "Electronic Control Unit (ECU)", page 21.
- Mount ECU so that the distance to the wheel modules is as equal as can be. Select distance to truck driver's cab such that length of ECU cable (8 m) is sufficient to reach driver's cab.
- Attach ECU to roof area of bus and to bottom of frame on truck.
ECU longitudinal axis must be in parallel with longitudinal vehicle axis. Maintaining good radio contact the ECU should not be shielded off by metal walls in its direct vicinity, e.g. by a U-section.
Ensuring optimal radio reception through the integrated antenna you particularly need to leave out the longitudinal floor.
- Use bracket 960 901 050 4 see figure 4-5 "Bracket 960 901 050 4", page 23 on towing vehicle. Screw the bracket to the vehicle.
Welding could impair the stability of the frame.
- Tighten ECU to bracket using torque of 15 ± 1.5 Nm.

6.3 Wiring in towing vehicle/bus

Proceed as follows to install the wires of the OPTITIRE into the bus or the towing vehicle:

- Read the chapter, see chapter 4.4 "Connecting cable", page 24.
- Select the appropriate circuit diagram according to the chapter, see chapter 3.3 "Configuration for bus and towing vehicle", page 11.
- Attach display to support supplied at a suitable attachment location.
The display must not necessarily be located inside driver's direct field of vision.
- Fit the diagnostic socket to a suitable attachment location and label it with "Diagnostic OPTITIRE".
Locations where diagnostic ports are already located would be specially suitable as the attachment location.
- Install cables according to the wiring diagram using cable ties in parallel with already existing wiring harnesses.
Form large loops from long lengths.
- Turn off the ignition.
- In the fuse box, search for appropriate fused circuits or connect 5 A fuses "on the fly" to terminals 15 (ignition) and 30 (U Batt). Designate the flying fuses with "OPTITIRE".
- Connect the cable set with the fuses. Connect the ground line to the ground contact.
- Connect display and ECU.

6.4 Mounting the ECU in the trailer

- Read the chapter, see chapter 4.2 "Electronic Control Unit (ECU)", page 21.
- Determine the best possible installation position, depending on the type of the trailer:

Draw-bar trailer

Install the ECU between the first axle and the middle of the trailer.

Semitrailer

Mount the ECU at the cross member in the front area, so that this is pointing to the towing vehicle.

Central axle trailer

Mount the ECU at the right vehicle side ahead of the front axle.

! Use bracket 960 901 050 4, see figure 4-5 "Bracket 960 901 050 4", page 23.
Screw on bracket to vehicle. Welding could impede frame stability.

- Attach the ECU below on the frame.
ECU longitudinal axis must be in parallel with the vehicle axis.
Maintaining good radio contact the ECU must not be shielded off by metal walls in its direct vicinity.



fig. 6-8: Semitrailer: Assembly at cross member

- Tighten ECU to bracket using torque of 15 ± 1.5 Nm.

6.5 Wiring in trailer

Proceed as follows to install the wires of the OPTITIRE into the trailer:

- Read the chapter, see chapter 4.4 "Connecting cable", page 24.
- Select the appropriate circuit diagram according to the chapter, see chapter 3.4 "Configuration for trailers", page 13.
- Fit the diagnostic socket to a suitable attachment location and label it with "Diagnostic OPTITIRE".

Locations where diagnostic ports are already located would be specially suitable as the attachment location.

- Install the cable joint box if required, such as, for example, the WABCO VCS II cable joint box 446 010 092 2.

Also suitable is the AK 192 of Apparatebau Kirchheim-Teck GmbH & Co.

- Pull off the ABS plug.



Consider any risks with regard to the short circuiting of batteries inside the vehicle.

- Install cables according to the wiring diagram using cable ties in parallel with already existing wiring harnesses.
Form large loops from long lengths.
- Connect OPTITIRE cabling to existing cabling.
- Connect the ECU.

6.6 Start-up



Commissioning requires a system training course. You may ask WABCO for the PIN (PIN 2) after the training course.



No WABCO diagnosis is possible on vehicles having integrated display. In this case the OPTITIRE is basically parameterised through manufacturer-specific diagnosis.

Proceed as follows to put the diagnostic software of the OPTITIRE into operation:

Commissioning schedule:

- Make sure that the OPTITIRE system is installed according to the instructions in chapter, see chapter 6 "Installation", page 34.
- Check for correctly set tire pressures on the wheel module.
- Connect the computer to the vehicle using the diagnostic cable and interface.
- Start the diagnostic software and enter Pin2.
- Switch on ignition. Ensure power supply of trailer if necessary.
- Start "Startup" menu in diagnostic program.
- Enter vehicle type and vehicle data.
- Enter IDs of wheel modules and values of tire pressure (according to vehicle manufacturer) in list of axes and wheels.
- Stimulate the wheel modules.
- WM2: For this purpose, touch the housing of each wheel module below the sticker "OPTITIRE" for 5 seconds using a magnet (2 kg retention force) or using a bar magnet parallel to the OPTITIRE logo.
 - ➔ The wheel modules afterwards will transmit for the following hours their pressures any 30 s.
- WIS: For this purpose apply a TPMS handtool like ATEQ VT36 with suitable diagnostic capability on the area where the sensor is mounted (near the filling valve)
 - ➔ The wheel modules afterwards will transmit specific diagnostic mode for 5 min.



fig. 6-9: Stimulation wheel module

- Check if data has been received from all wheel modules.
- Configure possible warning lamps.
- Delete content of diagnostic memory.
- Print the commissioning protocol.
- Print the vehicle type plate on self-adhesive tin foil (WABCO no. 899 200 922 4).
- Affix vehicle type plate to protected, easy readable location on the vehicle.
- End the start-up in the diagnostic software.
- Check operation on OPTITIRE display and data exchange with towing vehicle respectively.

7 Workshop instructions

This chapter provides information for the repair. Furthermore, you will also receive help in the case that the product does not function as expected. Please observe the instructions for disposal at the end of the chapter.

WARNING**Regulations / Instructions**

- Observe the occupational health and safety regulations of the respective country, the workshop as well as the vehicle manufacturer's instructions.

WARNING**Rolling away of the vehicle**

Vehicles not secured may roll away during the assembly. This might lead to severe injuries or even death.

- Secure the vehicle against rolling away before carrying out work on the vehicle.

WARNING**Danger to health due to dust**

Dust that are dangerous to health are generated when the rim is cleaned using compressed air.

- For this purpose, do not clean the rims using compressed air.

WARNING**Loose wheel nuts**

Loose wheel nuts may lead to accidents when driving on roads.

- Wheel nuts must be tightened with torque specified by vehicle manufacturer.
- Check the tightness of the wheel nuts after 500 km.

Maintenance

OPTITIRE system is maintenance-free.

Only when the display indicates a malfunction, fault finding must be performed with diagnosis.

7.1 Diagnosis

Diagnostic components

The OPTITIRE diagnostic cable 446 300 348 0 is used for diagnosis on towing vehicles.

When carrying out diagnosis on trailers, please extract the product number of the required diagnostic components from the chart.

System in trailer vehicles	Type of diagnosis	Required components
Vario C VCS ECAS TCE VCS II TEBS before 2004	Diagnosis using diagnostic cable 446 300 329 2	Diagnostic cable 446 300 329 2
TEBS since 2004 VCS II	Diagnosis via Diagnostic Interface (serial) 446 301 021 0	Diagnostic Interface (serial) 446 301 021 0 CAN converter 446 300 470 0 Connection adapter ISO 7638 with CAN socket 446 300 360 0
TEBS since 2004 VCS II	Diagnosis via Diagnostic Interface (USB) 446 301 022 0	Diagnostic Interface (USB) 446 301 022 0 Diagnostic cable 446 300 361 0 Connection adapter ISO 7638 with CAN socket 446 300 360 0
TEBS E Premium (Diagnostic port with yellow cap)	Diagnosis via Diagnostic Interface (USB or serial)	Diagnostic Interface (USB or serial) Diagnostic cable 446 300 348 0

Table: 7-1: Diagnostic components for trailer vehicles

Diagnostic Software

The diagnostic software is available in various languages.



Information concerning the current version of the diagnostic software and language versions available can be obtained at <https://www.am.wabco-auto.com/mywabco/>.

The WABCO diagnostic software is self-explanatory. The function of the diagnostic software is described in help texts.

The diagnostic memory and current measuring data can be obtained using the diagnostic software. In the event of malfunctions, the fault will be described and possible countermeasures will be indicated.

The ECU settings can not be changed in diagnostic mode. Entering a PIN is required for the parameter settings.

7.2 Wheel Changes

Due to the external fixation of the wheel modules on the wheel bolts after wheel change a new sensor is not needed. It is only to be ensured, that after wheel exchange the wheel module is fitted exactly to the same position as before.

As long as the wheel module itself is not exchanged, there is no need for new settings of system parameters.



The wheel modules are not allowed to be swapped with each other.

Make sure that the wheel modules are respectively located in the same position on the vehicle after the wheel change.

Especially with dual tires, the accurate relationship to the inner or outer wheel must be observed.

Please perform wheel changes as follows:

- Remove any dirt from the wheel module and PA tube.
- Note ID code of wheel module (engraved on top of the housing) and its position on the vehicle, e.g. rear axle left, outside.
Alternative: Fix a plate with the description of the location to each module.
- Release the union nut of the PA tube on the tire valve and remove the PA tube from the tire valve.
- Unscrew firstly only those wheel nuts fixing wheel module(s).
- Remove wheel module completely, together with the PA tube.
Do not turn the PA tube at the wheel module and do not remove the PA tube from wheel module unnecessarily.
Prevent dirt from entering into the PA tube.
- Check the PA tube for any damage.
➔ Replace the PA tube if ageing ruptures or rubbing wear is visible, see chapter 7.3 "Replacing PA tubes", page 47.
- Now remove the residual wheel nuts and change the wheel or the tire.
- Put on the wheel or the wheels again and fix them with some wheel nuts on wheel bolts not used to fix wheel module or counterweight.
- While assembling the wheel make sure that the tire valve gets its original position.
With twin tires, the tire valves should be placed in opposite position.
- Place the wheel module to its original position and fix it with wheel nuts.
With individual wheels, assemble the counterweight in the opposite of the wheel module.
- Screw the union nut of the hose back on to the tire valve. Tighten union nuts manually only.
- Check that the connection is tight using a leakage indicating spray.
- Tighten wheel nuts crosswise as per vehicle manufacturer's instructions.

7.3 Replacing PA tubes

Proceed as follows when replacing a defective PA tube:

- Loosen the PA tube from the valve.
- Unscrew the V203 connection together with the PA tube from the wheel module.



When removing the PA tube from the wheel module, take care that the thread on the wheel module is kept clean.

- Check the thread on the wheel module for damage.
 - ➔ With damaged thread, replace the complete wheel module.
- Screw the new V203 connection into the thread of the wheel module.
A new V203 connection can be obtained using the WABCO product number 893 770 005 2.



fig. 7-1: VOSS SV 203 connection

- Tighten the V203 connection with a torque of 3 Nm (hand tight).
- Remove the protective cap of the V203 connection.
- Insert the new, cut to length PA tube (see page 35) into the V203 connection.
- Check if the PA tube has been pushed in until the stop into the V203 connection.
- Check if the PA tube has a tight connection (approx. 20 N).
- Connect the PA tube to the valve.
- Tighten union nuts on the valve hand tight.
- Check that the connection is tight using a leakage indicating spray.

7.4 Replacing hose connections

- Replace defective hose connections with PA tubes.
- At the same time, install a new wheel module type II, see chapter 7.5 "Replacing wheel module I with wheel module II", page 48.

7.5 Replacing wheel module I with wheel module II

Always replace wheel module I with wheel module II.

Replace the rubber hoses with PA tubes at the same time.



Vehicles with OE equipment

Rubber hoses can be fitted in vehicles installed with OE equipment. Before replacing the hoses, observe the release notes of the manufacturer.

The following table facilitates the replacement.



You will obtain further information on the use of wheel module II on our website <http://www.wabco-auto.com> => WABCO online product database INFORM. Enter the search term "OPTITIRE" in the input field. Open the application table.

In this table, the rims are sorted according to their attachment location, size and manufacturer. Next to an illustration of the respective installation situation, you will also be provided with the product number of the wheel module and connecting tube.

Wheel module I	Wheel module II
960 730 001 0 (Independent wheel)	960 731 011 0
960 730 001 0 (twin tires, Super Single)	960 731 031 0
960 730 006 0 (Independent wheel)	960 731 021 0
960 730 006 0 (twin tires, Super Single)	960 731 041 0
960 730 013 0	960 731 061 0
960 730 037 0	960 731 019 0

7.6 Creeping pressure loss

- When the display hints to a creeping pressure loss, first check the hose connection between valve and wheel module of the relevant wheel with leakage indicating spray.
- If these connections are tight, check bearing surface and edges.
So-called indicators at the tire edges point on damages at the carcass, which usually causes creeping pressure loss of the wheel.



If the carcass is damaged, the tire must be replaced.

7.7 No reception of the wheel module

Battery life

Wheel modules get their power supply via an internal lithium battery. In reason of the mechanical demands and tightness, the battery is coated within the wheel module and cannot be exchanged. The battery life-time depends on certain factors. Under usual circumstances the life-time will be longer than 5 years.

Since significant pressure deviation increases transmission frequency for short-term warning, frequent pressure changes cause a shorter life time.

Check list

- If the warning "no reception wheel module" is repeated often in the display, see figure 5-7 "No reception", page 32, using the check list, you are able to determine if the wheel module should be replaced.
- Copy in this table line per line the default value to the result column if the description matches.
- Then compare the sum of all results with the details below.



Ensure while trouble shooting that the vehicle is not in vicinity of high-frequency radiation, see chapter 4.1 "Wheel module", page 18.

No.	Description	Default	Result
1a	Warning "no reception" is not active but stored in diagnostic memory (failure shown blue in diagnosis)	0	
1b	Warning "no reception" is active (failure shown in red in diagnosis)	2	
2a	Warning "no reception" is given for one wheel module	0	
2b	Warning "no reception" is given for several wheel modules	3	
3a	The age of the wheel module (according to the engraved production date in format ww/yy) is less than 5 years	0	
3b	The age of the wheel module lies between 5 and 7 years	4	
3c	The age of the wheel module is more than 7 years	8	
4a	The average outside temperature was -20 ° C while occurrence of the failure	0	
4b	The average outside temperature was 0 ° C while occurrence of the failure	3	
4c	The average outside temperature was +20 ° C while occurrence of the failure	5	
5a	The activation of the wheel module with bar magnet, see figure 6-9 "Stimulation wheel module", page 43, was successful	0	
5b	The activation of the wheel module with bar magnet was not successful	4	
		Sum	

Table: 7-2: Check list wheel module

Test results**Sum between 0 and 11 points**

The battery of the wheel module is in order. The loss of the wheel module from time to time might be caused by deep temperature, contamination of wheel module / ECU or a not optimised installation position of the ECU.

Sum between 12 and 15 points

- Monitor the correct reception of the wheel module and replace as required.

Sum between 16 and 22 points

Battery of wheel module exhausted.

- Replace wheel module with a new one.
- Parameterise ID of the new module to the ECU via diagnosis.

7.8 Disposal



The system components are electronic scrap and must not be disposed of together with domestic waste. When disposing components, observe all the laws and regulations applicable in your country.

This applies in particular to wheel modules that contain lithium batteries. These are solidly potted inside the housing and can not be replaced. Once they have reached the end of their life, dispose of the wheel modules while observing all the laws and regulations that apply in your country.

WABCO strives to protect the environment. As with other old devices, all components can be returned to WABCO. Speak to your WABCO sales partner about this.



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systems supplied to the world's leading commercial truck, bus and trailer manufacturers.

With sales of \$2.8 billion in 2011, WABCO is headquartered in Brussels, Belgium. For more information, visit <http://www.wabco-auto.com>

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