Operating Instructions

Radio sensor
Heavy Duty TAG
Bluetooth sensor module
Rail Vehicles

1 Preface

In addition to the ZF documentation, observe the provisions of the vehicle manufacturer or the body manufacturer.

1.1 Validity and field of application

This documentation applies to the following add-on device:

- Radio sensor

1.2 Document overview

The specifications listed in these documents must be observed, because they are a prerequisite for fault-free operation of the product and for the warranty granted by ZF Friedrichshafen AG. Please get in touch with your contact person if you need binding documents.

Document no.	Designation	Technical information
6075.765.101	Technical Manual	Rail monitoring system

Tab. 1 Document overview

2 Safety

2.1 Signal words and symbols

This document contains specifically highlighted safety instructions which are marked with one of the following signal words depending on the severity of the danger.

⚠ DANGER

DANGER
The signal word DANGER indicates a dangerous situation that, if not prevented, will lead to a severe injury or death.
⇨ Information as to how the danger can be prevented.

⚠ WARNING

WARNING
The signal word WARNING indicates a dangerous situation that, if not prevented, can lead to a severe injury or death.
⇨ Information as to how the danger can be prevented.

⚠ CAUTION

CAUTION
The signal word CAUTION indicates a dangerous situation that, if not prevented, can lead to a slight or moderate injury.
⇨ Information as to how the danger can be prevented.

NOTICE

The signal word NOTICE indicates a situation that, if not prevented, can lead to property damage.
⇨ Information as to how the property damage can be prevented.

The following symbols are additionally used:

⚠ This symbol refers to additional, safety-relevant information.

ⓘ This symbol indicates information concerning special workflows, methods, application of auxiliaries, etc.

2.2 General safety instructions

Read all safety instructions and information. Non-compliance may lead to property damage, serious injuries or death.

Keep the documentation for future reference.

Intended use

The ZF product is exclusively intended for the contractually agreed purpose that is valid at the time of delivery. Any other or extended form of use does not comply with this definition of intended use. The intended use also includes compliance with this documentation and other applicable documents in order to avoid malfunctions and damage.

The ZF product is designed and produced in line with state-of-the-art technology. The ZF product in its delivery status is safe to operate. However, the ZF product may pose dangers if improperly used by unauthorized, untrained and uninstructed staff or if not used according to its intended use.

Figures might deviate from the ZF product and are not drawn to scale. No conclusions can be drawn with regard to size and weight.

Assembly, commissioning, operation, maintenance and repair

Perform assembly, commissioning, operation, maintenance and repair work exclusively according to this documentation and other applicable documents.

Observe the following points:

- Employ authorized, trained and instructed staff. Employ staff qualified in electrical engineering for work on electrical systems.
- Observe technical specifications.
- Unauthorized changes and modifications may lead to the expiry of the operator’s license, warranty or guarantee.

ZF recommends observing the following points:

- Use genuine ZF spare parts.
- Use genuine ZF accessories.
- Use genuine ZF special tools.

In case of damage, contact ZF and have the following information on the product ready:

- Type
- Parts list [BoM] number
- serial number
- Operating hours
- Description of damage

Observe safety instructions, applicable safety regulations and legal requirements to prevent malfunctions and damage.

Country-specific safety regulations, accident prevention regulations and environmental protection provisions apply additionally.

Wear safety-relevant workwear for all work. Depending on the work, also wear personal protective equipment.

After completing the work, check proper function and operational safety.

Handling of ZF product

Unauthorized changes and modifications may impair operational safety. Changes, modifications and applications are only permissible upon written approval by ZF Friedrichshafen AG.

Observe the following when working on the ZF product:

- Secure workspace.
- Check that all safety instructions and danger notices are legible. Clean or replace, if required.
- Carry out work with the electrical system being switched off and after its electrical isolation has been tested.
- Secure electrical system against being switched on accidentally. Attach instruction plate where it is clearly visible.
- Perform work when engine is switched off.
- Protect motor against being started accidentally. Attach instruction plate where it is clearly visible.
- Do not stand beneath a suspended load.
- Do not work on a suspended load.
- Only use permitted means of transport and lifting equipment with sufficient load rating.
- Close open pipings and hoses and avoid damage.
- Observe tightening torques.
- Protect wiring against mechanical damage.
- Beware of the impact on active and passive medical implants.

Noise

Noise might cause irreversible damage to hearing.

The perception of acoustic signals, warning calls or sounds that indicate danger is impaired by noise.

Observe the following when working on the ZF product:

- Avoid noise.
- Wear ear protection.

Operating supplies and auxiliary materials

Operating supplies and auxiliary materials might cause permanent damage to health and environmental damage.

Observe the following when selecting operating supplies and auxiliary materials:

- Health risks
- Environmental compatibility
- Material safety data sheets

Observe the following when handling operating supplies and auxiliary materials:

- Store operating supplies and auxiliary materials in suitable and correctly labeled containers.

- Seek medical help in the event of injuries due to hot, cold or caustic operating supplies or auxiliary materials.

Observe the following to protect the environment:

- Collect leaking operating supplies and auxiliary materials in sufficiently large containers.
- Observe disposal regulations.
- Observe material safety data sheets.

2.3 Product-specific safety instructions

2.3.1 Radio systems

Radio systems comply with requirements in Directive 2014/53/EU. This ensures an appropriate level of electromagnetic compatibility and efficient use of radio frequencies.

Observe the following safety instructions:

- Only use radio systems that comply with Directive 2014/53/EU.
- Devices installed in the vicinity of the radio systems must comply with the requirements and limitations of Directive 2014/53/EU.
- Before the installation and use of the radio system, the relevant laws and especially limitations on the use of radio connections at the location of use must be checked.
- Do not open or modify radio systems, as this can damage the safety devices. A lack of safety devices may cause heat or smoke to develop or may cause an explosion.
- Only operate interfaces to a wireless local network (WLAN) with a configured, regulatory domain. Comply with settings for the country, the number and the amplification of antennas.

2.3.2 Lithium thionyl chloride batteries

Handling

The ZF product contains primary lithium thionyl chloride batteries. These batteries are not rechargeable. If used improperly or damaged, the batteries may become dangerous.

Observe the following safety instructions:

- Please note the intended use
  Incorrect use may result in liquid leaking from the batteries. Liquid leaking from the batteries may cause skin irritation or burns. Avoid skin and eye contact. In case of accidental contact, rinse off with water and seek medical help.
- Avoid damage
  Damaged ZF products may develop unpredictable properties that may cause fire, explosions or injuries. Observe the following:
  - Replace damaged ZF products as soon as possible.
  - In case of damage, stop using the damaged ZF product immediately *(refer to Chapter Decommissioning)*.
- Do not throw the product into the fire or subject it to intense heat.
  If batteries are thrown into the fire or subjected to temperatures above 130°C, the resulting heat may cause an explosion and/or a fire and injuries.
- Do not immerse the product in liquids.
  The ZF product is sufficiently protected from water for safe operation. Immersing the ZF product in liquids will cause a defect.
- Do not recharge or short-circuit the batteries.
  An attempt to charge or short-circuit the batteries may cause a fire.
- Do not open the ZF product or the batteries.
  Opening or modifying the ZF product or the batteries will damage the safety devices. This may cause heat or smoke to develop or cause the product or batteries to ignite or explode.
- Dispose of ZF product properly.
- Store the ZF product outside the reach of children.

In case of fire

If lithium thionyl chloride batteries catch fire, the resulting fire can be fought with water. It is not necessary to use special fire extinguishing media for lithium thionyl chloride batteries.

Use conventional fire extinguishing media to fight surrounding fires of lithium thionyl chloride batteries.

If a battery catches fire, this fire cannot be considered separately from the surrounding fire. The cooling effect of water keeps the fire from spreading to the battery cells that have not yet reached the critical ignition temperature (thermal runaway).

A fire may result in the development of gases that, if inhaled, can cause damage to health. Observe the following:

- If it is necessary to remain in an area with fire, wear a respirator.
- If large quantities of smoke or gas develop or are emitted, leave the danger area immediately.
- Seek medical help in case of smoke and/or gas inhalation or respiratory tract irritation.
- Ventilate room sufficiently.

3 Description

3.1 Brief product description

3.1.1 Radio sensor

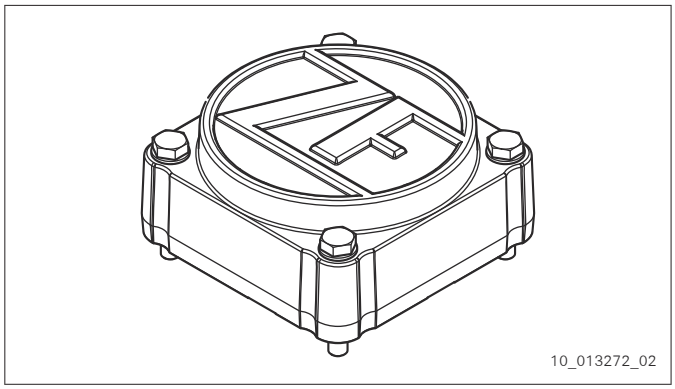


Fig. 1 Radio sensor

The radio sensor is a battery-powered, wireless sensor which measures the acceleration of components in the bogie or on other vehicle components to be monitored.

The measurement data is transmitted to the gateway inside the vehicle using radio technology.

The radio sensor is currently (as of April 2024) designed and intended for use in rail vehicles in Europe. For other operating ranges or applications, the suitability and technical conformity must be evaluated and, if necessary, proven.

The radio sensor may be operated within a frequency range of 2,402 MHz to 2,480 MHz.

The function of the radio sensor is only guaranteed in connection with the full rail monitoring system by ZF. For more information, please talk to your ZF contact or visit www.zf.com/hd-tag

4 Technical Data

4.1 Data sheet for radio sensor

Please request the technical data sheet from ZF or download it at www.zf.com/hd-tag-data.

Requirement	Name	Comment
Trade name	Heavy Duty TAG	—
Type of equipment	battery-powered, wireless sensor	for rail vehicles
Material number	6075.184.007	—
Weight	0.39 kg	
Radio technology	2.4 GHz, Bluetooth® 4.2 Low Energy	—
Frequency band	2,402 MHz to 2,480 MHz	—
Transmitting power	+5 dBm	—
Network interface	Bluetooth Low Energy (BLE)	—
Network service	Bluetooth Low Energy Generic Attribute Profile (BLE GATT) – Generic Access Profile (GAP)	—
IP protection class	IP65	in accordance with IEC 60529
Temperature range	-40°C to +70°C	Class TX according to DIN EN 50155
Vibration resistance and shock resistance	DIN EN 61373, category 3	—
Batteries	3x lithium thionyl chloride batteries	non-replaceable
CE conformity	www.zf.com/hd-tag-data	—

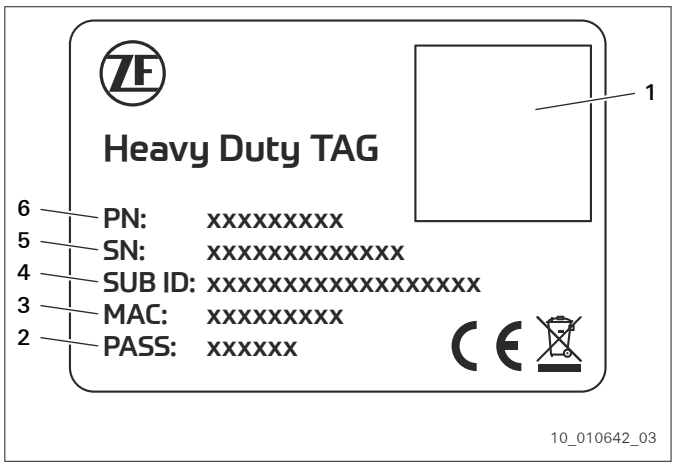
Tab. 2 Data sheet for radio sensor

4.2 Type plate

Position of the type plate

The type plate is located on the side of the housing.

4.2.1 Radio sensor type plate



1 Data Matrix code
2 PassKey identification number
3 MAC address
4 Sub1GHz identification number
5 Serial number
6 ZF parts list [BoM] number

Fig. 2 Radio sensor type plate

5 Application and Documentation

5.1 Cybersecurity

The vehicle manufacturer is responsible for the cybersecurity of the vehicle according to the ISO/SAE 21434 standard.

This must be determined in consultation with ZF.

6 Transport and Storage

6.1 Delivery condition

Adaption material for the radio sensors is available as an option.

Radio sensors are part of the rail monitoring system. The number of radio sensors depends on the respective application.

Radio sensors are supplied with installed batteries, screws for installation and material safety data sheet.

6.2 Transport

6.2.1 General transport instructions

- Protect the ZF product against dirt, moisture and damage with suitable covers.
- Do not set down or store the ZF product outdoors.
- Immediately notify ZF of transport damage.
- When transporting the radio sensor, observe the following:
  - Do not open the radio sensors.
  - Do not remove batteries.
  - Observe material safety data sheet.

Observe the described transport instructions for a return delivery to ZF.

6.2.2 Transporting dangerous goods

Notes for shipping the radio sensor

The radio sensor contains three lithium metal batteries (primary cells); these are physically separate and each must be assessed individually.

The lithium metal batteries each have a lithium content of 0.98 g.

The lithium metal batteries have passed the 38.3 test series (UN test). Test certificates or manufacturer confirmations are available.[1)]

ADR, RID, IMDG [2) 3)4)]

- Ship intact radio sensors in accordance with Special Provision 188. To do so, apply the marking “UN 3091” according to ADR 5.2.1.9.2 and pay attention to any applicable restrictions.

1) UN: United Nations
2) ADR: Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
3) RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (European Agreement concerning the International Carriage of Dangerous Goods by Rail)
4) IMDG: International Maritime Code for Dangerous Goods

- Inspect any damaged radio sensors separately according to dangerous goods law and any applicable restrictions and evidence.

IATA-DGR [5] [6]

- Shipping the radio sensor by air freight is generally possible if all applicable restrictions are followed. The sender must inspect the applicable restrictions in detail and comply with them.

6.3 Storage

The ZF product may not be stored under conditions that do not correspond to the specified technical data *(refer to Chapter Technical Data)*.

Observe the following:

- Avoid high temperatures.
- Store the product at room temperature (approx. 20°C).
- Store the product in a vibration-free space.
- Store the product in a dry place.

5) IATA: International Air Transport Association

6) DGR: Dangerous Goods Regulations

7 Installation Conditions

7.1 Installation provisions

7.1.1 Radio sensor

Installation provisions:

- Installation must be carried out on a clean, even and sufficiently stable surface
- Installation location must be protected from damage such as stone chipping or other mechanical impacts
- Installation location must not be surrounded with metal in the form of a Faraday cage
- Installation location with minimum possible mechanical damping between the components to be monitored and the radio sensor
- Installation must conform with fire protection requirements defined in DIN EN 45545-2
  Minimum distance to components that do not conform to Table 2 of the DIN EN 45545-2 standard:
  - Horizontal minimum distance: 20 mm
  - Vertical minimum distance: 200 mm
- Installation location without resonance vibrations in the relevant frequency range during operation (e.g., no protruding brackets)

8 Installation

8.1 Preparatory activities

Electric devices may only be installed by trained and instructed staff and in accordance with the provisions and specifications provided by the vehicle manufacturer or operator.

1. Ensure that all components are deenergized and have not been electrically connected yet.

2. Ensure that all components are undamaged.

3. Ensure that ambient conditions at the installation location and limit values for the connection are complied with *(refer to Chapter Technical Data)*.

4. Ensure that the installation location has adequate background ventilation to protect against overheating.

5. Installing the radio sensor: Ensure that no rubber elements or similar are installed between the components to be monitored and the radio sensor.

6. Installing the gateway and antennas: Ensure that the installation locations of these components are immobile. This prevents the connected cables and terminals from moving while the vehicle is in operation.

8.2 Installing the radio sensor

- Observe information in the vehicle documentation when choosing the installation location.
- Before installing the radio sensor, contact ZF Aftermarket. Depending on the nature of the installation location, additional adaption material may be necessary for fastening.

When installing the radio sensor, observe the following:

- Use M6x45 hexagon screws supplied by ZF (material number 0636.104.852).
- Only use the hexagon screws supplied with the sensor once.
- Use of different screws requires approval from ZF.

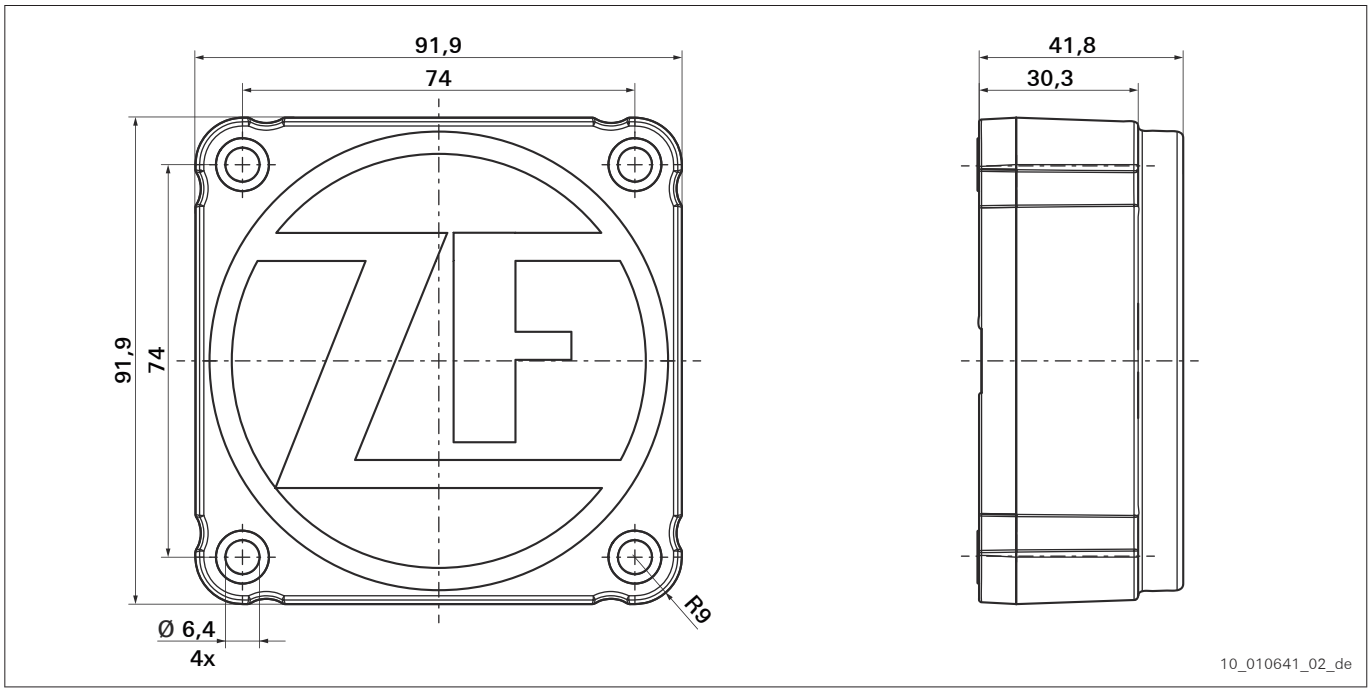


Fig. 3 Dimensions of radio sensor

1. Check radio sensor for damage.

2. Clean the contact surfaces on the vehicle.

3. Remove grease or other residues from the thread holes.

4. Wake up radio sensor from Deep Sleep Mode. To do so, rotate the radio sensor by 180° and place it with the stamped ZF logo on the housing facing down.

   After rotation, the radio sensor can be activated through the Dashboard user interface within the next following 30 minutes. Afterwards, the radio sensor will enter Deep Sleep Mode again; it can be woken up again if necessary.

5. Choose the installation position of the radio sensor so that the radio sensor can be installed at a right angle both horizontally and vertically.

   Position the radio sensor on the contact surface.

6. - Applying threadlockers, such as Loctite, or installing additional thread locking elements is not permitted.
   - Screws supplied with the sensor are micro-encapsulated and are therefore already sufficiently secured. The micro-encapsulated threadlocker is activated when the screw is screwed into the thread.
   - Make sure that the screw-in depth is min. 16 mm.

   Turn in and tighten four hexagon screws.
   Tightening torque: 9 Nm (±10%)

7. Mark four hexagon screws with touch-up pen.

Use new hexagon screws when replacing the radio sensor.

9 Maintenance

9.1 Checking the radio sensor

Due to a possibly exposed installation position, for example, near the track bed, the radio sensor must be regularly checked for damage.
The radio sensor is maintenance-free and must not be opened. The batteries cannot be replaced. Product safety information: *(refer to Section Product-specific safety instructions)*.

When installing the radio sensor, observe the following:

- Use M6x45 hexagon screws supplied by ZF (material number 0636.104.852).
- Only use the hexagon screws supplied with the sensor once.
- Use of different screws requires approval from ZF.

1. Perform a visual inspection of the radio sensor's condition. Condition assessment: *(refer to Chapter Decommissioning)*

2. Also check the condition of the add-on components and the joining elements (e.g., screw connections).

3. Replace defective parts immediately.

   Use new hexagon screws for installation when replacing the radio sensor.

10 Decommissioning

Superficial changes such as scratches and spalling are signs of use and are not regarded as damage.

Larger dents or deformation (of more than 3 mm) that can be expected to have affected internal components are regarded as damage. A breakage or hole through which the insides of the ZF product can be seen is regarded as a relevant damage.

A damaged ZF product represents an increased hazard potential. In case damage to the ZF product is detected, the ZF product may no longer be used and must be disposed of properly. This also applies to ZF products that are still functional.

If damaged, the batteries inside the ZF product may develop intense heat or cause a fire. In case of damage, the product may also release hazardous gases or leak hazardous liquids.

In case the ZF product is damaged, please inform ZF Aftermarket.

When handling a damaged ZF product, wear suitable protective equipment, handle the ZF product carefully and observe the following:

- Wear protective gloves to avoid direct skin contact.
- In the event of contact with skin or eyes, rinse thoroughly with water.
- In case of injuries or contact with the inside of the batteries, seek medical help.
- Store and transport damaged ZF products individually in fire-proof containers.

11 Disposal

11.1 Product-related notes on disposal

NOTICE

Incorrect disposal may cause environmental damage.

⇨ Please dispose of the ZF product, parts, operating supplies and auxiliary materials in accordance with the applicable regional, national, and international regulations of the respective operating country.

⇨ Please use an authorized disposal specialist to dispose of the ZF product, parts, operating supplies and auxiliary materials.

According to European Directive 2002/96/EC, all electrical and electronic equipment must be disposed of via local collection facilities.

ZF recommends using fire-proof containers for transporting the ZF product to disposal centers for proper disposal.

Bags or containers intended for this purpose, for example, can be used for transporting and storing lithium thionyl chloride batteries. The batteries may only be removed for disposal by trained staff.

The ZF product may only be opened for disposal by trained staff.

Once opened, the ZF product may not be started up again. Once the product has been opened, the housing is no longer properly sealed *(refer to Section Product-specific safety instructions)*.

WEEE register number[7]:

- www.zf.com/hd-tag-data
- VCU Pro Onboard Unit - Telematik-Gateway

7) WEEE: Waste Electrical and Electronic Equipment

12 Tightening Torques

The table of tightening torques only applies in conjunction with the referenced chapters/sections.The tightening torques used in the attached documents are not included in this table.

Designation	Tightening torque	Measuring instrument	Comment Chapter/Section
M6x45 hexagon screw	9 Nm (±10%)	Torque wrench	• Installing the radio sensor, page 18

13 Annex

13.1 Subject index

13.2 Revision history

Index	Date of issue
a	2021-11
b	2024-04
c	2025-08

Tab. 3 Revision history

ZF Friedrichshafen AG
88038 Friedrichshafen
Deutschland · Germany
Telefon/Phone +49 7541 77-0
Telefax/Fax +49 7541 77-908 000
www.zf.com

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