SKF Axletronic sensors for the railway industry

Flexible axlebox solutions for detecting bearing temperature, rotational speed, direction of movement, vertical and/or lateral acceleration, position and distance

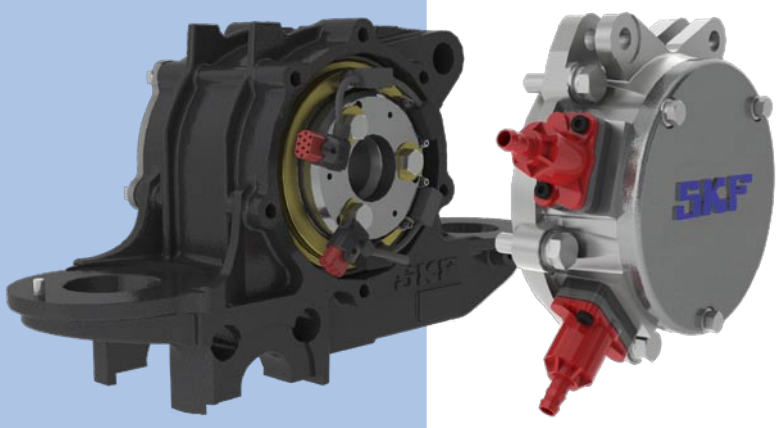
To meet the ongoing challenge of safety and reliability at any speed, the railway industry continues to advance the use of sensorized solutions for a wide range of signalling, control and protection applications.

With some 20 different signalling and speed control systems in use throughout Europe alone (and still others in Japan, China and the Americas), internationally viable solutions must be able to accommodate the diverse requirements of vehicle manufacturers and railway system operators worldwide. Ideally, these solutions will also support the industry's drive for standardization, as well as reduction of the number of components and suppliers.

The SKF Axletronic sensor solution is a flexible platform for railway vehicles that can be installed in axlebox bearing units or axlebox front covers, and can be easily incorporated into both new vehicles and existing rolling stock. Because of the solution's design principle, it is possible to incorporate several sensors for different electronic systems, either distributed on the circumference of the bearing unit or within the axlebox cover. This provides multiple options for detecting operational parameters for Automatic Train Protection (ATP), brake control and condition monitoring systems.

Benefits

- Customized sensor architecture based on customer specifications
- Compact design with fewer components saves space and mass
- Enables combination of sensors with mounted earth brush on one axlebox
- Integration of multiple sensors to support various systems
- Simple connection through intermediate front cover
- No maintenance needed for speed sensor
- Compatibility with other optical speed sensors
- Customized speed signals fully compatible with each electronic unit
- Complete independency and redundancy of speed signal in same axlebox
- Complete, turn-key delivery in all-inclusive kits

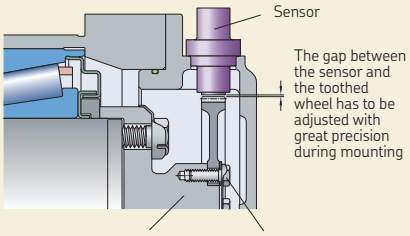


Bearing unit sensors

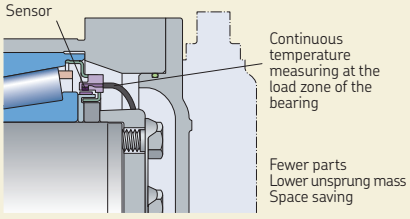
In this solution, an SKF Axletronic sensor is integrated into a pre-lubricated and sealed SKF axlebox bearing unit (TBU, CTBU or CRU). The bearing unit's outer seal is prepared in advance to accommodate the sensors: if these sensors are for measuring speed, the encoder or impulse wheel also forms a part of the sealing system. The system is mechanically fitted on the journal after the bearing unit has been mounted.

In addition to SKF Axletronic solutions developed to manufacturer's specifications for new trains, retrofit kits are available to easily and quickly upgrade SKF axlebox bearing units during maintenance of existing trains.

SKF bearing unit with SKF Axletronic "quadruple head" sensor systems installed onto the bearing seal as an integral part of the bearing unit



Example of a conventional external sensor mounted onto the axlebox and a toothed wheel located at the end of the axle odometer sensors in an axlebox front cover



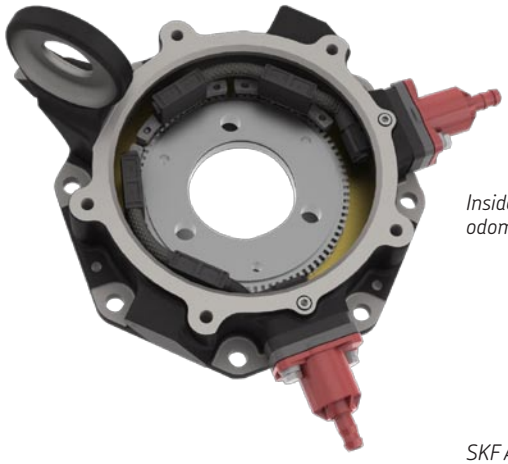
Example of an SKF Axletronic sensor integrated in an axlebox bearing unit

Front cover sensors

For applications where non-SKF bearing units are used or where unmodified bearing units are preferred, SKF Axletronic sensors can also be installed within the axlebox front cover. This modular solution enables from one to eight speed signals to be integrated within the same axlebox.

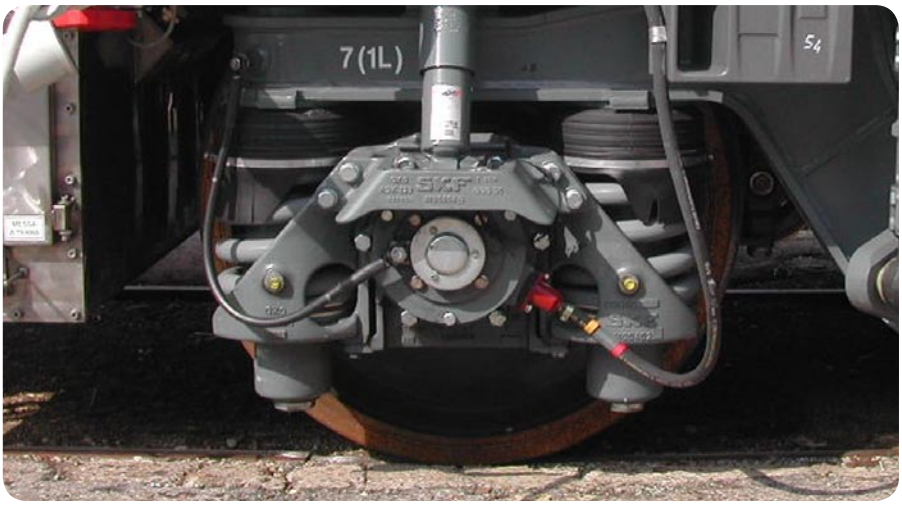
Two types of front cover kits are available, one of which does not require dismounting or altering the bearing unit. This solution is excellent for upgrading existing rolling stock, as there is minimum vehicle downtime. The solution also enables original equipment manufacturers to add the wheel speed function without implementing major design changes or switching bearing suppliers. The sensor is placed within the axlebox front cover and can be used with any type of axlebox bearing, on new or existing trains.

The second type of front cover kit includes everything needed to upgrade an SKF axlebox bearing unit to accommodate the SKF Axletronic sensor including a new outer seal, magnetic impulse wheel, intermediate front cover and external cable.



Inside view of two independent SKF Axletronic odometer sensors in an axlebox front cover

SKF Axletronic sensor used in an axlebox front cover in combination with an earth return device



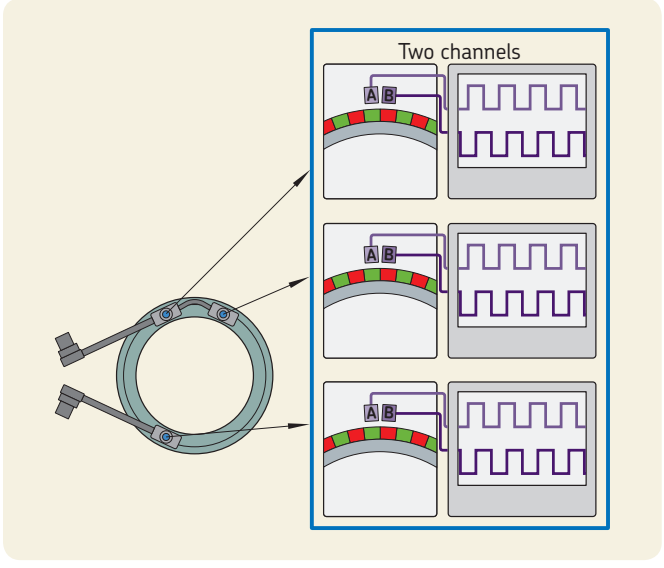
Sensor capabilities

The versatile SKF Axletronic sensor sub-system can detect a greater range of individual parameters than conventional sensor solutions. In most applications, detecting the rotational speed is needed, either to be used as a stand-alone signal for several applications, or to manage data evaluation in combination with direction of movement for odometry systems. The SKF Axletronic sensor can also detect bearing temperature as well as vertical and/or lateral acceleration signals. Data can be used in combination with other parameters, such as bogie condition monitoring.

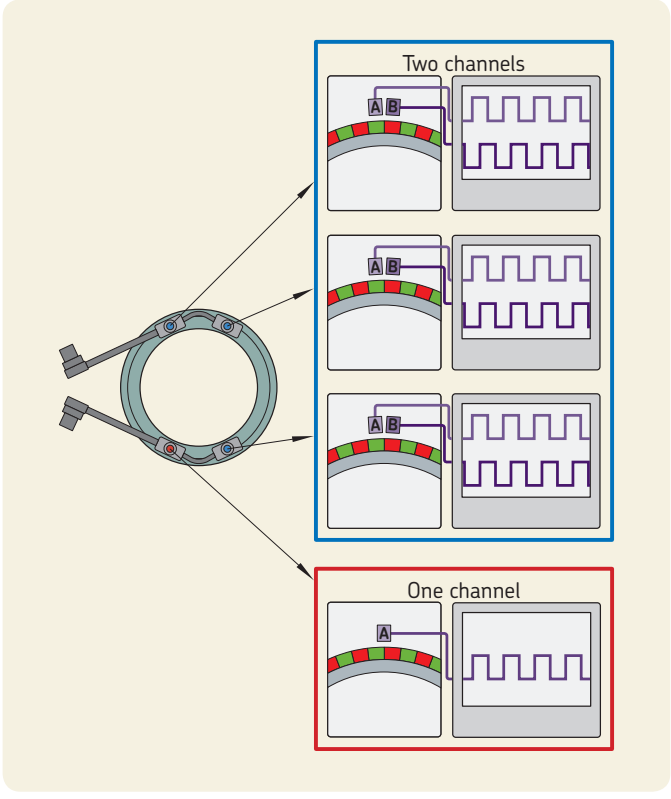
Parameter applications	Wheel Slide Protection (WSP) Rotational speed Tachograph Drive Information System (DIS) Traction control Motion detection Bogie condition monitoring Passenger Information System (PIS) Watt-hour meter
Direction of rotation	Automatic Train Control (ATC) Legacy Automatic Train Protection (ATP) European Train Control System (ETCS)
Odometer (distance measurement)	European Train Control System (ETCS)
Bearing temperature	Bearing damage detection
Vertical vibration	Bearing damage detection Bogie condition monitoring – wheel condition
Lateral vibration	Bogie condition monitoring – bogie stability

Single and multi-channel sensor configurations

To manage parameter requirements for different applications, several SKF Axletronic sensor configurations are available with one or more channels, distributed on the circumference of the bearing unit or within the axlebox intermediate front cover. The sensors' signals are compatible with the electronic control units (ECU) produced by different system suppliers.



"Triple head" SKF Axletronic sensor system with three independent two-channel sensors for ETCS



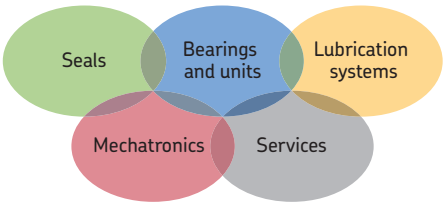
"Quadruple head" SKF Axletronic sensor system with three independent two-channel sensors for ETCS and one one-channel sensor for other applications such as wheel slide protection (WSP), tachograph and movement

Sensor performance verification

Sophisticated SKF sensor and cable performance verification equipment enables the inspection of all connections to make sure they are working properly. This method enables validating the performance without moving the wheelset. SKF offers customized electrical and manual performance verification equipment.

SKF Axletronic sensor general specification

Detection parameter	Sensor configuration	Power supply	Operating temperature
Speed and direction	Current Voltage NPN Voltage PNP Voltage Push-Pull	10 to 30 V DC	–40 to +110 °C
Temperature	Negative temperature coefficient (NTC) Platinum temperature resistor (PT)	N A	
	Thermal diode	12 to 24 V DC	
Vibration	Piezoelectric effect	18 to 28 V DC 2 to 20 mA	



The Power of Knowledge Engineering

Drawing on five areas of competence and application-specific expertise amassed over more than 100 years, SKF brings innovative solutions to OEMs and production facilities in every major industry worldwide. These five competence areas include bearings and units, seals, lubrication systems, mechatronics (combining mechanics and electronics into intelligent systems), and a wide range of services, from 3-D computer modelling to advanced condition monitoring and reliability and asset management systems. A global presence provides SKF customers uniform quality standards and worldwide product availability.

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