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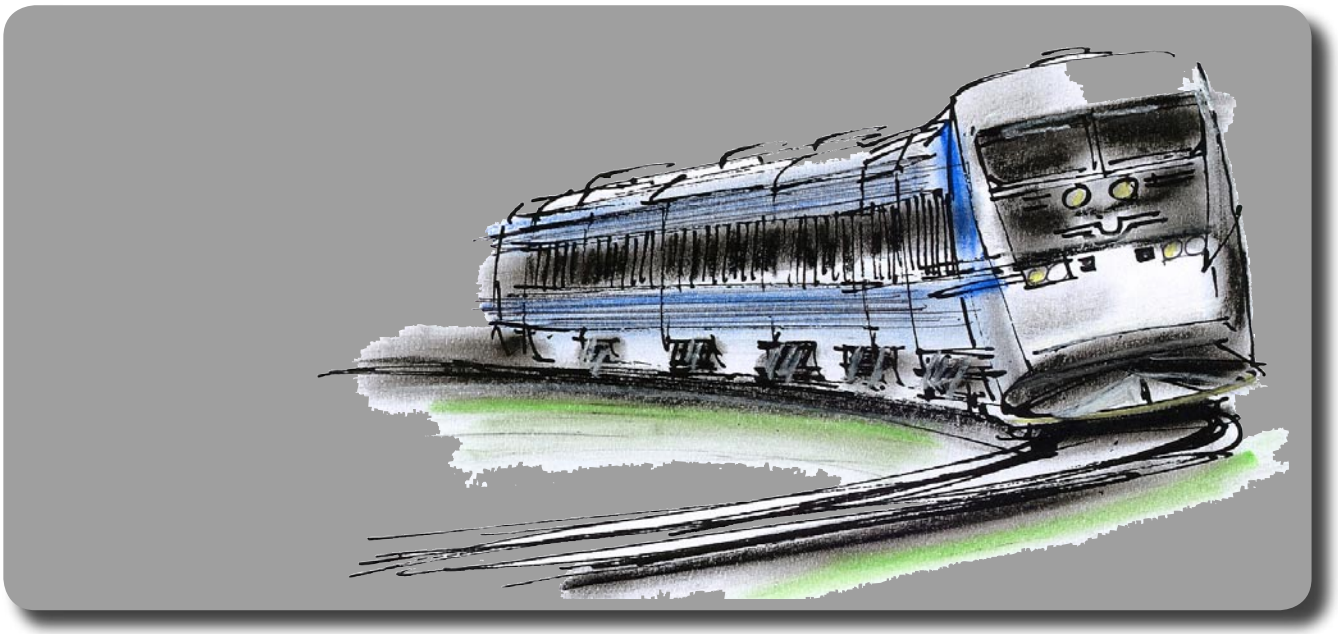
TECHNOLOGY GROUP

Application Note



Speedsensors for Railways Applications

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IN CHARGE OF SPEED
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Introduction

Speed sensors are used in railway, metro and tram applications to measure speed in the motive power system and to control the brakes to prevent brake locking and wheel slippage.

The motive power systems used in today's trains are either diesel engines or electricity. In every case however modern trains are finally driven by electric motors whose energy is delivered by a propulsion system. These motors are normally equipped with a pole wheel, which is sensed by a speed sensor. As the system needs to drive the train forwards and backwards, the sensor has 2 phase shifted channels thus enabling direction sensing.

High Propulsion Locomotive equipped with JAQUET Speedsensors

Diesel engines require speed sensors for start and operational control. Normally this is done with cam- and crack-shaft sensors. Although the engine would normally be equipped with a turbo-charger, a turbo speed sensor is sometimes not installed in this application since the engine runs at constant speeds most of the time.

Brake control systems are variously described as ABS (Anti Lock Braking System) or WSP (Wheel Slip Prevention). Coupled with the traction control offered by sensing motor speed, these systems prevent wheel slippage and locking of the brakes, thus reducing wheel and track maintenance, increasing reliability and enhancing safety.

Sensors for Brake control

Typically a single channel hall effect sensor with a push-pull output stage is used to detect the speed of the spinning wheel. This speed needs to be monitored down to very slow rpm as only like that an effective anti locking mechanism can be established.

Railways Speed Sensor with armored cable

Most important is the robust and strong construction of the sensor used in the harsh environment of a railway application. The fully encapsulated stainless steel housing on one hand and the armoured cable on the other hand allows the direct use on the motors, boogies or wheels.

In some applications it is desired to use a second channel of the speed sensor for a additional function. For example a security installation which only allows the doors to be opened at standstill. Naturally the electrical wiring must be galvanically separated from the primary function. For this purpose there are redundant double headed sensors which comes in the same housing.

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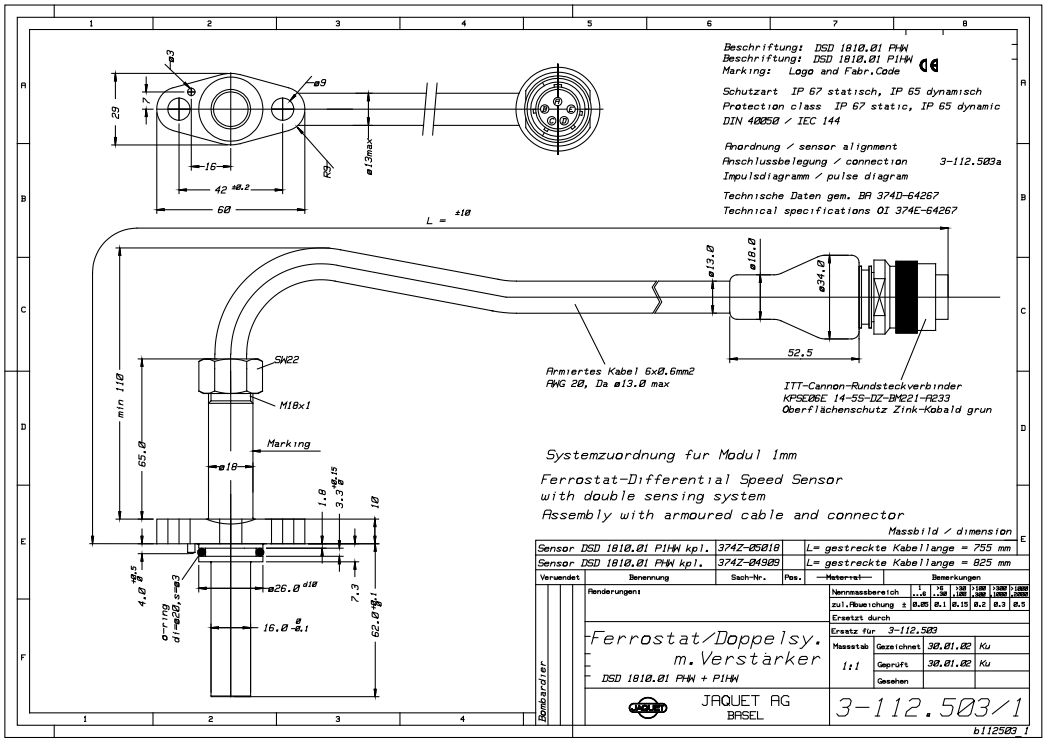
In most of the applications the sensor uses a connector to be wired in the boogie. The length of the armoured cable and the style and type of the connector are part of the definition of the sensor arrangement. Like that the sensor comes ready to be assembled to the site of the system integrator and does not need any additional preparation prior to use.

Fixed cabling however is also possible and the sensor would then be delivered with a free lead at the armoured cable.

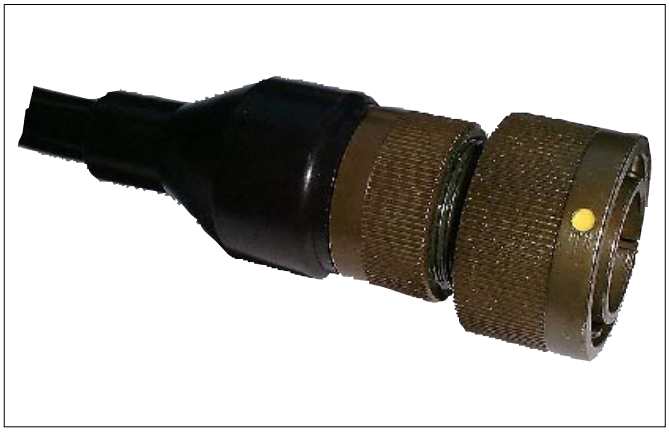
Technical Data

The main technical characteristics of a typical brake sensor would be:.

Supply voltage	**9 ... 30 VDC**
Protection ity	**Fully protected against false polar- and transient overvoltages**
Signal output	**Push-Pull max. load 25 mA**
At I = 20 mA	**HI: › supply voltage – 2,5 V LO: ‹ 1.5 V**
Frequency range	**2 Hz ... 20 kHz**
Operating Temperature	**-40 ... +125 °C**
Typical Polewheel distance	**0.1 .. 2.5 mm at Module 2**



Overmoulded connector at the end of the armored cable



Typical dimensions of a speed sensor used for brake control

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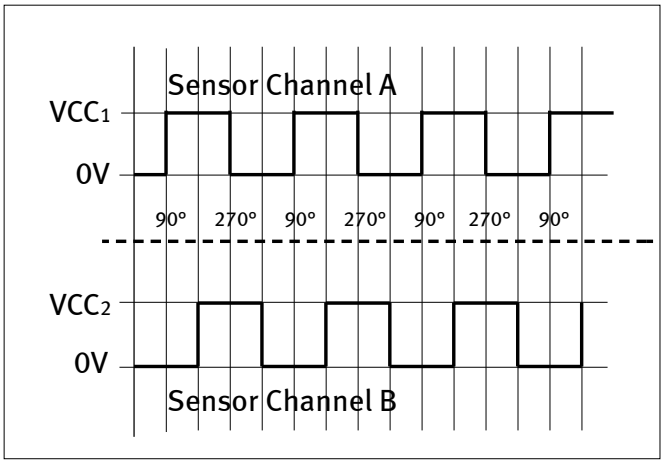
Sensors for propulsion systems

A dual channel hall effect sensor with push-pull output stages is used to detect the speed of the motor or is located in the gearbox on the boogie. Basically the sensor delivers two signals which are 90° phase shifted. From the relative position of the two signals the sense of direction can be gained.



Signal Output of a sensor with two channels

That means in addition to the speed signal there is also the information delivered whether the system is rotating clockwise (CW) or anti-clockwise (CCW). As the duty cycle – that means the ration between the high and the low time on the signal – can depend from the detected pole wheel and some other facts the definition of the phase shift is adapted to that facts.

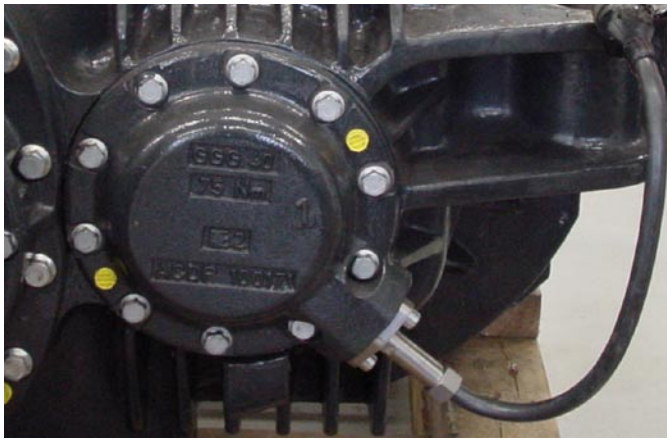
Even with this executions one must not use a second sensor for an additional information. It is possible to have a 3rd, galvanically separated sensorhead built in the same housing so that for example a brake control can be established in the same sensor which is used already with a quadrature signal for the propulsion system.

Variant of a raiway sensor with integral connector

Technical Data

Typical technical characteristics of propulsion sensor would be:.

Supply voltage	**9 ... 30 VDC**
Protection ity	**Fully protected against false polar- and transient overvoltages**
Signal output	**Push-Pull max. load 25 mA**
Phase Shift	**Min. edge shift between S1 and S2 = 20°**
At I = 20 mA	**HI: › supply voltage – 2,5 V LO: ‹ 1.5 V**
Frequency range	**0 Hz ... 20 kHz static behaviour**
Operating Temperature	**-40 ... +125 °C**
Typical Polewheel distance	**0.1 .. 1.5 mm at Module 2**



JAQUET speed sensor assembled in a railway gearbox

Avaliable Tests and Certificates

The JAUQET AG speedsensor for Railways applications are fully compatible with the specific norm EN50155. All necessary tests are done and reports available. For more details please refer to the compliance report EN50155 from JAQUET AG.

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Reference List

Project	Customer	Description	Product
X2000 Fast Train Göteborg-Stockholm, S	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 SHW**
Gardermoen Airport Shuttle NSB, Norway	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 AHW**
SEPTA Market-Frankford Philadelphia, USA	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 SHW**
IR4 Interregional train, DK	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 AHW**
LVR Light Rail Vehicle Baltimore, USA	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 SHW**
LVR Light Rail Vehicle Izmir, Turkey	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 SHW**
C20 Stockholm Metro, S	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 QHW**
LVR Light Rail Vehicle Manila, PI	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 SHW**
LVR Light Rail Vehicle Adana, Turkey	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 SHW**
LTS Train system London Tilbury, GB	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 QHW**
Connex Train System Great Britain	ADtranz S (Bombardier)	Sensor for Speed and sense of rotation	**DSD 1820.11 QHW**
Tram Kotbus	Hanning & Kahl	Speedsensor for Brakes	**DSD 1820.17 MHV**
Tram Mülheim	Hanning & Kahl	Speedsensor for Brakes	**DSD 1820.17 MHV**
COMBINO Tram Potsdam	Hanning & Kahl	Double Speedsensor for Brakes and door control	**DSD 1820.17 MHR**
Strassbourg Tram	Adtranz Milano	Sensor for Speed and sense of rotation	**DSD 1825.00 AHW**
ETR 500 High Speed Train FS Italy	Ansaldo	Sensor for Speed and sense of rotation	**DSD 2220.00 SHW**
TAF Commuter Train FS Italy	Ansaldo	Sensor for Speed and sense of rotation	**DSD 2220.00 SHW**
TAF Commuter Train FS Italy	ADtranz Milano	Sensor for Speed and sense of rotation	**DSD 2220.00 SHW**
E464 Locomotive FS Italy	ADtranz Milano	Sensor for Speed and sense of rotation	**DSD 2220.00 SHW**
LTS Train system London Tilbury, GB	Westinghouse Brakes	Speedsensor for brakes	**DSD 1820.17 PHV**
Connex Train System Great Britain	Westinghouse Brakes	Speedsensor for brakes and door locks	**DSD 1820.17 PHR**
Metro System Schanghai	Westinghouse Brakes	Speedsensor for brakes	**DSD 1820.21 PHV**
City Train System Guangzhou China	Bombadier Transport	Speedsensor for propulsion system	**DSD 1820.11 P6HW**

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Reference List

Train combination Locofrette	ALSTOM Transport	Speedsensor for propulsion system and Pole wheel	**DSD 1820.19 SHR**
Train system TRN2NNG	ALSTOM Transport	Speedsensor for propulsion system and Pole wheel	**DSE 2020.19 SHZ**
Tramway Boukarest	Bombardier Transport	Combined brake and propulsion sensor. 3 Channel sensor head	**DSD 1820.20 PHWR**
Locomotives for IRAN	ALSTOM Transport	Speedsensor for propulsion system and Pole wheel	**DSD 1810.19 AHRW**

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