

DEUTA Sensors





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»DEUTA Sensors -

Robustness, self-diagnosis and reliability!«

- **Robustness:** to extreme temperature/wear/impact of stones
- **Contactless:** Doppler radar with innovative evaluation algorithm
- **Self-diagnosis:** Information about operating mode and condition of the sensor
- **Long-lasting:** Low-wear thanks to non-contact measurements
- **Captive property:** Mechanical defined number of pulses per revolution als captive property of the product

Sensors for your safety!

For an entire system to be safe and precise, quality and robustness, self-diagnosis and reliability of the sensors are the decisive factors. Due to the different forms of output signals, DEUTA sensors transport information reliably and can be integrated and used flexibly in different environments.

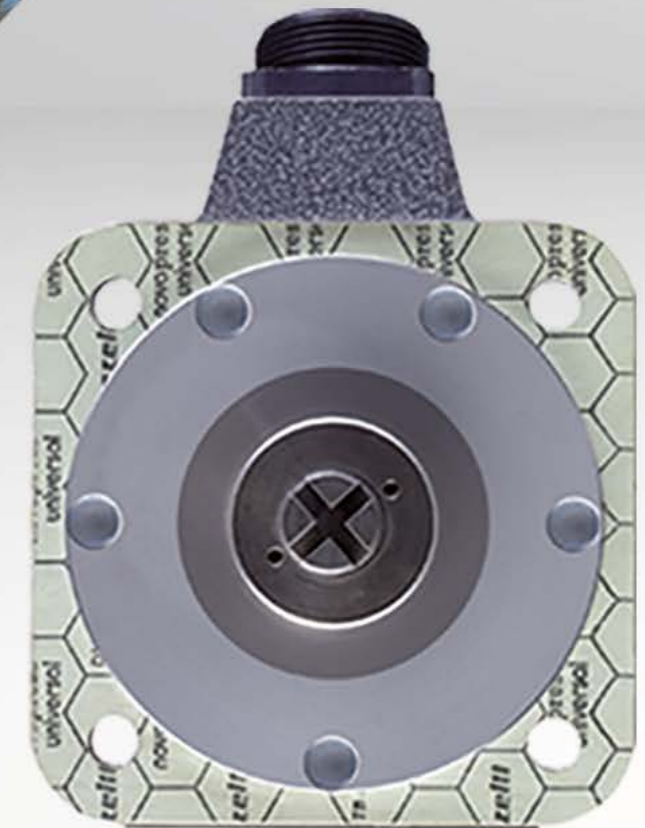
Longevity

Reliability

Robustness

Self-diagnosis

Quality



Product Overview



Radar sensors

Doppler radar with dual antenna system

The sensors operate contactless and measure the speed and distance over the ground by deploying the Doppler principle with an dual antenna system. The integrated digital signal processor performs sophisticated evaluation algorithms in the device.



DEUTA SmaRT App

The comfortable inclinometer app

With the SmaRT App, DEUTA has developed a completely new inclinometer technology. The useful smartphone app accompanies the user through the measurement. The SmaRT App manages the calibration factors, the different vehicles and attachment positions.



Pick-up sensors

Hall-Sensor

Feature an extremely long service life because the space-saving sensors operate contactless and therefore with low wear.



Radar Test Bench RTD10

Test Bench for Doppler radar sensors

The RTD10 verifies the functional characteristics of DEUTA Doppler radar sensors independently and unaffected by weather conditions or external influences. It can perform tests on both DRS05 sensors with a standard housing and DRS05S1 sensors with an integrated protective cover.



Axle-mounted sensors

1- to 6-channel pulse generator

Insensitive to soiling and vibration, the sensors operate largely maintenance-free and offer different resolutions (pulses per revolution). For all DEUTA axle-mounted sensors the pulses per revolution are mechanically defined and, therefore a captive property of the product. This „memorized“ number of pulses is the solid basis to ensure a reliable measurement.



»DEUTA Radar Sensors -

Speed not affected by slip and slide!«

- DRS05/3S1 with integrated protective cover against impact of stones
- suitable for ETCS, CBTC, high-speed trains and metro vehicles
- applicable for traction control

Minimum Life cycle costs (LCC)

The radar sensors operate completely wear-free and provide reliable measured values throughout the entire life cycle because they are not exposed to particular mechanical wear. There is no alternative to the favorable cost-benefit ratio resulting from low requirements of maintenance and repair over the entire life cycle.

Borderless applications

Radar sensors of the type DRS05 can be used worldwide. Declarations of conformity are available for Europe, U.K., Canada, USA, Japan and Australia.

Acceleration sensor

The integrated acceleration sensor supports speed measurement and minimises dynamic deviations. Short unavailability can be bridged. Interference signals at a standstill are suppressed.

Particularly robust under harsh environmental conditions

At the DRS05/3S1, an integrated protective prolongs the durability of the radar sensors when they are hit by stone and extends the availability in winter conditions. Such housing is specially recommended for high-speed trains.

Special applications?

Beyond the proven use in the established means of transport the radar sensors can also be adopted to unconventional transport modes like suspension railways or monorail systems. The experienced engineers at DEUTA will be happy to advise you on any issues related to radar sensors, speed detection and connection to your odometry, even at early project stage.

DEUTA Radar Sensors

Feature/Specification	DRS05/3	DRS05/3S1
Working principle	two-channel speed sensor	two-channel speed sensor
Determinable speed range	0.2 km/h up to max. 600 km/h	0.2 km/h up to max. 600 km/h
Measurement noise (1 σ)	<0.4 km/h (v <100 km/h) <0.4 % (v >100 km/h)	<0.4 km/h (v <100 km/h) <0.4 % (v >100 km/h)
Uncertainty due to variation of the underground	<1 % typical	<1 % typical
Path measurement reproducibility (1 σ)	<0.1% typical from 1,000 m distance	<0.1% typical from 1,000 m distance
Power supply	15 to 150 VDC, extended-range power, galvanically isolated, battery potential permitted	15 to 150 VDC, extended-range power, galvanically isolated, battery potential permitted
Power consumption	max. 10 W	max. 10 W
Standard interfaces	1. digital: RS485 2-wire bus, unidirectional, serial 2. analog: pulse output (open collector)	1. digital: RS485 2-wire bus, unidirectional, serial 2. analog: pulse output (open collector)
Forward/Backward recognition	yes	yes
Inverse polarity protection/ short-circuit-proof	yes/yes	yes/yes
Operating temperature	-40° C to +70° C	-40° C to +70° C
Dimensions	approx. 244 mm x 134 mm x 140 mm (LxWxH) (without plug connector and cable)	approx. 481 mm x 214 mm x 140 mm (LxBxH) (LxWxH) (without plug connector and cable)
Distance to the reflection surface	approx. 200 mm to 1,000 mm, depending on the application	approx. 200 mm to 1,000 mm, depending on the application
Housing material	aluminium cast anodised, cover PEEK	aluminium cast anodised, cover PEEK
Protection class	IP66/IP67/P69 (with plug and cable)	IP66/IP67/IP69 (with plug and cable)
Weight	approx. 2.6 kg (without plug and cable)	approx. 4.7 kg (without plug and cable)



DRS05/1, DRS05/2 & DRS05/3



DRS05/1S1 & DRS05/3S1



»DEUTA Pick-up Sensors - extremely high longevity!«

- almost wear-free due to contactless measuring

DEUTA pick-up sensors

Pick-up sensors from DEUTA have an extraordinary durability, as they operate contact-free and therefore wear-free. The measurement takes place by scanning a gear or magnet wheels, in the process the sensor is mounted in a defined distance over the wheel.

Pulse generator with hall sensor- determines speed and direction of rotation

They use the hall effect to measure the rotational speed. Within the HS 22 two hall elements are geometrically arranged in such a way that even the direction of rotation is identified. The output gauge of both signals receivable separated galvanically from each other is prepared for a wide area of power supply. If recording of the direction of rotation is not necessary, use the one-channel HS21. There are many variations with different output stages.

DEUTA Pick-up Sensors

Feature/Specification	HS21/22
Working principle	HS22: 2-channel system HS21: 1-channel system
Frequency range	0 to max. 20 kHz, depending on cable length and ext. load
Operating distance, air gap	0.5 to 2.0 mm
Operating temperature	-40° C to +120° C ¹⁾
Storage temperature	-40° C to +85° C
Protection class	IP66/IP67/IP69
Pulse duty factor	50 % ±10 %
Overlap safety	at least 30°
Short-circuit-proof	yes
Reverse polarity protection	yes
Power supply U _B	+5.5 VDC to +30 VDC ²⁾
Insulation voltage	500 V _{EFF} / 50 Hz / 1 min
Power consumption per channel	<20 mA ²⁾
EMC	EN 50155, EN 50121-3-2, EN 61000-6-x
Permitted mechanical load	EN 61373, category 3
Weight	approx. 280 - 340 g ²⁾ with 1 m cable and open cable end
MTBF	>1.800.000 bis 4.600.000 h, ground mobile ²⁾
Indication medium	ferromagnet. gear wheel, module 2 ³⁾ involute toothing acc. DIN 867 - 80 teeth
Gear wheel material	steel, demagnetised St37, St50 or 10-10 DIN EN 10025, grade FE430A

¹⁾ without cable protection or protective tube and plug

²⁾ depending on the output stage and design

³⁾ optimisation to other modules on request



HS21/22...



HS21/22...ca



HS21/22...hc



DF16/1 a, ac
1- to 4-channel pulse generator



EFI61/2 S1 a, ad
AC/pulse generator



EFI50/1 S1 a, d
AC/pulse generator

»DEUTA Axle-mounted Sensors -

The number of pulses per revolution are mechanically defined and therefore a solid basis for reliable measurement!«

- extremely high durability thanks to their predominantly wear-free operation
- insensitivity to dirt and vibration

Proven impulse sensors

Axle-mounted sensors from DEUTA are driven by a mechanical coupling on the axle of the vehicle. Impervious to dirt and vibration, they are virtually maintenance-free and achieve high resolution even at low rotational speeds.

The traditional AC generator generates a voltage and frequency that is proportional to the rotational speed, which can be fed directly to a converter or indicator via a cable, without the need for an additional power supply.

Impulse sensors in different variants

The electronic pulse generators (incremental encoders) are based on a variety of principles, for example optical barrier photocells or hall sensors

All axle-mounted sensors can be supplied as multi-channel units. They can be customised to a certain extent with regard to the number of pulses, the phase relationships, and the output circuits.

DEUTA Axle-mounted Sensors

Feature/Specification	DF16/1 a, ac, ad, af, nf	DF17/1 a, ac, ad, b
Working principle	1- to 6-channel pulse generator	1- to 4-channel pulse generator
Speed range	0 to 2,000 min ⁻¹	0 to 2,000 min ⁻¹
Pulse per revolution per channel	1 to max. 230	1 to max.140
Operating temperature	-40° C to +70° C	-40° C to +70° C
Storage temperature	-40° C to +70° C	-40° C to +70° C
Protection class	IP66/IP67 housing/ IP54 drive side	IP66/IP67 housing/ IP54 drive side
Pulse duty factor	50% ±20%	50% ±20%
Short-circuit-proof	at least 18°	at least 18°
Short-circuit-proof	yes	yes
Reverse polarity protection	yes	yes
Power supply UB	10 VDC to 30 VDC ¹⁾	10 VDC to 30 VDC ¹⁾
Insulation channel/housing	<1500 V _{EFF} / 50 Hz / 1 min	1500 V _{EFF} / 50 Hz / 1 min
Power consumption per channel	<35 mA	<35 mA
EMC	EN 50155, EN 50121-3-2, EN 61000-6-x	EN 50155, EN 50121-3-2, EN 61000-6-x
Permitted mechanical load	EN 61373, category 3	EN 61373, category 3
Weight without plug and drive	approx. 2.3 kg	approx. 1.7 kg
MTBF	>148,000 to 335,000 h ¹⁾ , ground mobile	>205,000 to 335,000 h ¹⁾ , ground mobile
Design drive	a: cross slot ac: fork drive ad: tongue 20 x 7 af: drive disk nf: flat shaft	a: cross slot ac: fork drive ad: tongue 20 x 7 b: tongue 14 x 5

¹⁾depending on the output stage and design



DF16/1 a, ac, ad, af, nf



DF17/1 a, ac, ad, b

»DEUTA Axle-mounted Sensors -

The number of pulses per revolution are mechanically defined
and therefore a solid basis for reliable measurement!«

DEUTA Axle-mounted Sensors

Feature/Specification	EFI67/1.20.16 a, ac, ad	EFI67/1.50.16 a, b, ac, ad, ae
Working principle	AC/pulse generator	AC/pulse generator
Polarity number	16	16
Voltage at 1,000 min ⁻¹	20 V ±1 %	50 V ±1 %
Frequency at 1,000 min ⁻¹	133.3 Hz	133.3 Hz
Distortion factor at 1,000 min ⁻¹	approx. 10 %	approx. 10 %
Resistance of the coil	approx. 6 Ω	approx. 15 Ω
Rotational speed max.	5.000 min ⁻¹	3.000 min ⁻¹
Impulse transmission	1:1 to 256:1 ¹⁾	1:1 bis 256:1 ¹⁾
Load pulse component	15 VA induction-free max. 250 VAC ²⁾	15 VA induction-free max. 250 VAC ²⁾
Pulse number	max. 20 Hz = 1.200 pulses/min	max. 20 Hz = 1.200 pulses/min
Test voltage	2 kV	2 kV
Protection class housing	IP65	IP65
Protection class drive side	IP64	IP64
Temperature range	-40° C to +80° C	-40° C to +80° C
Weight	approx. 1.85 kg	approx. 1.85 kg
Design drive	a: cross slot ac: fork drive ad: tongue 20 x 7	a: cross slot b: tongue 14 x 5 ac: fork drive ad: tongue 20 x 7 ae: elastic driver / flexible attachment



EFI67/1.20.16 a, ac, ad



EFI67/1.50.16 a, b, ac, ad, ae

DEUTA Axle-mounted Sensors

Feature/Specification	EFI67/1.20.16 a, ac, ad	EFI67/1.50.16 a, b, ac, ad, ae
Polarity number	16	16
Voltage at 1,000 min ⁻¹	20 V ±1%	50 V ±1%
Frequency at 1,000 min ⁻¹	133.3 Hz	133.3 Hz
Distortion factor at 1,000 min ⁻¹	approx. 10 %	approx. 10 %
Resistance of the coil	approx. 6 Ω	ca. 15 Ω
Rotational speed max.	5.000 min ⁻¹	3.000 min ⁻¹
Operating temperature	-40° C to +80° C	-40° C to +80° C
Protection class housing	IP65	IP65
Protection class drive side	IP54	IP54
Weight without drive	approx. 1.6 kg	approx. 1.6 kg
Design drive	a: cross slot b: switch 14 x 5 (length as per specification) ad: tongue 20 x 7 ae: elastic driver/ flexible attachment	a: cross slot b: switch 14 x 5 (length as per specification) ac: fork drive ad: tongue 20 x 7 ae: elastic driver/ flexible attachment



EF67/2.20.16 a,b



EF67/2.20.16 ad, ae



EF67/2.50.16 a,b,ac



EF67/2.50.16 ad, ae

DEUTA Axle-mounted Sensors

Feature/Specification	EFI61/2S1 a,ad	EFI50/1S1 a,d
Working principle	pulse generator	8-pin
Voltage at 1,000 min ⁻¹	80V ± 0.5% per phase	24 V ±10%
Rotational speed max.	max. 2.000 min ⁻¹	max. 3.500 min ⁻¹
Protection class housing	IP65	IP65
Protection class drive side	IP54	IP54
Temperature range	-30° C to +90° C	-40° C to +80° C
Weight	approx. 4.7 kg	approx. 1.6 kg
Design drive	a: cross slot ad: tongue 20 x 7	a: cross slot d: tongue 20 x 7



EFI61/2S1 a,ad



EFI50/1S1 a,d



»DEUTA SmaRT App -

The comfortable inclinometer app«

DEUTA Doppler radar sensor DRS05 is the top-selling radar sensor for rail vehicles world-wide. The wide-range power supply 24 V-110 V, the large measuring range up to 600 km/h and the wide variety of output protocols allow an easy integration into the customers' system. Especially, the housing variant DRS05/1S1, a housing with integrated protective hood has proven its reliability in many projects.

Special two-channel algorithms reduce the calibration-shift effect thus providing high accuracy even with changing surfaces. Under winter conditions the integrated protective hood together with a redundancy concept basing on Doppler signal amplitudes and taking into account a spectral evaluation assures the high availability.

SmaRT App - SmaRT Radar Tool

We decide together with our customer on the mounting position which will then be optimized during the integration period.

The horizontal alignment of the mounting position is crucial since the angle to the horizontal in direction of the movement in relation to a reference surface on the radar sensor has a direct impact on the speed detection. For the calibration our customers use the so-called inclinometer.

The completely new inclinometer technology

With the SmaRT App, DEUTA has developed a completely new inclinometer technology. The useful smartphone app accompanies the user through the measurement. The SmaRT App manages the callibration factors, the different vehicles and attachment positions.

- Cost effective
- One tool for measuring inclination, calculating and managing calibration factors
- Guides the user through the measurement process
- Supports to manage the calibration factors of different vehicles and locations
- Easy to integrate into customers' maintenance processes





»DEUTA Radar Test Bench RTD10 -

Test Bench for Doppler radar sensors«

The RTD10 verifies the functional characteristics of DEUTA Doppler radar sensors independently and unaffected by weather conditions or external influences. It can perform tests on both DRS05 sensors with a standard housing and DRS05S1 sensors with an integrated protective cover. Upon completion of the examination, the test bench automatically generates the test result and creates a test report.

RTD10 Simulation of the moving ground

Doppler radar sensors are mounted on the under side of the vehicle and detect the speed based on the moving ground. Objects in the track bed and the timing of the positional changes of these in relation to each other form the basis for the speed capture.

Component testing in the Workshop

The RTD10 Radar Test Benches are an important part of quality assurance. Testing of functions during and following maintenance and servicing measures ensure the correct function of the signal chain:
Sensor—Recorder—Indicator.

RTD10 Radar Test Benches for Railway Operators:

- System testing of replacement component parts
- Function testing of replacement components prior to installation in the vehicle
- Testing of components which have been in storage (incoming and outgoing goods)
- Error diagnosis of components in laboratory environments and maintenance workshops

Radar Test Bench RTD10

Feature/Specification	
Rated supply voltage range	AC 220 V to 240 V
Power consumption	max. 80 W
Temperature range	0 °C to +50 °C (operation) 0 °C to +50 °C (storage)
EN Standards	EN 61010-1, EN 61326-1
Fire protection	EN 61010-1
Sound pressure level	60 dB(A), 50 cm distance
Load resistance	13 kΩ, optionally
Speed range	approx. 2 km/h to 40 km/h
Simulation driving direction	forward, backward
Test method	fully automatically
Interface	RS485 / RS232 Pulse input with switchable pull-up resistance



Dimensions

Width	765 mm
Height	266 mm
Depth	852 mm
Weight	approx. 53 kg
Protection category	IP 20



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