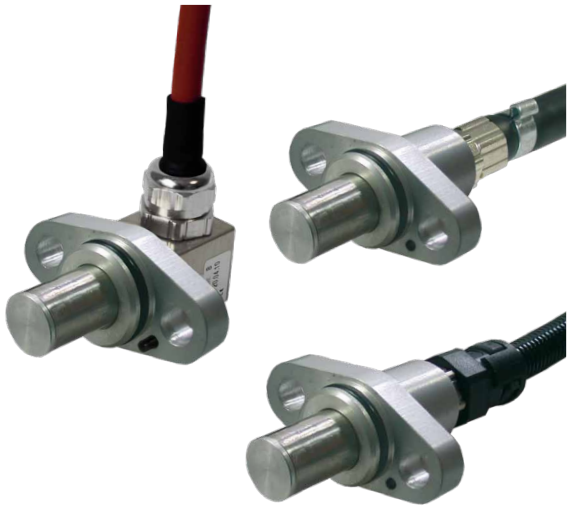
Non-Contacting Dual Speed Sensor with Signal Amplifier, Difference-Hall-Effect Principle

- High-grade speed sensor with rectangular-pulse signal output
- For harsh conditions in rail transport, shipbuilding and industry
- Stainless steel sensor tube
- Two galvanically isolated sensors in one housing
- Two scanning systems with signals 90° offset to detect speed and direction of rotation (in module m1 - m3)
- For ferromagnetic toothed wheels from module m1 up
- Frequency range from < 0.2 Hz to 20,000 Hz
- Senses very low speeds (near-zero-speeds) with wide pulse spacing
- Unaffected by out-of-true errors, vibrations and electric motor magnet fields
- Push-pull output stage
- Loadable with 50 mA SINK and 20 mA LOAD
- High degree of EMC immunity for severe electrical environments
- Wide operating temperature range from -40 °C ... +105 °C
- Face side is metal-enclosed
- Rugged construction, IP68 case tested for pressure-tightness at 5 bar
- Optionally, cables with protective function



CE

Speed Sensor FAHD5...

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Method of Operation

Non-contacting speed sensors of the FAHD5... series are basically designed for speed sensing. The two sensor units are separate and galvanically isolated. The rotation of ferromagnetic toothed wheels is sensed by means of a difference-Hall-effect sensor chip and converted by a signal amplifier into a rectangular signal. The frequency of the rectangular signal is proportional to the speed. Apart from speed, the sensors are adapted to sense any movement of ferromagnetic parts. The rectangular signal lends itself to evaluation or transformation by a variety of devices.

For detecting the direction of rotation the two sensor systems are arranged mechanically in the sensor head such that a phase offset is obtained between the output signals. This offset is 90° and can be individually factory-adjusted for module m1-m3. Standard is module m2.

Details

- Inputs may be generated by ferromagnetic toothed wheels, bolt heads, lands - detects holes, openings or grooves in ferromagnetic parts
- Wear- and maintenance-free due to contactless sensing
- Wide temperature range through use of high-grade automotive-class components
- Resistant to oil spray and lubricants, even at elevated temperatures
- Extensive electric snubber circuits integrated for protection
- Simple and safe mounting by flange
- Up to 10 signal-processing NORIS devices can be connected
- Suitable measuring transducers and limit-value switches are available
- Requirements of the classification societies far excelled

Output

The output signal is a noise-immune, rectangular signal whose frequency is proportional to the speed. The voltage range is within the load voltage and load-dependent. The geometry of the passing object determines the pulse duty factor. In the case of a toothed wheel, it corresponds to approx. 50 %. The output circuit is a push-pull stage. Short circuit protection is provided by a 60 Ω PTC-resistor. Spurious pulses are intercepted by an internal varistor against minus. The push-pull output stage can be used as a NPN output (current sinking) as well as a PNP output (current sourcing). The output voltage is galvanically coupled to the load voltage. The outputs Q1 to Q2 are galvanically isolated from each other.

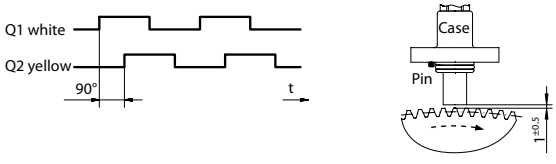
Difference-Hall-Effect Principle

The measuring element is a difference-Hall-effect sensor chip with a permanent magnet mounted. Two closely spaced Hall elements are located on the sensor chip (2.5 mm apart). The field of the magnet generates a constant voltage in the Hall elements. Ferromagnetic objects with an interrupted surface moving past the Hall elements cause the Hall voltage to change. When the moving part covers a Hall element and the other does not, a differential voltage is generated to provide a measuring signal. The frequency of this signal is proportional to the speed of movement (rotational speed). Thanks to the differential principle whereby the Hall elements generate a measuring signal only if alternately influenced and not if both are influenced, interference due to external magnetic alternating fields (e.g. out-of-true errors, vibrations, electric motor magnetic fields) is substantially reduced. This is an advantage compared to the inductive magnetic principle or other absolute principles.

The Hall-effect principle is independent of the speed of movement (static) and it would be possible to sense “standstill”. For improved noise immunity, the measuring signal is dynamically decoupled whereby the lower limit frequency is increased to < 0.2 Hz. The upper limit frequency is determined by sensor-internal characteristics. This results in a range of application from approx. 0.2 Hz to 20,000 Hz. The recommended distance to the toothed wheel for module m2 is 1 mm (absolute maximum 3 mm). The capture of small toothed wheels up to module m1 is possible by distance decelerating (recommended 0.8 mm). The difference-Hall-effect principle is direction-sensitive.

Definition of Phase Relation

For clockwise rotation signal 1 leads signal 2 approx 90°. Attend for the installing position the position pin (see drawing).



Installation and connecting information and trouble shooting, see separate leaflet.

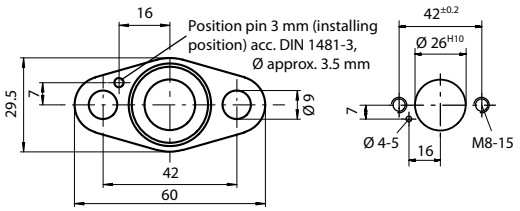
Technical Data

	Series FAHD5...	
Connection	Supply voltage	2 x U_{nom} 15 V_{DC}, range 8 ... 32 V_{DC} ±10% harmonic content
	Current consumption	2 x approx. 7 mA (max. 10 mA) @ 24V_{DC} + switching current (max. 20 mA)
	Reverse voltage protection	Integrated
	Over voltage protection	Integrated
Input	Measuring principle	2 x Difference-Hall-effect
	Frequency range	< 0.2 Hz ... 20,000 Hz
	Scan object	*Ferromagnetic toothed wheel*: m1-m3, tooth face width > 7 mm (spur gear DIN 867); *hole*: Ø > 5 mm, web > 2 mm, depth > 4 mm; *groove*: > 4 mm, web > 2 mm, depth > 4 mm
	Distance	0.2 ... max. 3 mm, recommended 1.0 mm ±0.5
Output	Output circuit	Push-pull output stage
	Output signal	2 x NORIS standard signal, square wave, level approx. U_{sup}, galvanically coupled with particular supply voltage
	Pulse duty factor	0.5 ±0.1 @ toothed wheel straight toothed DIN 867, 1.0 mm distance
	Phase offset	90° ±5% @ m1.5 ... m3; 90° ±15% @ m1 ... m1.25
	Output level	High: approx. U_{sup}-1.5 V @ 1 mA, U_{sup}-1.8 V @ 5 mA, U_{sup}-2.2 V @ 10 mA Low: approx. <0.5 V @ 1 mA, <0.8 V @ 5 mA, <1.2 V @ 10 mA
	Output resistance	Series resistance R_i: approx. 60 Ω
	Switching current	2 x NPN (SINK) 50 mA, PNP (LOAD) 20 mA, permanent short-circuit proof
	Rise time	≥ 10 V/µs
Environmental influences	Operating temperature	-40 °C ... +105 °C
	Climatic test	DIN IEC 60068-T2-1/-2/-30
	Storage temperature	Recommended -25 °C ... +70 °C (possible -40 °C ... +105 °C)
	Vibration resistance	DIN IEC 60068-T2-6: 10 g @ 5 ... 2,000 Hz (Sinus) DIN EN 61373: 30 g_{eff} @ 20 ... 500 Hz (Random)
	Shock resistance	DIN IEC 60068-T2-27/DIN EN 61373: 1,000 m/s² @ 6 ms
	Degree of protection	EN 60529: housing IP66/IP68; connection X IP67, connection XN/XP IP68
	ESD	IEC 61000-4-2: ± 6 kV/ContactD; ±8 kV/AirD
	HF-interference immunity	IEC 61000-4-3: 20 V/m f=80 MHz ... 2,500 MHz, 80% AM @ 1 kHz
	Burst	IEC 61000-4-4: ±2 kV/PowerL; ±2 kV/DataL
	Surge	IEC 61000-4-5: ±1 kV/DiffM (R_g=42 Ω); ±2 kV/ComM (R_g=42 Ω) ±0.5 kV/DiffM (R_g=2 Ω); ±1 kV/ComM (R_g=12 Ω)
	Conducted HF-interference	IEC 61000-4-6: 10 V_{eff} f=150 kHz ... 80 MHz, 80% AM @ 1 kHz
	Conducted LF-interference	IEC 60553: 10 V_{eff} 0.05 ... 10 kHz
	Interference emission	CISPR 16-1, 16-2: EMC2
	Insulation voltage	500 V_{AC}, 50 Hz @ 1 min
Mech. quantities	Material	Flange: aluminium chromalized, sensor tube: stainless steel
	Mounting	Mounting with flange housing
	Installation position	Preset with direction of rotation definition, with position pin defined
	Installation mode	Direction-sensitive
	Weight	Approx. 100 ... 300 g (dependent to connection and length)
Other	Pressure resistance	Measuring tip pressure-tight single-tested up to 5 bar
	Recommended cable length	1,000 m/1 kHz @ 0.5 mm² screened
Approvals	Approvals	CE
	Applied standards	DIN EN 50155, DIN EN 50121-3-2, DIN EN 61373
	Fire protection standard	DIN 5510

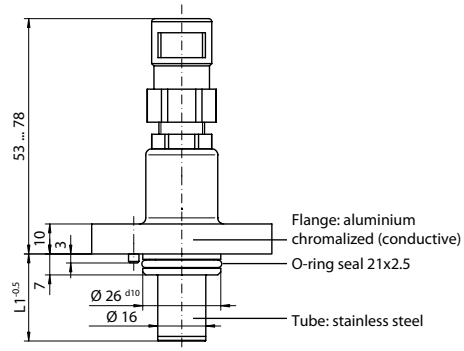
Dimensions, Connection, Diagram

Installation and Drill Layout

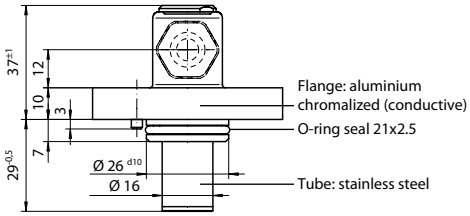
Recommended fixing:
Hexagon socket screw DIN 912 M8x20 with spring ring



Connection outlet straight: FAHD5-...-X...

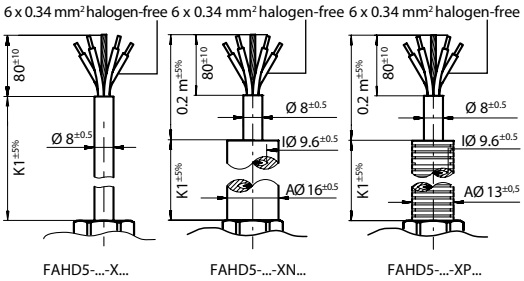


Connection outlet lateral: FAHD5-...-SX...

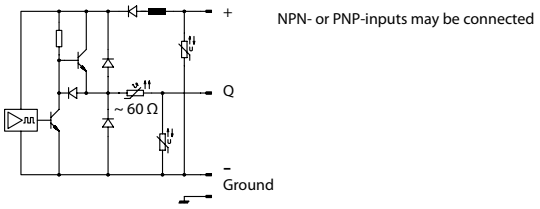


Electrical connection

1. Sensor unit: brown: +1, green: −1, white: Q1
2. Sensor unit: pink: +2, grey: −2, yellow: Q2



Elementary Circuit Diagram (push-pull output stage)



Type Code/Standard Variants

FAHD5	–	11		–	XP05	(–)		(e. g. FAHD5-11-XP05)
1		2	*		4	5	6	*Pos. 3 not applicable for series FAHD5...

1	Device and series (basic versions, other on customer request available)
FAHD5	Non-contacting speed sensor Dual difference Hall-effect principle (two galvanically isolated outputs) Series oval-flange aluminium chromalized, sensor tube stainless steel

2	Nominal length (drawing L1)
11	29 mm
12	57 mm

4	Connection outlet
without	*without code means:* straight
S	lateral

5	Electrical connection
X...	Cable jumper with jacketlength (drawing K1), halogen-free (Standard: X03=0.5 m; X05=2.0 m; X06=3.0 m; X07=5.0 m; X08=7.5 m; X09=10.0 m)
XN...	Cable jumper with jacketlength (drawing K1), halogen-free, with neoprene-protective tubing (Standard: X03=0.5 m; X05=2.0 m; X06=3.0 m; X07=5.0 m; X08=7.5 m; X09=10.0 m)
XP...	Cable jumper with jacketlength (drawing K1), halogen-free, with polyamid-protective tubing (Standard: X03=0.5 m; X05=2.0 m; X06=3.0 m; X07=5.0 m; X08=7.5 m; X09=10.0 m)

6	Module
without	*without code* means standard module: m2
M...	10=m1; 12=m1.25; 15=m1.5; 25=m2.5; 30=m3

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