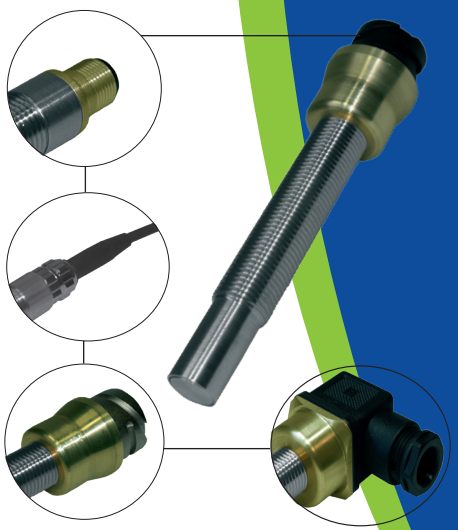
Non-contacting speed sensor with signal amplifier, difference Hall-effect principle

NORIS AUTOMATION

FAH12...

Speed Sensors

- **High grade speed sensor with rectangular-pulse signal output**
- **Threaded stainless steel sensor tube**
- **For ferromagnetic toothed wheels from module m2 (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 50 mA LOAD**
- **Indicator-LEDs for status indication**
- **High degree of EMC immunity for severe electrical environments**
- **Wide operating temperature range from -40 °C ... +105 °C**
- **Excellent vibration and shock resistance**
- **Face side is metal-enclosed**
- **Rugged construction, IP68 case tested for pressure-tightness at 5 bar**
- **Choice of lengths, screw-in threads and electrical terminations**



DNV · Lloyd's Register TYPE APPROVED · CE · ABS TYPE APPROVAL PROGRAM · Germanischer Lloyd

Non-contacting Speed Sensor of Series FAH12...

Method of operation of the speed sensor

Non-contacting speed sensors of the FAH12... series are basically designed for speed sensing. The rotation of ferromagnetic toothed wheels is sensed by means of a differential 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.

Details of the speed sensor

- 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
- Requirements of the classification societies many times far excelled
- Extensive electric snubber circuits integrated for protection
- Simple screw-in mounting by threaded sensor tube
- Up to 10 signal-processing NORIS devices can be connected
- Suitable measuring transducers and limit-value switches are available

Output of the speed sensor

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.

Differential-Hall-effect principle of the speed sensor

The measuring element is a differential 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 1.5 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 differential Hall-effect principle is direction-sensitive.

Indicator-LEDs of the speed sensor

For monitoring the operating status easily two indicator LEDs are integrated. The green LED will be lit when the supply voltage is applied. The orange output-LED will be lit when the signal Q is „high“. Slow speed levels are shown with bright „flickering“ of the output-LED. With faster speed levels the „flickering“ will merge to steady burning light.

Installation and connecting information and trouble shooting, see separate leaflet

Technical Data

	Series FAH12...	
General	Supply voltage	U_{nom} 24 V/DC, range 8 ... 32 V/DC ±10% harmonic content
	Current consumption	Approx. 10 mA @ 24V/DC + switching current (max. 50 mA)
	Reverse voltage protection	Integrated
	Over voltage protection	Integrated
Input	Measuring principle	Difference Hall-effect
	Frequency range	< 0.2 Hz ... 20,000 Hz
	Scan object	Ferromagnetic toothed wheel: >m2, tooth face width >5 mm (spur gear DIN867); 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 1.5 mm ±0.5
Output	Output circuit	Push-pull output stage
	Output signal	NORIS standard signal, square wave, level approx. U_{sup}, galvanically coupled with supply voltage
	Output level	High: approx. U_{sup} -0.8 V @ 1 mA, U_{sup} -1.2 V @ 5 mA, U_{sup} -1.6 V @ 10 mA Low: approx. U_{sup} +0.2 V @ 1 mA, U_{sup} +0.5 V @ 5 mA, U_{sup} +0.9 V @ 10 mA
	Output resistance	Series resistance R_i: 60 Ω
	Switching current	NPN (SINK) 50 mA, PNP (LOAD) 50 mA, permanent short-circuit proof
	Rise time	≥ 10 V/µs
Environmental influences	Operating temperature	-40 ... +105°C
	Climatic test	DIN IEC 60068-T2-1/-2/-30
	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: 1,000 m/s² @ 6 ms
	Degree of protection	EN 60529: housing IP66 / IP68; connection A IP65, connection C/E/H/X IP67
	ESD	IEC 61000-4-2: ± 6 kV/CD; ±8 kV/AD
	HF-interference immunity	IEC 61000-4-3: 10 V/m f=80 MHz ... 2,000 MHz, 80% AM @ 1 kHz
	Burst	IEC 61000-4-4: ±2 kV/PL; ±1 kV/DL
	Surge	IEC 61000-4-5: ±0.5 kV/DM (R_g=2 Ω); ±1 kV/DM (R_g=42 Ω); ±1 kV/CM (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: 3 V_{eff} 0.05 ... 10 kHz
	Interference emission	CISPR 16-1, 16-2: EMC2
	Insulation voltage	500 V/AC, 50 Hz @ 1 min
Other	Storage temperature	Recommended -25 ... +70 °C (possible -40 ... +105 °C)
	Mounting	Screw-in by threaded sensor tube
	Pressure resistance	Measuring tip pressure-tight single-tested up to 5 bar
	Electrical connection	See drawing
	Recommended cable length	1,000 m / 1 kHz @ 0.5 mm² screened
	Installation position	Any
	Installation mode	Direction-sensitive
	Material	Adapter: aluminium chromalized, sensor tube: stainless steel
	Weight	Approx. 100 ... 300 g (dependent to connection and length)
	Approvals	CE; ABS, DNV, GL, LR

Type Key / Standard Variants

FAH12	–	02	15	–	X03	(-)		(FAH12-0215-X03)
1		2	3		*5		*	*Pos. 4, 6 not applicable for series FAH12...

1	Device and series (basic versions, other on customer request available)
FAH12	Non-contacting speed sensor, difference Hall-effect principle, series cylindric with threaded stainless steel sensor tube, plug socket and sensor socket aluminium chromalized, electronic integrated in sensor tube

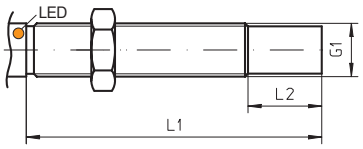
2	Nominal length (drawing L1, L2)
02	L1=60 mm, L2=5 mm
03	L1=80 mm, L2=5 mm
04	L1=100 mm, L2=20 mm
05	L1=120 mm, L2=40 mm

3	Thread type (drawing G1)
15	M18x1
23	M18x1,5
88	5/8“ - 18 UNF

5	Electrical connection
A	DIN43650-A pin connector, 3 terminals + PE (solenoid valve 30 x 30)
C	Mil 14-5PN VG95234 pin connector, 5 terminals
E	EURO M12x1, pin connector, 5 terminals, contact gold-plated
H1	DIN72585 Bajonette pin connector, 4 terminals, coding 1 (BK)
X..	Cable jumper with jacketlength (drawing K1) (standard: X03=0.5m; X05=2.0m; X06=3.0m; X07=5.0m; X08=7.5m; X09=10.0m)

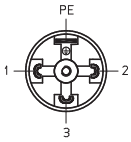
Dimensions, Connection, Diagram

Sensor tube

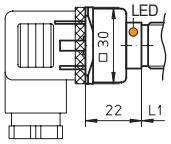


Terminal DIN43650 A: type FAH12-xxxx-A

Supplied with female connector

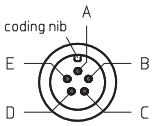


1: +
2: -
3: Q
PE: GROUND

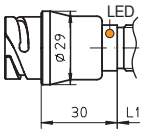


Terminal Mil 14-5PN: type FAH12-xxxx-C

Supplied without female connector (accessory set ZL4-1A)

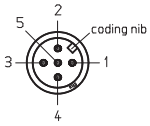


A: GROUND
B: -
C: Q
D: Q
E: +

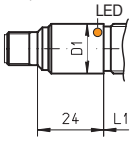


Terminal Euro M12x1: type FAH12-xxxx-E

Supplied without female connector (accessory set ZL4-2A)

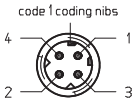


1: + (brown)
2: unassigned
3: - (blue)
4: Q (black)
5: GROUND (grey)



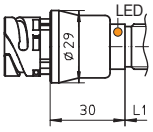
Terminal DIN72585 Bajonette: type FAH12-xxxx-H

Supplied without female connector (accessory set ZL4-5)



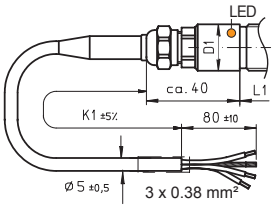
1: +
2: -
3: Q
4: GROUND

Optional with degree of protection IP69K

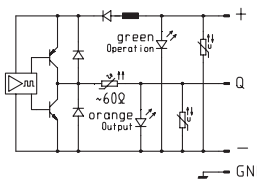


Terminal cable jumper: type FAH12-xxxx-X

brown: +
green: -
white: Q
Shielding: GROUND

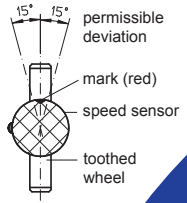


Elementary circuit diagramm (push-pull output stage)



NPN- or PNP inputs may be connected.

Mounting position



NORIS AUTOMATION

NORIS Automation GmbH
Muggenhofer Strasse 95
90429 Nürnberg
GERMANY

Tel.: +49 911 3201-0
Fax: +49 911 3201-150
info@noris-automation.com
www.noris-automation.com

en_V01.00 - 05/2010
Changes reserve