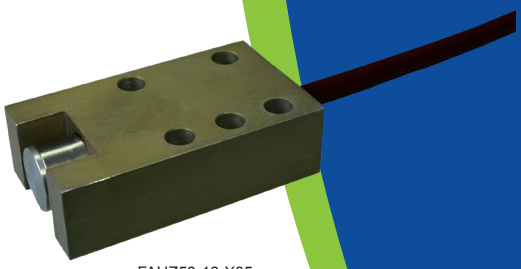
Non-contacting two-channel speed pick-up with signal amplifier, difference Hall-effect principle

NORIS AUTOMATION

FAHZ53...

Speed sensors

- For harsh conditions in rail transport, shipbuilding and industry
- High-grade speed pick-up with rectangular-pulse signal output
- Stainless steel sensortube
- 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



FAHZ53-13-X05

CE

Non-contacting speed pick-up of series FAHZ53...

Method of operation of the speed pick-up

Non-contacting speed pick-ups of the FAHZ53... 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 pick-ups 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 a second sensor system is integrated. 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 of the speed pick-up

- 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 and safe mounting by flange
- Up to 10 signal-processing NORIS devices can be connected
- Suitable measuring transducers and limit-value switches are available

Output of the speed pick-up

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 150 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.

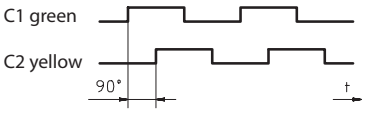
Differential-Hall-effect principle of the speed pick-up

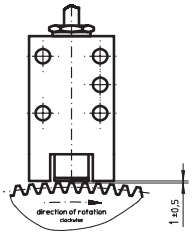
The measuring element is a differential Hall-effect sensor chip with a permanent magnet mounted. Two closely spaced Hall elements are located on the sensor chip (2.5 mm apart). The field of the magnet generates a constant voltage in the Hall elements. Ferromagnetic objects with an interrupted surface 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 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.

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 seperate leaflet

Technical Data

	Series FAHZ53...	
General	Supply voltage	U_{nom} 15 V/DC, range 8 ... 24 V/DC (29 V/DC) ±10% harmonic content
	Current consumption	Approx. 14 mA (max. 20 mA) @ 24V/DC + switching current (max. 2 x 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 gear: m1-m3, tooth face width >7 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 1.0 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 supply voltage
	Pulse duty factor	0.5 ±0.1 @ toothed wheel streight toothed DIN867
	Phase offset	90° ±5% @ m1.5 ... m3; 90° ±15% @ m1 ... m1.25
	Output level	High: approx. U_{sup}-2.0 V @ 1 mA, U_{sup}-2.5 V @ 5 mA, U_{sup}-3.5 V @ 10 mA Low: approx. U_{sup}+1.2 V @ 1 mA, U_{sup}+1.8 V @ 5 mA, U_B+2.6 V @ 10 mA
	Output resistance	Series resistance R_i: 150 Ω
	Switching current	NPN (Sink) 50 mA, PNP (Load) 20 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/DIN EN61373: 1,000 m/s² @ 6 ms
	Degree of protection	EN 60529: housing IP66 / IP68; connection X IP67
	ESD	IEC 61000-4-2: ± 6 kV/CD; ±8 kV/AD
	HF-interference immunity	IEC 61000-4-3: 20 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: 10 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	Mounting with flange housing
	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	Preset with direction of rotation definition, with position pin defined
	Installation mode	Direction-sensitive
	Material	Flange: aluminium chromalized, sensor tube: stainless steel
	Weight	Approx. 100 ... 300 g (dependent to connection and length)
	Approvals	CE
	Applied standards	DIN EN 50155, DIN EN 50121-3-2, EN 61373
	Fire protection standard	DIN 5510

Type key / Standard variants

FAHZ53	–	13		–		X05	(–)		(FAHZ53-13-X05)
1		2	*		*	5		6	*Pos.3, 4 not applicable for series FAHZ53...

1	Device and series (basic versions, other on customer request available)
FAHZ53	Non-contacting speed pick-up, Two-channel difference Hall-effect principle (two galvanically connected outputs), Series ‚ALSTOM'-Block-flange aluminium chromalized, sensortube stainless steel

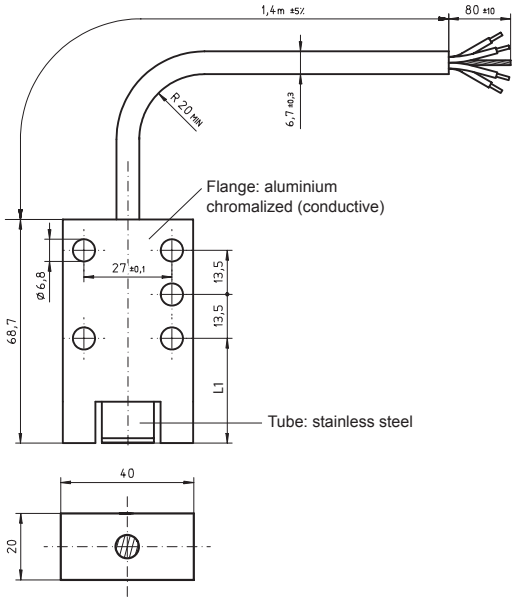
2	Nominal length (drawing L1)
13	32,2 mm

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

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

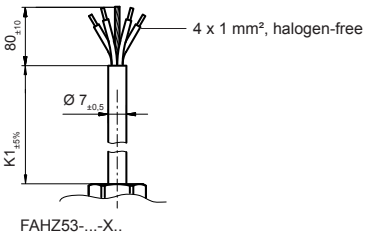
Dimensions, Connection, Diagram

Installation and drill layout



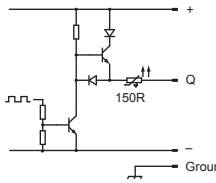
Electrical connection

red: +, blue: -, green: C1, yellow: C2, shielding: GROUND



FAHZ53-...-X..

Elementary circuit diagramm (push-pull output stage)



NPN or PNP inputs may be connected

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