

# Non-contacting speed pick-up with signal amplifier, differential Hall-effect principle



FA2H..

Speed sensors

- High-grade speed pick-up with rectangular-pulse output signal
- For use in conjunction with ferromagnetic toothed wheels from module m2 up
- Frequency range from < 0.2 Hz to 20,000 Hz
- Senses very low speeds (near-zero-speeds) with wide pulse distance
- Unaffected by out-of-true errors, vibrations, and electric motor magnet fields
- Open-collector NPN- or PNP-output, to be combined as push-pull output stage
- Loadable with 50 mA SINK and 50 mA LOAD
- Mounting position direction-sensitive
- Highest EMI immunity for extremely severe electrical environments
- Wide operating temperature range from -25 °C ... +100 °C
- Elevated pole-piece temperature up to +145 °C (+175 °C for short time)
- Pick-up pole-piece is metal-enclosed
- Rugged construction, IP68 case tested for pressure-tightness at 5 bar
- Choice of lengths, screw-in threads, and electrical terminations



Germanischer Lloyd

## Non-contacting speed pick-up of series FA2H..

### Method of operation of FA2H.. speed pick-up

Non-contacting speed pick-ups of the FA1H.. series are primarily 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.

### Details of FA2H.. speed pick-up

- Inputs may be generated by ferromagnetic toothed wheels, bolt heads, lands - Detects holes, openings, grooves in ferromagnetic parts
- Wear and maintenance-free due to contactless sensing
- Wide temperature range through use of high-grade automotive-class components
- Signal amplifier incorporated in temperature-reduced square head
- Resistant to oil spray and lubricants, even at elevated temperatures
- Extensive electric snubber circuits integrated for protection
- Simple screw-mounting by threaded pick-up body
- Up to 10 signal-processing NORIS devices can be connected
- Suitable measuring transducers and limit-value switches are available

### Output of FA2J.. speed pick-up

The output signal is a noise-immune rectangular-pulse signal whose frequency is proportional to speed. The voltage range is with-in 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 an *open-collector* stage with 10kΩ load resistance integrated. Short circuit protection is provided by a 130 Ω NTC-resistor. Spurious pulses against ground (case) are intercepted by a varistor. Optionally, the NPN output (current sinking), or the PNP output (current sourcing) may be used. Both outputs can be connected to a push-pull stage. The output voltage is electrically connected with the load voltage.

In the case of types with termination to DIN43650-A, only the NPN-output is provided. A PNP-version is available by special request.

### Differential-Hall-effect principle of FA2H.. 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.

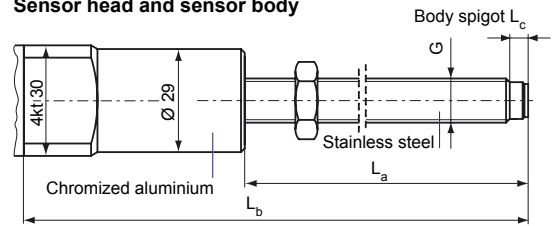
The Hall-effect principle is independent of the speed of movement (static) and it would be possible to sense "standstill". For improved noise immunity, the measuring signal is dynamically decoupled whereby the lower limit frequency is increased to < 0.2 Hz. The upper limit frequency is determined by sensor-internal characteristics. This results in a range of application from approx. 0.2 Hz to 20,000 Hz. The differential Hall-effect principle is direction-sensitive.

## Technical Data

Series FA2H..	
Operating voltage	$U_o=10 \dots 32 \text{ V/DC}$ , $U_R=24 \text{ V/DC}$
Ripple	$< 5\% U_o$
Reverse voltage protection	Integrated
Overvoltage	2.5 times $U_R$ up to 2 ms
Voltage drops	100% up to 10 ms
Power consumption without Load	Approx. 15 mA (24 V/DC) + switching current
Measuring principle	Differential Hall-effect
Frequency range	$< 0.2 \text{ Hz}$ up to 20,000 Hz
Scannable objects	Ferromagnetic materials in motion: toothed wheels $> m2$ , holes $\varnothing > 4 \text{ mm}$ / $d > 4 \text{ mm}$ , webs and grooves $w > 4 \text{ mm}$
Air gap	0.2 ... 3 mm
Output circle	NPN- or PNP <i>open-collector</i> with integrated load resistance Push-pull output stage by switching NPN- and PNP output together
Output signal	Rectangular-pulse electrically connected with the operating voltage
Output resistance	Series resistance: 130 $\Omega$ , cross resistance: 10 k $\Omega$
Output level	High: ca. $U_o - 2.0 \text{ V} / 1 \text{ mA}$ , $U_o - 2.5 \text{ V} / 5 \text{ mA}$ , $U_o - 3.5 \text{ V} / 10 \text{ mA}$ Low: ca. $+1.2 \text{ V} / 1 \text{ mA}$ , $+1.8 \text{ V} / 5 \text{ mA}$ , $2.6 \text{ V} / 10 \text{ mA}$
Output current	NPN (Sink) 50 mA, PNP (Load) 50 mA, permanent-short-circuit proof
Rise time	$\geq 10 \text{ V}/\mu\text{s}$
Recommended cable length	1,000 m / 1 kHz @ 0.5 mm <sup>2</sup> screened
Vibration resistance	DIN IEC60068-T2-6 4g @ 25 ... 100 Hz, amplitude 1.6 mm @ 2 ... 25 Hz
Shock resistance (impact)	DIN IEC60068-T2-27 300 m/s <sup>2</sup> @ 18 ms
Climatic test	DIN IEC60068-T2-1/-2/-30
Operating temperature	Sensor head: $-25 \text{ }^\circ\text{C} \dots +100 \text{ }^\circ\text{C}$ Measuring tip: $-25 \text{ }^\circ\text{C} \dots +145 \text{ }^\circ\text{C}$ (for short time up to $+175 \text{ }^\circ\text{C}$ )
Shelf temperature	$-45 \text{ }^\circ\text{C} \dots +85 \text{ }^\circ\text{C}$
Humidity	RH 96% maximum
Insulation test	$> 60 \text{ V}$ (Protection devices)
ESD	IEC61000-4-2 +/- 8 kV
Electromagnetic field	IEC61000-4-3 10 V/m $f=10 \text{ kHz} \dots 2000 \text{ MHz}$ , 80% AM @ 1 kHz
Burst	IEC61000-4-4 +/- 2 kV supply +/- 1 kV sensor
Surge	IEC61000-4-5 sym. +/- 1 kV ( $R_f = 2 \Omega$ ) asym. +/- 2 kV ( $R_f = 12 \Omega$ )
HF-susceptibility	IEC61000-4-6 3 V <sub>pp</sub> $f=10 \text{ kHz} \dots 100 \text{ MHz}$ , 80% AM @ 1 kHz
NF-susceptibility	IEC60553 3 V <sub>pp</sub> 0.05 ... 10 kHz
Interference field intensity	Basis CISPR 16-1, 16-2 reduced characteristic
Protection class	Housing: DIN EN60529 IP68 pressure-tightness up to 5 bar Connection: DIN EN60529 FA2J-A...: IP65, FA2J-C... and FA2J-E...: IP67
Pressure resistance	Measuring tip up to 5 bar
Mounting	Screw-in by threaded pick-up body
Installed position	Any
Installed wise	Direction-sensitive
Material	Head: chromized aluminium, body: stainless steel
Weight	Approx. 100 ... 300 g (decided by connection and length)
Standard supply	CE requirements complied with, approved by GL, LR, ABS, DNV, BV (up to 145 mm)

## Other Data

### Sensor head and sensor body



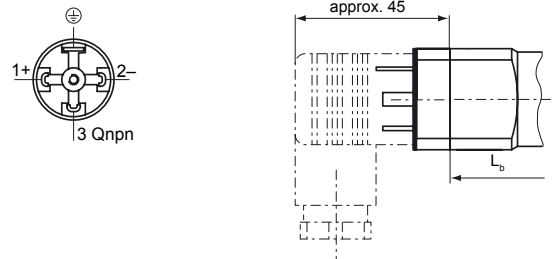
### Preferred dimensions: Body length $L_a$ in mm

- Add  $L_a$  to type code
- Bodies between 30 mm and 200 mm
- Up to 500 mm possible in some cases
- As the length increases, sensors are liable to be subjected to vibrations. We recommend lengths up to 145 mm.

$L_a$	$L_b$	$L_c$
70	135	5
90	155	25
115	180	15
125	190	70
145	210	90

### FA2.-A-.. Termination: DIN43650-A

Supplied with female connector.



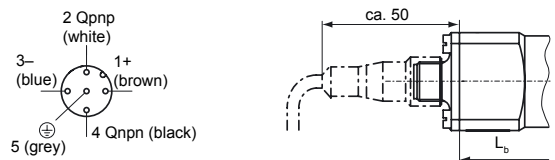
### FA2.-C-.. Termination: Cannon 14-5PN VG95234

Delivered without female connector, use accessories ZL4-1A.



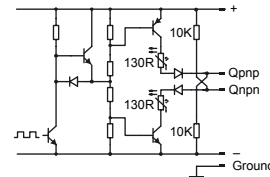
### FA2.-E-.. Termination: Euro M12x1

Delivered without female connector, use accessories ZL4-2A.



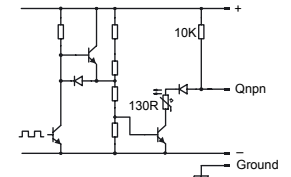
### Elementary circuit diagram

#### FA2.-E-.. and FA2.-C-..



Output *open-collector* current-sinking or current-sourcing or push-pull output stage

#### FA2.-A-..



Output *open-collector* current-sinking

## Type key / variants

Device codes					
FA	Non-contacting speed pick-up				
Type series					
2	Type with aluminium head and threaded body, body material stainless steel				
Measuring principle					
H	Differential Hall-effect				
Tube thread (others by inquiry)					
2	M12x1,25	3	M16x1,5	4	M18x1
5	M18x1,5	8	G 1/4	10	5/8 " 18 UNF
Electrical connection					
A	DIN43650-A pin connector, 3 terminals + PE (solenoid valve 30 x 30)				
C	Cannon 14-5PN VG95234 pin connector, 5 terminals				
E	EURO M12 x 1, pin connector, 5 terminals, gold-plated				
Tube length ( $L_a$ )					
...	According to customer requirements from 30 mm up to approx. 500 mm Preferred length: 70, 90, 115, 125, 145 (see table)				

FA 2 H -5 A -70 (FA2H-5A-70)



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