Non-contacting two-channel speed sensor FA52 with stainless steel flange housing and sensor tube

Scan type	Non-contacting
Measuring principle	**FAH[..]52:** Difference-hall-effect principle **FAW[..]52:** Eddy current principle
Frequency range	**FAH[..]52:** 0.2 ... 20,000 Hz **FAW[..]52:** 0.2 ... 25,000 Hz
Supply voltage	9 ... 32 VDC
Scan object	**FAH[..]52:** Ferromagnetic materials only **FAW[..]52:** Electrically conductive materials (e. g. aluminium)
Protection class	Housing: IP66/IP68/IP69 Connection: IP66/IP68; Only -XGT and -XGS: IP69
Material	Sensor tube: Stainless steel
Length	See drawing
Mounting	Flange mounting
Measuring channels	2 measuring channels
Output signals and signal form	2 square wave signals or 2 square wave signals + 1 status signal or 2 square wave signals + 2 inverted square wave signals
Output stage	Push-pull amplifier
Options	Inverted output signals; galvanically isolated output signals; status signal for direction of rotation detection

CE

Speed Sensor FA52

Application range

Speed sensors type series FA[..]52 are especially designed for use in transport technology and machinery and equipment. Speed sensors type FA**H**52 measure the speed of ferromagnetic (e. g. steel), and type FA**W**52 of electrically conductive toothed wheels (e. g. aluminium). Furthermore, they can be used to measure any movement of ferromagnetic or electrically conductive materials, e. g.:

- Toothed wheels with different tooth forms
- Bolt heads
- Lands detects holes, openings or grooves
- Impulse bands for plain shafts (accessories)

Specific features

- Type FAW[..]:Without magnetic preload and thus, no accumulation of metal chips
- Type FAW[..]:Scanning of all electrically conductive materials (steel or aluminium)
- Excellent vibration and shock resistance and double protection of the sensor head
- Robust and high quality housing: IP69 pressure-tight and individually tested at 5 bar (for details see technical data)
- Connection outlet straight or lateral; with protective tubing on request
- Due to its design and type approval according to DIN EN 50155 especially suitable for transport technology

Measuring principle

Speed sensors of the FA[..]52 series operate according to different measuring principles, depending on the sensor type:

Eddy current principle (FAW52)

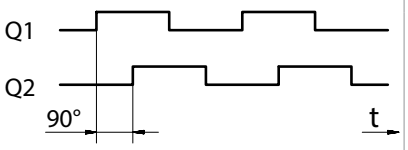
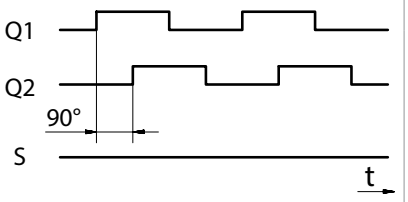
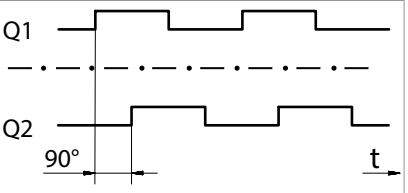
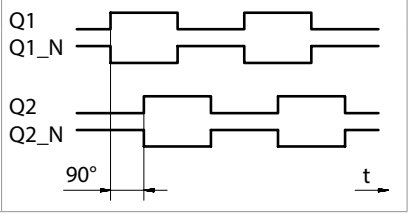
A coil with a high frequency alternating current supply is integrated in the sensor head. An electromagnetic field is produced with its field lines emitted from the sensor surface. Eddy currents are induced as the electrically conductive scanning object moves past the sensor face. These eddy currents in the scan object create a magnetic field opposing the coil field of the sensor. As a result, a voltage is detected on the sensor coil and analysed.

Difference-hall-effect principle (FAH52)

Two closely spaced Hall elements are located on the sensor chip. 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). The difference-hall-effect principle is direction sensitive.

Overview speed sensors FA[..]52

Except otherwise specified, the sensors in the next table have voltage signal outputs.

Type	Measuring principle	Signal outputs	Signal form
FAWZ52	Eddy current	Two square wave signals, Q2 to Q1 is 90° phase shift	
FAHZ52	Difference-hall		
FAWS52	Eddy current	Two square wave signals + status signal for rotation direction detection, Q2 to Q1 is 90° phase shift	
FAHS52	Difference-hall		
FAWD52	Eddy current	Two square wave signals, galvanically isolated, Q2 to Q1 is 90° phase shift, type FAHD52, FAWD52 with voltage signal output, type FAHI52 with current signal output	
FAHD52	Difference-hall		
FAHI52			
FAWQ52	Eddy current	Two + Two inverted square wave signals, Q1 to Q2 and Q1_N to Q2_N are 90° phase shift	
FAHQ52	Difference-hall		

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Dimensions, connections and drawings

Dimensions and mounting drawing

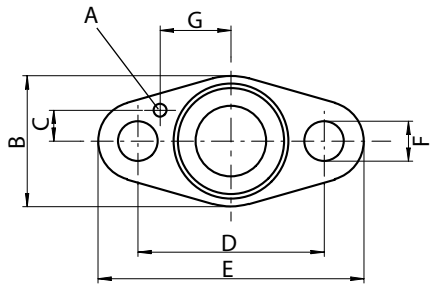

Fig.: FA[..]52_Front View_Dimensions

Explanation to the left illustration

A) Position pin 3 mm (installing position) acc. DIN1481-3
B) Length 29 mm
C) Length 7 mm
D) Length 42 mm
E) Length 60 mm
F) Diameter Ø $9^{-0.5}$ mm
G) Length 16 mm

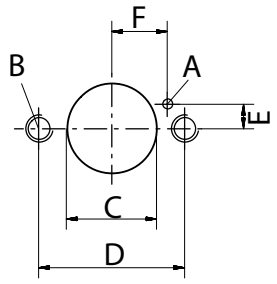

Fig.: Borehole for FA[..]52_Top view

Explanation to the left illustration

A) Borehole depth for position pin 3 mm (installing position) acc. DIN1481-3, borehole diameter Ø 4 to 5 mm
B) Borehole size M8-15
C) Diameter Ø 26^{H10} mm
D) Length $42^{\pm 0.2}$ mm
E) Length 7 mm
F) Length 16 mm

Recommended fixing: Hexagon socket screw DIN912 M8x20 with spring ring.

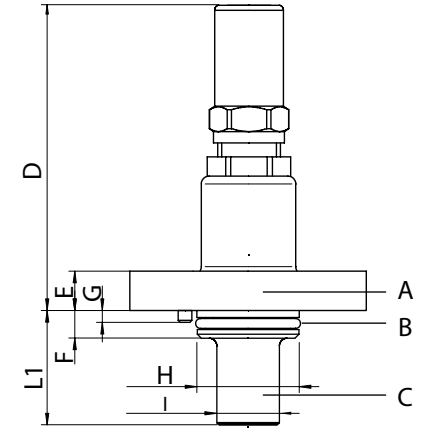

Fig.: FA[..]52_Straight connection outlet

Explanation to the left illustration

A) Flange: Stainless steel
B) O-ring 21 x 2.5 mm
C) Sensor tube: Stainless steel
D) Length 53…78 mm (depending from connection)
L1) Nominal length L1 (see type code)
E) Length 10 mm
F) Length 7 mm
G) Length 3 mm
H) Diameter 26^{d10} mm
I) Diameter 16 mm

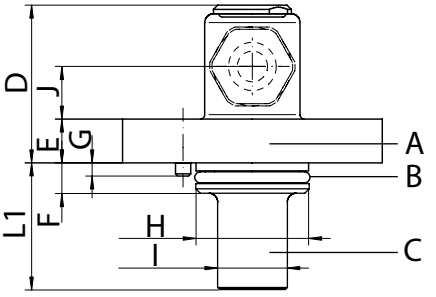

Fig.: FA[..]52_lateral connection outlet

Explanation to the left illustration

A) Flange: Stainless steel
B) O-ring 21 x 2.5 mm
C) Sensor tube: Stainless steel
D) Length $37^{\pm 1}$ mm
L1) Nominal length L1 (see type code)
E) Length 10 mm
F) Length 7 mm
G) Length 3 mm
H) Diameter 26^{d10} mm
I) Diameter 16 mm
J) Length 12 mm

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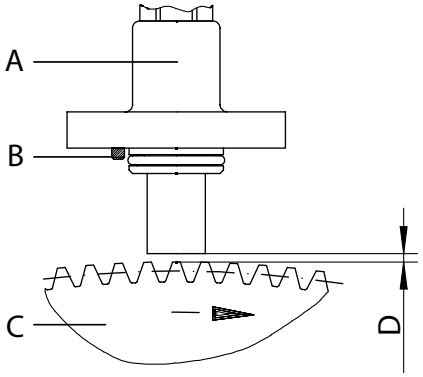
Mounting position and scan object distance



Explanations to the left illustration

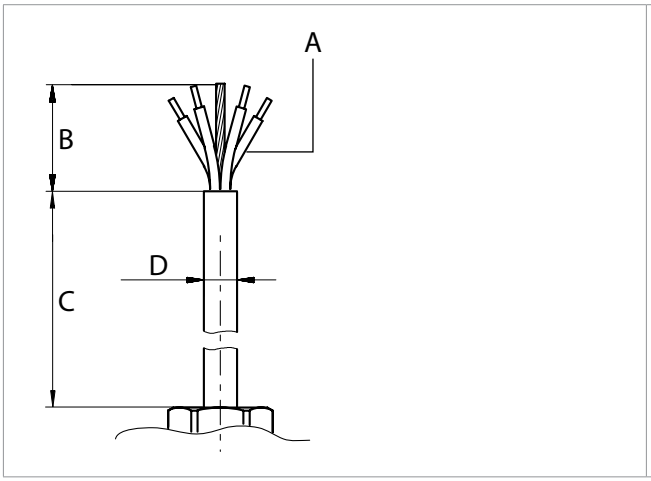
A) Sensor housing
B) Position pin for correct mounting position
C) Tooth Wheel
D) Recommended distance from scanning see technical data

Connection cables and pin assignment

The following table shows an overview about the speed sensors and the related connection cables. All cables are available without protective tubing (-X type), with textile reinforced protective tubing (-XGT type), with steel reinforced protective tubing (-XGS type) or with polyamide protective tubing (-XP).

Connection type -X, -XGS, -XP	FAHZ52 FAWZ52 FAHI52	FAHS52 FAWS52	FAHD52 FAWD52	FAHQ52 FAWQ52
Cable with 4 wires	X	-	-	-
Cable with 6 wires	-	X	X	X

Connection cable type -X for sensors with 4 connecting wires



Explanation to the left illustration

A) Wires 4 x 0.33 mm^2 halogen-free
B) Length 80 $^{\pm 10}$ mm
C) Length K1 ± 5% (K1 see customer drawing)
D) Diameter 7 $^{\pm 0.5}$ mm

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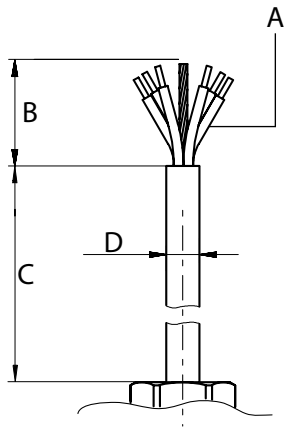
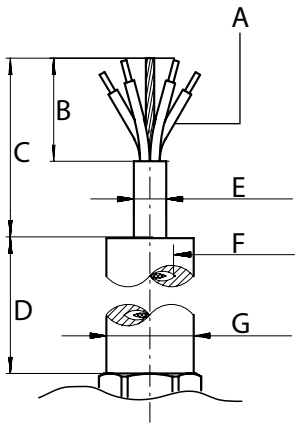
Connection cable type -X for sensors with 6 connecting wires



Explanation to the left illustration

A) Wires 6 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length K1 ± 5% (K1 see customer drawing)
D) Diameter 7 ±0.5 mm

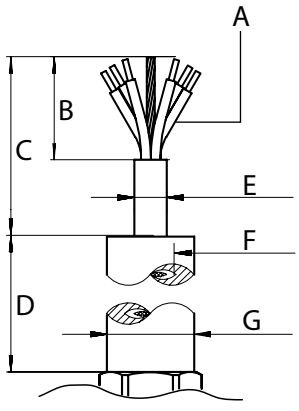
Connection cable type -XGS[..], -XGT[..] (protective tubing steel or textile reinforced) for sensors with 4 connecting wires



Explanation to the left illustration

A) Wires 4 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length 200 ±20 mm
D) Length K1 ± 5% (K1 see customer drawing)
E) Diameter 4.6 ±0.5 mm
F) Inner diameter 6.4 ±0.5 mm
G) Outer diameter 13.5 ±0.7 mm

Connection cable type -XGS[..], -XGT[..] (protective tubing steel or textile reinforced) for sensors with 6 connecting wires



Explanation to the left illustration

A) Wires 6 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length 200 ±20 mm
D) Length K1 ± 5% (K1 see customer drawing)
E) Diameter 7 ±0.5 mm
F) Inner diameter 9.5 ±0.5 mm
G) Outer diameter 16.5 ±0.5 mm

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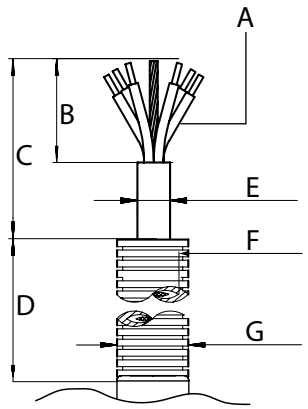
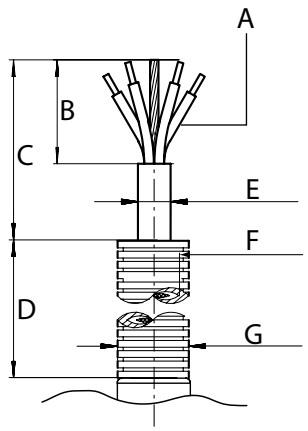
Connection cable type -XP[..] (polyamide protective tubing) for sensors with 6 connecting wires



Explanation to the left illustration

A) Wires 6 x 0.33 mm² halogen-free
B) Length 80 $^{\pm 10}$ mm
C) Length 200 $^{\pm 20}$ mm
D) Length K1 ± 5% (K1 see customer drawing)
E) Diameter 7 $^{\pm 0.5}$ mm
F) Inner diameter 9.6 $^{\pm 0.5}$ mm
G) Outer diameter 13 $^{\pm 0.5}$ mm

Connection cable type -XP[..] (polyamide protective tubing) for sensors with 4 connecting wires



Explanation to the left illustration

A) Wires 4 x 0.33 mm² halogen-free
B) Length 80 $^{\pm 10}$ mm
C) Length 200 $^{\pm 20}$ mm
D) Length K1 ± 5% (K1 see customer drawing)
E) Diameter 7 $^{\pm 0.5}$ mm
F) Inner diameter 9.6 $^{\pm 0.5}$ mm
G) Outer diameter 13 $^{\pm 0.5}$ mm

Connection assignment for type FA[..]Z

Colour	Explanation
Brown	U_S +
Green	U_S - (0V)
White	Signal Q1
Yellow	Signal Q2
Shielding	Ground

Connection assignment for type FA[..]I

Colour	Explanation
Brown	Sensor 1: U_{S1} +
Green	Sensor 2: U_{S2} +
White	Signal Q1
Yellow	Signal Q2
Shielding	Ground

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Connection assignment for type FA[..]S

Colour	Explanation
Brown	U_S +
Green	U_S - (0V)
White	Signal Q1
Yellow	Signal Q2
Grey	Status output for direction of rotation detection
Pink	NC
Shielding	Ground

Connection assignment for type FA[..]D

Colour	Explanation
Brown	Sensor 1: U_{S1} +
Green	Sensor 1: U_{S1} - (0V)
White	Sensor 1: Signal Q1
Pink	Sensor 2: U_{S2} +
Grey	Sensor 2: U_{S2} - (0V)
Yellow	Sensor 2: Signal Q2, 90° phase shift to Q1
Shielding	Ground

Connection assignment for type FA[..]Q

Colour	Explanation
Brown	U_S +
White	Q1
Grey	Q1_N, inverted to Q1
Yellow	Q2, 90° phase shift to Q1
Pink	Q2_N inverted to Q2, 90° phase shift to Q1_N
Green	U_S - (0V)
Shielding	Ground

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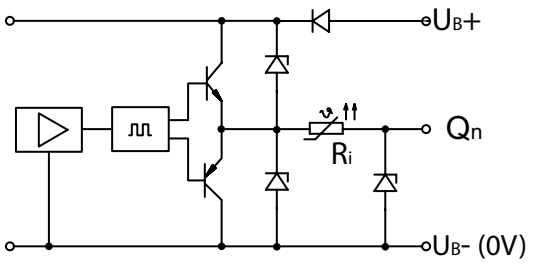
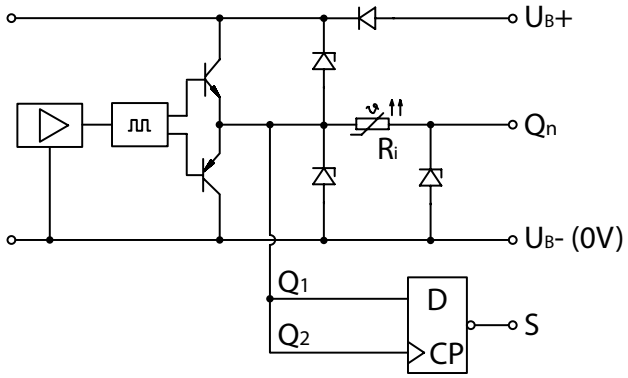
Electrical connection – Elementary circuit diagrams

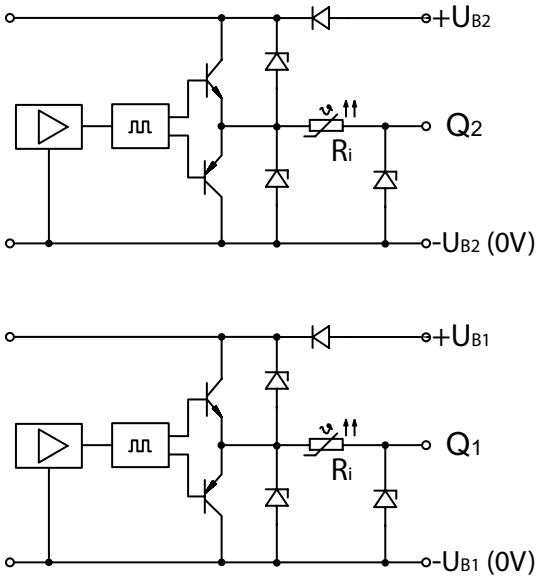
Elementary circuit diagram FA[..]Z



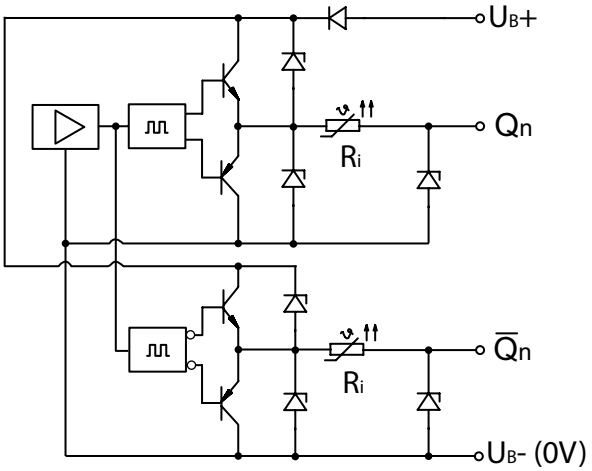
Elementary circuit diagram FA[..]S



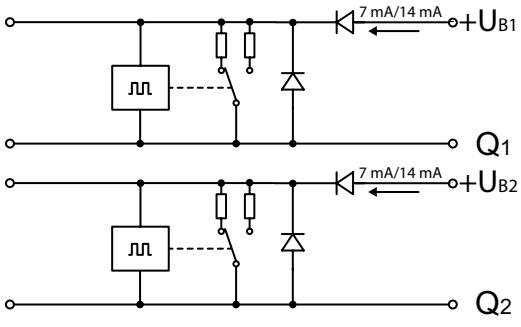
Elementary circuit diagram FA[..]D



Elementary circuit diagram FA[..]Q



Elementary circuit diagram FA[..]I



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General technical data

Electrical connection	
Supply voltage	*See specific technical data*
Nominal voltage	*See specific technical data*
Current consumption	*See specific technical data*
Reverse voltage protection	Yes
Over voltage protection	Yes
Connection	Cable end, customized connections acc. customer drawing
Recommended cable length	< 100 m
Used cable cross section	0,33 mm^2, shielded

Electrical output	
Measuring channels	*See specific technical data*
Output signals and signal form	*See specific technical data*
Output stage	Push-pull amplifier
Continuous short circuit prot.	Yes
Galvanic separation	*See specific technical data*
Output level Low	Sensors with voltage signal output: Per output: ≤ 0.8 V @ 15 VDC, 10 mA, 24 °C Sensors with current signal output: Per output: 7 mA +/- 2 mA @ 15 VDC, RL = 475 Ω, 24°C
Output level High	Sensors with voltage signal output: Per output: ≥ UB-1.6 V @ 15 VDC, 10 mA, 24 °C Sensors with current signal output: Per output: 14 mA +/- 2 mA @ 15 VDC, RL = 475 Ω, 24°C
Output current (Sink)	Per output: max. -50 mA
Output PNP (Load)	Per output: max. 50 mA
Internal resistance	Sensors with voltage signal output: 45 Ω
Rise time	≥ 10 V/µs

Signal acquisition	
Measuring principle	*See specific technical data*
Frequency range	*See specific technical data*
Scan object - distance	*See specific technical data*
Scan object	*See specific technical data*
Duty cycle	FAH[..] type: 50% ± 10% FAW[..] type: 50% ± 25%
Phase-shift	*See specific technical data*

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Environmental influences	
Operating temperature	Sensors with voltage signal output: -40 ... +120 °C Sensors with current signal output: -40 ... +100 °C
Storage temperature	Sensors with voltage signal output: Recommended: -25 ... +70 °C; max.: -40 ... +105 °C (max. limit values within 30 days per year @ relative humidity 5...95%) Sensors with current signal output: Recommended: -25 ... +70 °C; max.: -40 ... +100 °C (max. limit values within 30 days per year @ relative humidity 5...95%)
Protection class	Housing: IP66/IP68/IP69 Connection: IP66/IP68; Only -XGT and -XGS: IP69
Vibration resistance	DIN IEC 60068-T2-6, 10 g @ 5…2000 Hz (Sinus) DIN EN 61373, 30 g @ 20…500 Hz (Random)
Shock resistance	DIN IEC 60068-T2-27, 1000 m/s^2 @ 6 ms
Climatic test	DIN IEC 60068-T2-1/-2/-30
EMI - ESD	IEC 61000-4-2, Lev. 3
EMI - Burst	IEC 61000-4-4, Lev. 3
EMI - Surge	IEC 61000-4-5, Lev. 2
EMI - HF immunity	IEC 61000-4-3, 20 V/m (80 ... 2100 MHz), 10V/m (2.1 ... 2.7 GHz), 3V/m (5.1 ... 6 GHz) IEC 61000-4-6 (RF - conducted), 10 Veff
Emitted interference	EN 55011 , EMC B - DNVGL-CG-0339
Insulation voltage	500 VAC, 50 Hz @ 1 min (≥ 2kV for FAH[..] type on request)
Further standards	DIN EN 50155, DIN EN 55016, DIN EN 50121

Mech. Quantities	
Material	Sensor tube: Stainless steel Adapter: Stainless steel
Mounting	Flange mounting
Length	See drawing
Installation position	Preset with direction of rotation definition, with position pin defined
Weight	≥ 190 g (depending on connection)
Pressure resistance	5 bar (measuring tip)

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Specific technical data

Technical data on measuring principles

	Difference-hall principle	Eddy current principle
Scan object	Ferromagnetic materials, Tooth wheel: Module m1 to m3; tooth face > 7 mm (spur gear DIN867) Hole: Ø ≥ 5 mm, web ≥ 2 mm, depth ≥ 4 mm Groove: Ø ≥ 4 mm, web ≥ 2 mm, depth ≥ 4 mm	Electrically conductive materials (steel, aluminium, other on request) Tooth wheel: Module m2 to m3; tooth face width ≥ 10 mm (spur gear DIN867) (smaller on request) Hole: On request Groove: On request
Scan object - distance	0.2 ... 3 mm; recommended: 1.0 ± 0.5 mm	Module 2: 0.2 ... 1.2 mm, recommended 0.7 ± 0.2 mm ; Module 3: 0.2 ... 1.5 mm, recommended 0.8 ± 0.2 mm
Frequency range	0.2 ... 20,000 Hz	0.2 ... 25,000 Hz
Installation mode	Direction-sensitive	Direction-sensitive
Phase-shift	90° ± 10% @ m1.5...m3 | 90° ± 15% @ m1...m1.25	90° ± 25% @ m2...m3

Technical data for electrical connection and output

Sensors with two output signals (galvanically connected)

FAWZ[..], FAHZ[..]	
Supply voltage	9 ... 32 VDC
Nominal voltage	15 VDC
Current consumption	< 20 mA (without output current PNP)
Measuring channels	2 measuring channels
Output signals and signal form	2 x square wave signals
Galvanic separation	No

Sensors with two galvanically isolated output signals

	FAWD[..], FAHD[..] (voltage signal output)	FAHI[..] (current signal output)
Supply voltage	2 x 9 ... 32 VDC	2 x 10 ... 30 VDC
Nominal voltage	2 x 15 VDC	2 x 15 VDC
Current consumption	2 x < 10 mA (without output current PNP)	-
Maximum load resistance	-	RL max = (UB - 7.5V) / 16 mA + 10%
Measuring channels	2 galvanically isolated measuring channels	2 galvanically isolated measuring channels
Output signals and signal form	2 x square wave signals	2 x square wave signals
Galvanic separation	Yes	Yes

Sensors with two output signals and status output

FAWS[..], FAHS[..]	
Supply voltage	9 ... 32 VDC
Nominal voltage	15 VDC
Current consumption	< 20 mA (without output current PNP)
Measuring channels	2 measuring channels and 1 additional channel for rotation direction detection
Output signals and signal form	2 x square wave signals, 1 x status signal
Galvanic separation	No

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Sensors with two output signals und two inverted output signals

FAWQ[..], FAHQ[..]	
Supply voltage	9 ... 32 VDC
Nominal voltage	15 VDC
Current consumption	< 20 mA (without output current PNP)
Measuring channels	2 measuring channels
Output signals and signal form	2 x square wave signals not inverted, 2 x square wave signals inverted
Galvanic separation	No

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Type code

Type code structure										
FA	**W**	**Z**	**52-**	**11**	**S**	**X**	**07**	**-M30**	**-S0**	**Example: FAWZ52-11-SX07-M30-S0**
	Measuring principle									
		Measuring principle supplement								
			Construction type and material							
				Nominal length L1 of the sensor tube						
					Connection outlet					
						Electrical connection				
							Cable length			
								Module		
									Shielding	

Type code FAH[..]52										
Measuring principle	**H**	Difference-hall effect principle								**H**
Measuring principle supplement		**Z**	2 output signals (voltage)							**H**
		D	2 output signals (voltage), galvanically isolated							
		I	2 output signals (current), galvanically isolated							
		S	2 output signals (voltage) + Status output channel for direction of rotation detection							
		Q	4 output signals (voltage, 2 + 2 inverted)							**H**
Construction type and material			**52**	Flange, stainless steel sensor tube						**H**
Nominal length				**-11**	L1 = 29 mm					**H**
Connection outlet						Without code: straight cable outlet				**H**
					-S	Lateral cable outlet				
Electrical connection						**-X**	Cable end standard (without protective tubing)			**H**
						-XGS	Cable end, protective tubing, steel reinforced			
						-XGT	Cable end, protective tubing, textile reinforced			
						-XP	Cable end, protective tubing, polyamide			
Cable length							**05**	Sheath length 2.0 m, halogen-free		
							07	Sheath length 5.0 m, halogen-free		**H**
							08	Sheath length 7.5 m, halogen-free		
							09	Sheath length 10.0 m, halogen-free		
Module								**-M10**	Module m1	
								-M12	Module m1.25	
								-M15	Module m1.5	
									Without code: Module m2	**H**
								-M25	Module m2.5	
								-M30	Module m3	
Shielding									Without code: Shielding is attached to the sensor housing	**H**
									-S0 Shielding is not attached to the sensor housing	
FA	_ _	_ _	_ _-	_ _	**-**_ _	_ _	_ _	-_ _	_ _	**Example: FAHZ52-11-X07 (Preferred type)**

NORIS Automation GmbH | Muggenhofer Str. 95 | 90429 Nuremberg | Germany | Tel: +49 911 3201-220 | Fax: +49 911 3201-150 | sales@noris-group.com | www.noris-group.com

Type code FAW[..]52										
Measuring principle	**W**	Eddy current								**W**
Measuring principle supplement		**Z**	2 output signals							**W**
		D	2 output signals, galvanically isolated							
		S	2 output signals + Status output channel for direction of rotation detection							
		Q	4 output signals (2 + 2 inverted)							**W**
Construction type and material			**52**	Flange, stainless steel sensor tube						**W**
Nominal length				**-11**	L1 = 29 mm					**W**
Connection outlet						Without code: straight cable outlet				**W**
					-S	Lateral cable outlet				
Electrical connection						**-X**	Cable end standard (without protective tubing)			**W**
						-XGS	Cable end, protective tubing, steel reinforced			
						-XGT	Cable end, protective tubing, textile reinforced			
						-XP	Cable end, protective tubing, polyamide			
Cable length							**05**	Sheath length 2.0 m, halogen-free		
							07	Sheath length 5.0 m, halogen-free		**W**
							08	Sheath length 7.5 m, halogen-free		
							09	Sheath length 10.0 m, halogen-free		
Module									Without code: Module m2	**W**
								-M25	Module m2.5	
								-M30	Module m3	
Shielding									Without code: Shielding is attached to the sensor housing	**W**
									S0 Shielding is not attached to the sensor housing	
FA	_ _	_ _	_ _-	_ _	-_ _	_ _	_ _	-_ _	_ _	**Example: FAWZ52-11-X07 (Preferred type)**

Preferred types

Features marked with an indicator letter at the end of the line in the table are preferred features. If you select a preferred feature for each placeholder (same indicator letter), the device is specified as preferred type. Preferred types are available quickly from stock. Other types will be delivered according to scheduled appointments.

Special types

If our standard types do not correspond with your expectation, we are pleased to develop a special solution together with you.

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