Instruction Manual
FAH52

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1 General information

Use for intended purpose

- The product may only be used for the applications specified in this document and in the technical documentation. Transportation with due care and attention, correct storage and installation as well as careful use and maintenance during operation of the product must be ensured to guarantee trouble-free and safe operation.
- The product must be used at all times in agreement with the technical specifications. In particular, compliance with the ambient conditions recommended in the technical documentation must be ensured.

Installation, assembly, repair and maintenance work

- Observe the relevant national regulations and observe the applicable standards and directives for special applications.
- Installation, assembly, repair and maintenance work must be carried out exactly according to the installation and maintenance instructions applicable to the individual products in order to guarantee their functional reliability and avoid installation errors and damage.
- Installation, assembly, repair and maintenance work must only be performed by qualified and authorised technical personnel in accordance with the relevant documentation, especially the safety and warning information contained therein.
- Make sure that no excess parts (screws, tools, etc) are left behind in or on products after performing installation, assembly, repair or maintenance work. Non-compliance with this requirement may cause malfunctions and/or damage to the products or the system.
- Make sure a function test is carried out on completion of installation, assembly, repair and maintenance work to ensure trouble-free operation of the products.

Suitable tools and equipment

Only suitable tools and equipment, especially materials provided by NORIS, are to be used for installation, assembly, repair and maintenance work. Damaged products or components are to be replaced only by genuine NORIS components or parts. NORIS shall accept no liability whatsoever for any damage incurred as the result of using unauthorised spare parts. This will invalidate the warranty. Keep the operating instructions in a place that is accessible to all users at any time.

Modification of products

NORIS shall accept no liability whatsoever if unauthorised modifications have been made to the products. This will also invalidate the warranty. Therefore, consult our technical staff before undertaking any modifications.

Shipping, appropriate storage and packaging

Products that are sent in for repair must be appropriately packaged to prevent damage (from impacts, moisture, static charge, etc). Make sure that products and all spare parts are stored correctly. Refer to the corresponding technical information for further information.

Disclaimer

We review the contents of our technical documentation at regular intervals to ensure it agrees with our products. Nevertheless, variations cannot be completely ruled out. NORIS therefore cannot guarantee complete agreement of the documentation contents with the hardware and software. Changes and corrections will be included in subsequent issues of the technical documentation.

2 General information on this instruction manual

2.1 Scope of validity

This instruction manual applies to the Series FA52 sensors listed below:

Sensor type	Product revision
FAHZ52, FAHD52, FAHQ52, FAHS52, FAHI52	A
FAWZ52, FAWD52, FAWQ52, FAWS52	A
FAHU52	A

Important information on the use of this instruction manual and supplementary information

Please note that the sensors are often adapted to customer-specific requirements. The connection cables, cable lengths, connectors etc. described in this instruction manual may vary in terms of features on your specific product. Therefore, always first refer to the information in the customer drawing for installation, commissioning and operation.

2.2 Subject of the instruction manual

The subject of this instruction manual is the installation, commissioning, operation and maintenance of Series FA52 speed sensors. Furthermore, this instruction manual also contains important troubleshooting information.

2.3 Use of safety and warning notes

⚠ DANGER	**Warning about the type and source of immediate danger that leads to death or serious injuries when disregarding the given precautions.**
⚠ WARNING	**Warning about the type and source of danger that may possibly lead to death or serious injuries when disregarding the given precautions.**
⚠ CAUTION	**Warning about the type and source of danger that may lead to minor injuries when disregarding the given precautions.**

NOTICE **Warning about the type and source of danger that may lead to material damages when disregarding the given precautions.**

2.4 Use of symbols

Symbol	Explanation
	The following paragraph refers to tools and resources to be used.
	The following paragraph contains useful notes or an advice.

2.5 Scope of delivery

Note on customer-specific scope of delivery

The scope of delivery of your product may vary from the specifications below.

The scope of delivery is individually adapted to your specific requirements. In addition, certain items are dependent on other factors, e. g. the number of retaining clips on the cable length, the size of the retaining clips on the cable diameter. Refer to the corresponding parts list for a detailed overview of the scope of delivery for your product.

The standard scope of delivery contains:

- Speed sensor with protective cap and connection cable
- 2 screws each with one spring washer for mounting the speed sensor

Available documentation:

The general technical documentation for our sensors (data sheets, instruction manuals, certificates, etc.) can be downloaded from our website www.noris-group.com. For customer drawings of your sensor, please ask our sales team (sales@noris-group.com). On request, we also include the latest documentation in the scope of delivery. Available for sensors Series FA52 are:

- Data sheet
- Instruction manual for sensors Series FA52
- Customer drawing of your sensor

2.6 Product storage

Note the following information concerning the storage to avoid product damage:

- Store the product in the original package material in dry indoor areas.

- Do not store the product in humid or dusty environments. In case of longtime storage, precautions need to be taken to protect the connection from moisture and dust.
- Please also note the allowed storage temperature mentioned in the technical data.

2.7 Packaging and waste disposal

When unpacking the product, check the device for transport damage and in case of any damage inform the manufacturer immediately. Keep the packaging material, so you can pack your device properly in case of a future transport. In case you dispose of the packaging material, the regulations for the local waste disposal must be regarded.

2.8 Accessories and spare parts

Available accessories

In addition to the installation material, no further accessories are available for Series FA52 speed sensors.

Available spare parts

Available spare parts include installation material, seals and connectors. For detailed information, please contact our service department or sales team at sales@noris-group.com.

2.9 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				
							Sheath length			
								Module		
									Shield / Addition	

Type code FAH[..]52										
Measuring principle	**H**	Hall								
Measuring principle supplement		**Z**	2 output signals (voltage), galvanically connected							
		D	2 output signals (voltage), galvanically isolated							
		I	2 output signals (current), galvanically isolated							
		S	2 output signals (voltage), galvanically connected with status output (e. g. rotation direction detection)							
		Q	4 output signals (voltage), galvanically connected							
Construction type and material			**52-**	Flange, stainless steel sensor tube						
Nominal length				**11-**	L1 = 29 mm					
Connection outlet						Without code: straight cable outlet				
					S	Lateral cable outlet				
Electrical connection						**X**	Cable end standard (without protective tubing)			
						XGS	Cable end, protective tubing, steel reinforced			
						XGT	Cable end, protective tubing, textile reinforced			
						XP	Cable end, protective tubing, polyamide			
Sheath length							**05-**	Sheath length 2.0 m, halogen-free		
							07-	Sheath length 5.0 m, halogen-free		
							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	
								M25-	Module m2.5	
								M30-	Module m3	
Shield										Without code: Shield attached to the sensor housing
									S0	Shield not attached to the sensor housing
Addition									**F0**	Frequency range commencing at 0 Hz
FA	_ _	_ _	_ _-	_ _-	_ _	_ _	_ _-	_ _-	_ _	**Example: FAHZ52-11-X07**

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

* Module for steel gearwheel involute-thoothed, other on request

Type code FAHU52											
Measuring principle	**H**	Difference-Hall									
Measuring principle supplement		**U**	4 output signals, galvanically isolated								
Construction type and material			**52-**	Flange, stainless steel sensor tube							
Nominal length				**11-**	L1 = 29 mm						
Connection outlet						Without code: straight cable outlet					
					S	Lateral cable outlet					
Electrical connection						**X**	Cable end standard (without protective tubing)				
						XGS	Cable end, protective tubing, steel reinforced				
						XGT	Cable end, protective tubing, textile reinforced				
						XP	Cable end, protective tubing, polyamide				
Sheath length							**05-**	Sheath length 2.0 m, halogen-free			
							07-	Sheath length 5.0 m, halogen-free			
							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		
								M25-	Module m2.5		
								M30-	Module m3		
Shield										Without code: Shield attached to the sensor housing	
									S0-	Shield not attached to the sensor housing	
Signal variants										**Uxx**	Output signal variants (xx see next table)
FA	**_ _**	_ _	_ _-	_ _-	**_ _**	**_ _**	_ _-	_ _-	_ _-	_ _	**Example: FAHU52-11-X07-U01**

Special types

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

3 Product description

3.1 Scope of application

Series FA52 speed sensors are mainly used in the following area: Transport technology. Speed sensors type FA**H**52 usually 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 for detecting movements of any ferromagnetic or electrically conductive parts, e. g.:

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

3.2 Measuring principle

Speed sensors type FAW[..]52 operate by using the eddy current principle.

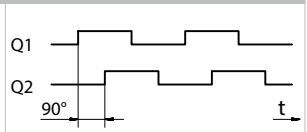
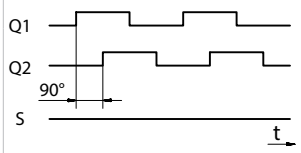
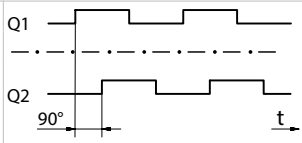
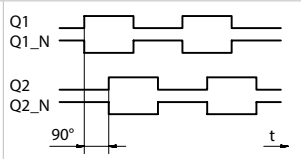
A coil with a high frequency alternating current supply is integrated in the sensor head. An electromagnetic field is produced with its field lines emitted from the sensor surface. Eddy currents are induced as the electrically conductive scanning object moves past the sensor face. These eddy currents 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.

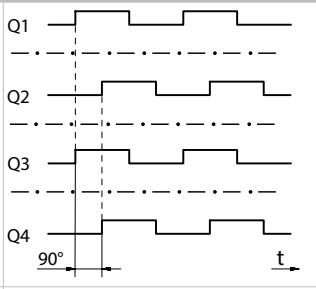
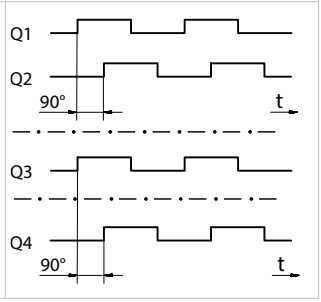
Speed sensors type FAH[..]52 sensors operate by using with the Hall principle.

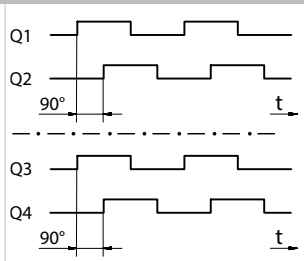
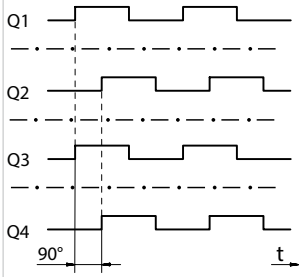
A field of a magnet generates a constant voltage in the Hall elements. Ferromagnetic objects with an interrupted surface cause the Hall voltage to change as they pass the Hall elements. The frequency of the change of the Hall voltage is proportional to the speed of movement (rotational speed). The speed sensor converts this change into an electric signal.

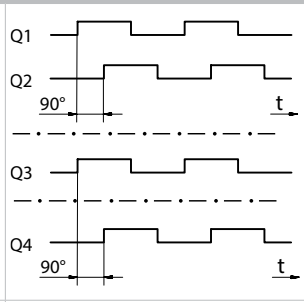
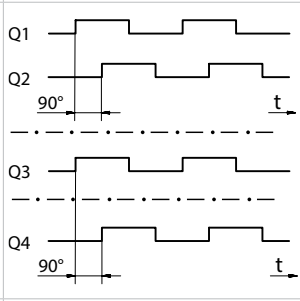
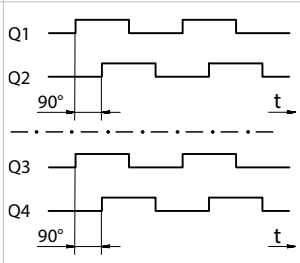
3.3 Signal forms

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 shifted	
FAHZ52	Hall		
FAWS52	Eddy current	Two square wave signals, Q2 to Q1 is 90° phase shifted, one rotation direction signal	
FAHS52	Hall		
FAWD52	Eddy current	Two galvanically isolated square wave signals, Q2 to Q1 is 90° phase shifted, type FAHD52, FAWD52 with voltage signal output, type FAHI52 with current signal output	
FAHD52	Hall		
FAHI52			
FAWQ52	Eddy current	Two + Two inverted square wave signals, Q1 to Q2 and Q1_N to Q2_N are 90° phase shifted	
FAHQ52	Hall		

Typ	Measuring principle	Signal outputs	Signal form
FA-HU52[..]-U01	Hall	Four galvanically isolated square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Type –U01: voltage output Type –U11: current output	
FA-HU52[..]-U11			
FA-HU52[..]-U02	Hall	Two square wave signals + two galvanically isolated square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Type –U02: voltage output Type –U12: current output	
FA-HU52[..]-U12			

Typ	Measuring principle	Signal outputs	Signal form
FA-HU52[..]-U03 FA-HU52[..]-U13	Hall	Two galvanically isolated measuring systems, each with two square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Type –U03: voltage output Type –U13: current output	
FA-HU52[..]-U21	Hall	Four galvanically isolated square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Q1, Q2 with voltage output Q3, Q4 with current output	

Typ	Measuring principle	Signal outputs	Signal form
FA-HU52[..]-U22	Hall	Two square wave signals + two galvanically isolated square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Q1, Q2 with voltage output Q3, Q4 with current output	
FA-HU52[..]-U23	Hall	Two square wave signals + two galvanically isolated square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Q1, Q2 with current output Q3, Q4 with voltage output	
FA-HU52[..]-U24	Hall	Two galvanically isolated measuring systems, each with two square wave signals, Q1 to Q2 and Q3 to Q4 are 90° phase shifted Q1, Q2 with voltage output Q3, Q4 with current output	

3.4 Speed sensor design

3.4.1 General design features

Series FA52 speed sensors are available as standard with two different connection outlets (see illustrations below):

- Straight connection outlet
- Lateral connection outlet

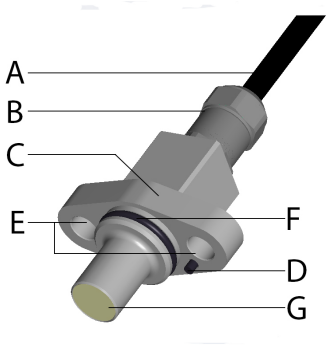


Fig.: FA[..]52 straight connection outlet

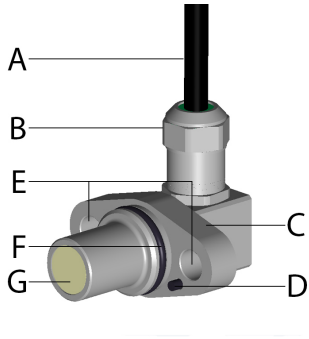


Fig.: FA[..]52 lateral connection outlet

Explanation to the previous illustration

A) Connection cable (standard, without protective tubing)
B) Cable fitting
C) Flange
D) Locator pin for coded installation position
E) 2 holes for sensor mounting
F) O-ring seal
G) Measuring area consisting of high-performance ceramic (FAW[..] type) or stainless steel (FAH[..] type)

3.4.2 Cable variants

Series FA52 speed sensors are available with three different cable variants:

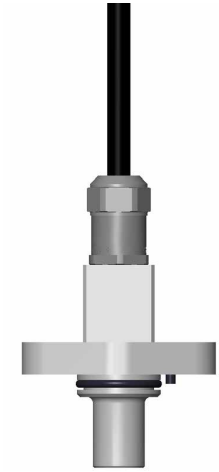


Fig.: FA[..]52[..]-X

Cable without protective tubing

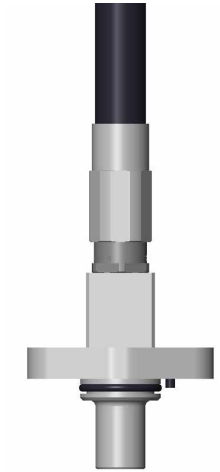


Fig.: FA[..]52[..]-XGS[..], -XGT[..]

XGS: Steel reinforced
XGT: Textile reinforced

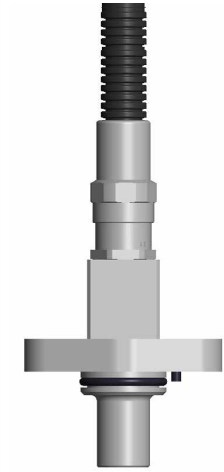


Fig.: FA[..]52[..]-XP[..]

Polyamide

3.4.3 Connection variants

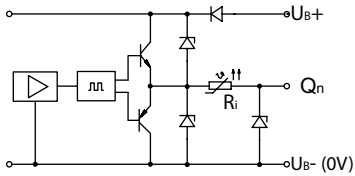
Information on customer-specific connections

Series FA52 speed sensors are available with different connections. In addition to the standard defined by the type code, the connections are often adapted to customer-specific requirements. Refer to the customer drawing for the required connection variant.

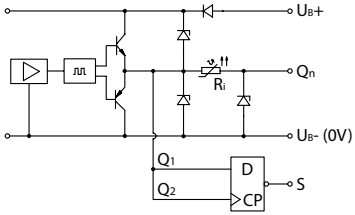
- **Standard:** Stranded cable ends for wiring by the customer.
- Customer-specific connectors, e.g. CANON FRCIR[..], Harting HNR Type 1, Type 2, etc.

3.4.4 Elementary circuit diagrams

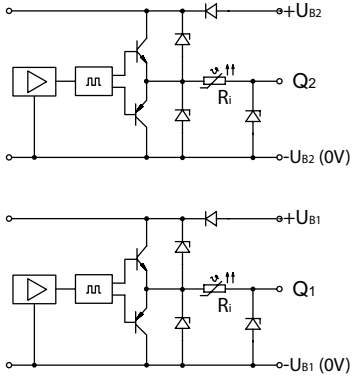
Elementary circuit diagram FA[..] Z52, FA[..]U52



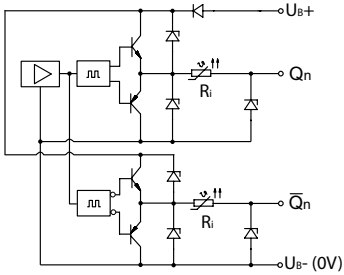
Elementary circuit diagram FA[..] S52



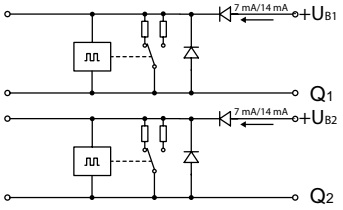
Elementary circuit diagram FA[..] D52



Elementary circuit diagram FA[..] Q52



Elementary circuit diagram FA[..] I52



4 Technical data FAH52, FAW52

Approvals

The specified approvals are only valid for the technical data of standard products described in this document. In case of customized-products technical deviations are possible. In this case the validity of the according approvals has to be verified.

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 mm², shielded

Electrical output	
Measuring channels	*See specific technical data*
Output signal and signal type	*See specific technical data*
Output stage	Push-pull amplifier
Continuous short circuit protection	Yes
Galvanic isolation	*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 NPN (Sink)	Per output: max. -50 mA

Electrical output	
Output current PNP (Load)	Per output: max. 50 mA
Internal resistance Ri	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*
Scanning object - distance	*See specific technical data*
Scanning object	*See specific technical data*
Duty cycle	FAH[..] type: 50% ± 10% FAW[..] type: 50% ± 25%
Phase shift	*See specific technical data*

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 (Sine) DIN EN 61373, 30 g @ 20…500 Hz (Random)
Shock resistance	DIN IEC 60068-T2-27, 1000 m/s² @ 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	*See specific technical data*
Emitted interference	*See specific technical data*
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

Mechanical properties	
Material	**FAH[..]52:** Stainless steel flange and measuring area **FAW[..]52:** Stainless steel flange and high-performance ceramic measuring area
Mounting	Via flange mounting
Length	See customer drawing
Installation position	Preset with direction of rotation definition, with position pin defined
Weight	≥ 190 g (depending on connection)
Pressure resistance	5 bar (measuring area)

Specific technical data

Technical data on measuring principles

	Hall principle	Eddy current principle
Scanning object	Ferromagnetic materials, Toothed wheel: Module m1 to m3; tooth face > 7 mm (spur gear DIN867) Hole: Ø ≥ 5 mm, web ≥ 2 mm, depth ≥ 4 mm Groove: ≥ 4 mm, web ≥ 2 mm, depth ≥ 4 mm	Electrically conductive materials (steel, aluminium, other on request) Toothed wheel: Module m2 to m3; tooth face width ≥ 10 mm (spur gear DIN867) (smaller on request) Hole: On request Groove: On request
Scanning 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 Hz on request)	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
EMI - HF immunity	IEC 61000-4-3, 10 V/m IEC 61000-4-6 (RF - conducted), 10 Veff IEC 60553 (AF - conducted), 10 Veff	IEC 61000-4-3, 20 V/m (80 ... 2100 MHz), 10 V/m (2.1 ... 2.7 GHz), 3 V/m (5.1 ... 6 GHz) IEC 61000-4-6 (RF - conducted), 10 Veff
Emitted interference	CISPR 16-1, CISPR 16-2 EMC2	EN 55011, EMC B - DN-VGL-CG-0339

Technical data for electrical connection and output

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 signal and signal type	2 square wave signals
Galvanic isolation	No

1: Sensors with two output signals (galvanically connected)

	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 signal and signal type	2 square wave signals	2 square wave signals
Galvanic isolation	Yes	Yes

2: Sensors with two galvanically isolated output signals

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 status channel for rotation direction detection
Output signal and signal type	2 square wave signals, 1 status signal
Galvanic isolation	No

3: Sensors with two output signals and status output

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 signal and signal type	2 square wave signals not inverted, 2 square wave signals inverted
Galvanic isolation	No

4: Sensors with two output signals und two inverted output signals

5 Technical Data FAHU52

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 mm², shielded

Electrical output	
Measuring channels	*See specific technical data*
Output signal and signal type	4 square wave signals
Output stage	Push-pull amplifier
Continuous short circuit protection	Yes
Galvanic isolation	Yes
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 NPN (Sink)	For voltage signal outputs: Per output: max. -50 mA
Output current PNP (Load)	For voltage signal outputs: Per output: max. 50 mA
Internal resistance Ri	For sensors with voltage signal outputs: Per system 45 Ω
Rise time	≥ 10 V/µs

Signal acquisition	
Measuring principle	Hall principle
Frequency range	0.2 ... 20,000 Hz
Scanning object - distance	0.2 ... 3 mm; recommended: 1.0 ± 0.5 mm
Scanning object	Ferromagnetic materials Toothed wheel: Module m1 to m3; tooth face > 10 mm (spur gear DIN867) Hole: Ø ≥ 5 mm, web ≥ 2 mm, depth ≥ 4 mm Groove: ≥ 4 mm, web ≥ 2 mm, depth ≥ 4 mm
Duty cycle	50% ± 10%
Phase shift	Q1 to Q2 and Q3 to Q4: 90° ± 20% @ m1.5...m3 | 90° ± 25% @ m1...m1.25

Environmental influences	
Operating temperature	-40 ... +120 °C
Storage temperature	Recommended: -25 ... +70 °C; max.: -40 ... +105 °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 (Sine) DIN EN 61373, 30 g @ 20…500 Hz (Random)
Shock resistance	DIN IEC 60068-T2-27, 1000 m/s² @ 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, 10 V/m IEC 61000-4-6 (RF - conducted), 10 Veff IEC 60553 (AF - conducted), 10 Veff
Emitted interference	CISPR 16-1, CISPR 16-2 EMC2
Insulation voltage	500 VAC, 50 Hz @ 1 min
Further standards	DIN EN 50155, DIN EN 55016, DIN EN 50121, DIN EN 45545

Mechanical properties	
Material	Flange: Stainless steel Measuring area: Stainless steel
Mounting	Via flange mounting
Length	See customer drawing
Installation position	Preset with direction of rotation definition, with position pin defined

Mechanical properties	
Installation mode	Direction sensitive
Weight	≥ 190 g (depending on connection)
Pressure resistance	5 bar (measuring area)

Specific technical data

FAHU[..]-U01	
Supply voltage	4 x 9 ... 32 VDC
Nominal voltage	4 x 15 VDC
Current consumption	4 x < 10 mA (without output current PNP)
Measuring channels	4 galvanically isolated measuring channels (voltage output)

5: Sensors with 4 galvanically isolated measurement systems

FAHU[..]-U11	
Supply voltage	4 x 10 ... 30 VDC
Nominal voltage	4 x 15 VDC
Measuring channels	4 galvanically isolated measuring channels (current output)

6: Sensors with 4 galvanically isolated measurement systems

FAHU[..]-U02	
Supply voltage	3 x 9 ... 32 VDC
Nominal voltage	3 x 15 VDC
Current consumption	1 x < 20 mA; 2 x < 10 mA (without output current PNP)
Measuring channels	2 measuring channels + 2 galvanically isolated measuring channels (voltage output)

7: Sensors with 3 galvanically isolated measurement systems

FAHU[..]-U12	
Supply voltage	3 x 10 ... 30 VDC
Nominal voltage	3 x 15 VDC
Measuring channels	2 measuring channels + 2 galvanically isolated measuring channels (current output)

8: Sensors with 3 galvanically isolated measurement systems

FAHU[..]-U03	
Supply voltage	2 x 9 ... 32 VDC
Nominal voltage	2 x 15 VDC
Current consumption	2 x < 20 mA (without output current PNP)
Measuring channels	2 x 2 galvanically isolated measuring channels (voltage output)

9: Sensors with 2 galvanically isolated measurement systems

FAHU[..]-U13	
Supply voltage	2 x 10 ... 30 VDC
Nominal voltage	2 x 15 VDC
Measuring channels	2 x 2 galvanically isolated measuring channels (current output)

10: Sensors with 2 galvanically isolated measurement systems

FAHU[..]-U21	
Supply voltage	2 x 9 ... 32 VDC (Spannung), 2 x 10 ... 30 VDC (Strom)
Nominal voltage	4 x 15 VDC
Current consumption	Per voltage output: < 10 mA (without output current PNP)
Measuring channels	4 galvanically isolated measuring channels (2 x voltage output, 2 x current output)

11: Sensors with 4 galvanically isolated measurement systems

FAHU[..]-U22	
Supply voltage	1 x 9 ... 32 VDC, 2 x 10 ... 30 VDC
Nominal voltage	3 x 15 VDC
Current consumption	1 x < 20 mA (without output current PNP) (voltage)
Measuring channels	2 measuring channels + 2 galvanically isolated measuring channels (2 x current output, 2 x voltage output)

12: Sensors with 3 galvanically isolated measurement systems

FAHU[..]-U23	
Supply voltage	2 x 9 ... 32 VDC, 1 x 10 ... 30 VDC
Nominal voltage	3 x 15 VDC
Current consumption	2 x < 10 mA (without output current PNP) (voltage)
Measuring channels	2 measuring channels + 2 galvanically isolated measuring channels (2 x current output, 2 x voltage output)

13: Sensors with 3 galvanically isolated measurement systems

FAHU[..]-24	
Supply voltage	1 x 9 ... 32 VDC, 1 x 10 ... 30 VDC
Nominal voltage	2 x 15 VDC
Current consumption	1 x < 20 mA (ohne Ausgangsstrom PNP)
Measuring channels	2 galvanically isolated systems, each with 2 measuring channels (2 x current output, 2 x voltage output)

14: Sensors with 2 galvanically isolated measurement systems

6 Installation

6.1 Information on avoiding faults and material damage

Mechanical and electrical stress

NOTICE

Note, that excessive mechanical stress of the sensor housing and the measuring area may damage the sensor.

The manufacturer will not be liable for damages caused by excessive mechanical stress.

NOTICE

Note, that excessive electrical stress (e. g. electrical field strengths in the range of the insulation resistance and high line-conducted interferences) may damage the sensor electronics.

The manufacturer will not be liable for damages caused by excessive electrical stress.

Protective cap / Soiling of sensor

NOTICE

Ensure that you remove the protective cap only when mounting the sensor. Otherwise the sensor may be damaged.

At delivery the sensor is equipped with a protective cap to protect the measuring area and the electronic parts against mechanical and electrical damage.

NOTICE

Ensure that the measuring area is not soiled.

A soiled measurement area may lead to signal loss or even damage to the sensor. Also note the recommendations in the “Maintenance” Section.

Sensor mounting

When mounting the sensor make sure that the screw connections are tightened appropriately. Therefore, note the instructions in Section “Installing the speed sensor”.

NOTICE

Use appropriate tools and do not apply excessive force when mounting the sensor.

The sensor may otherwise be damaged.

Scanning distance

Note the permissible scanning distance.

NOTICE

Make sure that the specified scanning distance is maintained.

If the distance to the scanning object is too low, signal distortion and signal loss may occur as well as damage to the sensor and the scanning object. Signal distortion and signal loss may also occur if the scanning distance is too high.

Connection and securing connectors

When mounting the sensor, the data and information on the customer drawings always have priority over the information in this instruction manual.

NOTICE

Do not touch electronic parts of the sensor (connector pins, open cable ends, etc.) without appropriate measures to ground your body (e. g. ESD wristband).

Otherwise electrostatic discharge may damage the sensors' electronic components.

NOTICE

Do not loosen the cable gland.

Otherwise humidity and dust may damage the sensors' electronic components.

NOTICE

The connection are to be made and connector secured exactly as described on the customer drawings and in this manual.

Incorrect wiring and incorrectly or inappropriately tightened screw connections can result in signal loss or damage to the sensor and connection.

Cable laying

NOTICE

Make sure that the connection cable is layed correctly.

Incorrectly layed connection cables may result in signal loss or damage to the sensor.

NOTICE

Note the minimum cable bending radius when laying the cable (see customer drawing).

Otherwise the connection cable may be damaged.

READ

You will find further information on cable laying in the “Important information on connection and cable laying” Section.

6.2 Preparing for installation

6.2.1 Dimensions

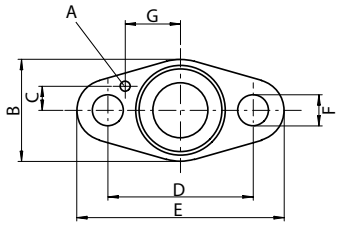


Fig.: FA[..]52_Front View_Dimensions

Explanation to the left illustration

A) Locator 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) Ø 9 $^{-0.5}$ mm
G) Length 16 mm

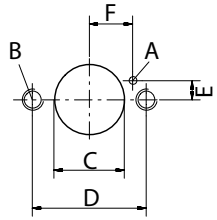


Fig.: Borehole for FA[..]52_Top view

Explanation to the left illustration

A) Borehole depth for locator pin 3 mm (installing position) acc. DIN1481-3, borehole Ø 4 to 5 mm
B) Borehole size M8
C) 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 washer.

The following dimensions are valid for type FAHZ52, FAHS52, FAHD52, FAHQ52, FAHI52, FAWZ52, FAWS52, FAWD52, FAWQ52:

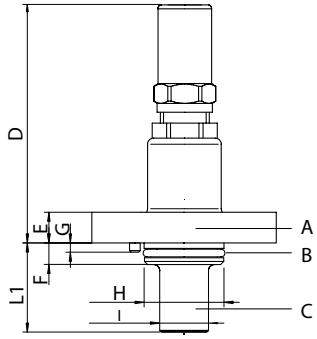


Fig.: FA[..]52_Straight connection outlet

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 on connection)
L1) Nominal length L1 (see type code)
E) Length 10 mm
F) Length 7 mm
G) Length 3 mm
H) Ø 26 ^{d10} mm
I) Ø 16 mm

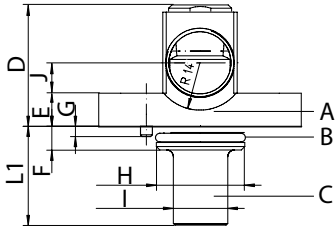
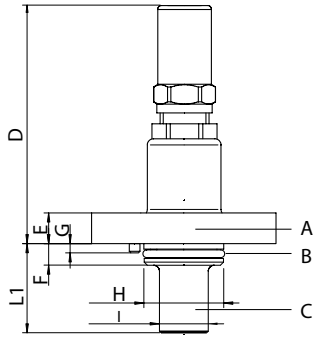


Fig.: FA[..]52_lateral connection outlet

Explanation to the left illustration

A) Flange: Stainless steel
B) O-ring 21 x 2.5 mm
C) Sensor tube: Stainless steel
D) Length 36 ±1 mm (for L1 ≥ 39 mm)
Length 46 ±1 mm (for L1 < 39 mm)
L1) Nominal length L1 (see type code)
E) Length 10 mm
F) Length 7 mm
G) Length 3 mm
H) Ø 26 ^{d10} mm
I) Ø 16 mm
J) Length 9 mm

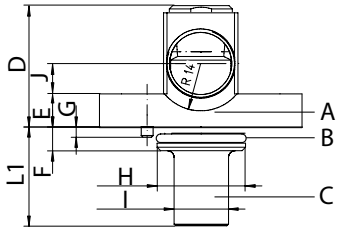
The following dimensions are valid for type FAHU52:



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 on connection)
L1) Nominal length L1 (see type code)
E) Length 10 mm
F) Length 7 mm
G) Length 3 mm
H) Ø 26 ^{d10} mm
I) Ø 20 mm

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 36 $^{\pm 1}$ mm (for L1 ≥ 39 mm)
Length 46 $^{\pm 1}$ mm (for L1 < 39 mm)
L1) Nominal length L1 (see type code)
E) Length 10 mm
F) Length 7 mm
G) Length 3 mm
H) Ø 26 ^{d10} mm
I) Ø 20 mm
J) Length 9 mm

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

6.2.2 Checking the scanning object

NOTICE

To ensure proper operation, the scanning object must not be damaged.

Damaged scanning objects can result in signal distortion, signal loss or even damage to the sensor.

Make sure that the scanning object is in perfect condition.

A. Check that the scanning object is undamaged (e.g. no scratches, material unevenness, etc.).

➡ If this is not the case, you must first rectify these faults before you continue with the installation of the sensor.

6.2.3 Checking the mounting holes

Check the mounting holes before you install the sensor.

NOTICE

A faulty mounting hole can result in signal distortion, signal loss or even damage to the sensor.

Therefore, carry out the following procedure:

A. Check whether the holes for the two screws for mounting the sensor have the correct position and size.

B. Check whether the hole for the locator pin has the correct position and size.

C. Check the mounting hole for the sensor tube.

   ⇨ The mounting hole must be chamfered 45° on the inside to avoid damaging the O-ring seal.

   ⇨ The mounting hole must be deburred and there must be no unevenness on the surface of the mounting hole.

HINT

D. Mount the sensor carefully in the mounting hole for testing purposes. Check the position of the holes for the screws and for the locator pin. Check whether the sensor rests evenly and is flush with the surface.

➡ The check is finished. You can now continue with the installation.

6.2.4 Preparing tools and resources

Have the following tools and equipment ready for installation:

- Torque wrench
- Proper screw-wrench
- 2 screws (recommended: M8x20), 2 spring washers
- Suitable cable clips for securing the cable (NORIS will supply suitable cable clips on request)
- Grease (e. g. Innotec AS1500)

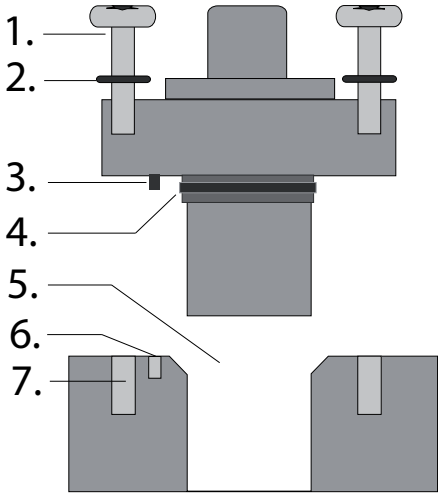
6.3 Mounting the speed sensor

NOTICE

The sensor installed in the wrong position or using an incorrect tooth wheel module will distort the 90° phase-shifted sensor output signal, resulting in faulty measurement.

Please note that the sensor can only be installed in one direction. The correct position is determined by the locator pin on the sensor.

Flange sensor



1: FA[..]5[…] installation

Legend to above illustration

1. 2 x mounting screw, recommended M8x20 conforming to DIN 912
2. 2 x spring washer, recommended M8 conforming to DIN 127
3. Locator pin
4. O-ring seal
5. Mounting hole chamfered 45°
6. Hole for locator pin
7. Hole for mounting screws

Mount the sensor according to the following instructions:

- **Prerequisite:** You have checked the holes and the scanning object prior to installation of the sensor.

A. Grease the O-ring seal on the sensor head.

B. Remove the protective cap from the sensor head.

C. Carefully insert the sensor tube in the installation hole provided and carefully align the sensor with the object to be scanned.

⇨ The locator pin must fit in the appropriate hole.

⇨ The cover ratio of the measuring area and scanning object should amount at least to 2:3.

D. Check the recommended distance to the scanning object (see Section Technical Data).

NOTICE

A too close scanning distance may lead to signal distortion, signal loss or may even damage the sensor and the scanning object.

Thus, maintain the recommended scanning distance.

E. Secure the sensor with the 2 screws and the spring washers provided. Use a torque wrench to tighten the screws to a maximum torque of 25 Nm.

NOTICE

Use appropriate tools and do not apply excessive force when mounting the sensor.

The sensor may otherwise be damaged.

➡ The mounting is finished.

6.4 Connection and cable laying

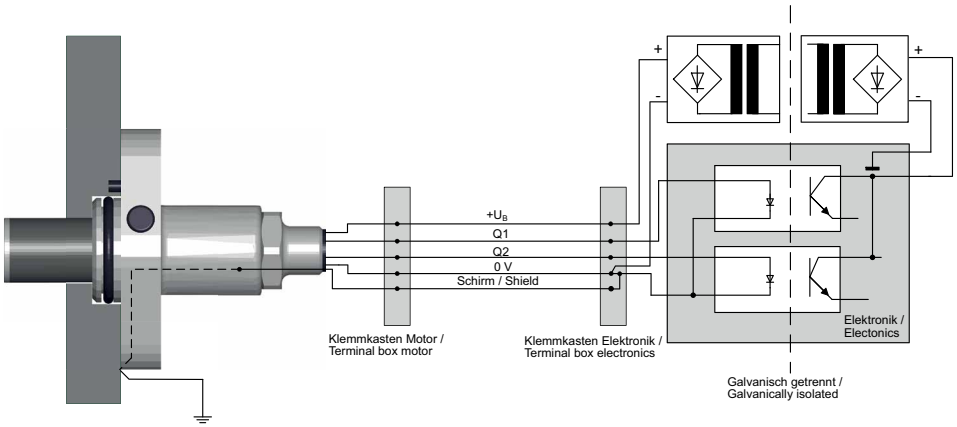
The connections for the different variants of the Series FA52 speed sensors are described in the following subsections. Carry out the connection for your sensor type as described in the corresponding section.

6.4.1 Connection concept

The connection concepts mentioned in this section are a recommendation from the manufacturer. Differences may be reasonable for your application, but depend on the local environmental conditions.

6.4.1.1 Connection concept for strong electromagnetic environments

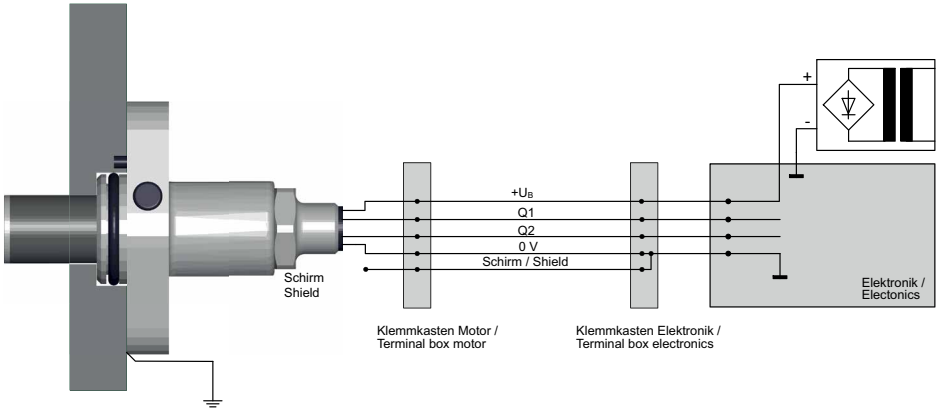
The signal outputs and the supply voltage of the processing electronics and of the sensor are galvanically isolated. The shield must be continuous and connected extensively at both connection points.



2: Concept with connected shield at both connection points, type FA[..]5[..]

6.4.1.2 Connection concept for weak electromagnetic environments

The signal outputs and the supply voltage of the processing electronics and of the sensor are not galvanically isolated. The shield is not continuous and not connected to the sensor. This connection type has to be ordered explicitly (see type code).



3: Concept with connected shield at one connection point, type FA[..]5[..]-S0

6.4.2 Important information on connection and cable laying

NOTICE

Note the information on the customer drawings as well as the information and technical data on the corresponding sensor type as provided in this instruction manual. The connection instructions provided in this section apply to sensor types mentioned in the Section “Scope of Application”. Make sure your body is correctly grounded (!electrostatic discharge!) before touching the sensor connections.

The cabling, connector or the sensor may otherwise be damaged.

- Sensors must be connected to the system with no interruptions.
- Shielded cables must be used.
- The connections must be shielded to an adequate extent and conduct well.
- Unshielded wires have to be kept as short as possible.
- Cable connections must be continuous, i.e. no terminals between sensor and system.
- Cable connections must be direct, i.e. shortest route without cable loops.
- Note the minimum bending radius to avoid damage to the connecting cables.
- Do not exceed the maximum permissible cable length.
- Do not install the cable in the vicinity of electromagnetic fields or power lines. Signal and control lines have to be laid separately from each other to avoid coupling tracks (a minimum distance of 20 cm or more is recommended). If the local separation of sensor and motor lines is not possible, a metal plate or a metal tube has to be used for decoupling.
- In the cabinet the cables have to be laid near the cabinet housing (cabinet ground) or on the mounting plates to avoid crosstalk of the signals.
- Avoid tension, pressure and torsion stress on the cables.
- Make sure that no sharp-edged objects can touch the connection cables.
- Extensive cable shield is required.
- The sensor is always a part of the motor or machine unit. Therefore, make sure that the equipotential bonding of the sensor is part of the overall shield concept.
- Make sure that no compensating current flows via the cable shield due to the potential differences between the motor/machine and electrical ground connections. Therefore, take suitable precautions, e. g. equipotential bonding lines with large cable cross section (minimum 10 mm^2). Note that the shield can be connected several times. In the switchgear cabinet, it can also be connected several times with the cabinet housing.

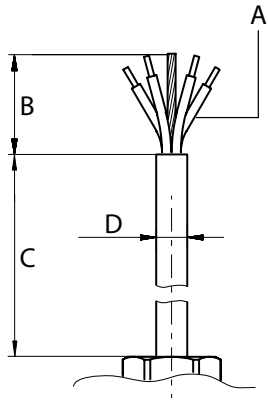
6.4.3 Electrical connection type FAH52, FAW52, FAHU52

Electrical connection of the speed sensor

- **Prerequisite:** The supply voltage of the sensor connection has to be disconnected.

A. Connect the sensor according to the following Figures and instructions. Note the instructions of your appropriate sensor type.

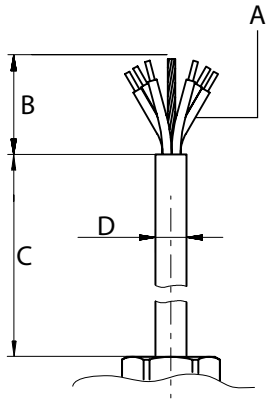
Connection cable type -X for sensors with 4 connecting wires



Explanation to the left illustration

A) Wires 4 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length K1 ± 5% (K1 see customer drawing)
D) Ø 7 ±0.5 mm

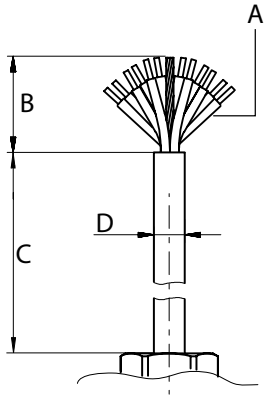
Connection cable type -X for sensors with 6 connecting wires



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) Ø 7 ±0.5 mm

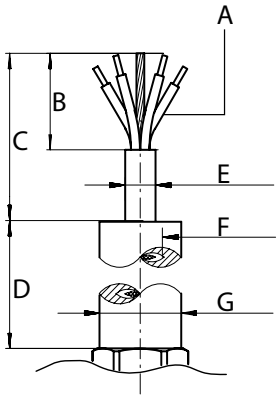
Connection cable type -X for sensors with 12 connecting wires



Explanation to the left illustration

A) Wires 12 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length K1 ± 5% (K1 see customer drawing)
D) Ø 7.7 ±0.5 mm

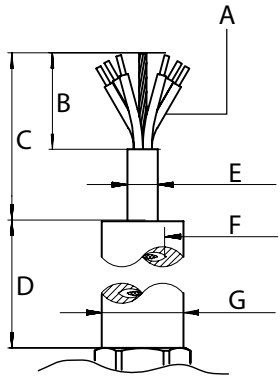
Connection cable type -XGS[..], -XGT[..] (protective tubing steel or textile reinforced) for sensors with 4 connecting wires



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) Ø 4.6 ±0.5 mm
F) Ø 6.4 ±0.5 mm
G) Ø 13.4 ±0.7 mm

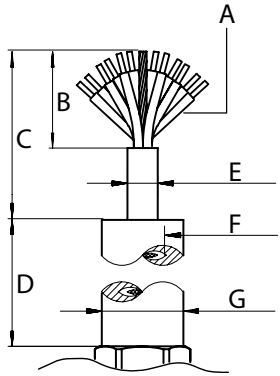
Connection cable type -XGS[..], -XGT[..] (protective tubing steel or textile reinforced) for sensors with 6 connecting wires



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) Ø 7 ±0.5 mm
F) Ø 9.5 ±0.5 mm
G) Ø 16.5 ±0.5 mm

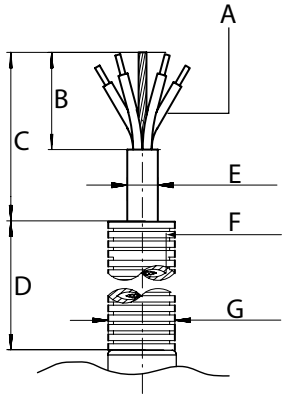
Connection cable type -XGS[..], -XGT[..] (protective tubing steel or textile reinforced) for sensors with 12 connecting wires



Explanation to the left illustration

A) Wires 12 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) Ø 7.7 ±0.5 mm
F) Ø 9.5 ±0.5 mm
G) Ø 16.5 ±0.5 mm

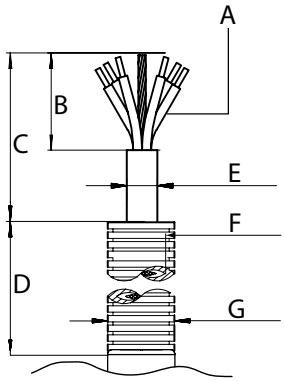
Connection cable type -XP[..] (polyamide protective tubing) for sensors with 4 connecting wires



Explanation to the left illustration

A) Wires 4 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length 200 ±20 mm
D) Length K1 ± 5% (K1 see customer drawing)
E) Ø 7 ±0.5 mm
F) Ø 9.6 ±0.5 mm
G) Ø 13 ±0.5 mm

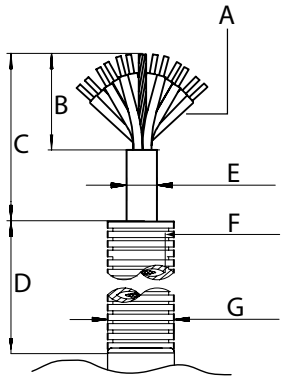
Connection cable type -XP[..] (polyamide protective tubing) for sensors with 6 connecting wires



Explanation to the left illustration

A) Wires 6 x 0.33 mm² halogen-free
B) Length 80 ±10 mm
C) Length 200 ±20 mm
D) Length K1 ± 5% (K1 see customer drawing)
E) Ø 7 ±0.5 mm
F) Ø 9.6 ±0.5 mm
G) Ø 13 ±0.5 mm

Connection cable type -XP[..] (polyamide protective tubing) for sensors with 12 connecting wires



Explanation to the left illustration

A) Wires 12 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) Ø 7.7 ±0.5 mm
F) Ø 9.6 ±0.5 mm
G) Ø 13 ±0.5 mm

Connection assignment for type FA[..]Z

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

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	Not connected
Shield	Ground

Connection assignment for type FA[..]D

Colour	Explanation
Brown (System 1)	U_{S1} +
Green (System 1)	U_{S1} - (0V)
White (System 1)	Signal Q1
Pink (System 2)	U_{S2} +

Colour	Explanation
Grey (System 2)	U_{S2} - (0V)
Yellow (System 2)	Signal Q2
Shield	Ground

Connection assignment for type FA[..]I

Colour	Explanation
Brown (System 1)	U_{S1} +
Green (System 2)	U_{S2} +
White	Signal Q1
Yellow	Signal Q2
Shield	Ground

Connection assignment for type FA[..]Q

Colour	Explanation
Brown	U_S +
White	Q1
Grey	Q1_N, inverted to Q1
Yellow	Q2
Pink	Q2_N inverted to Q2
Green	U_S - (0V)
Shield	Ground

Colour	Explanation –U01	Explanation –U11	Explanation –U21
Brown (System 1)	U_{S1} +	U_{S1} +	U_{S1} +
Green (System 1)	U_{S1} - (0V)	Not connected	U_{S1} - (0V)
White (System 1)	Signal Q1	Signal Q1	Signal Q1
Pink (System 2)	U_{S2} +	U_{S2} +	U_{S2} +
Grey (System 2)	U_{S2} - (0V)	Not connected	U_{S2} - (0V)
Yellow (System 2)	Signal Q2	Signal Q2	Signal Q2
Red (System 3)	U_{S3} +	U_{S3} +	U_{S3} +
Black (System 3)	U_{S3} - (0V)	Not connected	Not connected
Blue (System 3)	Signal Q3	Signal Q3	Signal Q3
Grey/Pink (System 4)	U_{S4} +	U_{S4} +	U_{S4} +
Red/Blue (System 4)	U_{S4} - (0V)	Not connected	Not connected
Magenta (System 4)	Signal Q4	Signal Q4	Signal Q4
Shield	Ground	Ground	Ground

29: Connection assignment for type -U01, -U11, -U21

Colour	Explanation – U02	Explanation – U12	Explanation – U22	Explanation – U23
Brown (System 1)	U_{S1} +	U_{S1} +	U_{S1} +	U_{S1} +
Green (System 1)	U_{S1} - (0V)	Not connected	U_{S1} - (0V)	Not connected
White (System 1)	Signal Q1	Signal Q1	Signal Q1	Signal Q1
Yellow (System 1)	Signal Q2	Signal Q2	Signal Q2	Signal Q2
Pink (System 2)	U_{S2} +	U_{S2} +	U_{S2} +	U_{S2} +
Grey (System 2)	U_{S2} - (0V)	Not connected	Not connected	U_{S2} - (0V)
Blue (System 2)	Signal Q3	Signal Q3	Signal Q3	Signal Q3
Red (System 3)	U_{S3} +	U_{S3} +	U_{S3} +	U_{S3} +
Black (System 3)	U_{S3} - (0V)	Not connected	Not connected	U_{S3} - (0V)
Magenta (System 3)	Signal Q4	Signal Q4	Signal Q4	Signal Q4
Grey/Pink	Not connected	Not connected	Not connected	Not connected
Red/Blue	Not connected	Not connected	Not connected	Not connected
Shield	Ground	Ground	Ground	Ground

30: Connection assignment for type FA[..]-U02

Colour	Explanation –U03	Explanation –U13	Explanation –U24
Brown (System 1)	U_{S1} +	U_{S1} +	U_{S1} +
Green (System 1)	U_{S1} - (0V)	Not connected	U_{S1} - (0V)
White (System 1)	Signal Q1	Signal Q1	Signal Q1
Yellow (System 1)	Signal Q2	Signal Q2	Signal Q2
Pink (System 2)	U_{S2} +	U_{S2} +	U_{S2} +
Grey (System 2)	U_{S2} - (0V)	Not connected	Not connected
Blue (System 2)	Signal Q3	Signal Q3	Signal Q3
Magenta (System 2)	Signal Q4	Signal Q4	Signal Q4
Black	Not connected	Not connected	Not connected
Red	Not connected	Not connected	Not connected
Grey/Pink	Not connected	Not connected	Not connected
Red/Blue	Not connected	Not connected	Not connected
Shield	Ground	Not connected	Not connected

31: Connection assignment for type FA[..]-U03

7 Commissioning

7.1 Preparing tools and resources

Have the following tools and equipment ready for commissioning:

- Multimeter
- 2-channel oscilloscope
- 10 kΩ load resistor

NOTICE

Make sure that the tools and equipment are in perfect working order.

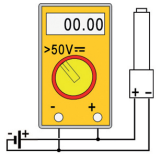
Otherwise the results of the measurements described below may be falsified.

7.2 Checking the operating voltage

You require the following tools and equipment:

- Multimeter

Check that the operating voltage $U_{nominal}$ corresponds to the specification:



4: Checking operating voltage

A. Switch to the measuring range for direct voltage.

B. Connect multimeter [+] to sensor [+] and multimeter [-] to sensor [-].

C. Switch on the operating voltage.

➡ **Result:** The multimeter shows $U_{nominal}$.

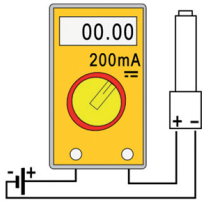
➡ Avoid reverse polarity.

7.3 Checking the current consumption

You require the following tools and equipment:

- Multimeter

Check whether the current consumption I_B is within the tolerance range:



5: Checking power consumption

A. Switch the measuring range to direct current.

B. Connect the multimeter in series in the power supply line [+].

C. Set to 200 mA, it may be necessary to reduce the range.

➡ **Result:** Power consumption I_B is within the tolerance range (see technical data).

7.4 Checking the operating function

You require the following tools and equipment:

- 2-channel Oscilloscope
- 10 kΩ load resistor

Check whether the output signal is a perfect square wave signal:

A. Connect oscilloscope [-] to sensor [-].

B. Connect oscilloscope [+] to sensor [Q].

C. Perform this measurement **with** and **without** the 10 kΩ load resistor between Q and [-].

➡ **Result:** The output signal is in both cases a distinct square wave signal with no interference.

HINT

Electrical interference can often be reduced by increasing or decreasing the scanning distance. Therefore, note the minimum scanning frequency.

7.5 Checking the phase shift

Checking the phase shift is relevant for sensors with 2 or more output signals.

You require the following tools and equipment:

- 2-channel oscilloscope
- 10 kΩ load resistor

Check whether the measured phase shift of the signals corresponds to the specification:

A. Connect oscilloscope [-] to sensor [-].

B. Connect oscilloscope channel [1] to sensor [Q1].

C. Connect oscilloscope channel [2] to sensor [Q2].

⇨ Perform this measurement with the 10 kΩ load resistor between Q1 and [-] and between Q2 and [-].

➡ **Result:** The output signal is a distinct square wave signal. Note, that for sensors with several output signals, you have to check all square wave signals and their phase shift.

7.6 Checking the shield

You require the following tools and equipment:

- Multimeter

Check whether the volume resistance is < 2 Ω:

A. Unplug the connector.

B. Connect multimeter [-] to the sensor housing. Connect multimeter [+] to the connector shield connection (check customer drawing) [-].

C. Start the resistance check.

➡ **Result:** The volume resistance is < 2 Ω.

8 Maintenance

Speed sensors contain no moving parts and are therefore declared as 'maintenance-free devices' by the manufacturer. Nevertheless, note that speed sensors are part of the system and are therefore subject to various ambient factors (heat, cold, motor abrasion, etc.). Therefore, they are to be included in the servicing concept of the system maintenance. Connections and cabling, their installation as well as downstream processing and evaluation components in particular are to be included in the maintenance concept.

The manufacturer recommends to check the speed sensors at regular intervals as part of system maintenance. The sensors should be cleaned if soiled. If on inspection the speed sensor is found to be damaged, replacement is recommended even if the damage does not directly cause signal loss. Damaged connections and cabling should also be replaced immediately. Function tests should be carried out afterwards to ensure trouble-free operation. This preventative maintenance avoids failures and consequential damage.

9 De-installation and disposal

De-installation of sensors

NOTICE

If the sensor is removed for maintenance purposes, the protective cap should be placed again on the measuring area immediately after removal.

Otherwise, the sensor may be damaged.

Disposal of defective sensors

Electronic devices should not be disposed of together with normal waste. Dispose of the sensors in accordance with local requirements for electronic equipment.

10 Troubleshooting

10.1 Recommended procedure

When troubleshooting the system, it is essential to precisely identify the source of faults. Faults are often suspected in the wrong place. Targeted fault localisation is therefore indispensable.

HINT

A reliable method is the **exclusion procedure**:

1. Temporarily replace components that are suspected of being damaged by new components.
2. Temporarily interchange signal paths in order to locate the fault. If the fault migrates, the cause of the fault can be clearly determined in most cases.

10.2 Considerations for troubleshooting

Questions that can help you to quickly limit the scope of troubleshooting

1. **What kind of fault is it?**
   Is no measuring signal present?
   Is the signal distorted, faulty or weak?
2. **Can the sensor be clearly identified as the cause of the fault (continue with Question 4) or could the fault be attributed to conditions on site or in the system, e.g. faulty wiring (continue with Question 3)?**
   If possible, try replacing the sensor by a new fully functional sensor to rule out the sensor as the cause of fault.
3. **Is the installation and/or wiring on site in perfect order? (If so, continue with Question 4)**
   Further questions concerning installation and cabling:
   Have you checked whether the installation is correct (installation direction, scanning distance, screw connection, operating voltage supply, etc.)?
   Is the cabling continuous (no terminal connections, etc.)?
   Are the cables damaged (abrasions, breaks, kinks, etc.)?
   Is the shield connected correctly? Is the system shield concept coherent?
   Are the connector and the plug connection in perfect order (e.g. no pushed-in contact pins)?
   Is the connector adequately sealed?
   Is the measuring area of the sensor clean (no metal chips)?
4. **Are there signs of mechanical damage on the sensor? If so, what kind of damage is it? (If not, continue with Question 5)**
   If there is external damage to the sensor, it is recommended to replace the sensor to ensure reliable operation of the system and to avoid subsequent failure or consequential damage.
5. **Have you checked the sensor technically?**

A function test may already provide an indication whether the sensor is functioning correctly or not. Such function tests are described in this instruction manual (see “Commissioning” Section).

10.3 Frequent causes of faults

General causes of faults

- Is the correct type of sensor installed? Is it suitable for the scanning object?
- Do the sensor operating conditions conform to the specification (environmental influences, scope of application)?

Electrical causes of faults

- Does the power source supply sufficient current?
- Is the sensor connected correctly (pin assignment, cable break, loose screws, etc.)?
- Is the load too high (output signal unclear)?
- Is the scanning frequency overshot or undershot?

Mechanical causes of faults

Checking the scanning object:

- Is the scanning object made of ferromagnetic material (for FAH[..], FAJ[..] Series) or electrically conductive material (for FAW[..] Series)?
- Is the scanning object in perfect condition (no burrs, no deformation, not covered)?
- Is the scanning object running correctly (bearing clearance, radial run-out error)?

Checking the sensor

- Is the sensor installed in the correct position?
- Is the distance from sensor to the scanning object correct?
- Is the vibration within the tolerance (sensor mounting)?

11 Service

Do you have any questions or do you require help with the installation, commissioning or maintenance? Contact our Service representatives:

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