Instruction Manual
FA13

NAN-KD-0009-EN_V01.01 | 16/06/2021

1 Issue

Information on issue	
Document ID	NAN-KD-0009-EN
Issue	V01.01
Date	Juni 2021

Issued by

© 2021 - NORIS Automation GmbH
Muggenhofer Str. 95
90429 Nuremberg
Germany
Phone: +49 911 3201 0
Fax: +49 911 3201 150
Email: info@noris-group.com

Table of contents

2 General information on this instruction manual

2.1 Scope of validity

This instruction manual applies to the Series 13 sensors listed below:

Sensor type	Produkt revision
FAH13	A
FAJ13	A
FAHZ13	A
FAHD13	A
FAHS13	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 FA13. 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.
HINT	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, packed in an antistatic polyethylene bag
- 2 nuts for mounting the sensor
- Thread protection

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 the customer drawing 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 FA13 are:

- Data sheet
- Instruction manual for sensors Series FA13
- 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 mounting material, further accessories are optionally available for these speed sensors.

Connector	Drawing No.	Order No.
Female connector DIN 43650-A	ZL-3A	311046
Female connector according VG95234	ZL4-1A-E	314015
Female connector Euro M12x1, shielded, straight with 2.0 m cable	ZL4-2A	522101
Female connector Euro M12x1, shielded, straight with 5.0 m cable	ZL4-2A	522102
Female connector Euro M12x1, shielded, straight with 10.0 m cable	ZL4-2A	522109
Female connector Euro M12x1, shielded, angled 90°, with 2.0 m cable	ZL4-2A	522439
Female connector Euro M12x1, shielded, angled 90°, with 5.0 m cable	ZL4-2A	522438
Female connector Euro M12x1, shielded, angled 90°, with 10.0 m cable	ZL4-2A	522437

1: List with available female connectors

Available spare parts

Available spare parts include mounting material 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	**H**	**Z**	**13-**	**02**	**15-**	**X03-**	**M10-**	**S0**	**Example: FAHZ13-0215-X03-M10-S0**
	Measuring principle								
		Measuring principle supplement							
			Construction type & material						
				Nominal length L1 and L2 of the sensor tube					
					Thread type				
						Electrical connection			
							Module version		
								Shield	

Type code FAJ13[..]									
Measuring principle	**J**	Inductive-magnetic							
Measuring principle supplement			Without code: 1 output signal						
Construction type & material			**13-**	Sensor tube: Stainless steel					
Nominal length				**02**	L1 = 60 mm, L2 = 5 mm				
				03	L1 = 80 mm, L2 = 5 mm				
				04	L1 = 100 mm, L2 = 20 mm				
				05	L1 = 120 mm, L2 = 40 mm				
					Other lengths up to 200 mm available on request				
Thread type					**13-**	M14 x 1			
					22-	M16 x 1.5			
					15-	M18 x 1			
					23-	M18 x 1.5			
					88-	5/8‘‘ – 18 UNF			
Electrical connection						**A-**	DIN43650-A pin connector		
						C-	MIL 14-5PN VG95234 pin connector		
						E-	Euro M12x1 pin connector		
						H1-	DIN72585 Bayonet		
						X03-	Cable end with sheath length 0.5 m		
						X05-	Cable end with sheath length 2.0 m		
						X06-	Cable end with sheath length 3.0 m		
						X07-	Cable end with sheath length 5.0 m		
						X08-	Cable end with sheath length 7.5 m		
						X09-	Cable end with sheath length 10.0 m		
Shield								Without code: Shield attached to the sensor housing	
							S0	Shield not attached to the sensor housing	
FA	_ _	_ _	_ _-	_ _	_ _-	_ _-	_ _	**Example: FAJ13-0323-E-S0**	

Type code FAH13[..]										
Measuring principle	**H**	Difference-Hall								
Measuring principle supplement			Without code: 1 output signal							
		Z	2 output signal, galvanically connected							
		S	2 output signals, galvanically connected with status output (e. g. rotation direction detection)							
		D	2 output signals, galvanically isolated							
		Q	4 output signals (2 + 2 inverted)							
Construction type & material			**13** -	Sensor tube: Stainless steel						
Nominal length				**02**	L1 = 60 mm, L2 = 5 mm					
				03	L1 = 80 mm, L2 = 5 mm					
				04	L1 = 100 mm, L2 = 20 mm					
				05	L1 = 120 mm, L2 = 40 mm					
					Other lengths up to 200 mm available on request					
Thread type					**13**-	M14 x 1 (FAH13 only)				
					22-	M16 x 1.5 (FAH13 only)				
					15-	M18 x 1				
					23-	M18 x 1.5				
					88-	5/8‘‘ – 18 UNF (FAH13 only)				
Electrical connection						**A**-	DIN43650-A pin connector (FAH13 only)			
						C-	MIL 14-5PN VG95234 pin connector (FAH13 only)			
						E-	Euro M12x1 pin connector (FAH13 only, on request for FAHZ13)			
						H1-	DIN72585 Bayonet (FAH13 only)			
						X03-	Cable end with sheath length 0.5 m			
						X05-	Cable end with sheath length 2.0 m			
						X06-	Cable end with sheath length 3.0 m			
						X07-	Cable end with sheath length 5.0 m			
						X08-	Cable end with sheath length 7.5 m			
						X09-	Cable end with sheath length 10.0 m			
Module (for FAHD, FAHZ, FAHS, FAHQ Series)							**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	
FA	_ _	_ _	_ _ -	_ _	_ _ -	_ _ -	_ _ -	_ _	**Example: FAHZ13-0323-X03-M12-S0**	

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 FA13 speed sensors are mainly used in the following areas: Ship-building industry and machinery and equipment. They usually measure the speed of ferromagnetic toothed wheels. Furthermore, they can be used to measure any movement of ferromagnetic parts, e. g.:

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

3.2 Measuring principle

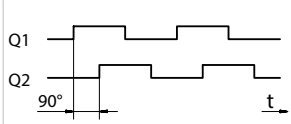
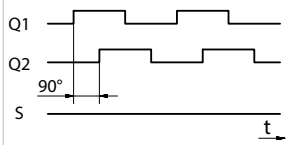
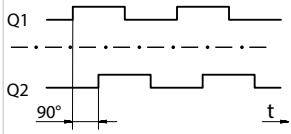
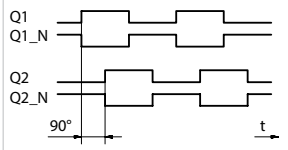
Series FAH[..] sensors operate by using the difference-Hall principle:

Two closely spaced Hall elements are located on the sensor chip. The field of a magnet generates a constant voltage in the Hall elements. Ferromagnetic objects with an interrupted surface as they pass the Hall elements cause the Hall voltage to change. When the moving object covers only one Hall element, a differential voltage is generated to provide a measuring signal. The frequency of this measuring signal is proportional to the speed of movement (rotational speed). The difference-Hall principle is direction sensitive.

Series FAJ[..] sensors operate by using the inductive-magnetic principle:

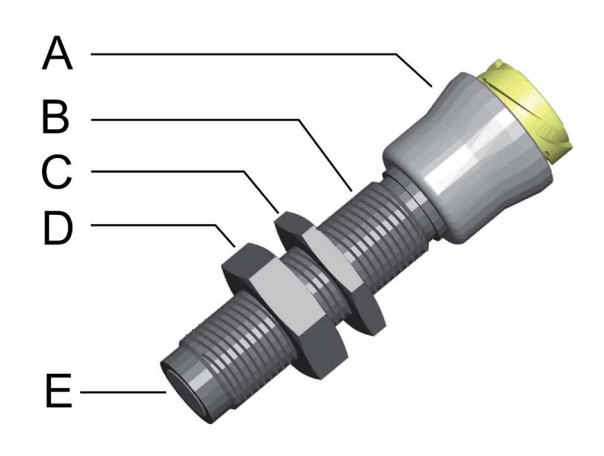
The measuring element consists of a sensing coil and an iron core with an attached permanent magnet. Ferromagnetic objects with an interrupted surface as they pass cause the constant field of the magnet to be changed and induce a voltage in the sensing coil. The frequency of this signal is proportional to the speed of movement (rotational speed). The inductive-magnetic principle is direction independent.

3.3 Signal forms

Type	Measuring principle	Signal outputs	Signal form
FAH13	Difference-Hall	One square wave signal	
FAJ13	Induct.-magnetic	One square wave signal	
FAHZ13	Difference-Hall	Two square wave signals, Q2 to Q1 is 90° phase shifted	
FAHS13	Difference-Hall	Two square wave signals, Q2 to Q1 is 90° phase shifted, one rotation direction signal	
FAHD13	Difference-Hall	Two square wave signals, galvanically isolated, Q2 to Q1 is 90° phase shifted	
FAHQ13	Difference-hall	Two + Two inverted square wave signals, Q1 to Q2 and Q1_N to Q2_N are 90° phase shift	

3.4 Speed sensor design

3.4.1 General structure



1: FA[..]1[..] Design

A Connecting plug (see connector variants)
B Sensor tube
C Counter nut
D Nut for mounting
E Measuring area
Material sensor tube: Stainless steel

3.4.2 Connection variants

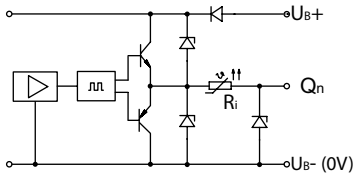
Information on customer-specific connections

Series 13 speed sensors are available with different connection variants. The connection variants are defined by the type code of the respective sensor type. Refer to your customer drawing for your connection variant.

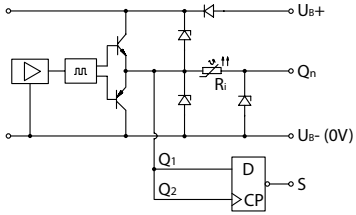
- **Standard:** e. g. Euro M18x1 or cable end (see preferred types in type code).

3.4.3 Elementary circuit diagrams

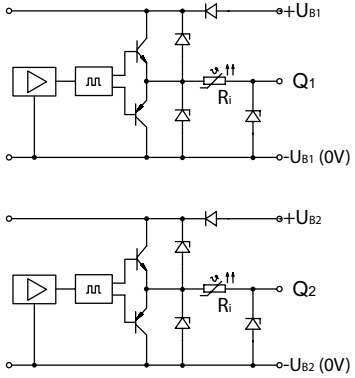
Elementary circuit diagram FAH13, FAJ13, FAHZ13



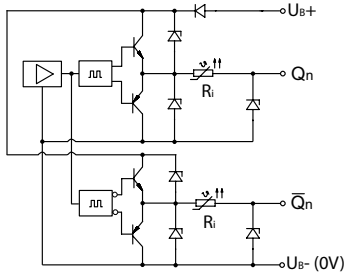
Elementary circuit diagram FAHS13



Elementary circuit diagram FAHD13



Elementary circuit diagram FAHQ13



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	*See specific technical data*
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	*See specific technical data*
Output level High	*See specific technical data*
Output current NPN (Sink)	*See specific technical data*
Output current PNP (Load)	*See specific technical data*
Internal resistance Ri	*See specific technical data*
Rise time	≥ 10 V/µs

Signal acquisition	
Measuring principle	FA**H**[..] series: Difference-Hall FA**J**[..] series: Inductive-magnetic
Frequency range	*See specific technical data*
Scanning type	Non-contacting
Scanning object - distance	0.2 ... 3 mm; recommended: 1.0 ± 0.5 mm
Scanning object	*See specific technical data*
Duty cycle	50% ± 10%
Phase shift	*See specific technical data*

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	*See specific technical data*
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), 3 Veff
Emitted interference	CISPR 16-1, CISPR 16-2 EMC2
Insulation voltage	500 VAC, 50 Hz @ 1 min

Mechanical properties	
Material	Sensor tube: Stainless steel Connecting plug: depending on connecting plug type
Mounting	Screw thread (see type code)
Length	L1 = 60 ... 200 mm
Installation position	Any
Installation mode	*See specific technical data*
Weight	100 ... 300 g (depending on connection and length)
Pressure resistance	5 bar (measuring area)

Specific technical data

Technical data on measuring principles

	Difference-Hall principle	Inductive-magnetic 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	Ferromagnetic materials, Toothed wheel: Module ≥ m1.5; tooth face width ≥ 5 mm (spur gear DIN867) Hole: Ø ≥ 5 mm, web ≥ 2 mm, depth ≥ 4 mm Groove: ≥ 4 mm, web ≥ 2 mm, depth ≥ 4 mm
Frequency range	0.2 ... 20,000 Hz	See diagram; 5 Hz...10,000 Hz depending from module and scan distance; under optimal conditions up to 15 kHz
Installation mode	Direction sensitive	Direction independent

Technical data on electrical connection and signal detection

Sensors with one measuring channel

	FAH13	FAJ13
Supply voltage	9 ... 32 VDC	
Nominal voltage	24 VDC	
Current consumption	< 10 mA (without output current PNP)	< 6 mA (without output current PNP)
Connection	DIN 43650A, Mil14-5PN, Euro M12x1, DIN 72585 or cable end (see customer drawing)	
Measuring channels	1 measuring channel	
Output level Low	≤ 0.8 V @ 24 VDC, 10 mA, 24 °C	
Output level High	≥ UB-1.5 V @ 24 VDC, 10 mA, 24 °C	
Internal resistance Ri	45 Ω	
Output current NPN (Sink)	max. -50 mA	
Output current PNP (Load)	max. 50 mA	
Protection class	Housing: IP66/IP68/IP69 Connection Type A: IP65; Type C, E, H: IP67; Type X: IP66/IP68	Housing: IP66/IP68/IP69 Connection Type A: IP65; Type C, E, H: IP67; Type X: IP66/IP68
Approvals	CE, ABS, BV, DNV, LR	CE, ABS, BV, DNV, LR

Sensors with two measuring channels

	FAHZ13	FAHD13
Supply voltage	9 ... 32 VDC	2 x 9 ... 32 VDC
Nominal voltage	15 VDC	2 x 15 VDC
Current consumption	< 20 mA (without output current PNP)	2 x <10 mA (without output current PNP)
Connection	Cable end, see customer drawing	
Measuring channels	2 measuring channels	2 galvanically isolated measuring channels
Output level Low	Per output: ≤ 0.8 V @ 15 VDC, 10 mA, 24 °C	
Output level High	Per output: ≥ UB-1.6 V @ 15 VDC, 10 mA, 24 °C	
Internal resistance Ri	45 Ω	50 Ω
Output current NPN (Sink)	Per output: max. -50 mA	
Output current PNP (Load)	Per output: max. 50 mA	
Phase shift	90° ± 10% @ m1.5...m3 | 90° ± 15% @ m1...m1.25	
Protection class	Housing: IP66/IP68/IP69 Connection Type X: IP66/IP68	
Approvals	CE, ABS, BV, DNV, LR	

Sensors with two measuring channels and rotation direction signal

FAHS13	
Supply voltage	9 ... 32 VDC
Nominal voltage	15 VDC
Current consumption	< 20 mA (without output current PNP)
Connection	Cable end, see customer drawing
Measuring channels	2 measuring channels and status channel for rotation direction detection
Output level Low	Per output: ≤ 0.8 V @ 24 VDC, 10 mA, 24 °C
Output level High	Per output: ≥ UB-1.6 V @ 24 VDC, 10 mA, 24 °C
Internal resistance Ri	45 Ω
Output current NPN (Sink)	Per output: max. -50 mA
Output current PNP (Load)	Per output: max. 50 mA
Phase shift	90° ± 10% @ m1.5...m3 | 90° ± 15% @ m1...m1.25
Protection class	Housing: IP66/IP68/IP69 Connection Type X: IP66/IP68
Approvals	CE, ABS, BV, DNV, LR

Sensors with four output signals

FAHQ13	
Supply voltage	9 ... 32 VDC
Nominal voltage	15 VDC
Current consumption	< 20 mA (without output current PNP)
Connection	Cable end, Cable end, see customer drawing
Measuring channels	2 measuring channels
Output level Low	Per output: ≤ 0.8 V @ 15 VDC, 10 mA, 24 °C
Output level High	Per output: ≥ UB-1.6 V @ 15 VDC, 10 mA, 24 °C
Internal resistance Ri	45 Ω
Output current NPN (Sink)	Per output: max. -50 mA
Output current PNP (Load)	Per output: max. 50 mA
Phase shift	90° ± 10% @ m1.5...m3 | 90° ± 15% @ m1...m1.25
Protection class	Housing: IP66/IP68/IP69 Connection Type X: IP66/IP68
Approvals	CE, ABS, BV, DNV, LR

4 Installation

4.1 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).

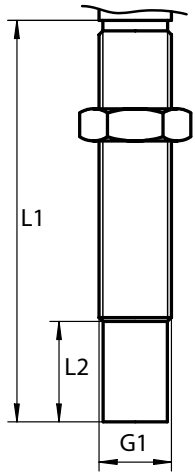
Otherwise the connection cable may be damaged.

READ

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

4.2 Preparing for installation

4.2.1 Dimensions



Explanation to the illustration
Please note the possible combinations of L1 and L2 for the nominal length in the type code.

L1: 60, 80, 100, 120 mm (up to 200 mm available on request)
L2: 5, 20, 40 mm
G1: M14x1; M16x1.5; M18x1; M18x1.5; 5/8“ – 18 UNF (see type code)

4.2.2 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.

4.2.3 Checking the mounting hole

Check the mounting hole before you install the sensor.

NOTICE

A faulty mounting hole may result in signal distortion, signal loss or even damage the sensor and the scanning object.

Therefore, carry out the following procedure.

A. Check the mounting hole for the sensor tube.

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

HINT

B. Mount the sensor carefully into the designated mounting hole for testing purposes.

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

4.2.4 Preparing tools and resources

For installation prepare the following tools:

- Proper screw-wrenches
- Torque wrench

4.3 Mounting the speed sensor

4.3.1 Mounting speed sensors with inductive-magnetic principle, type FAJxx

Mount the sensor according to the following instructions:

- **Prerequisite:** The system is switched off.
- **Prerequisite:** The mounting hole and the scanning object have been checked before mounting the sensor.

A. Remove the protective cap from the measurement area and the thread protection.

B. Screw the sensor carefully into the designated mounting hole and align the sensor exactly to the scanning object.

   ⇨ The mounting of the sensor is **direction independent**.

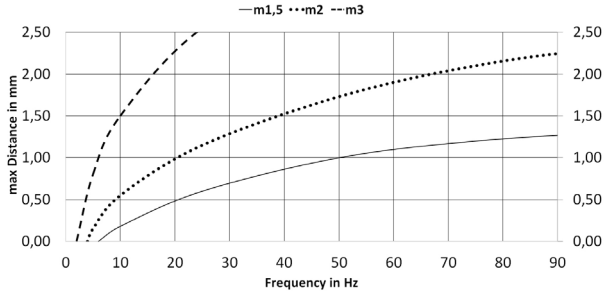
C. Check the recommended distance to the scanning object.

HINT

D. If the scanning object is not visible: screw the speed sensor clockwise to the end stop (until the sensor touches the scanning object). **NOTICE! Attention: The scanning object must stand still!!!** Now screw the sensor anti-clockwise according to its thread type to get the correct scanning distance (e. g. with thread type M18x1 one rotation correlates with 1 mm, with thread type M18x1.5 one rotation correlates with 1.5 mm, etc.). When mounting the sensor in a hole without a thread, the distance to the scanning object can be adjusted by the nut for mounting and the counter nut.

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

E. With modules > m2 the scanning distance may need to be adapted to get a valid output signal (see the following diagram).



2: FAJ Diagram max. scanning distance - frequency

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 correct scanning distance.

F. Mount the sensor with nut and counter nut.

⇨ Tighten the nuts with the correct torque (see next table).

NOTICE

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

The sensor may otherwise be damaged.

➡ The mounting is finished.

Thread	Material	Screw nut type	Torque
M18x1	Brass		30-35 Nm
			20-25 Nm
	Stainless steel		30-35 Nm
			20-25 Nm
M18x1,5	Stainless steel		35-40 Nm
			25-30 Nm
M16x1,5	Brass	- - -	20-25 Nm
M14x1	Brass	- - -	20-25 Nm
M14x1,5	Stainless steel	- - -	30-35 Nm
5/8“-18UNF	Brass	- - -	25-30 Nm

4.3.2 Mounting speed sensors with difference-Hall principle, type FAHxx

Mount the sensor according to the following instructions:

- **Prerequisite:** The system is switched off.
- **Prerequisite:** The mounting hole and the scanning object have been checked before mounting the sensor.

A. Remove the protective cap from the measurement area and the thread protection.

B. Screw the sensor carefully into the designated mounting hole and position the sensor exactly to the scanning object.

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

NOTICE

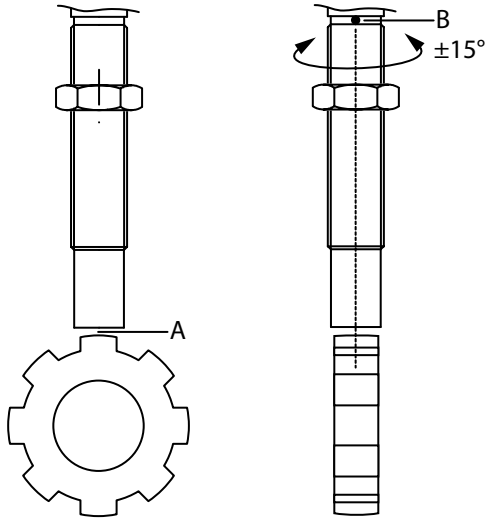
A too close scanning distance may lead to signal distortion, signal loss or may even damage the sensor and the scanning object.

Thus, maintain the recommended scanning distance.

HINT

D. If the scanning object is not visible: screw the speed sensor clockwise to the end stop (until the sensor touches the scanning object). **NOTICE! Attention: The scanning object must stand still!!!** Now screw the sensor anti-clockwise according to its thread type to get the correct scanning distance (e. g. with thread type M18x1 one rotation correlates with 1 mm, with thread type M18x1.5 one rotation correlates with 1.5 mm, etc.). When mounting the sensor in a hole without a thread, the distance to the scanning object can be adjusted by the nut for mounting and the counter nut.

E. The mounting of this sensor type is **direction sensitive**. Note the position of the marking. Now screw the sensor clockwise or anti-clockwise (use the shortest screw path) that the marking of the sensor is aligned in direction of rotation of the scanning object (see next Fig., Pos. B).



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

F. Mount the sensor with nut and counter nut.

⇨ Tighten the nuts with the correct torque (see next table).

NOTICE

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

The sensor may otherwise be damaged.

➡ The mounting is finished.

Thread	Material	Screw nut type	Torque
M18x1	Brass		30-35 Nm
			20-25 Nm
	Stainless steel		30-35 Nm
			20-25 Nm
M18x1,5	Stainless steel		35-40 Nm
			25-30 Nm

Thread	Material	Screw nut type	Torque
M16x1,5	Brass	- - -	20-25 Nm
M14x1	Brass	- - -	20-25 Nm
M14x1,5	Stainless steel	- - -	30-35 Nm
5/8“-18UNF	Brass	- - -	25-30 Nm

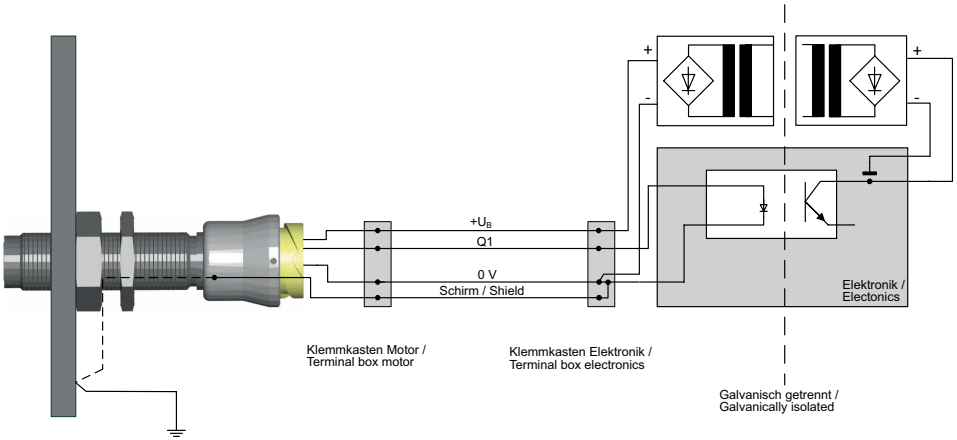
4.4 Connection and cable laying

4.4.1 Connection concepts

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.

4.4.1.1 Connection concept for strong electromagnetic environments

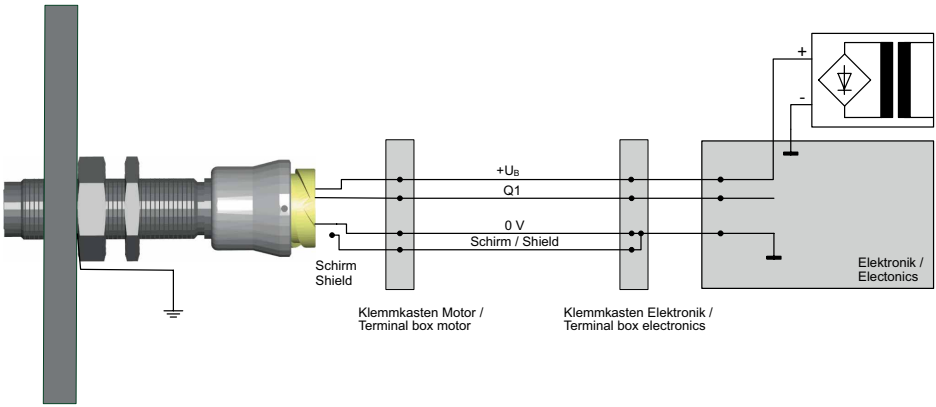
The signal outputs and the supply voltage of the processing electronics and of the sensor are galvanically isolated. The shield must be continuous and connected extensively at both connection points.



3: Concept with connected shield at both connection points, type FA[..]1[..]

4.4.1.2 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).



4: Concept with connected shield at one connection point, type FA[..]1[..]-S0

4.4.2 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.

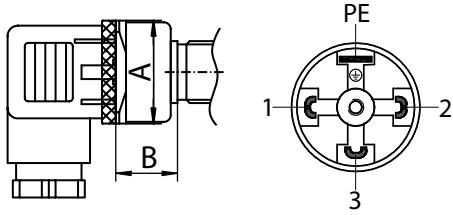
- In the cabinet the cables have to be laid near the cabinet housing (cabinet ground) or on the mounting plates to avoid crosstalk of the signals.
- Avoid tension, pressure and torsion stress on the cables.
- Make sure that no sharp-edged objects can touch the connection cables.
- Extensive cable shield 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.

4.4.3 Connection variants

Series 13 speed sensors are available with different connections.

Connection type	FAH13	FAHZ13	FAHS13	FAHD13	FAJ13	FAHQ13
DIN43650-A	X	-	-	-	X	-
MIL 14-5PN	X	-	-	-	X	-
EURO M12x1	X	On request	-	-	X	-
DIN72585	X	-	-	-	X	-

Connecting plug -A DIN43650 A



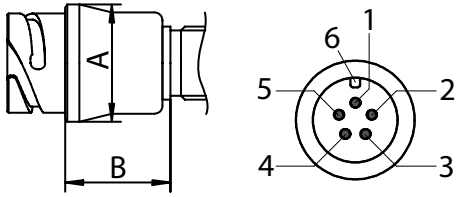
Protection class: IP65

Explanation to the left illustration

A: Length 30 mm
B: Length 18 mm
1: $+U_B$
2: $-U_B$ (0V)
3: Signal Q
PE: Shield

Note:
On delivery supplied with female connector.

Connecting plug -C MIL 14-5PN



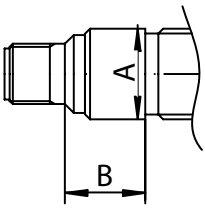
Protection class: IP67

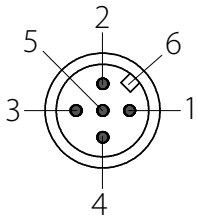
Explanation to the left illustration

A: Ø 29 mm
B: Length 26 mm
1: Shield
2: $-U_B$ (0V)
3: Signal Q
4: Signal Q
5: $+U_B$
6: Coding nib

Note:
On delivery without any female connector (accessories set ZL4-1A)

Connecting plug -E Euro M12x1





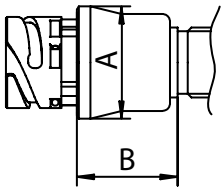
Protection class: IP67

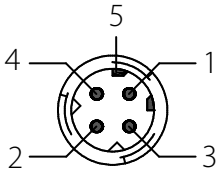
Explanation to the left illustration

A: Ø 18 mm
B: Length 16 mm
1: $+U_B$
2: not used
3: $-U_B$ (0V)
4: Signal Q
5: Shield
6: Coding nib

Note:
On delivery without any female connector (accessories set ZL4-2A)

Connecting plug -H1 DIN72585 Bayonet





Protection class: IP67

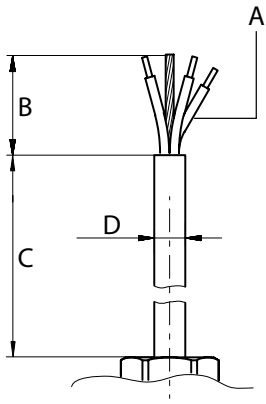
Explanation to the left illustration

A: Ø 29 mm
B: Length 26 mm
1: $+U_B$
2: $-U_B$ (0V)
3: Signal Q
4: Shield
5: Coding nib

Note:
On delivery without any female connector

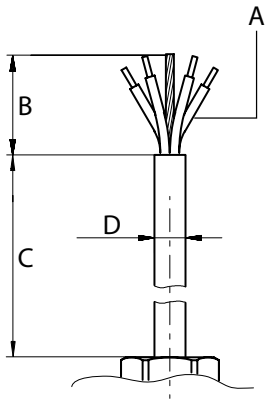
Connection type -X	FAH13	FAHZ13	FAHS13	FAHD13	FAJ13	FAHQ13
Cable with 3 wires	X	-	-	-	X	-
Cable with 4 wires	-	X	-	-	-	-
Cable with 6 wires	-	-	X	X	-	X

Connection cable type -X for sensors with 3 connecting wires



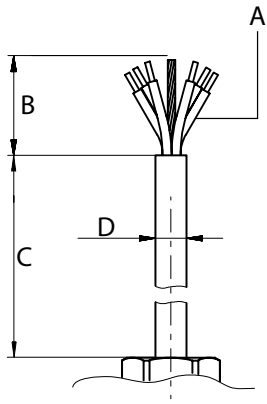
Explanation to the left illustration
A) 3 x 0.33 mm² halogen-free
B) 80 ± 10 mm
C) Length K1 ± 5 % (K1 see customer drawing)
D) Ø 4.6 ± 0.5 mm

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 mm^2 halogen-free
B) Length 80 $^{\pm 10}$ mm
C) Length K1 $^{\pm 5\%}$ (K1 see customer drawing)
D) Ø 7 $^{\pm 0.5}$ mm

5 Commissioning

5.1 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.

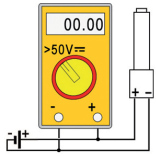
Otherwise the results of the measurements described below may be falsified.

5.2 Checking the operating voltage

You require the following tools and equipment:

- Multimeter

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



5: 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 $U_{nominal}$.

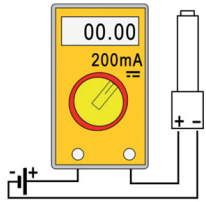
➡ Avoid reverse polarity.

5.3 Checking the current consumption

You require the following tools and equipment:

- Multimeter

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



6: 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).

5.4 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.

5.5 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.

5.6 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.

6 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.

7 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.

8 Troubleshooting

8.1 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.

8.2 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).

8.3 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)?

9 Service

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

NORIS Automation GmbH
Muggenhofer Str. 95
90429 Nuremberg
Germany
Phone: +49 911 3201 0
Fax: +49 911 3201 150
Email: info@noris-group.com
Web: www.noris-group.com

NORIS Automation GmbH
Friedrich Barnewitz-Str. 10
18119 Rostock
Germany
Phone: + 49 381 519944-0
Fax: + 49 381 519944-4
Email: info@noris-automation.de
Web: www.noris-group.com

NORIS Benelux B.V.
Nieuwland Parc 10L
2952DA Alblasserdam
Netherlands
Phone: + 31 78 890 7550
Fax: + 31 84 870 7666
Email: service.nblx@noris-group.com
Web: www.noris-group.com

NORIS Automation Far East Pte. Ltd.
No. 42 Toh Guan Road East
#01-80 Enterprise Hub
Singapore 608583
Singapore
Phone: + 65 62 67 85 36
Fax: + 65 62 67 85 37
Email: singapore@norisautomation.com

NORIS-SIBO Automation Co. Ltd.
G/F, No. 8 Building South
No. 2716 Pingliang Road, Yangpu
Shanghai (200090)
Phone: +86 21-68761180
Fax +86 21-68758808
Email: info@noris-sibo.com