

DATASHEET

NON-CONTACTING TWO-CHANNEL SPEED
SENSOR **TYPE HE 2000-52** WITH STAINLESS
STEEL FLANGE HOUSING AND SENSOR TUBE



Scanning type	Non-contacting
Measuring principle	HE 2000-H[...] : Hall principle HE 2000-W[...] : Eddy current principle
Frequency range	HE 2000-H[...] : 0.2 ... 20,000 Hz * HE 2000-W[...] : 0.2 ... 25,000 Hz
Supply voltage	9 ... 32 VDC
Scanning object	HE 2000-H[...] : Ferromagnetic materials only HE 2000-W[...] : Electrically conductive materials (e. g. aluminium)
Protection class	Housing: IP66/IP68/IP69 Connection: IP66/IP68; Only -XGT and -XGS: IP69
Material	Flange: Stainless steel
Length	See customer drawing
Mounting	Via flange mounting
Measuring channels	2 measuring channels
Output signal and signal type	2 square wave signals or 2 square wave signals + 1 status signal or 2 square wave signals + 2 inverted square wave signals
Output stage	Push-pull amplifier
Options	Inverted output signals; galvanically isolated output signals; status signal for direction of rotation detection

* 0 Hz on request

Application range

Series HE 2000-52 speed sensors are mainly used in the following area: Transport technology. Speed sensors type HE 2000-**H**52 usually measure the speed of ferromagnetic (e. g. steel), and type HE 2000-**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)

Specific features

- Type HE 2000-**W**[...]: Without magnetic preload and thus, no accumulation of metal chips
- Type HE 2000-**W**[...]: Scanning of all electrically conductive materials (steel or aluminium)
- Excellent vibration and shock resistance and double protection of the sensor head
- Robust and high quality housing: IP69 pressure-tight and individually tested at 5 bar (for details see technical data)
- Connection outlet straight or lateral; with protective tubing on request
- Due to its design and type approval according to DIN EN 50155 especially suitable for transport technology

Measuring principle

Speed sensors of the HE 2000-[...]52 series operate according to different measuring principles, depending on the sensor type:

Eddy current principle (HE 2000-W52)

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.

Hall principle (HE 2000-H52)

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.

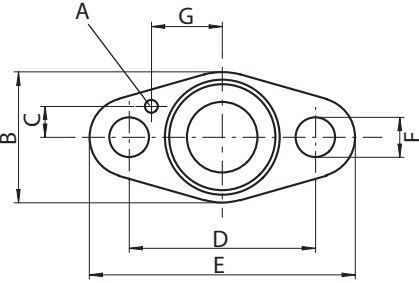
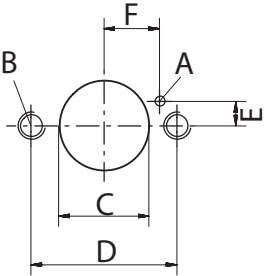
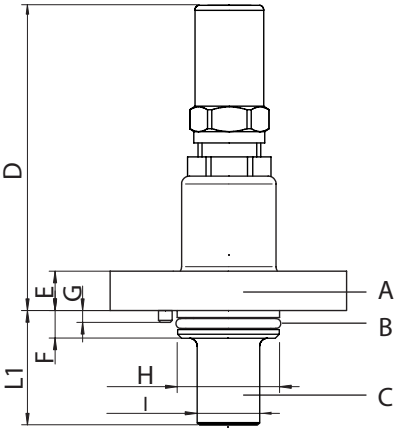
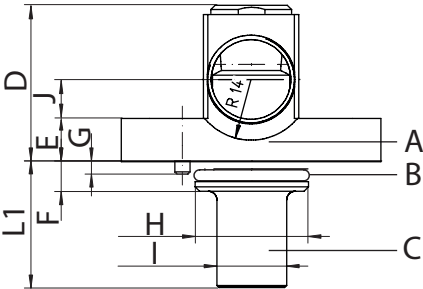
Overview speed sensors HE 2000-[..]52

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

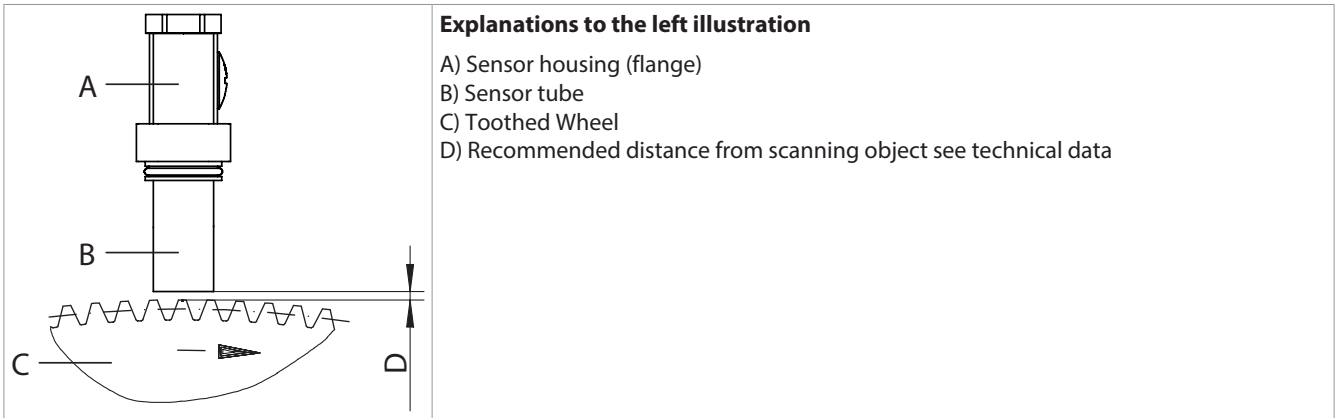
Type	Measuring principle	Signal outputs	Signal form
HE 2000-WZ52 HE 2000-HZ52	Eddy current Hall	Two square wave signals, Q2 to Q1 is 90° phase shifted	
HE 2000-WS52 HE 2000-HS52	Eddy current Hall	Two square wave signals, Q2 to Q1 is 90° phase shifted, one rotation direction signal	
HE 2000-WD52 HE 2000-HD52 HE 2000-HI52	Eddy current Hall	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	
HE 2000-WQ52 HE 2000-HQ52	Eddy current Hall	Two + Two inverted square wave signals, Q1 to Q2 and Q1_N to Q2_N are 90° phase shifted	

Dimensions, connections and drawings

Dimensions and mounting drawing

 <p>Fig.: HE 2000-[..]52_Front View_Dimensions</p>	<p>Explanation to the left illustration</p> <ul style="list-style-type: none"> 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) $\varnothing 9^{-0.5}$ mm G) Length 16 mm
 <p>Fig.: Borehole for HE 2000-[..]52_Top view</p>	<p>Explanation to the left illustration</p> <ul style="list-style-type: none"> A) Borehole depth for locator pin 3 mm (installing position) acc. DIN1481-3, borehole $\varnothing 4$ to 5 mm B) Borehole size M8 C) $\varnothing 26^{H10}$ mm D) Length 42 ± 0.2 mm E) Length 7 mm F) Length 16 mm <p>Recommended fixing: Hexagon socket screw DIN912 M8x20 with spring washer.</p>
 <p>Fig.: HE 2000-[..]52_Straight connection outlet</p>	<p>Explanation to the left illustration</p> <ul style="list-style-type: none"> 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) $\varnothing 26^{d10}$ mm I) $\varnothing 16$ mm
 <p>Fig.: HE 2000-[..]52_lateral connection outlet</p>	<p>Explanation to the left illustration</p> <ul style="list-style-type: none"> A) Flange: Stainless steel B) O-ring 21 x 2.5 mm C) Sensor tube: Stainless steel D) Length 36 ± 1 mm (for $L1 \geq 39$ 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) $\varnothing 26^{d10}$ mm I) $\varnothing 16$ mm J) Length 9 mm

Mounting position and scan object distance

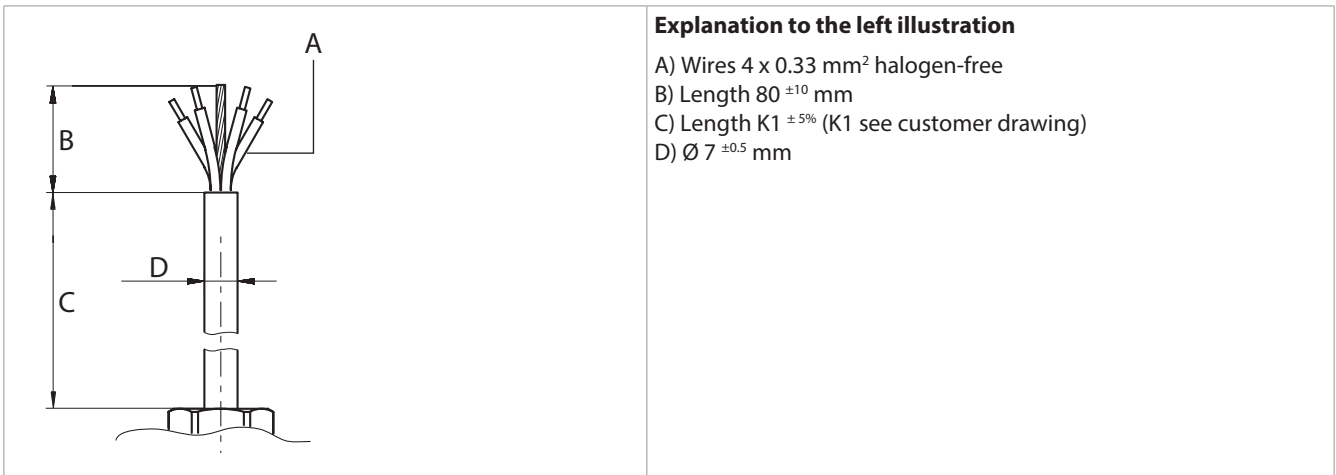


Connection cables and pin assignment

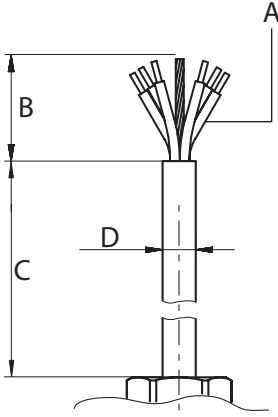
The following table shows an overview about the speed sensors and the related connection cables. All cables are available without protective tubing (-X type), with textile reinforced protective tubing (-XGT type), with steel reinforced protective tubing (-XGS type) or with polyamide protective tubing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

Connection type -X, -XGS, -XP	HE 2000-HZ52 HE 2000-WZ52 HE 2000-HI52	HE 2000-HS52 HE 2000-WS52	HE 2000-HD52 HE 2000-WD52	HE 2000-HQ52 HE 2000-WQ52
Cable with 4 wires	X	-	-	-
Cable with 6 wires	-	X	X	X

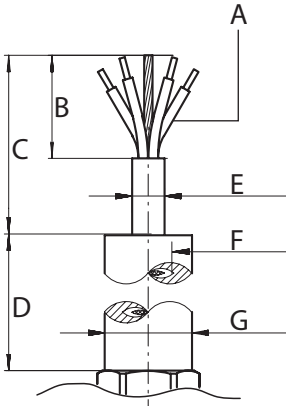
Connection cable type -X for sensors with 4 connecting wires



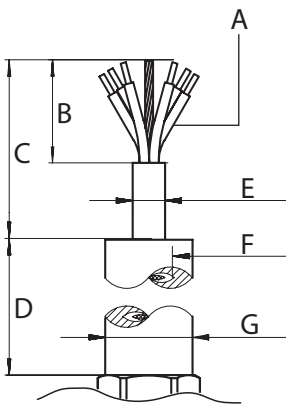
Connection cable type -X for sensors with 6 connecting wires

	<p>Explanation to the left illustration</p> <p>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</p>
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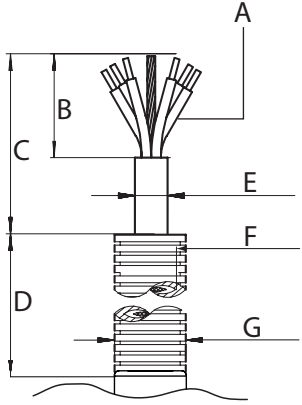
Connection cable type -XGS[...], -XGT[...] (protective tubing steel or textile reinforced) for sensors with 4 connecting wires

	<p>Explanation to the left illustration</p> <p>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</p>
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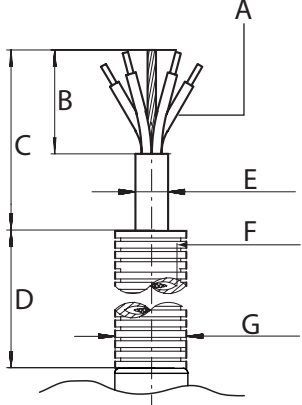
Connection cable type -XGS[...], -XGT[...] (protective tubing steel or textile reinforced) for sensors with 6 connecting wires

	<p>Explanation to the left illustration</p> <p>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</p>
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Connection cable type -XP[..] (polyamide protective tubing) for sensors with 6 connecting wires

	<p>Explanation to the left illustration</p> <p>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</p>
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Connection cable type -XP[..] (polyamide protective tubing) for sensors with 4 connecting wires

	<p>Explanation to the left illustration</p> <p>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</p>
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Connection assignment for type HE 2000-[..]Z

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

Connection assignment for type HE 2000-[..]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 HE 2000-[..]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 HE 2000-[..]D

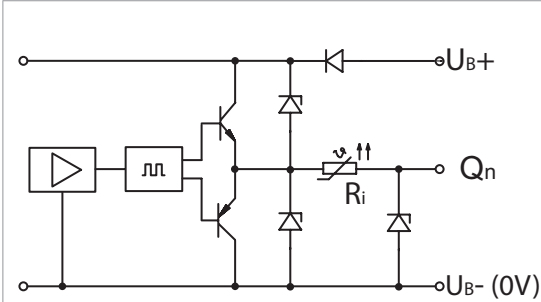
Colour	Explanation
Brown (System 1)	U _{S1} +
Green (System 1)	U _{S1} - (0V)
White (System 1)	Signal Q1
Pink (System 2)	U _{S2} +
Grey (System 2)	U _{S2} - (0V)
Yellow (System 2)	Signal Q2
Shield	Ground

Connection assignment for type HE 2000-[..]Q

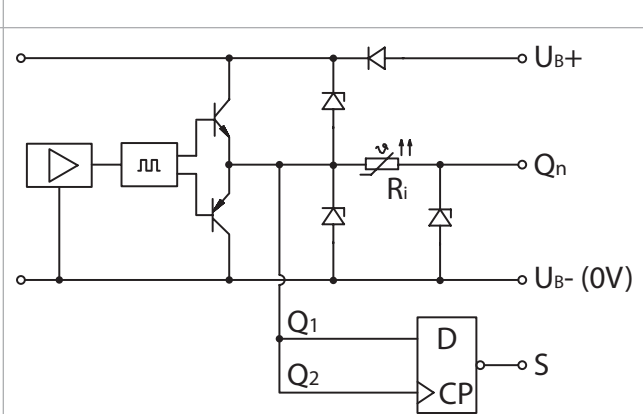
Colour	Explanation
Brown	U _S +
White	Q1
Grey	Q1_N, inverted to Q1
Yellow	Q2
Pink	Q2_N inverted to Q2
Green	U _S - (0V)
Shield	Ground

Electrical connection – Elementary circuit diagrams

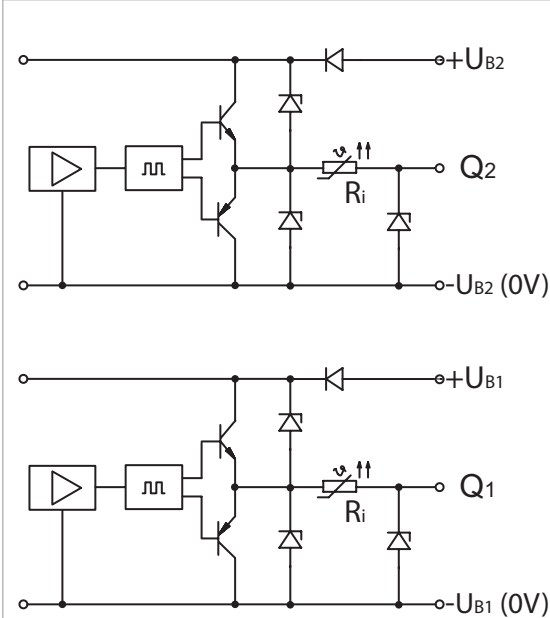
**Elementary circuit diagram HE 2000-[..]Z52,
HE 2000-[..]U52**



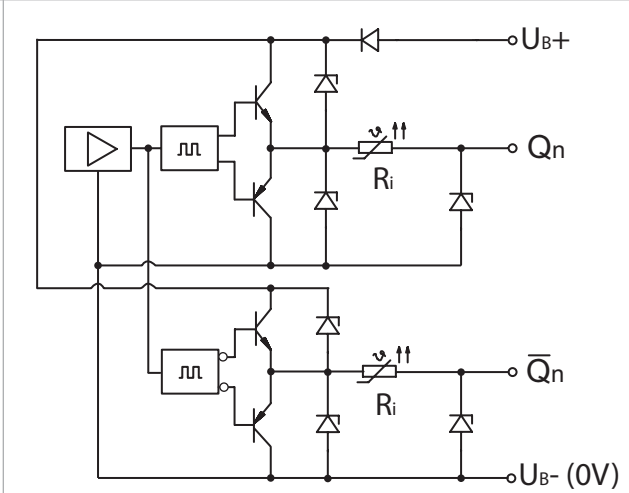
Elementary circuit diagram HE 2000-[..]S52



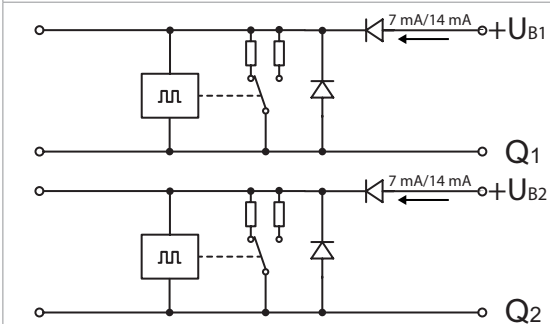
Elementary circuit diagram HE 2000-[..]D52



Elementary circuit diagram HE 2000-[..]Q52



Elementary circuit diagram HE 2000-[..]I52



General technical data

Electrical connection	
Supply voltage	See specific technical data
Nominal voltage	See specific technical data
Current consumption	See specific technical data
Reverse voltage protection	Yes
Over voltage protection	Yes
Connection	Cable end, customized connections acc. customer drawing
Recommended cable length	< 100 m
Used cable cross section	0.33 mm ² , shielded

Electrical output	
Measuring channels	See specific technical data
Output 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
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	HE 2000-H[...] type: 50% ± 10% HE 2000-W[...] 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/s ² @ 6 ms
Climatic test	DIN IEC 60068-T2-1/-2/-30
EMI - ESD	IEC 61000-4-2, Lev. 3
EMI - Burst	IEC 61000-4-4, Lev. 3
EMI - Surge	IEC 61000-4-5, Lev. 2
EMI - HF immunity	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	HE 2000-H[...]52: Stainless steel flange and measuring area HE 2000-W[...]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: $\varnothing \geq 5$ 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	$90^\circ \pm 10\%$ @ m1.5...m3 $90^\circ \pm 15\%$ @ m1...m1.25	$90^\circ \pm 25\%$ @ 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 - DNVGL-CG-0339

Technical data for electrical connection and output

Sensors with two output signals (galvanically connected)

HE 2000-WZ[..], HE 2000-HZ[..]	
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

Sensors with two galvanically isolated output signals

	HE 2000-WD[..], HE 2000-HD[..] (voltage signal output)	HE 2000-HI[..] (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	-	$RL_{max} = (UB - 7.5V) / 16 \text{ mA} + 10\%$
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

Sensors with two output signals and status output

HE 2000-WS[..], HE 2000-HS[..]	
Supply voltage	9 ... 32 VDC
Nominal voltage	15 VDC
Current consumption	< 20 mA (without output current PNP)

HE 2000-WS[..], HE 2000-HS[..]	
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

Sensors with two output signals und two inverted output signals

HE 2000-WQ[..], HE 2000-HQ[..]	
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

Type code

Type code structure										
HE 2000-	W	Z	52-	11-	S	X	07-	M30-	S0	Example: HE 2000- WZ52-11-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 HE 2000-H[..]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					
Shield				M30-	Module m3					
					Without code: Shield attached to the sensor housing					
				S0	Shield not attached to the sensor housing					
Addition				F0	Frequency range commencing at 0 Hz					
HE 2000-	---	---	---	---	---	---	---	---	---	Example: HE 2000-HZ52-11-X07-S0-F0 (Preferred type)

Type code HE 2000-W[...] 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						
HE 2000-	--	--	--	--	--	--	--	--	--	Example: HE 2000-WZ52-11-X07-S0 (Preferred type)

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

Special types

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

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HaslerRail AG

Freiburgstrasse 251
3018 Bern

CH-Switzerland

Tel: +41 31 990 71 11

Fax: +41 31 990 72 22

info@haslerrail.com

www.haslerrail.com