JAQUET DSD.7x

Dual Channel Hall Effect Speed Sensor for Railway Applications

Compliant with EN 50155

General

Function	The speed sensors family DSD.7x are suitable for generating two 90° phase-shifted square wave signals proportional to the rotary speed. They have a static behavior, so that pulse generation is guaranteed down to a speed **corresponding** to a frequency of 0 Hz. The monitoring elements consist of two magnetically biased differential Hall effect semiconductors. The internal dual channel structure requires that the sensor must be oriented. The sensors have a flange for proper installation.

Product identification

DS	D	_	_	.	_	_	_	_	H	_	-	_	_	_	
DS	D	16	30	.	7	0	P	1	H	W	-	F	300	G	Example of identification

Sensor housing
F: standard straight
G: 90° angle housing
S: customized housing design

Cable length in cm

Cable Screen
F: not connected to the sensor housing (standard)
C: connected to the sensor housing

Output signal characteristics
W: 2 channels with 90° phase shift, push-pull output
V : 1 channel push-pull output
RW: 2 galvanic insulated channels with 90° phase shift, push-pull output
R2W: 2 galvanically insulated circuits with one or two channels with typically 90° phase shift, push-pull output

Temperature Class
H: High temperature -40°C … +125°C

Customer specific version number

Connection Method
S: integral cable with open ends
A: connector integrated in housing
P: integral cable terminated with a connector
Q: cable protected with cable sleeve and connector
M: open end cable protected with cable sleeve

Electronic Type
Type 70:
Push-pull 2 channels with galvanic separation between channels
Type 71:
Push-pull 2 channels, no galvanic separation between channels
Type 72:
Push-pull 2 channels with galvanic separation between channels plus 2 channels with the digitally inverted signals
Type 73:
Push-pull 2 channels, no galvanic separation between channels plus 2 channels with the digitally inverted signals
Type 74:
Circuit 1: two channels typ.90° phase shift
Circuit 2: two channels typ. > 20° phase shift
Type 75:
Circuit 1: two channels typ. 90° phase shift, additionally the digitally inverted signals
Circuit 2: two channels typ >20° phase shift
Type 76:
Circuit 1: two channels typ. 90° phase shift
Circuit 2: one channel
Type 77:
Circuit 1: two channels typ. 90° phase shift,
Circuit 2: one channel with frequency division (f/2)
Type 78:
Circuit 1: two channels 90° phase shift
Circuit 2: two channels with frequency division (f/2)

Target module
xy: module multiplied by 10
p. ex. 20: module 2.0

Size of the sensor housing (diameter in mm)
16: sensor head diameter 16mm
25: sensor head diameter 24.5mm

Sensor Technology
D: differential Hall-effect sensor

Technical data

Supply voltage	Nominal 15VDC (9 VDC to 30 VDC), protected against transient over-voltages and reverse polarity
Supply voltage V1	9 VDC to 30 VDC, protected against transient over-voltages and reverse polarity (nominal 15V)
Supply voltage V2	9 VDC to 30 VDC, protected against transient over-voltages and reverse polarity (nominal 15V)
Signal output	**General data** • 2 phase shifted square wave signals, minimum edge shift with an involute gear wheel: minimal phase shift of 20° for gear of the defined module between output 1 (S1) and output 2 (S2) • Push-pull outputs : I_{max} = ± 30 mA o Output voltage HI (for I = I_{max}): $U_{HI} > U_{supply}$ - 1.5 V o Output voltage LO (for I = I_{max}): $U_{LO} < 1.5$ V • The output stages are current limiting and short-circuit proof due to a temperature shutdown mechanism: o Thermal shutdown threshold: 145 … 175°C o Thermal re-start threshold: 135 … 165°C o Hysteresis: 5 … 20°C **Type .70** • The two systems (V1, GND1, S1 and V2, GND2, S2) are galvanically isolated against each other. **Type .71** • No galvanic isolation between the two systems. **Type .72** • The signal /S1 is digitally inverted to the signal S1. The signal /S2 is digitally inverted to the signal S2. • The two systems (V1, GND1, S1 and V2, GND2, S2) are galvanically isolated. **Type .73** • The signal /S1 is digitally inverted to the signal S1. The signal /S2 is digitally inverted to the signal S2. • No galvanic isolation between the two systems. **Type .74** • 2 phase shifted square wave signals with a phase shift of 90°±45° between output S3 and output S4 for an involute gear of module 2 • The two systems (V1, GND1, S1, S2) and (V2, GND2, S3, S4) are galvanically separated against each other. **Type .75** • The signal /S1 is digitally inverted to the signal S1. The signal /S2 is digitally inverted to the signal S2. • 2 phase shifted square wave signals with a phase shift of 90°±45° between output S3 and output S4 for an involute gear of module 2 • The two systems (V1, GND1, S1, S2) and (V2, GND2, S3, S4) are galvanically separated against each other. **Type .76** • 1 square wave signal (S3) galvanically isolated and independent from S1 and S2 • The two systems (V1, GND1, S1, S2) and (V2, GND2, S3) are galvanically isolated against each other. **Type .77**

- 1 square wave signal (S3) galvanically isolated and independent from S1 and S2 with a frequency division by 2 (f/2)
- The two systems (V1, GND1, S1, S2) and (V2, GND2, S3) are galvanically isolated against each other.

Type .78

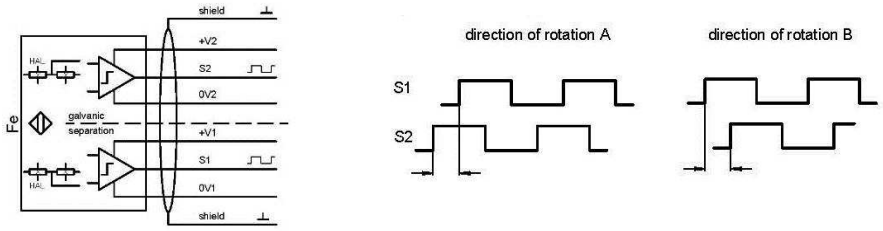
- 2 phase shifted square wave signals with a phase shift of 90°±45° between output S3 and output S4 for an involute gear of module 2 with a frequency division by 2 (f/2)
- The two systems (V1, GND1, S1, S2) and (V2, GND2, S3, S4) are galvanically separated against each other.

Current consumption	max. 10 mA (without load)
Frequency range	0 Hz … 20 kHz

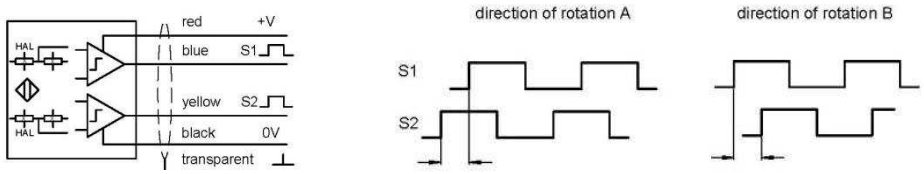
Signal patterns, electronic type

Schematic diagram **Pulse diagram**

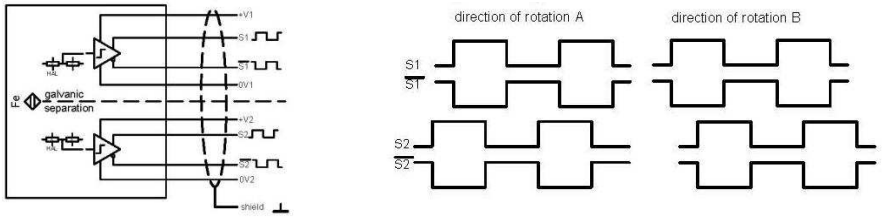
Type 70: push-pull 2 channels with galvanic separation between channels



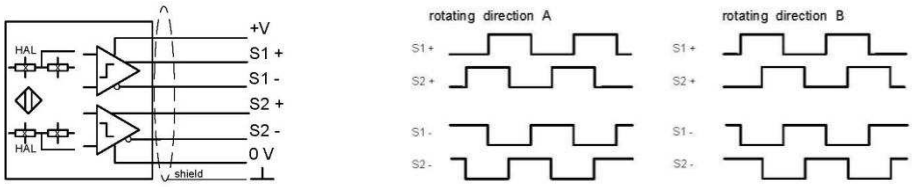
Type 71: push-pull 2 channels, no galvanic separation between channels



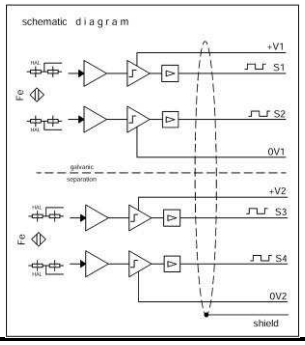
Type 72: push-pull 2 channels with galvanic separation between channels plus 2 channels with the digitally inverted signals

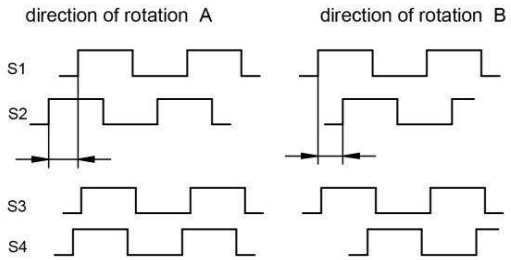


Type 73: push-pull 2 channels, no galvanic separation between channels plus 2 channels with the digitally inverted signals

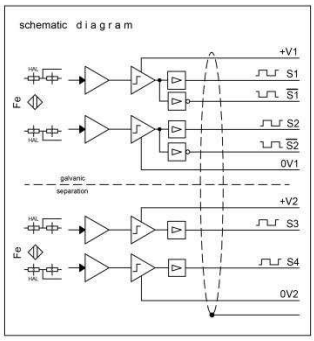


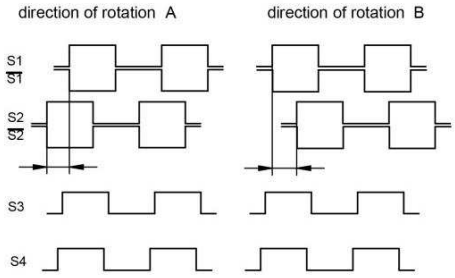
Type 74: Circuit 1: two channels typ.90° phase shift, Circuit 2: two channels >20° phase shift



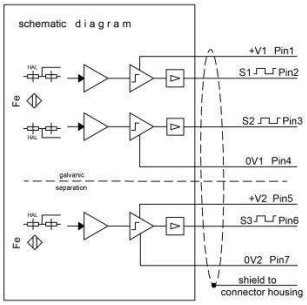


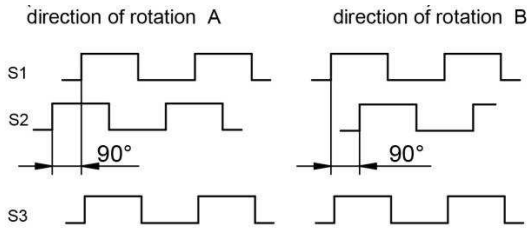
Type 75: Circuit 1: two channels typ. 90° phase shift, additionally the digitally inverted signals, Circuit 2: two channels typ >20° phase shift



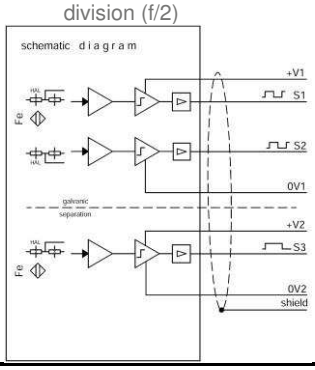


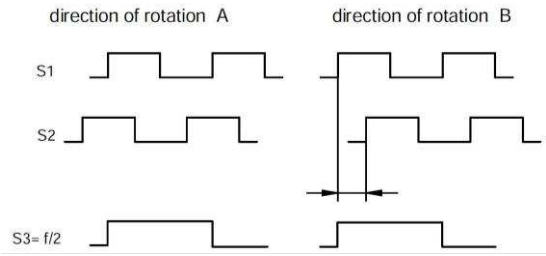
Type 76: Circuit 1: two channels typ. 90° phase shift, Circuit 2: one channel



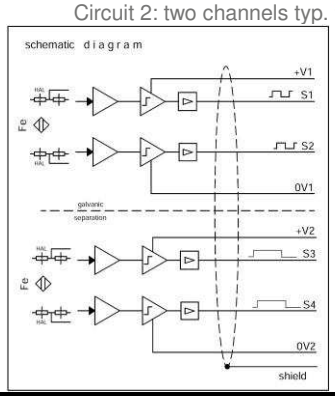


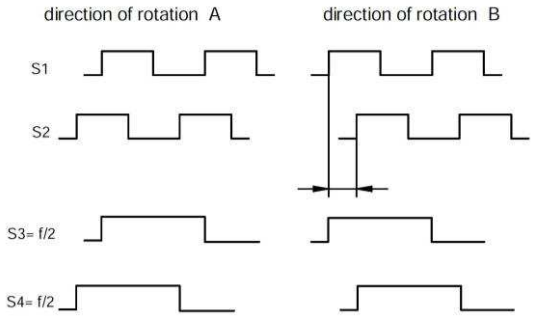
Type 77: Circuit 1: two channels typ. 90° phase shift, Circuit 2: one channel with frequency division (f/2)





Type 78: Circuit 1: two channels typ. 90° phase shift,
Circuit 2: two channels typ. 90° phase shift with frequency division (f/2)





Electromagnetic compatibility (EMC)	According to directive 2014/30/EU (2004/108/EC until 2016-04-19) EN 50155:2007 applying EN 50121-3-2:2015 **Common** Electrostatic discharge according to IEC 61000-4-2 • Up to ± 8 kV air discharge • Up to ± 6 kV contact discharge Electrical fast transients/bursts according to IEC 61000-4-4 direct coupling • Up to ± 2 kV peak, 5/50 ns, 5 kHz Surges according to IEC 61000-4-5 • ± 2 kV 1.2/50 ↘s (common mode) • ± 1 kV 1.2/50 ↘s (differential mode) Radio frequency injected current according to IEC 61000-4-6 • Up to 10 V, 80% AM, 1 kHz, 1000 ms in the range of 0.15 MHz ... 80 MHz with 50 ⌣ load and 560 ⌣ pull up resistance Power frequency magnetic field according to IEC 61000-4-8 • 300 A/m (1 min) tested with 16 2/3 Hz, 50 Hz in each axis • 1000 A/m (3 s) tested with 16 2/3 Hz, 50 Hz, 60 Hz in each axis Radiated emission (at 3 m) • 30 MHz …230 MHz: 50 dB mV/m • 230 MHz … 1 GHz: 57 dB mV/m **Type .70/.71/.73** Radiated electromagnetic field according to IEC 61000-4-3 • Up to 30 V/m, 80% AM, 1 kHz in the range of 80 MHz … 1000 MHz • Up to 10 V/m, 80% AM, 1 kHz in the range of 1400 MHz … 2500 MHz Electrical fast transients/bursts according to IEC 61000-4-4 direct coupling • Up to ± 2 kV peak, 5/50 ns, 5 kHz **Type .74/76** Radiated electromagnetic field according to IEC 61000-4-3 • Up to 20 V/m, 80% AM, 1 kHz in the range of 80 MHz … 1000 MHz • Up to 10 V/m, 80% AM, 1 kHz in the range of 1400 MHz … 2000 MHz • Up to 5 V/m, 80% AM, 1 kHz in the range of 2000 MHz … 2700 MHz • Up to 3 V/m, 80% AM, 1 kHz in the range of 5100 MHz … 6000 MHz Electrical fast transients/bursts according to IEC 61000-4-4 • Up to ± 4 kV peak, 5/50 ns, 5 kHz
Protection class	• Sensor head: IP68 • IP68 (head) and IP67 (connector, cable outlet) (P/Q/S) • Connector: according to connector specification (see below)

Shock & Vibration	compliant with EN 61373 Cat.3
Operating temperature	• Sensor head: -40° ... +125°C • Cable: according to cable specification (see below) • Connector: according to connector specification (see below) • Protection tube: according to protection tube specification
Requirements for pole wheel	Toothed wheel of a magnetically permeable material (e.g. Steel 1.0036) Optimal performance with • Involute gear • Tooth width ≥ 10 mm • Side offset < 1.0 mm • Eccentricity < 0.2 mm
Air gap between sensor housing and pole wheel for involute gear	Module 1 0.5 … 0.7 mm Module 1.5 0.5 … 1.3 mm Module >=2 0.5 … 1.5 mm
Insulation	• Insulation between electronics and housing: 700 VDC, > 100 MOhm • Insulation between shield and housing:700 VDC, > 100 MOhm

Mechanical

Housing	Stainless steel 1.4305, front side sealed hermetically and resistant against splashing water, oil, conducting carbon- or ferrous dust and salt mist. Electronic components potted in chemical and age proof synthetic resin. Dimensions according to the drawing.

Cable (Examples)

Jaquet cable type	Properties
824L-36622	Armoured cable: 6-wire, 0.6 mm^2 (AWG 20), PEIC insulated, fire retardant, low smoke, PVC and halogen free, oil-proof, waterproof, outer-Ø max. 13.0 mm, min. bending radius = 30 mm (static) and 65 mm (dynamic), screened (metal net), black casing (silicone) Operating temperature: -40°C to +150 °C
824L-36808	Armoured cable: 8-wire, 0.6 mm^2 (AWG 20), PEIC insulated, fire retardant, low smoke, PVC and halogen free, oil-proof, waterproof, outer-Ø max. 13.0 mm, min. bending radius = 30 mm (static) and 65 mm (dynamic), screened (metal net), black casing (silicone) Operating temperature: -40°C to +150 °C.

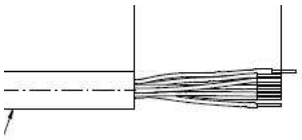
Connector (Examples)

Jaquet connector type	Manufacturer code
820E-37053	8380 F1E 075 BW1C Operating temperature: -40°C to +100°C Plug-and-socket connection: IP67 (with adapted backshell)
820E-37228	8380 F1E 091 BW1A Operating temperature: -40°C to +100°C Plug-and-socket connection: IP67 (with adapted backshell)
820E-37416	AB Connector ABCIRPSE06T1819SVON Operational temperature: -55°C to +125°C Plug-and-socket connection: IP67 (with adapted backshell)

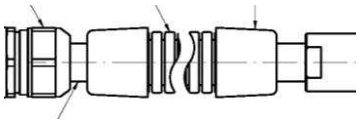
Protective conduit

Jaquet type	Properties
825G-36341	PCSG-17B, material: polyamide, high resistance to ultra violet rays and atmospheric corrosion, excellent flexibility, self-extinguishing, free from halogens and cadmium, bending radius min. 35 mm (static) and 85 mm (dynamic), black. Operating temperature (acc. to IEC EN 61386): -45°C to +120°C

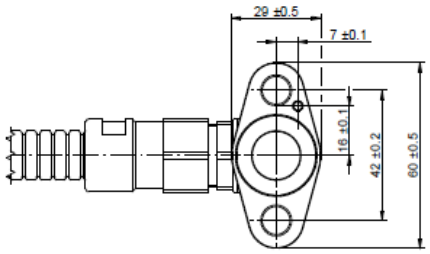
Examples of connection method



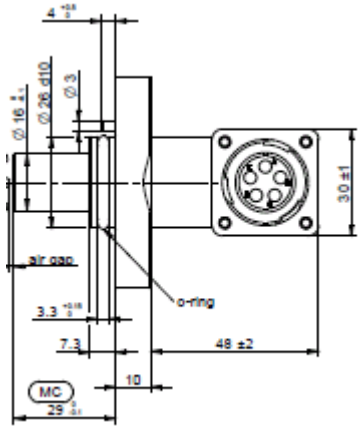
S: open wire ends



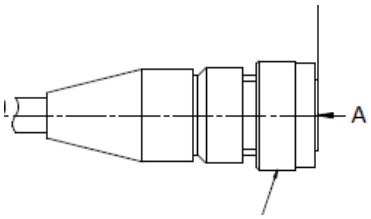
Q: straight with flexible cable sleeve



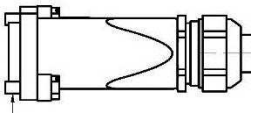
Q: fix cable sleeve and 90°



A: connector integrated in housing



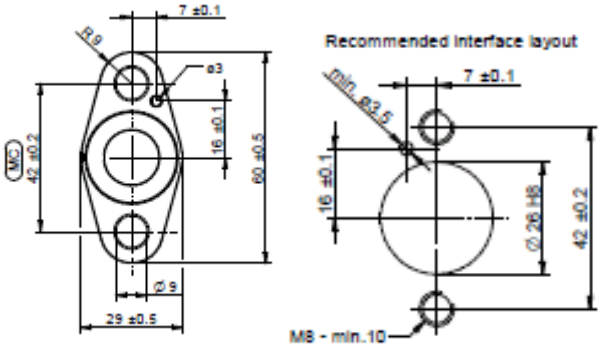
P: round connector



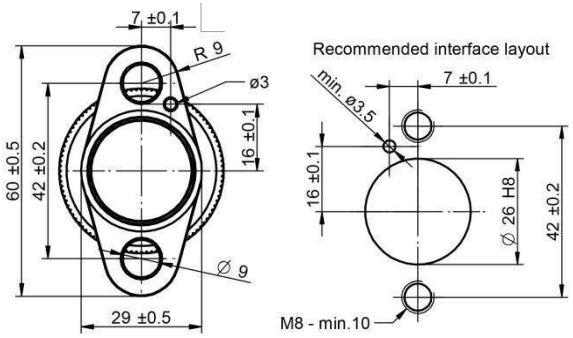
P: rectangular connector

Sensor housing basic dimensions

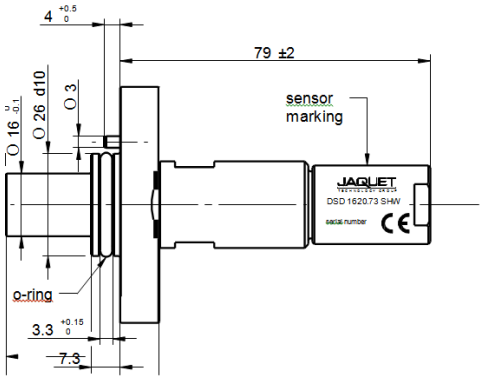
Recommended interface layout for 16mm shaft



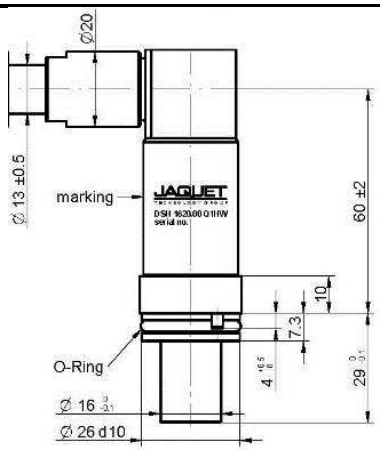
Recommended interface layout for 24.5mm shaft



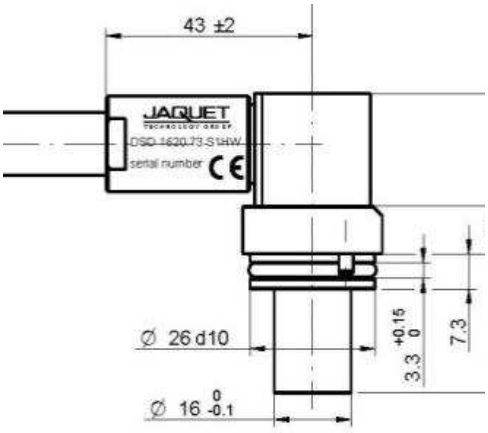
Examples of sensor heads



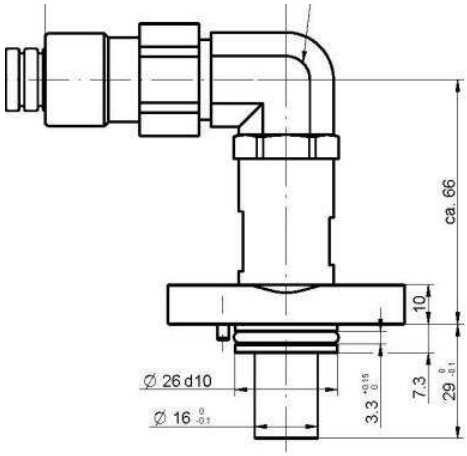
F: straight



G: 90° long



G: 90° short



G: 90° long nose

Further Information

Safety	All mechanical installations must be carried out by an expert. General safety requirements have to be met.
Connection	The sensors must be connected according to sensor drawing. Sensor wires are susceptible to radiated noise. Therefore, the following points haveto be considered when connecting a sensor: The sensor wires must be laid as far as possible from large electrical machines. They must not run parallel in the vicinity of power cables. The maximum permissible cable length is dependent upon the sensor voltage, the cable routing, along with cable capacitance and inductance. However, it is advantageous to keep the distance between sensor and instrument as short as possible. The sensor cable may be lengthened via a terminal box located in an IP20 connection area in accordance with EN 60529.
Installation	The sensor has to be aligned to the pole wheel according to the sensor drawing independent of its rotational orientation. Deviations in positioning may affect the performance and decrease the noise immunity of the sensor. During installation, the smallest possible pole wheel to sensor gap should be set. The gap should however, be set to prevent the face of the sensor ever touching the pole wheel. The amplitude of the output signal is not influenced by the air gap. A sensor should be mounted with the middle of the face side over the middle of the pole wheel. Dependent upon the wheel width, a certain degree of axial movement is permissible. However, the middle of the sensor must be at minimum in a distance of 3 mm from the edge of the pole wheel under all operating conditions. A solid and vibration free mounting of the sensor is important. Eventual sensor vibration relative to the pole wheel can induce additional output pulses. The sensors are insensitive to oil, grease etc. and can be installed in arduous conditions. Within the air gap specified the amplitude of the output signals is not influenced by the air gap.
O-Ring care	In these products, an O-Ring with dimensions Ø22x2mm is used. In order to guarantee for a correct mounting and sealing over the sensor's lifetime, the O-Ring shall be lubricated circumferentially with a thin film of grease or gearbox oil before installation. The preferred grease is Parker's O-Lube (Parker Item No. 30001000001). In order not to extrude the O-Ring during installation, the sensor shaft axis must be positioned concentrically with the axis of the mounting bore. The mounting bore must be free from burrs and the bore must be outfitted with an appropriate chamfer (outlined in the dimensional drawing). In case spare O-Rings are needed, JAQUET part No. 9062612724 is required.
Operation	The sensor is designed for normal use in its dedicated environment. The manufacturer cannot take responsibility for any abnormal use that might lead to a reduced lifetime of the sensor.
Maintenance	Product cannot be repaired
Transport	Product must be handled with care to prevent damage of the front face.
Storage	Product must be stored in dry conditions. The storage temperature corresponds to the operation temperature.
Disposal	Product must be disposed of properly; it must not be disposed as domestic waste

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