rexroth
A Bosch Company

Draft sensor
KMB

RE 95170/12.2018
Replaced: 11.2017

- Force measurement for hitch control and baling presses
- Measuring ranges ±25 kN ... ±160 kN
- Output signal proportional voltage
- Supply voltage 5 V / 8 ... 10 V
- Protection class up to IP67 / IP69K

Features

- Force sensor according to category 3 of ISO 730-1 rear-mounted three-point linkage
- Sensor element with magneto-elastic measurement principle
- Integrated electronics
- Output signal ratiometric and proportional to the force
- Zero point and sensitivity are calibrated

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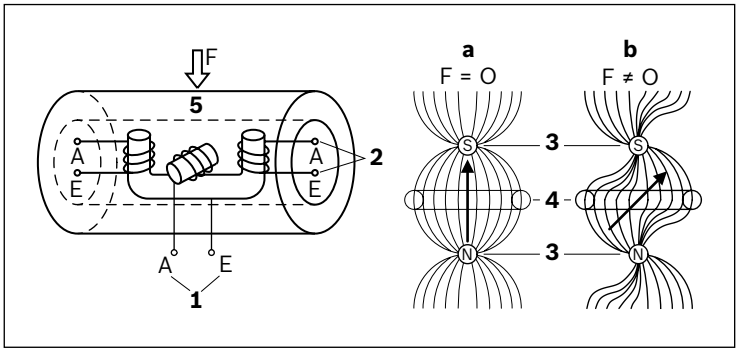
Product description

Description

The force sensor is constructed as a bearing block. Shear stress arises at the bearing position which is analyzed as a magneto-elastic effect.
In the unloaded state a symmetrical magnetic field forms between the poles due to the primary coil. If tensile or compressive forces are introduced, the magnetic properties of the originally isotropic material change. The magnetic field becomes asymmetric as a result. This leads to a magnetic potential difference between the secondary poles. This causes a magnetic flux through the secondary circuit so that a voltage is induced in the secondary coils.
This voltage is proportional to the force that is exerted. It is amplified an rectified in an integrated evaluation circuit.

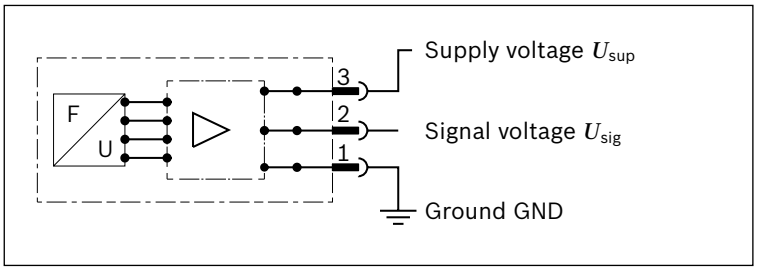
The sensor provides a ratiometric voltage (25 % to 75 % of the supply voltage). It is available for various measuring ranges and versions of cable. This sensor is a typical integral part of electro-hydraulic hitch control (EHC).
This sensor is intended for being used in agricultural technology.

Functional principle



1	Primary coil
2	Secondary coil
3	Primary pole area
4	Secondary pole area
5	Steel sleeve
a	Symmetrical magnetic field
b	Asymmetrical magnetic field

Block diagram



Type code

01	02	03	04	05		06	07
KMB					**/**	**30**	

Type		
01	Force measurement pin	**KMB**
Load range		
02	±25 kN	**025**
	±40 kN	**040**
	±50 kN	**050**
	±60 kN	**060**
	±90 kN	**090**
	±110 kN	**110**
	±150 kN	**150**
	±160 kN	**160**
Supply voltage		
03	5 ±0.5 V	**05**
	8 V ... 12 V	**10**
Cable versions		
04	Cable without protective sheath	**1**
	Cable with protective spiral sheath	**2**
	Cable with protective metal sheath	**3**
	Cable with protective plastic sheath	**4**
Plug		
05	AMP plug, 3-pin	**A**
	DEUTSCH connector; 3-pin	**B**
Series		
06		**30**
Cable length		
07	800 mm	**08**
	965 mm	**09**
	1000 mm	**10**
	1500 mm	**15**
	1600 mm	**16**
	1800 mm	**18**
	2700 mm	**27**

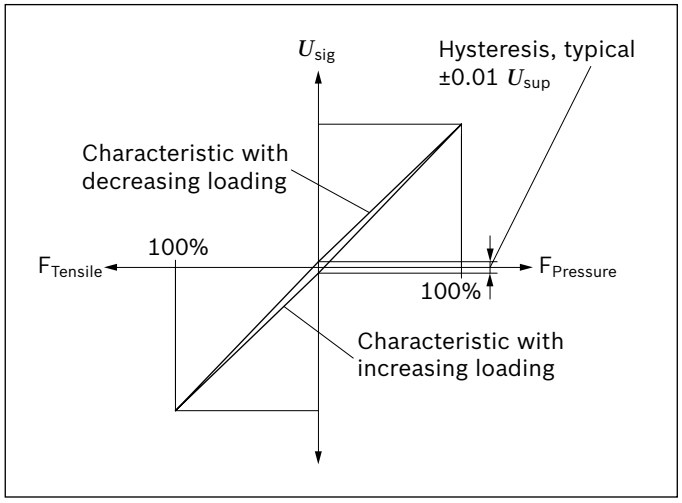
Type	Material number
KMB 025 05 1A/30–15	R917007592
KMB 025 05 4A/30–08	R917008079
KMB 025 05 4A/30–15	R917008045
KMB 025 10 1A/30–15	R917000161
KMB 025 10 4A/30–08	R917000177
KMB 025 10 4A/30–10	R917000158
KMB 025 10 4A/30–15	R917000175
KMB 040 05 1A/30–15	R917008099
KMB 040 05 3A/30–15	R917008667
KMB 040 05 4A/30–18	R917008003
KMB 040 10 1A/30–15	R917000153
KMB 040 10 2A/30–27	R917000160
KMB 040 10 3A/30–15	R917000155
KMB 040 10 3A/30–15	R917001320
KMB 040 10 4A/30–08	R917000167
KMB 040 10 4A/30–16	R917000159
KMB 040 10 4A/30–18	R917000180
KMB 050 10 2A/30–08	R917000157
KMB 060 05 1A/30–15	R917008098
KMB 060 05 3A/30–15	R917008077
KMB 060 10 1A/30–15	R917000154
KMB 060 10 2A/30–27	R917000164
KMB 060 05 3A/30–15	R917008077
KMB 060 10 3A/30–15	R917000156
KMB 060 05 4A/30–18	R917008060
KMB 060 10 4A/30–08	R917000166
KMB 060 10 4A/30–15	R917000173
KMB 060 10 4A/30–16	R917000165
KMB 060 10 4A/30–18	R917000181
KMB 090 10 1A/30–15	R917000168
KMB 090 10 1A/30–15	R917000171
KMB 090 10 2A/30–27	R917001969
KMB 090 05 3A/30– 15	R917008078
KMB 090 10 3A/30–15	R917000163
KMB 090 05 4A/30–18	R917008061
KMB 090 10 4A/30–15	R917000172
KMB 090 10 4A/30–18	R917000275
KMB 110 05 1A/30–15	R917005142
KMB 110 10 1A/30–15	R917000179
KMB 110 10 2A/30–08	R917000162
KMB 150 10 1A/30–15	R917A05986

Technical data

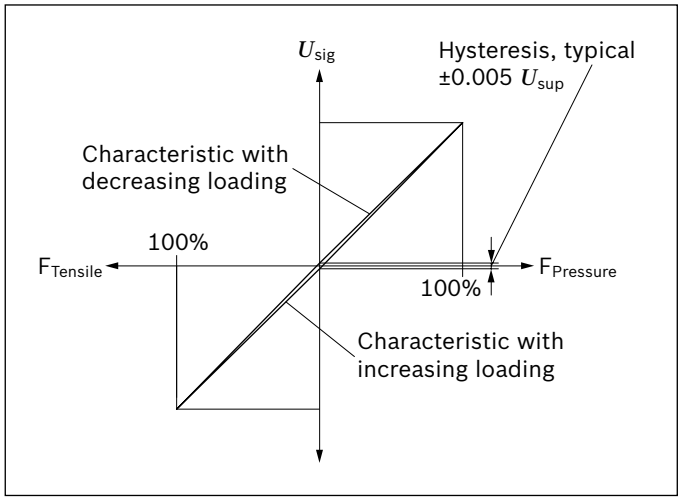
Type		**025**	**040**	**050**	**060**	**090**	**110**	**150**
Load range	F	±25 kN	±40 kN	±50 kN	±60 kN	±90 kN	±110 kN	±150 kN
Overload range: standard		±80 kN	±80 kN	±80 kN	±160 kN	±160 kN	±160 kN	±220 kN
Electrically measurable overload		+1.2 $F_{pressure}$ ... –1.5 $F_{tensile}$						
Supply voltage	U_{sup}	8 V... 10 V controlled voltage (no direct supply from the vehicle electrical system (battery) or 5±0.5 V						
Supply current	I_{sup}	< 100 mA at 8 V ... 10 V; < 50 mA at 5 ±0.5 V						
Signal voltage	U_{sig}	25% ... 75% U_{sup} at 8 V ... 10 V; 15% ... 85% U_{sup} at 5±0.5 V						
Load resistance		≥ 10 kΩ						
Characteristic curve		1	1	1	2	2	2	2
Hysteresis		See offer drawings						
Operating temperature range		-35 °C ... +85 °C						
Storage temperature range		-40 °C ... +125 °C (permanent); +130 °C (max. 2 hrs)						
Type of protection with installed mating connector	AMP	IP67 and IP69K						
	DEUTSCH	IP66K						
Vibrational load		24 g						
Mating connector		3-pin connector with single-wire seal						
Electromagnetic compatibility	ISO 11452-5 2002-04; 1 MHz ... 2 GHz	150 V/m ≤ ±0.5% U_{sup}						

Diagrams/characteristic curves

Characteristic curve 1 (load range up to 50 kN or 5 V versions)



Characteristic curve 2 (load range from 60 kN)

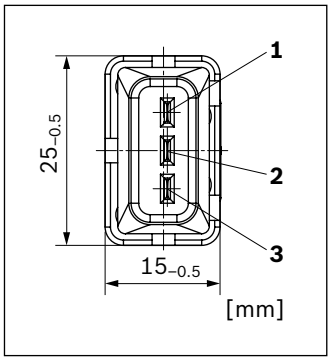


Electrical connection

Plug

AMP

Pin Assignment

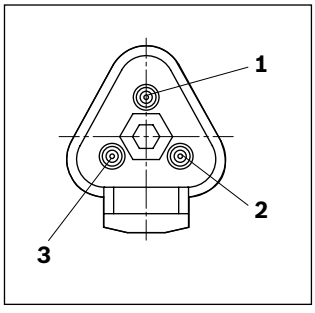


Connecting U_{sup} with GND will cause a short-circuit. The short-circuit current must not exceed 1A. Therefore, the current in the system must be limited.

Pin	Connection	
1	Weight	GND
2	Signal voltage	U_{sig}
3	Supply voltage	U_{sup}

DEUTSCH

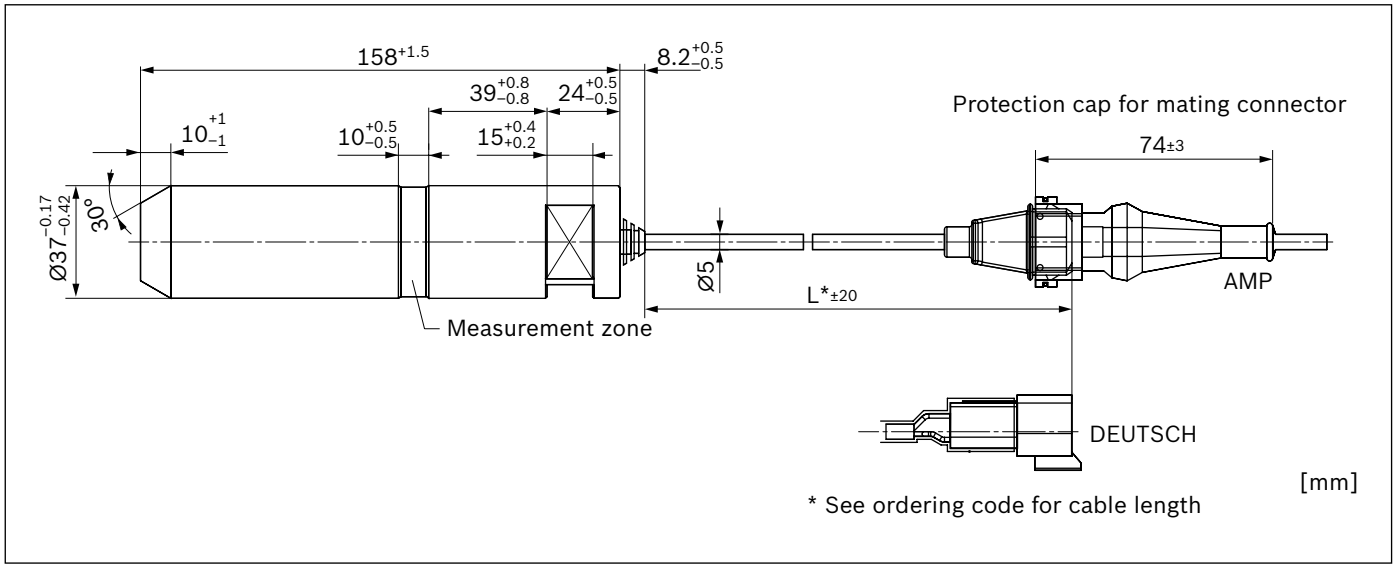
Pin Assignment



Connecting U_{sup} with GND will cause a short-circuit. The short-circuit current must not exceed 1A. Therefore, the current in the system must be limited.

Pin	Connection	
1	Supply voltage	U_{sup}
2	Signal voltage	U_{sig}
3	Weight	GND

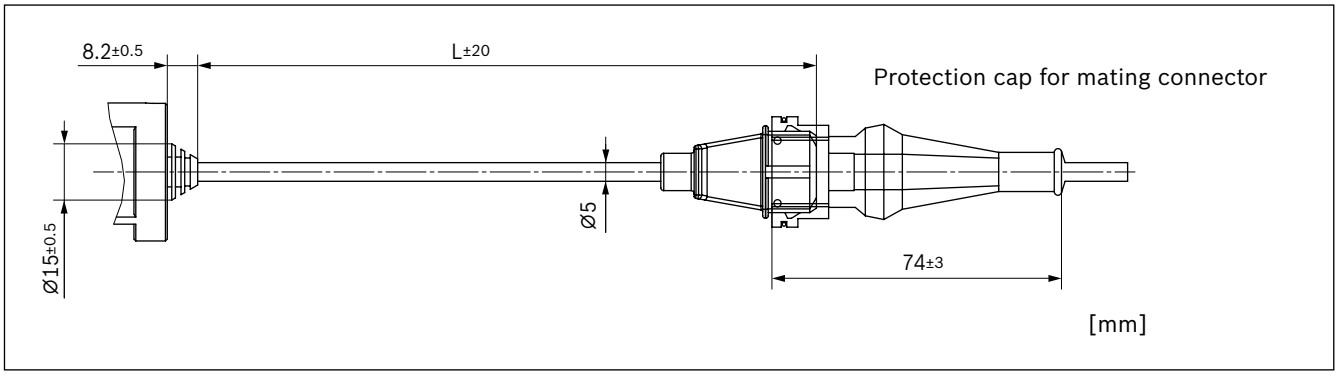
Dimensions


158+1.5
8.2+0.5 −0.5
39+0.8 −0.8
24+0.5 −0.5
10+1 −1
10+0.5 −0.5
15+0.4 +0.2
Protection cap for mating connector
74±3
Ø37−0.17 −0.42
30°
Ø5
L*±20
AMP
Measurement zone
DEUTSCH
[mm]
* See ordering code for cable length

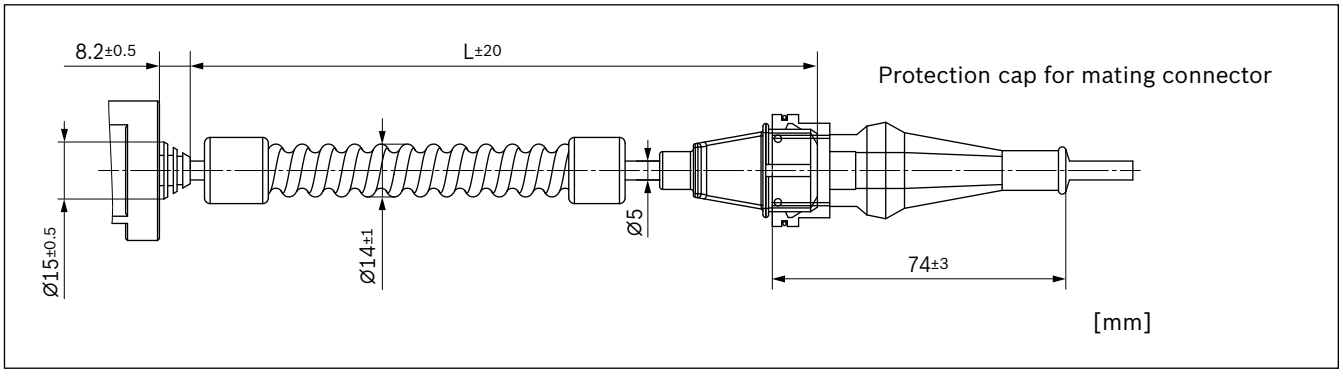
Project planning information

Cable versions

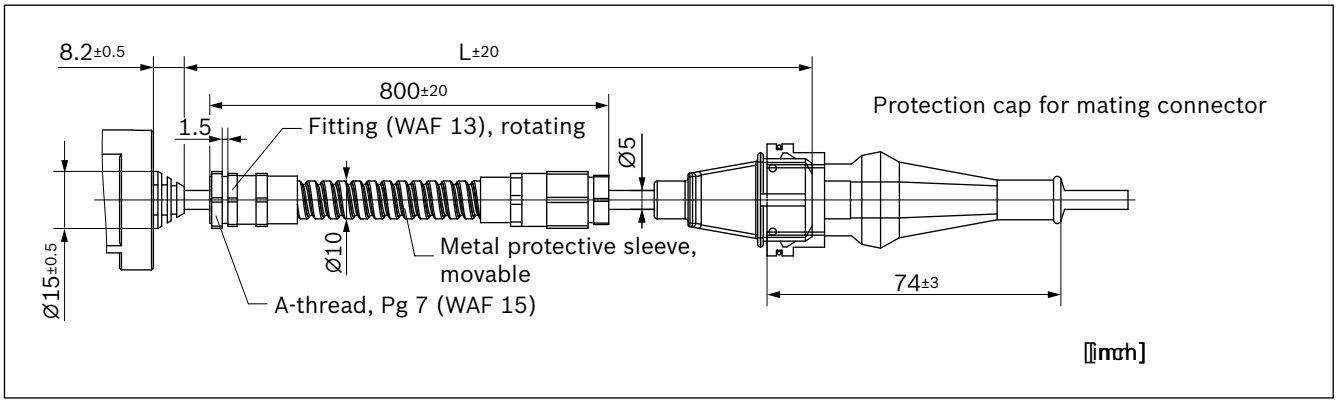
Cable without protective sheath



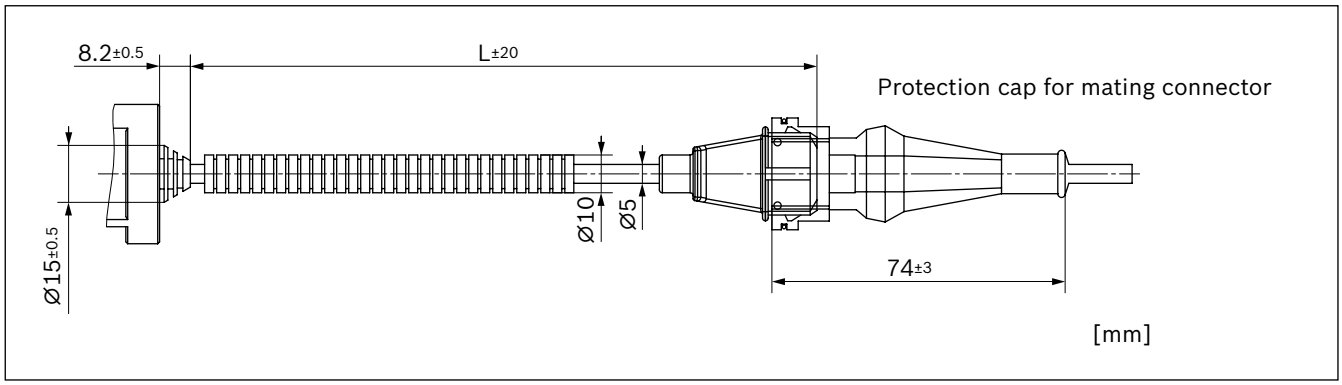
Cable with protective spiral sheath



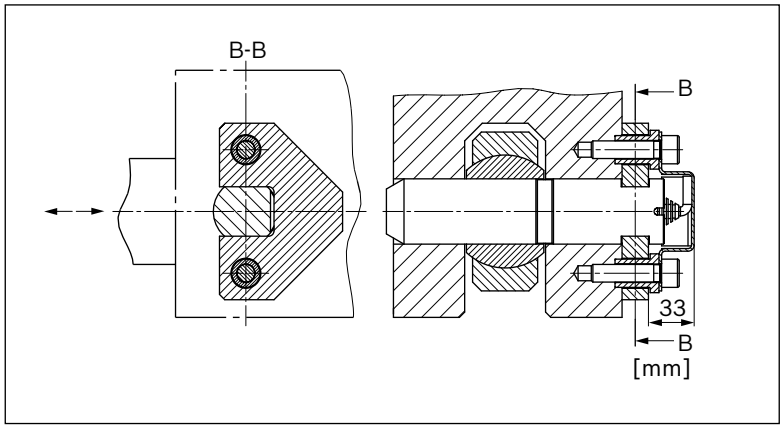
Cable with protective metal sheath



Cable with protective plastic sheath



Installation instructions



- See installation drawing Y 830 304 223 to avoid measurement uncertainties
- Defined force application, e.g. ball-type nipple
- Float mounting in radial direction with key plate

Information

Manufacturer confirmation of $MTTF_D$ values

The component was developed and series produced before the validity of the currently applicable machinery directive 2006/42/EC and the harmonized EN ISO 13849 standard. The KMB3 component is not a safety component in the sense of Directive on Machinery 2006/42/EC and has not been developed according to ISO 13849:2008.
The $MTTF_D$ value was determined in accordance with ISO 13849-1:2008-12, Appendix D, Parts Count Method, and the specified temperature profiles below for the component.
The $MTTF_D$ value for KMB3 is 113 years.

Operating time percentage [%]	Ambient temperature of control unit [°C]
0	10
0	30
0	40
0	50
0	60
0	70
0	80
100	85
0	100

The product meets the basic and proven safety principles as per ISO 13849-2: 2008-09 as they apply to the product.

Bewertung der Sicherheitsprinzipien

Chapter	General safety principles	Comment	Technology	Area of use	Implemented in product
D.1.6	Application of the principle of energy separation (GS-BGIA-M13: off-load current principle, spring, return spring)	A safe condition is achieved by separating all important equipment from the energy source, e.g. by using a normally closed (NC) contact for inputs (contact and position switches) and a normally open (NO) contact for relays [see also EN 292-2:1991 (ISO/TR 12100-2:1992), 3.7.1]. There can be exceptions in some cases, e.g. if a failure of the electrical supply represents an additional hazard. Time-delaying functions may be necessary to ensure that a safe condition of the system is achieved [see EN 60204-1:1997 (IEC 60204-1:1997), 9.2.2]	Electrical system	Components	When the energy supply is disconnected, the sensor stops transmitting. There is no appreciable capacitance, so shut-off takes less than 1 ms. Higher-level system must detect a cable break. A fault in the electronics that results in a plausible value is not detected.
D.1.7	Suppression of voltage peaks	A mechanism for suppressing voltage peaks (RC element, diode, varistor) should be used parallel to the applied load but not parallel to the contacts. NOTE: The switch-off time is increased by a diode.	Electrical system	Components	Measurement of radiated emissions was not carried out. The result is below the values that the standards require. The operating parameters defined inside TKU must be ensured by the higher-level system.
D.1.12	Protection from unexpected restarting after restoring the energy supply	Avoiding unexpected start-up, e.g. after restoring the energy supply [see EN 292-2:1991 (ISO/TR 12100-2:1992), 3.7.2, EN 1037 (ISO 14118), EN 60204-1 (IEC 60204-1)]. Special applications, e.g. maintaining the energy for clamping devices or securing a position, need to be considered separately.	Electrical system	Components	Assuming that the sensor is supplied with a supply voltage according to the specification, a ratiometric output signal is present. The higher-level system (control unit) must always ensure that the sensor signal is interpreted correctly.

List of the safety principles that must be to take into account in the higher-level system.

Chapter	Well-tried safety principles	Comment	Technology	Area of use	Implemented in product
A.2.2	Use of components with a defined failure behavior	The most frequent failure behavior of a component is known in advance and is always the same, see EN 292-2:1991 (ISO/TR 12100-2:1992), 3.7.4.	Mechanical system	Components	If the sensor is operated outside the specification, this can result in a zero shift or breakage. The higher-level system must detect this and evaluate it.
D.3.5	Limitation of electrical parameters	Limiting of the voltage, current, energy or frequency to avoid an unsafe status, e.g. by torque limitation, offset/time-limited running and reduced speed.	Electrical system	Components	The upper and lower limit of the supply voltage are defined. Outside of these limits, the sensor reaches a clamping voltage that the higher-level system must interpret. In general, the higher-level system must be able to interpret the ratiometric signal. From 4.2V to 18V, the sensor works on a ratiometric basis. Above and below the voltage limit, the output voltage becomes zero and is detected by the control unit as a cable break.
D.3.8	State switchover in event of failure	If possible, all mechanisms/circuits should transition to a safe state or be safe to operate.	Electrical system	Components	From 4.2 V to 18 V, the sensor works on a ratiometric basis. Above and below the voltage limit, the output voltage becomes zero and is detected by the control unit as a cable break. If the bolt is operated outside the mechanical specification, this can result in a zero shift or breakage. The higher-level system must detect faulty operating conditions of the sensor, and appropriate remedies must be defined and implemented.
D.2.9	Multiplication of parts	Reduction in the impact of defects by using several parts of the same type; for example, a defect that occurs in one spring (of many) does not lead to a dangerous condition.	Mechanical system	Components	Irrelevant for components, since the only mechanical part of the bolt itself is known (application-specifically) and the status orientation is known in the case of failures, see D.3.8.
D.3.9	Directed failure	If it is possible to implement, components or systems should be used whose types of failure are known in advance [see EN 292-2:1991 (ISO/TR 12100-.2:1992), 3.7.4].	Electrical system	Components	From 4.2V to 18V, the sensor works on a ratiometric basis. Above and below the voltage limit, the output voltage becomes zero and is detected by the control unit as a cable break. The higher-level system must detect faulty operating conditions of the sensor, and appropriate remedies must be defined and implemented.

List of the safety principles that must be to take into account in the higher-level system.

Accessories

AMP mating connector R917000515[1)]

Designation	Number	Ordering details	
Housing	1	1928402579[2)]	
Protective cap	1	1280703022[2)]	
Contacts	3	929939[3)]	
Single-wire seal (wire size 0.5 ... 1 mm²)	3	828 905-1[3)]	at FLK cable type
	3	828 904-1[3)]	at FLKr, FLX cable

1) The mating connector is not included in the scope of delivery.
2) Available from Bosch
3) Available from AMP

DEUTSCH mating connector[1]

Designation	Ordering details
Plug connection	DEUTSCH DT 04-3P[2)]
Wedge locking	DEUTSCH W 3P[2)]
Contacts	DEUTSCH 0460-202-16141[2)]

1) The mating connector is not included in the scope of delivery.
2) Available from DEUTSCH

Safety Instructions

General instructions

- Before finalizing your design, request a binding installation drawing.
- The proposed circuits do not imply any technical liability for the system on the part of Bosch Rexroth.
- Opening the sensor or carrying out modifications to or repairs on the sensor is prohibited. Modifications or repairs to the wiring could lead to dangerous malfunctions.
- The sensor may only be assembled/disassembled in a deenergized state.
- Only trained and experienced specialists who are adequately familiar with both the components used and the complete system should implement system developments or install and commission electronic systems for controlling hydraulic drives.
- When commissioning the sensor, the machine may pose unforeseen hazards. Before commissioning the system, you must therefore ensure that the vehicle and the hydraulic system are in a safe condition.
- Make sure that nobody is in the machine's danger zone.
- Do not use defective components or components not in proper working order. If the sensor should fail or demonstrate faulty operation, it must be replaced.
- Despite every care being taken when compiling this document, it is not possible to consider all feasible applications. If instructions for your specific application are missing, you can contact Bosch Rexroth.
- The use of sensors by private users is not permitted, since these users do not typically have the required level of expertise.

Notes on the installation location and position

- Do not install the sensor close to parts that generate considerable heat (e.g., exhaust).
- Lines are to be routed with sufficient distance from hot or moving vehicle parts.
- A sufficient distance to radio systems must be maintained.
- Before electric welding and painting operations, the sensor must be disconnected from the power supply and the sensor connector must be removed.
- Cables/wires must be sealed individually to prevent water from entering the sensor.

Notes on transport and storage

- Please examine the sensor for any damage which may have occurred during transport. If there are obvious signs of damage, please inform the transport company and Bosch Rexroth immediately.
- If it is dropped, the sensor must not be used any longer, as invisible damage could have a negative impact on reliability.

Notes on wiring and circuitry

- Lines to the sensors must be designed so that they are as short as possible and shielded. The shielding must be connected to the electronics on one side or to the machine or vehicle ground via a low-resistance connection.
- The sensor mating connector must only be plugged and unplugged when it is in a deenergized state.
- The sensor lines are sensitive to spurious interference. For this reason, the following measures should be taken when operating the sensor:
  - Sensor lines should be attached as far away as possible from large electric machines.
  - If the signal requirements are satisfied, it is possible to extend the sensor cable.
- Lines from the sensor to the electronics must not be routed close to other power-conducting lines in the machine or vehicle.
- The wiring harness should be fixated mechanically in the area in which the sensor is installed (spacing < 150 mm). The wiring harness should be secured so that in-phase excitation with the sensor occurs (e.g. at the sensor mounting point).
- If possible, lines should be routed in the vehicle interior. If the lines are routed outside the vehicle, make sure that they are securely fixed.
- Lines must not be kinked or twisted, must not rub against edges and must not be routed through sharp-edged ducts without protection.

Intended use

- The sensor is designed for use in mobile working machines provided no limitations/restrictions are made to certain application areas in this data sheet.
- Operation of the sensor must generally occur within the operating ranges specified and approved in this data sheet, particularly with regard to voltage, temperature, vibration, shock and other described environmental influences.
- Use outside of the specified and approved boundary conditions may result in danger to life and/or cause damage to components which could result in sequential damage to the mobile working machine.
- Serious personal injury and/or damage to property may occur in case of non-compliance with the appropriate regulations.

Improper use

- Any use of the sensor other than that described in the chapter "Intended use" is considered to be improper.
- Use in explosive areas is not permitted.
- Damages which result from improper use and/or from unauthorized, unintended interventions in the device not described in this data sheet render all warranty and liability claims with respect to the manufacturer void.

Use in safety-related functions

- The customer is responsible for performing a risk analysis of the mobile working machine and determining the possible safety-related functions.
- In safety-related applications, the customer is responsible for taking proper measures to ensure safety (sensor redundancy, plausibility check, emergency switch, etc.).
- Product data that is required to assess the safety of the machine is included in this data sheet.

Further information

- The sensor must be disposed of in accordance with the national regulations of the country in which it is used.