BALLUFF

Montage- und Bedienungsanleitung
Mounting and operating instructions
Instructions de service et de montage

BOD 26K

Abstandssensor
Distance sensor
Capteur de distance

LB04-S115-C / BOD0005
LBR04-S115-C / BOD000C
LB05-S115-C / BOD0006
LBR05-S115-C / BOD000E

Contents

1 Guide to symbols

Warnings and other information are signalled by symbols in this manual. They are accompanied by headings. The following symbols are used:

WARNING
... indicates a possibly dangerous situation which can cause death or serious injury if not avoided.

WARNING
... indicates possible risk of danger from laser beam.

CAUTION
... indicates a possibly dangerous situation which can cause material damage if not avoided.

INFORMATION
Useful tips and recommendations as well as information for efficient use of the sensor.

2 Safety instructions

In order to avoid accidents, injuries or material damage, act with caution and always observe the following safety instructions:

WARNING

The product is not approved for the protection of personnel (no safety component according to Machinery Directive).

All the safety and handling instructions indicated in these mounting and operating instructions must be observed.

The valid on-site accident prevention regulations and general safety regulations must be observed.

Read these mounting and operating instructions carefully before using the sensor.

The manual is a product component and must be kept in immediate proximity of the sensor and accessible to personnel at all times.

Connection, mounting and configuration of the sensor is to be carried out by trained personnel only.

It is forbidden to tamper with or alter the device in any way!

WARNING
Never look into the path of the laser. Do not suppress the reflex to close the eyelids. Gazing into the beam path for longer periods can damage the retina of the eye.

Observe the information in chapter 5 „Mounting“.

INFORMATION
The BOD 26K sensor complies with laser protection class 2 according to DIN EN 60825-1, status 2008-05. The technical requirements comply with EN 60947-5-2, 2000 edition. Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser Notice No. 50 dated June 24, 2007.

3 Correct use

The BOD 26K is an optical sensor and measures distances without contact. Object thickness or differences in thickness can be measured using two BOD 26K (type LBR only).

WARNING
The product is not approved for the protection of personnel (no safety component according to Machinery Directive).

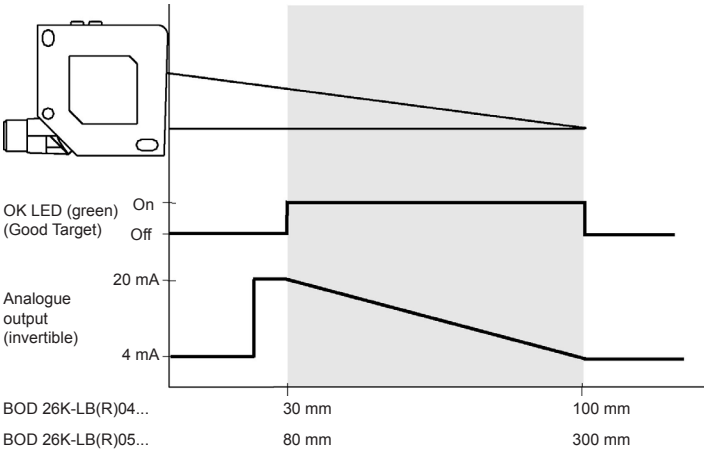
4 Performance

- Operating range BOD 26K-LB(R)04: 30 - 100 mm
- Operating range BOD 26K-LB(R)05: 80 - 300 mm
- Analogue output 4 ... 20 mA
- 2 switching outputs
- Compact casing (50 x 50 x 17 mm^3)
- High resolution
- Type LBR with bus-cmpatible, serial RS485 interface
- Setting by „teach-in", LBR type also by PC-software
- Wide functional range

Mode of function

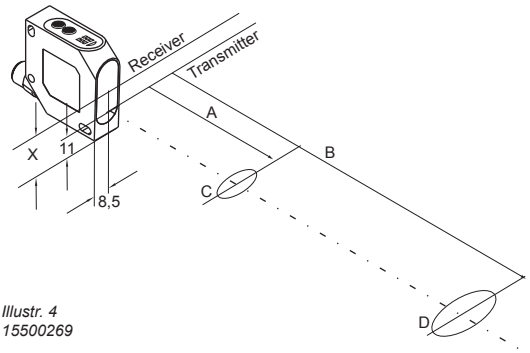
The **BOD 26K** sensor measures according to the **principle of triangulation**. The distance between the object and sensor is determined on the basis of the position of the light spot on the detector.

Operating range (Factory setting)



Illustr. 3
15500271

Dimensions of light spot



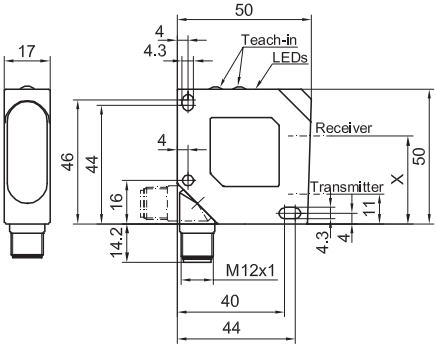
Illustr. 4
15500269

BOD 26K	-LB(R)04...	-LB(R)05...
A	30	80
B	100	300
C	1.5 x 3	1.5 x 3.5
D	1.5 x 3.25	2 x 4.5
X	29.4	32.5

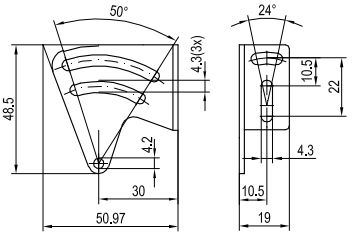
All dimensions in mm (typical values)

5 Mounting

5.1 Dimensional drawing



Illustr. 5
15300716



Illustr. 6
15300065

5.2 Mounting the sensor

Sensor alignment
Position sensor and screw to suitable holder, e.g. Typ BOS 26-HW-1* (not included in standard delivery), via fixing holes.

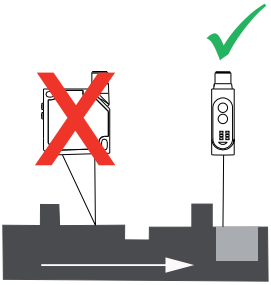
*Part number: see list of accessories

INFORMATION
Observe the following operating conditions:
- **The distance to the object must be within the sensor's operating range (see technical data).**
- **The direction of movement of the object should be cross-wise to the sensor's front screen (illustr. 7+8).**
- **With strongly reflective or shiny surfaces, incline the sensor by approx. 5 ° in relation to the surface of the object (illustr. 9).**

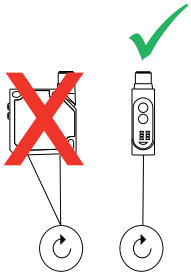
CAUTION
In the case of strong vibrations (shocks / oscillations), the sensor must be given constructive protection from damage.

WARNING
- **Never look into the path of the laser. Do not suppress the reflex to close the eyelids.**
- **Gazing into the beam path for longer periods can damage the retina of the eye.**
- **When mounting the sensor, ensure that the beam path is sealed off at the end.**
- **The laser must not be directed at people (head height).**
- **When aligning BOD 26K, ensure that there are no reflections on reflective surfaces.**
- **Should the safety label on the BOD 26K sensor be partly covered due to its installation position, other safety labels are to be positioned on visible parts of the sensor. When applying the new safety label, make sure that you cannot look into the laser beam whilst reading it.**

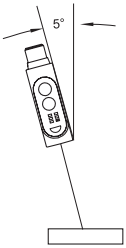
The BOD 26K sensor is now mounted.



Illustr. 7 Linear movement
15500270



Illustr. 8 Rotating movement



Illustr. 9 Reflective object
15500274

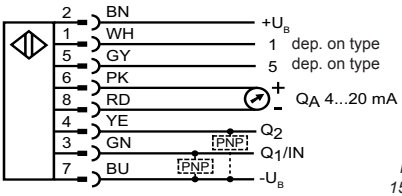
6 Electrical installation

Rotate the connector plug (illustr. 5) so that the **cable** can be connected **easily**, **without kinks**.

Fit socket of the connector cable and screw tight (authorised tightening torque approx. 0.5 to 1 Nm).

Secure connection cable (for example with cable retainer).

Connect sensor according to Illustr. 10.



Ilustr. 10
15400127

Typ / Type / Rèf.	Pin 1	Pin 5
BOD 26K-LBR...	RS485 Data+ (Y/A)	RS485 Data- (Z/B)
BOD 26K-LB...	-	-

CAUTION
PIN 1 and PIN 5 must not be connected to the operating voltage. Otherwise the RS485 interface will be damaged beyond repair.

Connection	Colour	Use	Remark
1 (WH)	White	RS485 Data+ (Y/A)	LBR version only
2 (BN)	Brown	+ U_B	
3 (GN)	Green	As signal output Q_1 or input with optional input function (see chapter 7 „Use and configuration")	
4 (YE)	Yellow	As signal output Q_2 or switching function "good target" (detectable object in measuring range)	
5 (GY)	Grey	RS485 Data- (Z/B)	LBR version only
6 (PK)	Pink	Q_A + analogue measurement	
7 (BU)	Blue	- U_B	
8 (RD)	Red	Q_A - analogue mass	

Once power supply has been connected, the BOD 26K is ready for operation after a short stand-by delay (< 300 ms).

INFORMATION
For maximum precision, please allow for a heating period (approx. 15 minutes).

7 Use and configuration

The sensor has different operating modes and functions.
Sensor configuration can be carried out via the control panel using the SET and ▶ keys.

CAUTION
Push buttons only with finger! Do not use sharp objects!

With BOD 26K-LBR (with RS485 interface) it is also possible to adjust the sensor functions via the serial interface.

7.1 Displays and configuration elements

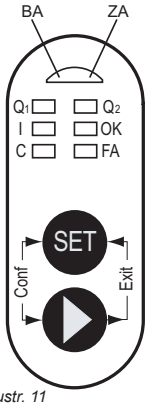
Keys and their functions:

The BOD 26K is configured using the SET and ▶ keys.

	General operating functions	
Keys	**In operating mode**	**In configuration mode**
Entire control panel 	**Activate set-up mode:** Simultaneously pressing these keys **(> 3 s)** activates the set-up mode. After this period, the **power supply indicator BA** flashes ⇨ set BOD 26K, see illustr. 11. The LEDs show the status of function no.1. When **all the LEDs** start flashing immediately ⇨ **unlock** BOD 26K, see „Unlocking keys" (below).	**Quit set-up mode:** First press the key and then also the SET key. All settings are then stored. Once the SET key is released, the sensor is in RUN mode. The operating indicator BA lights up permanently again. **INFORMATION** **Should the power supply fail during the setting procedure, all settings are lost.**
SET 	No function	A brief pressing of the SET key changes the status of respective function or activates storage and confirmation of the set values. The function status is indicated by the status indicator **ZA** (LED ON = active, LED OFF = not active).
	A**ctivate factory setting during Power ON:** Keep SET key pressed **(approx. 10 s)**, until the LEDs stop flashing and light up permanently. The operating indicator BA lights up green. Once the SET key is **released**, the sensor is reset. The **BOD 26K** is now in its **initial state.**	
Continue 	No function	**Press** the key to select the next function in the function table. The function number is indicated by a **clear** LED pattern. The first function follows the last available function.
	Unlock keys during **Power ON**: Keep key pressed **(approx. 10 s)**, until the LEDs stop flashing and light up permanently. The **status indicator ZA** lights up **red**. The control panel is unlocked once the key is released.	

INFORMATION
A time lock prevents short unintentional pressure on the keys from activating configuration mode.

The LEDs (illustr. 11) indicate the selected menus and configurations.



Illustr. 11
15500272

LED	Colour	In operating mode	In configuration mode
BA	Green	Operating indicator (LED lights up when sensor is ready for use)	LED flashes when set-up mode is active.
ZA	Red		Status indicator: Lights up when function is active. Off, when function is not active. During teach-in: confirmation signal
Q_1	Yellow	Lights up when Q_1 input/output is active	Table of functions in chapter 7.2.2 onwards explains the significance of the Q_1, Q_2, I, OK, C and FA LEDs in set-up mode.
Q_2	Yellow	Lights up when Q_2 output is active	
I	Green	Lights up when Q_1 trigger input or Q_1 enable input function is active	
OK	Green	Good Target (lights up when object is detected and in measuring range)	
C	Green	Lights up when sensor is programmed as master or slave	
FA	Green	Lights up when Q_1 autom. centre or Q_1 autom. zero function is active	

7.2 Setting functions with the control panel

First, activate set-up mode ⇨ push SET and ▶ simultaneously for 3 s (or longer), until LED BA (green) flashes. When green LED flashes, select function (according to table 7.2.2) with ▶.
When all functions are set (table 7.2.2), leave set-up mode ⇨ push SET and ▶ simultaneously. All settings are then stored and the sensor is in Run mode.

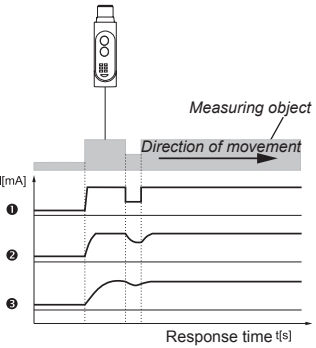
7.2.1 Quick user guide (068-13884) see fold-out page

7.2.2 Possible configurations and operating modes

No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
1	**Q_1: Set as switching input or output**				
	No action	Q_1■ Q_2 I $\square$ OK C $\square$ FA	Switch with SET	ON, when Q_1 is defined as switching output OFF, when Q_1 is defined as input	Q_1 = switching output („ZA" = ON)
2	**Q_1: Teach-in of 1st switching point**				
	▶ push 1x	Q_1 $\square$ Q_2 I ■ OK C $\square$ FA	Save measured value with SET	ON, if measured value valid OFF, if measured value invalid	Switching point at half measuring range
			When the SET key is released, the current measured value is stored as the 1st switching point of the Q_1 switching output.		

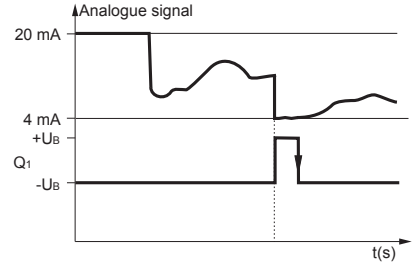
No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
3	**Q_1: Teach-in of 2nd switching point**				
	push 2x	Q1 ■ Q2 ☐ I ■ OK ☐ C ☐ FA ☐	Save measured value with SET	ON, if measured value valid OFF, if measured value invalid or no 2. switching point	-
			When the SET key is released, the current measured value is stored as the 2nd switching point of the Q_1 switching output and is set against 1st switching point to create a scanning zone.		
4	**Q_1: Set switching function (N.O. or N.C.)**				
	push 3x	Q1 ☐ Q2 ☐ I ☐ OK ☐ C ■ FA ☐	Switch with SET	ON, if N.C. OFF, if N.O.	N.O. („ZA" = OFF)
5	**Q_2: Set as switching output or „Good Target" output**				
	push 4x	Q1 ■ Q2 ☐ I ☐ OK ☐ C ■ FA ☐	Switch with SET	ON, when Q_2 = switching output OFF, when Q_2 = Good Target (Q_2 = Good Target = High, when object is detected in measuring range and function no.10 is activated)	Good Target („ZA" = OFF)
6	**Q_2: Teach-in of 1st switching point**				
	push 5x	Q1 ☐ Q2 ☐ I ■ OK ☐ C ■ FA ☐	Save measured value with SET	ON, if measured value valid OFF, if measured value invalid	-
			When the SET key is released, the current measured value is stored as the 1st switching point of the Q_2 switching output.		
7	**Q_2: Teach-in of 2nd switching point**				
	push 6x	Q1 ■ Q2 ☐ I ■ OK ☐ C ■ FA ☐	push	ON, if measured value valid OFF, if measured value invalid or no 2. switching point	-
			When the SET key is released, the current measured value is stored as the 2nd switching point of the Q_2 switching output and is set against 1st switching point to create a scanning zone.		
8	**Q_2: Set switching function (N.O. or N.C.)**				
	push 7x	Q1 ☐ Q2 ■ I ☐ OK ☐ C ☐ FA ☐	Switch with SET	ON, if N.C. OFF, if N.O.	N.O. („ZA" = OFF)
9	**Q_1, Q_2: Activate pulse stretching by 50 ms for switching outputs Q_1 and Q_2.**				
	push 8x	Q1 ■ Q2 ■ I ☐ OK ☐ C ☐ FA ☐	Switch with SET	ON, when pulse stretching on OFF, when pulse stretching off	OFF („ZA" = OFF)
10	**Q_2 = Activate / deactivate Good Target:**				
	push 9x	Q1 ☐ Q2 ■ I ■ OK ☐ C ☐ FA ☐	Switch with SET	ON, when Good Target on (activated) OFF, when Good Target off (deactivated)	Good Target („ZA" = ON)
			When activated, switching output Q_2 signals that an object is in the measuring range. The switch function can be inverted with function no. 8.		

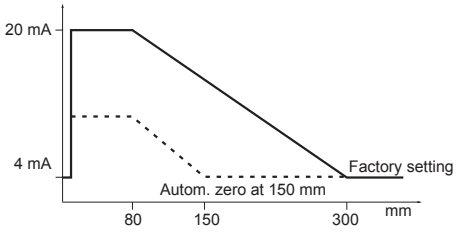
No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
11	**Set Q_1 as trigger input for sample and hold:**				
	push 10x	Q_1 ■ ■ Q_2 I ■ □ OK C □ □ FA	Switch with SET	ON, if Q_1 = trigger input OFF, if Q_1 = not a trigger input	Q_1 = no trigger input („ZA" = OFF)
			With rising edge on Q_1, measured value is held until the next trigger occurs. In master-slave operation, both sensors must be triggered.		
12	**Set Q_1 as control input for laser ON / OFF:**				
	push 11x	Q_1 □ ■ Q_2 I □ □ OK C ■ □ FA	Switch with SET	ON, if active OFF, if inactive	„ZA" = OFF
			Used to switch laser beam on and off. Laser beam is ON when Q_1 = +U_B. If Q_1 = - U_B, the laser beam is switched OFF. Last measured value remains. When reactivated, the response time is prolonged according to the set mean value.		
13	**Switch off averaging:**				
	push 12x	Q_1 ■ ■ Q_2 I □ □ OK C ■ □ FA	Activate with SET	ON = averaging off	Averaging off („ZA" = ON)
			Explanation of averaging: Moving averaging „smooths" the measuring result (output signal) and enables the „masking" of individual imperfections (e.g. when measuring objects with rough surfaces). The measured values are read continuously into a memory and the arithmetical mean is formed. Functions no.14 and no.15 determine the number of measurements (10 or 100) to be used for averaging. With a scanning rate of 0.4 ms per measurement, the response time lies between 0.4 ms (without averaging) and 40 ms.		
			Response times 0.4 ms = measured value (no average) (function 13) 4 ms = averaging with 10 measured values (function 14) 40 ms = averaging with 100 measured values (function 15)		
14	**Switch on 4 ms averaging:**				
	push 13x	Q_1 □ ■ Q_2 I ■ □ OK C ■ □ FA	Switch with SET	ON, if active OFF, if inactive	Averaging 4 ms OFF („ZA" = OFF)
			The last (max.) 10 measured values are used to form the average. For an explanation on „Averaging" see function no. 13		



Illustr. 12 Output characteristics in relation to arithmetical mean
15500273

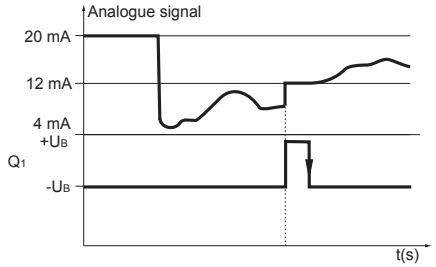
No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
15	**Switch on 40 ms averaging:**				
	push 14x		Switch with SET	ON, if active OFF, if inactive	Averaging 40 ms OFF („ZA" = OFF)
			The last (max.) 100 measured values are used to form the average. For an explanation on „Averaging" see function no. 13		
16	**Scaling the analogue output (set 4 mA point):**				
	push 15x		Save measured value with SET	ON, when object is within the measuring range OFF, when object is outside the measuring range	4 mA = end of measuring range
			Once the SET key has been activated, the current measured value corresponds with the 4 mA point of the analogue output. The incline of the output characteristics results from this point and the 20 mA point (function no. 17). Should no object be present in the detection range, the end of the measuring range is used.		
17	**Scaling the analogue output (set 20 mA point):**				
	push 16x		Save measured value with SET	ON, when object is within the measuring range OFF, when object is outside the measuring range	20 mA = end of measuring range
			Once the SET key has been activated, the current measured value corresponds with the 20 mA point of the analogue output. The incline of the output characteristics results from this point and the 4 mA point (function no. 16). Should no object be present in the detection range, the end of the measuring range is used		

<table>
<tr><th>No.</th><th>Action</th><th>Picture follows</th><th>Action</th><th>Reaction / Status indicator „ZA” (red)</th><th>Factory setting</th></tr>
<tr><td>18</td><td colspan="5">„Autom. zero” function (with Q_1 as control input):</td></tr>
<tr><td></td><td>push
17x</td><td>Q_1 Q_2
I OK
C FA</td><td>Switch with SET</td><td>ON, if autom. zero active
OFF, if autom. zero inactive</td><td>Inactive
(„ZA” = OFF)</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">The output characteristics (4 ... 20 mA) are simultaneously displaced with this function. When this function is activated and $Q_1 = +U_B$, the current measured value is set as the output value of 4 mA. The incline of the characteristic curve is maintained. The max. value of the characteristics is limited by the measuring range.
The distance to the object must be within the measuring range.</td></tr>
<tr><td></td><td></td><td></td><td colspan="3"> 

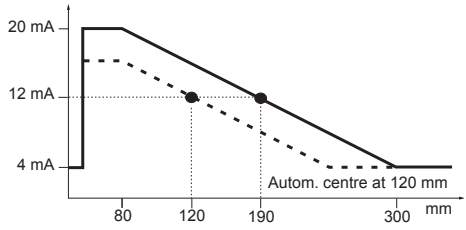
Illustr. 13
15500148
 

Illustr. 14
15500858</td></tr>
</table>

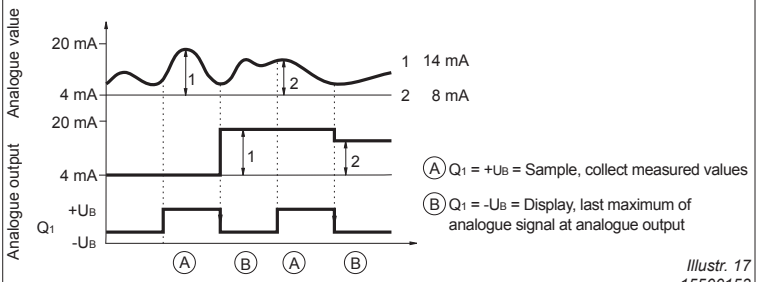
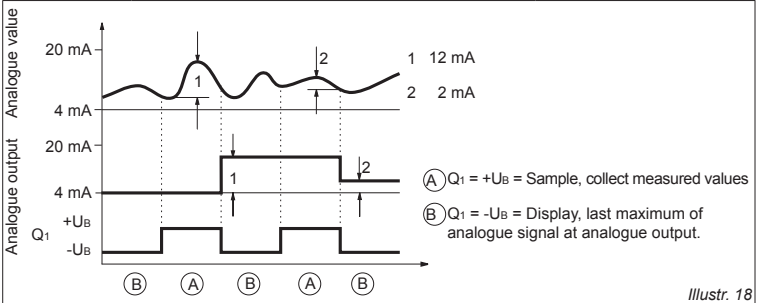
No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
19	**„Autom. centre" function (with Q_1 as control input):**				
	push 18x	Q_1 Q_2 I OK C FA	Switch with SET	ON, if autom. centre active OFF, if autom. centre inactive	Inactive („ZA" = OFF)
			The output characteristics (4 ... 20 mA) are displaced with this function. When the automatic centre function is activated and $Q_1 = +U_B$, the current measured value is equated with the output value of 12 mA. The incline of the characteristic curve is maintained. The min. or max. value of the characteristics are limited by the measuring range. The distance to the object must be within the measuring range.		

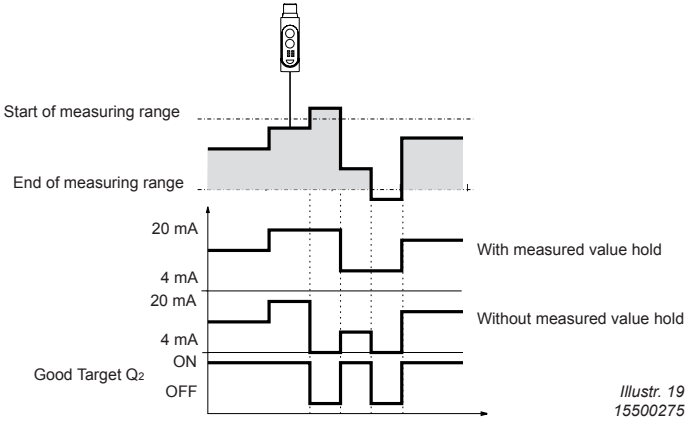


Illustr. 15
15500146



Illustr. 16
15500859

No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
20	**„Maximum (Minimum)-Hold" (with Q_1 as control input):**				
	push 19x	Q_1 Q_2 I OK C FA	Switch with SET	ON, if maximum-hold active OFF, if maximum-hold inactive	Inactive („ZA" = OFF)
			If this function is activated and Q_1 = +U_B, the maximum value of the measuring signal is determined and stored. If Q_1 is low (-U_B), the maximum value is transmitted at the analogue output. Example of use: determining the maximum value of a shaft. The minimum value can be determined by inverting the output characteristics (see function no. 16 and 17).		
			 *Illustr. 17* *15500153*		
21	**„Difference hold" function (with Q_1 as control input):**				
	push 20x	Q_1 Q_2 I OK C FA	Switch with SET	ON, if difference hold active OFF, if difference hold inactive	Inactive („ZA" = OFF)
			When this function is activated and Q_1 = +U_B, the difference between the minimum and maximum value of the measuring signal is determined and stored. If Q_1 = -U_B, the largest differential value is transmitted at the analogue output. Example of use: Checking the contents of open containers or packages.		
			 *Illustr. 18* *15500149*		
22	**Activate factory settings:**				
	push 21x	Q_1 Q_2 I OK C FA	Activate with SET	ZA lights up whilst the key is pressed	--
			If the SET key is pressed, all the settings are reset to the factory settings. This process cannot be reversed.		

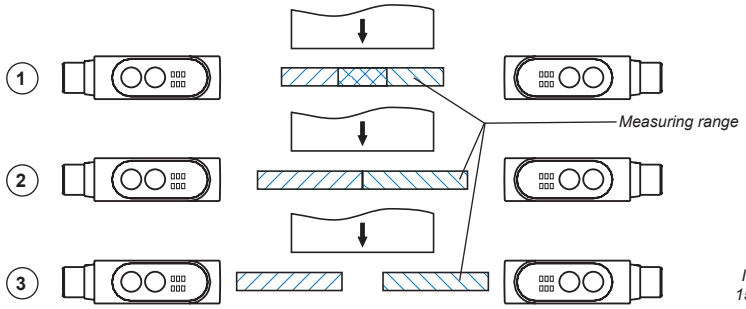
No.	Action	Picture follows	Action	Reaction / Status indicator „ZA” (red)	Factory setting
23	**Locking keys:**				
	push 22x	Q1 Q2 / I OK / C FA	Switch with SET	ON, if locking keys active OFF, if locking keys inactive	Inactive („ZA” = OFF)
			If function is activated, locking becomes active once the setting mode has been quit. It is possible to unlock keys with the functions „factory setting” during power ON or „unlock keys” during power ON (both described in chapter 7.1, paragraph „Keys and their functions”).		
24	**„Measured value hold” function:**				
	push 23x	Q1 Q2 / I OK / C FA	Switch with SET	ON, if measured value hold active OFF, if measurement hold inactive	Inactive („ZA” = OFF)
			If this function is activated, the last valid measured value is saved when no object is in the measuring range (OK LED = OFF), and is transmitted at the analogue output. The switching output also maintains its status (if set). The current value is only displayed again when an object is within the measuring range (OK LED = ON). Example of use: Maintaining the position of a machining tool during the change-over of a work piece. Illustration: Behaviour of analogue output with and without measured value hold.		
			 *Illustr. 19 15500275*		
	INFORMATION **Function 25 to function 27 only for BOD 26K version LBR.** **Simultaneous connection to a PLC control or a PC via the RS485 interface is not possible with differential measurement.**				
25	**Switch „Differential measurement” (master) mode on / off:**				
	push 24x	Q1 Q2 / I OK / C FA	Switch with SET	ON, differential measurement mode ⇨ master active OFF, differential measurement mode ⇨ master inactive	Inactive („ZA” = OFF)
			For description of function see chapter 7.2.3		

No.	Action	Picture follows	Action	Reaction / Status indicator „ZA" (red)	Factory setting
26	**Switch differential thickness measurement mode (slave) on / off:**				
	push 25x	Q_1 Q_2 I OK C FA	Switch with SET	ON, differential thickness measurement mode ⇨ slave active OFF, differential thickness measurement mode ⇨ slave inactive	Inactive („ZA" = OFF)
			Description of function - sensors positioned opposite each other (see chapter 7.2.3).		
27	**Switch parallel differential measurement mode (slave) on / off**				
	push 26x	Q_1 Q_2 I OK C FA	Switch with SET	ON, parallel differential measurement mode ⇨ slave active OFF, parallel differential measurement mode ⇨ slave inactive	(„ZA" = OFF)
			Description of function - sensors positioned parallel (see chapter 7.2.3)		

7.2.3 Differential measurement mode

INFORMATION
Only BOD 26K sensors with the same measuring range (type BOD 26K-LBR04, or -LBR05) and serial interface (version LBR) can be used for differential measurement.
Simultaneous connection to PLC control or a PC via the RS485 interface is not possible with differential measurement.

With this measuring procedure, two BOD 26K-LBR sensors are connected to one another. The sensors are positioned opposite each other (differential thickness measurement, function no. 26) or are aligned parallel to one another (parallel differential measurement, function no. 27). With differential thickness measurement, the measuring ranges can overlap (1), be directly adjacent (2) or apart (3) (illustr. 20).
If a sensor is set as master or slave, communication with the PC is not possible.

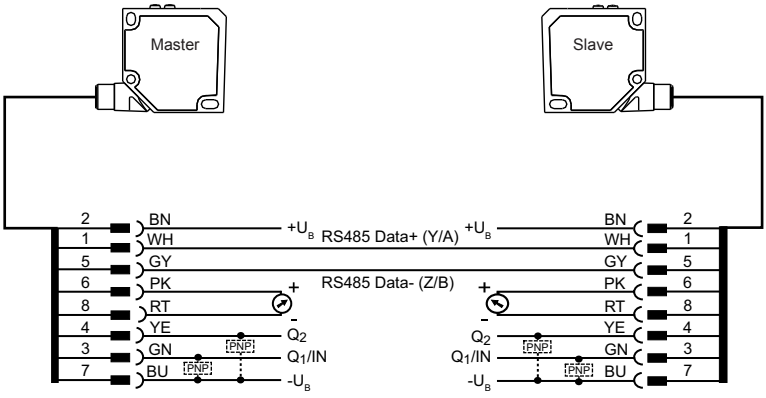


Illustr. 20
15500268

A. The following steps must be carried out for differential measurement:

INFORMATION
We recommend resetting sensors to factory setting (function 22, or 7.2.2) before configuration of sensors as master or slave.
When using two sensors, measuring errors (resolution, response time, non-linearity, etc.) have to be multiplied by factor 2 with differential thickness measurement.

1. Mounting: Position reference object (target value) in measuring range and mount both BOD 26K-...(LBR types) in a way that the distance to the object is always within the operating range of the sensors (illustr. 20 and 22).
2. Interlink sensors according to wiring diagram and connect them electrically (illustr. 21).



Illustr. 21
15400172

No.	Action	Picture follows	Action	Reaction
3	**Set-up of the slave:**			
	push 25 or 26x	Q1 Q2 I OK C FA	First of all configure one of the sensors as slave by activating the set-up mode and selecting function n° 26 (differential thickness measurement) or function n° 27 (parallel differential measurement) (see chapter 7.2.2 „Possible configurations and operating modes", as well as Examples of use).	LED „OK" (Good Target) of both sensors must light up.
4	**Set-up of the master:**			
	push 24x	Q1 Q2 I OK C FA	Configure second BOD 26K-LBR as master by activating the set-up mode and selecting function n° 25. Attention: Sensor can only be configured as master when the object is within the operating range of both sensors (see illustr. 20 and 22).	The analogue output of the master should now indicate 12 mA, corresponding to the measured reference/target value. Now all functions configured at the master refer to the difference to the reference value.

INFORMATION
After completion of the master/slave configuration, the analogue output of the master should display 12 mA, corresponding to the measured reference/target value. Now all functions configured at the master refer to the difference to the reference value.
For measurement, position objects within the measuring range. Then the measured value (analogue value at master) supplies the difference to the reference value. The analogue output of the slave indicates the distance between slave and object.

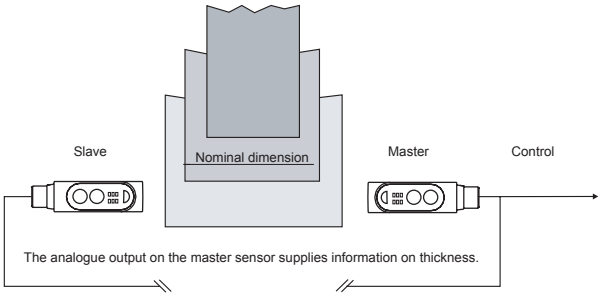
B. Adjustment of the analogue output (if required):

No.	Action	Picture follows	Action	Reaction
1.	**Set 4 mA point:**			
	push 15x	Q_1 Q_2 I OK C FA	Select function n° 16 (set 4 mA point). Position object at desired 4 mA point. Push SET.	Once the SET key has been activated, the current measured value corresponds with the 4 mA point of the analogue output.
2.	**Set 20 mA point:**			
	push 16x	Q_1 Q_2 I OK C FA	Select function n° 17 (set 20 mA point). Position object at desired 20 mA point. Push SET.	Once the SET key has been activated, the current measured value corresponds with the 20 mA point of the analogue output.

C. Examples of use

Differential thickness measurement with wide wooden boards
Two opposite facing sensors enable non-contact measurement and control of the thickness of the wood or wooden boards. A change in thickness is indicated at the analogue output of the master. 12 mA corresponds with the taught reference thickness of the object.

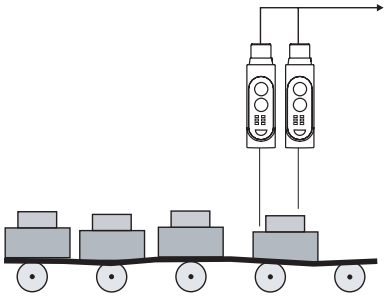
INFORMATION
Although a BOD 26K sensor only has a measuring range of 70 or 220 mm respectively, it is possible to measure **excess width** using **master-slave mode**. The solution is in the alignment of both sensors (illustr. 20). The necessary measuring range depends on the maximum difference in thickness. For slight differences in thickness and little fluctuation in feed position, sensors with a small measuring range can be selected.



Illustr. 22
15500280

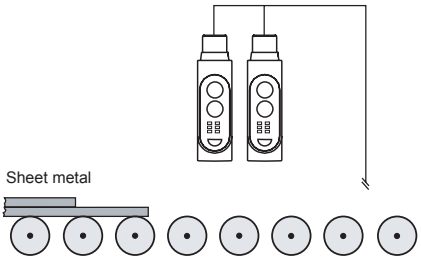
INFORMATION
To achieve optimum use of the measuring range, the object must be positioned in the centre of the measuring range.

Parallel differential measurement:
Object detection (or measurement) with **a fluctuating distance**.
The distance between the object and sensor often fluctuates. **Reliable detection** is thus not possible with a background sensor. Using two **BOD 26K-LBR04 /-LBR05 sensors** and **parallel differential measurement mode** (function no. 27), reliable object detection can be achieved via the analogue output of the master or through the teach-in of switch thresholds on the master (function no. 2 and 3).

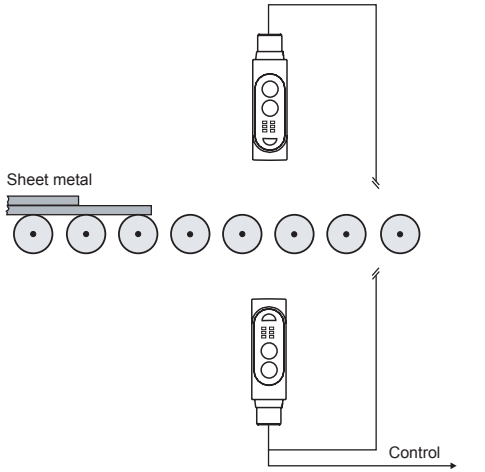


Illustr. 23
15500857

Double layer measurement
Reliable detection of double layers in sheet metal processing industry. The problems caused by an **uneven feeding of sheets** and a **strongly fluctuating distance to the sensor** can be solved with the aid of parallel differential measurement (illustr. 23 / illustr. 24) or differential thickness measurement (illustr. 22 / illustr. 25). The analogue value on the master results from the difference between the measured values of the two sensors. The analogue output of the slave indicates the distance from the sensor (slave) to the object. Double layers are detected when threshold values (teach-in of switching points ⇨ settings 2 and 3) for the thickness of the object have been previously set on the master.



Illustr. 24
15500860



Illustr. 25
15500267

8 Communication via the serial interface

All **BOD 26K-LBR04 /-LBR05** sensors are **equipped** with a **bus-compatible, serial interface (RS485)** for the transmission of distance values and the setting of sensor functions. The primary control system controls data exchange. Data transfer occurs through an exchange of short telegrams.

INFORMATION
If several sensors are connected via the RS485 bus, reflections can occur which may impair transmission. At the end of the RS485 bus, the cable must therefore be fitted with a resistor corresponding to the characteristic resistance of the used cable (normally 120 Ohm).
If a sensor is set as master or slave, communication with the PC is not possible.

8.1 Basic characteristics and parameters of the serial sensor interface

The serial interface of the sensor has the following characteristics:

	Fixed factory configuration	Modifiable
Hardware	RS485, half-duplex Pin1 Data+ (Y/A), Pin5 Data- (Z/B)	
Data transfer rate	38400 Baud	
Stop bits	1	
Parity	no	
Bits / Byte	8	
Access method	Master / Slave (the sensor behaves as a slave)	
Sensor address		1

8.2 Description of protocol

- The data transfer protocol is bus-compatible.
- The sensor only sends data on request. The sensor has an address within the range 1 to 127 (factory setting = 1).
- A data transfer cycle consists of a command telegram addressed to the sensor by the master and the sensor's reply telegram.
- The sensor begins with the reply telegram within 400 to 800 µs after receipt of the command telegram.

8.3 Telegram structure

Each byte consists of a selection bit (D7) and 7 data or address bits (D0 to D6).

Byte structure

D7	D6	D5	D4	D3	D2	D1	D0
Selection bit	7 data bits / address bits						

General telegram structure
A complete telegram, from both the master and the slave, consists of at least 4 bytes and has the following structure:

	Master	Reply sensor
1. Byte	Address 1 (to 127) corresponds with 129 (to 255), as the selection bit of the 1st byte (D7) =1	
2. Byte	Length of telegram, number of all bytes (4 to 127), D7=0	
3. Byte	Command (see "Overview of master commands") D7=0	Reply (see reply telegram, below) D7=0
4. Byte ... (n-1). Byte	Parameter (see parameter bytes, below) D7=0	
n. Byte (last Byte)	Check sum exclusive OR of byte 1 to byte n-1, D7 = 0.	

The **1st byte** always includes the sensor address. In addition, it is characterized by the selction bit (D7 = 1). This means that this byte is decimal: always „address +128". The selection bit is not set (D7=0) with any other bytes. When the master sends a byte with a set selection bit, a new data transfer cycle is started, regardless of whether the previous cycle has been completed.

The **last byte** is the check sum which is formed from the bitwise exclusive disjunction of all previous bytes. When calculating the check sum, the 8th bit (selection bit D7) must be deducted from the first byte (address and selection bit) ⇨ 129 = 1! If the sensor address is changed, the check sum for each command must be recalculated.
In the **command telegram**, the **3rd byte** can adopt the values listed in the chapter 8.5 “Examples for master commands”.
In the sensor’s **reply telegram**, the **3rd byte** (reply) can only adopt the following values:

Possible reply telegram from sensor

Decimal	Hex.:	ASCII	Meaning
89	**59**	**Y**	Command has been carried out
78	**4E**	**N**	Command could not be carried out; Possible causes: check sum or parameter / command incorrect

12 bit and 7 bit data is transferred in the parameter bytes **(4th byte to (n-1) byte)**. The following formats are used:

Possible parameter format:

7 bit data byte

D7	D6	D5	D4	D3	D2	D1	D0
0	Data byte bit [6..0]						

12 bit data item: data 1

Byte i								**Byte i + 1**							
D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
0	0	Data item bit [11..6]						0	0	Data item bit [5..0]					

D0 - D11 = distance value 0 - 4095 (according to the set measuring range)

12 bit data item: data 2

Byte i								**Byte i + 1**							
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
0	Data item bit [14..8]							0	Data item bit [6..0]						

12 bit data item: data 3 (with switching output recognition Q1 in bit D6, Byte i+1) and Good Target (GT at bit D6 Byte):

Byte i								**Byte i + 1**							
D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
0	GT	Data item bit [11..6]						0	**Q_1**	Data item bit [5..0]					

D0 - D11 = distance value 0 - 4095 (according to the set measuring range)
Q_1 = status of Q_1
GT = Good Target

12 bit data item: data 4

Byte i								**Byte i + 1**							
D7	D6	D5	D4	D3	D2	D1	D0	D7	D6	D5	D4	D3	D2	D1	D0
0	1	Data item bit [11..6]						0	0	Data item bit [5..0]					

D0 - D11 = distance value 0 - 4095 (according to the set measuring range)

8.4 Overview of master commands:

Command description	Dec.	Hex.:	ASCII	Remark	Example
Set switching output Q_1	**49**	**31**	1	Switching output Q_1 is set: 1st and 2nd switching point N.C / N.O. Pulse stretching	8.5.1
Set switching output Q_2	**50**	**32**	2	Switching output Q_2 is set: 1st and 2nd switching point N.C / N.O. Pulse stretching	8.5.2
Set Q_2 as output „Good Target"	**71**	**47**	G	Q_2 switches when an object is in the measuring range (Good Target).	8.5.3
Set Q_1 as Trigger input	**84**	**54**	T	Q_1 is set as trigger input. With rising edge on Q_1, measured value is held until the next trigger occurs.	8.5.4
Set Q_1 as control input for laser ON/OFF	**69**	**45**	E	Used to switch laser beam on and off. Q_1 = +U_B (laser beam ON), Q_1 = -U_B (laser beam OFF). Last measured value remains. When reactivated, the response time is prolonged according to the set mean value.	8.5.5
Averaging	**66**	**42**	B	The number of meas. values used for averaging (arithmetic mean) is set (1 / 10 / 100 meas. values).	8.5.6
Scaling analogue output (4 mA)	**78**	**4E**	N	The transmitted value is set as 4 mA point at analogue output.	8.5.7
Scaling analogue output (20 mA)	**72**	**48**	H	The transmitted value is set as 20 mA point at analogue output.	8.5.8
„Autom. zero" function (with Q_1 as control input)	**90**	**5A**	Z	The output characteristics 4 ... 20 mA are displaced. If Q_1 = +U_B the current measured value is set as the analogue value 4 mA. The incline of the characteristics is maintained. The max. value of the characteristics is limited by the measuring range.	8.5.9
Autom. centre" (with Q_1 as control input)	**67**	**43**	C	The output characteristics 4 ... 20 mA are displaced. If Q_1 = +U_B the current measured value is set as the analogue value 12 mA. The incline of the characteristics is maintained. The min. or max. value of the characteristics are limited by the measuring range.	8.5.10
„Maximum Hold" function (with Q_1 as control input)	**88**	**58**	X	Provided Q_1 = +U_B, the max. recorded measured value is stored. If Q_1 = -U_B, the determined value is transmitted at the analogue output or can be called up via **„Measured operating values".**	8.5.11
Minimum Hold" function (with Q_1 as control input)	**77**	**4D**	M	Provided Q_1 = +U_B, the min. recorded measured value is stored. If Q_1 = -U_B, the determined value is transmitted at the analogue output or can be called up via **„Measured operating values".**	8.5.12
„Difference Hold" function (with Q_1 as control input)	**68**	**44**	D	Provided Q_1 = +UB, the difference between the measured values is saved. If Q_1 = -U_B, the determined value is transmitted at the analogue output or can be called up via **„Measured operating values".**	8.5.13
Activate factory setting	**87**	**57**	W	The sensor resets all settings to the factory setting incl. sensor address.	8.5.14

Command description	Dec.	Hex.:	ASCII	Remark	Example
Lock and unlock keys	**86**	**56**	V	This command locks or unlocks the control panel keys.	8.5.15
Store settings permanently	**83**	**53**	S	The set parameters and data are stored permanently in the sensor. They thus remain in the sensor even after power supply has been disconnected.	8.5.16
Set Q_1 input	**81**	**51**	Q	Q_1 input is set by the software. The functions which depend on the status of the input (e.g. Q_1 as trigger input or autom. zero) can thus be controlled via the software.	8.5.17
Distance meas. values	**65**	**41**	A	Reads out the current distance to the object (raw data). Altered characteristic settings (4 mA point, 20 mA point, Min, Max, autom. centre ...) are not taken into account. The analogue output is not affected, it always transmits operating meas. values.	8.5.18
Operating meas. values	**73**	**49**	I	With this value, modified characteristic settings (4 mA point, 20 mA point, Min, Max, autom. centre ...) are taken into account. This value corresponds with that of the analogue output.	8.5.19
Fast meas. value output	**70**	**46**	F	After sending the command, distances values are (continuously) transmitted for as long as PIN 3 (Q_1) = $+U_B$. Data transmission: 16 data bits + 2 address bits 1 Zyklus = 0.4 ms	8.5.20
Change sensor's address	**76**	**4C**	L	Transfer new address to sensor.	8.5.21
Read sensor setting	**63**	**3F**	?	All sensor settings are read.	8.5.22
„Meas. value Hold" function	**82**	**52**	R	If this function is activated, the last valid measured value is saved when no object is in the measuring range (OK LED = OFF), and is transmitted at the analogue output. The switching output also maintains its status (if set). The current value is only displayed again when an object is within the measuring range (OK LED = ON).	8.5.23

8.5 Examples for master commands

8.5.1 Set switching output Q_1

Command (Byte 3):	decimal 49; hexadecimal 0x31	Parameter format:
Parameter:	Switching point 1	12 bit data item: data 1
	Configuration D0: 0 = N.O., 1 = N.C. D1: 1 = pulse stretching, 0 = OFF	7 bit data byte
	Switching point 2	12 bit data item: data 1

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Switching output Q_1 is defined (switching points 1+2, configuration)

Example telegram
(in this example the sensor has the address 1, switching output is defined as N.O. without pulse stretching, switching point 1 = 2049, switching point 2 = 0)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	9	09
3. Byte	Command	49	31
4. Byte	Switching point 1	33	21
5. Byte		0	00
6. Byte	Configuration	0	00
7. Byte	Switching point 2	0	0
8. Byte		0	00
9. Byte	Check sum	24	18

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.2 Set switching output Q_2

Command (Byte 3):	decimal 50; hexadecimal 0x32	Parameter format
Parameter:	Switching point 1	12 bit data item: data 1
	Configuration D0: 0 = N.O., 1 = N.C. D1: 1 = pulse stretching, 0 = OFF	7 bit data byte
	Switching point 2	12 bit data item: data 1

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Switching output Q_2 is defined (switching points 1+2, configuration).

Example telegram
(in this example the sensor has the address 1, signal output Q_2 is defined as N.O without pulse stretching, switching point 1 = selected value, switching point 2 = 0)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	9	09
3. Byte	Command	50	32
4. Byte	Switching point 1	63	3F
5. Byte		61	3D
6. Byte	Configuration	0	00
7. Byte	Switching point 2	0	0
8. Byte		0	00
9. Byte	Check sum	56	38

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.3 Set Q_2 as output „Good Target"

Command (Byte 3):	decimal 71; hexadecimal 0x47
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Q_2 switches when an object is in the measuring range.

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	71	47
4. Byte	Check sum	66	42

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.4 Set Q_1 as Trigger input

Command (Byte 3):	decimal 84; hexadecimal 0x54
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Q_1 is set as trigger input. With rising edge on Q_1, measured value is held until the next trigger occurs.

Example telegram
(in the example, the sensor has the address 1)

Master telegram					**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**			**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81		**1. Byte**	Address	129	81
2. Byte	Length	4	04		**2. Byte**	Length	4	04
3. Byte	Command	84	54		**3. Byte**	Reply	89	59
4. Byte	Check sum	81	51		**4. Byte**	Check sum	92	5C

8.5.5 Set Q_1 as control input for laser ON / OFF

Command (Byte 3):	decimal 69; hexadecimal 0x45
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Used to switch laser beam on and off. Laser beam is ON when $Q_1 = +U_B$. As long as $Q_1 = - U_B$, the laser beam is OFF. Last measured value remains. When reactivated, the response time is prolonged according to the set mean value.

Example telegram
(in the example, the sensor has the address 1)

Master telegram					**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**			**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81		**1. Byte**	Address	129	81
2. Byte	Length	4	04		**2. Byte**	Length	4	04
3. Byte	Command	69	45		**3. Byte**	Reply	89	59
4. Byte	Check sum	64	40		**4. Byte**	Check sum	92	5C

8.5.6 Averaging

Command (Byte 3):	decimal 66; hexadecimal 0x42	Parameter format
Parameter:	Configuration D0 = 1 : 0,4 ms (no averaging) D1 = 1 : 4 ms (10 measured values) D2 = 1 : 40 ms (100 measured values)	7 bit data byte

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The measurement result (output signal) is smoothed by averaging. The measured values are continuously stored in a memory and the mean value is formed. The number of measured values used for averaging is set here.

Example telegram
(in the example, the sensor has the address 1. Averaging is set to 4 ms.)

Master telegram				**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**		**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81	**1. Byte**	Address	129	81
2. Byte	Length	5	05	**2. Byte**	Length	4	04
3. Byte	Command	66	42	**3. Byte**	Reply	89	59
4. Byte	Data	1	01	**4. Byte**	Check sum	92	5C
5. Byte	Check sum	71	47				

8.5.7 Scaling analogue output (set 4 mA point)

Command (Byte 3):	decimal 78; hexadecimal 0x4E	Parameter format
Parameter:	Data	12 bit data item: data 1

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The transmitted measured value becomes the 4 mA value of the analogue output.

Example telegram
(in the example, the sensor has the address 1)

Master telegram				**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**		**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81	**1. Byte**	Address	129	81
2. Byte	Length	6	06	**2. Byte**	Length	4	04
3. Byte	Command	78	4E	**3. Byte**	Reply	89	59
4. Byte	Data	63	3F	**4. Byte**	Check sum	92	5C
5. Byte		63	3F				
6. Byte	Check sum	73	49				

8.5.8 Scaling analogue output (set 20 mA point)

Command (Byte 3):	decimal 72; hexadecimal 0x48	Parameter format
Parameter:	Data	12 bit data item: data 1

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The transmitted measured value becomes the 20 mA value of the analogue output.

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	6	06
3. Byte	Command	72	48
4. Byte	Data	63	3F
5. Byte		63	3F
6. Byte	Check sum	79	4F

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.9 „Autom. zero" function (with Q_1 as control input)

Command (Byte 3):	decimal 90; hexadecimal 0x5A
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The output characteristics (4 ... 20 mA) are simultaneously displaced with this function. When this function is activated and $Q_1 = +U_B$, the current measured value is set as the output value of 4 mA. The incline of the characteristic curve is maintained. The max. value of the characteristics is limited by the measuring range.

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	90	5A
4. Byte	Check sum	95	5F

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.10 „Autom. centre" (with Q_1 as control input)

Command (Byte 3):	decimal 67; hexadecimal 0x43
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The output characteristics (4 ... 20 mA) are displaced with this function. When the automatic centre function is activated and $Q_1 = +U_B$, the current measured value is equated with the output value of 12 mA. The incline of the characteristic curve is maintained. The min. or max. value of the characteristics are limited by the measuring range.

Example telegram
(in the example, the sensor has the address 1)

Master telegram					**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**			**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81		**1. Byte**	Address	129	81
2. Byte	Length	4	04		**2. Byte**	Length	4	04
3. Byte	Command	67	43		**3. Byte**	Reply	89	59
4. Byte	Check sum	70	46		**4. Byte**	Check sum	92	5C

8.5.11 „Maximum-Hold" function (with Q_1 as control input)

Command (Byte 3):	decimal 88; hexadecimal 0x58
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

When $Q_1 = +U_B$, the max. recorded measured value is stored. If $Q_1 = -U_B$, the determined value is transmitted at the analogue output or can be called up via **„Operating measured values".**

Example telegram
(in the example, the sensor has the address 1)

Master telegram					**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**			**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81		**1. Byte**	Address	129	81
2. Byte	Length	4	04		**2. Byte**	Length	4	04
3. Byte	Command	**88**	**58**		**3. Byte**	Reply	89	59
4. Byte	Check sum	93	5D		**4. Byte**	Check sum	92	5C

8.5.12 „Minimum-Hold" function (with Q_1 as control input)

Command (Byte 3):	decimal 77; hexadecimal 0x4D
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

When Q_1 = +U_B, the min. recorded measured value is stored. If Q_1 = -U_B, the minimum value can be called up via **„Operating measured values"**.

Example telegram
(in the example, the sensor has the address 1)

Master telegram					**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**			**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81		**1. Byte**	Address	129	81
2. Byte	Length	4	04		**2. Byte**	Length	4	04
3. Byte	Command	**77**	**4D**		**3. Byte**	Reply	89	59
4. Byte	Check sum	72	48		**4. Byte**	Check sum	92	5C

8.5.13 „Difference Hold" function (with Q_1 as control input)

Command (Byte 3):	decimal 68; hexadecimal 0x44
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Provided Q_1 = +U_B, the difference between the measured values is saved. When Q_1 = -U_B, the determined value is transmitted at the analogue output.

Example telegram
(in the example, the sensor has the address 1)

Master telegram					**Sensor's reply telegram**			
	Designation	**Decimal**	**Hex.:**			**Designation**	**Decimal**	**Hex.:**
1. Byte	Address	129	81		**1. Byte**	Address	129	81
2. Byte	Length	4	04		**2. Byte**	Length	4	04
3. Byte	Command	68	44		**3. Byte**	Reply	89	59
4. Byte	Check sum	65	41		**4. Byte**	Check sum	92	5C

8.5.14 Activate factory setting

Command (Byte 3):	decimal 87; hexadecimal 0x57
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The sensor is reset to factory setting.

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	87	57
4. Byte	Check sum	82	52

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.15 Lock and unlock keys

Command (Byte 3):	decimal 86; hexadecimal 0x56	Parameter format
Parameter:	D0 = 0: key lock inactive D0 = 1: key lock active	7 bit data byte

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

The keys on the sensor are locked or unlocked.

Example telegram
(in the example, the sensor has the address 1, the key lock is active)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	5	05
3. Byte	Command	86	56
4. Byte	Data	1	01
5. Byte	Check sum	83	53

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.16 Permanent storage of configurations

Command (Byte 3):	decimal 83; hexadecimal 0x53
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Sensor settings are stored in the EEPROM (they thus remain saved even after the power supply has been disconnected).

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	83	53
4 Byte	Check sum	86	56

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.17 Set Q_1 input

Command (Byte 3):	decimal 81; hexadecimal 0x51	Parameter format
Parameter:	D0 = 0: set Q_1 low D0 = 1: set Q_1 high	7 bit data byte

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Q_1 input is set via the software. The functions which depend on the status of the input (e.g. Q1 as trigger input or autom. zero) can thus be controlled via the software.

Example telegram
(in the example, the sensor has the address 1, Q_1 is set to high)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	5	05
3. Byte	Command	81	51
4. Byte	Data	1	01
5. Byte	Check sum	84	54

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.18 Measured distance values

Command (Byte 3):	decimal 65; hexadecimal 0x41
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59	Parameter format
Parameter:	Data	12 bit data item Data 3

Reads out the current distance to the object (raw data). Altered characteristic settings (4 mA point, 20 mA point, Min, Max, autom. centre ...) are not taken into account. The analogue output is not affected, it always transmits measured operating values.

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	65	41
4. Byte	Check sum	68	44

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	6	06
3. Byte	Reply	89	59
4. Byte	Data	64	40
5. Byte		0	00
6. Byte	Check sum	30	1E

8.5.19 Measured operating values

Command (Byte 3):	decimal 73; hexadecimal 0x49
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59	Parameter format
Parameter:	Data	12 bit data item: Data 3 with switching output recognition

The current measured values and switching output recognition are read whilst taking into account the settings which alter the characteristics (4 mA point, 20 mA point, Min., Max., autom. centre ...).

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	73	49
4. Byte	Check sum	76	4C

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	6	06
3. Byte	Reply	89	59
4. Byte	Data	0	00
5. Byte		0	00
6. Byte	Check sum	94	5E

8.5.20 Fast measured value output

Command (Byte 3):	decimal 70; hexadecimal 0x46
Parameter:	no

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	70	46
4. Byte	Check sum	67	43

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

If output Q_1 is set to high after this command, the continuous transmission of measured values begins according to parameter format data 4. No intervention is possible via the software during this time.

INFORMATION
This command must not be used in bus mode.

8.5.21 Change the sensor's address

Command (Byte 3):	decimal 76; hexadecimal 0x4C	Parameter format
Parameter:	New address	7 bit data byte

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

Change in the address of the connected sensor.

Example telegram
(in the example, the sensor has the address 1, it is switched to 2)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	5	05
3. Byte	Command	76	4C
4. Byte	Data	2	02
5. Byte	Check sum	74	4A

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

8.5.22 Read sensor settings

Command (Byte 3):	decimal 63; hexadecimal 0x3F	Parameter format
Parameter:	no	

Reply (Byte 3):	decimal 89; hexadecimal 0x59	Parameter format
Parameter:	Function 1 D8: Trigger input D9: Q1 is enable input D10: X D11: Maximum hold D12: Difference hold D13: Q1 is software input D14: fast measuring value output	12 bit data item: data 2
	D0: Q1 is signal output D1: Q1 is scanning zone D2: Q1 is signal output inversion (1 = N.C.) D3: Q1 is signal output pulse stretching D4: Minimum hold D5: Autom. zero D6: Autom. centre	
	Function 2 D8 ... D14: Identifikation of variants	12 bit data item: data 2
	D0: Q1 is signal output D1: Q1 is scanning zone D2: Q1 is signal output inversion (1 = N.C.) D3: Q1 is signal output pulse stretching D4: Q2 ist good target output D5 ... D6: X	

Reply (Byte 3):	decimal 89; hexadecimal 0x59	Parameter format
	Function 3 D8: Measured value hold D9, D10: X D11: Key lock D12 ... D14: X	12 bit data item: data 2
	D0: Mean value 0,4 ms D1: Mean value 4 ms D2: Mean value 40 ms D3 ... D6: X	
	Characteristic curve 4 mA point	12 bit data item: data 1
	Characteristic curve 20 mA point	12 bit data item: data 1
	Switching threshold Q_1	12 bit data item: data 1
	Scanning zone Q_1	12 bit data item: data 1
	Switching threshold Q_2	12 bit data item: data 1
	Scanning zone Q_2	12 bit data item: data 1

Example telegram
(in the example, the sensor has the address 1)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Command	63	3F
4. Byte	Check sum	58	3A

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	21	15
3. Byte	Reply	89	59
4. Byte	Function 1	32	20
5. Byte		1	01
6. Byte	Function 2	48	30
7. Byte		48	30
8. Byte	Function 3	55	37
9. Byte		1	01
10. Byte	Characteristic curve 4 mA point	0	00
11. Byte		0	00
12. Byte	Characteristic curve 20 mA point	63	3F
13. Byte		63	3F
14. Byte	Switching threshold Q_1	0	00
15. Byte		0	00
16. Byte	Scanning zone Q_1	0	00
17. Byte		0	00
18. Byte	Switching threshold Q_2	0	00
19. Byte		63	3F
20. Byte	Scanning zone Q_2	63	3F
21. Byte		63	3F
21. Byte	Check sum	101	65

8.5.23 „Meas. value hold" function

Command (Byte 3):	decimal 82; hexadecimal 0x52	Parameter format
Parameter:	D0 = 0: Measuring value Hold off D0 = 1: Measuring value Hold	7 bit data byte

Reply (Byte 3):	decimal 89; hexadecimal 0x59
Parameter:	no

If this function is activated, the last valid measured value is transmitted at the analogue output when no object is in the measuring range (OK LED = OFF). The switching output also maintains its status (if set).
The current value is only displayed again when an object is within the measuring range (OK LED = ON).

Example telegram
(in the example, the sensor has the address 1, „meas. value hold" is activated)

Master telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	5	05
3. Byte	Command	82	52
4. Byte	Data	1	01
5. Byte	Check sum	87	57

Sensor's reply telegram			
	Designation	**Decimal**	**Hex.:**
1. Byte	Address	129	81
2. Byte	Length	4	04
3. Byte	Reply	89	59
4. Byte	Check sum	92	5C

9 Care and maintenance

9.1 Cleaning

Should the front screen of the sensor become dirty, wipe it with a soft cloth and if necessary use a cleaning agent for plastic surfaces.

CAUTION
Never use aggressive detergents.

9.2 Transport, packaging, storage

Check the delivery upon receipt to ensure that it is complete and that no damage occurred during transport. Should the delivery be damaged, contact the carrier immediately. When returning the sensor, the packaging must always be sufficiently solid.

INFORMATION
If a defect is found, a complaint must be made immediately. Claims can only be made within the valid time limit.

9.3 Disposal

Electronic components are subject to the regulations governing treatment of hazardous waste and may only be disposed of by specialist companies.

10 Troubleshooting

Description of error	Possible cause	Remedy
When changing to set-up mode all LEDs flash immediately.	Key lock activated.	Unlock BOD 26K, see chapter 7.1 „Unlock keys”.
The sensor does not switch to set-up mode (via control panel).	Sensor is simultaneously being operated via interface.	Disconnect serial interface.
Sensor is not found by software after connection.	Sensor is still programmed as master.	Reset sensor to factory settings via control panel, see chapter 7.1 „Activate factory setting“.
Sensor is not found by software after connection. The message: „Com Port is busy“ appears.	Sensor is programmed as slave.	Reset sensor to factory settings via control panel, see chapter 7.1 „Activate factory setting“.
Master - slave mode does not function. LED C is only alight on one sensor.	One sensor is not in correct mode.	Reprogram the sensor whose LED is not alight.
	One sensor does not have function no. 27.	Use the sensor that does not have function 27 as master.
After activating fast meas. value, the sensor no longer reacts to program.	PIN 3 (Q_1) = $+U_B$.	Set Q_1 back to low ⇨ settings are possible again.
	Q_1 was set to high via software.	Disconnect power supply. Restart the sensor, it will then be operational.

In the event of any other malfunctions, please contact us or our representations.

11 Technical data

Optical data (typ.)		
	BOD 26K-LB(R)04	**BOD 26K-LB(R)05**
Operating range	30 ... 100 mm	80 ... 300 mm
Measuring range	70 mm	220 mm
Resolution	< 0.1 % of end value of operating range (0.1 / 0.3 mm) *1	
Light used	pulsed laser light, red 650 nm, MTBF > 50.000 h *2	
Size of light spot	see illustr. 4	
Max. ambient light	constant light 5000 lux as per EN 60947-5-2	
Laser protection class	2 (EN 60825-1)	

Electrical data (typ.)	
Operating voltage U_B	18 ... 30 V DC *3
Power consumption I_O no load	≤ 40 mA at 24 V DC
Switching outputs	Q_1 / Q_2 (PNP, N.O. / N.C. reversible)
Output current I_e Q_1, Q_2	≤ 100 mA
Switching frequency (ti/tp 1:1) Q_1, Q_2	≤ 1 kHz
Response time Q_1, Q_2, Q_A	≥ 0.4 ms (when averaging = off) / 4 ms / 40 ms to end value
Max. capacitive load Q_1, Q_2	< 100 nF
Pulse stretching Q_1, Q_2	50 ms (when activated)
Analogue output Q_A	4 ... 20 mA *4
Serial interface	RS485 (LBR version only)
Linearity	< 0.25 % of end value of operating range (0.25 mm / 0.75 mm)
Temperature drift	< 0.02 % of end value of operating range / K
Repeatability	< 0.25 % of measuring range
Protective circuits	reverse battery protection, short-circuit protection (not RS485)
VDE protection class	☐ *5
Power-on delay t_v	< 300 ms

Mechanical data (typ.)	
Casing material	ABS, shock-resistant
Front screen material	PMMA
Protection standard	IP 67 *6
Ambient temperature range	-10 ... +60 °C
Storage temperature range	-20 ... +80 °C
Resistance to thermal shocks and vibration	EN 60947-2
Connection	M12 connector, rotatable, 8-pin
Weight	approx. 43 g

*1 smallest, measurable difference
*2 at ambient temperature: +40 °C
*3 limit values
*4 recommended burden ≤ 500 Ohm
*5 rating 50 V DC
*6 with attached connector

12 Order information

Order code	Part name	Description
BOD0005	BOD 26K-LB04-S115-C	Distance sensor, 30 ... 100 mm, resolution 0.1 % of measuring range, 2 x PNP, N.O. / N.C., 4 ... 20 mA, M12 8-pin connector, *1
BOD000C	BOD 26K-LBR04-S115-C	Distance sensor, 30 ... 100 mm, resolution 0.1 % of measuring range, 2 x PNP, N.O. / N.C., 4 ... 20 mA, RS485, M12 8-pin connector, *1
BOD0006	BOD 26K-LB05-S115-C	Distance sensor, 80 ... 300 mm, resolution 0.1 % of measuring range, 2 x PNP, N.O. / N.C., 4 ... 20 mA, M12 8-pin connector, *1
BOD000E	BOD 26K-LBR05-S115-C	Distance sensor, 80 ... 300 mm, resolution 0.1 % of measuring range, 2 x PNP, N.O. / N.C., 4 ... 20 mA, RS485, M12 8-pin connector, *1

*1 each include mounting and operating instructions for BOD 26K-LB04/LBR04 and -LB05/LBR05 (Nr. 834826)

12.1 Accessories

Accessory	Description
BKS-S139-PU-05	Connection cable, 8-pin, 5 m in length, straight, PUR
BOS 26-HW-1	Recommended mounting bracket
BAE002P	CS-428/9AT RS232/RS485-RS422 converter
BAE009A	UC-232A USB/RS232

Accessories not included in delivery

INFORMATION
To operate the BOD 26K-LBR sensor on a PC, the PC must be equipped with a RS485 interface. If this is not the case the existing interface (RS232, USB, etc.) can be used with a adaptor.
If your PC has a RS232 interface, we recommend to use the CS-428/9AT RS232/RS485-RS422 converter *2
If your PC has a USB interface, the additional UC-232A USB/RS232 *2 is required.

*2 see accessory list for order code

INFORMATION
Data sheets and instruction manuals can be downloaded from www.balluff.de