microsonic

Operating manual

bks+3/FIU

Ultrasonic web edge sensor with analogue output and IO-Link interface

Product Description

The bks+ ultrasonic web edge sensor is a fork sensor for scanning the edges of sound-impermeable materials such as foil or paper.

The fork's lower leg is equipped with an ultrasonic sensor which cyclically emits short sound impulses, which are detected by the ultrasonic receiver accommodated in the upper fork leg. Material immersing into the fork covers this sound path and thus attenuates the receive signal, which is evaluated by the internal electronics. An analogue signal is output in dependence of the coverage degree.

Using the LinkControl-Adapter LCA-2 and LinkControl software, the switched output can be programmed in window mode around the zero position.

- Via the Teach-in button on the edge sensor's top or via Pin 5 on the device plug, the sensor can be adjusted to the material to be controlled.
- Choosing between rising and falling output characteristic is possible.
- Three LEDs indicate the position of the web material inside the fork.

IO-Link

The bks+3/FIU sensors are IO-Link-capable in accordance with IO-Link specification V1.1.

Safety Notes

- **Read the operating manual prior to start-up.**
- **Connection, installation and adjustment works may only be carried out by expert personnel.**
- **No safety component in accordance with the EU Machine Directive.**

Installation

➔ Mount the sensor at the installation site.

➔ Connect a connection cable to the M12 device plug, see Fig. 1.

➔ For optimum measurement results the sensor should be mounted thermally conductive.

Start-Up

➔ Connect the power supply.

➔ Carry out the adjustment to the web material in accordance with Diagram 1.

Synchronisation

If two or more edge sensors are mounted in a distance <400 mm the internal synchronisation should be used. Connect Sync-channels (Pin 5 at the units receptacle) of all sensors.

		colour
1	$+U_B$	brown
3	$-U_B$	blue
4	F IO-Link	black
2	I/U	white
5	Com	grey

Fig. 1: Pin assignment with view onto sensor plug and colour coding of the microsonic connection cable

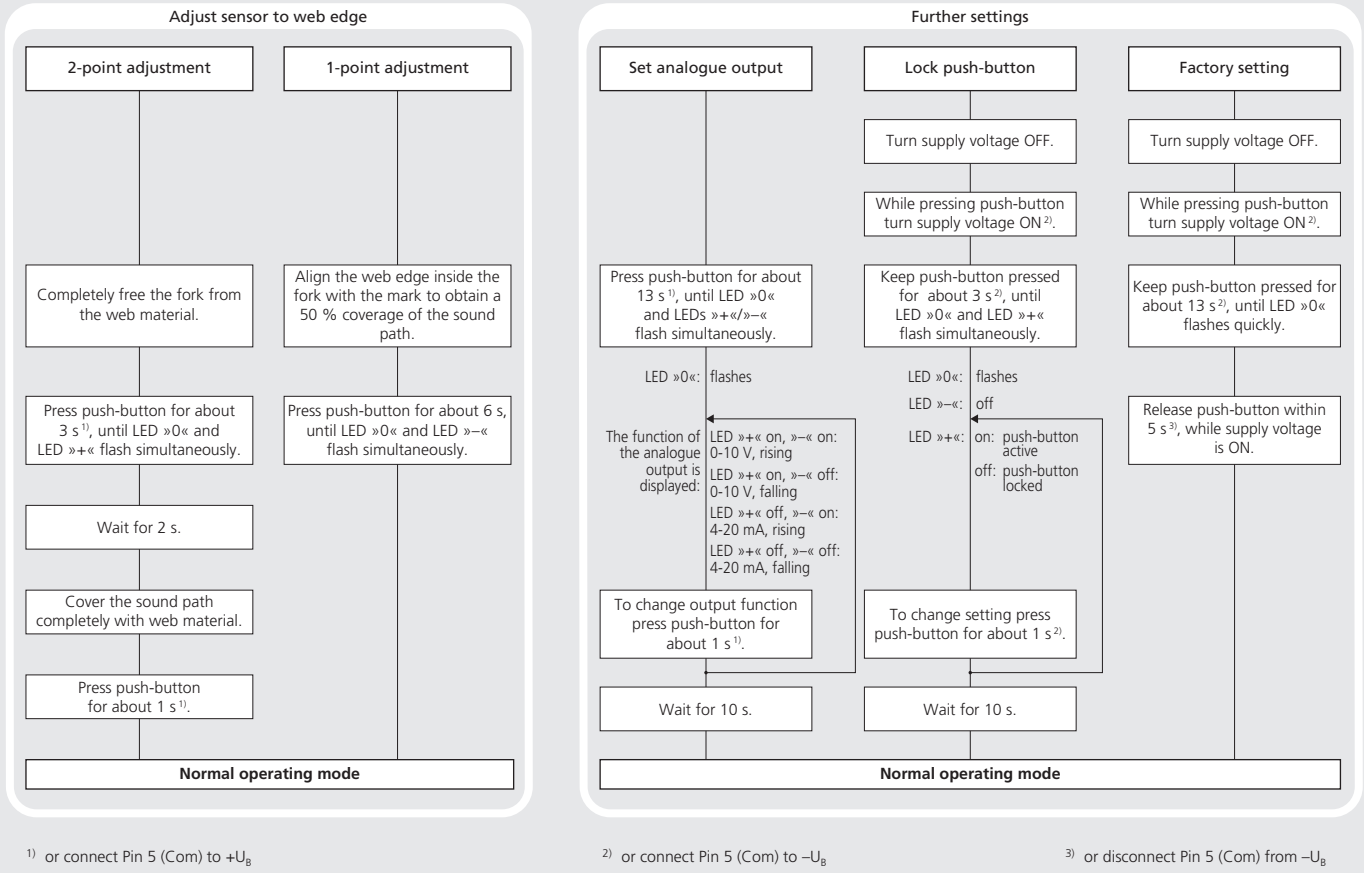
Factory setting

- Analogue output on voltage output
- Rising analogue characteristic (0 V at maximum coverage)
- Switching output on NOC
- Switching output window is ±1.5 mm around zero position.

Maintenance

microsonic sensors are maintenance-free. With heavy dirt deposits, we recommend a cleaning of the white sensor surface.

Diagram 1: Sensor adjustment via Teach-in procedure

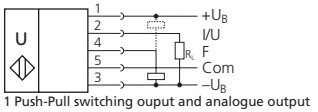


1) or connect Pin 5 (Com) to $+U_B$

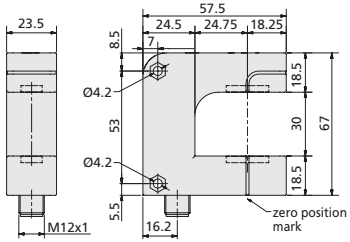
2) or connect Pin 5 (Com) to $-U_B$

3) or disconnect Pin 5 (Com) from $-U_B$

Technical data



1 Push-Pull switching ouput and analogue output



fork width	30 mm
fork depth	43 mm
working range	min. 12 mm (±6 mm)
transducer frequency	170 kHz
resolution	< 0,003 mm
reproducibility	±0,1 mm
operating voltage U_B	20 to 30 V DC, reverse polarity protection
voltage ripple	±10 %
no-load current consumption	≤60 mA
housing	zinc die cast lacquered, plastic parts: PBT ultrasonic transducer: polyurethane foam, epoxy resin with glass contents
class of protection to EN 60 529	IP 65
type of connection	5-pin M12 initiator plug, brass, nickel-plated
controls	Teach-in button and Teach-in via Pin 5
indicators	LED green: centre or within switching window LEDs yellow: outside the centre/switching window
programmable	LCA-2 with LinkControl and IO-Link
synchronisation	internal synchronisation up to 10 sensors
operating temperature	+5 to +60 °C
storage temperature	–40 to +85 °C
weight	190 g
response time	5,1 ms
measurement cycle time	4 ms
time delay before availability	<300 ms
order no.	**bks+3/FIU**
analogue output	current output 4 to 20 mA, voltage output 0 to 10 V short-circuit-proof, switchable rising/falling
switching output	Push-Pull, U_B–3 V, $-U_B$+3 V, I_{max} = 100 mA switchable NOC/NCC; short-circuit-proof

Notes

- For optimum measurement results the material to be detected should be kept in a range of ±5 mm around the centre between the upper and lower fork leg.
- The sensor can be reset to its factory settings (see »Further settings«, Diagram 1).
- Carry out the adjustment only after reaching the operating temperature (approx. 20 min).
- Using the LinkControl-Adapter LCA-2 (optional accessory) and the LinkControl-Software V7.6 additional sensor parameters can be adjusted and Teach-in procedures can be carried out.
- Depending on the function the ultrasonic transducers in the upper and lower fork leg are mounted with a slope of 2°.

IO-Link-Mode

The bks+3/FIU sensors are IO-Link-capable in accordance with IO-Link specification V1.1 and compatible to specification V1.0.

Note
In IO-Link mode Teach-in and LinkControl are not available.

Process data
The bks+ cyclically transmits the value corresponding to the measured coverage degree with a resolution of 0.003 mm.

Service data
The following sensor parameters may be set via IO-Link.

Teach-in via push-button
The push-button can be activated/deactivated for sensor settings with Teach-in.

Linearisation of the output characteristic
The linearisation of the output characteristic increases the accuracy in the central measuring range of the sensor. If higher accuracy is required in the edge areas, the linearisation of the output characteristic can be deactivated.

Temperature compensation
The temperature compensation is used for measurement value correction for varying ambient temperatures and can be disabled.

Analogue output mode
For the analogue output either voltage or current output can be selected.

Rising/falling analogue characteristic
The analogue characteristic can be set on rising (0 V/4 mA at full coverage) or falling characteristic.

Set NOC/NCC
The NCC or NOC output function can be preset for the switching output.

Switching off the LEDs
When activated, the LEDs are turned off 30 seconds after a key press. After a new key press they will run for 30 seconds. This automatic shutdown can be deactivated.

Measurement filter
bks+ ultrasonic sensors provide for a choice of 3 filter settings:

- F00 (no filter)
  Each ultrasonic measurement acts on the output in an unfiltered manner.
- F01 (average value filter)
  Forms approximately the arithmetic mean of several measurements. According to the mean value the output is set. The number of measurements, from which the mean is formed is dependent on the chosen filter strength.
- F02 (median filter)
  Finds the median of several measurements. According to the median the output is set. The number of measurements, for which the median is determined is dependent on the selected filter strength.

Filter strength
For both measurement value filters, a filter strength between P00 (weak filter effect) and P09 (strong filter effect) can be selected.

Switching window
If the web edge is within the switching window the switching output is set. The switching window is defined by the adjusted centre and the width.

Note
The switching window has to be within the operating range.

System commands
With 5 system commands the following settings may be carried out:

- restore IO-Link parameters to their factory settings (system command 130)
- sensor adjustment: fork cleared
- sensor adjustment: fork 50 % covered
- sensor adjustment: fork 100 % covered
- reset all sensor parameters including the IO-Link parameters to their factory settings (system command 164)

Events
The bks+ sensor sends the following events:

- parameter was changed
- sensor adjustment successful
- sensor adjustment failed

IODD file
The latest IODD file you will find on the internet under www.microsonic.de/en/IODD.

For further informations on IO-Link see www.io-link.com.

IO-Link Data

	bks+3/FIU				
physical layer					
IO-Link revision	V1.1				
compatibilty	V1.0				
block parameter	yes				
data storage	yes				
SIO mode support	yes				
min cycle time	4 ms				
baud rate	COM 2				
format of process data	16 Bit, R, UNI16				
content of process data	Bit 0-15: degree of coverage with 0.003 mm resolution				
service data IO-Link specific	**index**		**access**	**value**	
vendor name	0x10		R	microsonic GmbH	
vendor text	0x11		R	www.microsonic.de	
product name	0x12		R	bks+	
product ID	0x13		R	bks+3/FIU	
product text	0x14		R	Ultraschall-Sensor	
service data sensor specific	**index**	**format**	**access**	**range**	**default**
Teach-in via push-button	0x40	UINT8	R/W	0: activated; 1: deactivated	0
linearisation of the output characteristic	0x41	UINT8	R/W	0: deactivated; 1: activated	1
temperature compensation	0x42	UINT8	R/W	0: deactivated; 1: activated	1
analogue output mode	0x44	UINT8	R/W	2: current output, 3: voltage output	3
rising/falling output characteristic curve	0x45	UINT8	R/W	0: rising characteristic curve; 1: falling characteristic curve	0
NCC/NOC	0x46	UINT8	R/W	0: NOC; 1: NCC	0
automatic turning-off LEDs	0x48	UINT8	R/W	0: deactivated; 1: activated	1
measurement filter	0x4D	UINT8	R/W	0-2: F00-F02	0
filter strength	0x4E	UINT8	R/W	0-9: P00-P09	0
centre of switching window	0x4F	INT16	R/W	0-4095 [1]	2047
width of switching window	0x50	UINT16	R/W	0-4095 [1]	1023
system commands	**index**		**access**	**value**	
restore IO-Link parameter	0x02		W	130	
sensor adjustment: fork cleared	0x02		W	161	
sensor adjustment: fork 50 % covered	0x02		W	162	
sensor adjustment: fork 100 % covered	0x02		W	163	
reset to factory setting	0x02		W	164	
events	**code**	**type**		**name**	
	0x8ca0	Notification		parameter was changed	
	0x8ca1	Notification		sensor adjustment successful	
	0x8ca2	Notification		sensor adjustment failed	
observe	**index**	**format**	**access**	**range**	
measurement value	0x54	UINT16	R	0-4095 [1]	

[1] The value range 0-4,095 corresponds with the working range of the sensor.

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microsonic GmbH / Phoenixseestraße 7 / 44263 Dortmund / Germany / **T** +49 231 975151-0 / **F** +49 231 975151-51 / **E** info@microsonic.de / **W** microsonic.de

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