Operating manual

sks-15/CF

Ultrasonic proximity switch with one switching output and IO-Link interface

Product description

The sks sensor offers a non-contact-measurement of the distance to an object which must be positioned within the sensor's detection zone. The switched output is set in dependance of the adjusted detect distance.
Via the push-button, the distance and operating mode can be adjusted (Teach-in). Two LEDs indicate operation and the state of the switched output. The output function is changeable from NOC to NCC.
The sks-15/CF sensor is IO-Link capable in accordance with IO-Link specification V1.1.

Safety notes

- Read operating instructions pior to start-up.
- Connection, installation and adjustment works may only be carried out by expert personnel
- No safety component according to EU Machinery Directive

Proper use

sks ultrasonic sensors are used for non-contact detection of objects.

Mounting

- Mount the sensor at installation site, Maximum torque: 0.5 Nm
- Connect a connection cable to the M8 device plug

Start-Up

- Connect the power supply
- Carry out the adjustment in according with the diagram

Factory setting

- Operating with one detect point
- Switched output on NOC
- Detect points at operating range

		colour
1	$+U_B$	brown
3	$-U_B$	blue
4	F	black
2	Com	white

Fig. 1: Pin assignment with view of the sensor plug and color coding of the microsonic connection cables

- Filter F01
- Filter strength P00

Operating modes

Three operating modes are available for the switches output:
- Operation with one switching point
The switched output is set if the object falls below the set detect point.
- Window mode
The switched output is set if the object is outside the set window margins.
- Two-way reflective barrier
The switched output is set if the object is located between the sensor and reflector.

Checking operation mode

- In normal mode shortly press the push-button.

The green LED stops shining for one second, then it will show the current operating mode:

1 x flashing = operation with one switching point
2 x flashing = window mode
3 x flashing = reflective barrier

After a break of three seconds, the green LED shows the **output function**:
1 x flashing = NOC
2 x flashing = NCC

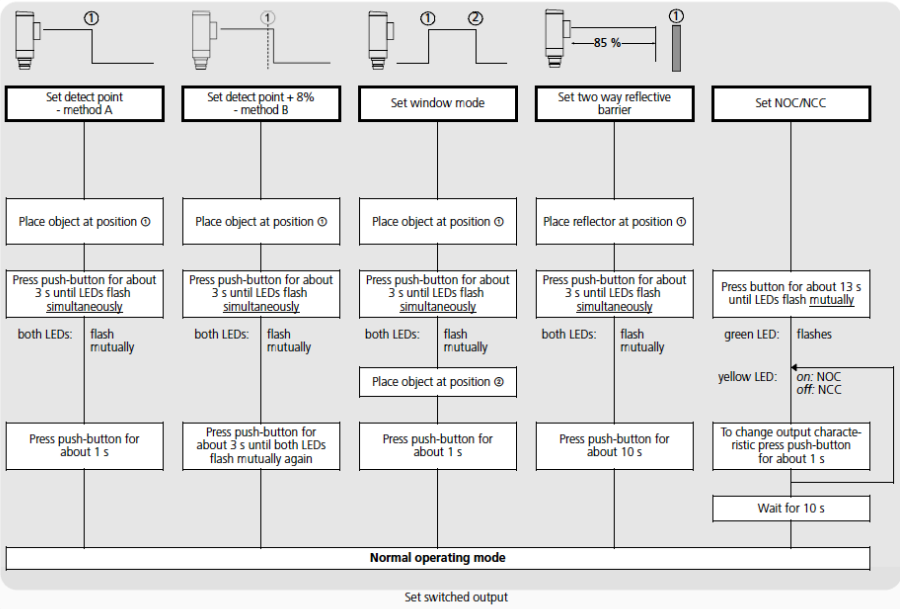
Maintenance

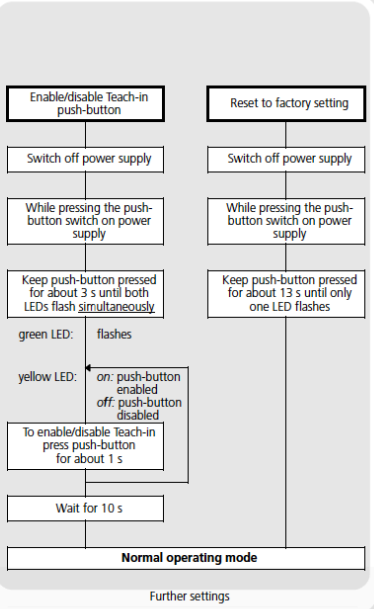
microsonic sensors are maintenance-free. In case of excess caked-on dirt we recommend cleaning the white sensor surface.

Notes

- Every time the power supply is switched on, the sensor detects its actual operating temperature and transmits it to the internal temperature compensation. The adjusted value is taken over after 45 seconds.
- If the sensor was switched off for at least 30 minutes and after power on the the switched output is not set for 30 minutes a new adjustment of the internal temperature compensation to the actual mounting conditions takes place.
- The sks sensor has a blind zone whithin which distance measurements are not possible.
- In the normal operating mode, an illuminated yellow LED signals the switched output is switched through.
- In the »Set detect point – method A« Teach-in procedure the actual distance to the object is taught to the sensor as the detect point. If the object moves towards the sensor (e.g. with level control) then the taught distance is the level at which the sensor has to switch the output.
- If the object to be scanned moves into the detection area from the side, the »Set detect point +8 % – method B« Teach-in procedure should be used. In this way the switching distance is set 8 % further than the actual measured distance to the object. This ensures a reliable switching distance even if the height of the objects varies slightly, see fig. 2.
- In the »Two-way reflective barrier« operating mode, the object has to be within the range of 0-85 % of the set distance.
- If the push-button is not pressed for 10 minutes during the teach-insetting, the settings made hitherto are deleted.
- The sensor can be reset to its factory setting.

Sensor adjustment with Teach-in procedure





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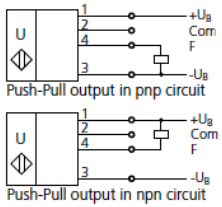
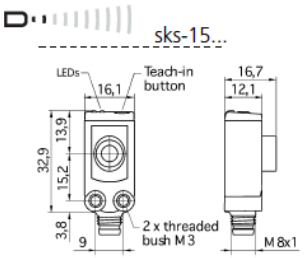
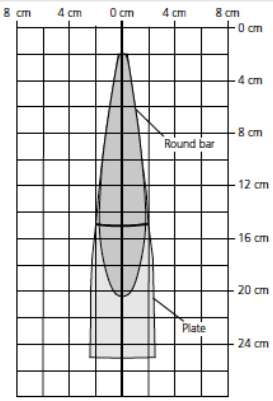
Technical data



Push-Pull output in pnp circuit

Push-Pull output in npn circuit



blind zone	20 mm
operating range	150 mm
maximum range	250 mm
angle of beam spread	See detection zone
transducer frequency	380 kHz
resolution, sampling rate	0.10 mm
reproducibility	± 0.15 %
detection zones for different objects: The dark grey areas are determined with a thin round bar (10 mm dia.) and indicate the typical operating range of a sensor. In order to obtain the light grey areas, a plate (100 x 100 mm) is introduced into the beam spread from the side. In doing so, the optimum angle between plate and sensor is always employed. This therefore indicates the maximum detection zone of the sensor. It is not possible to evaluate ultrasonic reflections outside this area.	
accuracy	± 1% (Temperature drift internal compensated)
operating voltage U_B	15 - 30 V DC, reverse polarity protection
voltage ripple	±10 %
no-load current consumption	< 25 mA
housing	ABS
	ultrasonic transducer: polyurethane foam,
	epoxy resin with glass content
class of protection to EN 60 529	IP 67
type of connection	4-pin M8 initiator plug
controls	Teach-in push-button
indicators	LED green (operation)
	LED yellow (state of output)
programmable	IO-Link
operating temperature	-25°C to +70°C
storage temperature	-40°C to +85°C
weight	8 g
switching hysteresis	2 mm
switching frequency	25 Hz
response time	32 ms
time delay before availability	< 300 ms
norm conformity	EN 60947-5-2
order no.	**sks-15/CF**
switched output	Push-Pull, U_B-3 V, -U_B+3 V, I_{max} = 100 mA
	switchable NOC/NCC, short-circuit-proof

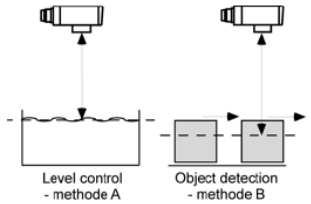


Fig. 2: Adjustment of the switching point when the object moves in different directions

CE IO-Link 2014/30/EU

MV-DO-165133-626227

Sensor adjustment in IO-Link mode

The sks sensor is IO-Link-capable in accordance with IO-Link specification V1.1.

Pointer

- In IO-Link mode Teach-in vis push-button is not available.
- For current information about IO-Link please contact the microsonic sales department.

Synchronisation in IO-Link mode

In IO-Link mode each sensor is synchronized on the protocol of the IO-Link master.
In multiple sensor operation the sensors are synchronous if the master protocols are synchronous.

Process data

The sks cyclically transmits the measured distance value with a resolution of 0.1 mm and the logical state of the switched output.

Service data

The following sensor parameters may be set via IO-Link interface using the IO-Link device description (IODD).

Detect point 1

The switched output is activated when the distance to an object is smaller than the present detect point.

Return detect point 1

The switched output is reactivated when the distance to an object is greater than the present return detect point (detect point + hysteresis).

Pointer

- The return detect point 1 must always be greater than the detect point 1.

Detect point 2, return detect point 2

By programming these two detect distances to a value smaller than the actual maximum distance the window mode is activated. The window lies between detect point 1 and detect point 2.

Pointer

- The return detect point 2 must always be smaller than the detect point 2.

Set NOC/NCC

The NCC or NOC output function can be present for the switched output.

Measurement filter

sks ultrasonic sensors provide for a choice of five filter settings:

- F00 (no filter)
  Each ultrasonic measurement acts in an unfiltered manner on the output.
- F01 (standard filter)
  On the object continuously approaching the sensor, the ongoing interval is immediately taken on and the output correspondingly activated. The effect of the object abruptly moving away from the sensor is for the existing distance to be saved for a retaining time dependent on the filter strength and for the switched output state to be maintained.
- F02 (Average value filter)
  Forms the arithmetic mean across a number of measurements. The output is activated in keeping with the average value. The number of measurements, from which the average value is formed, depends on the selected filter strength.
- F03 (foreground filter)
  This filter reacts very fast on sensor close measurement values and gives a straightened output on this sensor close level. Disturbances from objects in the background or momentary loss of echoes from the object to be detected are filtered out.
- F04 (background filter)
  This filter reacts very fast on sensor far measurement values and gives a straightened output on this sensor far level. Disturbances from obstacles in front of the object to be detected are filtered out.

Filter strength

A filter strength between 0 – weak filter effect – and 9 – pronounced filter effect – can be selected for each.

Teach-in via push-button

The push-buttons can be locked/unlocked for the Teach-in procedures in SIO mode.

Temperature compensation

The temperature compensation improves the measurement accuracy at changing ambient temperature and may be deactivated.

Pointer

- The measurement accuracy amounts to 0.17 %/K change of temperature without compensation.

System commands

With five system commands the following settings may be carried out:

- Teach-in detect point.
- Teach-in detect point +8 %.
- Teach-in window mode detect point 1
- Teach-in window mode detect point 2
- Teach-in two way refective barrier.

Pointer

To achieve the minimum response time the Master Cycle Time has to comply with the following requirements:

- Min Cycle Time ≤ Master Cycle Time ≤ Min Cycle Time + 1.2 ms.
- If this condition can not be fullfilled, the sensor will adapt its internal measurement cycle to the actual Master Cycle Time. This will have influence on the response time and the behaviour of the measurement filter.
- If an invalid Master Cycle Time is set, the sensor will send an event and will stop the ultrasonic measurement.

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

physical layer	sks-15...				
IO-Link revision	V1.1				
SIO mode support	yes				
min cycle time	8 ms				
baud rate	COM 2 (38.400 Bd)				
format process data	16 Bit, R, UNI16				
content process data	Bit 0: state of switched output, Bit 1-15: distance value with 0.1 mm resolution				
service data IO-Link specific	**index**		**access**	**value (dez)**	
Vendor ID				419	
Device ID				27	
Vendor URL				http://www.microsonic.de	
Device Family				sks	
Vendor Name	0x10		R	microsonic GmbH	
Produkt Name	0x12		R	sks-15/CF	
Product ID	0x13		R	sks-15/CF	
Product Text	0x14		R	Ultraschall-Sensor	
service data Sensor specific	**index**	**format**	**access**	**default value (dez)**	**range/format (dez)**
detection range	0x4B	UINT16	RW	5343 [1]	5343-8904 (300 mm - 500 mm)[1]
detect point 1	0x40	UINT16	RW	2671 [1]	356-4452 (20 mm - 249 mm)[1]
return detect point 1	0x41	UINT16	RW	2707 [1]	356-4452 (21 mm - 250 mm)[1]
return detect point 2	0x47	UINT16	RW	53426 [1]	356-53426 (22 mm - 3000 mm), > 4452 deactivates window mode [1]
detect point 2	0x48	UINT16	RW	53426 [1]	356-53426 (23 mm - 3000 mm), > 4452 deactivates window mode [1]
switching mode	0x42	UINT8	RW	0	0: NOC; 1: NCC
filter	0x43	UINT8	RW	1	0: F00; 1: F01; 2: F02; 3: F03; 4: F04
filter strength	0x44	UINT8	RW	0	0-9: P00-P09
Teach-in via push button	0x4A	UINT8	RW	1	0: activated; 1: deactivated
temperature compensation	0x4C	UINT8	RW	1	0: disabled; 1: enabled
system commands	**index**		**access**	**value (dez)**	
Teach-in detect point	0x02		W	161	
Teach-in detect point +8%	0x02		W	162	
Teach-in window mode 1. detect point	0x02		W	165	
Teach-in window mode 2. detect point	0x02		W	166	
Teach-in two way refective barrier	0x02		W	164	
events				**value (dez)**	
Teach-in fault				36000	
parameter changed				36001	
master cycle time not valid				36002	

[1] Distance values, e.g. detect points, are given as multiple of the internal resolution of the measurement value = 0.056 mm (example: 356 ▲ 20 mm). The values in the table are decimal.