microsonic

Operating manual

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

lcs+340/F
lcs+600/F

Product description

The lcs+ 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 conditional upon the adjusted detect distance.
Via the Teach-in procedure, the detect distance and operating mode can be adjusted. One LED indicates operation and the state of the switched output.
The lcs+ sensors are IO-Link-capable in accordance with IO-Link specification V1.0.

Safety instructions

- Read the operating instructions prior to start-up.
- Connection, installation and adjustments may only be carried out by qualified staff.
- No safety component in accordance with the EU Machine Directive.

Use for intended purpose only

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

Installation

- Mount the sensor at the place of fitting.
- Connect a connection cable to the M12 device plug.

Start-up

- Connect the power supply.
- Carry out sensor adjustment in accordance with the diagram.

		colour
1	$+U_B$	brown
3	$-U_B$	blue
4	F	black
2	-	white
5	Sync	grey

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

Factory setting

- Switched output on NOC.
- Detect distance at operating range.

Operating modes

Three operating modes are available for the switched output:

- Operation with one detect point
The switched output is set when the object falls below the set detect point.
- Window mode
The switched output is set when the object is within the set window.
- Two-way reflective barrier
The switched output is set when the object is between sensor and fixed reflector.

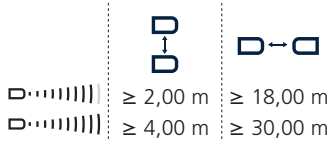


Fig. 2: Assembly distances

Synchronisation

If under multiple sensor operation the assembly distance falls below the values shown in Fig. 2, the internal synchronisation should be used. For this purpose interconnect each pin 5 of max. 10 sensors.

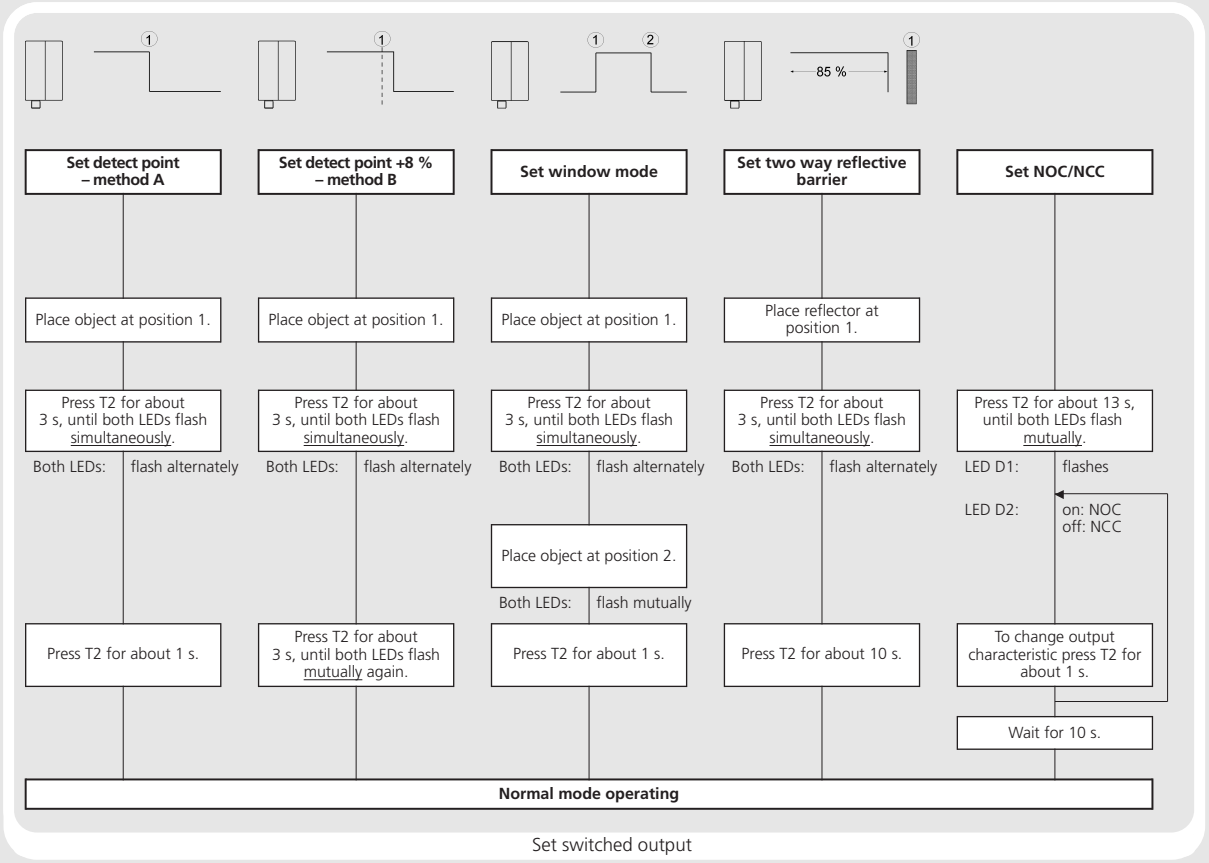
Maintenance

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

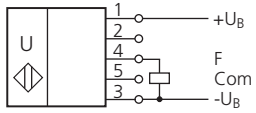
Notes

- The sensors of the lcs+ family have a blind zone, within which a distance measurement is not possible.
- The lcs+ sensors are equipped with an internal temperature compensation. Due to the sensors self heating, the temperature compensation reaches its optimum working-point after approx. 30 minutes of operation.
- In the normal operating mode, an illuminated yellow LED signals that the switched output is switched through.
- The lcs+ sensors have a push-pull switched output.
- In the »Two-way reflective barrier« operating mode, the object has to be within the range of 0-85 % of the set distance.
- 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.

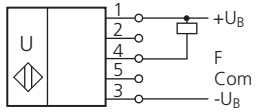
Sensor adjustment with Teach-in procedure



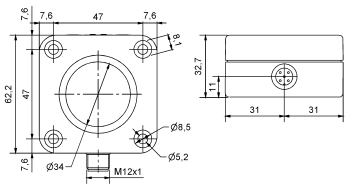
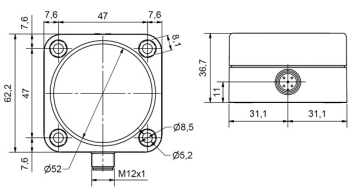
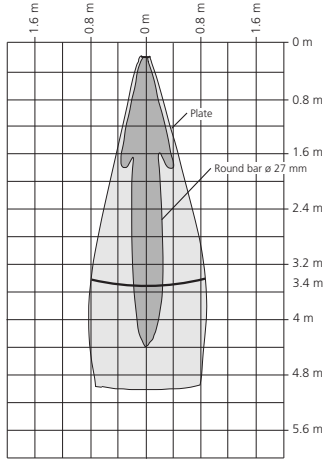
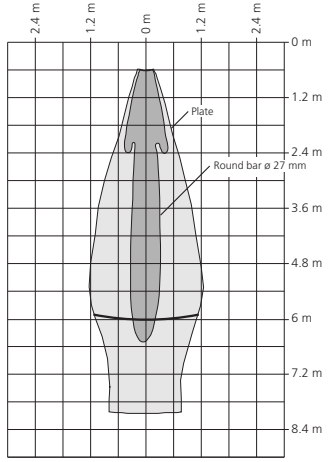
Technical data



Push-Pull output in pnp circuit



Push-Pull output in npn circuit

	lcs+340...	lcs+600...
		
blind zone	0 to 350 mm	0 to 600 mm
operating range	3,400 mm	6,000 mm
maximum range	5,000 mm	8,000 mm
angle of beam spread	see »detection zones«	see »detection zones«
transducer frequency	120 kHz	80 kHz
resolution	0.18 mm	0.18 mm
reproducibility	± 0.15 %	± 0.15 %
detection zones for different objects: The dark grey areas represent the zone where it is easy to recognise the normal reflector (round bar). This indicates the typical operating range of the sensors. The light grey areas represent the zone where a good reflector – for instance a plate – can still be regognised.. The requirement here is for an optimum alignment to the sensor. It is not possible to evaluate ultrasonic reflections outside this area.		
accuracy	±1 % (temperature drift internally compensated; may be deactivated, 0.17 %/K without compensation)	±1 % (temperature drift internally compensated; may be deactivated, 0.17 %/K without compensation)
operating voltage U_B	9 V to 30 V DC, reverse polarity protection	9 V to 30 V DC, reverse polarity protection
voltage ripple	±10 %	±10 %
no-load current consumption	≤ 60 mA	≤ 60 mA
housing	PBT, Polyester; ultrasonic transducer: polyurethane foam, epoxy resin with glass content	PBT, Polyester; ultrasonic transducer: polyurethane foam, epoxy resin with glass content
class of protection per EN 60 529	IP 67	IP 67
type of connection	5-pin M12 circular plug, PBT	5-pin M12 circular plug,. PBT
controls	2 push-buttons	2 push-buttons
programmable	• Teach-in via push-buttons • LCA-2 with LinkControl	• Teach-in via push-buttons • LCA-2 with LinkControl
indicators	LED yellow/green (switched output set/not set)	LED yellow/green (switched output set/not set)
synchronisation	internal synchronisation up to 10 sensors	internal synchronisation up to 10 sensors
operating temperature	-25°C to +70°C	-25°C to +70°C
storage temperature	-40°C to +85°C	-40°C to +85°C
weight	180 g	240 g
switching hysteresis [1]	50 mm	100 mm
switching frequency [1]	4 Hz	3 Hz
response time [1]	172 ms	240 ms
time delay before availability [1]	< 380 ms	< 450 ms
norm conformity	EN 60947-5-2	EN 60947-5-2
order no.	**lcs+340/F**	**lcs+600/F**
switched output	Push-Pull, U_B-3 V, -U_B+3 V, I_{max} = 100 mA NOC/NCC adjustable, short-circuit-proof	Push-Pull, U_B-3 V, -U_B+3 V, I_{max} = 100 mA NOC/NCC adjustable, short-circuit-proof

1) Can be programmed with LinkControl and IO-Link

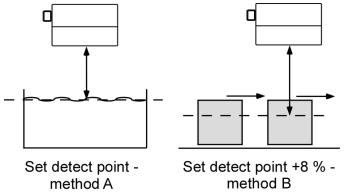


Fig. 4: Setting the detect point for different directions of movement of the object

- The sensor can be reset to its factory setting (see »Further settings«).
- Using the LinkControl adapter (optional accessory) and the LinkControl software for Windows, all Teach-in and additional sensor parameter settings can be optionally undertaken.

2004/108/EG

Enclosure Type 1
For use only in industrial machinery NFPA 79 applications.

Sensor adjustment in IO-Link mode

The lcs+ sensors are IO-Link-capable in accordance with IO-Link specification V1.0.

Pointer

- In IO-Link mode LinkControl is not available.

Process data

The lcs+ cyclically transmits the measured distance value with a resolution of 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.

Foreground suppression

Spurious reflections, caused by objects in the foreground of the sensor may be blocked out by the foreground suppression.

Pointer

- The object in the foreground can cause multiple reflections that lead to invalid measurement.
- The object in the foreground must not cover the sensor in a way that the detection zone is influenced.

Maximum range

The value specifies the maximum measurement range.

Teach-in via push-buttons T1/T2

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

Set NOC/NCC

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

Measurement filter

lcs+ ultrasonic sensors provide for a choice of 5 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 measurement filter.

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.

Switch-on delay

If the switch-on delay is activated, the switched output will not be set before the programmed time once the measurement value falls below the set detect point. If the measurement value increases to the detect point again, the switched output will be reset after 50 % of the programmed on-delay time.

Detection zone sensitivity

The size of the detection zone can be varied in three steps.

Synchronisation and multiplex in IO-Link mode

As in SIO mode up to 10 sensors can be synchronised by interconnecting the sync-channel (Pin 5) of each sensor. Additionally the multiplex mode is available.

Multiplex mode device address

In multiplex mode for every sensor connected via the sync-channel a unique device address has to be set. The sensors then perform there measurement in increasing order of the device addresses. With multiplex address »0« the sensors work synchronous, with address »11« synchronisation/multiplex is disabled.

Pointer

- In multiplex mode the response time of each sensor extends corresponding to the number of connected sensors.

Multiplex mode highest address

To optimise the multiplex speed the highest assigned device address may be set instead of the default value »10«.

Interference noise suppression

This filter keeps the state of the output for the time a ultrasonic interference noise, e.g. leaking compressed air, makes a measurement impossible.

Pointer

- The Interference noise suppression filter extends the measurement cycle of the sensor and for this it's response time.

Echo quality

To simplify the adjustment of the sensor towards the measurement object the echo quality can be observed. The value gives back the strength of the reflected echo.

System commands

With 6 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 reflective barrier.
- Reset sensor to factory settings.

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

	lcs+340...				lcs+600...			
physical layer								
SIO mode support	yes				yes			
min cycle time	43 ms				60,8 ms			
baud rate	COM 2 (38.400 Bd)				COM 2 (38.400 Bd)			
format of process data	16 Bit, R, UNI16				16 Bit, R, UNI16			
content of process data	Bit 0: logical state of switched output, Bit 1-15: distance value with 1 mm resolution				Bit 0: logical state of switched output, Bit 1-15: distance value with 1 mm resolution			
service data IO-Link specific	**index**		**access**	**value**	**index**		**access**	**value**
Vendor name	0x10		R	microsonic GmbH	0x10		R	microsonic GmbH
Vendor text	0x11		R	www.microsonic.de	0x11		R	www.microsonic.de
Product name	0x12		R	lcs+	0x12		R	lcs+
Product ID	0X13		R	340/F	0X13		R	600/F
Product text	0x15		R	Ultraschall-Sensor	0x15		R	Ultraschall-Sensor
service data sensor specific	**index**	**format**	**access**	**range (dez)**	**index**	**format**	**access**	**range (dez)**
detect point 1	0x40	UINT16	R/W	0-4.256 (0-1.050 mm)	0x40	UINT16	R/W	0-7.295 (0-1.800 mm)
return detect point 1	0x41	UINT16	R/W	2.044-29.104 (351-4.999 mm)	0x41	UINT16	R/W	3.499-46.570 (601-7.999 mm)
detect point 2	0x42	UINT16	R/W	2.049-58.214 (352-4.999 mm)[1]	0x42	UINT16	R/W	3.505-58.214 (602-7.999 mm)[1]
return detect point 2	0x43	UINT16	R/W	2.044-58.214 (351-4.998 mm)[1]	0x43	UINT16	R/W	3.499-58.214 (601-7.998 mm)[1]
	[1] > 58.162: window mode deactivated				[1] > 58.162: window mode deactivated			
foreground suppression	0x44	UINT16	R/W	0-4.256 (0-1.050 mm)	0x44	UINT16	R/W	0-7.295 (0-1.800 mm)
maximum range	0x45	UINT16	R/W	29.110-58.162 (5.000-9.990 mm)	0x45	UINT16	R/W	46.576-58.162 (8.000-9.990 mm)
Teach-in via push-button T1/T2	0x46	UINT8	R/W	0: deactivated, 2: activated	0x46	UINT8	R/W	0: deactivated, 2: activated
set NOC/NCC	0x47	UINT8	R/W	0: NCC, 2: NOC	0x47	UINT8	R/W	0: NCC, 2: NOC
measurement filter	0x48	UINT8	R/W	0-4: F00 - F04	0x48	UINT8	R/W	0-4: F00 - F04
filter strength	0x49	UINT8	R/W	0-9: P00 - P09	0x49	UINT8	R/W	0-9: P00 - P09
temperature compensation	0x4A	UINT8	R/W	0: deactivated, 2: activated	0x4A	UINT8	R/W	0: deactivated, 2: activated
switch-on delay	0x4B	UINT8	R/W	0-20: 0-20 s	0x4B	UINT8	R/W	0-20: 0-20 s
detection zone sensitivity	0x4C	UINT8	R/W	1: high, 2: standard, 3: low	0x4C	UINT8	R/W	1: high, 2: standard, 3: low
multiplex mode device addressing	0x4D	UINT8	R/W	0-11: 0: sync, 11: deactivated	0x4D	UINT8	R/W	0-11: 0: sync, 11: deactivated
multiplex mode highest address	0x4E	UINT8	R/W	1-10	0x4E	UINT8	R/W	1-10
interference noise suppression	0x4F	UINT8	R/W	0: deactivated, 2: activated	0x4F	UINT8	R/W	0: deactivated, 2: activated
system commands	**Index**		**access**	**value**	**Index**		**access**	**value**
Teach-in detect point	0x02		W	161	0x02		W	161
Teach-in detect point + 8 %	0x02		W	162	0x02		W	162
Teach-in window mode detect point 1	0x02		W	163	0x02		W	163
Teach-in window mode detect point 2	0x02		W	164	0x02		W	164
Teach-in two way reflective barrier	0x02		W	165	0x02		W	165
reset to factory settings	0x02		W	166	0x02		W	166
observe	**Index**		**access**		**Index**		**access**	
distance value	0x51	UINT16	R		0x51	UINT16	R	
echo quality	0x50	UINT16	R		0x50	UINT16	R	

1) Distance values as e.g. detect points are given as a multiple of the internal measurement resolution = 0,172 mm (example: 2.038 ≙ 350 mm).

MV-DO-121023-478544