microsonic

TEACH-IN EXTENDED

Operation Manual

Ultrasonic proximity switch with one switching output

zws-15/CD/QS	zws-15/CE/QS
zws-24/CD/QS	zws-24/CE/QS
zws-25/CD/QS	zws-25/CE/QS
zws-35/CD/QS	zws-35/CE/QS
zws-70/CD/QS	zws-70/CE/QS

Product Description

The zws sensor offers a non-contact measurement of the distance to an object which must be positioned within the sensor's detection zone. The switching output is set in dependence of the adjusted detect distance. Via the push-button, the detect distance and operating mode can be adjusted (Teach-in). Two LEDs indicate operation and the state of the switching output.

Safety Notes

■ Read the operation 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, use in the area of personal and machine protection not permitted

Use for intended purpose only

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

Installation

→ Mount the sensor at the installation site with the aid of the enclosed mounting plate (see Fig. 1). Maximum torque of attachment screw: 0,5 Nm
→ Connect a connection cable to the M8 device plug.
→ Avoid mechanical load on the connector.

Start-Up

→ Connect the power supply.
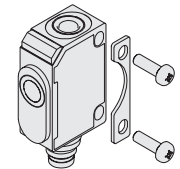→ Carry out the adjustment in accordance with Diagram 1.

Fig. 1: Attachment with mounting plate

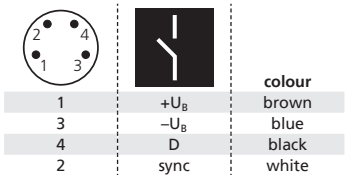|		colour
1	$+U_B$	brown
3	$-U_B$	blue
4	D	black
2	sync	white

Fig. 2: Pin assignment with view onto sensor plug and colour coding of the microsonic connection cable

Factory Setting

zws sensors are delivered with the following settings:

■ Operation with one switching point
■ Switching output on NOC
■ Switching point at operating range

Operating modes

Three operating modes are available for the switching output:

■ **Operation with one switching point**
The switching output is set if the object falls below the set switching point.
■ **Window mode**
The switching output is set if the object is within the set window limits.
■ **Two-way reflective barrier**
The switching output is set if there is no object between sensor and reflector.

Checking operating mode

→ In normal operating mode shortly press the push-button. The green LED stops shining for one second, then it will show the current operating mode:

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

After a break of 3 s the green LED shows the output function:

■ 1x flashing = NOC
■ 2x flashing = NCC
■ 3x flashing = NOC (twin)
■ 4x flashing = NCC (twin)

Mutual Influencing and Synchronization

If two or more sensors are mounted too close to one another and the minimum assembly distances (see Fig. 3) between the sensors are not reached they can influence one another. There are two methods available to avoid this.

■ If only two sensors are operating, the twin mode can be selected at one of the two sensors via the sensor setting »Set NOC/NCC and twin mode«. The other sensor stays at the standard NOC/NCC setting. For the sensor in twin mode, response delay is slightly increased und therefore the switching frequency reduced.
■ If more than two sensors are operating close to one another, the sensors can be synchronised by the accessory SyncBox2.
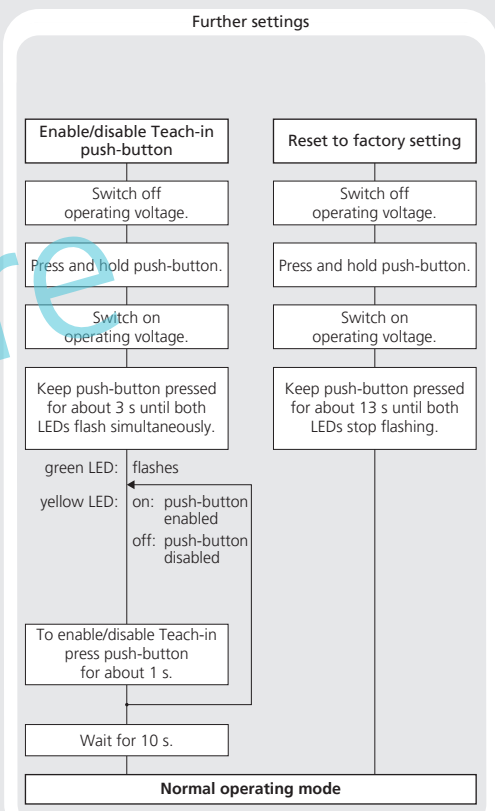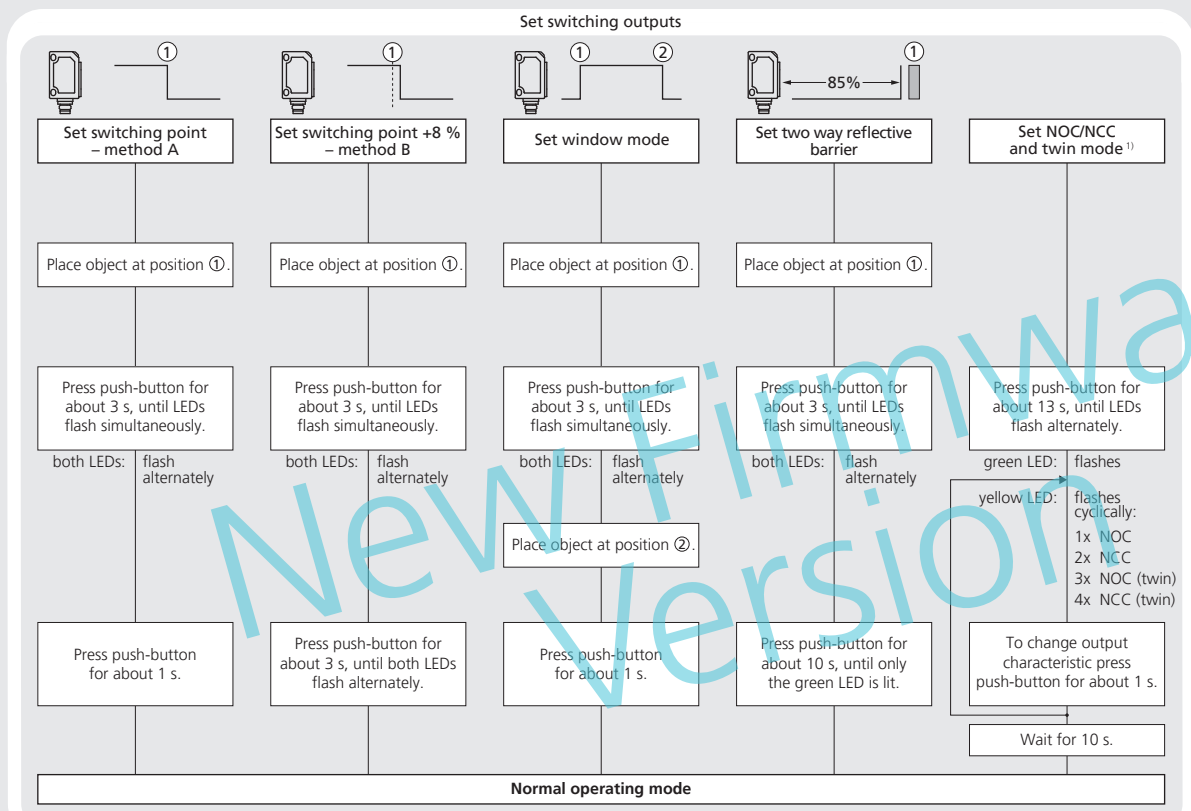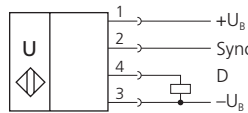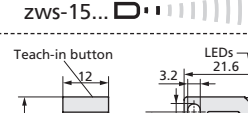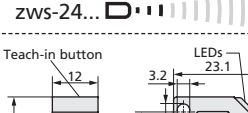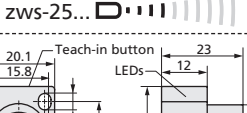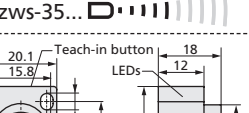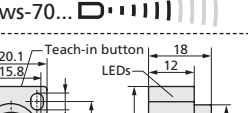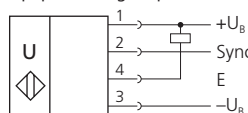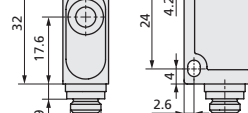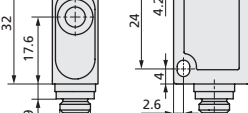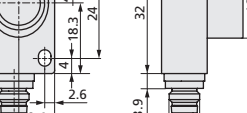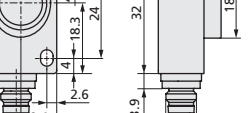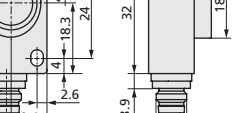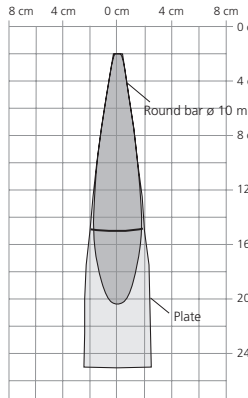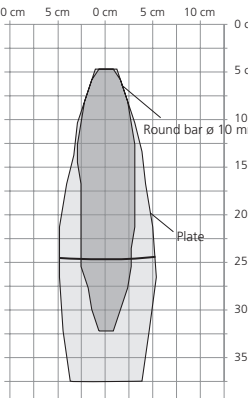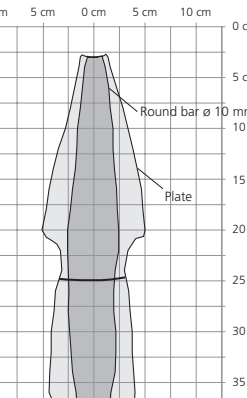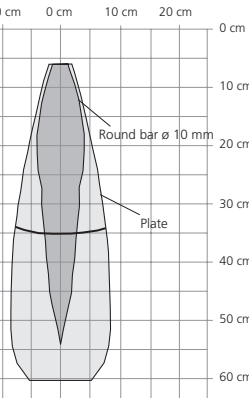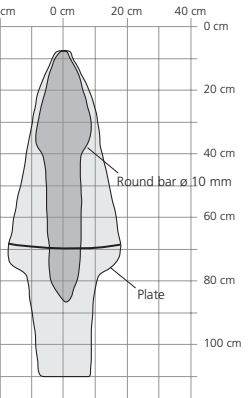
zws-15...	≥0.25 m	≥1.30 m
zws-24...	≥0.25 m	≥1.40 m
zws-25...	≥0.35 m	≥2.50 m
zws-35...	≥0.40 m	≥2.50 m
zws-70...	≥0.70 m	≥4.00 m

Fig. 3: Minimum assembly distances for Sync

Maintenance

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

Diagram 1: Set sensor parameters via Teach-in procedure

Set switching outputs

Set switching point – method A
Place object at position ①.
Press push-button for about 3 s, until LEDs flash simultaneously.
both LEDs: flash alternately
Press push-button for about 1 s.

Set switching point +8 % – method B
Place object at position ①.
Press push-button for about 3 s, until LEDs flash simultaneously.
both LEDs: flash alternately
Press push-button for about 3 s, until both LEDs flash alternately.

Set window mode
Place object at position ①.
Press push-button for about 3 s, until LEDs flash simultaneously.
both LEDs: flash alternately
Place object at position ②.
Press push-button for about 1 s.

Set two way reflective barrier
85%
Place object at position ①.
Press push-button for about 3 s, until LEDs flash simultaneously.
both LEDs: flash alternately
Press push-button for about 10 s, until only the green LED is lit.

Set NOC/NCC and twin mode [1]
Press push-button for about 13 s, until LEDs flash alternately.
green LED: flashes
yellow LED: flashes cyclically:
1x NOC
2x NCC
3x NOC (twin)
4x NCC (twin)
To change output characteristic press push-button for about 1 s.
Wait for 10 s.

Normal operating mode

Further settings

Enable/disable Teach-in push-button
Switch off operating voltage.
Press and hold push-button.
Switch on operating voltage.
Keep push-button pressed for about 3 s until both LEDs flash simultaneously.
green LED: flashes
yellow LED: on: push-button enabled / off: push-button disabled
To enable/disable Teach-in press push-button for about 1 s.
Wait for 10 s.

Reset to factory setting
Switch off operating voltage.
Press and hold push-button.
Switch on operating voltage.
Keep push-button pressed for about 13 s until both LEDs stop flashing.

Normal operating mode

[1] This operation manual applies to zws sensors from firmware version V3. The firmware version can be checked via Teach-in procedure »Set NOC/NCC and twin mode«. If the yellow LED flashes, this zws sensor has firmware V3 or higher.

Technical Data

1 pnp switching output

1 npn switching output

	zws-15...	zws-24...	zws-25...	zws-35...	zws-70...
blind zone	20 mm	50 mm	30 mm	64 mm	120 mm
operating range	150 mm	240 mm	250 mm	350 mm	700 mm
maximum range	250 mm	350 mm	350 mm	600 mm	1000 mm
angle of beam spread	see detection zone	see detection zone	see detection zone	see detection zone	see detection zone
transducer frequency	380 kHz	500 kHz	320 kHz	400 kHz	300 kHz
resolution	0.20 mm	0.20 mm	0.20 mm	0.20 mm	0.20 mm
reproducibility	±0.15 %	±0.15 %	±0.15 %	±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 very large reflector – for instance a plate – can still be recognised. The requirement here is for an optimum alignment to the sensor. It is not possible to evaluate ultrasonic reflections outside this area.					
accuracy	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K
operating voltage U_B	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)
voltage ripple	±10 %	±10 %	±10 %	±10 %	±10 %
no-load current consumption	<25 mA	<25 mA	<25 mA	<25 mA	<25 mA
housing	ABS	ABS	ABS	ABS	ABS
	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content
class of protection to EN 60529	IP 67	IP 67	IP 67	IP 67	IP 67
type of connection	4-pin M8 initiator plug	4-pin M8 initiator plug	4-pin M8 initiator plug	4-pin M8 initiator plug	4-pin M8 initiator plug
controls	Teach-in push-button	Teach-in push-button	Teach-in push-button	Teach-in push-button	Teach-in push-button
indicators	LED green (operation)	LED green (operation)	LED green (operation)	LED green (operation)	LED green (operation)
	LED yellow (state of output)	LED yellow (state of output)	LED yellow (state of output)	LED yellow (state of output)	LED yellow (state of output)
synchronisation	twin mode [1] or external	twin mode [1] or external	twin mode [1] or external	twin mode [1] or external	twin mode [1] or external
pulse width synchronisation signal t_i	>150 µs	>150 µs	>150 µs	>150 µs	>150 µs
cycle time synchronisation signal t_p	10 ms < t_p < 1 s	10 ms < t_p < 1 s	10 ms < t_p < 1 s	16 ms < t_p < 1 s	14 ms < t_p < 1 s
operating temperature	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C	–25 to +70 °C
storage temperature	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C	–40 to +85 °C
weight	10 g	10 g	11 g	11 g	11 g
switching hysteresis	2 mm	2 mm	2 mm	5 mm	10 mm
switching frequency	25 Hz (19 Hz in twin mode [2])	25 Hz (19 Hz in twin mode [2])	31 Hz (22 Hz in twin mode [2])	15 Hz (10 Hz in twin mode [2])	17 Hz (12 Hz in twin mode [2])
response time	30 ms (39 ms in twin mode [2])	30 ms (39 ms in twin mode [2])	24 ms (33 ms in twin mode [2])	48 ms (69 ms in twin mode [2])	42 ms (60 ms in twin mode [2])
time delay before availability	<300 ms	<300 ms	<300 ms	<300 ms	<300 ms
norm conformity	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
order no.	**zws-15/CD/QS**	**zws-24/CD/QS**	**zws-25/CD/QS**	**zws-35/CD/QS**	**zws-70/CD/QS**
switching output	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA
	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof
order no.	**zws-15/CE/QS**	**zws-24/CE/QS**	**zws-25/CE/QS**	**zws-35/CE/QS**	**zws-70/CE/QS**
switching output	npn, $–U_B$+2 V, I_{max} = 200 mA	npn, $–U_B$+2 V, I_{max} = 200 mA	npn, $–U_B$+2 V, I_{max} = 200 mA	npn, $–U_B$+2 V, I_{max} = 200 mA	npn, $–U_B$+2 V, I_{max} = 200 mA
	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof

[2] For information on twin mode, see section »Mutual Influencing and Synchronization«

Notes

- The zws sensor has a blind zone, within which distance measurements are not possible.
- The sensor has no temperature compensation.
- In the normal operating mode, an illuminated yellow LED signals the switching output is switched through.
- In the »Set switching point – method A« Teach-in procedure the actual distance to the object is taught to the sensor as the switching 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 switching 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. 4.
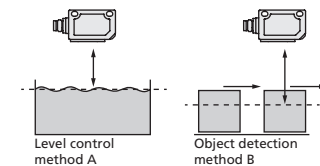

Level control method A

Object detection method B

Fig. 4: Set the switching point for different directions of movement of the object

- In the »Two-way reflective barrier« operating mode, the object has to be within the range of 0 to 85 % of the set distance.
- If the push-button is not pressed for 8 minutes during the Teach-in setting, the settings made until now are deleted.

This operation manual applies to zws sensors from firmware version V3. The firmware version can be checked via Teach-in procedure »Set NOC/NCC and twin mode«. If the yellow LED flashes, this zws sensor has firmware V3 or higher.

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

The proximity switches shall be used with a Listed (CYJV/7) cable/connector assembly rated minimum 32 Vdc, minimum 290 mA, in the final installation.

2014/30/EU

MV-DO-222329-831960

microsonic

Product Description

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→ Connect a connection cable to the M8 device plug.
→ Avoid mechanical load on the connector.

Start-Up

→ Connect the power supply.
→ Carry out the adjustment in accordance with Diagram 1.

Fig. 1: Attachment with mounting plate

		colour
1	$+U_B$	brown
3	$-U_B$	blue
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Fig. 2: Pin assignment with view onto sensor plug and colour coding of the microsonic connection cable

Factory Setting

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Operating modes

Three operating modes are available for the switching output:

- **Operation with one switching point**
  The switching output is set if the object falls below the set switching point.
- **Window mode**
  The switching output is set if the object is within the set window limits.
- **Two-way reflective barrier**
  The switching output is set if there is an object between sensor and reflector.

Checking operating mode

→ In normal operating mode shortly press the push-button. The green LED stops shining for one second, then it will show the current operating mode:

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

After a break of 3 s the green LED shows the output function:

- 1x flashing = NOC
- 2x flashing = NCC

Synchronisation

You can synchronise as many sensors as you like.

→ Apply a square-wave signal to the sync-input with pulse width t_i and repetition rate t_p (Fig. 3 and technical data).

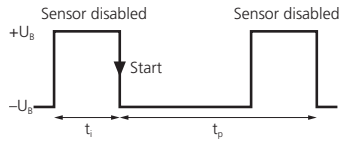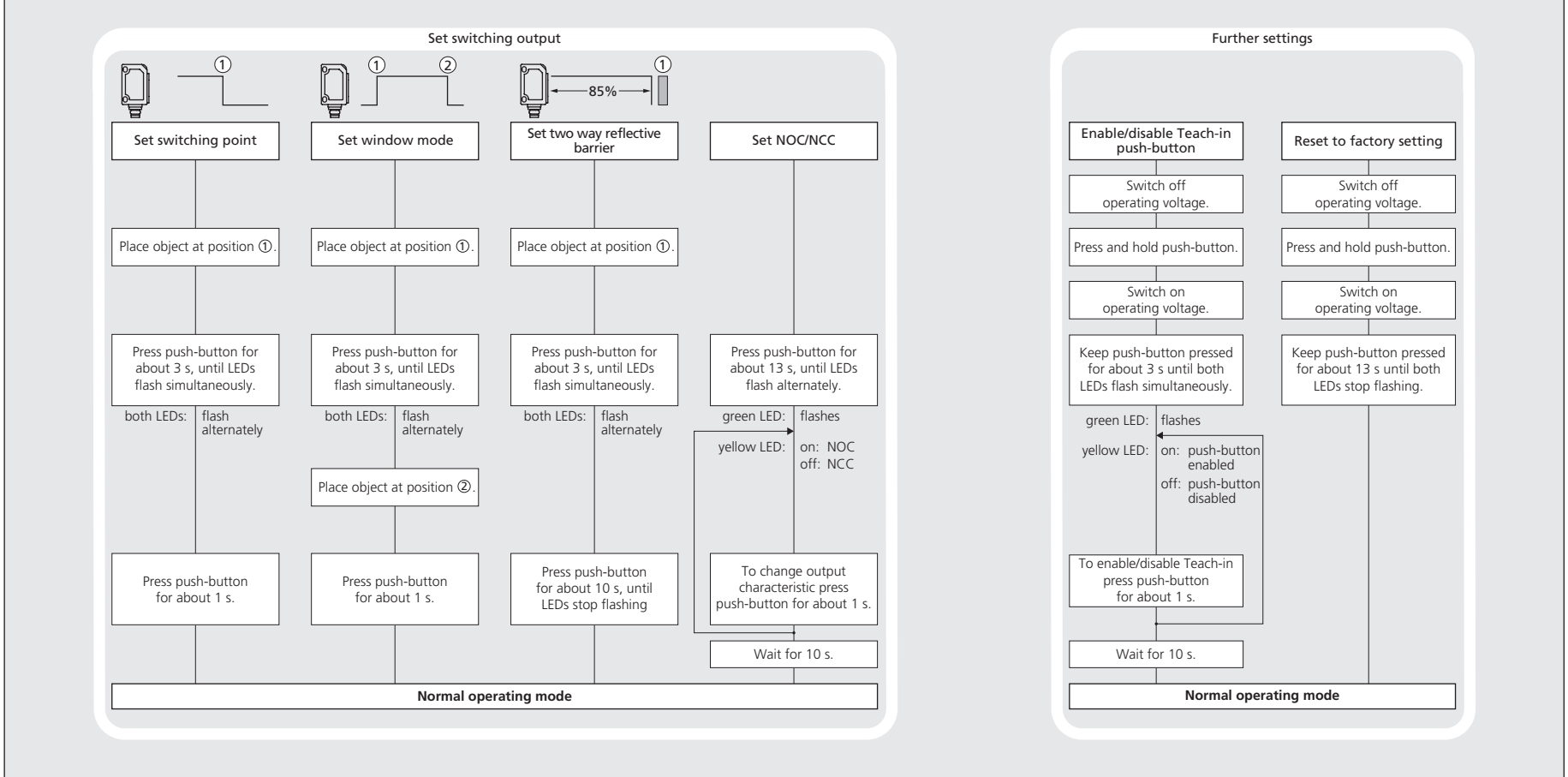A high level on the sync input will disable the sensor.

Fig. 3: External synchronisation signal
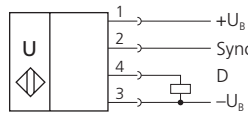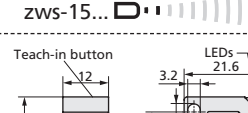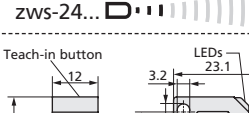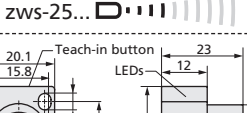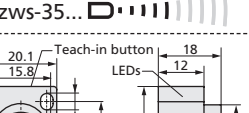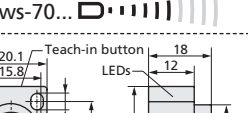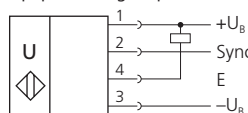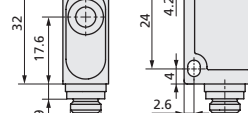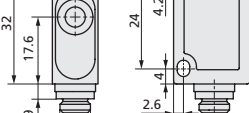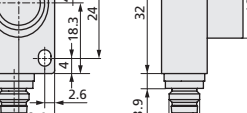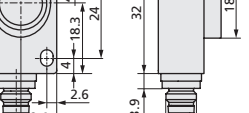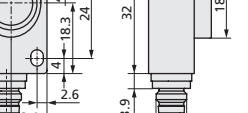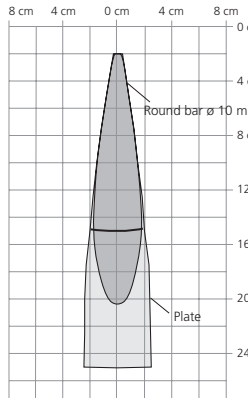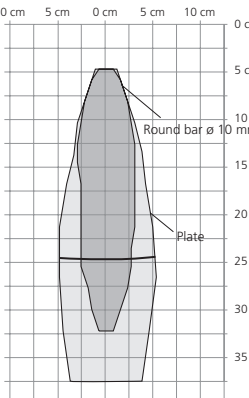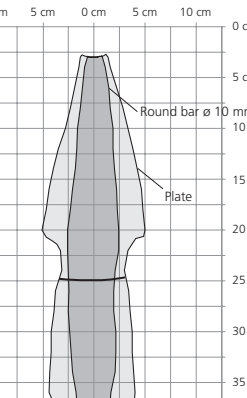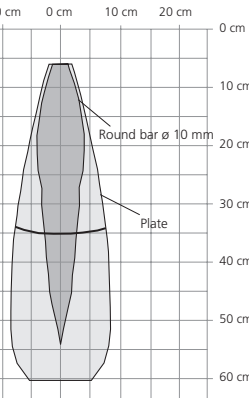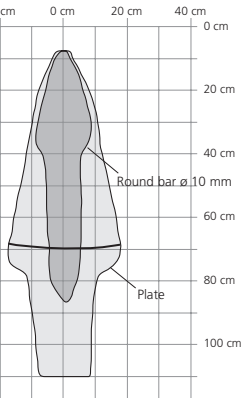
	$\square \atop \square$	$\square \leftrightarrow \square$
zws-15...	≥0.25 m	≥1.30 m
zws-24...	≥0.25 m	≥1.40 m
zws-25...	≥0.35 m	≥2.50 m
zws-35...	≥0.40 m	≥2.50 m
zws-70...	≥0.70 m	≥4.00 m

Fig. 4: Minimum assembly distances for Sync

Maintenance

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

Diagram 1: Set sensor parameters via Teach-in procedure

Set switching output

Set switching point
- Place object at position ①.
- Press push-button for about 3 s, until LEDs flash simultaneously.
- both LEDs: flash alternately
- Press push-button for about 1 s.

Set window mode
- Place object at position ①.
- Press push-button for about 3 s, until LEDs flash simultaneously.
- both LEDs: flash alternately
- Place object at position ②.
- Press push-button for about 1 s.

Set two way reflective barrier (85%)
- Place object at position ①.
- Press push-button for about 3 s, until LEDs flash simultaneously.
- both LEDs: flash alternately
- Press push-button for about 10 s, until LEDs stop flashing

Set NOC/NCC
- Press push-button for about 13 s, until LEDs flash alternately.
- green LED: flashes
- yellow LED: on: NOC / off: NCC
- To change output characteristic press push-button for about 1 s.
- Wait for 10 s.

Normal operating mode

Further settings

Enable/disable Teach-in push-button
- Switch off operating voltage.
- Press and hold push-button.
- Switch on operating voltage.
- Keep push-button pressed for about 3 s until both LEDs flash simultaneously.
- green LED: flashes
- yellow LED: on: push-button enabled / off: push-button disabled
- To enable/disable Teach-in press push-button for about 1 s.
- Wait for 10 s.

Reset to factory setting
- Switch off operating voltage.
- Press and hold push-button.
- Switch on operating voltage.
- Keep push-button pressed for about 13 s until both LEDs stop flashing.

Normal operating mode

Technical Data

	zws-15...	zws-24...	zws-25...	zws-35...	zws-70...
blind zone	20 mm	50 mm	30 mm	64 mm	120 mm
operating range	150 mm	240 mm	250 mm	350 mm	700 mm
maximum range	250 mm	350 mm	350 mm	600 mm	1000 mm
angle of beam spread	see detection zone	see detection zone	see detection zone	see detection zone	see detection zone
transducer frequency	380 kHz	500 kHz	320 kHz	400 kHz	300 kHz
resolution	0.20 mm	0.20 mm	0.20 mm	0.20 mm	0.20 mm
reproducibility	±0.15 %	±0.15 %	±0.15 %	±0.15 %	±0.15 %
accuracy	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K	Temperature drift 0.17 %/K
operating voltage U_B	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)	20 to 30 V DC, reverse polarity protection (Class 2)
voltage ripple	±10 %	±10 %	±10 %	±10 %	±10 %
no-load current consumption	<25 mA	<25 mA	<25 mA	<25 mA	<25 mA
housing	ABS	ABS	ABS	ABS	ABS
	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content	ultrasonic transducer: polyurethane foam, epoxy resin with glass content
class of protection to EN 60529	IP 67	IP 67	IP 67	IP 67	IP 67
type of connection	4-pin M8 initiator plug	4-pin M8 initiator plug	4-pin M8 initiator plug	4-pin M8 initiator plug	4-pin M8 initiator plug
controls	Teach-in push-button	Teach-in push-button	Teach-in push-button	Teach-in push-button	Teach-in push-button
indicators	LED green (operation)	LED green (operation)	LED green (operation)	LED green (operation)	LED green (operation)
	LED yellow (state of output)	LED yellow (state of output)	LED yellow (state of output)	LED yellow (state of output)	LED yellow (state of output)
synchronisation	external	external	external	external	external
pulse width synchronisation signal t_i	>150 µs	>150 µs	>150 µs	>150 µs	>150 µs
cycle time synchronisation signal t_p	8 ms < t_p < 1 s	10 ms < t_p < 1 s	10 ms < t_p < 1 s	16 ms < t_p < 1 s	14 ms < t_p < 1 s
operating temperature	−25 to +70 °C	−25 to +70 °C	−25 to +70 °C	−25 to +70 °C	−25 to +70 °C
storage temperature	−40 to +85 °C	−40 to +85 °C	−40 to +85 °C	−40 to +85 °C	−40 to +85 °C
weight	10 g	10 g	11 g	11 g	11 g
switching hysteresis	2 mm	2 mm	2 mm	5 mm	2 mm
switching frequency	25 Hz	25 Hz	31 Hz	15 Hz	11 Hz
response time	24 ms	24 ms	20 ms	48 ms	36 ms
time delay before availability	<300 ms	<300 ms	<300 ms	<300 ms	<300 ms
norm conformity	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
order no.	**zws-15/CD/QS**	**zws-24/CD/QS**	**zws-25/CD/QS**	**zws-35/CD/QS**	**zws-70/CD/QS**
switching output	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA	pnp, U_B–2 V, I_{max} = 200 mA
	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof
order no.	**zws-15/CE/QS**	**zws-24/CE/QS**	**zws-25/CE/QS**	**zws-35/CE/QS**	**zws-70/CE/QS**
switching output	npn, −U_B+2 V, I_{max} = 200 mA	npn, −U_B+2 V, I_{max} = 200 mA	npn, −U_B+2 V, I_{max} = 200 mA	npn, −U_B+2 V, I_{max} = 200 mA	npn, −U_B+2 V, I_{max} = 200 mA
	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof	switchable NOC/NCC, short-circuit-proof

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 very large reflector – for instance a plate – can still be recognised. The requirement here is for an optimum alignment to the sensor. It is not possible to evaluate ultrasonic reflections outside this area.

Pin connections:
1 pnp switching output: 1 +U_B, 2 Sync, 4 D, 3 −U_B
1 npn switching output: 1 +U_B, 2 Sync, 4 E, 3 −U_B