ULTRASONIC DISTANCE SENSOR

Series UPR-A ATEX

Key-Features:

- Measurement range 120 to 1500 mm
- For use in hazardous areas with dust (ATEX zone 22) and gas (ATEX zone 2)
- Complies with the directive 2014/34/EU
- In compliance with EN 60079:2012
- Distance sensor or 1-point proximity switch
- Teachable measurement range
- Linearity <1 % of full scale
- With mechanical reinforcements on the front and connector side
- Operating temperature 0 to +60 °C
- Protection class IP67, waterproof, oil-resistant
- Configurable size of sound cone
- Optional with synchronisation

Content:

03.08.20

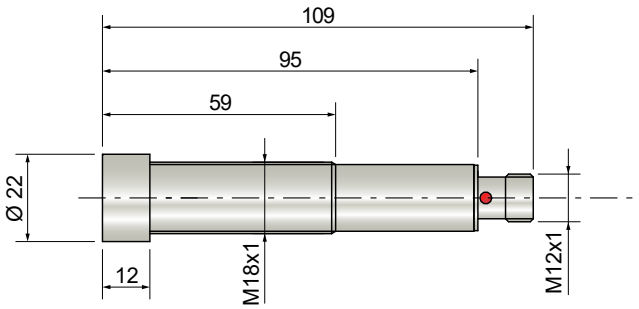
WayCon
Positionsmesstechnik

TECHNICAL DATA

		UPR-A-1500-TOR-24-CAI-Ex	UPR-A-1500-TVPA-24-C-Ex
Measurement range	[mm]	120...1500	
Linearity	[% MB]	<1	-
Linearity over full temperature range [1]	[% MB]	<2	
Hysteresis of switching point, axial	[mm]	-	4
Resolution	[mm]	approx. 0.5	
Operating frequency	[kHz]	approx. 180	
Output [2]		0...10 V (R_{load} min. 10 kΩ) 4...20 mA (R_{load} max. 400 Ω)	PNP NO/NC (Load max. 0.1 A)
Switching speed max.	[Hz]	-	approx. 5
Output speed analog output	[Hz]	approx. 30	-
Supply	[VDC]	11...30	
Ripple of supply voltage	[%]	10	
Average power consumption	[mA]	approx. 45...65	approx. 45
Reverse polarity protection		yes	
Short circuit protection		no	yes
Connection [3]		connector M12, 4 pins	
Protection class		IP67	
Operating temperature	[°C]	0...+60	
Pressure area	[mbar]	900...1100	
Housing material		nickel plated brass	
Weight	[g]	approx. 65	
Status indicator		LED yellow / red	
ATEX designation		dust: Ex tc IIIC T60°C Dc 0°C ≤ T_a ≤ +60°C gas: Ex nA IIC T6 Gc 0°C ≤ T_a ≤ +60°C	

[1] The accuracy can be improved beyond by teaching the sensor only after it has reached its thermally stable state (e.g. after 30 minutes).
[2] The analog sensor automatically recognises the load connected and emits the corresponding signal 4...20 mA or 0...10 V.
[3] Use special cable sockets with self-locking only!

TECHNICAL DRAWING

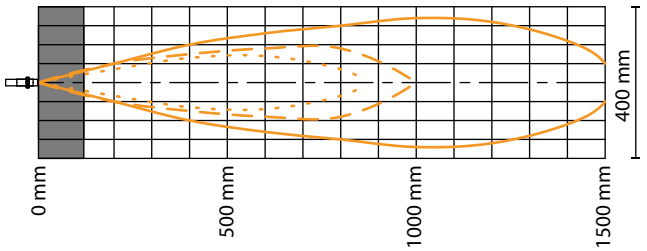


SOUND BEAM

The detection beam of an ultrasonic sensor has the shape of a cone. The size depends on the target and its sound reflecting characteristics. Small and poorly reflecting objects result in a smaller cone (narrower and shorter). Bigger objects and those with surfaces which are not perpendicular to the central axis can expand the cone. The exact cone shape and size can be determined only at the object itself. No disturbing objects must be between the sensor and the target within the cone. Otherwise the sensor would detect the disturbing object instead of the desired target. The diagram shows the three typical cone shapes of the UPR-A-1500 sensors (small, medium and large cone). Furthermore, the size of the detection beam is influenced by air temperature and humidity. The colder and dryer the air, the larger is the beam. On UPR-A-1500 sensors three different cones can be programmed by the user. This is helpful when e.g. sensing into small containers or between narrow gaps.

The cone size is set by connecting the teach input for >5 s with the power supply -U_B (0 V). See also „Overview Teach Function“:

- Small cone: Teach 5...10 s with -U_B (yellow LED blinks fast)
- Medium cone: Teach 10...15 s with -U_B (yellow/red LED blinks fast)
- Large cone: Teach 15...20 s with -U_B (red LED blinks fast)



SETTING THE SWITCHING POINTS IN SCANNING MODE

In scanning mode, the target reflects a portion of the ultrasound, which in turn is detected by the sensor. The switching points are set by attaching the voltage supply $-U_B$ (0 V) or $+U_B$ (+24 VDC) during 1...5 s to the Teach input.

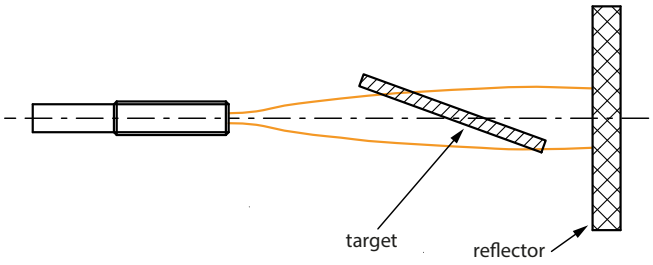
Window operation NO:	**Window operation NC:**
• Set target to near switching point • Teach switching point 1...5 s with $-U_B$ • Set target to far switching point • Teach switching point 1...5 s with $+U_B$	• Set target to near switching point • Teach switching target at 1...5 s with $+U_B$ • Set target to far switching point • Teach switching point 1...5 s with $-U_B$
Switching point NO:	**Switching point NC:**
• Set target to switching point • Teach switching point 1...5 s wit $+U_B$ • Point sensor at space (>1.5 m) • Teach 1...5 s with $-U_B$	• Set target to switching point • Teach switching point 1...5 s with $-U_B$ • Point sensor at space (>1.5 m) • Teach 1...5 s with $+U_B$

During the learn-in process a flashing LED indicates whether the sensor detects the target.
- Yellow flashing LED: detected
- Red flashing LED: not detected

SETTING THE SWITCHING POINTS IN RETROFLECTIVE MODE

Retroflective mode uses a reflector in the background (max. 1.5 m from the sensor). Unlike optical sensors the reflector can be any material which is somewhat sound reflecting. Retroflective mode is used in place of scanning mode if the target is at a very sharp angle to the sensor beam (see drawing) or is extremely sound absorbing (no evaluable signal would be reflected from the target to the sensor). In this mode the sensor permanently checks whether it sees the reflector or if it is covered by the target. Likewise, the sensor has no blind range in this operating mode.
In reflection barrier mode the reflector is taught as follows:

NO:	**NC:**
Teach 5...10 s with $+U_B$ (Rapid flashing yellow LED)	Teach 10...15 s with $+U_B$ (Rapid flashing red LED)



SETTING THE ANALOG OUTPUT MEASURING LIMITS

The two measuring limits are set by attaching the voltage supply $-U_B$ (0 V) or $+U_B$ (+24 VDC) to the Teach input for 1...5 s. During the teaching process the flashing LED indicates if the sensor detected the target:
- Yellow flashing LED: detected
- Red flashing LED: not detected

The lower evaluation limit (0 V or 4 mA) can be taught with $-U_B$ and the upper evaluation limit (10 V or 20 mA) with $+U_B$. It can be used to program a rising or falling ramp:
- Position the target at the lower measuring limit (i.e. where 0 V or 4 mA is desired)
- Teach lower limit 1...5 s with $-U_B$
- Position the target at the upper measuring limit (i.e. where 10 V or 20 mA is desired)
- Teach upper limit 1...5 s with $+U_B$

Upper and lower measuring limits can also later be programmed individually.

Attention: The Teach wire/input must be disconnected after the Teaching process is completed. The sensor can therefore also be operated with a 3-wire cable after teaching.

OVERVIEW TEACH FUNCTION

Time	Connect Teach wire to	LED flashes	Version with switching output	Version with analog output
1...5 s	+U_B (typ. +24 VDC)	slowly yellow	NO: far window point or switching point NC: near window point	10 V or 20 mA
1...5 s	-U_B (typ. 0 VDC)	slowly yellow	NO: near window point NC: far window point or switching point	0 V or 4 mA
5...10 s	+U_B (typ. +24 VDC)	fast yellow	retroreflective barrier NO	-
10...15 s	+U_B (typ. +24 VDC)	fast red	retroreflective barrier NC	-
5...10 s	-U_B (typ. 0 VDC)	yellow	small detection cone	
10...15 s	-U_B (typ. 0 VDC)	yellow / red	medium detection cone	
15...20 s	-U_B (typ. 0 VDC)	red	large detection cone	
>20 s	-U_B (typ. 0 VDC)	-	factory reset	

SYNCHRONISATION AND SUPPRESSION MODE

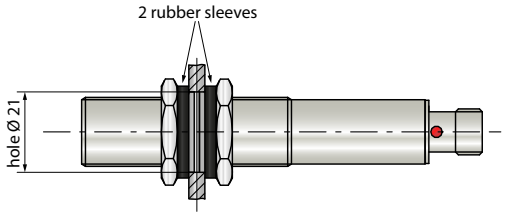
Ultrasonic sensor of the UPR-A ATEX series with option Y have the following two additional functions:

Synchronisation:
If several sensors are placed close together and scan the same object or if a common background is present, the sensors must be synchronized. For this, the Teach/Sync. wires of all sensors (max. 6 sensors) are interconnected. Important is the order:
1. teach each sensor individually (!)
2. turn off the power
3. interconnect all Teach/Sync. wires
4. power on again only when everything is wired!

Suppression mode:
This additional function is interesting, for example, in level measurement with troublesome agitators. The sensor can be stopped by an external signal. For this purpose, the Teach/Sync. wire is powered externally with a signal of 1...3 VDC. As long as this voltage is present, the sensor no longer transmits and keeps the last measured distance. To reactivate the sensor, the external power source has to be removed (not on mass but separated at high impedance!).

INSTALLATION

Ultrasonic sensors shall be mounted as soft as possible in order keep acoustic disturbances away from the mounting spot. Thus, two M18 nuts, washers and rubber sleeves for mounting are included. The rubber sleeves for a hole of Ø21 mm shall be used.

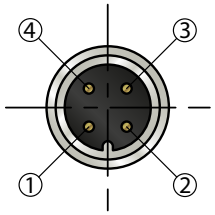


ELECTRICAL CONNECTION

Pin	Analog output version	Switching output version	Connection cable K4P... cable colours
1	+V	+V	BN
2	Teach/Sync. [1)]	Teach/Sync. [1)]	WH
3	GND	GND	BU
4	OUT (0...10 V / 4...20 mA)	OUT (PNP)	BK

[1)] Sync. input with option Y only

sensor side:
connector M12 (male)



The cables should never be mounted parallel or close to high current cables. Please order the necessary cables separately (see „Accessories“).

INFLUENCES ON THE MEASUREMENT

Environmental Influences

Ultrasonic sensors are made for the use in atmospheric air. Environmental Influences like rain, snow, dust or smoke have influence on the accuracy of the measurement. However, measurements under pressure (higher that the atmospheric pressure) are not possible with ultrasound sensors. Strong wind or air turbulences may lead to instability in measurement values. A flow speed up to a few m/s is unproblematic and will have no influence on the sensor's accuracy.

Target Influences

- ***Liquids*** are excellently detectable with ultrasound. A classic application for ultrasonic sensors is level measurement. The sound beam axis however must have a maximum deviation of 3° vertically to the liquid level (no strong waves), otherwise the reflected sound will miss the sensor.
- ***Hot Targets*** with high temperatures cause a thermal convection in the surrounding air. For this reason, the sound beam may be strongly diverted vertically to its axis, so that the echo is weakened, or can no longer be received at all.
- ***For convex (cylindrical and spherical) surfaces,*** every area element has a different angle to the sound cone's axis. The reflected cone thus diverges, and the portion of the sound energy reflected to the receiver is reduced correspondingly. The maximum range decreases with the decreasing size of the cylinder (ball).
- ***The roughness and surface structures of the object*** to be detected also determine the scanning capacities of the ultrasonic sensors. Surface structures that are larger than the ultrasound wavelength, as well as coarse-grained bulk materials, reflect ultrasound in a scattered manner, and are not detected optimally by the sensor under these conditions.
- ***Hard material*** reflects almost all the impulse energy from ultrasound applications in a way that makes them very easy to detect with ultrasound.
- ***Soft material,*** on the other hand, absorbs almost all the impulse energy. It is thus harder to detect with ultrasound. These materials include felt, cotton, coarse meshes, foam, etc.
- ***Thin-walled foils*** behave like soft materials. To be able to use ultrasound, the foil thickness should be at least 0.01 mm.

SAFETY INSTRUCTIONS

Never use these products as safety- or emergency shut-off devices, nor in other applications where a malfunction of this product may result in personal injury. Failure to follow this notice may result in serious or fatal injury.

- The above-mentioned devices may be used only in zones compliant with the marking.
- Temperature range 0...+60 °C.
- Pressure range 0.9...1.1 bar absolute.
- Use only special cable sockets with self-locking!
- Tightening torque for M12 cable socket max. 25 Nm.
- Do not disconnect cable under tension!
- The sensor housing as well as the DC power ground must be earthed by an appropriate cable. A soldering eyelet is scope of delivery.
- The following statement has to be placed close to the device: "Do not disconnect cable under voltage!"

MODELS

UPR-A-1500-TOR-24-CAI-Ex	Analog output
UPR-A-1500-TOR-24-CAIY-Ex	Analog output, synchronisation
UPR-A-1500-TVPA-24-C-Ex	Switching output
UPR-A-1500-TVPA-24-CY-Ex	Switching output, synchronisation

ACCESSORIES

Cable with connector (female) M12, 4 poles, shielded, IP67	
K4P2M-S-M12	2 m, straight connector
K4P5M-S-M12	5 m, straight connector
K4P10M-S-M12	10 m, straight connector
K4P2M-SW-M12	2 m, angular connector
K4P5M-SW-M12	5 m, angular connector
K4P10M-SW-M12	10 m, angular connector

Mating connector (female) M12, 4 poles, shielded	
D4-G-M12-S	straight, for self assembly
D4-W-M12-S	angular, for self assembly

Digital displays for sensors with analog output, 2 channel	
WAY-AX-S	touch screen, supply: 18...30 VDC
WAY-AX-S-AC	touch screen, supply: 115...230 VAC

For more information and options please refer to the WAY-AX data sheet.

WayCon Positionsmesstechnik GmbH
email: info@waycon.de
internet: www.waycon.biz

WayCon Positionsmesstechnik

Head Office
Mehlbeerenstr. 4
82024 Taufkirchen
Tel. +49 (0)89 67 97 13-0
Fax +49 (0)89 67 97 13-250

Office Köln
Auf der Pehle 1
50321 Brühl
Tel. +49 (0)2232 56 79 44
Fax +49 (0)2232 56 79 45