

# INSTALLATION GUIDE

## Ultrasonic Sensors Series UPR-A Atex

For further information please see the data sheet at [www.waycon.biz/products/ultrasonic-sensors/](http://www.waycon.biz/products/ultrasonic-sensors/)

### FIRST STEPS

WayCon Positionsmesstechnik GmbH would like to thank you for the trust you have placed in us and our products. This manual will make you familiar with the installation and operation of our ultrasonic sensors. Please read this manual carefully before initial operation!

#### Unpacking and checking:

Carefully lift the device out of the box by grabbing the housing. After unpacking the device, check it for any visible damage as a result of rough handling during the shipment. Check the delivery for completeness. If necessary consult the transportation company, or contact WayCon directly.

### EXPLOSION PROTECTION

Equipment for use in potentially explosive atmospheres must comply with the directive 94/9/EC. When working with hazardous substances, the plant operator must carry out a safety analysis and the resulting zoning. Among others are the zones 2 and 22: Areas in which an explosive atmosphere does not occur or occurs only briefly during normal operation. These are for example areas in the vicinity of dust-containing systems, if dust can escape from leaks and can form deposits in dangerous quantities.

In Zone 2 (gas) devices must be used, which correspond to the device group II, equipment protection level (EPL) Gc. In Zone 22 (dust) those of the device group III, EPL Dc. The protective measures are based on the tightness and impact resistance of the sensor housing, the maximum achievable housing temperature and the avoiding of sparks.

### NOTES ON SAFETY

- The above mentioned devices may be used only in zones compliant with the marking.
- Temperature range 0...+60 °C.
- Pressure range 0.8...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.



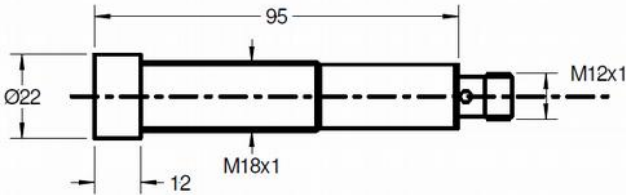
The following statement has to be placed close to the device: „Do not disconnect cable under voltage!“  
In addition the data sheet UPR-A has to be noticed.

# INSTALLATION GUIDE

## Ultrasonic Sensors Series UPR-A Atex

For further information please see the data sheet at [www.waycon.biz/products/ultrasonic-sensors/](http://www.waycon.biz/products/ultrasonic-sensors/)

### TECHNICAL DRAWING



### MOUNTING THE SENSOR

Ultrasonic sensors may be installed in any position, as long as depositions like dust, spray mist, or condensing humidity are avoided on the sound active membrane.

It is important to avoid structure-borne sound bridges between the sensor and its holder. Please use the rubber rings for the installation, that are included in the delivery.

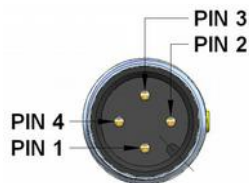
In case several ultrasonic sensors are used in one application, it is important to leave sufficient distance between them. Otherwise the sensors may interact which leads to false measurement values.

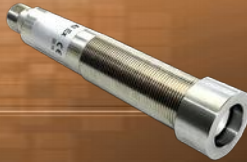
By using a sound deflection angle the sound beam can be redirected, at the expense of the sensor's maximum measurement range. A plain and hard surface should be used for the deflection of the sound beam. Redirecting the sound beam with multiple sound deflection angles should be avoided.

### ELECTRICAL CONNECTION

Function	PIN
+24 V	1
Teach-In	2
0 V	3
Analog * / OUT PNP	4

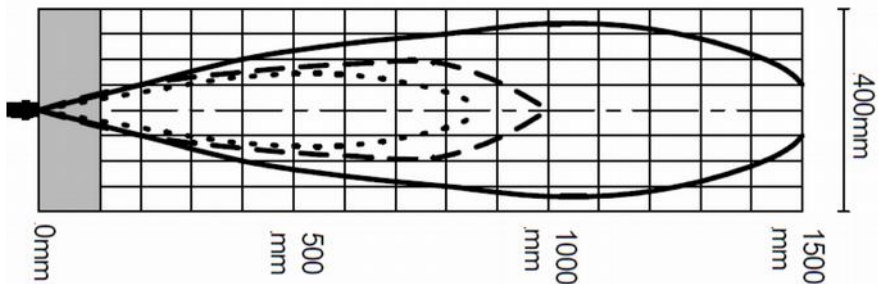
\* The analog sensor automatically detects the connected load, and exits accordingly mA or V.





## SOUND CONE GEOMETRY

The exact geometry of the sound cone depends on the air-pressure, temperature, humidity and the size of the target.



The diagram shows the 3 typical sound cone sizes, that can be programmed.

The cone size is set by connecting the teach input for  $>5$  s with the power supply  $-U_B$  (0V). See also the teach table at page 4:

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

### Inclination angle of object

Smooth surfaces can be detected up to an inclination angle of  $10^\circ$ . However rough and structured (granular) surfaces can be detected up to much higher angles. In the retroreflective mode the angle does not matter at all.

# TEACH-IN GUIDE

## Ultrasonic Sensors Series UPR-A Atex

For further information please see the data sheet at [www.waycon.biz/products/ultrasonic-sensors/](http://www.waycon.biz/products/ultrasonic-sensors/)

### TEACH TABLE

TIME	Connect Teach input to	LED flashes	Switching output version	Analog output version
1 to 5 s	+U <sub>B</sub> (typ. +24 VDC)	slow yellow	Closer NO: far window point, or switching point Opener NC: close window point	10 V or 20 mA
1 to 5 s	-U <sub>B</sub> (0 VDC)	slow yellow	Closer NO: near window point Opener NC: far window point, or switching point	0 V, or 4 mA
5 to 10 s	+U <sub>B</sub> (typ. +24 VDC)	fast yellow	Retroreflective barrier closer NO	-
10 to 15 s	+U <sub>B</sub> (typ. +24 VDC)	fast red	Retroreflective barrier opener NC	-
5 to 10 s	-U <sub>B</sub> (0 VDC)	yellow	small detection cone	small detection cone
10 to 15 s	-U <sub>B</sub> (0 VDC)	yellow / red	medium detection cone	medium detection cone
15 to 20 s	-U <sub>B</sub> (0 VDC)	red	large detection cone	large detection cone
>20 s	-U <sub>B</sub> (0 VDC)	No LED	Factory reset	Factory reset

### ANALOG OUTPUT

The two measuring limits are set by attaching the voltage supply -U<sub>B</sub> (0 V), or +U<sub>B</sub> (+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

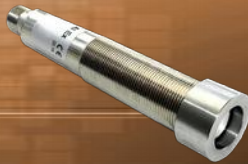
-U<sub>B</sub> teaches the lower evaluation limit (0 V or 4 mA) and the upper evaluation limit with +U<sub>B</sub> (10 V or 20 mA). It can be used to program a rising or falling ramp

- 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<sub>B</sub>
- 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<sub>B</sub>

Upper and lower measuring limits can be reprogrammed at any time.

#### Attention:

The Teach wire/input (PIN 2) must be disconnected after the teaching process is completed. The sensor can therefore also be operated with a 3-wire cable after teaching.



## 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. During the learn-in process a flashing LED indicates whether the sensor detects the target:

Yellow flashing LED: detected  
 Red flashing LED: not detected

### Window operation closer NO:

- 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  $+U_B$

### Window operation opener NC:

- 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 closer NO:

- 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  $-U_B$

### Switching point opener NC:

- 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  $+U_B$

## RETROFLECTIVE MODE

### UPR-A-1500-TVPA-24-C-Ex

Retroflective mode uses a reflector in the background (max. 1.5 m away 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.

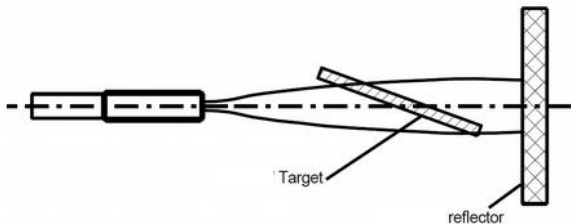
In reflection barrier mode the reflector is taught as follows:

#### Closer NO:

Teach 5...10 s with  $+U_B$   
 (Rapid flashing yellow LED)

#### Opener NC:

Teach 10...15 s with  $+U_B$   
 (Rapid flashing red LED)



# TEACH-IN GUIDE

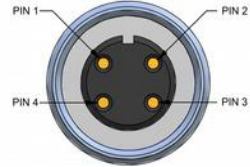
## Ultrasonic Sensors Series UPR-A Atex

For further information please see the data sheet at [www.waycon.biz/products/ultrasonic-sensors/](http://www.waycon.biz/products/ultrasonic-sensors/)

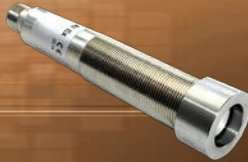
### ACCESSORIES

#### Cable with mating connector M12, 4 pole, shielded

K4P2M-S-M12	2 m, straight connector, IP67
K4P5M-S-M12	5 m, straight connector, IP67
K4P10M-S-M12	10 m, straight connector, IP67
K4P2M-SW-M12	2 m, angular connector, IP67
K4P5M-SW-M12	5 m, angular connector, IP67
K4P10M-SW-M12	10 m, angular connector, IP67



PIN	Cable colour
1	brown
2	white
3	blue
4	black



## NOTES

### **Warning**

These devices are not designed for critical safety or emergency shut-down purposes. Therefore they should never be used in an application, where a malfunction of the device could cause personal injury.

### **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 than 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 ultra sound. A classic application for ultrasonic sensors is level measurement. The sound beam axis however must have a maximum deviation of  $3^\circ$  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 it's 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

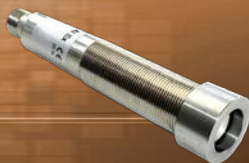
reflects almost all of the impulse energy from ultrasound applications in a way that makes them very easy to detect with ultrasound.

#### Soft material,

on the other hand, absorbs almost all of 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.



## DECLARATION OF EC-CONFORMITY

WayCon Positionsmesstechnik GmbH

Based on: EN 60947-5-2 + amendments (proximity switches)  
EN 60947-5-7 + amendments (proximity sensors with analogue output)

This is to certify that the following products correspond to the mentioned specifications.

Classification Ultrasonic Sensors  
Series UPR-A-Atex

Test on immunity IEC 61000-6-2 (Industry)

Type of test applied harmonized standards:  
EN 61000-4-2, EN 61000-4-3, EN 61000-4-4

The declaration of conformity loses its validity if the product is misused or modified without proper authorisation.

Taufkirchen, 13.03.2013

Andreas Träger  
CEO

## ATEX DECLARATION

The manufacturer certifies conformity to the basic safety requirements of the following devices for the intended use in hazardous areas with dust (ATEX zone 22) and Gas (ATEX zone 2). The basic safety requirements are met by compliance with EN 60079:2012. The results are recorded in the test report.

Devices:

Ultrasonic sensor UPR-A 1500 TOR 24 CAI Ex

Ultrasonic sensor UPR-A 1500 TVPA 24 C Ex

Ultrasonic sensor UPR-A 1500 TVNA 24 C Ex

Marking of the devices has to be as follows:

**Dust: Ex tc IIIC T60°C Dc 0°C ≤ Ta ≤ +60°C**

**Gas: Ex nA IIC T6 Gc 0°C ≤ Ta ≤ +60°C**