

# ULTRASONIC

## Ultrasonic Distance and Proximity Sensors



### 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 94/9/EC
- 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
- Working temperature 0 to +60 °C
- Protection class IP67, waterproof, oil-resistant
- Configurable size of sound cone

#### Content:

|                          |       |
|--------------------------|-------|
| Technical Data           | ....2 |
| Adjustments              | ....3 |
| Connection & Teach-In    | ....4 |
| Order Code & Accessories | ....5 |
| Safety                   | ....5 |

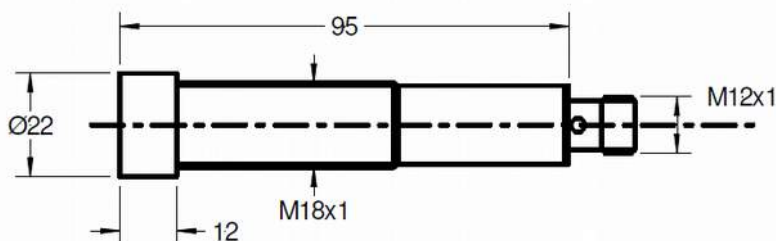
## TECHNICAL DATA

|                                                        |        | UPR-A-1500-TOR-24-CA-Ex<br>Distance sensor                                                                | UPR-A-1500-TVPA-24-C-Ex<br>Proximity sensor |
|--------------------------------------------------------|--------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Measurement range MR                                   | [mm]   | 120...1500                                                                                                | 120...1500                                  |
| Switching point hysteresis, axial                      | [mm]   | -                                                                                                         | 2                                           |
| Linearity                                              | [% MR] | <1                                                                                                        | -                                           |
| Resolution                                             | [mm]   | approx. 0.5                                                                                               |                                             |
| Linearity over full temperature range *                | [% MR] | <2                                                                                                        |                                             |
| Operating frequency                                    | [Hz]   | approx. 180                                                                                               |                                             |
| Status indicator                                       |        | LED yellow / red                                                                                          |                                             |
| Switching output, short circuit proof, max. load 0.1 A |        | -                                                                                                         | PNP closer / opener                         |
| Switching speed, max.                                  | [Hz]   | -                                                                                                         | approx. 5                                   |
| Analog output frequency                                | [Hz]   | approx. 30                                                                                                | -                                           |
| Analog output **                                       | [V]    | 0...10 (R <sub>min</sub> 10 kOhm)                                                                         | -                                           |
|                                                        | [mA]   | 4...20 (R <sub>max</sub> 400 Ohm)                                                                         | -                                           |
| Voltage supply (reverse polarity protection)           | [VDC]  | 11...30                                                                                                   |                                             |
| Ripple of supply voltage                               | [%]    | 10                                                                                                        |                                             |
| Mean current consumption                               | [mA]   | approx. 45...65                                                                                           | approx. 45                                  |
| Temperature range                                      | [°C]   | 0...+60                                                                                                   |                                             |
| Pressure area                                          | [mbar] | 800...1100 absolute                                                                                       |                                             |
| Protection class                                       |        | IP67                                                                                                      |                                             |
| Weight                                                 | [g]    | approx. 65                                                                                                |                                             |
| Housing material                                       |        | Nickel-plated brass                                                                                       |                                             |
| Marking                                                |        | Dust: Ex tc IIIC T60°C Dc 0°C ≤ T <sub>a</sub> ≤ +60°C, Gas: Ex nA IIC T6 Gc 0°C ≤ T <sub>a</sub> ≤ +60°C |                                             |
| Electrical connection                                  |        | M12 connector, 4-pole (Use only special cable sockets with self-locking!)                                 |                                             |

\* linearity can be further improved by only teaching the sensor in a heat-resisting state (e.g. 30 minutes after switching on).

\*\* The analog sensor automatically recognises the load connected and emits the corresponding signal 4...20 mA or 0...10 V.

## TECHNICAL DRAWING

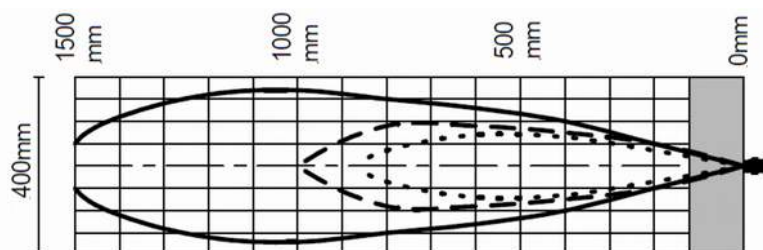


## SOUND CONE

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 e.g. helpful when 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<sub>B</sub> (0V). See also the teach table at page 5:

- Small cone: Teach 5...10s with -U<sub>B</sub> (yellow LED blinks fast)
- Medium cone: Teach 10...15s with -U<sub>B</sub> (yellow/red LED blinks fast)
- Large cone: Teach 15...20s with -U<sub>B</sub> (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.

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

- Yellow flashing LED: detected
- Red flashing LED: not detected

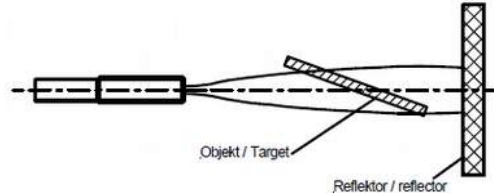
|                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Window operation closer NO:</b></p> <ul style="list-style-type: none"> <li>• Set target to near switching point</li> <li>• Teach switching point 1...5 s with <math>-U_B</math></li> <li>• Set target to far switching point</li> <li>• Teach switching point 1...5 s with <math>+U_B</math></li> </ul> | <p><b>Window operation opener NC:</b></p> <ul style="list-style-type: none"> <li>• Set target to near switching point</li> <li>• Teach switching target at 1...5 s with <math>+U_B</math></li> <li>• Set target to far switching point</li> <li>• Teach switching point 1...5 s with <math>-U_B</math></li> </ul> |
| <p><b>Switching point closer NO:</b></p> <ul style="list-style-type: none"> <li>• Set target to switching point</li> <li>• Teach switching point 1...5 s with <math>+U_B</math></li> <li>• Point sensor at space (&gt;1.5 m)</li> <li>• Teach 1...5 s with <math>-U_B</math></li> </ul>                       | <p><b>Switching point opener NC:</b></p> <ul style="list-style-type: none"> <li>• Set target to switching point</li> <li>• Teach switching point 1...5 s with <math>-U_B</math></li> <li>• Point sensor at space (&gt;1.5 m)</li> <li>• Teach 1...5 s with <math>+U_B</math></li> </ul>                           |

## SETTING SWITCHING POINT 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:

|                                                                                                       |
|-------------------------------------------------------------------------------------------------------|
| <p><b>Closer NO:</b></p> <p>Teach 5...10 s with <math>+U_B</math><br/>(Rapid flashing yellow LED)</p> |
| <p><b>Opener NC:</b></p> <p>Teach 10...15 s with <math>+U_B</math><br/>(Rapid flashing red LED)</p>   |



## 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

$-U_B$  teaches the lower evaluation limit (0 V or 4 mA) and the upper evaluation limit with  $+U_B$  (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  $-U_B$
- 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.

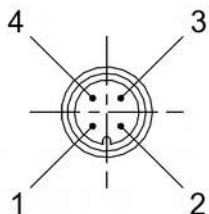
### Attention:

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.

## ELECTRICAL CONNECTION

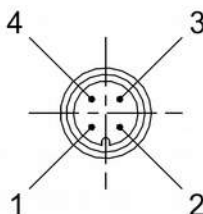
The sensors feature a 4-pole M12 connector. The cables should never be mounted parallel or close to high current cables. Please order the necessary cables separately (see accessories).

### PIN assignment: UPR-A-1500-TOR-24-CAI-Ex



- 1 +24 VDC (brown)
- 2 Teach (white)
- 3 0V (blue)
- 4 OUT 0...10 V (black)

### PIN assignment: UPR-A-1500-TVPA-24-C-Ex



- 1 +24 VDC (brown)
- 2 Teach (white)
- 3 0V (blue)
- 4 OUT PNP (black)

### Connection cable (accessory)

#### Cable with connector M12, 4 poles, shielded

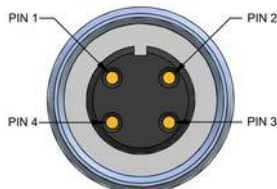
|               |                          |
|---------------|--------------------------|
| K4P2M-S-M12   | 2 m, connector straight  |
| K4P5M-S-M12   | 5 m, connector straight  |
| K4P10M-S-M12  | 10 m, connector straight |
| K4P2M-SW-M12  | 2 m, connector angular   |
| K4P5M-SW-M12  | 5 m, connector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



### Mating connector (accessory)

#### Mating Connector M12, 4 poles, shielded

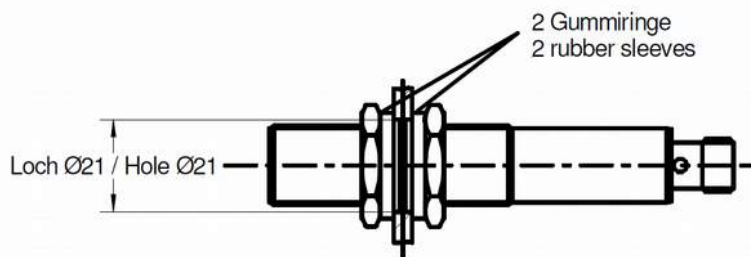
|            |                                                 |
|------------|-------------------------------------------------|
| D4-G-M12-S | straight, M12 for self assembly                 |
| D4-W-M12-S | angular, M12 for self assembly                  |
|            | protection class: IP67                          |
|            | temperature: -25...+90 °C                       |
|            | cable passage: $\varnothing$ 4...8 mm           |
|            | wire cross-section: 0.14...0.34 mm <sup>2</sup> |
|            | mode of connection: spring cage                 |



| PIN No. | cable colour | PIN No. | cable colour |
|---------|--------------|---------|--------------|
| Pin 1   | brown        | Pin 3   | blue         |
| Pin 2   | white        | Pin 4   | black        |

## MOUNTING THE SENSOR

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  $\varnothing$ 21 mm shall be used.



## 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<br>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<br>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         |

## ORDER CODE

|                                |                  |
|--------------------------------|------------------|
| <b>UPR-A-1500-TOR-24-CA-Ex</b> | Analog output    |
| <b>UPR-A-1500-TVPA-24-C-Ex</b> | Switching output |

## ACCESSORIES

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

|               |                          |
|---------------|--------------------------|
| 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 M12, 4 poles, shielded

|            |                                 |
|------------|---------------------------------|
| D4-G-M12-S | straight, M12 for self assembly |
| D4-W-M12-S | angular, M12 for self assembly  |

### Digital display 1 channel, 0...10V/4...20 mA

|          |                                       |
|----------|---------------------------------------|
| PAXP000B | 1 channel, supply: 85 to 250 VAC      |
| PAXP001B | 1 channel, supply: 11...36 VDC/24 VAC |

### Digital display 2 channels, 0...10V/4...20 mA

|          |                                        |
|----------|----------------------------------------|
| PAXDP00B | 2 channels, supply: 85 to 250 VAC      |
| PAXDP01B | 2 channels, supply: 11...36 VDC/24 VAC |

For further information please see the data sheet of the PAXD display series



## !! WARNING – PERSONAL INJURY !!

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.

### 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!“

Subject to change without prior notice.

### WayCon Positionsmesstechnik GmbH

E-Mail: [info@waycon.de](mailto:info@waycon.de)  
Internet: [www.waycon.de](http://www.waycon.de)

### Head Office

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

### Cologne Office

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