# INSTALLATION GUIDE

## Ultrasonic Sensors Series UFA-1500

For further information please see the data sheet at 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.
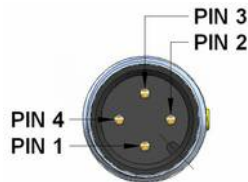
## MOUNTING THE SENSOR

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 Ø21 mm shall be used at all events.
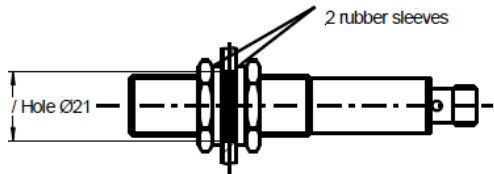


## ELECTRICAL CONNECTION

| 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.
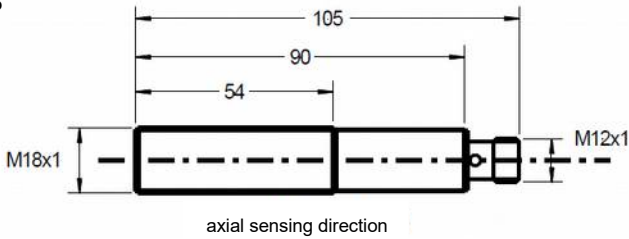


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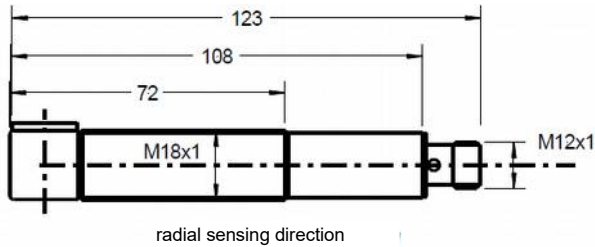
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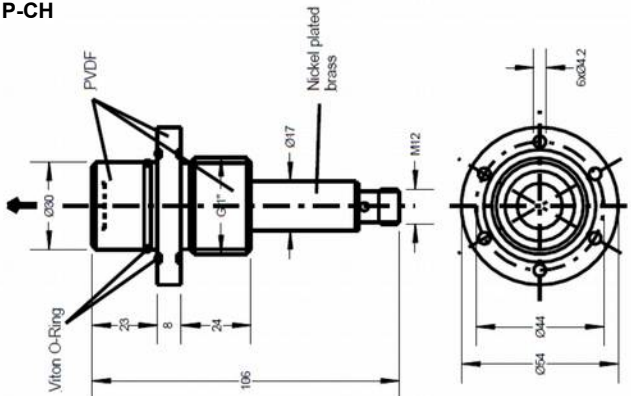
## TECHNICAL DRAWING

**UFA-1500-M18-A /
UFA-1500-M18-1P**



axial sensing direction

**UFA-1500-M18-A-R /
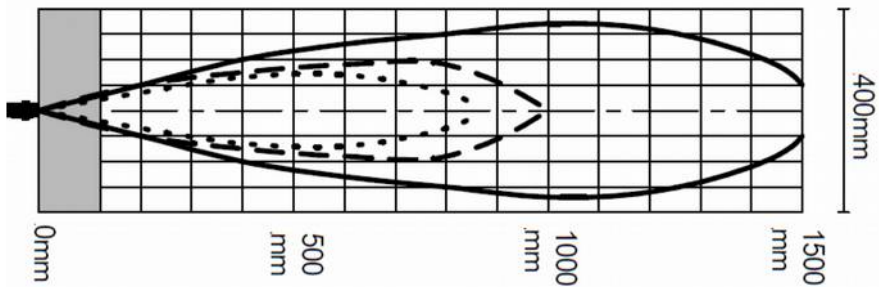UFA-1500-M18-1P-R**



radial sensing direction

**UFA-1500-M30-A-CH /
UFA-1500-M30-1P-CH**

# SOUND CONE GEOMETRY

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



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°. 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 UFA-1500

For further information please see the data sheet at 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 | $+U_B$ (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 | $-U_B$ (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 | $+U_B$ (typ. +24 VDC) | fast yellow | Retroreflective barrier closer NO | - |
| 10 to 15 s | $+U_B$ (typ. +24 VDC) | fast red | Retroreflective barrier opener NC | - |
| 5 to 10 s | $-U_B$ (0 VDC) | yellow | small detection cone | small detection cone |
| 10 to 15 s | $-U_B$ (0 VDC) | yellow / red | medium detection cone | medium detection cone |
| 15 to 20 s | $-U_B$ (0 VDC) | red | large detection cone | large detection cone |
| >20 s | $-U_B$ (0 VDC) | No LED | Factory reset | Factory reset |

## ANALOG OUTPUT

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 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 wit +$U_B$
- 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

**UFA-1500-M18-1P / -R / -CH**

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.
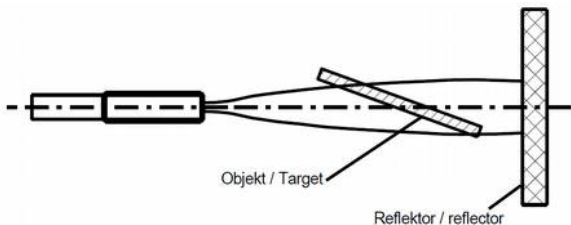
In reflection barrier mode the reflector is taught as follows:

**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)



Objekt / Target

Reflektor / reflector

# TEACH-IN GUIDE

## Ultrasonic Sensors Series UFA-1500

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## CHEMICAL RESISTANT VERSION

### UFA-1500-M30-A-CH / UFA-1500-M30-1P-CH

UFA...CH sensors are designed specifically for use in chemically harsh environments. The high resistance corresponds to that of PVDF, or of PTFE. One possible application is level metering acids and alkalis in small containers. The front exposed to the medium consists of PVDF. What makes these chemical-resistant sensors special is that the ultrasonic converter is fully encased in a special PTFE film which allows ultrasound waves to pass through.

### Mounting

Mount to the flange with 6 M4 screws, or mount to the G1 thread. Sealing with the included Viton O-rings.
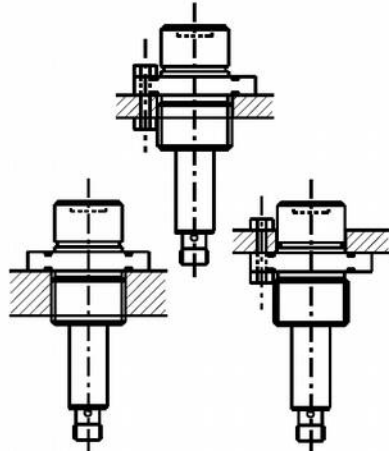
## NOTES

**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 no 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 ultra sound. 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 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.
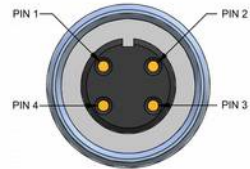
Thin-walled foils
behave like soft materials. To be able to use ultrasound, the foil thickness should be at least 0.01 mm.

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# 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 |

# DECLARATION OF EC-CONFORMITY

| | |
|---|---|
| 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 | UFA-1500 |
| 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 Täger
CEO