

# INSTALLATION GUIDE

## Ultrasonic Sensor Series UFA2, UFA-CP and UFA-6000

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:

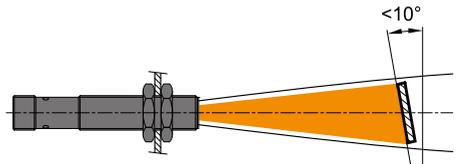
Carefully lift the device out of the box by grabbing the housing. After unpacking the device, check it for any visible damage as a result of rough handling during the shipment. Check the delivery for completeness. If necessary consult the transportation company, or contact WayCon directly.

### SAFETY NOTICES

- These products are neither allowed to be used 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.

### MOUNTING NOTICES

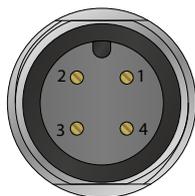
- The sensor can be mounted with the two M12 nuts (UFA2/UFA-CP) or M30 nuts (UFA-6000) which are included in the delivery.
- The sensor has to be protected against mechanical loads for example shocks and impacts.
- The sensor can be mounted in any position, however a vibration-free or vibration-dampening assembly must be observed.
- The transducer surface as well as the field of the detection beam must be kept free mandatorily. You need to pay attention on having no disturbing objects between the sensor and the target object within the detection beam. Otherwise the sensor will detect the disturbing object instead of the target object required.
- The object reflects a part of the ultrasonic in the diffuse mode - this reflected sound will be evaluated by the sensor. Objects with a smooth surface are reliably detected up to a tilting angle of approx.  $10^\circ$ . The max. allowed tilting angle increases on objects with a rough or heavy structured (granular) surface.



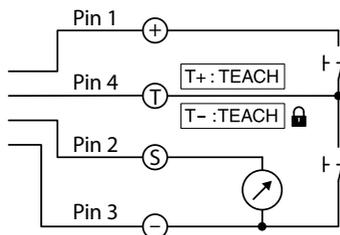
# ELECTRICAL CONNECTION

Pin	UFA2 and UFA-6000		UFA-150-CP		Connection cable K4P
	Analog output	Switching output	Analog output	Switching output	
1	+V	+V	+V	+V	BN
2	Analog output	Teach	Teach	Teach	WH
3	GND	GND	GND	GND	BU
4	Teach	Switching output	Analog output	Switching output	BK

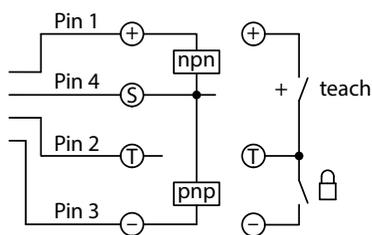
**connector M12 (male)**



**circuit diagram UFA2/UFA-6000 analog output**



**circuit diagram UFA2/UFA-6000 switching output**



## TEACHING FUNCTION UFA2 AND UFA-6000 ANALOG OUTPUT

### Teaching the measurement range:

The measuring range is defined by two teach points. The output signal is scaled to the taught measuring range.

#### Procedure:

- Place the target on the position of the 1st teach point (i.e. where 0 V or 4 mA should be output).
- Connect the teaching line (Pin 4) with +V (Pin 1) for 0.1...2 s. LED flashes slowly (1 Hz).
- Within <20 s, place the target on the position for the 2nd teach point (i.e. where 10 V or 20 mA should be output) and connect the teaching line with +V for 0.1...2 s.
- LED flashes 2 times: teach procedure successful  
LED flashes 4 times: teach procedure not successful

### Changing the analog output signal:

The physical quantity (current/voltage) of the analog output is changed.

#### Procedure:

- Connect the teaching line (Pin 4) with +V (Pin 1) for >6 s.
- LED flashes 2 times: change successful  
LED flashes 4 times: change not successful

## Teaching the window size:

The window size is defined by two switching limits.

### Procedure:

1. Place the target on the position of near switching point.
2. Connect the teaching line (Pin 2) with +V (Pin 1) for 0.1...2 s. LED flashes slowly (1 Hz).
3. Within <20 s, place the target on the position of the far switching point and connect the teaching line with +V for 0.1...2 s.
4. LED flashes 2 times:        teach procedure successful  
   LED flashes 4 times:        teach procedure not successful

## 2-step teaching:

Both conditions (background and object) can be taught successively. The switching point is placed between the object and the background.

### Procedure:

1. Place the target on the position of near switching point.
2. Connect the teaching line (Pin 2) with +V (Pin 1) for 2...4 s. LED flashes slowly (1 Hz).
3. Within <20 s, remove the target and connect the teaching line with +V for 2...4 s.
4. LED flashes 2 times:        teach procedure successful  
   LED flashes 4 times:        teach procedure not successful

## Autoteach procedure:

Opens a teach window for 4...8 s and automatically teaches passing objects. The switching point is placed between the object and the background.

### Procedure:

1. Connect the teaching line (Pin 2) with +V (Pin 1) for 4...6 s. LED flashes fast (2 Hz).
2. Within the next 4...8 s, the autoteach procedure detects passing objects.
3. LED flashes 2 times:        teach procedure successful  
   LED flashes 4 times:        teach procedure not successful

## Changing the switching function:

Changes between NO  $\Leftrightarrow$  NC. Causes a inversion of the switching output function (signal inversion on objects within / outside the window).

### Procedure:

1. Connect the teaching line (Pin 2) with +V (Pin 1) for >6 s.
2. LED flashes 2 times:        change successful  
   LED flashes 4 times:        change not successful

## TEACHING FUNCTION UFA-150-CP ANALOG OUTPUT

### Teaching the measurement range:

The two measuring limits are set by connecting the teaching line with either the power supply GND (0 V) or +V (+24 VDC). The voltage must be active for min. 1 s on the teaching line. During the teaching procedure the LED shows if the sensor has detected the object. With GND the lower measuring limit (0 V or 4 mA) and with +V the upper measuring limit (10 V or 20 mA) is taught. Thus, it is possible to teach a rising or a falling ramp.

### Procedure:

1. Place the object on the lower measuring limit (i.e. where 0 V or 4 mA is desired).
2. Connect the teaching line with GND for >1 s.
3. Place the object on the upper measuring limit (i.e. where 10 V or 20 mA is desired).
4. Connect the teaching line with +V for >1 s.

Lower and upper measuring limits can also be programmed individually at a later time.

**Attention:** The teach wire must not be connected during normal operation. Those the sensor can be operated after teaching with a 3 wire cable.

## TEACHING FUNCTION UFA-150-CP SWITCHING OUTPUT

### Setting of the switching points:

The switching points are set by connecting the teach wire with either the power supply GND (0 V) or +V (+24 VDC). The voltage must be active for min. 1 s on the teaching line. During the teaching procedure the LED shows if the sensor has detected the object.

### Procedure:

#### Window operation closer NO:

1. Set target to near switching point
2. Teach switching point with GND
3. Set target to far switching point
4. Teach switching point with +V

#### Switching point closer NO:

1. Set target to switching point
2. Teach switching point with +V
3. Point sensor at space (>1.5 m)
4. Teach with GND

#### Window operation opener NC:

1. Set target to near switching point
2. Teach switching target at with +V
3. Set target to far switching point
4. Teach switching point with GND

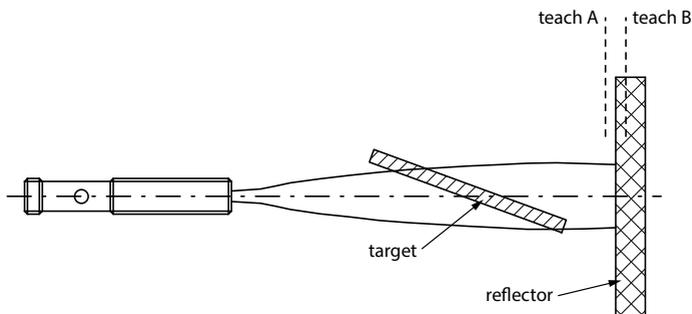
#### Switching point opener NC:

1. Set target to switching point
2. Teach switching point with GND
3. Point sensor at space (>1.5 m)
4. Teach with +V

## TEACHING FUNCTION UFA-150-CP SWITCHING OUTPUT

### Retroreflective mode:

In window operation the sensor detects only targets which are within the window limits. The same function can also be used to simulate a kind of retro-reflective sensor. The reflector is mounted in the small window between Teach A and Teach B (see drawing below). In such setup the sensor detects also targets which pass the sensor beam in a very flat angle. The sensor would not detect such targets in normal scan operation mode.

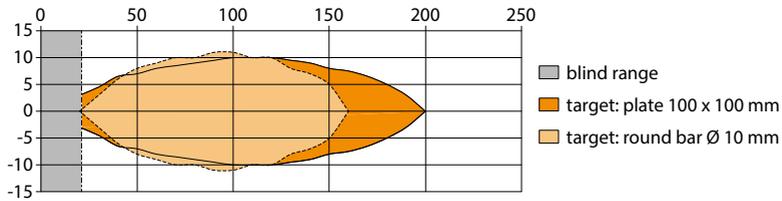


## LED LIGHTING PATTERN UFA-150-CP

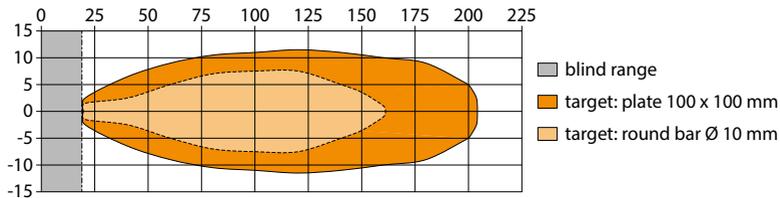
	Red LED	Yellow LED
During teaching procedure:		
• object detected	off	blinking
• no object detected	blinking	off
• object not reliably detected	on	off
Normal operation PNP	off	switching status
Normal operation analog	on	on
Error	on	last status

# DETECTION BEAMS

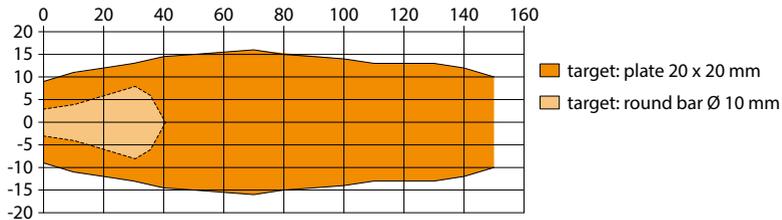
## UFA2-200-A: Standard version with analog output



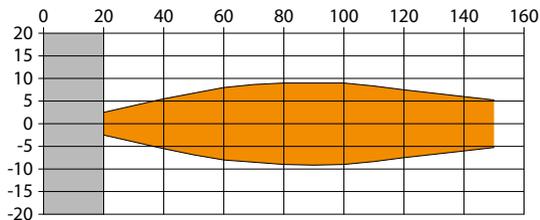
## UFA2-200-PN: Standard version with switching output



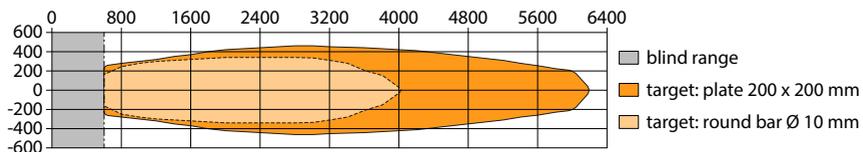
## UFA2-FB-150: Focus beam version



## UFA-150-CP: Chemical resistant version



## UFA-6000



## 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 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 ultrasound. 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 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 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 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-150-CP, UFA2, UFA-6000

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, 30.06.2020

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CEO