Ultrasonic distance and proximity sensors
DUPR-A Series

- Measuring distances from 120mm to 1500mm
- Analogue or binary output
- Teach-In
- Configurable beam size
- To be configured as scanner or retroreflective barrier
- Wide power supply voltage range 11…30VDC
- Very fast analogue output
- Watertight, IP 67, oil resistant, robust
- Measurement independent of material, surface, colour and size of target
- Work under dust, dirt, fog, light
- Detect transparent and shiny objects
- Option: ATEX 2/22
- Option: stainless steel housing, 1.4571 (V4A)
- Option: chemically resistant housing
- Option: Synchronization and suppression mode

programmable!

Technical data		**DUPR-A 1500 TOR 24 C(W)AI**	**DUPR-A 1500 TVPA 24 C(W)**
Detection range	mm	120...1500	
Blind range (no reasonable analogue signal)	mm	0...120	
Hysteresis of binary output, axial	mm	-	4
Resolution	mm	~0.5	
Linearity	%FS	<1	-
Over all accuracy in whole temperature range *1)	%FS	<2	
Operating frequency	kHz	~180	
Status indicator	-	LED yellow/red	
Binary output, short circuit proof, max. 0.1A	-	-	PNP NO/NC
Switching speed max.	Hz	-	~5
Time to readiness when power on	s	1.3	
Speed of analogue output	Hz	~30	-
Analogue output: R_L min. 10kΩ with V output	V	0...10V	-
R_L max. 400Ω with mA output	mA	4...20mA	-
Power supply voltage (reversal polarity protection)	VDC	11...30	
Ripple of supply voltage	%	10	
Mean consumption	mA	~45…65	~45
Temperature range *2)	°C	0...+60	
Pressure range	$mbar_{abs}$	900...1100	
Mass	g	~65	
Protection class	-	IP67	
Housing material	-	nickel plated brass	
Electrical connection	-	M12 connector 4-pin	
Option: for ATEX zones 2+22	-	Ex tc IIIC T60°C Dc 0°C ≤ Ta ≤ +60°C Ex nA IIC T6 Gc 0°C ≤ Ta ≤ +60°C	
Option: stainless steel housing (incl. connector)	-	1.4571 (V4A)	

*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) Operation <0°C is partially possible when the sensor membrane is kept free from icing by the self-heating in continuous operation or by external heating.

Versions

	axial sensing direction	radial sensing direction
Analog output 0...10V and 4...20mA	DUPR-A 1500 TOR 24 CAI	DUPR-A 1500 TOR 24 CWAI
Binary output PNP	DUPR-A 1500 TVPA 24 C	DUPR-A 1500 TVPA 24 CW
Binary output NPN	DUPR-A 1500 TVNA 24 C	DUPR-A 1500 TVNA 24 CW
with synchronization, Analog output 0...10V and 4...20mA	DUPR-A 1500 TOR 24 CAIY	DUPR-A 1500 TOR 24 CWAIY
with synchronization, binary out PNP	DUPR-A 1500 TVPA 24 CY	DUPR-A 1500 TVPA 24 CWY
with synchronization, binary out NPN	DUPR-A 1500 TVNA 24 CY	DUPR-A 1500 TVNA 24 CWY
ATEX 2/22, analog output 0...10V and 4...20mA	DUPR-A 1500 TOR 24 CAI Ex	-
ATEX 2/22, binary output PNP	DUPR-A 1500 TVPA 24 C Ex	-
ATEX 2/22, binary output NPN	DUPR-A 1500 TVNA 24 C Ex	-
Stainless steel, analog output 0...10V and 4...20mA	DUPR-A 1500 TOR 24 SCAI	-
Stainless steel, binary output PNP	DUPR-A 1500 TVPA 24 SC	-
Stainless steel, binary output NPN	DUPR-A 1500 TVNA 24 SC	-
Chemical resistant, analog output 0...10V and 4...20mA	DUPR-A 1500 CP TOR 24 CAI	-
Chemical resistant, binary output PNP	DUPR-A 1500 CP TVPA 24 C	-
Chemical resistant, binary output NPN	DUPR-A 1500 CP TVNA 24 C	-

Description

The compact ultrasonic sensors of the DUPR-A series are characterized by a wide range of max. 1.5m. Furthermore, they are configurable by the user. Thanks to three different sized detection lobes, the sensor can be adapted locally to the application. And they can optionally be synchronized among themselves and stopped with an external signal (suppression mode).
The sensor is available as a pure proximity switch as well as a distance sensor with analog output. Suitable applications include object detection as well as distance and level measurement.
The switching and analogue outputs can be teached by the user (rising/falling or NC/NO or window). The binary type is also programmable as a reflective barrier. This is useful when badly to detect objects stay in front of a background. The analogue sensor automatically detects the connected load, and exits accordingly mA or V. Programming is done using a single teach input. Optionally a teach-in box is available.
Thanks to the new transducer sealing the DUPR-A sensors are very robust against many environmental influences. In particular, they are oil resistant, unlike many other ultrasonic sensors.

Choice of model (standard models)

There is a version with binary and one with analogue output, and one each with axial and radial sensing direction.

DUPR-A 1500 TVPA 24 C(W)
Ultrasonic sensor with a binary output with 2 teachable switching points (NO, NC or window or retro-reflective function).

DUPR-A 1500 TOR 24 C(W)AI
Ultrasonic sensor for distance measurement with an analogue output 0...10V or 4…20mA. Automatic detection of the connected load (measuring device). When changing from V to mA or vice versa, the sensor must be switched off and on again. The lower and upper limits are teachable.

Special versions

As can be seen from the table above, special versions are available:

- ATEX 2/22
- Stainless steel housing, 1.4571 (V4A)
- Chemical resistant housing (see page 6)

These are only available with axial sensing direction. The operation is exactly the same as for the standard models.

Blind range

The lower detection range between 0…120mm is called blind range. It is typical for ultrasonic sensors. In the blind range no distance measurement is possible. However the pure function as proximity switch (binary output) is possible in the blind range with certain restrictions (only bigger objects).

Setting the switching points in scanning mode DUPR-A 1500 TVPA 24 C(W)

In scanning mode the target partially reflects the ultrasound which is then detected by the sensor. The switching points are set by connecting the teach input with either the power supply $-U_B$ (0V) or $+U_B$ (+24VDC) for 1…5s.
The blinking LED shows during teaching if the sensor has detected the object.

- LED blinks yellow: detected
- LED blinks red: not detected

Window operation NO

- Place the object at the near switching point
- Teach 1…5s switching point with $-U_B$
- Place the object to the far switching point
- Teach 1…5s switching point with $+U_B$

Window operation NC

- Place the object at the near switching point
- Teach 1…5s switching point with $+U_B$
- Place the object to the far switching point
- Teach 1…5s switching point with $-U_B$

Switching point NO

- Place the object at the switching point
- Teach 1…5s switching point with $+U_B$
- Let the sensor look into the empty space (>1.5m)
- Teach 1…5s with $-U_B$

Switching point NC

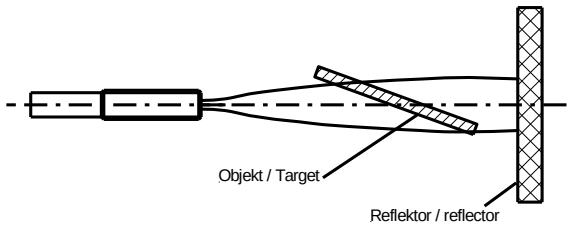
- Place the object at the switching point
- Teach 1…5s switching point with $-U_B$
- Let the sensor look into the empty space (>1.5m)
- Teach 1…5s with $+U_B$

Setting the switching point in retroreflective mode DUPR-A 1500 TVPA 24 C(W)

In retroreflective mode a reflector is used in the background of the scenery (max. 1.5m away from sensor). In contrast to optical sensors the reflector can be of any material, which is able to reflect the sound. Retroreflective mode is used instead of scanning mode when the target is in a small angle to the sensor beam (see below sketch) or when it is very sound absorbing, i.e. when not sufficient sound is reflected. In this mode the sensor permanently checks whether it sees the reflector or if it is covered by the target. Furthermore the sensor has no blind range in retroreflective mode.

In retroreflective mode the reflector is teached as follows.

- NO: Teach 5...10s with $+U_B$ (yellow LED blinks fast)
- NC: Teach 10...15s with $+U_B$ (red LED blinks fast)



Setting the measuring limits analogue output DUPR-A 1500 TOR 24 C(W)AI

The two measuring limits are set by connecting the teach input with either the power supply $-U_B$ (0V) or $+U_B$ (+24VDC) for 1…5s. The blinking LED shows during teaching if the sensor has detected the object.
LED blinks yellow: detected
LED blinks red: not detected

With $-U_B$ the lower measuring limit (0V or 4mA) and with $+U_B$ the upper measuring limit (10V or 20mA) is taught. Thus it is possible to teach a rising or a falling ramp.

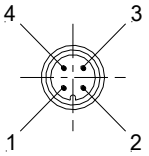
- Place the object at the lower measuring limit (i.e. where 0V or 4mA is expected)
- Teach 1...5s lower measuring limit with $-U_B$
- Place the object at the upper measuring limit (i.e. where 10V or 20mA is expected)
- Teach 1...5s upper measuring limit with $+U_B$

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

Caution:
The teach wire must not be connected during normal operation. The sensor can e.g. be operated after teaching with a 3 wire cable.

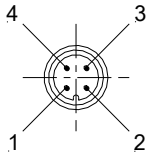
Electrical connections (view to the sensor)

DUPR-A 1500 TVPA 24 C(W)



1 +24VDC (braun/brown)
2 Teach/Sync. (weiss/white)
3 0V (blau/blue)
4 OUT PNP/NPN (schwarz/black)

DUPR-A 1500 TOR 24 C(W)AI



1 +24VDC (braun/brown)
2 Teach/Sync. (weiss/white)
3 0V (blau/blue)
4 OUT 0...10V / 4...20mA (schwarz/black)

Synchronization ("Y" option)

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. leads of all sensors (max. 6 sensors) are interconnected. Important is the order:

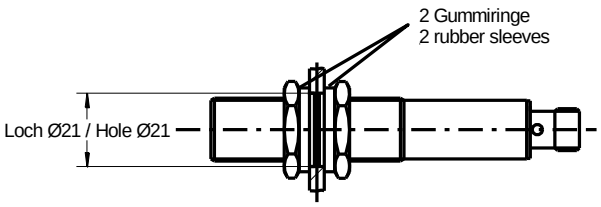
1. teach each sensor individually (!)
2. turn off the power
3. interconnect all Teach/Sync. lines
4. power on again only when everything is wired!

Suppression mode ("Y" option)

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. line 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!).

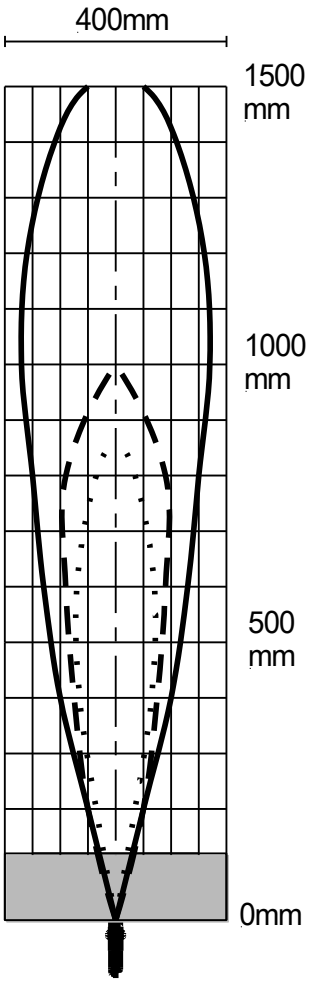
Mounting

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 Ø21mm shall be used.



Detection 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 more badly 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.



Beside the three typical cone shapes for the DUPR-A sensors are shown (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 DUPR-A 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 >5s with the power supply $-U_B$ (0V):

- 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)

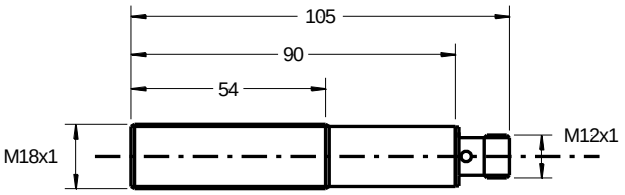
Inclination angle of object

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 retroreflective mode the angle does not matter at all.

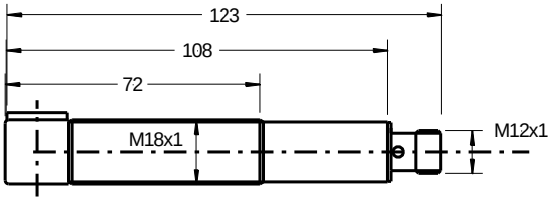
Cable

The sensors have an M12 4-pin connector for screw mounting. The cable should not be mounted parallel or close to high current cables. Cables have to be ordered separately.

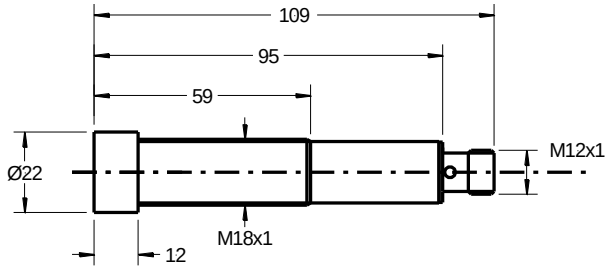
Dimensions



axial sensing direction



radial sensing direction



ATEX Version

Teach-In box: see separate data sheet

Parts included

- Sensor
- 2 of each M18 nuts, washers and rubber sleeves for mounting
- ATEX version: soldering eyelet
- Chemical resistant version: 2 O-rings

Teach Table

Time	*Connect teach wire with:*	*LED blinking*	*Version with binary output DUPR-A 1500 TVPA 24 C(W)*	*Version with analogue output DUPR-A 1500 TOR 24 C(W)AI*
1...5s	+U_B (typ. +24VDC)	yellow slowly	NO: far window point or switching point NC: near window point	10V or 20mA
1...5s	-U_B (0VDC)	yellow slowly	NO: near window point NC: far window point or switching point	0V or 4mA
5...10s	+U_B (typ. +24VDC)	yellow fast	retroreflective barrier NO	-
10...15s	+U_B (typ. +24VDC)	red fast	retroreflective barrier NC	-
5...10s	-U_B (0VDC)	yellow	small detection cone	small detection cone
10...15s	-U_B (0VDC)	yellow/red	medium detection cone	medium detection cone
15...20s	-U_B (0VDC)	red	large detection cone	large detection cone
>20s	-U_B (0VDC)	no LED	factory reset	factory reset

The distance value is teached which was present at the end of the teach process.

Ultrasonic distance and proximity sensors resistant against chemicals DUPR-A CP Series

- based on DUPR-A series
- CP means “Chemical Protection”
- resistant against most chemicals such as acids and alkalis
- exposed parts made of PVDF, PTFE, Kalrez ®
- for level measurement and control of aggressive media

Versions

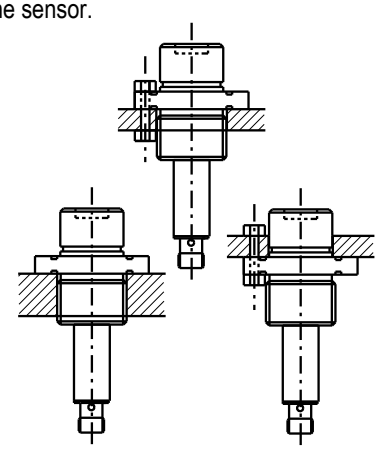
Analogue output 0...10V and 4...20mA	DUPR-A 1500 CP TOR 24 CAI
Binary output PNP	DUPR-A 1500 CP TVPA 24 C
Binary output NPN	DUPR-A 1500 CP TVNA 24 C

Description

The DUPR CP series sensors are specially designed for use in a chemically harsh environment. The high resistance is based on PVDF or PTFE material. A typical application is the level measurement of acids and alkalis in smaller containers. The basic sensor is a model DUPR-A 1500. The front part exposed to the medium is made of PVDF. The outstanding feature is the ultrasonic transducer which is PTFE foil covered allowing the ultrasonic waves to pass. Another specialty are the internal seals made of the super-resistant elastomer Kalrez ®.
The technical data correspond to those of the DUPR-A sensors (see page 1).

Mounting

Mounting on the flange with 6 M4 screws or mounting on the G1” thread. Sealing with Viton O-rings which are included with the sensor.



Dimensions