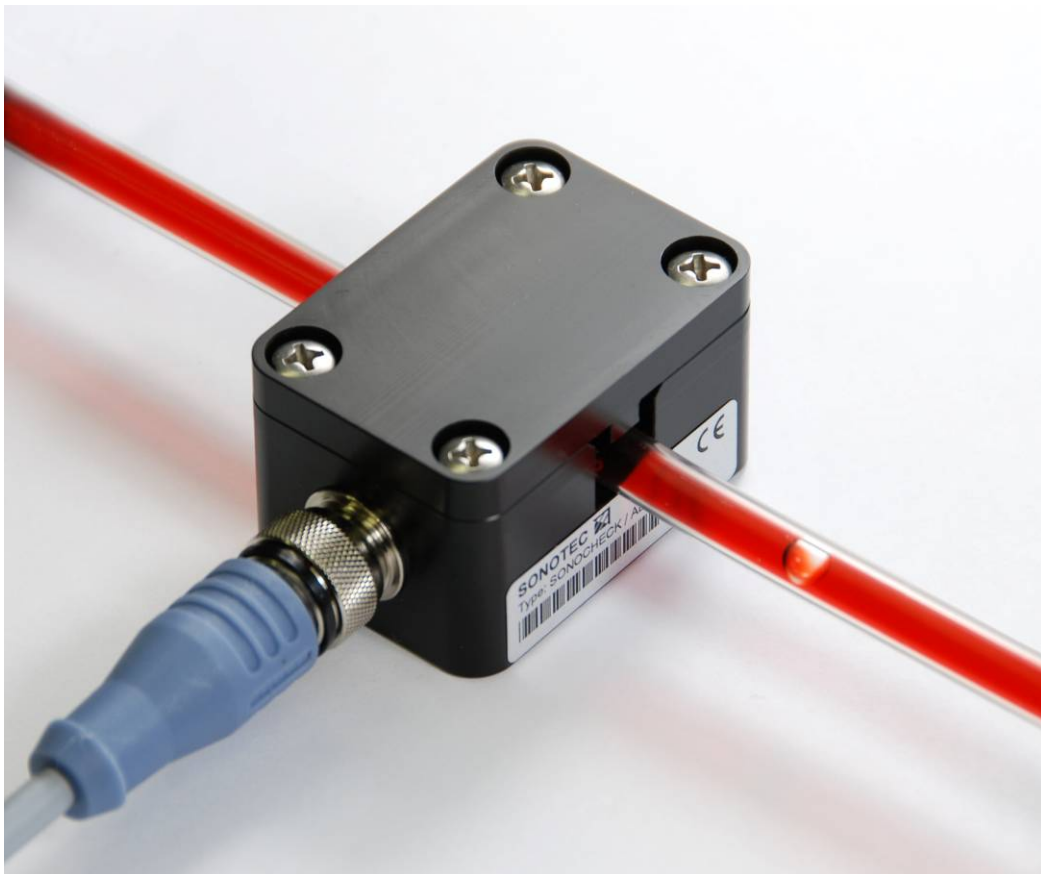


Sensor for Air Bubble Detection at Liquid Filled Tubes

SONOCHECK
Type ABD06.xx

Operating Manual



Manufacturer: SONOTEC Ultraschallsensorik Halle GmbH
Model: Air Bubble Detector
Type: ABD06.xx

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1 General Information

1.1 Safety information

The SONOCHECK ABD06 is a state of the art product that complies with all applicable safety regulations. The sensor is factory tested and is delivered in a safe condition for operation. The following safety instructions apply:



Warning!

Incorrect installation and use of the ABD06 sensor and its components can present a hazard for the user.

- The plant operator is responsible for the legal compliance of the SONOCHECK ABD06 installation and documentation.
- The SONOCHECK ABD06 may only be operated with power sources in the operating voltage range specified in the technical data.
- Operation and storage of the SONOCHECK ABD06 outside the temperature ranges specified in the technical data is not permitted.
- The SONOCHECK ABD06 may not be immersed.
- The SONOCHECK ABD06 may only be exposed to a minimal risk of mechanical damage. In other cases, the sensor must be protected against mechanical influences.
- If there is visible damage, the SONOCHECK ABD06 must be taken out of operation immediately.

1.2 Application

The air bubble detector is used for the recognition of air bubbles in liquid filled tubes made of synthetic material. It is also suitable for wet/dry indication at tubes.

The sensor is used especially in the fields of medical and food technology, since it has no contact with the liquid. The sensor is also suitable for industrial applications such as the bubble detection at tubes filled with glue or paint.

The type and dimensions of the sensor depend on the diameter and the flexibility of the tube as well as on the kind of liquid.

Without using any coupling medium the tube is easily put into the sensor and enables a smooth and uncomplicated change.

The sensor is constructed as a component to be integrated into machines and apparatus. The mechanical installation and electrical integration into the control system can be carried out easily.

Besides standardized applications the sensors can also be adapted to customized applications.

1.3 Measuring Principle

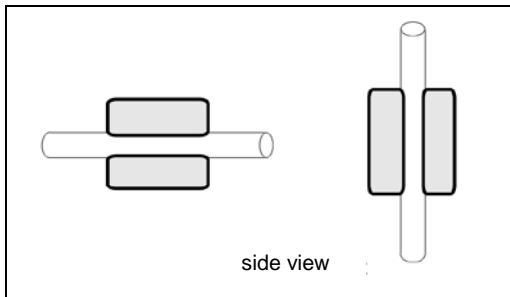
An ultrasonic principle with short high-frequency pulses is used for measuring. If there is liquid in the tube, a part of the ultrasonic sound is transmitted from the emitter through the tube to the receiver. If the tube is empty or a bubble is placed in the measuring point, the part of sound is much smaller. The amplitude of the received ultrasonic pulses is analysed.

The sensor adapts to dynamically changing acoustic conditions. Hence, a high reading stability against varying environmental conditions can be ensured.

2 Technical Specifications

2.1 Sensitivity of Bubbles/Direction of Mounting

The bubble sensitivity depends on the diameter of tube and on the mounting position. For optimal bubble detection the tube must be placed vertically or horizontally with lateral insertion. This way bubbles with a diameter greater than 30 % ... 50 % related to the inner diameter of tube will be detected.



Example:

Outer diameter of tube = 6.5 mm

Inner diameter of tube = 4.9 mm

→ *Bubbles bigger than 5 μ l are detected at a flow rate of 1 ... 1000 ml/min.*

Figure 1. Recommended mounting position of the sensor

If the opening of the channel points upwards, the threshold at which bubbles can be detected reliably is the highest.

2.2 Liquid Standards

In general, all low-viscosity liquids which contain no or only little filler are suitable. The intensity of ultrasound, which is transmitted into the liquid is so small, that no biological damage occurs.



For industrial applications with high-viscosity liquids (e.g. fats/special paints), screening tests must be made.

2.3 Tube Standards

According to the tube diameter there are various models with a different channel width. The type of sensor depends on the outer diameter, the flexibility as well as the wall thickness of the tube.



In order to make sure to select the most appropriate type consult our service team. If available, a short piece of the tube should be sent to our company.

Outer diameter	3 ... 17 mm
Wall thickness	optimal 10 ... 20 % of outer diameter
Material	Plastics, e.g. PVC, PE, silicon, PUR Other materials only on request or after test
Features	Tube must be plane on the outside, no textile tube
Elasticity	Tube must be adaptable

Table 1. Requirements to the tube



The tube is put into the measuring cell without coupling gel.

ATTENTION: There must be no liquid in the channel. An acoustic short circuit may be caused due to the liquid. The function of the sensor is strongly disturbed.

Normally, after being put in, the tube is fixed firmly by a cover. Especially when using very small tubes or tubes with a very low wall thickness (less than 10 % of the outer diameter) it is necessary, that the cover presses the tube and keeps it firmly on the right position.

Optionally, there are sensors without cover available. In case the tube is made of a flexible material and it is suitable for the application, a cover is not mandatory.



The elasticity of the tube may be changing by an increased operating temperature.

In case of a frequent changing of the tube (using disposables) we recommend a sensor type with a snap-in cover.

2.4 Connection of the Sensor

For normal operating the sensor is connected via a M12 sensor connector (3 poles).

A suitable cable can be delivered optionally (lengths: 2 m/5 m/10 m). A shielding cable is not necessary for short distances. We recommend a shielding for longer length (> 30 m) or in rough industrial environments.

For the service a special cable (5 poles) is required. Using the additional lines it is possible to configure the sensor and to adapt it to customized specifications. Do not connect unused lines!



Use the service lines only in combination with the ABD Monitor for the SONOCHECK (delivered on request). Otherwise, the sensor could be damaged.

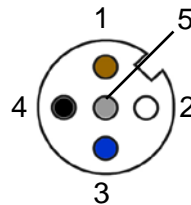
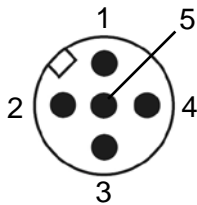


Figure 2. View on connector of the sensor Figure 3. View on connector of the cable (female)

Pin	Colour	Connection
1	brown	Power supply voltage +12 ... 30 VDC
2	white	For service only: serial control input (5V/TTL)
3	blue	Ground
4	black	Switching output, PNP, max. 150 mA
5	grey	For service only: serial control output (5V/TTL)
	shield	If available: should be grounded on the side of controlling unit

Table 2. Pin configuration of M12 sensor connector

2.5 Settings/ABD Monitor

For settings or for diagnostics a computer is required.

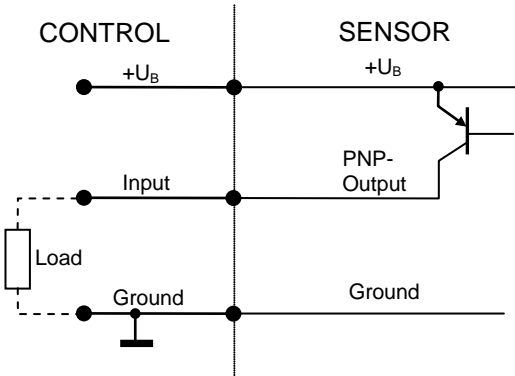

By setting the parameters the sensor could be customized:

- Response time/hold time for output/state of output
- Adaption to the right kind of tube



For detailed information do not hesitate to contact our service team.

Technical Data

SONOCHECK, Type ABD06.xx Sensor for air bubble detection at liquid filled tubes	
Measuring Principle	Ultrasonic principle Tube is put dry in sensor, no coupling gel is required.
Type of Models	Model
	Outer Diameter of Tube
	S
L	8.0 ... ca. 17.0 mm
Dimensions of sensor and cover depend on diameter, wall thickness and flexibility of tube. If possible, provide a short piece of tube for an optimal selection!	
Materials	<ul style="list-style-type: none"> ▪ Housing/cover: plastics/POM/black ▪ Measuring cell: plastics/PMMA/black ▪ Potting: PUR <i>Note: Other materials are available on request.</i>
Mounting	2 x holes M4 on the rear side of the sensor
Operating Temperature	+5 °C ... +60 °C
Storage Temperature	-20 °C ... +70 °C
Degree of Protection	IP67
Power Supply Voltage	+12 ... 30 VDC, ripple max. 10 %, protection against reverse connection
Power	Max. 50 mA (without switching current)
Switching Output	PNP, max. switching current 150 mA  <div style="display: flex; align-items: center; margin-top: 10px;">  <p>No fuse inside the sensors! Pay attention to max. switching current!</p> </div>


Output Specification (Standard)	State	Level of PNP-Output
	Air/bubble	+24 V
	Liquid	Ground
	Internal error (self-test)	+24 V
	<i>The state of output can be configured according to the application by means of the ABD Monitor.</i>	
Measuring Cycle	200 μ s	
Response Time Hold Time	minimal < 0.5 ms <i>The Response Time can be adjusted in a wide range. Furthermore, the Hold Time can be set in order to increase the duration of the output signal.</i>	
CE Compliance	Compliance with DIN EN 61326-1: 2006 EN 61000-4-3 EMC, Radiated radio-frequency - Electromagnetic field immunity, Test Result A, Test with 10 V/m (0.15 ... 1000 MHz) EN 61000-4-4 EMC, Electrical fast transient/burst immunity test, Test Result A (see restrictions below) EN 61000-4-6 EMC, Immunity to conducted disturbances, induced by radio-frequency fields, Test Result A, Test with 10 V/m EN 55011 Electromagnetic disturbance characteristics, Limit 30 dB μ V/m  <i>For testing typical settings for bubble detection have been applied. The immunity depends on a reasonable configuration. Operating with very high bubble sensitivity combined with a very short response time can cause disturbances of the system, induced by electromagnetic disturbing, pressure changing, mechanical vibration, etc.</i>	
Scope of Delivery	Bubble detector type ABD06, model and dimensions adjusted to tube of customer Cover with screws, dimensions adjusted to sensor and tube Technical datasheet	
Accessories/Options	M12 sensor cable, 3 poles, length 2m/5m/10m ABD Monitor, consisting of: <ul style="list-style-type: none"> ▪ USB data converter ▪ M12 sensor cable, 5 poles, length 2m ▪ USB cable type A-B, length 1.5m ▪ CD with software ABD Monitor Snap-in cover, dimensions adjusted to sensor and tube (cannot be retrofitted)	

Table 3: Technical data of the sensor SONOCHECK - type ABD06.xx

4 Technical Drawings



4.1 Dimensions Model S for an Outer diameter of the Tube of 3.0 ... approx. 8.5 mm

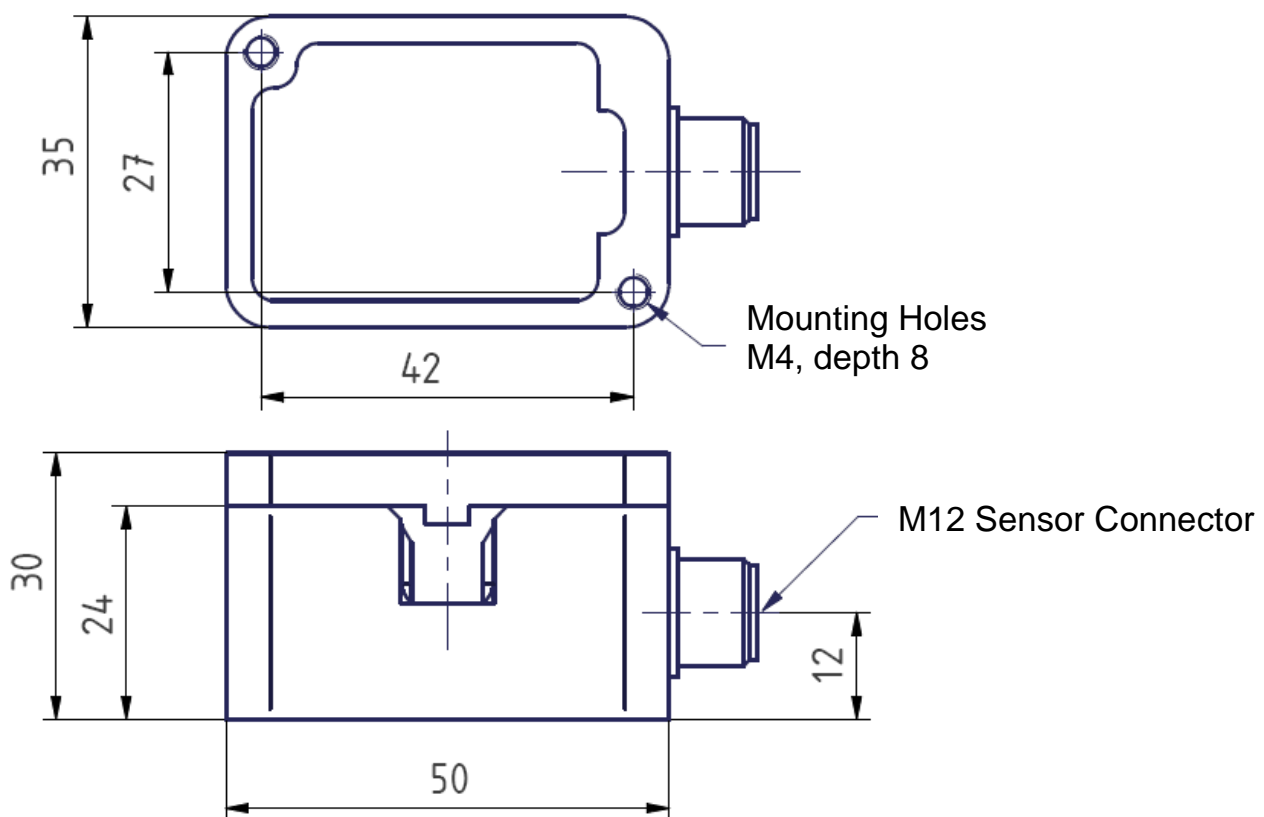


Figure 6. Drawing of sensor model S

Note: The drawings do not conform to real dimensions

4.2 Dimensions Model L for an Outer Diameter of the Tube of 8.0 ... approx. 17.0 mm

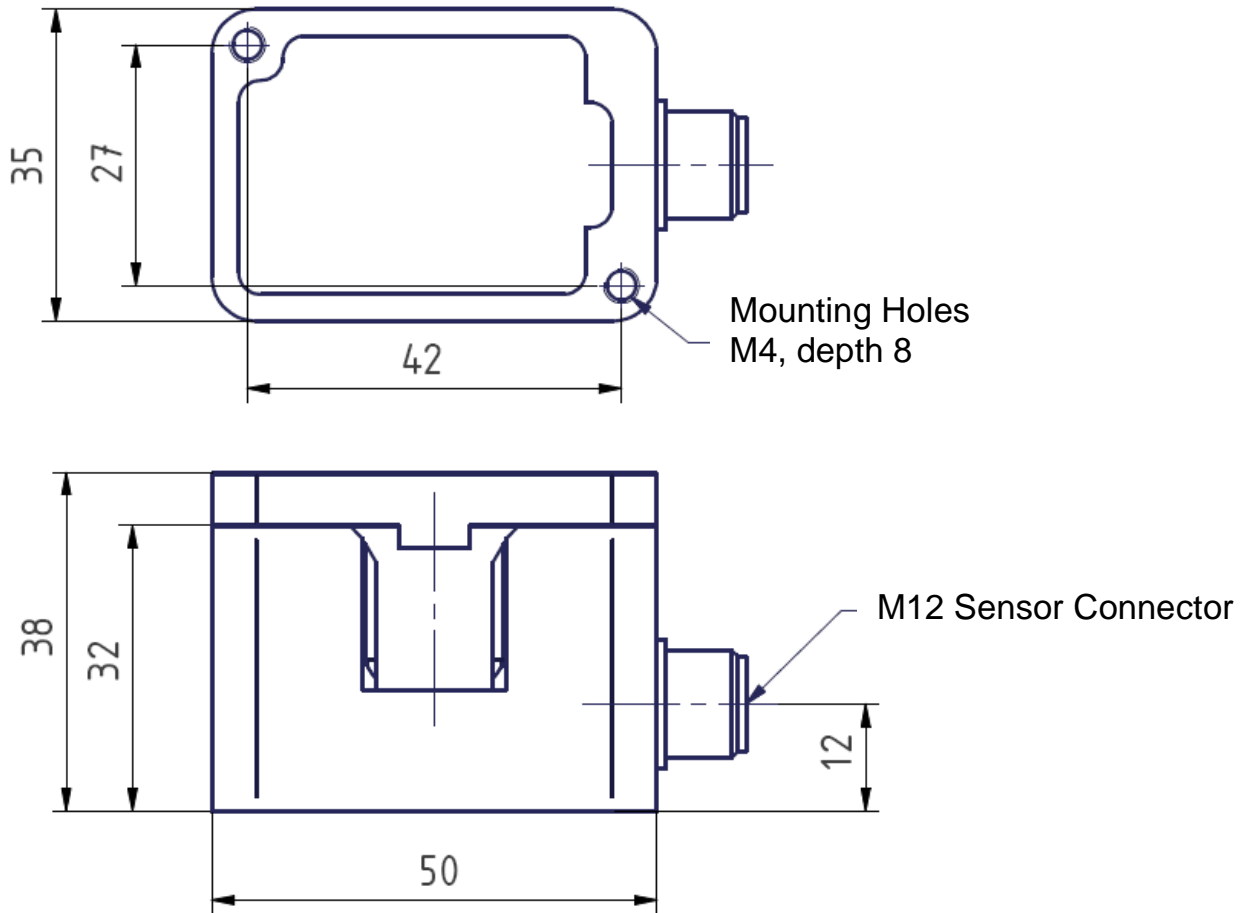


Figure 7. Drawing of sensor model L
Note: The drawings do not conform to real dimensions