



Air Bubble Detector
Type SONOCHECK ABD05
Operating Manual

Manufacturer: SONOTEC Ultraschallsensorik Halle GmbH
Model: Air bubble detector
Type: SONOCHECK ABD05

SONOTEC Ultraschallsensorik Halle GmbH
Nauendorfer Str. 2
06112 Halle (Saale), Germany

Phone: +49 (0)345 133 17-0
Fax: +49 (0)345 133 17-99

E-mail: sonotec@sonotec.de
Internet: www.sonotec.eu

© 2013

SONOTEC Ultraschallsensorik Halle GmbH
All rights reserved

The content of this manual is the property of SONOTEC Ultraschallsensorik Halle GmbH and is protected by copyright. Duplication and distribution in any form, particularly reprinting, photographic, mechanical or electronic reproduction, or in the form of storage in data processing systems or data networks, is prohibited without the consent of the copyright holder.

Revision: 1.1; Date: 2013-07-25

Information is subject to change without notice!

Contents

1	Notes on operating manual	4
1.1	General.....	4
1.2	Symbols used.....	4
2	Safety	5
2.1	Safety information	5
2.2	User qualifications	5
3	Sensor description	6
3.1	Intended use.....	6
3.2	Construction	6
3.3	Measuring method and functioning	7
3.4	Accessories/versions	7
4	Installation.....	8
4.1	Installation position.....	8
4.2	Attaching the sensor	9
4.3	Connecting the Sensor.....	9
4.4	Output specification and settings	10
5	Operating the Sensor	11
5.1	Operating information.....	11
5.2	Inserting the tube	11
6	Cleaning and disinfection.....	12
7	Troubleshooting and maintenance.....	12
8	Technical Data	13
8.1	General data.....	13
8.2	Technical drawings	15

1 Notes on operating manual




1.1 General

Thank you for choosing the SONOCHECK ABD05.

This manual forms part of the SONOCHECK ABD05 and should therefore be stored in its immediate vicinity where it can be accessed by all operators at any time. It contains all the information needed to ensure proper and efficient use, along with all the instructions to ensure safe operation of the SONOCHECK ABD05.

1.2 Symbols used

Hazards or special information can be indicated in the following ways:

	Warning! This information warns of possible injury and damage.
	Caution! This information warns of possible damage.
	Notice This symbol provides information or draws attention to special features.

2 Safety

2.1 Safety information

The SONOCHECK ABD05 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 ABD05 sensor and its components can present a hazard for the user.

- The plant operator is responsible for the legal compliance of the SONOCHECK ABD05 installation and documentation.
- The SONOCHECK ABD05 may only be operated with power sources in the operating voltage range specified in the technical data.
- Operation and storage of the SONOCHECK ABD05 outside the temperature ranges specified in the technical data is not permitted.
- The SONOCHECK ABD05 may not be immersed.
- The SONOCHECK ABD05 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 ABD05 must be taken out of operation immediately.

2.2 User qualifications

**Warning!**

The SONOCHECK ABD05 may only be installed and operated by users who have read and understood the entire operating manual.

3 Sensor description

3.1 Intended use

The SONOCHECK ABD05 is used to detect air and gas bubbles in plastic tubes filled with liquid and is intended to prevent air infusions. However, it can also be used as a wet/dry sensor in tubes. The sensor has no contact with the liquid and is suitable for applications in medical and food technology. The sensor is best suited for disposable tubes.

The SONOCHECK ABD05 is designed as a component for fixed installation in machines and equipment and is mechanically and electrically incorporated into the controller.

Any use other than the designated use is prohibited and can result in injury or damage to property. SONOTEC Ultraschallsensorik Halle GmbH accepts no liability for damage, including to third parties, caused by improper handling of the sensor.

3.2 Construction

The exact design of the sensor depends on the tube diameter, the tube hardness and, where required, the medium in the tube. The following designs are available:

- Rectangular design
- Circular design

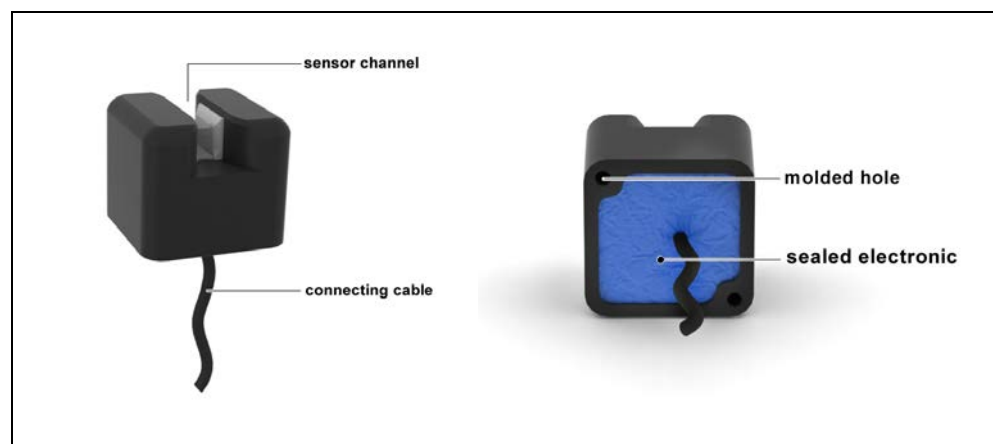


Fig. 1: Version with rectangular design: View from side and below

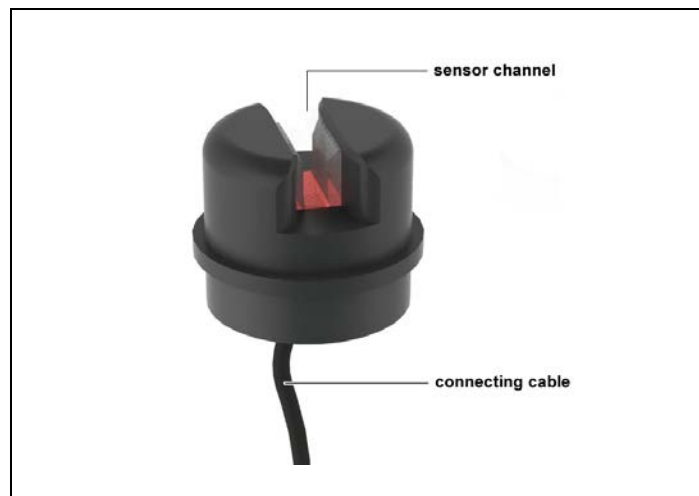


Fig. 2: Version with circular design: View from side

3.3 Measuring method and functioning

An ultrasound method based on short, high-frequency pulses is used for measurement. When liquid is in the tube, part of the ultrasound transmitted passes through the tube to the receiver. When the tube is empty, or if there is a large bubble in the measuring path, the proportion of the ultrasound that reaches the receiver is considerably lower.

The intensity of the ultrasound transmitted into the liquid is low, to ensure that no biological effects occur. The sensor is tested for many media, including applications involving human blood.

The amplitude of the ultrasound pulse that reaches the receiver is evaluated. A defined signal is sent to the connected device. The device responds to the signal and, depending on the application, outputs a warning message.



Notice

Continuous use and significant temperature fluctuations change the flexibility of the tube, the propagation of the measuring signal and therefore the acoustic output conditions. The sensor automatically adjusts itself to these changes.

3.4 Accessories/versions

A “failsafe” version is available as an option for use in medical products, in compliance with EN 60601.

4 Installation

The SONOCHECK ABD05 is designed as a component for fixed installation in machines and equipment and is mechanically and electrically incorporated into the controller.

4.1 Installation position

The sensitivity of the sensor to bubbles depends on the diameter of the tube. In tubes with an internal diameter greater than 2 mm, the installation position needs to be taken into account. For optimum bubble detection, the tube must be inserted vertically, or horizontally for lateral insertion.

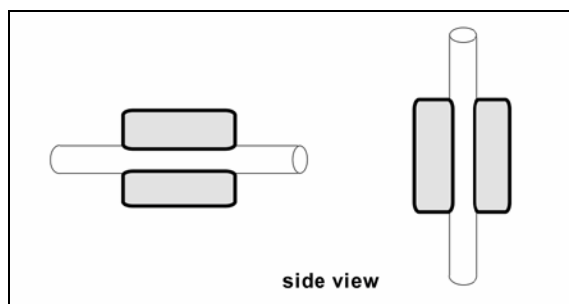


Fig. 3: Recommendation: Channel opening pointing to side, or vertical position

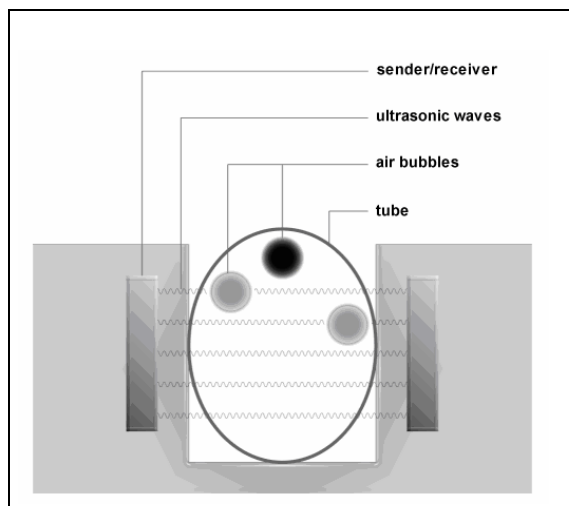


Fig. 4: Low bubble sensitivity

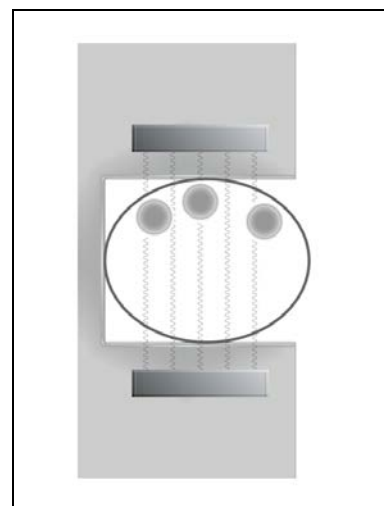


Fig. 5: Good bubble sensitivity

With the correct installation position, bubbles with a size of around 1/3 of the internal tube diameter can be detected.


Example: Outer tube diameter = 6.5 mm
Internal tube diameter = 4.9 mm
→ Bubbles with a volume above around 5 µl are detected with a flow rate of 1 to 1000 ml/min.

4.2 Attaching the sensor

The sensor is attached to the device as follows:

Design	Attachment
Rectangular	Using recessed M4 threaded holes on rear of sensor
Circular	Using appropriate clamping fixture

Table 1: Attachment of different designs

	Notice During operation, the tube must be securely held in the channel opening. If this is not possible due to changes in elasticity, an additional fixture must be installed on the device.
---	--

4.3 Connecting the Sensor

The connecting cable has a fixed connection to the sensor.

Colour	Connection
Red	Operating voltage $+5 \pm 0.2$ VDC
Yellow	Control input (e.g. for reset / LED activation)
White	Output (5 V logic, TTL)
Blue	Ground (GND)
Screening	Must be connected to ground (blue) at terminal

Table 2: Connecting the sensor

4.4 Output specification and settings

The default settings are:

Condition	Signal at output (H/L: TTL output)	LED
Air/bubble	H	Red
Liquid	L	Green
Internal error (self test)	H	Blue


Table 3: Output specification (standard)

Internal settings can be used to configure the sensor for specific customer requirements. For example, the switching output can be connected as a serial output, which results in a differentiated signal output depending on the bubble size detected.

Tools for optimum adjustment are available as optional accessories.

5 Operating the Sensor

5.1 Operating information

	<p>Warning!</p> <p>Incorrect installation and use of the ABD05 sensor and its components can present a hazard for the user.</p> <ul style="list-style-type: none"> • The sensor and the associated tube must be clean and intact during operation. • No liquid may get into the sensor channel. Otherwise, particularly with small channel widths, an acoustic short circuit of the measuring cell can occur, which severely impairs the function. • Using tools or sharp objects to place the tube in the channel is not permitted.
---	--

5.2 Inserting the tube


If no tube is inserted, the sensor in the channel lights up red.

1. The tube is inserted into the measuring cell dry and with no couplings.
2. The tube is attached to the cover (if fitted in the device).

➤ The sensor is ready to operate. When the tube is full, the sensor in the channel lights up green.

➤ If an air bubble is detected, the sensor in the channel lights up red and sends a defined signal to the connected device.

6 Cleaning and disinfection

	<p>Caution!</p> <p>Incorrect cleaning of the ABD05 sensor and its components can present a hazard for the user.</p> <p>Cleaning is prohibited</p> <ul style="list-style-type: none">• in a steam steriliser or with hot steam in general.• with white spirit or acetone• by immersion in solvents or other liquids
---	---

The sensor should be cleaned using standard commercial cleaning agents. Standard commercial spray disinfectants should be used for disinfection.

7 Troubleshooting and maintenance

Output of errors can be adapted to individual requirements.

The sensor has self-test routines and outputs a defined signal if an error is detected:

Condition (standard)	Signal at output (H/L: TTL output)	LED
Internal error (self test)	H	Blue

Table 4: Output in case of error

The SONOCHECK ABD05 is practically maintenance free.

8 Technical Data

8.1 General data

SONOCHECK type ABD05 Air Bubble Detector		
Measuring method	Ultrasound	
Bubble sensitivity	Bubbles larger than 1/3 of internal tube diameter are detected	
Measuring cycle	200 µs	
Response time;	Minimum < 0.5 ms, typical 1 ms	
Holding time	On request: Delays or holding times for bubble events	
Operating temperature	+5 °C to +60 °C	
Storage temperature	-20 °C to +70 °C	
Materials	Housing: Plastic/POM Measuring cell: PMMA Potting: PUR	
Versions / Designs	The sensor version depends on the tube diameter, the hardness of the tube and its wall thickness. If possible, provide us with a sample of the tube so that we can select an optimum design.	
Requirements for liquid	Low-viscosity liquids containing no or few solids	
Requirements for tube	Parameter	Property
	Outer diameter	2.4 to 10.5 mm
	Wall thickness	Optimum 10 to 20% of outer diameter
	Material	Plastic, e.g. PVC, PE, silicone, PUR Other materials on request or after test only
	Special features	Tube must be smooth on outside, no fabric tube
	Elasticity	Tube must be able to adjust flexibly
	Tube is inserted into sensor dry	

Mounting	Rectangular design	2 x recessed M4 threaded holes on rear of sensor	
	Circular design	Appropriate clamping fixture	
Operating voltage	+5 ± 0.2 VDC		
Current consumption	≤ 60 mA		
Protection	IP67		
Connecting cable	Standard: 1 m (other lengths on request) Fixed connection to sensor		
Inputs and outputs	Color	Connection	
	Red	Operating voltage +5 ± 0.2 VDC	
	Yellow	Control input (e.g. for reset / LED activation)	
	White	Output (5 V logic, TTL)	
	Blue	Ground (GND)	
	Screening	Connect to ground (blue) at terminal	
Output specification (default)	Condition	Signal at output (H/L: TTL output)	LED
	Air/bubble	H	Red
	Liquid	L	Green
	Internal error (self test)	H	Blue
Configuration (optional)	Serial interface		
Directives / Standards	The sensors were developed to be tested with respect to the following standards: <ul style="list-style-type: none">• Safety Requirements: IEC 60601-1:2005 (3rd edition)• EMC: EN 60601-1-2:2007 (3rd edition)• Acoustic Output (Ultrasonic): IEC 61157:2007		
Scope of delivery	Air bubble detector type ABD05, channel width and design adapted to tube diameter		
	Operating manual		
Accessories / Options	ABD Monitor for configuration and diagnostics, consisting of: <ul style="list-style-type: none">• USB data converter (type 007_V001)• USB cable, type A-B, length 1.5 m• CD with ABD Monitor software		
	“Failsafe” version available as an option for use in medical products, in compliance with EN 60601.		

Table 5: Technical data for SONOCHECK sensor type ABD05

8.2 Technical drawings

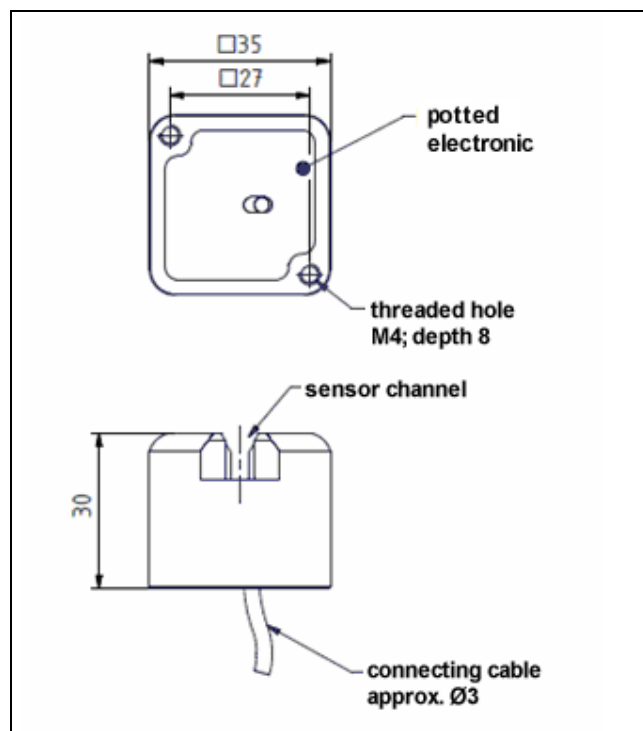


Fig. 6: Version with rectangular design

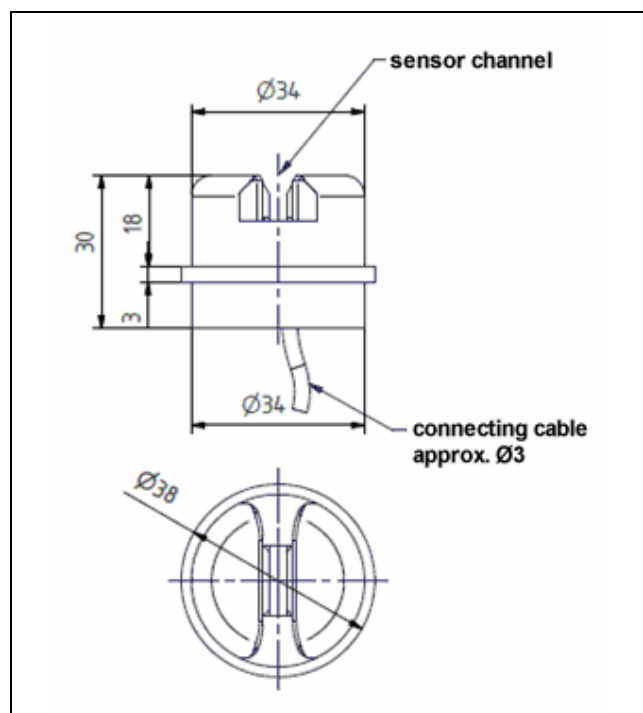


Fig. 7: Version with circular design
(The drawings are not to scale)