

Air Bubble Detector



SONOCHECK[®] ABD06 with Analog Output

User Documentation

Including

Operating Manual
Technical Data Sheet
Certificates

Manufacturer

HEADQUARTERS GERMANY

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

Tel.: +49 (0)345 / 133 17- 0

AMERICAS

SONOTEC US Inc.
190 Blydenburgh Rd
Suite 8, 2nd Floor
Islandia, New York 11749, USA

© SONOTEC GmbH
All rights reserved.

The content of this manual is the property of SONOTEC 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.

Compilation of Documents
Revision: 1.3 | 2023-08-01

Information is subject to change without notice.

Air Bubble Detector



Type SONOCHECK ABD06 with Analog Output Operating Manual

Revision: 1.1 | 2023-08-01
Information is subject to change without notice!

Contents

1 Introduction..... 5

1.1 Notes on this documentation.....5

1.2 Labeling of safety-relevant information7

1.3 Representations in this documentation.....7

2 Safety instructions 8

2.1 Basic hazards.....8

2.2 General safety instructions.....8

2.3 Requirements for personnel and necessary qualifications9

2.4 Prohibition of modifications and alterations9

2.5 Notes on data security 10

3 Sensor description 11

3.1 Intended use..... 11

3.2 Construction 11

3.3 Measuring method and functioning..... 12

3.4 Interfaces and outputs..... 12

4 Optimal mounting position, installation and coupling 13

4.1 Selecting the correct sensor version: measuring channel and tubing 13

4.2 Mounting positions and effects on appearance of bubbles..... 13

5 Installation..... 15

5.1 Mounting the sensor..... 15

5.2 Connecting of the sensor 15

6 Operating the Sensor 16

6.1 General operating information..... 16

6.2 Inserting the tube 16

6.3 ‘Initial Test’ after power on or restart..... 17

6.4 Cleaning and disinfection 17

6.5 Troubleshooting and maintenance..... 18

| | | |
|----------|--|-----------|
| 7 | Dismantling, storing and disposing of sensors | 19 |
| 7.1 | Dismantling the sensors..... | 19 |
| 7.2 | Storing and transporting sensors | 19 |
| 7.3 | Disposing of the sensors..... | 19 |
| 7.4 | Service and support | 20 |
| 8 | Manufacturer information | 21 |

1 Introduction

The following section explains the function, structure and relevant information types of this documentation. This is intended to make it easier to find information.

1.1 Notes on this documentation

Purpose of the following information

The following contents are an integral part of the product.

They contain important and necessary instructions for safe operation. Before any application, each user must read and understand the contents. All rules and regulations must be strictly followed.

In addition, you will find information and guidance necessary for proper and efficient use.



NOTE

Even if commissioning and usage seem to be largely self-explanatory – not all functions are perfectly transparent at first glance. In addition, some action steps require deeper knowledge of the scope of functions. Read all details carefully to take advantage of all supported features and use them optimally for your application.

Scope of the documentation

The following information is part of the 'User Documentation' of SONOTEC sensors and associated accessories, e.g. software for parameterization. Components of this 'User Documentation' are (depending on the scope of order and application):

- 'Operating Manual' (instructions for safety, trouble-free installation and operation)
- 'Technical Data Sheet' (lists specifications of the sensors standard version)
- 'Customer Specification' (deviations from the SONOTEC standard, optional)
- Certificates proving special product properties

Please contact us if you find inaccuracies in these documentations and if parts or content are missing. We will be happy to help you.

Accessibility

All staff working with the sensors must have constant access to this information to prevent handling errors and guarantee trouble-free operation. Ensure that all required information – especially the safety instructions – is available to all persons working with the sensors.

User groups can be depending on the application:

- Device and system developers planning the adaption and integration of the sensors,
- Technicians who install the sensors in devices and systems,
- Personnel who, for example, have to change the tubing during operation.

Up-to-dateness

Every effort has been made to ensure that the information contained in this documentation is complete and correct at the time of release. This documentation describes all units and functions known at the current point of time.

The information is subject to change without notice in the course of continuous product development. The information is not subject to an automatic change service.

Standard version and customer-specific adaptations

The 'Technical Data Sheet' lists standard sensor types with

- Dimensions and calibration for typical tubing diameters/materials as well as
- Different interfaces for sensor integration.

The implemented parameter sets have been tested many times for numerous applications.

If the sensors are not suitable for a planned application, they can be adapted by SONOTEC or partly by the customer (e.g. by parameter changes via additional software). Deviations of the standard sensors ex works are listed in the 'Customer Specification'.

1.2 Labeling of safety-relevant information

If and where hazards to users exist, the relevant information and instructions for prevention are specifically labeled according to the level of risk.
The hazard level is indicated by different signal words and colors.

**DANGER**

Warns of immediate danger, which, if ignored, may lead to death or serious injury.

**WARNING**

Warns of possible immediate danger, which, if ignored, may lead to lasting damage to health and/or property – including financial losses due to operational impairment.

**CAUTION**

Warns of dangers, which, if ignored, may lead to injury or damage to property – including damage to property due to operational interruptions.


**ATTENTION**

Warns of dangers, which, if ignored, may lead to damage to property – including damage to property due to operational interruptions.

General structure of warning messages:

SIGNAL WORD

Type of the hazard and source. Probable consequences of non-observance. Instructions for avoiding the hazard.

The safety alert symbol  in combination with the listed signal words indicates hazards that can occur during individual work steps.

1.3 Representations in this documentation

Illustrations and sample data

The illustrations used do not always include all details or special cases (e.g. in the case of deviating specifications of a product series). To explain the basic design or functionality, only the relevant information is shown in some cases.

Due to the many possible different applications, not every individual case can be described. Examples (e.g. parameters or measurement data) should enable a better understanding of functions and applications.

Notes (tips)

Tips are marked as follows:

**NOTE**

This paragraph draws attention to special features.

2 Safety instructions

The reliable and safe operation of sensors and all accessories depend on the observation of all safety regulations as well as the careful handling and execution of all operational tasks.

▲ Ensure to carefully read and understand all information provided by the manufacturer in the parts belonging to the user documentation.

2.1 Basic hazards

The sensors comply with the current state of the art and applicable safety regulations. All components are tested thoroughly before they leave the factory and are delivered in a condition for safe operation.

However, residual risks can never be completely eliminated by the manufacturer because

- not all details of the application or the installation site are known
- the circumvention of integrated protective measures cannot be ruled out by the design of the equipment
- operating errors can occur due to carelessness even after instruction of all users and with safety-conscious, intended use.

▲ It is essential to observe all safety instructions and warnings in the user documentation as well as applicable regulations for the application environment.

Failure to comply with safety instructions can, in the worst case, lead to serious injury with lasting health consequences for personnel as well as malfunctions, damage or destruction of sensors or components. Depending on the application, this may have unforeseeable consequences. Serious financial consequences due to business interruptions can also not be ruled out in this case.

2.2 General safety instructions

Incorrect installation and use of the sensor and its components can present a hazard for the user. The following basic safety instructions apply:

- Install and operate the sensors only if you have the required qualifications and experience.
- Valid technical standards and applicable installation regulations must be observed. Ensure that the sensor is installed in such a way as not to impair safe use. The plant operator is responsible for the legal compliance of the installation and the documentation.
- All conditions specified in the 'Technical Data Sheet' must be observed without exception. Exceeding or falling below the specified limit values, even temporarily, is not permitted.
- Never use the sensors in potentially explosive atmospheres. If you have sensors that are certified for potentially explosive atmospheres and sensors that are not, make absolutely sure that the sensor types cannot be interchanged. Observe the corresponding labeling.

- When installing sensors in systems with increased mechanical hazards: If applicable, choose a protected installation position or protect the sensors and all associated accessories from damage (e.g. by covering them).
- The sensor must be installed so that it is protected from sunlight, UV light sources and intense artificial lighting to avoid material aging.
- The sensor must only be operated together with the belonging cover (included). The lid must be completely closed and securely fixed.
- The sensor must always be kept clean. There must never be any liquid in the channel during operation. Liquid can trigger an acoustic short circuit and massively impair the measuring function of the sensor.
- The sensors and accessories must never be immersed.
- Do not use the sensors and their accessories if they show visible damage. Take the sensors and accessories out of operation immediately in the rare event that functional errors occur.
- The sensors and accessories must never be opened. They do not contain any user-serviceable parts. Repairs must always be carried out by the manufacturer.
- Sensor settings and parameters can be changed using software. Never change settings before you have saved the default settings. Be sure to observe the corresponding documentation.

Further safety instructions that must be observed can be found before the corresponding steps, if applicable. They are specially marked. For more details, see the introductory section.

2.3 Requirements for personnel and necessary qualifications

All tasks involved in

- the adaptation of the sensors to the planned measuring task (parameterization or calibration),
- installation of the sensors and electrical connection and
- operation of the sensors (e.g. changing the tube or cleaning)

must only be performed by personnel qualified for the special task. All groups must have read and understood the entire 'User documentation'. Authorized persons must be instructed for the relevant work steps. All necessary information from the manufacturer must be made available.

2.4 Prohibition of modifications and alterations

The sensors and its accessories must never be opened or disassembled. The equipment does not contain any components to be cleaned, maintained or repaired by the operator. Any modifications to the sensors (e.g. to the potting, connectors or cables) or to the accessories are prohibited. In this case, safe operation can no longer be guaranteed. SONOTEC is not liable for any resulting damage or consequences.

Modifications to the software used are prohibited. The software or individual parts of it must never be disassembled, decrypted or decompiled.

2.5 Notes on data security

Based on analysis of vulnerabilities according to IEC 62443-4-1 and IEC 62443-4-2, no cyber security measures are necessary. However, a direct cyber-attack or tampering with the application environment cannot be completely ruled out.

Thus, we strongly recommend to implement safety measures (e.g. anti-virus programs, firewalls, access restrictions) against potential cyber-attacks within the application environment.

3 Sensor description

3.1 Intended use

The air bubble detector SONOCHECK ABD06.xxx with analogue output is used to detect air, gas bubbles and foam in liquid filled tubes made of synthetic materials. It also serves as wet/dry indicator. Industrial applications in the automation, semiconductor or food and beverage industry (e.g. filling processes of glue, paint and lubricants) are typical.

The SONOCHECK ABD06 with Analog Output is designed as a component for fixed installation in machines and equipment and is mechanically and electrically incorporated into the controller. The sensor has no contact with the liquid.

In comparison to standard sensors of SONOCHECK ABD06 the sensors described in the following have a configurable analogue output for the distinction of bubble size. The sensors are suitable especially for the use on hard plastic tubing and under harsh process conditions (pressure, flow rate, vibration).

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

3.2 Construction

The selection of the exact sensor design (width of measuring channel and cover version) depends on the tube diameter, the hardness of the tube and its wall thickness. The following designs are available (other on request):

- Sensor with hinged cover
- Cover with screws



Figure 1: Versions of SONOCHECK ABD06.xxx with analogue output

A list of sensor versions and typical tubing sizes can be found in the 'Technical Data Sheet'.

3.3 Measuring method and functioning

An ultrasonic method based on short, high-frequency pulses is used.

When liquid is in the tube, a detectable part of the ultrasonic sound is transmitted from the emitter through the tube to the receiver. The minimum value of the received signal amplitude is recorded in a defined period. The integrated electronics of the sensor evaluates the signal and sets the output accordingly.

Bubbles in the liquid stream or an empty tube result in a reduction of the signal as the ultrasound is significantly attenuated by air. So, the proportion of ultrasound that reaches the receiver is considerably lower – how much depends on the bubble size as well.

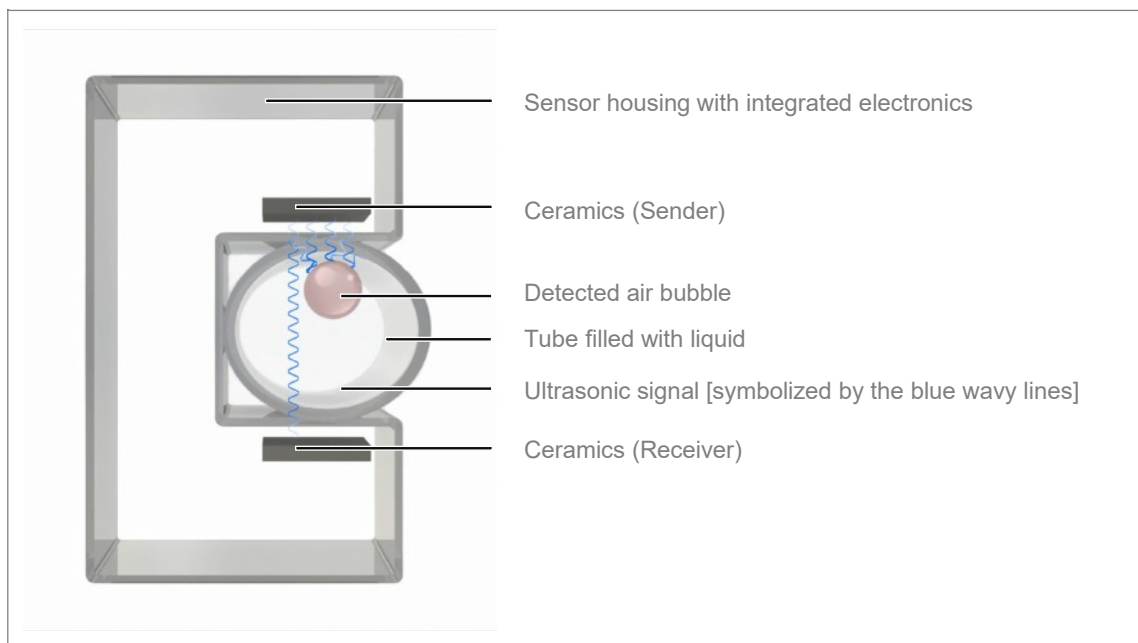


Figure 2: Sensor design and function [symbolic representation without cover]

3.4 Interfaces and outputs

The service interface is not needed in measuring mode. It is used for servicing for changing settings or for diagnostic purposes only.

The sensor configuration can be adapted to individual operating conditions. As soon as a communication via the serial interface is built up, e. g. the following parameters can be adjusted with the help of the ABD Monitor: bubble sensitivity, parameters depending the adaption to the right kind of tube, response time/ holding time for output/ state of output or internal control, e.g. for optimizing the behavior in the event of pressure fluctuations in the tube.

The ABD Monitor (software) for the adjustment of the sensor parameters is available as optional accessory.

4 Optimal mounting position, installation and coupling

⚠ WARNING

No or low bubble sensitivity due to liquid in measuring channel poor coupling of ultrasound or incorrect installation possible.

Failed bubble detection can pose a serious danger.

Read the following chapters carefully and observe all requirements.

4.1 Selecting the correct sensor version: measuring channel and tubing

The reliable detection of bubbles and the bubble sensitivity depend among other conditions on the selection of the correct sensor version.

Only if the sensor channel and the cover match the tube (depending on outer diameter and hardness), the coupling surface is large enough to couple sufficient ultrasound into the tube.

4.2 Mounting positions and effects on appearance of bubbles

The bubble sensitivity of the sensor depends among other things (e.g. settings) on the tube parameters – diameter, material and hardness – but as well on the mounting position (compare the following figures).

**NOTE**

The mounting position influences the bubble sensitivity. To ensure high bubble sensitivity, prevent sharp bends of the tubing within 5 cm before and after the sensor.

Also, the flow velocity in cases of extremely low flow (< 1 cm/s) or fast flow (> 3 m/s) can have an impact on the bubble sensitivity.

By parameterization with the help of ABD Monitor the bubble sensitivity can be adapted to various applications.

According to physical principles bubbles typically move along the highest path in the tube.

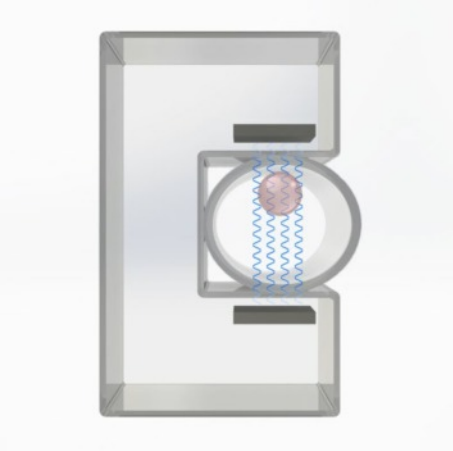
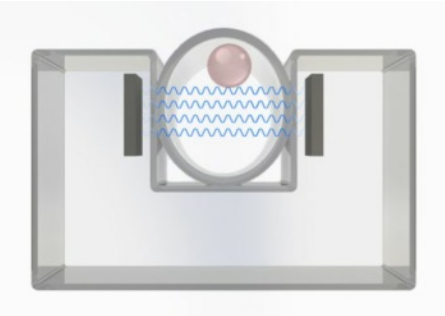
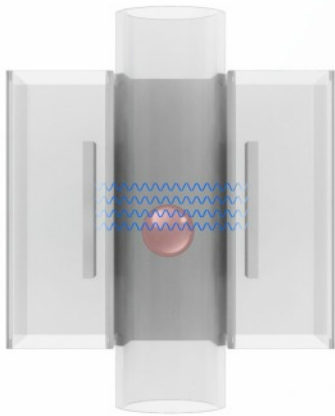
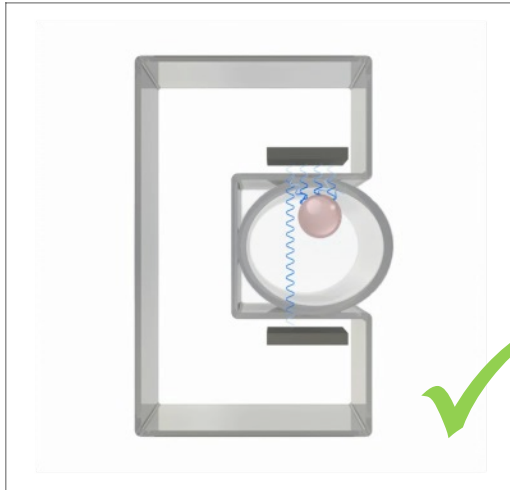
| | |
|--|--|
| <p>High Bubble Sensitivity</p> <p>Lateral sensor positioning with sideways aligned measuring channel and lateral insertion direction of the tube:</p> <p>Bubbles pass the ultrasonic sound field (symbolized by the blue wavy lines) in center of the measuring channel</p> <p>→ Even small bubbles are detected</p>  | <p>Low Bubble Sensitivity</p> <p>Smaller air bubbles do not pass the ultrasonic sound field in the center of the measuring channel</p> <p>→ Bubbles with a diameter larger than 30 ... 50 % related to the inner diameter of tube will be detected. Small bubbles are not being detected reliably.</p>  <p>Example:</p> <p><i>Outer diameter of tube = 14.0 mm</i> <i>Inner diameter of tube = 10.0 mm</i></p> <p>Bubbles larger than approx. 4 mm are detected at a flow rate of 0.05 ... 10 l/min.</p> |
| <p>Bubble Sensitivity with Vertical Tube Insertion (flow direction upwards):</p> <p>High bubble sensitivity only in case of exact vertical position of sensor (and machine) plus high flow rates!</p> <p>⚠</p> <ol style="list-style-type: none"> 1. If the mounting position is only slightly hanged (tilted position) bubbles change their path within the tube. They move along the tube wall – sideways or above (compare right picture above). 2. The fluid and bubble behaviour change as well in case of low flow rates. It is not ensured that the bubbles pass the ultrasonic sound field in every case.  | |

Figure 3: Examples for high and low bubble sensitivity [symbolic representation – not in scale and without cover]

5 Installation

The sensor is designed as a component for the integration into machines and equipment. It is mechanically and electrically integrated into the control system of a device.

Recommended installation:



→ **Tubing fits in the measuring channel:** coupling surface is sufficiently large for the coupling of ultrasound, tube is not squeezed.

→ **Recommended sensor orientation:** Bubbles move along the highest path in the tube within the sound path.

→ **Tube and measuring channel are dry** and clean.

→ **Sensor cover is closed** (without picture).

⚠ Observe all relevant safety instructions and explanations!

Figure 4: Good bubble sensitivity [symbolic representation: without cover, not in scale, blue wavy lines = ultrasonic path]

5.1 Mounting the sensor

⚠ For details regarding the mounting position observe the 'Safety instructions' and the corresponding section 'Optimal mounting position'.

The sensor has to be mounted by screws using the recessed threaded holes on the rear of the sensor. For dimensions please refer to the 'Technical Data Sheet'.

5.2 Connecting of the sensor

ATTENTION

Use the service lines (compare with pin assignment in the Technical Data Sheet) only in combination with the USB Data Converter. Otherwise, the sensor could be damaged.

The cables of service interface are not needed in normal operation. They must not be connected and must be attached securely to a free terminal. Ensure that the cables of the service interface never come in contact with the operating voltage or with the switch output.

The sensor has to be connected via the 5 pin M12 sensor cable (see Technical Data Sheet for the assignment of pins).

The Power Consumption is limited by an internal fuse inside of the sensor to max. current of 200 mA. The fuse is resettable, type 'BOURNS, MF-R010'. In case of serious electrical fault, the integrated fuse limits current to less than 200 mA.

6 Operating the Sensor

6.1 General operating information

⚠ WARNING

Incorrect installation and use of the sensor and its components can constitute a hazard to the user:

- The sensor and the associated tubing must be clean and intact during the operation.
 - The sensor channel must be kept free of liquids. Otherwise, particularly with small channel widths, an acoustic short circuit of the measuring cell can occur. This might severely impair the functionality of the sensor.
 - The sensor must only be operated together with the appropriate cover (included).
 - It is forbidden to use tools, especially sharp tools (e. g. screw driver or scissors) to press the tubing into the channel. It is only allowed to press the tubing by hands.
-

Neither coupling gel nor any other liquid is allowed in the channel of the sensor for coupling, as it might cause an acoustic short circuit, which would strongly disturb the functionality of the sensor.

**NOTE**

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

Prevent pulling or torsion movements on the tube.

6.2 Inserting the tube

1. Inserted the tube dry into the measuring channel, without coupling gel and without using any sharp tools.
 2. Close the cover of the sensor.
- ↪ The sensor is ready for operation. When the tube is fulfilled with liquid, the corresponding signal is sent to the connected device.
 - ↪ If an air bubble is detected, the sensor sends defined signals to the connected device.

Larger amounts of foam in the liquid will be detected as air.

6.3 'Initial Test' after power on or restart

After power on or restart the sensor is ready for measuring within approximately 1.5 seconds.

**NOTE**

The sensor starts with 'Init Interval', which takes approximately 1 second. Then the 'Initial Test' is performed, which takes max. 0.5 seconds. After that the normal operation mode is started.

Additional to initial test after power on several internal cyclical self-test routines are implemented. The Failure Tolerance Time is (FTT) < 300 ms. For example, following cyclical self-test routines are active:

RAM Test - Prevention against improper cells in RAM

CPU Test - Prevention against improper functionality of commands in the CPU of MCU

In case of permanent operation, it is recommended to restart the sensor regularly.

↪ Restart the sensor to perform the implemented self-test routines.

6.4 Cleaning and disinfection

⚠ WARNING

Incorrect cleaning of the sensor can demolish the sensor or impact the functioning. The consequences can constitute a hazard to the user or damage device components.

Cleaning is prohibited:

- in a steam sterilizer, with hot steam in general or by ethylene oxide, gamma- or beta-sterilization
 - with white spirit, acetone or acetone-based solutions
 - by immersion in solvents or other liquids.
-

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

6.5 Troubleshooting and maintenance

The error handling can be adapted to individual requirements. The sensor has self-test routines and sets defined output signals if an error is detected.

The SONOCHECK ABD06 with Analog Output is maintenance-free.

In case of major problems, please contact our support (see last chapter).

Keep available:

- Sensor type | HW Version | serial number.
(Please find the information on the type label)
- If you use ABD Monitor software and if available: exported measurement data
- Brief description of failure

7 Dismantling, storing and disposing of sensors

Instructions for disassembly, storage and disposal can be found in the following sections.

7.1 Dismantling the sensors

1. Disconnect operating voltage.
2. Unscrew the cable connector and unplug the sensor cable.
3. To dismount the sensor: Remove the screws on the rear side, if required.

7.2 Storing and transporting sensors

The sensors are delivered in appropriate packaging material. Use the original or an appropriate packaging material to protect all parts. Observe the required environmental conditions listed in the 'Technical Data Sheet'.

Use the original packaging as well for dispatch. In case the material is not available, please contact us before.

7.3 Disposing of the sensors

Electrical and electronic devices may pose a risk to health and the environment if disposed of incorrectly. Therefore, they cannot be disposed of as domestic waste according to WEEE Directive 2012/19/EU (Waste Electrical and Electronic Equipment Directive). Instead, they must be taken to designated collecting points or returned to the manufacturer.

They must undergo specified recycling processes (e.g., with respect to batteries or circuit boards) which enable safe, environmentally compatible re-use or separate disposal of different device elements.



The return of used equipment is regulated differently in the individual countries and regions. Find out about the return conditions for commercially used electrical appliances at the local authorities and other responsible public bodies.

The sensors and its accessories contain no toxic substances requiring separate identification for disposal such as mercury (Hg), cadmium (Cd), lead (Pb) or chrome 6 (e. g., in plated parts or circuit boards).

7.4 Service and support

Please find our contact details in the last section of this documentation.

Further information can be found on our web pages:

SONOTEC worldwide www.sonotec.eu

SONOTEC USA www.sonotecusa.com

Homepage Products Non-Invasive Fluid Monitoring Service: Calibration Service & Repair

- Calibration and recalibration
- Inspection and repair
- Technical support

Feel free to contact us! We will be happy to help you.

8 Manufacturer information

Copyright

© SONOTEC GmbH
All rights reserved.

All contents of this documentation are property of SONOTEC GmbH and are protected by copyright. Duplication, modification and/or distribution in any form, particularly for reprint, for photographic, mechanical or electronic reproduction or in the form of saving in data processing systems or data networks is forbidden without written approval by SONOTEC GmbH.

Certifications and registrations

- Quality management according to EN ISO 13485:2016
(Registration No.: SX 1625253-1)
- Quality management according to ISO 9001:2015
(Certificate Registration No.: 091006014)
- Acceptance notification of quality assurance production process according to ATEX Directive 2014/34/EU (No.: IBExU20ATEXQ021)
- Registration according to ElektroG at the 'stiftung elektro-altgeräte register' (ear):
WEEE Reg. No. DE 22125904

Contact

Manufacturer

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

Phone: +49 345 13317-0
sonotec@sonotec.de

www.sonotec.eu

USA

SONOTEC US Inc.
190 Blydenburgh Rd.
Suite 8, 2nd Floor
Islandia, New York 11749, USA

Phone: +1 631 4154758
sales@sonotecusa.com

www.sonotecusa.com

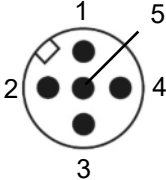
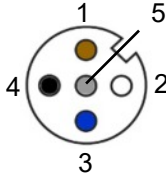
This page has been deliberately left empty.

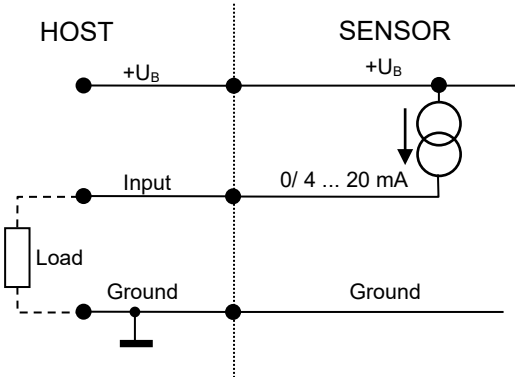
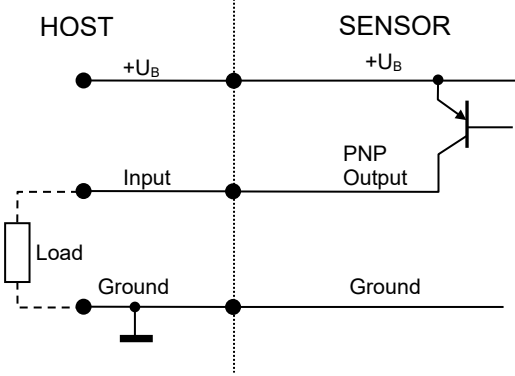


The air bubble detector SONOCHECK® ABD06.xxx with analogue output is used to detect air, gas bubbles and foam in liquid filled tubes made of synthetic materials. It also serves as wet/dry indicator. Typical applications are in **biotechnology** or industrial applications in the automation, **semiconductor or food and beverage industry** (e.g. filling processes of glue, paint and lubricants) are typical. The SONOCHECK® ABD06 with analog output is designed as a component for fixed installation in machines and equipment. The sensor has no contact with the liquid. The sensors have a configurable analogue output for the **distinction of bubble size** in a wide range and are suitable especially for the **use on hard plastic tubing** and under harsh process conditions (concerning pressure, flow rate, vibration).

Technical data

| ABD06.xxx with Analogue Output Air Bubble Detector | |
|---|---|
| Measuring method | Ultrasound |
| Bubble sensitivity | Bubbles larger than approx. 1/3 of the inner tube diameter are detected (depending on tube properties, application and process characteristics) |
| Measuring cycle | 200 µs |
| Response time / Holding time | Minimum 0.2 ms, maximum 2 ms, typical 1 ms (Furthermore, the holding time can be set in order to increase the duration of the output signal.) |
| Operating temperature | +5 °C ... + 60 °C |
| Storage temperature | -20 °C ... +70 °C |
| Materials | Housing: Plastic, PET black (ABD06.102: PVC grey) Cover: Plastic, POM black, (ABD06.116 / ABD06.123: PET black; ABD06.102: PVC grey) Potting: PUR Cover clasp: stainless steel Handle (screw clamp): Plastics, PA, steel |

| | | | |
|--|---|--|-------------------------------------|
| Requirements for tube (provide us with a tube sample, if possible; list of sensors and tubing properties behind) | Parameter | Property | |
| | Material | Hard or soft plastic tubes (e.g. PTFE, FEP, PFA, PVC, Silicone, PUR, PE, reinforced tubing; other materials on request or after test only) | |
| | Special features | Tube must be smooth on outside, no fabric tube | |
| | Wall thickness | Depending on application, optimal 10... 20 % of outer diameter for typical usage | |
| | Tube is inserted into sensor dry, no coupling medium required | | |
| Requirements for liquid | Water, saline, other solutions, paint, glue or low-viscosity liquids containing no or few solids in general. | | |
| | <p>i NOTE! For applications with high-viscosity liquids (e.g. fats/special paints) screening tests must be made. Large amounts of foam in the liquid will be detected as air.</p> | | |
| Protection | IP67 | | |
| Operating voltage | +12 ... 30 VDC, ripple max. 10 %, protection against reverse polarity | | |
| Current consumption | Max. 50 mA (without switching current) | | |
| Connecting cable | M12 sensor cable, 5 pins | | |
| Pin assignment | <i>Male connector at the sensor</i>  | <i>Female connector at the cable</i>  | |
| | Pin | Colour | Connection |
| | 1 | Brown | Power supply voltage +12 ... 30 VDC |
| | 2 | White | RS-485 A |
| | 3 | Blue | Ground |
| | 4 | Black | Output |
| | 5 | Grey | RS-485 B |
| | Shielding | If available: must be grounded on the side of host. | |
| Outputs (specification can be adopted with the Monitor software) | Configurable as: <ul style="list-style-type: none"> • Current output 0/4 ... 20 mA (default factory setting) • Switching output PNP/ PWM output (max. 25 mA): period 1 kHz, modulation 0 ... 100 % • Voltage output 0/2 ... 10 V • RS-485 service interface (default factory setting) | | |

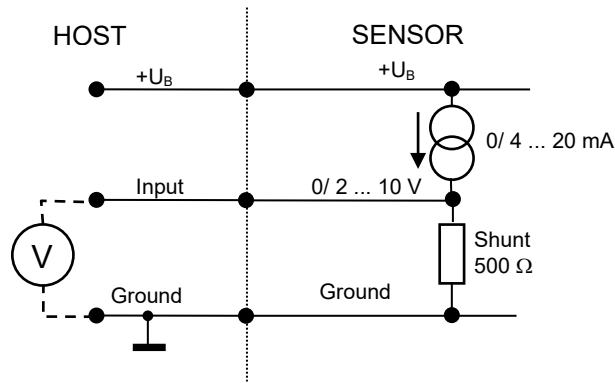
| <p>Configuration as: Current output (factory setting)</p> | <p>The current output can be configured in the range of 0 ... max. 25 mA</p>  <p>Example: Measuring range 4 ... 20 mA / error output 0 mA or 22 mA</p> <p>CAUTION! Pay attention to the max. load depending on the operating voltage: 12 V: 0 ... 400 Ω 24 V: 0 ... 200 Ω 30 V: 0 ... 100 Ω</p> | | | | | | | | |
|--|--|-------|---------------------|-------------|-------|-------|--------|----------------------------|-------|
| <p>Output specification (default configuration)</p> | <table border="1"> <thead> <tr> <th>State</th> <th>Current output</th> </tr> </thead> <tbody> <tr> <td>Air/ Bubble</td> <td>20 mA</td> </tr> <tr> <td>Fluid</td> <td>4 mA</td> </tr> <tr> <td>Internal error (self-test)</td> <td>0 mA</td> </tr> </tbody> </table> | State | Current output | Air/ Bubble | 20 mA | Fluid | 4 mA | Internal error (self-test) | 0 mA |
| State | Current output | | | | | | | | |
| Air/ Bubble | 20 mA | | | | | | | | |
| Fluid | 4 mA | | | | | | | | |
| Internal error (self-test) | 0 mA | | | | | | | | |
| <p>Configuration as: Switching output / PWM output</p> | <p>PNP und PWM, switching current max. 25 mA</p>  <p>NOTE! In the event of a short circuit the current is limited internally to approx. 33 mA</p> | | | | | | | | |
| <p>Output specification (default configuration)</p> | <table border="1"> <thead> <tr> <th>State</th> <th>Level of PNP-Output</th> </tr> </thead> <tbody> <tr> <td>Air/ Bubble</td> <td>+24 V</td> </tr> <tr> <td>Fluid</td> <td>Ground</td> </tr> <tr> <td>Internal error (self-test)</td> <td>+24 V</td> </tr> </tbody> </table> | State | Level of PNP-Output | Air/ Bubble | +24 V | Fluid | Ground | Internal error (self-test) | +24 V |
| State | Level of PNP-Output | | | | | | | | |
| Air/ Bubble | +24 V | | | | | | | | |
| Fluid | Ground | | | | | | | | |
| Internal error (self-test) | +24 V | | | | | | | | |

**Configuration as:
Voltage output**

The current output is used as voltage output. Internally a shunt (500 Ω) is connected to output.

The voltage output can be configured in the range of 0 ... max. 12.5 V.

Example: Measuring range 2 ... 10 V / error output 0 V or 11 V

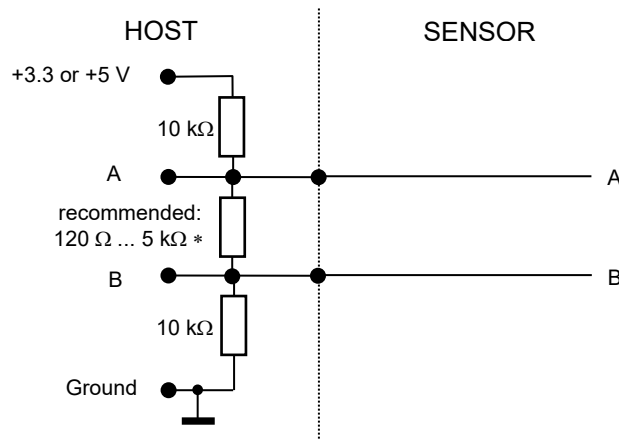


CAUTION! Pay attention to the internal resistance (shunt) at the connection of voltage output. Adhere to the maximum output voltage depending on the operating voltage: 12 V: 0 ... 9 V | 14 V: 0 ... 10 V | 18 V: 0 ... 12.5 V

RS-485 service interface

Half-duplex operation / 115.200 baud / no parity / 1 stop bit / no handshaking / Bus operation not possible

Recommended electrical connection of the RS-485 interface



* According to bus standard: depending on number of sensors and cable length

NOTE! For details of the protocol please contact our service. If the interface is not used, the two pins A and B shall remain open.

| | |
|--------------------------------------|---|
| <p>Directives / Standards</p> | <p>Electromagnetic compatibility, tests in compliance with DIN EN 61326-1: 2013</p> <p>EN 61000-4-3 EMC, radiated radio-frequency - electromagnetic field immunity, test result A, test with 10 V/m (0.15... 1000 MHz)</p> <p>EN 61000-4-4 EMC, electrical fast transient/burst immunity test, test result A (see restrictions below)</p> <p>EN 61000-4-6 EMC, immunity to conducted disturbances, induced by radio-frequency fields, test result A, test with 10 V/m</p> <p>EN 55011 Electromagnetic disturbance characteristics, limit 30 dBµV/m</p> <p>i NOTE! For testing typical settings for bubble detection have been applied. The interference 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.</p> |
| <p>Scope of delivery</p> | <ul style="list-style-type: none"> • Bubble detector type ABD06.xxx with analogue output, • Cover with screws / hinged cover / hinged cover and handle, dimensions adjusted to sensor and tube • User documentation |
| <p>Accessories / Options</p> | <p>M12 sensor cable, 5 pins, length 2 m / 5 m / 10 m</p> <p>ABD Monitor, consisting of:</p> <ul style="list-style-type: none"> • USB Data Converter Type 011 (for RS-485) • Power supply • USB cable, type A-B, length 2 m • Software ABD Monitor <p>With the help of software ABD Monitor (optional) for configuration of the sensors and assistance in diagnostics:</p> <ul style="list-style-type: none"> • Bubble sensitivity (threshold air / liquid) • Response time / holding time for output conditions • Output specifications, e.g. of serial output, switching output or PWM value <p>Furthermore measurement values can be recorded for diagnosis.</p> |
| <p>Customization</p> | <p>Customized modifications for special applications upon request (e.g. adapted channel width, individual output specifications or settings)</p> |

Overview of sensor and tubing dimensions

The sensors series ABD06 are suitable for a variety of tubes.

The sensor version depends on the tube diameter, the hardness of the tube and its wall thickness. Please note, that because of diverse tubing dimensions and materials an aptitude test has to be made. Please provide us with a tube sample (minimum length 30 cm) and contact our service to find the appropriate sensor and cover.

Note, that the cover is necessary to fix the tubing in the measuring channel to ensure correct coupling. The cover sizes and the bridge as well depend on the tubing properties and the application. Contact our Service to determine the correct cover and order number.

Dimensions, listed in the following, are guiding values:

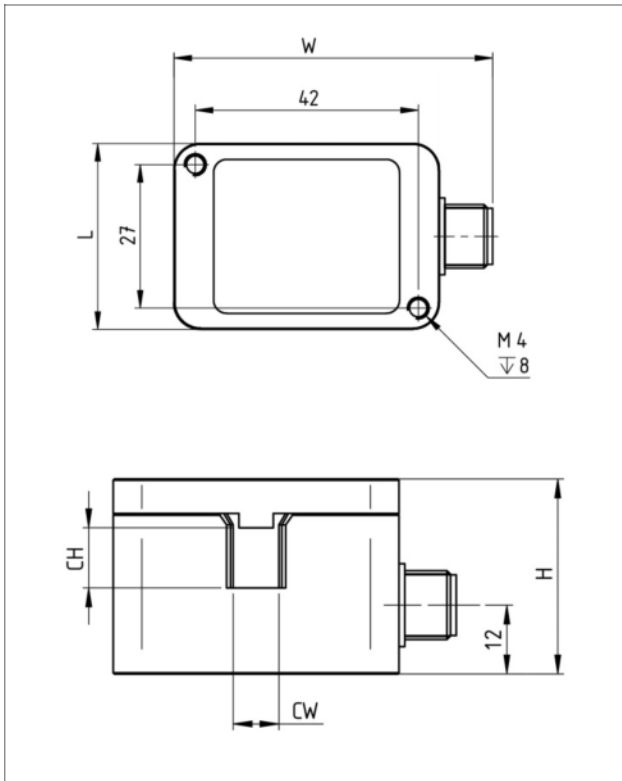
| SONOCHECK® type | Sensor | | Tube Dimensions [mm] | | Tube Dimensions [inch] | |
|--|---------|---------|----------------------|------------------|------------------------|-------------------|
| | CW | CH | OD | ID | OD | ID |
| Sensors with screw cover | | | | | | |
| ABD06.115 | 5.6 mm | 11.0 mm | 6.0 ... 9.5 mm | 2.5 ... 7.0 mm | 0.235" ... 0.375" | 0.1" ... 0.275" |
| ABD06.114 | 8.0 mm | 13.0 mm | 8.0 ... 11.5 mm | 4.0 ... 9.0 mm | 0.315" ... 0.455" | 0.175" ... 0.355" |
| ABD06.119 | 11.0 mm | 17.0 mm | 12.0 ... 16.0 mm | 6.0 ... 11.0 mm | 0.470" ... 0.630" | 0.235" ... 0.435" |
| Sensors with hinged cover | | | | | | |
| ABD06.122 | 3.4 mm | 6.5 mm | 3.9 ... 5.5 mm | 1.6 ... 4.5 mm | 0.156" ... 0.219" | 0.063" ... 0.172" |
| ABD06.125 | 5.2 mm | 8.0 mm | 5.9 ... 7.9 mm | 2.0 ... 6.4 mm | 0.234" ... 0.313" | 0.078" ... 0.250" |
| ABD06.120 | 7.2 mm | 11.5 mm | 8.0 ... 11.0 mm | 3.5 ... 8.0 mm | 0.315" ... 0.435" | 0.140" ... 0.315" |
| ABD06.117 | 12.0 mm | 15.5 mm | 13.0 ... 16.0 mm | 6.5 ... 13.0 mm | 0.500" ... 0.630" | 0.255" ... 0.510" |
| ABD06.121 | 15.5 mm | 20.0 mm | 16.0 ... 22.0 mm | 10.0 ... 17.0 mm | 0.630" ... 0.865" | 0.395" ... 0.670" |
| Sensors with handle (screw clamp) | | | | | | |
| ABD06.102 | 24.5 mm | 19.5 mm | 25.4 ... 28.6 mm | 15.9 ... 22.2 mm | 1.000" ... 1.125" | 0.625" ... 0.875" |
| ABD06.116 | 26.0 mm | 28.0 mm | 26.6 ... 34.5 mm | 19.1 ... 25.4 mm | 1.050" ... 1.360" | 0.750" ... 1.000" |
| ABD06.123 | 32.0 mm | 28.0 mm | 34.5 ... 35.7 mm | 25.4 ... 27.0 mm | 1.360" ... 1.405" | 1.000" ... 1.050" |

Abbreviations: CW = channel width at the narrowest part of the channel; CH = channel height; OD = outer diameter; ID = inner diameter

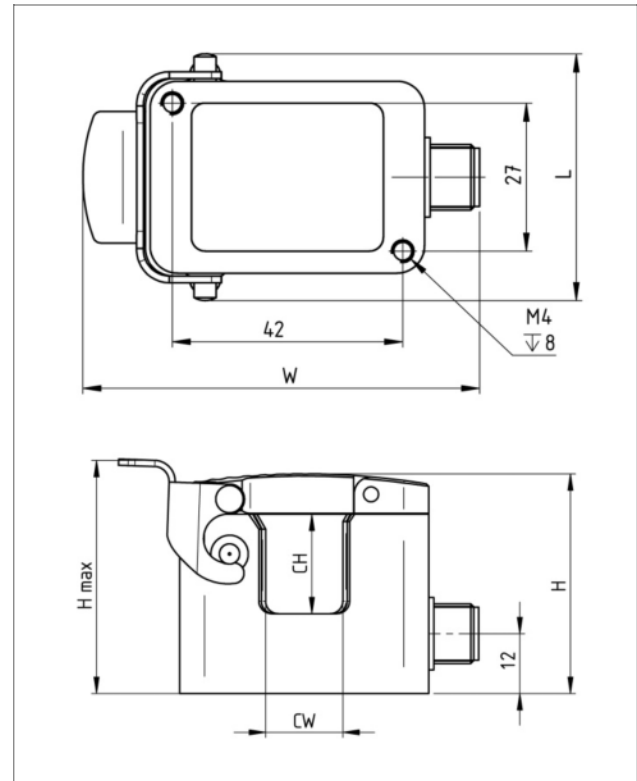
| SONOCHECK® type | Product No. | Dimensions L x W x H [H max] | Mounting Sc W Sc L (threaded holes on rear side, see technical drawings) |
|--|-------------|---------------------------------|---|
| Sensors with screw cover | | | |
| ABD06.115 | 200 02 0116 | 35 x 50 x 32 mm | 2 x M4, depth 8 mm 42 mm 27 mm |
| ABD06.114 | 200 02 0114 | 35 x 50 x 34 mm | |
| ABD06.119 | 200 02 0125 | 35 x 50 x 38 mm | |
| Sensors with hinged cover | | | |
| ABD06.122 | 200 02 0048 | 45 x 73 x 32 mm | 2 x M4, depth 8 mm 42 mm 27 mm |
| ABD06.125 | 200 02 0154 | 45 x 73 x 34 mm | |
| ABD06.120 | 200 02 0024 | 45 x 73 x 34 mm | |
| ABD06.117 | 200 02 0137 | 45 x 73 x 39 mm | |
| ABD06.121 | 200 02 0126 | 45 x 73 x 44 mm | |
| Sensors with handle (screw clamp) | | | |
| ABD06.102 | 200 02 0081 | 40 x 100* x 55 [75] mm | 2 x M6, depth 8 mm 54 mm 30 mm |
| ABD06.116 | 200 02 0021 | 40 x 100* x 67.5 [85] mm | 4 x M6, depth 10 mm 70 mm 30 mm |
| ABD06.123 | 200 02 0148 | 40 x 100* x 67.5 [85] mm | 4 x M6, depth 10 mm 70 mm 30 mm |

Abbreviations: L = sensor length; W = sensor width; H = sensor height; H max = height with handle;
 Sc W = screw distance in sensor width; Sc L = screw width in sensor length
 * Value depending on handle position, approx. 10 mm

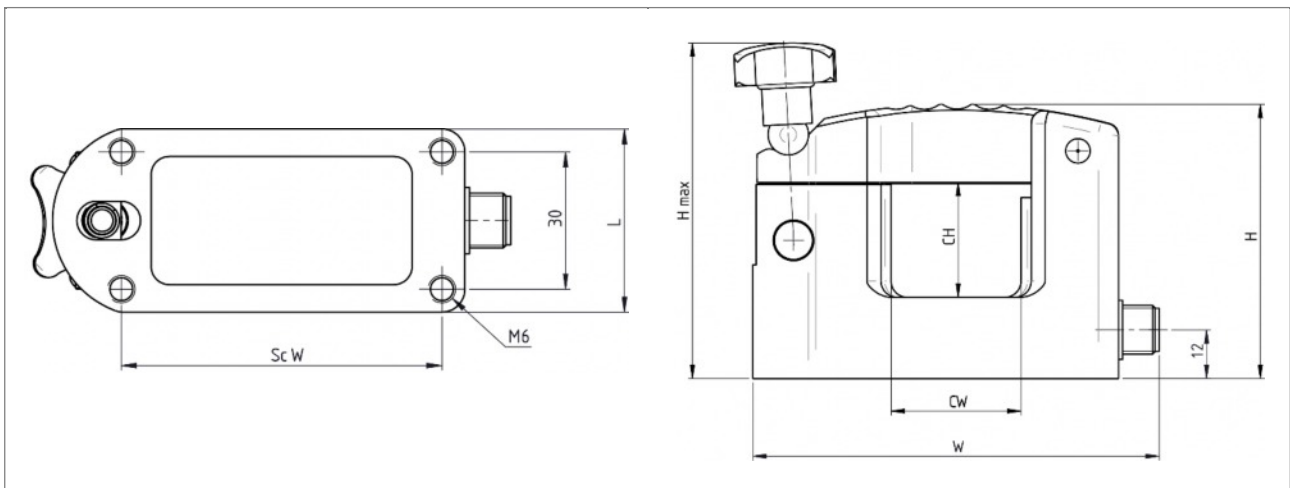
Technical drawings



Sensor design with screw cover



Sensor design with hinged cover



Sensor design with handle

Drawings are not to scale. Dimensions in mm, unless otherwise specified. Information is subject to change without notice.
SONOTEC is a registered trademark.

HEADQUARTERS GERMANY
SONOTEC GmbH
Nauendorfer Str. 2
06112 Halle (Saale)
Germany

AMERICAS
SONOTEC US Inc.
190 Blydenburgh Rd
Suite 8, 2nd Floor
Islandia, New York 11749, USA



E.C. DECLARATION OF CONFORMITY
STANDARD ROUTE TO COMPLIANCE

SONOTEC Ultraschallsensorik Halle GmbH

Nauendorfer Straße 2
06112 Halle (Saale)
Germany

declares under our sole responsibility, that the product

SONOCHECK ABD06

to which this declaration relates is in conformity with the following standards, including the valid changes at time of declaration:

2011/65/EU Restriction of Hazardous Substances (RoHS)

2014/30/EU Electromagnetic Compatibility

in agreement with the following standard:

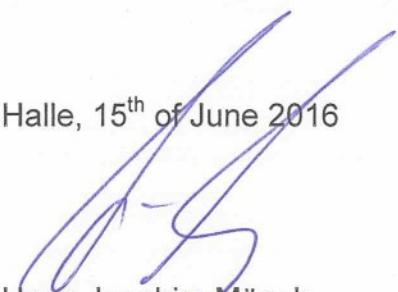
DIN EN 61326-1:2013

Electrical equipment for measurement, control and laboratory use
– EMC requirements; Part 1: General requirements

The device family SONOCHECK ABD06 are ultrasonic bubble detectors for liquid filled flexible tubing.

The correspondence of the product mentioned above with the directives and laws of the EC-directives are guaranteed by means of a quality management system.

Halle, 15th of June 2016



Hans-Joachim Münch
Managing Director

Zertifikat | *Certificate*

RoHS– Konformitätserklärung | *RoHS– Declaration of Conformity*

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

bestätigt, dass die unten aufgeführten Komponenten die Richtlinie 2011/65/EU (RoHS) zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten und die delegierte Richtlinie (EU) 2015/863 vom 31. März 2015 einhält. Folgende Ausnahmen finden Anwendung:

Anhang III Ausnahme 7c I
 Anhang IV Ausnahme 15

Ausgenommen vom Zertifikat sind Kundenbestellungen/-lieferungen.

confirms that the listed components are compliant with the EU Commission published Directive 2011/65/EU (RoHS) on the restriction of the use of certain hazardous substances in electrical and electronic equipment and the delegated directive (EU) 2015/863 of March 31st, 2015. The following exceptions apply:

*Annex III exception 7c I
 Annex IV exception 15*

Customer deliveries are excluded from certificate.

| SONOTEC Artikelnummer <i>Part Number</i> | Bezeichnung <i>Description</i> |
|---|---|
| 100 01 xxxx | SONOCHECK® |
| 200 01 xxxx | SONOCHECK® |
| 200 02 xxxx | SONOCHECK® |
| 200 70 xxxx | SONOCHECK® |
| | |
| | |

SONOTEC stellt dies durch vertragliche Vereinbarungen mit den Lieferanten sicher.

SONOTEC ensures this by contractual agreements with our suppliers.



Auf Grund gesetzlicher Festlegungen und Übergangsfristen ist davon auszugehen, dass die für unsere Technik genannten Ausnahmen auch über das derzeit bekannte Ablaufdatum hinaus ihre Gültigkeit behalten, mindestens für 12 Monate im Fall der Zurückziehung der Ausnahmegenehmigung.

Based on legal stipulations and transition periods, it can be assumed that the exceptions mentioned for our technology will remain valid beyond the currently known expiry date, at least for 12 months in the event of withdrawal of the exemption.

Wir werden unsere Kunden schnellstmöglich nach Bekanntwerden einer Nicht-RoHS-Konformität informieren.

We will contact our customers as soon as possible after becoming known of a non-RoHS-compliance.

Halle (Saale), 15.07.2021



Michael Münch

Geschäftsführer | Managing Director

SONOTEC GmbH
Nauendorfer Straße 2
06112 Halle (Saale)
Tel.: +49 (0)345-13317-0
sonotec@sonotec.de