Operating manual for admodus®USP*pro*

Operating manual (english)

www.admodus.de

Synergetik

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Translation

Upon delivery to the countries of the EEA, the operating manual must be translated to the language of the destination country. In case of any discrepancies in the language of the destination country, either the original operating manual (German language) must be consulted or the manufacturer must be contacted for clarification.

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Ver.	Date	Created/revised chapters (heading)	Subject of amendment / remarks	Author
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1.1	20.08.15		Release	A. Klockner
1.2	30.11.15	9	Description of the logged measure-ment data	T. Stahl
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1.6	07.10.25		Release	M. Uhle

Contents

1 General safety instructions and warnings

1.1 Hazard notes

Hazard notes

are marked with a warning triangle.

Notes

are marked with a hand.

Electrical hazards

are arked with the adjacent symbol.

Warnings

are marked with a stop sign.

For safety and warranty reasons, any modifications on the device which exceed installation and connection procedures must only be performed by the manufacturer.

1.2 Responsibility of the operator

For connection, commissioning and operation of the device, the following informations and parent legal regulations of the country (e.g. in German VDE) must be observed. Further, any safety and accident prevention regulations for the respective individual case must be applied.

In regular intervals of three months, all connections and the device housing must be visually inspected for corrosion damage.

If connectors which are attached to the cables show signs of corrosion, they must be replaced.

If there are signs of corrosion on the device housing or on integrated connectors, the device must be sent back to the manufacturer.

At the end of its life cycle, the device must be disposed as electronic waste properly.

The device may only be put into operation if the following conditions are met:

- The operating personnel became familiar with the operating manual and the therein reported hazards. The operating manual is part of the device and must always be available for the operating personnel. The safety instructions contained therein must be observed.
- The device must be connected mechanically safe to a lifting device. For this purpose, the mounting eyelet provided by the device must be used.
- The device must be electrically connected correctly at all ports.

The electrical installations around the device must only be carried out by a competent and electrically qualified person.

2 Overview and intended use

2.1 Product description

The admodus®USP*pro* allows a quick and precise measurement of various soil physical parameters of silt layers, as can be found in waterways and ports. During the controlled lowering of the probe, a depth profile of the following parameters is created in real-time:

- Density
- Frequency dependent acoustic attenuation
- Sound velocity
- Temperature

Enabled by the combination of a high-precision pressure sensor and an integrated 3D accelerometer, the following parameters are recorded during the entire the lowering operation:

- Depth
- Sink rate
- Inclination angle

The recorded data is transmitted to the display module (standard PC, not included in the scope of supply) and displayed there in real time and stored for later review and archiving.

Connected to an external GPS system, the exact geographical position of the measurement is automatically recorded.

In accordance with its functionality and its performance characteristics, the product can be used as survey instrument ("survey grade").

For the intended use, additional accessories are required.

2.2 Intended use

The admodus®USP*pro* is designed for creating depth profiles of silt layers in waterways and ports. The allowed limiting values, as specified in the chapter „Technical data“, must be observed. Any case of application outside these limits which is not approved by Synergetik GmbH in written form is omitted from the liability of the manufacturer.

The device may only be operated by trained personnel.

The proper calibration of the probe must be checked immediately prior to each measurement.

The measurement results of the admodus®USP*pro* must only be used in conjunction with other independent measuring methods for determining the nautical depth.

The maintenance cycle of the probe is specified to 12 months. Then an inspection in connection with a general overhaul must be performed.

2.3 Misuse

The device is intended solely for the purpose specified in chapter 2.2. Any other use beyond this scope or a modification of the device is considered to be not the intended use. The manufacturer is not liable for any resulting damages. The risk is borne solely by the operator.

2.4 Residual hazards

The following residual hazards emanating from the product admodus®USP*pro*:

Lifting, carrying

The total weight of the probe including the transport case is 50 kg. The probe itself weighs 36 kg. Transport and operation must therefore always be done by two persons simultaneously. A careless handling can lead to back injuries.

Contact with biologically substances of concern

After a measurement silt residues can be found on the probe and the supply cable. These are biologically questionable. Direct contact with the skin as well as ingestion should be avoided. Wear gloves and pay attention to hygiene.

Loss of stability

The stability of the upright standing probe is not provided. The probe is as far as possible be stored always horizontally.

Slipping, tripping and falling

The supply cable can be a tripping hazard due to its length.

Pulling in, catching

When lowering the probe, the supply cable is towed by the probe. Persons can be captured and entrained.

Crushing

Due to the heavy weight of the probe, a careless handling can lead to finger or foot crushing.

Contact with sharp edges and corners

On the wing-mounts and wings, sharp corners and sharp edges are present.

Impact

Due to pendulum motions of the probe hanging on the crane, persons can be hit. A sufficient safety distance must be maintained anytime.

Break during operation

The impact of large forces can lead to a break of the suspension of the probe. During operation it must be ensured that the probe is not blocked. A sufficient safety distance must be maintained anytime.

Fall down

Due to a failure of the mechanics, the probe may crash down suddenly. A sufficient safety distance must be maintained anytime.

Short circuit

The power supply voltage for the probe must be carried out with a switching apparatus and a fuse. The voltage may only be switched on, if all cables are connected correctly.

Harsh environments

The probe is used on survey vessels under open sky in conjunction with heavy equipment. The instructions of the ship's crew must be obeyed.

Troubleshooting

Malfunctions may only be removed by qualified personnel with appropriate training. All operations on the device which exceed installation and connection procedures must only be performed by the manufacturer.

Corrosion

The housing and the electrical contacts must be regularly inspected for corrosion damages.

3 Delivery, transport and storage

3.1 Incoming inspection

Please check the contents of the delivery immediately upon receipt for completeness and intactness. We ask to report promptly any shipping damage to the delivering freight carrier. An immediate written notification must be sent to Synergetik GmbH. Please report any delivery incompleteness in writing within 7 days to your responsible distributor.

Any complaints received later will not be accepted!

3.2 Scope of delivery

The standard delivery of an admodus®USP*pro* system includes:

(1) Transport case
(2) Wings (2x small, 1x big)
(3) Open-end wrench for assembly of the pressure sensor protective cap
(4) admodus®USP*pro* probe
(5) Small parts case with
    a. Hex key for assembly of the wings
    b. Hexagon socket screws (9x) for assembly of the wings
    c. Open replacement riser tubelets (12x) for the pressure sensor protective cap
    d. Closed replacement riser tubelets (8x) for the pressure sensor protective cap
(6) Seawater resistant connection cable
(7) Dummy plug for connector protection
(8) USB Stick with operating software
(9) Fine oil for filling the pressure sensor reservoir
(10) Calibration certificate

(11) Connection box incl. power supply

(12) Grease

3.3 Accessories and prerequisites

For using the admodus®USP*pro,* the following preconditions must be met and the following accessories must be present:

- PC or laptop with Microsoft Windows11/10/7 and Ethernet-interface
- Crane with winch (required lowering speed > 0,5 m/s)
- Supply voltage (15 to 28 V DC)

3.4 Storage

The following storage conditions are strictly adhered to:

- max. temperature: +55°C
- min. temperature: -20°C
- max. humidity: 70%, non-condensing

The device must be kept protected from corrosive or organic solvent vapors, radioactive radiation and strong electromagnetic radiation.

3.5 Transport

The device is designed for the harsh marine use. Nevertheless, it should not be exposed to unnecessary heavy shocks or vibrations. The transport must be done in the original transport case. The device must always be dried off before storage.

3.6 Return delivery

The return delivery of the device must be done in its original package exclusively free of postage or carriage to Synergetik GmbH. Otherwise, the return cannot be accepted!

4 Installation

4.1 Electrical connection

The scope of delivery of the admodus®USPpro includes the probe, the seawater-resistant supply cable, and the connection box including power supply unit.

The connection box acts as an interface between the probe and the control module (PC). To establish the connection, first connect the free connector of the connection cable to the connection box. The PC is then connected to the connection box via a LAN cable. Once both the probe and the PC are connected to the connection box, the power supply unit is connected. The power supply unit immediately supplies power to the probe, enabling data communication between the PC and the probe.

admodus®USP pro

Supply cable

Connection box

LAN-cable

Display module

Supply voltage

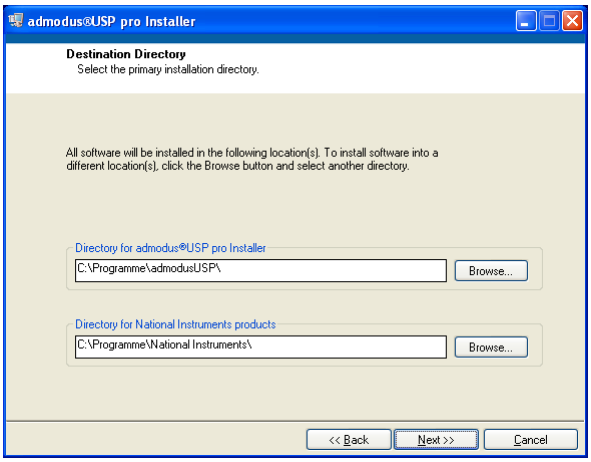
When routing cables and positioning the connection box, the following situations must be avoided in any case:

- Close proximity to objects, which emit intense heat (max. +40 °C)
- Water or liquids entering the connection box
- Mechanical shocks
- Vibrations
- Corrosive chemicals or gases
- The proximity to objects with high electromagnetic fields (frequency converters, etc.)
- Close proximity to appliances or equipment on a vessel, which
    - evaluate the earth's magnetic field (magnetic compass, etc.)
    - are used for radio communication

4.2 Installation of the operating and display module

4.2.1 Installation of the operating program

The admodus®USP*pro* is operated via a standard PC or laptop with Windows11/10/7 operating system. The necessary admodus®USP*pro* control software is included in the delivered USB stick. The installation is started by executing the file „setup.exe“.



The default settings can be accepted unchanged except for the confirmation of the license agreements. By accepting the license agreements from National Instruments there are no costs or further obligations.

After successful installation, the admodus®USP*pro* control software can be started via the desktop icon or via the Windows start menu.

4.2.2 Integration of an existing GPS system

The admodus®USP*pro* control software can receive data from a connected GPS system through a serial port. If the data from the GPS receiver needs to be used by multiple programs at the same time, the open-source software "com0com", "com2tcp" and "hub4com" can be used to distribute a physical serial port on multiple virtual interfaces. The software is available for free at http://com0com.sourceforge.net/.

4.3 Network settings and configurations

The admodus®USP*pro* network connection can be connected via a separate network switch or direct to the PC. **Operation via an network switch is recommended.**

The Network-IP-Address of your admodus®USP*pro* is shown on the sticker of the supplied USB-Stick, the transport case or on your delivery note.

4.3.1 Operation via a network switch

4.3.1.1 Creating a ROUTE

In order for the admodus®USP*pro* control software to receive measurement data from the device, a so-called ROUTE must be created on the PC.

- Determine the IP address of the network adapter of your PC, which should be used to communicate with the admodus®USP*pro* (referred to as „PC-IP“ in the following):
  - Communication via LAN or WLAN?
  - Example: LAN-Adapter „PC-IP“: 192.168.0.14
- Command Prompt „Run as administrator“
  - Example: cmd.exe → right click → „Run as administrator“
- Enter the following command and replace the dummy „PC-IP“ through your determine IP address:

- `route add 10.10.0.0 mask 255.255.0.0 [PC-IP] /p`

- Example:
  `route add 10.10.0.0 mask 255.255.0.0 192.168.0.14 /p`

- Pay attention, that the connection is **not** blocked by a firewall or a virus scanner

4.3.1.2 Delete a ROUTE

This is a tip in case this function is ever needed.

- Command Prompt „Run as administrator“

  - Example: cmd.exe → right click → „Run as administrator“

- Enter the following command

  - `route delete 10.10.0.0`

4.3.1.3 List installed ROUTEs

This is a tip in case this function is ever needed.

- Command Prompt „Run as administrator“
- Enter the following command

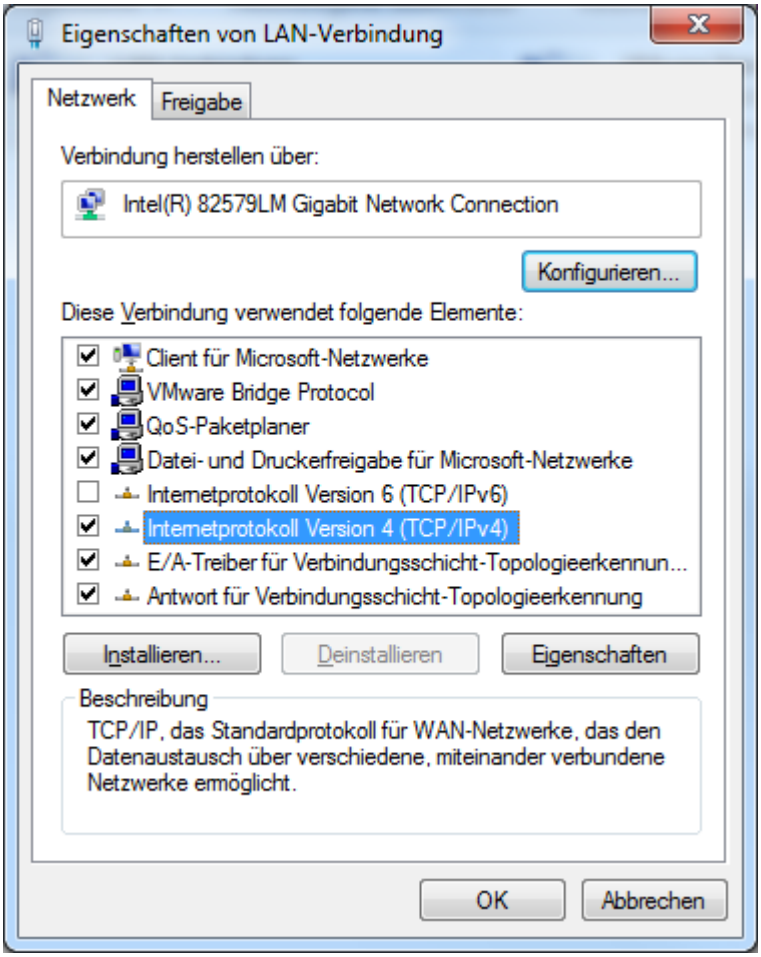
  - `route print -4`

- If there is an existing ROUTE to the admodus®USP*pro* it will be listed in the „IPv4“-routes table under „permanent routes / persistent routes“. The entry usually starts with network address „10.10.0.0“.

4.3.2 Peer-to-Peer operation

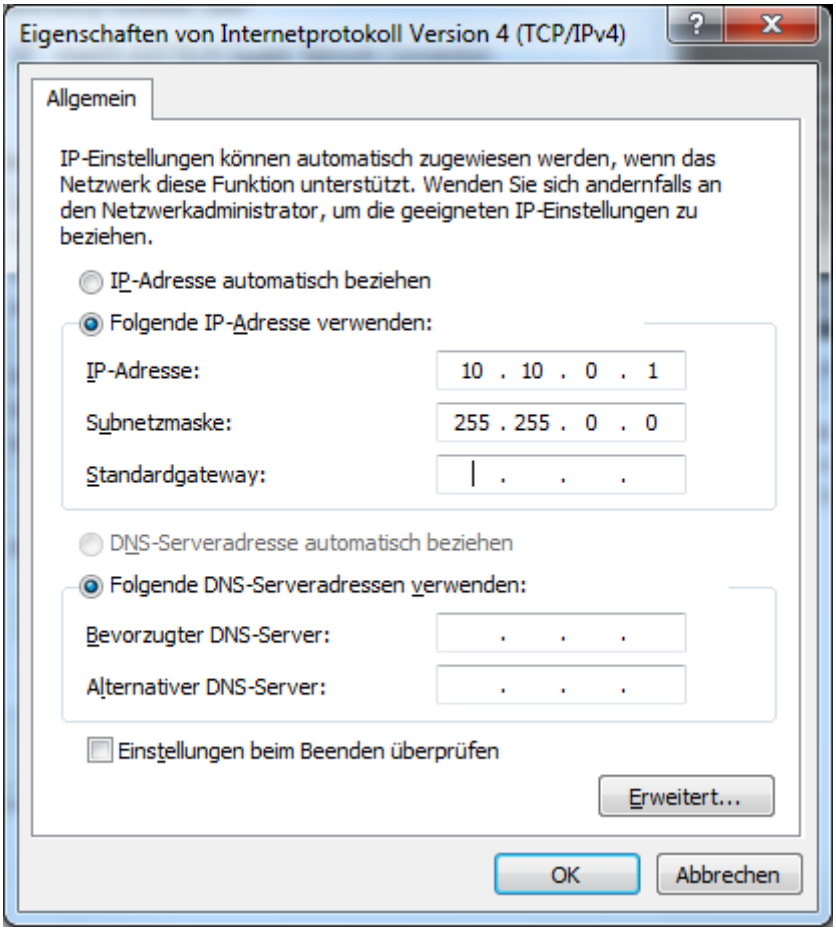
Connect the admodus®USP*pro* and your PC directly with a network cable. **In rare cases it may be necessary for you to use a so-called „crossover“ network cable.**

- Open the network settings of your LAN adapter (not WLAN!)



- Deactivate „Internetprotocol Version 6 (TCP/IPv6)

- Double-click on „Internet Protocol Version 4 (TCP/Ipv4)“ and enter the following values, while replacing the IP-address with the actual IP-address of your admodus®USP*pro*:



- Click “OK”

- If there is an existing ROUTE you must delete it:

  - Further information in section „4.3.1.2 Delete a ROUTE“ and „4.3.1.3 List installed ROUTEs“

4.3.3 Tips for troubleshooting

4.3.3.1 PING

To test the connection with the admodus®USP*pro,* you can do a ping-test:

- Open the Command Prompt

- Enter the following command and replace the dummy „admodus-IP“ through the IP address of your admodus®USP*pro*:

  - `ping [admodus-IP]`

  - Example:
    `ping 10.10.32.36`

  - The Network-IP-Address („admodus-IP“) of your admodus®USP*pro* is shown on the sticker of the supplied USB-Stick, the transport case or on your delivery note

5 Commissioning and Operation

5.1 Notes to the operator

This manual contains important information which are required to operate the device and is addressed to technically qualified personnel with appropriate knowledge in the field of measurement technology and hydrography. To ensure the proper functioning of the device, this manual must be read carefully before the device is connected and put in operation.

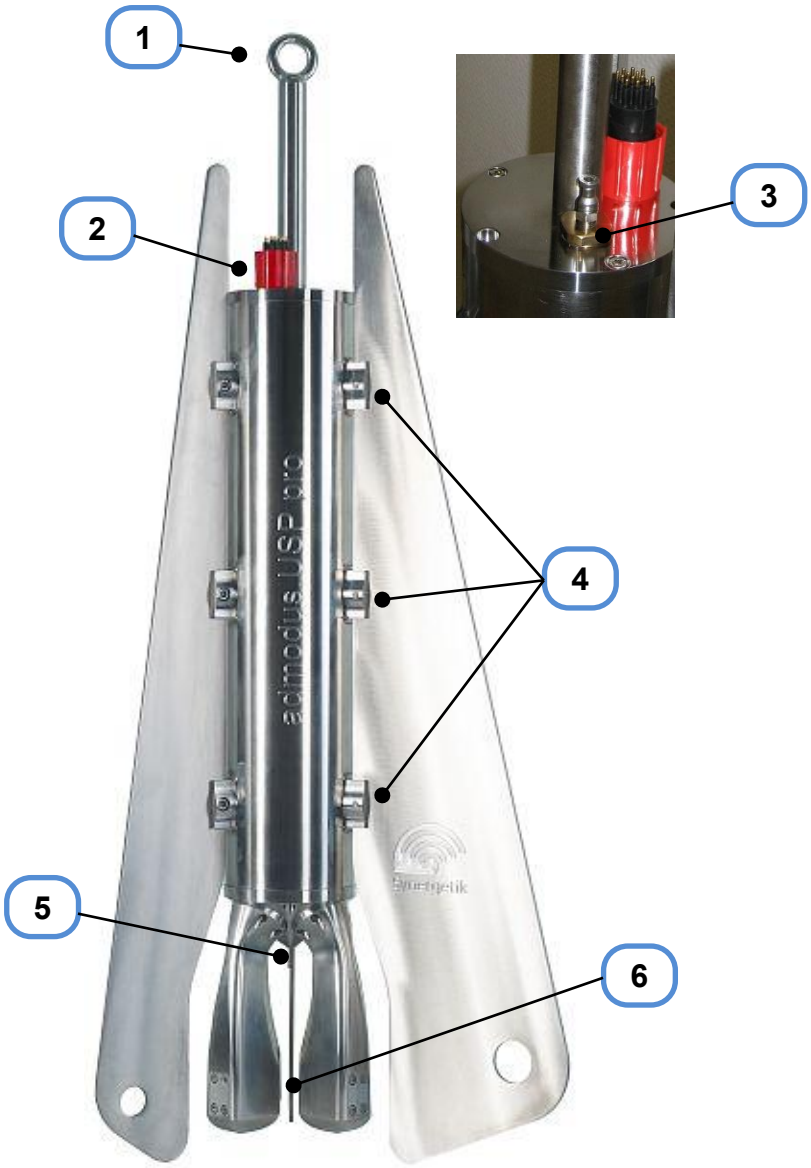
Prior to commissioning all steps which are required to install the admodus®USP*pro* must be performed.

To prevent short circuits by open cable ends (e.g., unconnected probe) lying in the water, the supply voltage is only allowed be switched on if all connections are properly connected.

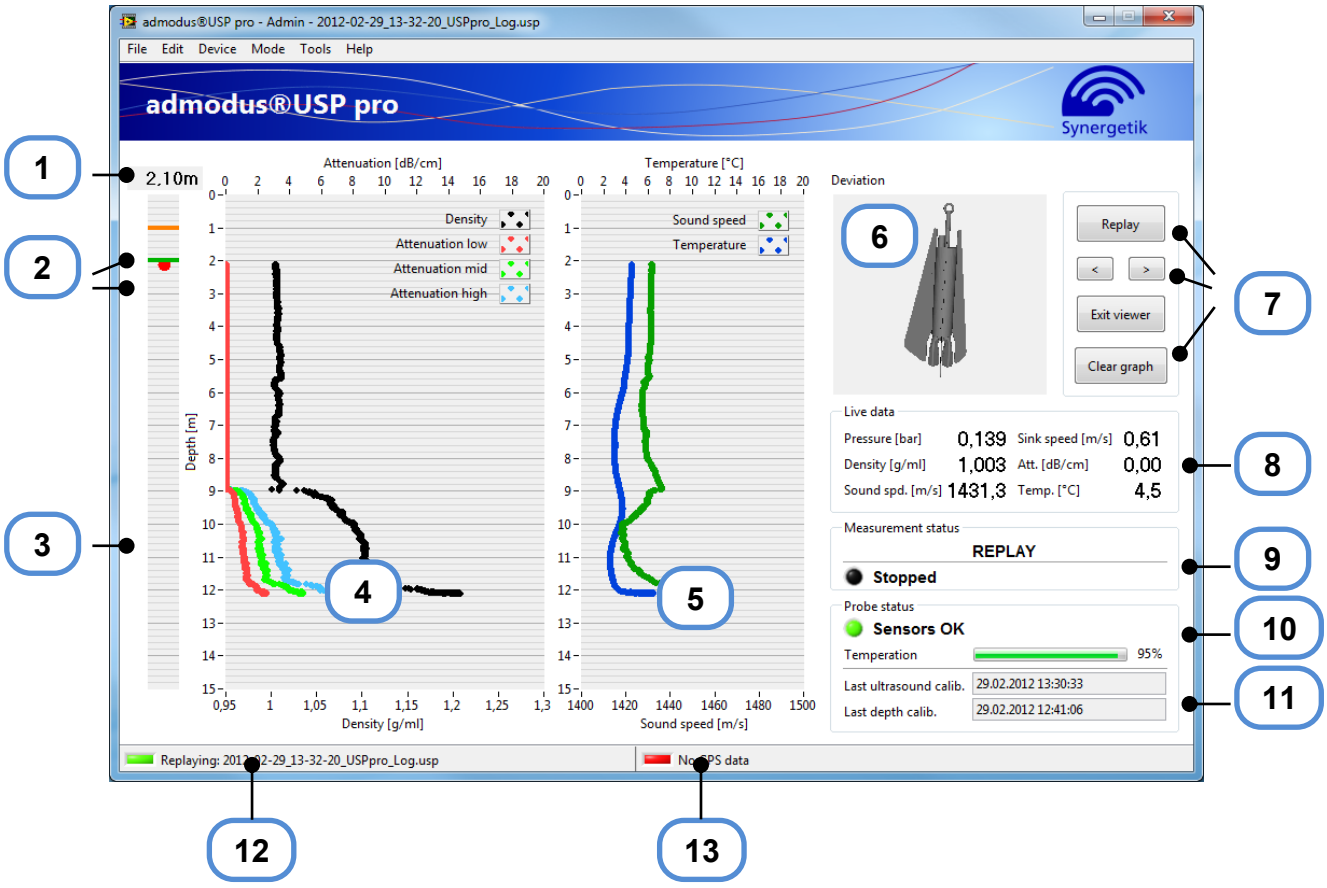
All connectors must be plugged together, as protection class IP68 is only achieved in the connected state.

The housing of the admodus®USP*pro* must not be opened. For this reason, the device is equipped with an electronic seal. The warranty gets void if this seal is broken.

5.2 Overview



1	Mounting eyelet	4	Attachment points for wings
2	Supply cable connector	5	Temperature sensor
3	Depth gauge oil reservoir	6	Ultrasonic transducers



1	Current depth of US-transducers Click for depth calibration
2	Marker for automatic-mode
3	Current position of the probe
4	Density- and attenuation graph
5	Temperature- and sound velocity graph
6	3D-orientation of the probe
7	Control elements
8	Realtime data of the probe
9	Measurement procedure and play-back info
10	Sensor status and tempering
11	Time stamp of last calibration
12	Probe connection status, serial number and playback information
13	GPS information

5.3 Carrying out a measurement series

The specified measurement accuracy can only be achieved if all parameters dependent on the specific use and conditions on-site are correctly configured and the measurement procedure is followed as described below:

- Setup and commissioning
- Calibration
- Carrying out a measurement series
  - Verification of the calibration directly before measurement
  - Carrying out the measurement
- Disassembling

All parameters, depending on the specific use and conditions on-site, must be specified by the user. These parameters have a direct impact on the measurement results. The maximum allowable limits, as specified in chapter "Technical data" must be maintained.

It is the user's responsibility to verify the measurement results with respect to their plausibility.

The user must ensure that measurements are taken only with a correctly calibrated probe.

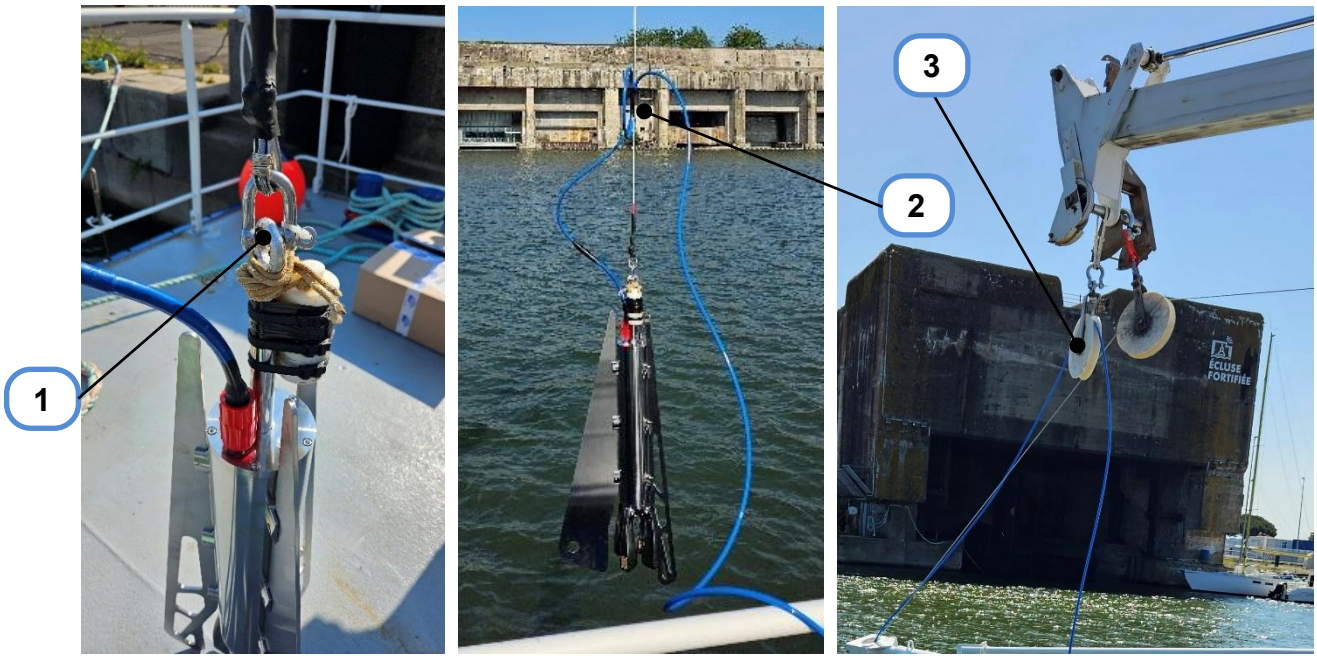
5.3.1 Setup and commissioning

• ***Wing assembly***

The three wings must be fixed to the probe housing, each one by using three of the included hexagon socket screws and the hex key.

• ***Attaching the probe to the crane***

The probe must be connected to a suitable lifting device (crane) via the mounting eyelet. Care must be taken to a safe mechanical connection. The connection cable should be fixed with strain relief (e.g., with a cable tie) in the near of the probe suspension and should be guided over a deflection pulley on the crane. When handling the connection cable, the minimum bending radius of the cable must be observed at all times.



1	Safe mechanical connection with the crane	2	Strain relief for connection cable
3	Deflection pulley		

• Filling and checking the pressure sensor oil reservoir

The probe can now be placed in an upright position. An unforeseeable topple over of the probe can be avoided by tightening the crane cable.

The depth gauge oil reservoir, which protects the sensitive pressure sensor against aggressive salt water and mud, must now be opened with the included wrench.

The oil reservoir cap and the plugged riser tubelet must be clean. If necessary, the riser tubelet must be replaced. The oil reservoir must also be clean. If necessary, the reservoir must be carefully rinsed with fresh water and cleaned with a cotton swab.

After cleaning, the oil reservoir must be completely filled up with sewing machine oil. The oil reservoir cap is then reattached and tightened gently with the wrench. This causes excess oil to be pressed out of the oil reservoir through the riser tubelet. Once complete, the riser tubelet must be free of bubbles and completely filled up with oil.

The pressure sensor is very sensitive and can be damaged easily. Be careful during the cleaning procedure.

The length of the riser tubelet must be exactly 40 mm. Differences will have a direct impact on the depth measurement.

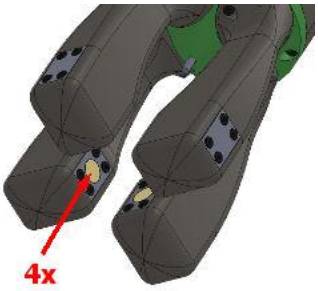
• Connecting the supply cable and activating the supply voltage

The dummy plug, which protects the electrical contacts of the probe against corrosion or mechanical damage, must be removed. The seawater-resistant supply cable must then be connected to the probe on one side and to the connection box installed on board on the other side. When connecting the supply cable to the probe, please note that the connector must be greased with the grease supplied.

On deck the cable must be placed in a way that it does not get suddenly blocked or that it can capture persons during the execution of the measurements.

• Cleaning the sensors

The four ultrasonic transducers as well as the temperature sensor must be cleaned carefully.



The surface of the ultrasonic transducers must not be damaged. For this reason, neither aggressive cleaning agents, nor sharp or spike objects should be used for cleaning.

• ***Tempering of the probe***

Since of the integrated sensors are sensitive to temperature gradients, it is necessary to temper the entire probe before calibration or performing a measurement. This can be done by the aid of the crane by submerging the device underwater up to the attachment eye for a period of at least 5 minutes.

Before starting the first calibration, the probe must be tempered for at least 5 minutes in the waters, where the measurements will be done later.

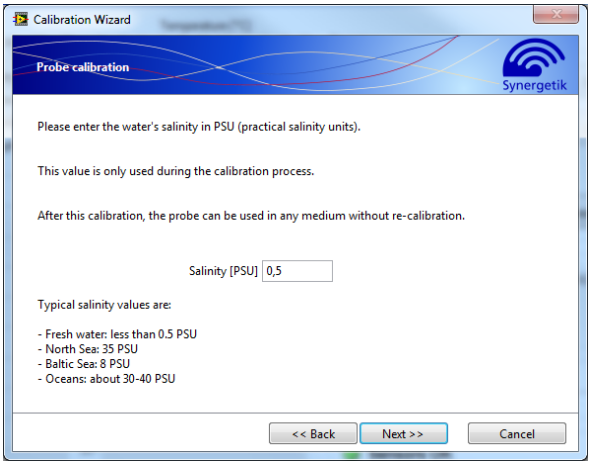
5.3.2 Calibration

For compensating aging effects and minor damages of the ultrasonic transducers, a calibration of the probe must be performed before carrying out a measurement series.

The calibration of the ultrasonic transducers is independent of the depth calibration.

The calibration wizard guides the user through the calibration process step by step:

<u>Step 1</u> – Enter salt concentration

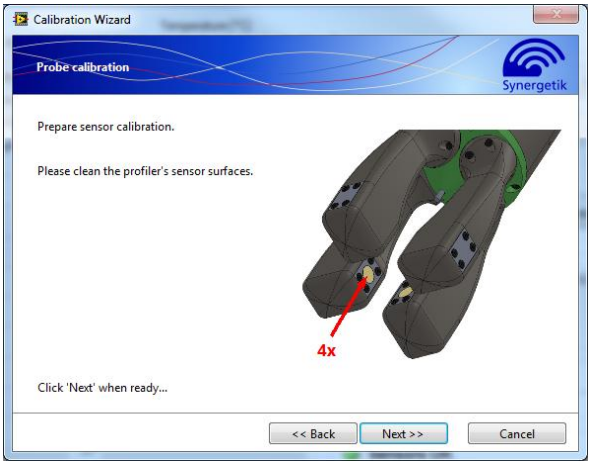


The salinity of water is directly related to its density. For a correct calibration of the density sensor and the sound velocity measurement it is mandatory to specify the salt concentration (salinity) of the calibration medium. The salinity is specified in the unit PSU.

The salinity specified at this point is used <u>exclusively</u> for the calibration described here, but its value has to be entered **absolute exactly**!

Note: After a successful calibration, the admodus.USP pro can be used in water of **any** salinity – the salinity of the measuring medium can be different from this value here. If the salinity of the measurement area is not equal to the one used here, you should enter its value in the "Probe status" settings menu (used for plausibility checks).

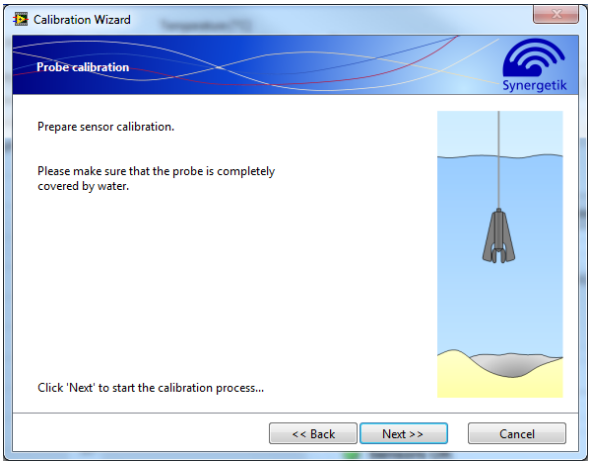
<u>Step 2</u> – Cleaning the sensor surfaces



The surfaces of the four ultrasound sensors must be cleaned for the calibration process. Dirt and sedimentary depositions distort the calibration.

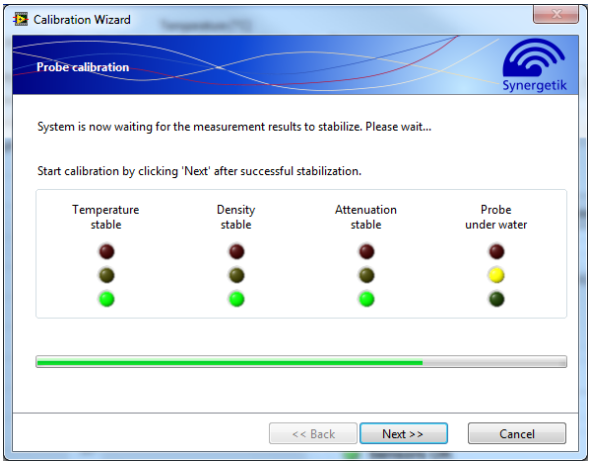
The surface of the ultrasonic transducers must not be damaged. For this reason, neither aggressive cleaning agents, nor sharp or spike objects should be used for cleaning.

<u>Step 3</u> – Submerging the probe in the calibration medium



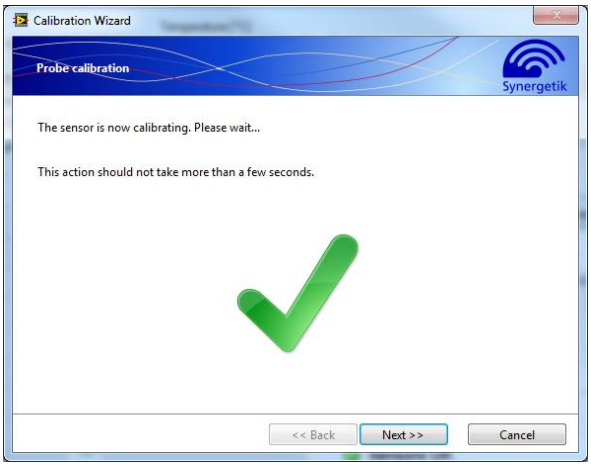
The probe should be completely submerged for the calibration process. The medium must be clear and clean. Suspended particles and air bubbles distort the calibration.

<u>Step 4</u> – Waiting for sensor stabilization and manual triggering the calibration



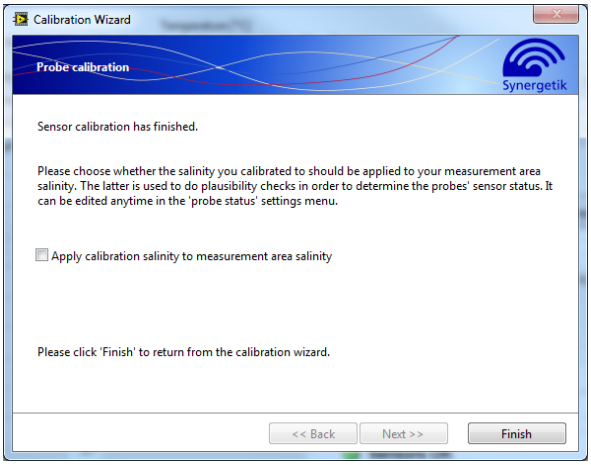
To ensure a correct calibration, the software checks the actual sensor values and only activates the "Next" button, if all sensor values are stable. The calibration will be executed when the user clicks on the "Next" button.

<u>Step 5</u> – Verification of the calibration



The status of the performed calibration is displayed in a final window. If the calibration fails, the last valid calibration is restored automatically.

Step 6 – Completing the calibration



The calibration process is now completed.

If the salinity of the measurement area is identical to the value used for calibration, you can apply the calibration salinity to be used for the plausibility checking in the automatic mode by checking “Apply calibration salinity to measurement area salinity”.

If the salinity of the measurement area is not equal to the one used while calibrating, you should enter its value in the “Probe status” settings menu (used for plausibility checks).

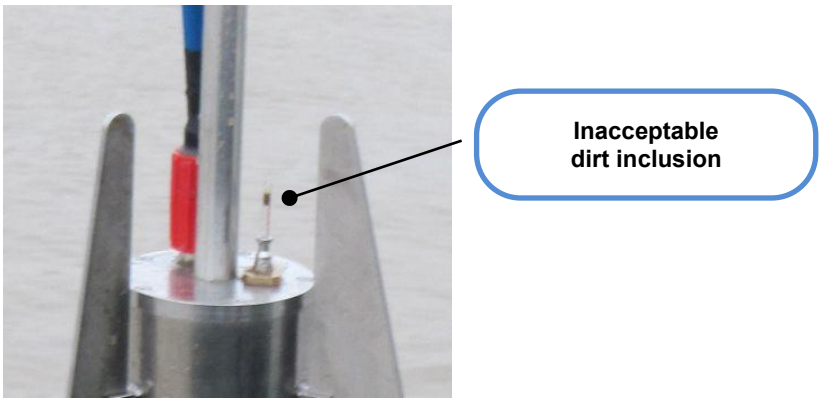
5.3.3 Verification of the calibration directly before the measurement

• Cleaning the sensors

After a performed measurement it may often be the case that mud residuals stick on the sensors. These must be removed. This can be done e.g. by leaving the probe partially submersed in the water while riding to the next measuring point.

• Visual sensor check

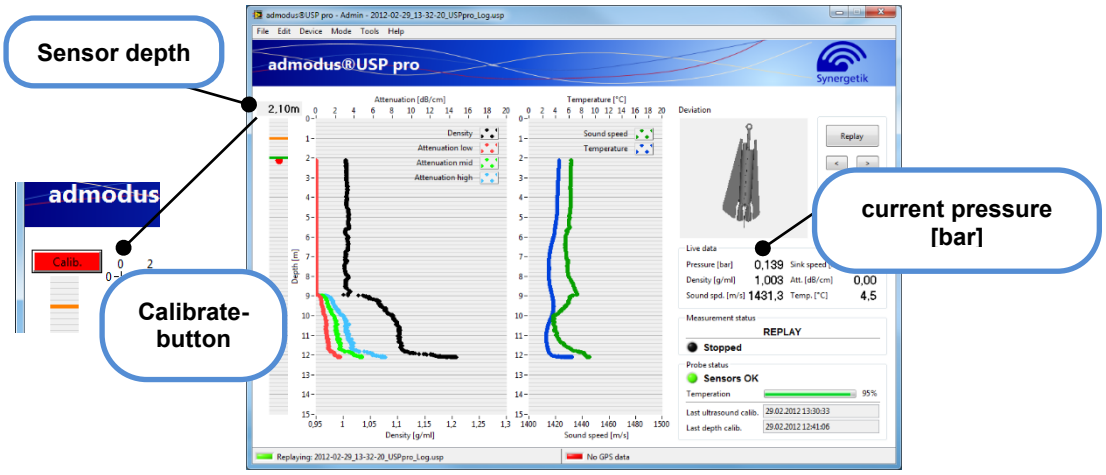
The four ultrasonic transducers, the temperature sensor and the depth sensor must be checked visually. Sedimentary depositions are not allowed to stick on the sensors. The pressure sensor riser tubelet must be free of dirt particles.



• ***Verification of the depth calibration and execution if necessary***

As the depth calibration is referred to the current ambient air pressure, the probe must not be under water during the verification and calibration of the pressure sensor. Because of the permanently changing air pressure, the depth calibration must be checked frequently and executed if necessary.

The verification is performed by observing the actual pressure value (see picture). It should be in a range of ± 0.001 bar (equivalent to ± 1 cm).



The calibration is performed by hovering the mouse over the display „sensor depth" on the left top of the window. The display then changes to a red-colored "Calib" button with which the calibration can be initiated. For proper depth calibration, the pressure sensor must be out of the water.

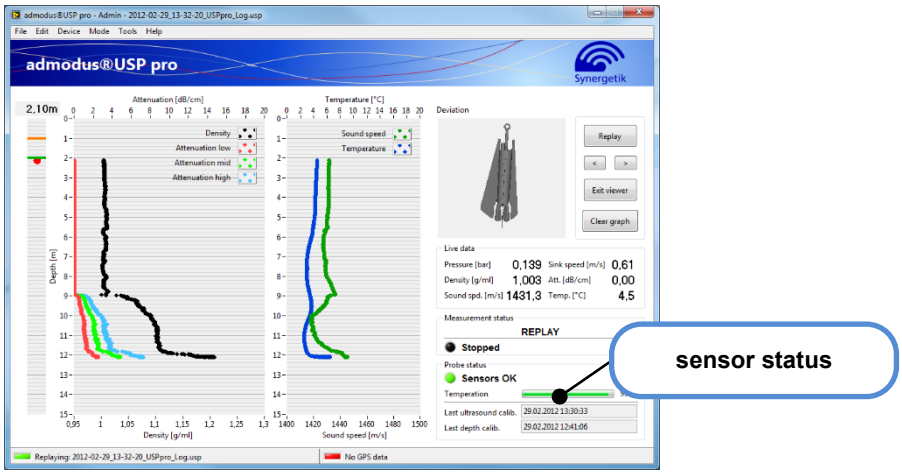
The depth of the ultrasonic transducers in relation to the water surface is determined by the pressure sensor in combination with the integrated inclination sensor. Because the pressure sensor is located exactly 71.2cm (incl. riser-tubelet) above the transducers, this difference is displayed after a successful depth calibration if the probe is aligned exactly vertical.

• Submerge the probe to the mounting eyelet

To check the calibration of ultrasonic transducers, the probe must be entirely under water. It is important to ensure that the sensor data is not affected by suspended particles or other debris.

• Wait for tempering and check calibration

The operating program displays the current status of the sensors at the lower right. Once the probe is completely submerged, the actual sensor values are automatically compared with the expected values. The tempering of the sensors is monitored too and is displayed with a progress bar. The tempering process can take up to ten minutes, depending on the temperature of the medium. Accurate measurements are only possible once the temperature control display reaches 95%. As soon as the probe is ready for measurement, the green light will turn on.



The expected values depend on the salinity of the measurement area which must be set in the configuration menu. An incorrect entered value may cause the probe to stay disabled for measurement, because the expected sound velocity and density does not coincide with the measured values.

5.3.4 Performing a measurement

• Before recording (optional)

A prefix can be added to the file name of the measurement data. To do this, this option must be activated in the settings and the desired prefix entered in the main window.

• Start recording

Measurements can be started and stopped by hand in manual mode. In the „hands-free" automatic mode, starting and stopping of the measurements is performed automatically by the operating program. For this purpose, appropriate threshold values can be set in the configuration menu.

• Controlled lowering of the probe (lowering speed 0.5 m/s)

The probe can now be lowered with the aid of the crane with a defined speed. With a lowering speed of 0.5m/s, a depth resolution of about 1 cm is achieved. At slower speeds, the probe may not penetrate the complete silt layer. At faster speeds, the probe could be damaged.

• Wait for reaching a solid sediment layer and stop measurement

The measurement must be stopped after reaching the solid sediment layer. In the „hands-free" automatic mode, sinking speed and inclination angle of the probe are used for automatic stopping the measurement.

• Pull the probe entirely out of the water

After stopping the measurement, the probe must be completely pulled out of the water.

Please clean the probe’s sensors after each measurement if they are covered with silt.

5.3.5 Disassembly

• Switch off power supply

To avoid short circuits due to open cable ends, the supply voltage should be switched off using the fixed installed on/off switch.

• Cleaning the probe

The device must be cleaned and the oil reservoir of the depth meter must be emptied. For detailed instructions refer to the chapter "cleaning".

• Drying probe and wings and storing in the transport box

The wings can now be dismantled. Before storing in the transport case, make sure that the device has been dried well, otherwise mold can be formed.

5.4 PDF reports

After completing a measurement, the recorded data can be exported in the form of a PDF report. The export is performed via the menu path *"File → Export report..."*. The generated PDF report contains the following information:

- File name of the corresponding USP log file
- GPS string of the measuring point (if available)
- Firmware information
- Time of the last calibration of the pressure sensor
- Time of the last calibration of the ultrasonic sensors
- Density/damping graph
- Temperature/sound velocity graph

In addition to the information contained in the PDF report, a screenshot of the user interface of the control software is generated, showing the respective measurement.

6 Maintenance and cleaning

6.1 Cleaning

After usage the device must be rinsed and cleaned with fresh water. Any mud residuals and other debris must be removed.

The oil reservoir of the depth sensor must be opened with the enclosed wrench and to be emptied. Thereafter the oil reservoir as well as the oil reservoir cap and the riser tubelet should be rinsed with fresh water and gently cleaned and dried with a cotton swab.

Following this the entire device, including the wings, must be dried with a towel. To prevent mold formation, the device should be stored in a dry condition in the transport case.

The device must only be cleaned with liquids if it is ensured that the probe connector is protected either by the supply cable or by the dummy plug.

The surface of the ultrasonic transducers must not be damaged. For this reason, any aggressive cleaning agents as well as sharp or spike objects should not be used for cleaning.

6.2 Maintenance

The function as well as the calibration of the whole measurement system must be checked and documented regularly by the operator. Furthermore, the entire measurement system including the connection cable must be checked for damage. The inspection intervals are determined by the operator.

However, the manufacturer recommends urgently carrying out an annual general inspection. If the general inspections are not carried out, the specified accuracy cannot be guaranteed.

The housing of the admodus®USP*pro* must not be opened. For this reason the device is equipped with an electronic seal. The warranty gets void if this seal is broken.

You have the possibility to perform an annual maintenance based on a maintenance contract.

7 Disposal

The admodus®USP*pro* must be disposed according to the applicable local environmental regulations for electronic products.

The correct disposal of your old product helps to prevent negative consequences on the environment and health.

Note the applicable local regulations and do not dispose the device with normal household waste.

On the end of the lifecycle, the device can be left at your local recycling center for free. The device is then recycled professionally.

8 Technical data

Mechanical data	
Housing	Stainless steel V4A „1.4571“, seawater and acid resistant
Dimensions	93 cm x 55 cm (with wings) 93 cm x 18 cm (without wings)
Weight	Probe body (with wings): 35,8 kg Probe body (without wings): 28,4 kg Transportation case: 13,9 kg
Cable length	30 m (others on request)
Min. bend radius of the cable	Static: 80mm Dynamic: 120mm
Maximum operating depth	40 m (others on request)
Operating temperature	-20°C bis 40°C
Storage temperature	-20°C bis 55°C
Features	Wings easy to install, no moving/external parts, all sensors integrated and protected against mechanical stress

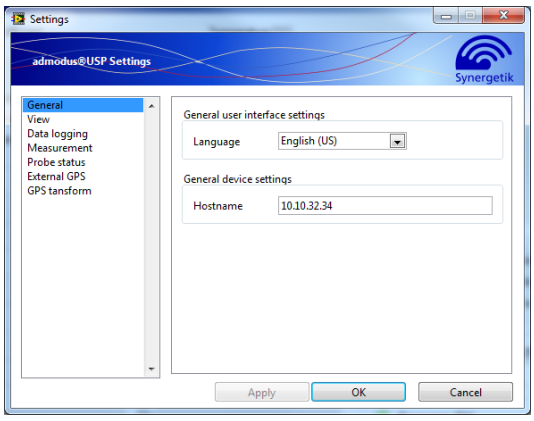
Electrical data	
Supply voltage (U_B)	15 to 28 V DC
Power consumption	6 W
Network interface	LAN – 100Base-TX (standard RJ45 connector)

Sensor technology	
Analog-to-digital converter	Ultrasound: 12 Bit, 40 MHz other sensors 24 Bit, 4 kHz
Internal / External sampling rate	4 kHz / 50 Hz (others on request)
Density resolution / accuracy	0,001 g/cm^3 / ±0,005 g/cm^3
Vertical resolution	< 1cm (for vertical velocity < 0,5 m/s)
Pressure range	0 to 5 bar (others on request)
Pressure resolution / accuracy	0,001 bar / ±0,0015 bar
Temperature resolution / accuracy	0,1°C / ±0,15°C

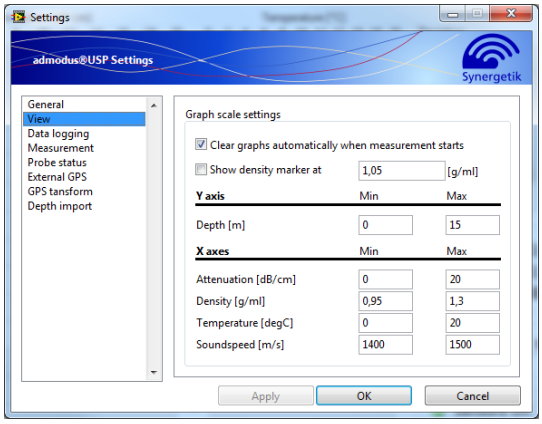
Application software	
Hardware requirements	Notebook or PC with LAN – 10/100Base-TX
Operating system	Windows 7 / 10 / 11
Language	German, English (others on demand)
Display	realtime data
Logging interval	Adjustable from realtime to 1 value per minute
Operation	Manual and „Hands-free“ automatic mode
Determination of the location of the survey vessel	Synchronized feeding of position data in the evaluation software via a PC possible.
Customization	possible on request

9 Annex

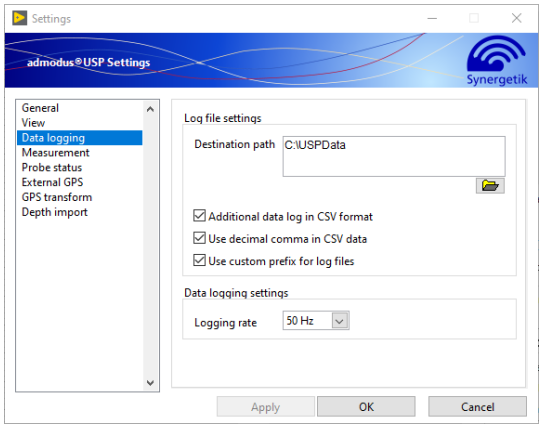
9.1 Configuration settings of the PC operating software



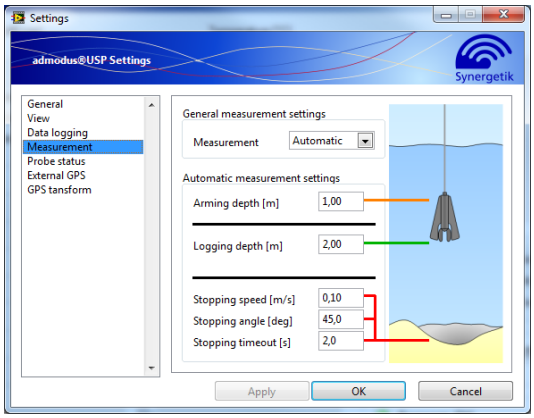
Language	Display language of the text elements
Host-name	IP-Address or host name of the probe



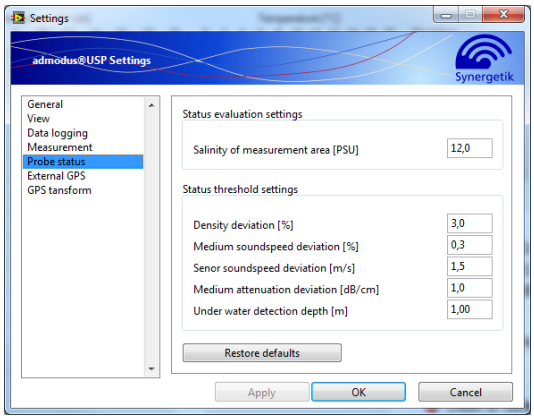
Clear graphs automatically …	Clears the measurement data shown in the graphs when a new measurement starts
Show density marker at …	Displays a marker (horizontal red line) as soon as the density value exceeds the given threshold during playback or recording.
Depth	Y-display range of the depth-dependent plots
Attenuation	X- value range of the damping plot
Density	X- value range of the density plot
Temperature	X- value range of the temperature plot
Soundspeed	X- value range of the soundspeed plot



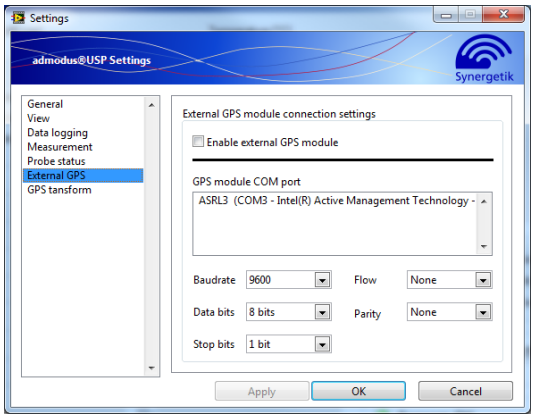
Save path	Save path for the measurement data
Storage in CSV format	If enabled, the data will be stored in an Excel readable CSV file in addition to the internal storage format
Decimal comma in CSV Data	When enabled, a comma is used as decimal separator, otherwise a point
Prefix for log files	When enabled, the log files get a specific prefix
Log-rate	Log-rate, display- and save speed of the data



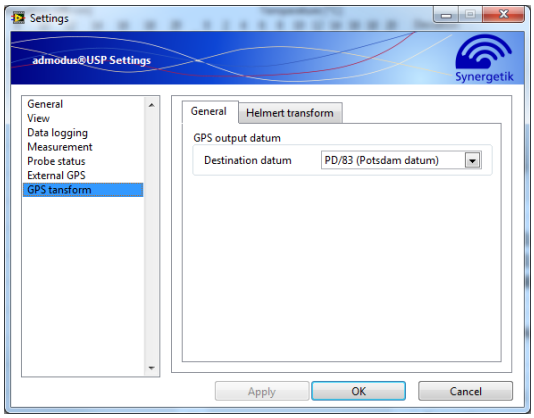
Measurement mode	Selection between manual start / stop of the measurement and "hands-free" automatic mode
Arming depth	Arming the measurement if this line is passed during lowering the device and the sensors are OK
Recording depth	Start of the measurement if this line is passed when lowering device and arming was successful.
Stop-speed	Measurement is stopped as soon as the specified rate of descent falls below this limit for longer than the duration of the stop timeout.
Stop-angle	Measurement is stopped if the inclination has been exceeded for the specified duration of the stop timeout.
Stop-timeout	Minimum duration for which the sink speed must fall below stop-speed or the probe deviation must exceed the stop-angle



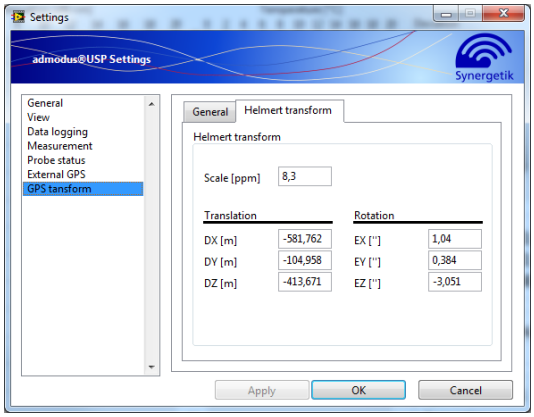
Salinity of the measurement area	Salt concentration of the measurement area. Used for plausibility test. Can be overwritten during calibration by the value entered there.
Density tolerance	Maximum deviation for plausibility check
Medium-sound velocity deviation	Maximum deviation for plausibility check
Sensor- sound velocity deviation	Maximum deviation for plausibility check
Attenuation deviation	Maximum deviation for plausibility check
Under water detection depth	Minimum depth at which the probe state is detected as 'completely under water'



Activate external GPS-module	When enabled, the below selected COM port is opened for GPS input data
COM port for GPS-module	COM port for GPS-data
Baud rate, etc.	Communication parameters of the GPS COM port
Activate external GPS-module	When enabled, the below selected COM port is opened for GPS input data

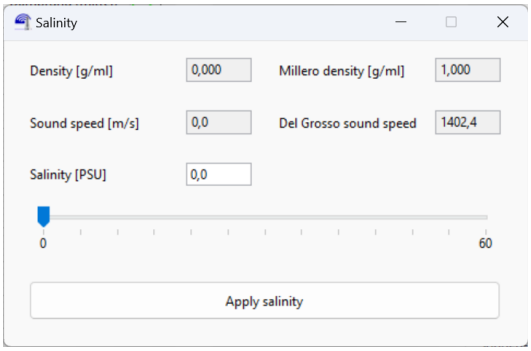


Zieldatum	Sets the output format for GPS positions: ☐ PD/83 (Potsdam-Datum) Transformation to Bessel 1841 ellipsoid and position output in Gauss Krueger GK_3 format. Adjustments to the Helmert transform parameters are possibly necessary ☐ ETR89 (UTM) Position output in UTM format.



Scale	Helmert transform scale factor in PPM.
Translation	Translation components DX, DY, und DZ in meters.
Rotation	Rotation components EX, EY, und EZ in arcseconds

9.2 Tool for determining salinity



Density	Currently measured density of the probe in g/ml
Sound Speed	Currently measured sound velocity of the probe in m/s
Salinity	Set theoretical salinity value
Millero density	Theoretical calculated density in g/ml according to Millero at specified salinity
Del Grosso Sound Speed	Theoretical calculated sound velocity in m/s according to Del Grosso at specified salinity

This tool can be used to determine the approximate salinity of the measuring medium. It is based on the temperature and pressure measurements recorded by the probe, from which the theoretical sound velocity according to Del Grosso and the theoretical density according to Millero are calculated, assuming a theoretically specified salinity.

The assumed theoretical salinity can be varied using the slider or the input field, causing the theoretically calculated values to gradually approach the actual values measured by the probe. If the calculated and measured values match, the corresponding salinity is considered an approximation of the actual salinity of the medium.

The sound velocity is always measured correctly, even with an uncalibrated probe, so that it is possible in principle to determine the salinity by changing the theoretical salinity until the theoretical sound velocity matches the actual measured sound velocity.

It should be noted that this method only provides an estimate. For a precise and reliable determination of salinity, the use of an appropriate measuring device is required.

9.3 Recorded measurement data

The data recorded while measuring with the **admodus®USP*pro*** density probe is saved to the directory defined in the “Settings” menu (see chapter 9.1). File names correspond to the format „YYYY-MM-DD_HH-MM-SS_USPpro_Log“, where „YYYY-MM-DD“ is the recording date in ISO format and „HH-MM-SS“ is the recording’s start time in hours, minutes and seconds.

Depending on the logging settings (see chapter 9.1) a text based „.CSV“ file is exported besides the standard „.USP“ binary log file. CSV files can be easily viewed or edited using Microsoft Excel or most other spreadsheet software.

The columns contained in a CSV file are desribed as follows:

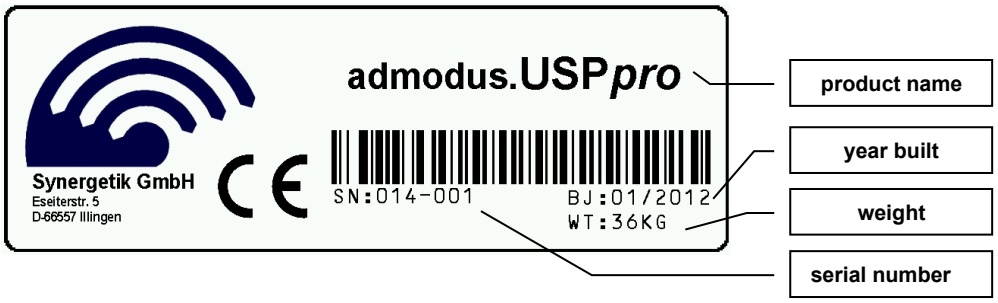
Label	**Description**	**Unit**
Date	Recording date of the measurement point	YYYY-MM-DD
Time	Recording time of the measurement point	HH:MM:SS
Depth [m]	Depth at the density-measurement point	m
SinkSpeed [m/s]	Sink speed of the probe	m/s
Pressure [bar]	Pressure at the level of the pressure sensor	bar
Temp [degC]	Medium temperature at the level of the sensor head	°C
TempGrad [degC/s]	Medium temperature gradient at the level of the sensor head	°C/s
SurfDensity [g/ml]	Additional Info: Density measured at the surface of the impedance sensor	g/ml
IntDensity [g/ml]	Mean density of the medium in between the sensor head (displayed density value)	g/ml
MediumSoundspeed [m/s]	Mean speed of sound in the medium in between the sensor head	m/s
Attenuation [dB/cm]	Mean acoustic attenuation in the medium in between the sensor head	dB/cm
Freq0 [kHz]	Frequency at the first node of the frequency-dependent attenuation	kHz
Att0 [dB/cm]	Attenuation at the first node of the frequency-dependent attenuation	dB/cm

Freq1 [kHz]	Frequency at the second node of the frequency-dependent attenuation	kHz
Att1 [dB/cm]	Attenuation at the second node of the frequency-dependent attenuation	dB/cm
Freq2 [kHz]	Frequency at the third node of the frequency-dependent attenuation	kHz
Att2 [dB/cm]	Attenuation at the third node of the frequency-dependent attenuation	dB/cm
Freq3 [kHz]	Frequency at the fourth node of the frequency-dependent attenuation	kHz
Att3 [dB/cm]	Attenuation at the fourth node of the frequency-dependent attenuation	dB/cm
Freq4 [kHz]	Frequency at the fifth node of the frequency-dependent attenuation	kHz
Att4 [dB/cm]	Attenuation at the fifth node of the frequency-dependent attenuation	dB/cm
Freq5 [kHz]	Frequency at the sixth node of the frequency-dependent attenuation	kHz
Att5 [dB/cm]	Attenuation at the sixth node of the frequency-dependent attenuation	dB/cm
Deviation [deg]	Imbalance/pitch of the probe	°
RelHum [RH]	Relative humidity inside the probe (leakage detection)	RH (%)
DepthCalibDate	Date of the latest pressure sensor calibration	YYYY-MM-DD
DepthCalibTime	Time the latest pressure sensor calibration	HH:MM:SS

UltrasoundCalibDate	Date of the latest ultrasound sensor calibration	YYYY-MM-DD
UltrasoundCalibTime	Time of the latest ultrasound sensor calibration	HH:MM:SS
Zone	Zone of the GPS position (relevant for UTM datum)	-
Easting	East coordinate of the GPS position	m
Northing	North coordinate of the GPS position	m
GPSString	Raw data string of the GPS receiver (NMEA GPGGA)	-
QualityE1	Echosounder signal quality of the first echo of the imported depth data	-
DepthE1 [m]	Echosounder depth of the first echo of the imported depth data	m
QualityE2	Echosounder signal quality of the second echo of the imported depth data	-
DepthE2 [m]	Echosounder depth of the first second of the imported depth data	m
DepthString	Raw data string of the imported Echosounder data (Echotrac DBT)	-

9.4 Device Identification

The serial number is stored in the device and is read out and displayed by the operating software. The nameplate is attached to the transport case and contains the following information:



- Product name
- Name and address of the manufacturer
- CE-identification
- Serial number
- Year built (date of manufacture: month/year)
- Weight

The correct serial number is required for all queries. Only then a proper and quick processing is possible.

9.5 Declaration of conformity

In accordance to the following European Directives the CE mark was affixed:

CE

Declaration of conformity

with applicable regulations

EMC-Directive 2004/108/EC

We hereby declare that the product

admodus®USP *pro*, year of construction 2011

complies with the regulations listed above.

Harmonized standards applied:

DIN EN 62079	Preparation of instructions – Structuring, content and presentation

Harmonized national / international standards and technical specifications applied:

DIN EN 61000-6-4	Electromagnetic compatibility (EMC) Emission standard for industrial environments
DIN EN 61000-6-2	Electromagnetic compatibility (EMC) Immunity standard for industrial environments

Any unauthorized changes to the device will invalidate this declaration.

Illingen, 16.12.2011

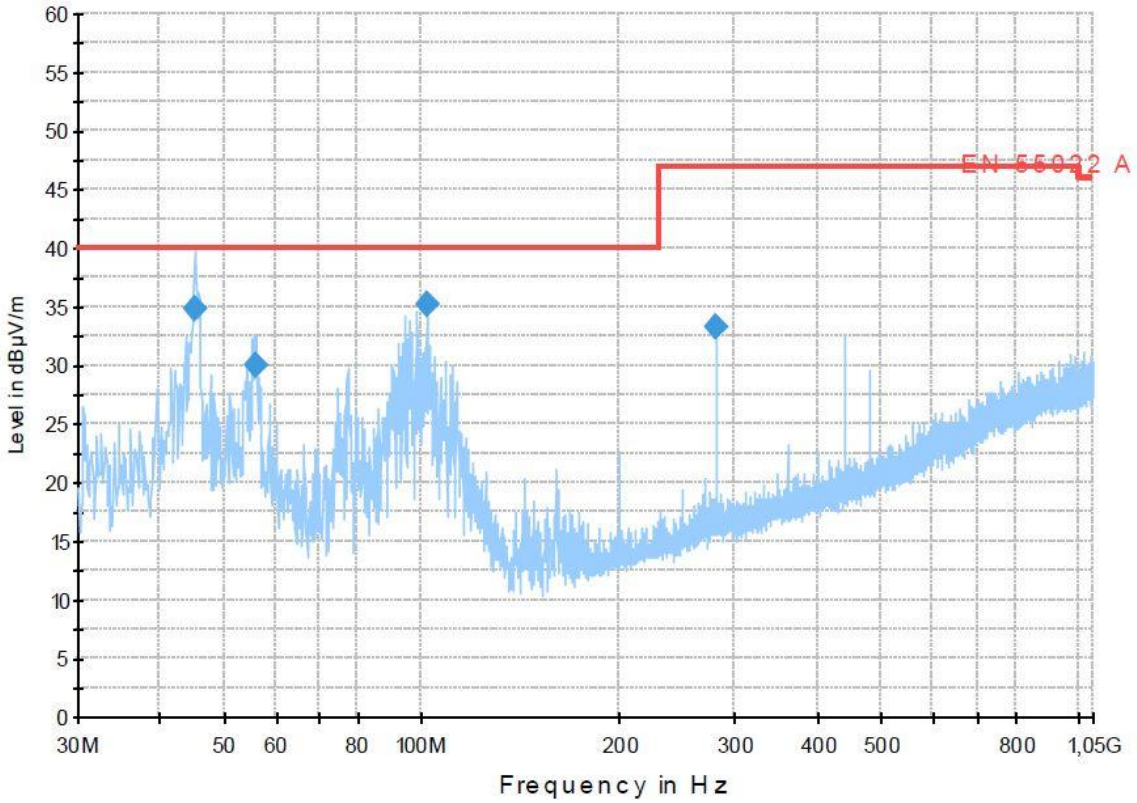
Markus Uhle
Head of Quality Management

Manufacturer:

Synergetik Gesellschaft für Industriesensorik mbH
Eseiterstraße 5
66557 Illingen
Tel.: +49 (0)6825-94291-0

9.6 EMI results

Radiated emissions



Conducted emissions