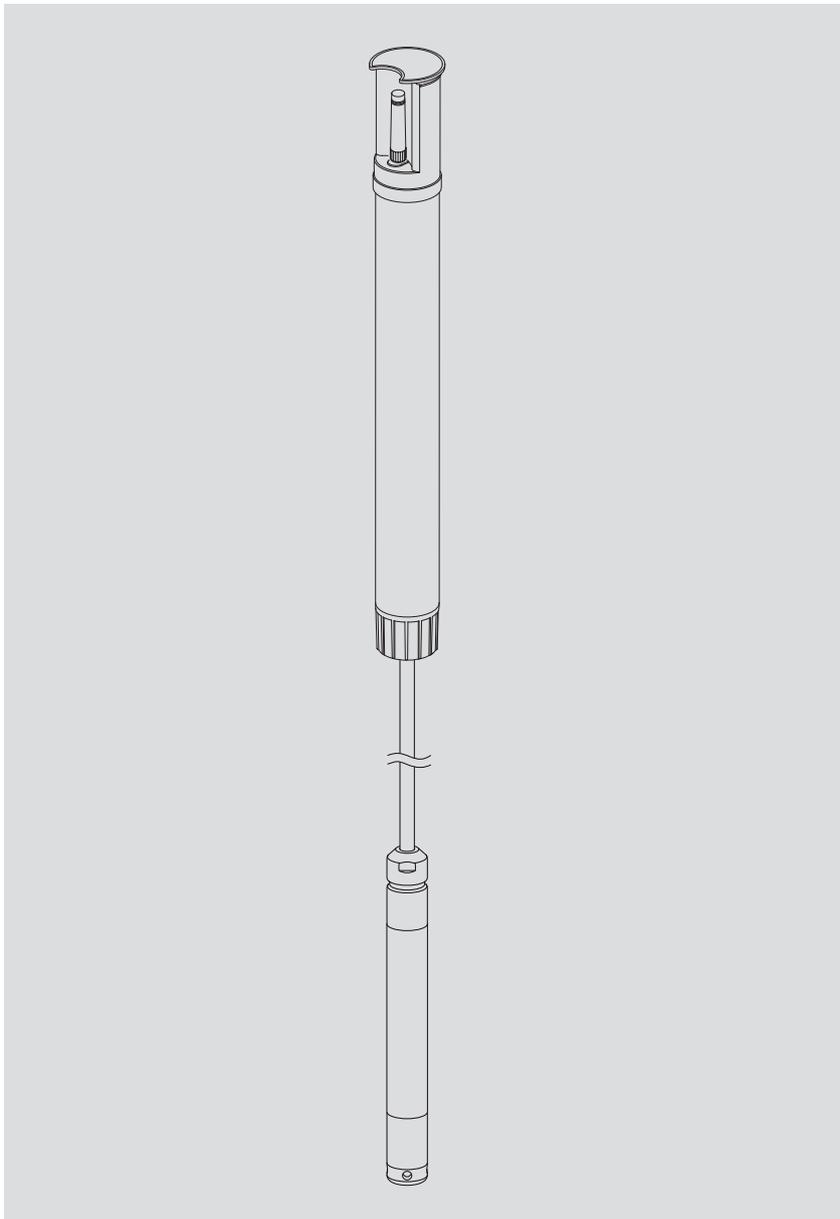




Operating instructions
Groundwater Datalogger
OTT ecoLog 1000



English

We reserve the right to make technical changes and improvements without notice.

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1 Scope of supply

- ▶ **OTT ecoLog 1000**
 - 1 groundwater datalogger consisting of a communication unit with built-in datalogger and cellular modem, pressure probe cable with pressure compensation capillary and Kevlar core for longitudinal stabilization, 2 desiccant capsules, pressure probe
 - 1 factory acceptance test (FAT) certificate

2 Order numbers

▶ OTT ecoLog 1000	Groundwater datalogger	55.450.001.9.0
	required ordering information	
	- measuring range:	0 ... 4 / 10 / 20 / 40 / 100 m
	- system length:	2 ... 200 m ($\pm 1\%$ ± 5 cm)
	- lithium battery (26 Ah):	without/with
	- operating instructions:	without/with, in DE, EN, FR or ES
▶ Accessories ¹⁾	Adapter plates	
	for OTT top caps with cut-out	
	- 3"	55.446.022.9.2
	- 4"	55.446.023.9.2
	- 4.5"	55.446.024.9.2
	- 5"	55.446.025.9.2
	- 6"	55.446.026.9.2
	Universal suspension bracket	55.446.021.9.2
	for top caps from 3" upwards, without cut-out as well as for universal installation	
	OTT ecoCap	
	Special top cap made of plastic for OTT ecoLog ... (after installation, the radio antenna of the OTT ecoLog ... is positioned above the metal observation well)	
	- for 2", 3" and 4" observation wells; universal design	55.446.015.9.2
	- for 3" observation well	55.446.017.9.2
	- for 4" observation well	55.446.016.9.2
	- adapter to 4.5" observation well (for OTT ecoCap 4")	55.530.478.3.1
	- adapter to 5" observation well (for OTT ecoCap 4")	55.530.479.3.1
	- adapter to 6" observation well (for OTT ecoCap 4")	55.530.480.3.1
	OTT top cap KST	
	Top cap made of plastic; yellow	
	- for 2" observation well	24.220.099.3.2
	- for 4" observation well	24.220.100.3.2
	- adapter plate for OTT top cap KST 4"	55.446.424.3.1
	USB flash drive with OTT Software	56.572.002.9.7
	OTT HydroMet LinkComm Software for Microsoft Windows 10 and OTT ecoLog 1000 operating instructions in PDF format	
	External radio antenna	
	cable length: 0.5 ... 3.0 m	on request
	5-sided key	20.250.095.4.1
	for locking OTT top caps	
	OTT Stripping tool	99.000.136.9.5
	to shorten the OTT ecoLog 1000 pressure probe cable	

¹⁾ additional accessories – e.g. aluminium top caps, top caps with fitted radio antenna on request

► **Spare parts/
Consumables**

Lithium battery (26 Ah)	97.800.011.9.5
Desiccant capsules 2 pieces in aluminum bag	97.100.296.9.5
Communication unit with integrated data logger and radio modem; incl. 2 desiccant capsules	55.450.005.9.0
Pressure probe with permanently fixed pressure probe cable; required order details – measuring range: 0 ... 4 / 10 / 20 / 40 / 100 m – cable length: 2 ... 200 m ($\pm 1\%$ ± 5 cm)	55.450.006.9.0

3 Basic safety information

3.1 Markings and symbols used in the instruction

■ This bullet point indicates an instruction relating to a specific action.

▶ This bullet point indicates an item in a list.

– This bullet point indicates a sub-item in a list.

• **Remark:** ...

▶ Information on easier and more efficient work

▶ Further information

▶ Definition



Please note: ...

Information that prevents potential damage or malfunction on the OTT ecoLog 1000.

3.2 Explanation of safety information used

The safety information used in these operating instructions is classified according to the nature and severity of a particular hazard. The hazard levels defined are indicated by the following signal words (Warning/Caution) and pictograms (orange/yellow triangle) in these operating instructions.

WARNING

Warning of a hazardous situation with a medium level of risk



The safety information specifies the nature and source of the hazard.

If you fail to carry out the specified actions, the hazardous situation can result in **death** or **serious injuries**.

▶ Action to prevent the hazardous situation!

▶ Action to prevent the hazardous situation!

CAUTION

Warning of a hazardous situation with a lower level of risk



The safety information specifies the nature and source of the hazard.

If you fail to carry out the specified actions, the hazardous situation can result in **minor** or **moderately severe injuries**.

▶ Action to prevent the hazardous situation!

▶ Action to prevent the hazardous situation!

3.3 Note the following for safe and trouble-free operation

- ▶ Read these operating instructions before using the OTT ecoLog 1000 for the first time! Become completely familiar with the installation and operation of the OTT ecoLog 1000 and its accessories! Keep these operating instructions for later reference.
- ▶ Only use the OTT ecoLog 1000 as described in the operating instructions! The intended use of the OTT ecoLog 1000 is to measure the water level and water temperature of natural ground and surface waters and to transmit measured values via a cellular network. Any other use is not permitted!
For further information → refer to Chapter 4, "Introduction".
- ▶ Only install and maintain the OTT ecoLog 1000 if you are appropriately qualified to do so. If necessary, arrange training by OTT HydroService.
- ▶ Please note all safety and warning information given within the individual work steps.
- ▶ Ensure the electrical, mechanical, and climatic specifications listed in the technical data are adhered to.
For further information → refer to Chapter 22, "Technical data".
- ▶ When operating the OTT ecoLog 1000, keep a minimum distance of 0.2 metres between radio antennae and
 - people, as well as
 - other electrical equipment/antennae!
- ▶ Handle the pressure probe cable with care. Do not kink the cable or pull it across sharp edges!
- ▶ Do not make any changes or retrofits to the OTT ecoLog 1000! If changes or retrofits are made, all guarantee claims are voided.
- ▶ Have a faulty OTT ecoLog 1000 inspected and repaired by our repair center. On no account carry out repairs yourself!
For further information → refer to Chapter 20, "Repair".
- ▶ After putting the unit out of service, properly dispose of the OTT ecoLog 1000. On no account put the OTT ecoLog 1000 into the normal domestic waste.
For further information → refer to Chapter 21, "Note about the disposal of used units".

4 Introduction

The OTT ecoLog 1000 groundwater datalogger is designed to precisely measure and store groundwater levels and temperature and to transmit these measured values through a cellular network.

The pressure probe equipped with a relative pressure probe cell uses the hydrostatic pressure of the water column to determine the water level. As a reference, a pressure compensation capillary in the pressure probe cable provides the measuring cell with the current ambient air pressure. Erroneous measurement results due to atmospheric air pressure fluctuations are thus eliminated.

The OTT ecoLog 1000 is available in five measuring ranges:

- ▶ 0 ... 4 m water column (0 ... 0.4 bar)
- ▶ 0 ... 10 m water column (0 ... 1 bar)
- ▶ 0 ... 20 m water column (0 ... 2 bar)
- ▶ 0 ... 40 m water column (0 ... 4 bar)
- ▶ 0 ... 100 m water column (0 ... 10 bar)

Based on a reference value that is input during startup, the OTT ecoLog 1000 default setting provides measurement results in the form of depth values. Alternatively, levels or pressure values are possible. The measurement intervals (sample intervals) can be preselected as necessary.

The operating parameters are set using the operating software "LinkComm" of OTT HydroMet. This software allows the system to be conveniently and flexibly tailored to the different requirements of a measuring site. LinkComm is available for PCs running the Microsoft Windows operating system. It is also available as a mobile app for smartphones and tablets under Android and iOS.

Local communication on site is carried out via the Bluetooth standard BLE (Bluetooth Low Energy).

The OTT ecoLog 1000 includes a built-in cellular modem (with SMA antenna connector) that is used for remote data transfer and remote parameterizing via the cellular network. The remote data transfer can be optionally carried out by SMS text messages or via IP data communication via the mobile radio standard 2G/4G. If necessary – e.g. when the signal strength of the cellular network is low at the installation site – the factory installed radio antenna may be replaced by an external one.

The OTT ecoLog 1000 is installed by simply hanging it into observation wells of 2" in diameter and above. For this purpose, various adapters/universal suspension brackets are available as accessories. The power supply is provided by a lithium battery with a capacity of 26 Ah. Battery lifetime is (depending on additional parameters) at least 10 years, taking into account one single remote data transfer per day.

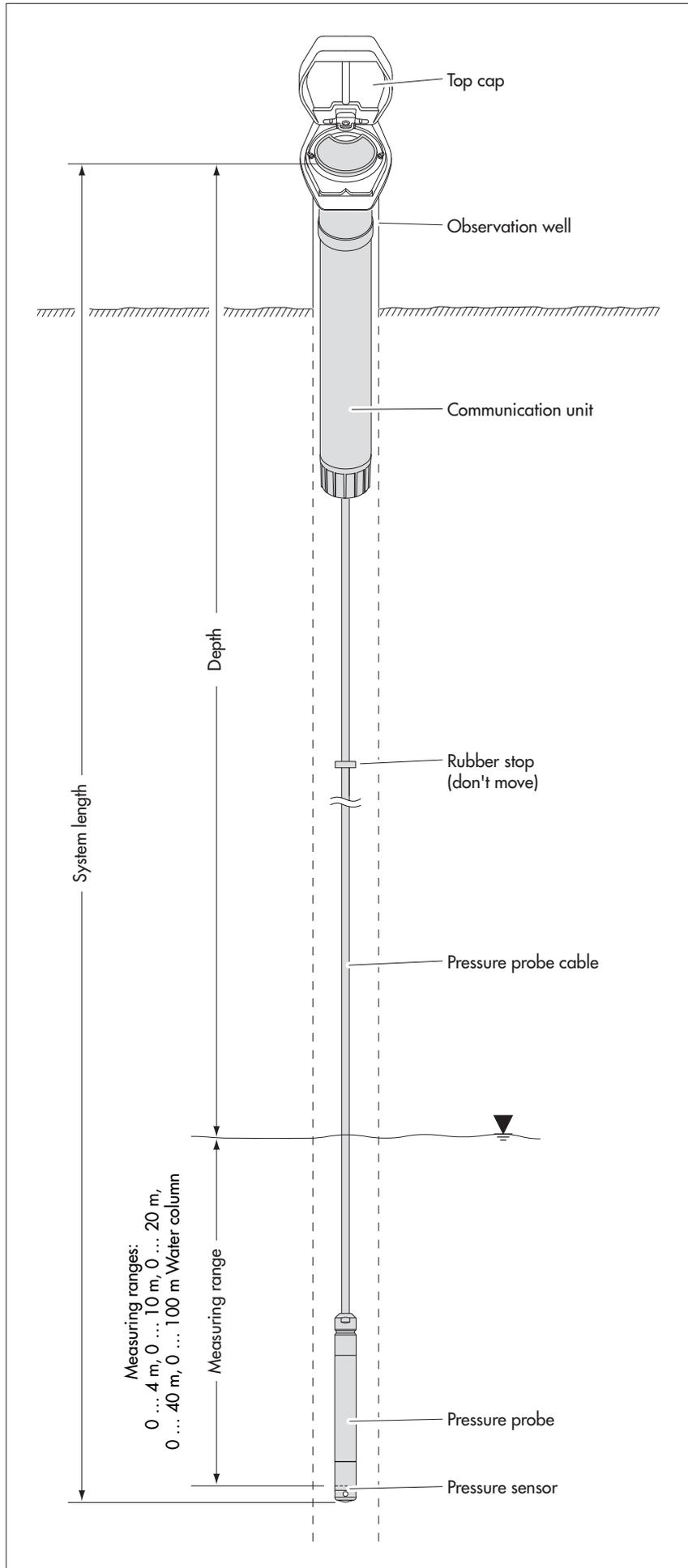
The communication unit of the OTT ecoLog 1000 can withstand temporary flooding (for details, refer to Chapter 22, "Technical data").

Fig. 1: Setup of a groundwater measurement station using the OTT ecoLog 1000.

The OTT ecoLog 1000 essentially consists of three components: communication unit, pressure probe cable, and pressure probe.

OTT ecoLog 1000 system length = length of communication unit + cable length + length of pressure probe.
 (The system length is required when ordering an OTT ecoLog 1000. When setting the OTT ecoLog 1000 operating parameters, the system length is not required.)

The rubber stop attached to the pressure probe cable prevents the pipe casing from falling when the communication unit is open. Do not move the rubber stop!



5 Installing, checking, and replacing batteries

WARNING Risk of fire and explosion due to improper handling of batteries



- ▶ Only use the specified lithium battery (26 Ah) from OTT HydroMet.
- ▶ Do not charge the battery.
- ▶ Avoid electrical short-circuits.
- ▶ Avoid mechanical damage.
- ▶ Do not open the battery.
- ▶ Do not throw the battery into a fire and do not expose it to temperatures of above +100 °C.
- ▶ Do not carry out any soldering work on the battery.
- ▶ Do not pull the battery connecting cable.
- ▶ Protect the battery from moisture.

CAUTION Risk of crushing fingers/hands during installation and maintenance



- Fingers/hands can become trapped or crushed when lowering the pressure sensor into the observation well and when closing the housing tube.
- ▶ Wear protective gloves during installation and maintenance.

CAUTION Risk of burns due to hot surface at high ambient temperature



- The metal parts of the OTT ecoLog 1000 housing can become very hot at high ambient temperatures ¹⁾. This can result in burns.
- ▶ Wear protective gloves during installation and maintenance.

¹⁾ > approx. +60 °C



Please note: Properly dispose of exhausted batteries! Do not put them into domestic waste!

Suitable battery type

- ▶ Lithium battery with connector; 3.6 V / 26 Ah; see accessories

Battery lifetime

With a sample interval of 1 hour; one single remote data transfer per day and one local communication (BLE) per month: at least 10 years.



Remarks:

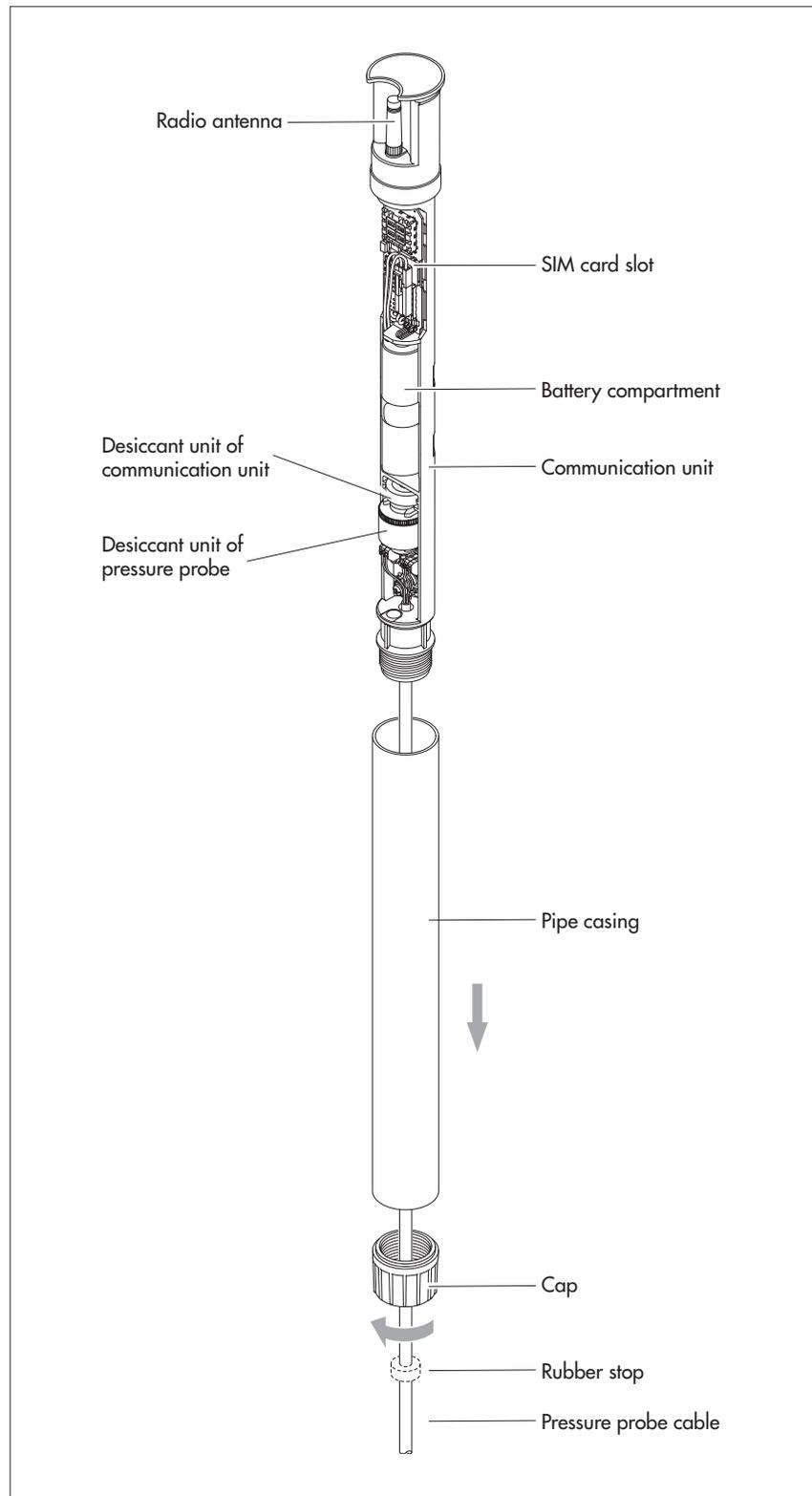
- ▶ The OTT ecoLog 1000 starts measuring within a few seconds after inserting the batteries (there is no ON/OFF switch).
- ▶ If the OTT ecoLog 1000 is to be shut off → disconnect the batteries. This will prevent the batteries from draining prematurely and will stop any recording of unusable measurements.
- ▶ When transporting the OTT ecoLog 1000 → disconnect the batteries. This will prevent the batteries from draining prematurely and will stop any recording of unusable measurements.

5.1 Power supply with lithium battery

How to insert the lithium battery

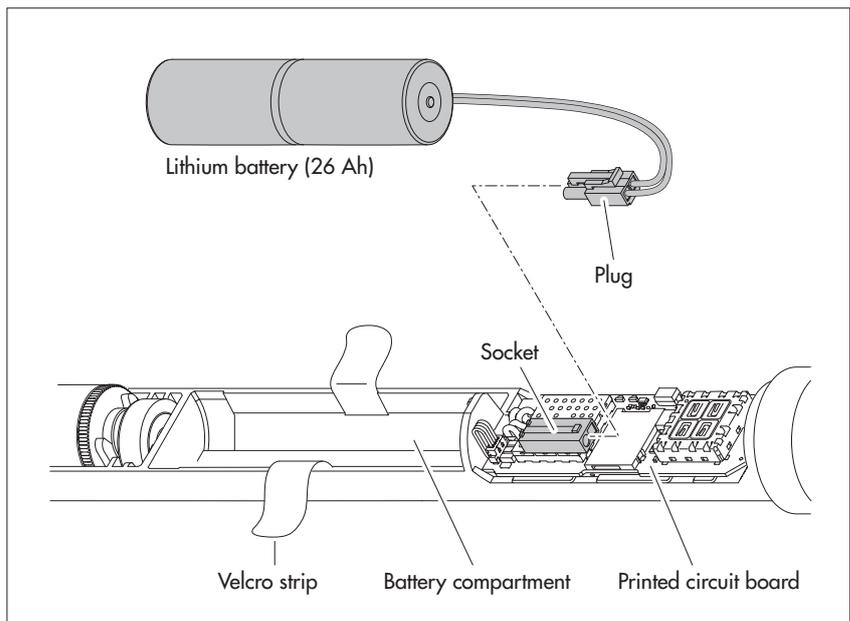
- Loosen the communication unit cap.
- Slide the cap and pipe casing of the communication unit approx. 50 cm towards the pressure probe cable.

Fig. 2: Setup of the OTT ecoLog 1000 communication unit.



- Connect the lithium battery plug to the socket of the printed circuit board, as shown in figure 3.

Fig. 3: Inserting the lithium battery.



- Open the Velcro strip of the battery compartment.
- Insert the lithium battery into the battery compartment (connecting cable guidance, see Fig. 4).
- Firmly close the Velcro strip around the lithium battery.
- Slide the cap and the pipe casing of the communication unit back up to the stop. Do not bend or pinch the battery lead.
- Reinstall the cap to the communication unit.

Check the battery voltage as follows

- Use the operating software "LinkComm" to establish a communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- If not yet selected: click on the "Dashbord" button.
- Click on the "Measure All" button → the OTT ecoLog 1000 starts an instantaneous value measurement → the measured value "Battery used (est.)" indicates the energy drawn from the battery so far in milliamper hours (mAh).
- Criterion for replacing the battery: milliamper hour drawn > approx. 20 000 mAh → replace the battery (for technical reasons, the battery voltage displayed cannot not be used as a criterion for replacing the battery.)
- Click on the "Disconnect" button.
- Quit LinkComm.

How to replace the lithium battery

- Open the top cap/observation well cover.
- Pull and hold the communication unit approximately 1 m out of the observation well (a second person would be useful).
- Loosen the communication unit cap.
- Slide the cap and pipe casing of the communication unit approx. 50 cm towards the pressure probe cable. (The rubber stop located on the pressure probe cable (refer to Fig. 2) prevents the pipe casing from falling. Do not move the rubber stop!)
- Disconnect the lithium battery plug from the socket of the printed circuit board, while pressing the connector latch.
- Open the Velcro strip of the battery compartment.
- Remove the exhausted lithium battery and make sure not to pull the lead!
- Within 40 seconds, connect the lithium battery plug to the socket of the printed circuit board, as shown in figure 3.
- Insert the lithium battery into the battery compartment (connecting cable guidance, see Fig. 4).
- Firmly close the Velcro strip around the lithium battery.
- Slide the cap and the pipe casing of the communication unit back up to the stop. Performing this, do not bend or pinch the battery lead.
- Reinstall the cap to the communication unit.
- Slowly and carefully reinsert the communication unit into the observation well.
- Reset value "Power consumption" (energy taken from the battery in milliampere hours) to "0" (LinkComm: "Diagnostics" button | "Reset PBAT").
- Close the top cap/observation well cover.

• Remarks:

- ▶ The OTT ecoLog 1000 stores the measured values in a non-volatile memory. There is no loss of data when changing battery. This also applies to storage without battery for a long period.
- ▶ If replacing the battery takes longer than approx. 40 seconds the time (and possibly the date) will have to be re-entered, (refer to Chapter 13, "Setting date and time").
- ▶ When replacing the battery, we recommend changing the desiccant capsules at the same time, (refer to Chapter 17.2, "Replacing the desiccant capsules").

5.2 Note on power supply using alkaline batteries

Power supply with alkaline batteries is not possible for the OTT ecoLog 1000!

6 Inserting a SIM card

For communicating over the cellular network, a SIM card is required (Type Mini-SIM card).

CAUTION Risk of crushing fingers/hands during installation and maintenance



Fingers/hands can become trapped or crushed when lowering the pressure sensor into the observation well and when closing the housing tube.

- ▶ Wear protective gloves during installation and maintenance.

CAUTION Risk of burns due to hot surface at high ambient temperature



The metal parts of the OTT ecoLog 1000 housing can become very hot at high ambient temperatures ¹⁾. This can result in burns.

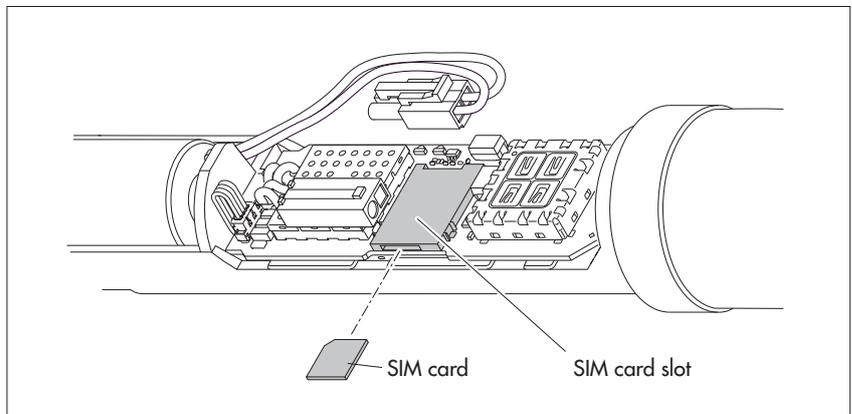
- ▶ Wear protective gloves during installation and maintenance.

¹⁾ > approx. +60 °C

How to insert the SIM card:

- Loosen the communication unit cap.
- Slide the cap and pipe casing of the communication unit approx. 50 cm towards the pressure probe cable, refer to Fig. 2.
- Temporarily disconnect battery (refer to Section 5.1).
- Make sure not to touch the gold-colored contacts of the SIM card! Insert the SIM card into the SIM card slot as shown in Fig. 4 (with the bevelled edge pointing left) until you hear it clicking into place. Make sure that the SIM card is fully inserted and engaged!

Fig. 4: Inserting the SIM card.



- Reconnect battery (refer to Section 5.1).
- Slide the cap and the pipe casing of the communication unit back up to the stop. Performing this, do not bend or pinch the battery lead.
- Reinstall the cap to the communication unit.

Changing/removing the SIM card

- Press the SIM card approx. 1 mm further into the SIM card slot before letting go. The SIM card will then be ejected a few millimeters and can easily be pulled out.

7 If required: Connecting an external radio antenna

If the local signal strength of the cellular network prevents transmitting from the closed observation well, an external radio antenna (accessory) is to be connected to the OTT ecoLog 1000. In this case, only the dedicated external radio antenna specified by OTT must be used for this particular application (cable length max. 3 m).

You may fasten the external radio antenna to a suitable location using the shim and nut supplied (drilling a hole for the thread of the external antenna is required: \varnothing approx. 18 mm). For this installation, an individual solution to fasten the external antenna must be found depending on the station.

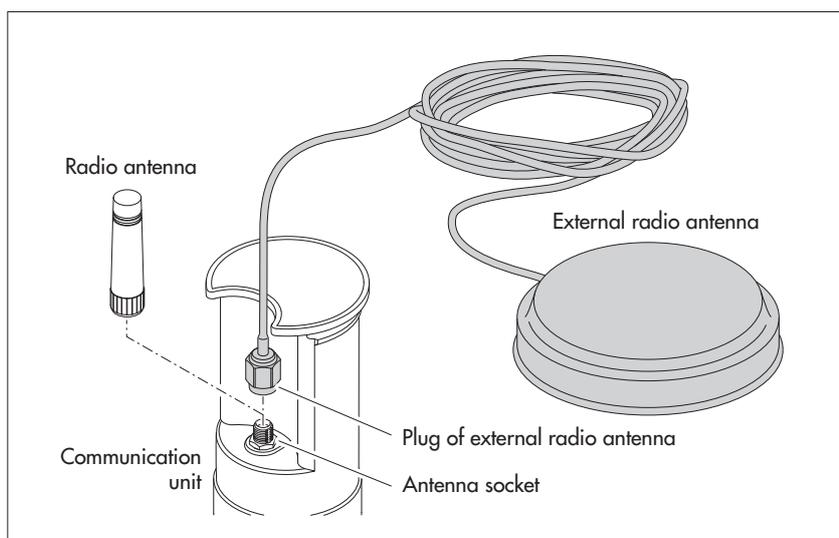
If the observation well is closed by a top cap you need to have a hole in the observation well so that the antenna cable can be routed to the outside (to prevent rain water from entering into the observation well, it is recommended to place the hole on the side). If required seal the cable feedthrough.

How to connect an external radio antenna

Depending on the particular local situation (diameter of the observation well, type of the top cap, and other mounting characteristics), the external radio antenna must be connected prior to or during installation. Please note the relevant chapters 8.2 through 8.4.

- Carefully unscrew the factory mounted antenna by hand.
- Route the plug of the antenna cable through a hole in the observation well.
- Connect the plug to the antenna socket and hand-tighten the locknut.
- Fasten the external radio antenna to a suitable location outside the observation well.

Fig. 5: Connecting an external radio antenna.



Remarks:

- ▶ When installing an external radio antenna, the minimum distance to people and other electrical equipment or antennae must be at least 0.20 m.
- ▶ Additional accessories for optimizing the radio conditions at the station are available on request (e.g. plastic top caps, top caps with external or internal radio antenna).

8 Installing the OTT ecoLog 1000 unit

WARNING Risk of explosion due to spark formation and electrostatic charge



If the OTT ecoLog 1000 is operated in an explosive atmosphere, there is a risk of the atmosphere igniting. This can cause an explosion involving a risk of very severe injury and damage.

- ▶ Never operate the OTT ecoLog 1000 in potentially explosive areas (e.g. waste water channels). The OTT ecoLog 1000 does not have EX protection (explosion protection).

WARNING Health hazard due to malfunctioning of cardiac pacemakers



Electromagnetic fields at the mobile wireless antenna on the OTT ecoLog 1000 can lead to malfunctioning of cardiac pacemakers. This can be life-threatening for users of pacemakers.

- ▶ Always maintain a safety distance of 0.2 metres between the mobile wireless antenna and personnel during installation and operation of the OTT ecoLog 1000

WARNING Risk of strangulation by pressure sensor cable



Hanging a pressure sensor cable around the neck during transportation/ installation can lead to strangulation if sufficient care is not exercised.

- ▶ Never hang the pressure sensor cable around the neck.

CAUTION Risk of crushing fingers/hands during installation and maintenance



Fingers/hands can become trapped or crushed when lowering the pressure sensor into the observation well and when closing the housing tube.

- ▶ Wear protective gloves during installation and maintenance.

CAUTION Risk of burns due to hot surface at high ambient temperature



The metal parts of the OTT ecoLog 1000 housing can become very hot at high ambient temperatures ¹⁾. This can result in burns.

- ▶ Wear protective gloves during installation and maintenance.

¹⁾ > approx. +60 °C

The OTT ecoLog 1000 is installed by hanging it into the observation well. The necessary accessories and type of installation vary depending on the diameter of the observation well and the design of the top cap:

- ▶ 2" observation wells
OTT top cap **with** cut-out for adapter plate refer to 8.1
- ▶ 4" or 6" observation wells,
OTT top cap **with** cut-out for adapter plate refer to 8.2
- ▶ Observation wells of 3" in diameter and above,
Top caps **without** cut-out for adapter plate refer to 8.3
- ▶ Special case: observation wells beginning at 3" in diameter
without top cap, universal installation refer to 8.4

Fig. 6: Accessories for installation – Part 1

- 1 = drilled hole for OTT ecoLog 1000
- 2 = cut-out for screws of the top cap
- 3 = cut-out for contact gauge

(Each adapter plate consists of two parts and three bolts. In the figure, the adapter plates are shown in installed condition (on delivery, they are not installed). Furthermore, an O-ring is supplied with the adapter plates.

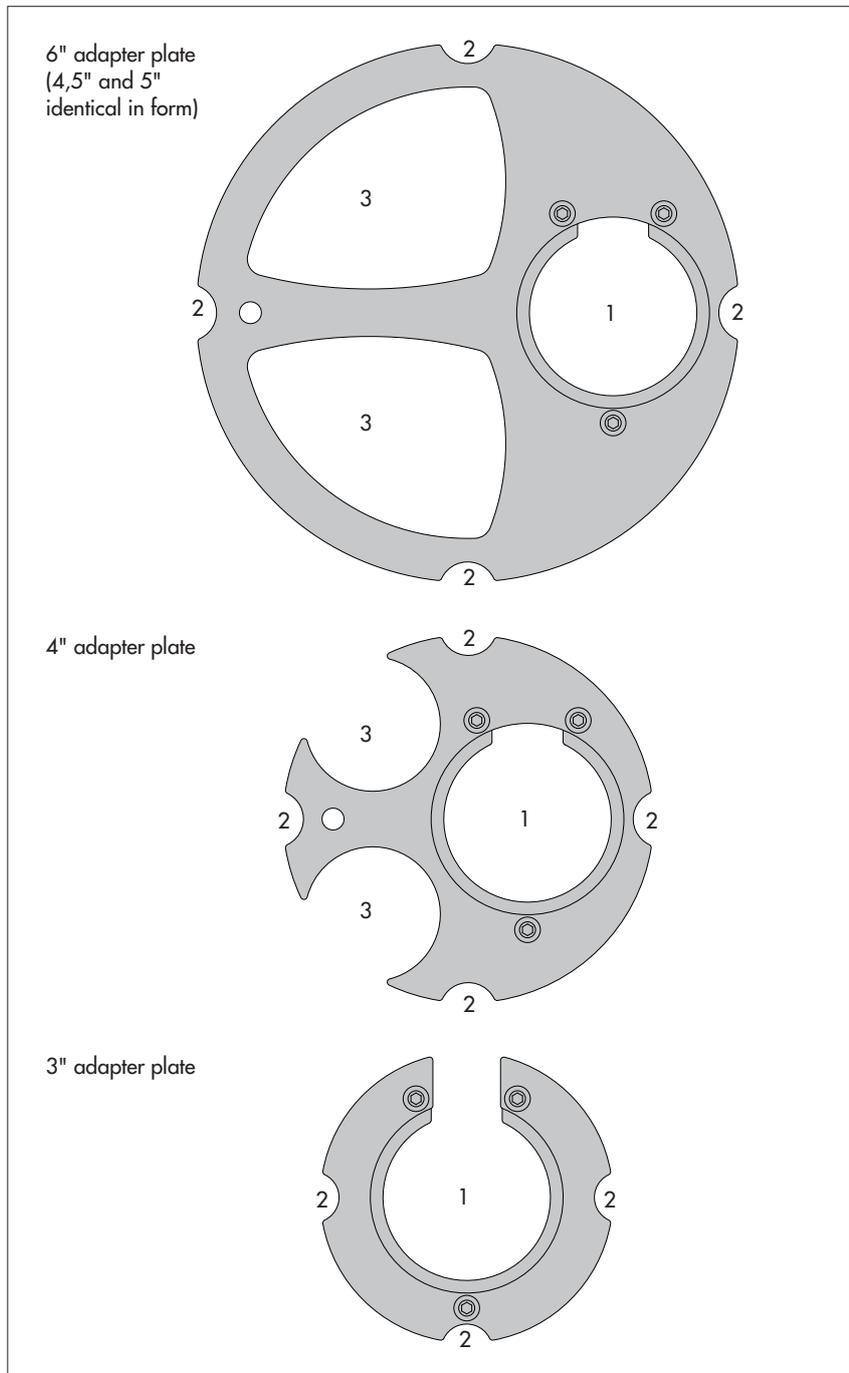
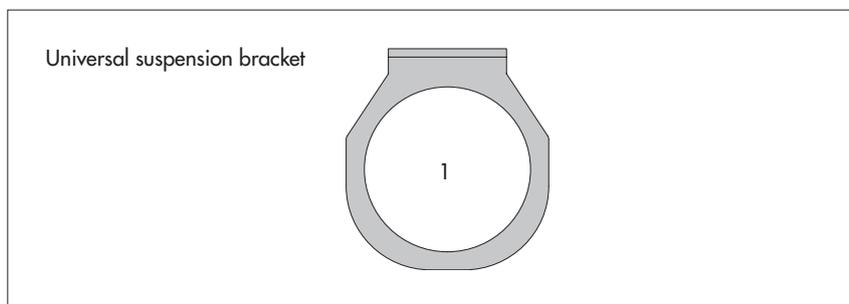


Fig. 7: Accessories for installation – Part 2

- 1 = drilled hole for OTT ecoLog 1000



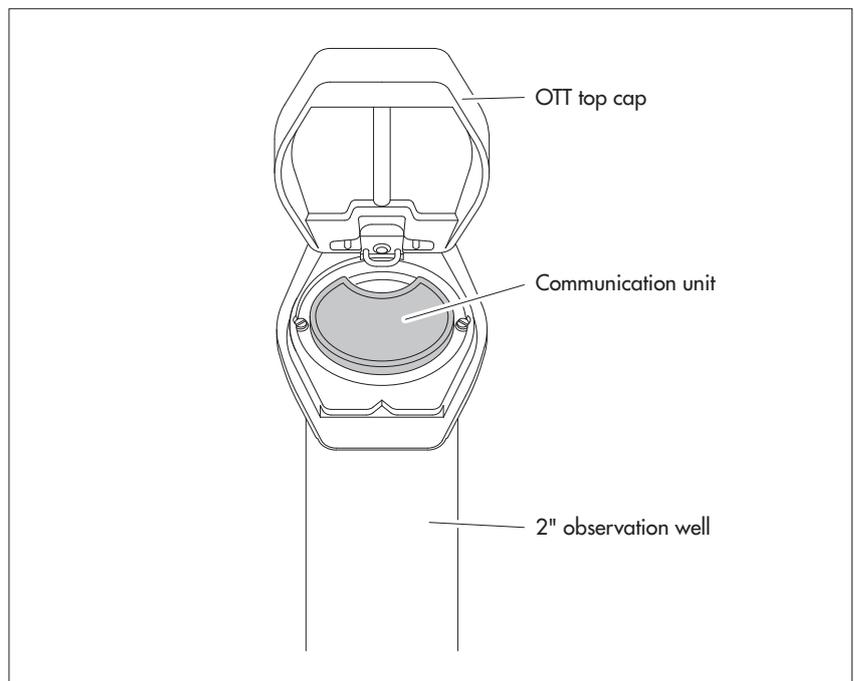
8.1 Installing the unit into 2" observation wells, top cap with cut-out

► Required accessories: 2" OTT top cap with cut-out

How to install the OTT ecoLog 1000

- Preliminary work: If not already done, install battery and SIM card, refer to Chapter 5 and 6.
- Open the top cap.
- Determine the current depth using a contact gauge and note the measured value.
- Insert the pressure probe into the observation well.
- **Slowly** and **carefully** lower the pressure probe by means of the pressure probe cable!
- Insert the communication unit into the observation well until the upper part of the communication unit is fully seated on the top cap, refer to Fig. 8.
- Set the operating parameters, refer to Chapter 9.
- Close the top cap.

Fig. 8: Installing the OTT ecoLog 1000 into a 2" observation well.



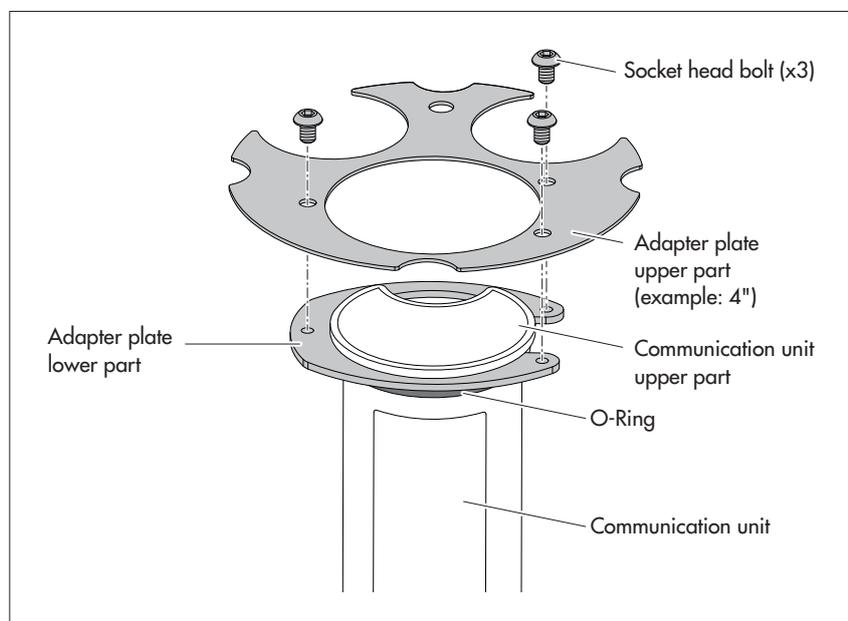
8.2 Installing the unit into 3", 4", 4.5", 5" or 6" observation wells, top cap with cut-out for adapter plate

- ▶ Required accessories: OTT top cap with appropriately sized cut-out and compatible adapter plate (incl. O-Ring).

How to install the OTT ecoLog 1000

- Preliminary work: If not already done, install batteries and SIM card, refer to Chapter 5 and 6.
- Put the O-ring over the upper part of the communication unit and slide 20 mm down.
- Slide the lower part of the adapter plate (horseshoe-shaped) below the communication unit over the pressure probe cable and, on the communication unit, slide it up horizontally until it touches the O-ring.
- Slightly tilt the lower part of the adapter plate and, while rotating it, slide it up over the O-ring.
- Slide the O-ring and the lower part of the adapter plate up until the O-ring is seated in one of the grooves provided for it.
- Assemble the required upper part of the adapter plate (3", 4", 4.5", 5" or 6") as shown in Figure 9 with the lower part using three M 2.5 socket head bolts.
- Open the top cap.
- 3" observation wells: Determine the current depth using a contact gauge and note the measured value.
- Insert the pressure probe into the observation well.
- **Slowly** and **carefully** lower the pressure probe into the observation well with the pressure probe cable, refer to Fig. 10!
- Insert the communication unit with adapter plate assembled into the observation well until the adapter plate and the upper part of the communication unit are fully seated on the top cap. Align as shown in Figure 11.
- 4" and 6" observation wells: Use a contact gauge to determine the current depth and record it (in the adapter plate, there is a cut-out for the contact gauge).
- Set the operating parameters, refer to Chapter 9.
- Close the top cap.

Fig. 9: Install the adapter plate to the upper part of the communication unit.
Example: 4" observation well.



- **Remark:** As an alternative to the procedure described above, you may install the adapter plate independently of the communication unit. In this case, you have to feed the pressure probe through the O-ring and the hole in the adapter plate and to pull the entire pressure probe cable.

Fig. 10: Feed the communication unit and adapter plate into the observation well.

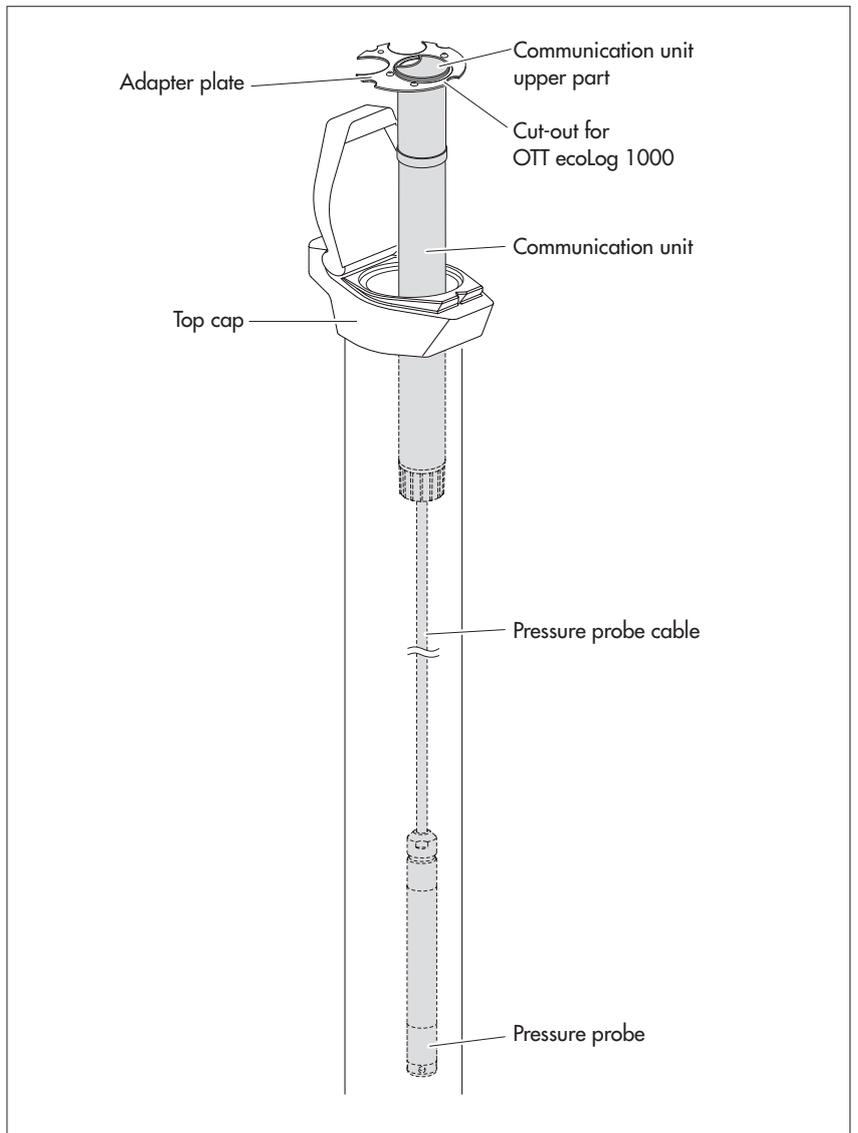
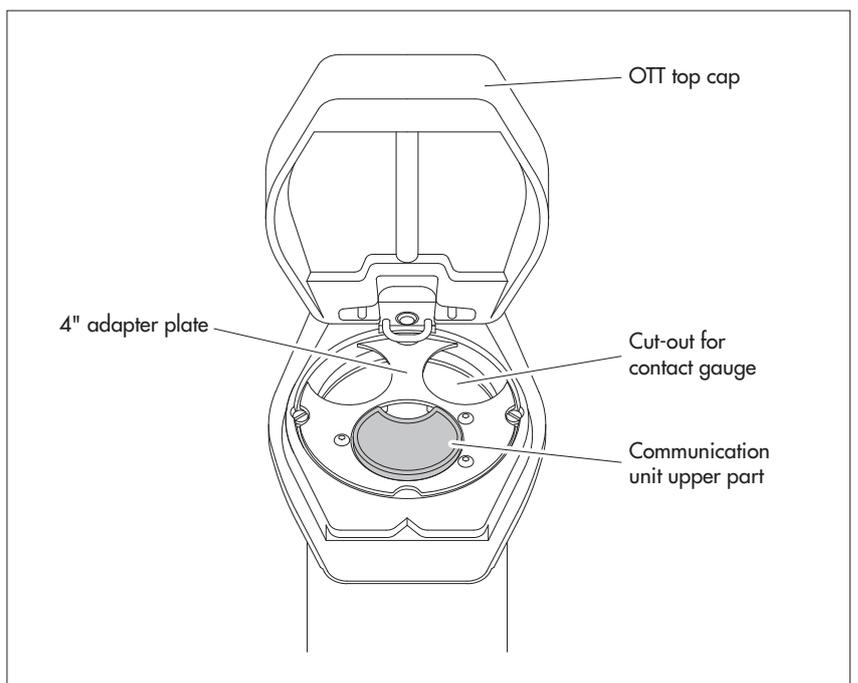


Fig. 11: Installing the OTT ecoLog 1000 into a 3", 4" or 6" observation well.
Example: 4" observation well.



8.3 Installing the unit into observation wells of 3" in diameter and above, top cap without cut-out for adapter plate

For this installation case, an individual solution to fasten the OTT ecoLog 1000 must be found depending on the station. Example: fix the universal suspension bracket using an M6 hex head bolt/hex nut laterally to the upper end of the observation well.

- ▶ Required accessories: universal suspension bracket, mounting bolts, e.g.: M6 hex head bolt, washer, and M6 hex nut (all made of stainless steel).

How to install the OTT ecoLog 1000

- Preliminary work: If not already done, install battery and SIM card, refer to Chapter 5 and 6.
 - Open the top cap.
 - Drill 2 holes (\varnothing 6.5 mm, 20 mm apart) laterally into the upper end of the observation well. The universal suspension bracket is to be mounted in such a way that there is a gap of a few millimeters between the top cap and the upper part of the communication unit with the top cap closed.
 - Attach the universal suspension bracket to the observation well using two M6 hex head bolts, washers, and M6 hex nuts. Use the two lower of the three drilled holes of the universal suspension bracket, refer to Fig. 12.
 - Pass the pressure probe through the cut-out of the universal suspension bracket.
 - ! ■ **Slowly** and **carefully** lower the pressure probe into the observation well with the pressure probe cable.
 - Pass the communication unit through the holes of the universal suspension bracket until the communication unit is seated on the universal suspension bracket, refer to Fig. 13.
 - Determine the current depth using a contact gauge and note the measured value.
 - Set the operating parameters, refer to Chapter 9.
 - Close the top cap.
- **Remark:** If protection against vandalism is required M6 threads are to be tapped into the observation well instead of mounting the unit by means of hex nuts.

Fig. 12: Mounting diagram for universal suspension brackets in observation wells of 3" and above.

Example: 4" observation well
 Minimum clearance (A) of the upper hole to the upper edge of the opened top cap: 43 mm!

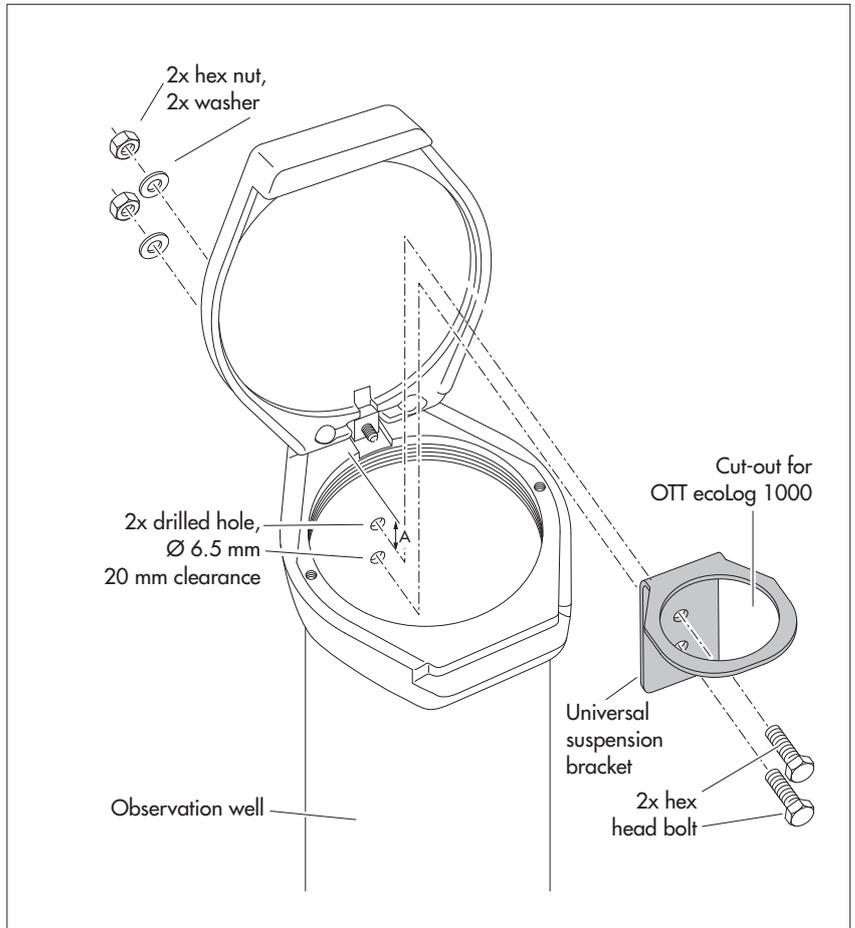
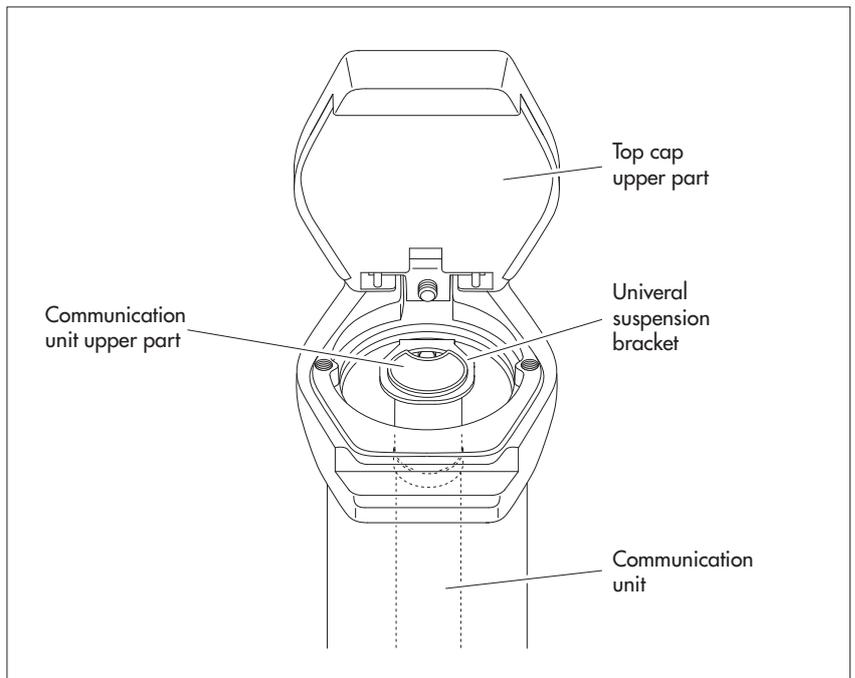


Fig. 13: Installing the OTT ecoLog 1000 into observation wells of 3" diameter and above with a top cap without cut-out.

Example: 4" observation well.



8.4 Installing the unit into observation wells of 3" in diameter and above, without top cap, universal installation

For this installation case, an individual solution to fasten the OTT ecoLog 1000 must be found depending on the station. Example: fix the universal suspension bracket using an M6 hex head bolt/hex nut laterally to the upper end of the observation well.

- ▶ Required accessories: universal suspension bracket, mounting bolts, e.g.: M6 hex head bolts, washers, and M6 hex nuts (all made of stainless steel).

How to install the OTT ecoLog 1000 (example)

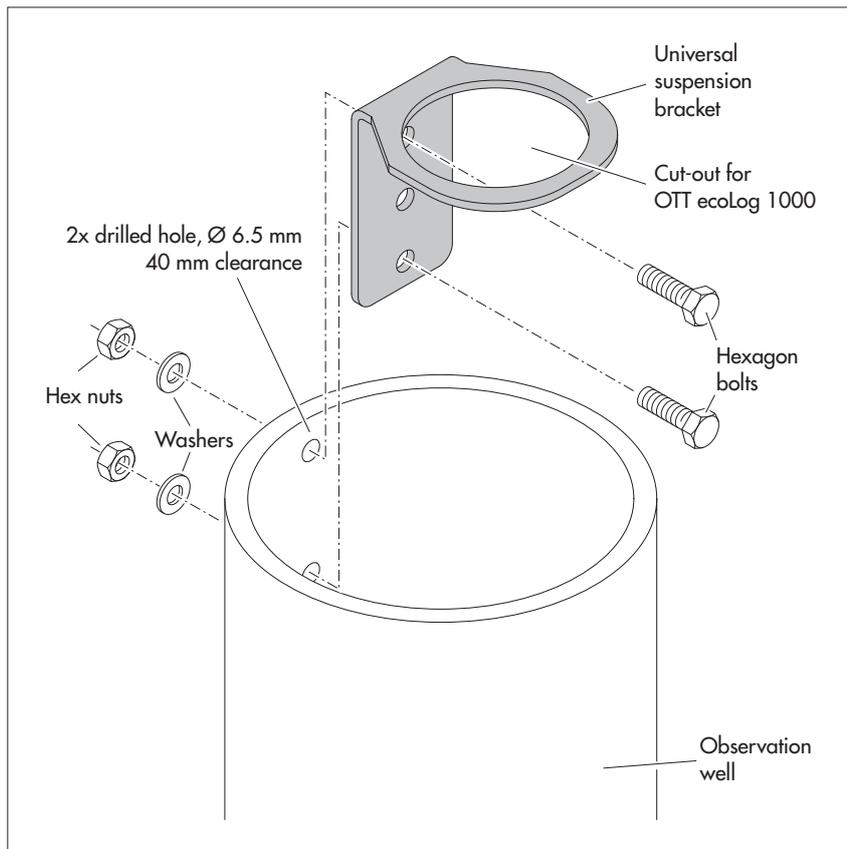
- Preliminary work: If not already done, install battery and SIM card, refer to Chapter 5 and 6.
- Drill 2 holes (\varnothing 6.5 mm, 40 mm apart) laterally into the upper end of the observation well, refer to Fig. 14.
- Attach the universal suspension bracket to the observation well using two M6 hex head bolts, washers, and M6 hex nuts. Use the uppermost and lowermost of the three drilled holes of the universal suspension bracket, refer to Fig. 14.
- Pass the pressure probe through the cut-out of the universal suspension bracket.
- **Slowly** and **carefully** lower the pressure probe into the observation well with the pressure probe cable.
- Pass the communication unit through the holes of the universal suspension bracket until the communication unit is seated on the universal suspension bracket, refer to Fig. 13.
- Determine the current depth using a contact gauge and note the measured value.
- Set the operating parameters, refer to Chapter 9.



Fig. 14: Mounting diagram for universal suspension brackets in observation wells of 3" and above.

Example: 4" observation well

If required, you may fix the universal suspension bracket reversed by 180° as well. The socket head bolts will then be easily accessible.



- **Remark:** If protection against vandalism is required M6 threads are to be tapped into the observation well instead of mounting the unit by means of hex nuts.

9 Setting OTT ecoLog 1000 operating parameters

9.1 Operating software "LinkComm"

To set the OTT ecoLog 1000 operating parameters, you will need the "LinkComm" software (operating software) from OTT HydroMet.

LinkComm is available for the following hardware:

- ▶ PCs with Microsoft Windows operating system, from version 10, Release 1607, Build 14393
- ▶ Mobile devices (smartphone/tablet) with Android operating system, from version 5
- ▶ Mobile devices (iPhone/iPad) with iOS operating system, from version 10.0

The PC-versions of LinkComm are included on the "USB flash drive with OTT Software" (see accessories). Alternatively they can be downloaded free of charge from the website "www.ott.com", section "Resources". An installation is not required. Unzip the download file and copy the contents to any directory on your PC.

You can also install LinkComm for mobile devices free of charge via the "App Store" / "Google play" store.

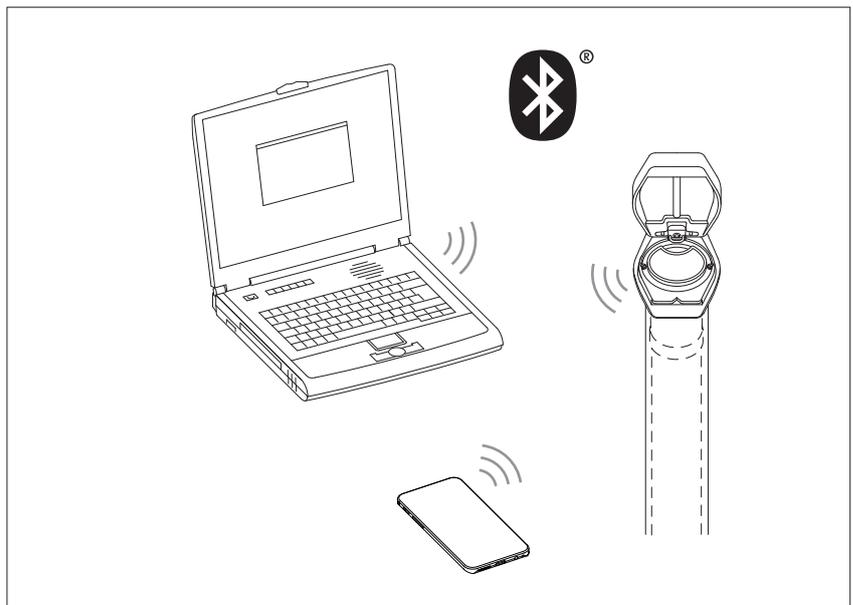
- **Remark:** The hardware intended for LinkComm requires a Bluetooth interface and must support the Bluetooth standard "BLE" (Bluetooth Low Energy). This is usually the case with current laptop PCs/mobile devices. Desktop PCs usually require a separate Bluetooth USB dongle.

9.2 Establishing a communication connection to OTT ecoLog 1000 (on site)

In the following chapters the establishment of a communication connection between the OTT ecoLog 1000 and a PC/mobile device is a prerequisite for the further worksteps.

Communication between the OTT ecoLog 1000 and a PC/mobile device is contactless via Bluetooth short-range radio using the Bluetooth standard "BLE" (Bluetooth Low Energy).

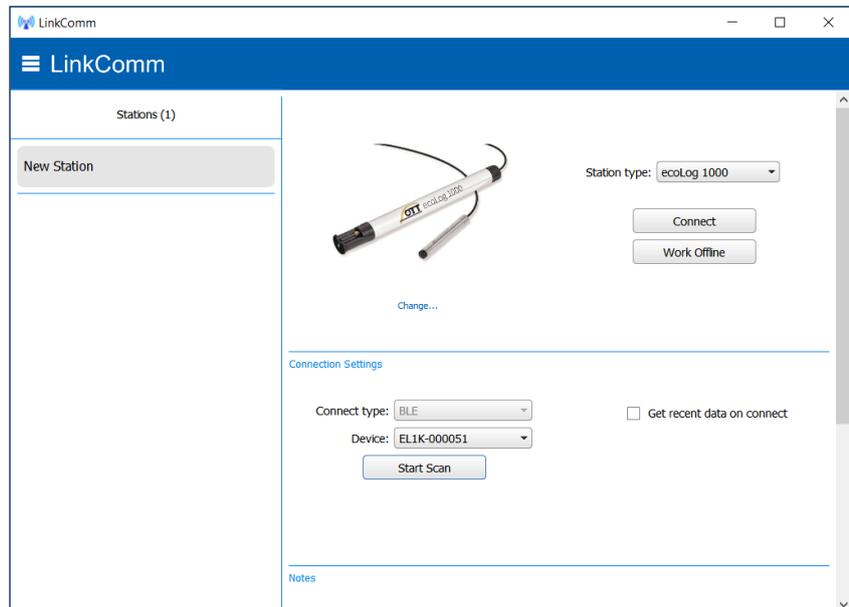
Fig. 15: PC/OTT ecoLog 1000 communication link.



How to establish a communication connection

- **Remark:** The maximum range of BLE is 10 meters (with free line of sight). As a rule, it is not possible to establish a communication connection to an OTT ecoLog 1000 in a well pipe with a closed well cap (made of metal).
 - Start the operating software "LinkComm".
 - Click on the "New Station" button ¹⁾.
 - If not yet done: select "Station type:" "OTT ecoLog 1000".
 - If not yet done: select "Connection type:" "BLE".
 - If a scan has not been performed automatically: click on the "Start Scan" button → the operating software searches for devices within radio range.
 - If several devices were found: select the desired device.
 - If required: activate the checkbox "Get recent data on connect"; this additionally retrieves the measured values of the last seven days.
 - Click on the "Connect" button → the operating software establishes a connection to the OTT ecoLog 1000 and reads the current configuration and the last measured values. The operating software then opens an overview window, the so-called "Dashbord".
- ¹⁾ alternatively, if the desired OTT ecoLog 1000 is already stored in the list of stations (via the main menu (≡) | "Save Station..."):
 - Click on the button of the stored OTT ecoLog 1000.

Fig. 16: Establish a communication connection to the OTT ecoLog 1000.



9.3 Establishing a communication connection remotely

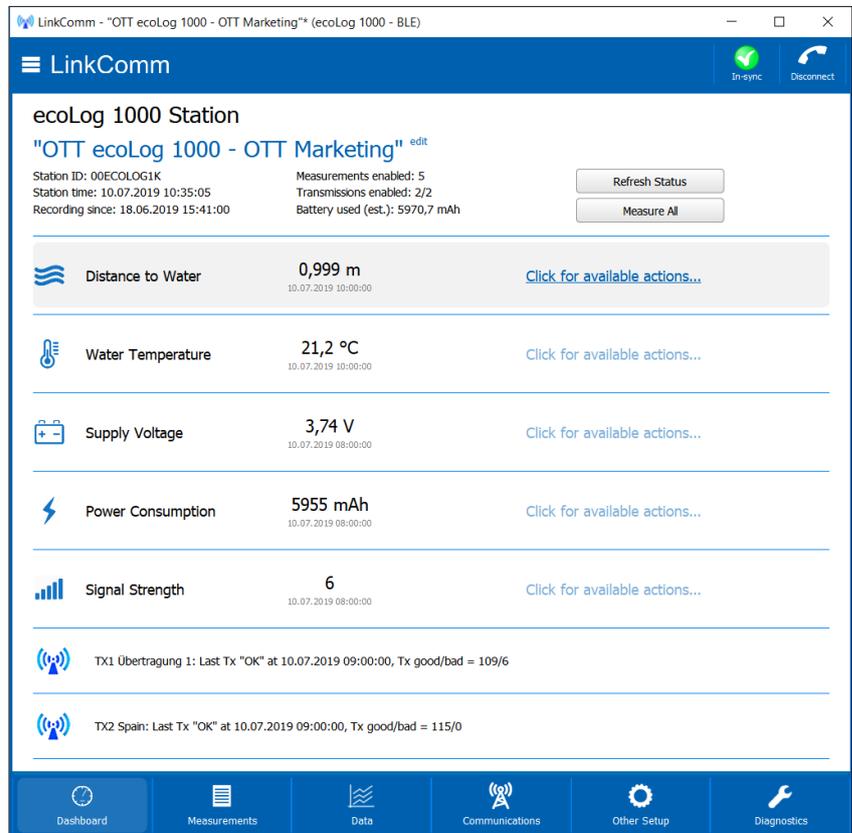
- **Remark:** a remote communication connection is not possible with an OTT ecoLog 1000.

Alternatively, to change the OTT ecoLog 1000 configuration remotely, the functions "Send SMS Command" (via the "LinkComm" operating software) and "OTT-ML command" (via the "OTT Hydras 3 net" application software) are available.

9.4 Setting OTT ecoLog 1000 operating parameters

- Start the operating software "LinkComm".
- If not yet done: use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).

Fig. 17: Setting OTT ecoLog 1000 operating parameters – dashboard of the operating software "LinkComm".



How to configure measurements

- Click on the "Measurements" button.
- Make the settings required for the measurements 1 ... 5 (measuring channels):
 - M1: Measurement of distance to water, water pressure
 - M2: Measurement of water temperature
 - M3: Measurement of supply voltage
 - M4: Measurement of power consumption
 - M5: Measurement of signal strength (RSSI)
- ▶ Number Sensor number, 4 characters (alphanumeric)
- ▶ Name Sensor name, max. 40 characters (alphanumeric)
- ▶ Sampling interval 5 s (15 min)... 24 h; the time interval in which the OTT ecoLog 1000 determines and stores measured values; (storing only if averaging is deactivated). The set sampling interval is on a fixed time grid (e.g. sampling interval 10 minutes; resulting time grid ..., 00:10, 00:20, 00:30, ...).

- ▶ Sensor type Measuring range
- ▶ Measurement type Water level or pressure
- ▶ Measurement mode Level or depth to water (not for pressure measurement)
- ▶ Gravity Local gravitational acceleration at the measurement site.
Gravity at the Earth's surface varies between 9.78036 m/s² at the equator and 9.83208 m/s² at the poles. It also decreases by 0.003086 m/s² for each kilometre above sea level.

- ▶ Density Density of water at the measuring site.
If necessary, set the actual density of the water at the measuring site; this is useful, for example, at measuring points with brackish water.

- ▶ Unit;
 Level unit;
 Pressure unit Depending on the respective measurement Mx
- ▶ Right digits Fixed default, depending on the unit

- ▶ Last reading Last measured value
- ▶ Time of last Date and time of the last measured value

- ▶ The "Refresh" button → retrieves the measured value of the last sampling interval.
- ▶ The "Measure" button → carries out an instantaneous value measurement.
- ▶ The "Live Poll" button → opens a window and continuously carries out instantaneous value measurements with adjustable time interval.

- ▶ Checkbox "Enable manual entry" see Chapter 10
- ▶ Checkbox "Update measured value" see Chapter 10
- ▶ Button "Calibrate ..." see Chapter 10
- ▶ Button "Enter value..." see Chapter 10

- ▶ Scaling
 → Linear scaling of measured values according to the equation
 "y = ax + b"
 a = Slope; b = Offset

- Example: In order to relate a level value to NN, it is necessary to provide the measured value with an offset. If, for example, the level reference point is 178 m NN, the scaling is "y = 1 · x + 178".
- ▶ Averaging
 Enable averaging
 → Averaging interval: the time interval within which the OTT ecoLog 1000 calculates and stores an arithmetic mean value from sampling interval values. The averaging interval must be an integer multiple of the sampling interval (e.g. sampling interval: 10 minutes; averaging interval 1 hour: the OTT ecoLog 1000 stores an arithmetic average of 6 sampling interval values every hour.
 → Min. good values: minimum number of valid values for the averaging (invalid values = stored error messages, see Chapter 17 "Error messages").

► Limits

Enable limits

- defines a limit value at which the OTT ecoLog 100 generates an alarm or performs an action.
- "+" / "-": creates up to 3 limit values or deletes them.
- Apply to sampled value: can be activated when averaging is active.
- Value: >= (greater than or equal to) or <= (less than or equal to) limit value
- Hysteresis: value by which the measured value must fall/rise again, before the OTT ecoLog 100 generates a new alarm.
- Tolerance count: number of sampling intervals at which the limit value must be reached before an alarm is generated.
- Enable gradient
 - Gradient direction: rising; falling; rising and falling
 - Gradient threshold: additional condition, independent of the statistic limit value, at which the OTT ecoLog 1000 generates an alarm.
 - Gradient deadtime: number of sampling intervals for which the OTT ecoLog 100 does not generate a further alarm when a new slope limit value occurs.
- Execute at limit end too: alarm generation also at subsequent undercut / exceeding the limit value threshold (when returning to the normal range).

► Storage

Enable storage delta

- the OTT ecoLog 1000 only saves a measured value if this value differs from the last stored measured value by the storage delta value. (If the storage delta value = 0, the OTT ecoLog 1000 saves all measured values.)

Remarks:

- the Storage delta function generates aperiodic time series.
- if the storage delta value is not equal to 0 and the OTT ecoLog 1000 contains a measured value for storage, the OTT ecoLog 1000 also stores the previous measured value (which did not exceed the storage delta value). This procedure optimizes the display when the measured values are evaluated graphically.

Example:

Polling interval: 1 hour
Averaging interval: 1 hour
Storage delta value: 0,05 m
Stored values: 11:00 o'clock; 1,20 m
 19:00 o'clock 1,21 m (subsequently saved)
 20:00 o'clock; 1,28 m

► Extremes

Enable daily min/max

- determines and stores the daily minimum/maximum.

Make communication settings

- Click on the "Communication" button.
- Make the required communication settings:
 - IP Transmissions
 - SMS Transmissions
 - Modem settings
 - SMS Commands

IP transmissions

Maximum possible number of IP transmissions: 2

- ▶ Name: name for this IP transmission
- ▶ Scheduled time: start time for the set time interval ("Scheduled interval")
- ▶ Scheduled interval: time interval at which the OTT ecoLog 1000 transmits the measured values via HTTP/HTTPS/FTP
Value range: OFF, 1 minute ... 24 hours, weekday
- ▶ Limit interval 1 ... 3: changed time interval when a limit value is reached. The limit value interval refers in each case to "Limit 1" to "Limit 3" of the conditions defined under "Limits" ("Measurements" button). For example, if a defined water level is exceeded, the OTT ecoLog 1000 carries out a data transmission every 6 hours instead of every 24 hours (planned interval).
Value range: 1 minute ... 24 hours
- ▶ Content: the OTT ecoLog 1000 transmits the measured values of the measurements that are activated.
- ▶ Server type: type of IP receiving server; HTTP, HTTPS or FTP
- ▶ Server address: IP address or URL of the HTTP/HTTPS/FTP server
- ▶ Server port: specifying the port allows the control of a specific TCP/IP communication interface (default: HTTP: 80; HTTPS: 443; FTP: 21)
- ▶ Timeout (sec): defines the maximum number of seconds the OTT ecoLog 1000 waits for a response from the HTTP/HTTPS/FTP server after sending a request (default: 20 s).
- ▶ Data path: path to the (sub) directory on an FTP server. When using the root-directory, leave input field empty (use separator "/" instead of "\").
- ▶ Enable basic authentication: activate checkbox if the HTTP/HTTPS server requires authentication.
- ▶ User name: login name of a user registered on the HTTP/HTTPS/FTP server.
- ▶ Password: password of the registered user; for security reasons, the operating software does not display the entered password legibly (a click on the symbol behind the input field displays the password).
- ▶ Data script: relative URL (to the server address) of a (PHP) script on the HTTP/HTTPS server that handles the automatic sending of data or a data request (mandatory).
- ▶ Alarm script: relative URL (to the server address) of a (PHP) script on the HTTP/HTTPS server that the OTT ecoLog 1000 calls in case of an alarm (optional).
- ▶ Command script: relative URL (to the server address) of a (PHP) script on the HTTP/HTTPS server that the OTT ecoLog 1000 calls and checks for commands to execute (optional).
- ▶ Acknowledge script: relative URL (to the server address) of a (PHP) script on the HTTP/HTTPS server that the OTT ecoLog 1000 calls to acknowledge executed commands or requests (optional).
- ▶ Configuration script: relative URL (to the server address) of a (PHP) script on the HTTP/HTTPS server receives a configuration (*.bin file) sent by OTT ecoLog 1000 (optional).
- ▶ OTT Hydras 3 Net Server: activate checkbox if the (PHP) scripts are managed by an OTT Hydras 3 net server.

- ▶ Workspace Type: if necessary, select the number or ID of the work area to which this OTT ecoLog 1000 is assigned.
- ▶ Checkbox "Data", "Alarms", "Commands": type of scripts used by the OTT Hydras 3 net server.
- ▶ Checkbox "Enable secondary server": activate if you want the IP data to be transferred to another server.
Redundancy mode: "Backup" (if primary server fails) or "Both Servers" (for greater data security and availability).

Modem settings

- ▶ PIN: PIN (Personal Identification Number) of the SIM card. Format: 4 digits. (You can deactivate the PIN of the SIM card in a mobile phone, for example; security risk! In this case leave the input field empty.)
- ▶ Phone number: phone number of SIM card
- ▶ Roaming: On (allow)/Off (do not allow)
- ▶ Provider name : select the mobile network operator belonging to the SIM card from the selection list. The selection list is sorted by leading countries. The corresponding network access (APN) as well as the user name and password (if required) are automatically specified by the operating software. Alternatively, enter any operator name and the associated additional settings manually.
- ▶ User name: see "Provider name"
- ▶ Password: see "Provider name"
- ▶ Access number: abbreviated number of the PPP dial-in point for establishing an Internet connection via the mobile modem (in the standard case "*99***1#").

SMS transmissions

Maximum number of SMS transmissions: 2

- ▶ Phone number 1/2: telephone number of the receiving modem or of a "Large Accounts".
- ▶ Scheduled time: start time for the set time interval ("Scheduled interval").
- ▶ Scheduled interval: time interval, in which the OTT ecoLog 1000 transmits measured values by SMS.
Value range: OFF, 1 minute ... 24 hours, weekday
- ▶ Limit interval 1 ... 3: 3 additionally definable time intervals at which the OTT ecoLog 1000 automatically transmits data via SMS when certain limit value events are reached.
Value range: 1 minute ... 24 hours
- ▶ Max. messages count: maximum number of SMS messages in case one SMS is not sufficient for the amount of data to be transmitted.
- ▶ Content: the OTT ecoLog 1000 transmits the measured values of the measurements that are activated.
- ▶ Button "SMS Test": immediately sends a test SMS with specified transmission content to the set phone number(s).

SMS commands

With the function "SMS Listening" it is possible to activate the mobile modem of the OTT ecoLog 1000 for approx. 1.5 minutes. For this purpose the OTT ecoLog 1000 switches on the mobile radio modem at a preset time (the mobile radio modem of the OTT ecoLog 1000 books itself into the mobile radio network) and after approx. 1.5 minutes it switches off again. During this time, the SMS Service Center can copy SMS messages sent to the OTT ecoLog 1000 mobile modem's phone number into the OTT ecoLog 1000 mobile modem's memory. The OTT ecoLog 1000 then searches the received SMS for a system command and executes it.

- ▶ Scheduled interval: time interval at which the OTT ecoLog 1000 activates the mobile radio modem.
- ▶ Scheduled time: Start time for the set time interval ("Scheduled interval").
- ▶ Password: Password that must be contained in the SMS in order for the SMS command to be executed; for security reasons, the operating software does not display the entered password in a legible form (click on the symbol behind the input field to display the password).
- ▶ Additional text: any text that appears as prefix in the response SMS to the SMS command "Systeminformation anfordern".
- ▶ Acknowledge SMS command: sends an SMS confirmation to an SMS command.

If LinkComm is used on a mobile device, SMS commands can be sent directly from the operating software to an OTT ecoLog 1000.

- ▶ Change SMS listening interval
- ▶ Change transmission interval (TX1)
- ▶ Change storage interval (M1)
- ▶ Change limit value (M1)
- ▶ Enter observed value(M1)
- ▶ Request system information

The information required for the respective SMS command as well as the OTT ecoLog 1000 phone number must be entered in the corresponding input fields. Then send the SMS command via the "Send now" button.

Send operating parameters to the OTT ecoLog 1000

After all required operating parameters have been set, a yellow warning triangle indicates that the configuration within the operating software has changed.

- Click on yellow warning triangle → a window to send the configuration to the OTT ecoLog 1000 opens.
- Click on the "Send Setup to Station" button → a warning appears.
- Acknowledge warning with "Yes" → the operating software sends the changed configuration to the OTT ecoLog 1000.

9.5 Importing/exporting the OTT ecoLog 1000 configuration

The import/export functions are available for forwarding an OTT ecoLog 1000 configuration, for example via USB flash drive or e-mail. A configuration can also be transferred to the OTT Hydras 3 application software via export as an XML file. The OTT Hydras 3 application software thus creates the entire measuring site-/sensor configuration in an OTT Hydras 3 working range.

It is also possible to save the configuration of an OTT ecoLog 1000 as so-called "Station" in the "LinkComm" operating software.

Available export/import formats

- ▶ Export ("bin" file)
- ▶ Export for user software OTT Hydras 3
- ▶ Import ("bin" file)

The "LinkComm" operating software saves all necessary configuration data in a single "*.bin" or "*.xml" file, depending on the export type.

How to export a configuration (*.bin" file)

This export type is required to pass on an OTT ecoLog 1000 configuration as "*.bin" file. The configuration can be read back into the operating software via the "Import Setup..." function.

- If not yet done: use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- In the main menu (≡) of the operating software select the function "Export Setup ..." → a window for setting the file name and storage location opens.
- Make the settings and click on "Save" → the operating software saves the configuration in a "*.bin" file.

- **Remark:** the file name of the "*.bin" file is arbitrary. The operating software will suggest a combination of station name, configuration and date.

How to export a configuration (OTT Hydras 3)

This export type is required to pass on an OTT ecoLog 1000 configuration to the application software OTT Hydras 3. This "*.xml" file can be read in via the Hydras 3 function "File", "Import Station configuration (XML)".

- If not yet done: use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- In the main menu (≡) of the operating software select the function "Export Hydras 3 (XML)" → a window for setting the file name and storage location opens.
- Make the settings and click on "Save" → the operating software saves the configuration in a "*.xml" file.

- **Remark:** the file name of the "*.xml" file is arbitrary. The operating software will suggest a combination of station name, configuration and date.

How to import a configuration

- If not yet done: use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- In the main menu (☰) of the operating function select "Import Setup ..." → a window to select the "*.bin" file opens.
- Select "*.bin" file and click on "Open" → a yellow warning triangle indicates that the configuration within the operating software has changed.
- Click on the yellow warning triangle → a window to send the configuration to the OTT ecoLog 1000 opens.
- Click on the "Send Setup to Station" button → a warning appears.
- Acknowledge warning with "Yes" → the operating software sends the changed configuration to the OTT ecoLog 1000.



Please note:

- ▶ The measured values stored in the OTT ecoLog 1000 are irrevocably lost when the configuration is changed! If necessary, read out measured values before deleting!
- ▶ The previous configuration of the OTT ecoLog 1000 is also lost. If necessary, export the configuration to a file beforehand (see "How to export a configuration").

10 Creating an observer entry (observer function) and adjusting measured values

The operating software enables the input of a manually determined measured value (observer entry) – e.g. contact gauge value – via a so-called "Observer". A manually determined measured value can also be used to adjust the measured values (offset setting). These functions are available for measurement "M1" (water level/pressure measurement). The effect of a manually measured value (control value) can be set via checkbox options.

As an alternative to the following procedure, you can also display instantaneous values or make observer entries from a mobile phone via SMS short message. This requires that the "SMS Commands" function is activated and configured.

How to set the options

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Measurements" button.
- If not selected yet: click on measurement "M1".
- Activate the checkbox "Enable manual entry".
- If required: checkbox "Update measured value" (the button directly below changes its label from "Enter value..." to "Calibrate ...") → a yellow warning triangle indicates that the configuration within the operating software has changed.
- Click on the yellow warning triangle → a window for sending the configuration to the OTT ecoLog 1000 opens.
- Click on the "Send Setup to Station" button → the operating software sends the changed configuration to the OTT ecoLog 1000.

Remarks:

- ▶ The OTT ecoLog 1000 stores each observer entry in an info channel with date and time. This information can be displayed in the evaluation window of a sensor ("Observer registration general") after it has been read in and transferred to the OTT Hydras 3 application software via the "Info Data" | "Station" | "Displays" function. They are also visible via "Data" | "View: Events" in the operating software.
- ▶ If the checkbox "Calibrate..." in the "Measurements" window is not activated, the OTT ecoLog 1000 additionally stores the entered control value to the currently measured instantaneous value. These two values can be displayed in the evaluation window of a sensor ("Observer registration with check value") after they have been read in and transferred to the application software OTT Hydras 3 via the "Info Data" | "Sensor" | "Displays" function. They are also visible via "Data" | "View: Events" in the operating software.

How to adjust measured values (offset setting)

Precondition: the checkbox "Update measured value" is **activated!**
(see "How to set the options")

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Measurements" button.
- If not selected yet: click on measurement "M1".
- Click on the "Calibrate..." button → a window for entering a control value opens.
- Enter control value and click on "OK" → the operating software sends the control value to the OTT ecoLog 1000.

- **Remark:** the control value entered can then be seen under "Scaling" | "Offset" (rounding error is possible). The OTT ecoLog 1000 now determines all other measured values taking this offset into account.

How to create an observer entry

Precondition: the checkbox "Update measured value" is **deactivated!**
(see "How to set the options")

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Measurements" button.
- If not selected yet: click on measurement "M1".
- Click on the "Enter value..." button → a window for entering a control value opens.
- Enter control value and click on "OK" → the operating software sends the control value to the OTT ecoLog 1000.

11 Downloading, displaying and saving data

How to download data (on site)

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Data" button.
- Choose the time span; set "Start time" and "End time" if required.
- Activate the checkbox "Include Events" if required. If this checkbox is activated, the operating software also loads all events stored in an info channel; e.g. observer entries.
- Activate the checkbox "Disable Graph" if required. This prevents the potentially time-consuming (with a large number of measured values) graphical display immediately after downloading .
- Click on the "Download" button.

- **Remark:** If the "Download" button is marked with ***, the data displayed do not (any longer) correspond to the selected time span. If this is the case, click on the "Download" button once again.

How to display data graphically

- Click the view "Graph" → the operating software displays all measured values in graphical form (if the checkbox "Disable Graph" is activated: deactivate checkbox).
- Activate/deactivate checkbox for the desired measured values (Water Level, Water temperature, Power Consumption, Signal strength (RSSI), Supply Voltage).

- **Remark:** the operating software automatically scales the y-axis of the graphical display – depending on the activated measured values.

How to display data numerically

- Click the view "Table" → the operating software displays all measured values in tabular form.
- Activate/deactivate checkbox for the desired measured values (Water Level, Water temperature, Power Consumption, Signal strength (RSSI), Supply Voltage).

How to display events (info channel)

- Click the view "Events" → the operating software provides the content of the info channel as a text file (in OTT ML format). (The checkbox "Include Events" must have been activated during download).

How to save data in a file

- Click the view "Graph" or "Table".
- Activate/deactivate checkbox for the measured values you want to save.
- Click on the "Save File ..." button → a window for selection of the data format opens.
- Select the data format:
 - CSV: structured text file in CSV-format (Comma-Separated Values)
 - MIS: OTT-specific file format for automatic import into the measured value database of the OTT Hydras 3 application software.
- Click on the "OK" button → a window for setting file name, storage location and file extension opens.
- Make settings and click on "Save" → the operating software saves the selected measured values in a corresponding file (file format: "*.csv"; "*.mis" or "*.txt").

How to save a graphical presentation as an image file

- Click the view "Graph".
- If the checkbox "Disable Graph" is activated: deactivate checkbox.
- Activate/deactivate checkbox for the desired measured values.
- Click on the "Save Image ..." button → a window for setting the file name and storage location opens.
- Make settings and click on "Save" → the operating software saves the selected graph in a corresponding image file (file format: "*.png").

How to save events in a file

- Click the view "Events". (The checkbox "Include Events" must have been activated during download).
- Click on the "Save File ..." button → a window for setting the file name and storage location opens.
- Make settings and click on "Save" → the operating software saves the events in a corresponding file (file format: "*.xml").

- **Remark:** Events (info data) are available in the OTT-specific "OTT-ML"-format (OTT Markup Language). Info data is explicitly provided for display and evaluation of data in the OTT Hydras 3 application software.

12 Protecting the OTT ecoLog 1000 with a password

To prevent unauthorized access (via local communication via BLE) to the OTT ecoLog 1000, you can protect it with a password.

How to protect the OTT ecoLog 1000 with a password

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Other Setup" button.
- Click on the "Change Password ..." button → a window to define the password opens.
- Enter password (max. 64 alphanumeric characters/special characters).
- Enter password again.
- Click "OK" → a yellow warning triangle indicates that the configuration within the operating software has changed.
- Click on the yellow warning triangle → a window for sending the configuration to the OTT ecoLog 1000 opens.
- Click on the "Send Setup to Station" button → the operating software sends the changed configuration to the OTT ecoLog 1000.

! **Please note:** If you lose your password, you will no longer be able to access the OTT ecoLog 1000 with the operating software. In this case, please contact the OTT HydroService.

How to release a password-protected OTT ecoLog 1000

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2) → a window to enter the password opens.
- Enter password and click on "OK" → the operating software retrieves the current configuration of the OTT ecoLog 1000.

• **Remark:** To remove a specified password: proceed as described under "How to protect the OTT ecoLog 1000 with a password" but leave both password input fields empty.

13 Setting date and time

The internal clock of the OTT ecoLog 1000 is a real-time clock with high accuracy. It runs as soon as the battery is inserted into the OTT ecoLog 1000. After removing the battery, the clock continues to run for approx. 40 seconds.

The OTT ecoLog 1000 loses the date and time in the event of a longer power interruption. When the battery is reconnected, the OTT ecoLog 1000 will accept the date and time of the last stored measured value, adding one minute to the stored time. The date and time are set via the operating software "LinkComm".

In addition, the OTT ecoLog 1000 can synchronise the date/time via the mobile network using the "SNTP time synchronisation" function. In this case it uses the so-called Coordinated Universal Time (UTC), whereby the local time of the measuring site is adjusted via a set time zone. The SNTP time synchronisation checks the date/time once a day and corrects the values if necessary.

! **Please note:** It makes no sense to use daylight saving time (DST) on the OTT ecoLog 1000 if you want to obtain continuous time series. An activated SNTP time synchronisation automatically prevents this (prerequisite: correctly set time zone of the measurement site).

How to set date and time

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Other Setup" button.
- Recommended: activate the checkbox of the SNTP time synchronization (prerequisite: a SIM card is inserted and the required modem settings are entered).
- Enter at least one server address for the SNTP time synchronisation (e.g. "0.europe.pool.ntp.org").
- Click on the "Set Clock" button.
- Activate the checkbox "Set clock using PC time" (if the PC uses daylight saving time (DST) do not activate the checkbox but set time manually).
- Click on the "Set Clock" button → the operating software sets the OTT ecoLog 1000 date and time according to the PC time/PC date or according to the individually set values.
- Click on the "Close" button.

• **Remark:** When restarting after a long period of inactivity, it may be useful to delete the database after setting the date and time (Refer to Chapter 14).

14 Deleting the database

! **Please note:** The measured values stored in the OTT ecoLog 1000 are irrevocably lost when the database is deleted! If necessary read out measured values before deletion!

How to delete the database

- Start the operating software "LinkComm".
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2).
- Click on the "Diagnostics" button.
- Click on the "Delete database" button.
- Acknowledge warning with "Yes" → the operating software deletes the complete database of the OTT ecoLog 1000 (all measured value channels including the info channel). The OTT ecoLog 1000 then determines and stores the water level and water temperature as well as the other measured values at the set intervals.

15 Updating the OTT ecoLog 1000 Firmware

If required, you have the option of updating the OTT ecoLog 1000 firmware (operating system software). This makes sense, if e.g. devices delivered at different times are to receive the same operating system version.

Updating is carried out via the operating software "LinkComm". According to availability, an updated version of the OTT ecoLog 1000 firmware can be found on the internet site "www.ott.com", in the "Resources" section.

How to update the firmware

- Download new version of firmware from the website (File: e.g. "5545030293_01001_el1000.bin").
- Use the operating software to establish a local communication connection to the OTT ecoLog 1000 (Refer to Chapter 9.2)
- Click on the "Diagnostics" button.
- Click on the "Upgrade" button → a window for selection of the firmware file opens.
- Select firmware file and click on "Open" → the operating software copies the new firmware to the OTT ecoLog 1000. The OTT ecoLog 1000 then determines and stores the water level and water temperature as well as the other measured values at the set intervals.

! **Please note:** When updating, be sure to avoid a break in the communication connection (e.g. by accidentally exceeding the BLE range). If the communication connection is interrupted, the firmware is no longer executable. Likewise, you should not start any further programs/apps during the copy process and should not open any files.

• **Remark:** The measured values stored in the OTT ecoLog 1000 are not lost when the firmware is updated.

16 Further functions of the operating software "LinkComm"

The "LinkComm" operating software provides a range of additional functions for convenient operation, monitoring of communication and troubleshooting.

Calling a function via the "Diagnostics" button:

► System Info

Firmware Diagnostics

LinkComm Data Usage

LinkComm Diagnostics

show details of the individual areas.

The "Save Diagnostics" button (PC) or "Share Diagnostics" button (App) retrieves an extensive diagnostic log from the OTT ecoLog 1000, which can be saved to a file or sent. This diagnostic log is intended for very experienced and trained users as well as for the OTT HydroService!

► Button "Terminal"

Represents the communication flow via the Bluetooth interface (BLE) between the operating software and the OTT ecoLog 1000. In addition, special commands can be sent to the OTT ecoLog 1000. This function is intended for very experienced and trained users as well as for the OTT HydroService!

► Button "Data Flow"

Represents the communication data flow via the Bluetooth interface (BLE) between the operating software and the OTT ecoLog 1000. This function is intended for very experienced and trained users as well as for the OTT HydroService!

► Button "Set Clock"

Sets the time of the OTT ecoLog 1000; refer also to Chapter 13, "Setting date and time".

► Button "Upgrade"

Executes a firmware update of the OTT ecoLog 1000; refer also to Chapter 15, "Updating the OTT ecoLog 100 Firmware".

► Button "Factory Defaults"

Resets the OTT ecoLog 1000 to the factory settings and simultaneously deletes the database completely and irrevocably.

► Button "Delete Database"

Deletes the database of the OTT ecoLog 1000 completely and irrevocably; refer also to Chapter 14, "Deleting the database".

► Button "Reboot"

Restarts the OTT ecoLog 1000 (disconnects the active connection).

► Button "Reset PBAT"

Resets the value "Power consumption" (energy taken from the battery in-milliampere hours) to "0"; refer also to Chapter 5, "Installing, checking, and replacing batteries".

Calling a function via the main menu (≡) of the operating software:

▶ **Import Setup**

Imports all data of stations contained in a "*.ldz" file (database file) (OTT ecoLog 1000 configurations) into the operating software.

▶ **Export Setup**

Exports all data of stations stored in the operating software (OTT ecoLog 1000 configurations) into a "*.ldz" file. This can be used to back up data and share a variety of configurations.

▶ **About**

Shows the version of the operating software "LinkComm" as well as other information.

▶ **Language**

Opens a window for setting the language of the LinkComm user interface (German, English, French, Spanish).

▶ **Event Log**

Shows all internal activity of the operating software. The event log is intended for very experienced and trained users as well as for the OTT HydroService

▶ **Exit**

Exits the operating software (not available in the LinkComm-Apps for Android and iOS).

17 Maintenance work

CAUTION Risk of crushing fingers/hands during installation and maintenance



Fingers/hands can become trapped or crushed when lowering the pressure sensor into the observation well and when closing the housing tube.

- ▶ Wear protective gloves during installation and maintenance.

CAUTION Risk of burns due to hot surface at high ambient temperature



The metal parts of the OTT ecoLog 1000 housing can become very hot at high ambient temperatures ¹⁾. This can result in burns.

- ▶ Wear protective gloves during installation and maintenance.

¹⁾ > approx. +60 °C

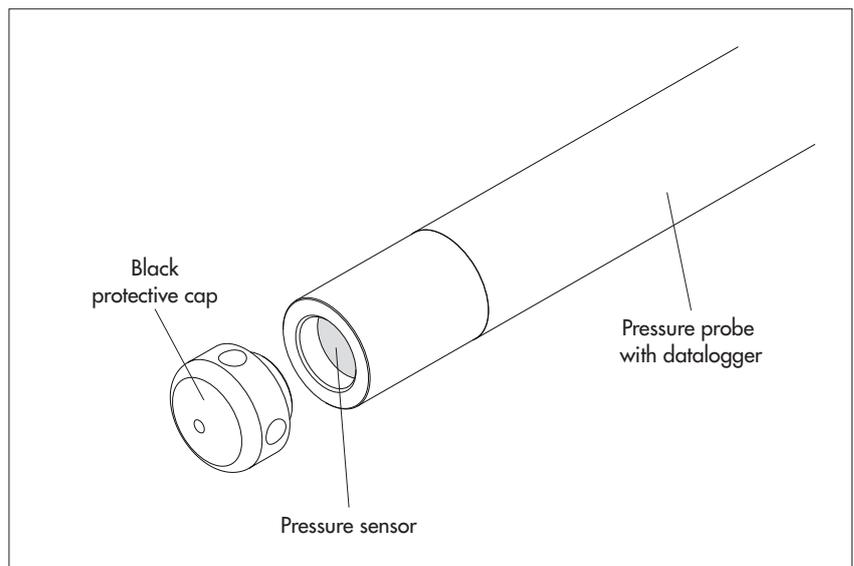
17.1 Cleaning the pressure probe

Recommended interval: Every 12 months
In case of difficult local measuring conditions (heavy deposits): as required every 4 to 6 months.
(Measurements that are inaccurate or not plausible indicate a contaminated pressure sensor.)

How to clean the pressure probe

- Open the top cap/observation well cover.
- Completely remove the OTT ecoLog 1000 from the observation well.
- Remove the black protective cap.
- Clean the pressure sensor carefully using a brush and water. Lime scale deposits can be removed using a common household scale remover.
CAUTION: Make sure to follow the use and safety instructions for the scale remover!
- Rinse the pressure probe **thoroughly** with clear water!
- Reattach the black protective cap.
- Reinstall the OTT ecoLog 1000, refer to Chapter 8.
- Determine current reference value by means of a contact gauge and enter it, refer to Chapters 9.4 or 10.
- Close the top cap/observation well cover.

Fig. 18: Cleaning the pressure probe.



17.2 Replacing the desiccant capsules

Recommended interval: Depending on the level of air humidity at the station, every 12 to 24 months and when replacing the battery. There is a humidity indicator on the desiccant capsule. When this indicator changes its color from blue to pink the desiccant capsule has to be replaced, irrespective of the time elapsed.

Quantity: 2 (1x pressure compensation capillary, 1x communication unit).

Remarks:

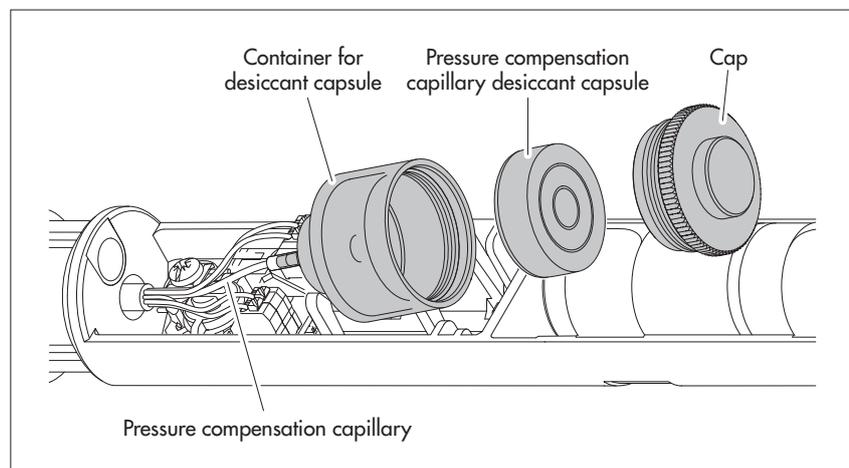
- ▶ Store the desiccant capsule only in its original packaging.
- ▶ Use only desiccant capsules that are fitted with a blue humidity indicator.

How to replace the desiccant capsules

A) Desiccant capsule for pressure compensation capillary

- Open the top cap/observation well cover.
- Pull and hold the communication unit approximately 1 m out of the observation well (a second person would be useful).
- Loosen the communication unit cap.
- Slide the cap and pipe casing of the communication unit approx. 50 cm towards the pressure probe cable. (The rubber stop located on the pressure probe cable (refer to Fig. 2) prevents the pipe casing from falling.)
- Pull the desiccant capsule container of the pressure compensation capillary from the holder, as shown in Fig. 19. Do not pull the container off the pressure compensation capillary!
- Remove the cap of the container by rotating it counter-clockwise.
- Remove the exhausted desiccant capsule.
- Install new desiccant capsule. Labeling must face towards pressure compensation capillary.
- Install the cap by rotating it clockwise.
- Reinsert the container into the holder.

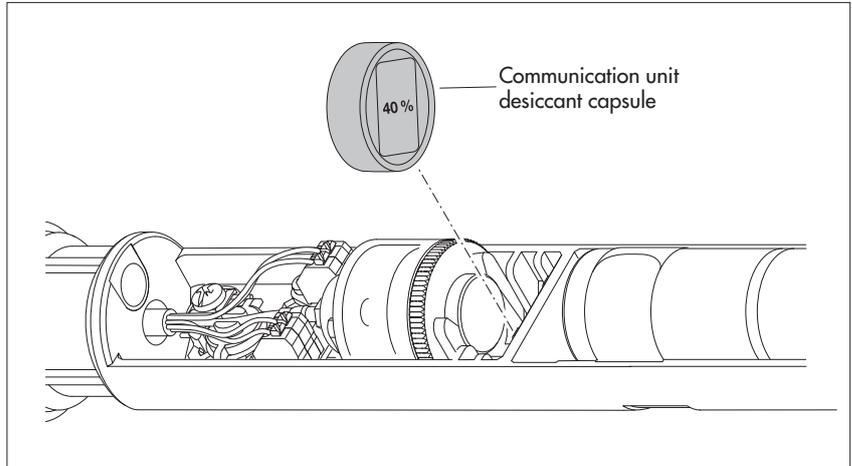
Fig. 19: Replacing the pressure probe desiccant capsule.



B) Desiccant capsule for communication unit

- Remove the exhausted desiccant capsule of the communication unit, as shown in Figure 20.
- Install new desiccant capsule.

Fig. 20: Replacing the communication unit desiccant capsule.



- Slide the pipe casing of the communication unit back up to the stop. Performing this, do not bend or pinch the battery lead
- Reinstall the cap to the communication unit.
- Slowly and carefully reinsert the communication unit into the observation well.
- Close the top cap/observation well cover.

17.3 Checking/replacing the battery

Refer to Chapter 5.

18 Error messages

When faulty measurements or a malfunction occur, the OTT ecoLog 1000 stores one of the following error messages in the data memory instead of a measured value.

- ▶ Err 00 Internal error (automated measurement)
- ▶ Err 01 Internal error (A/D conversion error)
- ▶ Err 03 Measuring range exceeded
- ▶ Err 10 Measured value (still) not recorded; "Err 10" indicates measured values that are missing from the database and that
 - have not yet been recorded, or
 - could not be determined due to a short-term, temporary fault (in-dividual measured values). As these faults cannot be avoided in all cases due to technical reasons, they may also occur occasionally during regular operation.

Internal errors indicate a device fault, if they occur repeatedly.

19 Troubleshooting/remedy

No communication possible

(Operating software "LinkComm" ↔ OTT ecoLog 1000)

- ▶ Password assigned?
 - Enter correct password.
- ▶ Battery installed?
 - Install battery.
- ▶ Battery exhausted?
 - Replace the battery.
- ▶ PC/tablet/mobile phone does not have a (current) BLE interface?
 - Use other hardware for the operating software.

Communication starts and then aborts

- ▶ Battery exhausted?
 - Replace the battery.

Faulty measured values

- ▶ Temperature values faulty
 - Check configuration ("Measurements" button).
- ▶ Pressure sensor values faulty
 - Check configuration ("Measurements" button).
 - Check the pressure compensation capillary in the communication unit (blocked?). Clean as necessary.
 - Check pressure sensor for contamination. Clean as necessary.

No measured values in database

- ▶ Configuration incorrect?
 - Check configuration ("Measurements" button).
- ▶ Battery exhausted?
 - Replace the battery.

Communication through cellular network not possible/ not successful

- ▶ Modem settings (modem, IP connection) are not or incorrectly configured
 - check modem settings (refer to Chapter 9.4).
- ▶ Data transmission is not or incorrectly configured
 - Check settings of "IP transmissions" and/or "SMS transmissions" (refer to Chapter 9.4).
- ▶ SMS Commands are not or incorrectly configured
 - Check settings of "SMS Commands" (refer to Chapter 9.4).
- ▶ Battery exhausted?
 - Replace the battery.
- ▶ SIM card missing
 - Insert the SIM card, refer to Chapter 6.
- ▶ Incorrect PIN
 - Check PIN, refer to Chapter 9.4.
- ▶ Signal strength of cellular network too weak.
 - Check whether an external radio antenna should be used, refer to Chapter 7.
- ▶ No measured values present (by transmitting data)
 - Wait for the next data interval.

20 Repair

- In case of a device malfunction, use Chapter 19, Troubleshooting/remedy to see if you can resolve the problem yourself.
- In case of device failure, please contact the OTT repair center.

OTT HydroMet GmbH
Repaircenter
Ludwigstrasse 16
87437 Kempten · Germany
Phone +49 831 5617-433
Fax +49 831 5617-439
repair@ott.com

! **Please note:** Have a faulty OTT ecoLog 1000 checked and repaired only by the OTT repair center. Never attempt to repair the unit yourself! Any repairs or attempted repairs carried out by the customer will void any warranty.

21 Notes about the disposal of old units



Within the member countries of the European Union

In accordance with the European Union guideline 2002/96/EC, OTT takes back old devices within the member countries of the European Union and disposes of them in an appropriate way. The devices concerned by this are marked with the symbol shown aside.

- For further information on the return procedure, please contact your local sales contact. You will find the addresses of all sales partners in the internet on "www.ott.com". Please take into consideration also the national implementation of the EU guideline 2002/96/EC of your country.

For all other countries

- After putting the unit out of service, properly dispose of the OTT ecoLog 1000.
- Observe the regulations applicable in your country for the disposal of electronic devices.
- Never dispose of the OTT ecoLog 1000 in the normal domestic waste.

Materials used

Refer to Chapter 22, Technical data.

22 Technical data

Water level

Measuring range	0 ... 4 m water column (0 ... 0.4 bar) 0 ... 10 m water column (0 ... 1 bar) 0 ... 20 m water column (0 ... 2 bar) 0 ... 40 m water column (0 ... 4 bar) 0 ... 100 m water column (0 ... 10 bar)
Resolution	0.001 m; 0.1 cm; 0.01 ft; 0.1 inch 0.0001 bar; 0.001 psi
Accuracy (linearity + hysteresis)	± 0.05 % full scale
Long-term stability (linearity + hysteresis)	± 0.1 %/a full scale
Zero	± 0.1 % full scale
Overload-resistant without permanent mechanical damage (pressure sensor)	
0 ... 0.4 bar	4 bar
0 ... 1 bar	10 bar
0 ... 2 bar	15 bar
0 ... 4 bar	25 bar
0 ... 10 bar	40 bar
Units	m, ft, inch, bar, psi, pascal
Pressure sensor	ceramic; temperature-compensated
Temperature-compensated operating range	-5 °C ... +45 °C (ice free)

Temperature

Measuring range	-25 °C ... +70 °C
Resolution	0.1 °C
Accuracy	± 0.5 °C
Units	°C · °F
Power supply	lithium battery with connector; 3.6 V / 26 Ah
Current consumption	
Sleep mode	< 100 µA
Local communication (BLE)	approx. 30 mA
Measuring operation	approx. 20 mA
Mobile communication activ	approx. 160 mA
Lifetime (1 hour sample interval, one transfer per day, one local communication (BLE) per month)	> 10 years
Clock	
Design	Real-time clock
Accuracy	±26 seconds/month (at +25 °C) when using SNTP < ±3 seconds approx. 40 seconds (at +25 °C)
Buffer period for battery replacement	
Interface for local communication	
Type	BLE 5.0 (Bluetooth Low Energy)
Antenna	integrated circuit board antenna
BLE range	≤ 10 m; with a clear line of sight
Networks/cellular modem frequencies	
2G	GSM, GPRS, EDGE; 900 MHz, 1800 MHz
4G	LTE Cat-1; B3 (1800 MHz), B8 (900 MHz), B20 (800 MHz)
SIM card	Mini-SIM (UICC; 2FF)

Radio antenna	Built-in, robust and weather-proof; optional connection of an external antenna is possible (SMA connection); to be installed by OTT HydroMet (SMA connection); see accessories A minimum distance of 0.20 metres must be maintained between the radio antenna and people and between radio antenna and other electrical equipment/antennae!
Temperature range, operating	-30 °C ... +85 °C
Temperature range, storage	-40 °C ... +85 °C
Air humidity	5 % ... 95 % (non-condensing)

Data memory

Measurement memory	28 MB
Number of measured values	Approx. 1,000,000
Measured physical quantities	Water level/pressure Temperature Supply voltage Mobile radio signal strength (RSSI) energy taken from the battery (in mAh)
Sample interval	5 seconds ... 24 hours
Storage interval (mean interval)	5 seconds ... 24 hours

Individually configurable functions

- Selection of units
- Pressure/level measurement or depth measurement
- With consideration of the local gravitational acceleration
- Display of instantaneous values
- Password protection
- Measured value processing: Calculation of mean; delta storage; scaling function; extreme value storage; limit control of the sampling interval
- Alarm management
- Remote data transfer

Mobile communications functions

Transmission interval	1 minute ... 1 week
SMS transmission	✓
SMS command	✓
IP communication	FTP, HTTP, HTTPS (TLS 1.2)

Mechanical Data

Can be installed in observation wells	
- Top caps with cut-out (OTT, HT)	2"
- With adapter plates for top caps With cut-out (OTT, HT)	3", 4", 4.5", 5", 6"
- With universal suspension brackets for top caps Without cut-out/universal installation	> 2"
Dimensions	
Communication unit (L x Ø)	520 mm x 50 mm
Pressure probe (L x Ø)	195 mm x 22 mm
System length (cable length including communication unit/pressure probe)	2 ... 200 m ±1 % ±5 cm
Minimum bending radius of pressure probe cable	45 mm
Weight	
Communication unit (incl. lithium batteries)	approx. 0.9 kg
Pressure probe	approx. 0.670 kg
Pressure probe cable	approx. 0.042 kg/m

Material	
Pressure probe housing	POM, stainless steel 1.4539 (904 L)
Seals	FPM
Separating membrane	Al ₂ O ₃ ceramics (96 %)
Cable jacket	PUR
Communication unit housing	Aluminum, PA-GF
Type of protection	
Communication unit	flood-proof up to 1 week / 1 m water column
Pressure probe	IP 68
Desiccant	2 capsules (2.65 g silica gel), recommended replacement interval: once per year

Performance classification of the sensors according to DIN EN ISO 4373

Measurement reliability	Performance class 1
Temperature range	Temperature class 2
Relative air humidity	Class 1

EU directives compliance

the OTT ecoLog 1000 complies with the EU directives applicable at the time of production; for details, see Declaration of Conformity (www.ott.com/resources)



Annex A - Note on Declaration of Conformity

If necessary, you can download the current version of the Declaration of Conformity for the OTT ecoLog 1000 from our website as a PDF file:
"www.ott.com/resources"!

Annex B – Shorten pressure probe cable

If required, you can shorten the pressure probe cable of an OTT ecoLog 1000 independently. This is useful in all cases where a groundwater well to be installed requires a shorter system length (do not loop a pressure probe cable that is too long). It is not possible to extend the pressure probe cable.

! **Please note:** Shorten a pressure probe cable only under completely dry ambient conditions! If possible, do this in an interior (e.g. in a workshop). No moisture may penetrate into the pressure compensation capillary!

Tool required

- ▶ OTT Stripping tool; see accessories
- ▶ Side cutting pliers
- ▶ Phillips screwdriver; PH 2
- ▶ Open-end wrench; wrench size 17

CAUTION Risk of cuts when trimming the pressure sensor cable!



When trimming the pressure sensor cable, the stripping tool / wire cutters can cause injuries to the fingers or hands.

- ▶ Wear protective gloves when trimming the pressure sensor cable.
-

1) Disconnecting the pressure probe cable on the communication unit

- Unscrew cap, see Fig. 2.
- Slide the cap and pipe casing approx. 50 cm towards the pressure probe cable, refer to Fig. 2.
- Disconnect the lithium battery plug from the socket of the printed circuit board; to do this, press on the locking of the plug connection, refer to Fig. 3.
- Remove the desiccant capsule container from the holer (refer to Fig. 20) and disconnect the pressure compensation capillary.
- Disconnect blue, green, orange and red wire: to do this, press the respective key on the terminal block (do not use any tools).
- Loosen the clamping screw, pull out the purple strain relief and unwind from the cylinder.
- Loosen the cable gland with the open-end wrench, refer to Fig. B2.
- Pull the pressure probe cable completely out of the communication unit.
- Remove pipe casing and cap from the pressure probe cable.
- Leave the rubber stop on the pressure probe cable and move it to point where you want to shorten the cable.

2) Shorten pressure probe cable

- Shorten pressure probe cable by "x.xx" meter*;
 $x.xx = \text{system length}_{\text{old}} - \text{system length}_{\text{new}}$
* the measure "x.xx" relates to the total length (incl. strain relief shown in purple)

• **Remark:** You find the system length (old) in the FAT (included in the scope of delivery), or you can read out the system length from the device using the "OTT HydroMet LinkComm" operating software ("Diagnostics" button).

- Pull back the pressure probe cable until the cable sheath exceeds approx. 6 ... 8 mm the bore of the communication unit.
- Turn the pressure probe cable so that the purple strain relief is at the bottom; refer to Fig. B2
- Lead purple strain relief first 1.5 times around the cylinder and then around the clamping screw; make sure the strain relief is in the correct position in relation to the guide; refer to Fig. B2.
- Tighten clamping screw (1.5 ... 2 Nm).
- Pull the pressure probe cable back a little until the strain relief is slightly under tension.
- Carefully tighten the cable gland with an open-ended wrench until the sealing rubber inside the cable gland slightly bulges outwards.

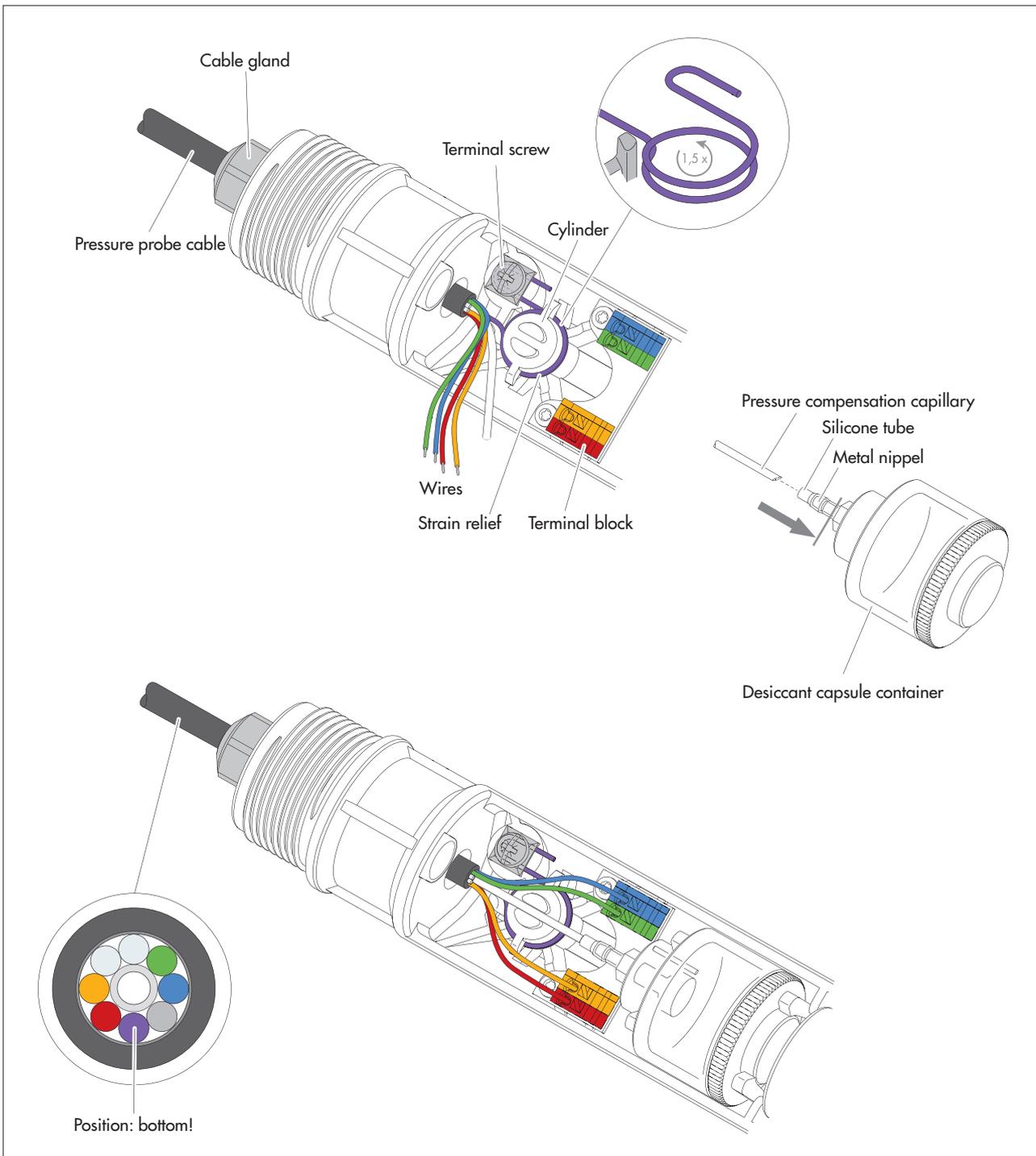


Fig. B2: Connecting the pressure probe cable to the communication unit.

- Connect blue, green, orange and red wires to the terminal blocks in the corresponding colour; to do this, press the respective push-button of the terminal block when inserting the wire (do not use any tools).
- Shorten the pressure compensation capillary to 45 ± 2 mm; do not make the cut at a right angle but diagonal!
- Insert the pressure compensation capillary into the transparent silicone tube of the desiccant capsule container (as far as the grey line shown in figure); the end of the pressure compensation capillary must then be in the metal nipple!
- If required: exchange desiccant capsule; refer to Chapter 17.2.
- Replace the desiccant capsule container in its holder.
- Press the pressure compensation capillary into the cut-out on the cylinder.
- Reconnect the plug of the lithium battery to the socket on the circuit board; refer to Fig. 3.
- Push the cap and the pipe casing of the communication unit back as far as it will go. Please note: Do not bend or pinch the battery lead!
- Screw cap back on.
- Correct position of the rubber stop: distance = approx. 53 centimeters.

Document number
55.450.001.B.E 02-0719



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