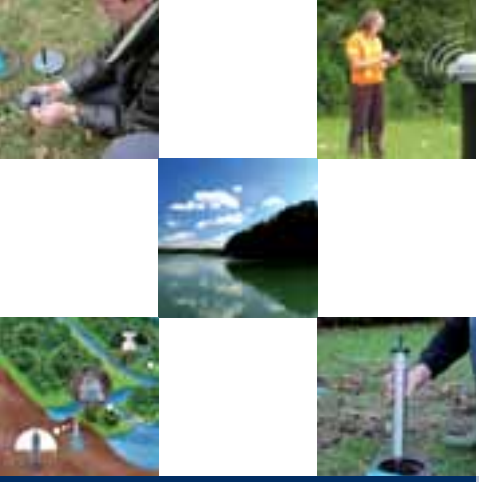
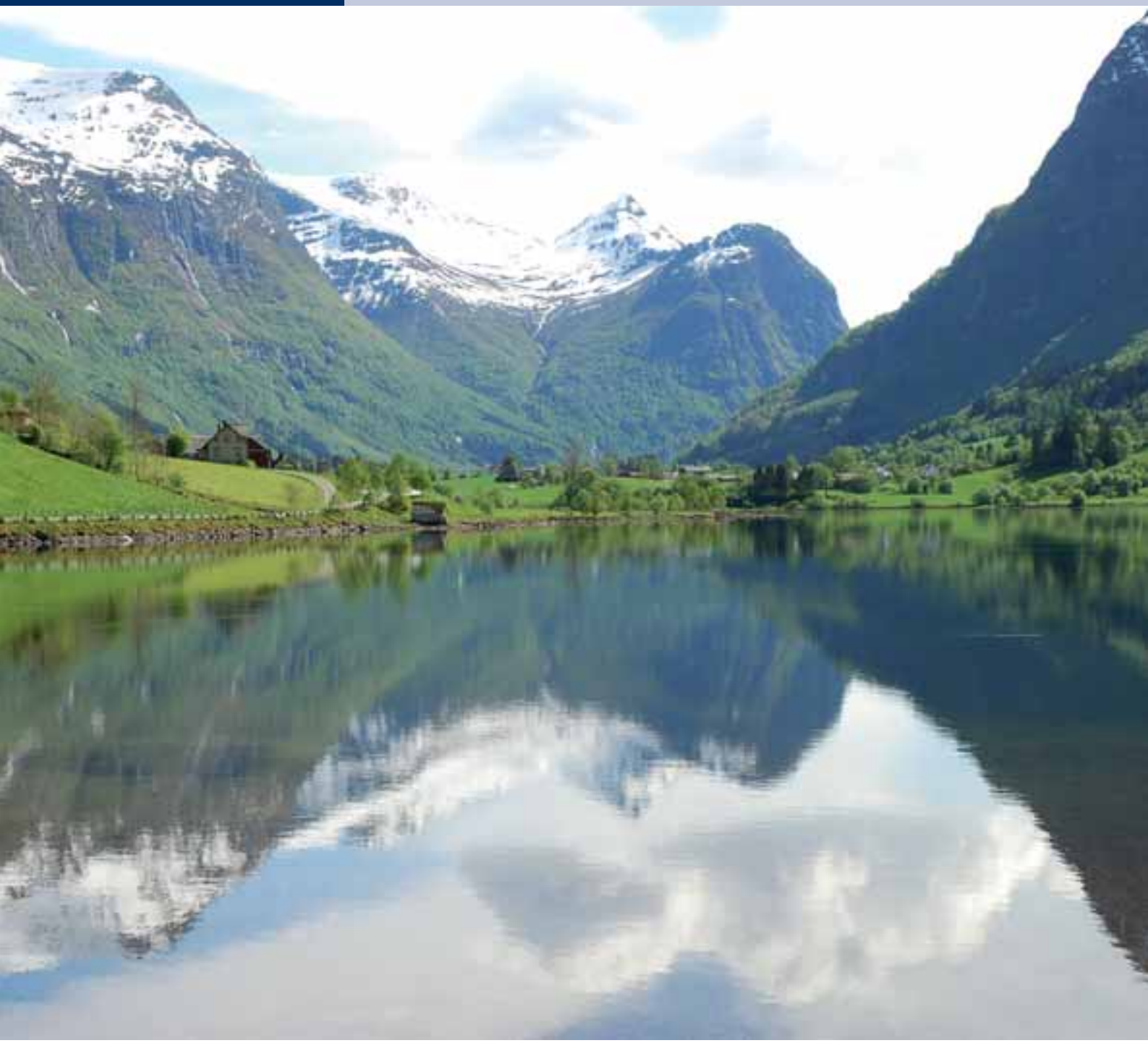


# Ground water monitoring and communication solutions

## Diver®/e-SENSE®



All it takes for **environmental** research

Eijkelkamp
Agrisearch Equipment
a Royal Eijkelkamp Company

# Content

In this brochure you will find information about ground water monitoring and communication solutions:



# Diver®

We cannot live without water. It is a worn-out phrase but that does not make it less true.

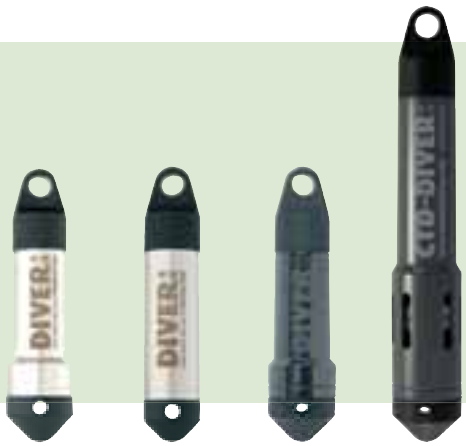
Not only will it be hard for human beings to stay alive, but most crop and animals will not keep up long either.

Millions of people have no access to clean drinking water, but besides a shortage of water, a surplus of water will cause problems as well, like for example the serious floods in eastern Europe in 2005. To thoroughly make use of all possibilities that water offers, water will have to be managed. That concerns both a dry area in Africa as well as a relatively wet country, such as the Netherlands.

To interfere in the water-balance of a certain area, full knowledge is necessary. A small change can have immense consequences. Reliable and frequent measuring of the ground water situation is the foundation. Diver is the ideal instrument for this purpose!

### Diver ground water data loggers

The Diver, from *Schlumberger Water Services*, is the smallest instrument in the world for automatic measurement and registration of groundwater levels and ground water temperatures; the CTD-Diver also measures conductivity. The Diver fits in the palm of your hand and is remarkably light. With its length of only 90 mm (135 mm for the CTD-Diver) and a diameter of 22 mm (18 mm for the MicroDiver), the Diver can be used in virtually any monitoring well.



## Sound and reliable

The pressure sensor, temperature sensor, conductivity sensor, as well as the data logger and battery are contained within a hermetically sealed stainless steel or ceramic housing. This ensures that the Diver is less sensitive to moisture or external electrical influences (Faraday cage). The Diver can be installed in the monitoring well simply suspended from a steel wire. Once installed, no part of the monitoring system is left protruding above ground level, greatly reducing the risk of vandalism. The Diver can now automatically measure the ground water level and temperature and register these data in the internal memory. The built-in battery has a life of approximately 8-10 years.

## Programming

Programming the Diver, either in the field or in the office, is a matter of just a few seconds. Simply enter the location, (future) starting time, sample rate and select either a fixed measuring frequency, a fixed setup or an event-related frequency.

## The Diver is available in various designs:

**The MiniDiver®**: stainless steel housing and ceramic pressure sensor, diameter 22 mm, length 90 mm, available in various measuring ranges, memory capacity 24,000 measurements.

**The MicroDiver®:** stainless steel housing and ceramic pressure sensor, diameter 18 mm, length 90 mm, available in various measuring ranges, memory capacity 48,000 measurements.

**The CeraDiver®:** ceramic housing and ceramic pressure sensor, diameter 22 mm, length 90 mm, available in various measuring ranges, memory capacity 48,000 measurements.

**The CTD-Diver®** has a ceramic housing, ceramic pressure sensor and platinum/ceramic conductivity sensor (measuring range 0 - 120 mS/cm), diameter 22 mm, length 135 mm, available in various measuring ranges, memory capacity 48,000 measurements. The CTD-Diver is a compact instrument that allows you to measure the ground water level, ground water temperature and conductivity of the ground water all in one. Where monitoring ground water, especially where it concerns decontamination of polluted soil, the monitoring of rubbish dumps and the detection of salination, once used to be a labour-intensive and troublesome job, the arrival of the CTD-Diver has changed all that.

**The Baro-Diver®** has the function to register barometric pressure. Compensation for these atmospheric pressure variations is subsequently carried out simply and easily with the use of the Diver-Office software program.

*All members of the Diver family have a warranty of 3 years and can be used as an e+® sensor in the e-SENSE® system.*

# Technical specifications

## MiniDiver

| | |
|---|---|
| **Measuring frequency** | : 0.5 sec up to 99 hours (fixed only) |
| **Memory capacity** | : 24,000 measurements (non-volatile) |
| **Material housing** | : stainless steel 316L |
| **Material pressure sensor** | : ceramic ($Al_2O_3$) |
| **Temperature range** | : -20 °C up to 80 °C |
| **• accuracy** | : ± 0.1 °C (OT) |
| **• resolution** | : 0.01 °C |
| **• compensated range** | : 0 °C up to 50 °C |
| **Battery life** | : 8-10 years (dependent on use) |
| **Dimensions** | : Ø 22 mm x 90 mm |
| **Weight** | : 70 grams |

| **Type** | **11.11.01.02** | **11.11.01.04** | **11.11.01.06** | **11.11.01.08** |
|---|---|---|---|---|
| Measuring range | 10 $mH_2O$ | 20 $mH_2O$ | 50 $mH_2O$ | 100 $mH_2O$ |
| • typ. accuracy** | ± 0.05% FS*** | ± 0.05% FS | ± 0.05% FS | ± 0.05% FS |
| • resolution | 0.25 $cmH_2O$ | 0.4 $cmH_2O$ | 1 $cmH_2O$ | 2 $cmH_2O$ |

| **BaroDiver** | **11.11.55.01** |
|---|---|
| Measuring range | 1.5 $mH_2O$ |
| • typ. accuracy** | ± 0.5 $cmH_2O$ |
| • resolution | 0.2 $cmH_2O$ |


## MicroDiver

| | |
|---|---|
| **Measuring frequency*** | : 0.5 sec up to 99 hours |
| **Memory capacity** | : 48,000 measurements (non-volatile) |
| **Material housing** | : stainless steel 316L |
| **Material pressure sensor** | : ceramic ($Al_20_3$) |
| **Temperature reach** | : -20 °C up to 80 °C |
| **• accuracy** | : ± 0.1 °C (OT) |
| **• resolution** | : 0.01 °C |
| **• compensated range** | : 0 °C up to 50 °C |
| **Battery life** | : 8-10 years (dependent on use) |
| **Dimensions** | : Ø 18 mm x 88 mm |
| **Weight** | : 60 grams |

| **Type** | **11.11.02.02** | **11.11.02.04** | **11.11.02.06** | **11.11.02.08** |
|---|---|---|---|---|
| Measuring range | 10 $mH_2O$ | 20 $mH_2O$ | 50 $mH_2O$ | 100 $mH_2O$ |
| • typ. accuracy** | ± 0.1% FS*** | ± 0.1% FS | ± 0.1% FS | ± 0.1% FS |
| • resolution | 0.2 $cmH_2O$ | 0.4 $cmH_2O$ | 1 $cmH_2O$ | 2 $cmH_2O$ |

| **BaroDiver** | **11.11.55.01** |
|---|---|
| Measuring range | 1.5 $mH_2O$ |
| • typ. accuracy** | ± 0.5 $cmH_2O$ |
| • resolution | 0.25 $cmH_2O$ |


*) Various measuring methods available (steady, variety dependent, averages and pump tests)
**) Within temperature compensated range
***) Full Scale

# Technical specifications

## CeraDiver

| | |
|---|---|
| **Measuring frequency*** | : 0.5 sec up to 99 hours |
| **Memory capacity** | : 48,000 measurements (non-volatile) |
| **Material housing** | : ceramic ($ZrO_2$) |
| **Material pressure sensor** | : ceramic ($Al_2O_3$) |
| **Temperature reach** | : -20 °C up to 80 °C |
| **• accuracy** | : ± 0.1 °C (OT) |
| **• resolution** | : 0.01 °C |
| **• compensated range** | : 0 °C up to 50 °C |
| **Battery life** | : 8-10 years (dependent on use) |
| **Dimensions** | : Ø 18-22 mm x 90 mm |
| **Weight** | : 55 grams |

| **Type** | **11.11.03.02** | **11.11.03.04** | **11.11.03.06** | **11.11.03.08** |
|---|---|---|---|---|
| Measuring range | 10 $mH_2O$ | 20 $mH_20$ | 50 $mH_2O$ | 100 $mH_2O$ |
| • typ. accuracy** | ± 0.05% FS*** | ± 0.05% FS | ± 0.05% FS | ± 0.05% FS |
| • resolution | 0.2 $cmH_2O$ | 0.4 $cmH_2O$ | 1 $cmH_2O$ | 2 $cmH_2O$ |

| **BaroDiver** | **11.11.55.01** |
|---|---|
| Measuring range | 1.5 $mH_2O$ |
| • typ. accuracy** | ± 0.5 $cmH_2O$ |
| • resolution | 0.25 $cmH_2O$ |


## CTD-Diver

| | |
|---|---|
| **Measuring frequency** | : 1 sec up to 99 hours |
| **Memory capacity** | : 48,000 measurements (non-volatile) |
| **Material housing** | : ceramic ($ZrO_2$) |
| **Material pressure sensor** | : ceramic ($Al_20_3$) |
| **Temperature** | : -20 °C up to 80 °C |
| **• accuracy** | : ± 0.1°C (OT) |
| **• resolution** | : 0.01 °C |
| **• compensated range** | : 0 °C up to 50 °C |
| **Conductivity** | |
| **• reach** | : 0 up to 120 mS/cm |
| **• accuracy** | : ± 1% of the measured value or 10µS/cm, whatever the largest |
| **• resolution** | : 0.1% of the measured value or 0.1µS/cm, whatever the largest |
| **Battery life** | : 10 years (dependent on use) |
| **Dimensions** | : Ø 18-22 mm x 135 mm |
| **Weight** | : 95 grams |

| **Type** | **11.11.59.01** | **11.11.59.02** | **11.11.59.03** |
|---|---|---|---|
| Measuring range | 10 $mH_2O$ | 50 $mH_2O$ | 100 $mH_2O$ |
| • typ. accuracy** | ± 0.05% FS*** | ± 0.05% FS | ± 0.05% FS |
| • resolution | 0.2 $cmH_2O$ | 1 $cmH_2O$ | 2 $cmH_2O$ |

| **BaroDiver** | **11.11.55.01** |
|---|---|
| Measuring range | 1.5 $mH_2O$ |
| • typ. accuracy** | ± 0.5 $cmH_2O$ |
| • resolution | 0.1 $cmH_2O$ |


*) Various measuring methods available (steady, variety dependent, averages and pump tests)
**) Within temperature compensated range
***) Full Scale

# Communicating with Diver®

## Hardware

### Reading Diver data

There are different options to install Divers in the field or to read out Diver data in the field or the office environment:

If the Diver is installed in the borehole with use of a standard stainless steel or Vectran (non-corrodible) cable, the Diver has to be removed from the borehole to read out the data. The Diver is connected to the computer using a special reading unit.

Next to the standard stainless steel cable used to install a Diver in a borehole, the Diver Data Cable is the other option. With this cable the Diver can be connected to the top of the borehole. This allows reading out the Divers' memory changes without removing the Diver from the well. Diver Data Cables are available in standard lengths for attachment to any Diver type, even up to 200 m length. To connect a laptop PC or the Pocket PC to the wellhead, a 1.5 m interface cable is quickly attached. This allows downloading and / or programming in the field.

### Diver-Mate

Plug-in, download and store data right in the field. Diver-Mate is a simple storage device that connects directly to Diver Data Cables. It is cost-effective and minimizes the need for carrying laptops into the field. Because of the MiniSD Card (512 MB) Diver-Mate stores almost an unlimited number of full Diver memory reads. The instrument is powered by an internal rechargeable battery (charge by USB port), with time to read more than 500 Divers.

## Software

### Diver-Pocket (Reader / Manager)

This Personal Digital Assistant (PDA) software package can be used on a PocketPC for programming Divers and reading stored measurements. Diver-Pocket comes in two variants: 'Diver-Pocket Reader' enables you to read data, while 'Diver-Pocket Manager' also includes the Diver programming facility. For this purpose, the Divers must be connected to a Reading Unit or through an interface cable to the Diver Data Cable.
Requirements: Windows Mobile 2002 or 2003 or Windows Mobile 5, USB Host CF Card.

### Diver-Office

Read-out and program multiple Diver dataloggers in the office and prepare your data for advanced analysis using the Waterloo Hydrogeologic modeling software. Diver-Office simplifies readout and programming of the Diver in the office. Built-in features include CTD-Diver Calibration Wizard and Barometric Compensation Wizard. With Diver-Office you can export to various file formats for advanced analysis (e.g. CSV, MON, NITG, etc.)
Requirements: Windows 2000, XP and Vista, USB port.

# e-SENSE®

The management of monitoring of equipment is increasingly done remotely at a (considerable) distance. Configuration and reading of data and, if necessary, taking action on data received from a remote location of one's choice are possibilities that are nowadays standard requirements.

You can do a lot more than just measure with the e-SENSE® telemetry measuring system, where measurement data can be collected by Divers. Your measurements or alarm signals are sent to a database in your own PC (e-SENSE direct) via the connection with the e-SENSE field modem.

### e-SENSE direct

e-SENSE direct is easy to install (Plug & Play), to manage and to maintain. With e-SENSE direct, you can manage and communicate with your sensors from your PC. You have an overview over the whole installation and you can change all the settings. This allows you to operate the system optimally with respect to response speed, data traffic costs and the use of batteries. The measurements can be imported into the e+ software, after which they can be processed, e.g. into graphical representations and reports. You can also export the data to your own personal database.
We also offer e-SENSE direct with an Open Interface for connection to i.e. SCADA-systems.

### e-SENSE communication by sending data via SMS

For e-SENSE a GSM/SMS-network is used. The reason for this is that the GSM-network now has an almost world encompassing range and data communication by SMS is relatively inexpensive. As far as this is concerned, this system distinguishes itself from other commonly used systems. Communication with these systems occurs via GSM-networks that depend on interaction between the sending and receiving modem.

e-SENSE enables two-way communication between the measuring element in the field and the central computer system. The data is sent from the sensor to the database. The settings of the sensors in the field can easily be changed from your workstation without having to go into the field. The e-SENSE system can also generate different alarms.

# e-SENSE® system configuration for Diver® applications

## 1 PC Modemset

To facilitate communication between your PC and the e-SENSE-field modem, you need the PC-modem set for communication via e-SENSE direct. The complete set comprises a modem, a power source (100 – 240 Vac), an antenna, a communication cable and software.

## 2 Field modem

The e-SENSE SMS-modem is used for GSM data communication with a Diver and an analogue sonsor. Power supply 3.6 Vdc. Readout and configuration via database.

### Installation in the field, 'Plug & Play'

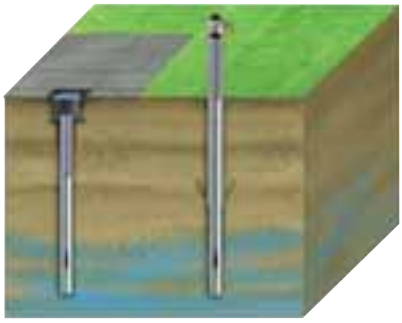
The e-SENSE field modem is equipped with a function panel on the top side. When connecting the sensors to the e-SENSE modem while using watertight connectors, it will check whether the connected sensors work correctly. If desired, the current measurement values of the sensors can be checked using a laptop. The configuration of the measurement setup is sent in coded SMS messages to the database. This processes the messages and sends confirmation of receipt back to the measuring units. The e-SENSE modem indicates that everything is working correctly and the user can close the watertight fraud proof field housing with an easy mind.

### Advantages

- The modem can be used in mobile installations
- Flexibility as regards the measurement parameters
- Long lifespan
- In addition to Divers, other e+ sensors can be connected
- Alarm function
- The batteries have the capacity to provide the whole installation with power for a year

## 3 Installation options for field modem

The e-SENSE field modem can be installed underground or above-ground. When installing the modem underground a monitoring well cover is needed. The cover is also available with an integrated antenna. For installation above-ground a protective casing of electro-zinced steel with a mounting hole for an external antenna can be provided.



## 4 Divers

All members of the Diver family can be connected to the e-SENSE system.

## 5 Communication cables for e-SENSE modem

Communication cables to connect Divers to the SMS modem are available in different lengths, varying from 1 to 200 m, with an IP68 connector for watertight connections.

## 6 Software

The readout and configuring of the Divers can occur through the e-SENSE modem, via the software of e-SENSE direct.

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## Specifications

**General**

| | |
|---|---|
| Message mode | : SMS (GSM Quad band) |
| Number of sensor ports | : 1 for Diver |
| Temperature (operating range) | : -20 … +60 °C |
| Number of measurements | : 66 measurements per SMS-message |
| Send interval | : 15 minutes till 40 days, user programmable |
| Battery type | : DD-cell Li-SoCL2, 3.6 V / 35 Ah (replaceable by user) |
| Battery monitor | : Alarm function at low battery |

**Housing**

| | |
|---|---|
| Dimensions | : Ø tube = 48.3 mm, Ø top = 60 mm, length tube = ca. 340 mm |
| Protection | : IP67 |
| Material | : Housing stainless steel 304, top POM |
| Weight | : Ca. 1750 gr. |

**Optional:**

- E-mail / GPRS communication
- External analogue sensor (4-20 mA or 0-5 V)
- Redundancy (data sent double for improved data communication security)
- Barometric compensation for Diver measurements and alarming

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