

Smart Instructions

Deutsch

English

Français



Smart PRO Smart COM

UWATEC®

SWISS MADE BY UWATEC AG

Safety considerations

You must carefully read and understand this entire manual before using your Smart.



Diving has many inherent risks. Even if you follow the instructions of this manual in a careful manner, it is still possible that you may be seriously injured or die from decompression sickness, oxygen toxicity or some other inherent risk of scuba with Nitrox or compressed air. Unless you are fully aware of these risks and are willing to personally accept and assume responsibility for those risks, do not use the Smart!


Guidelines for the use of Smart:

The following guidelines for using Smart are derived from the latest medical research and the recommendations of the American Academy of Underwater Sciences for diving with diving computers. Following these guidelines will greatly increase your safety whilst diving, but cannot guarantee that decompression sickness or oxygen toxicity will not occur.

- The Smart is designed for dives with nitrox (to a max. 100% O₂) and compressed air (21% O₂) only. Do not use the Smart for dives made with other mixed gases.
- It is absolutely necessary to check the set mixture before each dive and to compare it to the gas mixture actually used. Always remember: Setting an incorrect mixture carries an inherent risk of decompression sickness and/or oxygen toxicity! Maximum deviation from the measured mixture must not exceed 1% O₂. An incorrect gas mixture can be lethal!
- Only use Smart with open circuit breathing systems. Smart must be set for a determined gas mixture. In partially open and in closed circulation-systems, the gas mixture can vary considerably. The calculations may yield results different from those necessary for the actual mixture.
- Only use Smart for diving with an independent breathing apparatus.
- Always observe the optical and acoustic alarm signals of the Smart. Avoid situations of increased risk which are marked with a warning sign in this operating manual.
- If the ascent arrow appears, start ascending. ▲
- If the flashing ascent arrow appears in the lower display window, start to ascend immediately. ▲
- Smart has a ppO₂-warning, the default-limits of which are set at 1.4 bar ppO₂max. This limit can be adjusted via SmartTrak. An alteration of the ppO₂max to higher than 1.6 bar is dangerous and we do not recommend this.
- Frequently check the "oxygen-clock" (CNS O₂ Limit), especially in the range higher than 1.4 bar ppO₂. Finish the dive if the CNS O₂ Limit exceeds 75%.
- Always check the diving limits considering the oxygen content and standard sports diving procedures (decompression sickness, oxygen toxicity).
- In accordance with the recommended maximum diving limit of all instructional agencies, do not dive deeper than 40 metres/130 feet.
- The danger of nitrogen narcosis has to be taken into consideration in accordance with the gas mixture used. The Smart gives no warning about this.
- On all dives with the Smart, make a safety stop for at least 3 minutes at 5 metre (15 feet).
- All divers using dive computers to plan dives and indicate or determine decompression status must use their own computer, which they take with them on all dives.
- If the Smart fails at any time during the dive, the dive must be terminated, and appropriate surfacing procedures (including a slow ascent and a 3 to 5 minute safety stop) should be initiated immediately.
- Comply with the ascent rate and carry out any decompression stop required. If the computer should fail for any reason, you must ascend at a rate of no greater than 10m (30 feet) per minute.
- On any given dive, both divers in a buddy pair must follow the most conservative dive computer for that particular dive.
- Never dive without a buddy. The Smart does not substitute for a dive buddy.
- Only make dives that are appropriate to your level of dive training. The Smart does not increase your knowledge of diving.
- Avoid repeated ascents and descents (yo-yo diving).
- Avoid repeated heavy workload whilst at depth.
- Plan the dives to be shorter if they are made in cold water.

- After finishing the decompression or at the end of a no-stop dive, the final stage of the ascent should be as slow as possible.
- You MUST be familiar with all signs and symptoms of decompression sickness before using the Smart! Seek IMMEDIATE treatment for decompression sickness should any of these signs or symptoms occur after a dive! There is a direct correlation between the effectiveness of treatment and the delay between the onset of symptoms and the treatment for decompression sickness.
- Only dive with Nitrox after you have been thoroughly instructed by a recognised institution.
- **COM** The HP-hose is limited to a max of 40% O₂ Nitrox!
- Do not use the Smart without taking a set of accepted nitrox diving tables with you as a back up decompression tool on every dive.
- If you switch off the acoustic alarm of the Smart you must pay careful attention to the visual attention messages and alarms on the face of the Smart. Failure to follow all alarms whether audible or not may lead to serious injury or death due to decompression sickness, and/or drowning.
- Ensure that you have enough gas for the ascent. Do not use the RBT to the limit if prolonged ascents or an increased rate of breathing (currents...) are expected.
- Diving while at altitude can considerably increase the risk of decompression sickness. Do not undertake high altitude diving without being specifically trained in the special techniques of such diving.
- Never dive the Smart to the limits. Neither the Smart, nor any other diving computer or decompression table should be pushed to its limit. Give yourself a margin of safety by always leaving at least a few minutes in the "no-stop box" before making your ascent.

Repetitive dives

- Do not start your next dive before your CNS O₂ % status has dropped below 40%.
- Diving with nitrox: Make sure your surface interval is long enough (just like diving with compressed air). Plan for a minimum surface interval of three to four hours. Oxygen, too, needs sufficient time to leave the body.
- Match gas mixture to the intended dive.
- Do not attempt a repetitive dive if the Microbubble-Warning  is visible on the display.
- Plan a day without diving once a week.
- If you have to change computers, wait at least 24 hours before carrying out your next dive.



CE mark is used to show conformity with the European Union PPE directive 89/686/EEC and 89/336/EEC.

prEN 13319:

Rina SA (Gruppo Registro Italiano Navale) gave the EC type examination certificate prEN13319 for Smart Pro and Smart Com concerning depth gauge and combined depth and time measuring devices. The functional and safety requirements test methods are an European diving standard draft. Any information on decompression obligation displayed by equipment covered by this standard is explicitly excluded from its scope.

EN 1000-4-2 BZT

Introduction

Congratulations on purchasing Smart and welcome to UWATEC. From now on you will enjoy the assistance of the most extraordinary dive computer - equipped with UWATEC's most innovative technology - whilst diving. With several marvelous features Smart stands out from its predecessors and other common dive computers. Smart's most innovative feature - individually adjustable microbubble-levels - is based on latest research results from DAN Europe. The new technology allows the diver to follow more conservative profiles that help reduce the formation of microbubbles in the body whilst diving. It is an extension of UWATEC's famous decompression calculation model ZH-L8 ADT. Diving with microbubble-levels introduces a new dimension of individual diving safety. For more information see page 22.

This operating manual provides full information on the operation and functions of Uwatec Smart dive computers. Please note that this manual contains information on Smart PRO as well as on Smart COM. Additional data for Smart COM has been specifically marked. We thank you for choosing an Smart and we hope you will enjoy safe dives in the future! Further information on Uwatec Smart dive computers and other products by UWATEC can be found on our web page at www.uwatec.com.

To make this manual easier to read we will use the term 'Smart' for 'Uwatec Smart dive computers' throughout the booklet.

Safety considerations

Dive computers provide divers with data; they however, do not provide the knowledge how this data should be understood and applied. Dive computers cannot replace common sense! You must therefore carefully read and understand this entire manual before using your Uwatec Smart dive computer.

Important remarks concerning signal words and symbols

This operating manual makes use of the following icons to indicate especially important comments:

Remarks



Information and tips which are important for optimal use of the functions of Smart.

Danger!

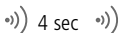


Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

The following symbols are used in the operating manual:



Flashing display



Acoustic attention signal



Acoustic alarm signal



Operating instruction for manual input
Example: bridging contacts B and E

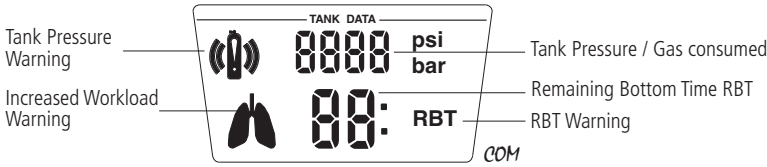
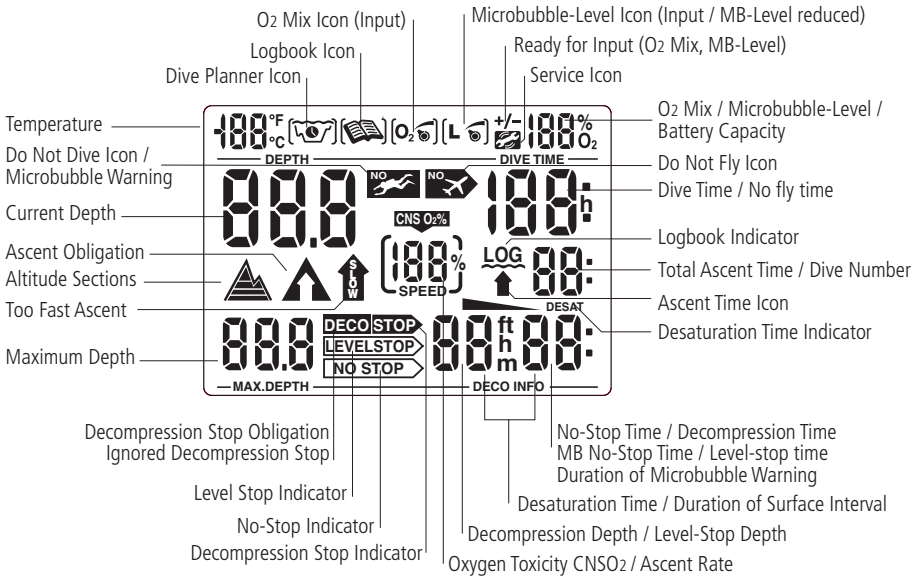
COM

Only valid for Smart Com.



Page reference

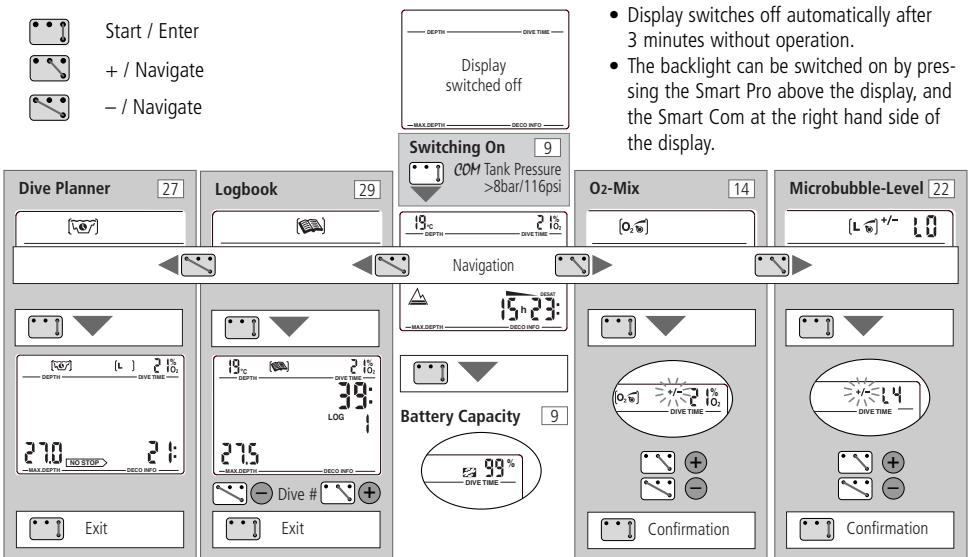
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Operating Scheme

- Start / Enter
- + / Navigate
- / Navigate

- Display switches off automatically after 3 minutes without operation.
- The backlight can be switched on by pressing the Smart Pro above the display, and the Smart Com at the right hand side of the display.



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II System and Operation

1 System Description

The Smart displays all important dive and decompression data.

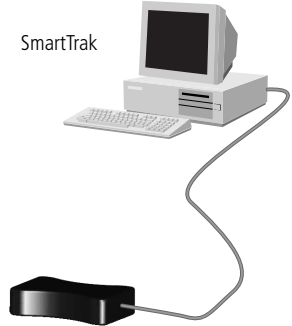
The Smart has a data memory, which stores the dive data. The data can be transmitted with the standard infrared interface (IrDA) and the SmartTrak software to a Windows® personal computer. The SmartTrak CD software is included with the SmartTrak Package. Infrared interfaces are available in PC-stores. A list of recommended interfaces is available on the Uwatec homepage (www.uwatec.com).



Smart Com



Smart Pro



SmartTrak

Infrared Interface

2 Operation



On page 5 you will find an operating schematic.

2.1 Operating Elements

The Smart has 4 operating contacts B, E, +, – on the outside of the housing. For manual operation, touch base contact B and any one of the other three contacts above the display with moistened fingers.

Contact B:

Base contact, which has to be touched for all operations.

In order to keep the text as simply as possible, it will no longer be pointed out that the contact B must be touched every time.

Contact E:

Enter contact. It serves to switch on the Smart and to confirm or enter the displayed value. It is therefore comparable to the ENTER- or RETURN-key of a computer.

+ / – Contacts:

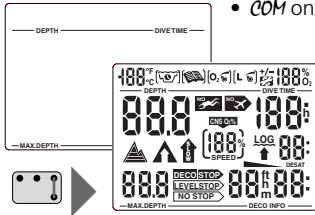
At the surface you can select with these contacts the dive planner, the logbook and the functions to adjust the O₂ mix and the Microbubble-Level. See page 9.

Once inside the function the + increases the indicated value and the – reduces it.

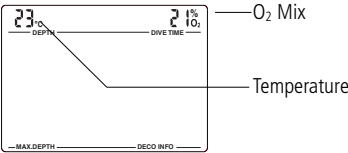


2.2 Switching on the display

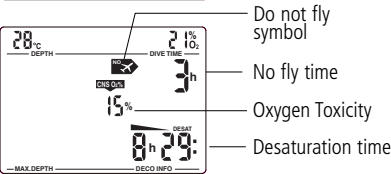
- automatically, on submerging in water or when adaptation to atmospheric pressure is necessary.
- manually by manipulating contacts on housing (B-E).
- COM on opening the tank valve (if connected) (Tank pressure ≥ 8 bar / 116 psi).



- When the Smart is in state of rest; no information is displayed but the atmospheric pressure is continuously monitored. If a higher altitude is detected, it switches on for 3 minutes automatically. See also page 21.
- The Smart switches on by bridging the contacts B and E. To check the display, all signs light up for 5 seconds.

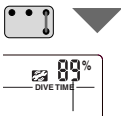


Afterwards the display shows the selected O₂ mix, the temperature and in certain circumstances an altitude section (see page 21). The Smart Com displays the tank pressure also.



If there is a remaining saturation due to the last dive or change of altitude, the Smart also displays the remaining desaturation time, the Oxygen toxicity and the "No fly time" (see page 20).

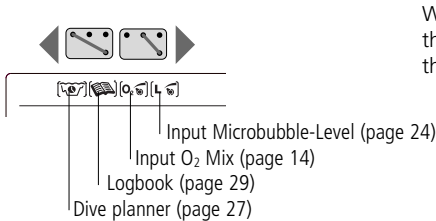
2.3 Checking the battery capacity



Battery capacity

After switching on the Smart you can check the battery capacity with the contact E. The remaining capacity is displayed during 3 seconds as a percentage. If the value reaches 0%, the battery warning gets activated (see page 13) and the battery has to be replaced by an authorised Scubapro-Uwatec dealer. A battery capacity of 2 to 5 % is definitely enough energy for the dives of usual dive vacations (20 to 50 dives).

2.4 Selection and Activation of User Functions



With the contacts + and – you can select the Dive Planner, the Logbook and the functions to enter the O₂ Mix and the Microbubble-Level.



After the selection of the desired function you can activate and deactivate it with the contact E.



Details to the user functions are to be found on the pages mentioned above.

2.5 Active backlight



The display of the Smart can be illuminated both on the surface and underwater. The backlight can be switched on by pressing the Smart Pro above the display, and the Smart Com at the right hand side of the display. The light will turn off automatically after 8 seconds or after the time selected in the SmartTrak software. The backlight can only be activated if the computer display is on.

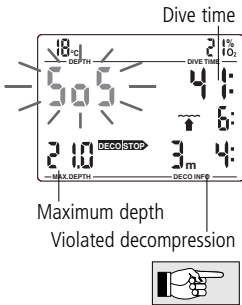


The active backlight is no substitute for a dive torch. When diving at night or at increased depth we recommend the use of a dive torch.

2.6 Switching off the display

- automatically after 3 minutes without operation on the surface.
- **COM** at the surface: automatically after 3 minutes without a reduction of tank pressure. The display switches on again after starting breathing from the tank.

3 SOS-mode



Activation: automatic

If the diver remains above a depth of 0,8 m (3 feet) for more than three minutes without observing the prescribed decompression, the computer switches into SOS-mode after the dive and displays <SOS> instead of the depth. The computer is locked from use for the next 24 hours. The display shows the most important information of the dive. Desaturation is further calculated including microbubbles in the tissues. Diving is again possible after 24 hours, but the SOS-mode can influence the calculations of the Smart for three days after the incident due to the possible presence of microbubbles.

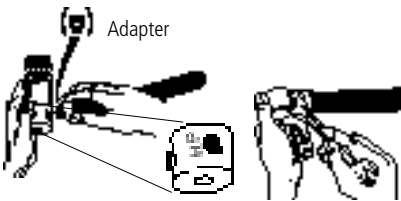
If a diver using Smart experiences a diving accident resulting in decompression sickness, the dive can be analysed by means of the infrared interface and the SmartTrak software.



Serious injury or death may result if a diver does not seek immediate treatment should any signs or symptoms of decompression sickness occur after a dive.

4 COM Setting Up the Smart Com

4.1 Mounting the high-pressure hose to the first stage



The high-pressure hose is mounted on the high-pressure outlet (HP-outlet) of the first stage of the regulator.

1. Mount the high-pressure hose on the HP-outlet. If the threads do not match, you can obtain an adapter from your diving retailer.
2. Tighten the connection with a matching wrench.



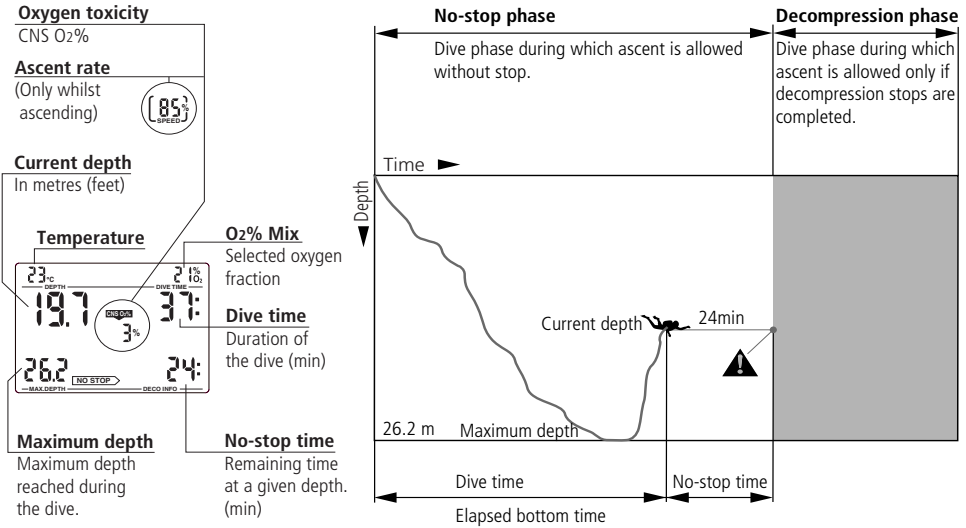
- Use air - and Nitrox HP-hoses in accordance with the law of the country.
- The HP-hose is limited to a max of 40% O₂ Nitrox!

1 Terminology / Symbols

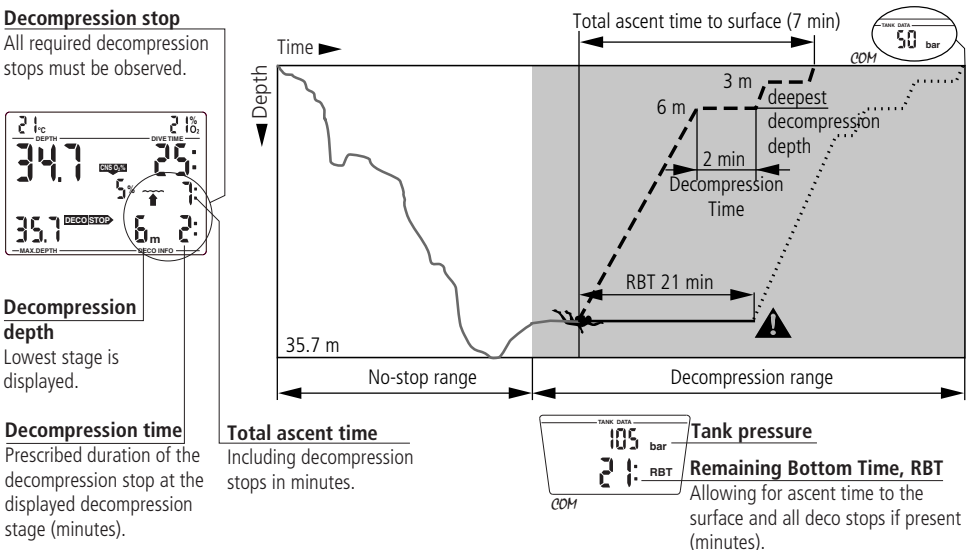
The information on the display of the Smart varies depending on the kind of dive and the dive phase
 For information about diving with microbubble-levels (MB-level) see chapter IV (page 22).



1.1 General terminology / Display during no-stop phase



1.2 Display during decompression phase / Remaining Bottom Time (RBT)



1.3 Nitrox information (O₂-information)

For dives with compressed air in normal recreational diving, nitrogen is the decisive gas for the decompression calculations. When diving with nitrox, the toxicity of oxygen rises with the increase of the fraction of oxygen and increasing depth and can limit dive time and the maximum depth. Smart includes this in the calculations and displays the necessary information:

<O₂% MIX>

Fraction of oxygen: The fraction of oxygen in the Nitrox mixture can be set between 21% (normal compressed air) and 100%. Your selected mix will be the basis for all calculations.

ppO₂ max

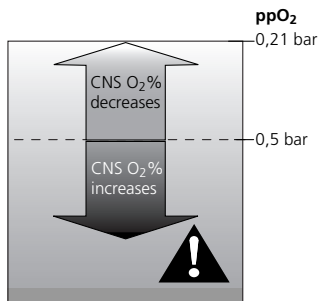
Maximum allowable partial pressure of oxygen: The higher the percentage of oxygen in the used mixture, the shallower the dive depth at which the tolerable partial pressure of oxygen (ppO₂ max) is reached. Default setting is a limit of 1.4 bar, it can be changed with the SmartTrak software in the range of 1.2 to 1.95 bar. The Smart does not display the entered ppO₂ limit, but warns the diver acoustically and optically if he reaches the depth at which the ppO₂ limit is reached.



The CNS O₂%-value/alarm is not influenced by the selected ppO₂max.-setting.

<CNS O₂ LIMIT>

Oxygen toxicity: With the increased percentage of oxygen, the oxygen in the tissues, especially in the central nervous system (CNS) becomes important. If the partial pressure of oxygen rises above 0.5 bar, the CNS O₂ value increases, if the partial pressure of oxygen is below 0.5 bar, the CNS O₂ value decreases. The closer the CNS O₂ value comes to 100%, the closer the limit, where symptoms can occur. See page 17.



Nitrox diving may only be attempted by experienced divers after proper training from an internationally recognized agency.

2 Attention Messages and Alarms

Smart draws the diver's attention to certain situations and warns the diver of unsafe diving practices. Attention messages and alarms are always optical and acoustic under water, only optical at the surface except the decompression alarm.



The acoustic attention messages (but not the alarms) can be switched off with the SmartTrak.



2.1 Attention Messages

Attention messages are communicated to the diver visually by symbols, letters or flashing figures. In addition, two short acoustic sequences can be heard (in an interval of 4 seconds) in two different frequencies under water.

»)») 4 sec »)») (can be switched off)

Attention messages come up in the following situations:
(More information can be found on the listed pages)

	Page
• End of no-stop time	18
• Set maximum partial pressure is reached	16
• Set maximum depth has been reached	15
• Oxygen toxicity reaches 75%	17
• Warning of bubbles	20
• COM Remaining Bottom Time <3 minutes	18
• COM Tank pressure reaches set alarm pressure	17
• COM Increased workload	17
• Prohibited altitude*	21
Diving with Microbubble-Levels (L1-L5):	
• Level-stop ignored	25
• Microbubble-level reduced	25
• Begin decompression obligation	25

* without acoustic attention beep

2.2 Alarms

Serious injury or death may result from failing to immediately respond to alarms given by Smart.

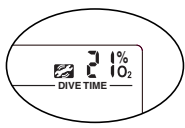
Alarms are given to the diver optically by flashing symbols, letters or figures and symbols. In addition, an acoustic sequence in one frequency can be heard during the whole duration of the alarm.

»)»)») »)»)») (can not be switched off)

An alarm occurs in the following situations:
(More information can be found on the listed pages)

	Page
• Oxygen toxicity reaches 100%	17
• Ignored decompression	19
• COM Remaining Bottom Time zero	18
• Exceeding the prescribed ascent rate (Particular scale of beeps, see page 16)	16
• Low battery alarm*	see below

Low battery alarm*



The service symbol appears if the battery capacity reaches 0%. Take the unit to your authorised Scubapro Uwatec retailer.

*without acoustic alarm

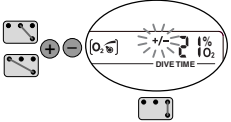
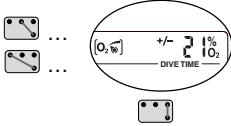
3 Preparation for the Dive

3.1 Setting the gas mixture [O₂]



WARNING

Before every dive and after changing the tank, make sure that the setting of the gas mixture corresponds to the actual mixture used. An incorrect setting causes the Smart to miscalculate this particular dive. If the fraction of oxygen is set too low this can lead to oxygen poisoning without warning. If the value is set too high decompression damage due to nitrogen saturation may occur without a warning from the Smart.



To set the gas mixture, the Smart must be in user-mode.

1. Bridge contacts B and + or – until the symbol for the setting of the O₂ mixture appears.
2. Confirm that you wish to change the displayed oxygen fraction by bridging B and E.
3. Change the oxygen fraction by bridging contacts B and + to increase or B and – to decrease (21-100%).
4. Confirm with B and E the selected percentage.
Without confirmation the display will disappear after 3 minutes and your entries will not be accepted.



WARNING

If you exit the O₂ % Mix function automatically without confirming, the new settings will not be accepted and the Smart reverts to the previous settings.

The time to reset the O₂% mix to air (21% O₂) can be set with SmartTrak between 1 hour to "no reset" (default).

3.2 Setting the MB-level [L] See chapter IV, page 24.

3.3 COM Preparation for the Dive with Smart Com

The following description of the preparation of a dive is based on the assumption that the high-pressure hose is correctly mounted on the HP-outlet and the Smart Com is connected with the HP-hose (see page 10).



WARNING

If the high-pressure hose is not correctly mounted, it will not perform properly and serious injury or death may result.

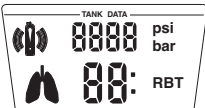
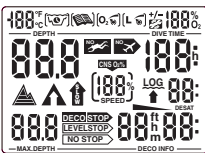
1. Mount the regulator together with the high-pressure hose on the tank.
2. Check the reserve valve of your tank (if fitted), the reserve valve must be open.
3. Open the valve and check the tank pressure (after approx. 10 sec.). If the pressure is insufficient, change the tank.



WARNING



3.4 Inspection



Make an inspection before each dive:

1. Switch on the Smart (B-E).
2. Check the test display: Are all the elements of the display activated? Use the Smart only if all elements of the display are activated.
3. **COM** Check the connections and instruments for leaks. Never dive with leaky equipment!

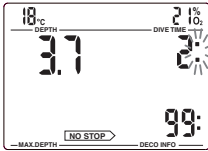
4 Functions during the Dive



4.1 Immersion

After immersion, starting at a depth of about 0.8 m (3 ft), all diving functions are monitored, i.e. depth and dive time displayed, maximum depth stored, saturation of tissues calculated, no-stop time or decompression prognosis determined, ascent rate controlled and displayed and the correctness of the decompression procedure supervised. The Smart Com shows in addition the tank pressure and the Remaining Bottom Time (RBT).

4.2 Dive time



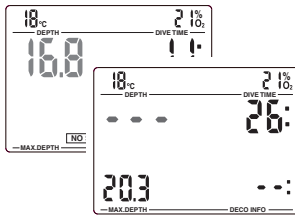
The whole time spent below a depth of 0.8m (3 feet) is displayed as dive time in minutes. The time above 0.8m (3 feet) is counted as dive time only then, if the diver descends within 5 minutes below 0.8m (3 feet).

While the dive time is running, the colon on the right of the figures is flashing in one second intervals. Maximum dive time displayed is 199 minutes.



If a dive lasts longer than 199 minutes the dive time display starts again at 0 minutes.

4.3 Current depth

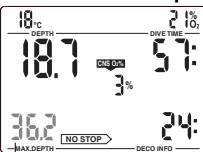


Current depth is given in 10 cm-increments (1 foot). On switching on and at a diving depth of less than 0,8 m (3 ft) the display shows <--->.



Depth measurement is based on freshwater. Therefore, Smart shows a slightly greater depth than actually true when diving in salt water, depending on the salinity of the water.

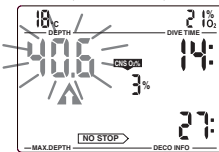
4.4 Maximum depth



Maximum depth is only displayed if it exceeds the current depth by more than 1 m (3 feet) (maximum indicator function).

maximum depth

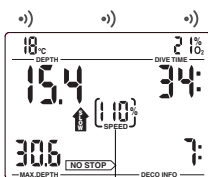
))) 4 sec)))



Set maximum depth reached

The maximum depth set with SmartTrak has been reached (default 40 m / 130 feet). Ascend until the ascent arrow disappears.

4.5 Ascent rate



ascent speed %

Optimal ascent rate varies depending on depth between 7 and 20 m/min (23 and 67 ft/min). It is displayed as a percent of the reference variable ascent rate. If the ascent rate is greater than 100% of the set value, the black arrow <SLOW> appears. If the ascent rate exceeds 140%, the arrow starts flashing. The Smart provides an acoustic alarm if the ascent rate is 110% or greater. The intensity of the alarm increases in direct proportion to the degree that the prescribed ascent rate is exceeded.



The prescribed ascent rate must be observed at all times! Exceeding the prescribed ascent rate can lead to bubbles in the arterial circulation which can lead to serious injury or death due to decompression sickness.

- The Smart may require a decompression stop even within the no-stop phase because of the danger of formation of microbubbles due to an improper ascent.
- The decompression time necessary for the prevention of microbubbles can increase massively if the ascent rate is exceeded.
- From great depth a slow ascent may cause heightened saturation of tissues and an extension of both decompression time and total ascent time. At shallow depth, a slow ascent may shorten the decompression time.
- Display of the ascent rate has the priority to <CNS O₂LIMIT>.

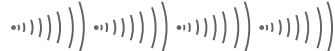
Messages:



Ascent rate

Optical alarm

Acoustic alarm



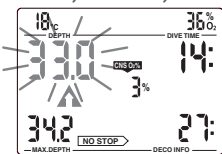
Response:

Reduce ascent rate

Excessive ascent rates for longer periods are entered in the logbook.

4.6 Partial pressure of oxygen (ppO₂)

») 4 sec »)



The tolerable partial pressure of oxygen can be set by means of the SmartTrak software between 1.2 and 1.95 bar (default 1.4 bar). The set value and the information about the actual ppO₂ are not displayed.



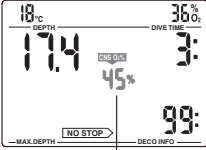
Messages: Depending on the mixture used and the setting of the maximum partial pressure of oxygen (ppO_{2 max}) the limit for an attention message is reached at different depths. When the set maximum partial pressure is reached Smart sends an acoustic attention message, the ascent arrow appears and the current depth display starts flashing.

Response: Ascend to a shallower depth in order to diminish the danger of oxygen poisoning.



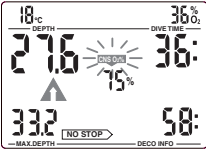
- The allowed maximum depth should not be exceeded. Disregarding the warning can lead to oxygen poisoning.
- ppO_{2 max} should not be set higher than 1.6 bar

4.7 Oxygen toxicity (CNS O₂%)

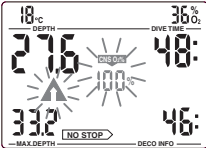


Oxygen toxicity

))) 4 sec)))



))))))))))))))))))))))))



Oxygen toxicity is calculated from depth values, time and the gas mixture by the calculation model and displayed in place of the ascent rate in percent of a maximum value tolerated (O₂ clock). The toxicity is expressed in 1%-increments. Together with the percentage the symbol <CNS O₂ LIMIT> is displayed.



WARNING

Messages: An acoustic signal is sent if oxygen toxicity reaches 75%. The symbol <CNS O₂ LIMIT> is flashing and the ascent arrow appears.

Response: Ascend to shallower depth to decrease oxygen loading.



WARNING

Messages: When oxygen toxicity reaches 100%, an acoustic alarm is sent every 4 seconds. <CNS O₂ LIMIT>, the percentage value and the ascent arrow are flashing. Danger of oxygen toxicity!

Response: Start ascent at once.

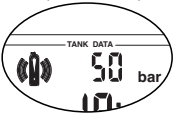
- During an ascent and if the CNS O₂ % value does not increase anymore (due to a lower partial pressure of oxygen), the acoustic warning is suppressed.
- During the ascent, the display of the oxygen toxicity extinguishes and the ascent rate is displayed. If the ascent is stopped, the display changes back to the indication of the CNS value.

4.8 COM Tank pressure

Tank pressure is indicated in the lower display.



))) 4 sec)))



))) 4 sec)))



The tank pressure is also used for the calculation of the remaining bottom time (RBT) and the workload.



WARNING

Messages: If the tank pressure falls short of the set alarm pressure (SmartTrak) an acoustic alarm is sent and the tank symbol is shown. Default value of the alarm pressure: 100 bar (1400 psi)

Response: Start ascent at once.



WARNING

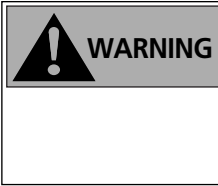
Messages: In case of increased workload, the Smart Com displays a lung symbol in the lower display and an acoustic warning occurs.

Response: In order to prevent additional saturation, reduce exertion, relax and breathe more slowly.

4.9 COM Remaining Bottom Time (RBT)

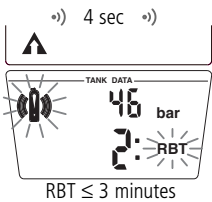


RBT is the time left at the current depth until the point of time when the ascent must be started. The RBT is shown in the lower display. The RBT is calculated on the basis of the current tank pressure, the temperature, and the dive data so far recorded. The RBT is based on the assumption that the tank pressure should amount to the set pressure (default 40 bar/560 psi) at the end of the dive. Alterations can be made with SmartTrak. A graphic representation of RBT is on page 11.



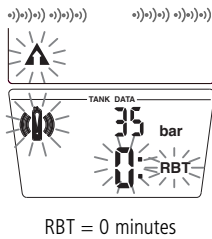
Never allow the RBT to go below three minutes. If the RBT goes below three minutes there is a danger of insufficient supply of gas mixture for the ascent as well as an increased risk of decompression sickness and serious injury or death may result!

Correct calculation of RBT when using a reserve or "J"-type valve is possible only if the reserve function of the valve is in the open (down) position during the dive.



Messages: If the RBT drops below three minutes, an acoustic attention signal is activated, the ascent arrow is displayed and the tank icon and RBT start flashing.

Response: Start ascent immediately.




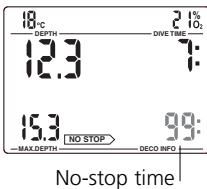
Messages: The RBT-value should never reach <0>. With a RBT=0 the remaining tank reserve may not be guaranteed anymore after ascending. It is possible that the gas reserve will not be large enough for the ascent.

When the last minute has passed (RBT=0) an acoustic alarm is activated every 4 seconds. The RBT, the ascent arrow and the tank icon start flashing. The acoustic alarm on exceeding the RBT is suppressed at depths less than 6.5 m (21 ft) if Smart Com is in the no-stop phase.

Response: Start ascent at once

4.10 Decompression information

No-stop time is displayed if no decompression stops are necessary. The arrow  is visible if no decompression stops are necessary. The figures indicate no-stop time in minutes.

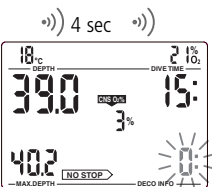


- No-stop display <99:> means remaining time of 99 minutes or more.
- No-stop time is calculated on line and influenced by the actual workload and current water temperature.



Messages: There is an acoustic signal if no-stop time is less than 1 minute. In this last minute, the no-stop display shows the flashing value <0>.

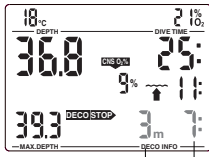
Response: In order to prevent a decompression dive, you must ascend a few metres (feet) after this message.



Do not use the Smart for planned decompression dives!

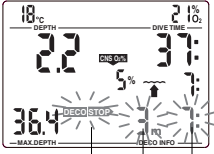
Decompression values

On entering the decompression phase, the arrow **NO STOP** disappears. The arrow **DECOSTOP** appears. Right beside the arrow, the deepest decompression stage in metres (feet) is displayed. Beside the decompression depth, the decompression time of the displayed stage in minutes appears. The display <3m 7:> means that a decompression stop of 7 minutes at a depth of 3m has to be made. When a decompression stop has been finished, the next higher decompression stop is displayed. When all decompression stops have been made, the arrow **DECOSTOP** extinguishes and the arrow **NO STOP** reappears. The indication of time on the lower right shows the no-stop time again.



Decompression depth
Decompression time

↶↷↶↷↶↷↶↷ ↶↷↶↷↶↷↶↷



Ignored decompression alarm



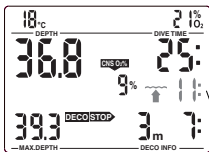
Messages: The decompression alarm is activated if the decompression stop is ignored. The arrow **DECOSTOP**, the decompression time and decompression depth begin to flash and an acoustic alarm is initiated. Due to the formation of micro-bubbles decompression can increase massively if a decompression stop is ignored. When the surface is reached during the decompression alarm, the arrow **DECOSTOP**, the decompression time and decompression depth continue flashing, in order to point to the risk of a decompression accident. The SOS-mode is activated 3 minutes after the dive, if corrective action is not taken (see page 10).

If the total (cumulative) duration of the decompression alarm is longer than a minute, it is entered in the logbook.

Response: Descend to the prescribed decompression depth immediately!

Total time of ascent

As soon as decompression stops are necessary Smart shows the total time of ascent. This includes the total ascent time from the current depth to the surface and all decompression stop obligations.



Total time of ascent



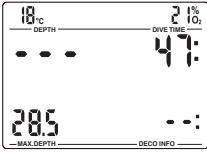
The time of ascent is calculated on the basis of the prescribed ascent rate and a normal workload. Total time of ascent can be subject to change if the ascent rate is not ideal (100%) or if a Smart Com detects a higher workload.



On all dives with the Smart, make a safety stop for at least three minutes at a depth of 5 m (15 feet).

5 Functions at the Surface

5.1 End of a dive



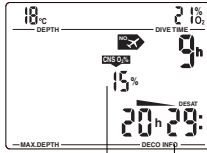
After reaching the surface (<0.8 m/3 ft) Smart remains on for 5 minutes after the dive is terminated. The delay allows for surfacing for a short period for orientation.

When the dive is closed after 5 minutes, it is entered into the logbook.




For the calculations of the desaturation and No Fly Time it is assumed that the diver breathes air.

5.2 Desaturation time

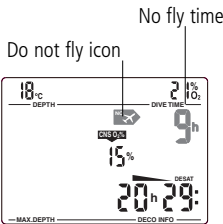


Oxygen toxicity

Desaturation time

After the dive has been closed  DESAT Desaturation time in hours and minutes and, if available, oxygen toxicity is displayed. Desaturation time is determined either by oxygen toxicity, nitrogen saturation or the regression of microbubbles, depending on which requires the longer time. Oxygen saturation (<CNS O₂ LIMIT>) is displayed and adjusted until the value becomes 0%. Desaturation time is indicated until the next dive or until it reaches zero. The display is switched off to save energy three minutes after the last manipulation is made. The calculations are nevertheless continued in the background.

5.3 No fly time



Do not fly icon

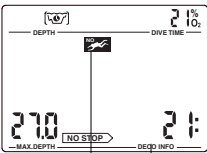
No fly time

The <No fly time> is indicated beside the icon <Do not fly>. <No fly time> is the time in hours that should pass before a flight and is displayed and adjusted until the value becomes 0 hours.



Flying while the Smart displays <Do not fly> may lead to serious injury or death from decompression sickness.

5.4 Warning of bubbles



Microbubble warning

Desaturation time

Through repetitive dives microbubbles accumulate in the lungs if the surface interval is not long enough. Ignoring decompression stops or an excessive ascent rate can also lead to bubbles in tissues. In order to reduce the risk of decompression sickness for future repetitive dives, the surface interval should be planned long enough to reduce the risk of decompression sickness. If Smart calculates that the formation of microbubbles occur during the surface interval, it will advise a diver to extend the surface interval. Duration of the microbubble warning: see page 27.



If the <bubble warning (NO DIVE)> is visible during the surface interval, the diver should not undertake another dive.

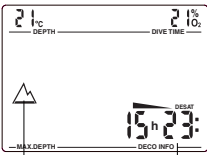


If the dive is made in spite of the bubble warning, the diver must cope with a clearly shorter no-stop time or an extension of decompression. The duration of the bubble warning at the end of the dive can increase considerably.

6 Diving in Mountain Lakes



6.1 Altitude sections



Altitude section 1

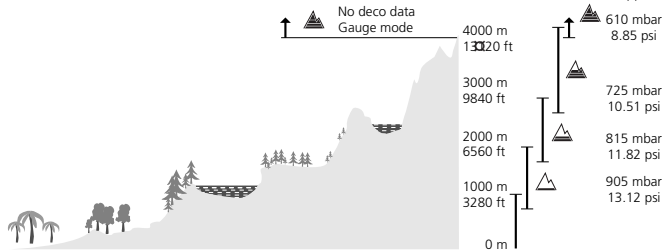
Desaturation time
Adaptation time

Altitude sections



Smart measures every 60 seconds the atmospheric pressure even while the display is switched off. If the computer detects an increase in altitude, it switches on automatically and indicates the new altitude section (1-4) and the desaturation time. Desaturation time indicated at this moment refers to adaptation time at this altitude. If the dive starts within this adaptation time, Smart treats it as a repetitive dive, since the body still has a higher saturation.

The entire altitude range is divided into four sections, which are influenced by barometric pressure. That is why the defined altitude sections overlap on their fringes. If a mountain lake altitude is reached, the altitude section is indicated at the surface, in the logbook and in the dive planner by a stylised mountain filled with 4 segments representing the 4 sections. Sea level to an altitude of approximately 1000m (3000 feet) is not indicated. In the following diagram, you can see the approximate altitude ranges of the four sections:



6.2 Prohibited altitude

WARNING To avoid microbubbles, the Smart shows at surface with flashing altitude segments, to which altitude the diver may not rise. This attention message is subject of the set MB-level.



Ascent to altitude range 3 and 4 prohibited.
Max. allowed altitude:
2650 m (8694 ft).

Max. altitude:



850 m
2790 ft



1650 m
5413 ft



2650 m
8694 ft



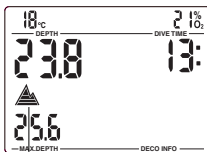
4000 m
13120 ft

The ascent prohibition can also be displayed together with an altitude section:



You stay at 1200 metre (3937 ft) (altitude section 1) and you may ascend to range 2 only (2650 m / 8694 feet). You may not rise to the altitude section 3 or 4.

6.3 Decompression dives in mountain lakes



Altitude section 4:

- no deco data
- COM no RBT

In order to assure optimal decompression even at higher altitudes, the 3m (10 ft) decompression stage is divided into a 4 m (13 ft) stage and a 2 m (7 ft) stage. The prescribed decompression depths are, in sequence, 2m / 4m / 6m / 9m... (7 ft / 13 ft / 20 ft / 30 ft...).

If atmospheric pressure is below 620 mbar (8.99 psi) (altitude higher than 4100 m / 13450 ft above sea level), no decompression data is displayed (Depth Gauge Mode).

This has the consequence, that the RBT (COM) and the dive planner are not available anymore. The oxygen toxicity and the tank pressure (COM) are still indicated.



IV Diving with Microbubble-Level (MB)



The following chapter will deal with the characteristics of diving with microbubble-levels (MB-level). For general information about displays and features of diving with Smart see chapter III.

Microbubbles are tiny bubbles that can build up inside a diver's body during any dive and normally dissipate naturally during an ascent and on the surface after a dive. Dives within no-stop time and observation of decompression stops does not prevent the formation of microbubbles in the venous blood circulation.

Dangerous microbubbles are those migrating into the arterial circulation. The reasons for the migration from the venous blood circulation to the arterial circulation can be a great many bubbles collecting in the lungs or if a diver suffers from PFO (patent foramen ovale), an open connection between the right and left atrium of the heart.

With Smart Uwatec has developed a new technology to keep the formation of microbubbles in check. The diver chooses – according to his/her needs – an MB-level and influences through it the suppression of microbubbles.

Diving with MB-levels requires additional ascent stops (level-stops), the ascent is slowed and the body gets more time to desaturate. This works contrary to the formation of the microbubbles and increases the safety.

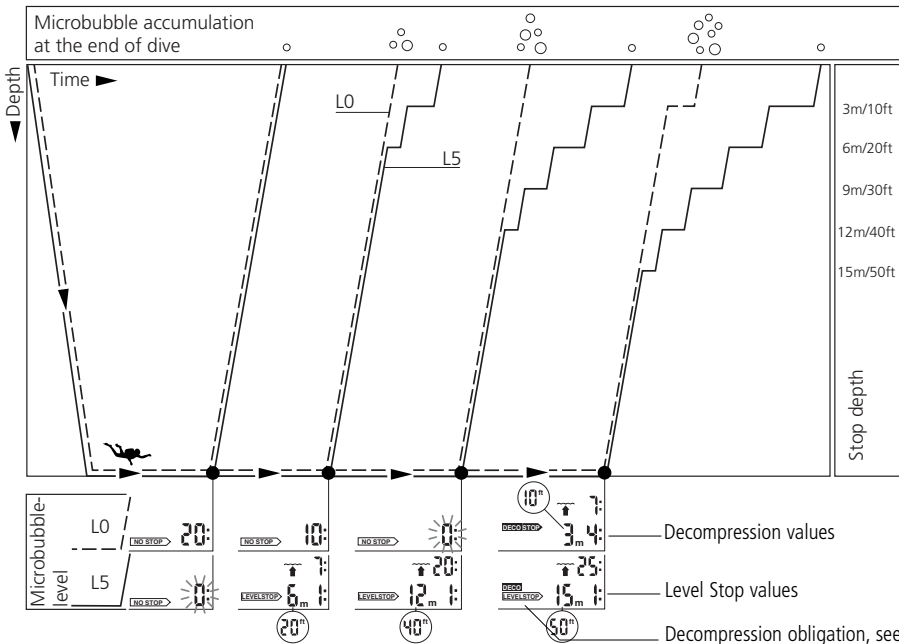
Smart features **6 microbubble-levels** (L0-L5). Level 0 corresponds with Uwatec's well-known decompression model ZH-L8 ADT and does not require level-stops due to microbubble formation. Levels L1 to L5 offer additional protection from bubble formation with level 5 offering the highest protection and should be selected for example by divers suffering from PFO.

Similar to the display of information during decompression dives or dives within no-stop time, Smart displays depth and duration of the first level-stop as well as the total time of ascent, as soon as the MB no-stop time has run out. As the MB no-stop time is shorter than the ordinary no-stop time a diver will be required to carry out a stop (level-stop) sooner than a diver using level 0.

If a diver ignores a required level-stop, Smart will change over to a lower MB-level and the dive can not be completed with the initially chosen MB-level. E.g. If a diver sets level 4 on the Smart prior to the dive and during the dive ignores the stops recommended the Smart will automatically adjust the setting to level 3 or lower.

1 Comparison of dives with MB-level 0 and MB-level 5

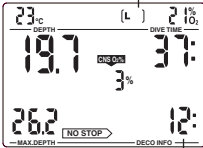
When two Smarts are used simultaneously, one unit is set on MB-Level L5, the other on L0, whilst diving with MB-levels L1 to L5 the no-stop time will be shortened and level-stops will be required before the diver has the obligation of a decompression-stop. These additional level-stops help dissipate the microbubbles.



This chapter will exclusively deal with terminology and display features used whilst diving with MB-levels. All other features are described in chapter III (page 11).

2.1 Display during Microbubble (MB) No-Stop Phase

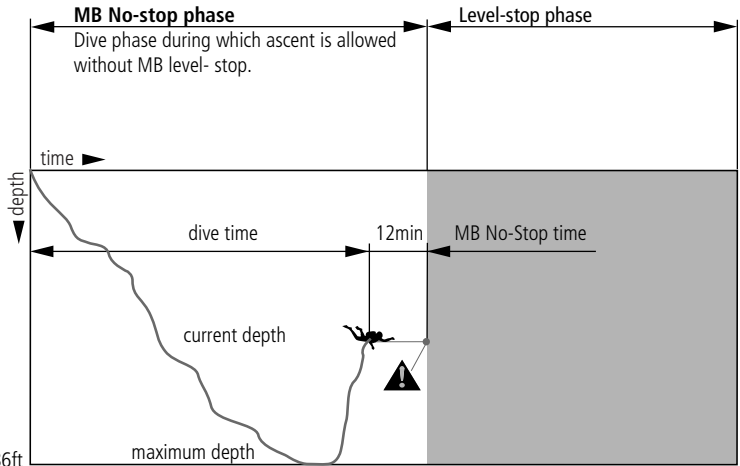
An MB-level between L1 and L5 was chosen.



MB No-Stop time

Remaining time at a respective depth allowing ascent without level-stop.

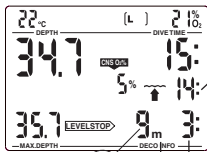
26.2 m/86ft



2.2 Display during Level-stop phase

Total ascent time

including Level-stops

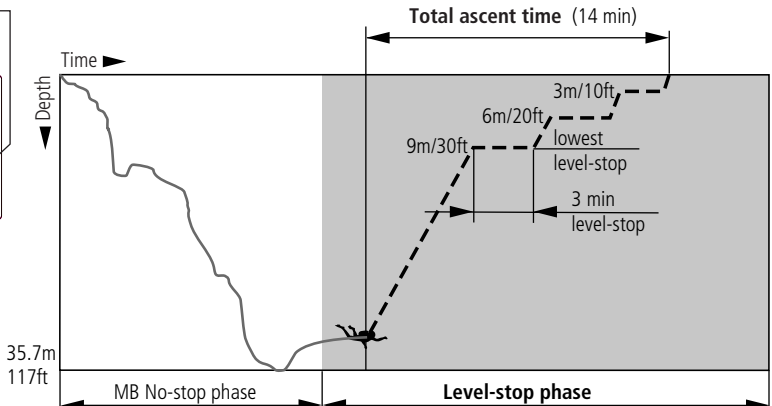


Level-stop depth

The deepest Level-stop at the time will be displayed.

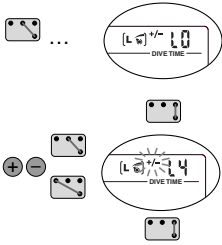
Level-stop time

The duration of a level-stop at a given level-stop depth will be displayed.



3 Preparation for a dive with Microbubble-Levels (MB-levels)

3.1 Setting the MB-level



To change the MB-level Smart must be in user-mode.

1. Bridge contacts B and + until the symbol for MB-levels appears.
2. Confirm that you wish to change the displayed MB-level by bridging B and E.
3. Change MB-level by bridging contacts B and + or B and - .
4. Confirmation with B and E the selected MB-level.

Without confirmation the display will disappear after 3 minutes and your entries will not be accepted.

Smart will display the [L] symbol to confirm that an MB level beyond L0 (L1-L5) has been chosen. During the dive the MB-level itself will only be shown if a level-stop has been ignored (see p. 28).



MB-Levels do have an influence on your dive planner, your desaturation and no-flight time. They can also alter the range of altitudes a dive can safely carry out.

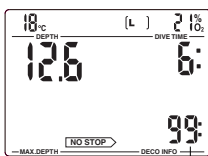
4 Functions during the Dive with Microbubble-Levels

4.1 Level-stop information

Microbubble (MB) No-Stop Time

While diving with MB-levels L1 to L5 Smart will display the MB no-stop time instead of the ordinary no-stop time. Within the MB no-stop time no level-stops are required.

The arrow **NO STOP** and the MB-level symbol [L] are visible. The remaining MB no-stop time is shown in minutes.

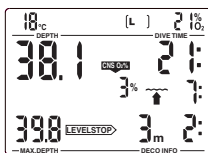


MB no-stop time



- Information and alarms for MB no-stop time and ordinary no-stop time are the same (see p. 18).
- In spite of the MB-level program, we generally recommend to perform a slow ascent during the last few metres / feet.

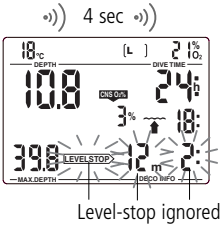
Level-stop



On entering the level-stop phase, the arrow **NO STOP** disappears and the arrow **LEVELSTOP** appears. The **LEVELSTOP** arrow flashes for 8 seconds and an acoustic alarm is initiated. To complete the dive without being reduced to a deeper MB-level, all requested level-stops must be observed.

To the right of the **LEVELSTOP** arrow, the deepest level-stop is displayed in metres/feet. The display <3m 2:> (<10ft 2:>) means that a level-stop of 2 minutes at a depth of 3 metres (10ft) has to be made.

When a level-stop has been finished, the next higher level-stop – if necessary – is displayed. When all level-stops have been made, the arrow **LEVELSTOP** extinguishes and the arrow **NO STOP** reappears. The indication of time on the lower right shows the MB no-stop time again.

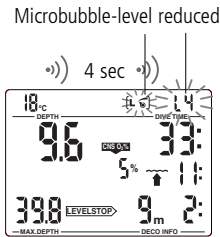


Level-stop ignored

WARNING

Response: To complete the dive without being reduced to a lower MB-level, you must descend to the prescribed depth immediately!

Messages: The attention message "**Level-stop ignored**" is activated, if the requested level-stop is not observed. An attention beep* is initiated, the arrow **LEVELSTOP**, the depth and time of the ignored level-stop begin flashing.



Microbubble-level reduced

WARNING

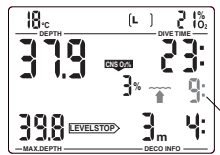
Response: To complete the dive without being further reduced to a lower MB-level the new level-stop must be observed.

Messages: The warning "**Microbubble-level reduced**" is activated, if the depth of a required level-stop is exceeded by more than 1.5 m (5ft). Smart then reduces the MB-level, an attention beep* goes off and the new MB-level will flash until the end of the dive. The new MB level-stop is displayed.



* Attention beeps can be suppressed with the aid of SmartTrak software.

4.2 Total time of ascent



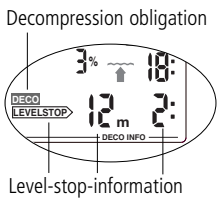
Total ascent time

Smart displays the level-stop information and the total time of ascent. This includes the time of ascent as well as all level-stops.



The time of ascent is calculated on the basis of the prescribed ascent rate. Total time of ascent can be subject to change if the ascent rate is not ideal (100%).

4.3 Decompression obligation



Level-stop-information

Smart calculates and displays level-stops to reduce microbubble formation, but it also calculates the diver's decompression data. If decompression stops become obligatory, the **DECO** symbol will be displayed. The total ascent rate will now also contain a decompression stop.



If the indicated depth corresponds with the actual depths of a divers first deco stop, the symbol **DECOSTOP** appears. See also page 26.



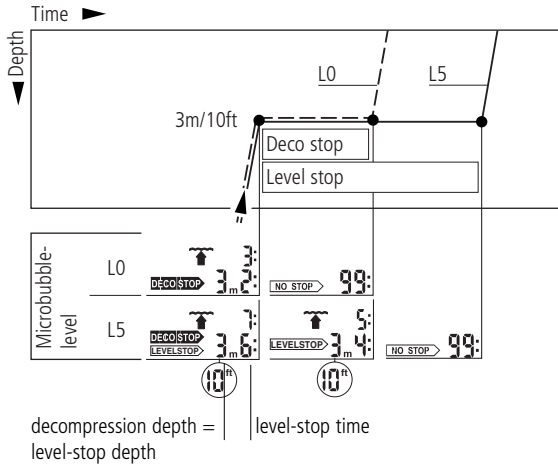
WARNING

Response: In order to prevent a dive with long decompression stops it is recommended that you ascend a few metres/feet on seeing this message.

Messages: At the beginning of a decompression phase an attention beep goes off and the **DECO** - symbol flashes for 8 seconds.

4 Functions during the Dive with Microbubble-Levels

4.4 Level-stop and Deco stop



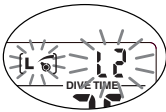
As soon as the level-stop depth equals the depth of the first obligatory decompression stop, the symbols **DECOSTOP** and **LEVELSTOP** are displayed. The indicated time refers to level-stop time.

When the decompression stop has been completed the display changes from **DECOSTOP** **LEVELSTOP** to **LEVELSTOP** only.

5 Functions at the Surface

5.1 Complete a dive with MB-levels


A dive with MB-levels is completed the same way as a dive without MB-levels (L0) (see page 20), save for the following exceptions:



If the MB-level has been reduced during the dive, the indicated MB-level will continue flashing for five minutes after reaching the surface. The dive is then completed and Smart changes to user mode with the MB-level switching back to the original MB-setting.

5.2 Repetitive dives and Microbubble-Levels

If during a dive a level-stop is being ignored and the diver starts another descent shortly afterwards, Smart might immediately request level-stops. To complete the dive with the initially set MB-level all level-stops must be observed.

 The Smart is equipped with a dive planner, which allows the planning of no-stop dives with freely determinable surface intervals.

Basis of the planning:

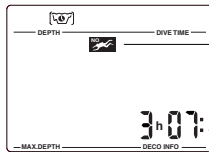
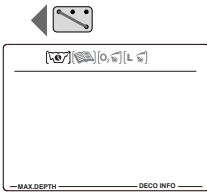
- selected percentage of oxygen (O₂% Mix)
- selected Microbubble-level
- water temperature of the most recent dive
- altitude sections if any
- assuming a normal performance



If two or more divers using computers are planning a dive, planning for all divers has to be based on the dive computer showing the shortest no-stop times. Failure to do this may lead to serious injury or death from decompression sickness.


1 Planning a No-Stop Dive

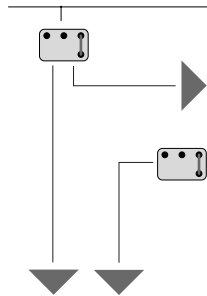
With the contacts B and – you can select the dive planner at the surface.



Microbubble warning (Do Not Dive)

Duration of the warning

 The microbubble warning and its duration are displayed if the Smart detects an increased risk due to the accumulation of microbubbles.




Enter the dive planner with B and E.



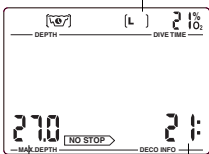
Input of the waiting time



The input window for the interval time is displayed, if there was a remaining desaturation (DESAT) before the Dive Planner has been selected. This waiting time between now and the beginning of the dive can be changed with the contacts + and - in steps of 15 minutes

 If a microbubble warning (no dive) and their duration has been displayed, the Smart proposes this time – rounded up to the next 15 minutes – as surface interval. If the proposed interval is shortened, the microbubble warning appears.

Icon for microbubble-level 1-5




No-stop time or MB no-stop time
Depth



With B and E you confirm the displayed interval (if there was any) and start the scrolling no-stop times. The no-stop times are displayed in 3 metre-increments (10-ft) and are displayed for every increment for about 3 seconds. The process starts at 3 metre (10 feet).

(L) If a microbubble-level has been selected (L1 to 5), the Smart shows the microbubble no-stop time instead of the no-stop time.

No-stop times are displayed only to the depth at which the partial pressure of oxygen (ppO₂) has not yet reached the set maximum value or the CNS O₂ value has not exceeded 100%.

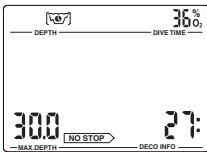
 On page 20 you will find further information and safety considerations regarding the microbubble warning.

2 Planning a Nitrox-dive

The Smart is able to calculate ...

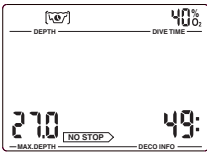
- the maximum depth (MOD, Max. Operation Depth) to be reached with a given mixture or
- the necessary mixture (Best Mix) for a dive with a given depth or
- for a given mixture the maximum dive time or
- the CNS O₂%-value at a certain depth.

2.1 Calculating the Max. Operating Depth (MOD)



1. Set the desired percentage of oxygen (see page 14).
2. Activate the dive planner as described on page 27.
3. Observe the depth indications and note the greatest depth displayed. This is your maximum depth for a dive with the set mixture and the set maximum partial pressure of oxygen.

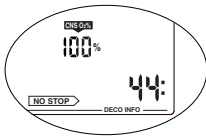
2.2 Calculating of the mixture for a given depth (Best Mix)



1. Activate the dive planner and observe the maximum depth displayed.
2. If the desired depth is not reached or exceeded, leave the dive planner (B-E), alter the percentage of oxygen and return to the scrolling no-stop times. Repeat this procedure until the desired depth appears as the maximum depth.
3. The displayed percentage of oxygen is now the ideal one for this depth.

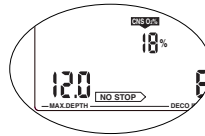
After entering the desired percentage of oxygen (see page 14) and activating the dive planner as described on page 27 you can...

2.3 Calculating the maximum dive time for a given mixture



When the CNS O₂-value reaches 100%, the displayed no-stop time corresponds with the maximum dive time.

2.4 Calculating the CNS O₂%-value



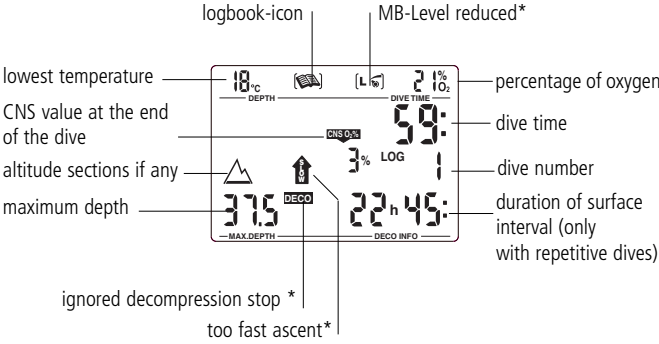
The Smart displays together with the depth the corresponding CNS O₂%-value.

3 Leaving the Dive Planner

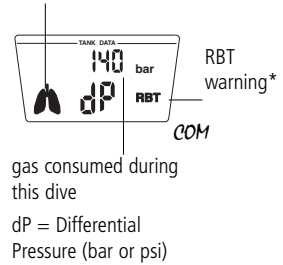
With the contacts B and E you can leave the Dive Planner. This also occurs after three minutes without operation.

1 Survey

Smart Pro records dive profiles of about 100 hours of diving and the Smart Com records the profiles of about 50 hours. This information can be transferred with the standard infrared-interface (IrDA) and the Windows® software SmartTrak to a PC. Up to 99 dives can be displayed directly on the dive computer. A dive is only entered in the logbook if the dive time is longer than 2 minutes. Displayed information of the dive:



increased workload warning made during the dive

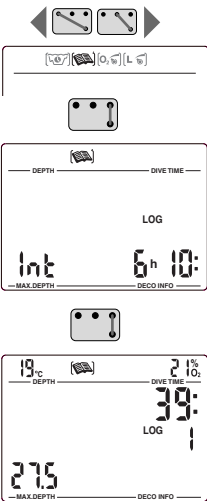


*alarms during the dive



If a dive is started within adaptation time (after a change of altitude), the adaptation time is displayed instead of the surface interval.

2 Operating



With the contacts + and – you can select and with B and E open the logbook at the surface.

If there was a remaining desaturation time (DESAT.) before the logbook has been selected, the time between the last dive and now (surface interval) is displayed.

With B and E you get the most recent dive displayed (LOG 1).

Each bridging of + or – causes a jump to the next older or more recent dive. On constant bridging of the contacts all dives are displayed successively.

With the contacts B and E you can leave the logbook. The logbook closes automatically after 3 minutes without operation.

VII Appendix

1 Technical Information

- Operating altitude:** with decompression information: sea level up to approx. 4000 m (13120ft)
w/o decompression, w/o RBT information: usable in gauge mode (at any altitude)
- Max. displayed depth:** 120m (395 ft), resolution between 0.8 m and 99.9 m: 0.1 m, >99.9 m: 1m
The resolution in feet is always 1 feet



WARNING

- Do not dive deeper than limits given by the chosen fraction of oxygen (decompression sickness, oxygen toxicity).
- Never dive deeper than your training qualification (experience) allows you.
- Always observe local dive depth restrictions.

- Decompression calculation depth range:** 0.8 to 120m (3 to 395 ft)
- Maximum environment pressure:** 13 bar (189 psi)
- High pressure connection:** *COM* Maximum working pressure: 300 bar (4350 psi)
- Clock:** Quartz timer, display up to 199 minutes
- O₂ Mix:** Adjustable between 21%O₂ (compressed air) and 100% O₂
- Operating temperature:** -10° to +50°C (14°F to 122°F)
- Power supply:** Special battery Uwatec LR07
- Life of the battery:** 500 to 1000 dives, depending on the quantity of dives per year and the use of the backlight.

2 Maintenance

Your Smart is virtually maintenance free. All you need to do is to rinse it carefully with fresh water after each use and to have the batteries changed when needed. To avoid possible problems with your Smart, the following recommendations will help assure that it will give you years of trouble free service:



WARNING

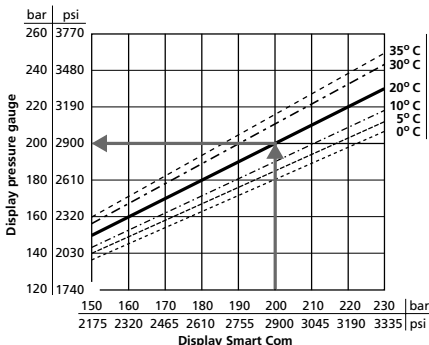
- Avoid dropping or jarring your Smart.
- Do not allow your Smart to be exposed to direct, intense sunlight.
- Rinse your Smart thoroughly with fresh water after each dive.
- Do not store your Smart in a sealed container; make sure there is free ventilation.
- If there are problems with operating the contacts, use soapy water to clean Smart and dry it thoroughly. The surface of your Smart housing can be treated with silicone grease.
- Do not clean the Smart with liquids containing solvent (apart from water).



WARNING

Take the dive computer to an authorised Uwatec dealer in order to change the batteries. The actual change of the batteries is made by Uwatec or a Scubapro Uwatec subsidiary. The Smart is checked for its technical functioning at the same time. Do not attempt to have the batteries changed by anyone other than an authorised Scubapro Uwatec dealer.

3 *COM* Conversion of tank pressure



Tank pressure indicated in the lower display may diverge from the information given by a manometer/ pressure gauge. Smart Com displays pressure always converted to a temperature of 20°C / 68°F, whereas the mechanical pressure gauge displays the actual pressure influenced by temperature.

The figure on the left allows you to compare the information given by a conventional pressure gauge and by Smart Com at six different temperatures.

4 Warranty

The warranty only covers dive computers, which have been provably bought from an authorised Scubapro Uwatec retailer.

The warranty is given for a period of 12 months.

Repairs or replacements during the warranty period do not increase the warranty period.

In order to put forward a warranty claim; send the dive computer together with a dated receipt of the purchase to your authorised retailer or an authorised servicing point.

UWATEC reserves the right to determine the merits of a warranty claim and to determine whether the computer will be repaired or replaced.

Excluded are faults or defects due to:

- excessive wear and tear.
- exterior influences, e.g. transport damage, damage due to bumping and hitting, influences of weather or other natural phenomena.
- servicing, repairs or the opening of the dive computer by anybody not authorised by the manufacturer. This especially concerns the change of battery.
- pressure tests which do not take place in water.
- diving accidents.

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