DECOMPRESSION COMPUTER



SAFETY WARNING NOTICE

■ IF THE LOW BATTERY WARNING APPEARS THE BATTERY MUST BE REPLACED AT ONCE, TO AVOID SUDDEN FAILURE OF THE INSTRUMENT. ■ A USED BATTERY IS UNDER NO CIRCUMSTANCES TO BE REUSED (EVEN IF IT IS ONLY PARTLY DISCHARGED). THE UNSOLDERING AND RESOLDERING, ALSO THE SHORT CIRCUTING OF THE BATTERY BEFORE EXPIRY OF THE BATTERY LIFE ARE ABSOLUTELY PROHIBITED. IN CASES OF DOUBT A NEW BATTERY MUST BE FITTED IN ORDER TO GUARANTEE CORRECT FUNCTION OF THE BATTERY WARNING. REPLACEMENT CAN ONLY BE EFFECTED BY AN AUTHORISED DEALER.

STORE IN A DRY PLACE (NOT IN A DIVER BAG OR OTHER SEALED HUMID CONTAINER), STORAGE IN A DAMP ENVIRONMENT CAN GREATLY REDUCE THE BATTERY LIFE.

 THIS INSTRUMENT DOES NOT REPLACE SOUND DIVING INSTRUCTION AND DOES NOT EXEMPT THE OWNER FROM DIVING RESPONSIBLY AND REASONABLY.

READ THE OPERATING INSTRUCTIONS.

Decscription and user's manual

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1. Introduction

The ALADIN PRO has been designed to use the latest medical and technical findings in computing decompression information. When compared with the ALADIN no-decompression computer, the ALADIN PRO gives additional information which is particularly relevant when planning decompression dives. Its main features, which include the most advanced developments in decompression research, are:

- The ALADIN PRO is the first dive computer which operates continuously throughout the lifespan of its batteries, allowing it to follow all the changes in altitude experienced by its owner, including flights. It takes into account the period required to adapt to a new altitude, allowing the diver to go to an altitude of 4000 metres above sea level and dive immediately on arrival without the need to activate the computer.
- The ALADIN PRO is the first dive computer to forecast precisely the no-decompression time and the total time required for ascent, taking into account the entire saturation and desaturation profile of the dive. This means that the decompression data will not change unexpectedly, even when ascending from a deep dive, as long as the ascent is conducted at a constant rate of 10 m/min.

- The ALADIN PRO is the first dive computer to take into account the decreased rate
 of release of nitrogen from the diver's tissues due to the reduced flow of blood in
 his lungs. For divers sensitive to decompression, this results in enhanced safety
 when doing repetitive dives, without the need for unduly long decompression
 stops.
- The ALADIN PRO is the first dive computer to incorporate both visual and acoustic hazard warning systems. If decompression is incomplete, the ALADIN PRO will display the number of the tissue involved, giving valuable information to guide the treatment of decompression sickness.

These are the features which make the ALADIN PRO by far the most modern and complete piece of sports diving equipment.

Features of the ALADIN PRO:

- Dive depth
- Dive time
- Total time for ascent
- Deepest decompression stop
- Desaturation time
- Waiting period prior to flying
- Altitude sector (if at high altitude)
- Operating mode indicator
- Alarm indicating contravention of decompression instructions
- Alarm indicating too fast ascent (2 steps)
- Tissue number indicator, when decompression is incomplete

- Maximum depth
- No-decompression time
- No-decompression limit
- Decompression time
- Surface interval
- Logbook for 9 dives
- High altitude adaptation time
- Low battery warning

In order to give the simplicity in use, the ALADIN PRO displays only the information which is essential at any time. All alarm warnings are displayed visually (e.g. **«DECO-STOP», «SLOW»**). This has allowed a simple display with which the diver can quickly become familiar.

All the decompression calculations are based on the work of Prof. A. A. Bühlmann (Decompression – Decompression Sickness, Springer) and take into account all the very latest findings. Our experience with the ALADIN no-decompression computer (several hundred thousand dives at altitudes up to 4000 metres) has confirmed the benefits and the safety of the computer model of Dr. Bühlmann. The ALADIN PRO even takes into account the slower rate of nitrogen desaturation at the surface, making it the diving instrument which best meets the highest safety requirements, second to none in the field of diving.

The data used to give the decompression limit and decompression take into account the time elapsed prior to diving and the actual diving profile (a multi-level tissue calculation). For this reason the instrument may indicate different decompression stops for dives with an identical maximum depth and bottom time, but with different periods at altitude prior to diving, and with different rates of descent and ascent during the dive.

The ALADIN PRO is therefore a <u>personal</u> instrument and should only be loaned to other divers when no data are displayed, and if the next user does not intend to carry out a repetitive dive.

Although the ALADIN PRO functions perfectly down to depths of 100 metres, it is recommended that only experienced and qualified divers undertake dives deeper than 40 metres. Although the ALADIN PRO makes diving easier and simpler, it does not release the diver from the need to dive responsibly and with due consideration for his own safety. The following three points must be strictly observed when using the ALADIN PRO:

- 1. The ALADIN PRO is to be used only when diving with compressed air.
- The ALADIN PRO is intended only for use by sports or recreational divers. Divers working professionally, undertaking saturation diving or prolonged periods of time underwater should not use the ALADIN PRO.
- The ALADIN PRO may only be lent to another diver if both the diver and the instrument have remained at the same altitude and have not dived for the preceeding 24-hour period.

The ALADIN PRO has no moving parts, such as switches, making it safe, maintenance-free and user-friendly. The unit is switched on automatically on entry into the water, or by touching contacts A and B. It switches off automatically when the nitrogen partial pressure in all the tissues has adapted to the ambient atmospheric pressure.

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2. Description of functions

All position statements refer to figure 22 (page). Figures and symbols in pointed brackets « » correspond to the figures and symbols as they actually appear on the display of the ALADIN PRO.

2.1. Switching on the instrument

The ALADIN PRO will switch on automatically when submerged in water. It is not necessary to switch it on beforehand, even when it is in standby mode (no display). It can be switched on manually by touching contacts A and B simultaneously, in which case the unit emits a short beep and all segments of the display are activated for about 5 seconds (fig. 1). Following this, position 1 will show «---» and position 3 «**0**» (fig. 2). If the dive does not commence, or if no change in altitude occurs, in the next three minutes the instrument will automatically switch off.

Point 1:

When the ALADIN PRO is in stand-by mode, there should not be a change in altitude of more than 150 m within the 35-min. period prior to diving, as the instrument requires this 35-min. period to assimulate the altitude information. Should a dive become necessary within this 35-min. period then the instrument can be switched on **manually**. This waiting period need not be observed if the instrument is in **«SURFACE»** mode. Point 2:

If a change of altitude sector is experienced (in the most recent 35 min. after crossing the altitude borderline) when the instrument is in stand-by mode, the ALADIN PRO will automatically switch to **«SURFACE»** mode and will display the time required to adapt to the new altitude (fig. 3) instead of the desaturation time.









2.2. Current dive depth

Depth appears at position 1 (**«depth**») in metres and tenths of metres down to a maximum depth of 99.9 m. When the unit is switched on, and at depths shallower than 0.5 m, the display shows **«----»** (fig. 2). The depth is calibrated in metres of fresh water, according to international practice. When diving in salt water, therefore, the instrument will show a depth slightly greater than the actual depth, depending on the salinity of the water.

2.3. Maximum depth

Maximum depth is displayed at position 2 (**«max. depth»**), whenever it is higher than the current depth. In order to avoid a continually changing display when at the maximum depth, the display is only activated when the maximum depth is at least 1 m deeper than the current depth.

2.4. Dive time

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The actual dive time is displayed at position 3 (**«dive time»**) and indicates the time elapsed in minutes below 1.2 m. The colon to the right of the display flashes at one-second intervals when the dive time display is activated. Maximum time displayed is 199 minutes.



2.5. No-decompression time

The no-decompression time is displayed at position 4, until decompression stops are required. In addition, at position 6 an arrow with **«NO STOP»** is displayed. The no-decompression time **«24**» means that no-decompression stops will be required if the dive continues for another 24 minutes (fig. 4). The no-decompression limit is continuously adjusted to the current depth and dive time. When it shows **«99**» this indicates that the no-decompression limit is longer than 99 minutes (fig. 5).





2.6. Decompression stop indicator

After the no-decompression limit has been exceeded, the depth of the decompression stop will be displayed at position 5, and the duration of the stop will be displayed at position 4. In addition, at position 6 a black arrow carrying **«DECOSTOP»** will appear. The information **«9m 3:»** means that a decompression stop of 3 minutes is required at a depth of 9 metres (fig. 6). When the last decompression stop has been completed, the **«DECO-STOP»** arrow display will be switched off and the no-decompression limit will be displayed once more.

The decompression stop levels correspond to those used in the Bühlmann decompression tables (3, 6, 9, 12, 15, ... m at sea level and 2, 4, 6, 9, 12, ... m at higher altitudes, fig. 71. Point 1:

Decompression should be carried out at the depths indicated. Decompressing at a shallower depth is **forbidden** (see section 2.9.). Should heavy seas require it, decompression can be carried out at a deeper depth. In this case, however, the time required at the decompression stop, and the total ascent time, will be longer than that indicated as the instrument predicts the time required for decompressing at the correct depth. Point 2:

If decompression stops are required below 24 m (sea level dives) or 21 m (high altitude dives), horizontal lines **«---»** will be displayed in place of the decompression stop depth and time, and the total ascent time displays. It will still be possible to carry out a safe decompression by using the decompression alarm (see 2.9. below).





2.7. Total time of ascent

As soon as decompression becomes necessary the ALADIN PRO will display the total time required for a safe ascent (symbol $\mathbf{\tilde{t}}$:), e. g. **« \mathbf{\tilde{t}} 27**:» indicates that a total time of 27 mins is required for the ascent to the surface from the present depth (fig. 6). The total ascent time is predicted by assuming an ascent rate of 10 m/min. (see 2.8. below) and including the correct decompression stops. Should the predicted time exceed 99 mins then the display will show **«99**:».

2.8. Ascent rate alarm

The recommended ascent rate is 10 m/min. If the ascent rate exceeds 12 m/min, a black upward-pointing arrow carrying **«SLOW»** will appear at position 8. If the ascent rate should exceed 16 m/min. the **«SLOW»** arrow will start to flash and the acoustic warning will operate (fig. 8). If the ascent rate exceeds 16 m/min. for more than 15 seconds, then the warning display will be included in the dive display in the logbook (see 2.12. below).





2.9. Decompression alarm

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If the depth at which the decompression stop is being carried out is too shallow compared with the required depth, the **«DECOSTOP»** display at position 6 will start flashing (fig.9) and the acoustic signal will operate. This indicates that it is necessary to descend immediately to the decompression stop depth indicated by the instrument, While the **«DECO-STOP»** display is flashing the instrument suspends calculation of the tissue desaturation. If the diver continues the ascent, the **«DECOSTOP»** display will continue to flash, even at the surface, indicating the possible risk of a decompression accident. This alarm would allow the user to make a correct ascent even in complete darkness, such as when a dive lamp fails during a night dive or in a cave.



Point 1:

All desaturation computation is suspended when the display is flashing. If the decompression indicated is not completed the ALADIN PRO will go into emergency made, blacking the desaturation calculation for a period of 24 hours. 5 minutes after surfacing, the number of the fastest (most dangerous) tissue group to have been insufficiently decompressed will be indicated at position 10 (fig. 10). After the 24-hour period the ALADIN PRO will recommence computing. The data shown on the ALADIN PRO during the period of suspension should be copied out and communicated to any physician who may require to administer a subsequent therapeutic recompression. The half-times of the tissues concerned can be obtained from the tables on page . . .

Should symptoms of decompression sickness occur after insufficient decompression, <u>reim-</u> <u>mersion is to be avoided under all circumstances</u>, even within the first 5 minutes. Point 2:

If the «DECOSTOP» alarm has been activated for more than 3 minutes, then it will be included in the dive display in the logbook.



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2.10. «SURFACE» mode

For the first 10 minutes after surfacing, **«---:**» will be displayed at position 4 (**«deco info**») (fig. 11). If a further dive is commenced during this period, it will be treated as a continuation of the previous dive. After the 10-minute surface period the dive is considered as completed and entered into the logbook, together with the **previous** surface interval (in the case of repetitive dives), see section 2.12. below.

Entry into surface mode is indicated by the display of **«SURFACE»** at position 9, together with the current desaturation time in hours and minutes, e. g. **«8h 29:»** (fig. 12). The desaturation time will continue to be computed and displayed until the next dive, or until it reaches zero, when the instrument will switch to stand-by mode.

During the period after a dive when it is not recommended to fly the **«NO** — » will be displayed at position 7. To the right of this display the time in hours is shown during which the flying restriction applies le. g. **«NO** — **1h**» in fig. 8).





Point 1:

The latest findings indicate that harmless microbubbles develop during the ascent and are filtered out by the lungs, where they produce a reduced blood flow. This in turn gives a slower rate of nitrogen desaturation, explaining the well-known slightly greater risk of decompression sickness attached to repetitive dives. The ALADIN PRO takes this into account, making it the first dive computer to offer identical standards of safety for both single and repetitive dives, without requiring exaggerated decompression stops. Point 2:

The surface interval since the last dive, which is of interest when planning a dive using dive tables, is displayed in the planning mode **«DIVEPLAN»** (see section 2.1). below). Point 3:

If the period during which flying is forbidden is longer than 9 hours, then the time will be indicated without an **«h»** le. g. **«NO — 12»**. When the flight restriction has expired it is safe to fly or to go to altitudes up to 4000 metres. Point 4.

The instrument will automatically go into **«SURFACE»** mode if it is taken to a higher altitude sector when in stand-by mode lswitched off). This will occur 35 minutes after crossing into the new altitude sector. The desaturation time displayed at positions 4 and 5 is replaced by the adaptation time for the new altitude sector, with **«Adt»** indicated at position 1 (fig. 3).



2.11. «DIVEPLAN» mode

If contacts A and B are fouched while the instrument is switched on, the ALADIN PRO will go into **«DIVEPLAN»** mode, and this will be indicated at position 9.

On switching from **«SURFACE»** mode into **«DIVEPLAN»** mode, the current surface interval will be displayed at positions 4 and 5 for approx. 5 seconds le. g. **«6h 42.»** in fig. 13). In addition, **«Int»** (surface interval) will be displayed at position 2, and the altitude sector at position 1. If the ALADIN PRO is not set to **«SURFACE»** mode this display is omitted. This is followed by the display of no-decompression time limits for every 3 m increment of depth from 9 m to 42 m, for the current altitude sector (fig. 14). Each limit is displayed for 3 seconds. After the sequence is complete the ALADIN PRO will leave **«DIVEPLAN»** mode.

The no-decompression limits shown for a repetitive dive are shorter than those shown for a first dive, as the body is not yet completely desaturated. No-decompression limits for dives at altitude will also be shorter, due to the reduced atmospheric pressure.



depth (mtr) time DVEPLAN 120 INT STOP 18: max. depth deco info

2.12. «LOGBOOK» mode

The ALADIN PRO features a logbook of the last 9 dives. Only dives below 1.2 m and longer than 3 mins are recorded.

If contacts B and C are touched simultaneously when the instrument is switched on, or during a surface interval, **«LOGBOOK»** will be displayed at position 9. Position 1 will display **«DIVE 1»**, and the relevant data on maximum depth, dive time, altitude sector, and **preceeding** surface interval will be displayed (fig. 15). For a single (first) dive no surface interval is displayed (fig. 16). Therefore, if a surface interval is displayed the dive was a repetitive dive (with the exception of a first dive made after a change of altitude, see section 2.13. below).

Each time the logbook contacts are touched the next dive will be displayed, e.g. **«DIVE2»** for the last but one dive, etc. After displaying the 9th dive the instrument will leave **«LOG-BCOK»** mode. This will also happen after 3 mins if the logbook contacts are not touched. When contact is maintained, all dives in the logbook are displayed consecutively. After an additional dive has been completed, the data are stored as **«DIVE1»**, and the previous dive now becomes **«DIVE2»**, etc., and **«DIVE9»** is deleted. It therefore always stores. the last 9 dives.

Point 1:

A high-altitude dive will include the altitude sector indication (see section 2.13. below).

Point 2:

If the **«SLOW»** or **«DECOSTOP»** alarms have been activated for the required time during a dive, then they are also stored in the logbook (see previous sections 2.8. and 2.9.). Point 3:

If a first dive at altitude is commenced during the adaptation time, then the adaptation time which elapsed prior to commencing the dive will be stored, together with the **«Adt»** indicator.

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depth [mtr] depth



2.13. High altitude diving

The ALADIN PRO can be used at an altitude up to 4000 metres above sea level. The altitude profile is divided into 4 sectors. As these sectors can be affected by barometric factors, such as the weather, they overlap as specified below. The altitude sector indicator is displayed at the surface, in the logbook, and in «DIVEPLAN» mode at position 11, in the form of stylised mountains whenever a high-altitude situation applies (fig. 17).

Sector O is not indicated. The approximate altitude levels for the 4 sectors are as follows:

Sector 0	:	0	-	1000 m a. s.	(theoretical limit: 800 m)
Sector 1 « 🔺 »	:	600	-	1900 m a. s.	(theoretical limit: 1650 m)
Sector 2 « A A »	:	1400	-	2800 m a. s.	(theoretical limit: 2550 m)
Sector 3 « A A A »	:	2300	_	4000 m a. s.	

When the instrument travels through one or more altitude sectors when in stand-by mode Iswitched offl, it will automatically switch to **«SURFACE»** mode. The descturation time displayed is the time required to adapt to the new altitude (indicated by **«Adt»**). If you dive within this period the ALADIN PRO will compute the dive as a repetitive dive, since the body will be experiencing a higher saturation level.



Point 1:

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Due to minimal differences between pressure sensors, it is possible for different instruments to display different altitude sectors when operating in the limits of the sectors. These differences are not relevant and do not impair the safe functioning of the instrument. However, if an altitude sector is shown at sea level, or if the altitude sectors differ by more than one level (e. g. sector 2 instead of sector 0), this might indicate malfunctioning of the instrument. Point 2:

The adaptation time is computed so as not to make the decompression limits shorter or the decompression stops longer for normal recreational diving. Complete altitude adaptation requires a longer period (approx. 3 days), and this would need to be taken into consideration for professional diving.

2.14. Low battery alarm

The low battery warning **«LOW BAT»** at position 12 indicates that the battery should be replaced. Even though the ALADIN PRO will continue to function for some time, it is recommended that the battery be replaced as soon as possible in order to avoid a sudden failure of the instrument. The lifespan of the battery is specified in Chapter 6 (Technical data). Roint 1:

Continuous computing thoughout the lifespan of the battery makes great demands on its capacity, discharging, and temperature sensitivity. Only the specified UWATEC LR-07 should be used and replacement can only be effected by an authorized dealer. Point 2:

The battery should be removed only for replacement purposes. Contrary to the recommendations for other instruments, it should be left in the ALADIN PRO even during long periods of non-use. Unauthorized battery removal will result in cancellation of the warranty.

3. Servicing and maintenance of ALADIN PRO

The ALADIN PRO is extremely robust and requires little servicing, the battery being the only consumable part. Nevertheless, the following recommendations will ensure the instrument's continuous and trouble-free performance:

- After a sea water dive, the ALADIN PRO should be rinsed in fresh water; special
 care is to be given to thoroughly cleaning the contacts used to switch on the unit
 and activate the logbook functions. A thin layer of silicone spray, applied periodically with a soft piece of cloth, will help facilitate water drainage.
- Exposure to sun, extreme heat, and cold can harm the instrument. Avoid leaving it in an exposed position, e. g. on a car dashboard or rear window.
- The ALADIN PRO should be stored in a cool and dry place (even in the original packing).
 After a dive, avoid putting the ALADIN PRO into a wet dive bag, so that it may dry properly.

- Follow the instructions for battery replacement (2.14).

4. Warning

The ALADIN PRO does not replace sound diving instruction and does not exempt its owner from diving responsibly and reasonably. Please remember the main rules concerning diving with the ALADIN PRO:

- Never dive alone! The ALADIN PRO cannot replace a diving buddy.
- Due to the dangers of nitrogen narcosis, aim to limit your diving to a maximum depth of 40 m.
- Never exceed an ascent rate of 12 m/min., since a faster ascent rate increases the danger of overextension of the lung and increases the occurrence of micro-bubbles in the body.
- The predicted ascent time will only be correct if you follow the correct rate of ascent and carry out the recommended decompression stops. Ascending too slowly will give **longer** ascent times.
- Always keep a check on your air supply. Plan to have a reserve left in case of emergency.

5. Troubleshooting

The following list will assist in tracking down the correct diagnosis if the instrument seems to be acting irregularly. Should the situation not be explained below, please contact your dealer, **but only after thoroughly reading these operating instructions.** This will avoid the possibility of you contacting the dealer when the instrument is not malfunctioning at all.

Situation

Cause and Remedy

«DECOSTOP» flashes at the surface

«Wrong» dives in logbook Rainbow colours on the display Incomplete decompression. The display will switch off automatically after approx. 24 hours. The figure at position 10 is the number of the fastest tissue which is not sufficiently desaturated (section 6, fig. 16 page 29).

Before delivery ALADIN PRO is tested in a pressure chamber. These test dives are recorded in the logbook.

The colours are caused by tension in the glass (due to changes in temperature) and are of no further importance.

Situation

Weak and irregular display

Alliitude wrong by one sector

Surface mode not displayed

Altitude wrong by two or three sectors

ALADIN PRO «dives» at surface

Cause and Remedy

Low battery power that can be caused by water leaking into the battery compartment. Have the battery and the battery compartment cover replaced by your dealer.

This can happen at the limit between two altitude sectors and is of no further importance.

Same effect as short surface interval.

Malfunctioning unit should be returned for servicing.

Malfunctioning unit should be returned for servicing.

6. Technical data

Operating altitude: Operating depth: Time computing: Temperature range: Energy supply: Battery lifespan: *

- Sea level to 4000 metres 0 to 99.9 metres Quartz timer, range 199 mins. -10° C to +50° C Special battery, UWATEC LR-07 for 50 dives/year: approx. 6-7 years for 100 dives/year: approx. 4-5 years
 - for 200 dives/year: approx. 2-3 years for 500 dives/year: approx. 1-2 years

Computing model Model developed by Dr. A. A. Bühlmann (University Hospital Zurich), using 6 tissue groups with different half times and oversaturation tolerances. For the first time, the model takes into account the changes in the rate of flow of blood to the lungs after a dive, resulting in slower desaturation.

The following table describes the tissue groups used. The tissue number which is displayed in the case of incomplete decompression can be used to defermine the fastest tissue group affected and its half time.

Tissue number:	1	2	3	4	5	6
half-time:	6 min.	14 min.	34 min.	64 min.	124 mi	n. 320 min.
tissue:	blood	d, CNS **	ski	n mu	scles	joints

- * For an average dive-time of 45 mins. and a typical desaturation time of 10 hours after each dive
- ** CNS = Central Nervous System (brain, spinal cord)

7. Warranty

The following conditions apply to the ALADIN PRO warranty:

- Damage or defects in the unit that are proven to be caused by faulty manufacture will be repaired at no cost to the end user within 12 months after delivery.
- 2 Any repairs performed under this warranty will not extend the warranty period.
- To make a claim under this warranty, send the unit to an authorized dealer or directly to a servicing agent together with the dated purchase invoice or receipt.
- The warranty becomes void if damage is caused by external circumstances or if the unit has been serviced or repaired by third parties unauthorized by ourselves or our national agents. This particularly applies to the replacement of the battery, as an improperly fitted battery can damage the unit.
- Pressure tests must only be carried out in water. «Dry» pressurizing of the unit will render the warranty void.
- All further claims, especially for defects after diving accidents, are excluded.
- The manufacturer has no obligation to honour any extension of warranty granted by his national agent.

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8. Waiver of liability

The buyer and user of the ALADIN PRO relieves the manufacturer and vendor from all liability for damage incurred when and after diving with the instrument.

October 1988 / UWATEC AG, 5705 Hallwil / Switzerland

