SCUBAPRO

UWATEC

Technical Diving
Software for

Galileo

User Manual

TABLE OF CONTENTS

⚠ WARNING FOR GALILEO TRIMIX SOFTWARE

When breathing compressed air or EAN Nitrox during a dive, the diver accepts a certain level of risk. When breathing a Trimix gas or other mix gases during a dive, the risk level increases.

We have used all relevant data and the most recent hyperbaric research on Trimix diving to bring the risk level of our Trimix algorithm to the lowest possible acceptable level. Nevertheless, we can in no way guarantee that breathing Nitrox, Trimix, mixed gases or compressed air during a dive using our Trimix algorithm will eliminate or prevent the risk of serious injury or death from decompression sickness, oxygen toxicity or some other inherent risk.

The Trimix diver using our Trimix algorithm on our dive computers should be aware of the risk level and be willing to accept that personal risk and bear the full legal responsibility of such risks. If the diver is not willing to accept those risks, including serious injury or death, then he or she should not dive with our Trimix software.

Never risk your life on only one source of information. Eventually, every computer has the potential to fail, so do not depend exclusively upon it and always have a plan for how to handle failures. Use a second computer or carry backup tables and depth/time instrumentation. If you make riskier dives, obtain the proper training from a recognized agency to gain the requisite technical skills and experience needed for this type of diving. Computer technology is never a substitute for knowledge and training.

General info

This user manual describes the settings and differences of the Galileo technical software version (herein referred to as "Tec SW") compared to the main Galileo user manual.
You should first read and understand the main Galileo manual before updating and using the Galileo Tec SW.
Galileo Tec SW has been developed for experienced divers, whereas the standard original software included on your Galileo at the time of purchase has all the features that are needed for safe recreational diving.

☞ *Note:*
  Added menus, warnings and features of the Tec SW may add complexity to your Galileo Diving computer use. If you are not making serious Technical dives you should not upgrade to Tec SW and instead continue to use the standard Galileo software.

You should be trained and properly certified by a recognized agency in technical diving before using Tec SW. Decompression diving, diving with high oxygen percentage blends, multi gas diving and mixed gas diving all require skills and demand know-how that only specific training and education can provide. A dive computer is an electronic instrument that cannot make decisions for you and can not take all parameters into account while diving.

In technical diving a dive computer is not the primary instrument to follow during the dive. Before the dive you must make a plan and during the dive follow it. If your plan and the computer show different schedules, follow the more conservative one.

⚠ WARNING

If you decide to revert to using Galileo standard software after installing Tec SW, you may return to SW version 1.7 or higher. Downloading an earlier (lower number) versions will use the Galieo memory differently and your dive computer will not operate correctly and may lock up.

⚠ WARNING

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, Trimix, mixed gases, 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 Tec SW.

Warnings

Both this Trimix model and trimix diving are developed for healthy, physically fit, advanced divers. You should have regular medical check-ups with a specialized physician, confirming your physical aptitude for diving. This is even more important for technical diving.

Patience is a very important characteristic to maintain when conducting complex dives. It is necessary to build your personal depth limit and decompression amount based on your real diving experience and then increase little by little as you gain experience.

Tec SW is not designed for commercial diving. Special procedures such as surface supplied gas, heated suit, decompressing in a chamber or bell and long, high workload dives may cause algorithm to calculate incorrectly or even disturb the operation of the Galileo dive computer.

Never dive without a backup instrument. It is imperative to always have backup instruments for depth, time and tank pressure, as well as a dive table with you while diving.

Plan your dives in advance and cross check your plan with another commercial planner program or table. Your dive plan should always include reserve gas amounts sufficient to handle emergencies and/or delays. Always make bail out tables for the dive.

Technical diving is not for everyone. Decompression diving, especially with Helium mixes, will always have a higher inherent potential for an accident which could lead to permanent injury and death. The risk may be higher due to differences in an individual's physical condition, environmental conditions, human errors, etc. If you are not willing to take the risk, don't dive!

Update

Tec SW can be downloaded to any Galileo computer like a normal software update. To obtain the Trimix update please contact your Authorized SCUBAPRO UWATEC dealer or see our web site at **www.scubapro.com**.

☞ *Note:*

Tec SW upgrade will only enable the algorithm use for Helium. If you have a Galileo Terra or Luna without PMG upgrade Tec SW will not allow the use of multiple tanks. The PMG upgrade must be done separately and prior to upgrading to the Tec SW.

1. Differences between the Standard Galileo SW and Tec SW

1.1 Model Uwatec ZH16-ADT DD

For years Uwatec has successfully used the Bühlmann ZHL-8ADT model for recreational and nitrox computers. For our Trimix version, the algorithm ZHL-16 has been used as the basis. This widely used and referenced algorithm for technical diving has been modified for middle compartments, becoming the version DD. Uwatec uses MB levels like gradient factors are used in the original ZHL-16 to adjust the model to be more conservative. The standard MB level setting is 3.

Figure 1 - Effect of MB level settings to the dive profile. MB 0 = blue, MB3=yellow, MB5=brown.

Our experience in adaptive algorithm development has also been integrated into the Trimix version in order to customize it for individual divers and their dive plans.

Uwatec recommends using the workload feature when making technical dives and also the Heart Rate feature. When the dive goes as planned there is no effect to the decompression schedule. However, when workload is high more decompression time will be required.
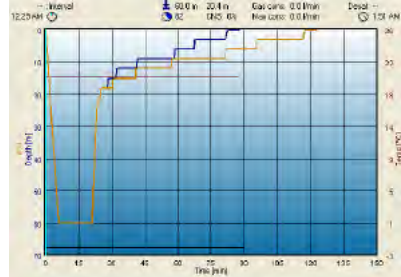

Figure 2 - Workload effect on dive profile. Low WL=Blue, High WL=brown.

Adaptive algorithm additionally incorporates into the calculation the water temperature, workload and micro bubble formation.

1.2 Trimix

Tec SW uses standard technical diving gas mix markings: Oxygen%/Helium%.

For example a mix containing 18% of oxygen and 40% of helium is shown as 18/40.

1.3 10 tanks

In technical diving, especially with Trimix blends, the decompression efficiency becomes extremely important. Gas mixes with high helium content and low oxygen content are not well suited for decompression. For example, where two decompression mixes are in most cases enough when air or nitrox is used as a bottom gas, in the case of trimix the optimal off gassing requires more decompression mixes.

The order in which gases are used is not restricted according to oxygen content as in our standard Galileo software. The PMG will sort and suggest the use of the gases according to given Absolute Minimum Depth (AMD) and Maximum Operating Depth (MOD) values. The diver may also switch the mixes manually as described in the main Galileo manual.

⚠ WARNING

It is possible to manually select a gas while diving which may have unsuitable high or low oxygen content or narcotic effect for that depth. The gas selection is not limited by the computer due to possible emergency situations that may arise. Selecting the improper gas may result in serious injury or death.

1.4 Minimum and Maximum Operating Depth

Absolute Minimum Depth (AMD) and Maximum Operating Depth (MOD) are calculated from the oxygen content in the mix. The ppO2 that is given by the user is divided by the oxygen fraction. The result will be pressure, which is converted to depth. The maximum MOD is valid for all gases, while the minimum AMD is only applicable to a gas mix where the oxygen fraction is less than air.

☞ *Note:*
Air (21/0) gives different MOD than for example Trimix 21/10. The reason is Galileo uses a more precise value for the oxygen in the air, which is 20.7%.

1.5 PDIS for both N2 and He

Profile Dependent Intermediate Stop (PDIS), as described in the main manual, has been extended to both Nitrogen and Helium gases. The optimal off gassing depth will be indicated when PDIS is enabled. PDI stops are not obligatory, but will potentially assist in reducing possible bubble formation.

1.6 Oxygen Toxicity Units (OTUs)

During long decompression dives, the diver's body will be loaded with high oxygen concentrations for a longer period of time. There are two limits that need to be monitored; the Central Nervous System (CNS) clock (described in main manual) and the Oxygen Toxicity Units OTUs.
For OTU credits and limits the NOAA values are used.

1.7 Ascent speed

The optimal ascent rate is fast enough to prevent further compartment saturation, but slow enough to prevent bubble formation in tissues. When making decompression dives with mixed gases this becomes an important factor. Galileo allows faster ascent at greater depths and slower ascent at shallower depth (see Ascent Speed Alarm Limits). Be aware that the alarm limit only indicates ascents which are too fast and not optimal.
Maximum allowed ascent speed has been reduced compared to the standard Galileo SW. Standard SW ascent speed is used when Trimix is disabled. When TMx setting is enabled the slower ascent speeds are taken in use.
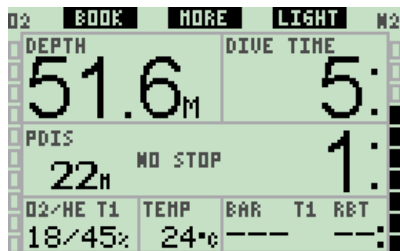
☞ *Note:*
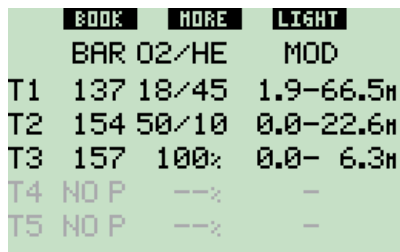*Reduced Ascent speed increases the Total Ascent Time (TAT) that is shown during diving.*
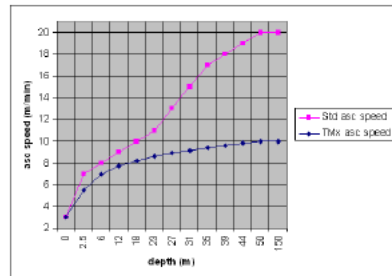
2. Diving with the Galileo Tec SW

Warning: Before performing Trimix dives with the Galileo you should practice no-stop recreational diving to become accustomed to the interface and functions of the diving computer.
Galileo Tec SW has some screen differences on the diving displays when compared to the standard Galileo software.

```
O2  BOOK   MORE   LIGHT   N2
DEPTH            DIVE TIME
51.6m               5:
PDIS                1:
  22m    NO STOP
O2/HE T1  TEMP   BAR  T1 RBT
18/45%    24°c   ---    --:
```

On the main display screen the gas content field shows the O2/He format for each gas when Tec SW is enabled.

```
     BOOK    MORE    LIGHT
     BAR O2/HE    MOD
T1   137 18/45   1.9-66.5m
T2   154 50/10   0.0-22.6m
T3   157  100%   0.0- 6.3m
T4   NO P   --%      -
T5   NO P   --%      -
```
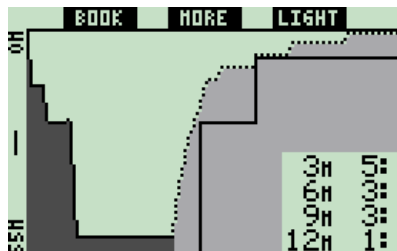
While diving, when pressing long the **more** button, the gas summary is shown. The second column shows the pressure when transmitters are used. The transmitter communicates the pressure signal only from the actively used gas. When the gas is not used within 5 minutes, the transmitter goes to a power save mode and Galileo shows "--" in the pressure field.

☞ *Note:*

Future generation transmitters for the Galileo will however remain active when pressurized, even when gas is not used.
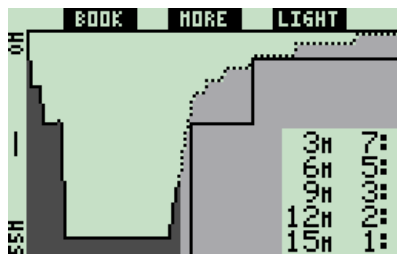
The third column shows the content of the gas in format O2/He in case of Trimix or xxx% if the gas is nitrox or pure oxygen.

```
   BOOK    MORE    LIGHT
                        3m  5:
                        6m  3:
                        9m  3:
                       12m  1:
```

Short press **more**, the profile display is shown. The dark color indicates the part that is done and the dashed line shows the ascent profile. Normally predicted gas changes are shown on ascent profile, but in the Tec SW there can be additional steps depending on gas mix enabling (Tank x, on/off). The following screen shows the tissue saturation at that point.

```
   BOOK    MORE    LIGHT



  GMS    SKIN   MUSCLE   BONE
```

The tissue saturation screen shows 16 bars where the standard Galileo SW had 8 bars.

```
   BOOK    MORE    LIGHT
                        3m  7:
                        6m  5:
                        9m  3:
                       12m  2:
                       15m  1:
```

When the previously shown dive proceeds to the ascent phase the decompression is still increasing, as seen from the table information on the right side. The fast compartments begin off gassing and the effect is shown in the saturation bar diagram below.
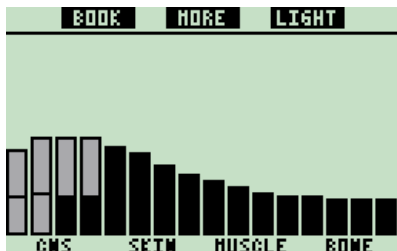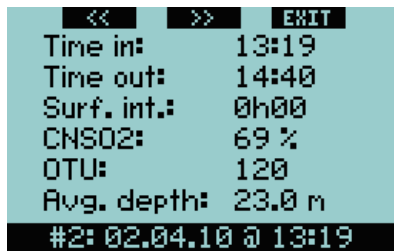
When off gassing the compartment color changes from black to gray. Each bar is divided into Helium and Nitrogen in this phase, if Trimix is used during the dive.

3. After the dive

3.1 Logbook

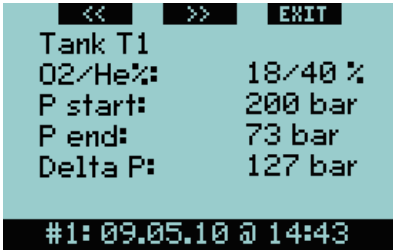| Depth:	55.0 m
Dive time:	81 min
O2%:	4G
Temperature:	6°C
Repetitive:	1

#2: 02.04.10 @ 13:19

After selecting a dive from the log list, the first page shows a summary of the dive. The content of the gas is shown differently from the standard SW. By pressing the >> the profiles (with temperature and HR) are shown, which are similar to the standard SW. By pressing >> the next page is shown.

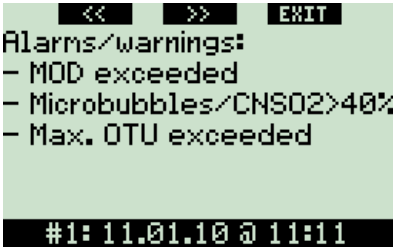| Time in:	13:19
Time out:	14:40
Surf. int.:	0h00
CNSO2:	69 %
OTU:	120
Avg. depth:	23.0 m

#2: 02.04.10 @ 13:19

In this page the OTU information is shown for this dive. By pressing >> the next page with MB levels are shown, also similar to standard SW. By pressing >> the tank information is shown.
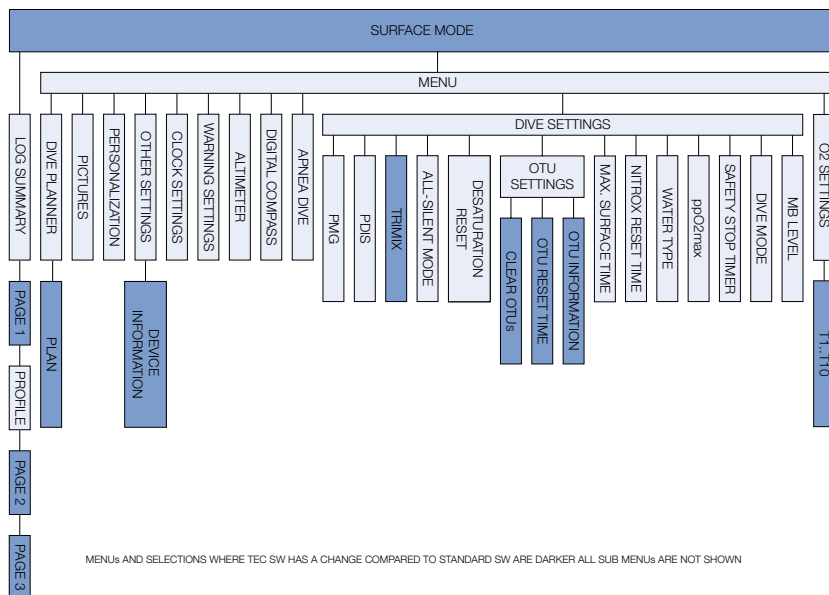
MENUs AND SELECTIONS WHERE TEC SW HAS A CHANGE COMPARED TO STANDARD SW ARE DARKER ALL SUB MENUs ARE NOT SHOWN

```
 <<      >>      EXIT
Tank T1
O2/He%:        18/40 %
P start:       200 bar
P end:         73 bar
Delta P:       127 bar

 #1: 09.05.10 @ 14:43
```

All the gases that have been switched on (see: Tank setting) are listed on separate pages. By pressing >> the last page identifying warnings from the dive are shown.

```
 <<      >>      EXIT
Alarms/warnings:
- MOD exceeded
- Microbubbles/CNSO2>40%
- Max. OTU exceeded


 #1: 11.01.10 @ 11:11
```

In case OTU values for the dive have been exceeded, the alarm is shown in the list. The AMD/MOD violations are shown as well.

4.   Settings:

The diagram shown on the previous page highlights the features that have changed when comparing the Tec SW to the standard Galileo SW.

4.1   Enabling Trimix - See 4.2

```
    ▼        ▲      ENTR
▲ Trimix
  PDIS
  PMG
▼ MB level
 Current setting = On
```

By selecting **menu** -> Dive settings, you can scroll with up or down buttons to Trimix selection. By pressing **enter** you go to the following selection.
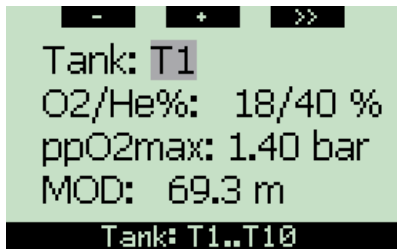
```
    -        +       SAVE

Trimix: On


 Trimix: on, off
```

With + or – buttons you may switch between on (enable) or off (disable). By selecting On, you enable Helium at Tank settings and allow Helium to be used in calculations.

☞ Note:
   If you are not using Trimix, the setting "off" reduces the complexity in the Tank settings and computer use.

4.2   Tank settings

```
   -        +        >>
Tank: T1
O2/He%:  18/40 %
ppO2max: 1.40 bar
MOD:  69.3 m
     Tank: T1..T10
```

By pressing long the left button at main display (shortcut) or selecting **menu** -> O2 settings (**enter**), you can change the content of the tanks. When the gray cursor is highlighting the Tx, you may scroll between the tanks with +/- buttons. The >> button selects the current tank to be modified.

☞ *Note:*

Tank 1 is always the starting gas from the surface.When you have set more than one tank, you may change Gas during the dive manually, or when Galileo suggests it.

```
   -        +        >>
Tank: T1
O2/He%:  18/40 %
ppO2max: 1.40 bar
MOD:  69.3 m
  O2 setting: 18..100%
```
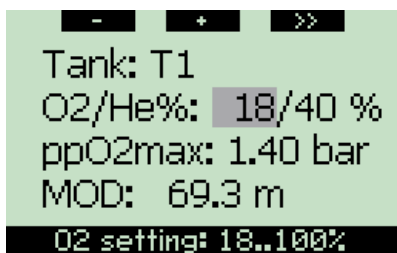
When the cursor highlights the O2 part, you may edit the Oxygen percentage of the mix with the + or – buttons. The possible range for the O2 setting is shown at the bottom of the screen with black background. By pressing >> you select the current value and proceed to the Helium fraction.

☞ *Note:*

The minimum O2 setting for tank T1 is 18%. This is due to the limitation that a dive must begin with gas 1.

To ensure an adequate supply of oxygen to the body, the gas used at the beginning of the dive must contain enough oxygen (you can use a travel mix or one of the decompression gases), as is required for Tank 1. Thereby, the first alarm about Absolute Minimum Depth would be given at shallower than 1.2 meters.

⚠ **WARNING**

Heavy work while at the surface or at shallow depths while breathing with less than 21% oxygen fraction may cause a loss of consciousness and lead to drowning.

```
   -        +        >>
Tank: T1
O2/He%:  18/40 %
ppO2max: 1.40 bar
MOD:  69.3 m
  He setting: 0..82%
```
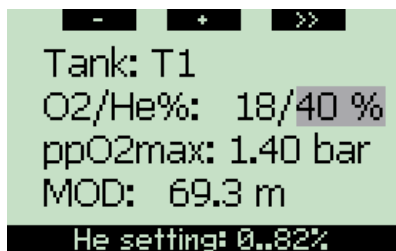
When the cursor highlights the Helium part, you may edit the Helium fraction of the mix with the + or – buttons. The possible range for the Helium setting is shown at the bottom of the screen with black background. By pressing >> you select the current value and proceed to ppO2 setting.
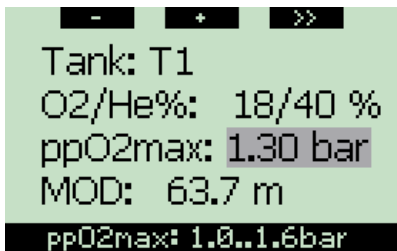
☞ *Note:*

The Galileo calculates the maximum possible Helium fraction by subtracting the Oxygen fraction from 100%.

⚠ **WARNING**

Helium reduces the narcotic effect of the mix, but doesn't remove it. At great depths Helium also may cause an effect called "Helium tremors", or HPNS (High Pressure Nervous Syndrome).
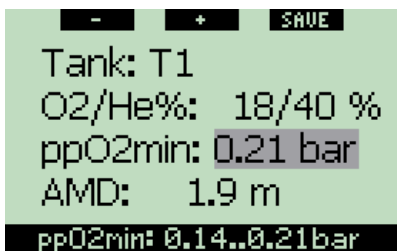
When the pp02max value is highlighted, you may edit the maximum partial pressure value of oxygen with the + or – buttons. The possible range for the ppO2max setting is shown at the bottom of the screen with black background. By pressing >> you select the current value and proceed to ppO2min value.

Note: You may set the maximum allowed ppO2 level at **menu** -> Dive settings -> ppO2max.

⚠️ WARNING

High pp02 settings may cause sudden loss of consciousness (general seizure induced by oxygen toxicity) and lead to drowning. Turning the pp02 alarm off is dangerous. Use of Trimix with lower oxygen fractions will lead to lower pp02 at depth.

When the pp02 value is highlighted, you may edit the minimum partial pressure value of oxygen mix with the + or – buttons. The possible range for the ppO2min setting is shown at the bottom of the screen with black background. By pressing >> you select the current value and save the modification for that tank.

☞ Note:
By selecting a lower value for the ppO2min you may get Absolute Minimum Depth of 0 meters as shown in the screen below. However, we recommend always using at least 0.21 bar as the minimum to prevent accidental loss of consciousness due to hypoxia (oxygen starvation).
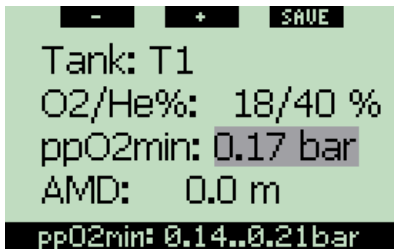

☞ Note:
Your current altitude also has an effect on ppO2 value. At higher altitudes the pressure is lower and leads to lower ppO2 value.
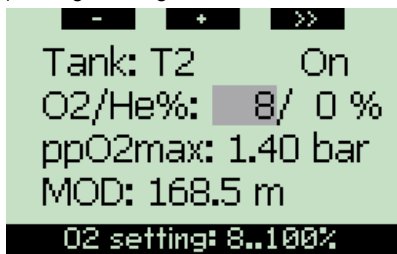
⚠️ WARNING

Altitude diving with hypoxic mixes requires proper acclimatization. Adaptation to lower pp02 levels is a slow process requiring your body to produce more red blood cells. The adaptation time is personal and cannot be directly calculated. Desaturation due to pressure drop when arriving at altitude is another factor (see main manual: altitude levels)
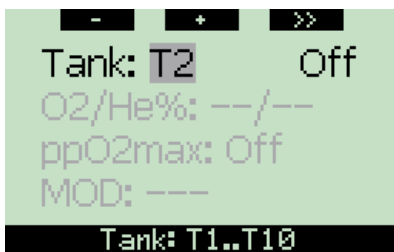
When the tank number is highlighted (T2..T10), you may scroll between the tanks with + or - buttons. The >> button selects the current tank to be modified.

```
  -        +       >>
Tank: T2        On
O2/He%:  21/  0 %
ppO2max: 1.40 bar
MOD:  59.0 m
      Tank: on, off
```
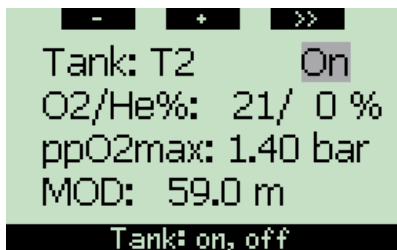
When the on/off field is highlighted by the gray curser, you may scroll between enable/disable for that tank with + or - buttons. When On is set, the further settings for that gas will change from gray to black. By pressing >> the gas can be edited.

```
  -        +       >>
Tank: T2        On
O2/He%:   8/  0 %
ppO2max: 1.40 bar
MOD: 168.5 m
    O2 setting: 8..100%
```

With Tanks 2..10 the minimum Oxygen fraction is 8%.

⚠ WARNING

Warning: Low Oxygen fraction settings may allow greater MOD values. The dive computer cannot evaluate your skills, experience or condition to dive the MOD which is showing. Dive only at depths which your certification allows.

4.3 OTU

```
   ▼        ▲      ENTR
▲OTU settings
 Desaturation reset
 All-silent mode
▼Trimix
      OTU settings
```
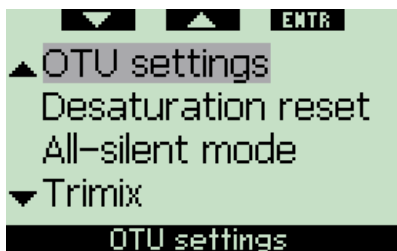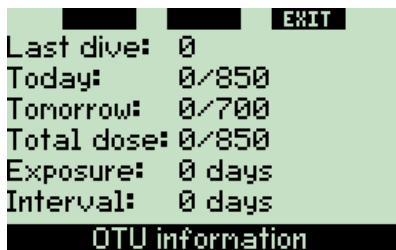
By selecting **menu** -> Dive settings, you can scroll with up or down buttons to OTU settings selection. By pressing **enter** you go to following selection.

```
   ▼        ▲      ENTR
OTU information
OTU reset time
Clear OTUs

      OTU information
```
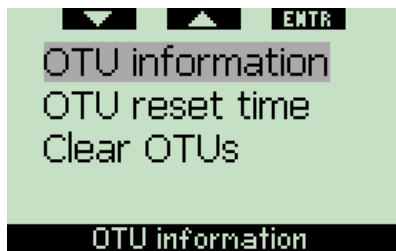
By pressing up or down you may select between OTU information, OTU reset time or Clear OTUs. By pressing **enter** at OTU information you go to following display.

```
                   EXIT
Last dive:  0
Today:      0/850
Tomorrow:   0/700
Total dose: 0/850
Exposure:   0 days
Interval:   0 days
      OTU information
```

On the OTU display screen you will see the current OTU related information:
1. OTUs from the last dive
2. OTUs from the dives today and the maximum allowed value
3. OTUs allowed for tomorrow (current situation)
4. Total OTU dose during the mission (series of diving days)
5. Exposure (how many days diving has occurred during this mission)
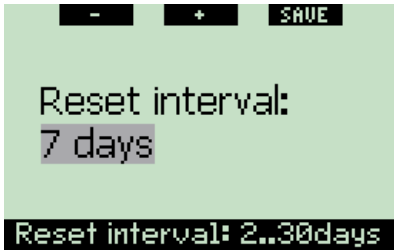6. Interval (how many days have passed since the last dive day)

☞ Note:
   OTUs are calculated per day, changing at midnight (00:00) to the next day and limits changing accordingly.

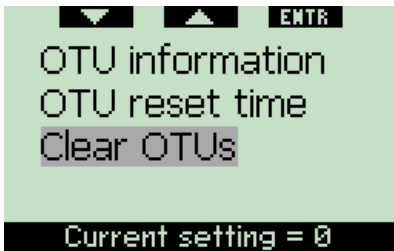By pressing **EXIT** you will return to OTU settings.
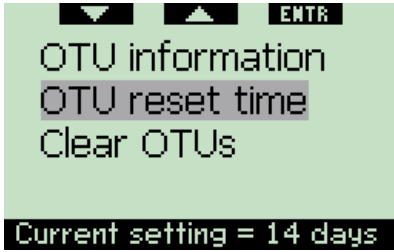
By pressing **ENTER** at OTU reset time you will get to following screen.

By pressing + or – you may select OTU reset interval from 2 to 30 days.
For example if you select 7 days, the OTU value and limits will be reset after 7 days without diving.

☞ *Note:*
   Even a short dive which may not greatly influence the OTU value will continue calculating OTUs until the reset interval is reached.

By pressing **ENTER** when Clear OTUs is highlighted you will manually clear your OTU counters.
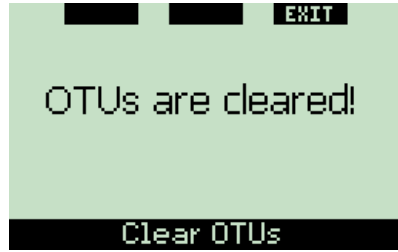
This screen will show that the OTUs have been reset. By pressing **EXIT** you will get to OTU settings.

4.4   Trimix version info

The version of the Galileo can be checked under the **menu** -> Other settings -> Device information.

When updating the Galileo Tec SW the only changing information will be in the field: SW version: x.x. Where original downloaded standard software versions are in range 1.0 to 4.0 the Tec SW versions will start from 5.0.

4.5   Additional information on the Tec SW

The Tec SW supports only a coded HR belt. The coding reduces spurious heart

rate readings during diving. A coded belt can be recognized from the word: Coded, printed after the model name Polar Heart Rate belts.

4.6   Galileo Tec SW limits

Limit	Value	Note
Maximum depth limit before Galileo changes to Gauge mode	155 m / 508 ft	Alarm about the change at 150m / 492 ft
Maximum dive time	Not limited	Battery capacity limited. However, not suited for surface supplied or bell diving.
Maximum logged dive time	24h of profile for one dive	
Decompression stop calculated depth	75 m / 246 ft	PDI stops are calculated deeper than 75m / 246 ft

5.   SmartTRAK (PC Interface)

After updating the Galileo with Tec SW the older versions of SmartTRAK are no longer able to properly communicate with your Galileo. Download the latest release of the SmartTRAK from **www.scubapro.com**. SmartTRAK has it's own user manual and help functions, which you will receive when downloading the latest version.

6.   Glossary:

AMD   Absolute Minimum Depth. The Depth where a mix can begin to be used based on its Oxygen Content.

Hypoxic   Gas mix containing less oxygen than air.

MOD   Maximum Operating Depth. Depths where the mix can be used based on its Oxygen content.

NOAA   National Oceanic and Atmospheric Administration.

OTU   Oxygen Toxicity Unit, used for estimating allowed oxygen exposure against pulmonary effects.

PDIS   Profile Dependent Intermediate Stop.

PMG   Predictive Multi Gas.

ppO2   Partial Pressure of Oxygen.

TAT   Total Ascent Time.

Tec SW   Technical Diving Software for Galileo series.

Trimix   Gas mix containing Oxygen, Nitrogen and Helium. Marked as Oxygen/Helium %.