



MultiDeco-X1

user manual

for the Liquivision X1



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<http://www.multideco-x1.com/>

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License and usage

THE USE OF THE MULTIDECO-X1 SOFTWARE USED IN THE X1 COMPUTER IS LICENSED TO THE OWNER OF THE COMPUTER SUBJECT TO THE LICENSE AGREEMENT AND DISCLAIMER INCLUDED AT THE END OF THIS DOCUMENT. DO NOT USE THIS COMUPTER PROGRAM OR X1 UNTIL YOU HAVE READ THE LICENSE AGREEMENT AND DISCLAIMER AND SUCH USE IS RESTRICTED AT LAW TO SUCH LIMITATIONS.

Introduction

This manual describes the MultiDeco-X1 firmware for the Liquivision X1 dive decompression computer. The X1 comes with its own hardware user manual that describes various functions. Review the X1 manual for descriptions of charging, the USB attachment fitting, warranty, etc.

Description

The Liquivision X1 dive computer has the powerful ARM32 processor. The X1 can be re-programmed with any dive decompression program by the user and it has a bright OLED display that is easily viewed in the water. The X1 does not have any buttons and instead uses an inertia measurement system that converts the diver tapping input actions into scrolling motions for use in the menus and settings.

MultiDeco-X1 uses genuine VPM-B and VPM-B/E, along with Bühlmann ZHL-16C and Gradient Factor (GF) for its decompression calculations in a complete submersible dive decompression firmware program. This program has been designed to perform continuously updating decompression calculations for the underwater environment. MultiDeco-X1 tracks the diver's progress and conditions and tissue state, and is computing a new set of ascent limits continuously. At first the NDL limits are displayed and progressing into decompression stops and time limits. The diver is able to select a decompression model to suit the conditions or preferences.

The VPM (Varying Permeability Model) has its origins in research into micro bubbles that began in the mid 70's. More details on the VPM model history and revisions, technical references and links to its theory and methods of calculations are available here: <http://www.hhssoftware.com/v-planner/vpmdetail.html>

MultiDeco-X1 includes the VPM-B/FBO model version for use by CCR divers during bail out situations. Fast Bail Out (FBO) can reduce the required bailout mix volume requirements.

The Gradient Factor (GF) method was created by Eric Baker in the late 90's, and applies a conservatism layer onto the Bühlmann ZHL-16 calculations.

The Gradient Factor Surface (GFS) method is a combined plan. This takes a regular VPM-B plan and a ZHL-16C with a GF Hi setting only, and uses the deeper or longer parts of the ascent segments from each plan.

MultiDeco-X1 and desktop PC plans

The MultiDeco-X1 configurations are designed using many of the same model settings and conservatism levels from the desktop version of V-Planner. Gradient factor desktop plans can be created with programs such as DecoPlanner by GUE, or the GAP software package. This allows for the dive to be planned with the desktop V-Planner, and then carried out exactly in the water with the MultiDeco-X1 program. The desktop plan and the results of the same dive carried out on MultiDeco-X1 will be a match, providing the diver follows the plan.

A real life diver is not likely to follow the plan so precisely, and so the runtimes will vary slightly. In any case, the diver's progress throughout the dive is tracked and the deco updated and re-calculated and the new limits shown every few seconds.

The biggest influences causing the variations between pre planned desktop and the achieved (in water) results are:

- The descent rate and crushing pressure achieved is quite critical to the VPM-B algorithms. The real life diver is not likely to match exactly the planned descent rate for the entire descent. A slower descent may actually increase the deco obligations.
- The ascent rate achieved in the water and the precise and exact following of the decompression stops and depths will probably vary throughout the dive.
- The diver rarely follows the planned depth and planned or displayed stop times exactly.

For most dives, the diver can expect the decompression times and stops match closely and they will be within a few minutes overall. In the case when decompression stops are shown but the diver is slow to reach that stop level, then the overall runtime required for decompression will slowly extend longer while the diver remains deeper than the stops displayed and required. In all situations, the deco limits are re-computed every few seconds and the new limits shown.

Installation

The MultiDeco-X1 program is installed onto the X1 with a Windows PC installer program. This requires a PC with Win2000, Win XP or Vista, or Windows 7 or 8, and a USB port. Mac users report successful installs using Parallels, Boot camp and other virtual environments. The X1 comes with a USB driver file disk from Liquivision (in the box) and these drivers need to be installed first (once only). See your X1 user manual for more details of the driver install, and the hardware attachment procedures (also described below). The installation of the MultiDeco-X1 firmware will take just a few minutes and then the X1 and MultiDeco-X1 is ready for diving.

USB driver install – using HHS Software supplied drivers

This method is the preferred for driver install. Note that both this and the Liquivision disks achieve the same end result with the same drivers, but this method here is more efficient.

This procedure is required just once per PC.

- Start the MultiDeco-X1 program.
- Navigate to the USB tab.
- It should show an Install Drivers button – press this, and it will reply with success or failure. If failed, then use the Liquivision method below.
- Now plug in the USB, the system should recognize and proceed with final install.

Note: For use on an x64 bit OS, you may require additional steps listed here. This applies to all users of x64 bit OS and it must be performed. Note that from about late 2009, Liquivision shipped attachments with this conversion completed already. The only way to identify this issue is if it works in a 64bit OS or not – you can only try for yourself.

http://www.hhssoftware.com/multideco-x1/usb_update.html

USB driver install – using Liquivision CD disks

This procedure is required just once per PC.

- Plug in the USB cable to the X1 and the attachment,
- Plug in the wall charger
- Connect USB cable to the PC,
- Insert the CD from Liquivision.

Windows will announce it has “New hardware found”. Use the search and advanced settings selections to make the Wizard search and look for drivers on the CD drive. Windows may warn that the driver is ‘not signed’ - ignore this and press ‘Continue

anyway'. After this process completes.... unplug the USB cable from the PC, wait a few moments and then re-insert the USB cable.

Note: For use on an x64 bit OS, you may require additional steps listed here. This applies to all users of x64 bit OS and it must be performed. Note that from about late 2009, Liquivision shipped attachments with this conversion completed already. The only way to identify this issue is if it works in a 64bit OS or not – you can only try for yourself. http://www.hhssoftware.com/multideco-x1/usb_update.html

The MultiDeco-X1 programs also include the same drivers and will place these on your hard drive if required. You can as an alternative, manually install these if required.

MultiDeco-X1 install

The install process is performed by the user with a PC, and with the USB cable and attachment that came with the X1. There is no need to return the X1 for this installation.

The procedures for activation, upgrade or first install of MultiDeco-X1, are the same and all methods use the same process and installer utility file.

Download the latest MultiDeco-X1 installer file from the web at <http://www.hhssoftware.com/multideco-x1/download.html>. Your X1 serial number is required (look at the top wrist band mount).

Start and run this install file. It includes instructions to guide you through the process and steps. That includes registration, license fee, the key entry, and the loading on the MultiDeco-X1 firmware program onto the X1. After installing, the MultiDeco-X1 is ready for diving use.

Upgrades and replacement X1's

New or upgraded versions of MultiDeco-X1 do not affect the settings or installed license. Your existing dive logs and settings will remain. The install process will save your last license on the PC for the next time it's required. Existing licenses can be re-sent from this link: <http://www.hhssoftware.com/multideco-x1/lostkey.html>

If your X1 is replaced, then a new license will be required to install MultiDeco-X1. Replacement license files are available free of charge. Contact below for further details:
Email: support@multideco-x1.com

Product and program support

X1 Product and program support is divided between the hardware maker and the firmware maker of your X1 dive computer. Hardware issues are handled by the retail outlet or shop you purchased your X1 from, or by Liquivision directly. HHS Software and V-Planner will handle the firmware issues for MultiDeco-X1.

Liquivision X1 computer – hardware issues

Contact your retail supplier where you purchased the X1, or directly with Liquivision products at:

Email: info@liquivision.com

Website: <http://www.liquivision.com/>

Liquivision maintains a user support forum at (for discussion on X1 hardware issues):

<http://www.liquivision.com/forums/>

MultiDeco-X1 – firmware issues

Program support and help is available at:

Email: support@multideco-x1.com Website: <http://www.multideco-x1.com>

HHS Software maintains a user support forum at (for discussion on MultiDeco-X1 issues):

<http://forums.multideco-x1.com/>

X1 basic operation

Tapping and menu navigation

The X1 does not use buttons like a regular dive computer. Instead the X1 is controlled and navigated by a tapping action on the case. These taps are measured by inertial motion sensors inside the X1, and converted into a scrolling action for the menus and systems in the X1.

For best results, hold the X1 lightly in the palm of the hand or by the wrist strap. Tap on it briskly with the end of the index finger, or with a flick of the fingernail. Some actions require a sequence of taps (wake-up and to bring up the menu system), and these need to be performed as a short series of taps within a second of each other.



Operating modes

MultiDeco-X1 and the X1 have three distinct modes or states of operation for running, turned off or shutdown. These are: Awake, Standby and Shutdown modes.

Awake

This mode is present when the X1 is fully running with the screen functioning and tap system operating. This is the normal state anytime the X1 is being used on the surface or during diving operations.

Standby

Standby mode (originally called Sleep mode) is an in-between state where the screen is turned off and the CPU power consumption is reduced to help preserve the battery charge. The X1 will continue monitoring for tapping actions (which will awaken the X1), and to sample air pressure readings during this state. The X1 will transition automatically from the Awake mode to Standby mode when on the surface, about 10 minutes after the diver activity stops. This happens automatically after a dive, or after the last tap action with the X1 on the surface.

This time period is controlled by the Surface display time setting and can be adjusted in the “[Display times](#)“ menu. Standby mode can also be selected from the main menu to shortcut the surface time out period setting.

Shutdown

Shutdown mode has the X1 fully turned off and preserving the battery. When shutdown the tap system is turned off and does not function. To wake the X1 from shutdown mode – see [Starting X1](#) below. The X1 will transition from Standby mode to Shutdown mode silently several hours after a dive, or after any surface activity ceases. Shutdown mode cannot be selected directly – only Standby mode can be selected, which will transition into shutdown mode by itself.

Standby mode allows the diver to restart (wake up) the display with the tap action on the X1 case. The X1 continues to monitor ambient air pressures during this time. After the standby mode time expires, the X1 will transition silently into Shutdown mode.

Standby mode and Shutdown mode look the same: The screen is blank and only the apparent difference is that the tap action continues to function in Standby mode, but does not work in Shutdown mode.

During battery charge or any time AC power is being supplied, the X1 will remain in standby mode and the tap action will function.

Starting the X1

The X1 can be started in five different ways:

- Three taps on the top/bottom case to wake the X1 (during standby mode only),
- Water contact – taking the X1 into water (unless water sensor is disabled),
- A wet finger pressed on the pin contacts (simulating water),
- Plugging in the AC Charger,
- Pressing the reset button on the attachment (when connected).

The tap action is available when the X1 is in Standby mode or Awake mode. To wake up the X1 from standby mode requires three (or five) firm taps on the top or bottom case, and all performed within a second of each other.

When the X1 is in Shutdown mode, place a wet finger across the pin pad contacts on the right hand side of the X1 case. A splash of water or dipping the X1 in water will also bridge the contacts and wake the X1.

When the X1 wakes up, it will turn on the screen, show the MultiDeco-X1 logo briefly, beep a few times, and then enter surface mode display. It can then be configured or used as required.

If the X1 fails to start, then try to wake it with a wet finger on the pin contacts, or plug in the adapter and press the reset. If the battery has fully discharged, then the X1 will remain in Shutdown mode until re-charging commences.

Note: There are different X1 designs that place the water pins in different locations on the unit. Earlier X1's up to about s/n 2,400 used the two upper pins on the right hand side of the X1 case for water contacts. Shorting these pins with some saliva will wake the X1. Later units added two extra pins on the upper and lower faces, towards the left. These units require two fingers to bridge the water pins. Often it requires the unit to be dipped or splashed in water, to cause the unit to wake up.

The water contact wake up can be disabled by adjusting the Standby mode time setting to "Always", and this will turn off the water sensor completely. This also allows the X1 to be put into Standby mode when it is still wet or damp.

The X1 can also be reset and rebooted, clearing all prior settings – see the [Re-booting the X1 firmware](#) topic.

Turning off the X1

The X1 will transition into Standby mode by itself, and then later into full shutdown mode. This occurs after the X1 has finished a dive, or a few minutes after the diver last used the X1 menu selections. The diver can enter Standby mode manually by selecting Standby from the main menu. The time setting for automatic transition to Standby mode is adjusted with the configuration item - see "[Display times](#)" menu.

Note: The X1 must be dry to enter Standby mode or Shutdown. An X1 that is placed in a damp environment, or packed with wet diving equipment will continue to remain in Awake mode. The water sensor can be turned off, if desired by setting the Standby mode time setting to "Always".

X-Link PO2 module

This section of the manual applies to the X-Link PO2 module only.

Overview

Liquivision offers an additional module for use with a CCR called the X-Link. The module monitors the PO2 values on a CCR via a direct cable connection from the O2 sensors, and delivers that data to the X1. See also details about [X-Link calibration](#) procedure, diving the X-Link PO2 module and [underwater PO2 menu](#).

The X-Link connects to the rebreather O2 sensors and provides the X1 with a secondary or duplicate set of O2 sensor values. These signals are processed by the X1 and are converted to PO2 information for the decompression algorithm. The data is computed into an ascent calculation for producing decompression limits.

Warnings and limitations

Be aware and understand these points:

- X-Link can stop functioning without warning, at any time, thereby depriving the diver of all PO2 information.
- X1, X-Link and MultiDeco-X1 will completely stop showing all PO2 data, any time the “No Data error” is activated, or the diver selects a manual SP.
- X1, X-Link and MultiDeco-X1 cannot determine the satisfactory condition of an O2 sensor, and cannot detect any defective components in the rebreather systems.
- An additional and independent PO2 display is required at all times.
- MultiDeco-X1 must not be used as the authoritative or sole display of PO2 level, or other rebreather status information.
- X1, X-Link and MultiDeco-X1 cannot be used to replace a rebreather’s original equipment that controls oxygen injections or other oxygen level control systems.
- The PO2 information displayed in MultiDeco-X1 may not be accurate and it must not be used for making adjustments to the rebreather’s oxygen settings.
- A defective or old O2 sensor will generate false signals that can have deadly consequences, or give readings that lead to incorrect amounts of decompression.
- O2 sensor cells have an expiry date.
- O2 sensor cells can fail before the expiry date.
- O2 sensor cells must be validated for satisfactory signal output regularly before use, in accordance with the rebreather test procedures, or cell manufacturers procedures, or by using other established procedures and test equipment.
- A valid and accurate O2 sensor calibration procedure is required before use.
- Inaccurate sensor calibration procedures can have deadly consequences, or give readings that lead to incorrect amounts of decompression.
- X-Link, X1 and MultiDeco-X1 do not have any control of the rebreather’s oxygen injection system, or any other systems or components of the rebreather.

Wiring of cells

The X-Link and X1 will accept any combination of one, two or three cells connected to any of the three O2 input channels. The X1 will test and discover the connected components, and does not need to be configured for the number of cells or locations.

During the calibration process, the O2 cells will be tested against the cell manufacturers specifications for output voltage. MultiDeco-X1 accepts the two common cell types (11mV and 25mV in air). Cells that do not meet the Teledyne or AI specifications in air or at a corrected 1 ATA of O2, will be rejected and the calibration will fail. The allowed range for 11mV cells is 36.5 to 69.4mV at a corrected 1 ATA O2. The 25mV cell allowed range is 106.2 to 133.5mV at a corrected 1 ATA O2.

PO2 data logic

3 cell inputs

During the dive: The X1 will display the highest reading cell, or 3 cells as numbers, or as bars. All three cells values can be seen via a menu item - see underwater PO2 menu.

The PO2 reading used for decompression calculations is an averaged value. The formula used will vary, depending on the quality of the three data signals received. If the 3 cells are within 10% of each other, then an average of all three is used. Beyond this, the average is gradually biased towards the two most consistent cell values. When the disagreement exceeds 25%, the extreme cell value is dropped from the average and the cell inputs are forced to a 2 cell system, but the highest cell reading remains visible. If the errors grow another 15%, then all signals are ignored and the X1 is forced into manual Set Point operations.

2 cell inputs

During the dive: The X1 will display the highest reading cell, or 3 cells as numbers, or as bars. All three cells values can be seen via a menu item - see underwater PO2 menu.

The PO2 reading used for decompression calculations is an averaged value from the 2 cell readings. If the 2 cells disagree by more than 25%, then both signals are ignored and the X1 is forced into manual Set Point operations.

1 cell input

During the dive: The X1 will display the single reading cell at all times, and it is used for the decompression PO2 value.

In all cases, the value used for decompression calculations is further dampened to reduce the strong oscillating found in PO2 readings. The actual value used is not available underwater, but can be seen after the dive in the dive log manger. Under normal operations, it will be similar to the high PO2 value.

PO2 display in the dive

The PO2 values can viewed on the main dive screen in 4 different ways:

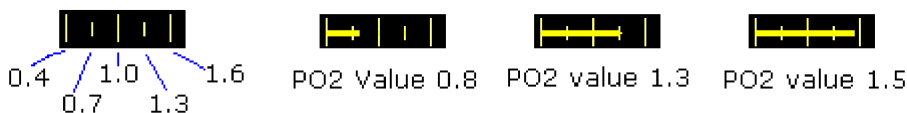
- As a single PO2 value, displayed as the highest cell reading eg. PO2 1.24, (hi cell option)
- As a series of three PO2 readings eg. 12 12 13. These represent values of 1.2, 1.2 and 1.3. (3 cell option).
- As a bar display, drawn over a graph background – see the diagram below (bar option).
- Scrolling the dive screen during the dive, to show alternate displays.



Three ways to display PO2 information: Hi cell, 3 cells or bars (1.2 shown). These are selected via the Config setting, and the UW display menu item.

The 3 bar display is works like the gas (petrol) gauge in a car:

(E, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, F). At the left side the PO2 value is 0.4, the middle bar ($\frac{1}{2}$) is 1.0, and the high bar is 1.6. If the diver is aiming for a PO2 of 1.0 to 1.3, then keeping the bars in the $\frac{1}{2}$ to $\frac{3}{4}$ range would represent this.



Samples of the PO2 bar values display.

The PO2 display option can be set under the [X1 config](#), and set during the dive with the underwater [Display](#) options menu.



This screen is available during the dive with [Screen scroll](#) taps. The data shown is 3 cells, with expected flush reading shown.

X-Link - Alarms, warnings, beeps

MultiDeco-X1 will monitor for high or low PO2 values and issue warnings. The high PO2 warning is based on the highest reading value. The low PO2 warning is based on the value used for decompression calculations.

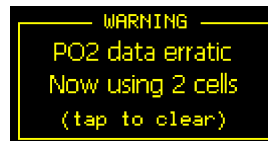
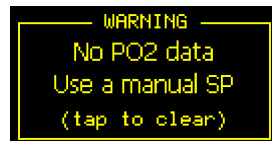
Warnings and beeps will trigger for the following conditions:

- Highest PO2 cell reading exceeds 1.65,
- Averaged or highest PO2 cell readings are less than 0.35,
- Averaged PO2 cell readings are lower than the natural ppO2 of the diluent ((PO2 < FO2 x ATA) while PO2 < 1.00),
- For a 3 cell input, PO2 signal data becomes erratic and the data input is forced to 2 cells,
- For a 2 or 3 cell input, signal data errors or variance become unusable,
- X-Link stops functioning,
- X-Link is configured ON but module was not present when starting a new dive.



PO2 is high, or low. The screen will flash with current PO2 value.

The PO2 high / low warning screen cannot be cleared. It will continue to flash while the extreme PO2 condition exists. The menu system may still be accessed if required.



Left: PO2 data is not present, or data quality has degraded to unusable.

Right: A 3 cell input, data erratic, one channel is dropped.

The “No PO2 data” and “data erratic” warning will flash until cleared by the diver. To clear these warnings, tap three / five times (same as bringing up the menu system). Clearing the error, does not correct the error – it only acknowledges the diver was informed of the error, and clears the warning screen from the view.

The “No PO2 data” warning indicates that the computer has stopped receiving or using PO2 data. The warning will transition the X1 into fixed SetPoint mode automatically. The diver MUST now control the setpoint value manually, and the underwater PO2 value display is REMOVED. The initial SP used here will be the value entered into the dive

plan mix table. The “spt” text and alarm symbol will flash as a reminder to the diver for the remainder of the dive.

NOTE: During all warnings, the menu system can still be accessed. Three (or 5) regular taps will bring up the menu system for selection of Bailout, or other items as required.

Switching to / from manual SP

The PO2 data may be turned off during a dive from the underwater menu. This will disable all data from the X-Link from entering into the display and decompression calculations. All PO2 data is removed. This action cannot be reversed. The dive must then be completed in manual SP mode, with the diver adjusting the setpoint value manually via the underwater setpoint menu.



Select “Use a manual SP”, and confirm to turn off all PO2 data.

SP mode will be engaged automatically any time the X-Link fails, the data signal is lost, a dive starts when the module was set to operating but is missing, or the signal values disagree significantly.

A warning will show on the dive screen display and will flash the “spt” continuously to remind the diver to maintain the SP manually. This warning cannot be disabled. If the X1 is to be used in CCR mode but without the X-Link module attached, then turn the PO2 input OFF, to prevent this warning.



Left: Normal PO2 data in use. Right: manual SP mode “spt” flashes.

Selecting cells / lost signal

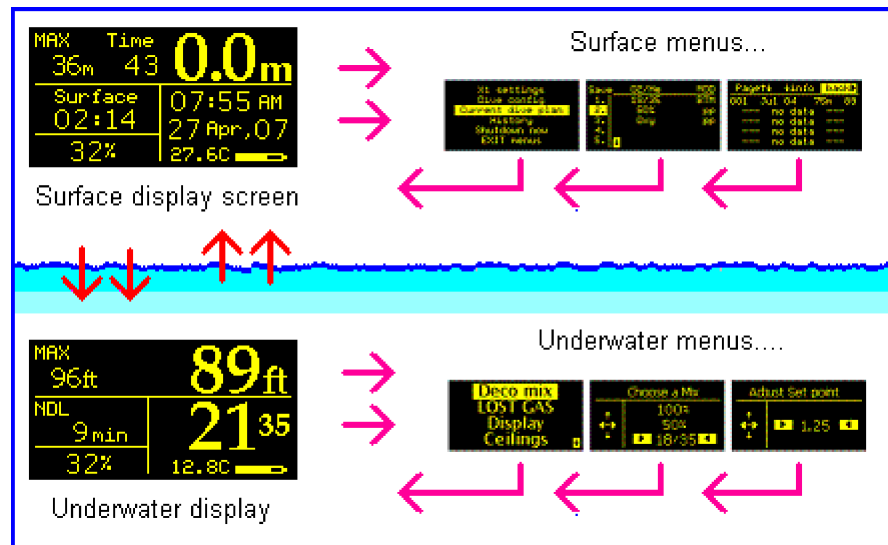
The X1 and MultiDeco-X1 does not permit the diver to select cells individually for the display or decompression calculation values. The X1 will always show the highest reading cell to the dive screen. The inbuilt algorithm will use an average of the most

agreeable cells for decompression calculations. It also looks for and cuts out extreme single cell readings in a multiple cell data set. If the cable should be disconnected, then the X1 will wait a short time for the signals to resume, and then fall back to manual SP mode. When the signal returns, it will resume PO2 operation in this situation.

MultiDeco-X1 operation

Overview

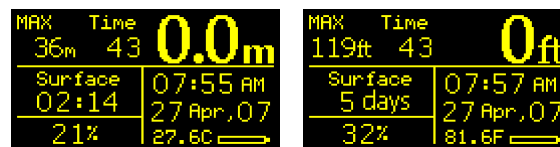
The MultiDeco-X1 design uses two main display screens – one for diving, and a second display for surface mode. Each of these displays has a menu system that comprises of configuration items and further sub menus.



MultiDeco-X1 program flow.

The Surface display

When the X1 display is blank, this indicates the X1 is in Standby or Shutdown mode. Bring the X1 into Awake mode by three firm taps to the top case in quick succession, or by bridging the water contact pins on the side with a wet finger. This should cause the X1 to start and will bring up the surface display. The surface display is the main interface to the X1 and MultiDeco-X1.



Surface display samples.

The surface display shows information such as Maximum depth and time of last dive, surface time from last dive, the current time and date, and current temperature and battery condition.

Surface Menu system

With the surface display showing, tap on the X1 case 3 times again at the top to bring up the surface menu system. The screen should change to show the menu selections below.



Main menu: Tap in the up or down direction to scroll the highlight bar through the choices. Tap in the left or right direction to select that item.

Menu items with a square box symbol lead to additional menu items, and an item with a minus sign shows the way back out.

The menu screen is the main entry point into all X1 settings, configurations, dive setup items and other features. The menus are navigated by a single tapping action. Tap at any of the four directions, top, bottom, left, right. In general, up and down taps will scroll through the items or list shown. A left or right tap will normally select that item, or perform that action, or it can give deeper access into the menu items.

Each item in the surface menu system will have a symbol next to it. The box items lead to further menu items and selections, while the minus sign shows the way out and back to the Main menu.

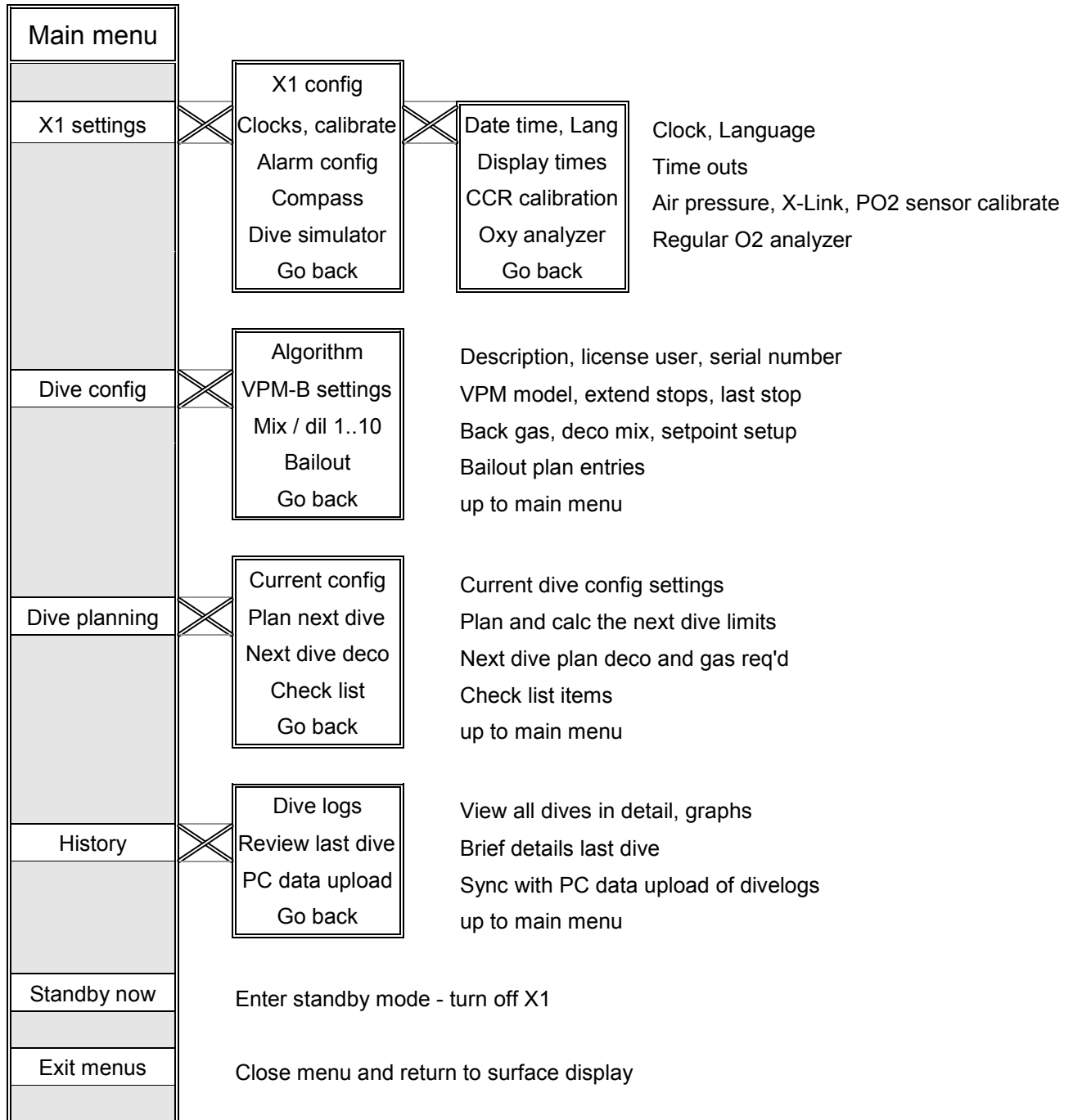
To exit the menus system and return to the Surface display, select EXIT menus. Do this by tapping on the top or bottom to scroll until the Exit menus item is highlighted, then left or right tap. The X1 also has a time out period (a minute or two), and the X1 will leave the menu system and return to surface display automatically.

To turn off the X1, select “Standby (x time)”. This will turn off the screen and reduce the CPU power used by the X1 by placing it into Standby mode. The X1 will also enter Standby mode automatically after a period of no activity (no taps) from the diver. This and other timeout values can be set in the “[Display timeouts](#)” configuration.

With the default settings, the X1 will turn off the screen after 10 minutes on the surface and enter Standby mode. The X1 continues to monitor the depth pressure sensor and water sensor in a Standby mode. If a dive was commenced at this time, the X1 will wake-up and commence to monitor the dive as normal.

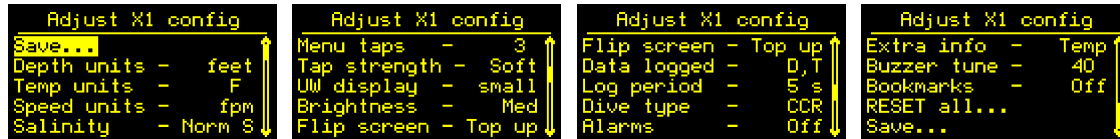
After a few hours of the Standby mode, the X1 will shutdown completely and will no longer monitor the depth sensor. The diver will need to wake the X1 manually with a wet finger across the pin contacts. For this reason, it is most important that the diver wake-up the X1 sometime during the hour prior of every dive. The X1 will also wake itself anytime water contact is sensed. Once again, these actions are influenced by the Standby mode settings in “[Display timeouts](#)”.

Menu items table – surface mode



X1 settings and configuration

The X1 can be configured to adjust basic settings such as Imperial or Metric depth displays, and screen brightness and more. To access this screen, bring up the menu system from the surface display with 3 taps (see Surface Menu system description below). Then scroll up or down to select X1 settings, then perform a left or right tap to select, then scroll and select the “X1 config” item.



X1 settings under menu items “X1 settings”, then “X1 config”.

Depth

- Meter or feet.

This also adjusts temperature into F or C and the speed units to mpm or fpm.

Speed units

Set this to display descent and ascent rates in:

- Feet per Minute (fpm), or
- Meter per Minute (mpm).

When MultiDeco-X1 senses a rate change of depth, the top left dive display will show the appropriate rate of change in depth with an up or down arrow. A third rate setting of percent per second (%/s) is for use with the Bottom timer and of interest to Free divers.

Salinity

Set the water salinity value. This will affect the water density used by the X1 and therefore have a small affect on the indicated depth. Select from:

- Fresh: fresh water = Specific Gravity 1.000,
- Mix FS: a mix of fresh and salt waters = Specific Gravity 1.010,
- Light S: light salt = Specific Gravity 1.020,
- Norm S: medium salt = Specific Gravity 1.025 (standard seawater, 3.6% salt),
- High S: high salt = Specific Gravity 1.030.
- EN13319: This will configure the depth reading to comply with the EN13319 depth indication standards (v3x and v4x hardware only). Doing this should make the depth align with other devices approved to this standard. EN13319 is based on an atmosphere with Specific Gravity 1.020 for salt water. For true depth, select a salinity value that best matches your diving environment.

Note also that the decompression calculation is not affected by any of the salinity settings. Decompression uses ambient pressure values at all times.

Menu taps

- 3 or 5: Sets the number of taps to bring up the menu system on the surface, during the dive, and to restart the X1 from Standby mode.

Tap strength

- Soft or hard: changes the amount of tap motion energy required to register as a tap in the X1. Note that the soft setting may give problems when the diver is getting into his/ her diving equipment. It can trigger the three taps to activate the menus, which leads to random selection or changes to settings. It is recommended to use the Hard setting when using the X1 on a dive to avoid this situation. Divers with scooters also need to consider that vibrations from the scooter handle may trigger unwanted tap actions.

UW Display

- Set to Big or small. Controls the text size of the underwater menus and dive display. This item is also available in the under water menu system.

Brightness

- Select Low, Med or High. The High setting might be needed to read the display in the direct sunlight. When underwater, the Med setting is often enough, and Low at night or indoors use. Using the Med or High values indoors might be too bright and can hurt your eyes. Note: Avoid using the High setting for any extended period. The Oled (Organic light emitting diode) display is prone to a burn in condition, much like early CRT computer screens. Just 10 hours of use at high settings will show permanent marks in the display.

Flip Screen

- Top up or bottom up. This will cause the screen to invert and the X1 can be worn upside down. The taps are reversed as well to match the inverted display. This upside down feature can be used to have the accessory pin pad always facing inboard, for use on either the left or right arms.

Log Period

- Set to a time period from a 1/4 second through to 1 minute. This controls the time between dive log samples. For deco modes (OC or CCR), this minimum period is 1 second. This information makes up the History and Dive logs (see above for details). Dive logs cannot be turned off.

Dive type

- Select from OC (open circuit), CCR (closed circuit) or Timer (bottom timer gauge mode). This setting is repeated in the VPM-B config menu.

Note: See the [Bottom Timer](#) topic for important details about operations in Gauge mode.

Alarms

Activates all the items in the “Alarm config” menu.

- Off, On, or Silent: Silent will cause the flashing of affected items in the water, but without the alarm beep. On will include the Beep. This item can be adjusted underwater too.

Extra info

This controls the details shown in the lower right screen adjacent to the battery symbol. The selections are:

- Temp (water temperature),
- Avg (average of depth this dive),
- CNS % (the current dive CNS value),
- PPO2 (current mix selection ppO2),
- CNS and ppO2 (cycles both), or
- All...(cycles through all items). Each item appears with an abbreviated letter, such as “Av” “C” “PP”.

The PPO2 value reflects both the water density selections of Salinity setting, and the current ambient surface pressure of the dive site. For the CCR diver, the PPO2 value is the natural PPO2 of the diluent.

Buzzer tune

This adjusts the tone of the buzzer.

- The default is 40. Select up or down to fine tune the buzzer for volume or tone.

Stopwatch

Turns the underwater stopwatch and time option on or off.

- On or Off. See the Underwater Menu item [StopWatch](#).

PO2 display

This applies to the X-Link option only. Adjusts the PO2 display for use during the dive.

- Hi Cell, 3 cell, bars. See the [PO2 display topic](#).

Menu order

The order that underwater menu items appear during the dive can be customized.

This allows divers to shift the common or favorite items to the top of the list. To shift an item, enter the list and tap up /down to re-order the list. The list contains all possible menu items, but only menus that apply to the dive configuration will appear during the dive.

Bookmarks

- On or Off.

This allows the diver to enter 5 waypoints or bookmarks into a dive whilst under the water. These should be setup before a dive. Set the Bookmarks to On and tap again sideways to bring up the text edit screen. Move left / right through the available text space and up / down tap to bring up the [Keyboard](#) for text entry. Move off the right or left sides of the edit screen to see the last recorded dive number and dive time for each bookmark.

A bookmark can be recorded whilst in the dive by selecting the under-water Bookmarks menu, scrolling to the individual bookmark to record, and left / right tap to capture the current dive time. The memory will record the last 20 captured bookmarks. A single bookmark can be re-used in the same dive and in follow on dives. Each capture will be saved to the log.

The bookmarks will be uploaded along with the dive logs and inserted into the displayed dive graphs. The divelog manager allows for these to be deleted or new bookmarks created.

RESET All

This resets all configured settings back to default values. This includes all dive plans and VPM-B config settings. The dive logs will remain intact. This will also restart the X1's CPU. Note that this reboot is only a partial reboot. A full reboot can be achieved with the procedure described [Rebooting the X1](#).

Save

Saves the adjustments applied. Exit to the main menu through this item.

The X1 configuration settings can be uploaded to the Dive log manager (v2.46 or later) for inspection. This allows the diver to see the current settings on the X1, all in one screen. However, all settings must be changed in the X1, as the ability to transfers settings from Dive log manager into the X1 is not permitted.

X1 Hardware options

This section applies to X1's with v50 or later hardware (approx. s/n 2,400 onwards).

Later model X1's include options to adjust the hardware and component selection. A menu item "X1 Hardware" is available from under the X1 settings, Clocks, Calibrate menus.

Pressure sensor

Version 50 X1 hardware and later, added a second depth pressure sensor. Users can select between the top or bottom sensor, or an average of both sensors, which controls the pressure reading input into the software calculations. The option includes either of "auto" or "locked" for each of the sensor selections.

For the Auto selections: If a fault occurs in an active sensor (a complete loss of signal only, or it generates an error code), then the software will attempt to switch to the other sensor (or drop one if two were selected). Pressure reading will then be sourced from the other sensor. Note that the ability for this system to test and adjust for faulty readings from active sensors during a dive is not possible. The software does not interfere or try to determine good v bad readings. Only if a sensor has a total failure, will the software adjust the source of pressure readings to the alternative active sensor. Also the diver does not have control of this during a dive, but a warning is issued if the auto swap occurs during a dive. After 12 months of this twin sensor design in circulation, there has not been any report of failures in the field.

For the Locked selections: This locks the choice to the selected sensor(s), and it will not change in response to any faults. Use this setting to lock onto a known good sensor only.

The recommended setting is to "both". This will provide an average of the two readings and a stable pressure value for the computer to work with.

Water Sensitivity

Version 50 X1 hardware and later, added the ability to adjust the water pin sensitivity. This controls how easily the X1 will respond when using wet fingers to wake the unit. Select from Low or High.

Time Adjust

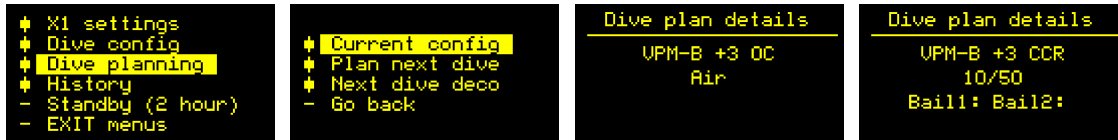
This setting allows the diver to adjust the internal clock in the X1. The values are shown in "seconds per day". Typical settings are from -60 to -120. A negative number is used for a slow clock.

If your X1 is losing time, then Adjust the setting lower (-100, -110, -120, etc).

If your X1 is gaining time, then Adjust the setting higher (-100, -90, -80, etc).

Dive configuration

A summary of the current Dive configuration and planning settings is shown under the Main menu item “Dive planning” and “Current config”. This should be checked and verified before every dive, as some dive configuration items cannot be adjusted while underwater.



Two samples of dive plans: OC air dive, CCR dive with 10/50 diluent and no bailouts.

MultiDeco-X1 requires the following details to be set for every dive, before entering the water.

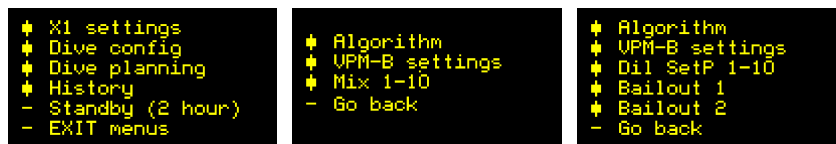
- The O₂ and He components of every mix to be used in the dive.
- For decompression mixes, the expected depth that the mix will be selected at.
- For CCR dives, the expected set point value of the mix, and an initial set point value for the descent portion from surface.

MultiDeco-X1 uses the dive configuration information to calculate and predict the NDL or decompression time limitations. The mix and set point information and proposed changes are re-computed throughout the dive. This gives the dive computer some knowledge of the divers intentions, and available deco mixes for use later in the dive. The computer will calculate the remainder of the dive accordingly and present the appropriate NDL or decompression limits.

However, at all times MultiDeco-X1 uses the current in-water information (diver selected mix and diver selected set point) to calculate and display current limitations. The actual in-water conditions and the diver selections of mixes and set point will modify or override the planned dive information. The final computed ascent times and limits are a result of actual dive conditions and the divers selection or adjustments made underwater.

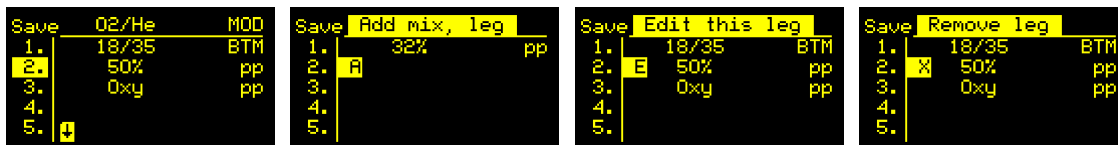
OC / CCR Mix, diluent, set point.

From the Main menu, select Dive config and then Mix 1-10 for OC mode, or Dil SetP 1-10 for CCR mode. To swap to/from OC or CCR mode, see the VPM-B settings menu.

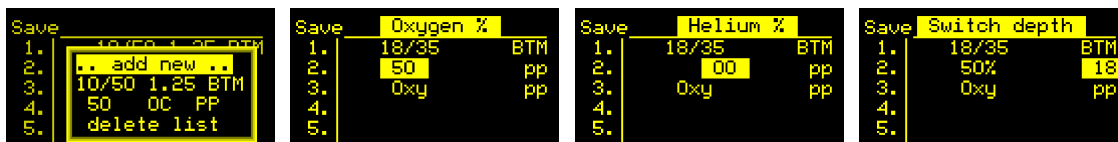


Dive configuration: OC and CCR displays.

The OC mix and CCR diluent tables each allow for 10 possible selections or entries. Five items are visible at a time and the balance can be seen by scrolling the list up or down to bring the remaining mixes into view. A separate entry is required for each different mix carried. For CCR mode, any planned swaps in set point values can be entered on the same mix.



Add, edit, or remove a bottom mix or deco mix.



Mix quick pick list.

Edit a mix – Oxygen, Helium, and MOD / BTM / pp value.

Add a new mix

- Scroll down to find a blank row. Left tap to shift cursor highlight into the blank region. Up/down tap to select “A” for Add. The top row description bar gives the current selected action.
- Left tap to bring up the mix quick pick list. Select a mix from this list with a left tap. Or select “add new” to enter a new dive leg.
- Left tap again to reach Oxygen component selection with “Oxygen %” shown is the description bar. Up/down tap to set the O2 value.
- Left tap again to enter Helium component selection with “Helium %” shown is the description bar. Up/ down tap to set He Value.
- For CCR mode, left tap again to enter the proposed set point value of this diluent, with “SetP” shown is the description bar. Note that the set point value set by the diver during the dive, will always override this planned setting. If an OC mix is required, then set a value of 0.0.
- Left tap again to enter MOD (Max. operating depth) or mix swap depth data with “MOD” shown is the description bar. Tap down to reach the BTM value for the bottom mix. The next item shown is PP. For pp, MultiDeco-X1 will calculate the ascent with this mix based on a switch depth of 1.6pp O2%. Or set the actual depth into the MOD column that the diver plans to use this mix. Note that MultiDeco-X1 will never switch a mix for the diver – the diver must make all switches manually in water with menus.

Delete a mix

- Scroll down to the row to delete. Left tap into the data area.
- Up or down tap to select “X” for remove.

- Left tap again to cause the row to be deleted.

Edit an existing mix

- Scroll down to the row to edit. Left tap into the data area.
- Up or down tap to select “E” for Edit
- Left tap again to reach the Oxygen component. Now follow the instructions per Add new mix above.

The following points are relevant to dive mixes:

- Mixes must be entered and configured on the surface prior to commencing a dive.
- The order of mixes in the list is not important, and blank lines are ignored. MultiDeco-X1 will sort the mixes based on O2 component, regardless of the order they appear in the display.
- Only one bottom mix allowed per plan, and it is required for every plan.
- The deepest mix (lowest O2% component) must be the BTM mix.
- No duplicate mixes allowed in OC. CCR legs can have a duplicate mix, but with different set point and MOD settings. E.g. a planned increase in set point value during deco.
- A CCR table can have both regular CCR set point legs and OC legs. Use a set point of 0.0 to obtain an OC leg in the CCR table.
- A summary of the current plan settings is available on the Main menu under “Dive planning” and “Current config”.
- MultiDeco-X1 will check the information entered and may generate an error message describing the problems. Any errors that are found must be corrected prior to starting a dive.
- MultiDeco-X1 will start with the BTM mix selected.
- A travel mix for descent must be selected manually as the diver commences the dive.

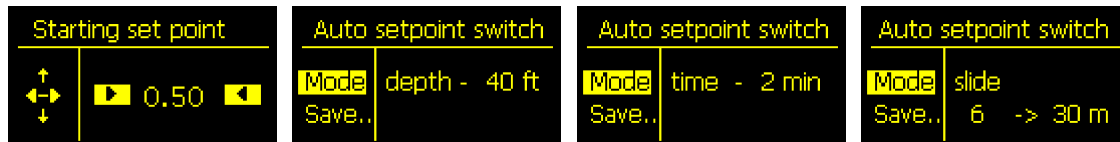
See the underwater menus topic below for details on making mix and set point selections during the dive.

Note for X-Link PO2 module users: When the PO2 data fails / stops / is turned off / or terminates, MultiDeco-X1 will fall back to the manual SetPoint values entered in these mix tables.

The mix quick pick mix list is populated from all the mixes entered into the program. It is a secondary list that can hold about 100 dive legs and mixes, and it will help speed up re-entering common and favorite mixes. The list will grow automatically every time a new mix is entered. The delete list item will remove all entries from the list only, and does not affect the legs in the dive plan.

CCR Initial setpoint

The Start setpoint specifies the initial setpoint to be used when commencing the dive in CCR mode. This screen appears after the Diluent mix setup. This Start set point value is set automatically when MultiDeco-X1 starts a new dive.



CCR starting setpoint, and Auto setpoint switch option.

A second option is the Auto setpoint switch. This will cause the setpoint to self adjust based on a depth or a runtime, or gradually over a range of depths. The setpoint value will transition automatically (provided certain conditions are met) from the Start setpoint value, to the setpoint value of the BTM leg segment in the dive plan, at the appropriate depth or runtime.

The automatic setpoint switch function is subject to these conditions:

- Depth must be greater than 10m / 33ft for a timed setting,
- Proposed new set point must be a higher value than the Start setpoint,
- Any manual manipulation of the setpoint during the dive, or swapping to a bailout plan, will cancel the pending Auto switch operation.
- For the Slide switch, the change applies to descent only. If the dive only descends part way to the maximum switch depth, then the highest achieved setpoint will prevail for the remainder of the dive.

CCR bail out plan

MultiDeco-X1 has two separate bailout plans, each with a maximum of 5 entries. These are named Bailout I and II and they appear in the Dive config menu. Bailout plan mix and leg details are configured in the same manner as the regular dive plan legs and mixes above. Each bailout plan is a completely unique plan, with the possibility of using different mixes and model settings.

Each bailout plan has its own unique decompression model selection and conservatism settings. The bailout plans are separate plans from the main plan. Each bailout plan is calculated separately in the background, and they are ready to be switch into action through the underwater menu.

The model choices for bail out are VPM-B, VPM-B/E or VPM-B/FBO, and each can has its own conservatism settings from 0 through 5. [Fast Bail Out](#) (FBO) model option is described below.

An alarm option will trigger when the TTS (Time To Surface) i.e. required decompression and ascent time combined, reaches the value set for this bail plan. Also the current deco and first stop details for each bailout plan, can be previewed underwater through the [BailOut 1 or 2](#) menu item.

| | | | | | | | |
|----------------|------|-------|------|-----|--------|--------|--------|
| Algorithm | Save | O2/He | Setp | MOD | Save | Bail 1 | Bail 2 |
| UPM-B settings | B1. | 10/50 | OC | BTM | Model | UPM-B | UPMB/E |
| Dil SetP 1-10 | B2. | 50% | OC | pp | Consrv | 0 | 1 |
| Bailout 1 | B3. | | | | Alarms | OFF | 35 min |
| Bailout 2 | B4. | | | | | | |
| - Go back | B5. | | | | | | |

CCR Bailout planning, CCR bail out model and alarm settings.

When a bailout plan is switched into action, the decompression stop depths and times will show those of the bail out plan. If the diver switches back to the main CCR plan, times and depths show those of the main plan again. A flashing “1” or “2” is shown in the middle of the screen when bailout 1 or 2 is engaged.

A bail out plan is computed using this concept: “how to exit the current situation in different ways?” i.e. the divers progress is common to all three plans, with three possible solutions to take from this point onwards. See the [Bail out considerations](#) diagram on the following page.

Note for X-Link users: Bail out plan ascents are computed using a fixed SP value from the mix table entry settings (if the leg is an SP leg). The predicted times of bailout deco will reflect those settings. However, when the bailout plan is selected for use, it commences using the PO2 data applied to the SP legs (unless manually disabled / offline). As usual, if the mix selected is specified as an OC mix, then its computed as OC.

The following points are relevant to bailout mixes:

- Bailout plans are optional.
- Bailout plans must be setup on the surface prior to commencing the dive.
- Each bailout operates independent of all other plan tables ,including model and conservatism settings.
- Alarms will trigger when that amount of decompression time is reached in the bailout plan.
- Either or both bailout plans can be used, or left empty to remove it from use.
- Bailout plans can have an entirely different set of mixes or set points from the base CCR plans.
- Bailout plan can have half a plan, that is, only the details of the early or later parts of a dive – it can have a different BTM mix from the base plan.
- Switching to bail out does not automatically imply OC. OC is determined by the type of mix entered for use in the mix table (OC = sp 0.00).
- When the bailout plan is activated underwater (or a return to the CCR plan), MultiDeco-X1 will start a new set of decompression calculations, using the

current tissue gas loads, the new bailout gas details, and the current diver selected set point ppO₂ values.

The diver can select a bailout plan for use when under water with the underwater menu items Bailout I or Bailout II (see Underwater Bailout menu for sample). The new Bailout plan is then used from this point for the remainder of the dive. The selected mix will move to the BTM item of the selected bailout plan. The initial set point (if the bailout legs are CCR) will be the current underwater setting, or OC mode if the bailout plan BTM leg is an OC leg.

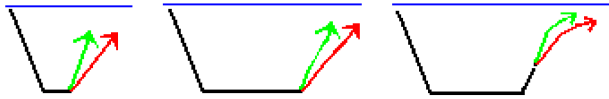
The diver can return to the original CCR plan by selecting the “Back to CCR” menu item.

VPM-B/FBO – Fast Bail Out

The VPM-B/FBO model variation (Fast Bail Out) is for the use with closed circuit diving and a bail out situation. The purpose is to help reduce the required diluent gas volume during bailout (typically a 30 to 50% reduction). A Fast Bail Out ascent will reduce the time spent at the deeper stops, and cause the decompression to expand into the shallow stops. The changed ascent shape is still calculated within the context of the VPM-B model. These ascents are aggressive and have fewer deep stops than a regular plan, but VPM-B/FBO still has more deco time than a matching raw ZHL-16 plan.

The VPM-B/FBO is available to CCR divers only, as a bail out plan model option only. The stop table and required gas volumes can be seen in the [Dive planning](#) tool.

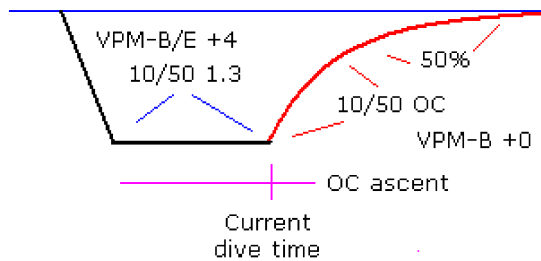
Bailout considerations



Bailout is computed from the "current" location, for all plans. The current location uses a common tissue state in all three calculations.

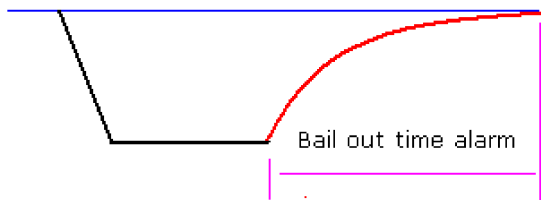


Bailout is not calculated as 3 discrete plans. The diver breaths only one mix at a time - the tissues are in one common state when switching to bail out mode.



Bailout is computed as a hybrid dive of regular SP or PO2, with an ascent of gases from the bail out table.

Each bailout ascent has its own deco model and settings.



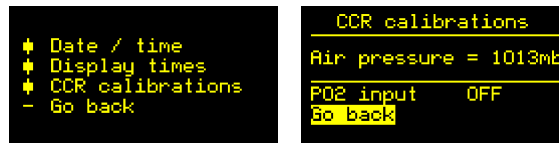
Bail out alarm is triggered on a deco time required value.

Bail out considerations.

CCR calibrations

For the X-Link PO2 module see the [X-Link PO2 calibration](#) topic below.

The ambient air pressure can be read from the X1 under the menus - X1 settings, Clocks/ calibrate, CCR calibrations.



Under X1 settings, Calibrate, current air pressure.

For best results, allow the X1 to run in standby or awake mode for 5 minutes to achieve a stable reading.

Note: The value shown is the raw ambient pressure value. This has not been corrected for the effects of elevation, temperature or humidity. This reading should align closely with a direct reading barometer. The public weather and aviation information requires an elevation correction applied for inland divers.

The pressure sensor in the X1 is designed and calibrated to measure water pressure changes and it is not the best instrument for measuring air pressure. The air pressure reading is probably accurate to $\pm 5\text{mb}$, and may drift further over time. A more accurate reading can be obtained using an atmospheric barometer.

X-Link PO2 calibrations

This section of the manual applies to the X-Link PO2 module only.

The calibrations and control menu is located under menus X1 settings, Clocks/ calibrate, CCR calibrations.



X-Link signal input on/off, calibration details.

This menu displays the following details:

Air pressure

Displays the ambient air pressure over the last 5 minutes. See the [note above](#) concerning the air pressure readings.

Last cal

This shows the time since the last successful O2 sensor calibration was carried out. A successful calibration is required to use the X-Link PO2 module data. Calibrations can be used for 7 days.

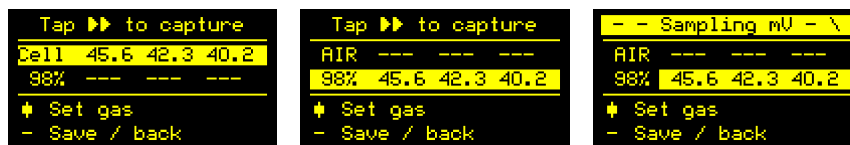
PO2 Input

Turns the PO2 module signal On/Off. The PO2 module must be attached to activate this option On. The display will cycle / show the module version number and the battery state for the module. If the X1 is used in OC or non PO2 CCR dives when the X-Link is not attached, then turn the Input to Off to save on battery power.

Calibrate

Select 1 gas or 2 gas. The X1 accepts calibrations for both a one or two gas calibration procedure. Set this to match your rebreather's O2 sensor calibration procedure. Select the >> arrows and tap further to the right to bring up a calibration screen.

The O2 calibrate screen will display the direct millivolt (mV) readings from each of the connected cell channels. The X1 will accept one, two or three cell inputs, placed in any position of the three channels.



1 and 2 gas calibrate screens. Sample capture in progress.

Calibration procedure

Select or set the calibration gas fraction of O2% that will be used in the calibration procedure. Enter an O2 value that represents the actual FO2 that the sensors will be immersed with during the calibration procedure. MultiDeco-X1 will make necessary adjustments for atmospheric pressure and elevation changes.

Warning: Good flushing technique is essential. Any variance between the value set as a mix, and the actual gas mixture that the sensors experience, will result in indication errors. That error is multiplied when the sensors are in operations at the regular 1.xx Po2 values in the water. For best results, use oxygen and follow your instructors, or rebreather's procedures carefully.

To commence a data capture, scroll up /down to the gas section and highlight the appropriate calibration gas. Tap sideways on the X1 to start the data sampling. The X1 will then sample the O2 cell readings for about 5 seconds. MultiDeco-X1 will apply all corrections required for ambient air pressure during the data sampling as required.

After the sampling period completes, the data sample is tested for validity. See the [X-Link description](#) for details of this. A valid data point set is then saved for reference in later calculations of PO2.

The sampling process may generate one of these errors:

"Cell mV values not in range." This occurs when the readings taken do not match the expected range of values, or are not within a range that meets the specifications of the O2 sensor manufacturer.

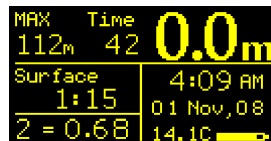
"Cell readings not linear." This applies to a two gas calibration only. The Air sample reading and the high gas reading are compared to test for a linear measurement from a low to high reading. If these do not align, this error is shown.

The calibration process may be repeated as often as required, and a successful calibration is required to accept the data points for use in PO2 calculations. An accepted sample set is indicated by the text "Calibration OK", and the captured readings are then shown in the gas window. Note: poor flushing technique, and incorrect setting of cal mix, can and does introduce errors into PO2 readings as high as 20%.

Synchronizing calibration to an automated primary controller.

On some rebreathers, the primary controller will run it's own automated calibration sequence, or may not easily allow manual flushing afterwards. For these RB's, it is suggested that you carry out the X1 calibration at the same time as the RB is performing its automated sequence. Observe the raw Mv values on the X1 during the automated calibration sequence, and identify the time period of highest readings. Then use that same period to begin the sample process on the X1. Set the sample gas fraction O2% to match that used by the RB during its automated process.

After a successful calibration, select Save / Go back, and return to the main surface screen. The lower left window should now be cycling through the various O2 cell readings converted to a PO2 value.



Surface display with scrolling PO2 cell readings (cell #2 shown).

Oxygen analyzer

This section of the manual applies to the X-Link PO2 module only.

MultiDeco-X1 includes a conventional Oxygen Analyzer display. This can be used to see the raw mV readings of cells, and to calibrate and measure EAN and other gas mixtures. This requires additional equipment: a spare cable connected to the X-Link, with a loose O2 cell and sample tube.

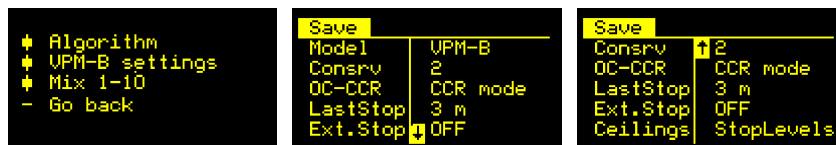
Calibrate against a known mixture (air or compressed O2), and adjust the displayed FO2 display – tap the cursor sideways under each digit, and then up/down to adjust the reading.

```
Oxy analyzer
mV = 11.2 11.9 10.7
FO2 = 20.9 21.0 20.8
Cal      ← set →
Exit
```

Oxy analyzer

Deco model and options

Dive settings are made under menu items “Dive config” and then “VPM-B Settings”.



Model settings menu: Model, Conservatism value, OC / CCR mode, deco stop controls.

Model

Select from either VPM-B or VPM-B/E, ZHL-GF or VPM-B + GFS.

Consrv

Conservatism setting on VPM – select from Nominal through to 5. These levels match the V-Planner desktop settings. For ZHL-GF, set the Lo and Hi gradient values. The Lo is within the range of 10 to 100, and the Hi range is 50 to 100. The Lo value must never exceed the Hi value. For VPM-B + GFS, select the VPM conservatism, plus the GF Hi setting for the GFS.

OC-CCR

Select OC dive mode, CCR dive mode, or “timer only” to turn all decompression calculations off and use the X1 as a simple bottom timer in gauge mode only.

LastStop

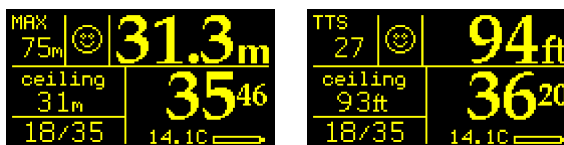
Set the depth of the final decompression stop. Select from 10ft, 15ft or 20ft, 3m, 4.5m or 6m.

Ext.Stop

Extended stops configuration – Select Off/On to engage. To adjust and setup extended stops, select “On”, then “setup” then up/down tap to bring up the Extended stop menu setup screen.

Ceilings

This feature controls the method of displaying a decompression ceiling limit value, and the times required. “Stops” are regular decompression stops, spaced at 10ft or 3m intervals, with a matching time at the stop depth. A “Direct” stops show the precise deco ceiling value. This allows the diver to follow the exact deco ceiling through the ascent very closely.



Direct ceiling display: deco ceiling
limit with smiley depth guide.

In MultiDeco-X1, the “Direct” stop ceiling values have been rounded into 1m, 3ft mini steps. This gives the diver a ceiling limit that is constantly moving up at very short intervals. When the dive ceiling ascends through to 10m, 30ft, the mini stop values reduces to 0.5m, 2 ft levels. With Direct stops, only a ceiling depth limit value is shown and a time limit value is not present. As the dive progresses, and the ceiling reaches the regular Last Stop value, that Last Stop takes effect for the remainder of the dive, and displays a stop time. A Direct ceiling will override and prevent the Extended stop settings from being applied.

Extended stops

The extended stops feature allows the diver to add extra time onto the required decompression stops. This can be controlled as extra time for the required stops at deco mix change points, or other depths as specified. As well the time component can be either added too a stop, or a stop extend out to a minimum stop time value.

| | |
|-------|-----------------|
| Save | |
| When | Mix swap stop |
| Time | 21.100 6 100+ 2 |
| How | Add onto stop |
| Extra | ...add/edit |
| 10-5 | |

| | |
|-------|-----------------|
| Save | |
| When | Mix swap stop |
| Time | 7..30m 6 30m+ 2 |
| How | Add onto stop |
| Extra | ...add/edit |
| 3-5 | |

Extended stops menu

When

Select when the extended stop is applied to the decompression. “Mix swap stops” applies any extended time upon a required deco mix swap only, and any “Extras” applied as well. “Extras only” ignores the deco mix changes, and follows the Extras values alone.

Time

Control the amount of time used in the extended stop. Two settings – the first one for stops in the 21 -100ft / 7 - 30m range. The other applies for depths deeper than 100ft / 30m.

How

Controls how the extended time is applied. “Add onto stop” will add the value of “Time” onto the computed and required stop time of the underlying deco stop. “Ext time too” will extend the current required stop time out to a minimum of the “Time” value. For “Ext time too”, if the actual required stop time is longer than the Time setting here, then the underlying stop time will apply.

Extra

Specify any manual extended stop times here. These values will be applied to the ascent when encountered in the dive, and not tied to any mix swap conditions.

Set the depth and time values, and the settings will show in the bottom row of the display. The sample picture above shows: 10ft for 5 minutes / 3m for 5minutes.

A diver can perform the extended stops, without the need to have entered the details before the dive. To do this, simply overstay at the current stop for the desired time, and the dive remainder will be calculated with this extra time considered.

The following points are relevant to extended stop behaviour:

- Extended stops will not appear in NDL dives. A dive must require real decompression stops to occur before any manually extended stops configured here will be appended to the ascent.
- Extended stop times for a particular depth will only display, and be time adjusted when an underlying real deco stop actually exists.
- The extended time will be applied to the initial required deco stop times only.
- If the diver is late arriving at the stop depth, then the extended times set by this option may have reduced or passed already.
- The decompression calculation takes this extended time into account, and subsequently the adjacent stops that follows after this lengthened stop, will usually have reduced stop times.
- Extended stops cannot be configured in the water.
- Extended stops will not apply with using the “Direct” deco ceiling.

Elevation diving in lakes and rivers

The X1 will measure the air pressure at the dive site when in Standby mode or Awake mode. MultiDeco-X1 will measure an average of air pressure over the five minutes before starting the dive. Divers should allow the X1 to run for a few minutes before starting a dive, and this is extra important for those divers who travel to / from home / dive site, when the elevation of each is quite different.

The air pressure information is applied to the decompression calculations automatically, and the X1 will display depths and decompression limits that have been corrected for the effects of the current ambient air pressure and elevation.

The atmospheric pressure is available for viewing in the [CCR calibrations](#) menu.

Repeat dives

MultiDeco-X1 will display the surface time since the last dive during the surface display. MultiDeco-X1 tracks and computes the residual tissues loading components, and applies this to the next dive. This will result in a slightly reduced NDL time and decompression stops that accumulate more quickly on any dive that follows within a few hours. The repeat time component will be similar to conventional NDL limits and reductions of recreational diving tables. The VPM model conservative settings can have a large effect on the resulting NDL times of follow on dive.

MultiDeco-X1 does not provide any advance information or display to predict or show the diver the reduced NDL times of the subsequent dives. This information is only calculated as the dive progresses in the water.

Multi-day dives

Divers must make extra allowance for multi-day dive profiles, or other multiple dive sequences that place the diver at additional risk. In these situations, the diver should refer to their training for the appropriate additional rest or additional safety margins and decompression stops for multi-day diving, and apply these to dive plans and the limits shown by MultiDeco-X1.

Bounce and yo-yo dives

Bounce dives and yo-yo style dives (short deep exposures, or deep spikes with little or no bottom time) will add additional risk. The decompression requirements on this style of dive profile are influenced greatly by the diving procedures carried out, and the choices of breathing mixes. Problems encountered with these and other considerations of deep bounce or yo-yo dives, and the additional times needed to clear these problems, can greatly exceed the relatively shorter displayed decompression times. Decompression obligations can accumulate at a rapid rate for very deep dives. A diver who undertakes these risky dive profiles, should apply additional safety to all plans and time limits shown.

Diving the X1 and MultiDeco-X1

Overview

Divers should review the current settings and dive configuration prior to entering the water with the item “Dive planning” and “Current config” menu item. Many of the configuration and setup items can only be adjusted on the surface, and are not available during a dive. Any omissions may require the diver to re-surface and adjust.



The current dive plan summary selection with OC and CCR samples.

The X1 should be powered up with the surface view display showing when entering the water and leaving the surface. The X1 can start by itself from standby or shutdown mode when underwater, but the recommended method is to have the X1 fully awake with the screen active.

The yellow Oled display on the X1 can be difficult to read in the sunlight. Set the display to Medium brightness for outside use. In the water during the dive, the display is easily read at the low setting.

When the diver climbs into his/her diving rig, the struggles and bumps can easily create inadvertent taps and cause the X1 to enter menu mode. Subsequently the motion can create menu tap commands that were not intended, or change items at random. To avoid this situation, set your X1 tap strength to “Hard”, and / or the tap count to five. Divers with scooters also need to be aware that the vibrations from the scooter handle can trigger unwanted taps and apparent auto select of random menu items.

The conservative level setting in the Model config menu, can have a significant effect on the NDL and decompression time limits shown. To match NDL times to the typical recreational times, set the conservatism to 1 or 2. For increased decompression times, set the conservatism to higher values.

The X1 can be worn on either wrist and the screen display inverted via a configuration item (flip screen). This also allows the accessory pin pads to be facing inboard from either wrist.

A diver will sometimes want to drop down under the surface to pick up items, before commencing the dive proper, and this would normally cause a dive record to start and end briefly in the computer. MultiDeco-X1 allows for this situation, and will compound any short surface intervals (less than 5 minutes) into a single dive record. Any brief surface intervals during or after a dive are also compounded into a single dive record. The displayed runtimes will resume and continue where it last finished upon surfacing.

The X1 will enter into dive mode automatically when passing a depth of 1.6m or 6ft deep from an Awake or Sleep state. Dive mode will stop on ascending through 0.5m / 1.5ft.

The X1 will commence the dive with the dive plan's Bottom mix auto selected (BTM item). For CCR divers using a fixed setpoint, the "Start SetPoint" value is set automatically into the Setpoint field on each new dive. If the Auto Setpoint switch is activated, then this will increase the setpoint automatically at the appropriate depth or time. At all other times, the diver will need to manually adjust the setpoint to use through the remainder of the dive.

For CCR divers with the X-Link PO2 module, the current highest PO2 signal will show in the mix window. PO2 mode is identified by the prefix "PO2" to the value, where as a manual set point mode dive uses a reversed value followed by a suffix of "spt". If the X-Link module fails to start (or is missing) when first submerging, a "No PO2 data" error shows, and it must be cleared manually. A dive that starts as a failed PO2 dive, must surface to repair the fault – repairing the fault in the dive, will not restore a PO2 mode.

The X1 will display Depth and Time throughout the dive. If more than one mix is set into the dive plan, then the current mix selection will also be displayed.



OC and CCR underwater display samples with a NDL time of 9 minutes,

Left: 32% EAN mix selected in OC at 89ft deep.

Middle: The CCR has a set point of 1.25 at a depth of 27.3m.

Right: CCR with X-Link PO2 value of 1.01.

All show the runtime of 21 minutes and 35 seconds.

Descent and ascent

MultiDeco-X1 will sense the changing depth and show an ascent or descent rate in the upper left corner. This will be in units of Meters per minute (mpm) or Feet per minute (fpm). It also shows an up or down arrow along with the value. Any rates that is less than 12 fpm / 4 mpm are not shown.



Top left window changes to show ascent / descent rates.

NDL – No decompression limit

The dive computation will run continuously, re-computing the ascent from the current position every few seconds and displaying the results. The X1 starts the dive computing an NDL limit for the dive. This is displayed in the middle left window. The NDL times are similar to many recreational dive limits in use. NDL times greater than 99 minutes are not shown and replaced with three dashes. As the dive becomes longer or deeper the

NDL time will reduce to 0 minutes, and then this window will convert to display Deco Stop depths and time limitations as appropriate. At this point in the dive, decompression stops are required. The maximum depth is displayed in the top left of the display.

Decompression stop limits for ascent



A decompression stop limit of 110ft for 1 minute.

EOD (end of dive), TTS (time to surface), MAX (max depth) samples.

The decompression stop information is shown in the middle left window, as a stop depth and required time at that depth. As the dive progresses, the depth and time values will increase. During the subsequent ascent, the diver will need ascend up too, and hold the depth shown in the middle left window.

The top left window will cycle through three different displays: EOD = End of Dive time. It is the sum of runtime + the TTS time. TTS = Time to Surface. This is the time required to complete all decompression stops and the ascent fragments to reach the surface. MAX = Maximum depth for the dive. When the diver is moving up or down in the water, the top left display is replaced with an ascent or descent rate value.

Decompression stops

When the diver is approaching the decompression zone and the displayed deco stop depth, a new smiley window display is shown in the top row. This is a scrolling graphic of the relative position of the diver to the deco stop depth.

When the diver is deeper than the required stops, a set of up arrows prompt the diver to rise up to the decompression stop level.

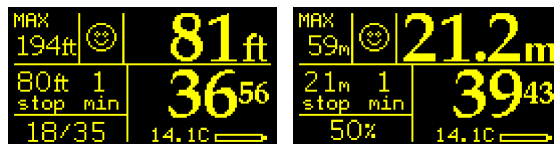


Left: approaching the required stop depth with up arrows,

Middle: getting closer and the smiley scrolls into view,

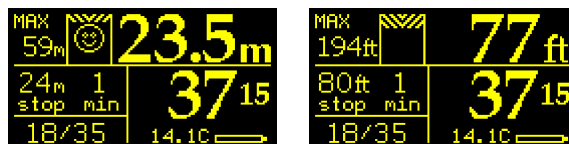
Right: diver is positioned at the stop depth, with the smiley centered.

As the stop level is approached, a smiley face will scroll into view and eventually center in the window as the diver reaches the displayed stop depth. The diver can monitor his/her location with the smiley face alone by aiming to keep the smiley centered in the window.



Diver positioned at the stop depth, with the smiley centered.

If the diver was to ascend above the required stop level, then a hard ceiling graphic lowers into view in the smiley window. If this intrusion above the deco ceiling is excessive, then the smiley face is deleted and the flashing hard ceiling is shown and intrudes further into view. To correct this situation, the diver must descend back down to the required decompression stop level.



Diver rises above the decompression stop limit.

The hard ceiling graphic intrudes into the picture, and replaces the smiley.

Diver needs to descend have the smiley return.

Direct ceilings

A “Direct” ceiling does not use the conventional stepped deco stop levels, but instead slowly decreases the ceiling limit to show the precise decompression ceiling value. This has the advantage that it allows the diver to follow the exact decompression ceiling though the ascent very closely. This will usually provide a slightly reduced overall decompression runtime, particularly on very deep dive profiles. The Direct ceiling limit will change often and by smaller amounts, and requires more attention from the diver to monitor and to follow these limits.



Direct ceiling display: deco ceiling limit with smiley depth guide.

For depths greater than 30ft / 10m the Direct ceiling limit is shown as a small decrements of 3ft / 1m. From 30ft / 10m up to the Last stop depth, the Direct ceiling mode will provide smaller steps of 0.5m and 1ft. When the Last stop depth is reached, the regular Last stop will take over. When a Direct Ceiling is being displayed, the individual stop times are not shown. The smiley face display is shown during direct ceilings, and is the easiest source for the diver to adjust depth with. When the deco reaches the last stop depth, the regular Stop display shows for the remainder of the required decompression.

Scroll Screen views

For CCR diving, the main dive screen can be scrolled to bring up a different view. To scroll the screen, two side taps on the X1 will scroll the display view layout to another. Continue scrolling in a loop with two side taps to return to the original display. Note that the compass display has priority over this display feature.



Alternate screen views, scroll these into view with two side taps during the dive.

Underwater Menus and settings

Overview

The underwater (UW) menus are activated with three or five taps on the top of the case of the X1. The menu system will display and various items are available, depending on the dive settings and the dive conditions. Scroll up or down the list, including items off screen, and then select the item by a left or right tap.

Note also that the Screen Scroll views are activated with side taps, but are different from the menu system described here. See [Screen Scroll](#).

These are samples of the most common menu items underwater, and the order and items may change, depending on the dive and options.



Sample OC and CCR underwater menu items.

The actual items available depend on the dive and settings (some items not shown).

After ten seconds (adjust with timeout menu), the menu system will vanish, and the regular depth and time dive display returns. If the diver selects and item and completes those choices, then the dive display returns immediately.

Under the water, the menu selection and scrolling is easily a performed with gentle but firm tapping action with the index finger. A pinch motion with the thumb or index finger to top or bottom works well too.

The order of underwater menus can be reorganized with X1 Config [MenuOrder](#) setting.

The following points are relevant to diving MultiDeco-X1 and menus in all dive modes:

- MultiDeco-X1 will not switch mixes for the diver. The diver must select any mix changes underwater manually.
- MultiDeco-X1 will start the dive using the bottom mix item from the dive plan (BTM item).
- If a descent travel gas is used, it needs to be selected by the diver after submerging.

- The diver can adjust the selected mix via the underwater menu items “Deco mix”, or “Diluent”. The set point is adjusted via underwater menu item “Set Point”.
- MultiDeco-X1 will monitor the current mix selection during decompression and compare these to the initial dive plan. It compares these based on the depth of the stop, and the pp or MOD settings used in the initial plan. It will flash the mix display if they do not agree.

The following points apply to menus with CCR divers using a fixed setpoint:

- The initial set point value is per the Start set point value specified in the CCR mix entry table.
- MultiDeco-X1 will not adjust the set point value ever (except for the initial Auto Setpoint select). The diver must make any set point changes manually underwater.
- When the Setpoint menu is first activated, the initial value shown will be that of the planned bottom mix Setpoint (to facilitate a quick swap after descent).
- When a new diluent is selected, the current set point value remains active. Any changes required to set point under water for constant / fixed CCR, require the diver to change the set point manually.
- The diver can have MultiDeco-X1 monitor the current setpoint at various stages through the dive. See the [Alarms](#) topic for details.

The following points apply to menus with CCR divers using the X-Link PO2 module:

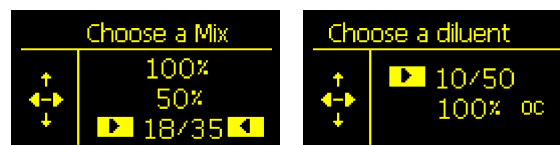
- Setpoint menu is not available during PO2 operations.
- If the PO2 data stops or fails, then the X1 will adopt SetPoint mode automatically, and the SetPoint menu conditions described above will apply.

Deco Mix / Diluent

Deco mix

Diluent

These menu items bring up a list of available deco and bottom mixes. Scroll up / down and side tap to select a new breathing mix. Use this list to have MultiDeco-X1 change the current mix selection, and start computing the dive with this new inspired mix. Note that MultiDeco-X1 will not switch deco mixes, and the diver must make all selections manually through this menu item.



Deco mix or Diluent swap selection menu.
Up / down tap to scroll, left or right tap to select.
Selected item will appear in bottom left window of dive display.

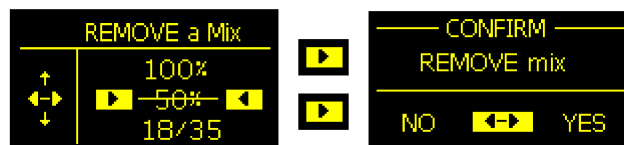
After selecting a new mix underwater, the current NDL or decompression limit times are replaced with the word “WAIT” while the new result is computed and displayed. Normally this is just a few seconds, but can be up to 10 seconds for dives of 150m / 400ft or more.

These menu items are not present when only one gas is used. The items in this list are those set by the diver in the dive plan, before the dive started. This list can be modified during the dive, by removing a mix with “Lost Gas” menu, or by adding to the list with the “Add a mix” menu item.

Lost Gas

LOST GAS

This menu is similar to the Deco Mix list. A lost gas is one that no longer is usable in decompression. Selecting and removing a mix here will exclude it from the current decompression calculations. The concept of this item is to allow re-planning underwater when a deco mix has become unserviceable.



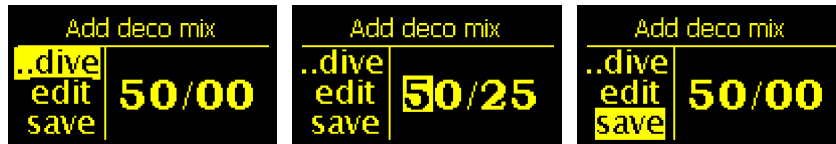
Mix 50% has been removed from the plan and the decompression calculations.
It can be restored by repeating the same procedure.

Lost or excluded mixes will appear with a strike through text. As a result of excluding a mix, the required overall decompression and dive run time will lengthen. A gas can be restored to usable state by repeating this selection process, and the display above will instead say “Restore”. This menu item is not present when only one gas is used.

Add a mix

Add a mix

Use this menu item to insert a new deco mix into the current dive plan and calculations. The concept of this menu item is to permit the diver to correct for omissions in the current plan. Note that the recommended method is to add deco mixes on the surface prior to entering the water.



..dive: returns to the. Edit: scroll right, then up or down to adjust mix.
Save: save and add this mix to the dive plan and mix selection lists

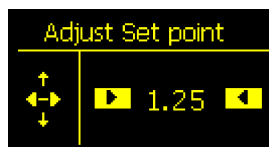
The following limits apply to adding a new mix:

- Only deco mixes can be added i.e. the O₂ component of the new mix must be greater than the current BTM mix O₂ component.
- The added mix is inserted and calculated into the plan immediately.
- The new mix must be selected manually, as per the Deco mix / Diluent menu above.
- There must be a blank entry in the existing mix table. When the OC / CCR reaches 10 active legs (5 for bail out), then any attempts to add more mixes is ignored.
- Duplicate mixes are ignored.
- This procedure does not restore a Lost mix – to restore a crossed off (lost) mix, repeat the Lost Gas menu again.

Set Point

Set Point

For CCR dives – adjust the constant or fixed set point ppO₂ to match the value in the rebreather. Scroll up down to adjust, side tap to accept. This new selection will then be used for all decompression calculations. This new value overrides any value set during dive planning. The current Set point selection is displayed in the lower left window of the dive screen.



Underwater set point adjustment.
Scroll up down to adjust, left right to accept.

When this menu item is first activated on each dive, the initial value will be preset with the planned setpoint of the bottom mix. This is to allow for a quick selection to advance from the low setpoint value used in the descent, up to the regular bottom portion setpoint value. See also the [CCR Initial setpoint](#) topic.

After selecting a new set point value underwater, the current NDL or decompression limit times are replaced with the word “WAIT” until the new result is computed and displayed.

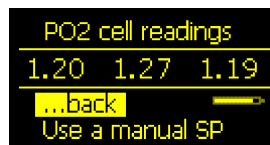
Normally this is just a few seconds, but can be up to 10 seconds for dives of 150m / 400ft or more.

PO2 value

PO2 value

This section of the manual applies to the X-Link PO2 module only.

This item will bring up the PO2 control menu and data view screen.



Display of current PO2 readings from each data channel.

“back” returns to the dive screen.

The X-Link battery state is visible here too.

The values shown in this screen are the latest reading received, and will update every second. A single or twin channel input will show only those channels.

If a channel has stopped sending data, or has gone offline for other reasons, it will be displayed with the value crossed out.



A cell reading crossed out indicating that channel signal is not available.

The diver can terminate PO2 data by selecting “Use a manual SP”. A confirmation is required. Once SP mode is selected here, MultiDeco-X1 will remain in this manual SP mode for the remainder of the dive. The initial setpoint used here, is the value entered in the dive plan mix tables. The diver must control the SP manually from this point onwards via the [Setpoint menu](#).



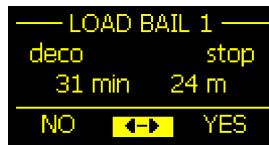
Confirmation screen to terminate PO2 mode and assume a manual setpoint mode.

WARNING: When the manual setpoint is selected, all PO2 data is removed from the screen and menu system in MultiDeco-X1 – you cannot view any PO2 data! Use the rebreathers primary PO2 display to view your PO2 information from this point onwards.

Bailout I and II, Back to CCR

Bailout II Back to CCR

These items allow the diver to switch from the regular CCR plan, over to a bailout out plan quickly. There is a confirmation page to prevent accidental entry to Bail out mode. After a bail out plan is selected, the diver can return to the regular CCR plan with the Back to CCR item. The bailout plan items must be completed on the surface before the dive. If a bailout plan is blank, then it will not be available underwater. See the [CCR bailout](#) section for more information on bailout plans.



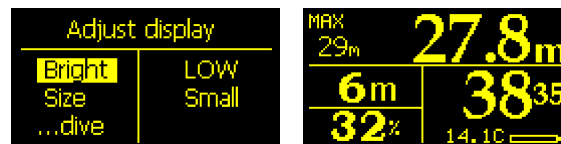
A confirmation screen before switching over to the bail out plan.
Screen includes a preview of the required TTS (deco) and first stop for this bailout plan.
Select Yes or No and tap up or down to accept.

A flashing “1” or “2” is shown in the middle of the screen when bailout 1 or 2 is engaged.

Display

Display

Options for changing screen brightness and text sizes. Font size small / big will adjust most of the text and numbers in the dive display, and most menu items.



Screen brightness and dive display text size adjustments.
Sample “big text” display.

The brightness has three settings. In direct sunlight, the High setting is usually needed to read the display. Underwater the Med is often enough, and Low at night or for indoors use.

Note: Avoid using the High setting. The Oled (Organic light emitting diode) display is prone to a burn in condition, much like early CRT computer screens. Just 10 hours of use at high settings will show permanent marks in the display.

For owners of the X-Link, an extra option will named “PO2 data” appears in the Display menu. This will change the PO2 display format. See the [PO2 display topic](#).

GF Adjust

GF Adjust

When the current dive plan is using the ZHL-GF decompression model, the GF settings can be adjusted during the dive. Care is required to only set GF values that are relevant to the current dive state.



Adjusts the ZHL-GF settings during a dive.

Ceilings

Ceilings

Controls the method of displaying a decompression ceiling limit value, and the times required. “Stops” are regular decompression stops, spaced at 10ft or 3m intervals, with a matching time at stop the depth. A “Direct” ceiling shows the precise deco ceiling value. This allows the diver to follow the exact deco ceiling through the ascent very closely. In MultiDeco-X1, the Direct ceiling values has been rounded off slightly to 1m, 3ft mini steps. When the dive ascends through 10m, 30ft, the mini steps reduces to 0.5m, 2 ft levels. With Direct ceilings, only a ceiling value is shown and a time value is not present. When the ceiling reaches the Last Stop value, the regular Last Stop takes effect, and displays a stop time.



Sets the deco ceiling style.
Up down to change, left right to accept.

LastStop

Last Stop

Set the depth of the final decompression stop. Select from 10ft, 15ft or 20ft, 3m, 4.5m or 6m.



Sets the depth for the last decompression stop.
Up down to change, left right to accept.

Stop table

Stop table

This menu item will bring up a table of individual stops and times for each stop. Note that this menu is available when there are at least two deco stop levels remaining to be carried out. Tap the top or bottom case to scroll the list. Tap to the side to exit. The stop table list will show stops down to 300ft or 90m only. Stop time shown is the individual time required at each stop, and do not show total runtime information. The total runtime can be seen in the TTS item on the regular dive screen.

| | |
|----|----|
| 10 | 14 |
| 20 | 10 |
| 30 | 8 |
| 40 | 5 |
| 50 | 3 |
| 60 | 2 |

In this example the depths from 10 through 60 on the left, and times at each level (14 mins at 10ft).

Alarms

Alarms

This turns the Alarm checks Off, Silent or ON (with the beep). The alarm values that trigger here must be set before the dive. See the [Alarms](#) topic for details.

Stopwatch

Stopwatch

This brings up the timer, stopwatch and regular time display. The stopwatch is a three press type of stopwatch where the actions perform a start, stop and reset. The timer will continue to run and add time through the surface interval. This item must first be enabled in the [X1 Settings](#). The stopwatch time will appear on the dive screen, compass screen and the bottom timer screen, underneath the current dive time.

Bookmarks

Bookmarks

This item allows the diver to record a waypoint or bookmark during a dive. See the [bookmarks](#) topic for details on setup procedures. The 5 available bookmarks are shown in a list. Up or down tap to select the individual bookmark, left or right tap to record the current dive time into this bookmark. The memory will hold the last 20 recorded times and dive numbers. The same bookmark can be reused in the same dive, and will appear as multiple entries in the dive logs.

Compass

Compass

This brings up the underwater compass display for navigation. See the surface [Compass](#) topic for notes of calibration and magnetic variation, and a full description of these compass elements. Note that the compass is “attitude sensitive”, and it will only display information when the face is being held flat. The compass display will remain onscreen for the time set in the [Display time settings](#). After this time period, it will return to the regular dive display. To leave the compass display earlier, tap 3 times to bring up menus and select the “...dive” item.

All decompression information including gas changes, stop levels or times are not displayed while the compass is being used. Return to the regular underwater display screen to see this information.

The compass display screen will not show if an Alarm or Warning is present, and the display will revert to the regular dive screen, if a warning or user alarm occurs while viewing the compass.



Left: X1 orientated to a heading of 045 degrees.
Right: blank display when X1 is tilted too far from horizontal.

The compass in the X1 requires a calibration procedure before use. See the surface [Compass](#) topic for details. The compass will also perform a self calibration while it is being used in the water. The compass display will only show information when it is being held flat (face upright). The screen information will go blank if the device is tipped over at an angle. If the diver finds a continuous blank display in the water, then simply

perform the calibration orientation procedure - roll, turn, twist and invert the X1 through all attitudes and angles – including upside down. The X1 should then display heading information when returned to the flat and level position.

Return to dive

...dive

Closes the underwater menus and returns to the dive display. This will also happen automatically after the value set into Display Times outs – UW menu.

After the dive

When a diver surfaces, MultiDeco-X1 will return to surface mode display. There is a five minute period where the diver can return to the water and resume the same dive. In this situation, the dive run time resumes where it left off when last surfacing. After five minutes on the surface, and new dive log and entry will begin upon the next dive.

After ten minutes or so on the surface, the X1 will automatically turn off the display and enter standby mode to conserve the battery. The X1 can be brought back to awake state with three taps. About an hour or so after surfacing, the X1 will shut down completely until the next time the diver wakes it up. In this situation, the X1 needs to be awoken with water contact on the side pins (use a wet finger to bridge the pins or a splash of water). See the Display Times menu to adjust these time settings.

The dive just carried out, can be reviewed with the surface menu item “[History](#)” and “Dive Logs” or “Review”. There are tables of data, and graphs of depth and temperature available. See the History / dive logs below.

Beeps, flashes and alarms

During the dive



Alarm symbol – this flashes in the lower right corner of screen for all errors.

MultiDeco-X1 make beep sounds under the following:

- Dive starts or ends – one long beep;
- Decompression starts or completes – one long beep;
- The required deco ceiling rises up one step level – two shorter beeps.
- When a diver exceeds 1.6 ppO₂, or breaks the decompression ceilings – a series of short beeps.
- When any of the user Alarm settings is met and alarms are set to ON – a series of short beeps,
- In CCR mode, a bail out time alarm is reached.
- Any of the X-Link PO₂ alarms show.

MultiDeco-X1 will cross check for the divers adherence to deco stops and the dive plan. The following items are checked and various alarms or flashes are generated.

- Diver rises above deco ceiling: Ceiling drops into smiley window, Deco stop value flashes.
- A deco mix switch was planned, but is not yet selected by the diver – bottom left mix value flashes. This will continue until the correct mix has been selected.
- Inspired mix exceeds 1.6 ppO₂: Bottom left flashes “ppO₂ 1.6”, and the current ppO₂ is displayed in the lower right window (replacing the Temp value).



Deco ceiling violation warning, Mix swap reminder,
1.6 ppO₂ warning shown when exceeding that level,

The alarm symbol – a bell, will flash for every error that occurs and remain on until the error is resolved. It is displayed on screen underneath the time.



Alarm symbol – this flashes in the lower right corner of screen for all errors.

Missed deco

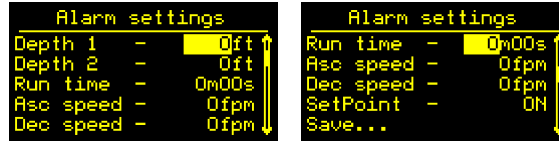
If the diver has surfaced with some decompression stop time still remaining to be completed, then MultiDeco-X1 will:

- Beep for 5 minutes.
- Flash an Alarm and descent symbol for 12 hours.
- Show the missed stop level that was violated.



The upper right window, showing the Alarm and descent symbols. These will occur when a diver surfaces without completing the decompression stop obligations.

Alarm settings



Alarm settings that will trigger during the dive.

The diver can set additional alarms into the X1 under menu X1 settings, Alarm config. When triggered, these will cause an alarm bell symbol to be shown under or next to the appropriate related item, and to flash (time, depth, ascent, decent rate), and a series of short beeps.

SetPoint Alarm

This applies to CCR dives with a fixed setpoint only. It will trigger for three different situations:

- At 5 minutes into a new dive, it checks to see if the Setpoint has been adjusted from the initial descent value (only when 20m or deeper). This check is cancelled when the Auto Setpoint switch is activated and has been tripped by its settings.
- During the ascent on decompression stops, and if the dive plan has adjustments to the setpoint in ascent, then it will check for changes at the correct depths to the planned setpoints (within 0.10).
- It will monitor the current setpoint to ensure it does not exceed the ambient ATA pressure (typical during the last 2 deco stops).

O2 stop ppO2

This allow the diver to set the ppO2 at which the alarm triggers for the final stop when using 100% O2 as deco mix. The selections are a ppO2 of 1.6 or 1.9. This option is intended only for those performing O2 stops at 9m / 30ft.

The Alarms can be operated in silent mode where the screen only flashes, or full on mode that has the alarm beep too.

The buzzer tone frequency can be tuned up or down slightly with the X1 Configuration menu.

Diver errors and decompression mistakes

Real life diving practices in decompression can sometimes include a variety of unintended and small excursions across limits or other infringements into deco zones. Also the diver rarely stays perfectly still during a deco stop to maintain the exact stop depth. Regardless of these diversions, MultiDeco-X1 is tracking the divers every move and re-calculating the results accordingly. MultiDeco-X1 will always do its best to compute the current required decompression stops. There are no lock out or “use tables” errors of any kind in MultiDeco-X1.

Small / brief deco ceiling infringements

If the diver breaks the deco ceiling by rising a small distance above the decompression ceiling limit, the diver is essentially speeding up the deco (called pushing the gradient). That is, the small increase in off gas gradients and off gas rates from the reduced ambient pressure (less depth), has sped up the deco overall.

In all cases MultiDeco-X1 is monitoring the diver's depth and computing this into the current gas loads and showing a set of limits accordingly. Short incursions into the deco zone, will not have any noticeable change on the final runtimes.

MultiDeco-X1 will warn when the diver breaks the deco stops limits, by flashing the alarm symbol, flashing the Deco stop depth and beeping. MultiDeco-X1 will continue to compute the deco as normal, taking these depth variations into the computations.

Larger deco ceiling infringements

If the diver breaks the deco ceilings by a large margin, i.e. was to rise up and miss several decompression levels, or to surface with decompression time still showing as required, then MultiDeco-X1 will still continue to compute the dive and deco stops required. If the diver can return to the required deco stop level within short time, then the diver can resume deco stops. The diver should however apply additional safety or take corrective actions for any large decompression stops mistakes.

NOTE: MultiDeco-X1 does not apply any penalties or extra time to decompression stops or runtimes for any diver decompression stop mistakes, or diving practices that infringe into the deco zone. It is up to the diver to decide if the infringement experienced, should require additional decompression time, whether to resume or even to abandon decompression altogether. When the diver has intruded excessively into the decompression zone, the information shown on MultiDeco-X1 should be treated as a guide only for the remainder of the dive, and the diver is to add an additional safety margin to the decompression stop times to adequately compensate for the deco zone infringement and diver errors.

NOTE: In these situations described above, and other areas of diving emergencies or mistakes, the diver should refer to their training for the appropriate corrective actions.

Gauge mode / bottom timer

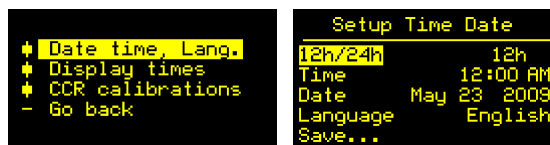
MultiDeco-X1 includes a bottom timer or gauge mode of operation. This is selected in the X1 setting – dive type and again from Dive config, settings, OC-CCR mode. Set either to Timer to have the X1 operate in basic bottom timer mode.

NOTE: The operation in Timer mode does not track or contribute to subsequent decompression modes (OC / CCR modes). During bottom Timer mode, no decompression calculations are performed and the tissue states are not tracked. Bottom timer is a separate and independent state.

During Timer mode, the X1 shows just the depth and run time, and an average depth of the dive. It will also show ascent or descent data as appropriate. A unique set of underwater menus includes an “Average reset” item that will reset the averaging values used in the display of average depth data.

Bottom timer mode has it's own surface display screen that shows various data relevant to. This screen is similar to the review screen available under the History menu.

Clock & time, Language



The Clock and language setting is under the Date / Time menu

The time and date are set into the X1 with the Date / time menu item. When the X1 first boots up, this menu is presented for setting, and again after the battery is fully discharged. All dive logs, surface times and tissues data is based on the clock settings supplied on the initial settings.

The time seconds value (which is not shown) is set to zero each time the Save is selected.

When the diver shifts geographic location into a new time zone, the clock should be reset to the new local time. The same applies for daylight saving changes. This will give relevant time details to all the saved logs and graphs. Note that changing the time settings will not change the displayed surface intervals. MultiDeco-X1 understands that the diver may shift in time zones, and adjusts automatically for a global time applied to the tissue state and surface interval times.

The Language item will change the displayed texts into a different language. Current languages are English, French, German, Italian, Czech, Dutch, Norway and others available in the near future.

Dive planning

MultiDeco-X1 includes a dive planning tool. This can be used to generate tables of stop times for the next dive, and to see the impact of a surface interval on the next dive. The result can be written onto the divers slate as a back up table. This feature also includes gas planning and gives total volumes for all OC gas predicted for the plan.

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---------|-----|----|-----|--|--|-----|-----|---------|------|--|--|--------|--|--|--|----|----|----|----|----|---|----|----|----|---|----|----|-----|---|----|----|-----|---|----|----|
| <div><div>✦ Current config</div><div>✦ Plan next dive</div><div>✦ Next dive deco</div><div>✦ Check list</div><div>- Go back</div></div> | <div>Plan - depth time</div> <table><tr><td>1.</td><td>45m</td><td>30</td></tr><tr><td>Add</td><td></td><td></td></tr><tr><td>SAC</td><td>20b</td><td>16d LPM</td></tr><tr><td>Calc</td><td></td><td></td></tr><tr><td>GoBack</td><td></td><td></td></tr></table> | 1. | 45m | 30 | Add | | | SAC | 20b | 16d LPM | Calc | | | GoBack | | | <div>CCR plan - stops</div> <table><tr><td>3m</td><td>12</td><td>70</td><td>rt</td></tr><tr><td>6m</td><td>8</td><td>58</td><td>rt</td></tr><tr><td>9m</td><td>6</td><td>50</td><td>rt</td></tr><tr><td>12m</td><td>4</td><td>44</td><td>rt</td></tr><tr><td>15m</td><td>3</td><td>40</td><td>rt</td></tr></table> | 3m | 12 | 70 | rt | 6m | 8 | 58 | rt | 9m | 6 | 50 | rt | 12m | 4 | 44 | rt | 15m | 3 | 40 | rt |
| 1. | 45m | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Add | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SAC | 20b | 16d LPM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Calc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GoBack | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3m | 12 | 70 | rt | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6m | 8 | 58 | rt | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9m | 6 | 50 | rt | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12m | 4 | 44 | rt | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15m | 3 | 40 | rt | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Plan next dive – dive level entry, SAC entry, dive plan.

Dive planning uses the current tissue state in its calculations, and the elevation history. The stop times shown will change to reflect current conditions of surface interval, elevation and dive plan. If the diver was to follow the planned depth and time levels exactly, they could expect to see these limits displayed.

However, the in water dive calculation is based on the actual diver performance and data collected during the dive - ascent limits are calculated from actual tissue state. It will not follow this table, and divers normally do not follow the plan perfectly. Expect to see slightly different times during the dive – depending on how far the diver strays from the plan.

The table result is shown on the “Next dive deco” screen. Scrolling downwards, the planned gas volumes are shown for each OC gas used. Gas volume does not include any reserves. The diver should adjust the rate, or apply additional volumes to include a reserve.

For CCR planning with bailout plans, the bailout plans are computed and displayed below the main CCR plan. Bailout on OC is computed as starting at the beginning of ascent. See the [Bailout considerations](#) diagrams above.

Operation

Add a level

Scroll to the Add line, enter the center screen and scroll up/down to set a depth and a time. Return to the Add in the left column, and the leg will be included in the calculations.

Edit / delete a level

To edit a level, tap into that level and adjust the depth or time. To Delete a level, set either the depth or time to zero(0) and exit that level row.

SAC rate

Adjust the SAC rate (or RMV) for use in the gas volume predictions. Two rates are provided – a bottom (b) segments rate and a deco (d) segments rate. The

bottom rate is also applied to the initial ascent to first deco stop. Adjust the units to LPM (liters per minute) or to CuFt (cu.ft. per minute). The resulting data will appear below the table data on the “Next Dive deco” screen. SAC calculations do not include reserves.

Calc

This starts the calculation of the plan. This can take some time to complete. The table result is shown on the “Next dive deco” screen.

Comparing plan times to the desktop V-Planner

The dive results from MultiDeco-X1 Dive planning and the desktop V-Planner plans can be made to align closely. Set the desktop program to the following configurations:

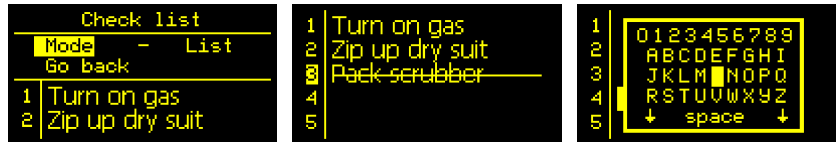
- Use the divers profile in the desktop – not Guest mode.
- Set descent at 60fpm / 18mpm and ascent at 30fpm / 9mpm
- Upload the tissue state from the X1 into the desktop V-Planner.
- Set the water type, elevation to match your current elevation, and check the ppO2 mix swap points match.
- CCR divers need to have ATM set points, and to check the Start set points match.
- Plans will match more closely with 30 second stop time rounding.

However, each program does some of its tasks differently, including the way it presents the first stop, and the rounding applied to ascent times. The dive and stop times will usually align within a minute or two, when the configuration and tissue states are synchronized. MultiDeco-X1 dive planning does not include any of the complex planning options of the desktop V-Planner program. Close attention is required in keeping the surface interval correct in the desktop V-Planner, and to making the configuration option match.

MultiDeco-X1 is calculating a plan based on actual tissue state from the last dive, and this must be transferred into desktop before any comparisons are made.

Check list

MultiDeco-X1 includes a Check List that can be used as a pre dive item list of conditions to test or verify. The list has 24 line text items that can be edited.



Checklist, and keyboard text entry.

Set up the text items: Change the mode to Edit, and then populate the items as required. Tap into the text region and then up / down to scroll the individual letters to form words.

A crossed off item list: Change the mode to List, scroll up down the items to select a line item, and side tap to cross off that item.

Effective June 2012, the Dive Log Manager can create and upload a new list to the X1.

Keyboard

The keyboard permits entry of text into the [Checklist](#) and [Bookmarks](#) features. To launch the keyboard, tap up / down while editing a text. The keyboard will appear with the current character selected. Now tap the cursor to select a new character. Wait 2 seconds, the keyboard will vanish and the character will be placed into the text. Repeat as required to spell out words.



To change the case of the keyboard, tap the cursor to the lower left / right corner arrows. The center blank character has a special purpose – when selected it will cause the remainder of the text to be deleted.

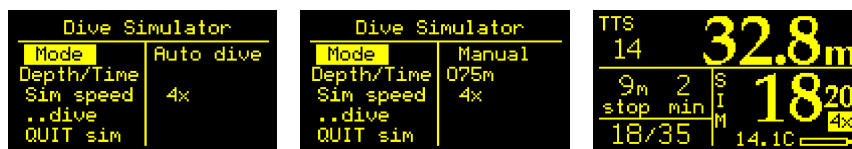
Dive simulator

MultiDeco-X1 includes a diving simulator. This can be used to learn and experience how the X1 dive computer and MultiDeco-X1 will behave under water, before actually taking it on a dive. The simulator causes the X1 to perform exactly as it does in the water, except that:

- The simulator always starts with a fresh (no dives) tissue state – therefore it will not consider any repeat dive components in its deco calculations.
- The simulator cannot be used for planning follow on dives from real dives.
- The simulated dives do not affect the saved tissue state after a dive – a simulated dive is a temporary condition that is independent of the current real tissue state.
- A simulated dive cannot be saved to logs and it will not show in any history or other review or surface display times.

Operation

When in simulator mode, the word “SIM” is flashed on screen during the simulated dive, along with the selected simulation speed (1x, 2x, 4x, 8x).



Dive simulator, as seen running a test dive.

Mode

Select Auto or Manual. Auto mode will cause MultiDeco-X1 to carry out the dive, and any deco stops automatically, as per the depth and time settings below. The diver still needs to perform the deco mix swaps manually. On manual mode, the diver controls the depth setting throughout the dive with the Depth value, and therefore the dive runtime as well.

Depth/Time

Sets the simulator to carry out the simulated dive as per the depth and time set here. In Manual mode, only the depth is available and is set by the diver.

Sim Speed

This controls the speed at which the simulated runtime is performed. Set 1x for a real time dive, or set through to 8x to speed up the dive. As the dive gets deeper and a greater decompression obligation becomes necessary, the workload on the CPU increases. For this reason, the allowable speed is reduced as the simulated dive depth increases.

Start Sim, Quit Sim

Starts or stops the simulated dive.

Go back / ...dive

Return to menus in surface mode, or to the simulated dive.

Simulated plans and the desktop V-Planner

The dive results from MultiDeco-X1 simulator and the desktop V-Planner plans can be made to align closely. Set the desktop program to the following configurations:

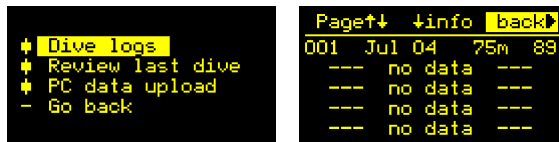
- Descend at 47fpm / 14.5mpm and ascend at 31fpm / 9.5mpm
- Use the “Guest” account, or a diver name with clean tissue state.
- Set the water type, elevation to 0 and check the ppO2 mix swap points match.
- CCR divers need to have ATM set points, and to check the Start set points match.
- Plans will match more closely with 30 second stop time rounding.

However, each program does some of its tasks differently. The MultiDeco program simulator does not change depth in perfectly straight lines – it has an inbuilt wobble to simulate real divers, and this affects crushing pressures. The MultiDeco program simulator sometimes overshoots its target or stop depth – like a real diver. In comparison, the desktop program is always a perfect cyber diver and never makes a diving mistake. The desktop V-Planner also includes code to round up the times into whole minutes so as to align the run time with a full minute boundary – the MultiDeco program does not need to do this, and so MultiDeco gets head start on deco by comparison. This rounding will also give the desktop a deeper first stop usually. The simulator when run at faster than real speeds (2x, etc) can get out of sync with the decompression calculations. A CCR dive needs to adjust the set point after leaving the surface, and the desktop needs extra data levels inserted to match up the set point changes in descent. The desktop plans have stops that are rounded up to a full minute boundary, where as the MultiDeco program is not limited to this.

These and other variances can add up to a few minutes difference between the two, and you should not expect to see a perfectly matched set of plans.

History / dive logs

The “History” menu and sub menus give access to previous dives for review, and various displays of dives and information saved into the X1’s memory.



Dive history menu items and dive log summary.

The amount of data saved into the X1 depends on the sample rate settings on the X1 config sample rate (log period). MultiDeco-X1 saves more data than the basic X1 and so the following memory constraints apply:

- 1 second sample rate – 30 hours of dive data
- 5 second sample rate – 154 hours of dive data

Note that the memory never fills up but will wrap around and it starts again, overwriting older dive information. For the dive data to be saved permanently, it should be uploaded to the PC using the MultiDeco Dive log Manager (available at:

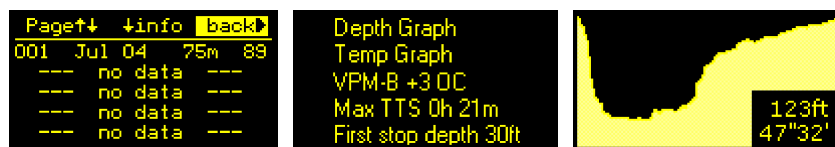
<http://www.multideco-x1.com/download.html>).

Dive Logs

This lists the dives in memory. The columns are a short summary of each dive: number, date, maximum depth, run time. This display leads to the details dive log displays.

To select and view a dive:

1. Shift the cursor to the Info item and then tap down to enter the list of dives,
2. Scroll down to reach a dive of interest,
3. Tap sideways to select that dive. This should display a list of the dives data,
4. Select Dive Graph or Temp graph, and side tap again to show a graph of these items.



List of dives carried out. Dive details, dive depth graph.

Page Up/down tap scrolls the current dives 5 at a time, and bring the summary into view. Use this to move through entire table of available dives.

Info Highlight this item and then down tap to enter the table of dives to view in greater detail. This then leads too...

Select Scroll up/down in the table section to a particular dive and bring the highlight to the dive to review, then Left tap off the screen to view the dive information in detail. This then leads too...

A list of dive parameters such as max depth, temp, times and so on. Two items have additional graphs attached: Highlight either the Depth graph or Temp graph, left tap and it shows a graphical display of the dive.

Exit the Dive logs by the reverse order of the entry, through the Select item and then the back item.

Back Left tap to shift highlight off the screen, to return to the History / dive logs.

Review last dive

Shows some details of the last dive. A second tap will bring up the detailed log information (see above) for this latest dive.

| | |
|-----------------|----------|
| Max | Dive |
| 96.29 | 38'35" |
| Surf 1h15m | 52.3F/32 |
| Max ↑ 35 @ 52ft | |
| Max ↓ 42 @ 32ft | |
| Avg 50ft | CNS 12% |

From L to R: Max depth, dive time and battery state now,
Surface interval, mid point dive temp, dive number,
Maximum ascent and descent rates and depth this occurred,
Average depth and CNS % for the dive. The CNS will show both the
end of dive value, and the current CNS value.

PC Data Upload

WARNING: Always connect the attachment fitting first, and then plug in the wall AC, power plug and USB cable second – do not connect or remove the attachment when it is providing power. When removing the attachment from the X1, always unplug the AC at the wall or remove the power plug, and remove the USB cable at the attachment first. After removing the attachment every time check that your X1 tap system is functioning! If not working then see the [X1 reboot procedure](#).

The PC data upload item is used in combination with the MultiDeco-X1 Divelog Manager on the PC. It retrieves log information from the X1 and uploads it to the PC.

The transfer procedures require the USB cable, the attachment and the X1 charger plugged in. Set up the X1 side before starting the PC side. The transfer process is described in detail in the help files included with the MultiDeco-X1 DiveLog Manager (available at: <http://www.multideco-x1.com/download.html>).

On the X1 - do a left tap from the “PC data upload“ menu to bring up the transfer instructions. Follow the on screen instructions in the X1. For the PC - start the Dive Log Manager and select the “Retrieve new dives” tab. Follow the directions given there for the PC procedures.

If the X1 does not detect a valid connection to the PC, it will resume normal operations after 30 seconds. If the time out occurs whilst preparing for a PC data upload, then start over with both PC and X1 procedures again.

Display Times and time out settings

Many of the time out events can be adjusted in the X1 menus and screen displays. The “Display times” menu is under the “X1 Settings” main menu.



Menu “Display times” for setting “time out” values.

Surface (Sfc) Display

Controls the amount of minutes that the screen remains active (X1 is in Awake mode) on the surface. This covers both the period straight after a dive, and anytime after the X1 was last tapped on the surface. When this time expires, the X1 will go into Standby mode and the display will turn off.

Surface (Sfc) menus

Controls the amount of minutes that any surface menu remains active without any user actions. After this period, the menu system will close automatically and return to the Surface display.

Standby time

This controls the time that Standby mode remains active. Standby mode is the state between full Awake and fully Shutdown modes. Standby mode is required to allow the taps to function and bring the X1 to full awake state in response to the divers tapping action. See the [Operating modes](#) topic for more details.

None: This setting will skip Standby mode altogether, and cause the X1 to go straight from Awake mode directly into Shutdown mode. This will provide greatest battery life, but the taps will not work when the screen is off, and the X1 must be started each time with the water pins.

30 min ... 12 hour: This will leave the X1 in standby mode for this time period since it was last used or tapped by the diver. Standby mode allows for the diver to wake the X1 with taps during the selected period. After this period has expired, the X1 goes into Shutdown mode silently.

To 6PM: This is a variation on the fixed time setting above. It will run Standby mode up to 6PM for that diving day. If used after 6PM that day with this option set, the X1 will run Standby mode for 2 hours.

Always: This causes the Standby mode to be active continuously and the tap system will function at all times. The setting also turns off the water sensor, and the X1 will no longer self wake-up on water contact, or with a wet finger on the pins. This Always setting requires that the diver wake up the X1 by hand with a series of taps, before every dive. However, the X1 will also check for ambient pressure conditions every minute, and will start a dive if it senses sufficient depth. This option will drain the battery more quickly and a single charge life will reduce to about 5-7 days on a daily diving routine.

This Standby mode time period will directly affect the battery life. Standby mode time should be reduced to extend the time between a battery re-charge.

Underwater (UW) Menus

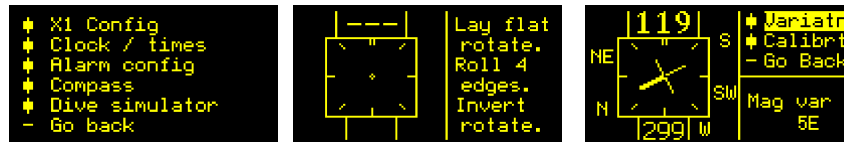
This controls the number of seconds that the underwater menu system remains active. After this period expires, the menu system closes and the X1 returns to normal dive display.

Compass time

Sets the time the compass screen is displayed. This controls both the surface and dive displays of the compass.

Compass display

The X1 includes a digital magnetic direction sensor and MultiDeco-X1 uses this information to create a digital compass display. The compass can be used both in the water and on land or surface. The calibration page also allows setting of a local magnetic declination (variation) setting. The component providing the magnetic information, is a tiny chip just 3.1 mm across. The X1 magnetic information will generally be stable and consistent to within a few degrees.



Middle: calibration procedure screen.

Right: Magnetic variation setting and surface compass display.

For surface operation, select the X1 Settings menu and then the Compass menu. For underwater operation the Compass menu appears in the [Underwater menu](#) list.

Calibration

The compass requires a calibration procedure to be performed before it can be used. Select the “Calibrat” item from the menu. This will clear any saved data and prepare for a new calibration. The procedures is as follows:

- Remove all power and attachment connections from the X1.
- Lay the X1 flat on the table.
- Rotate it around through 360 degrees twice. Stop at each of the cardinal positions of North South East and West, for a few seconds each time.
- Stand the X1 upright on its side.
- Roll the X1 over so that the each of the 4 sides of the X1 has rested on the table.
- Lay the X1 upside down so that it rests face down on the table.
- Return the X1 to face up, and it should now show compass information.

The X1 compass is in a continuous self-learning state and is testing the data for additional calibrations at all times. A specific calibration is not actually required, and the X1 will do a self calibrate by simply shifting the X1 attitude around through all angles. The self calibration procedure can be performed in the water by simply maneuvering the X1 through the full range of attitudes and orientations.

The best calibrations are achieved by having the X1 experience each of the maximum values possible. This requires magnetic and gravity detection in the X, Y and Z axis, and to spend a few moments at the cardinal points of each orientation.

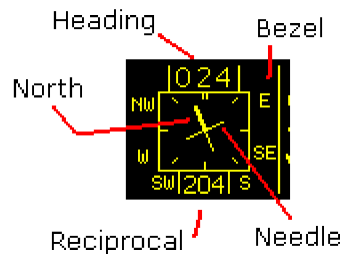
The calibration data is lost each time the X1 is booted or suffers a flat battery.

Variation

Magnetic variation or Declination is set into the compass with the “Variatn” menu item. The available range is from 25 degrees W to 25 degrees E. Consult a local navigation chart to determine your declination values. The variation setting could also be used to compensate for any deviation in your X1.

Operation

The X1 contains an attitude sensor that can sense the direction of gravity, and therefore calculate the orientation of the X1. The compass and MultiDeco-X1 uses this information to limit the compass operation to a level plain only. Tipping the X1 over past 45 degrees to the side, forward or rear ward, will cause it to stop displaying compass data. This operational limitation is imposed to keep the magnetic X and Y axis in line with the earths magnetic fields, and provide a stable and meaningful heading value. When using the compass, keep the X1 face upright.



The compass needle, bezel and heading information will self orientate to keep the needle pointing to magnetic north at all times.

For details on navigation and basic compass operation, conduct an internet search tutorials on “basic compass operation”.

Interference

Take care to avoid any source of magnetic disturbance when using the X1 compass. This includes other magnetic compasses, the HID light, the power cable for the light, video equipment and scooters. All these will affect the heading readings, and the X1 should be kept at a distance from these items.

Battery and charging

WARNING: Always connect the attachment fitting first, and then plug in the wall AC, power plug and USB cable second – do not connect or remove the attachment when it is providing power. When removing the attachment from the X1, always unplug the AC at the wall or remove the power plug, and remove the USB cable at the attachment first. After removing the attachment every time check that your X1 tap system is functioning! If it is not working, then see the [X1 reboot procedure](#).

WARNING: If the battery becomes fully discharged (flat), then the X1 will usually require a reboot to restart the tap system. See the [X1 reboot procedure](#).

Consult your X1 user manual for further details of the re-charging procedures.

The X1 has a powerful computer chip inside – the ARM32 and this is common to expensive PDA's and modern cell phone devices. It can consume a lot of battery power in a short time. You can expect 25 hours or more of dive time from the X1 on a single charge. It should easily last a week on a daily multi-dive routine.

Before diving each time, activate the X1 and view the surface screen and check the battery condition meter.



Battery symbol: Full, half and empty.

The battery meter shows the current battery charge state. As it approaches empty, it will flash the battery symbol. At that time, less than 15 minutes remain. Eventually it will warn of pending shutdown for 30 seconds, and then enter shutdown mode.

If the battery is depleted during a dive, then the current dive's decompression and ascent information is lost, and the X1 will remain off until its next battery recharge. The current dive log may also be lost too.

The amount of Standby mode time period has the greatest effect on the battery life. During standby mode the X1 screen is turned off, but the X1 continues to monitor for the tap action by the user, and it samples the ambient pressure to sense a dive or elevation changes. The amount of time that Standby mode is active can be adjusted in the [Time out settings](#) menu.

When the X1 is charging, or the AC power is being supplied, then MultiDeco-X1 will remain in Standby mode. After the AC power is removed, the X1 will fall back to Shutdown mode automatically within a few minutes (if permitted by standby time settings).

When the battery is completely discharged, the X1 will not restart until it is placed on recharge. Plug in the charger and the X1 should charge and start up to display the recharge status.

NOTE: The X1 will continue to consume the battery slowly during the standby mode, and can consume some power when not used and it's stored in the cupboard. Therefore, it is important that the diver starts the X1 before every diving day, and before each dive, to check the battery meter for sufficient power remaining. An X1 that only dives occasionally will likely need a recharge before use. As a precaution, it is a good idea to recharge the computer the night before any decompression diving.

NOTE: The Shutdown mode will normally take over about a minute after the AC power is removed – do not confuse this normal Shutdown condition with a problem in the X1. The X1 should always be able to wake from a wet finger across the pin contacts, and then the taps should work.

Re-booting the X1 firmware

WARNING: Always connect the attachment fitting first, and then plug in the wall AC, power plug and USB cable second – do not connect or remove the attachment when it is providing power. When removing the attachment from the X1, always unplug the AC at the wall or remove the power plug, and remove the USB cable at the attachment first. After removing the attachment every time check that your X1 tap system is functioning!

The reasons for this sequence: As the attachment is being connected or removed, the shifting pin electrical connections under power can make random commands into the X1. The worst of these situations will cause the X1 firmware to partially reboot, and that can leave the X1 in a hung state. The end result usually is that the tap system will cease to function. Therefore, when removing your X1 from charge each time (or a PC upload), check that the taps still function. If the X1 has stopped and locked up, then follow this procedure below.

NOTE: The Shutdown mode will normally take over about a minute after the AC power is removed – do not confuse this normal Shutdown condition with the problem described here. The X1 should always be able to wake from a wet finger across the pin contacts, and then the taps should work.

Either of these methods will reset the X1 firmware from the start.

Attachment reset

1. Reconnect the attachment, and the charger and AC power.
2. Do NOT connect the USB – unplug it if connected.
3. Now press the reset button (use a pencil or pen through the hole) – hold down for two seconds and release. The X1 should reboot and the Liquivision and MultiDeco-X1 logos will show.
4. Wait for the boot to complete, then unplug the AC and USB and remove the attachment.
5. Check that the tap action functions normally.

Installer reset

1. Reconnect the attachment, and the charger and AC power.
2. Connect the USB to the PC.
3. Start up the MultiDeco-X1 firmware installer and go to the USB setup tab.
4. Press the “test connection” button, and the X1 should reboot (Liquivision and MultiDeco-X1 logos),
5. Wait for the boot to complete, then unplug the AC and remove the attachment.
6. Check the taps the tap action functions normally.

A reboot does not affect any data. The settings, log and license details will all remain untouched.

The X1 and VPM program settings can be reset from the menu item “X1 Settings, X1 config, Reset ALL”. This reset sequence will also boot the main CPU. However this is a partial reboot only. Use the reboot sequence above to achieve a complete reboot of all the X1 components.

Dive logs cannot be erased. They will eventually be overwritten after 150 hours or so of dives (depending on the dive log time interval selected).

Limitations

X1:

| | |
|-------------------------------|---|
| Operating temperature | 0 to 45° C, 32 to 113° F |
| Battery life – single dive | 40+ hours |
| Battery life – daily dive use | 1 to 2 weeks, depending on times. |
| Battery life – shutdown | 6 weeks |
| Maximum depth reading | 30 bar / 288m / 944ft (X1 v3, v4) 50 bar / 490m / 1600ft (X1 v5) |

Consult the X1 hardware manual for further details.

MultiDeco-X1:

| | |
|-----------------------------|-----------------------------------|
| Max depth computation | 650m (see hardware limit) |
| Max dive time – single dive | 34 years |
| Max visible dive time | 999 minutes |
| Elevation settings | Automatic |
| Dive time start depth | 1.6m / 6ft |
| Dive time stop depth | 0.5m / 1.5ft |
| OC mixes | 10 OC legs |
| CCR mixes | 10 CCR or OC legs |
| Bail out mixes | 2 x 5 CCR or OC legs |
| Dive logging | 134 hrs @ 5 secs, 30 hrs @ 1 sec. |
| Depth accuracy | ± 1% |

Version, releases

MultiDeco-X1 inherits 4 years of development and revisions from V-Planner Live.

| | | |
|----------|---------------|---|
| Dec 2009 | v5.00 | Initial release |
| | v5.01 | Added Dutch and Norwegian languages, lost gas item repair. |
| Feb 2010 | v5.02 to 5.04 | Improved X1 hardware options, other minor issues. |
| Mar 2010 | v5.05 | X1 v50 hardware flash update, improved battery life. |
| Jul 2010 | v5.06 | Minor tidy up of texts, languages, add X-Link battery item. |
| Sep 2010 | v5.07 | X1 v55 hardware flash update, minor issues. |
| Nov 2010 | v5.08 | X1 timing issue, improved dive planning. |
| Dec 2010 | v5.09 | Correct for a display error with a specific config setup. |
| Feb 2011 | v5.10 | Correct for a v5x pressure sensor problems. |
| Jan 2012 | v5.11 | Minor issues, added VPM-B + GFS. |
| Jun 2012 | v5.12 | Czech language, patch for possible X1 memory issue. |
| Feb 2013 | v5.13 | Improve dive planning, salinity, various minor issues. |
| Apr 2014 | v5.14 | Add CCR SP slide, remove depth limit v5.x, minor issues. |

WARNING and DISCLAIMER for MultiDeco-X1

BE WARNED: This MultiDeco-X1 Software and firmware is experimental and may generate an incorrect profile. Any profile generated should be validated by comparison with other tables or Software.

HHS Software Corp, and the program author's, do not warrant that this program accurately reflects the Varying Permeability Model algorithms, that it won't get you bent or dead, or that it will produce safe, reliable results. The software is itself experimental and may generate an incorrect profile. Any profile generated should be validated by comparison with other tables or Software.

There are no decompression procedures of any sort that can guarantee that DCS will NOT occur. All dives are decompression dives and the concept of a “no-decompression” dive is a misnomer. The reliance upon this program to determine when one may safely ascend to the surface or to move to any shallower depth does not ensure that decompression illness or other malady won't occur. Everyone is unique and may be affected differently by the experience of decompression. Some persons may have specific undiscovered physical conditions that make them more likely to experience decompression illness and experience more dire symptoms. There is nothing in this program to take account of such preconditions.

This dive schedule produced by this program is experimental and you use it at your own risk. Diving in general is fraught with risk, and planned decompression diving adds significantly more risk. There is absolutely no express or implied warranty or guarantee that the proper preparation of a decompression schedule, using this program and diving precisely according to that schedule will avoid symptoms of decompression sickness or other injury. Deep diving utilizing multiple gasses, including helium, or rebreathers further increases both the potential incidence of decompression illness and the morbidity of the consequences even with the proper use of the schedules produced by this program.

MultiDeco-X1 and the decompression schedules it produces are tools for experienced mixed-gas decompression divers ONLY. If you have not been properly trained in mixed-gas decompression diving by an internationally recognized technical certification agency and/or don't have a firm handle on decompression planning and mixed-gas diving, then DO NOT use this software.

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