ap diving
built for adventure

2020VISION
Colour Display

User Instruction Manual

NOTE: Due to the limitations of the print process, the colour screen images in the printed user manual appear very dull compared to the bright, vivid reality of the product. For better facsimile please view the manual on PC/Mac screen.

Issue 6 - April 2018

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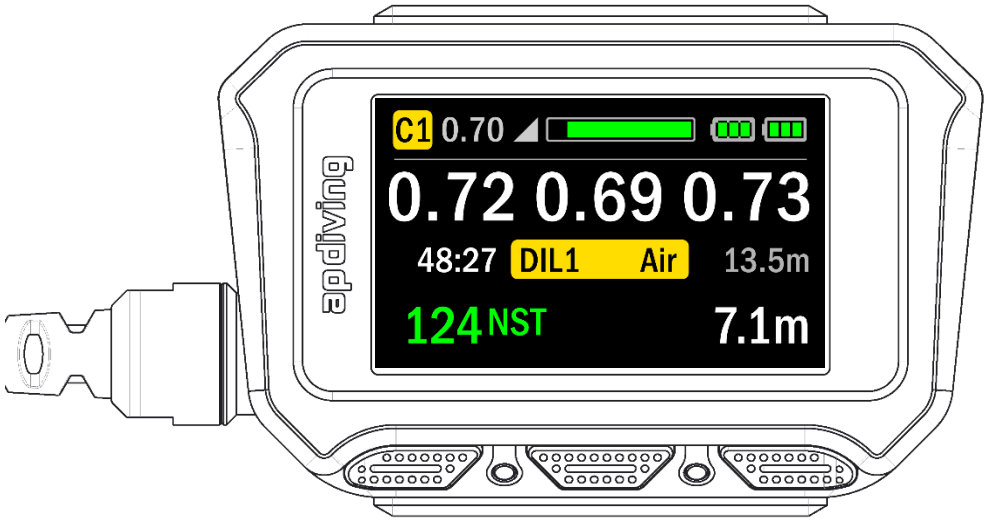
WARNING: These user instructions do not replace the AP Diving Rebreather Manual in any way and do not explain the full rebreather functionality. These instructions will detail the 2020 VISION Colour Display as part of the rebreather system only.

WARNING: The 2020 VISION Colour Display is a sealed unit and no attempt should be made to disassemble the housing in any way. Trying to do so could cause irreversible damage to the display and electronics.

The 2020VISION Colour Display

The AP 2020VISION Colour Display (RBV11) is a 2.8" full colour, high contrast display that shows the diver real-time PPO_2 fed directly from the rebreather's two independent oxygen controllers. The Colour Display incorporates all the features of the previous monochrome display with the addition of new features to enrich the user's diving experience. Familiar features are carried forward such as programmable gas mixes, intuitive operation and continuous ceiling Bühlmann decompression with gradient factor adjustability; complimented with new features such as the large format high resolution display with larger fonts and icons, expanded memory, selectable colour themes, to name just a few. All within a smaller but durable aluminium housing with scratch resistant ionised glass lens which is pressure resistant to 200m.

The 2020 VISION Colour Display has been specially developed for use with AP Diving's range of rebreathers equipped with Vision electronics. It is intended as a factory fitted upgrade for existing customers as well as a standard item with new AP rebreathers.



The full-colour display conveys all the key rebreather information with the added benefit of conditional colouring to highlight the current status of the information provided. Due to its size, brightness and clarity it can be read in very low visibility conditions and is excellent for those who may need to compensate for poor eyesight underwater.

It can be mounted on the wrist using an adjustable elasticated strap or clipped to the diver using the aluminium D ring on the strap. This gives flexible mounting options for each particular diver's preference, diving environment or scenario.

The 2020VISION Colour Display Features

- For use with all AP Diving rebreathers using Vision electronics with firmware Version 07.01.00 and onwards installed
- **Large format 2.8" full colour display** – 43% larger than previous Vision display
- Ultra-bright high resolution, high contrast, display – 96% sharper than previous Vision display
- **Conditional colouring** allows at a glance confirmation of "all is well" and emphasises critical and marginal warnings
- **Displayed data** includes depth, time, decompression obligation, PPO_2 values, Setpoint, Setpoint switch method, battery status and more
- **Intuitive graphical layout** complements the previous Vision handset and HUS
- **Familiar 3 button layout** giving instinctive operation for existing AP rebreather users
- **Excellent readability** even in very poor visibility conditions
- **Selectable colour themes** including 'Colour Blind' and 'Candy' themes
- **Customisable colour themes** using the 'AP Colour Theme Designer' program
- **Low power consumption**
- **Enhanced brightness control** features including auto-dimming for longer battery life, auto-brightness for warnings and brightness 'tilt activation'
- **Extreme durability** with hard-anodised marine grade aluminium housing and scratch-resistant ionised-toughened glass
- **Compact housing** design – 40% smaller than the previous Vision handset
- **Flexible mounting options** – either elasticated wrist-strap or D ring
- **Bespoke cable assembly with improved flexibility** and improved strength with Kevlar support
- **Self-activation** on water entry
- **Greatly expanded memory** – 500 times greater Dive Log memory than the Vision. Stores up to 3000 dive hours.
- **Bluetooth** dive download and software upload with PC or MAC - updates and downloads can be made without disassembly of the rebreather
- **Digital Compass** – a three axis, tilt compensated digital compass with the ability to mark a heading
- **Dive Display Log Book** – graphical display of Depth vs Time dive profile
- **Upgradable firmware** with the potential to unlock new features in the future
- **Compatible** with all existing AP Vision electronics peripheral devices including the Scrubber Monitor (Tempstick) and CO_2 Sensor
- **Independent** - driven off one I^2C bus arm giving appropriate isolation security from other peripherals
- **Multiple language options** including English, German, Dutch, Italian, French, Spanish, Portuguese, Danish, Swedish, Norwegian, Polish, Czech and Russian.
- **Type Tested for CE approval** according to the EN14143:2013 Rebreather Standard (Notified Body: SGS United Kingdom Ltd)

Important Information

DO: Read the instruction manual fully before using the rebreather.

DO: Carry out all pre-dive checks prior to each dive.

DO: Use the Colour Display to monitor the rebreather's performance at all times.

DO: Protect the Colour Display against shock at all times and avoid lens scratches by replacing the lens protector if it starts to peel.

DO: Make sure that the Colour Display is free from mechanical damage and that the lens, buttons and depth pressure sensor holes are not impeded in any way that could affect its use.

DO: Wash the Colour Display with fresh water after each dive to avoid any salt or dirt build up.

DO NOT: Ignore warnings displayed by the Colour Display.

DO NOT: Dive without sufficient battery power or enter the water until the rebreather is correctly calibrated and in surface mode.

DO NOT: Mount the Colour Display in any way that obstructs the use of other rebreather functions, such as operating the mouthpiece / OCB, or the use of inflators.

DO NOT: Attempt to open the Colour Display as it is designed as a sealed unit.

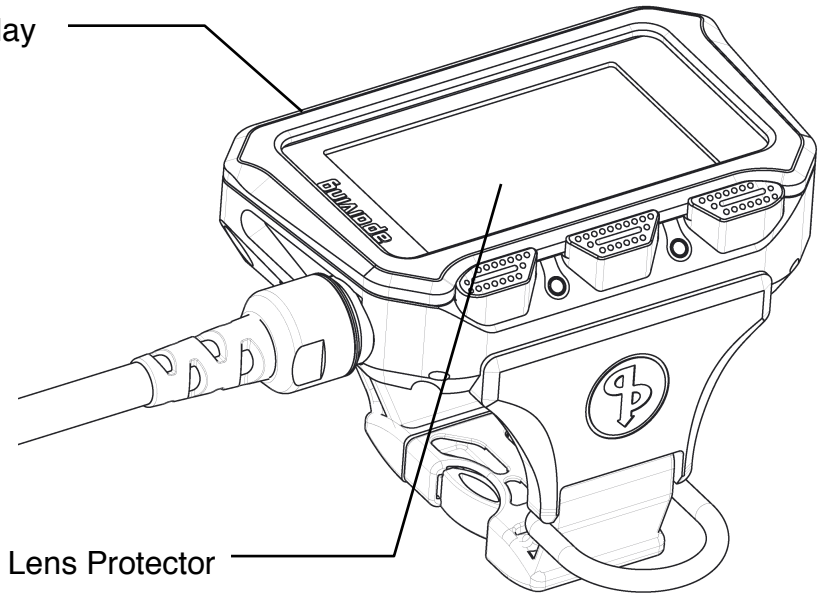
DO NOT: Attempt to modify the rebreather or Colour Display in any way.

DO NOT: Use chemicals to clean the Colour Display.

Parts Supplied

RBV11FF
2020 VISION Colour Display

(Factory-fitted to the Rebreather Lid, via a new lid fitting)

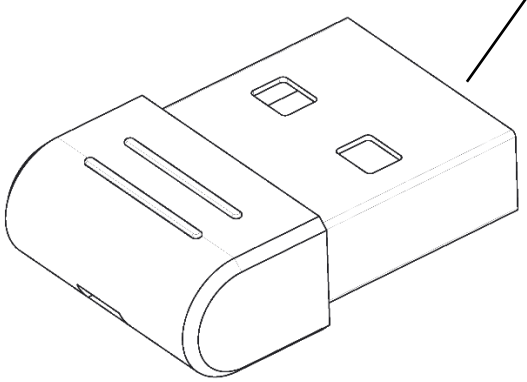


RBV11/19 Colour Display Lens Protector
(2 supplied)

The 2020 Colour Display comes factory-fitted to the Rebreather Lid. It is wired into the controllers via a new flexible cable assembly. The rebreather firmware must be V07.01.00 or higher for the Colour Display to work and this will be installed as standard.

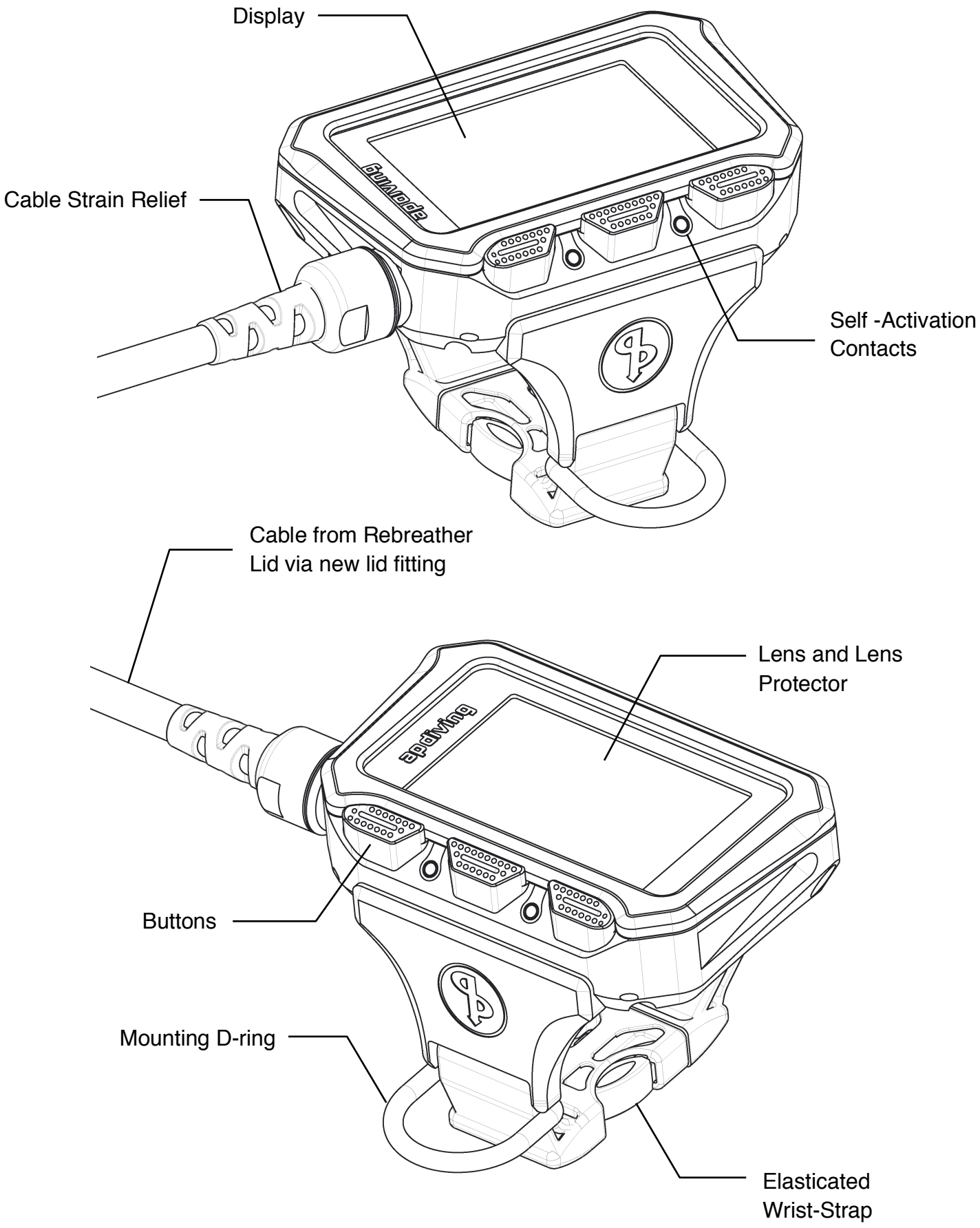
Optional Parts

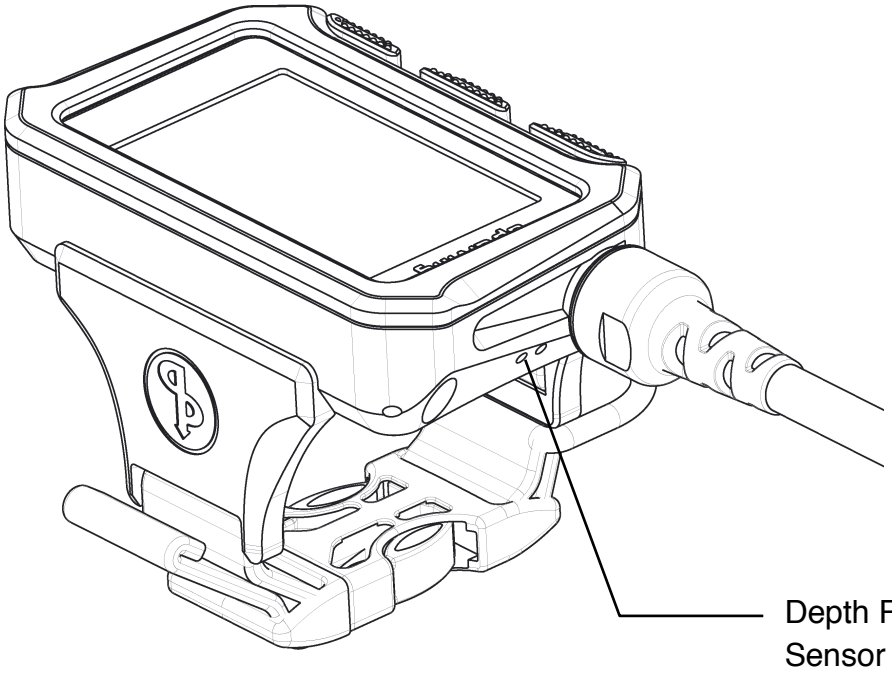
RBV91 Bluetooth USB Adaptor (complete with driver CD)



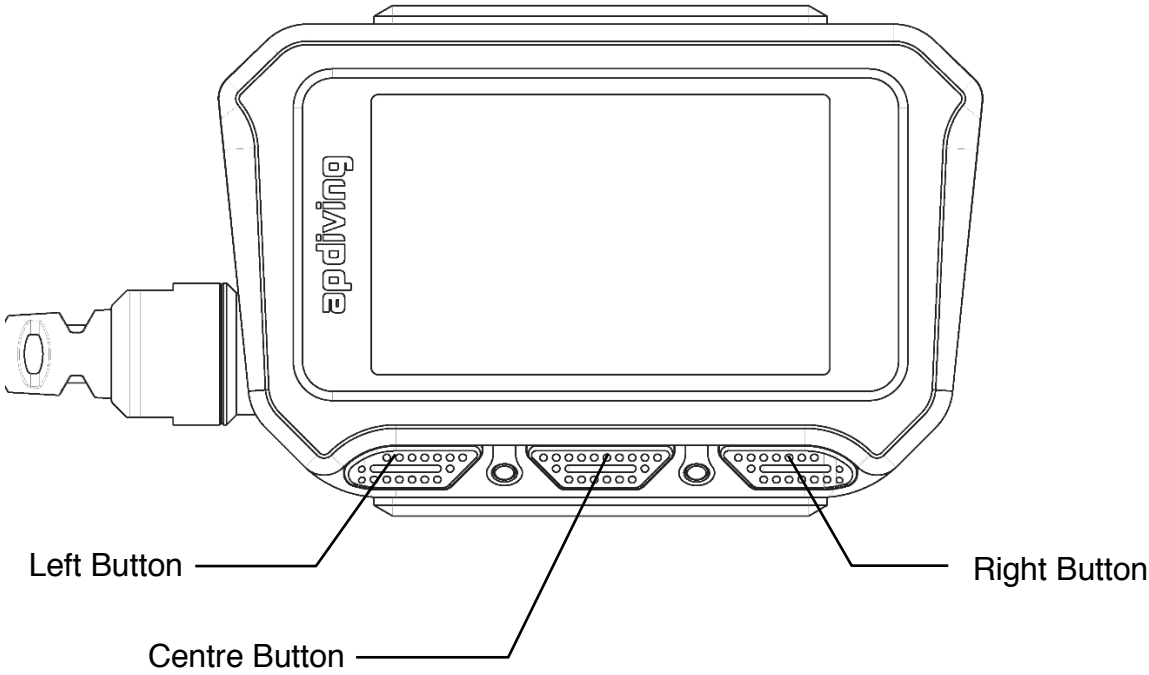
If your computer does not have a built-in Bluetooth adapter, a Bluetooth USB dongle can be purchased. The Belkin Mini Bluetooth v4.0 USB adaptor (Belkin Part No. F8T065) is recommended. Available from AP Diving (www.apdiving.com)
(AP Part Code: RBV91)

The 2020VISION Colour Display Configuration





Note: Make sure that the depth pressure sensor holes are not impeded in any way that could affect their use

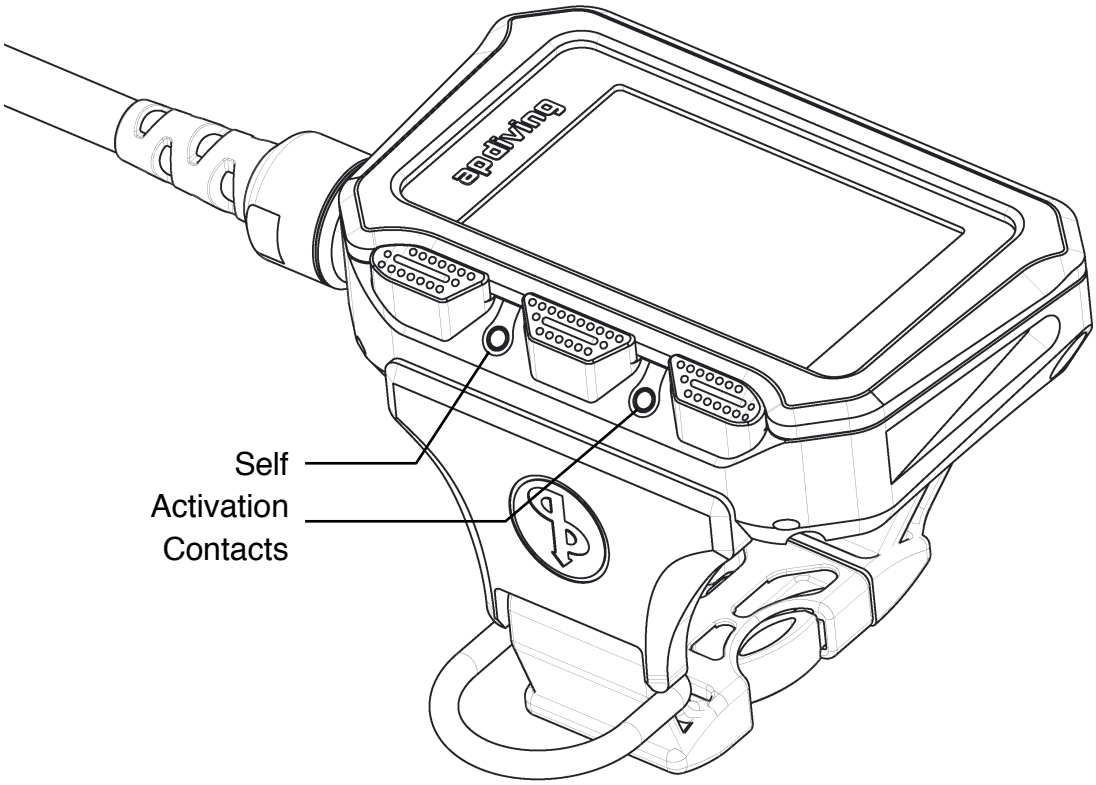


WARNING: The 2020 VISION Colour Display is a sealed unit and no attempt should be made to disassemble the housing in any way. Trying to do so could cause irreversible damage to the display and electronics.

Auto-Activation

Auto-activation has been added as a hardware feature to complement, in particular, the Recreational training requirements. There are two contacts, located on the front edge of the colour display. Once submerged or wetted these are designed to activate the rebreather.

> **NOTE:** This does not relieve you of the responsibility or need to switch the unit on before you enter the water. When you switch the handset on several automatic and essential power on self-tests are conducted and it's important to switch the rebreather on and allow your rebreather to do these tests before entering the water.



WARNING: All auto-activation systems rely on battery power. If your batteries do not have sufficient voltage the auto-activation will not work, you will receive no warnings and if you combine this scenario with submerging expecting it to work and fail to look at your handset, the oxygen pressure will soon drop, you will lose consciousness and die if not rescued by another person.

Switch on before use and **NEVER** breathe from the rebreather without first looking at the handset and knowing the PPO_2 is at a safe level & **ALWAYS** leave it switched on until you're safely out of the water.

WARNING: The auto-activation feature will not function properly in pure water.

The 2020VISION Colour Display Mounting

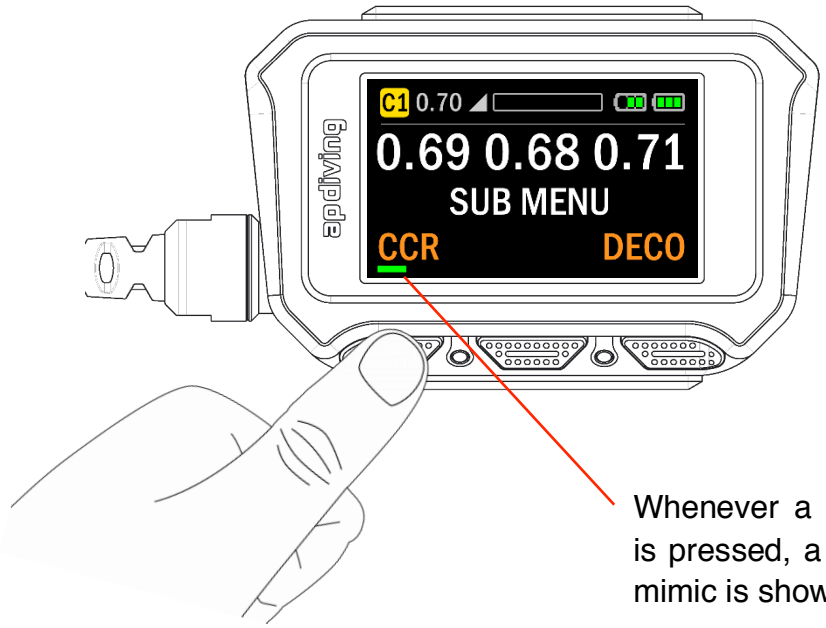
The 2020 Colour Display cable is designed to suit divers of all sizes, and for this reason has a cable length that will suit up to 95th percentile male arm length. This means that divers with shorter arms may want to manage excess cable by either wrapping the cable around the arm, tucking excess into the rebreather case or clipping the display to a harness D ring instead of wrist mounting.

We recommend that the 2020 Colour Display is mounted on the wrist.

Alternatively, leave the strap buckle assembled and clip the colour display to your equipment with the mounting D ring on the strap. Ensure that this is done in a position that allows you to monitor the display with ease.

Buttons

Button pressing methodology has been carried forward from the previous monochrome Vision handset.



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Button operation in Surface and Dive Mode

	Left	Centre	Right
Switch On	Hold for 4 secs		
Backlight	Hold for 1 sec = Backlight for 5 secs	Hold for 1 sec = Backlight for 10 secs	Hold for 1 sec = Backlight for 10 secs
Display 2nd Controller	Hold for 2 secs		
Display millivolt outputs of O_2 sensors	Hold for 4 secs		
Toggle between High and Low Setpoints		Hold for 2 secs	
Suppress 1st Level Warnings			Hold for 1.5 secs
Access Compass			Hold for 2 secs
Button Combinations			
Menu Mode	Press		Press
Power Shut Down		Press	Press
PC Link – Serial USB (when Serial USB bridge is attached)	Hold for 2 secs		
PC Link – Bluetooth	Hold for 2 secs	Hold for 2 secs	

Switch On

To switch on the unit, you press and hold the left button for 4 seconds. The two controllers perform their self-tests. If the connection to the display is operational the display backlight will come on and the AP DIVING splash screen is displayed.

Pre-Dive Sequence

During the rebreather start-up process and self-tests, the 2020 VISION Colour Display's larger full colour format creates a much clearer interface making it easier to identify the rebreather status through the use of Conditional Colouring.

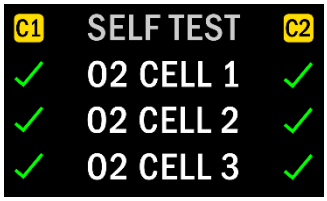
Pre-Dive Self-Tests

Splash Screen AP DIVING – Built For Adventure.

Software Version Trimix, Nitrox, Dive Timer, Recreational 1 or 2, Firmware version number and Rechargeable Battery Identification.

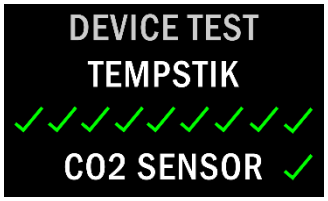
Customer Info Name, Telephone, ZIP and Serial Number (factory programmed).

When details change, please contact the factory for a free update.

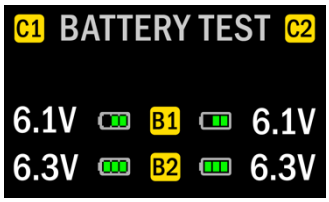


Self-Test Oxygen Sensors – connection test.

Self-Test Connection test for Solenoid and Buzzer.



Device Test Connection test for all of the sensors in the Tempstick and for the CO_2 Sensor.



Battery Test The voltage of each battery is measured by both oxygen controllers while the battery is under load

Self-Test The result of the battery test is shown.

Pre-Dive Checklist

NOTE: These are vital checks. Do not take them lightly.

User Prompt Confirm the Oxygen cylinder is open.

Look at the cylinder pressure gauge so you know the cylinder pressure. Then press the manual inflator while watching the pressure gauge. If the needle doesn't fall, you know the cylinder valve is open far enough and you know the hose is connected to the manual inflator.

User Prompt Confirm the Diluent cylinder is open.

Look at the cylinder pressure gauge so you know the cylinder pressure. Then press the manual inflator while watching the pressure gauge. If the needle doesn't fall, you know the cylinder valve is open far enough and you know the hose is connected to the manual inflator. Press the ADV purge to ensure gas is on.

User Prompt Check the location and function of your bailout system. Pull it out - breathe from it.

This check guarantees that you can reach your bailout, that the hose is long enough to allow you to put it in your mouth and that the gas is on.

User Prompt Confirm the counterlung automatic pressure relief valve is set in the lower pressure 'DIVE' position

Turn fully counter-clockwise – until it clicks.

User Prompt Confirm the operation of the mouthpiece mushroom valves

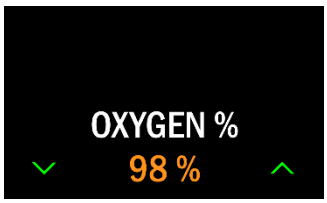
Refer to the AP Rebreather Manual for details.

Elapsed On Time Reset now – yes or no?

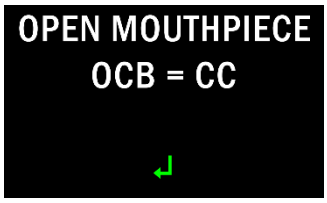
Calibration

Must Calibrate Select 'Yes' to calibrate the oxygen sensors and zero the CO_2 Sensor (if fitted).

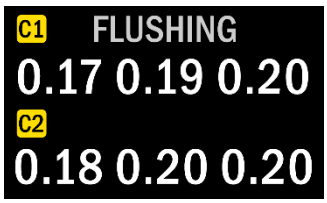
Ambient Pressure The ambient pressure as seen by the depth pressure sensor.



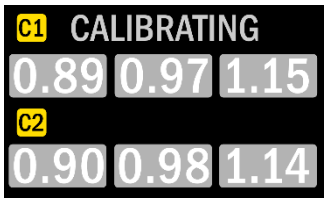
Oxygen % Enter the oxygen % to be used for calibration.



User Prompt Confirm the rebreather mouthpiece is open in preparation for calibration.
Ensures the loop is at ambient pressure for the calibration.

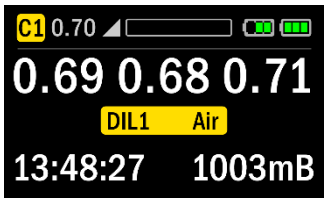


Flushing ppO_2 values climb as they are flushed with oxygen.



Calibrating ppO_2 values stabilise and highlight as the oxygen sensors are calibrating.

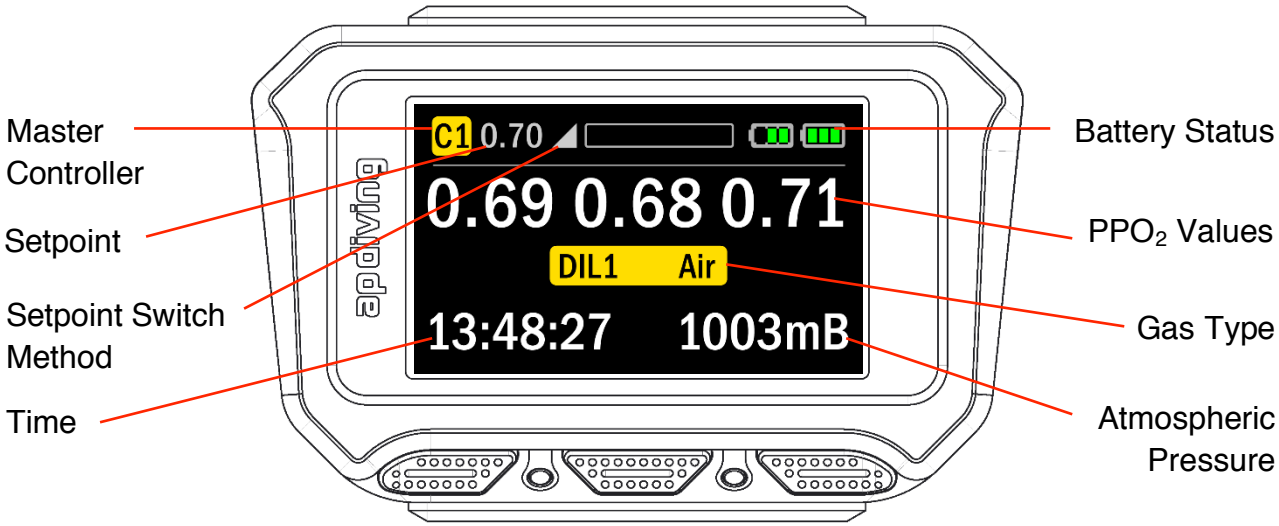
Calibrated Calibration factor applied to ppO_2 values.



Surface Mode Unit is ready to dive after successful calibration.
Now take a big breath and exhale into the loop and remove from your mouth, while you watch the display. The PPO_2 should fall rapidly and then immediately climb rapidly as oxygen is added.

Surface Mode

Following a successful calibration the 2020 Colour Display will enter ‘Surface Mode’.



The 2020 Colour Display has been laid out in a very similar fashion to the previous monochrome display so it is very easy for existing users to switch between the two displays.

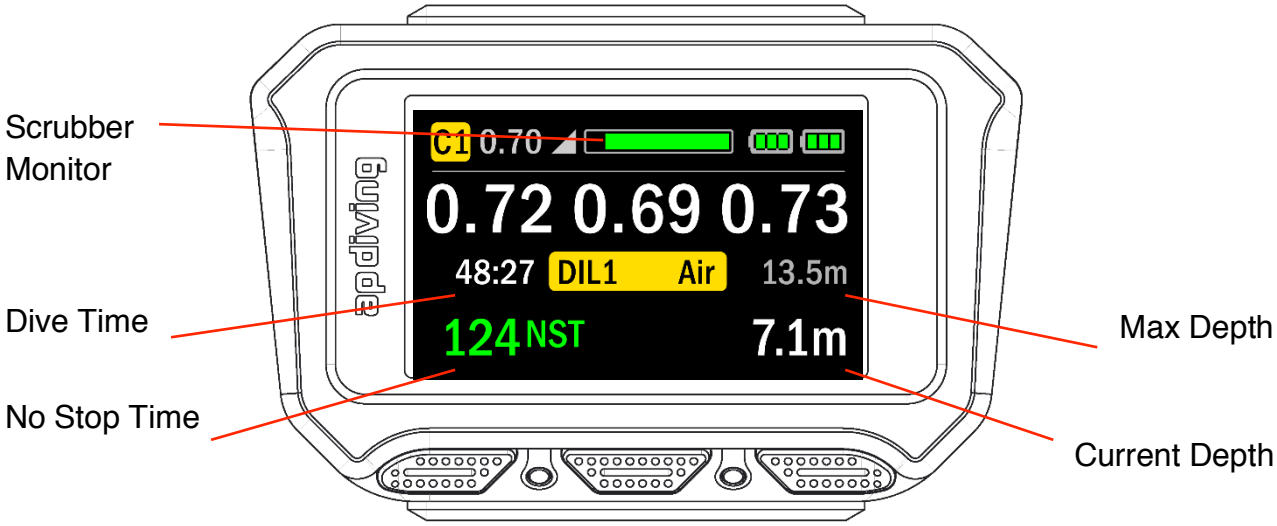
High contrast colours are used to ensure readability and “conditional colours” are used to highlight important information. In general terms white, grey and green are “good”, red is used to highlight conditions that are important to the diver. i.e. when a battery has low voltage, when they ascend too fast or have a warning of any sort. Yellow is used as an intermediate condition for decompression status, controller labelling and gas type.

The ‘Surface Mode’ is identified by the actual time and atmospheric pressure or after a dive by the dive time, maximum depth, surface interval and atmospheric pressure. On descent, at 1.2m, the display will change to ‘Dive Mode’ and show dive time, depth and decompression no stop time or obligation.

Dive Mode

No Stop Time (NST) Display

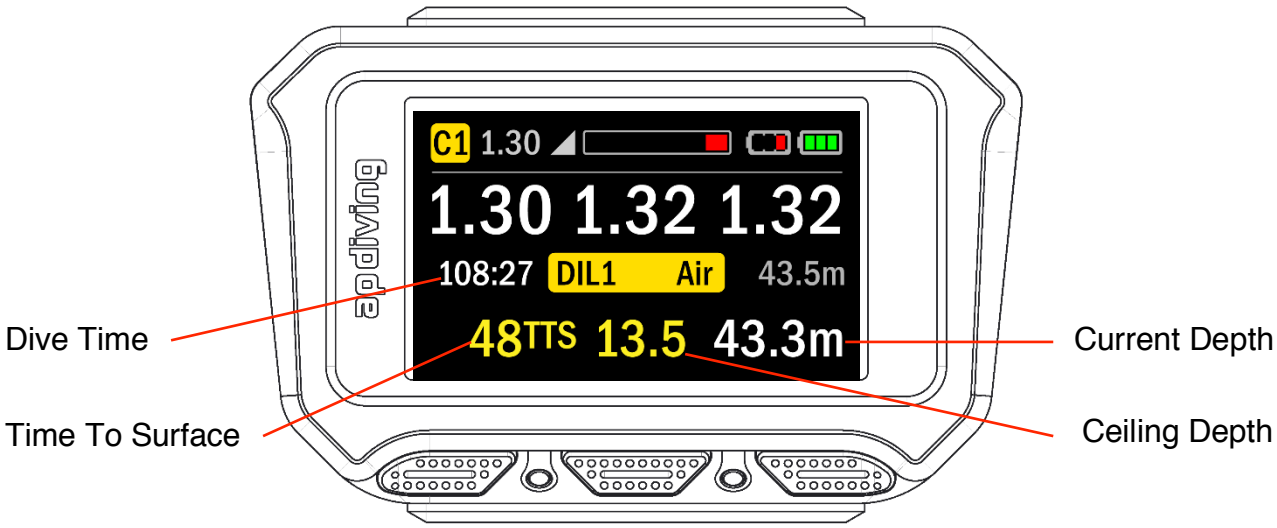
Until sufficient depth and time causes a decompression obligation, the colour display will show a no stop time (NST) along with the dive time and current depth.



The no stop time is shown in green, meaning there is currently no decompression required. The scrubber monitor and battery status are also in green showing a good condition. All other information in this example is shown in white and grey as they are all within the appropriate limits.

Time To Surface (TTS) Display

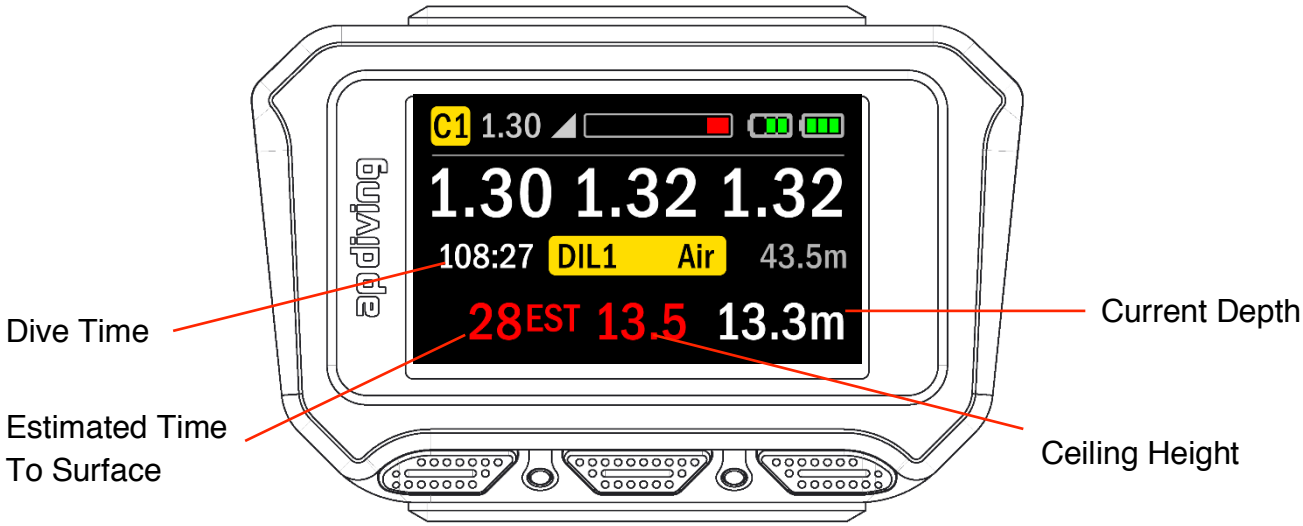
When sufficient depth and time causes a decompression obligation, the Colour Display shows a time to surface (TTS) along with the dive time, current depth, max depth and a ceiling that the diver should not ascend above.



The time to surface and ceiling depth are shown in yellow, highlighting the decompression obligation currently in place. The scrubber monitor and B1 battery status in this example are in red showing a low battery issue and poor condition of the CO_2 scrubber.

Estimated Time To Surface (EST) Display

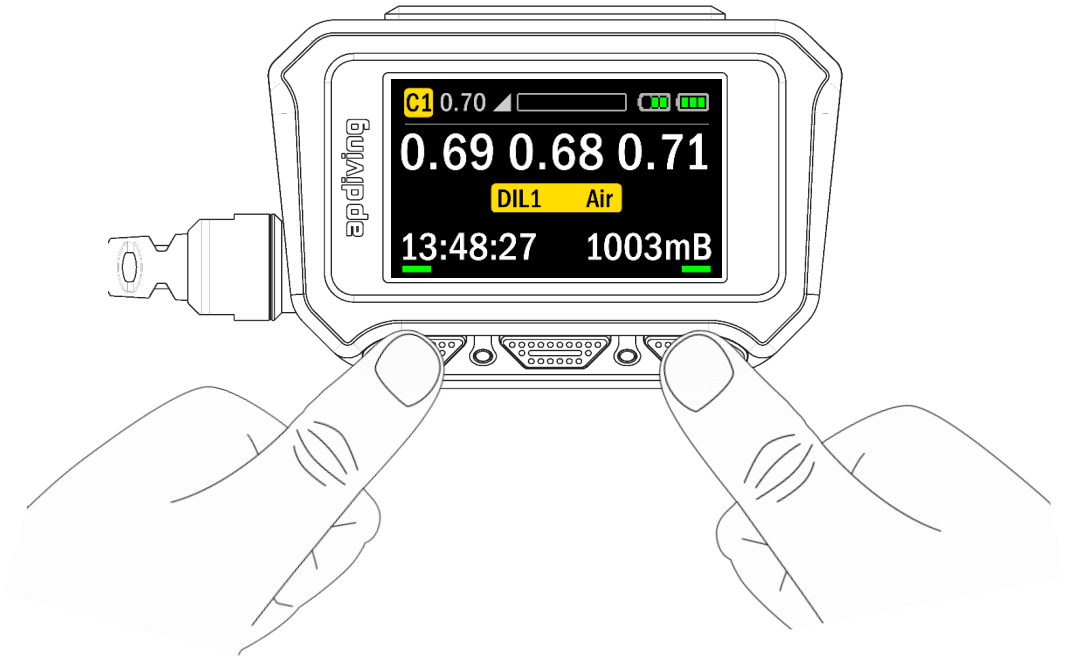
When the current depth has been shallower than the ceiling depth for more than 2 minutes (a ceiling violation), the TTS will be replaced with an EST (estimated time to surface).



The estimated time to surface and ceiling depth are shown in red, highlighting the fact that the decompression is now estimated due to the ceiling violation.

Menus

Menu Entry

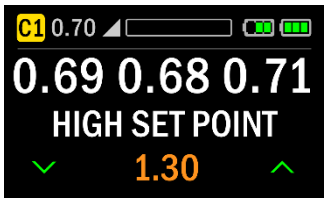


To enter or exit MENU Mode, press the outside two buttons simultaneously or within 0.5 seconds of each other.

The sub menus contain slightly different options depending on whether on the surface or underwater and the software version installed (Trimix, Nitrox, Dive Timer, Recreational 1 or 2). More details can be found in the main Inspiration Manual. However, the following is what you would expect to see on the 2020 VISION Colour Display from Trimix software on the surface:

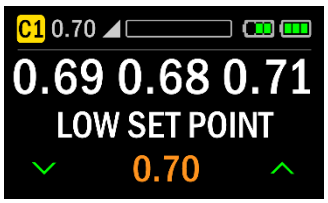
CCR Menu

Please note: the high Setpoint automatically defaults to 1.3 and the low Setpoint to 0.7 every time you switch on. All other options are user settable and remain on your chosen settings until you change them again.



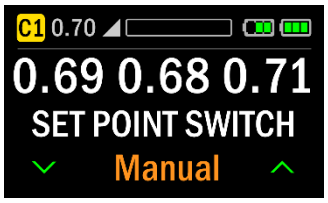
High Setpoint

Adjustment range = 0.90 – 1.50.
It automatically defaults to 1.3 every time you switch on. Tip: use 1.3



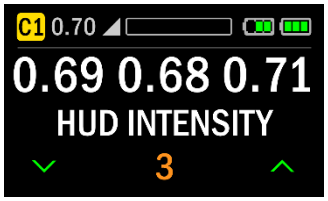
Low Setpoint

Adjustment range = 0.50 – 0.90.
It automatically defaults to 0.7 every time you switch on. Tip: use 0.7



Setpoint Switch

Gradual, Manual or Auto.
Tip: use Gradual. Should you enter decompression the highest possible Setpoint will be maintained to reduce decompression obligation.



HUD Intensity

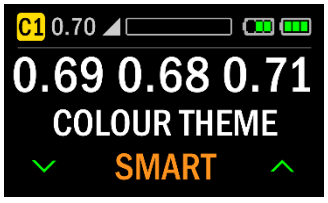
Adjustment range = 1 – 10.
Tip: set to 7. It is bright enough for most conditions and requires considerably less power than 8 -10.

Backlight

Key On, Always On or Off
Tip: when Key On is selected, the handset will tilt activate the backlight. A simple rotating action of the display towards the diver will turn the backlight on.

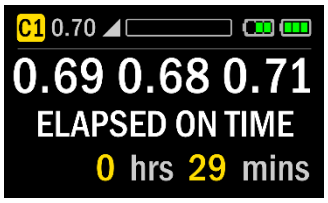
Brightness

Adjustment range = 1 – 31
Tip: Set to 21



Colour Theme

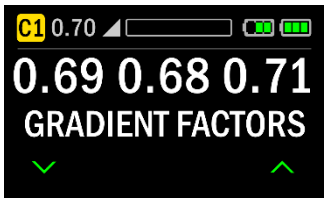
Smart, Colour Blind, Candy, Custom 1 or Custom 2.
The SMART colour scheme is shown throughout this manual.



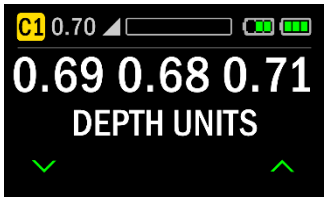
Elapsed On Time

This can be reset at any time on the surface or underwater.

Select Diluent 9 programmable gases.



Gradient Factors GF Low 5 – 90
GF High 30 – 98

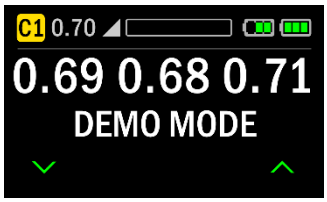


Depth Units Feet or Metres.

Oxygen Exposure % CNS % and OTU %.

Clock Edit Time and Date.

LogBook View Date, Time, Duration and Max Depth of previous dives.



Demo Mode Simulate a dive.

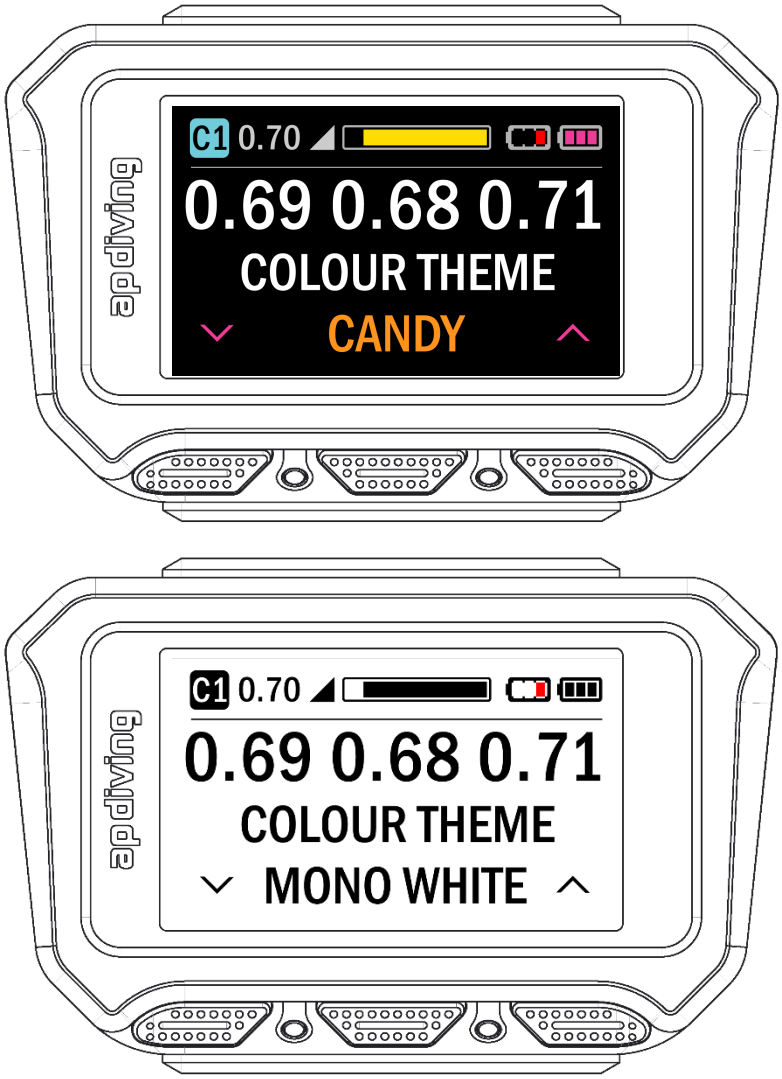
Exit Menu Return to Surface/ready to dive mode.

Colour Themes

The 2020 Colour Display features selectable colour themes including ‘Colour Blind’ and ‘Candy’ themes. The default ‘SMART’ theme utilises high contrast white text on a black background and conditional red and green colouring for dynamic elements. It is clear, crisp and easy to interpret.

In a bid to help the 1 in 12 men and 1 in 200 women who suffer from colour blindness or colour vision deficiency the AP Colour Display includes a ‘Colour Blind’ theme. This replaces colours that are commonly ‘unseen’ with those that are more commonly ‘seen’ by sufferers. Careful consideration has also been given to which colours are used next to one another, ensuring there is always a good contrast.

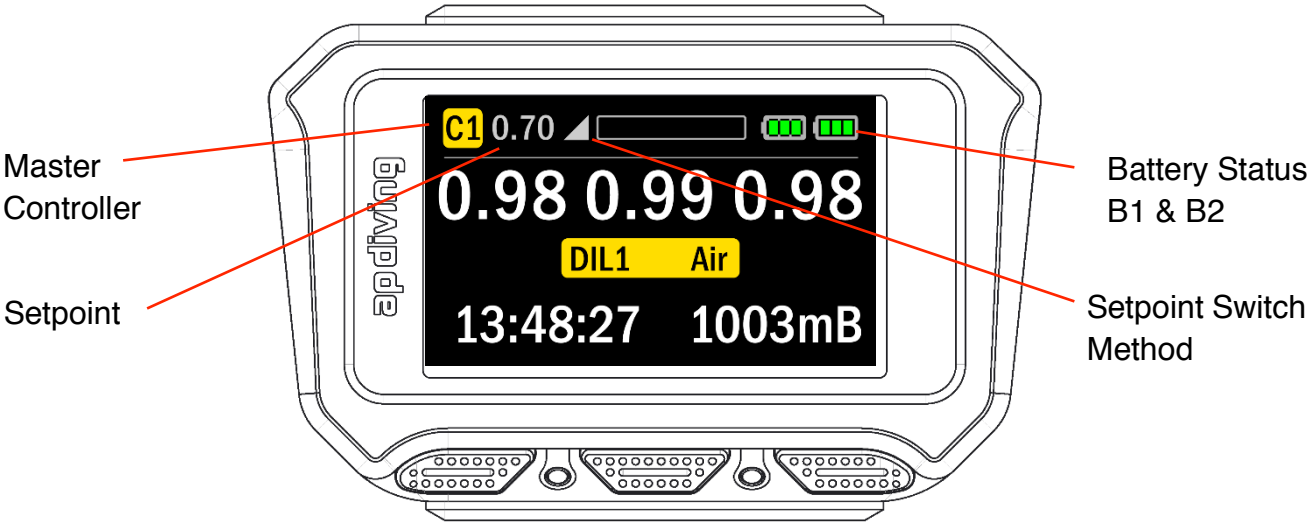
The ‘Candy’ and high contrast black on white ‘Mono White’ themes have been created to be more striking in certain water conditions.



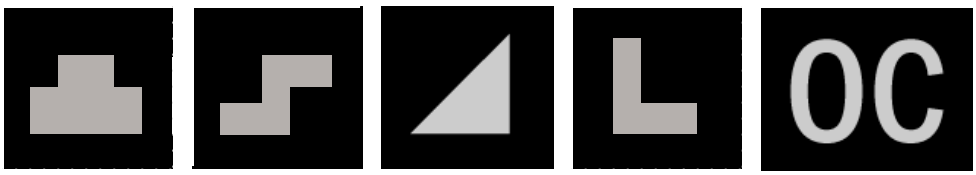
The new ‘AP Colour Theme Designer’ program allows divers to create and upload their own customised colour themes to ‘Custom 1’ and ‘Custom 2’.

Setpoint and Battery Icons

Setpoint

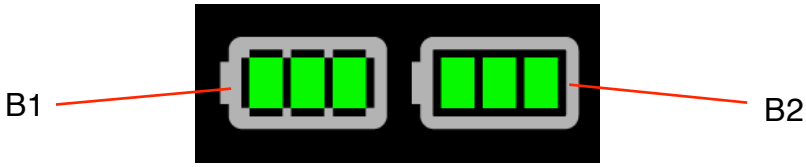


The Setpoint Switch Mode icons are shown below: manual, automatic, gradual and forced low (respectively). If the diver selects to switch to Open Circuit, the 'OC' symbol will replace the Setpoint mode icon.

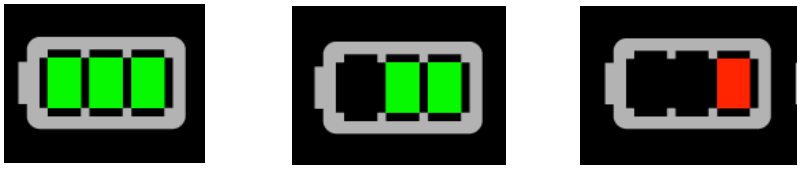


Battery Icons

The 2020 Colour Display incorporates the same highlighted frame to indicate which battery is the master (providing power to the solenoid and display).

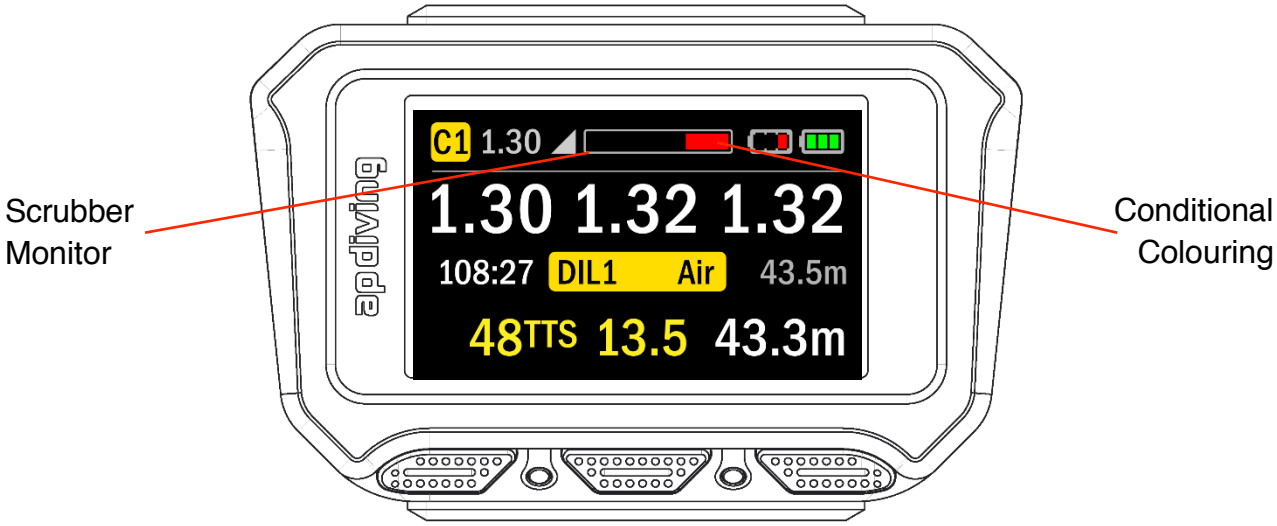


Conditional colouring is used to help highlight a low battery condition



Optional Connectivity

There are various options that can be used with AP rebreathers and these options are highlighted on the HUS (the AP Head-Up Screen - if fitted), as well as on the handset.



The Scrubber Monitor (Tempstick) is displayed in the same way as the previous handset but with the added benefit of Conditional Colouring. When the active area of the scrubber is becoming low the bar will change from green to red to highlight this issue.

CO_2 Sensor fitted

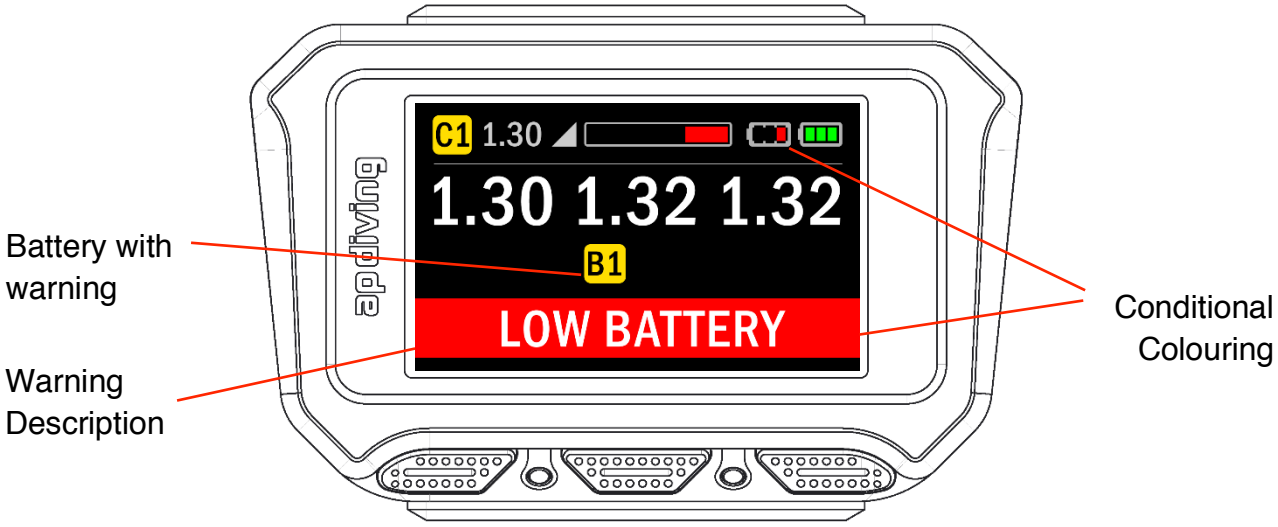
If a Scrubber Monitor is not fitted, but a CO_2 Sensor is present then '++++' is displayed. If both the Scrubber Monitor and CO_2 Sensor are fitted '++++' can be seen when the left button is pressed and held to verify that the CO_2 Sensor is fitted.

No options fitted

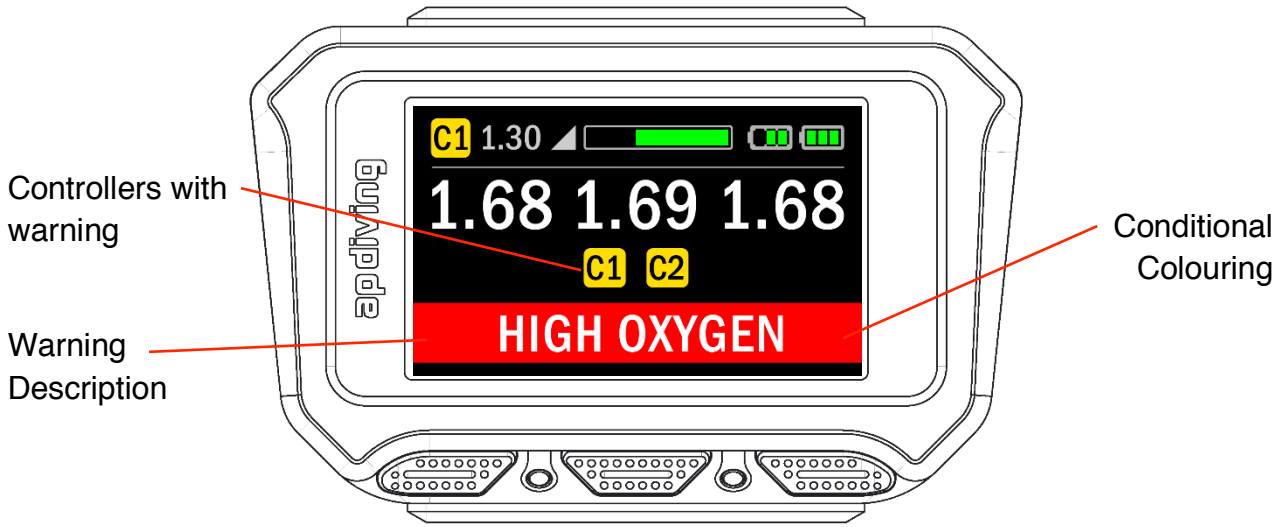
If neither a Scrubber Monitor nor CO_2 Sensor is fitted then '- - - -' is displayed.

Warnings

Warnings are shown on both the 2020 Colour Display and the HUS (if fitted).



The 2020 Colour Display shows which Controllers (or Batteries) are generating the warning and the warning is displayed in high contrast white on red.



Other warnings displayed on the 2020 VISION Colour Display are as follows:

Warning for	Warning text displayed
High Oxygen	HIGH OXYGEN
Low Oxygen	LOW OXYGEN
Scrubber Monitor - Ascend	SCRUBBER WARNING - ASCEND
Scrubber Monitor - Bailout	SCRUBBER WARNING - BAILOUT
CO_2 Alarm - Ascend	CO2 ALARM - ASCEND
CO_2 Alarm - Bailout	CO2 ALARM - BAILOUT
Oxygen Sensor	CELL WARNING
Low Battery	LOW BATTERY
PPO_2	HIGH / LOW OXYGEN
Fast Ascent	- - SLOW - -
Ceiling Violation	↓ ↓ DOWN ↓ ↓
CNS Exposure	CNS EXPOSURE
OTU Exposure	OTU EXPOSURE
Start Error	START ERROR!
Missed Decompression	MISSED DECO!
Decompression Alarm	DECO ALARM
Depth Pressure Sensor Failure	PRESSURE SENSOR FAILURE

Warning Suppression

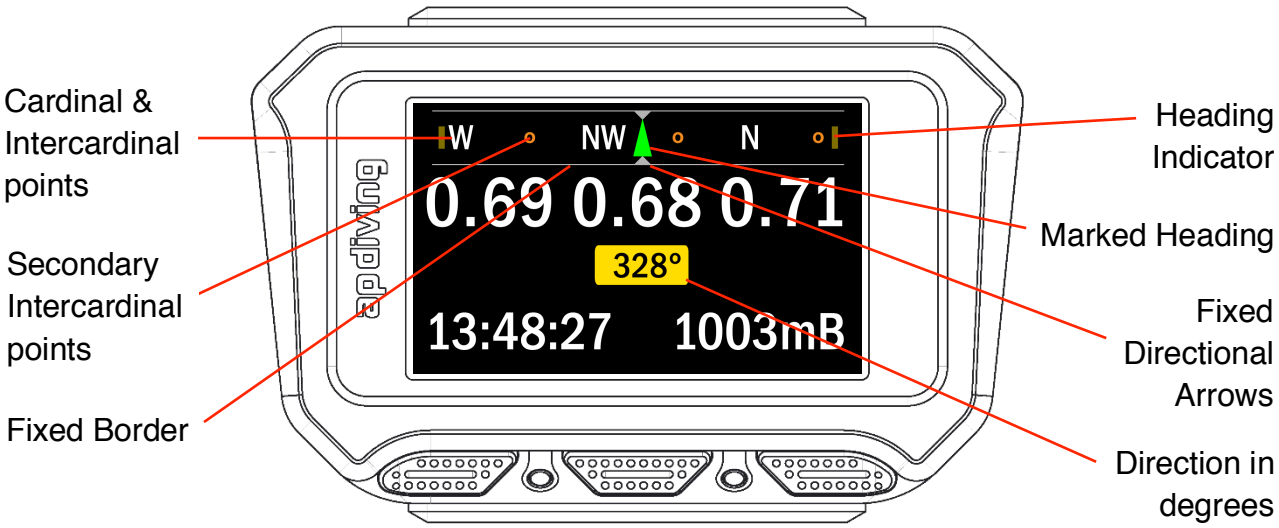
Any warnings that can be temporarily suppressed by pressing and holding the right switch for 2 seconds or more will only have the HUD and buzzer warnings suppressed, leaving the 2020 Colour Display and HUS (if fitted) showing the warning, alternating with dive depth/time and decompression information.

Compass

The 2020 Colour Display features a three axis, tilt compensated digital compass with the ability to mark a heading.

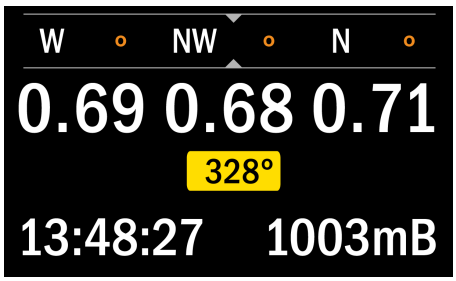
Compass Layout

When activated the compass replaces the top bar information. It is drawn as a horizontal band with fixed borders that include two small arrows marking your direction. The inner band features 8 cardinal and intercardinal points (N, NE, E and so on) and a further 8 orange dots that denote the secondary intercardinal points (NNE, ENE and so on). This inner band represents 120 degrees of the compass and scrolls smoothly in relation to your direction i.e. if you turn to the right, the band will scroll to the left. Your direction in degrees displayed in the central yellow box also updates constantly as you change direction.



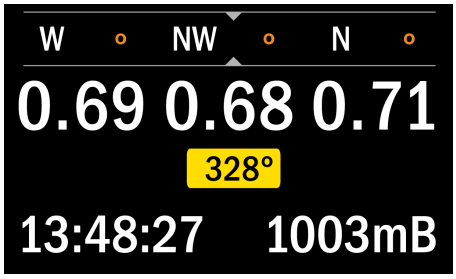
Activating the compass

In Surface or Dive Mode, the compass can be accessed by holding the right button for 2 seconds, then press the left button.



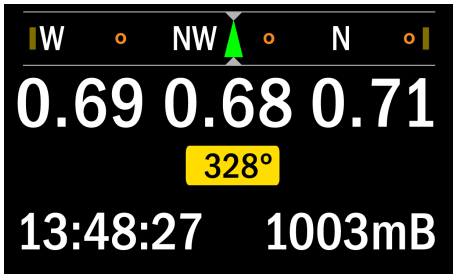
The compass band and direction in degrees then replaces the top line information and the diluent gas respectively. The top line information and diluent can be seen at any time whilst the compass is active by holding the left button for 2 seconds.

Set a heading

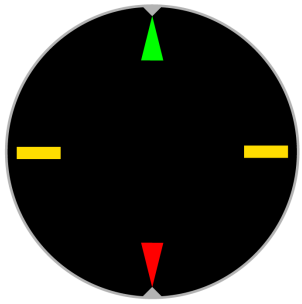


Once the compass is activated a heading can be set by holding the right button for 2 seconds

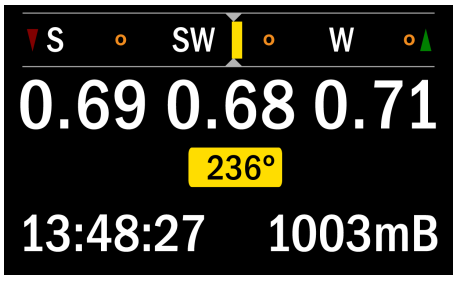
This displays the 'SET HEADING?' option. Pressing the left button to select 'Yes' will set your current direction as a heading, by placing a marker on the inner band of the compass.



The heading is shown as a green arrow on the inner band. As you change direction the marked heading will scroll with the cardinal points on the inner band, giving an indication of which way to turn to get back to your original heading.

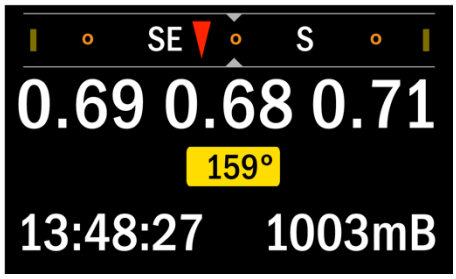


When a heading is set with a green arrow marker, 3 other markers are placed on the inner band at the same time. A red inverted arrow is placed at 180 degrees to the heading as a reciprocal marker and two yellow rectangular markers are also placed at 90 degrees to the heading. These are useful references when swimming perpendicular to the heading marker, for instance during a square search or to simply move along the reef.



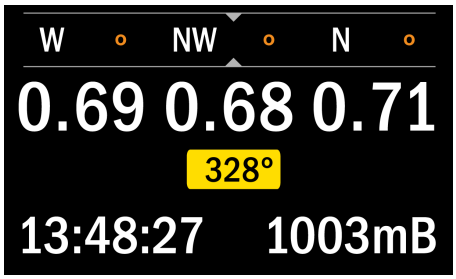
With a heading set, the compass features two heading indicators to show which way to turn to return to the original heading, reciprocal or 90 degree marker.

In this first example the small green arrow on the right of the compass band shows you would turn to the right to return to the original heading and the small red arrow on the left that you would turn to the left to follow the reciprocal heading.



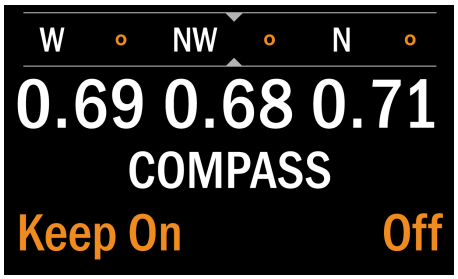
The second example shows a current direction just off the reciprocal heading and that if you were to turn left or right you would be turning towards either 90 degree marker.

Turning the Compass Off



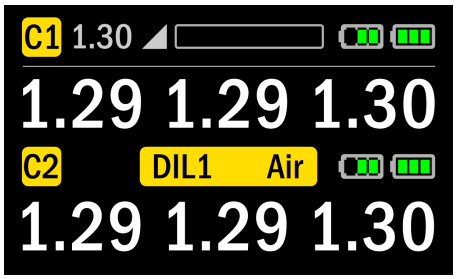
Once the Compass is activated either with or without a set heading, it can be turned off by again holding the right button for 2 seconds to display the 'Set Heading?' option.

Selecting 'Yes' by pressing the left button would set a new heading (replacing a current one if it had been previously set), but selecting 'No' by pressing the right button will give the option to turn the compass off:

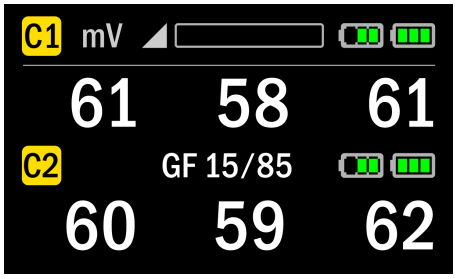


Selecting the right button turns the compass off. Any set heading markers are still retained and displayed when the compass is turned on again. The heading markers are lost though when the handset is powered down and it will be necessary to reset heading markers prior to the next dive.

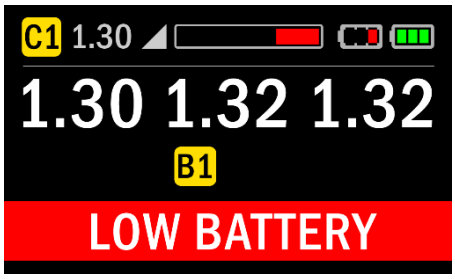
Monitoring the rebreather with the compass activated



The top line controller 1 information, controller 2 information and diluent can be seen at any time whilst the compass is active by holding the left button for 2 seconds.



The oxygen sensor mV readings and gradient factor details can be seen by keeping the left button held for a further 2 seconds.



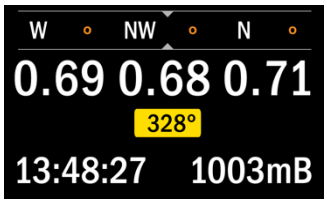
Whenever a warning is active on the display, the top bar information will be shown along with the warning but the compass details will still be shown as the warning alternates with the depth, time and decompression information.

Tilt Compensation

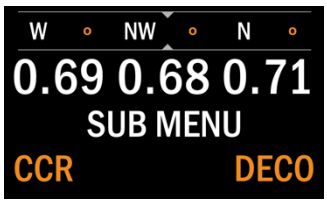
The compass is tilt compensated so the Colour Display does not need to be held completely level or horizontal to maintain a reasonably accurate reading. Properly calibrated an accuracy of ± 2^{o} for 60^{o} of tilt is possible.

Calibrating the Compass

There are two elements to the compass; a magnetometer and an accelerometer. The accelerometer calibration is a one off calibration. The Magnetometer though will require routine calibration particularly when used in a different geographic location or if the accuracy drifts or the handset is subjected to magnetic material. Inaccuracies can be identified by comparing the Colour Display compass to fixed references or a known good compass. During the calibration of the compass any nearby small metal/magnetic objects (including the magnets in the buttons of the handset) will be compensated for and will no longer have an effect on the compass readings. It is important that the Magnetometer calibration is done more than 3 feet away from any metallic objects that will not remain with the Colour Display during its use such as metal desks, radiators, wrist watches and parts of boats.



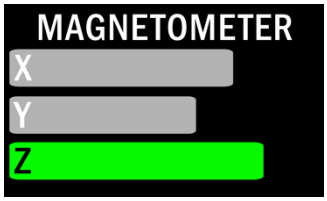
Press and hold the right button and switch the compass on. With the compass activated, press the left and right buttons simultaneously to show the menu options.



Enter the CCR Menu by pressing the left button and then navigate down to the bottom of the menu where you will find the option to calibrate the compass.

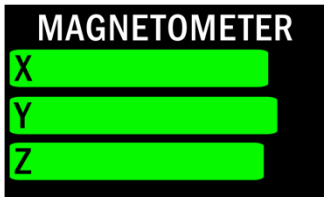
Selecting ‘Yes’ will start the calibration process and selecting ‘No’ will exit the menu.

Instructions on how to move the handset to calibrate the magnetometer will be displayed before the actual process begins.

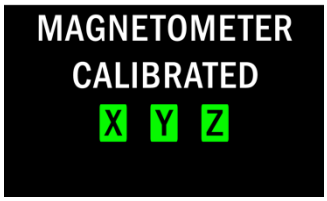


Begin rotating the handset SLOWLY in all orientations when this screen is displayed. Try to place the handset in as many 3D positions as possible. There are 6 surfaces on the handset, ensure all 6 are alternately facing the floor during the rotations.

As the handset is rotated a bar for each 3 Dimensional plane (X, Y and Z) will begin to grow along the display.

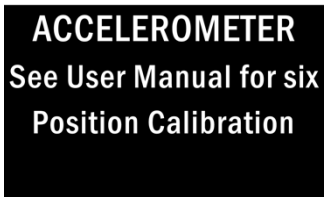


Keep rotating for the full 15 seconds with the goal of achieving a green bar for each plane, indicating that the magnetometer has been subjected to sufficient rotations. The longer the bar, the more accurate the calibration will be.



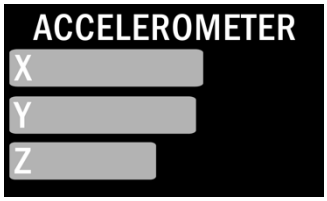
If each bar is green after 15 seconds, the magnetometer will calibrate successfully and this screen will be displayed.

An option to calibrate the Accelerometer is then given. This is something that is required less often than the calibration of the magnetometer and will only need to be carried out the first time you upgrade your software or if the accuracy of the compass is very poor.



The calibration process is similar to the magnetometer however the focus is on subjecting the handset to small movements around six planes.

Start with the display facing up and horizontal with the floor and slowly rotate ±5° around that plane. Then turn the display 90° towards you so the display is facing you and slowly rotate ±5° around that plane. Repeat this two more times rotating the handset 90° towards you each time and the X, Y and Z bars will grow.



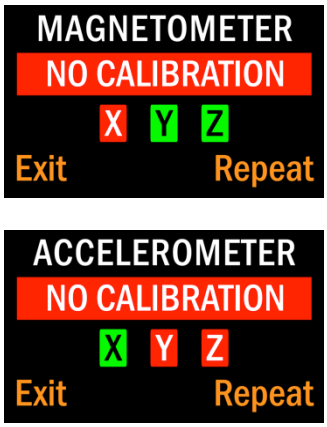
Bring the handset back to its original horizontal position (display facing up) and then turn the handset 90° towards your left so the display is facing to the left (cable downwards) and slowly rotate ±5° around that plane. Repeat this but rotating 90° towards your right so the display is facing to the right and cable upwards to calibrate in all 6 planes.

Keep rotating in this fashion to achieve a green bar for each plane and a successful calibration.

A video of the calibration process can be found online: http://www.apdiving.com/en/rebreathers/resources/videos/

After 15 seconds, the accelerometer will also calibrate successfully as long as all three planes showed green bars.

Failed Compass Calibration

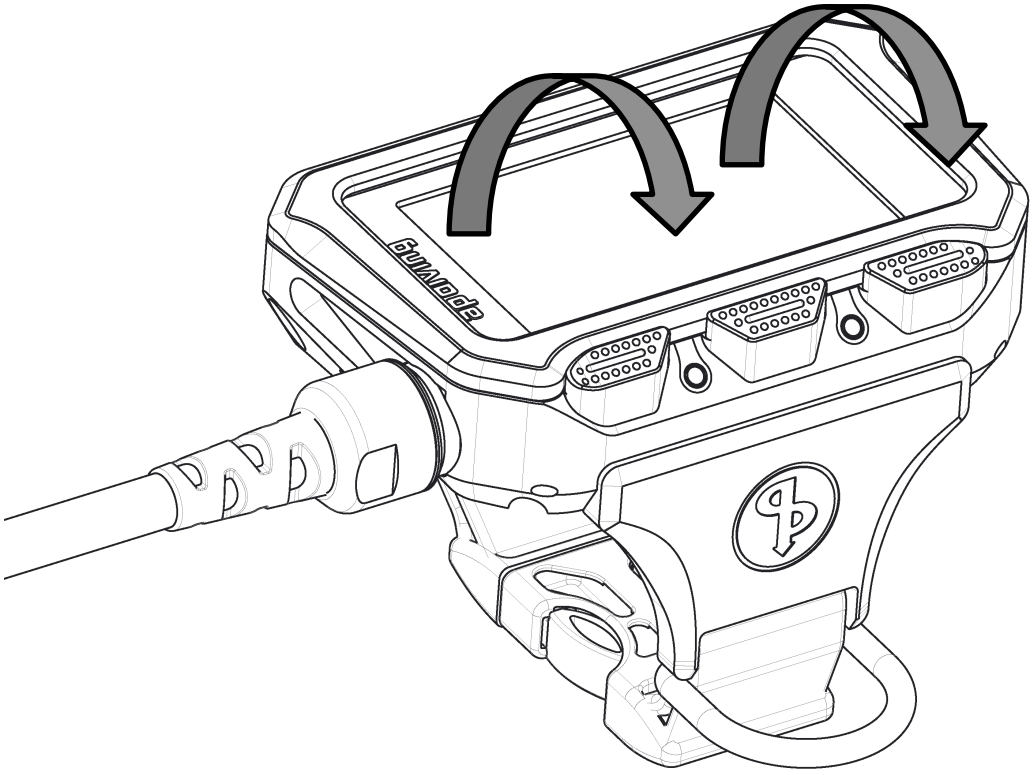


If the handset is not rotated sufficiently enough during either calibration process to give an accurate calibration, a 'No Calibration' screen will be displayed. This will indicate which plane did not receive enough rotations with a red box. In the first example the X plane caused the failed calibration and in the second example, it was the Y and Z. Simply select 'Repeat' and attempt to rotate the handset again or select 'Exit' to continue without calibrating the compass.

Backlight / Brightness Control

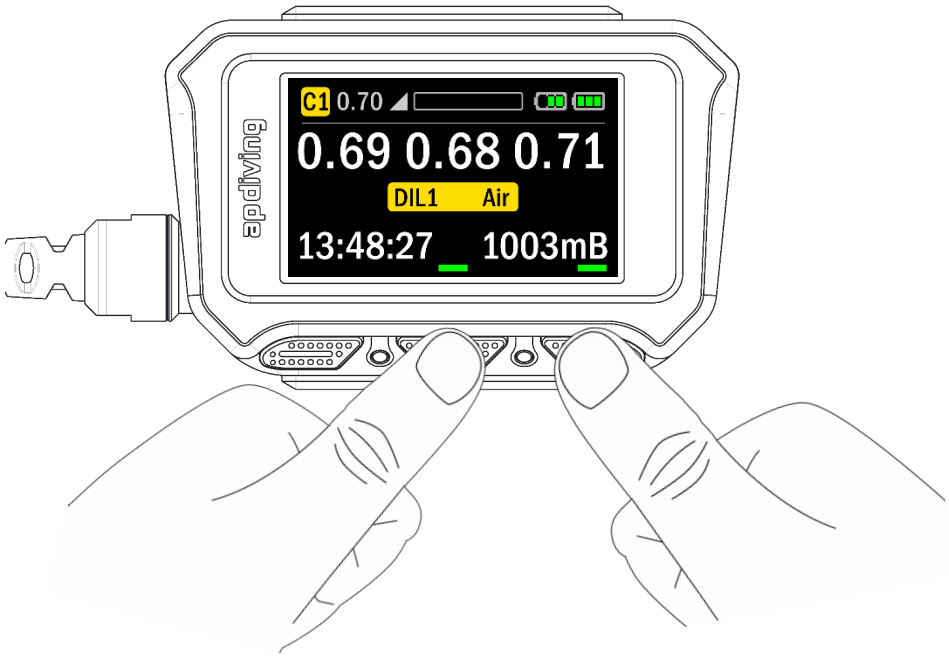
The 2020 Colour Display has enhanced brightness control features. The brightness of the backlight is dimmed automatically after 5 seconds to save power consumption. The diver can still select a desired brightness, opt to have the backlight on continuously, be activated by a key press or off continuously.

A tilt activation method has been added when the 'Key On' preference is selected. A simple rotating action of the display towards the diver will turn the backlight on.

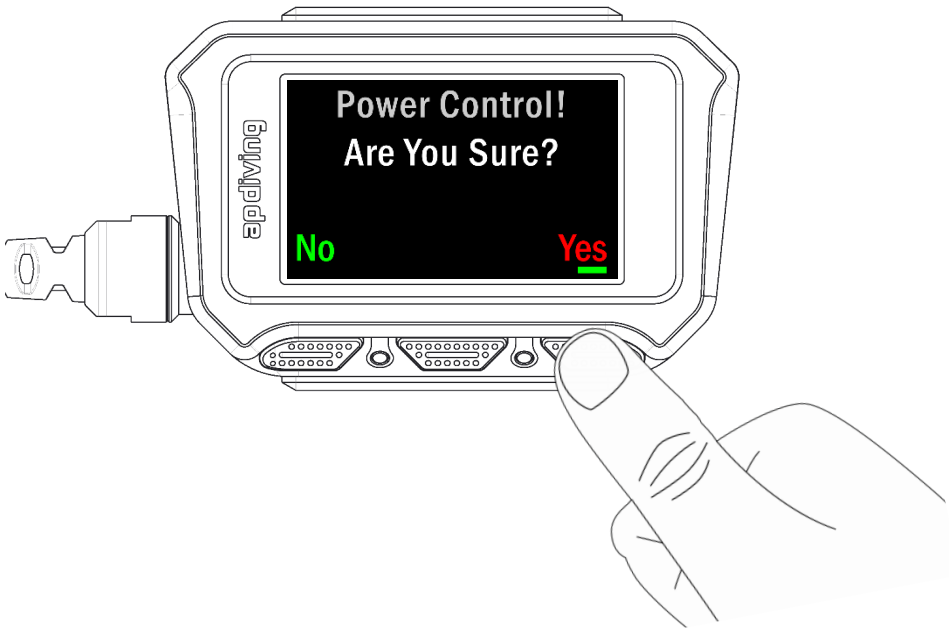


The backlight is activated automatically whenever a warning is displayed. The backlight setting may be changed on the surface and underwater if desired via the CCR menu.

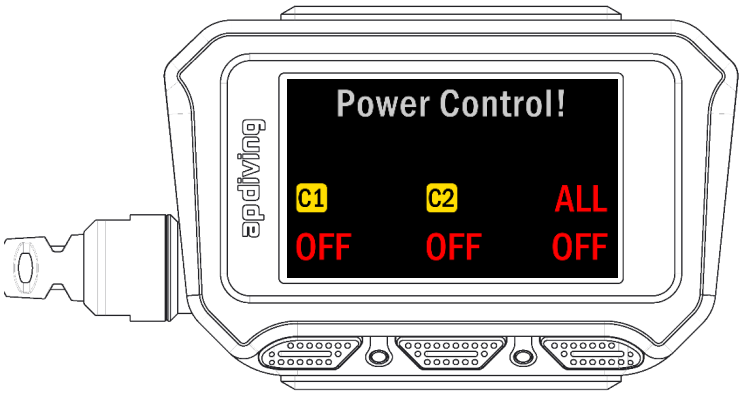
Power Control (Shutdown)



The Power Control screen may be entered at any time, from any screen by pressing the centre and right buttons simultaneously.



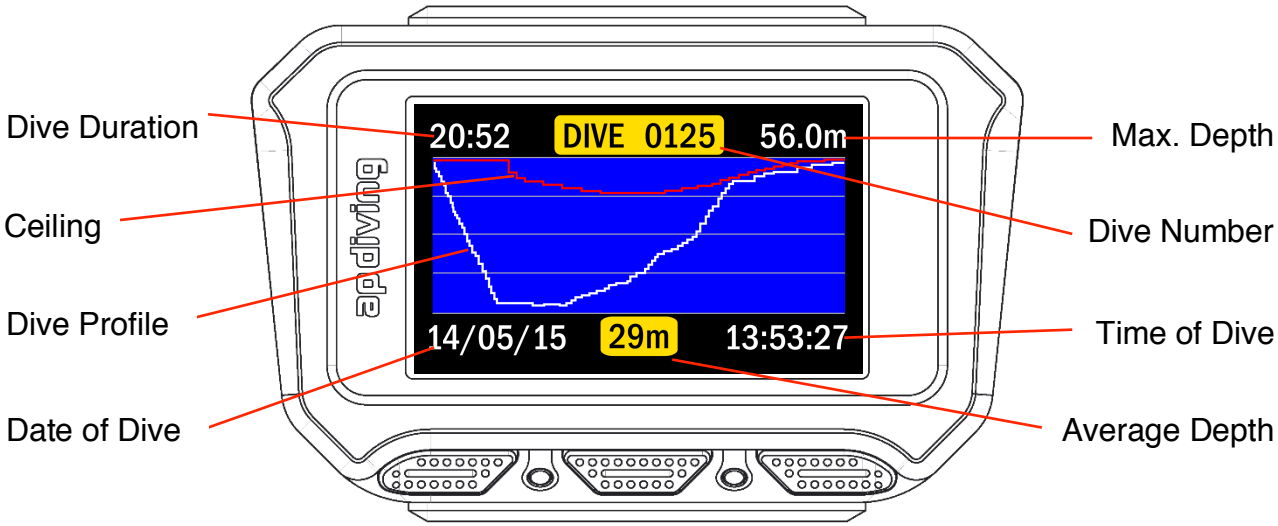
The Power Control allows the shutdown of either of the controllers or the whole system, except when underwater.

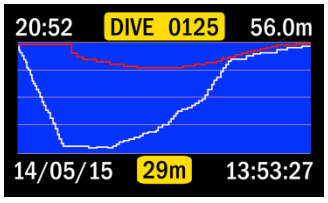


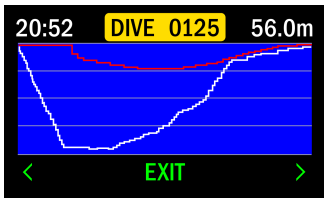
Whilst underwater you cannot turn off the entire system, the ALL OFF option shown at the surface becomes NONE OFF. If one controller is switched off it may be switched on again using the same power control screen.

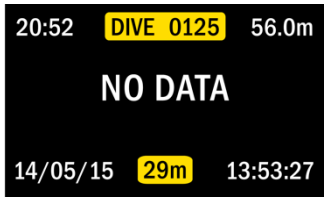
Log Book

The 2020 Colour Display features an improved Log Book that graphically displays dive profiles. The Depth vs Time graphic shows both the actual dive profile in white and any accrued decompression obligation as a ceiling in red.









To view logged dives, enter the DECO Menu, navigate down to 'Log Book' and then press the centre button to enter the Log Book feature.

The Dive Number, Dive Duration (mins/secs) and Maximum Depth (metres or feet) are shown on the top line. The dive profile in white and ceiling height in red plotted as depth vs time in the centre and the Date of Dive (dd/mm/yy), Time of Dive (hrs/mins/secs) and Average Depth (metres or feet) on the bottom line. Every 5 seconds the bottom line alternates to arrows and 'Exit' to show how to scroll through dives within the Log Book. Press the centre button to exit the Log Book at any time. The dive No. is incremented by one every time the rebreather descends below 1.2m providing the surface interval is greater than 5 mins. If the surface interval is less than 5 mins it is counted as an extension of the previous dive. The dive end is logged when the handset is at approx. 0.9m (3ft) or shallower.

If the dive profile can not be displayed for any reason, 'No Data' will be displayed.

Software Upgrades, Updates and Language Options

The software used in the 2020 Colour Display is user upgradable and it is important that the latest version of software is utilised as soon as it is released. Software upgrades will fix any potential bugs found within previous versions. Future software updates may also unlock new features.

The free software updates and language options (English, German, Dutch, Italian, French, Spanish, Portuguese, Danish, Swedish, Norwegian, Polish, Czech, Russian, Chinese, Japanese and Korean) can be downloaded from www.apdiving.com/en/rebreathers/resources/ and uploaded to your 2020 Colour Display using the AP Connect program.

Software upgrades to Nitrox or Trimix decompression models are also user upgradeable from the AP Connect once purchased – for more information please contact AP Diving directly – 01326 563834.

PC Connection

Standard equipment

Items incorporated or supplied with every rebreather fitted with VISION electronics and 2020 Vision Colour Display:

a. Bluetooth communication and extended dive memory built in to the handset.
b. AP DiveSight software for analysing and storing dives as an electronic rebreather logbook.
c. AP Connect Software for transferring files to and from the rebreather.

Optional Accessories

There are two methods of connecting the 2020 Vision electronics to your PC or MAC; either wirelessly via Bluetooth or hard-wired. The Bluetooth connection allows you to communicate with the Vision electronics without opening the scrubber lid. The 2020 Colour Display simply needs to be within Bluetooth range of the PC or MAC.

Bluetooth Accessory:

To check whether your PC has Bluetooth or not, click on the Windows icon in the bottom left corner and type Bluetooth into the “Search Programs and files” box, when a Bluetooth program will be evident if your computer has one. All MACs have Bluetooth capability.

If your PC does not have Bluetooth built in, a Bluetooth adaptor (RBV91) can be plugged into a USB port.

The Bluetooth USB Adaptor (complete with driver CD), available from AP Diving (www.apdiving.com), is a Belkin product: The Belkin Mini Bluetooth v4.0 USB adaptor (Belkin Part No. F8T065).

Hard-wired accessories:

For hard-wired connection an Interface Bridge is available; the same product as supplied with the monochrome Vision electronics since 2005.

The Bridge interface (EV91) connects the rebreather electronics to your PC/MAC with either a 9 pin serial cable (EV91/05) or a serial to USB adaptor cable (EV91/04A).

The Fischer connector on the Bridge interface plugs into the same lid connector as the TempStik. Please ensure you keep the connector dry when connecting and disconnecting.

WARNING! The rebreather must not be dived unless either the TempStik is connected or suitable blanking plugs are used on both halves of the connector.

Terminology

Download – Data, programs or software keys are “downloaded” FROM either the internet or the VISION electronics TO the PC.

Upload – Data, programs or software keys are “uploaded” TO the VISION electronics FROM the PC.

To aid the understanding of upload/download, the direction of information is shown pictorially on the front screen of the AP Connect program. The individual icons have colour graphics when the rebreather is connected, switched on and the correct Com Port is selected.

Data – a) Dive data, including depth, dive time, and ppO_2 information may be downloaded and stored dive by dive as a log book record of the dive, with accumulated times.

b) Equipment configuration, service history data, and owner details are occasionally required and updated by factory personnel.

Software Keys – A unique key is generated to release purchased software options e.g. Nitrox or Trimix. This key is linked to the serial number of your rebreather and is not transferable. Software keys are downloadable over the Internet.

Software

The AP DiveSight program is a logbook type program allowing you to store and view dive data for individual dives. The AP Connect is used for both downloading data from the rebreather and for transferring (uploading) alternate language programs, updated programs, software release codes, updated service history codes or amendments to owner details. Revised computer programs; AP Connect (V1_0_4_3 onwards) and AP DiveSight (V1_0_9_0 onwards) have been created to handle the new memory files and Colour Display code. They are available in two formats for Windows 7 onwards and Mac PCs.

File Formats

There are two file formats for data downloaded from the rebreather:

CCL – individual dive files

The "*.CCL" are the user data files and can be opened using the AP DiveSight software, supplied with the rebreather. These can be edited with DiveSight to add the diver's own details about the dive – location, weather, gas quantities used, etc. The filename is in the format 04C123456_030519_134531 Serial No_dive date_time of dive.dat . In this example 04C123456 is the serial No. of the rebreather, the date is the 19th May 2003, and the time of the start of the dive is 13:45 and 31 seconds. By timing it to the second every dive file will have a different name. The file name is assigned automatically and should not be changed.

CCX – total system download file

The *.CCX file is the Master download file containing the unit's service history and may be requested by the factory from time to time.

CCR – system updates

Rebreather firmware (embedded software) updates, language options, decompression option release codes and User registration screen updates may be downloaded over the internet or sent to you by email and uploaded to the rebreather via the same interface, these have the file format "*.CCR". There is data file checking (write and read back), continuously during the upload procedure to ensure the integrity of the data. Should a "corrupt data" notice occur, simply try again using the same file. If the problem persists obtain a new file and upload that one. As always, there is factory support available should it be required. The decompression option release code files have security codes, which are generated from the individual rebreather's serial Number. The file will not be usable on other rebreathers.

Step by Step Guide to Software and Hardware Installation

Overview:

The AP Connect program runs on your PC and is used to communicate with the 2020 Vision electronics. The Connect program is used to download data from the rebreather and divide it into individual dive files as well as upload new options and programs to the rebreather.

To use the Bluetooth facility, the 2020 Vision unit initially needs to be paired to your PC or MAC. The correct COM port number for the Vision's Bluetooth device needs to be entered into the "Settings" section in the AP Connect. Once done, it is simply a question of putting the 2020 Vision into PC link mode, starting the AP Connect program on your PC or MAC and you're ready to upload or download data.

The downloaded dive files can then be viewed using the latest version of the AP DiveSight program.

Step One: PC/Mac system requirements

Minimum PC/Mac requirements for using the AP DiveSight and AP Connect:

Operating Systems:

- Microsoft Windows 10, Windows 8, Windows 7 and XP (expected to work on Windows ME, Vista, 2000, 98 and NT but not guaranteed). It will not work with Windows 3.1, 95, or any non-Microsoft Windows Operating System.

- Both are now compatible with Mac OSX 10.9+ (without the need for Windows emulators such as Parallels or VMware Fusion).

- Built in Bluetooth or a USB Bluetooth adaptor or a USB or Serial Port.

Step Two: Establish Bluetooth or wired Connection

If using Bluetooth to connect,

Ensure your computer's Bluetooth is switched on or if unavailable install the Belkin Bluetooth adapter on your PC using the CD and instructions provided in the Bluetooth USB adapter packaging. If your computer does not have a CD/DVD drive then the driver can be downloaded from Belkin's website: http://www.belkin.com/uk/support-article?articleNum=4867. If that link is out of date, simply go to www.belkin.com and search for "Bluetooth USB Adapter F8T065 - Setup Driver".

Alternatively, you can use the wired Bridge Interface with serial/USB cable or serial/serial cable. Connect the Interface Bridge to the appropriate cable which can then be connected to a port on your PC. If using the white Serial/USB cable (EV91/04A) with Windows 7 or later your PC will automatically find the correct driver. If using the serial/serial cable no driver is necessary.

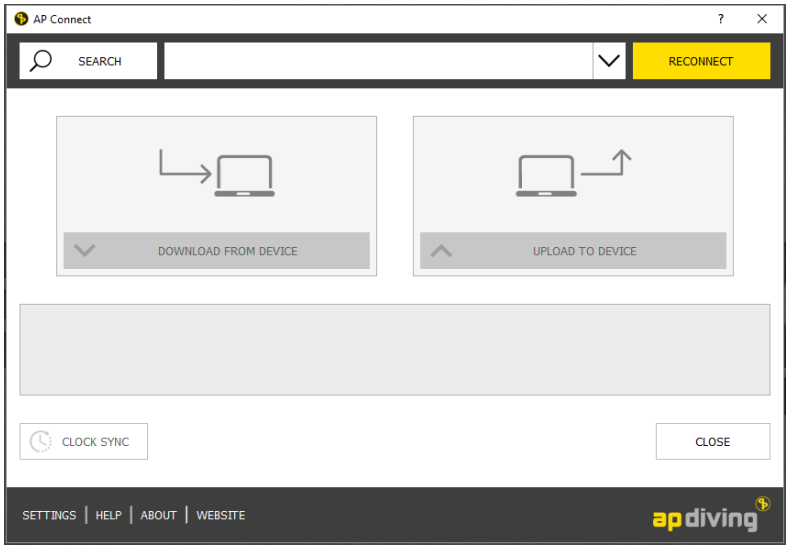
Step Three: Install AP Connect:

The latest version of the AP Connect may be downloaded from www.apdiving.com, under resources.

Run APConnect_Windows_Setup.exe by double clicking on it and follow the instructions on screen. If you download it from the web, save it somewhere convenient such as your Desktop, then run the program from there by double clicking on it. During the setup it creates its own folder under c:\program files\. Be sure to select “Create Desktop Icon”. Once installed you can delete the APConnect_Windows_Setup.exe program.

Step Four: Run AP Connect:

Run the AP Connect program by double clicking on the Desktop Icon. The following screen will be displayed:



Step Five: Activate PC Link Mode

Hardwired Bridge Interface:

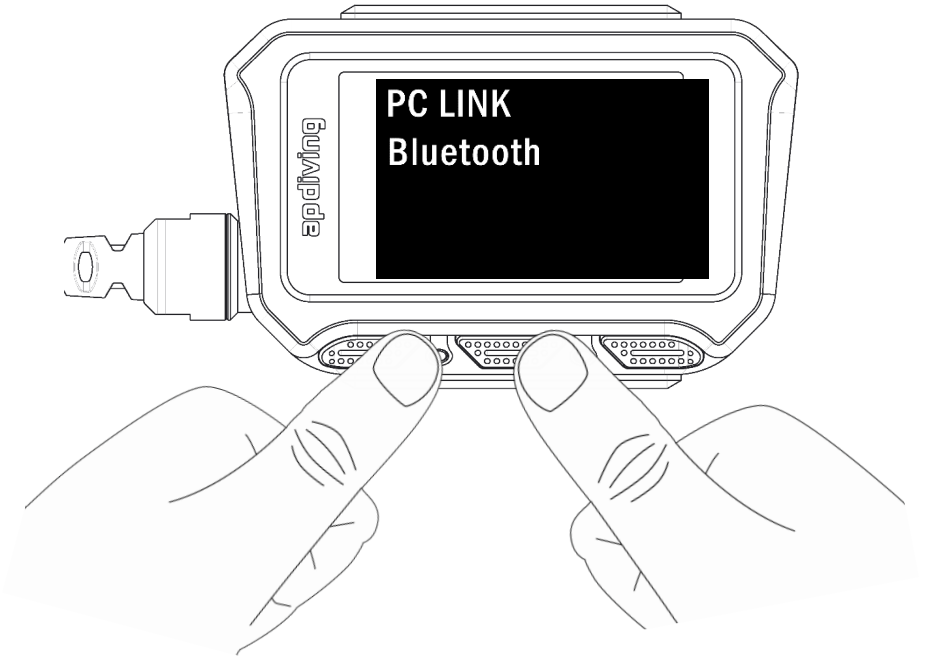
Connect the Bridge interface to the rebreather electronics using the connector inside the lid, press and hold the left button for 2 seconds. Identify the COM port your computer has assigned to this connection by looking at Ports in Device Manager and select that COM port in the AP Connect Settings.

Bluetooth Pairing and AP Connect COM Port setup:

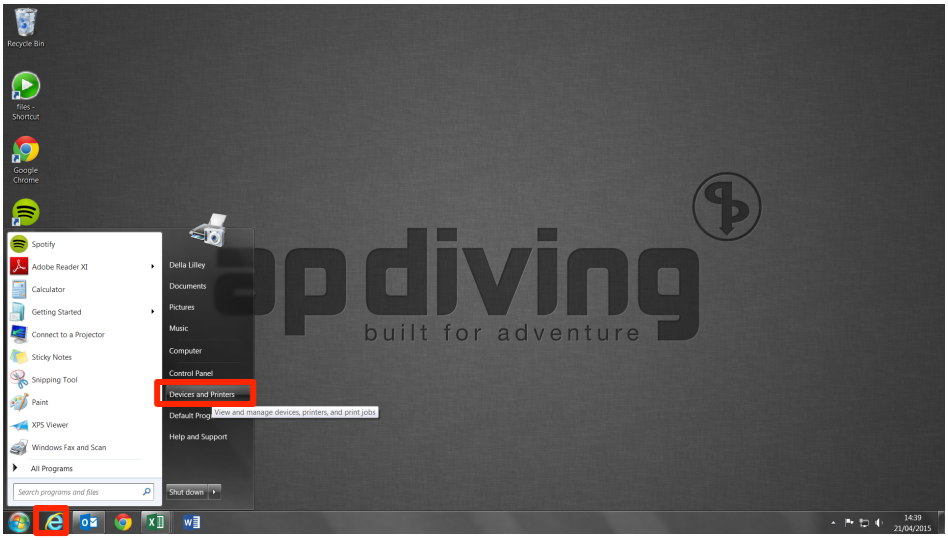
1. Move the Colour Display to within 0.6 metres (2 ft) of the Bluetooth dongle. With the Colour Display switched off, activate the Bluetooth mode on the handset by pressing and holding, for 2 seconds, both the left and centre buttons:

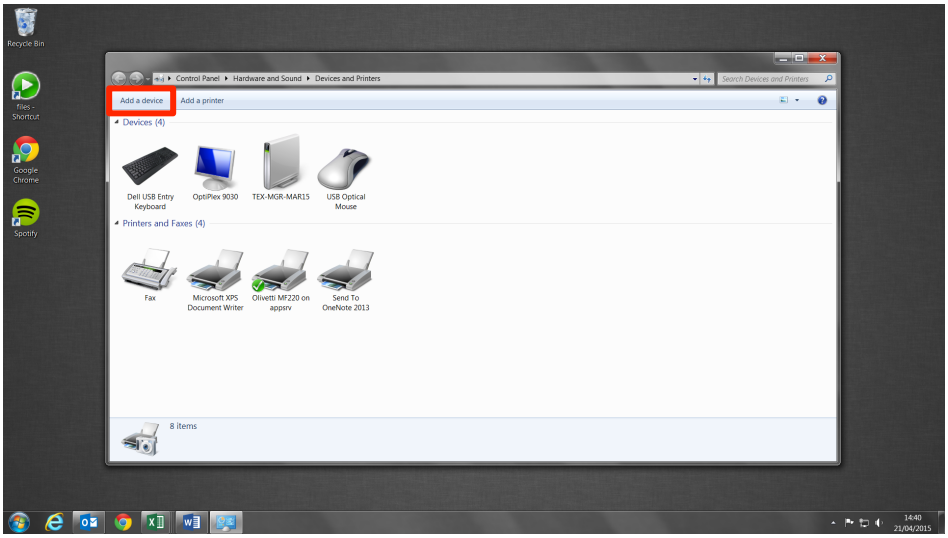
   Tip: pressing the centre button slightly before the left button will ensure the handset doesn't accidentally switch on as normal.

   Note: the handset will stay in Bluetooth mode for only 2 minutes. If the following steps take longer to perform, simply re-activate the Bluetooth mode by pressing and holding the left and centre buttons again.

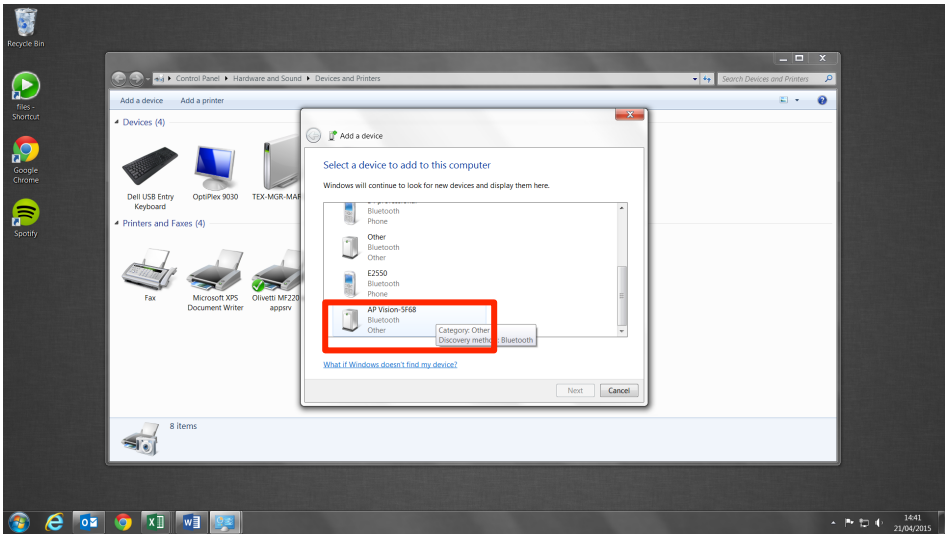


2. Click ‘Start’, ‘Devices and Printers’ and then ‘Add a Device’ at the top of the ‘Devices and Printers’ window:

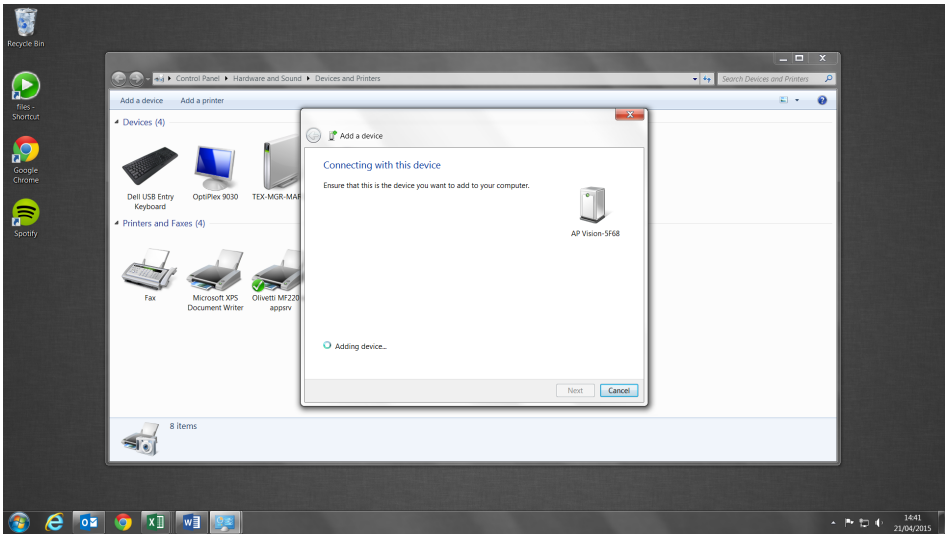


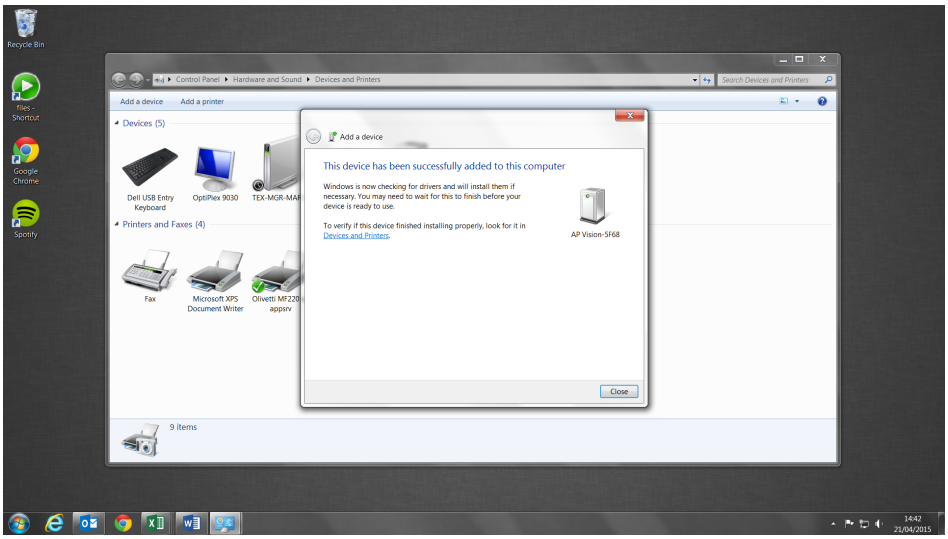


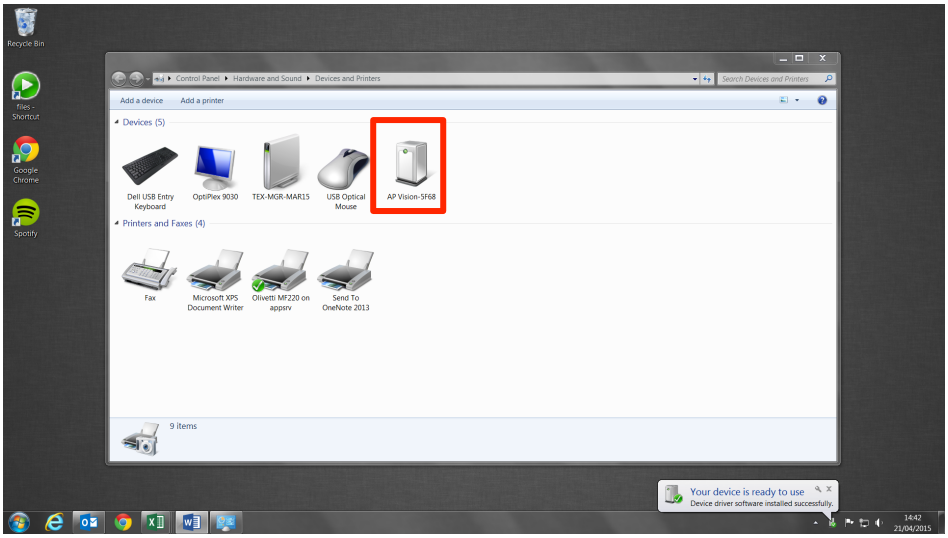
3. Double click the new Bluetooth device – AP Vision- xxxx



4. Often the device is automatically paired but on some systems, particularly MACs, you will be required to enter the “device’s pairing code”, which is ***apvision*** (all in lowercase, no spaces). This will pair the Vision electronics with the computer and it will now be displayed in the ‘Devices’ of the ‘Devices and Printers’ window.

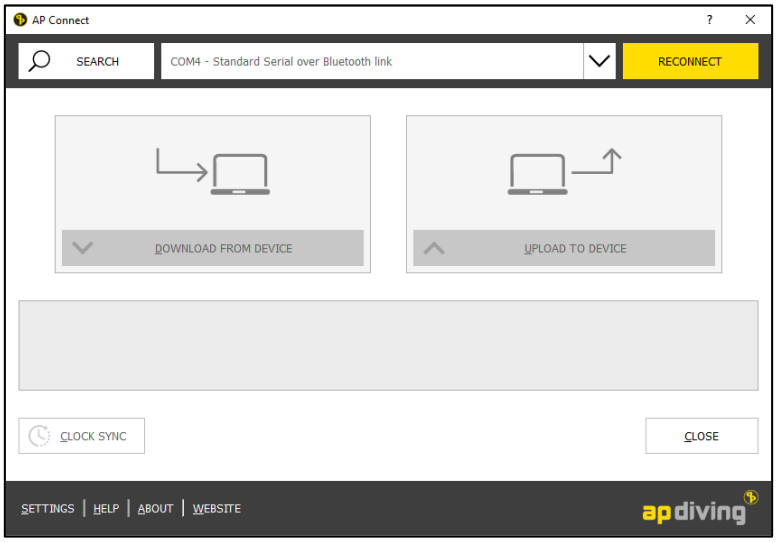




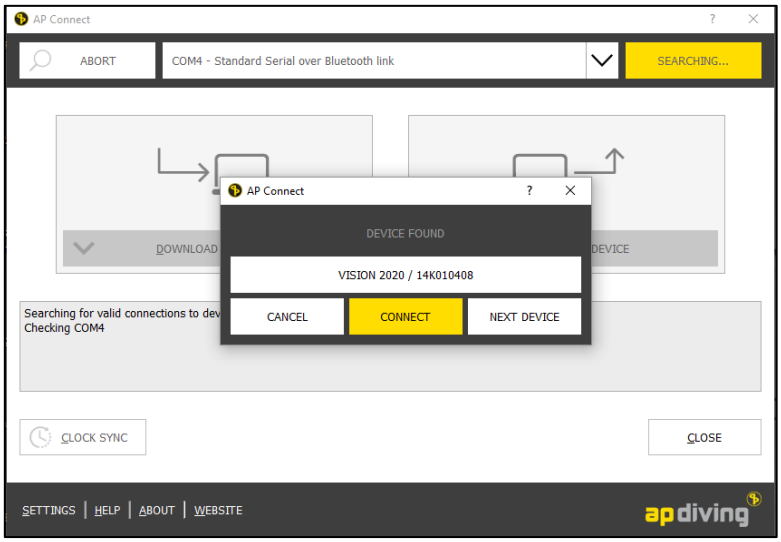


5. Right click on the AP Vision-xxxx Bluetooth device logo, select Properties and then the Hardware tab and note the ‘COM Port’ allocated to the device. You will need to use this port in the AP Connect program. If necessary you can go into Properties/Advanced and change the COM port number. If you have more than one AP Vision device it may be desirable to rename the device, which you can do by clicking on the Bluetooth tab.

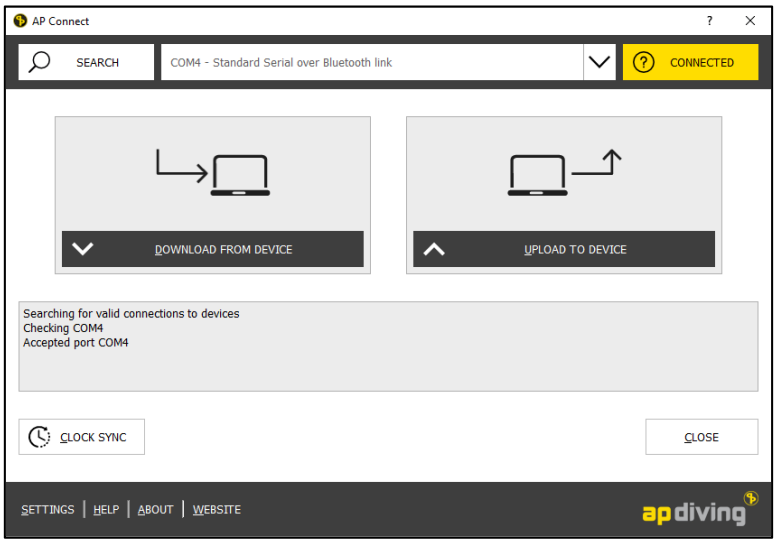
6. Start the AP Connect program by double clicking on the Desktop icon, check that the Bluetooth PC LINK is displayed on the rebreather handset, and then click on Search (top left corner).



7. If the connection is successful a pop up screen will appear, click on the yellow “Connect” button:



8. If the link is successful the yellow box in the top right corner will display “CONNECTED” and the “DOWNLOAD FROM DEVICE” and “UPLOAD FROM DEVICE” icons will be highlighted.



9. The rebreather and AP Connect are now setup for downloading dive data from the rebreather and for transferring any upgrade files to the rebreather.

10. The Download Directory will automatically default to a directory called “AP Log Files” under “My Documents”. If you desire you can change the download directory by entering the directory name and path in the “download directory” box on the Settings page. This is the name of the directory into which you want to save the *.CCL dive data files that you download from the rebreather.

11. The Upload Directory will automatically default to “My Documents”. You can change the Upload Directory by entering the filename and path in the “upload directory” box. This is the name of the directory into which you will save upgrade files that you either download over the Internet or are emailed by the technical support team at AP Diving. Tip: create a directory called “Rebreather Upgrades” under “My Documents”.

12. The first job is to set the date and time in the rebreather. Select CLOCK SYNC and then Synchronise if you are happy to have the rebreather on the same time and date as your PC.

13. Click on the top bar of the front screen and the details of your rebreather software will be displayed. This information can be compared to the latest software versions on the www.apdiving.com website to ensure you have the latest version of software for all three processors, display, C1 and C2.

Step Six: Install the AP DiveSight program:

The latest version of the AP DiveSight may be downloaded from www.apdiving.com.

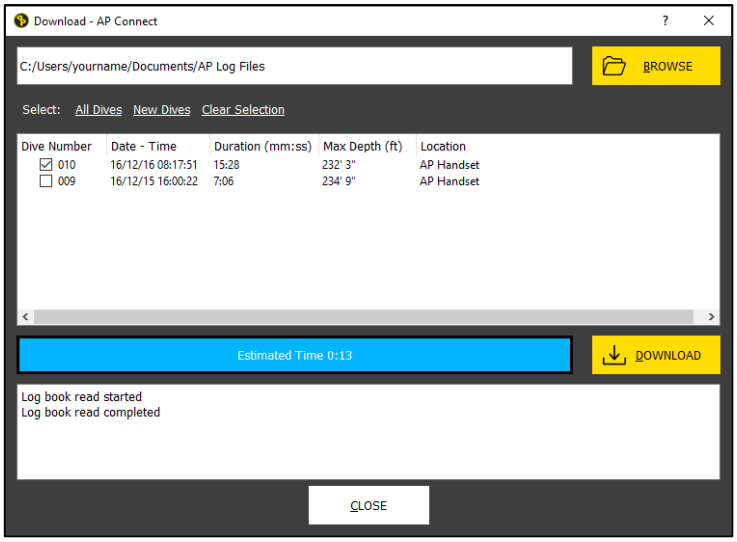
1. Run: APDiveSightSetup.exe and follow the on-screen instructions. If you download it from the web, run the program from wherever you saved it. During the setup it creates its own directory under c:\program files\. It is not necessary to uninstall previous versions, simply run the Setup program being sure to select “Create a desktop icon”.

Step Seven: Go diving:

You need to dive deeper than 1.2m (4ft) otherwise the rebreather will not enter underwater mode and start dive logging.

Step Eight: Download the dives:

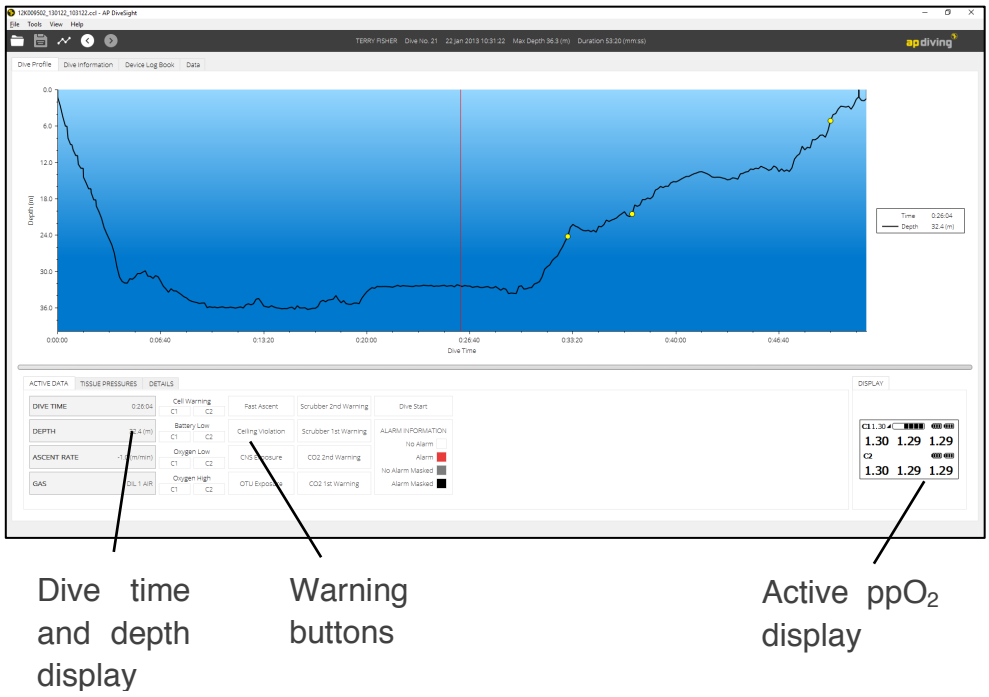
Once you have been diving, download the dives using the AP Connect by connecting the Interface, switching on the handset (press the left button once) so “PC Link” is shown on the handset or connect via Bluetooth. Start AP Connect and click “DOWNLOAD FROM DEVICE”, the “Download – AP Connect” screen appears. Select the dives you wish to download, then click on download button to transfer the data files (*.CCL) from the rebreather to the AP Log Files directory.



Step Nine: Start the AP DiveSight

1. Once installed run the AP DiveSight, select File, Open and change the directory in the “Look In” box to the same directory name used in the AP Connect to store downloaded rebreather log files:
   Tip: use C:\...\my documents\AP Log Files – browse to find the directory.

2. Double click on the relevant data file. A typical data file would have a similar filename to this: 12K009502_130122_103122.ccl, which shows the serial No. of the rebreather, followed by the date of the dive in the format yy,mm,dd (22ND January 2013 in this example), followed finally by the time of the dive in the format hrs,mins,secs. In this example the time of submerging below 1.2m (4 feet) was at 11:31 and 22 secs.



Dive time and depth display

Warning buttons

Active ppO_2 display

3. Move the cursor across the blue screen. The active ppO_2 display will show what the ppO_2 display was reading at all stages of the dive. The dive time and depth display box shows the dive time where ever the cursor is, the depth, the ascent rate, or descent if negative, and the gas (diluent) the handset is set on.

4. Warnings appear as yellow circles on the dive profile line. Moving the curser over the warning circle will cause the relevant warning type to be highlighted in the active data display below the dive profile display.

   If the alarm is highlighted red the alarm is active. If the alarm is highlighted black, the warning has been manually suppressed/masked. If the alarm is highlighted in grey the diver has masked the warning but then the warning has subsequently cleared itself.

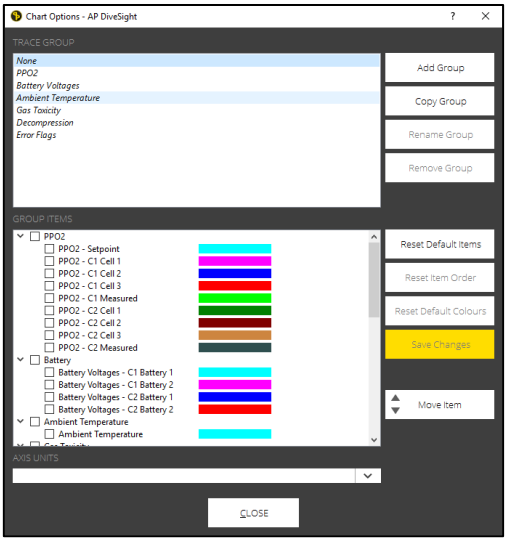
5. A right mouse click when the curser is in the dive profile display allows the selection of other display options.

6. Double left click over the display will create a “sticky cursor” fixing the vertical bar in position, the bar turns red when fixed. If you want to move the position of the vertical bar, simply click once and the cursor will move to the new position and remains fixed. Double left click over display again and the vertical bar is freed.

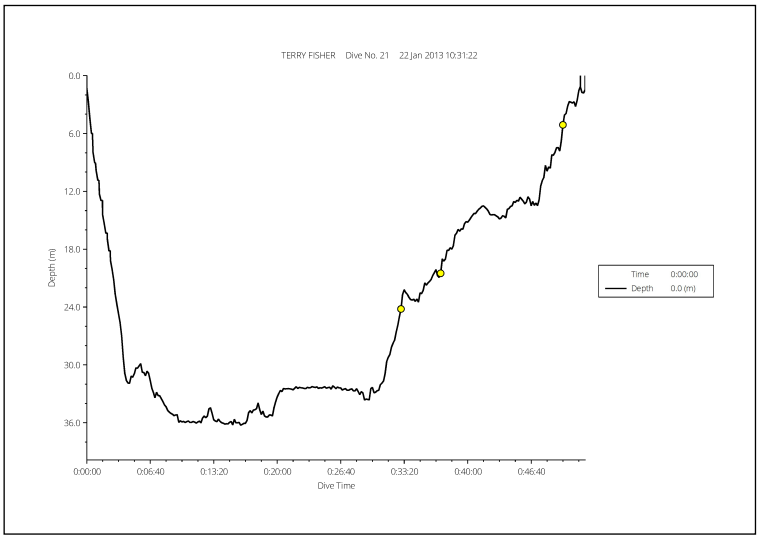
7. Focus on part of the dive:

    a. Zoom in and out using the mouse wheel.
    b. Stretch the chart by holding the left button and dragging the chart to the right
    c. Selectively zoom into a portion of the chart by placing the cursor at the start time, selecting ctrl + left click hold and dragging to the end time.
    d. Reset the zoom by right click and selecting “Reset Zoom”.

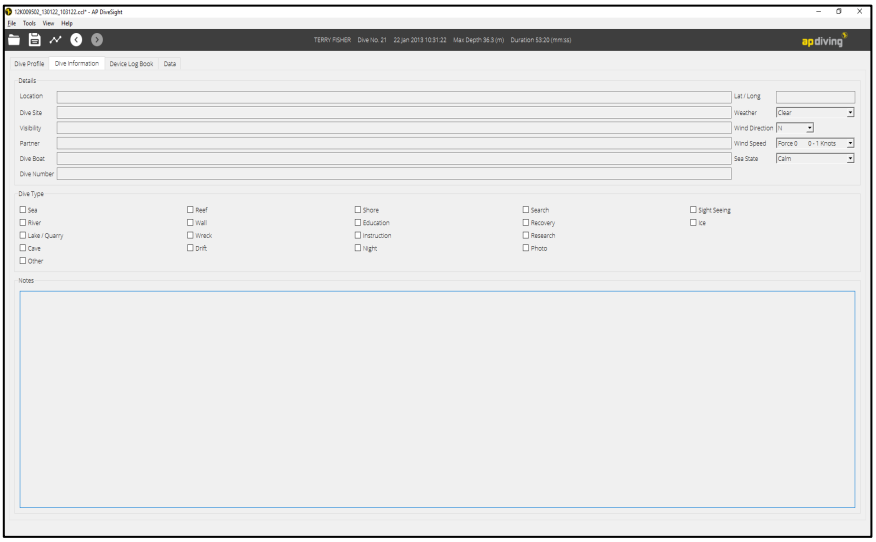
8. If you wish to overlay the dive profile with ppO_2, Battery Voltages, Ambient Temperature, Gas Toxicity, Decompression or Error Flags, select the Chart Options icon located at the top left of the screen, or right click over the dive profile and select Chart Options. Axis units and chart colours may also be changed in this screen, once you are happy with your selection click “Save Changes”, then click “Close” to return to the dive profile.



9. At any time the dive profile may be printed by selecting File, Print, Print Graphic.

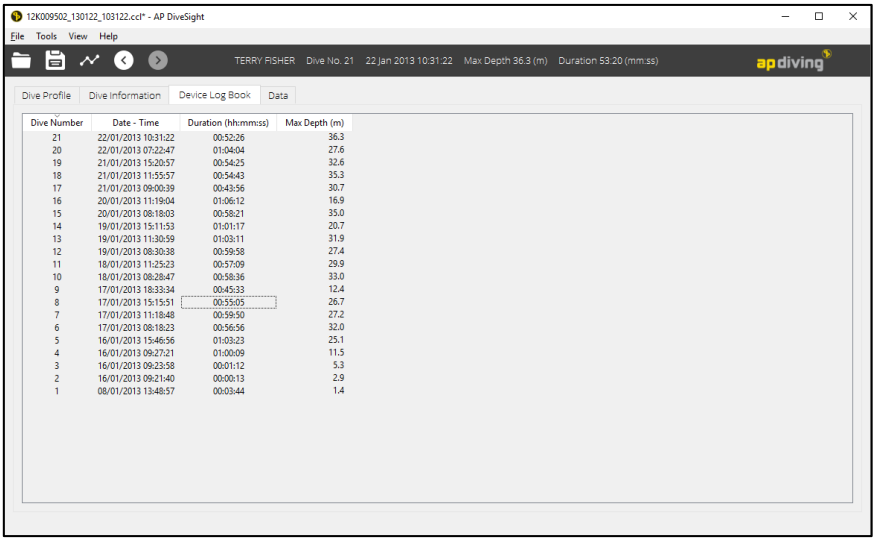


10. Selecting the Dive Information tab reveals the following screen:



Personal dive information can be manually entered into the relevant fields. Be sure to save the file once you have finished entering the data.

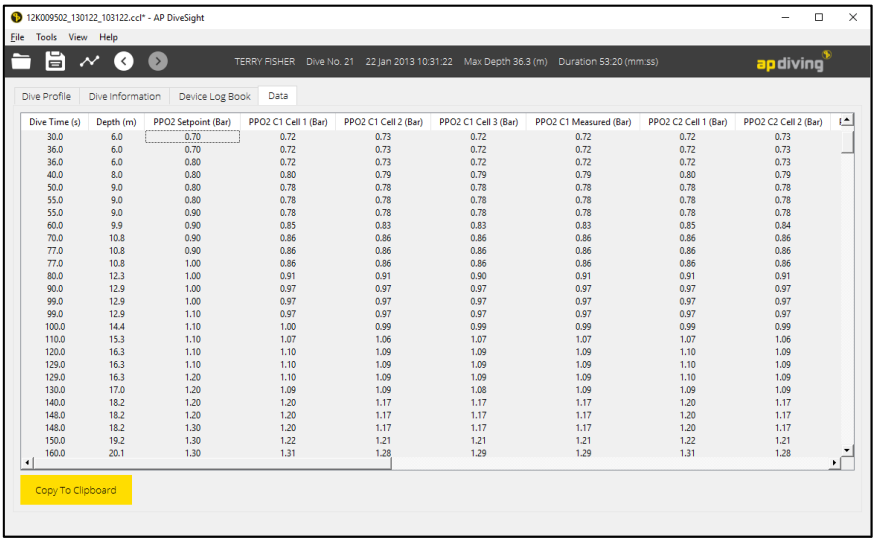
11. Selecting the Device Log Book reveals the following screen:



The Device Log Book is reserved for rebreather information:

- dive number.
- date and time (time of submerging below 1.2m (4ft)).
- duration (time from leaving 1.2m (4ft) to reaching 0.9m (3ft)).
- max. depth (m).

12. By selecting the Data tab reveals the following screen:



Dive Time (s)	Depth (m)	PPO2 Setpoint (Bar)	PPO2 C1 Cell 1 (Bar)	PPO2 C1 Cell 2 (Bar)	PPO2 C1 Cell 3 (Bar)	PPO2 C1 Measured (Bar)	PPO2 C2 Cell 1 (Bar)	PPO2 C2 Cell 2 (Bar)
30.0	6.0	0.70	0.72	0.73	0.72	0.72	0.72	0.73
36.0	6.0	0.70	0.72	0.73	0.72	0.72	0.72	0.73
36.0	6.0	0.80	0.72	0.73	0.72	0.72	0.72	0.73
40.0	8.0	0.80	0.80	0.79	0.79	0.79	0.80	0.79
50.0	9.0	0.80	0.78	0.78	0.78	0.78	0.78	0.78
55.0	9.0	0.80	0.78	0.78	0.78	0.78	0.78	0.78
55.0	9.0	0.90	0.78	0.78	0.78	0.78	0.78	0.78
60.0	9.9	0.90	0.85	0.83	0.83	0.83	0.85	0.84
70.0	10.8	0.90	0.86	0.86	0.86	0.86	0.86	0.86
77.0	10.8	0.90	0.86	0.86	0.86	0.86	0.86	0.86
77.0	10.8	1.00	0.86	0.86	0.86	0.86	0.86	0.86
80.0	12.3	1.00	0.91	0.91	0.90	0.91	0.91	0.91
90.0	12.9	1.00	0.97	0.97	0.97	0.97	0.97	0.97
99.0	12.9	1.00	0.97	0.97	0.97	0.97	0.97	0.97
99.0	12.9	1.10	0.97	0.97	0.97	0.97	0.97	0.97
100.0	14.4	1.10	1.00	0.99	0.99	0.99	0.99	0.99
110.0	15.3	1.10	1.07	1.06	1.07	1.07	1.07	1.06
120.0	16.3	1.10	1.10	1.09	1.09	1.09	1.10	1.09
129.0	16.3	1.10	1.10	1.09	1.09	1.09	1.10	1.09
129.0	16.3	1.20	1.10	1.09	1.09	1.09	1.10	1.09
130.0	17.0	1.20	1.09	1.09	1.08	1.09	1.09	1.09
140.0	18.2	1.20	1.20	1.17	1.17	1.17	1.20	1.17
148.0	18.2	1.20	1.20	1.17	1.17	1.17	1.20	1.17
148.0	18.2	1.30	1.20	1.17	1.17	1.17	1.20	1.17
150.0	19.2	1.30	1.22	1.21	1.21	1.21	1.22	1.21
160.0	20.1	1.30	1.31	1.28	1.29	1.29	1.31	1.28

The dive data can be copied to clipboard by clicking on the “Copy To Clipboard” button. The data can be then be pasted into a spreadsheet such as Microsoft Excel.

Maintenance

Post-dive, always store the rebreather lid in a clean, dry, environment and take care not to leave the lid and 2020 Colour Display exposed to high temperatures. Do not expose the 2020 Colour Display to disinfecting regimes. It should be protected against shock at all times and avoid scratches on the lens by replacing the lens protector if it is damaged or starts to peel.

It is recommended that the 2020 Colour Display is washed with fresh water after each dive to avoid dirt and salt build up. The buttons should be washed with fresh water in particular and then depressed several times to expel excess water before allowing the equipment to dry naturally and being stored.

Do not wash with high-pressure water jets as this may cause damage to the 2020 Colour Display.

Before each dive you should make sure that the 2020 Colour Display is free from mechanical damage and that the lens, strap, buttons and depth pressure sensor holes are not impeded in any way that could affect use.

The 2020 Colour Display is a sealed unit and no attempt should be made to disassemble the housing. Trying to do so could cause irreversible damage to the display and electronics.

Do not attempt to modify the rebreather or 2020 Colour Display.

The Colour Display will be inspected by AP Diving or one of their authorised service distributors during the rebreather lid annual service.

WARNING – Do not attempt to dispose of the Rebreather Lid or the 2020 VISION Colour Display at the end of their life. Contact AP Diving and we will advise on disposal.

Technical Data

Temperature Range	Operation:	4°C	to	32°C
	Short term air storage (hours):	-10°C	to	50°C
	Long term storage:	5°C	to	20°C
Atmospheric Range	650 – 1080 mbar			
Digital Pressure Sensor	0 – 14 bar			
Maximum Operating Depth	100m (this coincides with the maximum depth proven for all AP Diving rebreather parameters according to EN14143)			
Display	2.8” ultra-bright full colour LCD			
Housing	Hard-anodised marine grade aluminium			
Polycarbonate Lens	Heavy Duty, impact resistant screen, pressure tested to 200m			
Battery	Powered by Rebreather Lid power source			
Weight	Approx. 0.35Kg (handset and cable only)			
Dimensions	Approx. 102 x 64 x 28mm (aluminium housing)			
PPO_2 Display	Accuracy:	± 0.05 bar		
	Resolution:	0.01 bar		
Oxygen Setpoint Range	Low:	0.5 – 0.9 bar		
	High:	0.9 – 1.5 bar		
Oxygen Warning Level	Low:	0.4 bar		
	High:	1.6 bar		
Languages	English, German, Dutch, Italian, French, Spanish, Portuguese, Danish, Swedish, Norwegian, Polish, Czech, Russian, Chinese (Mandarin), Korean, Japanese			
Communication	Hardwired to rebreather with flexible, Kevlar-reinforced cable. Bluetooth download / upload with PC or MAC			
Firmware Upgradable	Hardware included for future software update to unlock additional features such as: tilt activation, digital compass and colour customisation capabilities.			
Warranty	1 year			

EC TYPE Approval

EC Type approved by SGS United Kingdom Ltd, Unit 202b, Worle Parkway, Western-Super-Mare, Somerset, BA22 6WA. Notified Body number 0120.

The “Inspiration XPD”, “Inspiration EVP” and “Inspiration EVO” (complete with Colour Display) are CE approved to 40m using an air diluent and 100m using a Heliox or Trimix (with a max. END of 30m at 70m, reducing to an END of 24m at 100m). The EC Type Approval was granted on the APD Manufacturer’s Technical Specification and satisfactory user trials. The Technical Specification was based on the “Respiratory equipment-Self-contained re-breathing diving apparatus” standard EN14143:2013.

EC PPE Article 11B Approval

The on-going certification to allow CE marking under Article 11B Directive 89/686/EEC is granted by Lloyd’s Register Quality Assurance Ltd. CE0088.

Manufacturer

Designed and Manufactured in the UK by:

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