APD Projection

A Theoretical Dive Planner

Help on Help (?)

In addition to this manual you can get contextual help at any time in the program by clicking on either the (?) tool or the (?) in the top frame to activate the help. Then simply click on the item you want to know more about and a brief explanation will be shown. You will need to click the (?) again if you want to interrogate another item. Also from any window in APD Projection, just press the F1 button and the relevant help page will open.

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WARNING!

The APD Projection, a Theoretical Dive Planner is a development tool for creating experimental dive profiles. It is not a substitute for proper dive planning and execution in a real world environment, experience and the use of sound judgment and safety procedures. You use this product at your own risk. Ambient Pressure Diving, Ltd., it's officers, directors or employees, or program authors or programmers, do not offer any guarantee of safety when you use this program.

Every effort is made to produce this software with no programming or calculation errors but this may not be the case.

The APD Projection Theoretical Dive Planner is simply a 'number cruncher', which produces decompression profiles. Because individuals have different susceptibility to Decompression sickness (DCS), based on different factors, which vary from day to day or dive to dive, the decompression profiles generated by this software may or may not work successfully. Use your own judgment based on your own circumstances when planning and executing each dive! This program is not a substitute for common sense.

All dive profiles involve a risk of Decompression sickness. By combining different parameters in the APD Projection Theoretical Dive Planner in an inappropriate way it is possible to create decompression profiles which will result in a higher than normal occurrence of DCS.

Following the decompression tables produced can result in neurological dysfunction, paralysis or even death. No advice is given as to which Gradient Factors, ascent rates, descent rates, or decompression algorithm to use. In line with its experimental purpose, the only constraints in the APD Projection Theoretical Dive Planner are the maximum Gradient Factors allowed, which are 100%; i.e. the maximum compartment over-pressures allowed are 100% of the Bühlmann values. The dive planner may have default values for various parameters, but these are by no means safe or ideal for all gas mixtures, depths and bottom times.

In short, this is a development tool and if you choose to use it, you do so entirely at your own risk. A level of expertise, training and understanding is required in order to plan dives in any particular depth range. Dives should only be undertaken within the limitations of your training but while formal training may increase your understanding of decompression and decompression practice, it may or may not improve your chances of suffering DCS.

The chance of you suffering DCS is known to vary from day to day and other factors are believed to contribute, including but not limited to: your level of hydration and your exercise level prior to, during and after the dive; multi-day diving; fatigue; cold temperatures and positioning in the water.

Warnings:
Despite 100 years plus of research and experimentation all the factors affecting decompression are not fully understood by anyone. It is therefore impossible to warn you about all circumstances affecting decompression. Within the air diving range, there are well established decompression tables and algorithms which work for the majority of people, but not all, within certain parameters. The use of this dive planner product allows you to explore outside the safer parameters, but by doing so you become you become an experimental diver.

DISCLAIMER
By using the APD Projection Theoretical Dive Planner, the user expressly agrees that under no circumstances will Ambient Pressure Diving Ltd., it's officers, directors or employees, or the program authors or programmers, be liable for the user, their heirs or assigns, for any and all claims that may arise from the use of this software, including, but not limited to, direct costs, indirect costs, punitive damages, hedonic damages, bereavement, special damages, incidental damages and/or consequential damages. Ambient Pressure Diving Ltd. makes no warranties of any kind, either express or implied, to the user of this product.

Contents

Acronyms and Abbreviations

CC   **-** Closed Circuit

CNS   **-** Central Nervous System toxicity shown as a % of limit

DCS   - Decompression Sickness

DSD   - Delayed Surface Desaturation

EAD   **-** Equivalent Air Depth

GF   - Gradient Factor

ICD   - Isobaric Counter Diffusion

NCS   - No Clear Surface

OC   - Open Circuit

OTU   - Oxygen Tolerance Unit

PPN2 - Partial Pressure of Nitrogen

PPO2 - Partial Pressure of Oxygen

SAC   - Surface Air Consumption rate (the volume inspired by you per minute on the surface)

Overview

The Projection Software is supplied on the DiveStore.

DiveStore

The DiveStore is a storage device which allows you to download the dives from the rebreather - in fact you can download as many rebreathers as you like for thousands of dives – and then later transfer the dives to your PC.

If you plug the DiveStore into your PC's USB port, you'll see there are some installation programs for a new Communicator – this has the translator in it for converting the ccx files into individual dive files (ccl), the new LogViewer which is able to read the new compressed file format, and the Projection DivePlanner.

The DiveStore also acts as a dongle which has to be inserted in order to run the Projection software.

APD Projection DivePlanner

PC requirements

Minimum PC requirements for using the APD LogViewer, Communicator and Projection.

- Processor - 486+
- RAM - 1MB
- Operating System - Windows 2000, XP or Vista. It will not work with Windows ME, 98, 3.1, 95, or any non-Windows Operating System.
- A USB port

Just double click on each installation program and it will install onto your PC.

Features

- Plan open circuit or closed circuit dives
- Deco matches that of the Vision dive computer used on APD rebreathers.
- Plan overhead environment dives, simple or complex.
- Calculate decompression for Nitrox, Heliox or Trimix gases.
- Single screen dive planner – change the settings and instantly see how it affects the dive.
- Add dives and create a dive plan, specifying the surface intervals and the desaturation algorithm, Bühlmann or the more conservative Hahn's DSD.

- Unique Bailout Planner (just right click at any point on the dive profile)
    - Instantly calculate a bailout plan, based on your bailout preferences:
    - You might specify less conservative Gradient factors to get you shallow and out of the water as quickly as possible (let's face it, you can add safety stops if you have the gas to do them).
    - You might specify a different ascent rate for bailout
    - You might specify you want to do two gas switches or 1 or three or more – and providing you have Auto-Recalc selected in Preferences, you can change the parameters and instantly see the effect it has on the deco schedule and the volume of gas you need to carry (click on the yellow cylinders – which light up on an OC dive or an OC bailout).
    - The best bailout gases are chosen for you.
    - Some of the bailout gases can be a little exotic or unusual, particularly on the Trimix bailout where it will be considering Isobaric Counter Diffusion unless you specify to ignore it.
    - The bailout gases though are easily altered – directly in the segment editor
    - You might just prefer to use your own gases, but these will often incur an Isobaric Counter diffusion risk, but you can toggle that on and off too. If your bailout gases aren't suitable for the dive, the program warns you.
    - The bailout gases and deco are calculated using your maximum PO2, and the maximum EAD you select. So , if you select a hot PO2 and equivalent air depth, it will get you out of the water quicker.
    - If you bailout from an overhead environment it keeps you on the dive profile until you have a clear surface, at which time it will then get you to the surface as quickly as possible within the constraints you have specified.

- Table Generator:
    - Perfect for creating back up tables for rebreather decompression, as one diluent will do for a large range of depths.
    - Simply enter a range of depths and step sizes, followed by a range of dive times and step sizes, specify the gases and any setpoint changes on the descent (by double clicking on the descent gas box), specify any gas switches and/or setpoint changes on the ascent and then click generate tables.
    - You can sort the tables on Depth which gives you a deco table for each depth or something which is useful for those of us diving in tidal windows – you can sort on Time, so you can carry a 5 minute table in case you bounce the dive, a 25 minute table for the planned dive and a 30 minute table in case you overrun – so you can get a huge depth range on three tables.
    - Add notes to the bottom of each table
    - Resize and print the tables to suit your needs.

Basic Principles of Operation

- Help
    - If you click on the Help button which has a question mark (?) on it and then click on one of the input boxes, a text box appears with some explanation – particularly useful for entering gases.

- Dive/DivePlan/Import/Export/Save/Open
    - One dive is a dive; once you have added another dive it becomes a Dive Plan.
    - You can either Save the entire DivePlan or you can Export one particular dive out of that plan, so you can import it later into another DivePlan.

- Dive Settings
    - Each dive has it's own settings which you can alter to suit.
    - If you do a bailout on that dive, that dive also has it's own bailout settings tab and
    - if you elect to use your own bailout gas list then that dive will also have it's own bailout gas list.
    - All of these dive and bailout settings can be altered for that one dive. So you can have different settings for every dive – if you feel that is appropriate.

- Preferences
    - Tip - set these up first
    - You set your own Preferences for NEW dives.
    - These are the default settings that will be used whenever you create a dive. Altering the Preferences after you have created a dive won't alter that dive, to alter that dive you would have to change the details on that individual dive's settings tab.
    - In Preferences you can set up your defaults for OC/CC, setpoint, Metric/Imperial, Print Options for the Tables, Enter Your Name so it appears on the Tables, a range of Dive Settings, DivePlan and Bailout Settings.

- Dive Plan Settings
    - Select the Surface desaturation algorithm
    - Select the decompression algorithm (at present only Bühlmann ZHL-16C is the only option)
    - Change the cylinder fill pressure, used in Open Circuit gas calculations
    - Change the Gas reserve %, used in Open Circuit gas calculations

The product is very much aimed at the technical diver. It uses Gradient Factor conservatism which can be tailored for different gases.

Installation

Using Start/My Computer/DiveStore go to the Projection_DivePlanner folder on the DiveStore and double click on the program file. This is an installation program and will install the APD Projection Dive Planner onto your PC. You may install it on as many PCs as you wish, however **the program will only work when the APD DiveStore is inserted into a USB port.**

Insert the Divestore security key in to a USB port on your PC.

Introduction

The **APD Projection** - a Theoretical Dive Planner, is a development tool, which allows you to change a multitude of parameters to plan and produce multi level dive tables for air and mixed gas dives using Nitrox, Heliox and Trimix.

This planner allows you to experiment with gas mixtures, gradient factors, ascent and descent rates and a host of other factors to see what Bühlmann's algorithm would produce for your new parameters.

Create a single dive or create a "Dive Plan"; multiple dives in one day or over multiple days of diving and see straight away the effects on Oxygen Toxicity, Time to Surface, Gas requirements, Bail out gas requirements and then print out quickly and easily a range of decompression tables for the diving range and dive times.

Gases

Plan decompression scenarios for Air dives, Nitrox (O_2, N_2), Trimix (O_2, He, N_2) or Heliox Dives (O_2,He)

The lowest Oxygen content allowed in any of the gas mixtures is 5%

The highest Oxygen content allowed is varied by your entry in the "Max PPO_2" allowed in *Settings/Dive Planning*

The highest Nitrogen Content allowed is varied by your entry in the "Max EAD" (Equivalent Air Depth) in *Settings/Dive Planning*

Algorithms

The **APD Projection** uses the Bühlmann ZH-L16C Algorithm which is the most widely used algorithm for calculating decompression requirements.

The algorithm is simply a method for modelling the behaviour of inert gases, which diffuse in and out of our body tissues when breathed under varying pressures. The intention is that if the algorithm models the actual processes in our bodies accurately enough, it can be used to plan dives with a view to avoiding decompression sickness.

It is important to realise that the Algorithm is just a mathematical model and in no way represents the actual physical processes which are taking place.

For his **ZH-L16** algorithm Bühlmann chose to split the body into **16 tissues** and give them a range of half-times, from several minutes to several hours. It is important to remember that these tissues do not represent any specific real tissues in the body and the half-times are simply chosen to give a representative

spread of likely values. They do not represent actual tissues, or the actual half-times for any particular tissue. The often used description of the 16 sections as **tissues** is confusing and they are better referred to as **compartments**.

When exposed to pressure, each compartment on-gases according to its given half time, so at any point we can calculate how much inert gas pressure exists in each compartment. There is a standard mathematical formula for half-time calculation, Bühlmann made some additions to it to make a complete before/after formula for the inert gas pressure in any given compartment after any given exposure time.

Surface Intervals

The surface interval is the time spent on the surface between dives. When you ascend all decompression algorithms allow some compartment overpressure. The more overpressure they allow, the more risk there is of DCS (Decompression Sickness). Whilst on the surface those compartments will desaturate and eventually they will return to the same pressure as before the dive. The rate at which different compartments desaturate is controlled by an algorithm and

We give you a choice of two:

Bühlmann - The Standard Surface Desaturation algorithm is seen by some as being too aggressive.

Delayed Surface Decompression - DSD was developed by Dr Hahn in the early 1990s after conducting controlled, repetitive, manned dives. It is a little bit more conservative than Bühlmann's original.

Gradient Factors

The APD Projection uses an Algorithm adjustment system called Gradient Factors to allow you to modify the conservatism and ascent profile for different gases. A GF of 100% gives the maximum compartment overpressure allowed by Bühlmann. Selecting a lower % makes the decompression more conservative. Two GFs are used, one for the deepest stop (Low Factor) and one for the last stop to the surface (High Factor). The factor used at any one time is a linear scale between the low and high factor based on the depth between the deepest stop and the last stop.

Warning: While it is safe to experiment on your PC with Gradient Factors it is foolhardy and possibly very dangerous to assume that all selections are appropriate.

Isobaric Counter Diffusion (ICD)

This condition occurs when the diver is using at least 2 inert gases such as Helium and Nitrogen and does a gas switch at or near a decompression ceiling. If the new gas mix has a relatively high Nitrogen content compared to the current tissue levels, the on gassing of Nitrogen exceeds the off gassing of Helium ("counter diffusion" - Helium out but more Nitrogen in) as such the tissues overpressure and break the decompression ceiling limit leading to a possible DCS. If this occurs deep when the controlling tissues are predominantly the fast tissues, then Inner Ear DCS or IEDCS can occur. This is also known as a vestibular bend and can cause vertigo and subsequent vomiting (motion sickness) whilst underwater. ICD can cause DCS at any depth and in any tissue.

Table Generator

This powerful tool allows you to create very quickly a range of Decompression Tables. Be careful though - if you make a mistake, the mistake will be repeated for every table. Take your time and carefully choose the parameters and then check them again before you Generate the Tables.

Bail Out Gas Planning

The Bail Out Gas Planner allows you to experiment with emergency gas planning and try several what-if scenarios. You can set up simple parameters such as maximum PPO_2, maximum EAD and how many gas switches you want and it will calculate the best gases and volumes you need to carry. You can then edit and modify the gases and switch depths to see the effect.

Diving Practice

A huge number of factors affect inert gas absorption, elimination and our susceptibility to decompression sickness. Some of these factors we know, some we guess at and some, no doubt, remain to be discovered. Among the first two categories are:

- Repetitive, yo-yo, reverse and bounce dive profiles
- Rapid ascents
- Missed decompression stops
- Heavy workloads
- Exercise, or lack of, during decompression
- Cold
- Flying after diving
- Poor physical conditioning
- Inter-pulmonary shunts
- Drug use (including alcohol)
- Dehydration
- Age

Preferences 🛠

What's the difference between preferences and settings?

The preference values enable you to set your preferred default values for all the dive and bailout "settings" parameters. Your preferences are used to populate the settings fields on each individual dive tab when the dive is first created. The settings are the "working values" on the dive tab, which can then be directly adjusted at will by you. Some of the preferences apply to the dive plan (all the dives in the series) as opposed to individual dive values.

General Preferences
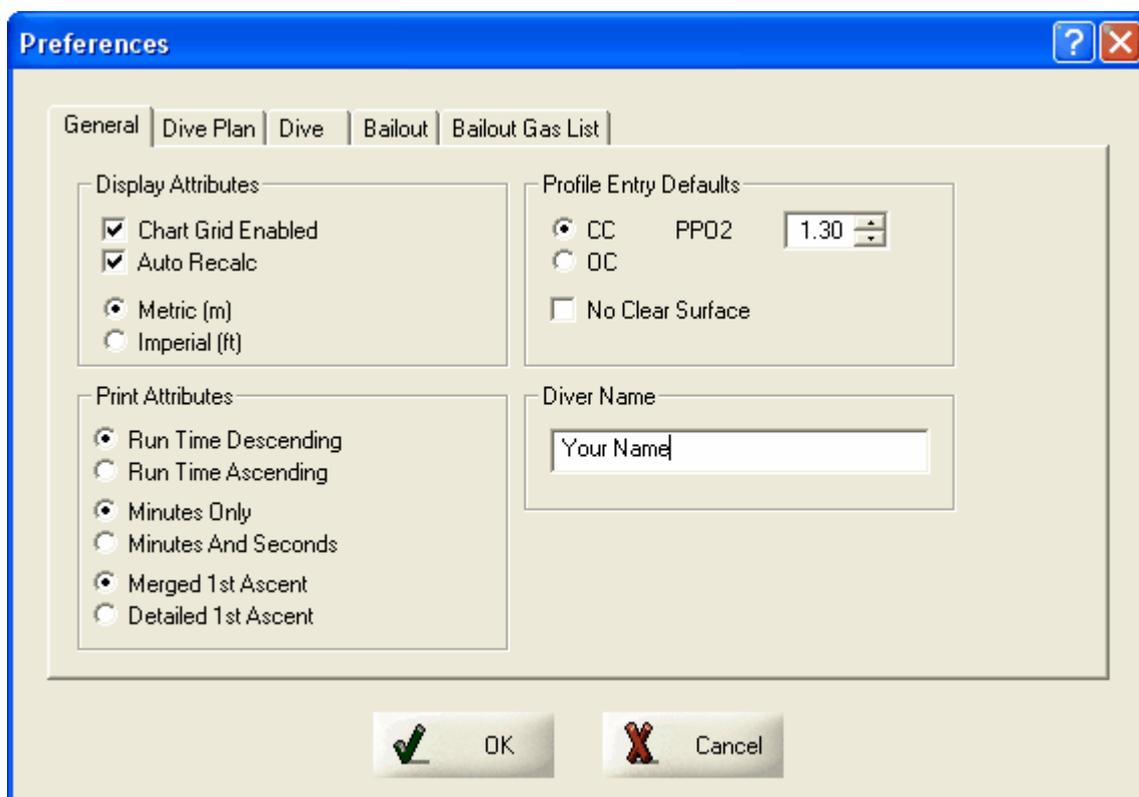
Display Attributes

> **Chart Grid Enabled -** Puts a linear grid on the dive profile to allow easier profile viewing.

> **Auto Recalc -** when selected all dives are automatically recalculated when any parameter is added or changed

> **Metric/Imperial -** choose depth units between Metric (m) and Imperial (ft).

Print Attributes

Print attributes allow personal customisation of dive tables.

Run Times Descending - select to have the deepest part of the dive at the top of the deco table. Run times increment from top to bottom of page

		Dive Plan		GF
60m	Dive 1 of 1, Duration (hh:mm) 2:11			**20/90**
	CNS Final 72.5% - OTU Final 64.4%			

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	1.30	0	3	3
13/55	1.30	Bottom Depth	37	40
13/55	1.30	39	4	44
13/55	1.30	36	1	45
13/55	1.30	33	2	47
13/55	1.30	30	1	48
13/55	1.30	27	3	51
13/55	1.30	24	3	54
13/55	1.30	21	3	57
13/55	1.30	18	5	62
13/55	1.30	15	5	67
13/55	1.30	12	8	75
13/55	1.30	9	10	85
13/55	1.30	6	46	131

Created 04.01.2011 15:08:13 by Your Name Here
APD Projection (Version 2.1.7.4)

Run Times Ascending - select to have the deepest part of the dive at the bottom of the deco table. Run times increment from bottom to top of page

		Dive Plan		GF
60m	Dive 1 of 1, Duration (hh:mm) 2:11			**20/90**
	CNS Final 72.5% - OTU Final 64.4%			

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	1.30	6	46	131
13/55	1.30	9	10	85
13/55	1.30	12	8	75
13/55	1.30	15	5	67
13/55	1.30	18	5	62
13/55	1.30	21	3	57
13/55	1.30	24	3	54
13/55	1.30	27	3	51
13/55	1.30	30	1	48
13/55	1.30	33	2	47
13/55	1.30	36	1	45
13/55	1.30	39	4	44
13/55	1.30	Bottom Depth	37	40
13/55	1.30	0	3	3

Created 04.01.2011 15:57:31 by Your Name Here
APD Projection (Version 2.1.7.4)

Minutes Only - The segment times and run times will be displayed on the Deco table in rounded minutes

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	1.30	0	3	3
13/55	1.30	Bottom Depth	37	40
13/55	1.30	39	4	44
13/55	1.30	36	1	45

Minutes and Seconds - The segment times and run times will be displayed on the Deco table in minutes and seconds

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	1.30	0	3:00	3:00
13/55	1.30	Bottom Depth	37:00	40:00
13/55	1.30	39	3:17	43:17
13/55	1.30	36	1:00	44:17

Merged 1st Ascent - the time to the first stop is combined in the first stop time

The ascent time from 60m to 33m at 10m/min would be 2 mins 42 secs, so the first stop at 33m would last for 18 secs.

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	1.30	0	3	3
13/55	1.30	Bottom Depth	37	40
13/55	1.30	39	4	44
13/55	1.30	36	1	45

Detailed First Ascent - the ascent time to the first stop is shown separately:

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	1.30	0	3	3
13/55	1.30	Bottom Depth	37	40
13/55	1.30	Ascent to 1st Stop	3	43
13/55	1.30	39	1	44
13/55	1.30	36	1	45

Defaults

CC - when you add a segment in the planner, or a gas switch in the Table Generator the entry will default to Closed Circuit

OC - when you add a segment in the planner, or a gas switch in the Table Generator the entry will default to Open Circuit

PPO2 - The default Closed Circuit Setpoint (partial pressure of oxygen) used when adding a dive segment or gas switch.

No Clear Surface - If checked defaults all segments to No Clear Surface (useful if you predominantly do cave dive planning)

Diver Name - put your name in here to personalise your printed tables. The footer of each printed table shows when it was created and by whom, so when there are a number of similar looking laminated tables scattered around the boat, you can find yours!

Dive Plan Preferences

These parameters apply to all dives within the plan.
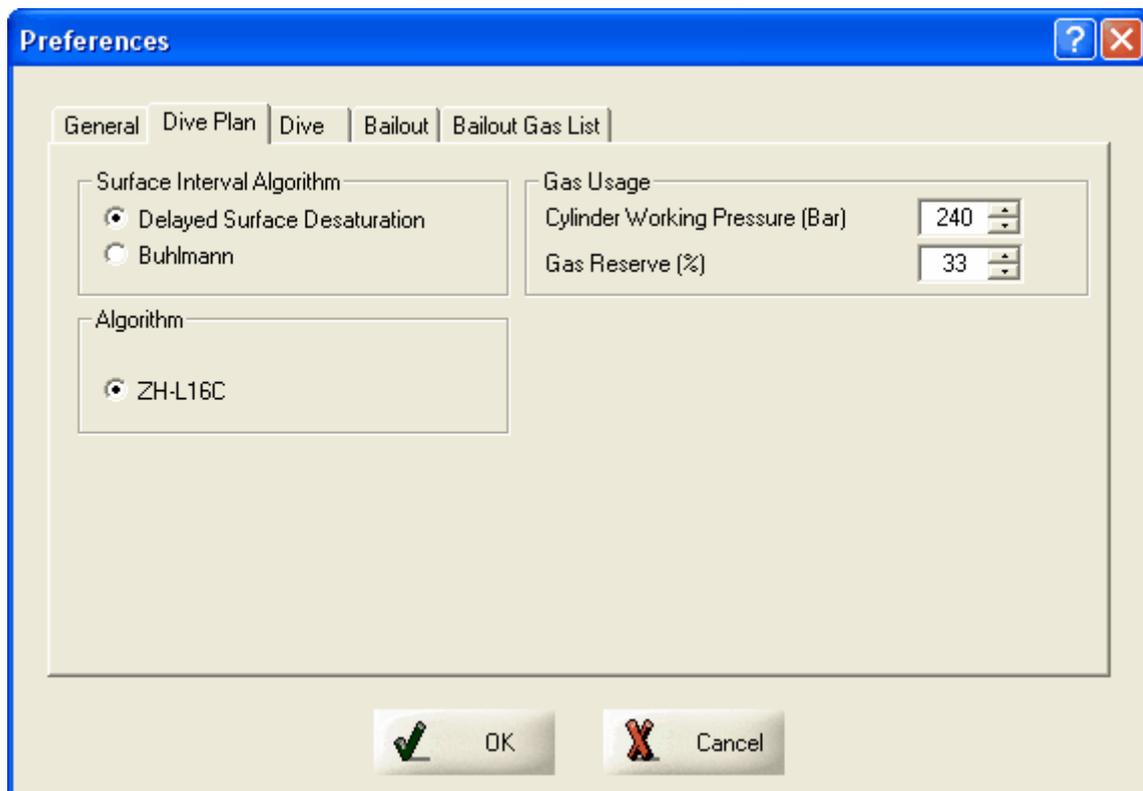
Surface Interval Algorithm

Delayed Surface Desaturation

DSD was developed by Dr Hahn in the early 1990s after conducting controlled, repetitive, manned dives. It is a little bit more conservative than Bühlmann's original.

Bühlmann

The standard Bühlmann surface desaturation algorithm is seen by some as being too aggressive and not accounting for bubble formation that inhibits or restricts the off gassing.

Algorithm

ZH-L16C - the modified Bühlmann algorithm for use with dive computers

Gas Usage

Cylinder Working Pressure (WP) - This is the pressure to which the cylinder will be pumped. From this value and the required gas volume the program calculates the size of cylinder you need to meet the OC gas requirement. If your cylinder is a 232 bar cylinder but in the location you are diving you can only get 200 bar, then you will need to adjust the figure to 200 Bar in the diveplan settings, otherwise the program will incorrectly advise on the size of cylinder/tank required.

Gas Reserve % - When calculating gas usage you normally have a reserve volume. If all goes well on the ascent then this should be the volume of gas left in the tank when you surface. The reserve volume is there in case you have under estimated your SAC rate or you have a problem on ascent that delays your surfacing. The normally accepted "Rule of 1/3rds" means that 33% of the gas is your reserve. If Cave/Wreck diving with no clear surface then this value of 33% should be considered a minimum. This reserve volume of gas is added to the calculated required volume of gas for each gas type in the gas usage table.

Dive Preferences

These parameters apply defaults to the settings that can be uniquely edited for each individual dive within the plan.

Note: when you change these values in Preferences, they will only apply to NEW dives. If you want to change the values in an existing dive, change the Settings for that dive or select NEW and re-create the dive.
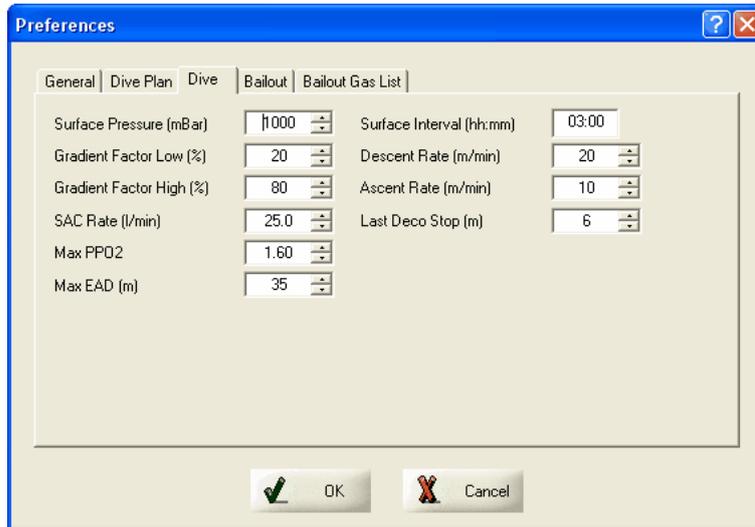
Surface Pressure

Set this to the ambient surface pressure at the sites you regularly plan dives for. If at sea level a nominal value of 1000 mB (approx. 1ATA) would be set. However if you dive at altitude then a lower level would be the norm.

Surface Interval

This provides a nominal default time period between dives.

Gradient Factor Low%

The default Low Gradient Factor is set for the deepest portion of the dive and is adjustable from 0 to 100.

Gradient Factor High %

The default High Gradient Factor is set for the last stop and surfacing. it is adjustable from 0 to 100.

Descent Rate

The descent rate for normal dive planning is adjustable from 10 to 50m. 20m/min is the recommended default descent rate.

Warning: the range of descent rates is provided to allow you to see the effect the descent rate has on decompression. e.g. for a given runtime, getting to the bottom quicker will require more decompression. Descending slower will result in less time on the bottom, so less decompression will be required.

Ascent Rate

The ascent rate for normal dive planning is adjustable from 5 to 25m/min. 10m/min is the recommended default ascent rate and is the ascent rate selected by Bühlmann.

Warning: Virtually all modern decompression tables and dive computers use 10m/min ascent rates. Using an alternative ascent rate may be extremely dangerous. The range of ascent rates in this program are ONLY allowed in order to give you the opportunity to explore "what if" scenarios at home, and not for real dives. E.g. on deep dives, what happens if you ascend too slowly?

Ascent rates faster than 10m/min are extremely dangerous and are to be avoided. Again though, they are allowed in this program to allow you to experiment at home – for instance there may be a bailout scenario when you consider that a 20m/min ascent rate might be allowed during the deeper portion of a dive???

Last Deco Stop

The last deco stop used during normal dive planning. It is adjustable from 3m to 6m.

SAC rate

This is the Surface Air Consumption rate, the volume of gas you inspire each minute whilst on the surface. This has the range 8-80 lpm (0.28 to 2.82 cuft/min). From the value you enter here, the dive planner will calculate the required volume for each OC gas mix used during normal dive planning.

Max PPO2

The maximum partial pressure of oxygen you will allow during "normal" dive planning. Various warnings built into the Dive Planner will activate based on your entry here if at any period during the planned dive the PPO2 exceeds this value.

Max EAD

The maximum Equivalent Air Depth you will allow during "normal" dive planning. Some of the warnings built into the Dive Planner will activate based on your entry here.

Bailout

These parameters apply defaults to the settings that can be uniquely edited for each individual bailout within the dive plan.
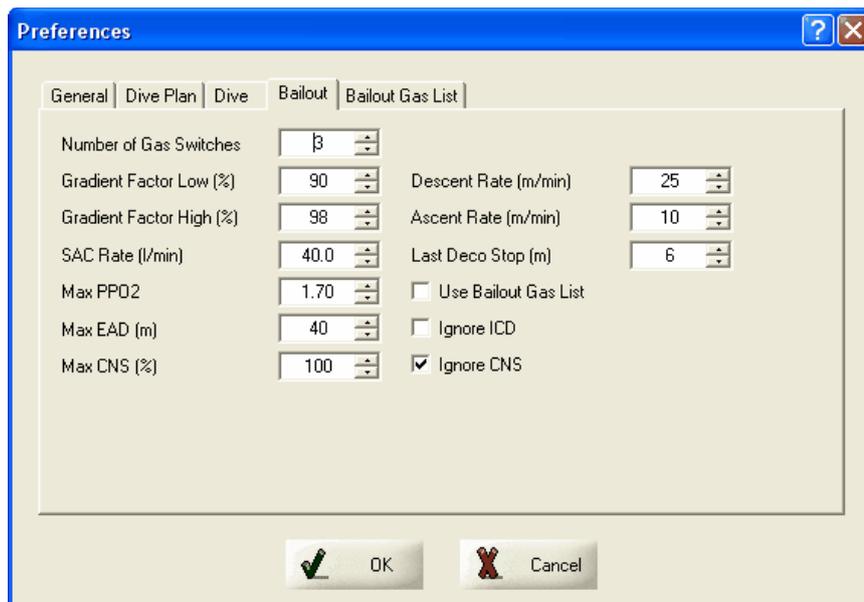
 During bailout the user has an independent set of preferences. When bailing out the diver may have limited gas or tidal windows and so may need to minimise in water time. As such the diver may accept a higher level of DCS or CNS risk in order to reach the surface.

Number of Gas Switches

This is the number of different bailout gases you will carry or have access to on the "bailout ascent". Based on this value the auto bailout generator will optimise the gas switch depths and then suggest the gas mixes to suit your other settings.

Gradient Factors

During bailout you may accept a higher DCS risk than normal by increasing the GF factors to minimise time in water and the Open Circuit gas requirements. When bailout mode is selected the model will independently select the higher of the values entered here on the bailout tab and on the dive plan. E.g. if you have GF (lo/hi) in the plan settings of 18/85 and in the bailout settings of 80/80 the model will use 80/85

Bailout Gradient Factor Low%

The default Low Gradient Factor is set for the deepest portion of the dive during the bailout ascent and is adjustable from 0 to 100.

Bailout Gradient Factor High %

The default High Gradient Factor is set for the last stop of the dive during the bailout ascent, it is adjustable from 0 to 100.

Bailout Descent Rate

The Bailout Descent Rate is adjustable from 10 to 50m. 20m/min is the default descent rate. In a cave system or wreck you may have to descend to reach the surface. In an overhead environment, up is not always the way out!

Bailout Ascent Rate

The Bailout Ascent Rate is adjustable from 5 to 25m/min. 10m/min is the recommended default ascent rate and is the ascent rate selected by Bühlmann and virtually all modern decompression tables and dive computers. However, in an emergency you may decide to accept the increased risk of DCS by ascending faster. You may not, the choice is yours.

Bailout Last Deco Stop

The last deco stop depth used during the bailout ascent is adjustable from 3m to 6m.

Bailout SAC rate

This is the Surface Air Consumption rate, the volume of gas you inspire each minute whilst on the surface. This has the range 8-80 lpm (0.28 to 2.82 cuft/min). From the value you enter here, the bailout planner will calculate the required volume for each gas mix used to complete the bailout ascent.

Bailout Max PPO2

The maximum partial pressure of oxygen **you** will allow during "bailout ascent" dive planning. Although the dive planner program allows a max PPO2 up to 1.8 bar, it recognises that during the initial ascent there is an immediate fall in PPO2 as the diver ascends to the ceiling. However for CNS reasons it is not recommended to breathe the mix above 1.6 for prolonged periods, as such the program limits the subsequent gas switches to a maximum PPO2 of 1.6. If you have set the maximum PPO2 below 1.6 the program will respect that setting at all times.

Bailout Max EAD

The maximum Equivalent Air Depth **you** will allow during "bailout ascent" dive planning.

Bailout Max CNS

This is the % of the NOAA CNS Oxygen Exposure limits that **you** will accept during a bailout ascent. This value can be adjusted to 250% so 2.5 times more exposure than recommended by NOAA. The more you exceed the limit the greater the probability of an "Oxygen Hit" which can lead to convulsions and unconsciousness. However you may

need to accept a CNS level above 100% in order to satisfy in water time and gas requirements.

Ignore CNS

If checked the auto bailout generator will select the highest possible Oxygen content for each gas mix in line with your maximum PPO2 setting. If this is not checked then the auto bailout generator may reduce the Oxygen content of the gas mixes so that the final CNS is within the maximum **CNS** set.

Ignore ICD

If checked the auto bailout generator will select the highest possible Nitrogen content for each gas mix in line with your maximum EAD setting. If this is not checked then the auto bailout generator will select the Nitrogen content for each gas mix based upon the ICD limit or the maximum EAD whichever is lower. The ICD limit is based on depth, ceiling and current EAD

Use Bailout Gas List

 If checked the auto bailout generator will select the best gases from the pool of gases enabled in the "Bailout gas list" to suit the number of gas switches set. If the gases in the list are inappropriate or insufficient for the bailout settings, warnings will be issued to enable you to modify the list.

If this is not checked then the auto bailout generator will suggest the gases to meet the other bailout settings.
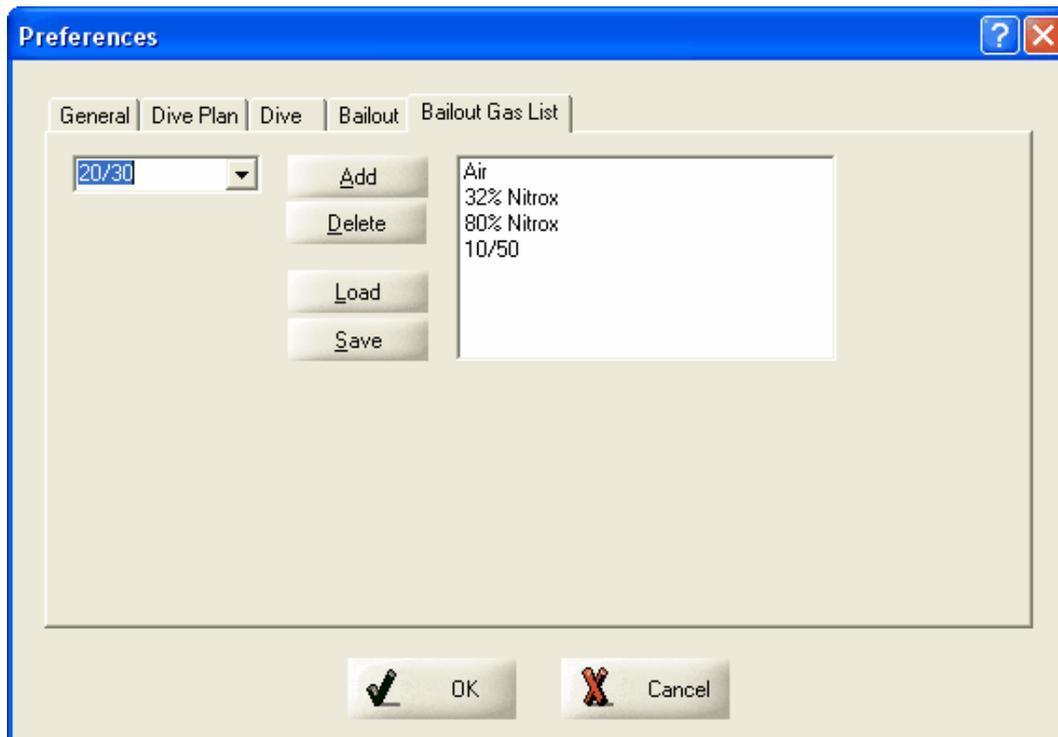
Bailout Gas list

This tab allows the preferred default bailout gas list to be created. You do not have to fill the list (12 gases maximum) but the number of gas switches will be limited by the number of appropriate gases entered. The gases do not have to be sequential as the bailout generator will select the best gas from the pool to meet the requirements set by the bailout settings. Bailout gas sets can be loaded or saved to allow for multiple bailout gas lists.

Use the standard gas mix entry box to either select or create the desired gas then use the ADD button to put it in the gas list. To remove a gas simply highlight and use either the delete button or the del key

Dive Editing

- Ensure the planner is using the desired units - metric (m) or Imperial (ft). (in Tools/Preferences/General).
- Set your personal parameters such as Maximum EAD and Maximum PPO2 (Settings)
- Dive details can be either entered through the main screen or via the Table Generator (see relevant section).

Main Screen
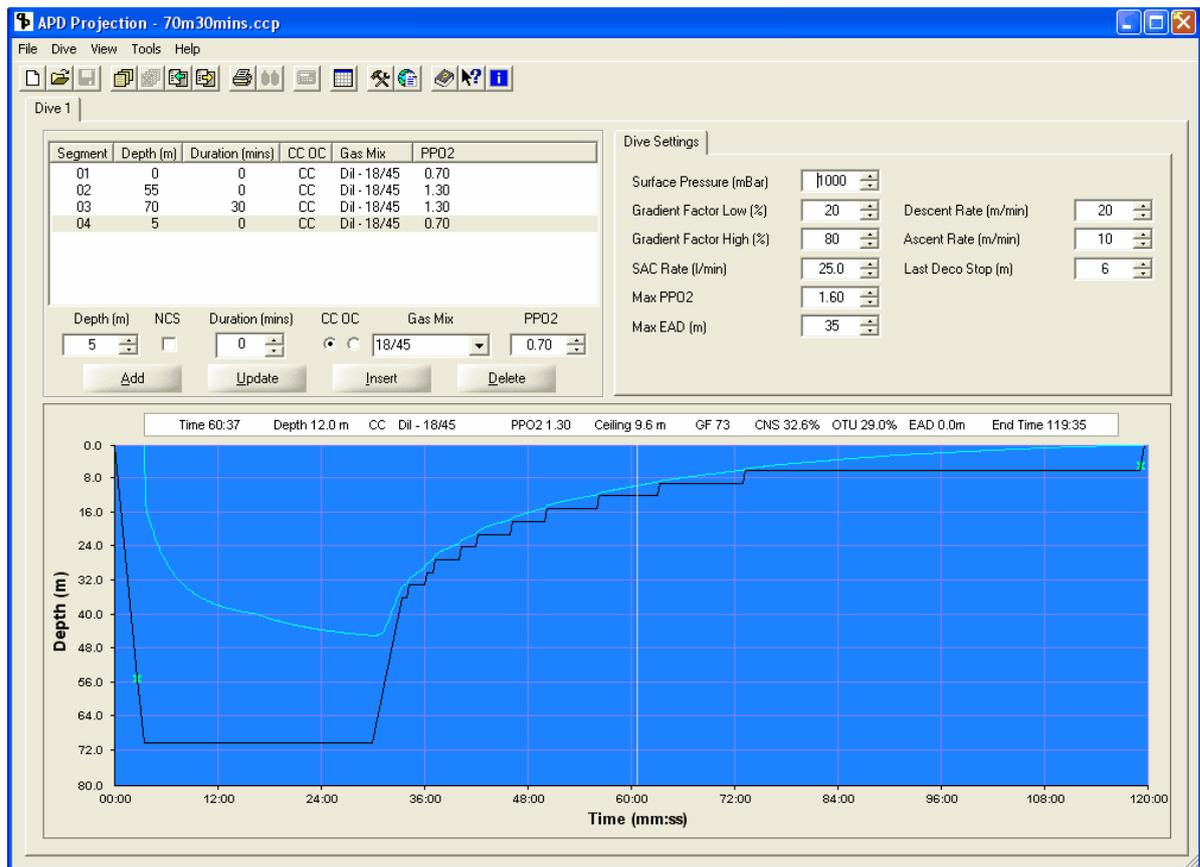
The main screen can be used for planning a single dive, simple or complex and creating a new dive plan/series of dives. Dive Plans created previously can be opened for review or used as a template for further dives.

APD Projection Dive Planner

The main screen has greater flexibility for planning as multiple segments of the dive can be created, giving you the ability to create simple or complex multi level dive plans.

Enter the Depth and Duration

Useful tip: If you plan a gas switch or setpoint change at any time on the dive, simply enter the depth and enter 0 mins in the duration

No clear surface (NCS)

If you are in an overhead environment (cave or wreck) the relevant segments can be marked as having no clear surface. This will then be taken into account when running the Decompression and Bailout Calculations. Any NCS segments are highlighted on the profile in orange.

Select Closed Circuit **(CC)** or Open Circuit **(OC)**

Gas Entry Fields

To select a gas, click on the arrow to the right of the field and a list of recently used gases will be shown. Click on the gas you wish to use.

Instead of clicking on the arrow you can simply type the details of the gas you want to use and if it is already in the list of recent gases the field will 'Auto Complete' your entry. Press tab or enter to accept the gas.
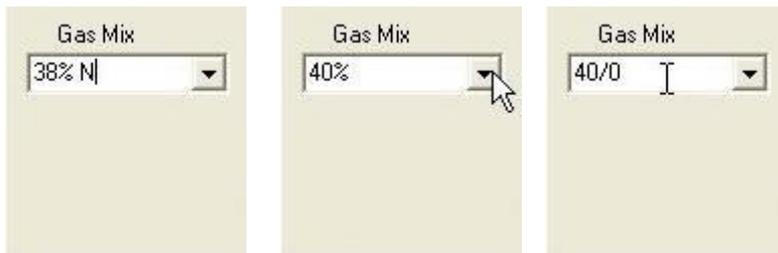
If you do not already have the gas you wish to use in the list simply type it in and if it is acceptable it will be added to your list of gases. Acceptable formats are,

Named - Air & Oxygen

Nitrox (O2%) - 32% Nx, 32% Nitrox, 32% N, 32%, 32/0

Trimix (O2%/He%) - 13/59, 16/44, 6/70

Deletion of Gases in your Gas list

Unused Gases in the list are deleted automatically according to the following criteria:

If you don't use a particular gas for 10 uses of the program, the gas will be deleted automatically from the list 10 days later.

PPO2 - Select Setpoint (CC mode only)

If OC mode is selected this field is simply a readout of the PPO2 of the gas mix at the depth entered. If CC mode is selected then this entry box is active and you can enter the desired Setpoint for this segment of the dive.

Add, Update, Insert, Delete Dive Segment

Once you have entered depth, time and gas information that segment of the dive needs to be added to the dive plan. Once added it will be shown in the centre/top panel. If you have already created a segment, you can alter it by changing the Depth/Time/Gas information and selecting "Update". A new segment can be inserted at any time or deleted building a dive segment by segment allows you to build in any gas switches or setpoint changes you plan to do during the dive.

Tip: for momentary events such as a setpoint change simply enter the Depth you want to make the change, the details of the change and enter 0 in the time.

Recalculate

In Preferences/General there is an option for Auto Recalc. If this option is not selected it will be necessary to select the re-calculate button in the tool line after you make your changes. When the profile is up to date the "calculate button" is greyed out but if recalculation is necessary then it is highlighted and active.

Export Dive/ Import Dive

If you create a particular dive that you want to use as a template in the future, export it so you can at a later date Import it into a new dive plan: e.g. if you were diving one particular dive site for one day, and then moving off to dive another which you have dived before, you could Import your first dive, then import your next dive, entering just the Surface Interval and Pressure to start your new dive plan or sequence of dives. You can add as many dives as you like, each one visible on a new tab.

Dive Settings Tab

Dive Settings	Bailout Settings	Bailout Gas List
Surface Pressure (mBar)	1000	
Gradient Factor Low (%)	20	Descent Rate (m/min) 20
Gradient Factor High (%)	80	Ascent Rate (m/min) 10
SAC Rate (l/min)	25.0	Last Deco Stop (m) 6
Max PPO2	1.60	
Max EAD (m)	35	

These are the working values applied to this dive only. Each dive has its own unique group of settings. The values are initially set as per your "dive preferences". See the preferences section for detailed description of each individual parameter. Once set you can then adjust these at will to suit the individual dive.

Surface Pressure

By altering the surface pressure you can plan altitude dives.

Gradient Factors

What are they?

In compartment decompression theories, a compartment normally "on gases" as you go down and "off-gases" as you ascend. The direction and speed of gas transfer is driven by the differences in partial pressure between the ambient (surrounding) pressure and the pressure within the compartment, the relative half-times of each compartment and the density of the gas being considered. In order to ascend there will inevitably be a higher pressure within the compartment than ambient. The amount of over-pressure allowed is one of the key issues in decompression. Too much over-pressure in the compartment and the diver gets DCS.

By limiting the allowable over-pressure of the controlling compartment, conservatism can be added to Bühlmann's algorithm. However, applying a simple conservatism factor would result in a faster ascent than would be prudent with mixed gases or a very long time in the shallows. A useful tool developed over more recent years has been to apply a "gradually changing" compartment over-pressure from the deepest portion of the dive to the surface, thereby giving control over the whole ascent. These factors that control the overpressure deep, (low) and shallow (high) are known as Gradient Factors.

100% Gradient Factors = the same compartment over-pressure allowed by Bühlmann. 100% is one of the few constraints within the APD Projection.

It is essential to apply Gradient factors to modify the ascent depending on gas mix used, bottom time and diving depth.

The following table represents gradient factors in common use for a variety of dives.

Depth	Bottom time (mins)	Gradient Factors: Low / High
0 - 40m (air diluent)		90/95
40 - 85m (Trimix diluent)	20	50/90
40 - 85m (Trimix diluent)	20 -60	15/85
85m - 100m (Trimix dil.)	20	30/85
85m - 100m (Trimix dil.)	20-45	5/85

It is clear that Bühlmann models work in the air diving range and result in a low DCS incidence. (Note: the word "low" is used as opposed to "zero"!) Between 40m and 100m there are no validated decompression tables for Trimix and the % of dives that result in DCS is unknown. This is truly exploration diving! When planning an "exploration dive" it is essential to make every effort to validate your planned decompression prior to the dive.

The Projection Theoretical Dive Planner decompression calculations are invalid below 100m and must be regarded as "best guess" only.

Typically, Trimix divers use a High (or exit) Factor of 85% to exit from the water with a loading 85% of that allowed by Bühlmann and a Low (or deep) Factor of 15%, which forces divers to do deeper first stops.

Compatibility with APD Vision Dive Computers:

The Nitrox version of the Vision software uses Conservatism Settings 1 to 5, which are pre-programmed Gradient Factors. Simply, 1 is the quickest decompression, 5 is the slowest. Conservatism setting 2 imposes a deeper first stop than 1, 3 has the same first stop as 1 but has a lower exit factor. Setting 4 imposes a deeper first stop than 3. 5 imposes both a lower exit factor and deeper first stop than any other 4 settings.

Conservatism Setting (Nitrox)	Pre-programmed GF Low	Pre-programmed GF High
1	90	95
2	75	95
3	90	90
4	75	90
5	75	85

If you are planning air dives on an APD Rebreather you can enter these Gradient Factors into the Projection Theoretical Dive Planner and see how they would vary the decompression. You could then enter them into dives that you have done in the past and compare them. It starts to give you some understanding and confidence in what may work for you.

Gradient Factor Low%

The Low Gradient Factor is set for the deepest portion of the dive and is adjustable from 0 to 100.

Gradient Factor High %

The High Gradient Factor is set for surfacing and is adjustable from 0 to 100.

Descent and Ascent Rates

This is a good example of how the APD Projection Theoretical Dive Planner is truly a tool for desktop experimentation with what if scenarios. By allowing extreme ranges of speeds you could create extremely dangerous profiles that are way in excess of known safe practice.

No attempt is made to warn you that what are planning is unsafe. If you take your ideas into the water and dive them, then that is entirely your responsibility.

Decompression is evolving and this tool allows you to see the effect of different descent and ascent rates.

What if scenarios can be run in the comfort of your arm chair: What happens to the decompression requirement if you descend slower or faster than planned?

The software does default to 20m/min descent rate and 10m/min ascent rate for every dive and has to be manually changed.

Descent Rate

The Descent Rate is adjustable from 10 to 50m. 20m/min is the default descent rate.

Warning: the range of descent rates is provided to allow you to see the effect the descent rate has on decompression. e.g. for a given runtime, getting to the bottom quicker will require more decompression. Descending slower will result in less time on the bottom, so less decompression will be required.

Ascent Rate

The ascent Rate is adjustable from 5 to 25m/min. 10m/min is the default ascent rate and is the ascent rate selected by Bühlmann.

Warning: Virtually all modern decompression tables and dive computers use 10m/min ascent rates. Using an alternative ascent rate may be extremely dangerous. The range of ascent rates in this program are ONLY allowed in order to give you the opportunity to explore "what if" scenarios at home, and not for real dives. E.g. on deep dives, what happens if you ascend too slowly?

Ascent rates faster than 10m/min are extremely dangerous and are to be avoided. Again though, they are allowed in this program to allow you to experiment at home – for instance there may be a bailout scenario when you consider that a 20m/min ascent rate might be allowed during the deeper portion of a dive???

Last Deco Stop

The last deco stop is adjustable from 3m to 6m.
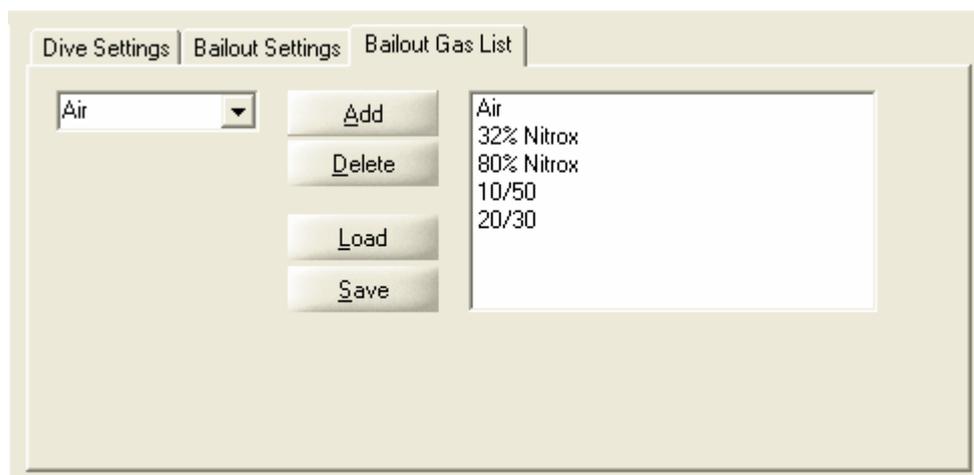
Diveplan Settings
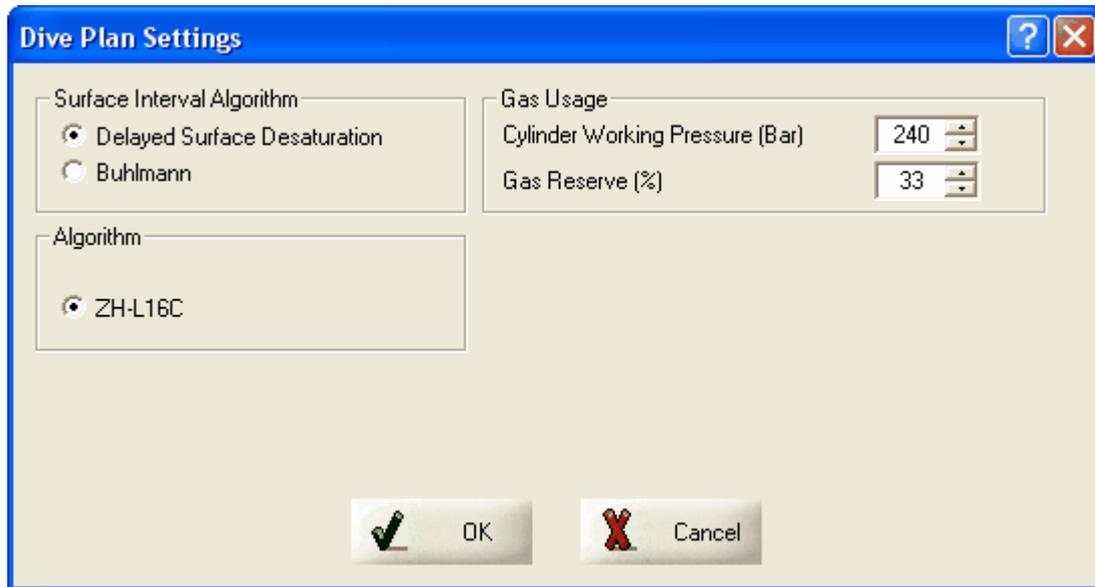
When selecting a NEW dive, these parameters are originally set by the default values in Preferences. However, you can change them for just the current dive plan (series of dives) by changing the Diveplan Settings. These are the working values applied to all the dives within the plan. See the preferences section for detailed description of each individual parameter.

Bailout Settings Tab
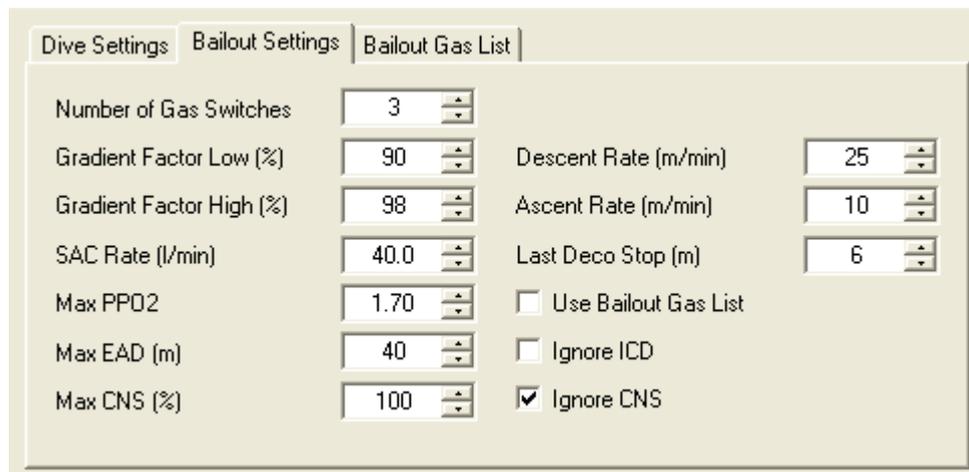
Similar to the dive settings but these values are applied during the bailout only. See the "bailout Preferences" for details of each parameter.

Bailout Gas List Tab

Again these settings are only used during the bailout. See the "Bailout Gas List preferences" for details of each parameter.
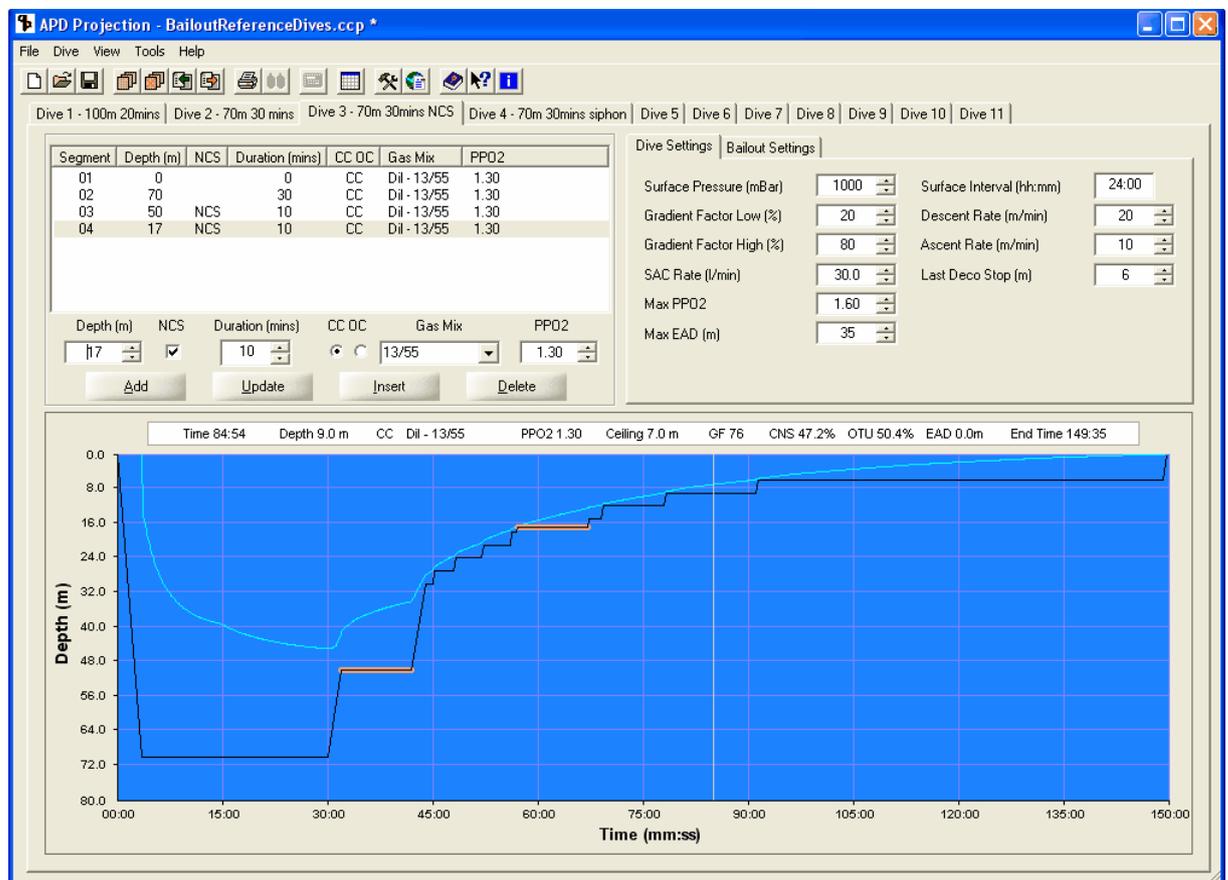
Dive Plan Generation

Create a series of dives.

Add/Delete/Rename/Sort Dives

Add dives to the dive plan with relevant surface intervals. Use Rename to apply a name to each dive for easy identification. Move a dive using the Sort Dive plans option or delete a dive to fine tune the plan.

Sort Dive Plans

You may decide you wish to rearrange your dive sequence. This can be done easily and elegantly using the sort dives feature.
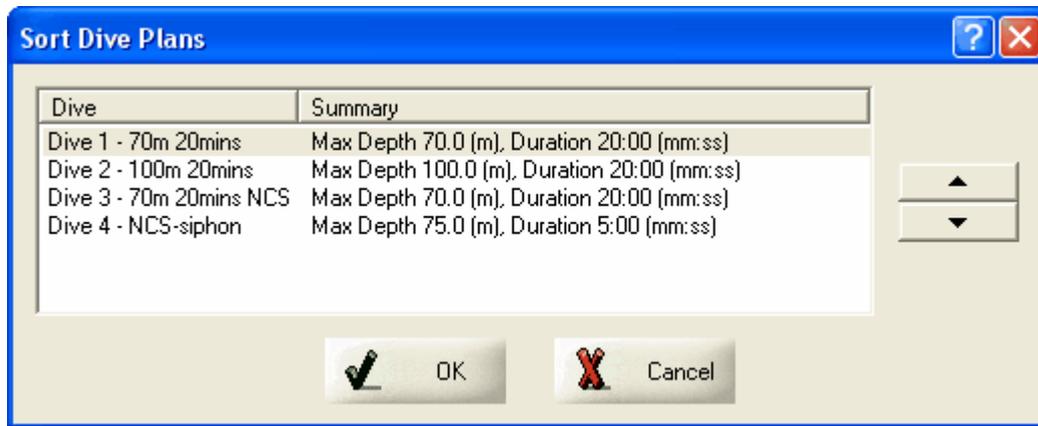
Simply select the dive you want to move and use the arrows to position it in the sequence. All dive details move with the dive but the Surface interval between the dive sequence remains as originally set by you.

View Compartment Pressures

View/ Dive Details show graphically the Inert gas pressures (Pigt) in the 16 Bühlmann compartments as a % of overpressure limit. So if the column for any compartment is above 100% decompression is required.
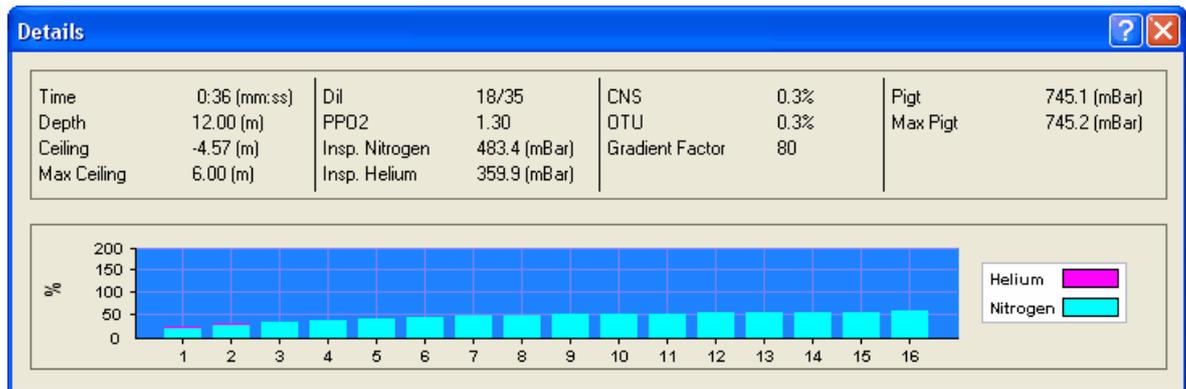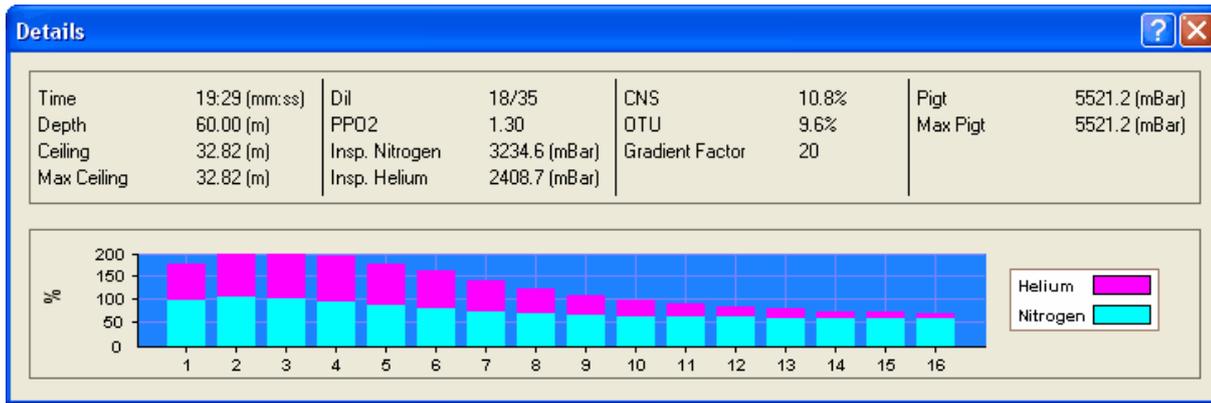

The readout details at the top are the instantaneous values at the profile cursor.
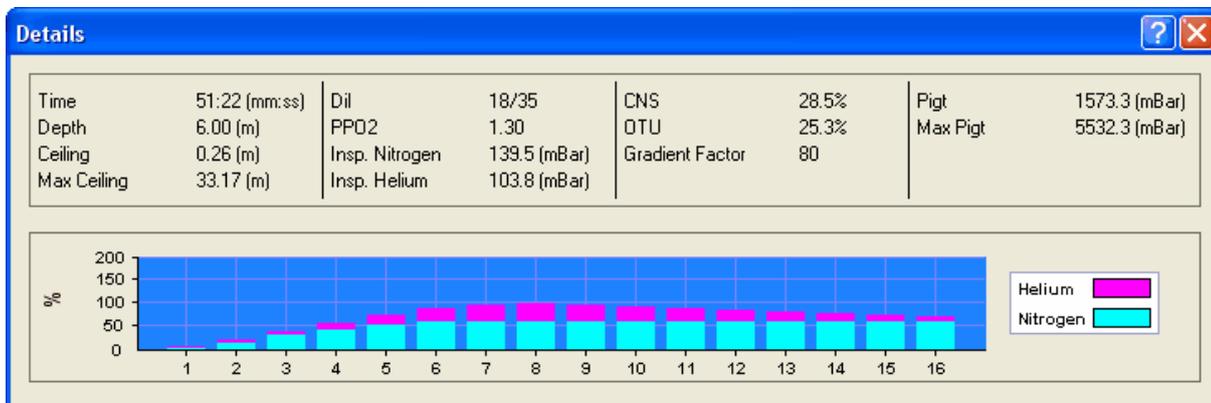
Time	= Current time at cursor
Depth	= Current Depth at cursor
Ceiling	= Current ascent ceiling at cursor
Max Ceiling	= Deepest ceiling during the dive to cursor, used to set the GF low depth.
Dil/Gas	= Diluent or Gas in use at cursor (Dil = CC mode Gas = OC mode)
PPO2	= Partial Pressure of Oxygen at cursor
Insp. Nitrogen	= Absolute pressure of inspired Nitrogen
Insp. Helium	= Absolute pressure of inspired Helium
CNS	= Central Nervous System Oxygen toxicity as % of limit at cursor
OTU	= Pulmonary Oxygen toxicity as % of limit at cursor
Gradient Factor	= Current Gradient factor used at cursor
Pigt	= The highest inert gas tissue pressure of all 16 compartments at cursor
Max Pigt	= The highest Pigt of all 16 compartments during the dive to cursor

If you move the cursor across the dive profile from right to left, you will see the change in Compartment Pressures.

Details

| Time	19:29 (mm:ss)	Dil	18/35	CNS	10.8%	Pigt	5521.2 (mBar)
Depth	60.00 (m)	PPO2	1.30	OTU	9.6%	Max Pigt	5521.2 (mBar)
Ceiling	32.82 (m)	Insp. Nitrogen	3234.6 (mBar)	Gradient Factor	20		
Max Ceiling	32.82 (m)	Insp. Helium	2408.7 (mBar)				

Then move it further towards the end of the dive:

Details

Time	51:22 (mm:ss)	Dil	18/35	CNS	28.5%	Pigt	1573.3 (mBar)
Depth	6.00 (m)	PPO2	1.30	OTU	25.3%	Max Pigt	5532.3 (mBar)
Ceiling	0.26 (m)	Insp. Nitrogen	139.5 (mBar)	Gradient Factor	80		
Max Ceiling	33.17 (m)	Insp. Helium	103.8 (mBar)				

Viewing and Printing the Dive Tables

HTML Viewer

All of the printable tables are generated in HTML and as such can be viewed and printed by any standard html viewer.
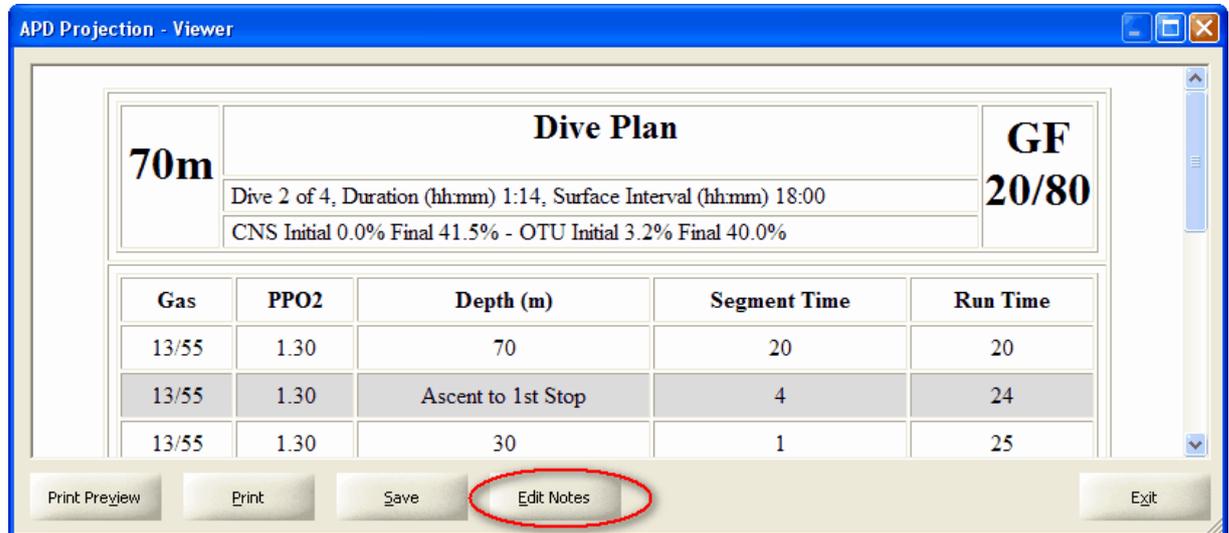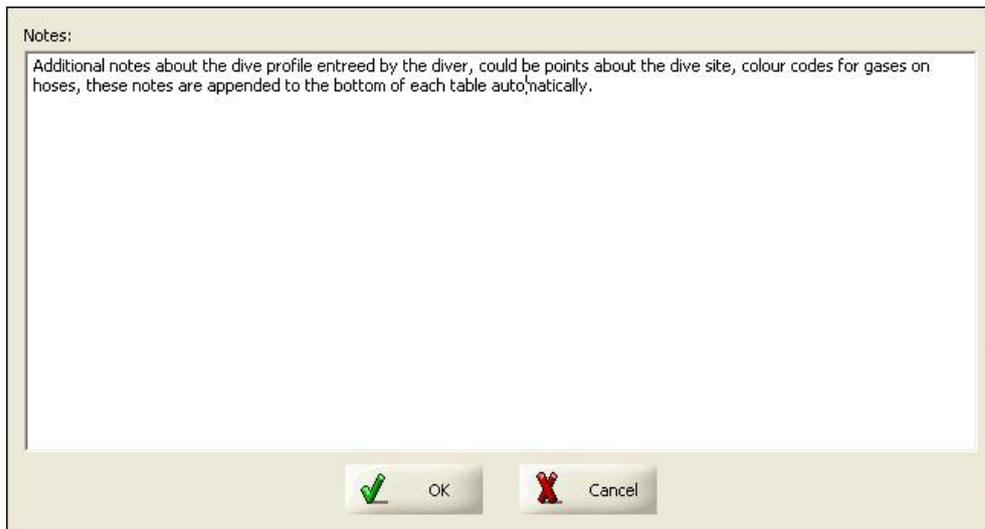

The 5 buttons in the window allow the user to:

Print Preview - allows the user to see exactly how the table will appear on the printed sheet. Here you can edit margins and modify your page layout if needed. Note if you have multiple tables in the viewer it will print 1 table per page.

Print - This opens the standard print dialog for your default printer you can then modify any printer settings before finally printing the tables.
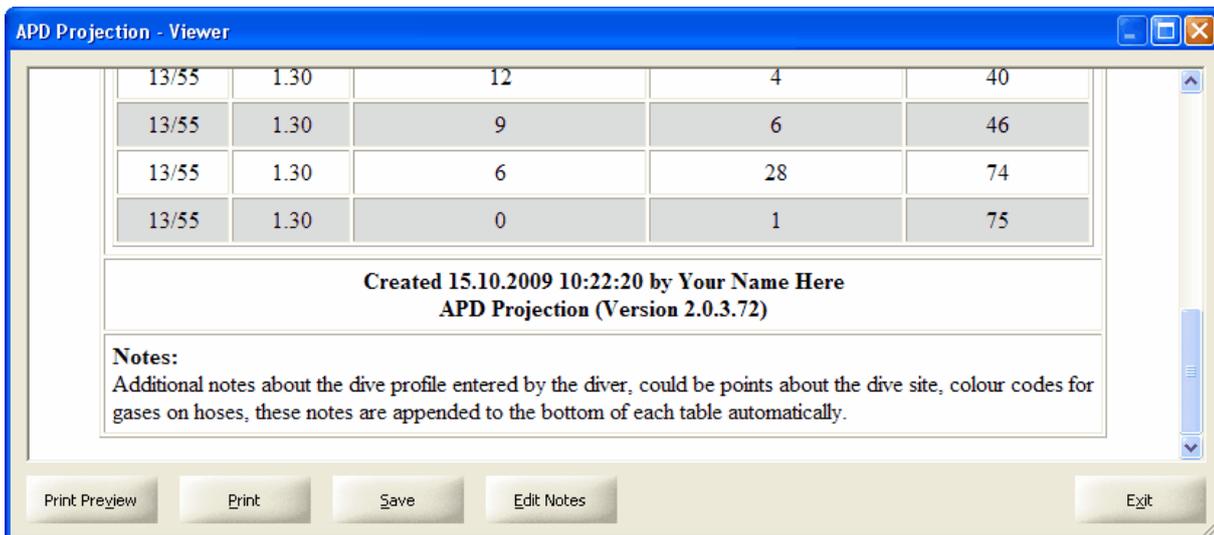
Save - allows you to save the HTML files for recall, viewing and printing at a later date of for e-mailing to other divers

Edit Notes - This opens a text field in which you can enter any details you wish to have printed on the bottom of the tables.

Notes:

Additional notes about the dive profile entreed by the diver, could be points about the dive site, colour codes for gases on hoses, these notes are appended to the bottom of each table automatically.

[✓ OK]   [✗ Cancel]

When you click OK the text in the notes field is automatically appended to all the tables you have in the viewer. It could be just one table or could be a string of dives with several tables.

APD Projection - Viewer

13/55	1.30	12	4	40
13/55	1.30	9	6	46
13/55	1.30	6	28	74
13/55	1.30	0	1	75

Created 15.10.2009 10:22:20 by Your Name Here
APD Projection (Version 2.0.3.72)

Notes:
Additional notes about the dive profile entered by the diver, could be points about the dive site, colour codes for gases on hoses, these notes are appended to the bottom of each table automatically.

[Print Preview]   [Print]   [Save]   [Edit Notes]   [Exit]

Exit - closes the window

Print/View Decompression or Bailout Table

From the either the tool bar or the View menu you can view and print the table for the current tab (dive or bailout).
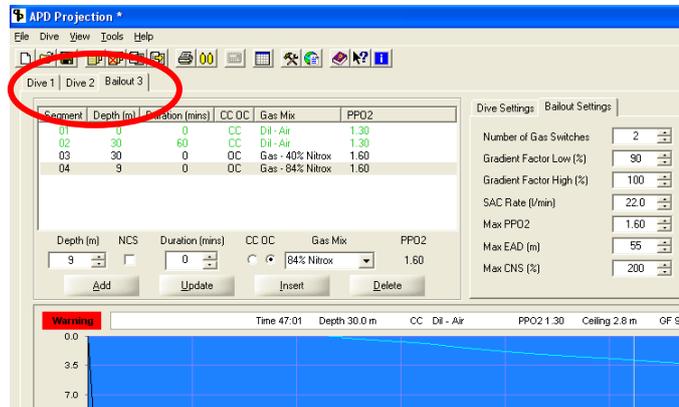
The current dive tab will state whether it is a Dive Tab or Bailout Tab.

Print /View Gas Usage

If the current dive has any OC segments or the current tab is in Bailout mode then this tool is active and allows you to view/print the gas consumption table.

Print/View Multiple Decompression Tables, Bailout Tables or Open Circuit Gas Usage

If you have multiple dive tabs and wish to view/print all the dive tables and all the gas consumption tables in one go then in the View menu you can use view/print ALL option.
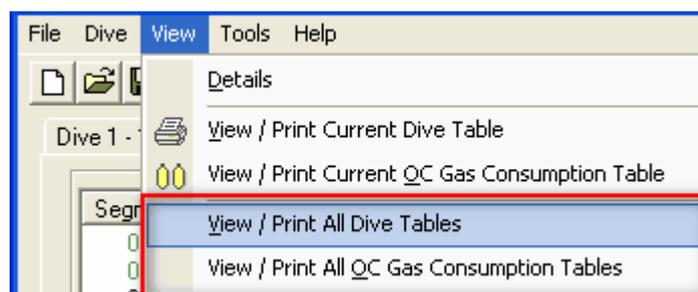
Print Options

The table below was generated with the preference "runtime descending", if you wish to view/print the table with the shallower stops at the top of the page and effectively work up the page as you ascend then you can change the direction in Preferences/General.

70m	**Dive Plan**			GF 20/85
	Dive 1 of 1, Duration (hh:mm) 1:11			
	CNS Final 39.4% - OTU Final 35.0%			

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	0.70	0	1	1
13/55	1.30	20	3	4
13/55	1.30	70	16	20
13/55	1.30	Ascent to 1st Stop	5	25
13/55	1.30	27	2	27
13/55	1.30	24	1	28
13/55	1.30	21	2	30
13/55	1.30	18	3	33
13/55	1.30	15	3	36
13/55	1.30	12	4	40
13/55	1.30	9	6	46
13/55	1.30	6	26	72

Created 21.10.2009 10:56:29 by (Your Name Here)
APD Projection (Version 2.1.3.0)

The Bailout table structure is the same as the decompression table but with the bailout settings shown in the title bar. The Gradient Factors (GF) shown in the title are the GF you have chosen for bailout. The GF on the right were those used for the main part of the dive prior to bailing out. Similarly the depth in the left column was the target depth of the dive, the depth and time shown in the title is the runtime and the depth at which the bailout was started.

Dive Plan

70m — Bailout @ 70m @ 20 mins GF90/100 SAC 35 (l/min) — **GF 20/85**

Dive 1 of 1, Duration (hh:mm) 1:00
CNS Final 27.2% - OTU Final 23.5%

Gas	PPO2	Depth (m)	Segment Time	Run Time
13/55	0.70	0	1	1
13/55	1.30	20	3	4
13/55	1.30	70	16	20
20/30	OC	Ascent to 1st Stop	6	26
57% Nitrox	OC	18	1	27
57% Nitrox	OC	15	3	30
57% Nitrox	OC	12	3	33
57% Nitrox	OC	9	4	37
57% Nitrox	OC	6	24	61

Created 21.10.2009 10:56:12 by (Your Name Here)
APD Projection (Version 2.1.3.0)

When using Open Circuit the letters OC are shown in the PPO2 column.

Printed Warnings

If any warnings exist when the tables are generated these are reported in Red in the Warnings column which disappears when no warnings are active. The Warnings are detailed in a separate warnings table at the bottom of the main segment table.

70m	Dive Plan	GF
	Dive 1 of 1, Duration (hh:mm) 1:32	20/85
	CNS Final 17.8% - OTU Final 10.6%	

Gas	PPO2	Warnings	Depth (m)	Segment Time	Run Time
13/55	0.70		0	1	1
13/55	1.30		20	3	4
13/55	0.70		70	16	20
13/55	0.70		Ascent to 1st Stop	1	21
Air	OC	ICD Risk, EAD, High O2	60	2	23
32% Nitrox	OC	High O2	40	2	25
32% Nitrox	OC		27	1	26
32% Nitrox	OC		24	1	27
32% Nitrox	OC		21	2	29
32% Nitrox	OC		18	2	31
32% Nitrox	OC		15	3	34
32% Nitrox	OC		12	5	39
32% Nitrox	OC		9	8	47
32% Nitrox	OC		6	46	93

Gas	Warnings
Air	ICD Risk EAD 45m @ 60m High O2 1.45 @ > 59m
32% Nitrox	High O2 1.45 @ > 35m

Created 21.10.2009 11:01:21 by (Your Name Here)
APD Projection (Version 2.1.3.0)

Print Tables Created in the Table Generator

The tables produced by the table Generator are for multiple depths and/or multiple bottom times based on a square profile dive. As such these show segment time (Seg) and Run time (Run) in the same box in each column as Seg/Run. These Tables are grouped on depth (1 depth with multiple times) you can change the option on the table generation dialog to group on time and so have a single time with multiple depths. This is handy if you are diving in tidal windows when you might carry for example just three tables for a wide depth range – a 10 minute table in case you have to finish the dive early, a 25 minute table for the normal dive time and a 30 minute table in case you over-run.

40m	Dive Table					GF
	Durations 20 - 40 Mins					90/95

Gas	PPO2	Depths \ Times	20	25	30	35	40
Air	0.70	0	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
Air	1.30	18	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Air	1.30	40	18 / 20	23 / 25	28 / 30	33 / 35	38 / 40
Air	1.30	Ascent to 1st Stop	4 / 24	4 / 29	4 / 34	4 / 39	4 / 44
Air	1.30	9	-	-	-	1 / 40	2 / 46
Air	1.30	6	4 / 28	7 / 36	11 / 45	14 / 54	17 / 63
Air	0.70	5	0 / 28	0 / 36	0 / 45	0 / 54	0 / 63

Created 21.10.2009 11:05:11 by (Your Name Here)
APD Projection (Version 2.1.3.0)

50m	Dive Table					GF
	Durations 20 - 40 Mins					90/95

Gas	PPO2	Depths \ Times	20	25	30	35	40
Air	0.70	0	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
Air	1.30	18	2 / 3	2 / 3	2 / 3	2 / 3	2 / 3
Air	1.30	50	17 / 20	22 / 25	27 / 30	32 / 35	37 / 40
Air	1.30	Ascent to 1st Stop	5 / 25	4 / 29	4 / 34	4 / 39	4 / 44
Air	1.30	15	-	-	-	1 / 40	2 / 46
Air	1.30	12	-	1 / 30	3 / 37	4 / 44	4 / 50
Air	1.30	9	1 / 26	3 / 33	4 / 41	5 / 49	7 / 57
Air	1.30	6	10 / 36	14 / 47	18 / 59	22 / 71	25 / 82
Air	0.70	5	0 / 36	0 / 47	0 / 59	0 / 71	0 / 82

Created 21.10.2009 11:05:11 by (Your Name Here)
APD Projection (Version 2.1.3.0)

Print Gas Usage Table 🔲

Open circuit gas requirements are calculated for any open circuit segments of a dive including Bailout, based on your current open circuit dive or bailout scenario. Click on the cylinders icon to open, preview and print the gas requirements table.

In dive planning mode the main title of the table simply shows the SAC rate used for the calculations as specified on the dive settings.

The "Gas volume required" column includes a % of reserve gas. This % is set by the user and displayed in the column header

To adjust the working pressure or the gas reserve% used in generating these tables you need to go to the 🔲 Diveplan Settings.

In Bailout mode the table structure is the same but the table title has changed to show the settings used during bailout mode. So the GF's shown in the title are the GF's you have chosen for bailout. The GF's on the right were those used for the main part of the dive prior to bailing out. Similarly the depth in the left column was the target depth of the dive, the depth and time shown in the title is the runtime and the depth at which the bailout was started.

APD Projection - Viewer

Gas Usage Table
Bailout @ 70m @ 30 mins GF90/100
SAC 40 (l/min)

70m

GF 20/80

Dive 1 of 1, Duration (hh:mm) 1:29
CNS Final 57.5% - OTU Final 42.4%

Gas Mix (O2% / He%)	Gas Volume Required (l) Reserve 25%	Cylinder Size Required (l) Working Pressure 240 Bar
20/31	1200	5.0
40% Nitrox	2106	8.8
84% Nitrox	3238	13.5

Created 13.10.2009 22:01:15 by Your Name Here

Print Preview   Print   Save   Edit Notes   Exit
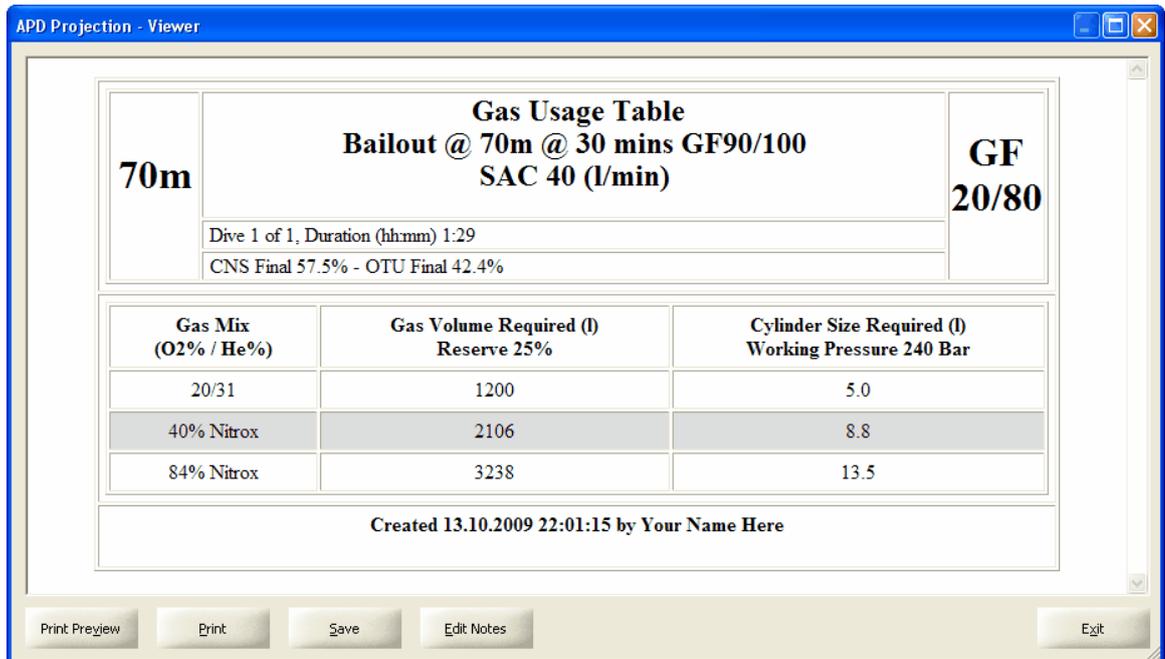
Warnings

If during the planning stage of the dive you exceed any of the internal limits or the limits set by yourself then a red warning bar extends below the profile for the duration of the warning. To see what limit has been violated move your mouse over and along the warning bar and a pop up box shows all the violations. At the same time if any of the parameters displayed on the status bar at the top of the profile exceed their limits they are displayed in red as opposed to black.

EAD - Equivalent Air Depth

This is effectively the level of narcosis you are willing to accept during the dive. The user can set the max EAD and normally the system checks the gas at the profile entry stage to prevent you from exceeding the limit. However if you then subsequently lower the limit you could break the new limit with a previously entered gas/depth combination. The Warning will alert you so you can correct any parameters.
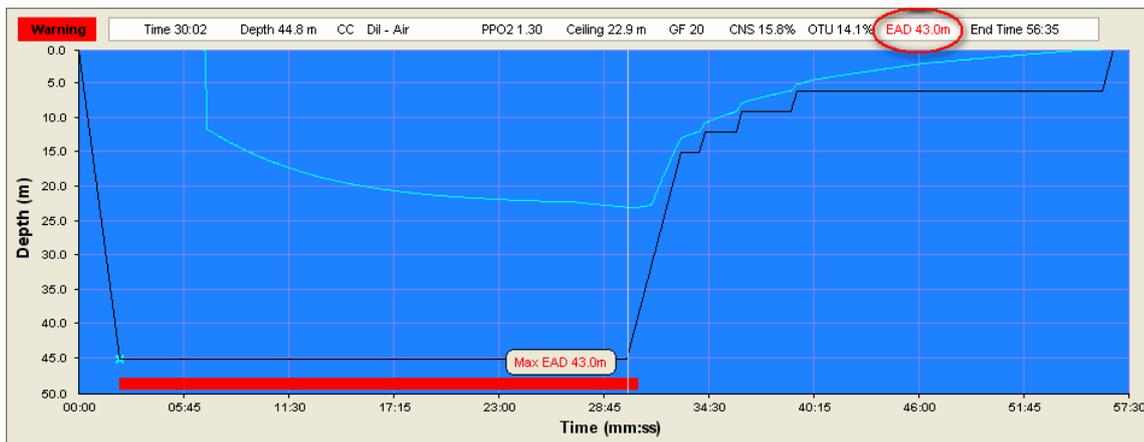
As you move the cursor shallower the EAD drops below limit as shown by black on the status bar. The ICD risk is continuous.

ICD Risk

Isobaric Counter Diffusion risk. This warning is triggered when you change to a gas with a higher EAD than your current EAD at the allowable ceiling. Once triggered this warning is active until the end of the gas mix that caused the ICD. If you have successive mixes that incur ICD then the warning will be extended across all the mixes. If you have a mix that causes ICD, by altering or deleting the mix, subsequent mixes which previously showed no ICD may suddenly generate an ICD warning. You may wish to ignore the ICD risk, however vestibular bends (Inner Ear DCS) are normally associated with ICD risk at depths beyond 18m and can be completely debilitating whilst underwater. ICD can lead to DCS at any depth. To eliminate the ICD risk, increase the amount of Helium in the shallower gas mix to reduce the EAD. A simple rule to follow for gas switches is once you have reached the first decompression stop keep the same or a lower % of Nitrogen in each successive mix. If you want to reduce the Helium then do so by increasing the % of Oxygen (within the Max PPO2 limit).
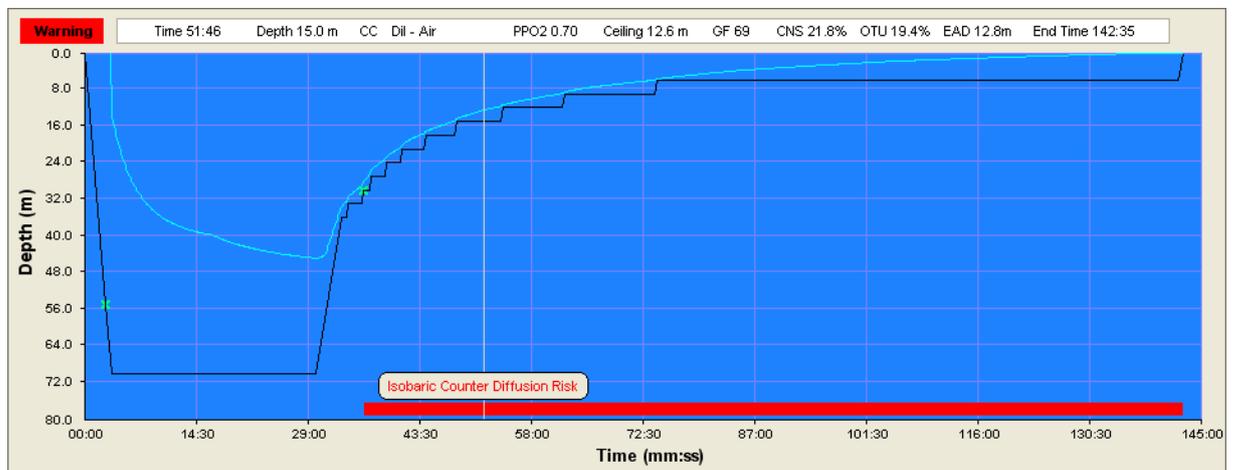
Oxygen Toxicity

Exposures to high PPO2 levels can lead to oxygen poisoning. The oxygen poisoning affects the body in two ways. The most dangerous to the diver, especially whilst underwater is **C**entral **N**ervous **S**ystem Oxygen Toxicity often shortened to CNS. As the name suggests it affects the nervous system and has a number of neurological effects that can lead to convulsions and eventually unconsciousness. The second form of poisoning affects the efficiency of the lungs (pulmonary Oxygen Toxicity) this is more of a long term problem but builds up over a number of dives. The work done by Dr. Bill Hamilton created the Repex tables which give the diver a number of Oxygen Tolerance Units or OTUs per day.

The CNS exposure limits were empirically determined and published by NOAA. The higher the PPO2 the shorter the exposure time and once you go above a PPO2 of 1.5 the exposure time reduces exponentially such that at a PPO2 of 1.5 you have 120 minutes whereas at a PPO2 of 1.8 you have only 2 minutes!

Similar to DCS, susceptibility varies from person to person and from day to day. Also similar to DCS the closer you are to the limit the higher the probability of an "Oxygen Hit" even within the limits.

APD Projection Dive Planner

The APD Projection shows both toxicities (CNS and OTU) as a % of the limit so when you exceed 100% you have broken the limit and so warnings are displayed.

The only way to reduce Oxygen toxicity level is to reduce either the PPO2 or the Exposure time or both.
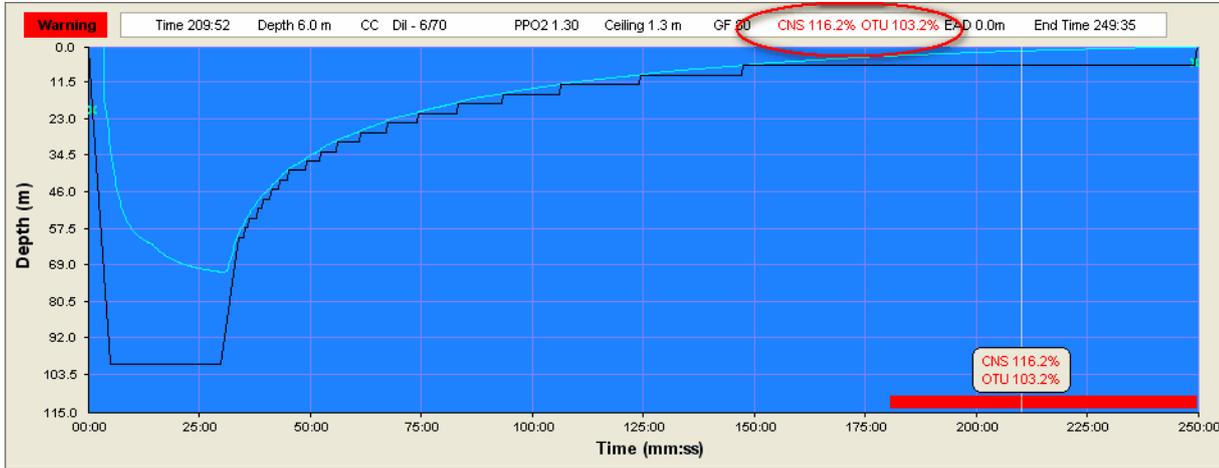

Max PPO2

The User can set the max PPO2 up to 1.80 bar, normally the system checks the profile entry to prevent you from exceeding the limit at entry. However if you then subsequently change the limit you could break the new limit with a previously entered gas/depth combination. The Warning will alert you so you can correct any parameters. The Max PPO2 is obviously linked to the CNS risk, as such it advisable to keep the PPO2 below 1.6
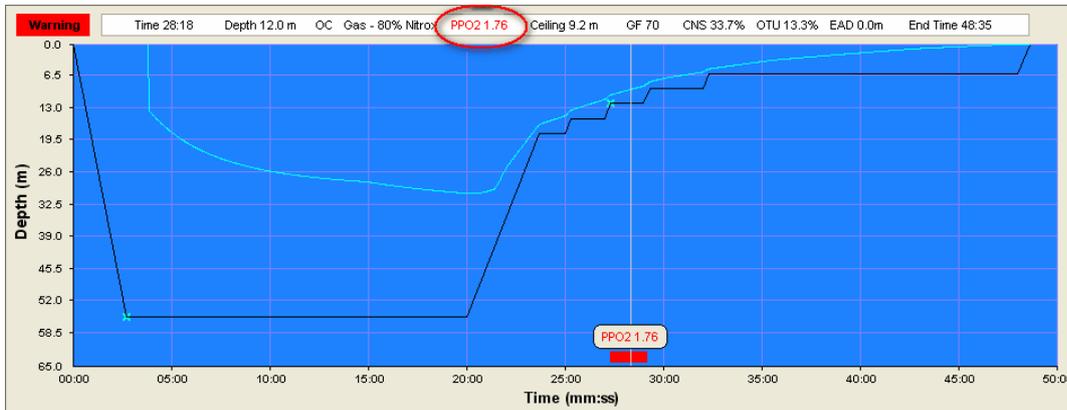
Hypoxic PPO2

This is an internal limit inside the program. If the PPO2 drops below 0.16. Again the PPO2 shows red in the status bar and the PPO2 value is displayed in the warning bar.
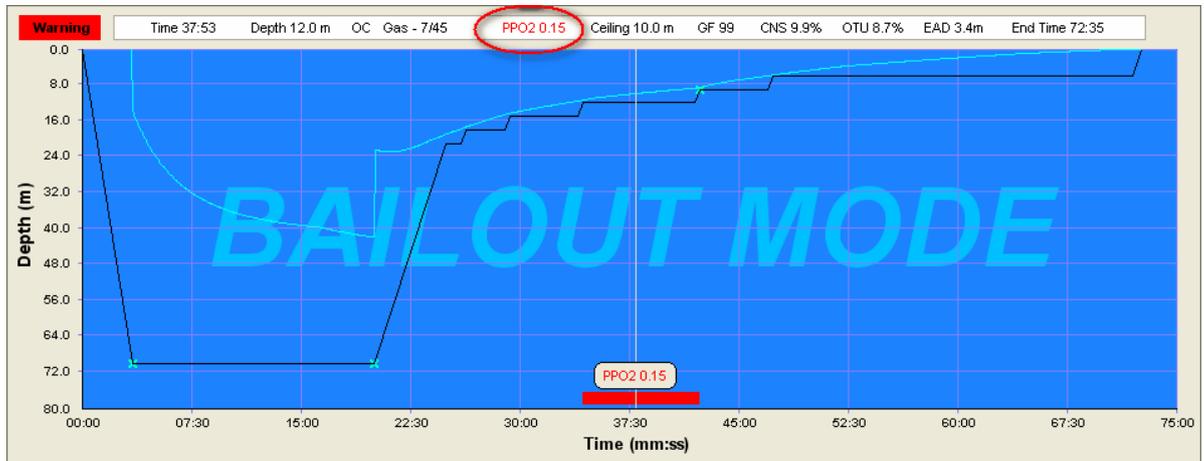
Bailout Planning

Enter the bailout option by right clicking the mouse when the cursor is on the profile graphic, the blue area.

The menu option shows:

Bailout from Cursor - Trim the current segment and bailout from here.

Bailout from End of segment - runs to the end of the current segment under the cursor then bails outs
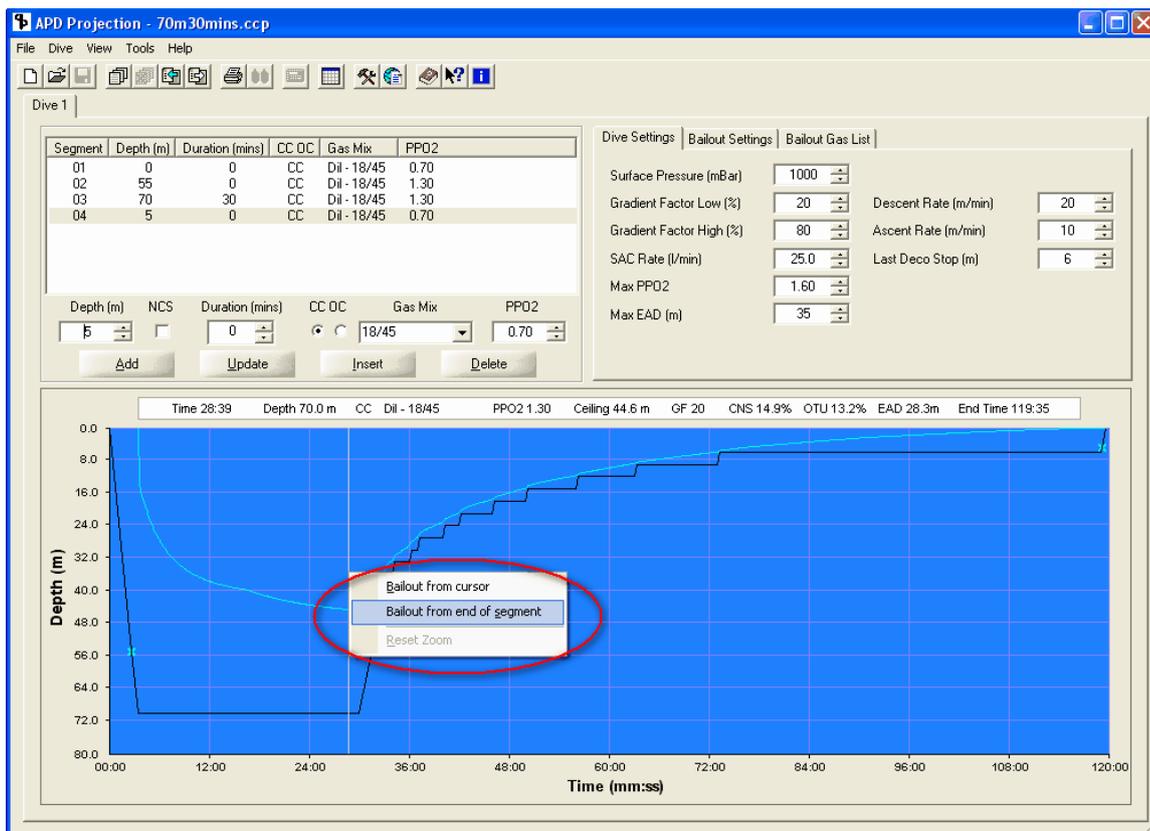
You can only bailout from a CC segment and when the current dive profile is calculated up to date. The bailout automatically calculates the gas switches and gas mixes from the Bailout settings you have entered. After the initial switch to bailout mode - shown by the watermark on the profile background you can then manually edit the segments, changing the gases etc. to explore the possibilities. See below in the segments box the dive segments prior to bailing out have turned green, this is to indicate that these segments are NOT editable in the bailout mode. Notice also that the dive tab renames from Dive to Bailout. So when you have multiple dive tabs you can easily see whether earlier bailouts have affected the decompression on the current dive.
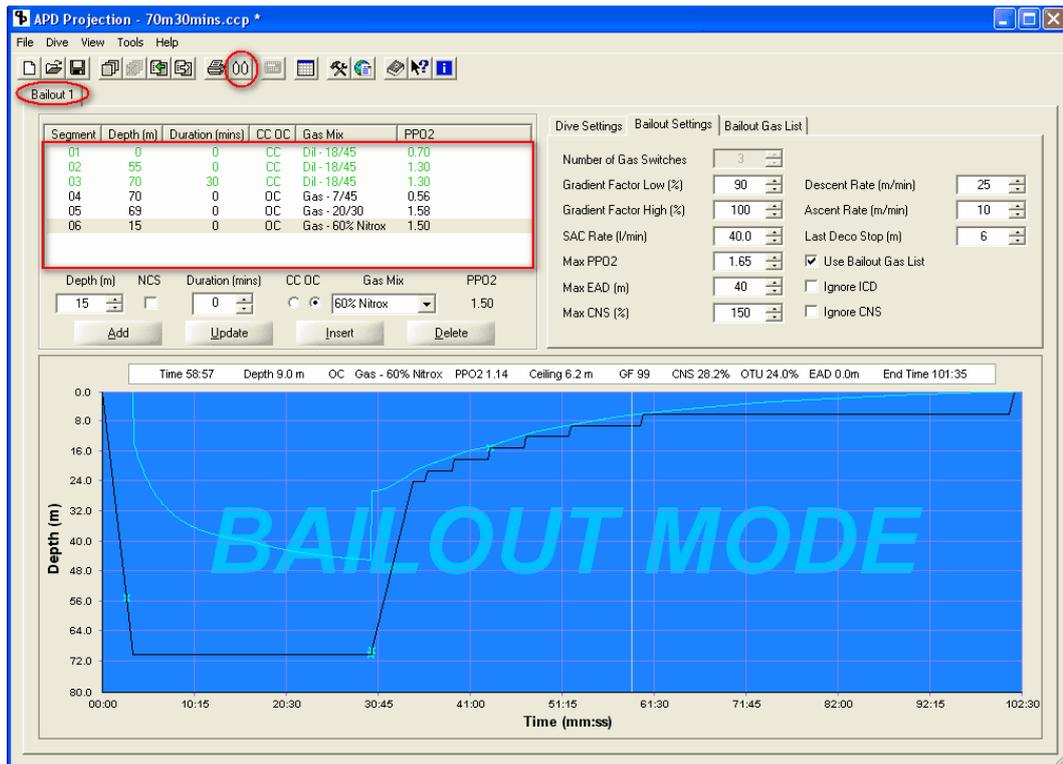
In these examples the user has selected to use their own list of gases, as such the user entry "Number of gas switches" has been disabled as the number of gas switches is controlled by the gases in the list suitable to meet the other bailout settings criteria. In the example above 3 gases were selected from the list when the ICD check was enabled. However as you can see below, when ICD is ignored 4 gases were selected
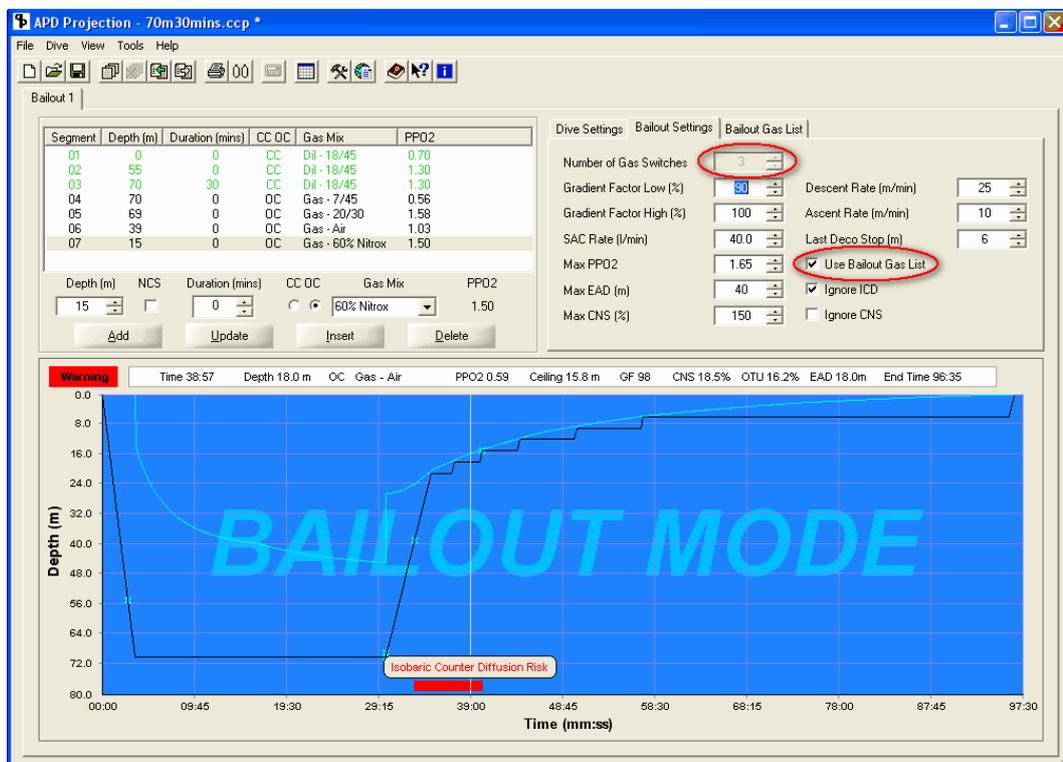
The gas list provided by the user may not provide a possible bailout solution to meet the settings criteria, if this happens a warning with the reason why is displayed.

If the user does not tick the "use Bailout Gas list", then the Bailout gas list tab is hidden and the user can simply set the number of gas switches, the bailout generator will then suggest the gases to suit the remaining settings criteria.
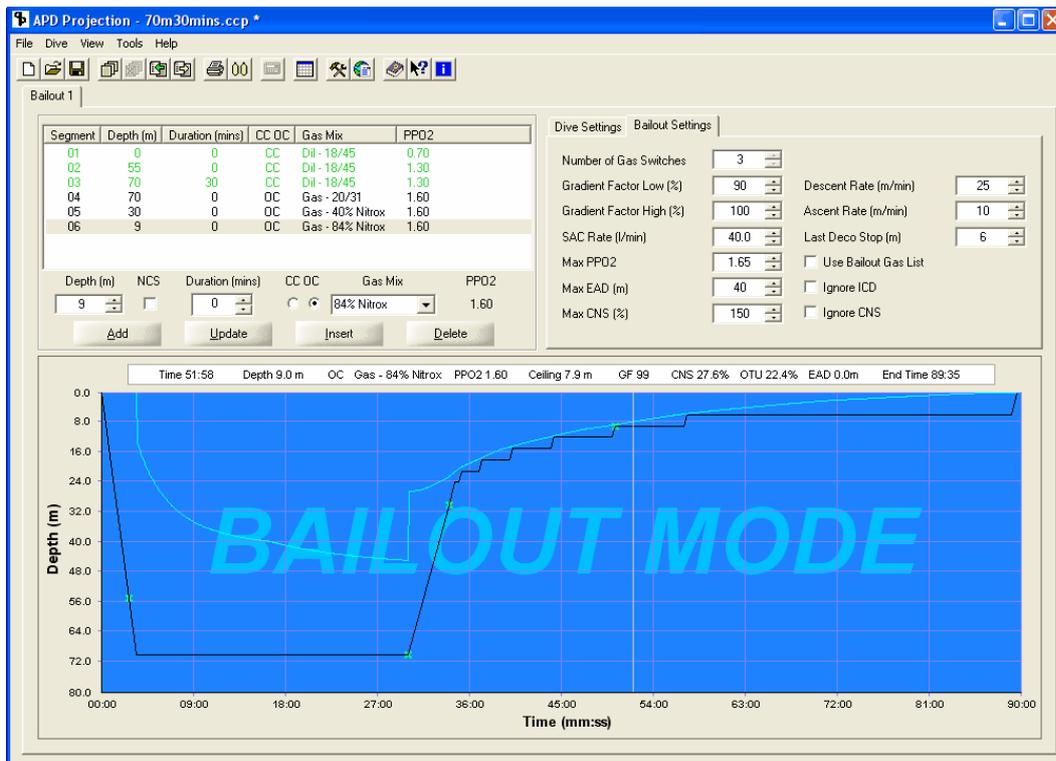
![Gas Usage icon] **Gas Usage -** click here to see how your gas requirements are calculated and presented in bailout mode

You cannot "bailout" from a bailout plan so if you want to change the bailout position in the dive you need to do so from the original dive. To return to normal dive planning or to change the bailout position you have two options:

1) Use the right click menu again whilst in bailout mode to return to dive.

2) Click the Dive settings tab - This will toggle to the dive details and profile.

Once a bailout has been created you can simply toggle between the "dive" and "bailout" by clicking on the respective settings tab.
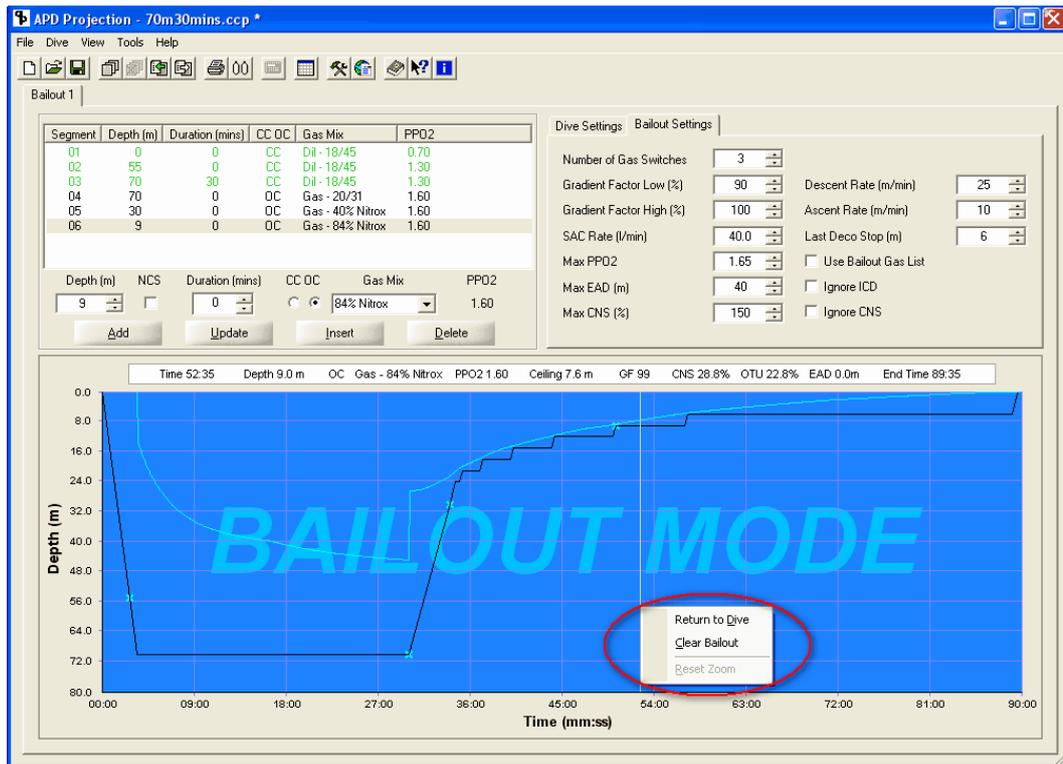
Table Generator

Use the Table Generator to create dive tables for a range of depths and a range of dive times.

Dive Times are all run times/durations. When planning a dive enter the time from leaving the surface to the time leaving the bottom. The planner will automatically calculate the time to descend based on the descent rate you have entered.

Table Grouping

Depth

Prints a Table for each depth:

If you select "Depth" and for example choose a Depth Range from 60 to 80m in 5m increments, and dive times from 5 mins to 30 mins in 5 minute increments, the Table Generator will produce a Table for 60, 65, 70, 75 and 80m - i.e. 5 decompression tables, each with the decompression requirements for the range of dive times.

Time

Prints a Table for each dive time:

If you select "Time" and choose the same Depth and Dive Time ranges as above the Table Generator will produce a Table for each of the run times: 5,10,15,20,25,30 - i.e. 6 decompression tables, each one having the decompression times for all the depths. Some divers prefer to carry just two tables, a 5 minute Table in case they have a problem early in the dive and wish to abandon the dive and reach the surface as quickly as possible, and then a 30 minute Table because that gives a good balance between a reasonable bottom time with reasonable decompression requirements.

Descent Gas

Double Click on the white area within the Descent Gas box, to enter Gas information: e.g. 0m,CC,13/55,0.70

Then add more Gas information for the Setpoint change: e.g. 30m,CC,13/55,1.30

To amend or delete a Gas simply **double click** on it.

You must always have **at least one** gas in this window and **the first gas will always start from the surface**.

Ascent Gas

If a gas switch or setpoint switch is planned on the ascent, then this can be simply entered by double clicking on the white Ascent Gas Box.

If during the gas entry any violation of your limits is encountered then either a warning or error icon will be flagged against the offending gas and a detailed description of the problem shown in the results window at the bottom of the page. You will not be able to generate tables if an error condition exists and you will need to correct the problem.

Once you have the desired settings, double check them then select "Generate Tables". In the Print Preview screen, print attributes can be altered to make the tables fit your preferred Paper size.

Import Settings

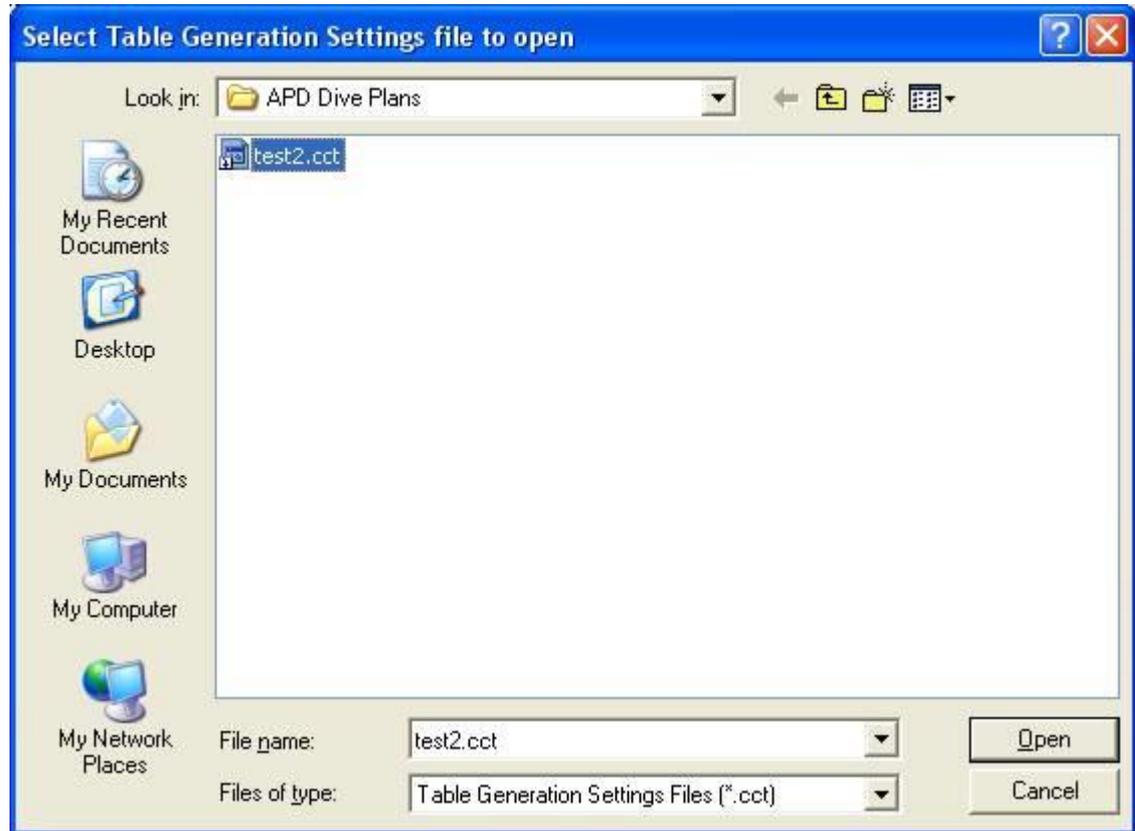In the main view you may have created your ideal dive.

You have the option to Import the Settings, such as Gradient factors and ascent rate as well as Import any Gas Switches.

If you have multiple dives in the main view you will see a list of dives to select from.

Load Settings

Load settings from a previously saved Table Generation.

Save Settings

Saves the current Table Generation settings. Note these are independent of the dive plan settings so saving the table generator does not save the dive plan and vice versa.

Dive Store

The DiveStore is a storage device which allows you to download the dives from your APD Vision rebreather(s) and save them for future transfer to your PC.

For full instructions please refer to the separate APD DiveStore Instructions, found on the DiveStore.