DIV PRO

User Manual

Professional diving decompression planning tools

DIV PRO v1.2 | Simplified Chinese

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Chapter1 Software Overview

1.1 Software Introduction

DIV PRO is a dive decompression planning tool for professional technical divers. It is developed based on the Bühlmann ZHL-16C algorithm and supports dynamic gradient factor (GF) adjustment, multi-gas switching, dual-mode SAC management, and emergency bailout plan generation.

1.2 Target Audience

This software is intended for use only by individuals with formal professional technical diving qualifications (such as GUE Fundamental, IANTD, TDI/SDI Advanced or equivalent qualifications).

1.3 Core Algorithm

The Bühlmann ZHL-16C 16 tissue compartment model was used as the decompression engine. This model, proposed by Swiss physician Albert A. Bühlmann , is one of the internationally recognized standard algorithms for decompression calculation.

1.4 Main Functions

- Dynamic Gradient Factor (GF) — Automatically adjusts conservatism based on workload
- Dual-mode SAC management—Independent settings for bilge SAC and decompression SAC.
- Professional gas pool — Supports AIR / EAN32 / EAN50 / O_2 / Trimix
- Multi-waypoint diving profile — Supports up to multiple waypoint combinations
- Emergency Bailout Plan — Simulating the worst-case scenario of pressure relief gas loss
- Detailed scheduling and gas consumption report
- PDF Export — Printable or Shareable Dive Plan
- Offline authorization — Supports device binding and activation code verification

Chapter2: First Use and Disclaimer

2.1 First Startup

Upon first installation and opening of DIV PRO, the "End User License Agreement and Disclaimer" will be displayed. Please read the entire document carefully.

2.2 Countdown Mechanism

The page has a forced reading countdown (8 seconds). Only after the countdown ends can you check the box to agree and click the "I agree and assume the risk myself" button to enter the main interface.

2.3 Disagree to withdraw

If you select "Disagree, Exit Application," the application will close. The disclaimer will be checked upon each launch; if not accepted, it will be displayed again.

Chapter3: Authorization and Activation

3.1 Trial Mode

When not activated, DIV PRO offers a limited number of trial uses. After the trial uses are exhausted, activation and authorization are required to continue using all features.

3.2 Authorization Status

Status	Description
Unverified	Initial state, no activation operation has been performed yet.
Trial mode	Currently in use, specified number of uses remaining.
Perpetual License	Activated successfully, no usage restrictions.
Trial period expired	Trial use expired; activation is required to continue using.
The authorization has been revoked.	An abnormal reset behavior was detected; the authorization has been revoked.

3.3 Offline Activation Process

- Step 1: On the "Authorization Activation" page, click "Generate Identity Code" to obtain the device's unique identity code (42 characters).
- Step 2: Send the identification code to the distributor or administrator.
- Step 3: The administrator uses the gen_license tool to generate a verification code (72 characters).
- Step 4: Paste the verification code into the "Enter Activation Code" input box.
- Step 5: Click "Verify and Activate" to complete the authorization.

3.4 Trial Deduction Mechanism

Each planning calculation generates a unique planId (based on waypoints, gas configuration, SAC, and altitude). One trial use is deducted only if the planId does not match a historical record. Recalculating with the same parameters will not result in repeated deductions.

Chapter4 Detailed Explanation of Main Interface Parameters

The main interface is divided into four parameter areas from top to bottom: Environmental Parameters (ENV), Physiological Parameters, Gas Configuration (GAS), and Waypoint Settings (WAYPOINTS).

4.1 Environmental Parameters (ENV)

Parameter	Unit	Range	Description
Water Temp	°C	0–40	Enter the current diving water temperature. The lower the temperature, the more conservative the decompression requirements. Below 10°C, cold water correction will be automatically triggered.
Altitude	m	0–3000	Enter the altitude of the diving location. The higher the altitude, the lower the atmospheric pressure, and the decompression calculation will adjust the environmental pressure accordingly.

4.2 Physiological parameters

Parameter	Unit	Range	Description
Bottom SAC	L/min	1–100	Breathing consumption rate at the bottom working section. This represents the average amount of air a diver consumes while working underwater; a higher value indicates faster air consumption.
Decompression SAC (Deco SAC)	L/min	1–100	Breathing consumption rate during decompression stops is typically lower than that during bottom cabin SAC (Sagging Acid), because divers are at rest or in a state of light activity during decompression stops.

Note: SAC (Surface Air Consumption) is the equivalent breathing rate at the water surface. Actual underwater air consumption = SAC × Ambient pressure (ATA).

4.3 Gas Configuration (GAS)

4.3.1 Specialized Gas Pool

The "Professional Gas Pool" at the top offers 5 preset gas templates, which can be added

to the "Gas Cylinder List for This Trip" below:

Gas	O_2 content	Purpose
AIR	21% O_2	Standard pressure, applicable depth less than 40m
EAN32	32% O_2	High oxygen levels prolong the no-decompression stay (NDL).
EAN50	50% O_2	Accelerated decompression, used for decompression segment switching.
O_2	100% O_2	Pure oxygen is used for nitrogen washing in extremely shallow vacuum sections.
Trimix	21% O_2 / 35% He	Triple-gas mixture, used for reducing nitrogen anesthesia in deep diving (>40m).

4.3.2 Custom Gases

Click "Custom Gas" to manually configure gas cylinder parameters:

parameter	Value	illustrate
Gas ID	G, H, I...	Gas cylinder identifiers are used to distinguish different gas cylinders in the results.
Oxygen content (fO_2)	1–100%	Percentage of oxygen in the gas mixture
Helium content (fHe)	0–99%	Percentage of helium in the gas mixture (Trimix only)

4.3.3 PO_2 Limitations

parameter	unit	default value	illustrate
Working segment PO_2	ata	1.4	The maximum oxygen partial pressure in the bottom working section is typically set at 1.4 ata.
decompression segment PO_2	ata	1.6	The maximum partial pressure of oxygen in the decompression hold is typically set at 1.6 ata.

4.3.4 Gas Cylinder List

The "Gas Cylinder List for This Trip" below displays the selected gases. At least one gas is required for planning calculations. You can click the × to delete any extra gases.

4.4 Waypoint Settings

Waypoints define each stage of the diving profile. Each waypoint contains three parameters:

parameter	unit	scope	illustrate
Depth	m	0–150	The target depth for this waypoint. The depth for the first waypoint is typically calculated from the surface (0m) during the descent.
Time	min	1–360	The duration of stay at this depth. This does not include descent and ascent time; it only refers to the duration of stay at the target depth.
Workload	—	—	The workload associated with this waypoint determines the GF conservatism and gas consumption rate. See Section 4.5 for details.

Tip: Clicking on a value will bring up the keyboard for manual input, or you can use the ± buttons to fine-tune it.

4.5 Workload and Dynamic GF

Workload is one of the core features of DIV PRO. Different workloads correspond to different gradient factors (GF) and gas consumption rates (SAC), which directly affect the conservatism of the decompression plan.

GF (Gradient Factor) is a pair of values (GF Low / GF High) used to control the degree of stress reduction conservation.

- GF Low (lower limit): Controls the depth of the initial decompression stop. The smaller the value, the deeper the initial stop and the more conservative the decompression.
- GF High (Upper Limit): Controls the allowable supersaturation of tissues upon reaching the water surface. The smaller the value, the longer the final residence time, and the more conservative the value.
- Value range: 0–100 (internal representation is 0.00–1.00).

Workload	GF (Low / High)	SAC	Applicable Scenarios
Rest	40 / 85	15 L/min	There is virtually no movement, such as decompression rest.
Mild Light	40 / 80	18 L/min	Light swimming or weak current

Moderate	35 / 75	22 L/min	moderate-intensity swimming or moderate water flow
Heavy	20 / 65	28 L/min	High intensity and/or strong water flow, extremely conservative

Special Note: Selecting "Heavy" workload will force the GF 20/65 to be enabled, ensuring maximum conservatism. The system will also trigger automatic degradation for deep diving/cold water/high altitude.

Chapter5 Planning Calculation

5.1 Begin Calculation

After configuring all parameters, click the "Planning Calculation" button at the bottom. The system will check the authorization status and then pass the parameters to the C++ Bühlmann ZHL-16C engine for decompression calculation.

5.2 Calculation Prerequisites

- Add at least 1 waypoint
- Choose at least one gas
- All values are within the valid range.
- The license is valid (trial or activated).

5.3 PlanId Anti-Duplicate Deduction

The system automatically generates a planId fingerprint, which includes: waypoints (depth + time + workload), gas configuration (ID + fO_2), SAC value, and altitude. The same combination of parameters will not deduct trial attempts repeatedly.

5.4 Automatic Safety Degradation

The C++ engine automatically adds the following security fixes on top of the dynamic GF provided by the Kotlin layer:

- Deep dive correction (>45m): Reduce GF Low by 0.05
- Cold water correction (<10°C): Reduce GF High by 0.05
- High altitude correction: Further adjustments based on atmospheric pressure

Chapter6: Interpretation of Results

After the calculation is complete, you will be taken to the results page, which contains five analysis tabs:

6.1 Summary

Metric	Description	Unit
Total Time	Total time from water inlet to water outlet	minutes
Maximum Depth	The deepest point of the entire diving profile	Meter (m)
Deco Stops	Number of decompression stops required	indivual
Gas Switches	Planned number of gas switching times	Second-rate
GF Low / GF High	The gradient factor actually used in this calculation	—

The large GF value is displayed at the top for quick and easy confirmation of the conservatism setting.

6.2 Decompression (DECO)

Displays the complete decompression station sequence, including for each station: depth (m), residence time (min), gas used, oxygen partial pressure (PO_2), and CNS cumulative value. If there is no decompression obligation, it displays "You can ascend directly".

6.3 Gases (GAS)

- **Total gas consumption:** Total gas consumption (L) for each gas, with a 1.5x redundancy recommendation.
- **Gas Cylinder Filling List:** Recommended Filling Volume for Each Gas Cylinder
- **Gas switching details:** time point and depth of each switching event

6.4 Scheduling

The detailed task schedule for the entire dive is presented in tabular form:

Stage	Depth	Duration (Time)	Run Time	Using gas	Gas consumption (Volume)
Stage	Depth	Duration (Time)	Run Time	Using gas	Gas consumption

					(Volume)

6.5 Emergency Response (Bailout)

Simulate the worst-case scenario of complete loss of depressurized gas and calculate the backup depressurization strategy relying solely on the base gas:

- Minimum required AIR volume
- Bailout decompression station sequence
- Bailout detailed schedule
- Safety Precautions (This is an extreme emergency plan and should be avoided as much as possible)

Note: If only a single gas is used (without depressurization gas), Bailout analysis will not be displayed.

Chapter7 PDF Export

Click the "Export PDF" button on the results page to generate a PDF document containing the complete dive plan, including: key parameters, decompression station sequence, gas switching, gas consumption, schedule, and bailout emergency plan. The PDF file can be saved, printed, or shared with your dive buddy.

Chapter8 Help

The main interface provides a "Help" entry, which includes a quick start guide, function descriptions, and explanations of key concepts (GF, decompression station, gas switching, Bailout).

Chapter9 Safety Reminder

- DIV PRO is for use only by personnel with professional technical diving qualifications.
- Before diving, please be sure to bring your own dive computer as your primary safety feature.
- The decompression plan is for reference only; actual diving should follow the procedures learned in training.
- Diving carries inherent risks; please be responsible for your own safety.
- Any decompression model has inherent uncertainties.
- Regularly inspect diving equipment to ensure that gas cylinder valves are functioning properly.