Scuba Diving Calculation Assistant

User Guide

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1. Introduction

Scuba Diving Calculation Assistant is an GUI application for common dive calculations, which could be useful for Scuba diver to dive safely. The aim to develop SDCA is to automate simple and complex calculations used by the dive industry commonly. The application is divided into two categories: *Simple calculations and complex calculations.*

Through *Simple Calculations,* User can provide input values and SDCA will display the following calculations:
EAD (Equivalent Air Depth) – To avoid the risk of nitrogen narcosis, it is very useful to know EAD which is calculated based upon the gas mixtures containing more than the normal 21% of o2.
MOD (Maximum Operating Depth) – This helps the diver to know the maximum safe depth at which it to dive in.
BM (Best Mix) – Best mix of gas is useful to know, using known depth to dive safely.
PPO2 (Partial pressure of oxygen) – partial pressure of oxygen is calculated by limiting the mixture to a safe level which is 1.1 ata-1.6 ata.
SMOD (Standard maximum operating depth) – This can be calculated by using standard PPO2 value 1.4.

Furthermore, through complex calculations, two tables will be produced by SDCA
EAD (Equivalent air depth) table: This will show EAD's for a start and end percentage of O2 along with start and end depth.
Table of partial pressures: This table will use same requirements as of EAD table with exception that when partial pressure is above 1.6, it should not be displayed.
Besides, *Simple calculations and complex calculations,* there is **Help** menu that should give instructions for how to use the program with acceptable values along with the meaning of the help menu items.

Furthermore, application has a dynamic cylinder as shown in figure 1, which shows the percentage of oxygen and nitrogen in the mixture and any change in oxygen values is reflected immediately in the cylinder.

2. How to use the Scuba Diving Calculation Assistant
The Scuba Diving Calculation Assistant is here to support you with your diving calculations. When you open the application, it should look like this:
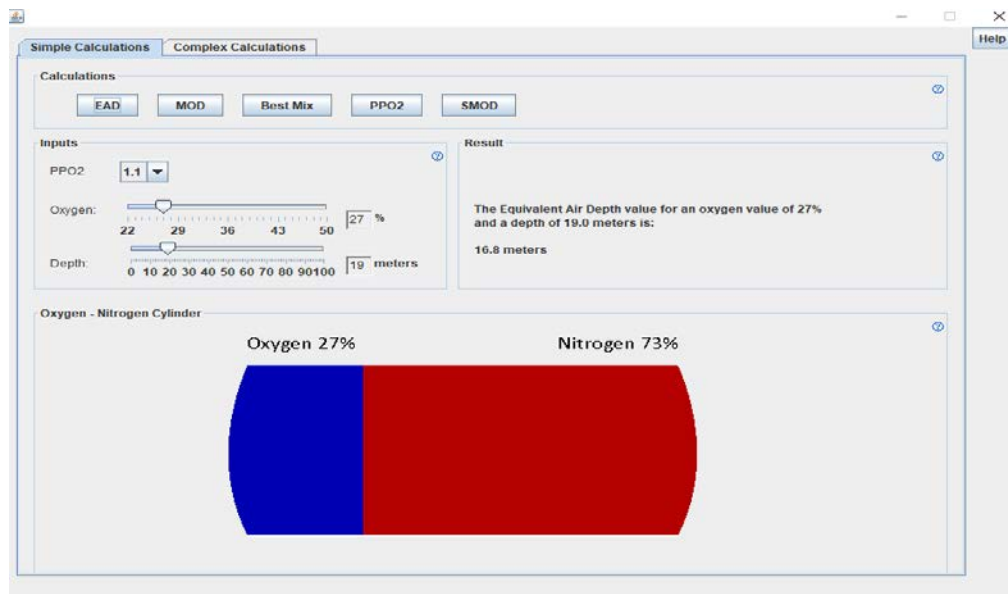
Figure 1: First snapshot of SDCA

To pick which calculation you would like to make, *click* the '*Simple Calculations'* or '*Complex Calculations'* tab.

3. Simple Calculations

The SDCA can calculate five common simple diving calculations. Equivalent Air Depth (EAD), Maximum Operating Depth (MOD), Standard Maximum Operating Depth (SMOD), Fraction of Oxygen (Best Mix), and Partial Pressure of oxygen (PPO₂)

3.1 Equivalent Air Depth (EAD)

To calculate the Equivalent Air Depth, enter the percentage of oxygen and depth by using the sliders When user provide input values through sliders, press [EAD] tab to know EAD value

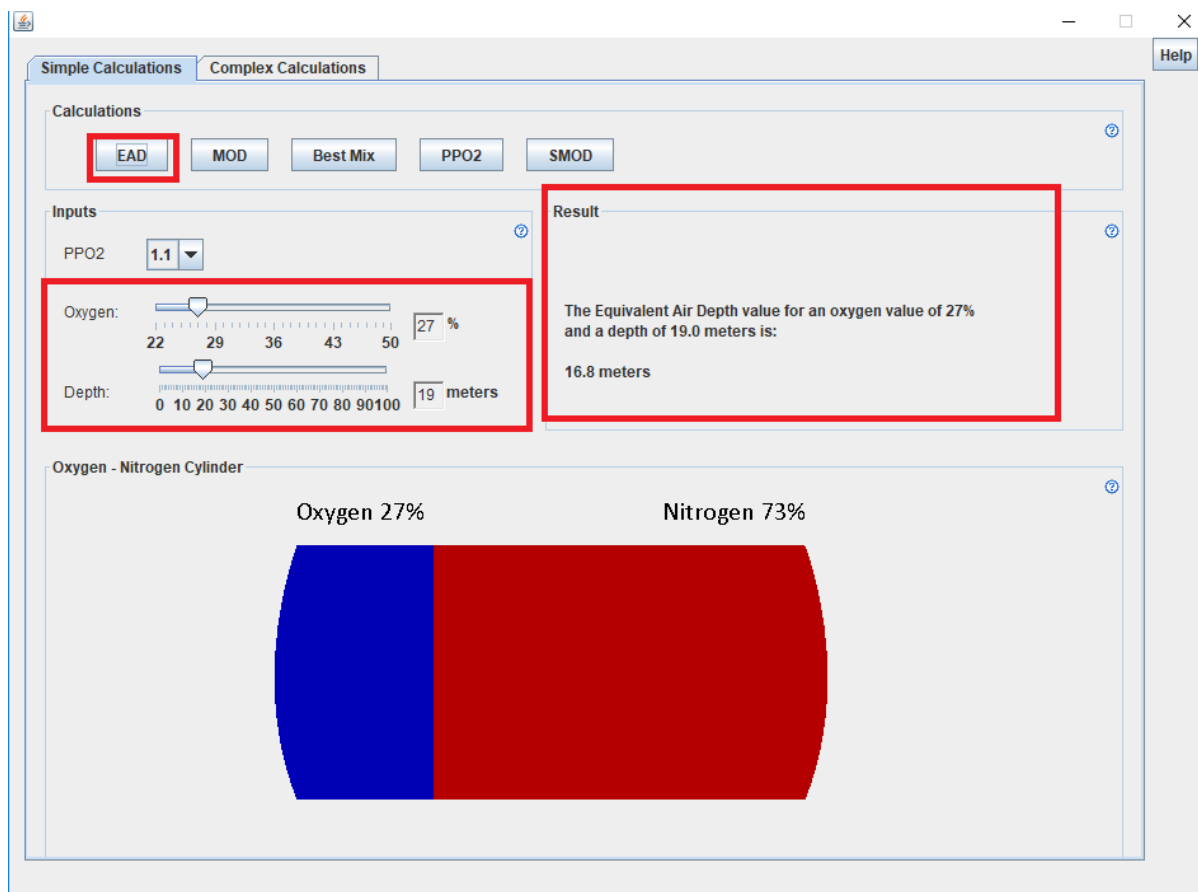The EAD is displayed to the right of the window in the 'Result' box.

Figure 2: EAD result

3.2 Maximum Operating Depth (MOD)

To calculate the Maximum Operating Depth, *click* the '*MOD'* button to the left of the window.
Enter the Partial Pressure of oxygen and the percentage of oxygen in the mix
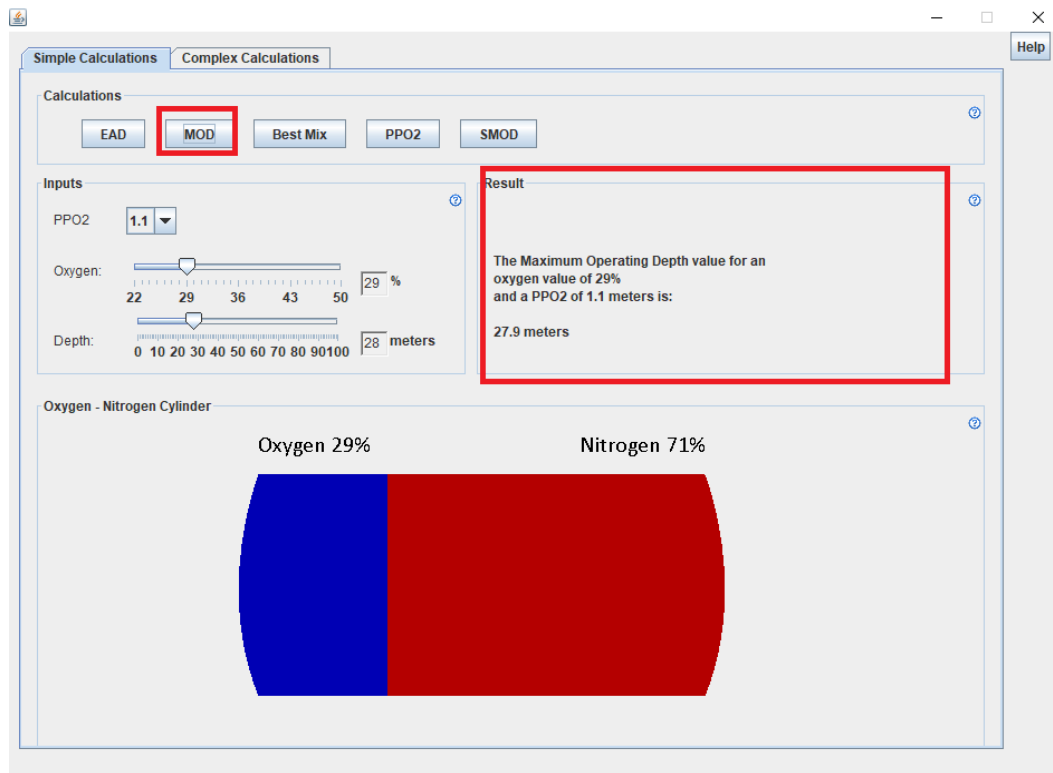The MOD is displayed to the right of the window in the 'Result' box in metres.

Figure 3: MOD result

3.3 Standard Maximum Operating Depth (SMOD)

To calculate the Standard Maximum Operating Depth, *click* the 'S*MOD'* button to the left of the window. In SMOD the PPO$_2$ is fixed to 1.4. Enter the percentage of oxygen, then click on "SMOD"

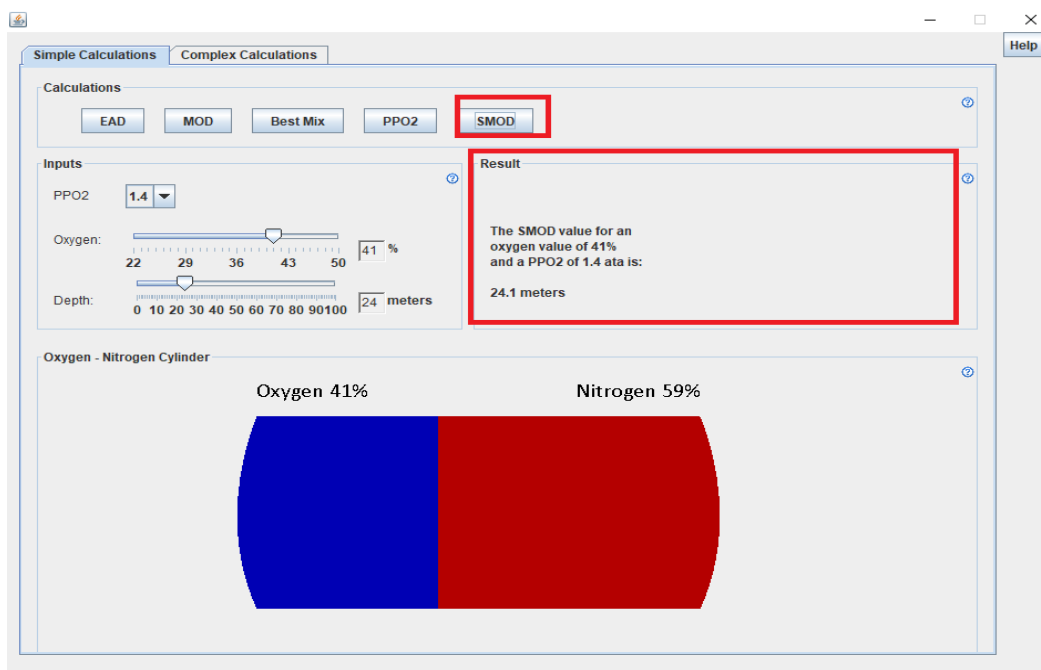The SMOD is displayed to the right of the window in the 'Result' box.

Figure 4: SMOD result

3.4 Fraction of Oxygen (Best Mix)

To calculate the Best Mix, *click* the '*Best Mix*' button to the left of the window.

Enter the partial pressure of oxygen and the depth, then click "Best Mix". The Best Mix is displayed to the right of the window in the 'Result' box.
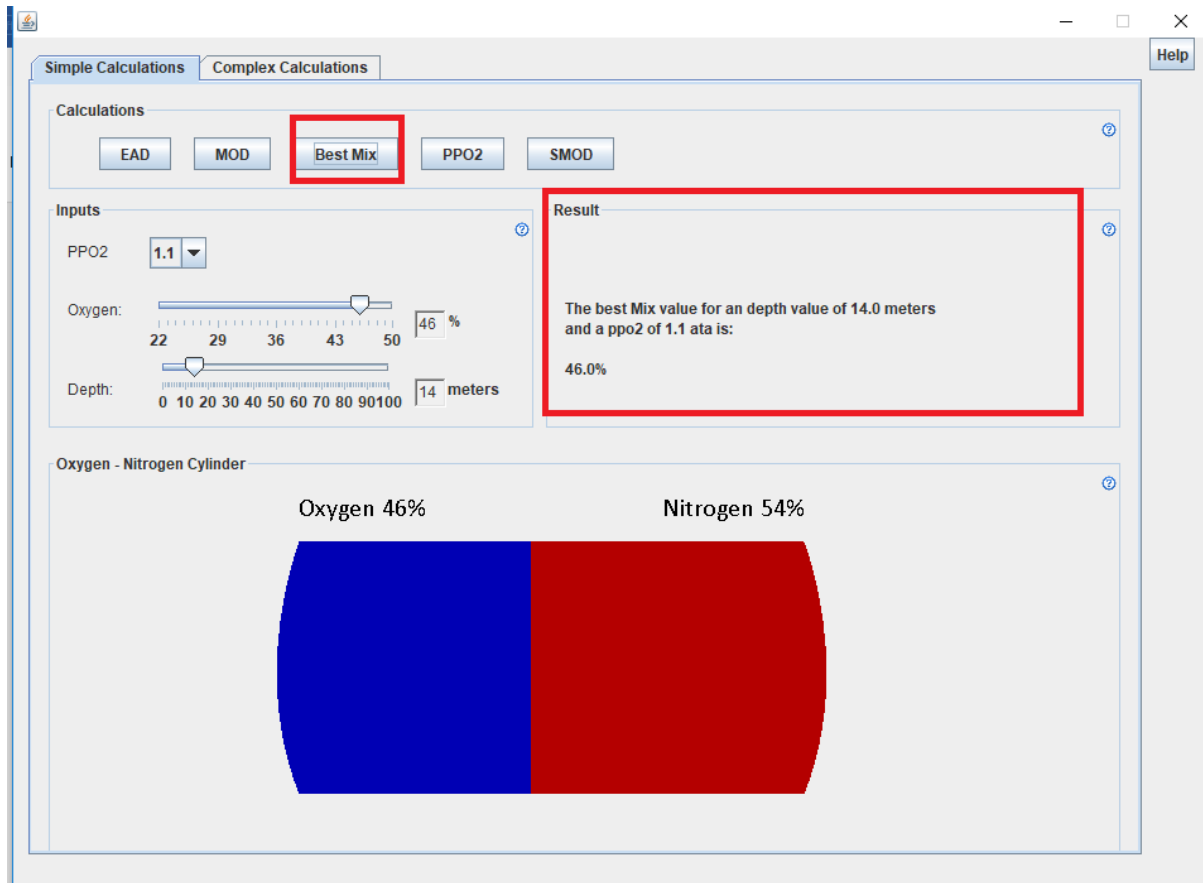

Figure 5: Best Mix result

3.5 Partial Pressure of Oxygen (PPO₂)

To calculate the Partial Pressure of Oxygen, *click* the 'PPO$_2$' button to the left of the window.

Enter the input values from the sliders to calculate PPO2, the PPO$_2$ is displayed to the right of the window in the 'Result' box.
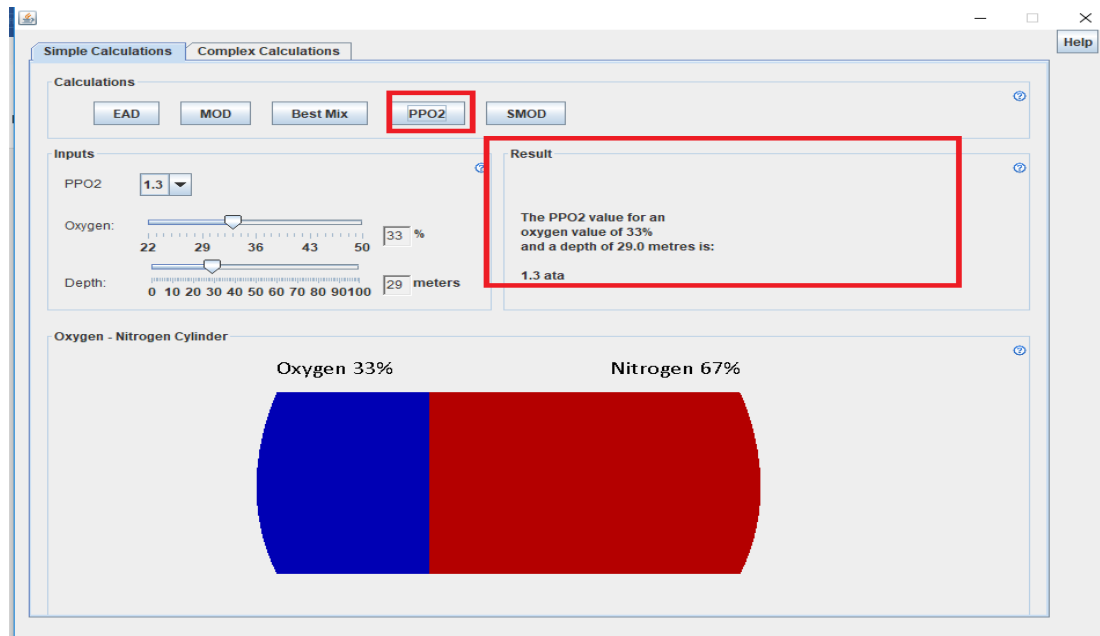
Figure 6: PPO2 result

4. Error Handling

The Scuba Diving Calculation Assistant application has been designed in such a way that if user provide invalid values which are not in the acceptable range, program will display errors/warnings through GUI to inform users about the mistakes and give them a chance to correct the values so that application produce correct calculations.

There could be many instances where results could be invalid but following are examples of some screenshots when values entered by user are not valid:

1. For Best mix, Oxygen value must be between 22% and 50%, when this value is out of range, warning will be displayed to user as shown below:
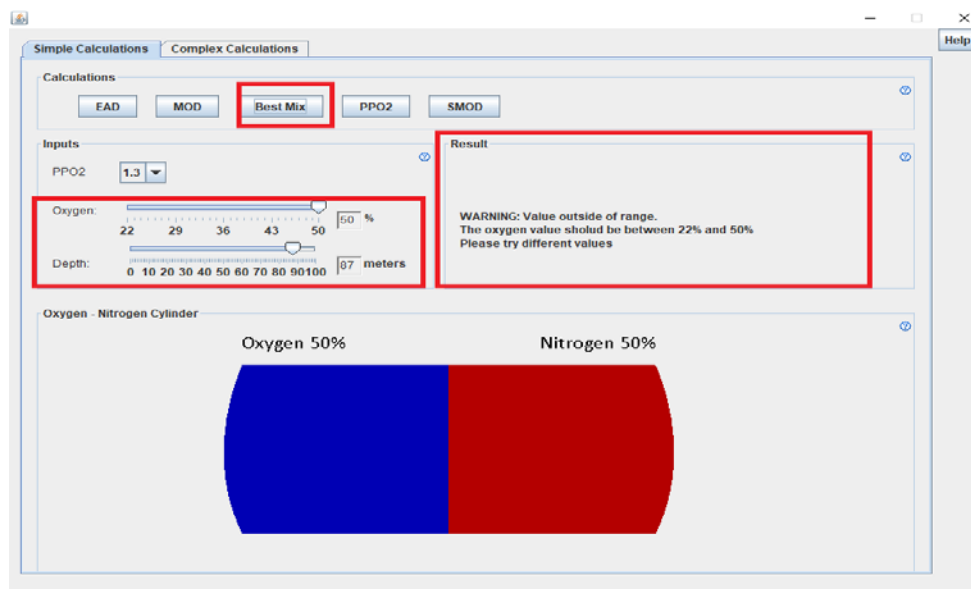

Figure7: Warning for Incorrect Best mix

2. When PPO2 exceeds recommended range of 1.1-1.6, warning will be displayed as following:
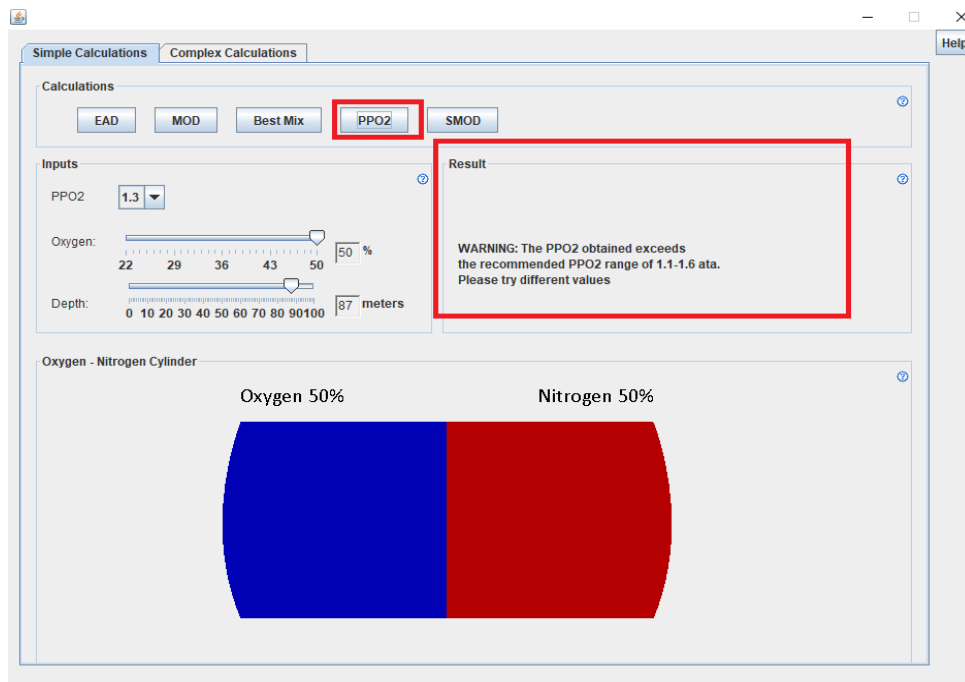

Figure 8: Warning for incorrect PPO2

5. Complex calculations

Complex calculations component in SDCA is used for producing two tables: EAD table and table of partial pressures. To calculate complex calculations, click on the *complex calculations tab* at the top left-hand side.
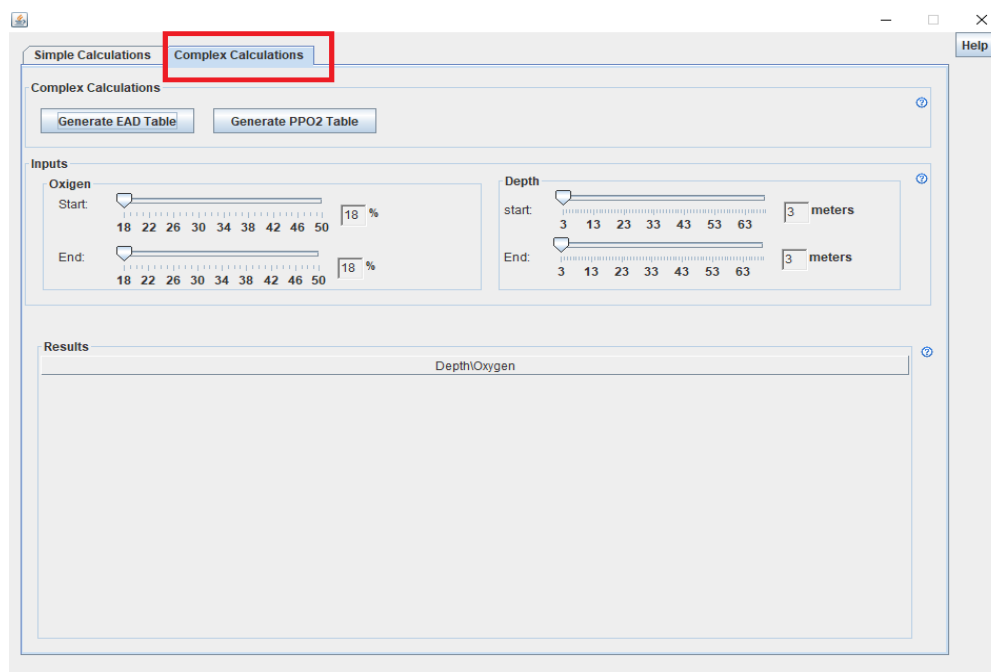

Figure 9: Complex calculation

5.1 EAD table

For this, user needs to input values for oxygen and depth where, oxygen values must be between 18%-50% or any combination between these values whereas depth values should only range between 3m to 70m. Any value out of these range is not acceptable by the system.

After providing inputs for EAD table, click on *generate EAD table tab*. Table of EAD's will be generated with increment of 1 in oxygen values and increment of 3 in depth values. This is shown in the following snapshot:
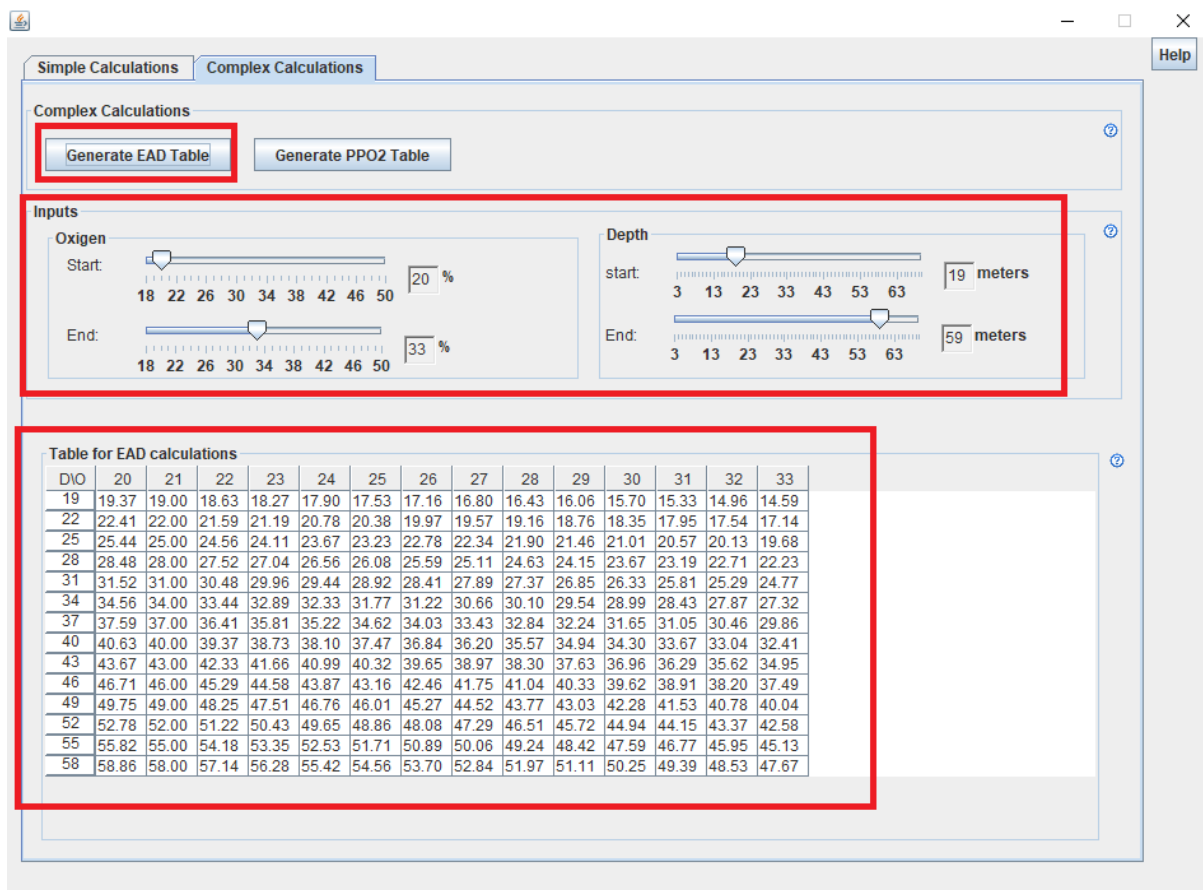

Figure 10: EAD table

5.2 PPO2 table

For PPO2 table, input requirements are same as of EAD table mentioned above, but the partial pressure above 1.6 will not be displayed. User will give input to the system, click on *generate PPO2 table tab*, PPO2 table will be generated as shown in the snapshot below:

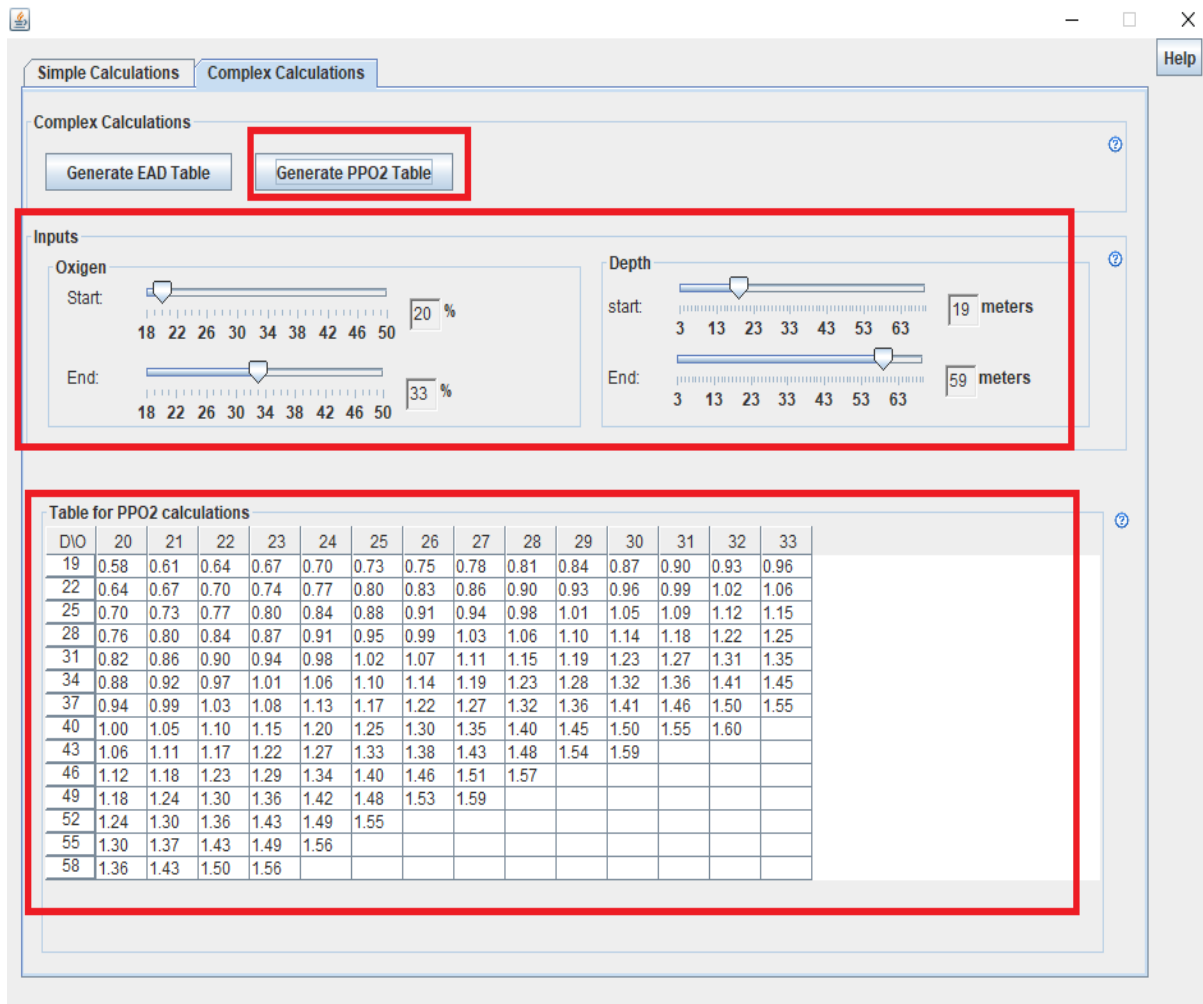Blank boxes in the table represent value of PPO2 is more than 1.6

Figure 11: PPO2 table

6. Help Menu

6.1 Simple Calculations help item

The help menu tan at the top right of the application can bring up manual/documentation for the help of user.

? icon provides a small description for each section of the application that what it is supposed to do. These icons are present along with each section so that user can get a clear idea about each section.

For instance, on browsing over ? in the right-hand side of the calculations sections will notify user that they can perform these five calculations by pressing the relevant tab and a pop-up window will appear with message and this can be cleared by pressing "OK"
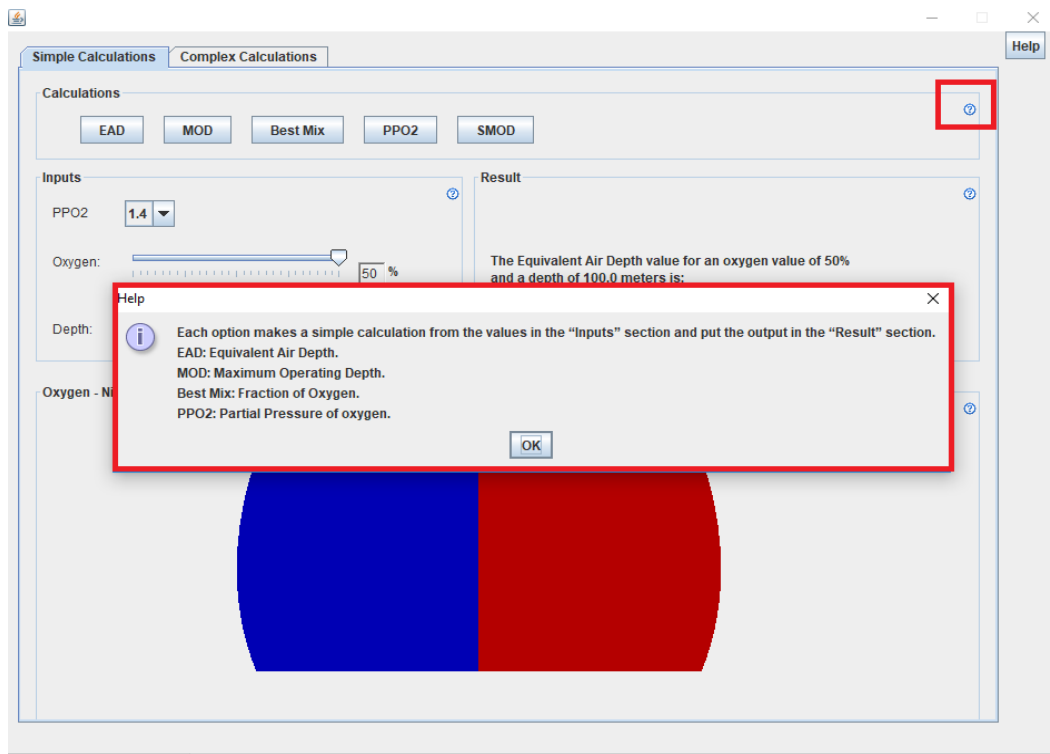
This is shown in the figure below:

Figure 12: Help item for simple calculation tabs

In the same way, if user browse over ? on the right-hand side of inputs section, it will display a message as shown below:
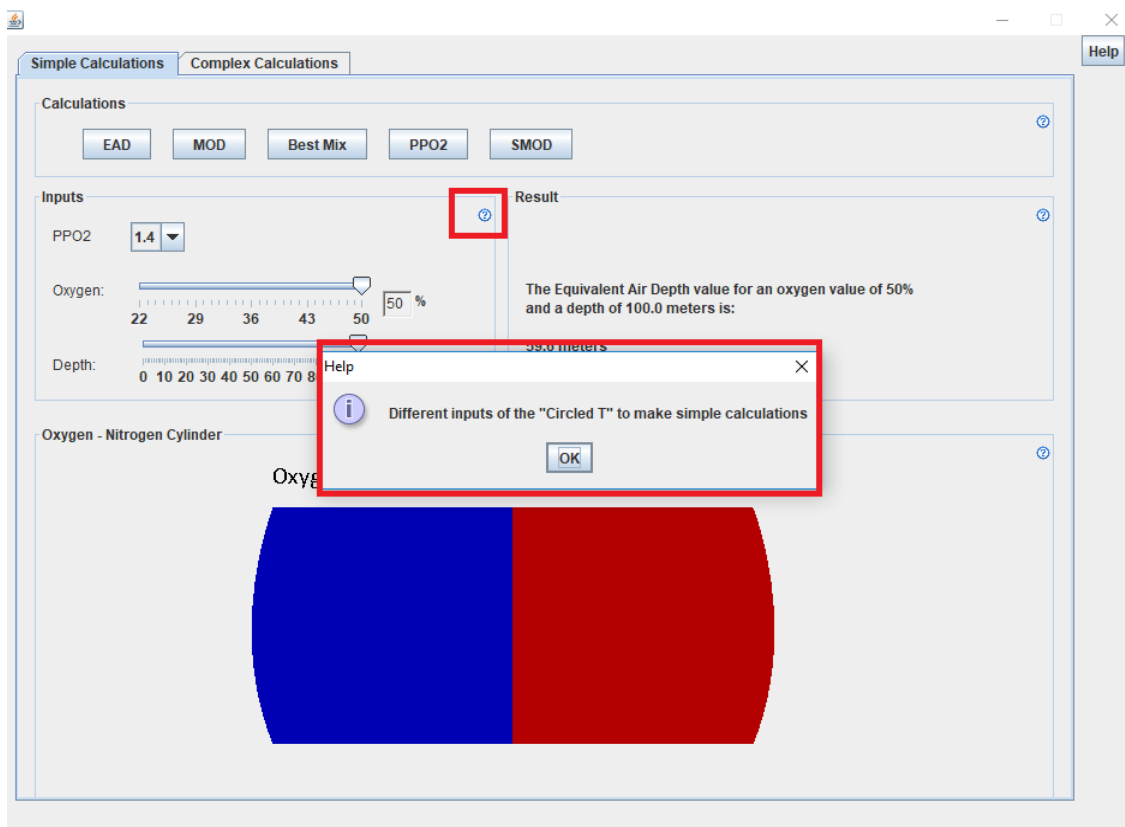

Figure 13: Help item for simple calculation (input section)

6.2 Complex Calculations help item

In the same way help items have been implemented in the complex calculations.

"Help" menu for overall application system and three ? items for each section of complex calculation. For instance, browsing over ? on the right-hand side of the *"tables section"* will show up pop-up message as shown in the following figure:
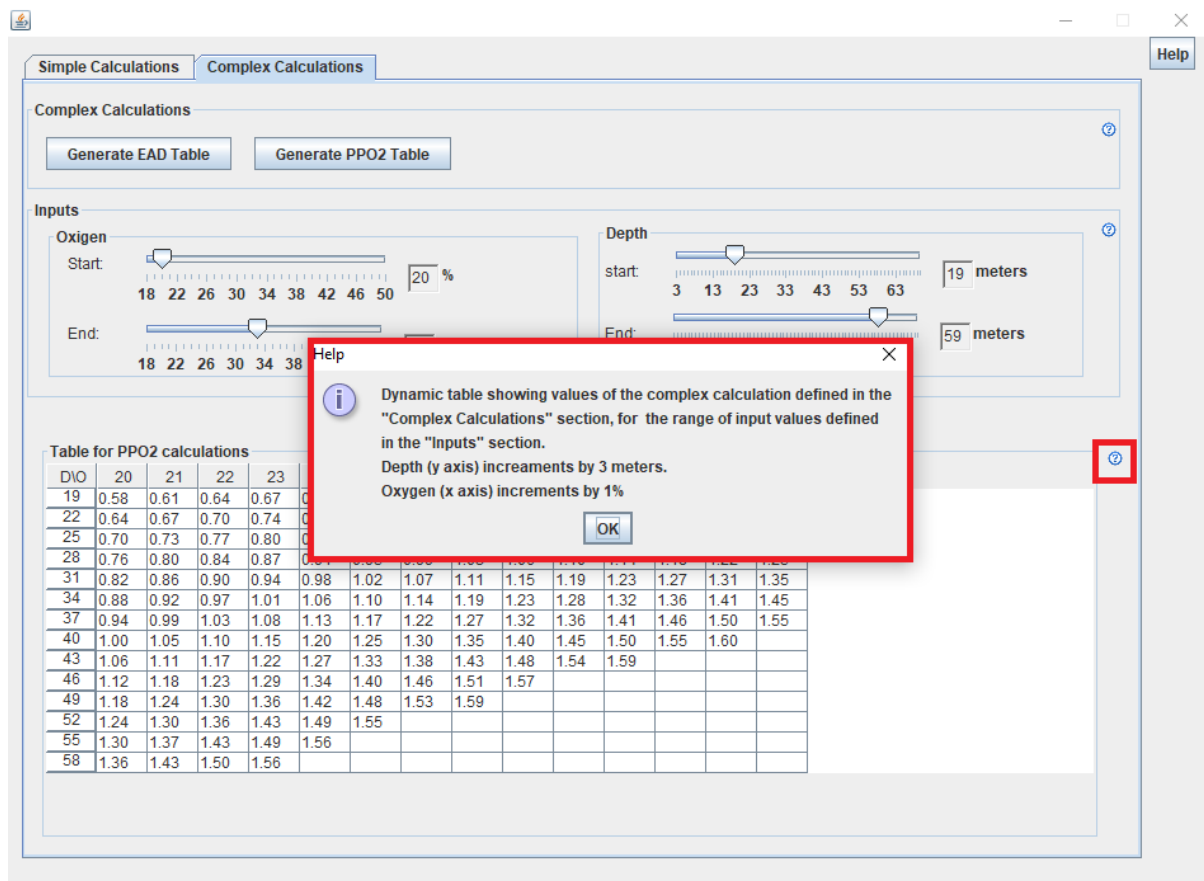

Figure 14: Help item for complex calculation (tables)

This user guide is very helpful for clients in understanding how the application works and errors are being handled. Further, "Help" menu makes it easy to understand what each section in simple and complex calculations is meant for.