BIOMEDTECH

Biomedical Research and Development

GO2Altitude® HYPOXICATOR
(High Altitude Simulator)

PC SOFTWARE MANUAL

TABLE OF CONTENTS

Program Overview

GO2Altitude® software consists of two separate modules – a real-time Graphical User Interface (GUI) used to monitor hypoxic training sessions, and another GUI specifically designed to view, manipulate, access, and store data from a history of hypoxic training sessions. Each module is selected from a specific icon located on the computer desktop during installation of the software. Each of these systems will be explained in turn. The user may also select from two distinctive "skins" for their GO2ALTITUDE® display, when the program is started. For the sake of clarity, this manual will use the "CRT" skin (*see* the **Skin Display Options** section for further information).

The GO2Altitude® Software Session Screen

GO2Altitude® software is specifically designed to complement the GO2Altitude® range of hypoxicator systems. Utilising the GO2Altitude® integral Pulse Oximeter (*see* Pulse Oximeter in Glossary at the end of this manual), physiological information - such as heart rate and arterial oxygen saturation - is monitored, recorded, and displayed on a standard, Windows-based computer during intermittent hypoxic training sessions. This information is then used to assist in determining the current state of an individual's fitness, their reaction to hypoxic stimulation, and the degree to which their body has responded to the treatment.

The information received by the GO2Altitude® software is displayed on a multi-function screen that plots the various input parameters – heartbeat, O_2 saturation – against specified time intervals.
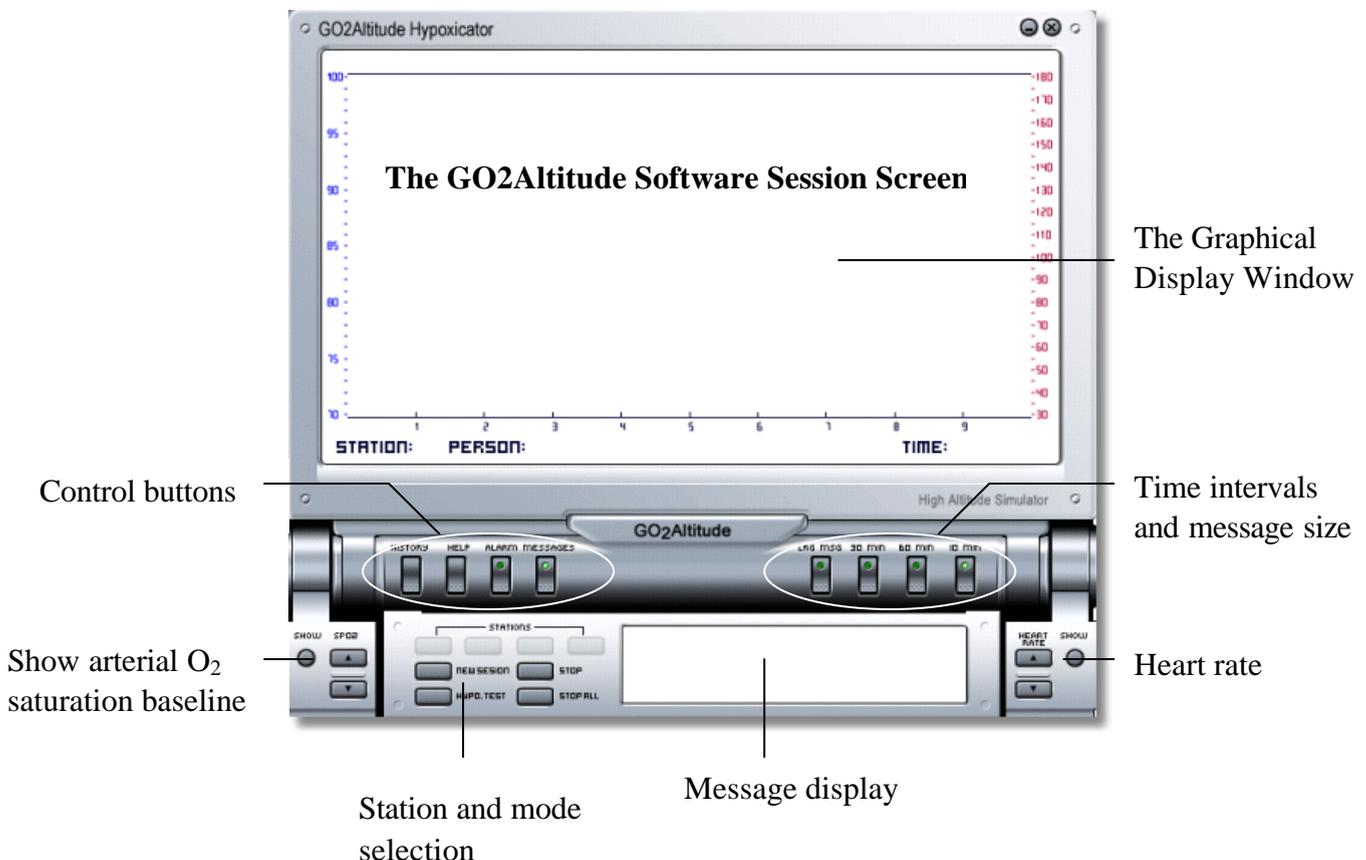
The GO2Altitude® Software History Screen

In addition to the Software Session Screen, the GO2Altitude® Software System also allows the user to access and compare stored data from a history of hypoxic sessions, to assist in the analysis of their training regime. The information displayed may be stored on the host computer, be printed as required, or manipulated in a variety of other ways, including export to a spreadsheet program (such as MS Excel) or to a database (such as MS Access), as a delimited text file.

Each of the functional areas shown will be discussed in turn in the following sections of this manual.
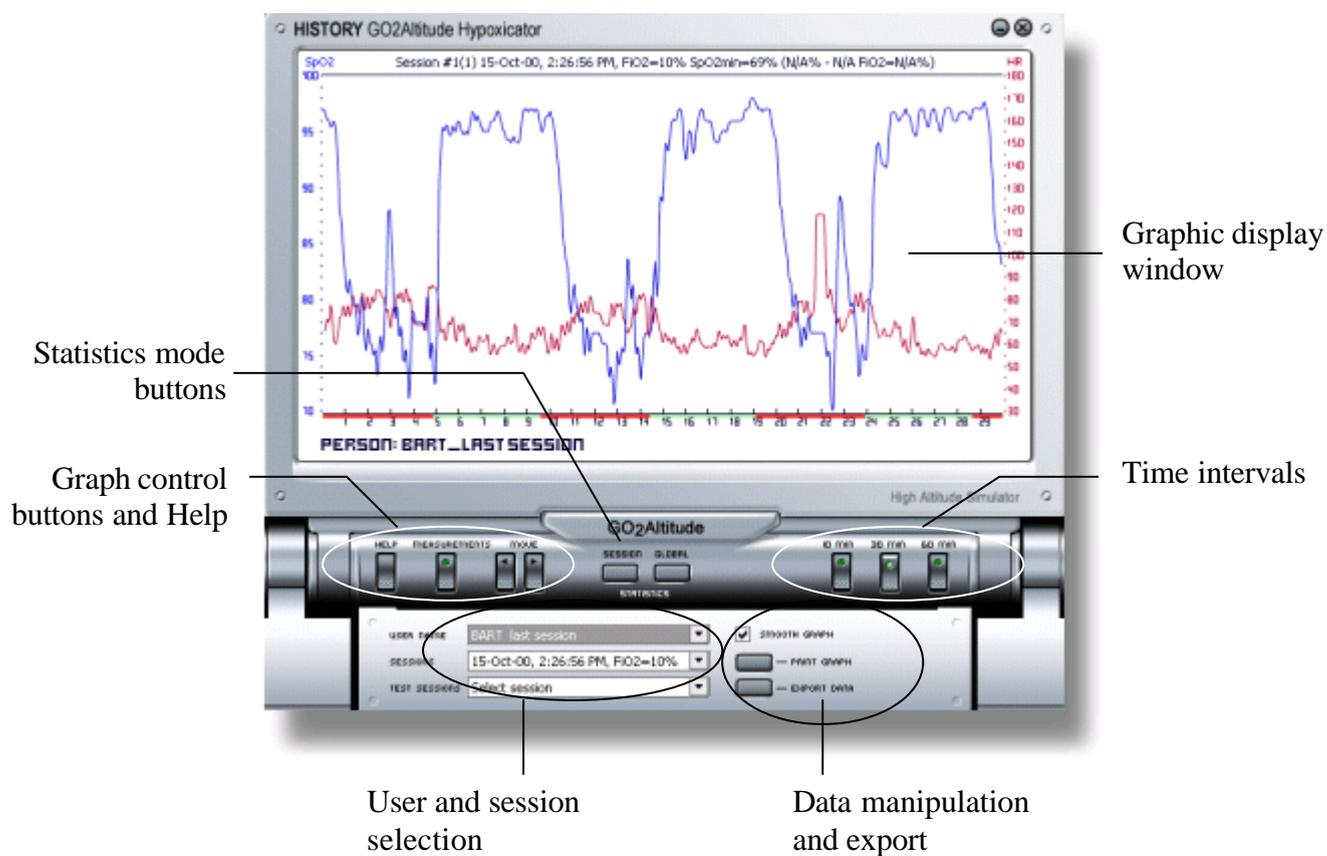
Real-time Screen Functions

Overview

The GO2Altitude® Software User Screen is accessed from its specific icon on the computer desktop:

To more clearly describe the screen functions, the main screen will be explained in two sections corresponding to the titles shown in the graphic,**GO2Altitude® Software User Screen**. The first section describes the Graphical Display Window, whilst the second section describes the Function Controls and the smaller Message Display screen:

The Graphical Display Window
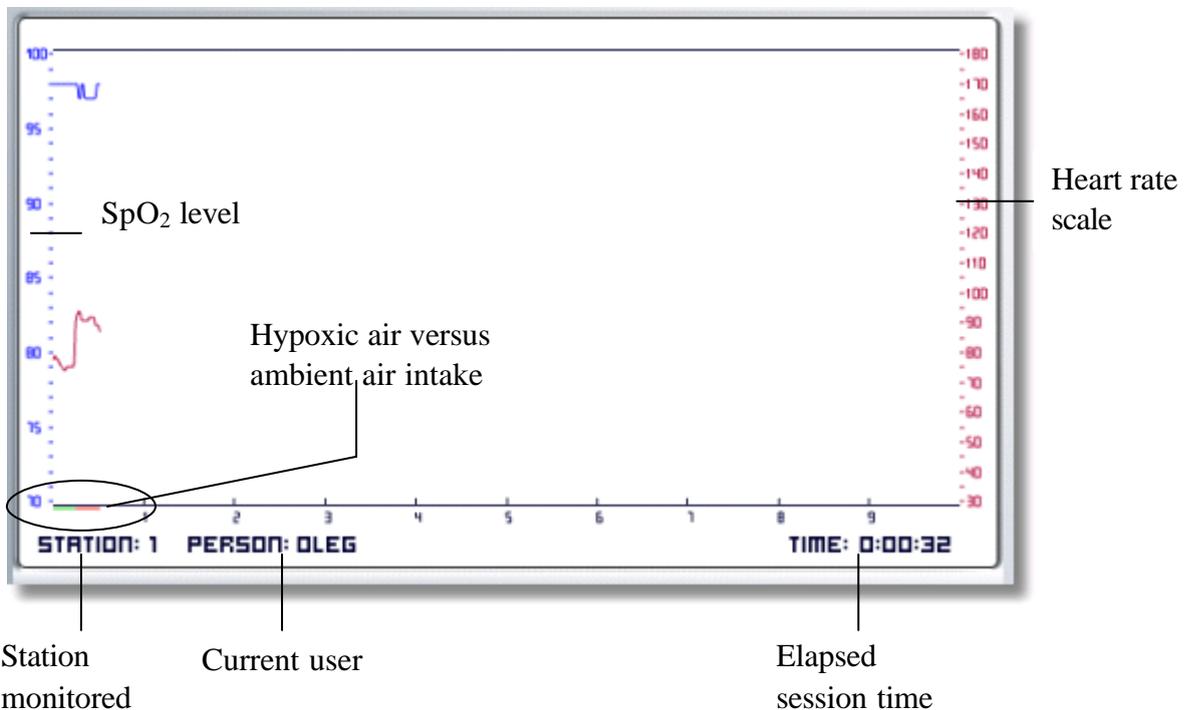
As illustrated, the Graphical Display Window shows the real-time data of the Selected Station (*see* **Stations** in the section **Function Controls**) in a comparative graphical form. As such, this window shows the variance in Heart Rate and Arterial Oxygen Saturation (SpO$_2$) over a given period of time.

Function Controls

Control Buttons

The Control Buttons are located on the lower left section of the GO2Altitude® Hypoxicator software screen. The function of each of these buttons is as follows:

Help Calls the GO2Altitude® Hypoxicator online help manual

Alarm Enables the warning buzzer to indicate that oxygenation levels are too low. The inbuilt green light glows when the button is activated.

The **Reset** button clears resets the software and clears the screen to allow taking of new measurements.

Messages Selecting this button enables messages in the Message Display window:

Message Display Window

Located to the right below the Control Buttons, is the Message Display Window:
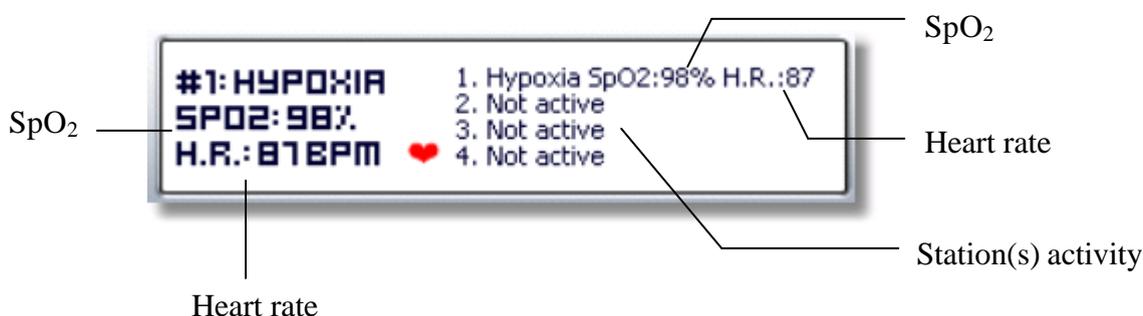
The Message Display Window shows the information obtained from a selected station, and is a real-time textual representation of the information shown in the Graphical Display Window.

The data exhibited includes the Station Number being used – represented as a number with a hash (#) on the left of the display, and as a list number on the right side of the window. The SpO_2 is shown as a percentage, and the heart rate is given in Beats Per Minute (BPM).

The information is displayed in a larger form to the left of the window to allow for reading from a distance, for example when the user is seated some distance from the computer.

Time Interval and Message Size Buttons

The Time interval and Message Size buttons are located on the lower right portion of the GO2Altitude® Software Session screen, previously described.

The **Display** button simply enables the viewing of the larger message on the left-hand portion of the Message Display Window previously described (*see* **Message Display Window**). The inbuilt green light glows when the button is activated.

The Time Interval buttons alter the time increment shown on the Graphical Display Window. Each interval can be changed to a preset selection of 10, 30, or 60 minutes, as shown in the following section from the Graphical Display Window:

Time increments
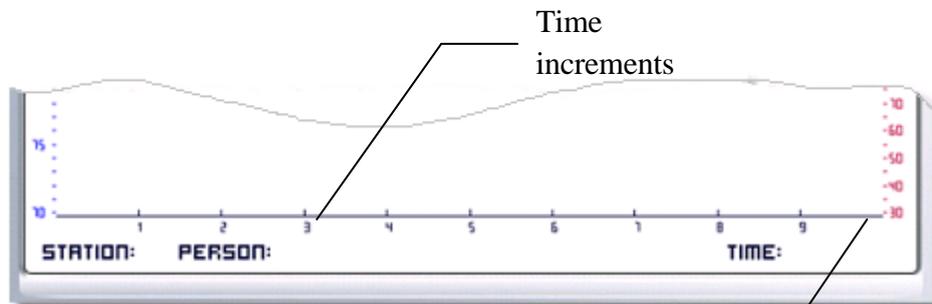
Total = 10 minutes

SpO₂ Baseline Levels

Show – This button enables the display of Saturated blood O_2 levels.

SpO₂ – These scroll buttons permit the setting of the baseline level of the percentage of arterial blood oxygen saturation, below which level the software will start to alarm the operator.

Heart Rate and Show Buttons

Simply, these buttons set the baseline Heart Rate, above which the program starts to alarm.

Station and Mode Selection

The Station and Mode Selection buttons are located in the lower portion of the GO2Altitude® Software User Screen, directly to the left of the Message Display Window. The function of these buttons is as follows:

Stations – Dependent on the model of hypoxicator used, if more than one station is in use, this function allows the operator to select which station information is to be displayed. Clicking this button to display the details of the station monitored will also result in the illumination of a confirmation "on" light, next to the button concerned.

If no stations are activated, the selection buttons are unavailable (greyed out).

When a station is activated and the program of treatment is started, its corresponding button becomes active.

Mode Selection - The **New Session** button simply allows the operator to initiate a new session, and select a station (if applicable).

The **Stop** and **Stop All** buttons put a halt to any current session or sessions, respectively. The user must select the **New Session** button to reinitiate a session.

The **Hypo. Test** button is used to start the special mode; Hypoxic Test.

Hypoxic Test

In order to determine a user's respiratory condition and to determine the base level reference of their fitness health level, a hypoxic test is recommended.

The information is collected over a maximum period of ten minutes, where the Pulse Oximeter (finger clip-on sensor) is used to measure heart rate and SpO_2 levels and the results are displayed graphically using the GO2Altitude® software. This is performed in real-time, with a one second sampling frequency:

SpO₂ scale   SpO₂ base level set   Heart rate base level set

Heart rate scale

Station in use   Person being tested   Elapsed time
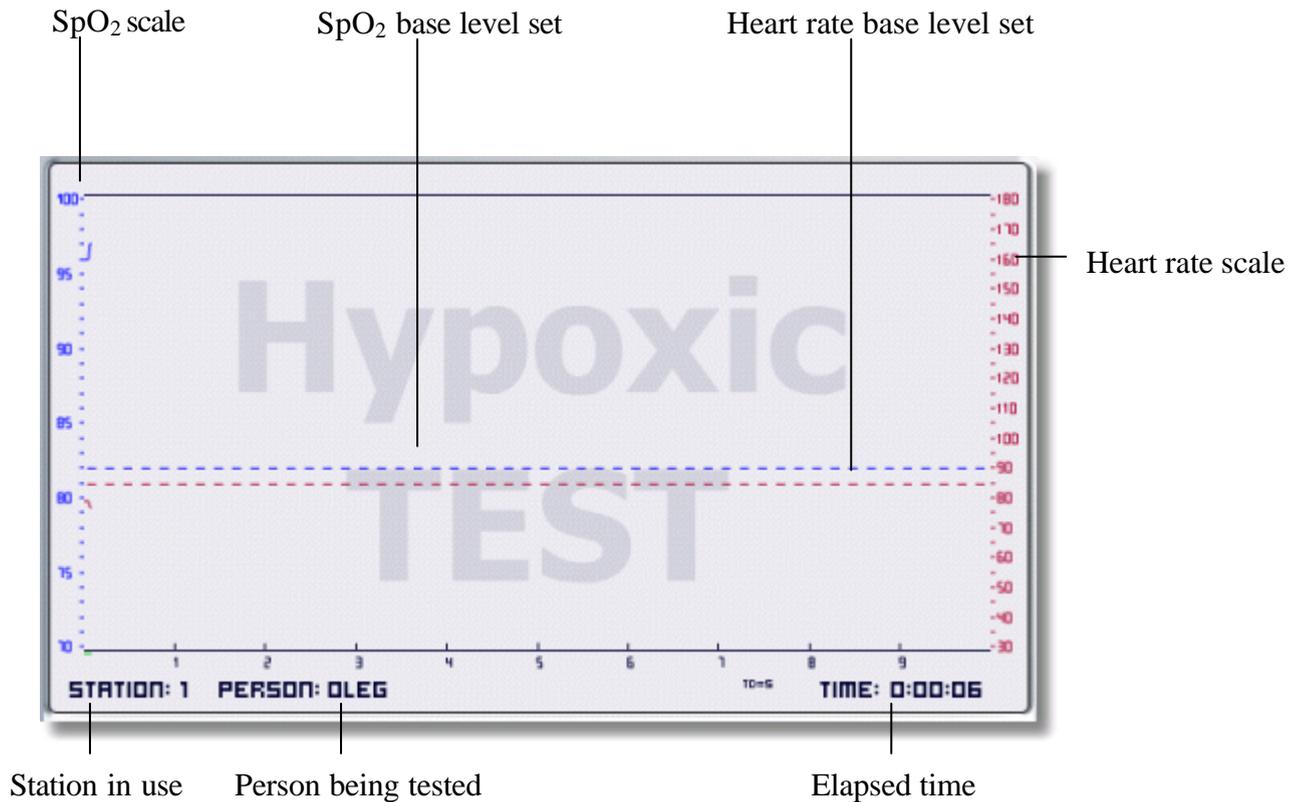
The Hypoxic Test helps indicate an individual's reaction to low-oxygen respiration. By default, or by connection, the oxygen saturation base line is set automatically to 85% for all people (Please refer to the main Hypoxicator User Manual for further information).

The results of this test are also displayed textually in the Message Display window, simultaneously:

SpO₂   Combined results

Heart rate   Station activity
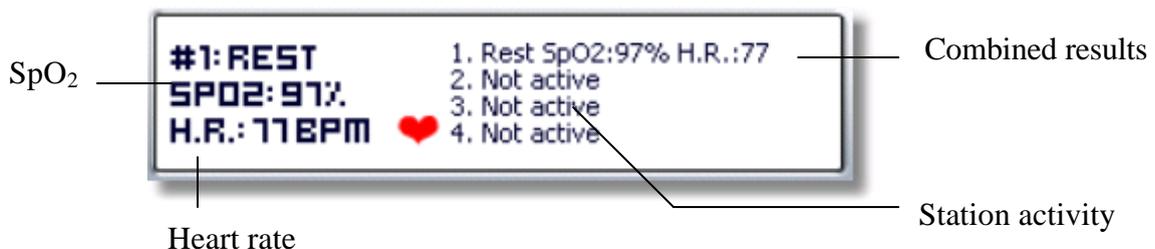
Messages Displayed

The Hypoxic Test screen continuously plots a graph of SpO_2 and Heart Rate on the screen at one-second intervals as the hypoxic test is being conducted:
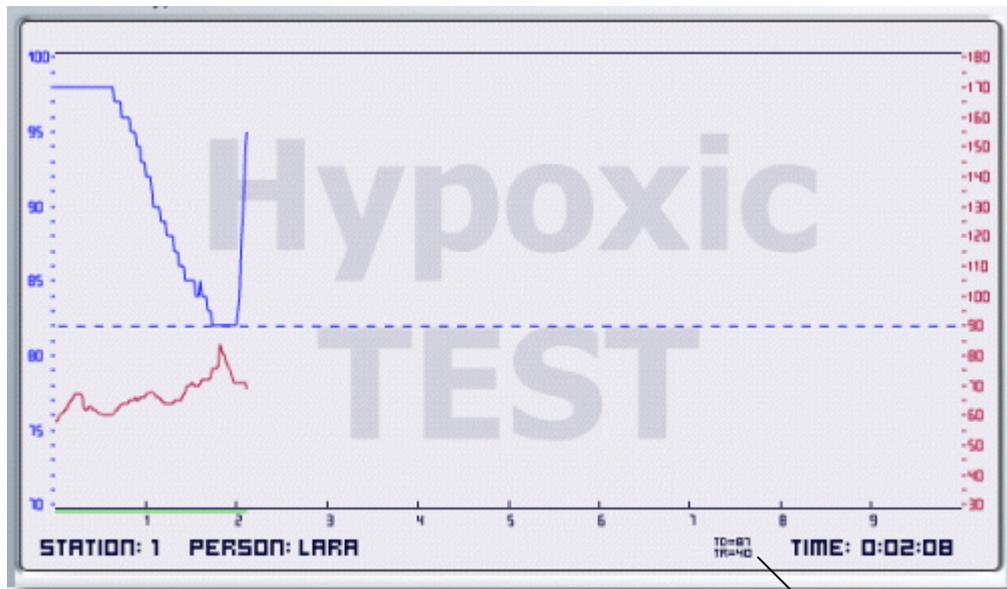
One result of this test is known as the **Time to Descend** – or Td. This figure is displayed constantly in the lower right-hand portion of the Hypoxic Test display window (as shown), and actively refers to the time taken for the user's SpO_2 level falls below 85%.

NOTE As a rule-of-thumb, the length of the Td parameter reflects the level of general respiratory and aerobic fitness of an individual. Generally, the longer the Td, the higher the fitness level of the person under test.

Once the Td has been reached, the user is advised by the software to remove the mask, and revert to breathing ambient air. From here, the recovery test is started when an SpO_2 level of 95% is reached, and is measured as Tr, or **Time to Recovery**, and is shown with the Td measurement in the display window, as illustrated.
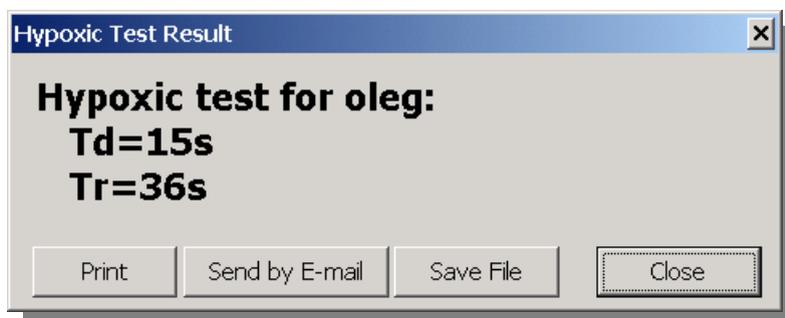
Once the Hypoxic Test has been conducted, a dialog box will be displayed showing both the Td and Tr results (as shown at left). From here, the user may elect to save, print, or email the information.

History Screen Functions

Overview

To access the History screen, the operator selects the GO2Altitude® History icon from their PC desktop, as shown at left.

Loading session data

Once the GO2Altitude® History icon has been selected, a dialog will display as follows:
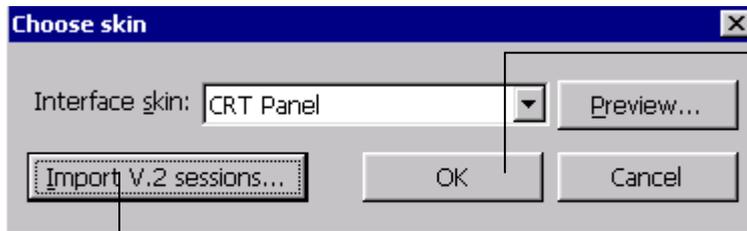
For new users, click on the OK button only

For previous users, click on the **Import V.2 sessions…** button to load saved session data from previous versions of the software.

This will then display a dialog in which the operator may browse for suitable files:
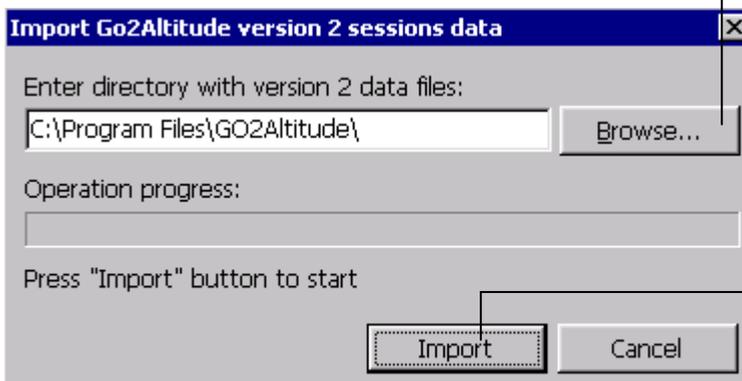
Once the appropriate files have been selected, click on the Import button to load them to the GO2Altitude® History screen.

When complete, a message window will display, confirming the number of files imported.

Files may now be accessed directly from within the GO2Altitude® History display from selected training sessions.

User and Session Selection

To access an individual session, or sessions, the operator now chooses from a group of drop-down boxes:
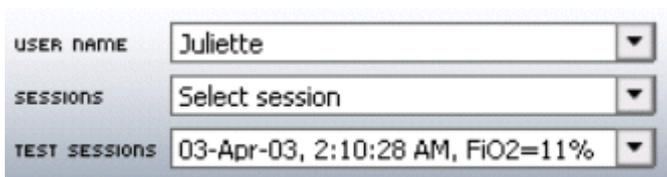
Directly below the Measurement Control buttons is a series of drop-down boxes that contain information pertinent to the data being displayed on the Graphical Display Window.

The first of these windows displays the User selected, to display their hypoxic test history. Only those users whose data is stored may be accessed.

Each session is stored separately, and may be accessed from this drop-down list.
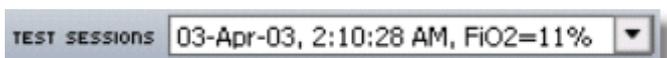
The Test Session, containing the date, time, and standard oxygen concentration level, are selected here.

As illustrated, this Window shows the collected history data of the Selected session in a comparative graphical form. As such, this window shows the variance in Heart Rate and SpO$_2$ levels over a given period of time, during a selected session:

Saturated O$_2$ scale   Test session details

Heart Rate scale

Precise point measurement

Person in test history

Time to Descend

Time to Recovery

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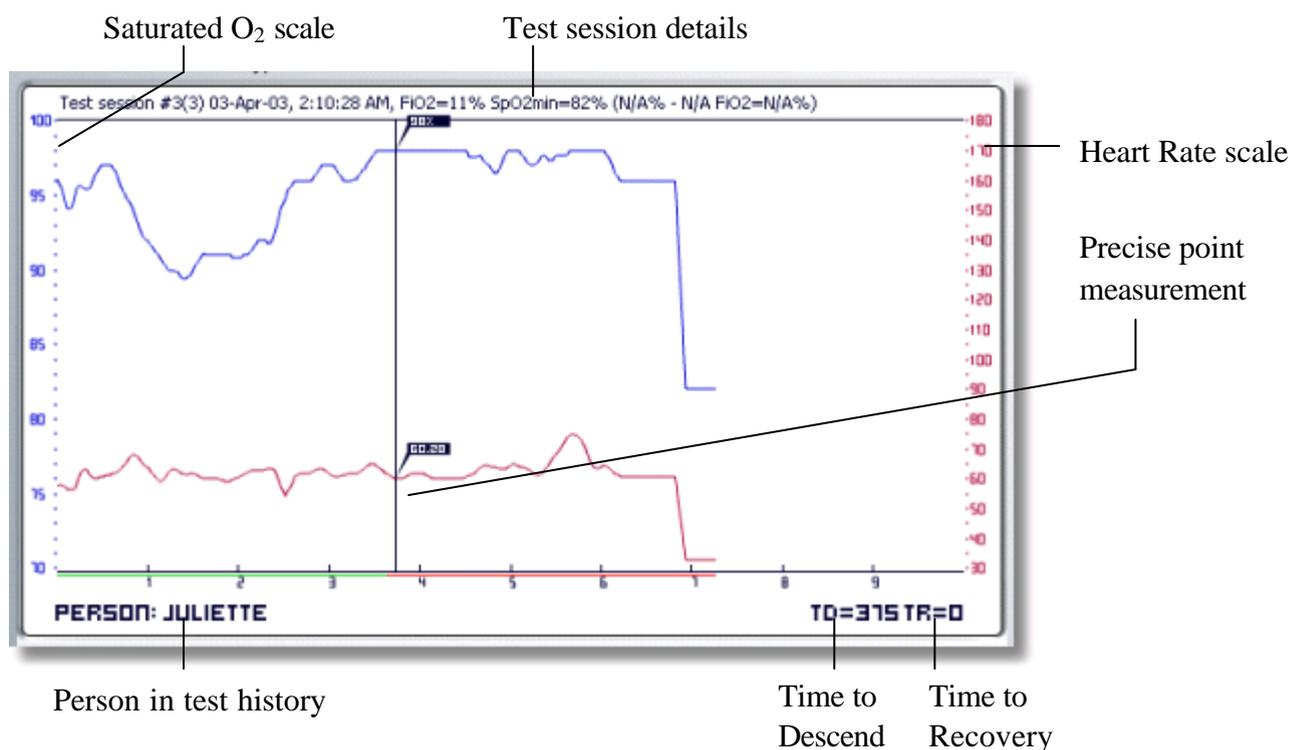
The Graphical Display Window – Session Statistics

To more clearly describe the screen functions, the main screen will be explained in two sections corresponding to the titles shown in the graphic, **GO2Altitude® Software History Screen**. The first section describes the Graphical Display Window, whilst the second section describes the Function Controls and the smaller Message Display screen.

The GO2ALTITUDE® History Software Graphical Display Window consists of several distinct functions. There are two displays from which to choose, the **Session Statistics** function, and the **Global Statistics** function, each of which is selected from the button found in the centre of the display, directly below the Graphical Display Window.

These buttons toggle between the two functions, and the display and controls change accordingly. The first of these, the **Session Statistics** mode, is as follows.

Function Controls

Control Buttons

The Control Buttons are located on the lower left section of the GO2ALTITUDE® History software screen. The function of each of these buttons is as follows:

Help Calls the GO2Altitude® Hypoxicator online help manual

Measurements Calls into action the precise point measurement lines used to display detailed data at a given section of the displayed graph. By positioning the cursor at the point required and clicking the left mouse button, a line of measurement will be inserted, and the data for that point displayed:
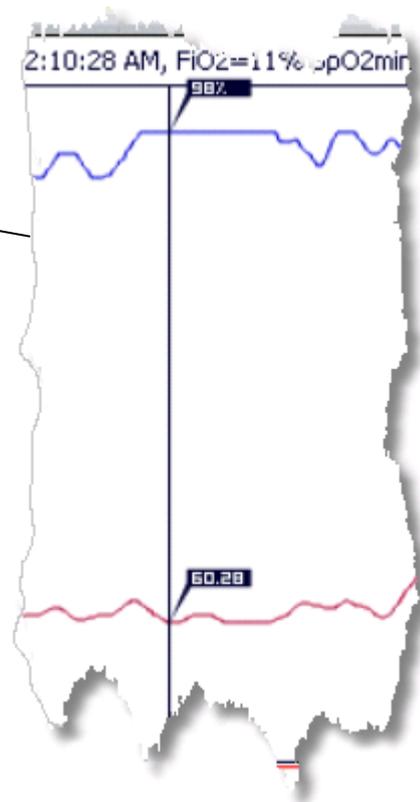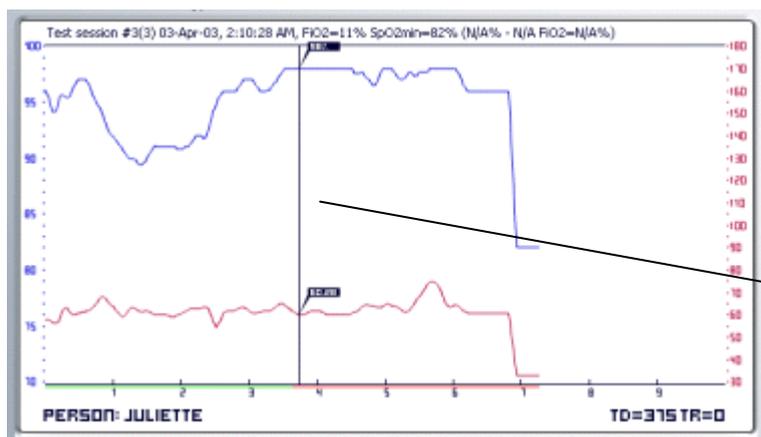
These precise point measurements are particularly useful in displaying the heart rate or an exact percentage of SpO$_2$ at any given time. Each measurement line is movable across the range, and multiple measurement lines may be inserted.

The **Move** buttons control the incremental movement of the measurement lines. Clicking the button denoting a left or right direction will move the line in that direction. Dragging with the mouse will also effect this.

The **Time Interval** buttons alter the time increment shown on the Graphical Display Window. Each interval can be changed to a preset selection of 10, 30, or 60 minutes

Data Manipulation and Export

Directly to the right, and on the same level of the Message Display boxes, are the Function Buttons:
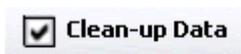
The **Clean-up Data** checkbox smooths the graphical data displayed, by averaging the measurements to remove the strictly linear appearance.

The **Print Graph** button outputs the graphical display directly to a printer connected to the computer.

The **Export to Excel** button allows the user to transfer the history results directly into the spreadsheet program, MS Excel, as a delimited text file. This results in the user being able to further manipulate, store, and display the collected history data:

The information shown in Excel may be then transformed into any of the graphical display methods available, including graphs, and pie, column, and line charts.

The Graphical Display Window – Global Statistics

The inverse toggle to the Session Statistics mode is the **Global Statistics** mode. This mode displays a summary of all sessions undertaken. Selecting this mode changes the Graphical Display Window contents, as well as the function and selection buttons relevant to use in this mode:

Independent of the session(s) selected, the Graphical Display Window will display certain parameters:

SpO$_2$ scale   Overall Session(s) statistics

Heart rate scale

Average SpO$_2$ achieved

Minimum SpO$_2$

Maximum Heart rate

Average Heart rate

User selected   Time to   Time to
                                                 Descend   Recovery
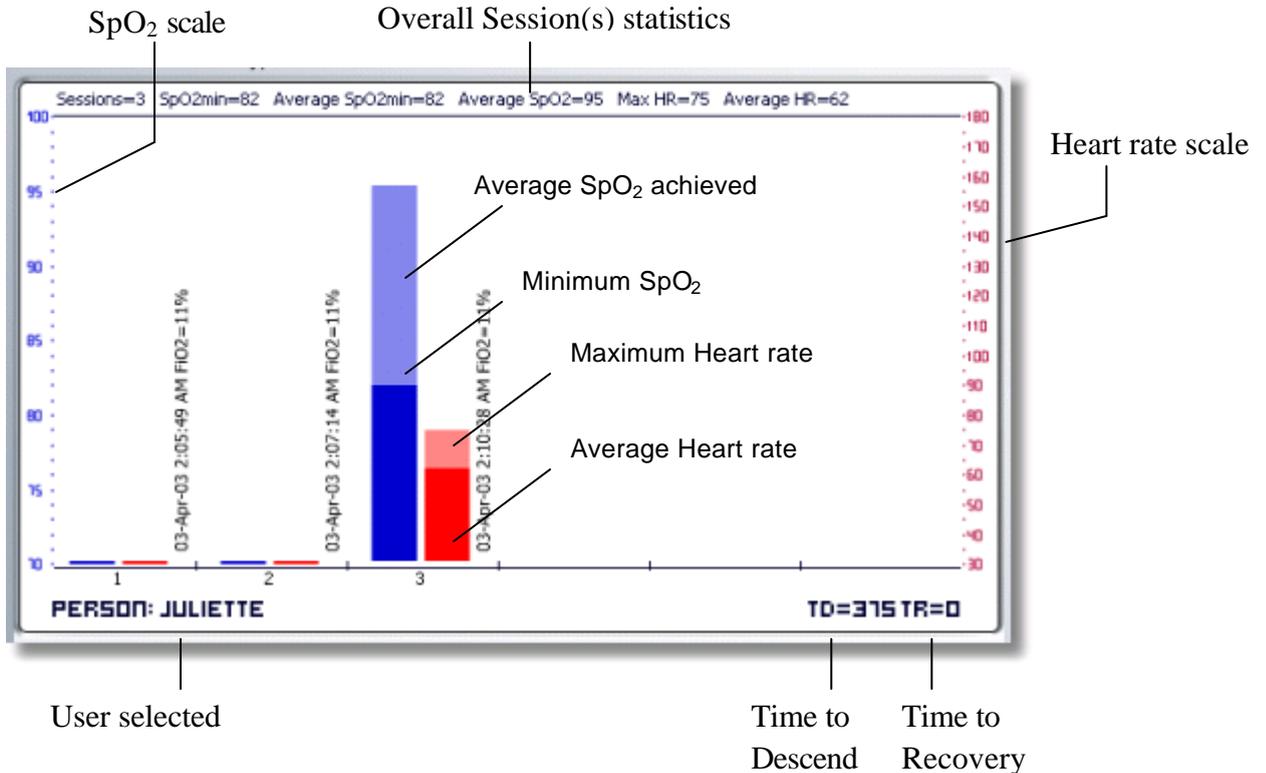
Control Buttons

The functions allocated in **Global Statistics** mode are fundamentally the same as those available in the **Session Statistics mode** (*see* **Control Buttons** in the section **Session Statistics** for the correct use of these buttons), with the exception of an additional checkbox:

The **full STAT**, or "Full Statistics", button is used to display all recorded sessions as a function of saturated blood oxygen levels and heart rate linearly:
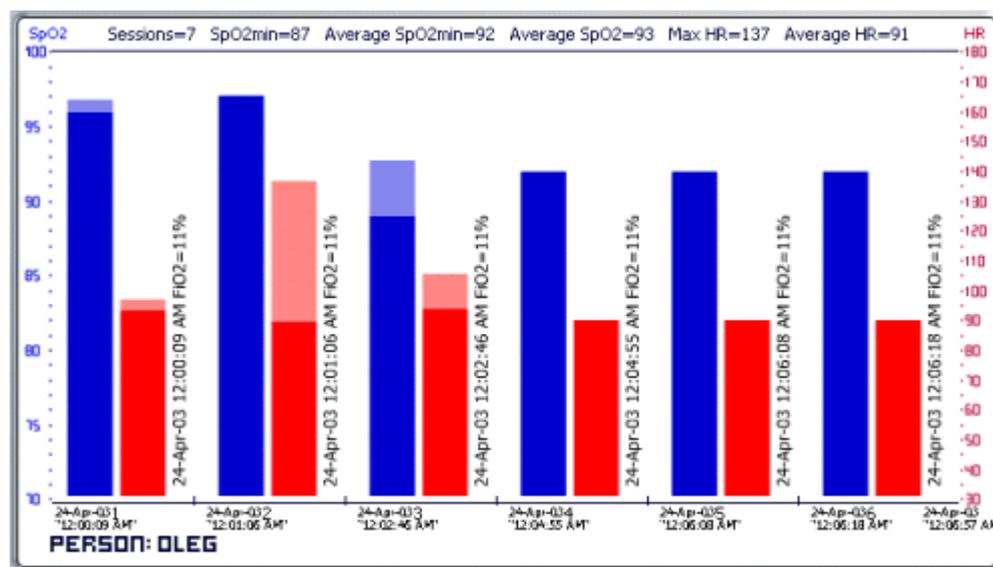
The user is also able to print, store, and export to MS Excel, all the data contained within this screen. From within MS Excel, the user may also manipulate the data to display other types of graphs, for example:

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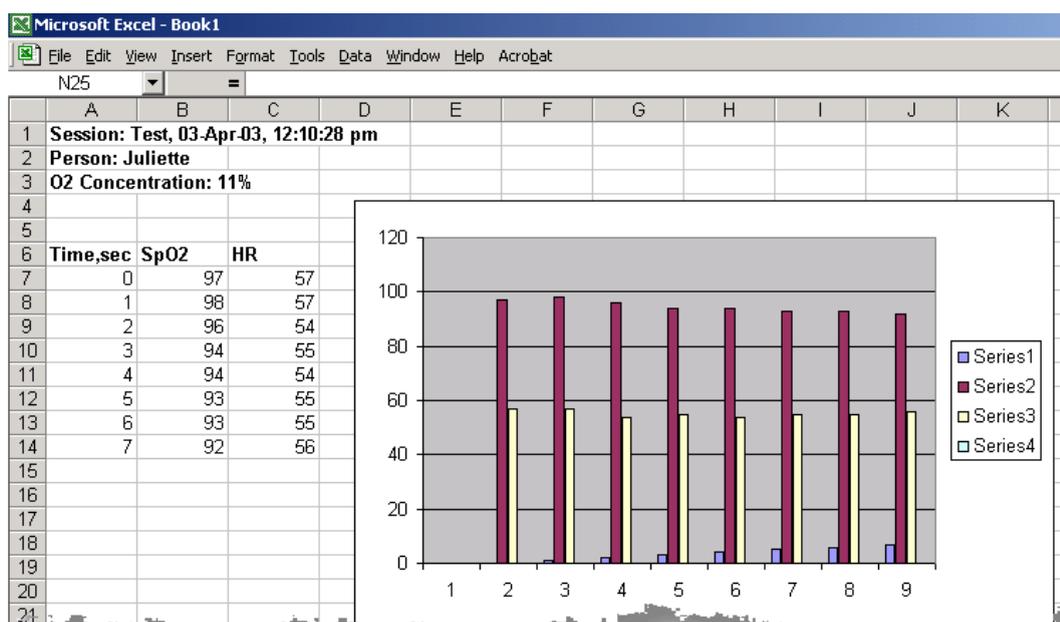
Course Statistics

COURSE STATISTICS

Within the GO2Altitude® History display screen, there is also the **Course Statistics** checkbox.

Located directly to the right of the Global and Session Statistics buttons, the Course Statistics checkbox, when selected, displays the statistical averages recorded over a range of hypoxic training sessions:
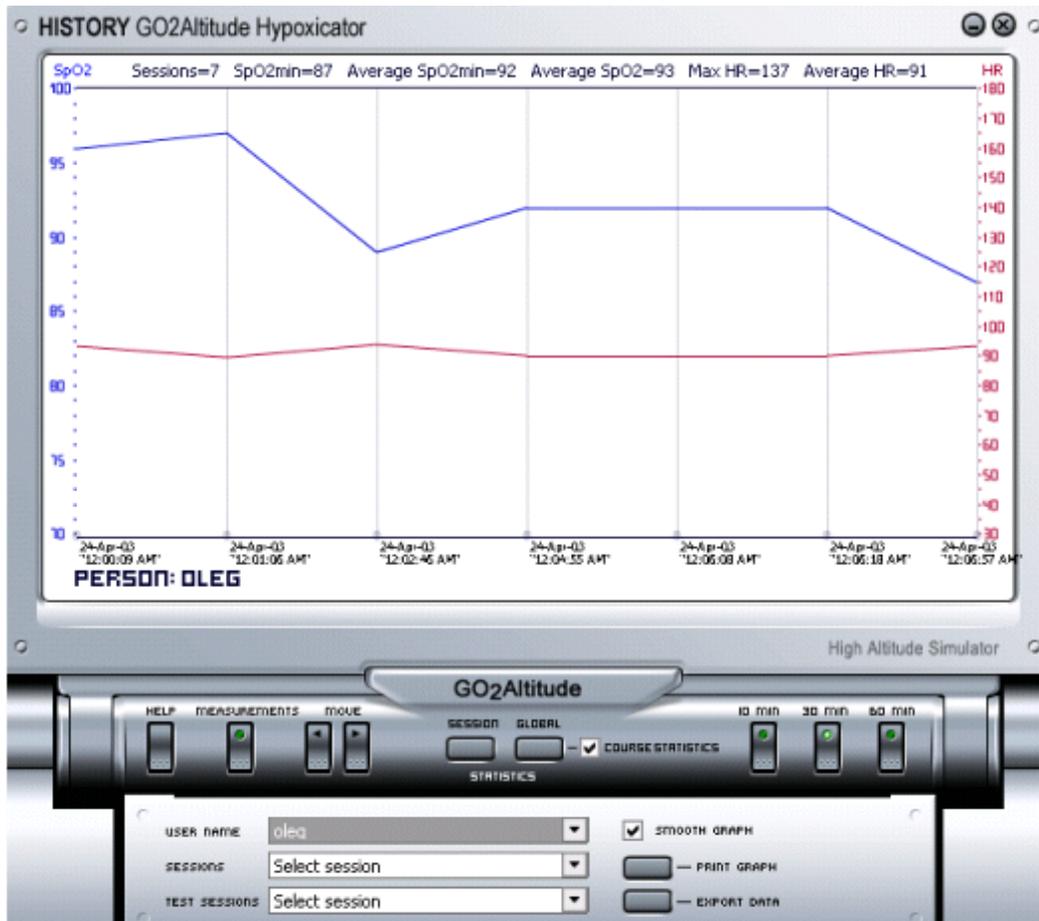
Each Hypoxic training session is displayed in a range scaled according to the number of sessions, with the date and time details shown on the lowermost part of the graph, and the SpO2 and Heart Rate parameter minimums and maximums displayed in the uppermost portion of the same window. Again, data may be exported to another program for table and/or graphical manipulation.

Operation of the GO2Altitude® Software

Preliminaries

After the installation of the software to the computer and the supplied serial cable is connected to both the GO2Altitude® Hypoxicator machine and the computer itself, the software is ready to use.

The COM port through which the Hypoxicator and the user's computer communicate, is set at default to "COM port 1". The user is prompted to change this, should that particular port be in use for other equipment, by opening the Communications menu and selecting a different port from the available drop-down list:

From here you may also select the "skin" for the display (see the section "Skin Display Options" for more information),

You may also import sessions from previous versions of the software for use by the GO2Altitude® History display (see the "History Screen Functions" section for more information.
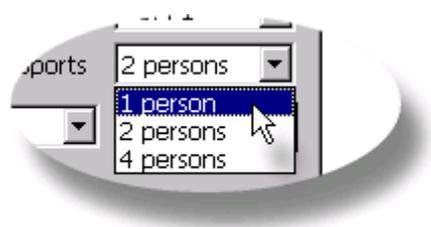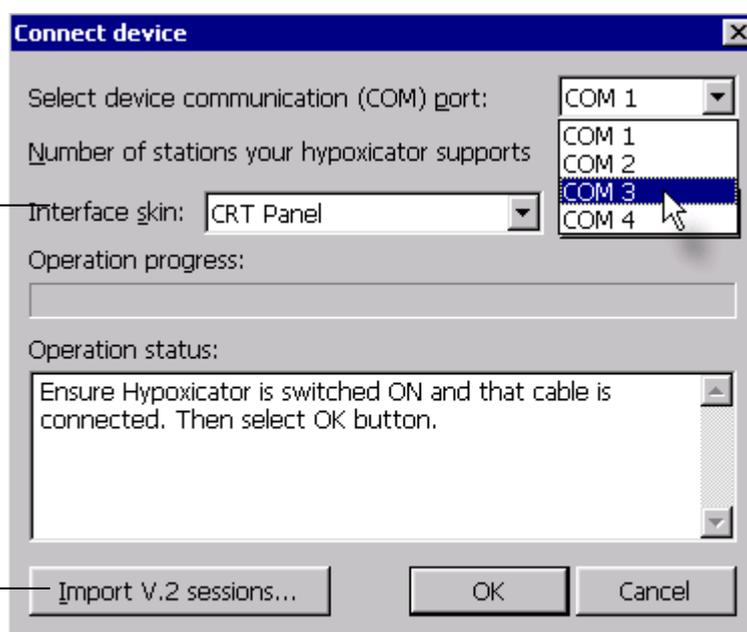
From the same window, the operator may also elect the model of the Hypoxicator used; whether it is a 1-, 2-, or 4-person system.

Recording a Session

To record a session, the following sequence should be followed:

1. Turn on the GO2Altitude® Hypoxicator and start the desired Training Program (*see* the full Operational Manual for further information).

2. Ensure that the Pulse Oximeter is securely clipped to the user's finger.

3. Set the same O_2 concentration in the software as that on the GO2Altitude® Hypoxicator.

4. Choose a user from the **Select User** drop-down box, or add a new user by clicking on the **Add User** button. **NOTE**
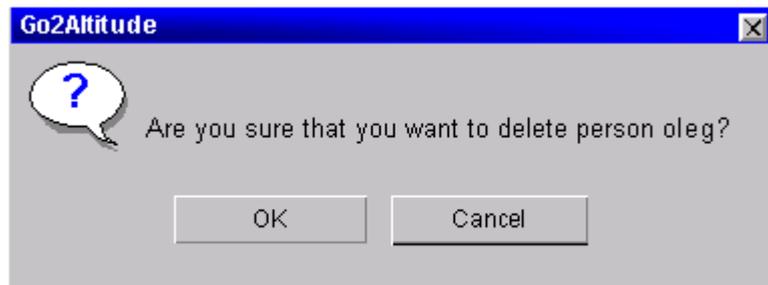
   To remove a user from the same list, select the user and click **Remove**.

5. Information should now begin to appear in both the Graphical Display Window, and the smaller Message Display Window.

6. The information in the Graphical Display Window will now steadily resolve into a graph at a rate determined by the incremental resolution applied to the screen. The line at the lowermost part of this window will display whether the user should be breathing hypoxic air (with mask), in red, or ambient air (without the mask), in green.

7. If the value of the user's arterial oxygen saturation level falls below the selected baseline, or if the heart rate rises above the baseline an alarm will sound and a warning display will be issued. For example:
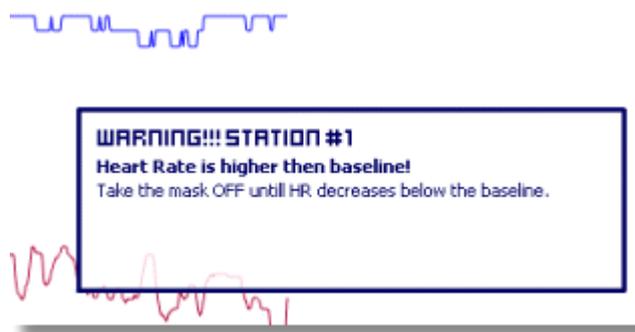
   Take note of the message displayed, and comply with the warning(s). The user *must* take the mask off and take 2 to 3 *regular* breathes, in and out.

8. To manipulate the graph, see the relevant sections elsewhere in this manual

NOTE Operation of the GO2Altitude® system may be found in much greater detail in the full Operations Manual accompanying the GO2Altitude® Hypoxicator equipment.

"Skin" Display Options

The GO2Altitude® Software System comes with two separate display options to suit individual user's tastes. Each of these options functions in exactly the same way in all respects, excepting that the display itself has different styles of buttons, display, and location of functions:
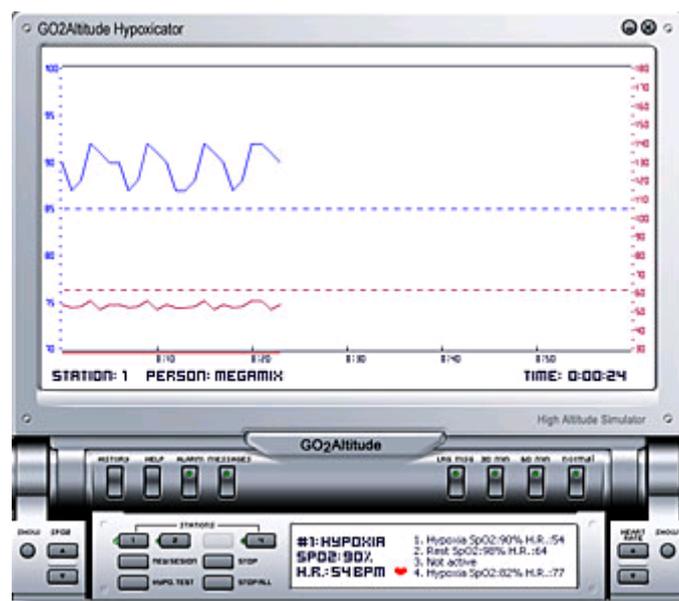
Standard CRT Display Screen

Optional Blue Display Screen

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The user is able to select the required skin from the drop-down option box displayed at the start of every session.

Glossary

Pulse Oximeter Pulse oximetry is a simple non-invasive method of monitoring the percentage of haemoglobin (Hb) in the blood that is saturated with oxygen. The pulse oximeter generally consists of a probe attached to the patient's finger or ear lobe that is linked to a computerised unit. The unit displays the percentage of Hb saturated with oxygen together with an audible signal for each pulse beat, a calculated heart rate and in some models, a graphical display of the blood flow past the probe. Audible alarms that may be programmed by the user can also be provided. A pulse oximeter detects hypoxia before the patient becomes clinically cyanosed.

A pulse oximeter works by generating a source of light at two wavelengths (650nm and 805nm). This light is partly absorbed by haemoglobin, by amounts that differ depending on oxygen saturation levels. By calculating the absorption at the two wavelengths, the processor can compute the proportion of haemoglobin oxygenated.

Hypoxicator A device designed to provide the user with reduced oxygen (hypoxic air) for breathing.

Hypoxic test The hypoxic test is used to assess a person's individual response to
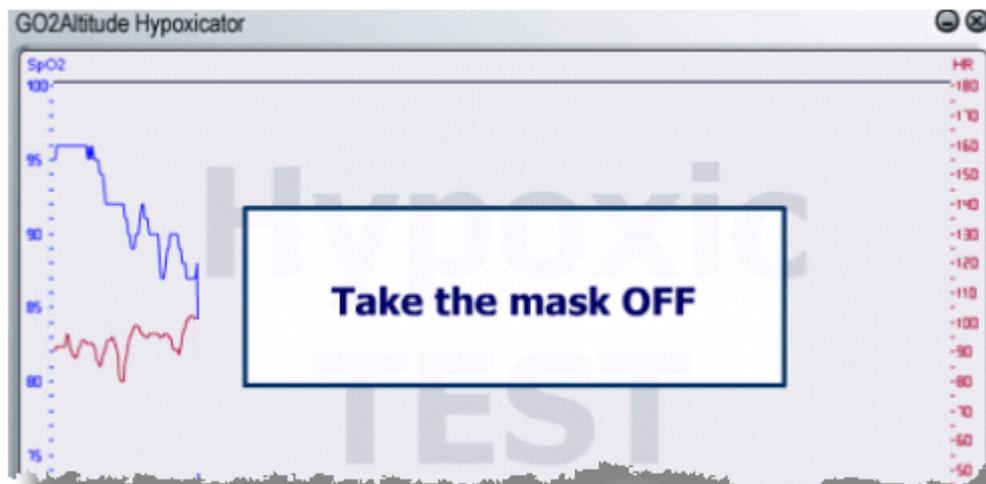
Hypoxic Hypoxia. That is, their response to breathing air with a reduced O_2 content.

During this test, the person under test is first required to breath hypoxic air of a known composition (recommended to be 11%) through a mask, whilst their individual physiological parameters – heart rate and SpO_2, specifically – are monitored. The

normal reaction to this test is a gradual decline in SpO_2; how much oxygen the blood carries.

The time taken to reach the baseline level set is known as the "time to descend" or "Td". Once the baseline level has been reached, the software prompts to remove the mask.

Upon removing the mask, the person under test will once again be breathing ambient air, and their SpO_2 level should start to return to a level of 95% (or more). The time taken to return to this "normal" level of SpO_2 is known as the "Time to recover" or "Tr".

Based upon the results observed, an IHT practitioner can determine an individual's sensitivity to hypoxic breathing, general level of fitness, and – in athletes and mountaineers – the level and effects of training.

SpO_2 The percentage level of haemoglobin saturated with oxygen in the user's system. This is an indication of the level of oxygen being carried by the bloodstream in a given Hypoxic training session.

Td Time to Descend. The time period taken for the user's SpO_2 levels decrease from their normal values of around 95% to 100% at sea level, below the pre-set value (normally set at 85%).

Tr Time to recovery. The time period elapsed from the point where the user reverts to breathing ambient air until their SpO_2 levels rise to 95%, or more.