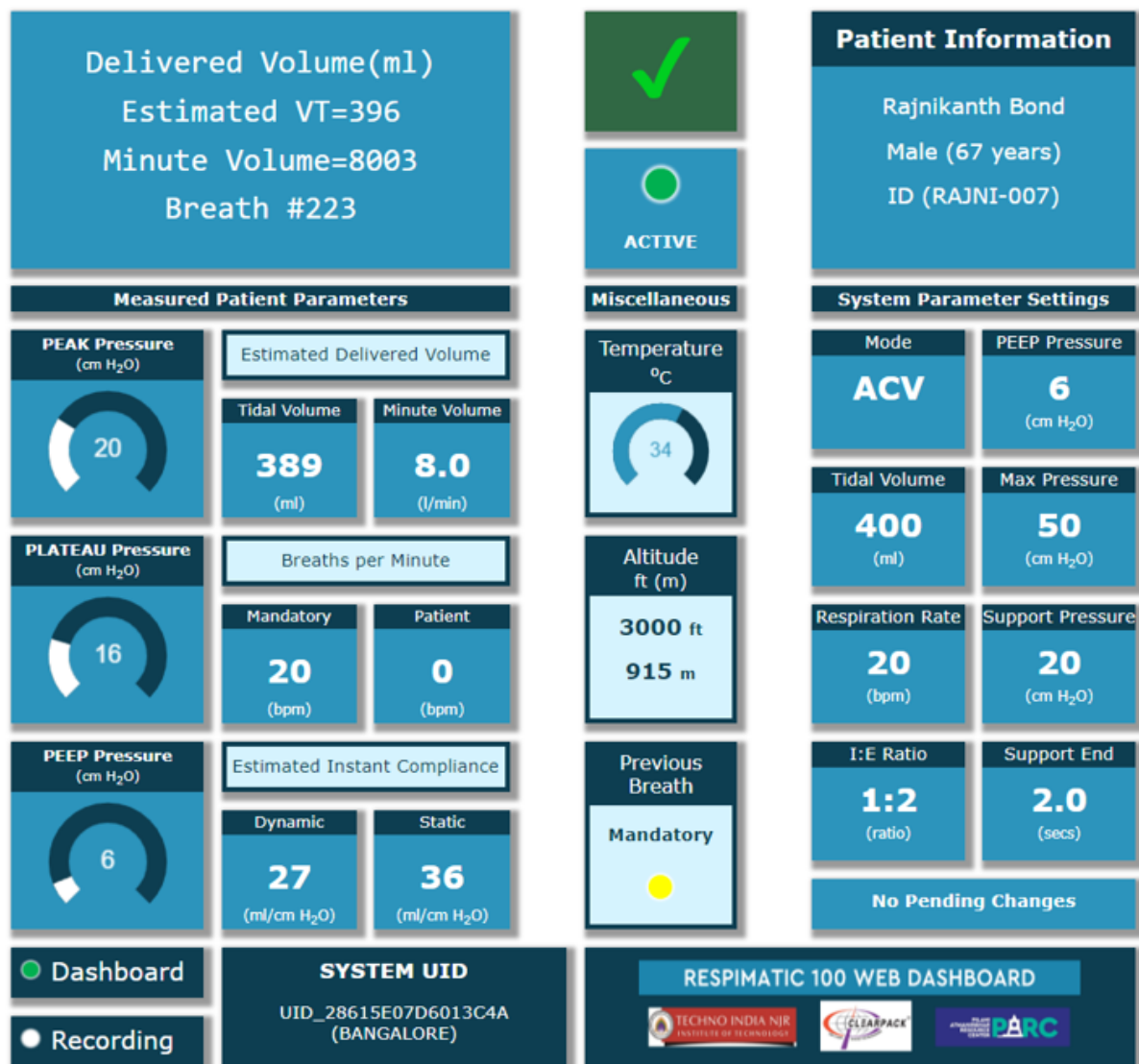


Respimatic 100



*An Affordable, Robust Emergency
Respiration Assist Device*

*Web Applications
Operating Manual*

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Introduction

In addition to the front panel, Respimatic 100 provides the ability to remotely monitor all respiration sessions via a WEB dashboard. Doctors and technicians can use the dashboard to connect to any Respimatic system using a unique system ID embedded in each system. This feature is useful to enable a remote specialist to observe the key system and patient parameters during a session and suggest a course of action for the local practitioners.

A brief overview of the process is as follows.

1. There must be a Wi-Fi network at the site where the Respimatic system is deployed. If required, use a 4G/5G dongle to establish a Wi-Fi network. One dongle can serve multiple systems at the same site at the same time.
2. There must be Wi-Fi or wired internet at the monitoring site.
3. Enable WEB dashboard monitoring on the Respimatic system.
4. Allow the Respimatic system to log on to the Wi-Fi network.
5. Visit the provided URL at the monitoring site.
6. Pair the WEB dashboard at the monitoring site with the Respimatic at the deployment site using the Respimatic System Unique ID.
7. WEB Dashboard allows monitoring only. It does not permit remote control of the system.

A blue rectangular screen with white text that reads: "Enable Remote WEB Dashboard via Wi-Fi (YES or NO) ?". The text is in a monospaced font, typical of a terminal or a simple display interface.

Figure 1: Enable/Disable Wi-Fi login

During the start-up sequence, the system gives an option to enable or disable remote monitoring for the system. Once enabled, the system guides the user to set up the remote WEB Apps.

Setting up Wi-Fi credentials

Respimatic system remembers the history of prior Wi-Fi networks that have been used by the system. The user is provided with an option to either auto-connect to a previously known Wi-Fi network or to configure a new one. If desired, the recorded Wi-Fi history can be erased at this time.

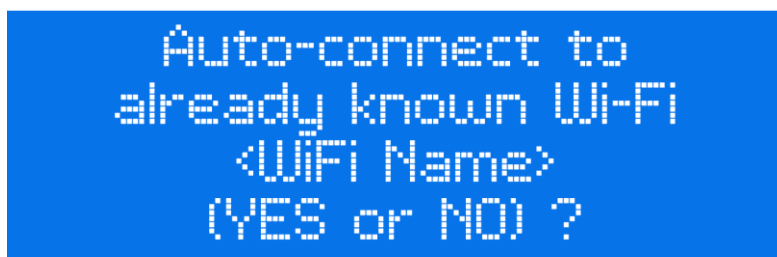


Figure 2: Wi-Fi Autoconnect

If Auto-connect is not enabled or if Auto-connect fails, the next option is to use a configuration portal to setup a new Wi-Fi network for the system to log in to. To enable login through a configuration portal, the system sets up a local, temporary Wi-Fi network named "Respimatic Wi-Fi". The user can choose to use either a wifi-enabled laptop or smartphone to log on to this network.



Figure 3: Connect to Respimatic W-Fi network

Upon login to this "Respimatic Wi-Fi" network, a portal screen is automatically presented on the laptop or the smartphone which guides the user step-by-step to enabling system to login to a desired Wi-Fi network. Choose from the list of available networks or manually enter the name of the network that the system should log in to. The portal time out in 2 minutes if unable to log on for whatever reason. If the system times out, the user can retry as many times as desired.

In case the portal does not automatically open, open a browser and navigate to 192.168.1.4 (URL) after connecting to the "Respimatic Wi-Fi" network.

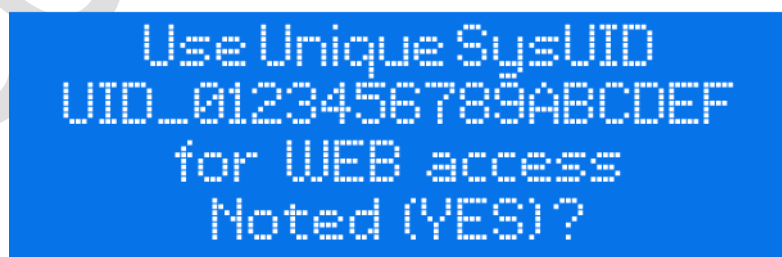


The image shows a dark blue login screen for the 'Respimatic 100' device. At the top, the title 'Respimatic 100 Wi-Fi Login' is displayed in white. Below the title is a horizontal separator line. The first input field is labeled 'Wi-Fi Name (SSID)' and contains the text 'My WiFi'. The second input field is labeled 'Wi-Fi Password' and contains the text 'My pwd'. Below the password field is another horizontal separator line. At the bottom of the screen is a blue rounded rectangular button with the word 'LOGIN' in white capital letters.

Figure 4: Wi-Fi Configuration Portal

If the Wi-Fi login was unsuccessful, the user can still continue without enabling a WEB dashboard.

Upon a successful Wi-Fi login, the system is now ready to be connected to the WEB Apps using the unique system id (SYSUID). The SYSUID is a 20 character string starting with the prefix "RSP_" followed by 16 hexadecimal digits.



The image shows a blue rectangular box with white text. The text reads: 'Use Unique SysUID', 'UID_0123456789ABCDEF', 'for WEB access', and 'Noted (YES)?'.

Figure 5: Wi-Fi Login Successful

Entering Patient Information

After a successful Wi-Fi login, the user is presented an opportunity to enter patient information for record-keeping. This information is later prominently displayed on the WEB Dashboard.

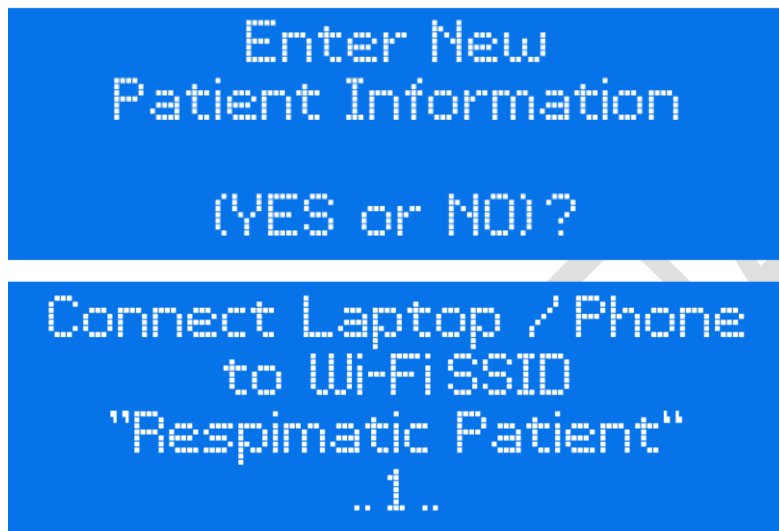


Figure 6: Connect to Respimatic Patient network

The image shows a dark blue mobile application form titled 'ENTER PATIENT DETAILS'. It contains three input sections: 'Patient name' with two text boxes containing 'Jane' and 'Doe'; 'AGE (Years) & Gender' with a numeric input box containing '68' and radio buttons for 'Male' and 'Female' (with 'Female' selected); and 'Patient ID TAG' with a text box containing 'JD-123'. A light blue 'SUBMIT' button is at the bottom. A large, faint 'CONFIDENTIAL' watermark is visible across the background.

Figure 7: Respimatic Patient Portal

To enter new patient information, the user must use a laptop or a smart phone to connect to a Wi-Fi network named "Respimatic Patient". Upon login to this network a patient information form is automatically presented. The "Patient ID" field is a placeholder for whatever format the facility uses to identify patients. Respimatic system treats it as a simple string.

In case the portal does not automatically open, open a browser and navigate to 192.168.1.4 (URL) after connecting to the "Respimatic Patient" network.

After form submission, the next browser screen presents an opportunity to confirm or edit again before the system saves the entered information as patient details. This patient information is available and used till the next time a new patient's details are entered.

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Launching the WEB Apps

<https://www.respimatic.com>

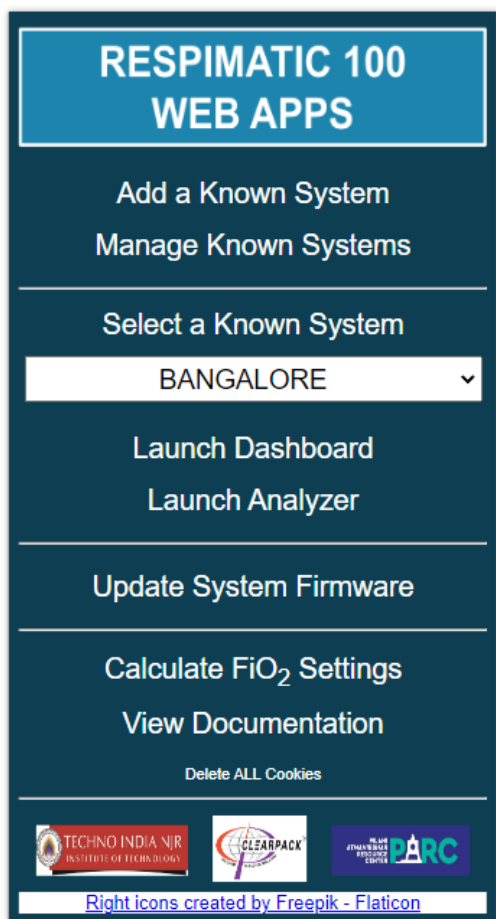


Figure 8: Web Apps Main Menu

| System Tag | System UID | FW Version | Actions |
|------------|----------------------|------------|-------------------------------------|
| BANGALORE | UID_28615E07D6013C4A | unknown | <input checked="" type="checkbox"/> |
| CAPL NOIDA | UID_28705904000000EE | unknown | <input checked="" type="checkbox"/> |
| UDAIPUR | UID_28B1A879A2010387 | unknown | <input checked="" type="checkbox"/> |

Figure 9: Respimatic Systems Table

IMPORTANT

Use CTRL key and +/- keys to zoom in/out
or hold down the CTRL key and use the mouse wheel to zoom in/out
till the content fits well in the browser screen.

The screenshot above on the left is the main menu while the screenshot on the right above is the Systems Table.

Each unique system id (SYSUID) of the Respimatic 100 systems can be associated with an easy to remember name tag. The browser remembers the history of all the SYSUIDs that have been used and presents them in the dropdown list in the main menu box above.

The table of name tags and associated SYSUID (Systems Table) is accessed through the "Manage Known Systems" button. The + menu button on the Systems Table adds a system. To select a system to communicate with either double click on the appropriate row or use the checkmark button against the row. A system can be removed from the table using the trash menu button in the appropriate row. The trash button on the top right removes all system information. The systems table can also be exported as a JSON xml file and can be imported from a JSON xml file by clicking the appropriate icons on the table banner. Finally, the back arrow menu button on the top left can be used to navigate back to the main menu.

The following WebApps are available via the links on the main menu.

- **Launch Dashboard** - Monitor a session remotely. It requires a SysUID to be selected to determine the Respimatic system to connect to.
- **Launch Analyzer** - Analyse a previously recorded session. It requires a SysUID to be selected to determine the Respimatic system to connect to.
- **Update System Firmware** – Download and install a new release of firmware for the Respimatic system.
- **Calculate FiO2 Settings** – Calculate required Oxygen inflow rate. It does not require a SysUID.
- **View Documentation** – All the pdf documents are accessible through this link. It does not require a SysUID. If a "PDF Viewer" extension is loaded in your browser the documents can be read online or else, they can be downloaded. Figure below is a screenshot of the documents web page.



Figure 10: Respimatic Documentation

WEB Dashboard

The live WEB dashboard, when connected, offers a choice of six different views. The user can switch between these views at any time. Figure below shows the sidebar for the dashboard.



Figure 11: Dashboard Menu

The box on the top shows some relevant summary data for the current session.

The next box allows for selecting the type of view to display. Available views are as below.

1. Snapshots view
2. Charts view
3. Statistics view
4. Alerts view
5. Breath Shapes View
6. Recording View

The next box allows for turning on/off session recording and dashboard updates. Pausing dashboard updates only stops the display from updating, fresh data continues to get collected and will get displayed once the 'Pause Dashboard' is turned OFF.

The box at the bottom displays all FiO₂ related settings. These settings are only for monitoring, the user must use the physical system's control panel to change these settings like all other settings.

The Figure below shows a Slider that can be used to select the range of breath numbers to display the required data for. The breath number range can be selected by grabbing the slider handles and sliding them to the required breath numbers. The range can then be committed using the checkmark button. Once committed the display is frozen to the selected range. The rolling button on the extreme left discards the selected range and enables a fresh display update on each new breath. The double arrow button selects the entire range and freezes the display to that.

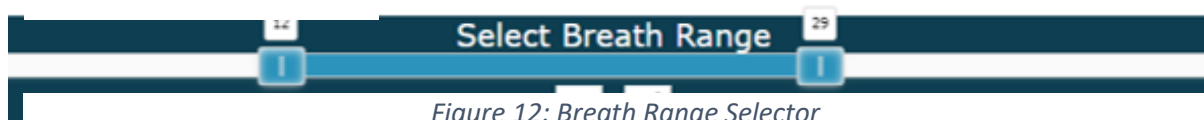


Figure 12: Breath Range Selector

Dashboard Snapshots View

Below is a screenshot of the WEB Dashboard "Snapshots View". All the Respiratic parameters, both input and output, are presented on the dashboard for easy viewing as a cohesive whole.

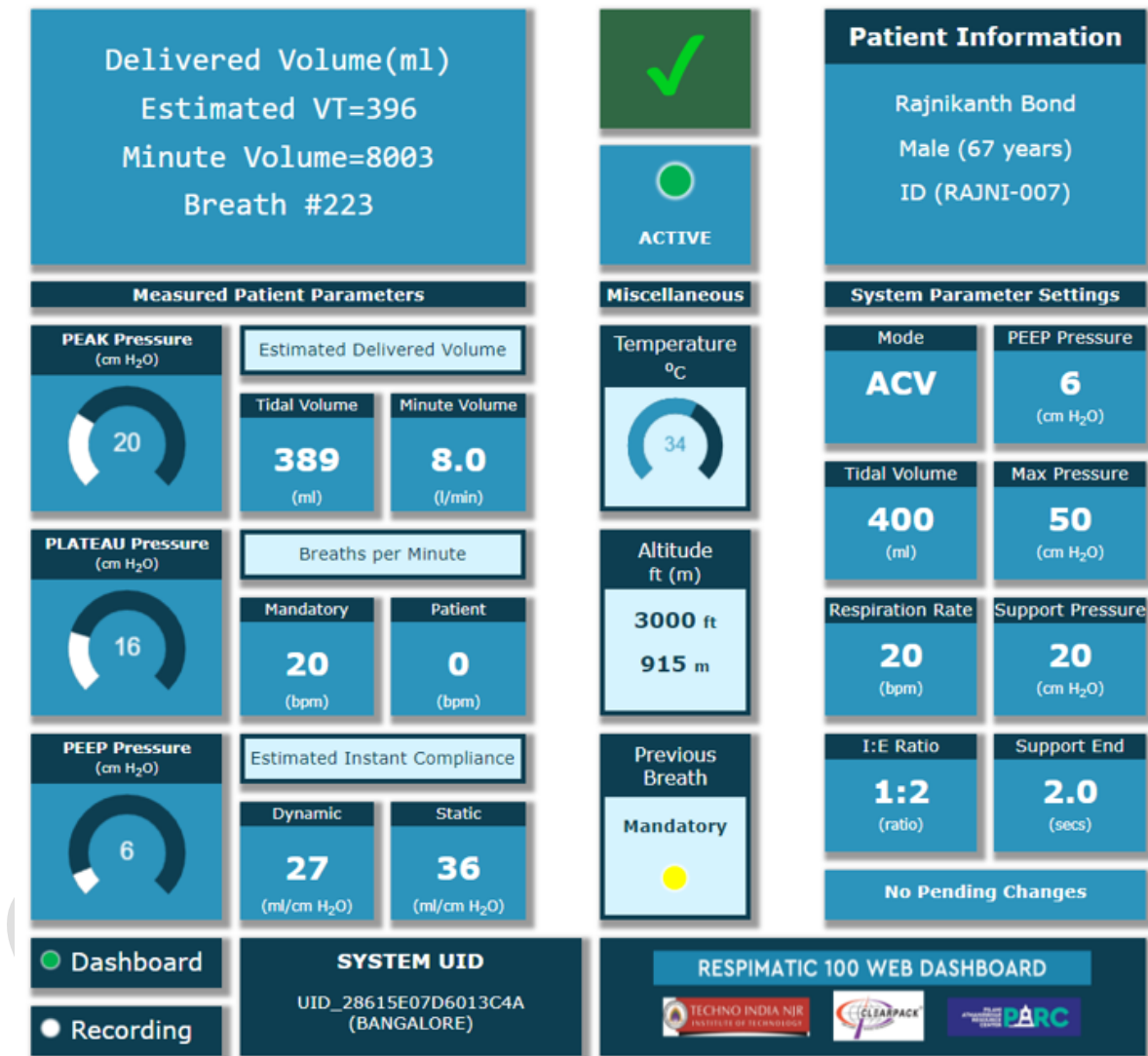


Figure 13: Dashboard Snapshots View

Note that for safety reasons, the Dashboard only allows monitoring of a remote system. The dashboard cannot be used to control the remote system. That must be done using the front panel of the physical Respimatic system.

Dashboard Charts View

The Dashboard also provides an option for a "Charts View". A screenshot of the charts view is shown below. This screenshot shows three chart boxes. A chart box can be added at any time using the + menu button on the top left of the chart box. Use the trash menu button on the top right to delete a chart box.

The parameters to chart can be selected using the checkboxes on the edit menu. The edit menu button is also on the top right of each chart box. The charts are updated after every breath. The X-axis can be selected as breath number or as elapsed time between breaths.

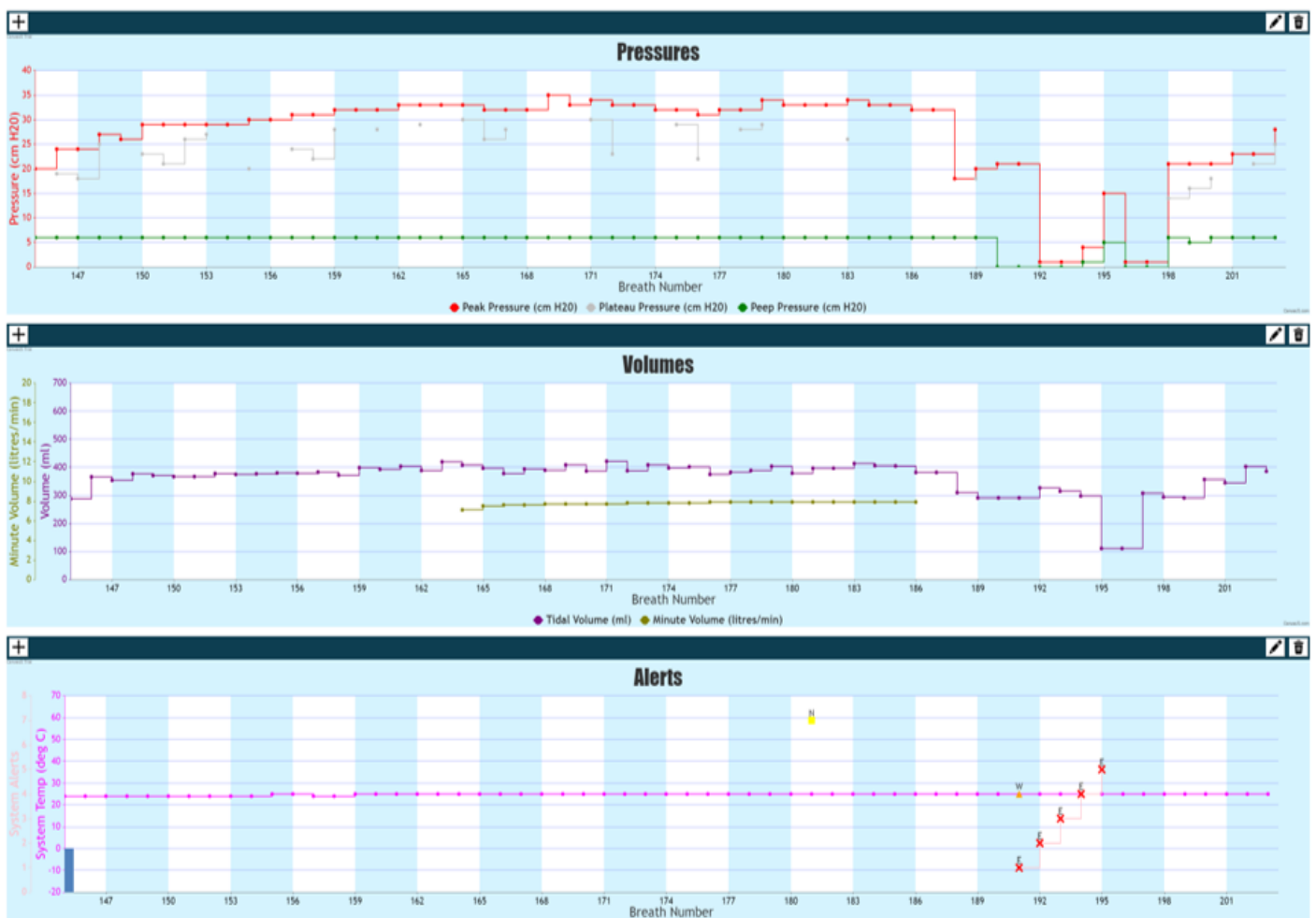


Figure 14: Dashboard Charts View

By default, the system charts the selected parameters for the past 60 breaths on a rolling basis, the charts are updated after each breath.

There is a Range Slider above the chart boxes to pan or zoom to any desired range of breath numbers. Use the handles on the Slider to select a particular range. If a particular

range is selected, further chart updates are disabled till the range is reset using the RESET button on the range slider, the new parameter values are still stored for later display. Upon RESET, the chart boxes return to their default display mode.

The chart box edit menu is shown below. Any collection of the shown parameters can be displayed in any chart box or in multiple chart boxes.

Title

Y-axis Parameters

- ☐ Pressures
 - ☐ Peak Pressure
 - ☐ Plateau Pressure
 - ☐ PEEP Pressure
- ☐ Volumes
 - ☐ Tidal Volume
 - ☐ Minute Volume
- ☐ Breaths Information
 - ☐ Mandatory BPM
 - ☐ Spontaneous BPM
 - ☐ Mandatory/Spontaneous/Error
- ☐ Instant Lung Compliances
 - ☐ Instant Dynamic Lung Compliance
 - ☐ Instant Static Lung Compliance
- ☐ Oxygen Related
 - ☐ FiO2
 - ☐ Incoming Oxygen Flow Required
 - ☐ Incoming Oxygen Purity
- ☐ Miscellaneous
 - ☐ System Errors
 - ☐ System Warnings
 - ☐ System Notifications
 - ☐ System Temperature

X-axis Units

☒ Breath Number ☐ Breath Times

Figure 15: Charts Edit Menu

Dashboard Statistics View

The Dashboard also provides an option for a "Statistics View". A screenshot of the statistics view is shown below.

The statistics are collected for the entire range updated after every breath by default. The range slider can be used to gather statistics for any range of breath numbers. The RESET menu button on the range slider causes the updates and display to go back to their default mode.

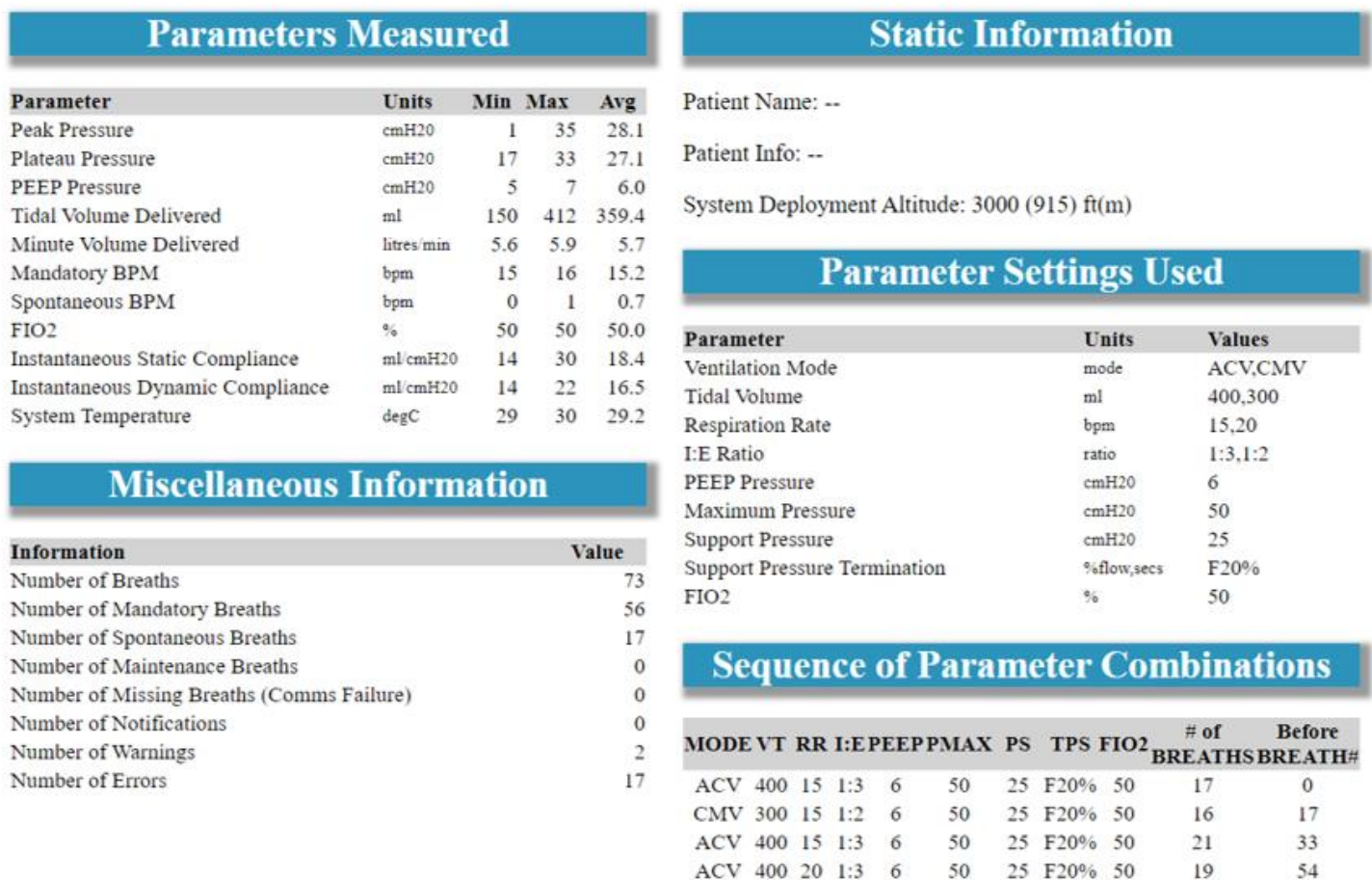


Figure 16: Dashboard Statistics View

Dashboard Alerts View

The Dashboard also provides an option for a "Alerts View". A screenshot of the alerts view is shown below.

By default, it displays the complete history of errors and warnings encountered in the current session. The range slider on top can be used to see the alerts for any range of breath numbers. The RESET menu button causes the updates to go back to their default mode.

| Session Errors | Session Warnings | Session Information |
|--|---|---|
| ERROR #1 DateTime: [09-12-2022]06:55:16 Leakage in Breathing Circuit Switching to Maintenance Breaths | WARNING #1 DateTime: [09-12-2022]06:43:16 PEEP delta measured up to -0.8 cm H2O Adjust valve/setting YES -> Commit | INFO #1 DateTime: [09-12-2022]06:45:23 1 Breath(s) missed Info not received by Dashboard due to Internet packet loss |
| ERROR #2 DateTime: [09-12-2022]06:55:21 [ERROR] state Press PAUSE to show the System state leading to ERROR | WARNING #2 DateTime: [09-12-2022]06:43:19 PEEP delta measured up to -1.0 cm H2O Adjust valve/setting YES -> Commit | INFO #2 DateTime: [09-12-2022]06:46:26 1 Breath(s) missed Info not received by Dashboard due to Internet packet loss |
| ERROR #3 DateTime: [09-12-2022]06:55:25 Leakage in Breathing Circuit Maintenance mode Deliver safe breaths | WARNING #3 DateTime: [09-12-2022]06:43:21 PEEP delta measured up to -0.9 cm H2O Adjust valve/setting YES -> Commit | INFO #3 DateTime: [09-12-2022]06:47:17 1 Breath(s) missed Info not received by Dashboard due to Internet packet loss |
| ERROR #4 DateTime: [09-12-2022]06:55:29 [ERROR] state | WARNING #4 DateTime: [09-12-2022]06:55:14 PEEP delta measured | INFO #4 DateTime: [09-12-2022]06:47:28 1 Breath(s) missed |

Figure 17: Dashboard Alerts View

Dashboard Waveforms View

The Dashboard also provides an option to view the detailed pressure and flow waveforms for selected breaths. Figure below shows a sample of such a view.

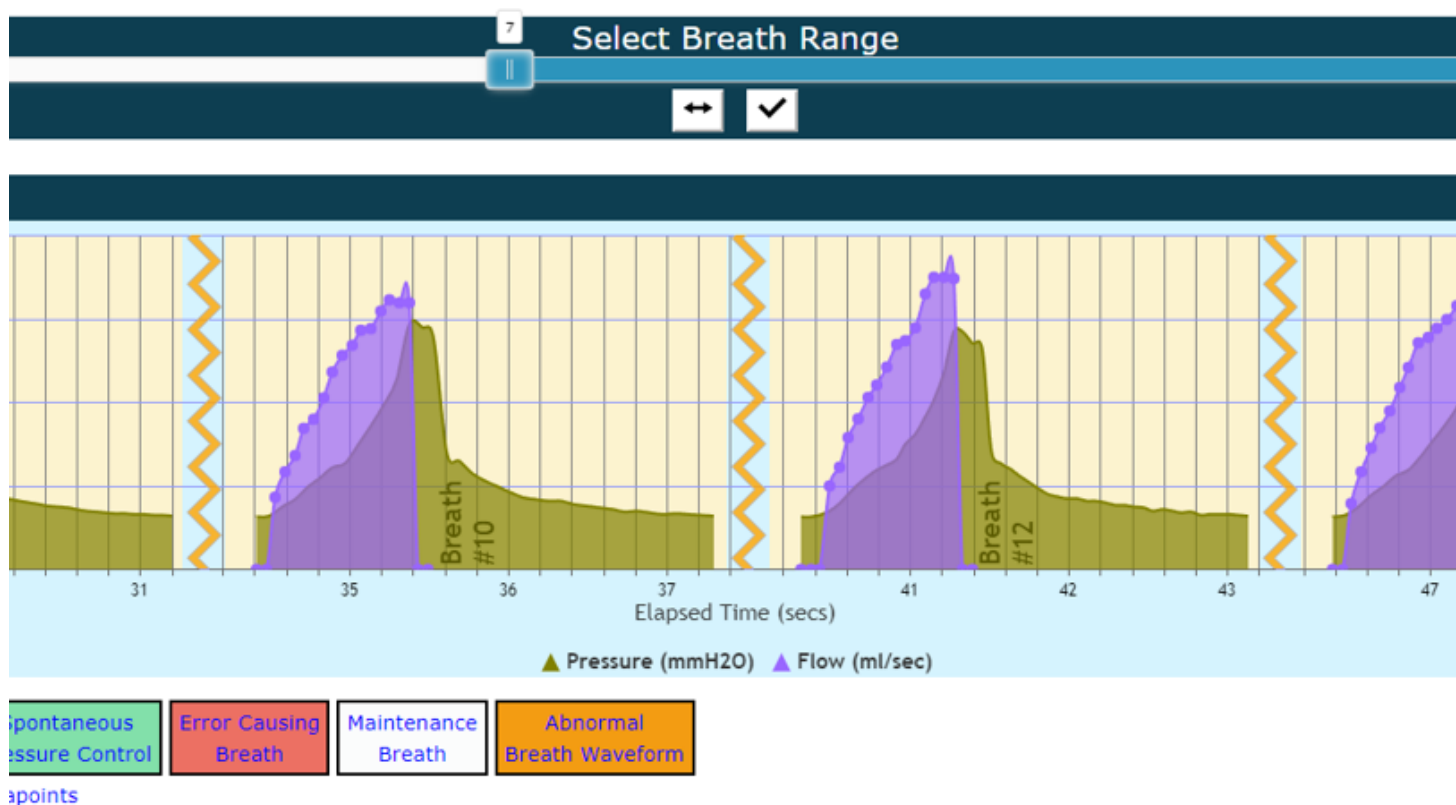
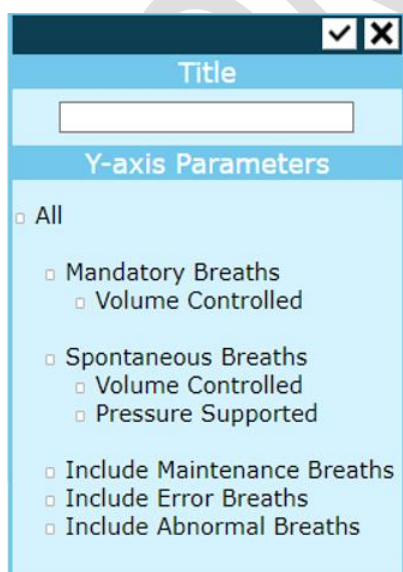


Figure 18: Breath Detailed Pressure and Flow Graphs



The EDIT icon on each box allows the selection of the kinds of breaths to display. The graphs are color coded as per the legend at the bottom of the page. The breath selection menu is shown in the Figure on the left.

Figure 19: Breath Type Menu

Dashboard Recording

The Dashboard also provides an option to record any part of the current session using the "Start Recording" menu button on the sidebar menu. The recording can be paused at any time causing that paused window to not be recorded. The Recording at the bottom left of the Snapshots view indicates whether the recording is currently active.

The recording is stored in a JSON database on the disk of the laptop or the desktop that the browser is running on. This recording can be analysed at any future time using the Analyzer WebApp. A screenshot of the recording view is shown below.

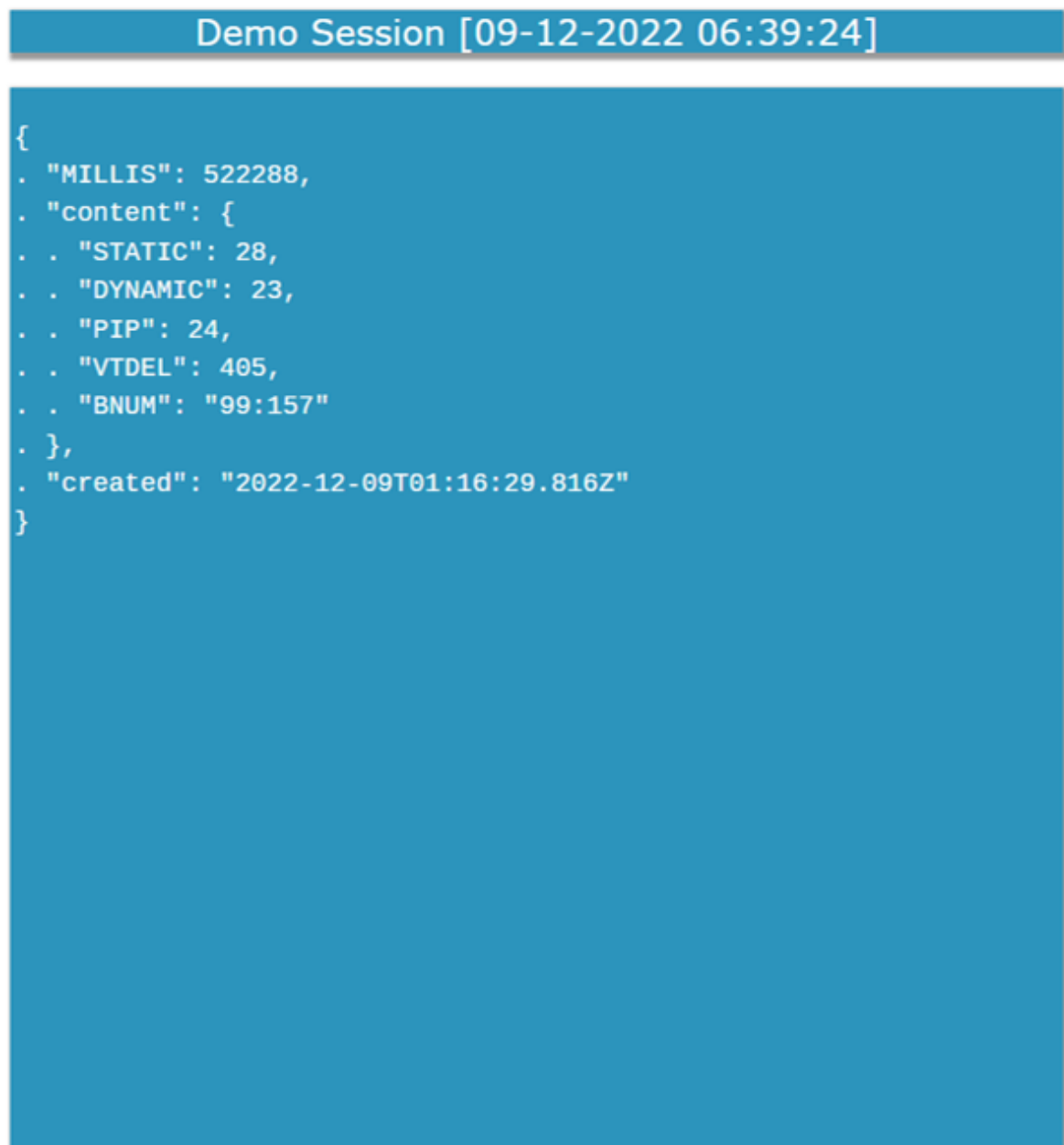
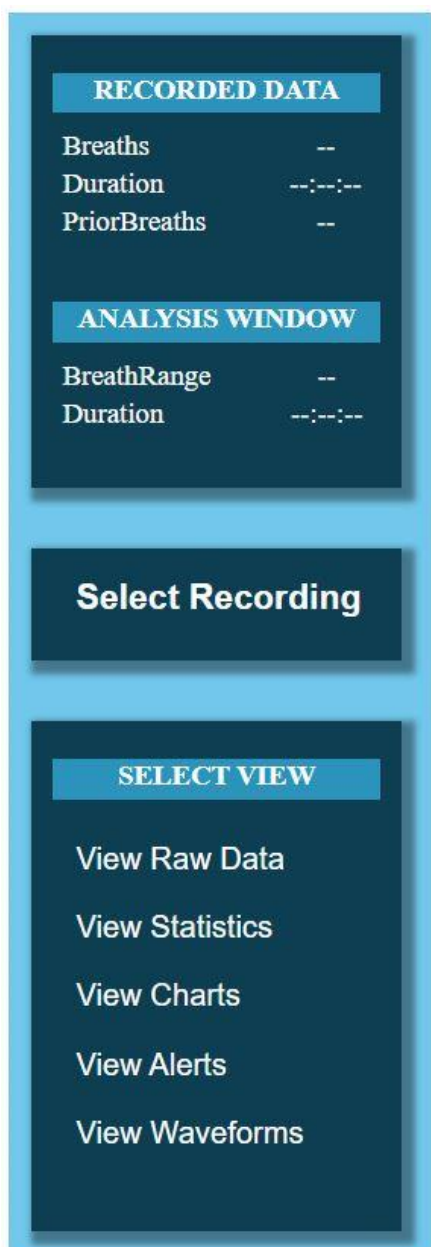


Figure 20: Dashboard Recording View

WEB Analyzer

The Analyzer enables the analysis of a previously recorded session with a patient. The process starts with selecting a session recording to analyse.



Analyzer Sidebar Menu

The main menu for the Analyzer is presented as a sidebar menu as shown in the Figure on the left.

The box on the top provides a summary of the currently selected recording for analysis.

Figure 21: Analyzer Sidebar Menu



Figure 23: Analyzer Breath Range Selector

the interval of interest. All Analysis actions use the currently selected analysis range. The range selector works in the same fashion as described earlier in the Dashboard section.

Analyzer Session Import Export

The EXPORT menu button on each row enables the user to export the database to a text file that can be sent to others for analysis. The + button on the top left allows the user to import a previously exported text file as a new session available for analysis. Below is a screenshot of the Import screen.

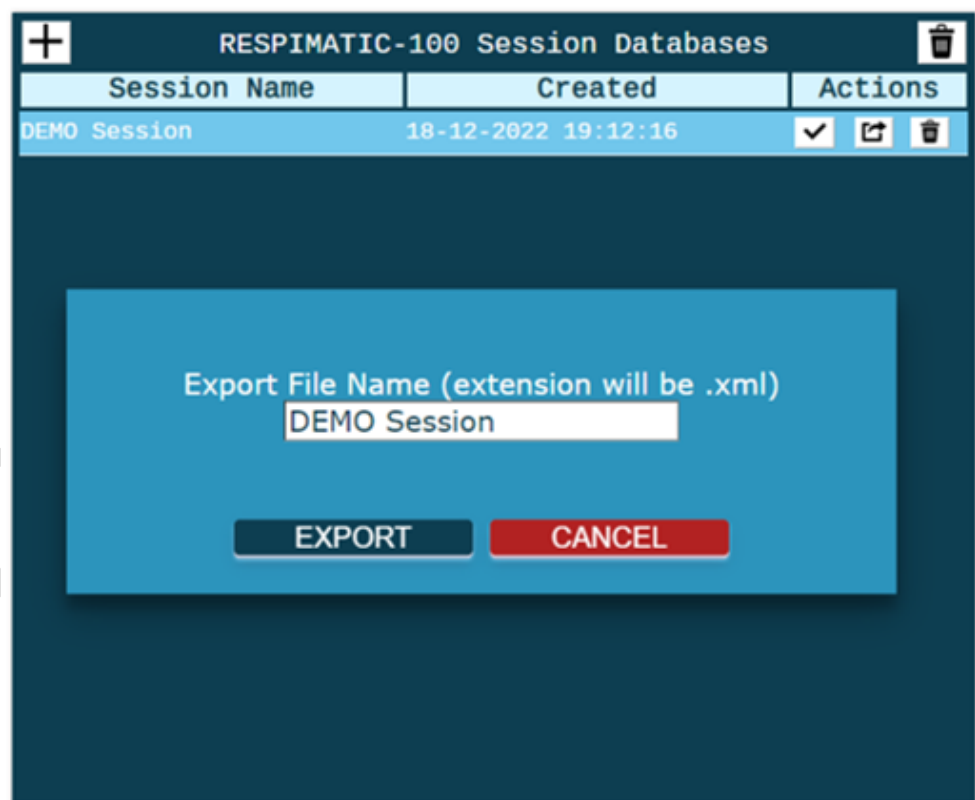


Figure 24: Analyzer Import View

Analyzer Charts, Statistics, Breath Waveforms and Alerts Views


Finally, the Charts, Statistics, Breath Shapes and Alerts views work in the same fashion as described in the Dashboard section above.

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Updating System Firmware

Occasionally the system may need to be upgraded in the field for new features or bugs. The new firmware releases are made available on the web for downloading and installing. The following menu interface is a part of the Web Applications to enable the end user to accomplish these upgrades.

For further details click on the Step-by-step Instructions on this application.



The screenshot displays the 'RESPIMATIC 100 Update Firmware' web application. It features a dark blue header with the title in white. Below the header, there are three main sections: 'Step-by-step Instructions', 'One-time Download Arduino Builder', and 'Select and Download Release'. The 'Select and Download Release' section contains a table with two columns: 'Version' and 'Release Date', and a 'Get' column. The table lists version 1.0.1 with a release date of 16-May-2023. At the bottom of the application, there are three logos: 'TECHNO INDIA NIR INSTITUTE OF TECHNOLOGY', 'CLEARPACK', and 'PARC'.


| Version | Release Date | Get |
|---------|--------------|---|
| 1.0.1 | 16-May-2023 |  |

Figure 25: Firmware Update Web Application

Below is a screenshot of step-by-step instructions.

Slide 1: How to Update Firmware Re...
Slide 2: Equipment needed
Slide 3: Firmware Update Overview
Slide 4: Download Arduino Builder
Slide 5: Download Arduino Builder S...
Slide 6
Slide 7
Slide 8: Install Arduino Builder
Slide 9: Install Arduino Builder Step 1
Slide 10: Install Arduino Builder Sta...
Slide 11: Install Arduino Builder Step 3
Slide 12: Install Arduino Builder Step 4
Slide 13: Install Arduino Builder Step 5
Slide 14: Download a Firmware Rele...
Slide 15: Download Firmware Releas...
Slide 16
Slide 17
Slide 18
Slide 19
Slide 20: Install Firmware Release
Slide 21: Install Firmware Release St...
Slide 22
Slide 23
Slide 24
Slide 25
Slide 26
Slide 27
Slide 28
Slide 29
Slide 30
Slide 31
Slide 32
Slide 33: DONE

HOW TO UPDATE FIRMWARE RESPIMATIC 100

STEP-BY-STEP PROCEDURE

EQUIPMENT NEEDED

| | | |
|--|---|--|
| USB Cable | Windows Laptop | Respimatic 100 |
|  |  |  |
| One end with micro-USB connector | | |

Figure 26: Step-by-step instructions on Updating Firmware

FiO₂ Calculator

FiO₂ is controlled externally by setting an appropriate Oxygen input flow rate from the external Oxygen source.

This stand-alone calculator enables calculating the required Oxygen flow rate given the following parameters.

- Deployment Altitude
- Desired FiO₂
- Purity of the Oxygen Source
- Tidal Volume
- Respiration Rate

Simply position the mouse over any gauge and turn the scroll wheel to change its value. Else, the required value can be typed in the center of each gauge.

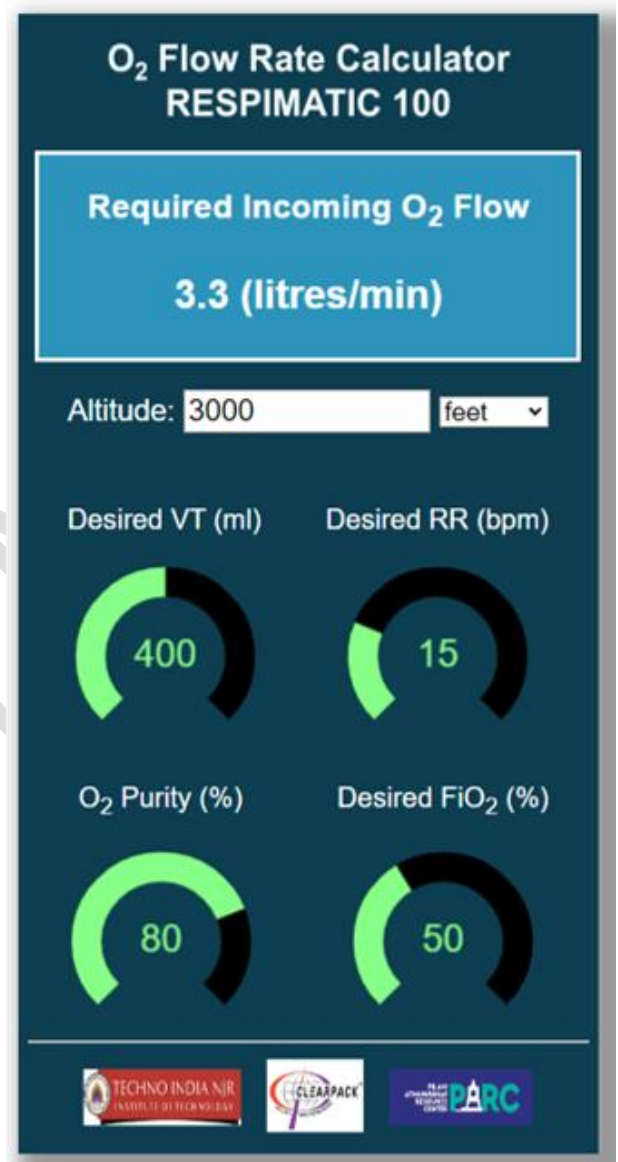


Figure 25: FiO₂ Calculator

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