SYSTEMS

SDR SensorDish® Reader

Instruction Manual

PreSens
PRECISION SENSING

SDR SensorDish® Reader

Specification:

24-channel reader for online monitoring of pH and oxygen in SensorDishes® and SensorVials

Software version:

SDR_v4.0.0

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1 Preface

You have chosen a new, innovative technology for measuring oxygen and pH.

The SDR SensorDish® Reader is an innovative system for measuring oxygen or pH in 24-well multidishes with integrated sensors (SensorDishes®). One device is capable of determining oxygen and pH, depending on the SensorDish® which is used: The OxoDish® contains an oxygen sensor at the bottom of each well, the HydroDish® a pH sensor. The SDR enables continuous monitoring of these parameters during cultivation of cells or bacteria in the incubator. It is an ideal tool for developing assays in the 24- or 6-well format as well as optimizing culture conditions. Respiration measurements using air-tight SensorVials are also possible. Up to 10 SDRs can be connected to one PC / notebook and monitored simultaneously using one software.

Optical oxygen and pH sensors (also called optrodes) have several important features:

- They are small.
- Their signal does not depend on the flow rate of the sample.
- They can be physically divided from the measuring system which allows a non-invasive measurement.
- They can be used in disposables.

Therefore, they are ideally suited for the examination of small sample volumes, for highly parallelized measurements in disposables, and for biotechnological applications. A set of different sensors, flow-through cells and non-invasive sensors is available to make sure you have the sensor which matches your application.

Please feel free to contact our service team to find the best solution for your application.

Your PreSens Team

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE WORKING WITH THIS DEVICE. WHEN DISREGARDING THESE INSTRUCTIONS THE SAFETY OF THE DEVICE CAN BE IMPAIRED.

2 Description of the SDR SensorDish® Reader

For operation, the SensorDish® Reader (SDR) must be connected to a PC / notebook with USB interface. The SDR is controlled by a user-friendly software which also stores and visualizes the measured data.
Up to 10 SDRs can be combined in parallel to a multi-device set-up. A splitter is connected to the first SDR via an RJ-45 cable (1.25 m), to the PC via an USB serial cable, and via the power adapter 24 V to a suited power supply (100 – 240 V). Subsequent SDRs are joined in series by RJ-45 cables (0.25m).

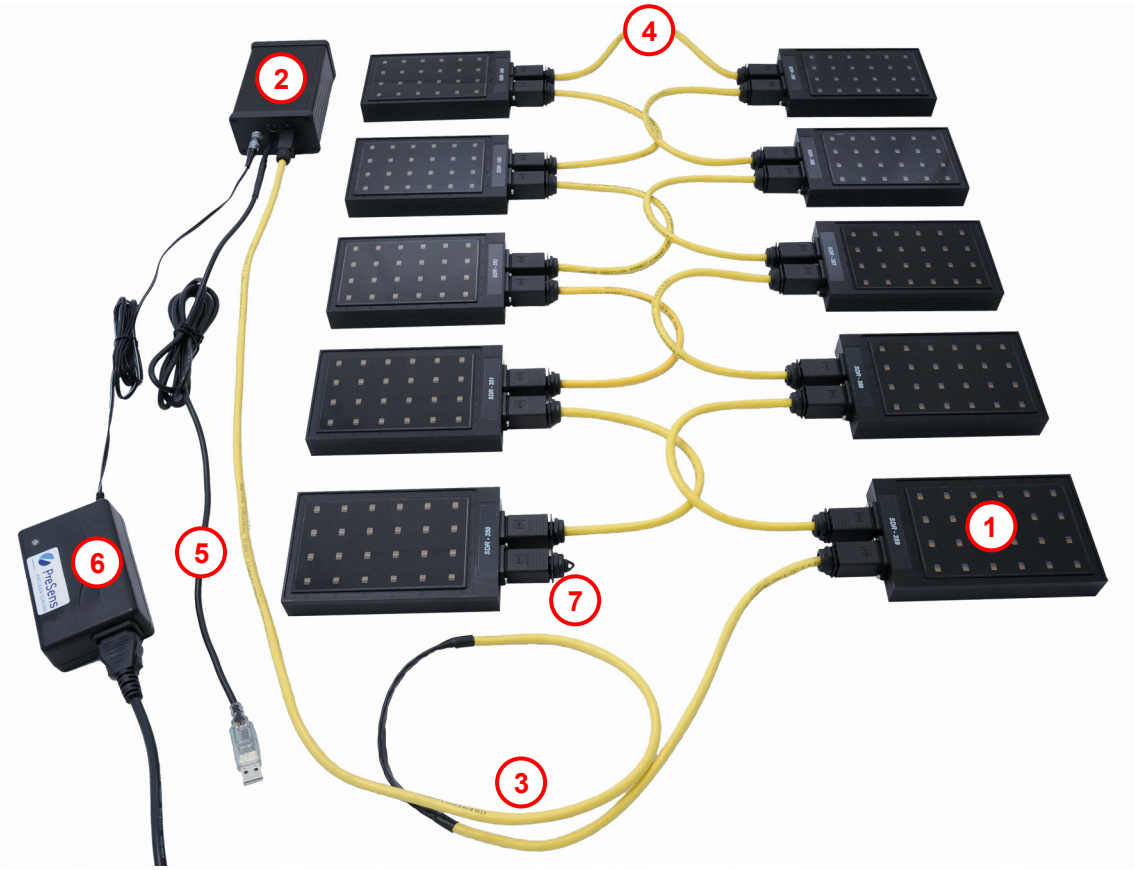

Fig. 1 Multi-device set-up: 10 SDRs combined in parallel
(numbered elements descriptions see table p.5)

No.	DESCRIPTION	FUNCTION
1	SDR SensorDish® Reader	The SDR is placed below the SensorDish® in the incubator or shaker.
2	Splitter (SP)	Connects the power supply and controls the SDRs. The splitter must NOT be run at high humidity. It has to be placed outside the incubator or shaker.
3	RJ-45 Connector cable SDR to SP	This cable connects the first SDR and the splitter; length 1.25 m. Its flat part can be clamped between the gaskets of the incubator door, if no cable outlet is available.
4	RJ-45 Connector cable SDR to SDR	These cables connect subsequent SDRs; length 0.25 m.
5	RJ 4-4 USB cable	Connects the splitter to a USB communication port of the PC / notebook.
6	Power supply	18 – 24 V DC power supply.
7	End cap	For closing the second connector of the last SDR in the row. Without this end cap, humidity will enter the SDR!

2.1 SensorDish® Reader

The SDR measures dissolved oxygen or pH of samples in an OxoDish®, HydroDish®, or SensorVial, respectively. It has 24 channels and two RJ-45 plugs for data transfer and power supply. These plugs connect the first SDR to the splitter and subsequent SDRs. Both plugs can be used equally. The cable is contained in the scope of delivery.

! Do not use other cables than the ones supplied.

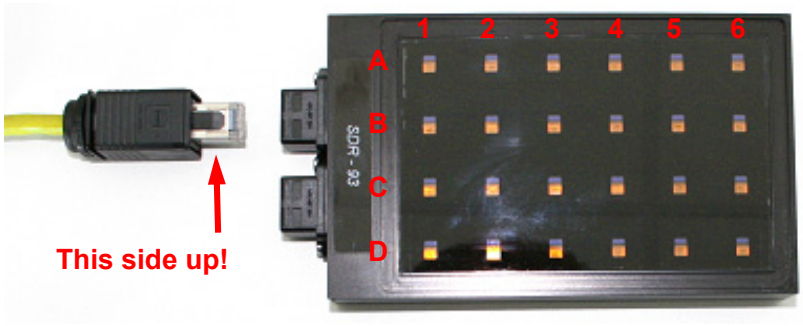

Fig. 2 Top view of the SDR. The well numeration A1 to D6 is engraved in the groove.

The SensorDish® can easily be placed in the right position due to a groove in the housing of the SDR (see Fig. 3).

! Please make sure that the SensorDish® rests in the groove properly, otherwise the measurement signal will not be sufficient, which results in a low resolution or even the message “NO SENSOR”.

! Make sure to put the SensorDish® aligned correctly onto the SDR (well numeration) to be able to associate the software values with your samples.

! For easy positioning of the SensorVials, please use the empty 24-well plate (for SensorVial orders).

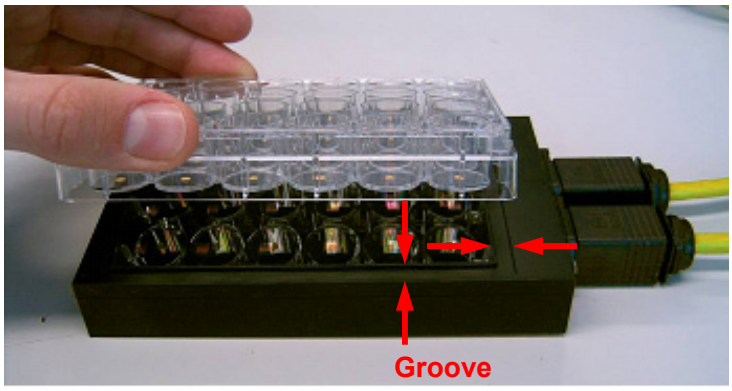

Fig. 3 Placing a SensorDish® on the SDR.

If you do not perform measurements inside an incubator, we recommend covering the SDR. Too much ambient light (> 300 LUX) will cause accelerated sensor bleaching and change the calibration data. The cover shown in Fig. 4 is not included in the scope of supply, but can be ordered separately (please contact our service team); other self-made or customized covers are also suitable.

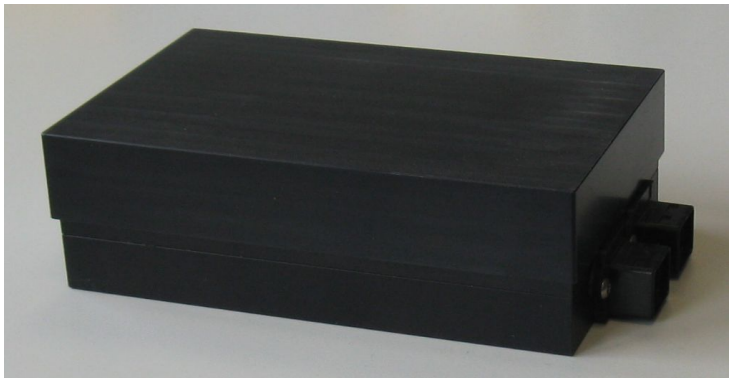

Fig. 4 Cover placed over the SensorDish® on the SDR

2.2 Splitter

There are three ports on the splitter´s front panel: For power supply (PWR), USB connection (PC) and the connection to the first SDR, as well as four status LEDs. The LED for power supply constantly glows if the splitter is connected to power. The LEDs for connection to the PC are illuminated during data transfer from the SDR to the PC or vice versa (left LED: transfer from PC to SDR; right LED: transfer from SDR to PC). The LED regarding the connection to the SDR only glows during software connection and when measurement points are taken. During waiting intervals, it is turned off.

Fig. 5 Front panel of the Splitter Control LEDs
(numbered elements descriptions see table p. 7)

No.	DESCRIPTION	FUNCTION
1	Line adapter for power supply	Connector for 18 – 24 V power supply.
2	USB interface (RJ 4-4)	Connects the device with the USB cable to your PC / notebook.
3	Device connector (RJ-45)	Connects the splitter with the first SDR via RJ-45.
4	Control LEDs	Show connection or data transfer. The LEDs are turned on or pulse green in case of an active line. LED functions: PWR – line power indicator PC – indicates communication in progress SDR – network / SDR power indicator

2.3 Scope of Delivery

Basic Set:

- SDR v3 or higher
- Splitter v1.1 or higher
- RJ-45 cable 1.25 m
- USB serial cable including driver (for XP and Vista)
- End cap
- Power adapter (output 18 – 24 V DC and min. 40 W)
- Software SDR_v4.0.0

Extension Set (addition of 1 SDR to the Basic Set; parallel connection of up to 10 SDRs possible):

- SDR v3 or higher
- RJ-45 cable 0.25 m

Additionally required equipment:

- PC / Notebook
  System requirements:
  Win XP, Vista, Win 7, Win 10; minimum 1.5 GHz, 512 MB RAM;
  monitor resolution 1024 x 1280 or better (for an overview of all 24 channels on one screen; otherwise scrolling is possible)
- Sensors
  HydroDish® (for pH measurement)
  OxoDish® (for oxygen measurement)
  SensorVials SV-PSt5 (for oxygen measurement in closed glass vessels)
  Sensor spots SP-PSt5 (for oxygen measurement in customized glass vessels)

! Please note: Measurement data acquired with a previous SDR software version (before version 4.0.0) cannot be opened in this software version, as it is not compatible. Make sure to mark or rename your old measurement data so it does not get mixed up with the new data. Open the measurements with the software version they were created with.

! Please use either English (US) or German regional settings. A measurement can only be opened with the same regional settings as were used for measurement.

! Please switch off any energy saving applications such as screen saver, monitor shutdown, hard disk shut down, standby mode or idle state.

! If you use a laptop, please disable switching to the standby mode at shutting the laptop.

! It is recommended to close all other applications on your PC / notebook (including internet). Especially programs using visual basic components might interfere with the SDR software. If you are connected to the internet, please disable automatic upload of Windows updates, as automatic restart of the PC will close down the SDR software. Please download your calibration files (and in case of using Windows 7, or 10 automatic download of the USB serial driver) and terminate the internet connection prior to starting the SDR software.

3 Installation

3.1 Set-Up Inside an Incubator / Shaker

The SDR can be placed inside an incubator or shaker, but the splitter has to be placed outside.

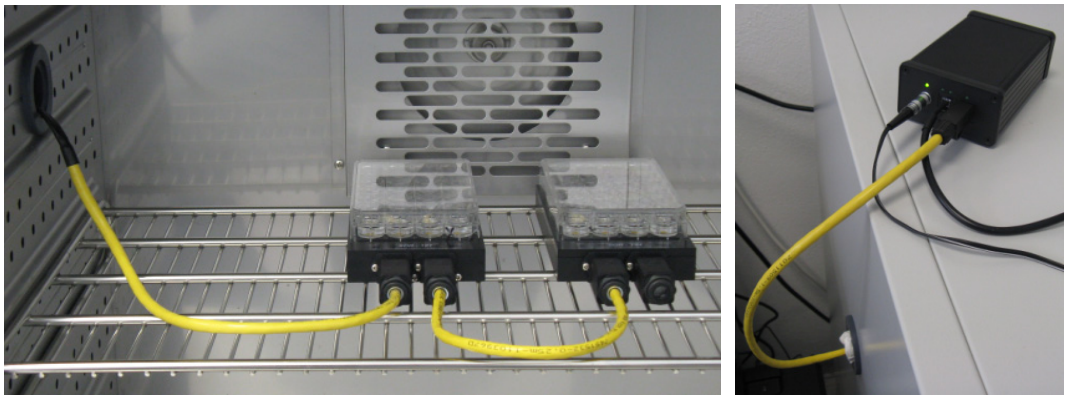

Fig. 6 left: SDRs inside the incubator; right: splitter placed outside the incubator

If your incubator / shaker has an opening, the splitter outside the incubator can be connected to the SDR by running the connection cable through this opening.

! Please make sure to seal up the rest of the opening as good as possible to avoid leakage of CO_2, humidity and heat.

Fig. 7 Connection cable in incubator opening; the opening is sealed.

If there is no opening in your incubator the cable can be led through the incubator door. The flat, black part of the cable has to be located at the door´s sealing to ensure that the door closes properly.

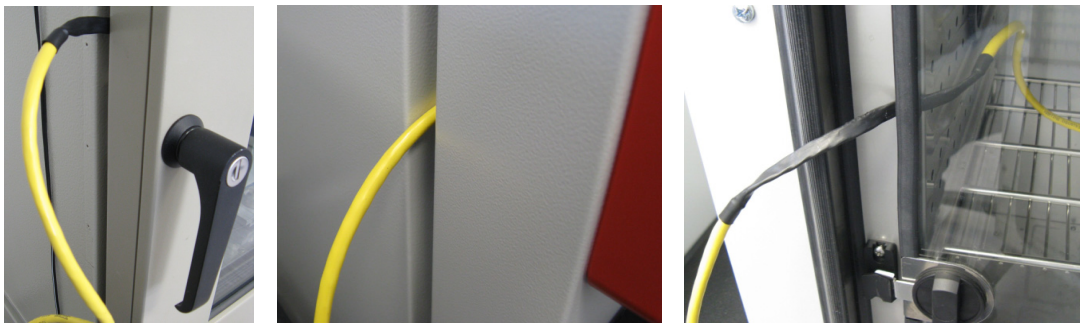

Fig. 8 left: connection cable led through shaker door; middle: connection cable led through incubator door; right: connection cable led with the flat part through inner glass door of the incubator; the outer door closes on the flat part as well.

Extension sets can be connected via the short RJ-45 cables (see Fig.1).

! The last connector has to be closed with the end cap. Otherwise, humidity from the incubator atmosphere will enter the SDR rapidly and may damage the device.

Fig. 9 SDR with attached end cap

The SDR can be used inside a shaker at low shaking speed (about 100 rpm at 50 mm shaking diameter) without any additional equipment; just place it on the shaker tray. With higher shaking speeds the SDR has to be attached to the shaker tray and the plate with your samples fixed to the SDR.

We recommend using the MicroFlask Clamp System offered by Applikon® Biotechnology to fix the SDR inside the shaker. Please refer to the Applikon Biotechnology website to find a distributor near you and mention that the system is going to be used with the SDR, as they offer a specially modified system for the SensorDish® Reader.

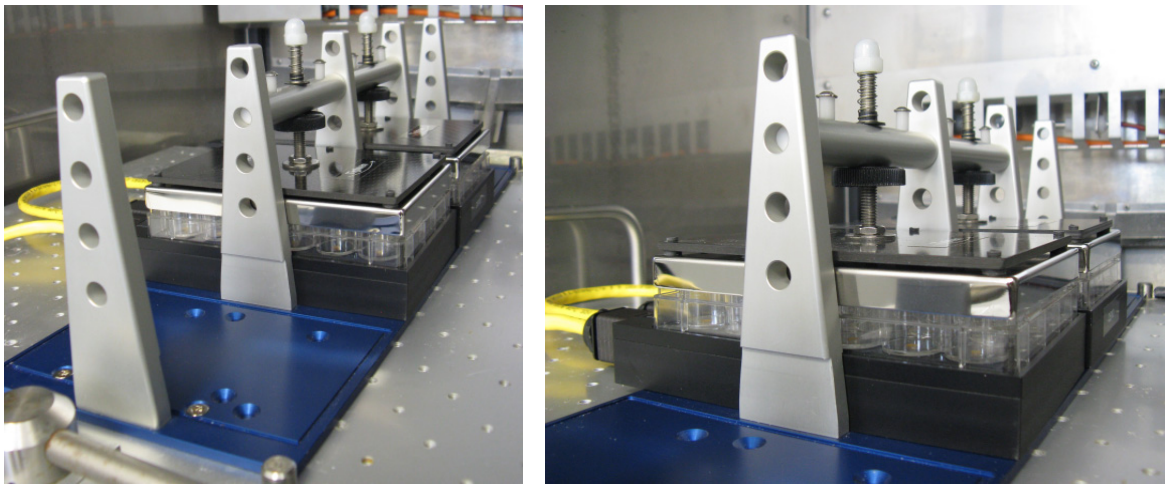

Fig. 10 SDRs inside the MicroFlask Clamp System installed in a shaker

Fitting covers (sandwich covers) are available with this system to ensure even evaporation and oxygen ingress (else edge effects might occur in the outer wells while shaking).

Fig. 11 Separate cover layers available for 24- and 6-well plates as well as deepwell plates

! The small rubber feet attached to the SDR bottom have to be removed so the device can be mounted in the clamp of the MicroFlask Clamp System.

! Please make sure the connection cable is not bent too much or hitting the shaker walls while shaking, because this might lead to connection errors or even damage the cable. Please contact our service team should you encounter errors in measurements of shaken samples.

3.2 Software Installation

! Please note: Measurement data acquired with a previous SDR software version (before version 4.0.0) cannot be opened in this software version, as it is not compatible. Make sure to mark or rename your old measurement data so it does not get mixed up with the new data. Open the measurements with the software version they were created with.

The software is working with English (US) or German regional settings. Please change to one of these settings before installing the software (see chapter 4).

1. Please close all other applications as they may interfere with the software.
2. Insert the supplied CD-ROM into the respective drive. You can also download the software from our homepage (http://www.presens.de/support/download-center/software.html) and extract the zip file to your PC.
3. If no dialog opens automatically using the CD, use the Windows Explorer to open the file menu. Run the file Setup-SDR_v4.0.0.exe and follow the onscreen instructions.

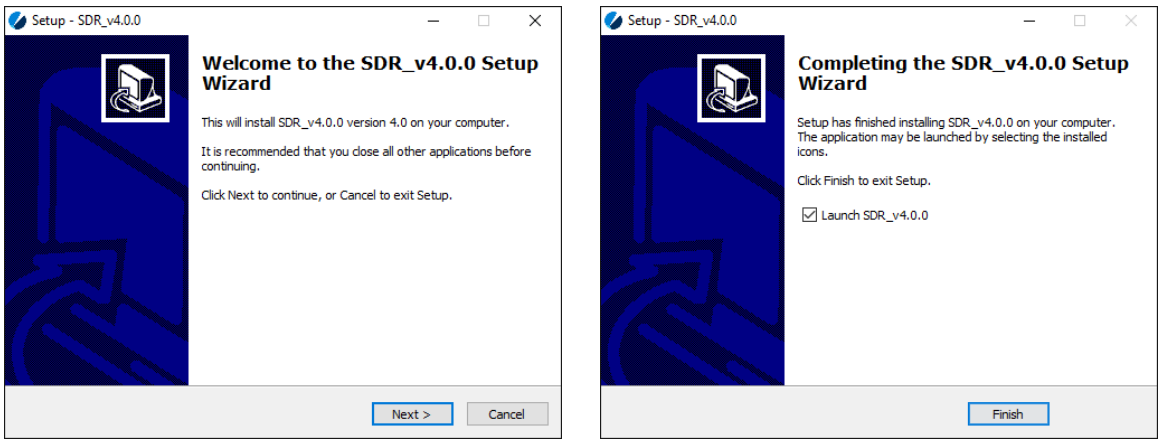

Fig. 12 First and last screen for installation of the SDR software

! When working with Windows 7 or higher please do not install the software to C:\ or C:\Program Files, as this will lock some of the files and they are not visible in the Windows Explorer anymore. This can cause problems later on when trying to open measurement data. Use the default path C:\PreSens that is automatically suggested or create a folder with another name.

Now the software is properly installed and you will find a shortcut on your desktop.
The software offers two levels:

- User level with a reduced amount of functions and
- Administrator level for full functionality and control

Fig. 13 SDR software Login window

The default **Username** and **Password** for the administrator is **admin**. The administrator can change his password but not his user name. Furthermore, he can create new users with arbitrary user names and passwords. The user can change his password (see page 22).

! Please consider upper and lower case.

! When the software has just been installed and is started for the first time, it might happen that the Login window does not appear. Please close the software and restart it once more. The Login window will be visible at every software start from then on.

3.3 USB Serial Driver Installation

The USB-RS232-RJ 4/4 cable requires

- At least one available USB port
- Windows XP / Vista / Windows 7 / Windows 10

! When working with Windows 7 or Windows 10 the USB serial driver will be installed automatically. Please make sure the PC / notebook is connected to the internet, so the driver can be downloaded.

Connect the USB cable to the PC / notebook and insert the delivered CD.

For manual driver installation: The **Found New Hardware Wizard** will launch automatically. Select **No, not this time** from the options and click **Next**.

Fig. 14 Found New Hardware Wizard

Select **Install from a list or specific location (Advanced)**; then click **Next**.

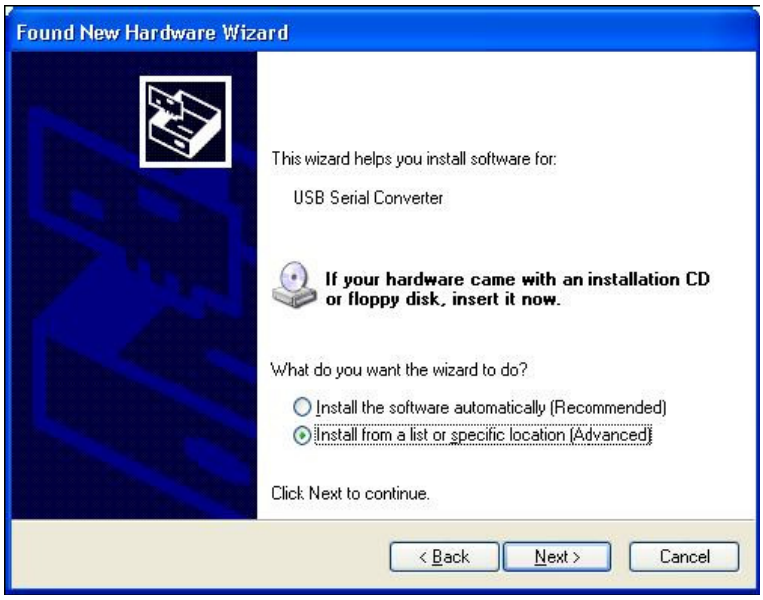

Fig. 15 Found New Hardware Wizard

Select **Search for the best driver in these locations** and go to **Search for removable media (floppy, CD-ROM…)**. If you don't use a CD but downloaded the file from our homepage, select **Include this location in the search** and choose the path to where you have stored the unpacked files. Click **Next** to proceed.

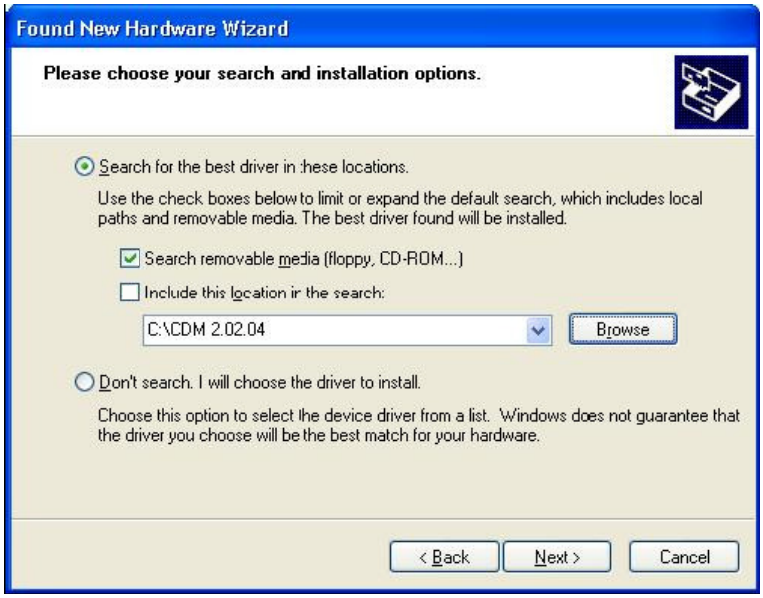

Fig. 16 Found New Hardware Wizard

Windows copies the required driver files and displays a message indicating that the installation was successful. Click **Finish** to complete the installation.

4 Operation

4.1 Adjustment of Regional Settings of the Operating System

The software is working with English (US) or German regional settings.
To change the regional settings on your PC press **Start** and go to the **Control Panel**. Choose **Regional and Language Options**.

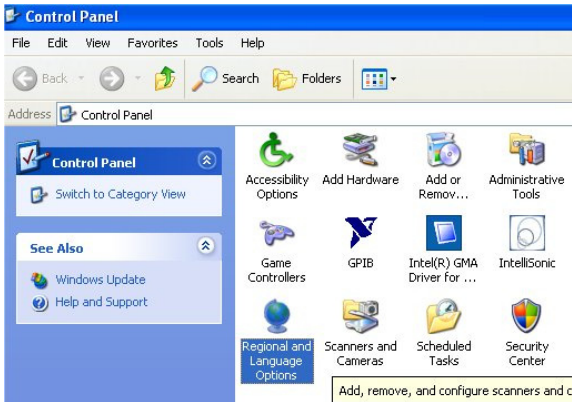

Fig. 17 Control Panel – Classic View

Select the **Regional Options** tab (e.g. English (United States)) and click **Customize**.

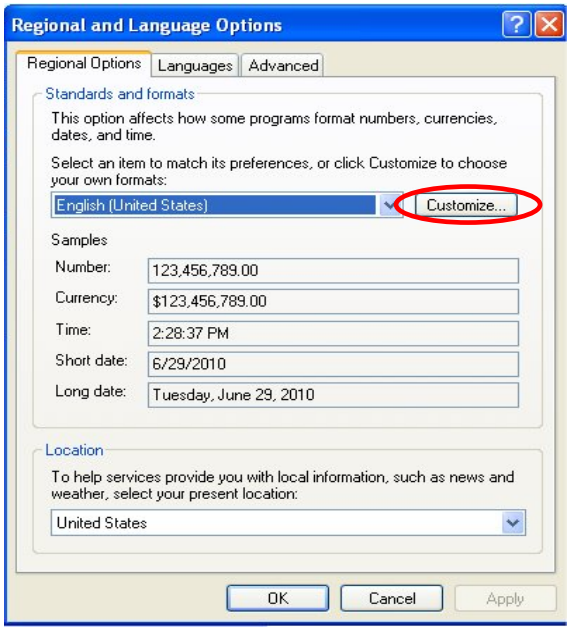

Fig. 18 Regional and Language Options window

A window opens; select the **Numbers** tab and choose the dot `.´ in the **Decimal Symbol** drop down menu. In the drop down menu **Digit grouping symbol** you have to choose space ` ´.

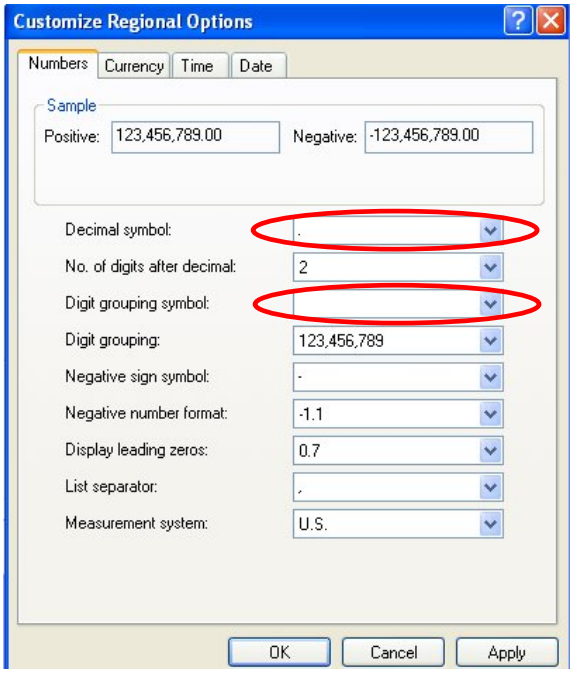

Fig. 19 Customize Regional Options window – Numbers tab

Then go to the **Date** tab now. Please note that depending on the regional version of your Windows Operating System the abbreviations for day, month, and year may be different as well as the case sensitivity. In the drop down menu **Short date format** you have to select `**dd.MM.yy**´ and choose the dot `**.**´ in **Date separator**. Then press **Apply** and **OK**.

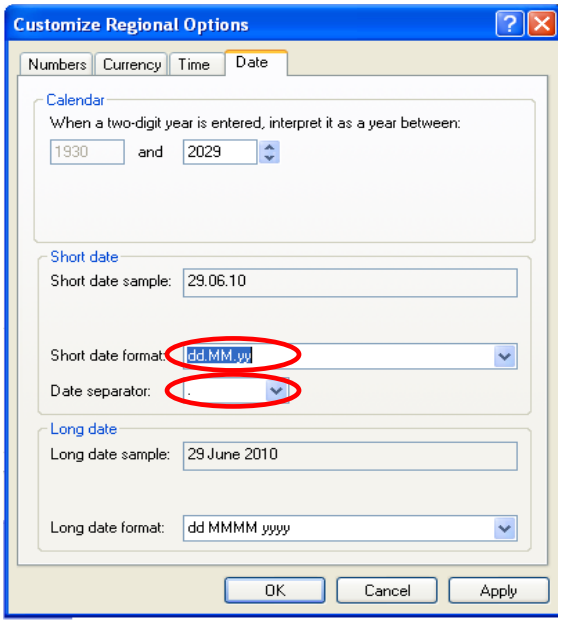

Fig. 20 Customize Regional Options window – Date tab

Press **OK** in the **Regional and Language Options** window, and you have finished adjusting the regional settings.

4.2 Configuration of COM Port

To check which COM port is assigned to the USB cable press **Start** in the Windows task bar and go to the **Control Panel**. Select **System**.

For Windows 7, or 10 you can now select the **Device Manager** in the menu on the left.

For other Windows versions select the **Hardware** tab in the **System Properties** window and click **Device Manager**.

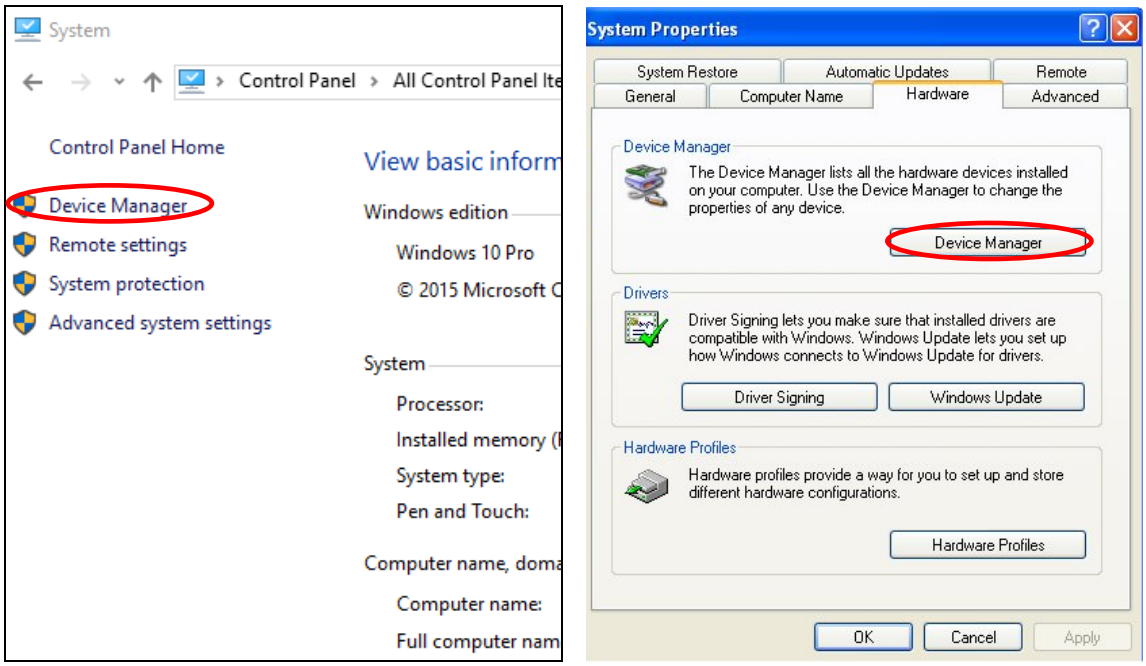

Fig. 21 Select the Device Manager in Win 7, 10 or Win Vista, XP.

You can find the USB serial Port under **Ports (COM & LPT)** (in the figure below this would be COM port 6 for example).

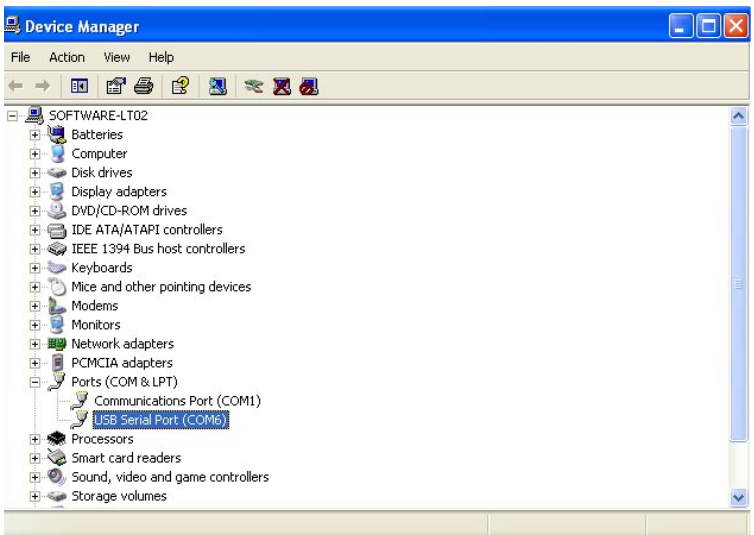

Fig. 22 Device Manager – USB Serial Port selected

If the automatically assigned ComPort number is higher than 15, the SDR software cannot recognize it. Thus, you have to change the respective ComPort number. To do so, open the **Device Manager** activate **Port (COM & LPT)** and double-click the USB Serial Port. A window opens; select the **Port Settings** tab and click on **Advanced**.

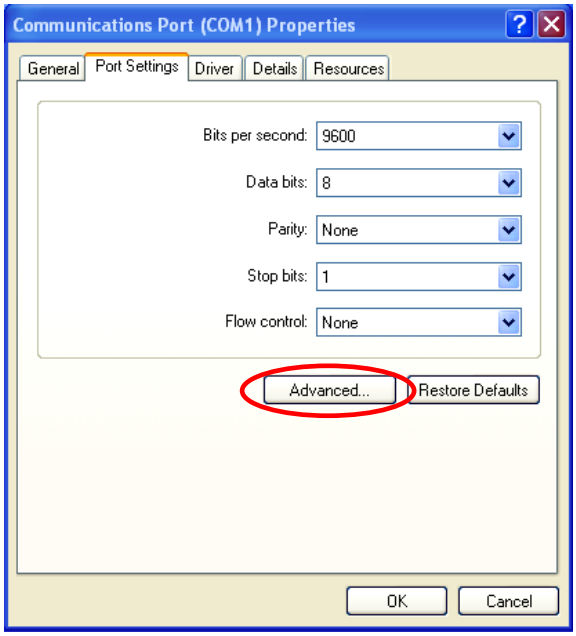

Fig. 23 USB Serial Port Properties – Port Settings tab

Change the **COM Port Number** to a free port number and click **OK**.

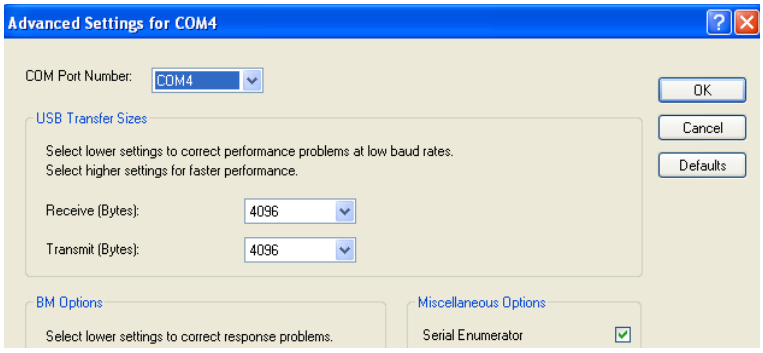

Fig. 24 Advanced Settings for COM Port window

You have to confirm the new port number by clicking **OK**; then you can close the device manager.

4.3 Description of Software Functions

The software surface is divided into six sections as assigned in the following screenshot:

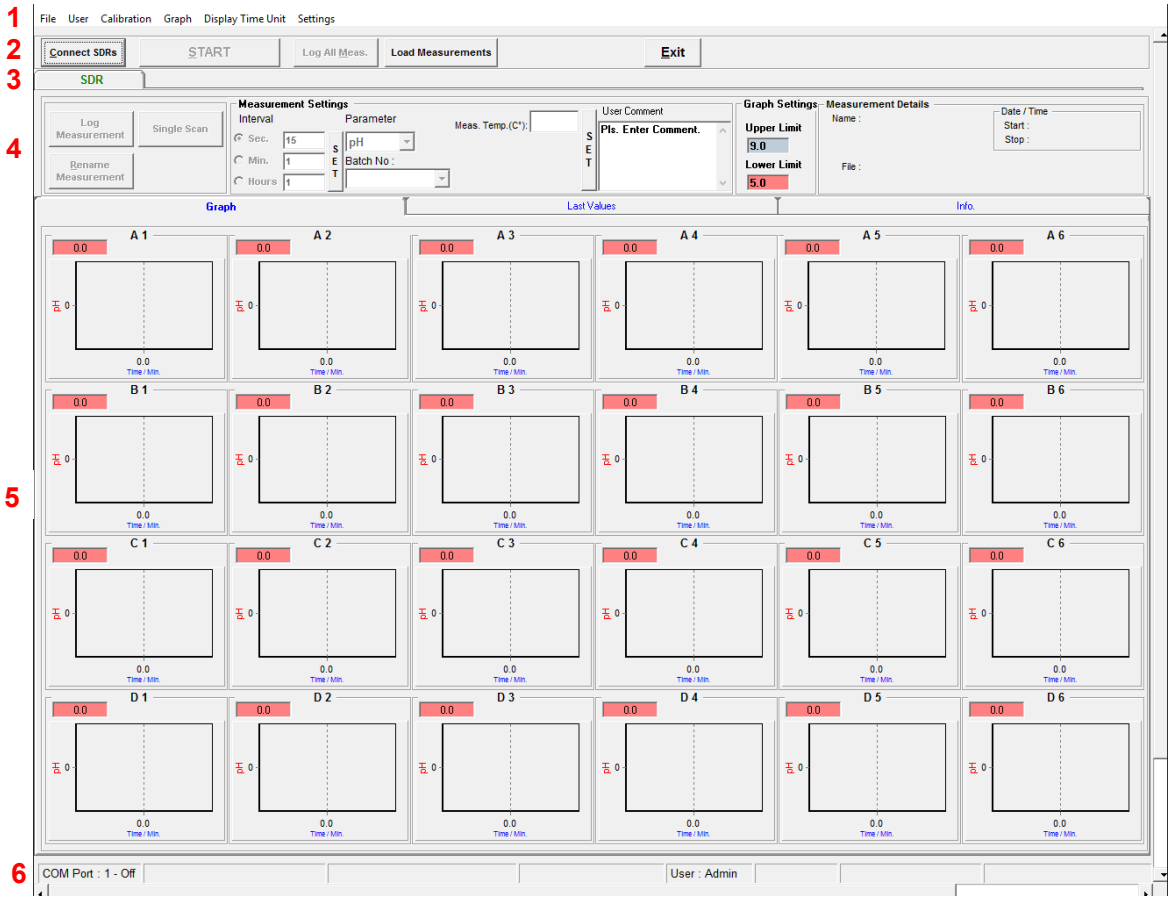

Fig. 25 Software surface divided into six sections

1. Menu bar
2. Control bar
3. SDR selection
4. SDR control bar
5. Result & Info. window
6. Status bar

This surface is shown after login. If you upload a previous measurement, connect the SDRs or create a new measurement, different buttons are shown and activated.
To view all 24 channels on the screen like depicted in Fig. 25, a minimum resolution of 1024 x 1280 pixel on your computer monitor is needed. Furthermore, the dpi setting has to be set to 96 dpi. At lower resolution, only a part of the graphs is shown. The others can be accessed by scrolling. All kinetics can be seen in one graph independent of the screen resolution using the 24-channel Graph (see chapter 4.3.5.1).

4.3.1 Menu Bar

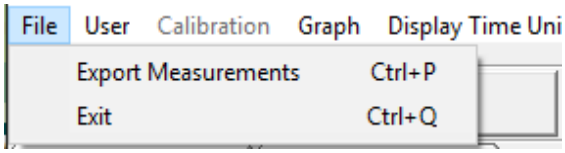

Fig. 26 File menu

File
Export Measurements: Saves the current data as an Excel or ASCII file. For more details please refer to chapter 4.5.2.
Exit: Closes the program.

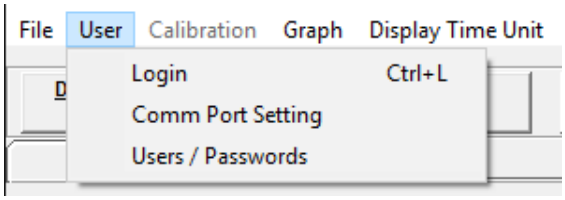

Fig. 27 User menu

User
Login: Changes the user /administrator. For every user, an admin-defined password is required.
Comm Port Setting: Defines the port to which the splitter is connected. The active COM Port is shown in the left corner of the status bar.
Users / Passwords: Here the admin or user can change (update) his password; the admin can also add or delete users. The name of the admin cannot been changed.

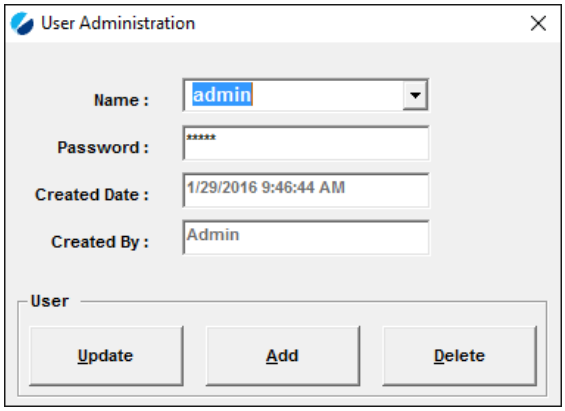

Fig. 28 User Administration dialog

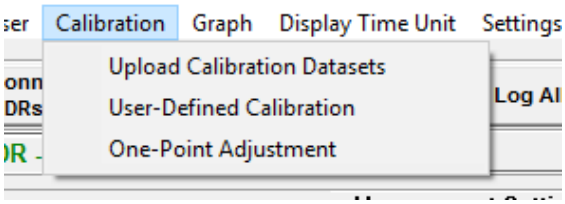

Fig. 29 Calibration menu

Calibration (Admin only)

Upload Calibration Datasets: Opens a dialog in which you can upload calibration data sets for OxoDish®, HydroDish®, and SensorVial batches. Each batch has different calibration data which are valid for every SensorDish® or SensorVial of this batch. The batch no. has to be chosen for every measurement in the Measurement Settings (see chapter 4.4.4) before starting a measurement. Details on where to find and how to upload calibration data for batches can be found in chapter 4.4.3.1.

User-Defined Calibration: Opens a dialog in which the user can enter his own calibration data sets. A detailed description of the calibration procedure and data entry is given in chapter 4.4.3.2.

One-Point Adjustment: This function is used in case of a significant offset of the measured value and an expected value (e. g. offline measured pH value prior to measurements). Oxygen, as well as pH can be adjusted to the expected value in a single point calibration and all following measurements will be corrected accordingly. For more details see chapter 4.4.3.3.

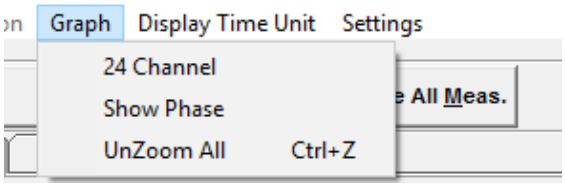

Fig. 30 Graph menu

Graph

24 Channel: Opens a window where all 24 channels of the active measurement are displayed in one graph. It is only active when the SDRs are connected or a measurement is uploaded and the Graph window (see chapter 4.3.5.1) is selected.

Show Phase: Displays the phase values of each channel in the respective graph on the secondary y-axis.

UnZoom All: Restores the default (automatically created) axis settings of all 24 graphs in case changes have been made.

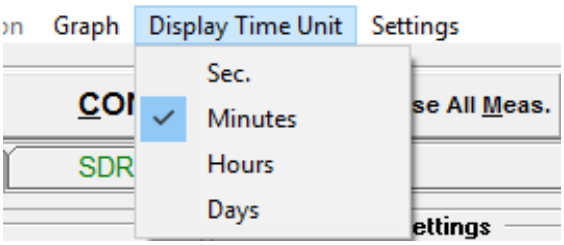

Fig. 31 Display Time Unit menu

Display Time Unit

Defines the time unit of the x-axis. It can be changed during or after a measurement and is applied in the 24-channel overview, the **Detailed Graph** and the **24 Channel Graph** windows. When exporting data to Excel or ASCII it will always be shown in the time unit ‘minutes’.

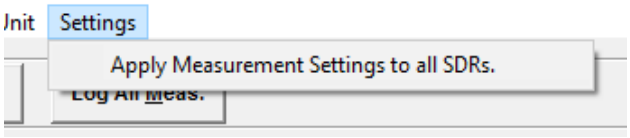

Fig. 32 Settings menu

Settings

Apply Measurement Settings to all SDRs.: In case you have multiple SDRs connected to the software you can adjust measurement settings of one SDR and then use this function to apply those settings to all connected devices.

4.3.2 Control Bar

The view of the control bar differs. Depending on the status (connected or disconnected to the SDRs, measurement uploaded or running), buttons or menu items are activated or deactivated.

1. After Login, or upload of one previous measurement:

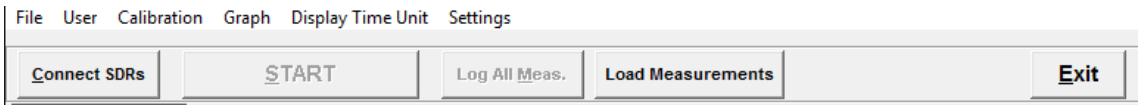

Fig. 33 View of control bar after login (not connected) and one uploaded previous measurement

2. With multiple uploaded previous measurements:

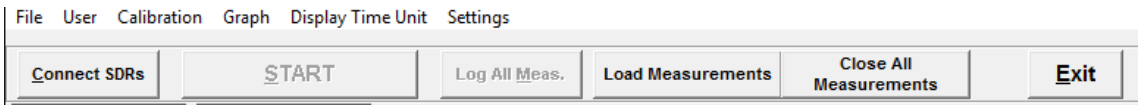

Fig. 34 View of control bar with multiple uploaded previous measurements

3. After Connection of the SDRs:

Fig. 35 View of the control bar after connection of the SDRs

4. During a running measurement:

Fig. 36 View of control bar during running measurement

5. At a paused measurement:

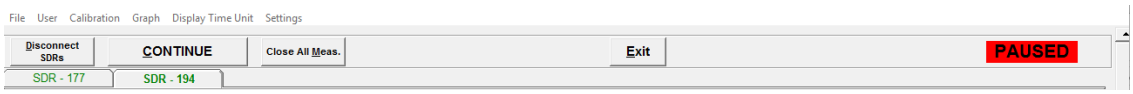

Fig. 37 View of control bar at a paused measurement

Connect SDRs / Disconnect SDRs: Connects or disconnects all SDRs to the software.

START / PAUSE/STOP / CONTINUE: Starts / Stops the measurements of all SDRs simultaneously.
To start a kinetic measurement, a measurement file has to be created first for all connected SDRs. Without logging, only Single Scans can be performed.
When the button **STOP/PAUSE** is pressed, a blinking **PAUSED** sign appears at the upper right corner. Stopped measurements can either be closed to start a new measurement, or continued.
A measurement is usually paused when the plate is removed from the SDR (e.g. for medium change, in order to avoid the “no sensor” message for the last values, and out-of-range values in the graphs), for data export, or to change the oxygen unit.

Log All Meas.: Creates measurement files for all connected SDRs simultaneously. For each SDR a separate file and folder is created. A prefix can be chosen for all files. The software automatically adds the serial number of the respective SDR at the end of the file name. This button switches to **Close All Meas.** after measurements have been created.

Close All Measurements: All measurements are closed simultaneously.

Load Measurements: Uploads one or more saved measurements. For uploading more than one measurement please mark them simultaneously. Multiple measurements can also be uploaded successively. The maximum number of open measurements is 10.

! Uploading previous measurement is only possible if the software is not connected to the SDR. Press **Disconnect SDRs** before uploading a saved measurement.

! Load measurements always with the same regional settings as used during measurement.

! Please note: Measurement data acquired with a previous SDR software version (before version 4.0.0) cannot be opened in this software version, as it is not compatible. Make sure to mark or rename your old measurement data so it does not get mixed up with the new data. Open the measurements with the software version they were created with.

Exit: Closes the program.

4.3.3 SensorDish® Reader Selection

In this software section you can switch between the SDRs. Before connecting or uploading previous measurements, a blank sheet is shown (SDR). After connecting or uploading, one sheet per connected SDR or uploaded measurement is created, displaying the serial number for correlation. All settings in the SDR control bar as well as in the result and Info. window refer to the selected highlighted SDR.

Fig. 38 Two connected SDRs: SDR – 177 is highlighted in boldface

4.3.4 SDR Control Bar

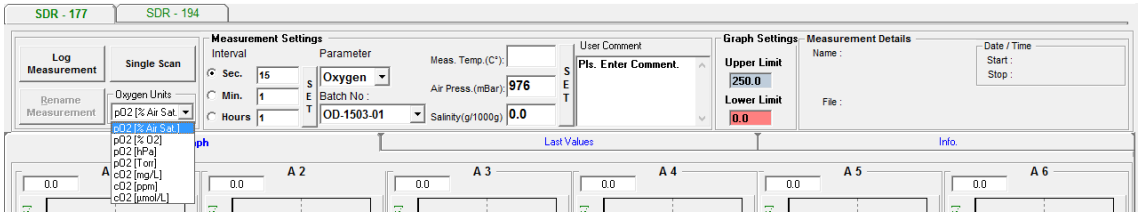

Fig. 39 SDR control bar

Log Measurement: Creates a new measurement for the highlighted SDR. A dialog window opens for choosing the measurement name and location. The button switches to **Close Measurement** after logging has been activated.

! The measurement temperature (Meas. Temp. (°C)) has to be set before you can log a measurement.

Rename Measurement: Rename the current and previous measurements.

! Only this button can be used for renaming measurements. Renaming in the Windows Explorer will lead to errors when reloading the measurement.

Single Scan: The currently selected SDR scans the sensors once. If the measurement has not been started, these data are not stored, cannot be exported to Excel or ASCII, and are deleted at switching to another SDR. Single Scan can also be used to get information about the current values during a long kinetic interval while the measurement is logged. In this case, the values are stored.

Oxygen Units: Defines the unit in which the oxygen values are displayed and exported. Following units for oxygen partial pressure (pO_2) or oxygen concentration (cO_2) are available:

- pO_2 in % air saturation
- pO_2 in % O2
- pO_2 in hPa
- pO_2 in Torr
- cO_2 in mg/L
- cO_2 in ppm
- cO_2 in µmol/L

Interval: Select the measurement interval. An interval of at least 2 min is recommended for long-term measurements, fast kinetics can be followed up to a 15 second resolution. The interval can be changed during the measurement; the remaining time until the next measurement point then starts again from this new interval. The interval is the same for all connected SDRs. If more than one SDR is connected, a message is displayed to prevent changing all intervals by mistake. Please press **SET** after changing the interval by typing in a different number. When exporting data to Excel or ASCII it will always be shown in the time unit 'minutes'.

! If an interval of less than 2 min is chosen, the internal temperature of the SDR will increase by a maximum of 2°C (at 37°C) and then stay constant.

! The interval can be changed during a measurement.

Parameter: Select between pH (HydroDish®) and oxygen (OxoDish®, SensorVial). This selection cannot be changed during a running measurement. The default setting is pH.

Batch No.: The batch no. of the respective SensorDish® is chosen before starting a measurement. The corresponding calibration data are used for calculation of pH or oxygen from the measured raw values. The batch no. of your SensorDish® or SensorVial is printed on its silver package and on the Final Inspection Protocol delivered with the SensorDish®/ SensorVial. The respective calibration data file can be downloaded from our homepage (http://www.presens.de/support/download-center/calibration-data.html). If a user-defined calibration was done, the user can also create a Batch No (see chapter 4.4.3.2).

Meas. Temp. (°C): Defines the measurement temperature. The measurement temperature has to be set before starting a measurement and can be changed while a measurement is running.

! The measurement temperature is used for temperature compensation in oxygen values calculation and for the choice of the correct calibration data set (oxygen and pH). pH calculation is not temperature-compensated. The measurement temperature is NOT a measured temperature, but given by the user. Please ensure to enter the correct measurement temperature when your samples have adjusted to the incubation temperature.

Air Press. (mBar) (oxygen only): Defines the air pressure at which the measurements are taken. The air pressure value can be changed during measurements. This is especially useful when conducting long term measurements as air pressure can vary significantly over longer time periods. Make sure to adjust the air pressure value if necessary.

Salinity (g/1000g) (oxygen only): Defines the salinity of the sample in g/1000 g. Salinity adjustment works in a range from 0 to 35 mg/1000g and temperature from 0 to 30 °C. This is only relevant when measuring in oxygen concentration units. The salinity is especially important for samples with high salinity, e. g. in sea water (salinity approx. 35 g /1000 g). The salinity value can be changed during a running measurement, although this is not necessary in most cases. The default value is 0.

! If you do not know the exact salinity of your sample, you can either estimate it by roughly calculating the mg salt per liter in your sample, or you can leave it at 0.

! If you enter a salinity value and perform a One-Point Adjustment (OPA), please make sure to choose the salinity BEFORE performing the OPA. Otherwise, the calculated values will be wrong.

User Comment: Input window for a description of the experimental set-up. The comment can also be added during measurement and is stored each time the measurement is stopped.

Graph settings: Defines upper and lower limit for color changes in the display of the current value in the **Graph** window as well as the **Last Values** window.

Measurement Details: General information about the current measurement (name and path, start and stop time) are displayed.

4.3.5 Result & Info. Window

4.3.5.1 Graph Windows

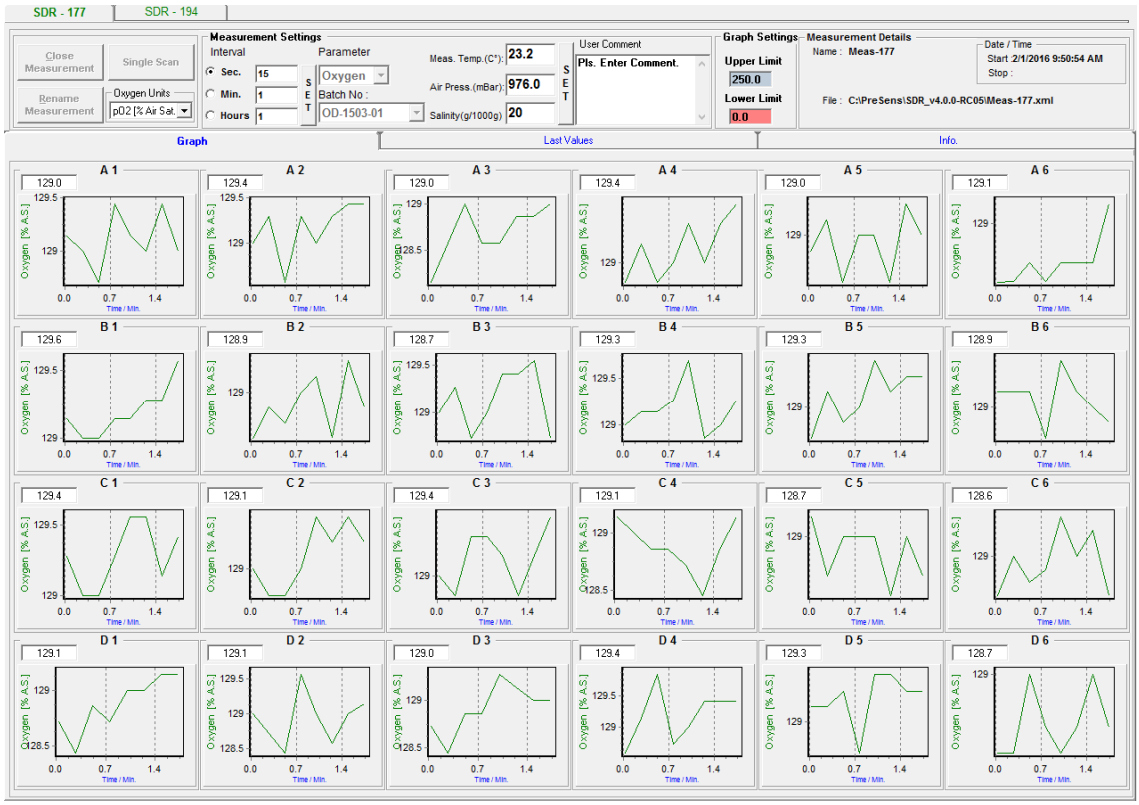

Fig. 40 Graph window

The time course of each well is shown in a separate graph. The green (for oxygen) and red (for pH) kinetics display the measured parameter (oxygen or pH). The last value of this parameter is shown in the upper left corner of each graph. The background color of the last value is adjusted to the **Graph Settings** (user-defined upper and lower limit). If the calculated value is not within the sensor limits (oxygen: 0 – 250 % air sat., pH: 5 – 9), or the amplitude of the sensor is too low, the last value field will blink and show a message.

Messages:

- pH < 5 / < 0 % air sat.: The calculated pH or oxygen value is below the limit.
- pH > 9 / >250 % air sat.: The calculated pH or oxygen value is higher than the limit.
- no sensor: The sensor amplitude is too low.

These messages are also stored in the Excel or ASCII file at exporting the data.

! Please note: If the pH value exceeds the upper limit considerably, pH < 5 will be shown, although the pH actually is > 9. The reason for this is that the value cannot be calculated by the formula anymore, which results in the values 0.

Following functions are available in the graph window as well as in the Detailed Graph window and the 24 Channel Graph window for all data visualization:

Zoom in

Perform a left mouse click on the graph, hold the left mouse key and drag a frame from left to right around the area of interest. Release the mouse key to show the zoomed area. You are still able to observe kinetics if the zoom area exceeds the right border of the initial graph window.

Unzoom

Click and hold the left mouse button and move the cursor to the left. Release the mouse key to clear the zoom. To zoom out all 24 graphs simultaneously choose **Graph / Unzoom all** in the menu bar.

Scroll

Use the scroll button of your mouse or the scroll bar on the right of the screen to move up and down in the window.

Move

Click the right mouse button, hold it, and move the cursor to move the kinetic in all directions (with the coordinates adjusting respectively).

Scaling

Double click on the y-axis to define the maximum and minimum values as well as the increment manually.

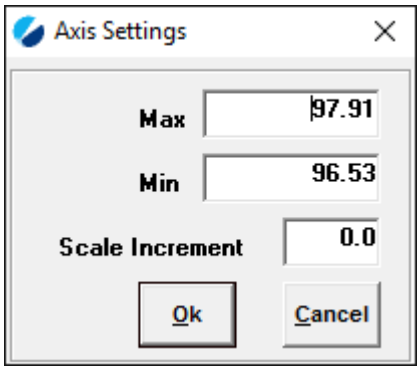

Fig. 41 Axis Settings window

The axis setting of one graph can be applied to the graphs of all other channels using **Graph / Apply axis settings of XX for all channels** in the menu bar.

Detailed Graph

Each graph can be enlarged by double click.

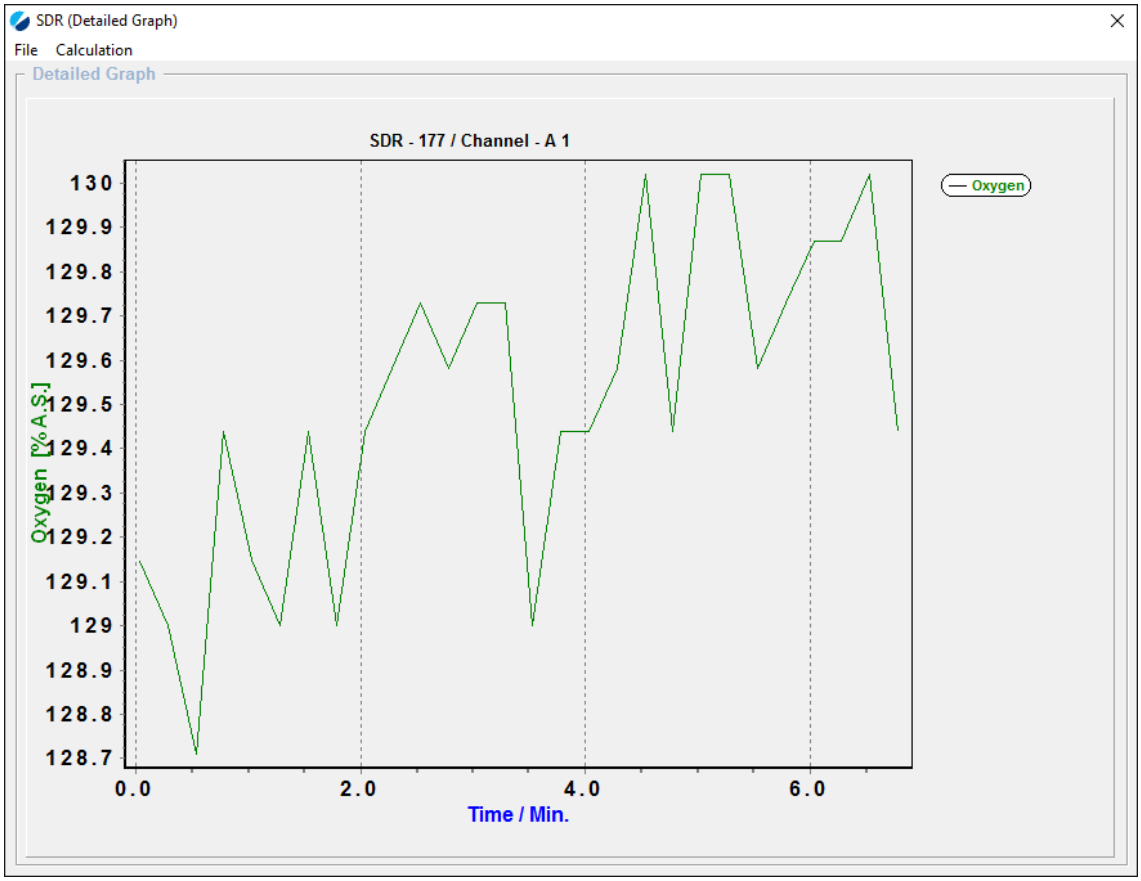

Fig. 42 Detailed Graph display

Again, the green (for oxygen) or red (for pH) kinetic displays the respective parameter (pH or oxygen).

Following functions are available on the enlarged graph:

File / Print Graph sends the graph data to a printer.

File / Exit closes the detailed graph window.

Calculation / Trend

To calculate the trend (slope and intercept) for selected graph points, please select **Calculation / Trend**. Select **Start Pt.** and click the required starting point on the graph. Select **End Pt.** and click the required end point on the graph.
The pH or oxygen trend per sec / min / hour is calculated automatically.

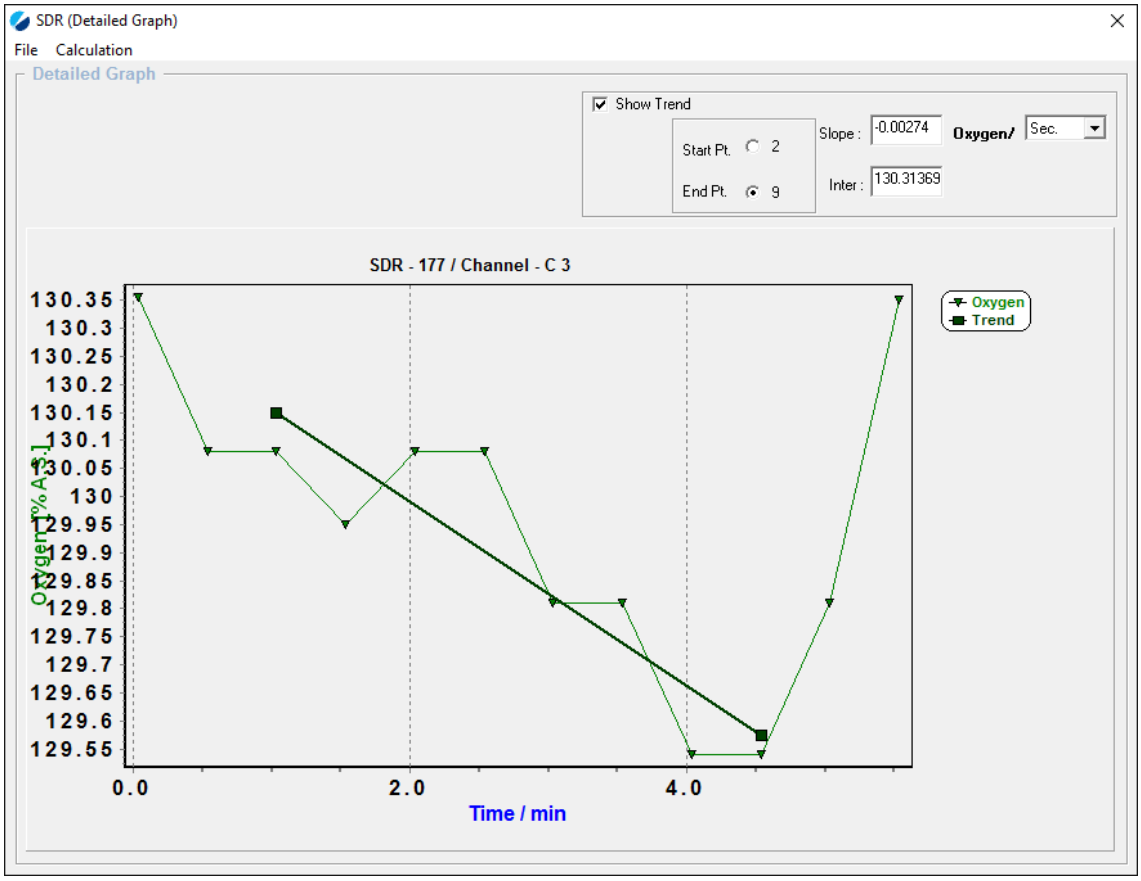

Fig. 43 Detailed Graph - Trend

Calculation / Arithmetic

Calculation (addition, subtraction, multiplication and division) can be either done with kinetic values of other wells or using variables by activating the check box **Variable**. This function is useful for comparing kinetics to a reference sample or calculation of oxygen consumption rates.

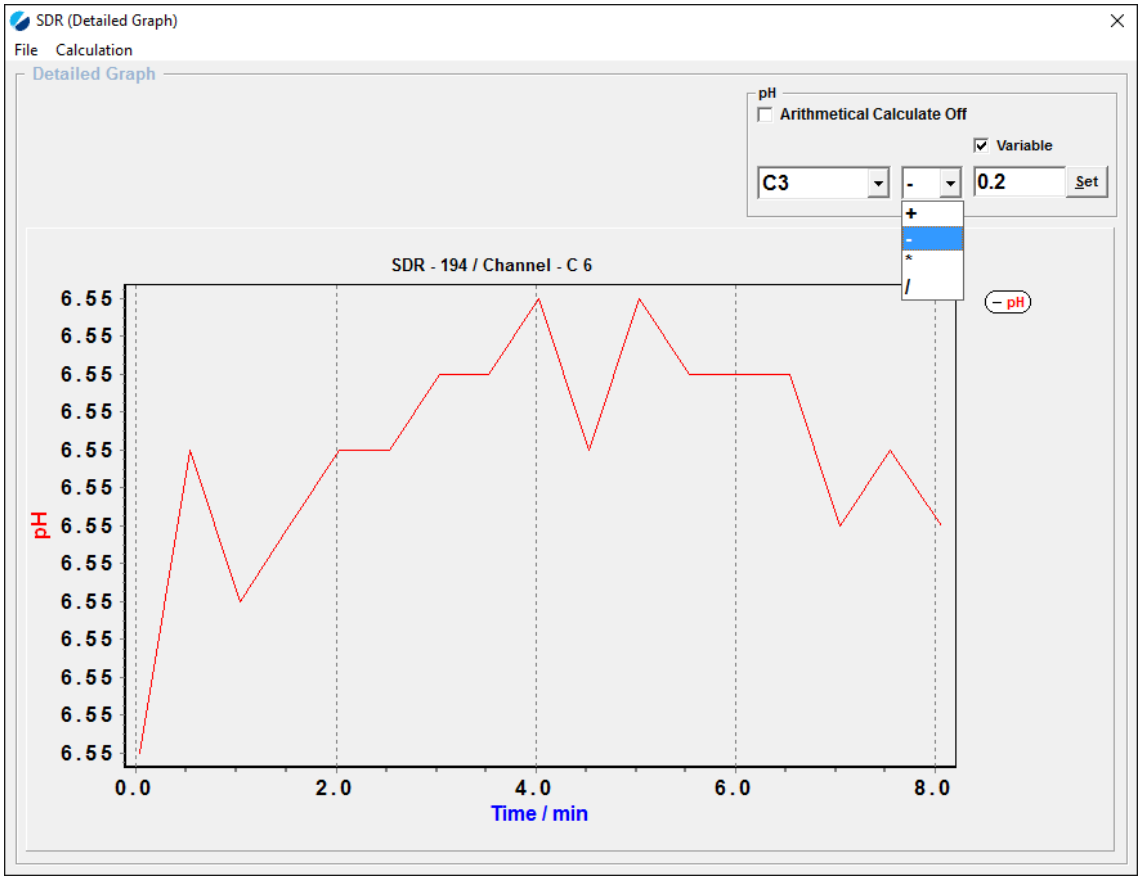

Fig. 44 Detailed Graph - Arithmetic

24 Channel Graph

All 24 wells can be displayed in a single graph by choosing **Graph / 24 Channels** in the menu bar. By placing the cursor on a data point, the parameter (Oxy = oxygen, or pH) value and the respective well are shown in the right lower corner. Individual wells can be chosen by activating or deactivating the respective check boxes on the right. The internal temperature of the SDR is shown if you activate the check box next to **Temperature**. A second axis appears on the right side. For activating individual phase values, please activate the phase value for all channels first using the check box next to **Phase**. Then you can deactivate all phase values again and choose individual ones. The phase values are shown on the second axis along with the temperature.

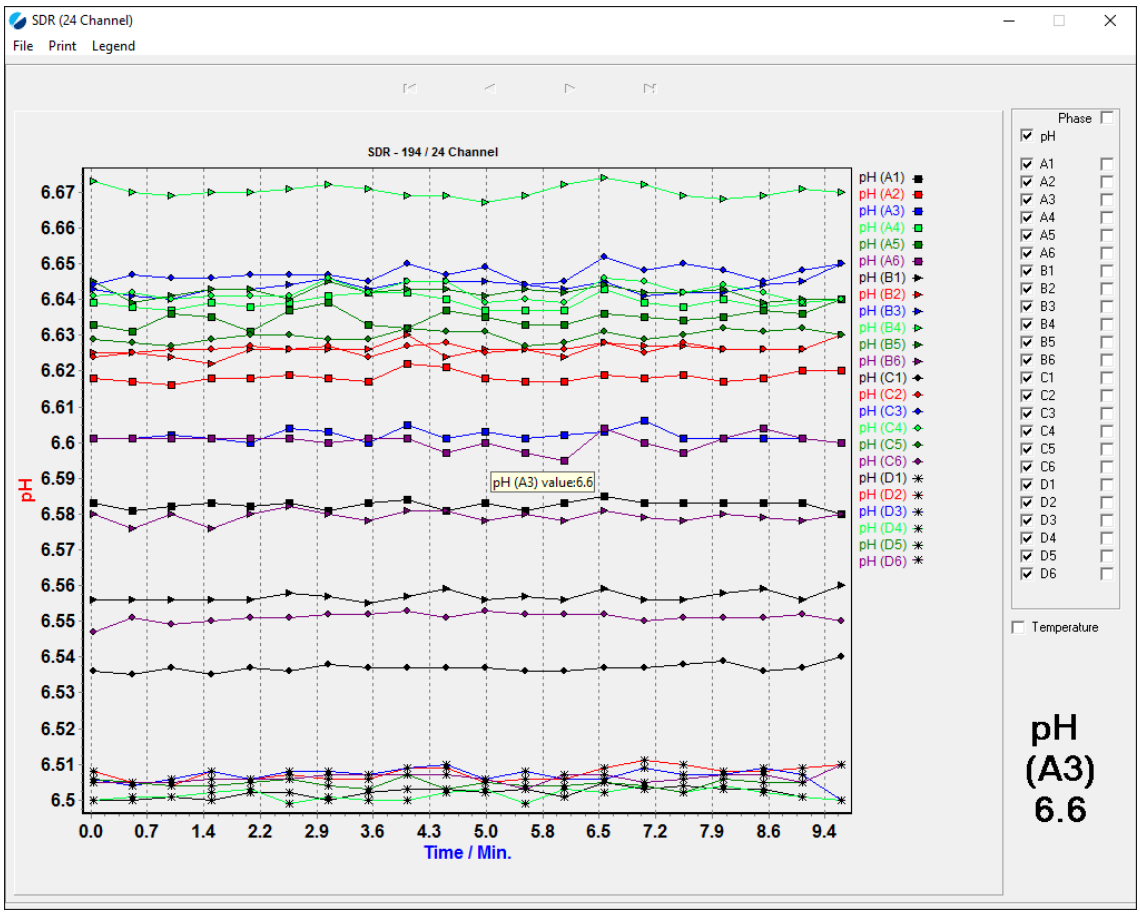

Fig. 45 24 Channel graphical display

The 24 channel graph can be printed using **Print / Printer** or exported to .jpg format with **Print / Custom / JPEG**.

Fig. 46 24 Channel Print menu

With **Legend** the colored legend below the graph can be deactivated to enlarge the graph area.

File / Exit will close the 24 channel graph.

4.3.5.2 Last Values

The last measured value of each well is displayed in the **Last Values** window. The background color of each well is defined by the upper and lower limit of **Graph Settings** in the SDR control bar. The limits can be varied for each SDR individually. Values can be entered manually after clicking into **Upper** or **Lower Limit**. This tool helps to recognize a change of the analyte concentration in the sample more easily.
Below the last value of the calculated parameter the information about a one-point adjustment is displayed in case this was performed (see chapter 4.4.3.3). At the bottom of each well displays of the last phase value (on the left) and amplitude (on the right) are shown. The amplitude indicates how much signal is received by the reader. At amplitudes below 2000 the text **no sensor** is shown instead of the calculated value, as the value would be too inaccurate due to the weak signal. Usually, the phase and amplitude values are not needed; however, they help our customer service to decide if your measurement is ok should the calculated oxygen or pH values be questionable.

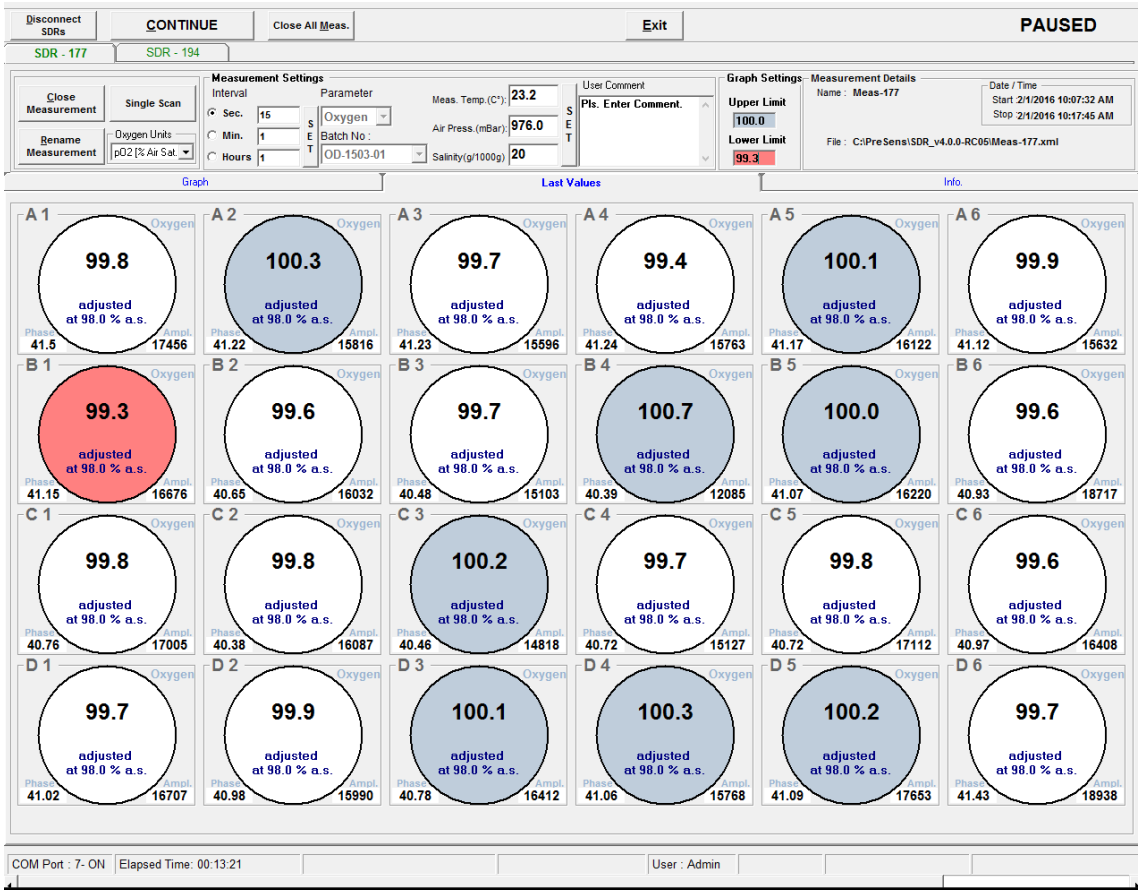

Fig. 47 Last Values display

4.3.5.3 Info. Window

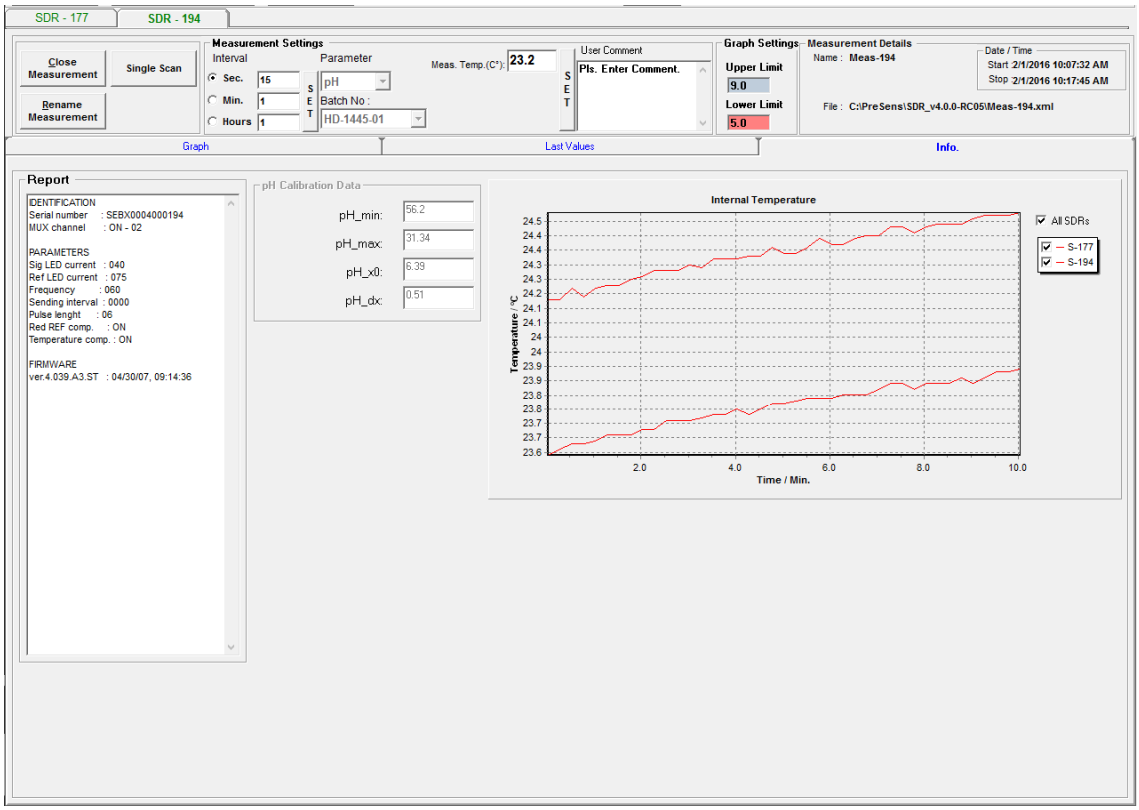

Fig. 48 Info. window

Report: Contains information about internal settings of the respective SDR (only for customer service).

Oxygen Calibration Data / pH Calibration Data: Depending on the choice of the SensorDish® and measurement temperature, the calibration data for the OxoDish®, HydroDish®, or SensorVial are displayed. The data cannot be changed in this window; for changing calibration data go to **Calibration** in the menu bar. If an oxygen One-Point Adjustment has been made, information on temperature and air pressure at OPA are also shown.

Temperature Graph: The internal temperature of the respective SDR is displayed. Please note that the absolute value as well as the kinetics may differ slightly from the temperature and kinetics of the sample. The SDR is in thermal equilibrium with the environment if the temperature has reached a constant value. At a significant change of this temperature, an external temperature change must be considered (e. g. due to opening the incubator). For information, this temperature is also exported to Excel and shown in the 24 Channels Graph (see chapter 4.3.5.1). It is possible to show the internal temperatures of all connected SDRs by activating **All SDRs**.

! For measurements with high measurement rates (below 2 min) a slight temperature shift (increase of up to 2°C) inside the SDR can occur. Please note that this will also influence the measurements. For long-term measurements, please choose an interval of more than 2 min.

! Please be aware that changes in the temperature change the measured oxygen or pH values. In case you see unexpected changes of these values check with the help of the temperature graph if the temperature was constant for this time. Even seemingly small interferences like opening the incubator door or taking off the plates shortly will be detected both in the temperature graphs as well as in the oxygen or pH graphs.

4.3.6 Status Bar

The Status Bar contains information about the measurement conditions:

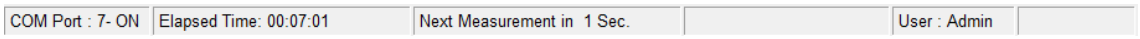

Fig. 49 SDR_v4.0.0 status bar

On the left you can see the connected **COM Port** number and its status (ON / OFF). **Elapsed Time** shows the time period since the measurement was started. **Next Measurement** displays the time till the next measuring point (countdown). On the right the logged in **User** is shown.

4.4 Measurement

This chapter describes each necessary step to start a measurement.

! It is recommended to close all other applications before running the SDR software. Especially internet programs can cause trouble.

! It is recommended to disable all energy saving applications and options, including the standby option of laptops if the laptop is closed. Also disable automatic Windows updates, as some of them require a shutdown of the PC (including SDR software).

! Too much ambient light (> 300 LUX) will cause an accelerated bleaching rate of the sensor and a change in the calibration data. Do not use the device next to windows or even in sunlight. If you do not perform the measurement in an incubator, we recommend covering the SDR.

4.4.1 Set-up

Connect the SDRs and the Splitter as described in chapter 2:

1. Connect the power adapter to the Splitter.
2. Connect the Splitter via the USB cable to a USB port of your PC / notebook.
3. Connect the first SDR via the 1.25 m RJ-45 cable to the Splitter.
4. Connect a subsequent SDR via the 0.25 m RJ-45 cables to the first SDR, the third SDR to the second, etc.
5. Cover the open connector of the last SDR with the end cap.

! If the end cap is not attached to the last SDR, humidity from ambient air will rapidly enter the device and may damage it.

6. Ensure that every cable is connected properly. The connectors snap in with a slight click.
7. Ensure that the power control LED of the Splitter is on.

4.4.2 Connect SDRs to the Software

1. Start the software SDR_v4.0.0.
2. Enter **admin** as user name and **admin** as password if the software is opened for the first time. After this, the administrator can change his password and generate users with different names and passwords (see chapter 4.3.1).

3. Select the serial Port to which the SDR is connected in the menu bar – **User / Comm Port Setting**: Confirm by clicking **Set Port**.

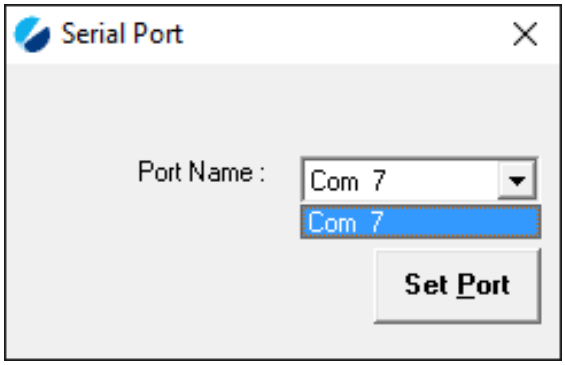

Fig. 50 Serial Port dialog

4. Press the **Connect SDRs** button in the control bar. Wait until all SDRs are configured. Each connected SDR will be listed in the SDR selection according to the last digits of its serial number (e. g. SDR – 49).

! If you connect further SensorDish® Readers via RJ-45 cables while the existing SensorDish® Readers are still connected to the software please press **Disconnect SDRs** and **Connect SDRs** again to recognize the newly connected SDRs.

4.4.3 Calibration (Admin only)

Before starting a measurement, calibration data for the HydroDish®, OxoDish®, or SensorVial must be entered. This is done by **Uploading Calibration Datasets** according to the Batch No. of your SensorDish® (see chapter 4.4.3.1) which are provided by PreSens, or by performing a **User-Defined Calibration** (see chapter 4.4.3.2). Furthermore, a **One-Point Adjustment** can be performed, in case of a significant offset between measured values and a known starting value (see chapter 4.4.3.3).

4.4.3.1 Upload Calibration Datasets

PreSens sensors come factory-calibrated. OxoDishes®, SensorVials and oxygen sensor spots SP-PSt5 are calibrated by a 2-point calibration using distilled water at air saturation and deoxygenated water. HydroDishes® are calibrated by a 6-point calibration using phosphate buffer saline (PBS) at an ionic strength of 140 mM to resemble cell culture media.

! The Batch No. of your HydroDish®, OxoDish®, or SensorVial is printed on its silver package and on the Final Inspection Protocol delivered together with the SensorDishes®. Calibration data of one batch are valid for all SensorDishes® with this batch number.

The respective file containing the calibration data can be downloaded from our homepage on www.presens.de/calibration . This file has to be uploaded under **Calibration / Upload Calibration Datasets**.

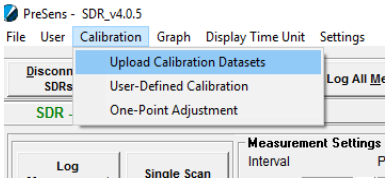

Fig. 51 Calibration menu – Upload Calibration Datasets

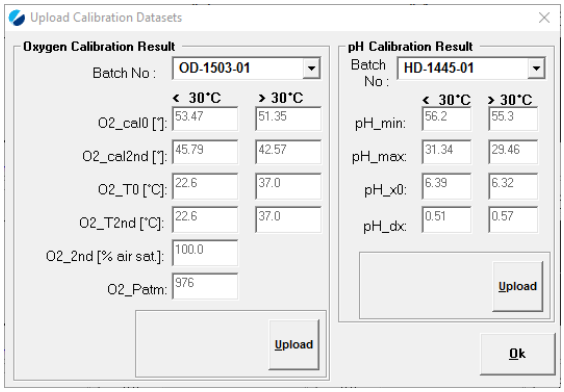

Fig. 52 Dialog for upload of batch files

Press **Upload** and choose the respective file containing the calibration data of your sensor.

! Batch numbers for OxoDishes® start with OD, those for HydroDishes® with HD, the ones for SensorVials or sensor spots with PSt5.

To store the uploaded batch, press the **Ok** button. The new batch can now always be found in the drop down menu for **Batch No** in the measurement settings (see Fig. 53). The calibration data of the currently selected batch file is displayed in the respective fields below. To enhance accuracy, calibration datasets for the SDR always come in pairs, one set for temperatures **< 30 °C** and one set for temperatures **≥ 30 °C**. The software automatically chooses the correct calibration dataset depending on the measurement temperature set at the start of a measurement.

! Please note that the calibration datasets do not change during a running measurement. If you change from a measurement temperature < 30°C to a temperature ≥ 30°C or vice versa, the software will continue to use the former calibration dataset and the calculated values will become more inaccurate. A message will inform you each time you change the temperature across the 30°C dividing line.

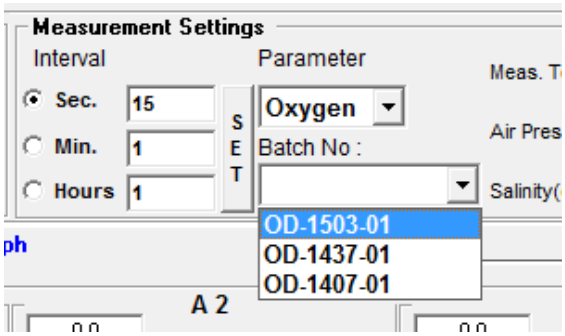

Fig. 53 Select the respective Calibration Dataset in Measurement Settings – Batch No

4.4.3.2 User-Defined Calibration

If you need special calibration data (e. g. due to working with special media or low temperatures), you can perform a user-defined calibration. After doing the calibration measurement (2-point for oxygen, 6-point for pH), you enter the obtained calibration values in the SDR software, thus creating your own Batch No.

Calibration of OxoDishes® or SensorVials

Step 1: Preparation of Calibration Solutions

1. You will need two calibration solutions – cal0 and cal2nd:
   Cal2nd: Use air-saturated water or medium (shake the vessel vigorously for 1 min to guarantee air-saturation, then remove the cap and shake it slightly to let excess oxygen and air bubbles leave the solution).
   Cal0: Prepare 1 % (w/w) sodium sulfite solution (sulfite reacts with the oxygen in the water, thus deoxygenizing it).
2. Store both solutions for at least 1 h at the calibration temperature. The vessel with cal0 should not have too much head space (gas phase) and must be closed with a cap. The vessel with cal100 should not be closed and be shaken slightly from time to time to speed up equilibrium.

! If you are calibrating at hypoxic conditions, please consider that it takes hours until the calibration solution cal2nd is equilibrated. SensorVials cannot be calibrated at hypoxic conditions.

! If you use medium, you might consider adding antifoam before shaking.

Step 2A: Preparation of an OxoDish® (OD24, OD24-DW, OD6, or OHD6) for Calibration

1. Depending on your OxoDish® type fill 12 (for OD24 and OD24-DW) or 3 (for OD6 or OHD6) wells of the OxoDish® with 3 (OD24) / 10 (OD24-DW) / 15 mL (OD6 or OHD6) (= maximum volume of the well) of cal0, and cover them with an oxygen-impenetrable adhesive foil (to stop oxygen entering the solution and using up all the sulfite).

! Make sure that the adhesive foil covers the wells completely without any gaps!

! Make sure you do not spill cal0 solution in wells intended for cal2nd!

2. Fill the other 12 or 3 wells of the OxoDish® with 1 / 2 / 5 mL of cal2nd.
3. Cover the OxoDish® with its lid.

Step 2B: Preparation of SensorVials for Calibration

1. Fill at least 3 SensorVials with approx. 5 mL (= maximum volume of the vial) of cal0 so that the meniscus is turned upwards. Close the SensorVials with their screw caps, thus spilling excess solution and eliminating any air in the vial.

! We recommend wearing disposable gloves when handling sodium sulfite.

2. Fill at least another 3 SensorVials with 1 mL of cal2nd.

Step 3: Calibration Measurement and Evaluation

1. Put the OxoDish® / SensorVials onto the SDR in a climate chamber at calibration temperature and start a measurement with an interval of 3 min.
2. Measure until the values are stable (at least 2 – 3 hours for non-hypoxic conditions at 37°C; longer for low temperatures or hypoxic conditions). Pay special attention to cal2nd as equilibration takes longer than for cal0 due to change of oxygen solubility at different temperatures.
3. Stop the measurement and export the phase values to Excel. Determine the exact calibration temperature and calibration air pressure with appropriate measurement devices at that time.

! Air pressure and the exact calibration temperature have to be determined with an external logger.

4. Calculate the averages for the least 5 phase values of the 12 (3) wells / 3 vials with cal2nd = calibration value **O2_cal2nd** in Excel. Then calculate the averages for the last 5 phase values of the 12 wells / 3 vials with cal0 = calibration value **O2_cal0**.

Step 4: Creating a new Calibration Dataset

1. Go to **Calibration / User-Defined Calibration**.
2. Type a name for the new calibration values in the field **Batch No** (e. g. OD-1602-01_2°C).
3. Type the **O2_cal0** and **O2_cal2nd** values along with the calibration temperatures (**O2_T0**, **O2_T2nd**) in the LEFT input fields, if your calibration temperature was < 30 °C. Type your calibration data in the RIGHT input fields, if your calibration temperature was ≥ 30 °C. The software automatically uses the correct calibration data set depending on the set measurement temperature at measurement start. If you have calibrated at one

temperature only, use random values or type in the same data twice. Type in the air pressure during calibration (**O2_Patm**) and the oxygen value **O2_2nd** (in % air saturation, other oxygen units are not possible) in the respective fields.

! Make sure to take other gases into consideration when filling in the **O2_2nd** value. For example when calibrating at 5 % CO_2 atmosphere cal2nd will not be 100 % air sat., but only 95 % air sat..

4. Press the button **Add**. The calibration values are now stored in the software and can be chosen as Batch No in the Measurement Settings drop down menu.

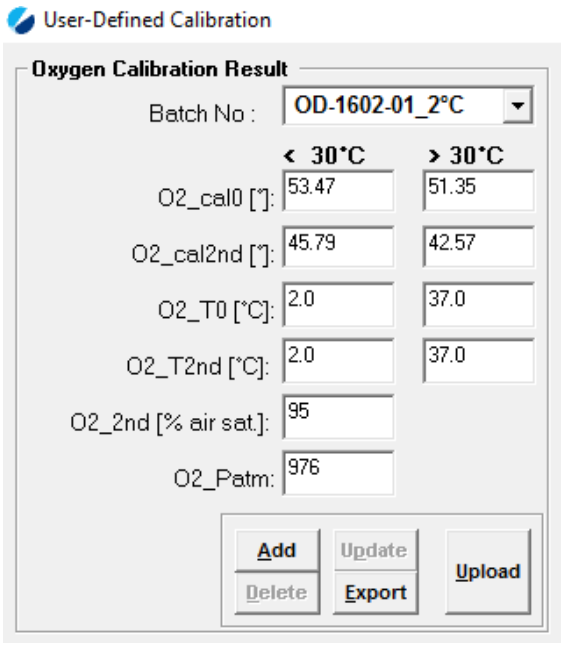

Fig. 54 Input of user-defined oxygen calibration values

Calibration of HydroDishes®

If working with difficult samples, e. g. with background fluorescence or differing significantly from physiological buffers, a 6-point calibration of the HydroDish® is recommended.

! HydroDishes® require solutions with a minimum ionic strength of 50 mM and a minimum
buffer capacity of 2 mM; they are not suited for measurements in tap / fresh water. At lower salt concentrations or buffer capacity pH may fluctuate or get displayed incorrectly.

Step 1: Preparation of Calibration Solutions

Prepare 6 solutions of similar composition as your sample and of different pH values. You can use a buffer of a similar ionic strength as your later sample, or the medium of your sample. If you use buffer (e.g. phosphate buffer), prepare acidic and basic stock solutions with the same ionic strength and mix them to get pH values in between these two. If you

use medium, titrate it with NaOH or HCl to get 6 different pH values. The solutions must have different pH values covering more or less the range from pH 5 to pH 8.5.

Step 2: Preparation of a HydroDish® (HD24, HD24-DW, HD6, OHD6) for Calibration

1. Depending on your HydroDish® type fill 4 (for HD24 or HD24-DW) or 1 (for HD6 or OHD6) wells of the dish with 1(HD24) / 2 (HD24-DW) / 5 mL (HD6 or OHD6) of the calibration solutions.

! If you are working with just one SDR and 6-well plates you will not be able to create replicates (as there is only one well per calibration solution). Filling several plates with calibration solutions and then measuring them with the same SDR one after another is not recommended, as the solutions might not be stable and lead to different pH readings.
However, when working with more than one SDR you can create replicates like this. Fill more than one plate with the calibration solutions and measure them on different SDRs simultaneously.

2. Cover the HydroDish® with its lid.

Step 3: Calibration Measurement and Evaluation

1. Put the HydroDish® onto the SDR in a climate chamber (no CO_2 atmosphere!) at the calibration temperature and start a measurement with an interval of about 3 min.
2. Measure until the values are stable. Stop the measurement.
3. Export the phase values to Excel and calculate the averages for the last 5 phase values of the 4 wells (only 24-well plates, or respective replicates for 6-well plates if more than 1 SDR is used).
4. Make a sigmoidal curve fit using the Boltzmann function. You can do this either using programs like Origin, or use our pH solver (www.presens.de/support/download-center/tools-utilities.html).
5. pH Solver:

   - Type the value pairs of pH and average phase into the field **Calibration Values** separating them by a blank. Use one line for each pair.

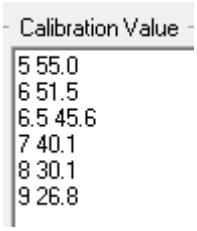

Fig. 55 pH Solver: Enter your calibration values

   - Press the button **Least Square Fit**. The 6 measurement points are shown in the graph window, along with the blue fit curve (the green curve is the one of the Initial Values). The result of the fit is shown in the window **Calibration Result**.

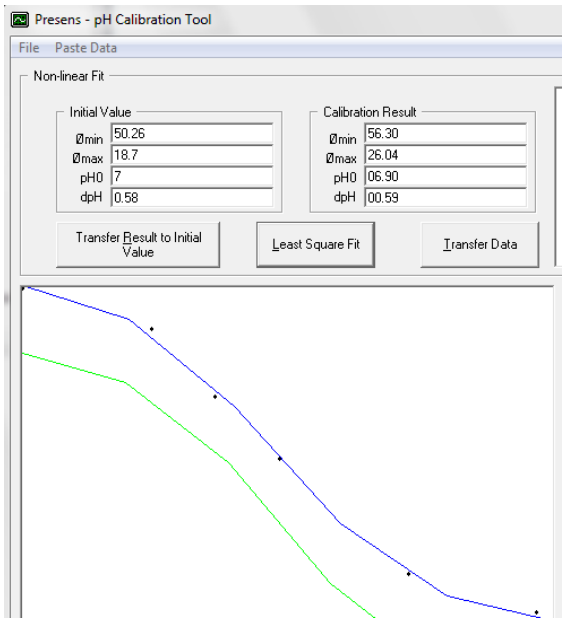

Fig. 56 pH Solver: Create the fit

- Press the button **Transfer Result to Initial Value** and press **Least Square Fit** again. Repeat this until the values in Initial Value and Calibration Result are the same.

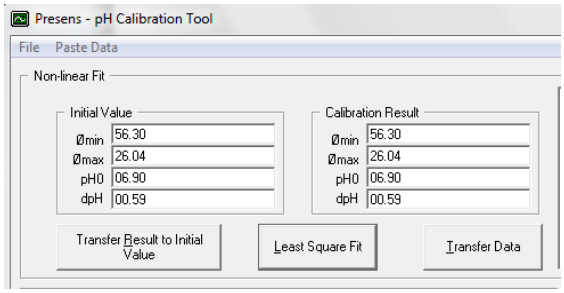

Fig. 57 pH Solver: Transfer the results

Step 4: Creating a new Calibration Dataset

1. Go to **Calibration / User-Defined Calibration**.
2. Type in a name for the new calibration values in the field Batch No (e. g. HD-1601-01_Medium1).
3. Type in the calibration values pH_min (Ømin), pH_max (Ømax), pH_x0 (pH0), and pH_dx (dpH) obtained with the pH solver into the LEFT fields for calibration temperatures < 30 °C. Type into RIGHT fields for calibration temperatures ≥ 30 °C. The software automatically uses the correct calibration data set depending on the chosen measurement temperature at measurement start. If you have calibrated at one temperature only, use random values or type in the same data twice.
4. Press the button **Add**. The calibration values are now stored in the software and can be chosen as Batch No in the Measurement Settings drop down menu.

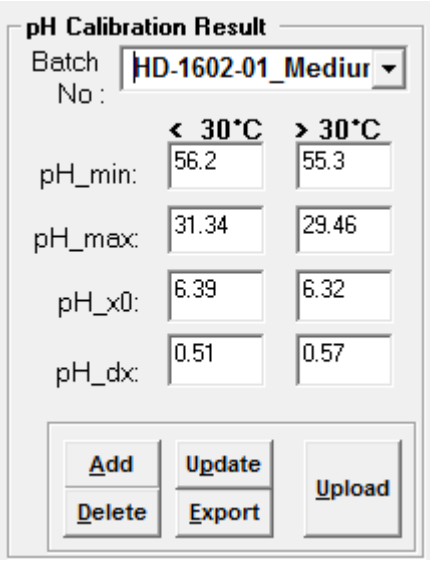

Fig. 58 Input of user-defined pH calibration values

4.4.3.3 One-Point Adjustment (OPA)

In case of a significant offset of the measured O_2 / pH values and a known starting value (e. g. if the media used for calibration differed from the measurement sample) a one-point adjustment of the cal2nd value can be performed prior to measurements. Select **Calibration / One-Point Adjustment**. As soon as the One-Point Adjustment function is activated, the currently selected SDR will perform a single scan of all wells automatically. (In case you want to repeat this and perform another single scan, press the **Scan Sensors** button on the right of the One-Point Adjustment dialog.)

! The measurement temperature (**Meas. Temp.**) and **Batch No**. have to be set in the measurement settings before a one-point adjustment can be performed.

! Please make sure to perform the OPA at the same temperature as your later measurement. Otherwise, your calculated data will be inaccurate.

Oxygen One-Point Adjustment

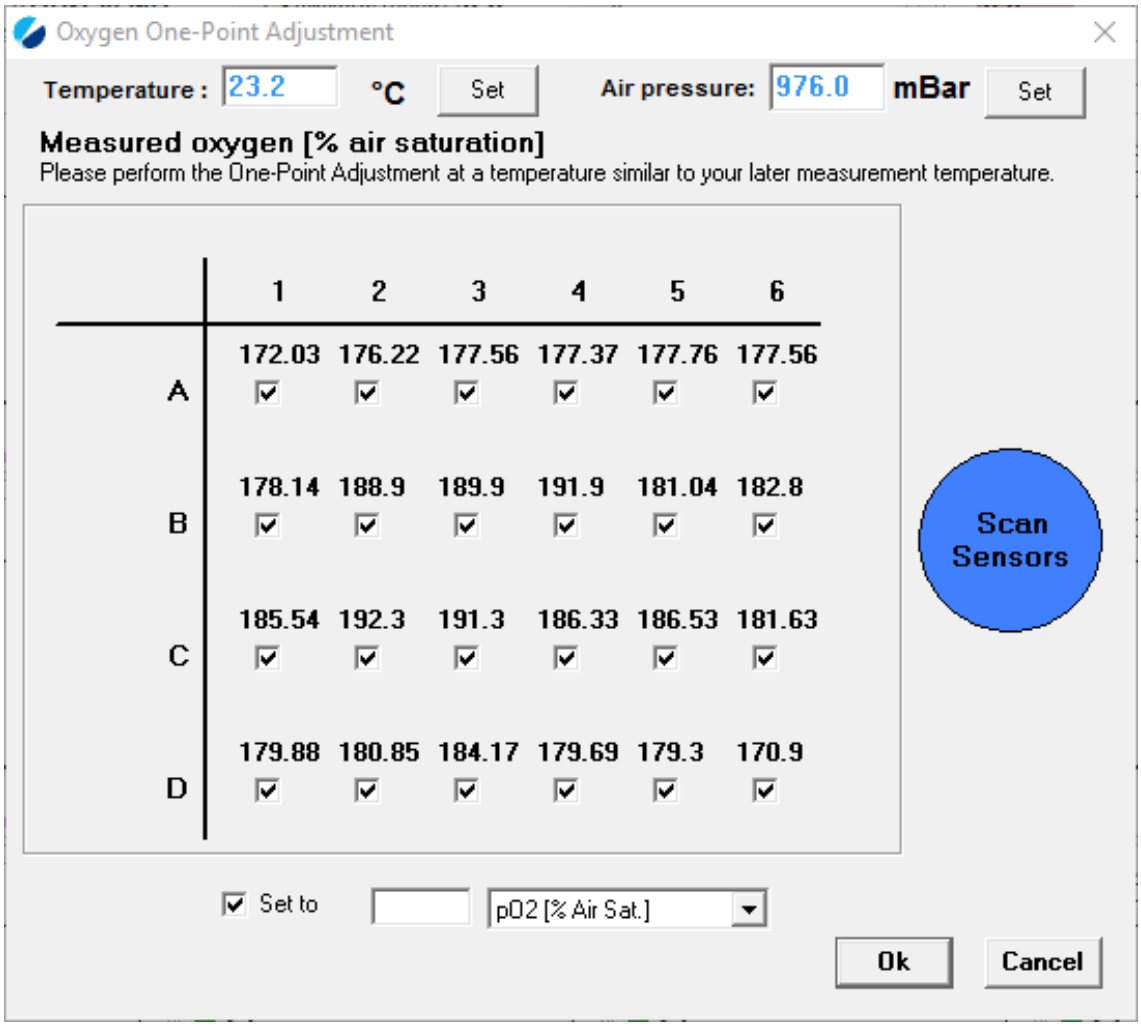

Fig. 59 Oxygen One-Point Adjustment dialog

The values measured in the automatic scan are displayed in the One-Point Adjustment dialog.

1. In case you do not want to perform the one-point adjustment with all wells of the OxoDish®, deselect the respective wells by unchecking the box underneath the respective oxygen value of the well.
2. Enter the oxygen value you want to calibrate to in the box next to **Set to** and select the respective oxygen unit from the drop down menu. Then press **Ok** and a message window will inform you, that oxygen one-point adjustment has been performed.

The adjustment will be shown in the Last Values window below the measured oxygen values of each well as “**adjusted at…**”. The temperature and air pressure are shown in the **Info.** window.

! In case you choose oxygen in concentration unit (mg/L, ppm, µmol/L) AND the salinity is not 0, please enter the correct salinity value in the Measurement Settings **prior to performing the one-point adjustment**, else the oxygen value calculation will be wrong.
(Salinity adjustment works in a range from 0 to 35 mg/1000g and temperature from 0 to 30 °C.)

! If you change the oxygen unit in the OPA window, the calculated oxygen values will also be changed to this unit. If you close the OPA window, the oxygen unit in the main window is also changed automatically.

! If you change the **Temperature** and **Air pressure** in the OPA window and press **Set**, they will automatically be changed in the main window. The oxygen values will automatically be re-calculated with these parameters.

pH One-Point Adjustment

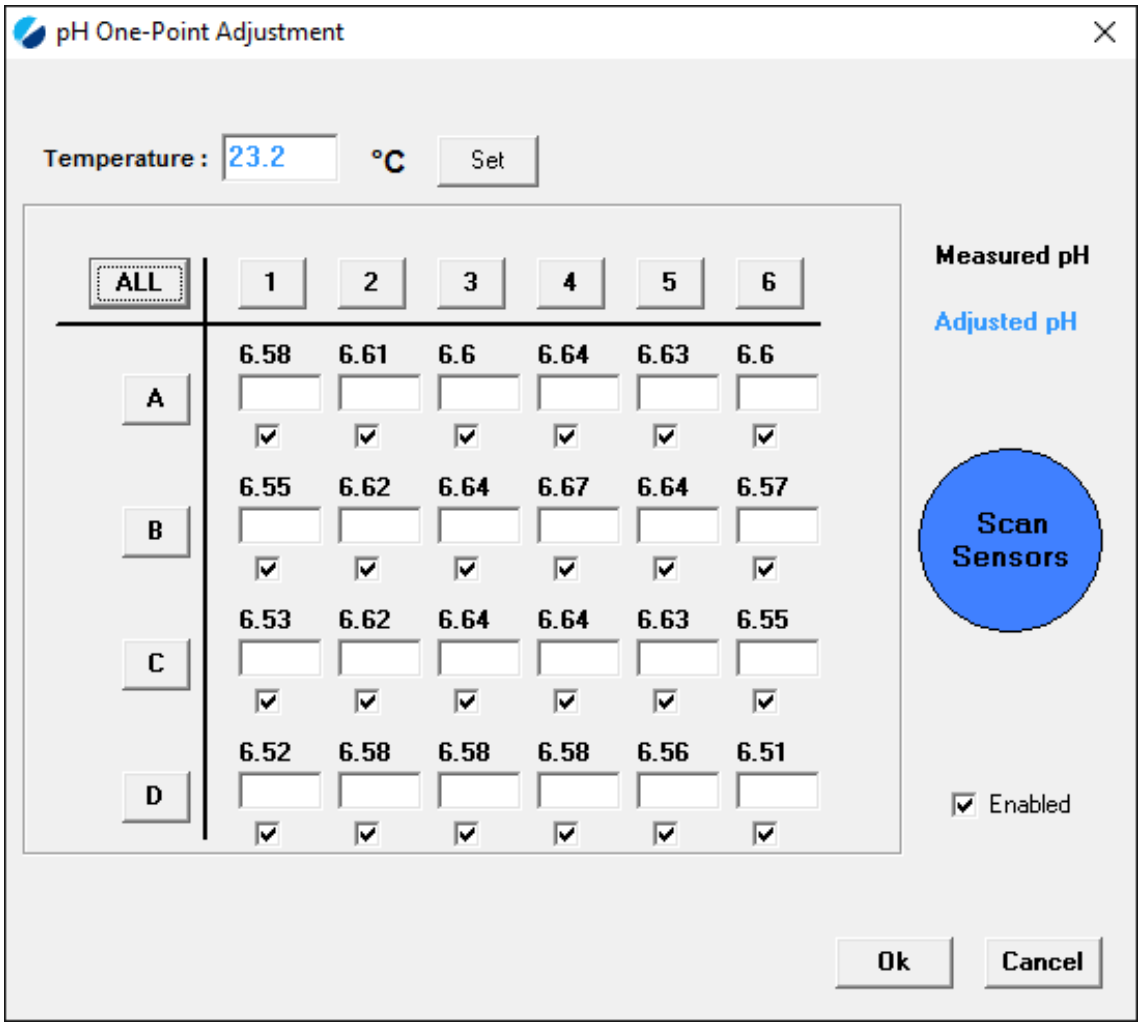

Fig. 60 pH One-Point Adjustment dialog

The calculated pH values measured in the automatic scan are displayed in the One-Point Adjustment dialog.

1. Enter the adjustment value for selected wells:
   Type the known pH values into the empty fields below the measured pH values. Click **ALL** in the upper left corner to enter the same adjustment value for all wells.
   By clicking on the respective row (**A – D**) or column (**1 – 6**) the adjustment value can be entered only for this line of wells. Also single wells can be enabled or disabled for adjustment by checking / unchecking the respective box. The **Enable / Disable** button in the lower right will select / deselect all wells.
2. Once an adjustment value for all activated fields is entered click the **Ok** button. A message window will inform you that pH One-Point Adjustment has been performed.

The adjustment will show in the **Last Values** window, where the offset of the adjustment compared to the originally calculated values is displayed below the measurement value.

! If you change the **Temperature** in the OPA window and press Set, it will be changed automatically in the main window. The pH values will only be automatically re-calculated if the temperature is changed from below to above 30°C or vice versa, as a different calibration dataset is used. Otherwise, no temperature compensation of pH is performed.

4.4.4 Choose Measurement Settings

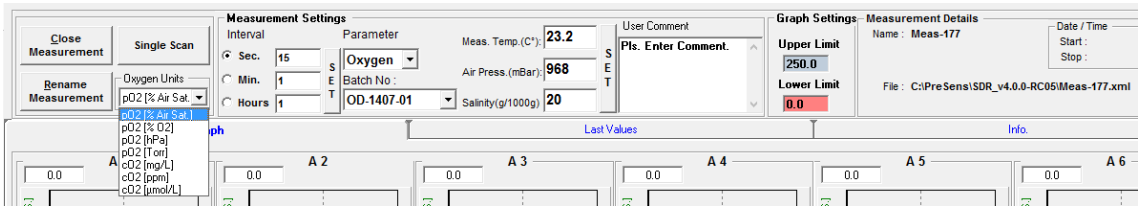

Fig. 61 Measurement Settings in the control bar

1. Select the measurement **Interval**:
   The measurement interval is the same for all connected SDRs. For fast kinetics an interval of up to 15 sec is possible.

! For update rates faster than 2 min a slight warming of the SDR will be observed (e. g. in 30 sec mode at 37°C about 0.5 °C). For any long-term measurement, please choose a measurement interval of at least 2 min.

The chosen measurement interval will always be applied to all connected SDRs. A message is displayed. (When exporting data to Excel or ASCII, time will always be shown in the time unit ‘minutes’.)

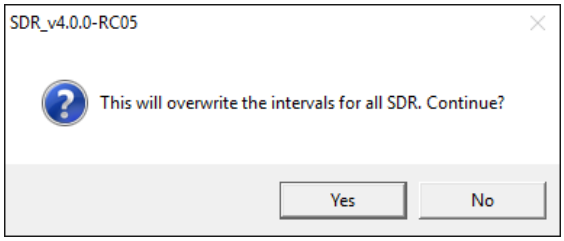

Fig. 62 Message window displayed when changing the measurement interval

2. Choose the **Parameter** (pH or oxygen):
   This, and the following settings are individual for each SDR.
3. Choose **Batch No.** of your Sensor Dish®:
   The batch no. is printed on the silver package of your SensorDish® and on its Final Inspection Protocol. You can also choose a self-made Batch No. (see User-defined calibration, chapter 4.4.3.2).
4. Set the **Meas. Temp.** (measurement temperature): The software uses this temperature to calculate the oxygen values and to choose the correct calibration data set for both OxoDish® and HydroDish®.
5. Set the **Air Press.** value (oxygen only): The software uses this atmospheric pressure value to account for the difference in air pressure at the time of measurement and the

time of calibration when calculating the oxygen values. By default, the air pressure of the calibration is shown. (During long-term measurements it is recommended to check and adjust the atmospheric pressure value in case there are significant variations over time.). The air pressure has to be measured with an external device.

6. Set the **Salinity** value (oxygen only): In case you are measuring in oxygen concentration units (mg/L, ppm or µmol/L), the salinity value of your sample will be accounted for in oxygen calculation (the oxygen pressure units % air saturation, % oxygen, hPa and Torr are independent of salinity). Salinity adjustment works in a range from 0 to 35 mg/1000g and temperature from 0 to 30 °C. It is especially important for measurement in marine samples (salinity of the ocean: approx. 35 g/1000g). If you use medium, you can estimate the salinity by adding the salts in g/L or leave it at 0. Factory calibration is done at a salinity of 0 (distilled water).
7. **User Comment**: You can type a description of your experiment in this window. This is individual for each SDR and can also be edited during measurement. It is saved every time you press STOP. The User comment is also stored in Excel or ASCII if the data are exported.
8. **Oxygen Units**: For oxygen measurement the unit in which the oxygen content is displayed (and exported to Excel or ASCII) has to be defined. The unit can be changed during the measurement if the measurement is paused, and for previous loaded measurements. Oxygen values are exported to Excel or ASCII in the selected unit. The default oxygen unit is % air saturation.

4.4.5 Log Measurements

To start a measurement a measurement file for storing the data has to be created for each connected SDR. This can be done for all SDRs simultaneously by pressing **Log All Meas.** in the control bar. A dialog opens for storing the measurement. A prefix for all file names can be entered, which is extended automatically by the serial number of the respective SDR. Alternatively, a measurement can be created for each SDR separately using individual file names by pressing **Log Measurement** in the SDR control bar.

The software will create a file with the extension .xml and a folder with the same name containing files with the extension .dat for storing the data of each channel as well as the measurement settings. The measurement can be uploaded in the software later (see chapter 4.5.1).

! Do not store a new file inside a folder created by the software. In this case the measurement cannot be uploaded later.

! Do not move the .xml file and the associated folder separately. Always maintain the internal storing path. The .xml file and the associated folder must be kept in the same folder.

! Do not rename a measurement file manually in the Windows Explorer. The measurement file can only be renamed by using the Rename button in the software.

Please notice that a measurement name must be defined for each connected SDR before taking a measurement.

4.4.6 Start the Measurement

After creating a measurement file for each SDR, the measurement for all SDRs is started simultaneously by clicking **START** in the SDR control bar. In case of a measurement interval of more than 30 seconds you have the possibility to update the values in between two measurement points by pressing **Single Scan** in the SDR control bar. This function is disabled if the next regular measurement point is within the next 30 seconds. The remaining time until the next measurement is displayed in the status bar. Single measurement points of a running measurement are stored and exported.

During a running measurement you can

- change the interval
- change the measurement temperature
- change the air pressure (only oxygen measurements)
- change the salinity (only oxygen measurements)
- change the oxygen unit after pressing STOP/PAUSE (only oxygen measurements)
- export the measurement data to Excel / ASCII after pressing STOP/PAUSE
- enter a comment
- open different graph views (Detailed Graph, 24 channel graph, see chapter 4.3.5.1)
- perform a Single Scan
- pause and continue the measurement

You cannot

- perform a One-Point Adjustment
- change the Calibration Data
- upload previous measurements

! Please note that the calibration data does not change to the respective dataset if you change from measurement temperatures < 30°C to >= 30°C or vice versa. Your calculated values will get more inaccurate in this case.

! Changing the salinity is possible, but for most applications not necessary.

4.5 Subsequent Data Handling

4.5.1 Reload Previous Measurements

Previous measurements can only be opened if the software is not connected to the SDRs. Before uploading previous measurements, **Disconnect SDRs** has to be pressed. The regional settings at loading a previous measurement must be the same as those it was recorded with (English (US) or German).
Up to 10 previous measurements can be uploaded successively or simultaneously using the **Load Measurements** button in the SDR control bar. For simultaneous upload, the files have to be located in the same folder and marked simultaneously.
Press the **Close All Measurements** button in the control bar to close all loaded measurements simultaneously, or the **Close Measurement** button to close only the highlighted measurement.

! A measurement can only be uploaded if the regional settings of the PC are the same as at the time of the measurement (English (US) or German).

! Please note: Measurement data acquired with a previous SDR soft (before version 4.0.0) cannot be opened in this software version, as it is not compatible. Make sure to mark or rename your old measurement data so it does not get mixed up with the new data. Open the measurements with the software version they were created with.

4.5.2 Export Data to Excel

The software stores each measurement´s information in .xml format, which can be uploaded again anytime using the SDR software (same version as it has been created with). For further data processing it is possible to export data to Excel format (generate an .xls file, or an .xlsx file for Office 2007 or higher versions) or ASCII format (generate a .txt file). By entering **File / Export Measurements** in the menu bar, the export assistant will open.

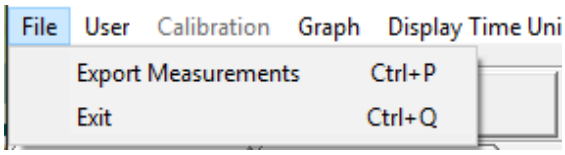

Fig. 63 Menu bar – File / Export

For Excel, the user can select between three different export formats (see table on page 56). The format for ASCII files equals format 1.

If exporting to Excel does not work, this may be due to your Excel version. In this case please export to ASCII format and then import the created .txt file in Excel.

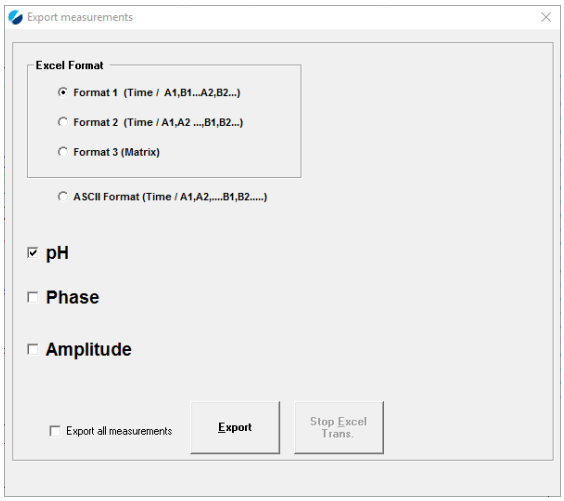

Fig. 64 Export measurement assistant

The check box next to **Oxygen** or **pH** respectively is activated by default. Activate **Phase** and / or **Amplitude** if you also want to export these raw values to separate files. Check the box next to **Export all measurements** to initiate the export of all currently uploaded or open measurements. Pressing **Export** opens a window for choosing the path and the file name. The respective suffix _Oxygen, _pH, _Phase, or _Ampl is added to the file name automatically. For **Export all measurements**, the serial no. of the SDR is also added to the file name.

! Do not store Excel files in the measurement subfolder created by the software. This may lead to a corrupted data structure.

! In case you have uploaded several previous measurements for the same parameter and recorded with the same SDR, **Export all measurements** will not be possible, as all the files would be named the same. Please export these measurements one after another assigning different file names.
The same applies for Phase and Amplitude data of measurements created with the same SDR, as they also would be named the same. (A distinction between oxygen and pH is not made here.) Again export those data one after another assigning different file names.

The Excel sheet is named **Oxygen / pH Original**. The first rows of the sheet contain general information about the SDR, and measurement settings. The subsequent rows contain the measurement data in the selected format. All measurement data is exported in minute time intervals. The time, measurement temperature, for oxygen measurements the air pressure and salinity, the internal temperature of the SDR (only for information, not for calculation), and an error message of any error that may have occurred during the measurement is stored in a separate row after the measurement data. If a one-point adjustment has been performed, a second sheet called **Oxygen / pH OPA** with the re-calculated data is created. It also contains information about the temperature at OPA. For oxygen it shows the air pressure and the adjusted oxygen value for the OPA, as well as the new **O2_cal2nd** values for each channel. For pH, it shows the offset for each channel.

FORMAT	EXCEL FORMAT
1	

Date/Time	Time/Min.	A1	B1	C1	D1	A2	B2	C2	D2
29.01.16 11:2	0.03	168.64	163.62	159.21	156.13	176.79	178.33	178.91	169.95
29.01.16 11:2	0.53	168.83	163.25	159.03	155.41	176.79	178.33	178.72	169.01
29.01.16 11:2	1.03	169.01	163.62	159.58	155.41	177.18	178.53	178.33	169.2
29.01.16 11:2	1.53	168.83	163.43	159.03	155.95	176.22	178.72	178.72	169.58

Date/Time	Time/Min.	A1	A2	A3	A4	A5	A6	B1	B2
02.02.16 08:40:08	0.03	97.62	97.27	97.6	97.93	98.14	97.38	97.38	97.66
02.02.16 08:40:23	0.28	97.62	97.27	97.6	98.14	97.82	97.27	97.27	97.66
02.02.16 08:40:38	0.53	97.84	97.17	97.7	97.93	98.03	97.38	97.38	97.76
02.02.16 08:40:53	0.78	97.73	97.06	97.49	97.93	98.14	97.38	97.48	97.55
02.02.16 08:41:08	1.03	97.84	97.27	97.17	98.36	98.57	97.7	97.48	97.55

3

Date/Time	02.02.16 08:4	Time / Min.	0.03			
	1	2	3	4	5	6
A	97.63	97.27	97.6	97.93	98.14	97.38
B	97.38	97.66	97.95	97.53	98.02	97.68
C	97.04	96.71	96.71	97.14	97.76	98.22
D	97.16	98.01	97.04	97.91	98.03	97.3

Date/Time	02.02.16 08:4	Time / Min.	0.28			
	1	2	3	4	5	6
A	97.63	97.27	97.6	98.15	97.82	97.27
B	97.27	97.66	97.02	97.33	98.12	97.58
C	96.93	96.51	96.51	97.35	97.35	97.8
D	97.05	97.58	97.35	97.8	98.14	97.19

4.6 Trouble Shooting

The following table should help you with some error messages which might occur using the software. If you discover other items, which should be on the list, or if the suggestion “What to do” does not help, please contact our service team.

ERROR	What´s the reason?	What to do?
At installing the software: Error 1931 (a dll file cannot be updated because it is protected by Windows)	Known Windows bug	Click OK (ignore the message); installation will be ok despite this message.
At opening the software: “Power Status checking software does not exist, please contact administrator!”	The file SDR_v4.0.0.exe has been removed from its original place (e. g. by drag & drop).	Copy the file SDR_v4.0.0.exe back to the original position (default: C://PreSens/SDR_v4.0.0).
After software installation and first start of the software the Login window does not appear.		Close the software and restart it. Now the Login window will appear each time the software is started.

ERROR	What´s the reason?	What to do?
At trying to upload a previous measurement: “Err no: - 13, Type mismatch cXML.getNodeValue”	The regional settings are not the same as the ones when the measurement was performed.	Switch back to original regional settings. If you have performed the measurement in regional settings different from English (US) or German accidentally try to upload the measurement with these settings. If it is not possible, please contact us.
At trying to upload a previous measurement, there are no data in the graphs and last values. Different error messages may occur.	The .xml file cannot find the data files (by default stored in a folder with the same name).	1. Check if the internal path was changed manually (often happens at copying measurements from one place to another): The folder and the .xml file must be located in the same folder. 2. Has the measurement been renamed manually? Check this by double-clicking on the .xml file. You find a line with “FileName”, check if it is the same as it is now. If not, rename it manually to the original name. 3. If no start and stop time is shown, the measurement had been created, but not started. No data had been created.
At connecting: “SDR not found”.	The software is searching for the SDR device and cannot find it. This can have several reasons.	Make sure that 1. the SDR is connected to power (left LED on the Splitter should be on). 2. the active COM Port (see lower left corner in the SDR software) is the one connected to the SDR. The middle LED should blink when you press **Connect**. 3. the COM Port with the SUB serial cable is < 15 (if not, please change it according to chapter 4.2). 4. the right LED is not on all the time. If it is, please move the connector a little or disconnect the SDR from the power supply and reconnect. 5. no other program is running. 6. the USB driver has been installed properly (the respective COM Port can be found in the device manager, see 4.2)
“No response from device after power on!”	Occurs after “No SDR found.”	Click on “Close” (cross in upper right corner) and continue.
“No sensor” for last values	The signal amplitude is too low.	Check if the SensorDish® rests in the groove of the SDR.
In the Excel file: error code E1 in the column Error, e. g. E1(C1), E1(C2)	Occurs at too much ambient light. Here, C1 and C2 are the respective channels involved.	1. Make sure no ambient light can get to the SDR. 2. If ambient light is not the reason, ignore it as a “false alarm”. The values are ok.
In case the SDR software has been accidentally opened a second time, the message “Another instance…” keeps reappearing.		Open the task manager. Go to the Processes tab and end ALL tasks associated with SDR (also SDRTRAY.exe). Then restart the software.

5 Technical Data

5.1 Specifications

MODES		
Oxygen	Range Resolution Precision	0 – 50 % O_2 ± 0.4 % O_2 ± 1 % O_2
pH	Range Resolution* Precision*	pH 6.0 – 8.5 ± 0.05 pH ± 0.2 pH (for known ionic strength)

*at pH 7, 37 °C

POWER ADAPTER	
Type	Mascot 9920
Input	100 – 240 V AC, 50 – 60 Hz, max. 0.9 A
Output	24 V DC, 1,6 A / 40 W

SPLITTER	
Type	SP 1.1 or higher
Input	18 – 24 V DC, 1,5 A
Circuit points	Power adapter, RS232 interface, SensorDish® Reader
Baud rate	38,400, 8 data bits, no parity, 1 stop bit, no handshake
Dimensions & Weight	12.4 cm x 8.0 cm x 4.5 cm, 240 g

SensorDish® Reader	
Type	SDR v3 or higher
Input	18 – 24 V DC 150 mA
Baud rate	38,400, 8 data bits, no parity, 1 stop bit, no handshake
Dimensions & Weight	16.3 cm x 8.9 cm x 2.2 cm, 380 g

6 Operational Notes

6.1 Maintenance

The device is maintenance-free.
The housing should be cleaned with a moist cloth only. Never use benzene, acetone, or other organic solvents. Cleaning with ethanol (using a cloth) is possible.

6.2 Service

Alignment, rework or repair work may only be carried out by the manufacturer:

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Please contact our service team in case of any question. We look forward to helping you and are open for any proposition or criticism.

7 CE and FCC Conformity

CE Conformity

The equipment is confirmed to comply with the requirements set out in the Council Directive relating to Electromagnetic Compatibility (2004/108/EEC) and for Low Voltage (2006/95/EEC). For the evaluation of above mentioned Council Directives following standards were consulted:
DIN EN 61326-1: 2006-10
DIN EN 61010-1: 2002-08

Verification of FCC Rules

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

8 Concluding Remarks

Dear Customer,

With this manual, we hope to provide you with an introduction to work with the SDR SensorDish® Reader.

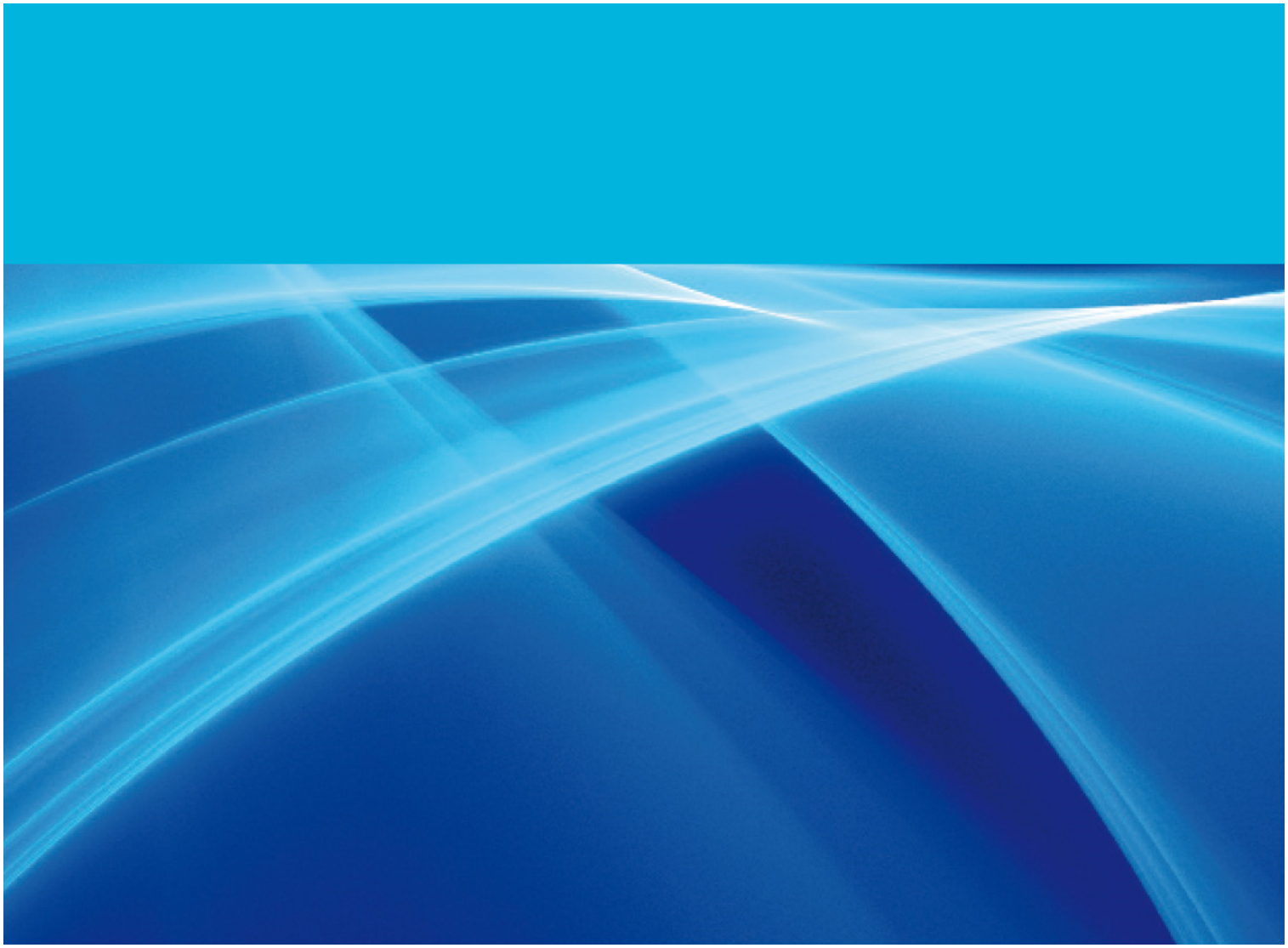
This manual does not claim to be complete. We are endeavored to improve and supplement this version.

We are looking forward to your critical review and to any suggestions you may have.

You can find the latest version at www.PreSens.de.

With best regards,

Your PreSens Team



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