PHYWE

User manual

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The quick start to measureLAB

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Content

1   General information

1.1   Introduction

The software measureLAB assists you and your students with analysing your experiment data: at school with student- and teach experiments and at universities in your lab rotation projects.

In combination with our Cobra4 data logging system you are able to easily record, display and analyse your data: No matter if it's a simple integral or a fully automatic equivalence point calculation.

Equipment and technical data

- Operating system-independent: Windows 7/8.1/10; MacOS from 10.9;
- System requirements: Core 2 Duo 2GHz, 4 GB RAM, screen resolution 1280 x 720 Pixel
- Recommended system requirements: i5 2.4 GHZ, 8 GB RAM, screen resolution 1280 x 720 Pixel
- More than 100 Cobra4 data logging experiments included
- Compatible with all current Cobra4 interfaces: Wireless/USB-Link, Mobile-Link2 and Xpert-Link
- All 29 Cobra4 sensors implemented resulting in more than 50 possible measuring parameters
- Regular free updates with further experiments, features and supported sensors

Accessories

- Cobra4 Xpert-Link (12625-99)
- Cobra4 Wireless/USB-Link incl. USB cable (12601-10)
- Cobra4 Junior-Link (12615-00)
- Cobra4 Mobile-Link 2 incl. accessories: battery, USB cable, charger and SD memory card (12620-10)

- curricuLAB ActivityManager, site licence (14575-62)
- curricuLAB ActivityManagerPHY, single user licence (14576-62)
- curricuLAB measureAPP (14581-61)

How to install measureLAB

The use of the purchased measureLAB software is constricted to the purchaser only. It may only be used for educational purpose.

measureLAB can be installed via execution of the provided installation files (*setup_measurelab_x86.exe*, *setup_measurelab_x64.exe* and *setup_measurelab.pkg*). For installation, follow the instructions that are displayed on the screen.

All available installation documents are accessible under:

https://www.phywe.com/14580-61/.

After installing the software, the registration code must be entered. This will be sent to you by e-mail after the order.

1.2 Getting started

After starting measureLAB, the software will automatically detect all connected sensors. To start a measurement, you have three options (Figure 1):
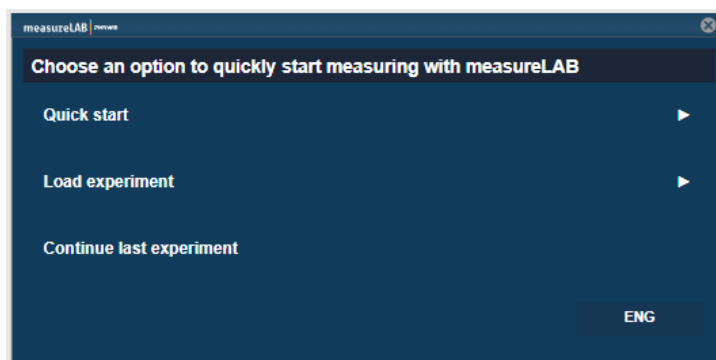

Figure 1: Getting started

1. **Quick start:** After selection of quick start, you can choose to measure only the desired parameters of the connected sensors; or you choose all parameters by clicking on the sensor symbol depicted on the left side.

2. **Load experiment:** With this option, you will be directed to the PHYWE library where you can select the desired experiment. After selection of the experiment click on 'Update', the necessary pre-settings will be automatically downloaded – this might take a few moments. You can also select your own experiments and respective settings under 'My experiments'.

3. **Continue last experiment:** If you want to continue your measurements of a previously conducted experiment with the same settings, you can choose this option.
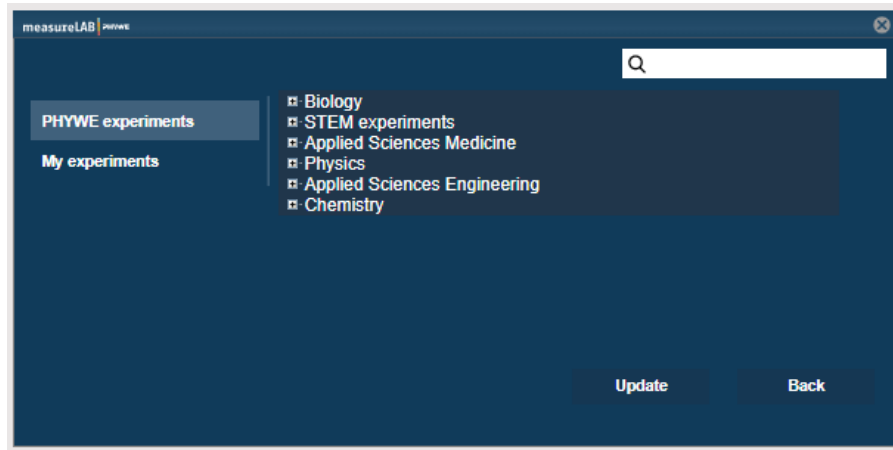
Figure 2: Load experiment

1.3 Basic functions

measureLAB offers a simple, intuitive user interface (Figure 3). On the left-hand side, you will find all connected sensors and the virtual channel option (1).

The top bar entails the following functions:

Home button (2): Brings you back to the main window (Figure 1) to load a new experiment or continue a previous one.

Settings (3): All necessary software settings including language, measurement mode and sensor settings (c.f. chapter 1.4.).

Save experiment (4): Save your experiment after measurements; optionally, you can save your own notes as PDFs alongside your experiments.

Data sharing (5): Share your data with other advices.

Full screen (6): Use measureLAB in full screen.

On the lower bar, you can use:

Record button (7): Start and stop your measurements.

Time scale (8): Observe the duration of your experiments.

Values (9): Depicts the amount of measurement values.

Rate (10): Sampling rate

Trigger option (11): Depicts whether a trigger is active or inactive.

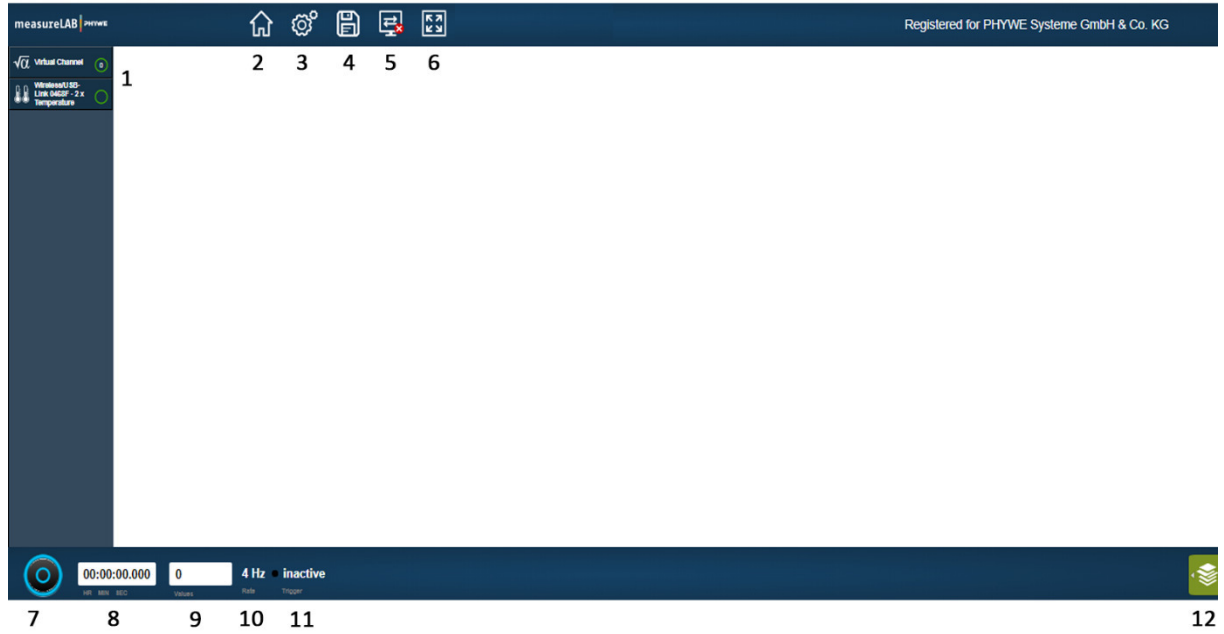**Data Pool (12):** Entails all measurement files.

Figure 3: Explanation of basic functions in measureLAB

1.4 Settings

General

In the general settings, you can choose between display languages, change your data sharing user name and choose whether you would like to display hints or not (Figure 4).
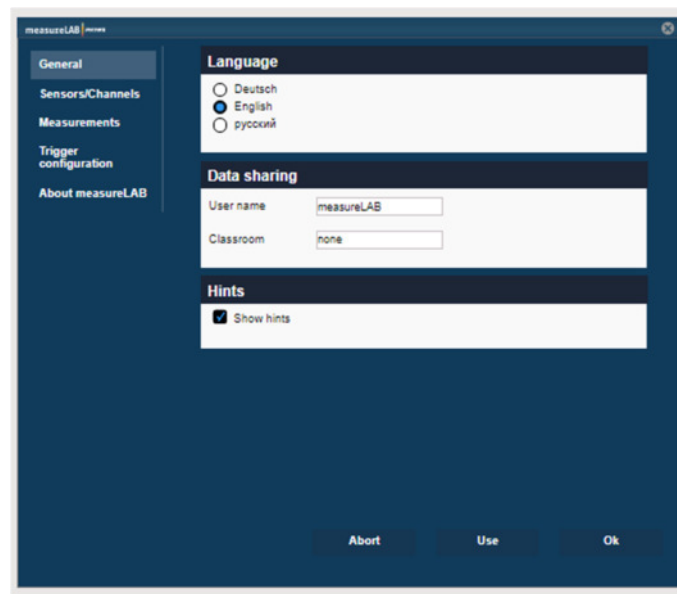

Figure 4: measureLAB Settings - General

Sensors / Channels

In the top right, you can choose the respective connected sensors or virtual channels and change the individual settings of each sensor. In Figure 5, the possible settings of the Energy sensor are displayed.
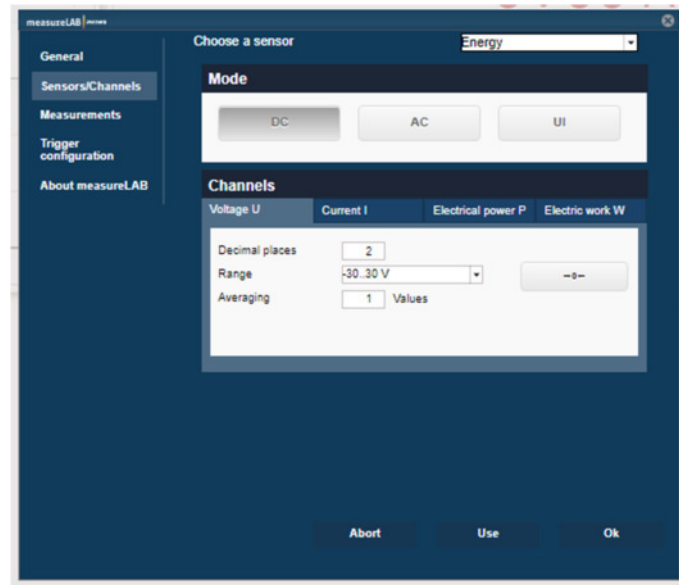

Figure 5: measureLAB Settings - Sensors/Channels

Measurements

Under measurements, you can set the sampling rate of your experiment and measurement mode - continual or single measurements (Figure 6).
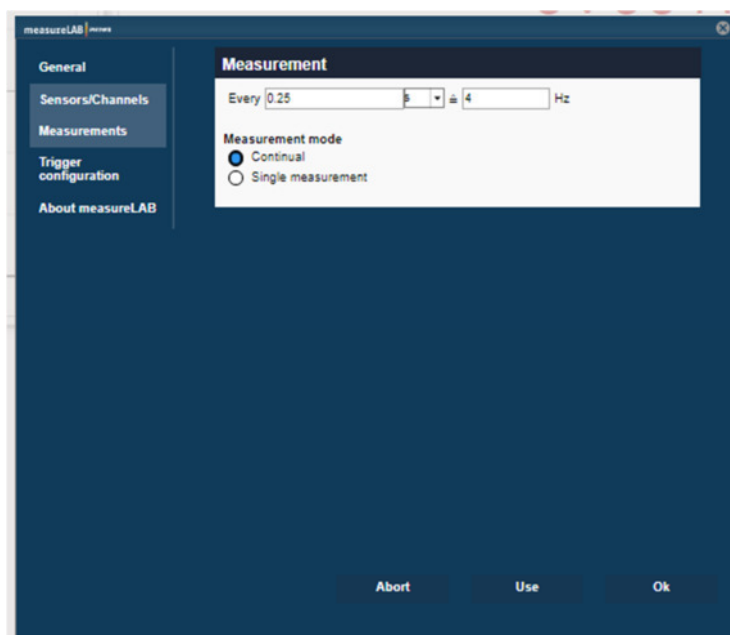

Figure 6: measureLAB Settings - Measurements

Trigger configuration

If you desire that your measurement is recorded with triggers for both start and termination of the measurement, you can select the following trigger options (Figure 7):

Start trigger

After selection of the respective sensor (Channel), you can set a threshold and determine whether the trigger should detect falling or rising values (Flank). Additionally, you can determine a pretrigger that allows the measurement start after a certain amount of time or values.

Stop trigger

You can choose to stop your measurements after a certain amount of time (Stop after option) or after detection of certain measurement values (Channel option). In the latter, you can select a threshold and respective flank (rising or falling values). You can also determine the amount of ignored flanks until termination of the measurement.
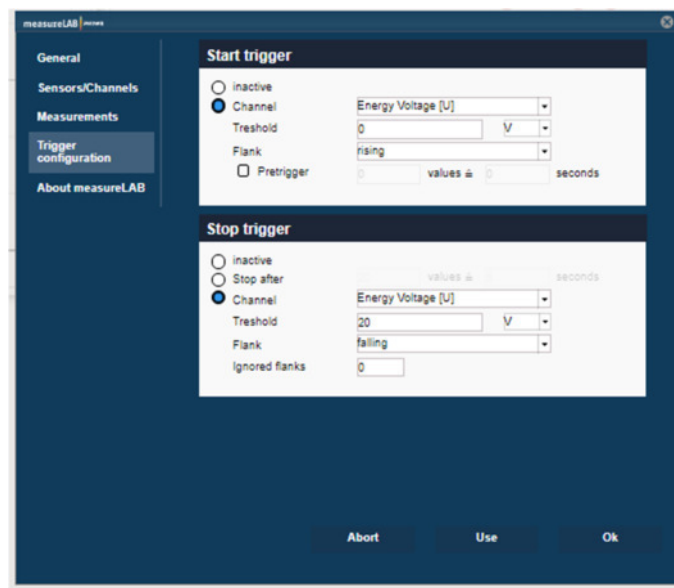

Figure 7: measureLAB Settings - Trigger configuration

About measureLAB

You can find all information about your measureLAB version and license (Figure 8).
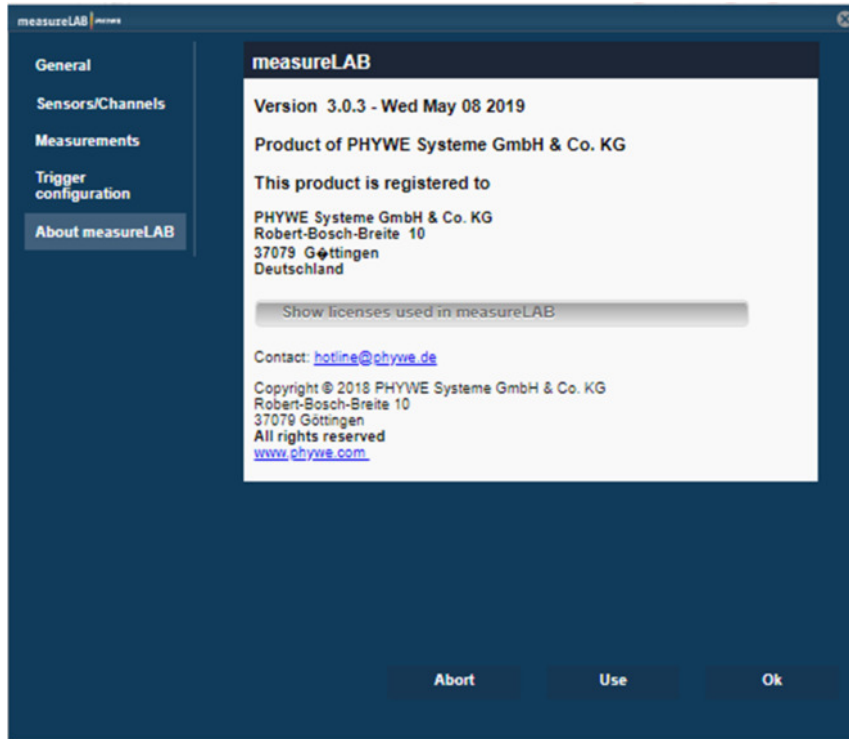

Figure 8: measureLAB Settings - About measureLAB

2   Data acquisition and analysis

2.1   First measurements

2.1.1   Sensor channel options

On the left-hand side of the main window (Figure 9), you will find the connected sensors and the virtual channel. By clicking on the individual sensor, a second window displaying the sensor's parameters. You can choose a single parameter or multiple parameters, once the parameter is highlighted in light grey, you can choose to display the parameters as an analogue display (1), a digital display (2), a diagram (3) or a table (4). For suitable sensors, you can also display an oscilloscope diagram (5).
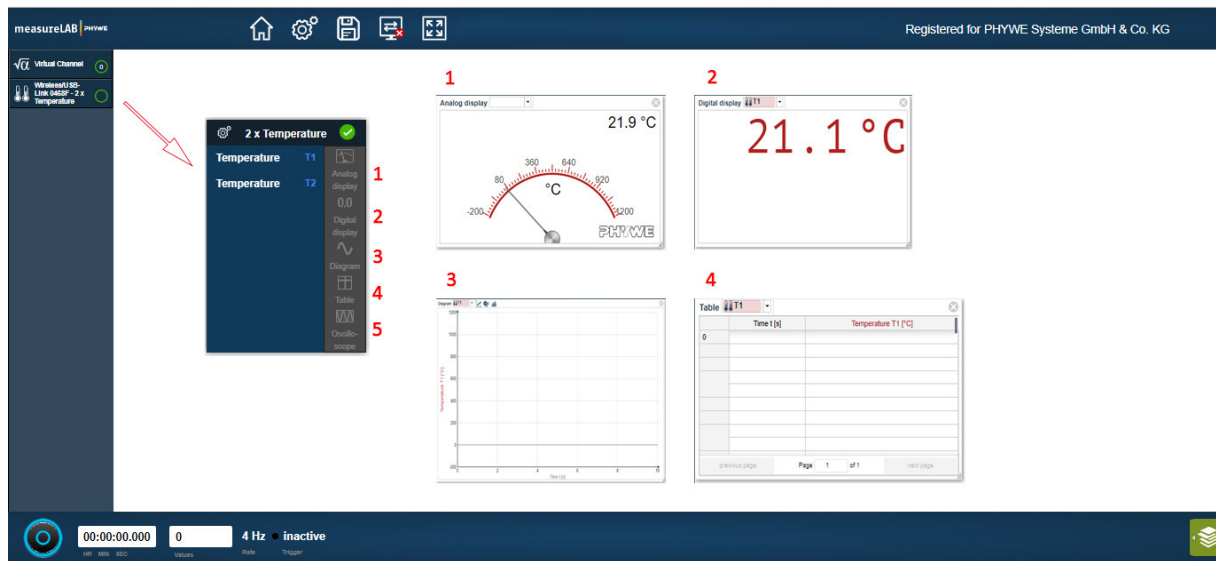

Figure 9: First measurements - Channel options

2.1.2   Recording options – continual or single measurements

Depending on the individual experiment, you might need to record your measurement continually or as single values. In settings (c.f. chapter 1.4, Figure 6), you can select the measurement mode. By choosing single measurement, a second button will appear next to the record button. To start a series of single measurements (Figure 10), click on the record button (1). An individual measurement value is recorded by clicking on the single measurement button (2).
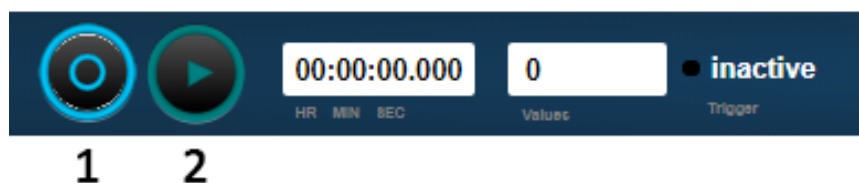

Figure 10: Single measurements

2.2 Advanced measurements

2.2.1 Virtual channels

For live measurement of converted channels (e.g. the reciprocal value of the temperature), you can use the option 'virtual channels' (Figure 2). Click on 'virtual channels' on the left-hand side and add a new virtual channel by clicking on the plus symbol. In the virtual channel settings, you can designate expected maximum/minimum, unit, colour, symbol and a name for your virtual channel. Under devices, you will find all connected sensors/parameters and under functions you will find all available functions to convert your channel recordings (Figure 11). Similar to sensor channels, you can select your created virtual channel and display it as analogue or digital display, diagram or table (Figure 9).
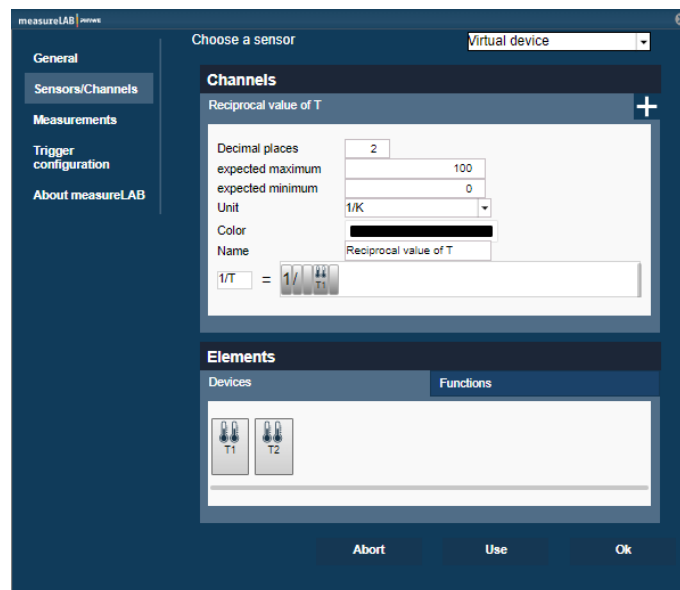

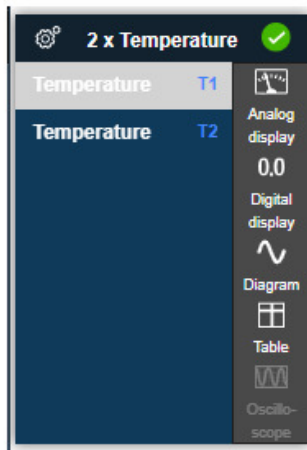Figure 11: Virtual channels

2.2.2 Tables

Live recording with tables

To record measurements in tables, go to the respective connected sensor, select the desired parameters that are highlighted in light grey after selection and choose the option 'Table' (Figure 12). The table will display index values, time stamp (sampling rate) and the measured values), in case you have a large amount of data you can flip through pages on the right bottom site (Figure 12).
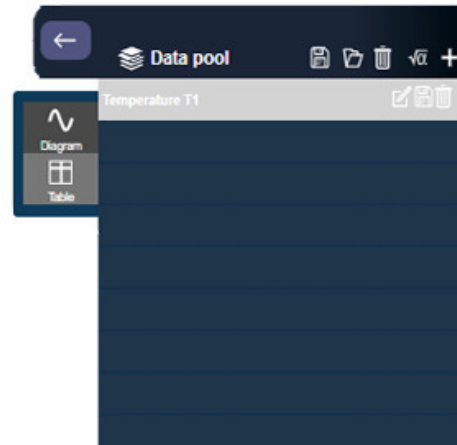
After measurement

After completion of an individual measurement, the measurement files will be displayed in the data pool (left-hand side, green symbol, c.f. Figure 3). You can choose to display multiple data sets or a single data file in a table (Figure 12) or as diagram (c.f. 2.2.3 Diagrams, Figure 14).

Figure 12: Tables in measureLAB

Create, edit and display your own measurements

In addition to the functionality of recording measurements and displaying them in tables, it is also possible to enter your own measurement files. The self-defined values can then be displayed in a diagram (Figure 13). Open the measurement data pool (1), click on the + (2) and then define the unit, the file name and the formula symbol (3). A click on Ok confirms the entry and opens a table for entering the measurement data. After entering and confirming the first value by pressing the Enter key (4), a new line is created in the table. If one selects a line between the first and the last line, two buttons (5) appear which allow the selective addition and removal of intermediate values.
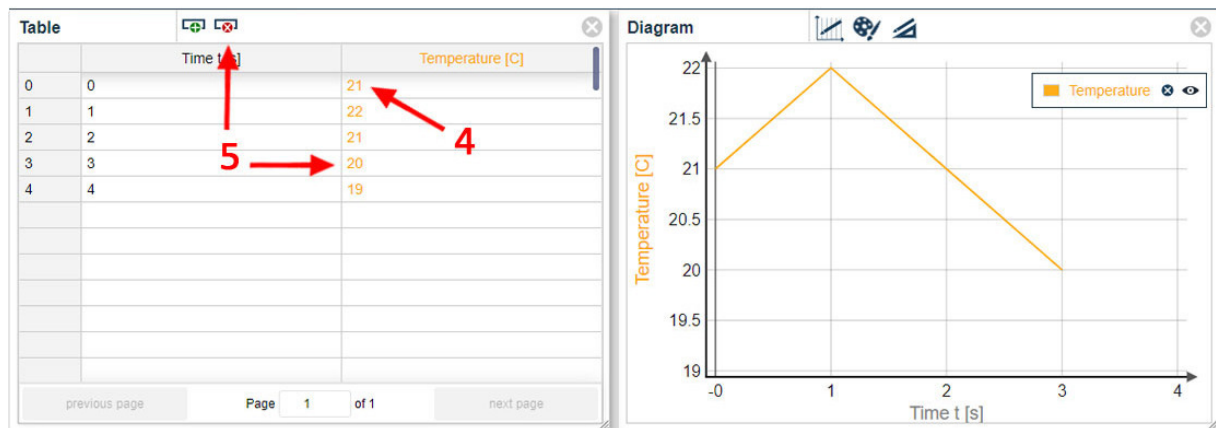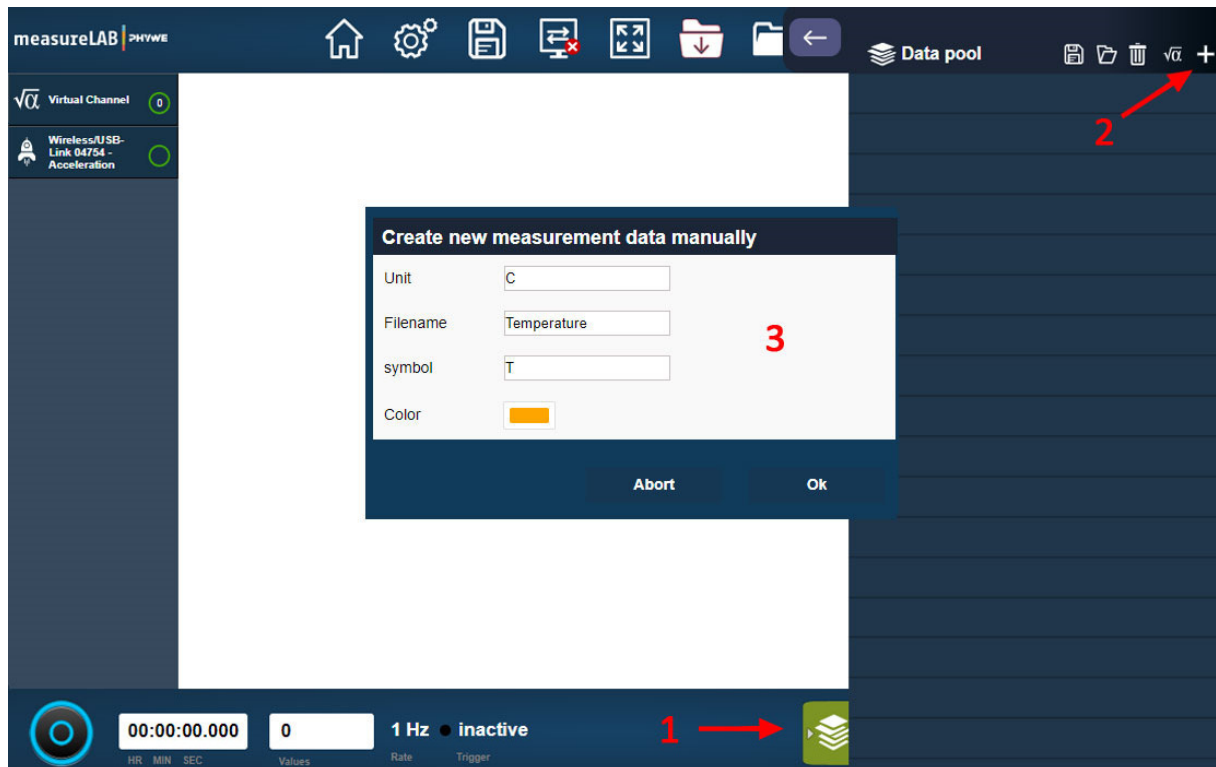
Figure 13: Working with your own measurement tables in measureLAB

2.2.3 Diagrams

Axis settings

To visualise your measurements, you can use the diagram options. Simply go to your connected sensor and select desired parameter or parameters (highlighted in light grey) and select the option 'Diagram'. After generation of a diagram, you can also add other parameters or virtual channels to the diagram by dragging and dropping into the diagram. Under **axis settings** (Figure 12), you can assign a parameter as y-axis or x-axis to display for example temperature against conductivity. To change the diagram display of the individual axes to either linear or logarithmic scale, click on the black symbol next to the X- or Y-symbol (Figure 14).
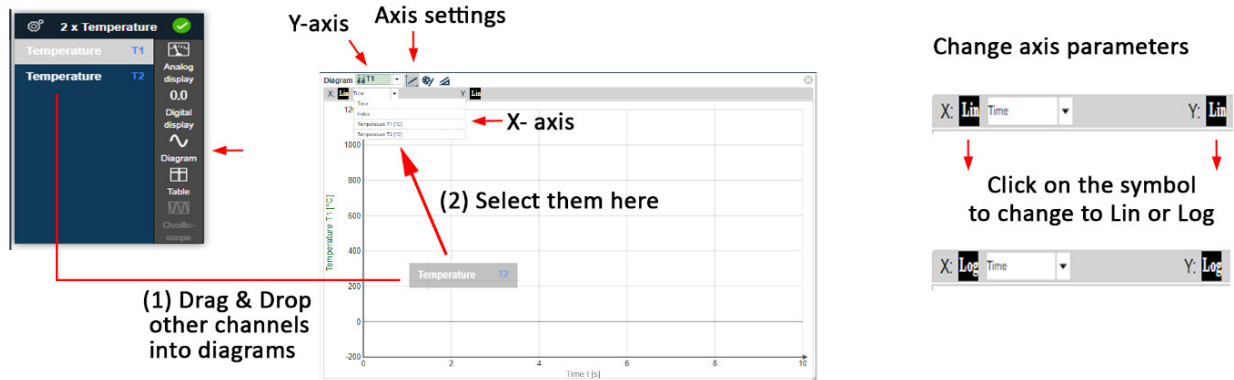
Figure 14: Diagrams in measureLAB - Axis settings

Curve settings

To change the appearance of your data in the diagram, you can go to 'Curve Settings' (Figure 15). You have the option to change the colour, the linewidth and symbols (lines or points).
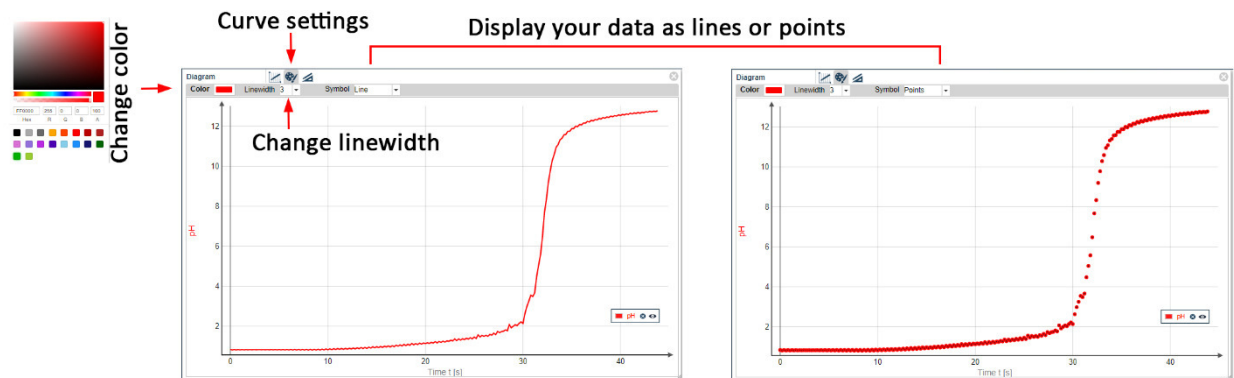

Figure 15: Diagrams in measureLAB - Curve settings
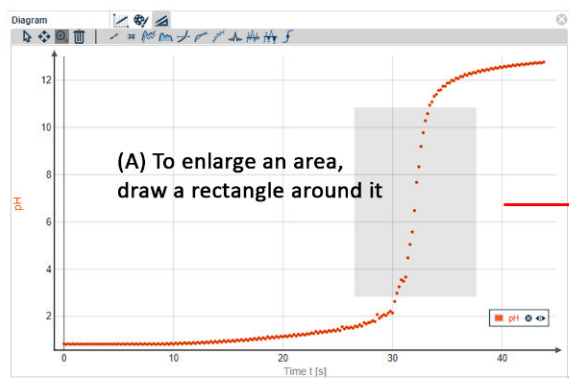
Basic tools

After measurement, you can view and analyse your data by selecting the 'Tools and Analysis' symbol. As basic functions (Figure 16), you can move within the diagram with the mouse pointer (1), fit your data to an optimal display (2), enlarge (zoom) certain areas (3) or delete the measurement from diagram (4). The latter is useful if you display more data sets in one diagram.
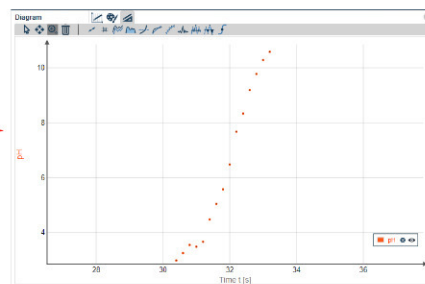
Basic tools
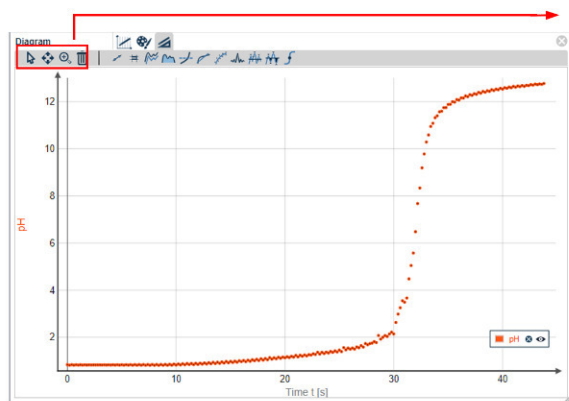
How to use the zoom tool

Figure 16: Diagrams in measureLAB - Basic tools

2.3 After measurement – data pool, saving options and data sharing

Saving options

Upon completion of your experiment, you can save the experiment and corresponding settings by using the save button in the top bar (c.f. Figure 3). You can name your experiment and attach a PDF file with your lab notes to it (Figure 17).
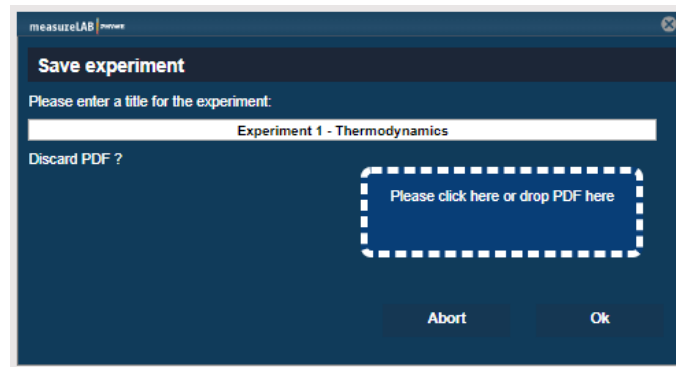
Figure 17: Save experiment

Data sharing

You can share your data with other devices and people by using the data sharing button in the top bar (Figure 3). Activate data sharing by ticking the respective box and choose whether you want to automatically accept incoming data or not in the same manner (Figure 18). You can send your data quick and easy using the symbol ⬆ in diagrams, tables or the data pool. Make sure to check your firewall settings to prevent unintentional blocking of the software.
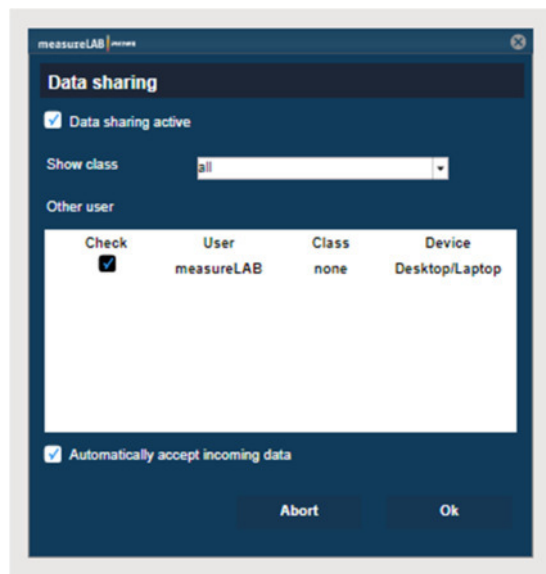

Figure 18: Data sharing

Data pool – Export and import of experiment data

After performing your experiments, you can view all measurement files by clicking on the Data Pool symbol on the bottom right-hand side (c.f. Figure 3).

In the data pool (Figure 19), you have the options to send your data to other devices (1), to export selected data sets (2) or individual data (8) as CVS files. To import data files, you can use the import button (3) or simply drag and drop your files into the data pool.

You can also delete data sets (4) or individual files (9) or rename them (7).

Create your own measurement files

Next to recorded measurement data, you might want to create your own measurement files (e.g. to plot the concentration of different solutions against their pH). To do so, click on the plus symbol (6) in the top bar of the data pool. After designating the respective unit, name, symbol and colour of your measurement file (Figure 20), you can enter the respective values in a table. The created table will appear below your measurement files in the data pool.

Channel conversion

You can also convert your measurement files using the 'channel conversion' symbol (5) in the top bar of the data pool. Drag your to be converted measurement files into the channel conversion window (Figure 21) and use the functions to convert your values.
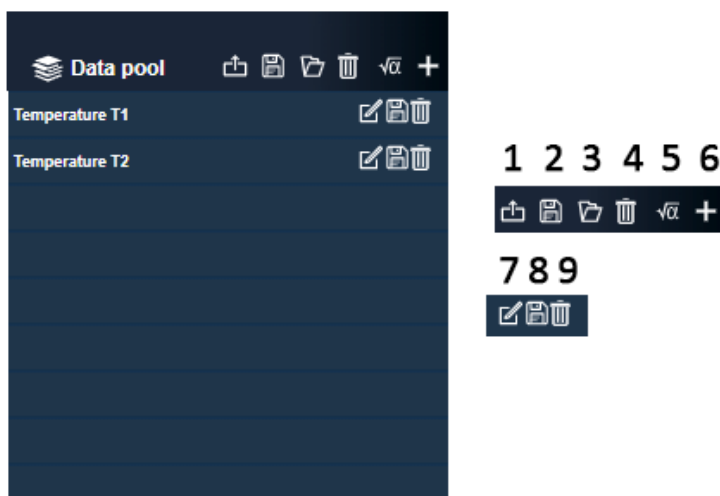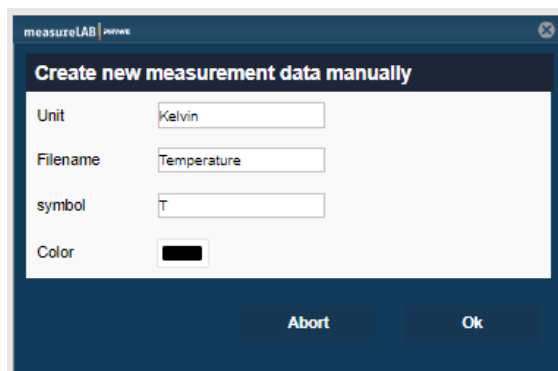

Figure 19: Data pool

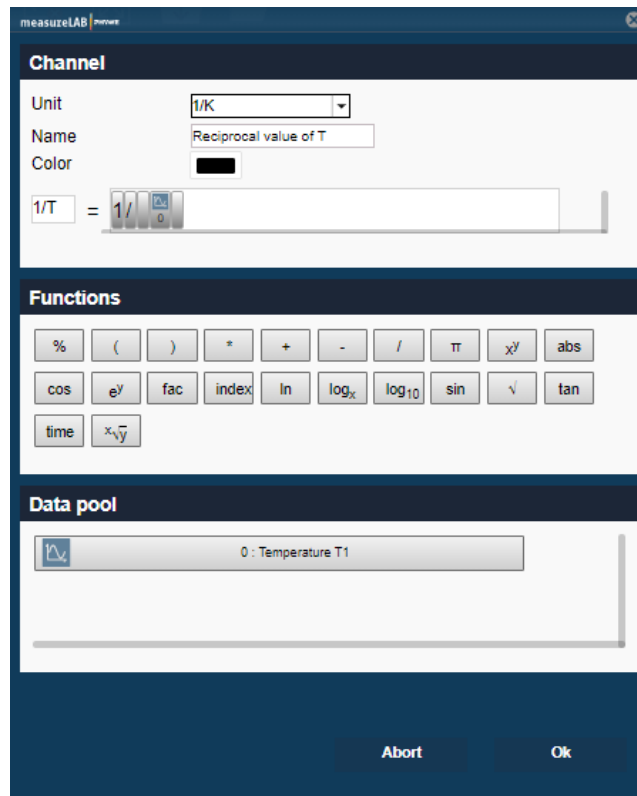*Figure 20: Create your own measurement files*

Figure 21: Channel conversion

2.4 Data analysis tools

2.4.1 Regression line

To draw a regression line, you can go to "Data tools and analysis" in the diagram and select an upper and range. Simply use the appearing measurement cross to assign a lower and upper range of your data. A second window will be displayed next to the diagram, indicating the concrete range values and the linear equation (Figure 22).
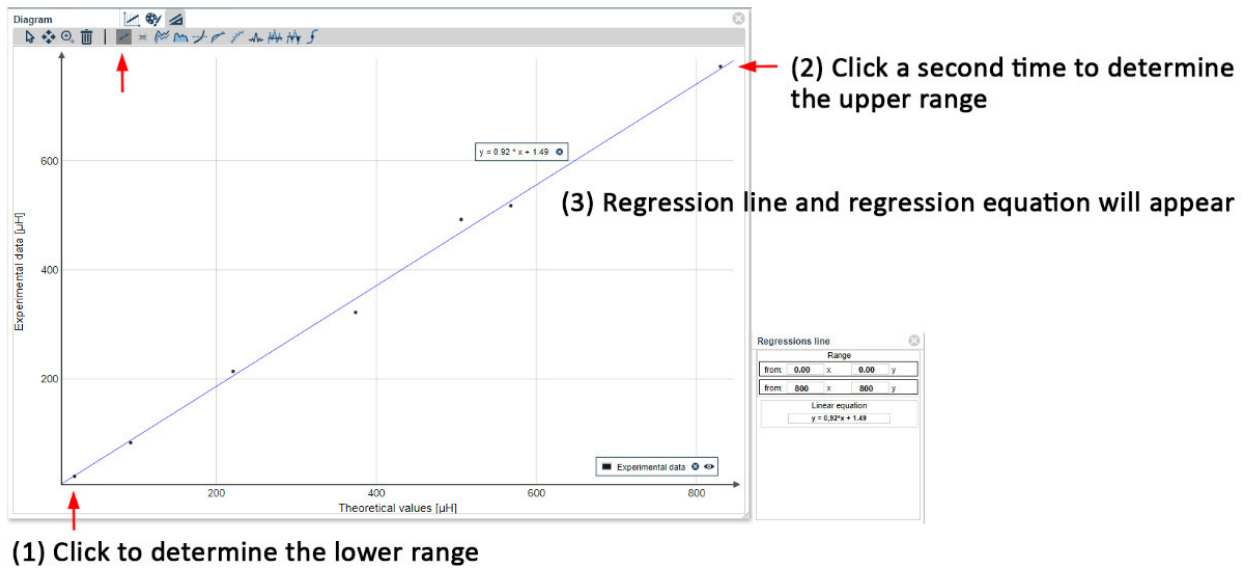
Regression line tool

Figure 22: Data analysis tools - Regression line

2.4.2 Measure

The measure tool can be, for instance, used to determine the extent of increase or decrease of your measurement values or time duration. To do so, go to 'Data analysis and tools' and select the 'Measure' tool. Draw a blue rectangle around your designated measurement values and display all necessary values in the measurement window next to the diagram (Figure 23).
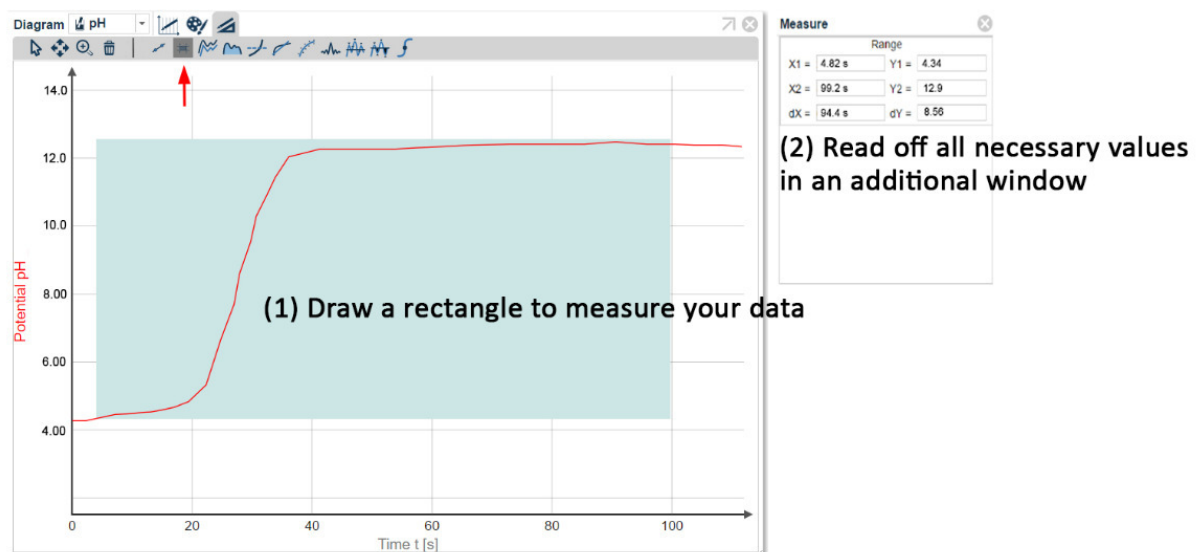
Measure

Figure 23: Data analysis tools – Measure

2.4.3 Smooth

To smooth your measured data, go to 'Data analysis and tools' and select 'Smooth'. This will generate a new window next to the diagram; first select your measurement file (highlighted in grey) and determine a suitable smoothing factor. To display the smoothed data, you can either select to make a new diagram or display it in the already existing data (Figure 24).
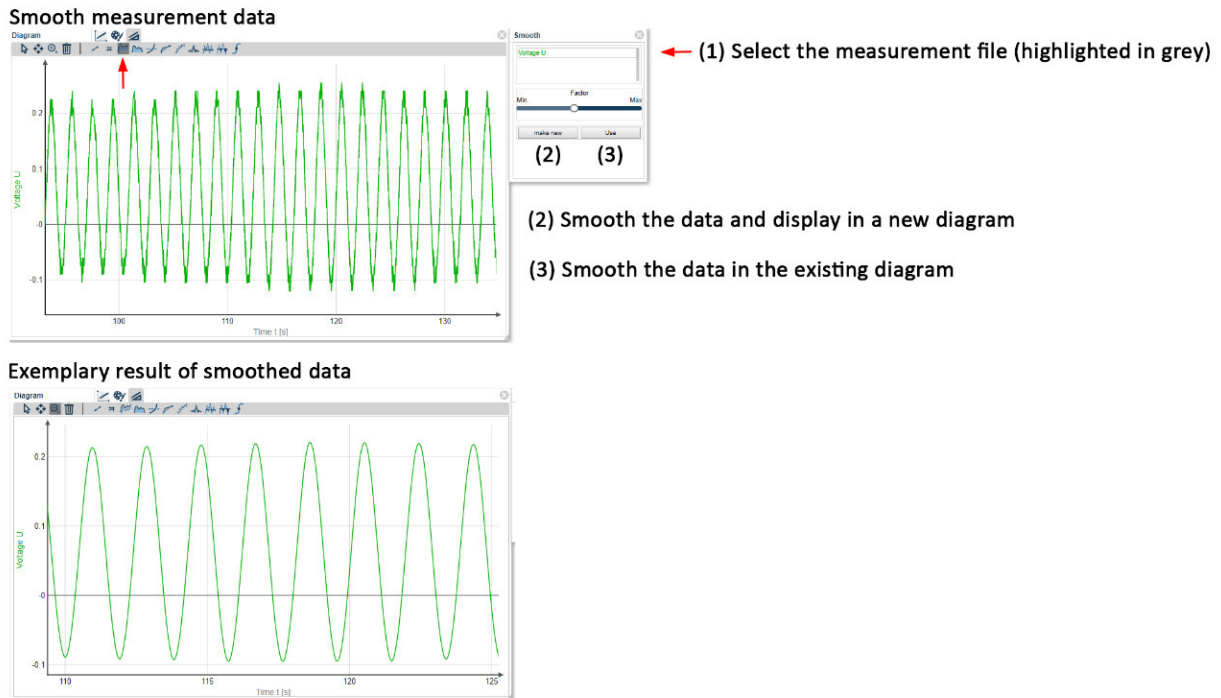

Figure 24: Data analysis tools – Smooth data

2.4.4 Integral

To determine an integral of your measured values, you can go to "Data analysis and tools" and select "Integrate". Designate a left (yellow bar) and right (green bar) range and select the desired measurement file in the 'Integrate' window next to the diagram. The calculated integral will be displayed here (Figure 25).

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Integrate measured data

(2) Select measurement file (highlighted in grey)

(3) Calculated integral will be displayed here

(1) Designate the range of the integral
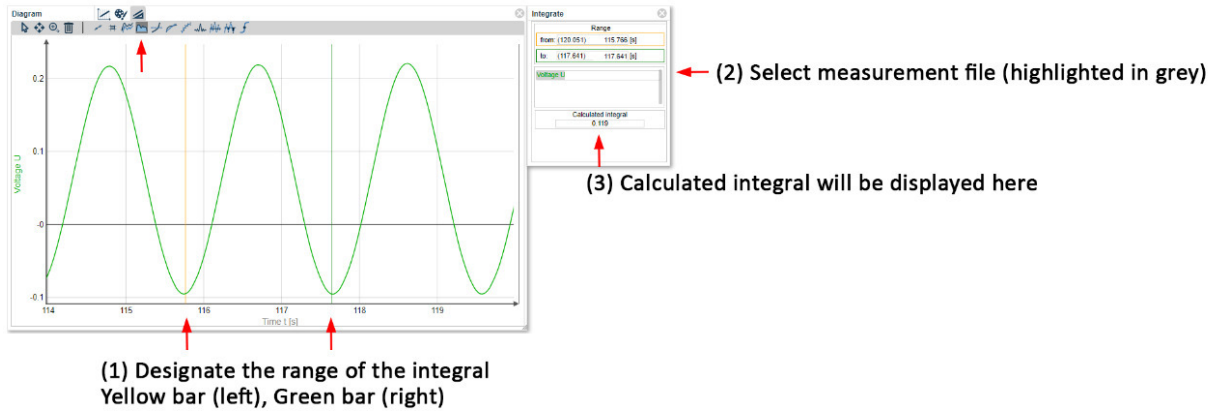Yellow bar (left), Green bar (right)

Figure 25: Data analysis tools – Integrate

2.4.5 Average

To determine an average of your measured values, you can go to 'Data analysis and tools' and select 'Average'. Designate a left (yellow bar) and right (green bar) range and select the desired measurement file in the 'Average' window next to the diagram. The calculated average will be displayed here (Figure 26).
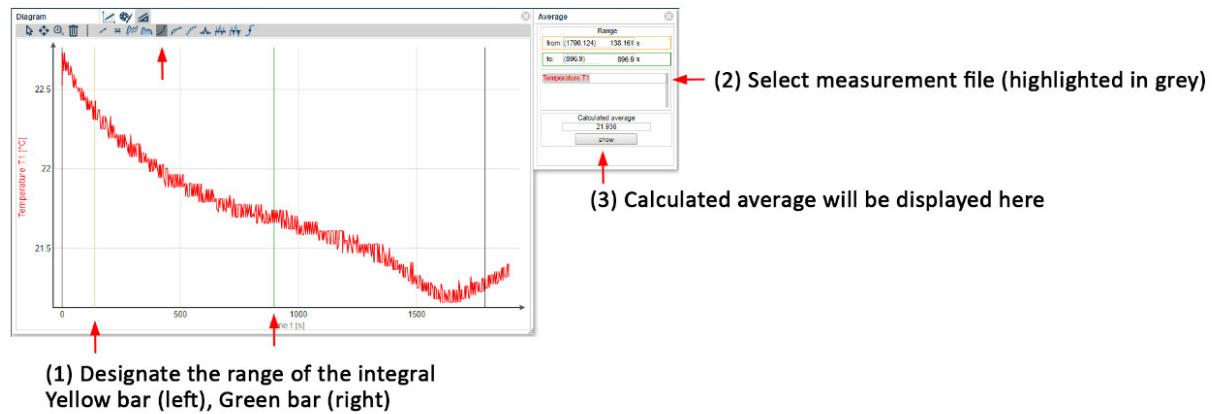
Calculate an average

(2) Select measurement file (highlighted in grey)

(3) Calculated average will be displayed here

(1) Designate the range of the integral
Yellow bar (left), Green bar (right)

Figure 26: Data analysis tools – Average

2.4.6   Average slope

To determine an average slope of your measured values, you can go to 'Data analysis and tools' and select 'Average slope'. Designate a left (yellow bar) and right (green bar) range and select the desired measurement file in the 'Average slope' window next to the diagram. The calculated average slope will be displayed here (Figure 27).
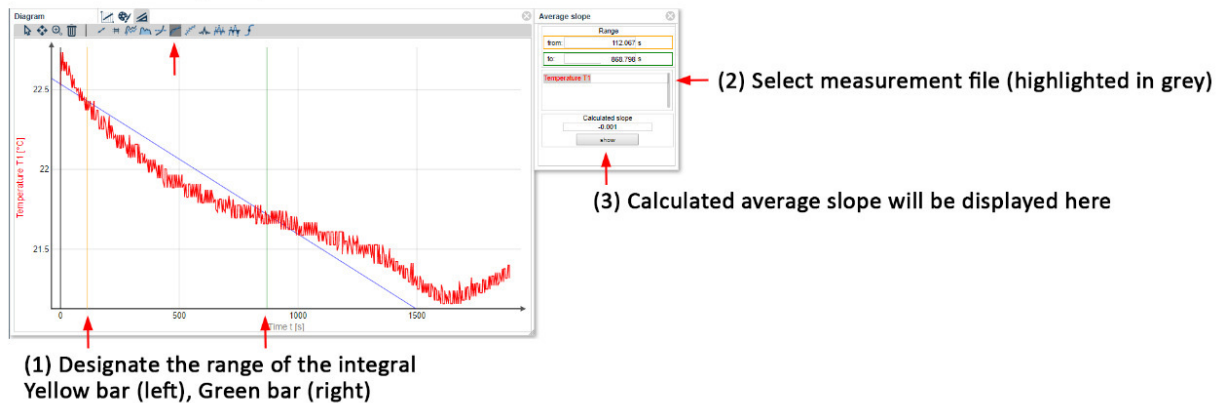

Figure 27: Data analysis tools - Average slope

2.4.7   Curve fitting

To generate curve fitting of measured values, go to 'Data analysis and tools' and select 'Curve fitting'. Next to the diagram, a 'Curve fitting' window will appear in which you can determine a curve fitting equation (1). After selection of respective measurement data (2), the curve fitted data will appear in the diagram (3) and the respective curve fitting parameters (4) are displayed in the 'Curve fitting' window (Figure 28).
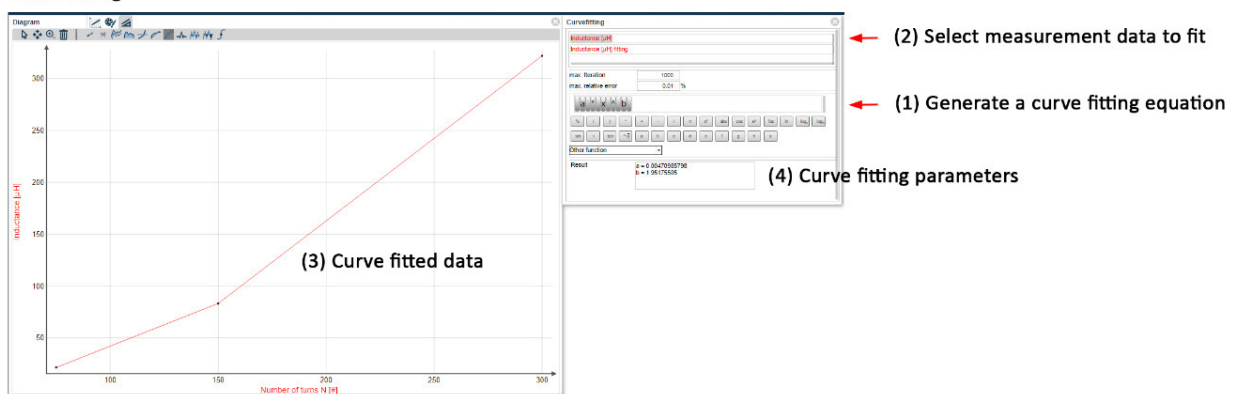

Figure 28: Data analysis tools - Curve fitting

2.4.8 Fourier transformation

To perform a Fourier transformation on measurement data, go to 'Data analysis and tools' and select 'Fourier transformation' (Figure 29). First, designate the respective ranges (left and right) and determine an appropriate offset (in exemplary shown in Figure 29 the offset is 1.80). Then, select a measurement file (highlighted in grey) by clicking on it. A new window with a generated Fourier transformation of your data will appear. You can apply peak analysis (chapter 2.4.9) to determine the main frequency.
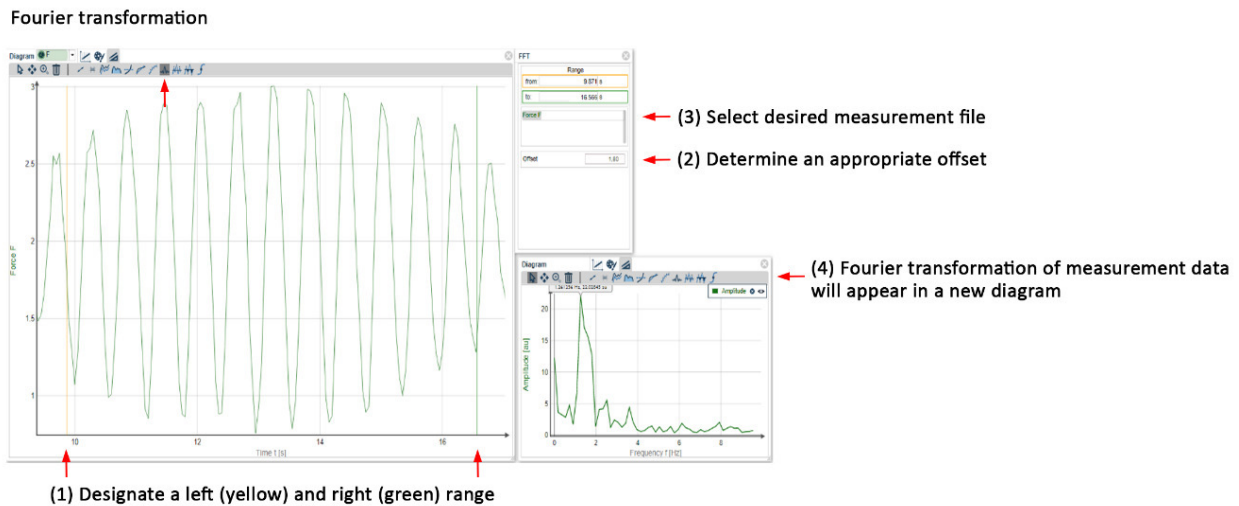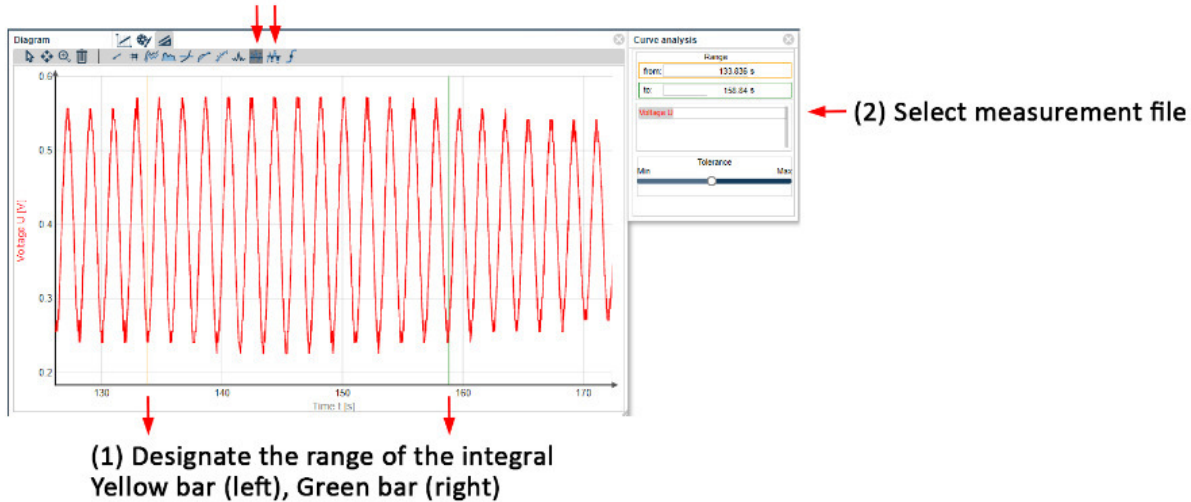

Figure 29: Data analysis tool - Fourier Transformation

2.4.9 Curve and peak analysis

You can perform curve and peak analysis of measurement data. In curve analysis, you may display the extrema and roots of a curve, whereas peak analysis will display x- and y-coordinated of curve peaks. Go to 'Data analysis tool' and select 'curve' or 'peak' analysis. Designate a measurement range with left (yellow) and right (green) bars and select your measurement file in the 'Curve or peak analysis' window next to the diagram (Figure 30). The respective analysis results (peak or curve analysis) will be displayed in a new window, you can additionally choose to show the results in the diagram.
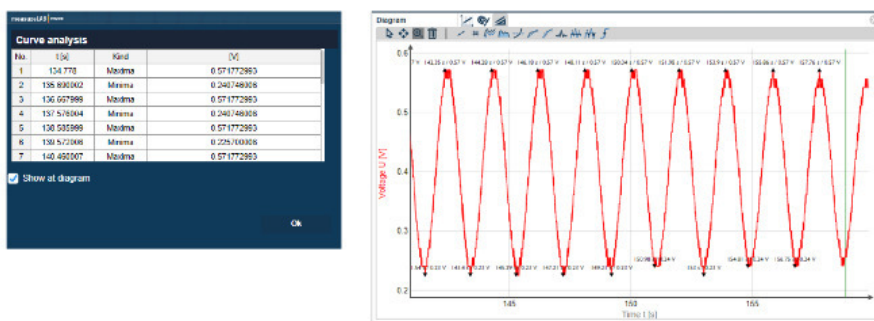
Figure 30: Data analysis tool - Curve and peak analysis

2.4.10 Point of equivalence

To determine an equivalence point of a titration curve, go to "Data pool analysis" and select "Equivalence point". Designate an appropriate range by left (yellow) and right (green) bars and choose to display either 1 or 2 equivalent points depending on the titration. Lastly, select the measurement file and press show to display the equivalence point and pk_a values in the diagram (Figure 31Figure 31: Data analysis tool - Equivalence point).

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Equivalence point determination

(3) Select measurement file

(2) Choose between 1 or 2 equivalence points

(4) Press show to display in diagram

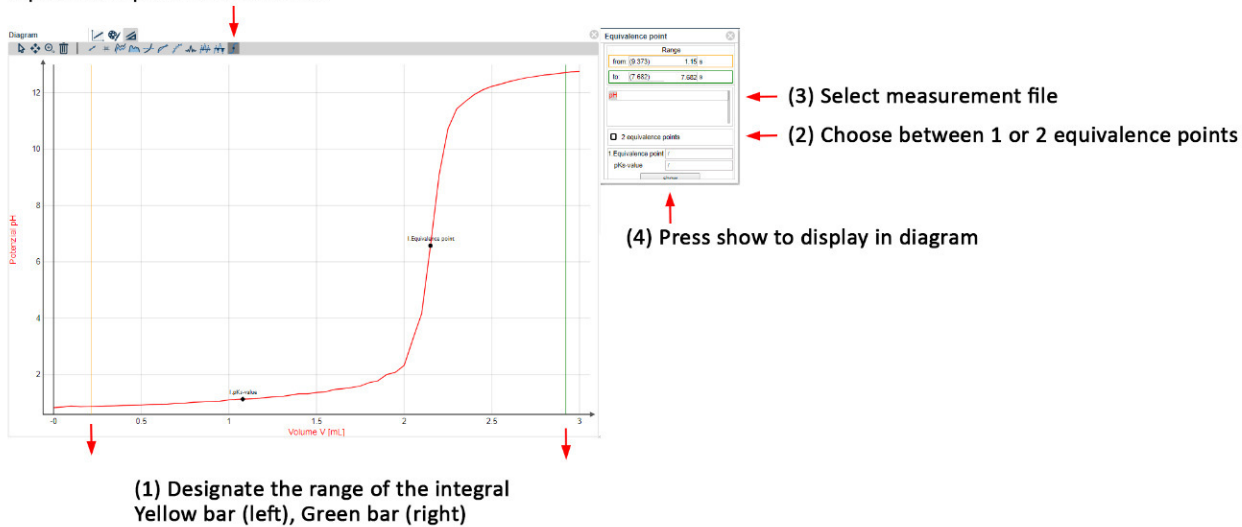(1) Designate the range of the integral
Yellow bar (left), Green bar (right)

Figure 31: Data analysis tool - Equivalence point