PHYWE

User manual

measureAPP

The quick start to measureAPP

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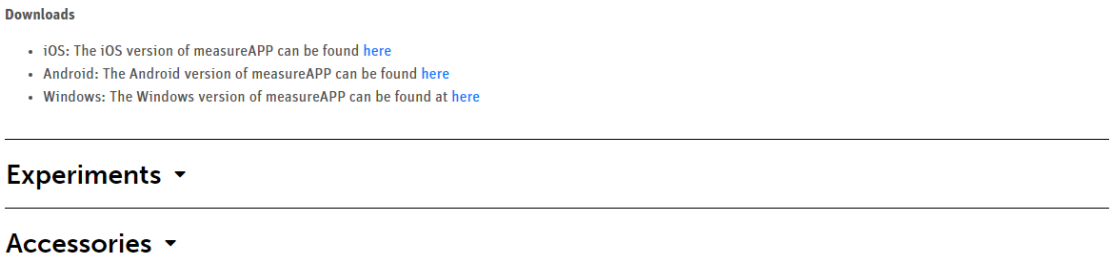
1 Purpose and properties

The PHYWE measureAPP is the data acquisition software for all Cobra SMARTsense sensors. The measureAPP can be used to connect the Cobra SMARTsense sensors to the respective end device via Bluetooth. All Cobra SMARTsense sensors with USB-C connection can also be connected to the end device using the USB-A/USB-C cable supplied. The measureAPP software is available for Android, iOS and Microsoft end devices, such as smartphones, tablets, laptops and PCs.
The PHYWE measureAPP is a measured value acquisition software that can be used to record the measured values of the Cobra SMARTsense sensors. The measurement data can also be edited and saved. The PHYWE measureAPP can be used to send measurement data via all communication interfaces of the end device.

2 Installing the measureAPP software

The PHYWE measureAPP can be downloaded for Android systems via the Google Play Store (https://play.google.com), for iOS via the Apple App Store (https://www.apple.com/de/app-store) and for Microsoft directly via the PHYWE web shop (https://www.phywe.de/sensoren-software/mess-software-apps/measureapp-die-kostenlose-mess-software-fuer-alle-endgeraete_2274_3205/). In the PHYWE web shop, please scroll down to the following paragraph, where you will find the download option.



Alternatively, the PHYWE measureAPP can also be downloaded using the following QR codes:

Android	iOS	Windows

3 Bluetooth and location permissions

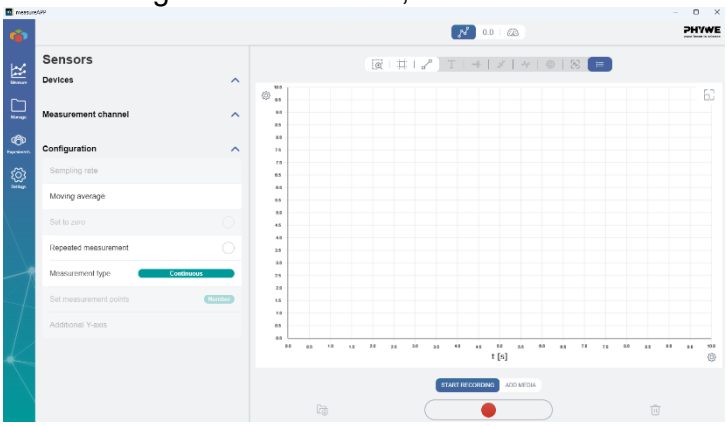
To connect the Cobra SMARTsense sensors to the PHYWE measureAPP, Bluetooth and location detection must be switched on. For Android systems, location permissions must also be activated in the settings/apps/measureAPP/permissions.

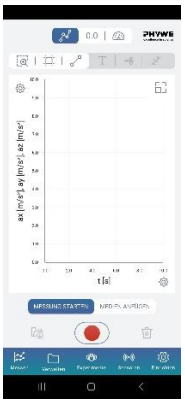
If Bluetooth and/or location permissions is switched on while the measureAPP is open, it must be closed and reopened. The changed settings are then accepted.

4 Operation and function

4.1 General information

After starting the measureAPP, the start screen looks as follows.





On the left is the start screen on the tablet and PC, on the right on the smartphone.

In the smartphone version of measureAPP, the "Measure" and "Sensors" items (blue menu bar) are displayed separately. This is due to the smaller screen size. This makes it possible to work clearly even with a small screen. The functions are the same for the smartphone, tablet, and PC versions.

4.2 Menu item Measure

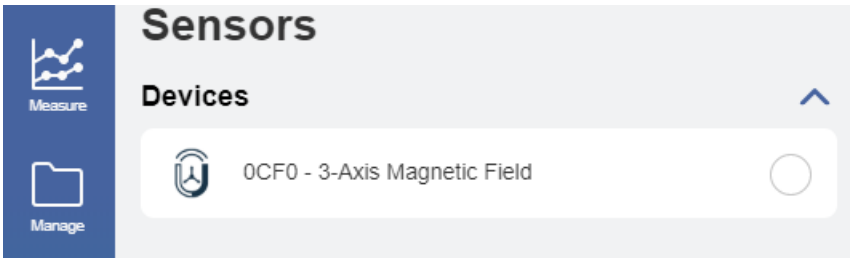
In the "Measure" menu item (blue side menu, top item), the available sensors, the associated measuring channels and the respective configuration options are listed on the left-hand side of the screen. The measured values are displayed on the right-hand side of the screen. There are also tools for editing the measured values and customising the display.

All settings made on the left-hand side of the screen must be set before starting a measurement and cannot be changed afterwards for the respective measurement. For example, the sampling frequency cannot be changed retrospectively.

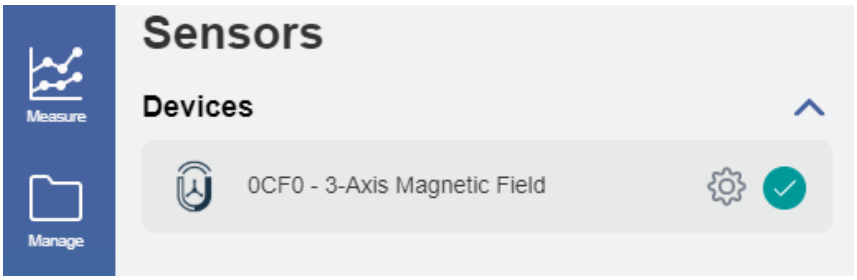
Changes to the diagram display, such as adding another Cobra SMARTsense sensor, renaming the measuring point number, adding an additional Y-axis, etc., are only displayed if there is no measurement data in the measured value diagram. If measurement data is available, it must be deleted for the change to be displayed. This prevents measurement data from being accidentally deleted.

4.2.1 Sensors

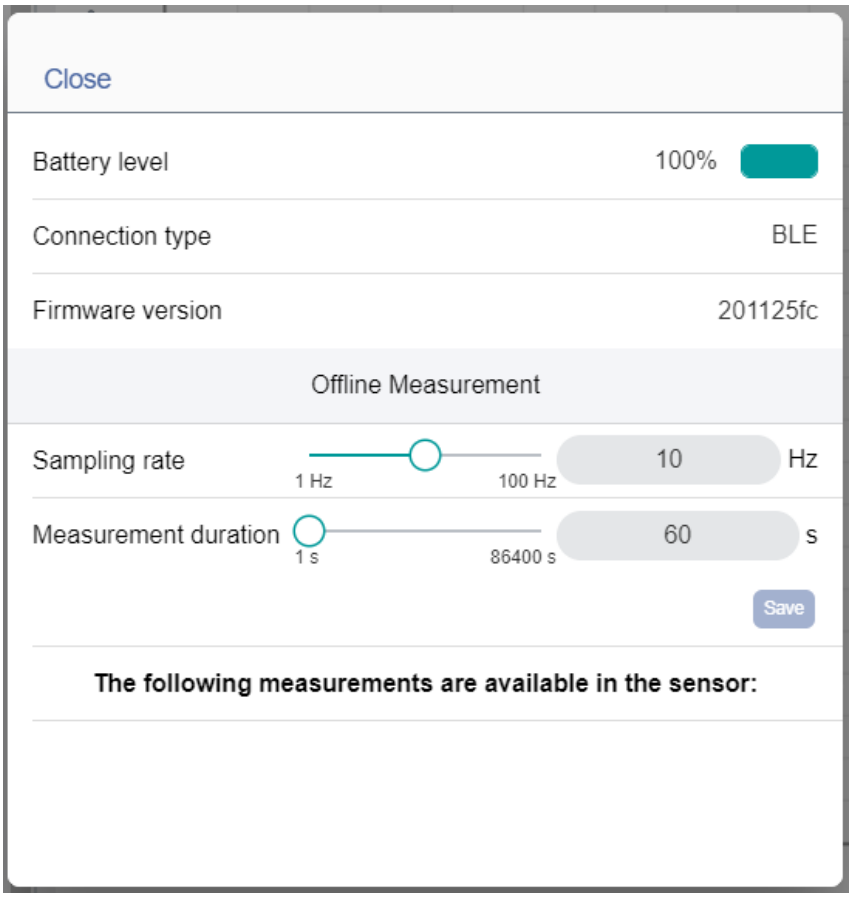
All Cobra SMARTsense sensors that are available for connection are listed here. These are listed with a four-digit identification code and sensor name. The round white button on the right indicates that the sensor is ready for connection.



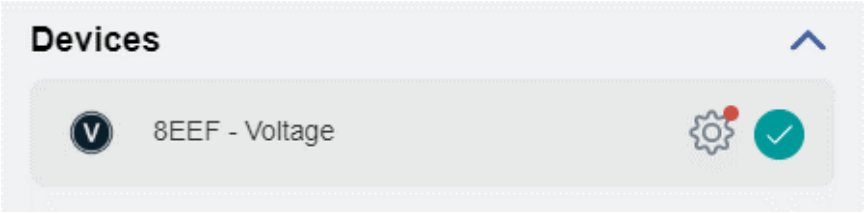
If the sensor is successfully connected, the button on the right is displayed in green with a white tick in it.



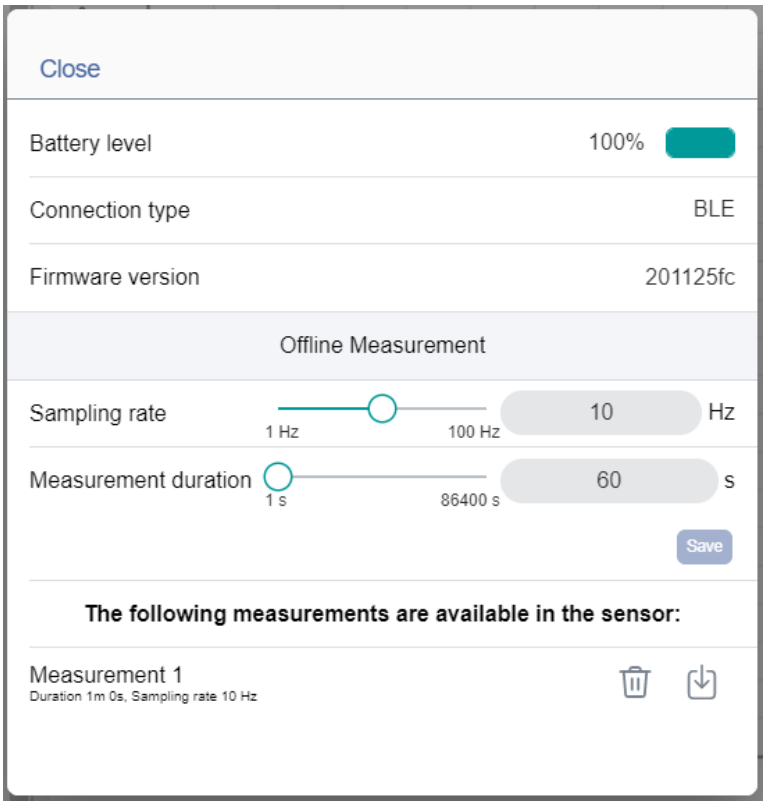
There is a cogwheel next to the button for connecting the sensors. Information about the sensor (battery charge status, connection type and firmware version) and the options for setting the offline measurements (sampling frequency, measurement duration) are stored here.



If measurement data from an offline measurement is stored on a Cobra SMARTsense sensor, the cogwheel next to the sensor name is marked with a red dot.



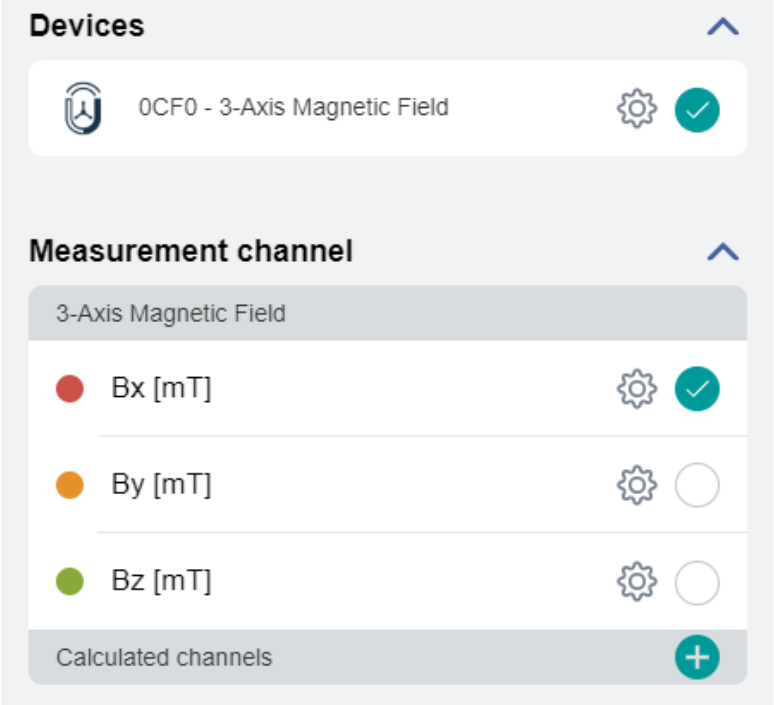
Click on the cogwheel to open the menu and the data available for download to measureAPP is listed in the lower area.



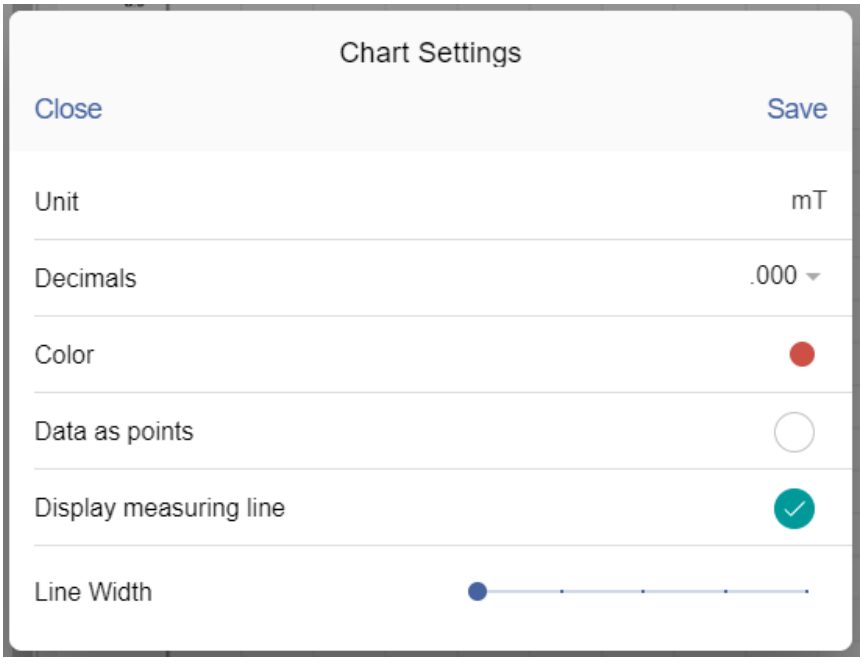
Click on the download icon to save the measurement data from the offline measurement in the measureAPP. Clicking on the trash symbol deletes the measurement from the sensor.

4.2.2 Measuring channel

The measurement channels associated with the sensors are listed here and can be selected or deselected for the measurements. A sensor can have several measurement channels. In the following example, a Cobra SMARTsense 3-Axis-Magnetic Field Sensor is connected to the measureAPP. This sensor has 3 measurement channels. The Bx channel is selected, and the other channels are deselected. If a measurement were now started, only the Bx data for the sensor would be recorded, but not By, and Bz.

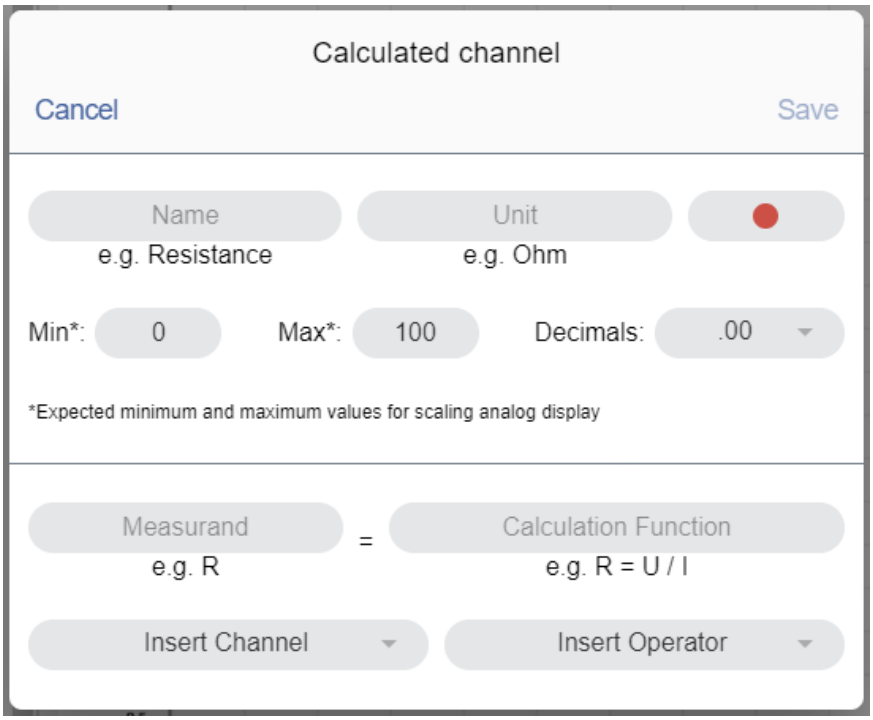


Next to the button for selecting and deselecting the measurement channels is a cogwheel . Information and setting options for the measuring channel (unit, number of decimal places, colour, display of data points and measuring line, line width) are stored here. After changing the parameters, they must be saved by clicking on "Save".

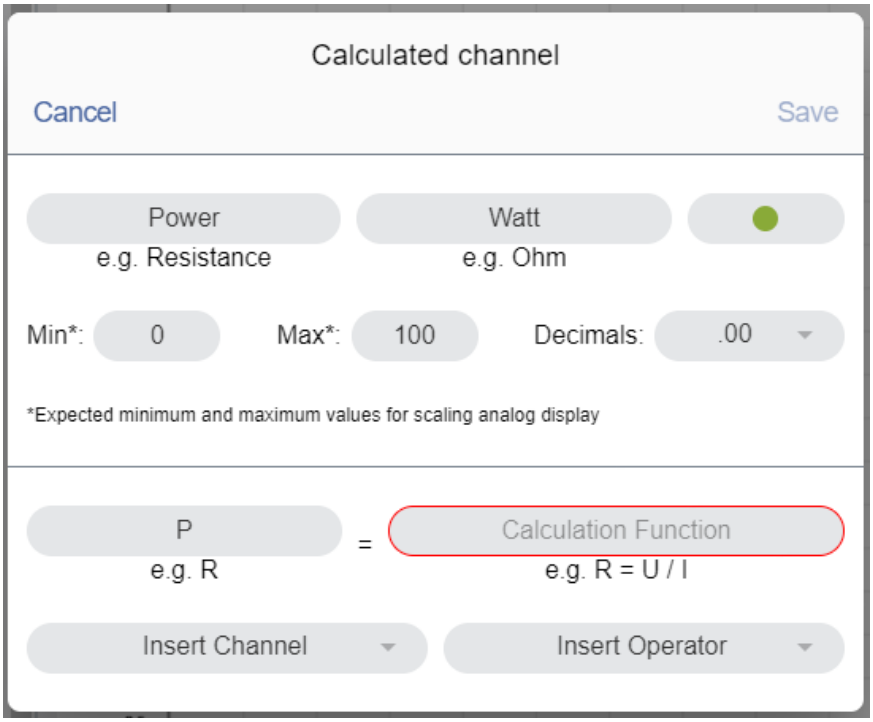


Below the measuring channels is the "Calculated channels" button. Existing measuring channels can be used here to calculate virtual measuring channels.

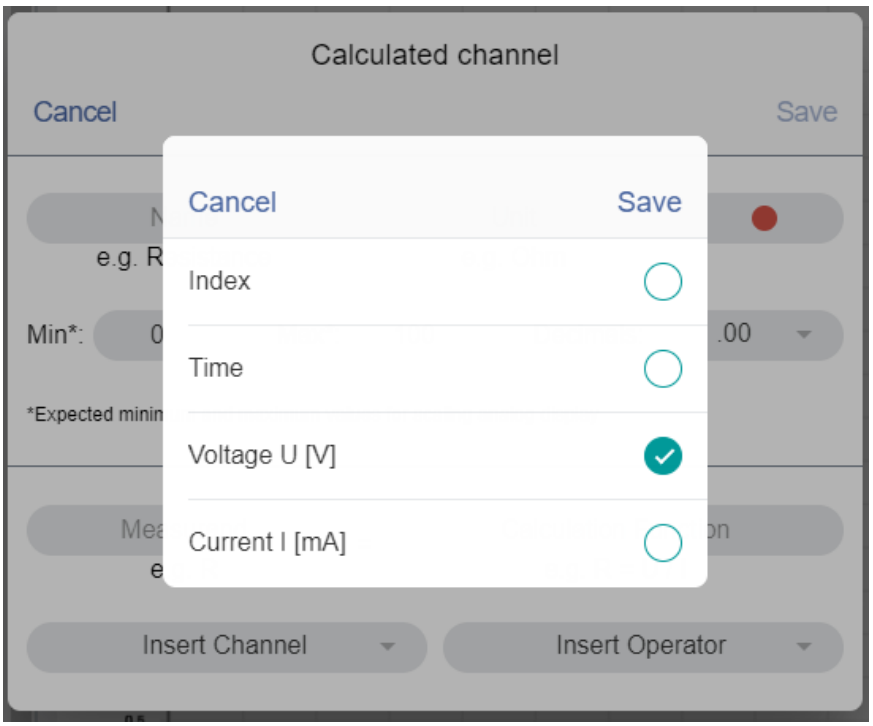
In the following example, this is shown with the Cobra SMARTsense Voltage and Current sensors for calculating the Power channel. A new calculated channel can be created by clicking on the plus sign . The following screen opens:



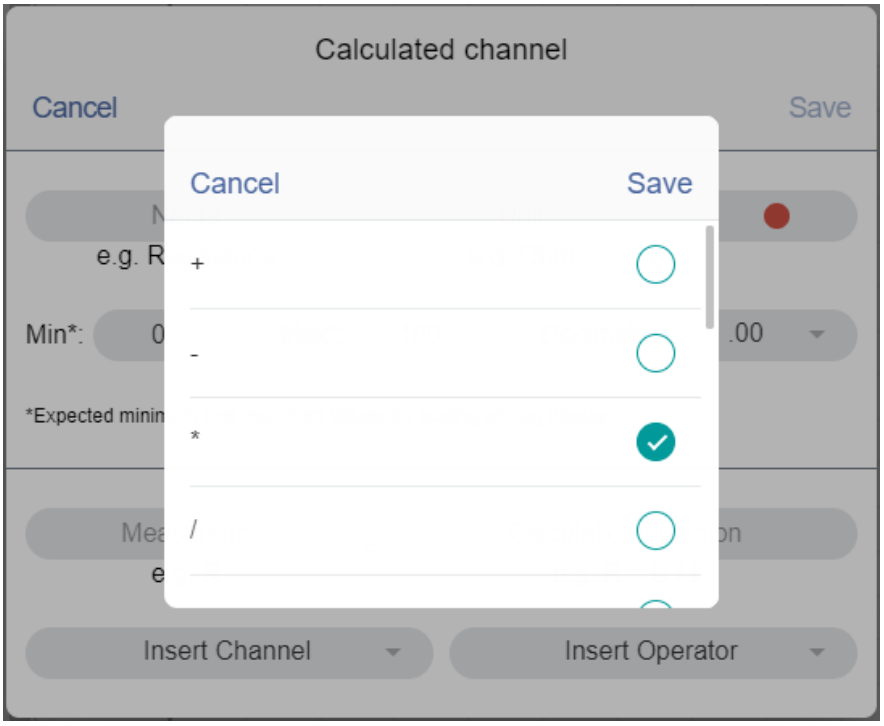
To create a calculated (virtual) channel, the fields "Name", "Unit" and "Measurand" must be filled in.



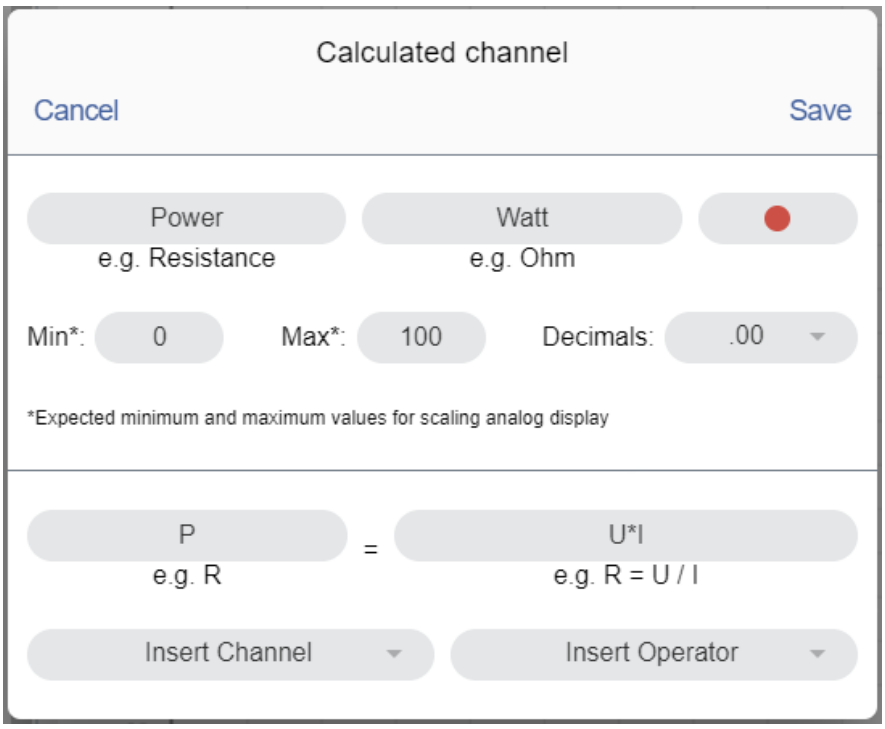
The "Calculation" of the channel must then be entered. To do this, a measurement channel must first be selected. This is done by clicking on the "Insert channel" drop-down menu.



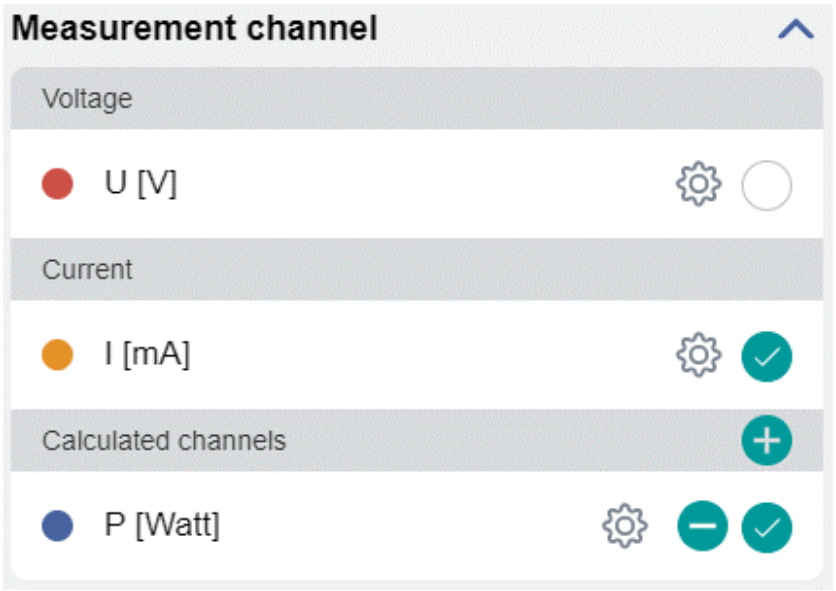
All available measuring channels are displayed here. In the example, the "Voltage U [V]" measuring channel is selected. Click on Save to include this measurement channel in the calculation. An operator is then selected. This is done by clicking on the "Insert operator" drop-down menu.



In addition to the standard operators, other operators such as pi, e^x, ln, log, sqrt, x^y, abs, sin, cos, tan, and integral are available in the scroll-down menu.



Once the "Calculation" has been completed, it is saved by clicking on "Save".



The calculated channel "P [Watt]" now appears below the measurement channels. Before a measurement is started, the measurement channels that are to be displayed in the measurement diagram must be selected. In the example above, the Voltage measurement channel is deselected, and the Current and Power measurement channels are selected. By clicking on the green tick in the Current measurement channel, this would also be white and no longer displayed in the measurement diagram, as only the Power measurement channel is selected.

The calculated channel can be used to calculate further calculated channels.

4.2.3 Configuration

4.2.3.1 Sampling rate

The desired sampling frequency is set here using the slider. The minimum is 1Hz, the maximum depends on the sensor used, e.g. a maximum sampling frequency of 10 kHz can be selected for the Cobra SMARTsense Voltage sensor and a maximum sampling frequency of 10Hz can be selected for the Cobra SMARTsense Temperature sensor. The data packets are transmitted simultaneously to the measureAPP via Bluetooth. If two sensors with different maximum sampling frequencies are connected to the measureAPP, the lower one is the limiting one. I.e. if the Cobra SMARTsense Sensor Voltage and Temperature are connected to the measureAPP, the maximum sampling frequency is 10Hz.

4.2.3.2 Moving average

The number (1-50) of measured values used to calculate the moving average can be set here using the slider. This function is used to smooth "unsteady" measurement data.

4.2.3.3 Set to zero

This function can be used to set a sensor to zero. To do this, select the sensor by clicking in the white circle. This tare function is particularly useful when using the Cobra SMARTsense Sensor Force & Acceleration.

4.2.3.4 Repeat measurement

If this function is activated, the next measurement data is written to the existing measurement diagram. In this way, two measurement series can be superimposed, and their differences analysed. When saving, however, only the last measurement is saved. If both measurement series are to be subsequently analysed and/or compared with each other, they must be saved separately.

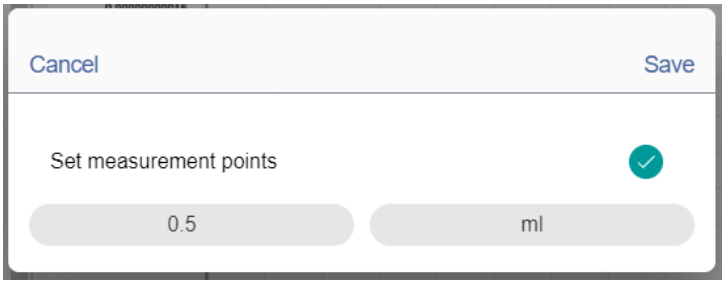
4.2.3.5 Measurement type

Measurement data can be recorded continuously (over time) or selectively (at the touch of a button).

If point measurement recording is selected, the "Set measurement points" configuration field opens. Click on the red button  below the measurement diagram to start the "Point measurement recording". After starting, the measurement recording must be executed by clicking on the round red button  . Each click on the button writes a new measurement point to the measurement diagram, starting at zero.

4.2.3.6 *Set measurement points*

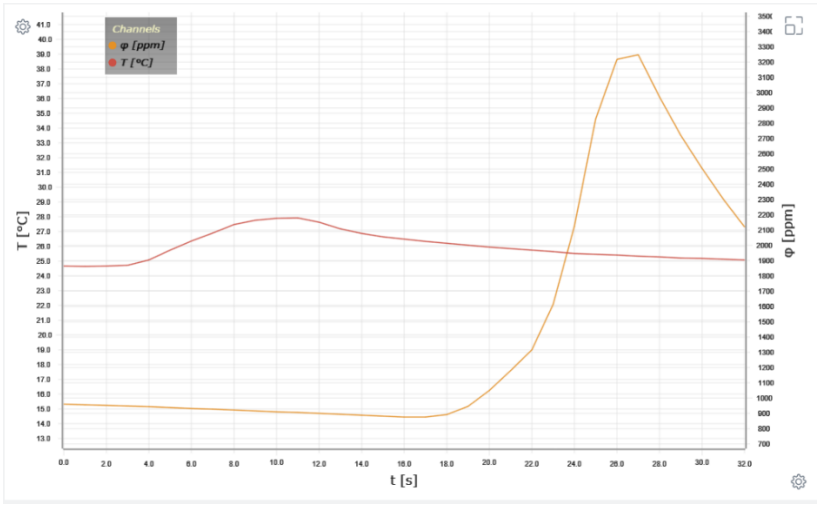
If point measurement is selected, the counting index can be adapted to the respective requirements. In the example, the conductivity is to be compared with the amount of solution dripped in. In the example, 0.5 ml of solution is dripped in at a time and then the measured value is recorded at one point, after a further 0.5 ml the next and so on.



4.2.3.7 *Additional Y-axis*

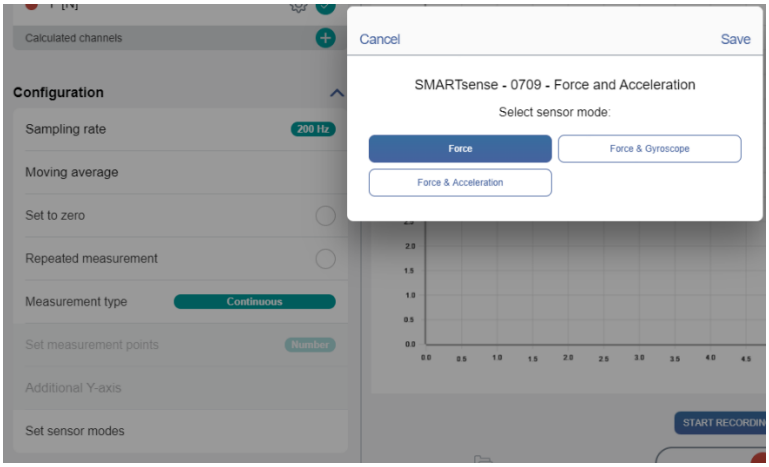
This can be used to set up an additional Y-axis on the right-hand side of the diagram. This function is useful if two measured values that differ greatly in quantitative terms are to be clearly displayed. In the following example, the Cobra SMARTsense sensors Temperature and CO2 have been selected. The CO2 sensor is to be displayed on the additional Y-axis. This is selected by clicking on it.

In the following measurement diagram, the temperature measurement curve is shown in red with the scale on the left-hand side. The CO2 measurement curve is shown in orange and the scale is on the right-hand side of the measurement diagram. Both scales can be set independently of each other, and the measurement results can be optimally displayed.



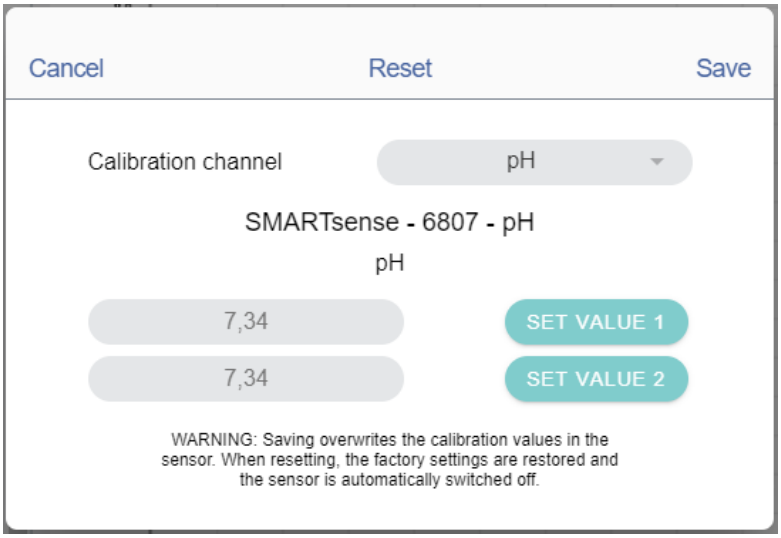
4.2.3.8 *Sensor modes*

Some Cobra SMARTsense sensors offer different measurement modes. In the example, the Cobra SMARTsense Force & Acceleration sensor is connected to the measureAPP and offers a choice of three different measurement modes. Select the desired mode before starting the measurements. The sensor mode can be changed at any time while the measurement is stopped.



4.2.3.9 *Calibrate*

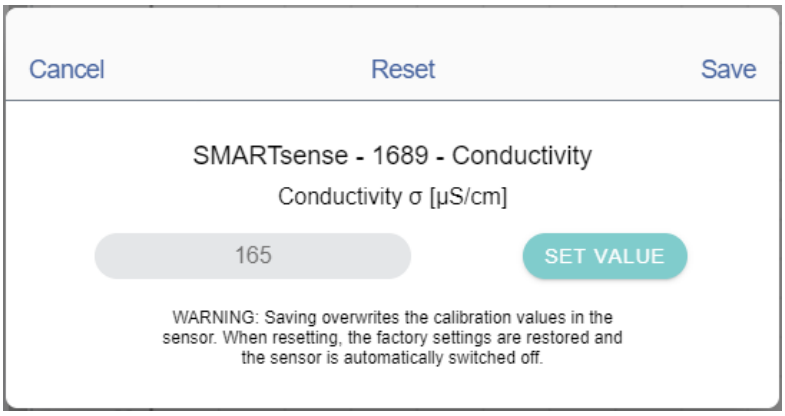
Some Cobra SMARTsense sensors must be calibrated for correct operation. Click on the "Calibrate" button to open the following window.



If more than one calibratable sensor or measuring channel is available, the calibration channel must be selected.

The measured actual values are automatically entered in the grey fields on the left. However, the field can be edited by clicking on it. The first measuring point (target value) can then be entered in the upper field and accepted with SET VALUE 1 The second measuring point (target value) must then be entered in the lower input field, and also accepted with SET VALUE 2. The calibration must then be finalised by clicking on "Save".

For sensors that require a single-point calibration, the second value is not transferred

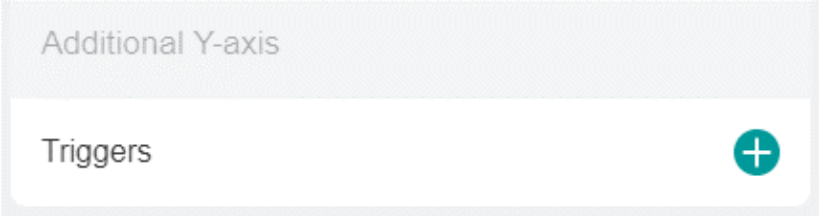


If the factory-set calibration values are to be used again, the "Reset" button at the top of the window must be pressed.

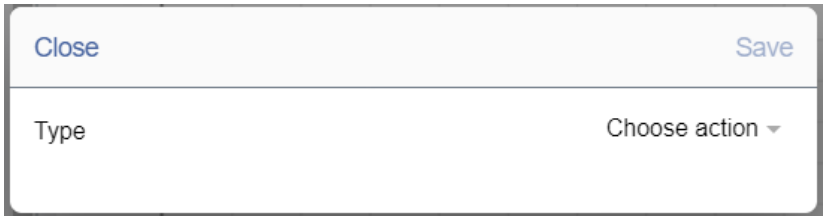
⚠ Attention: If the reset is carried out, the SMARTsense sensor then switches off, which means that the sensor must be reconnected to the measureAPP when it is switched on again.

4.2.3.10 Trigger

Measurements can be started and stopped using the trigger function. This is possible because the sensor connected to the measureAPP is in constant communication and the current measured value is permanently recognised. If the measured value rises or falls, this can be used as a start trigger for a measurement. A rising or falling edge can also be used to end a measurement. In addition, the measurement can be ended by means of a set measurement duration.



Click on the symbol ⊕ to open the following window:



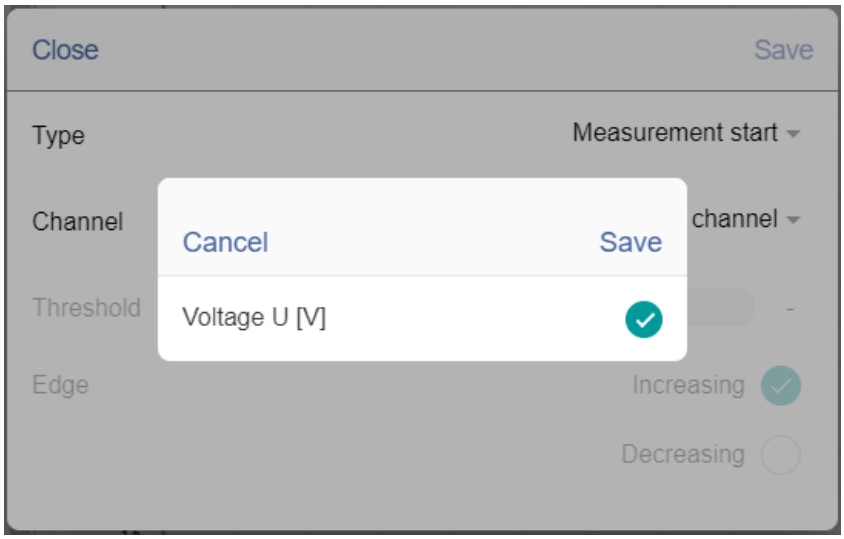
Select an action and the following window opens.

Measurement start: Start measured value recording automatically when the threshold value is reached.

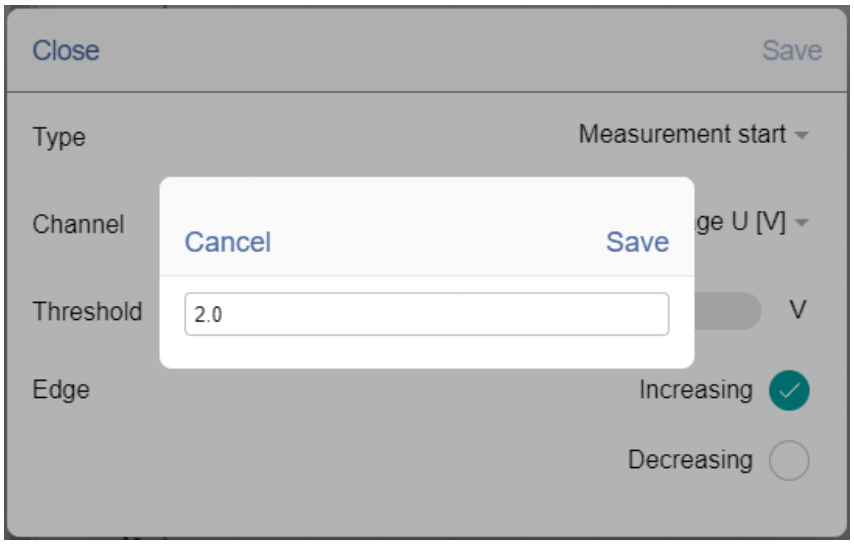
Stop measurement (edge): Automatically stop recording the measured value when the threshold value is reached.

Stop measurement (time): Automatically stop measurement recording after a specified time has elapsed.

You will then be asked to select a measurement channel. Select the desired channel and confirm with ‘Save’.



Click in the ‘Threshold’ field to open the following window.

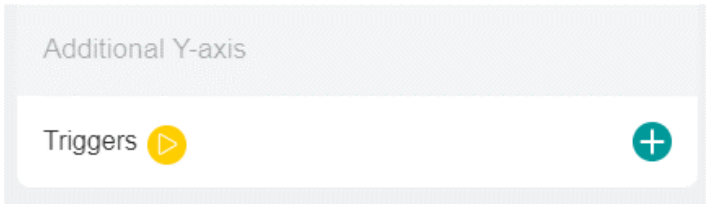


Enter the measured value at which the action should be triggered.

Then select the trigger for the action. If the action is to be triggered when at least one measured value is below the entered threshold value and then at least one measured value is above the threshold value, select the ‘rising edge’. Otherwise, select the ‘falling edge’.

Finally, click on ‘Save’ to apply the trigger settings.

The symbol for a start trigger now appears in the ‘Trigger’ area.

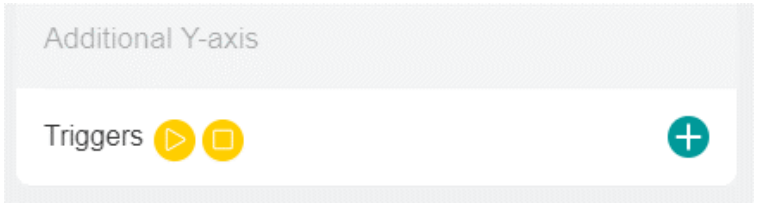


A stop trigger can also be selected in the same way as the procedure described. The measurement is then ended after the selected conditions (rising or falling edge of the measured value).

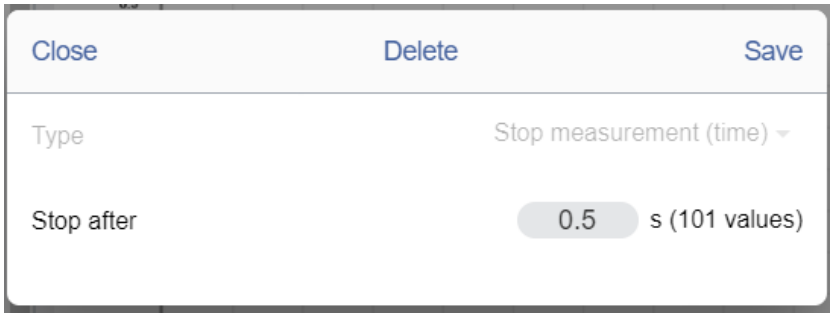
The measurement can also be stopped over time. To do this, select ‘Stop measurement (time)’ in the action window.

Enter the desired time value and save the entries.

In the 'Trigger' button, the symbol for a stop trigger now appears next to the symbol for the start trigger.



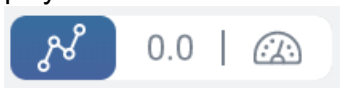
Click on the yellow start and stop icons in the trigger function button to open the following window. Here you can change your settings or delete the trigger function.



4.2.4 Diagram and tools

4.2.4.1 Representation

The setting options for displaying the measured values are located above the measured value diagram and the toolbar. The blue field indicates which display has been activated.

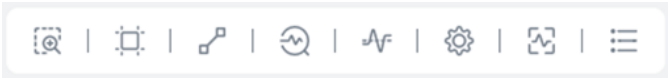


You can choose between three display options. In the illustration above, the diagram display is selected. Other options are the digital display (centre) and the analogue display (right).

4.2.4.2 Toolbar

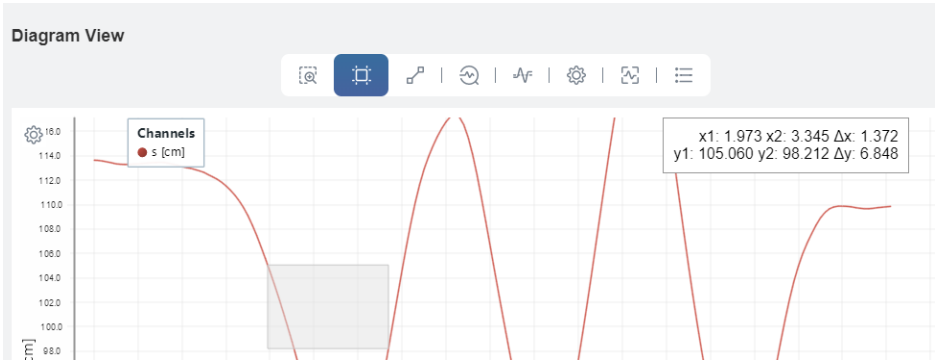
Various tools for editing and analysing the measured values are available directly above the measured value acquisition diagram. The toolbar can be used

for post-processing diagrams. All edits made with this toolbar can be undone. The three buttons shown in white on the left-hand side turn blue when selected.

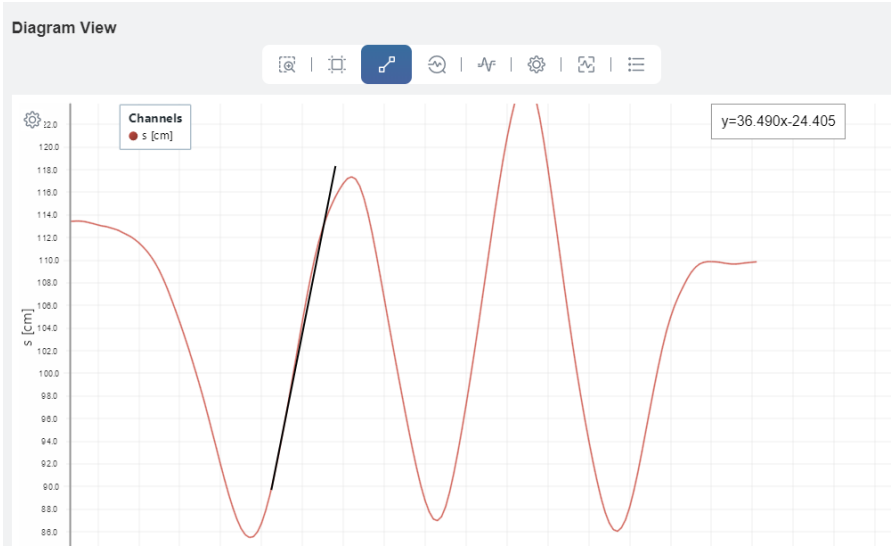


Magnifying glass: A rectangle can be drawn, which is then displayed enlarged.

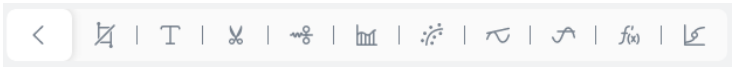
Measure: This can be used to draw a rectangle, as shown in the following illustration. The parameters of the rectangle are shown at the top right of the diagram, including x1, x2, y1, y2 and the corresponding delta values.



Draw straight line: This function allows you to draw a straight line in the diagram. The corresponding straight line equation is displayed at the top right of the diagram, as shown in the following illustration.

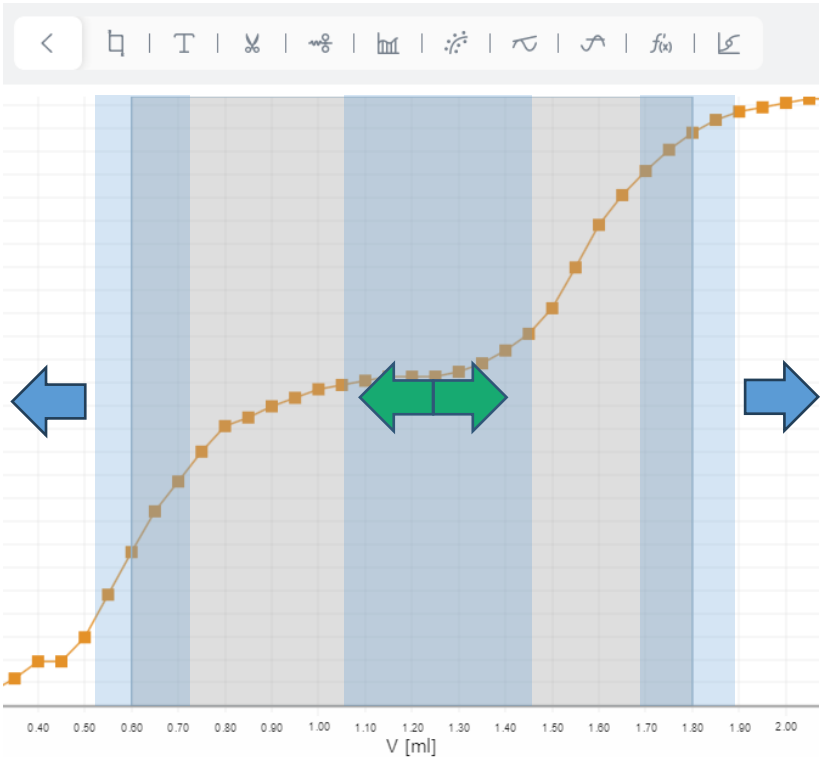


Evaluation functions: Click on the button to display an evaluation bar so that various evaluation functions can be carried out. Clicking on the white icon on the left takes you back to the toolbar



Switch area marking on/off: Click on the button to switch a marker on and off.

A marker can be widened or narrowed by clicking and moving the right or left edge area (green arrows). If you click in the centre of the area marking, the entire marking area can be moved along the x-axis (blue arrows).

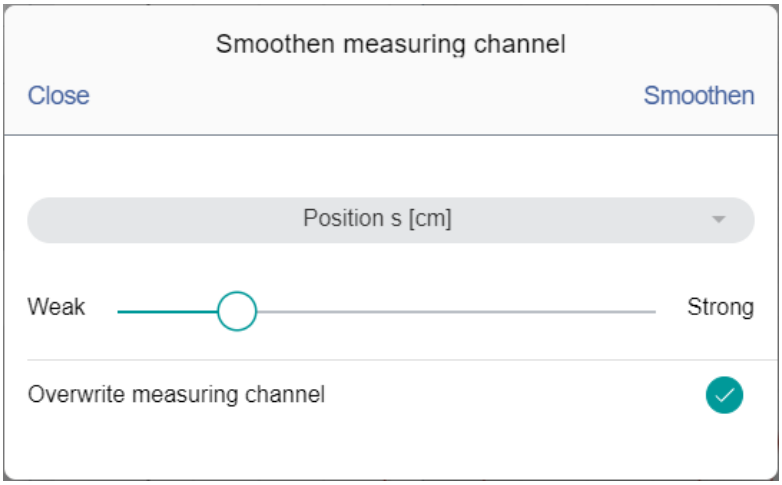


Text box: This can be used to write information directly into the diagram. The text box can be moved and used, for example, to mark special points in the diagram. Several text boxes can be inserted in a diagram. By clicking on an existing text in the diagram, it can be edited or deleted.

Cut: This can be used to cut out marked areas. This must be confirmed before the area is finally removed.

Smoothing function: The measurement channel to be smoothed must first be selected here, as shown in the following figure. The degree of smoothing (weak - strong) is then selected. If the 'Overwrite measurement channel' option is selected, the original measurement channel is not displayed,

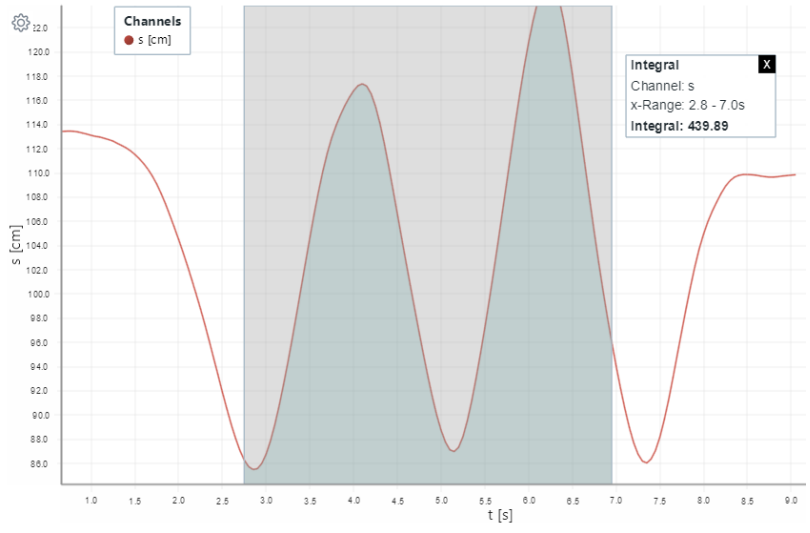
only the smoothed one. Otherwise, another smoothed curve is added.
If a marking range is available, smoothing only takes place within the marked range; if no range is available, the entire curve is smoothed.



If the smoothing is to be cancelled, set the degree of smoothing for the area or for the entire curve to ‘Weak’.

Calculate integral: The integral of the curve can be calculated for the marking area or an entire curve and displayed graphically if necessary. Several integrals can be calculated on one curve.

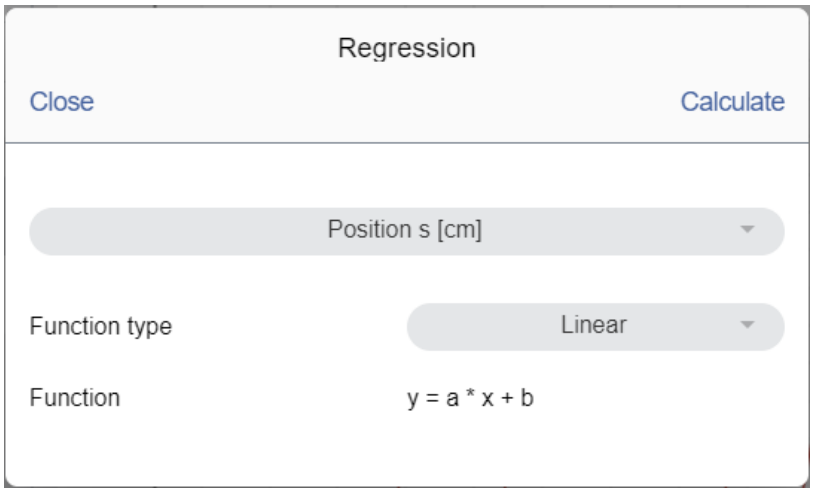
To do this, select the channel and specify whether you want to display the integral graphically.



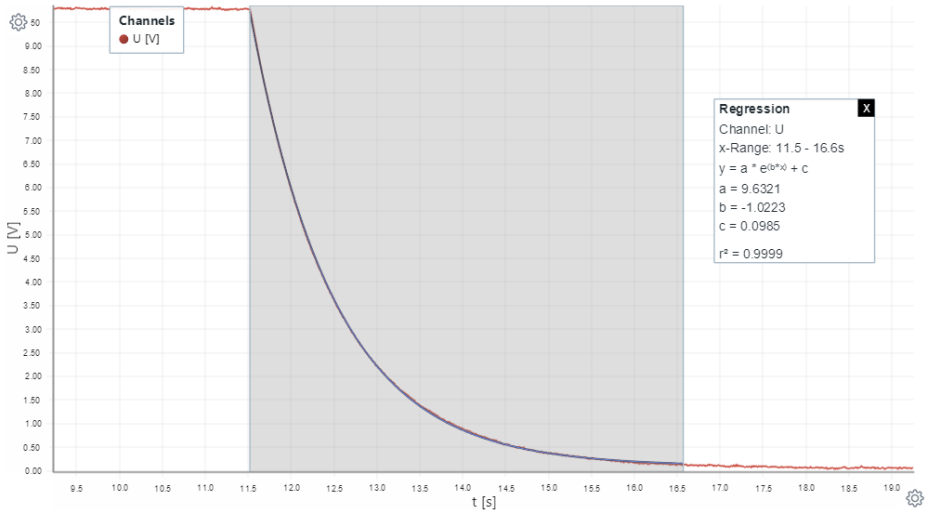
Click on the cross at the top right of the display window to delete the displayed integral.

Regression: A regression analysis can be carried out and the regression lines for a range or the entire curve can be calculated and plotted.

After clicking on the symbol, the following window appears:



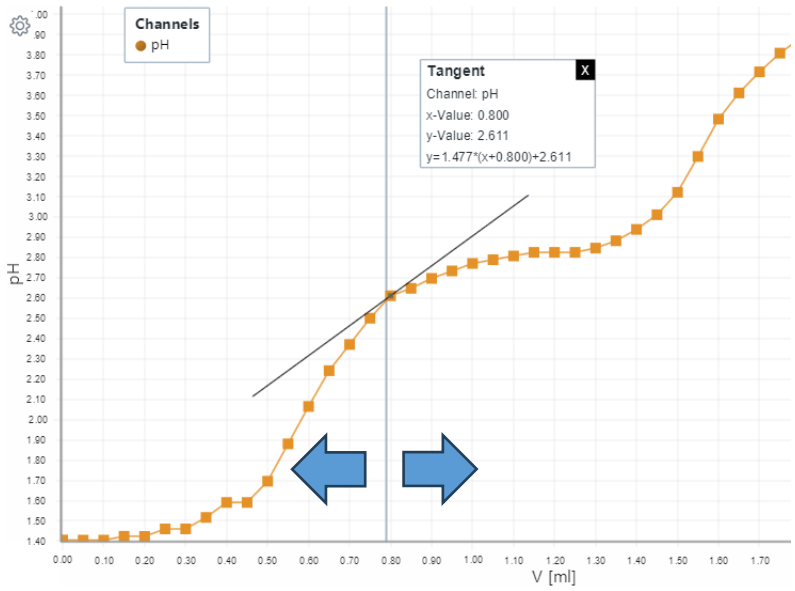
The measurement channel can be selected here, as well as the function type via which the curve adjustment is to be carried out. The function of the selected function type is shown below.



The display window shows the function with all coefficients, as well as the R^2 value, which represents a quality measure of the regression. The R^2 value lies between 0 (unusable model) and 1 (perfect model fit).

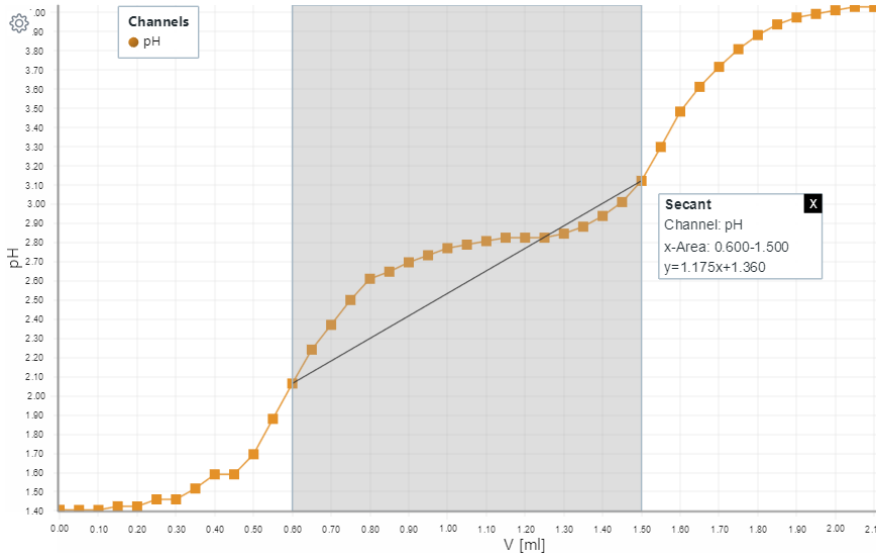
Clicking on the cross at the top right of the display window deletes the displayed regression line.

Create tangent: A tangent can be created along the selected measurement curve. The tangent can be moved along the measuring points by moving the vertical line. It is possible to create several tangents to a measurement curve.

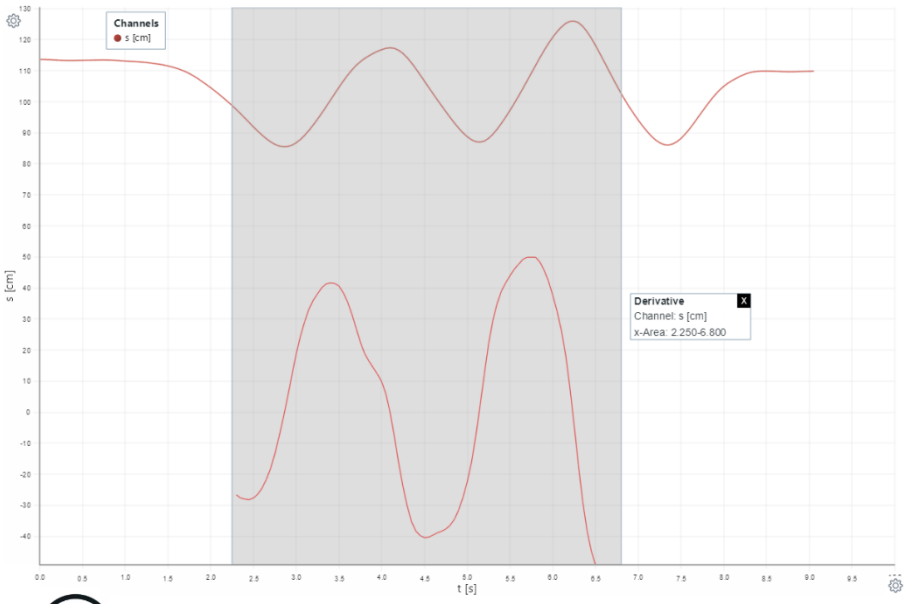


Click on the cross at the top right of the display window to delete the displayed tangent.

Create secant: A secant is added to the selected measurement curve between the edges of a selected range. Clicking on the cross at the top right of the display window deletes the displayed secant again.

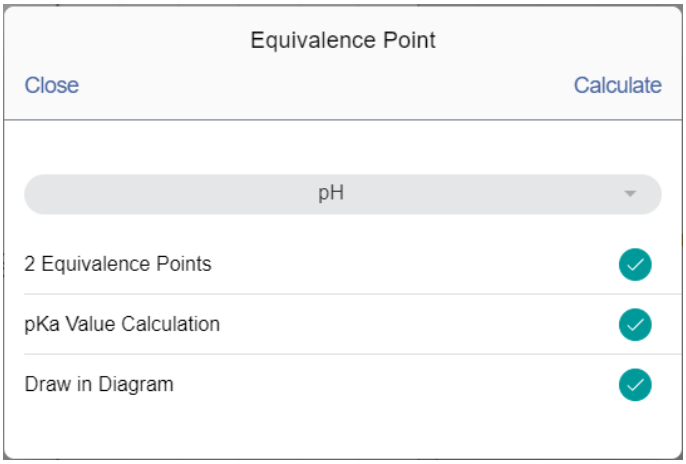


Derivative: Click on the button to determine the derivative of the selected measurement curve and display it graphically. Clicking on the cross at the top right of the display window deletes the displayed derivative again.

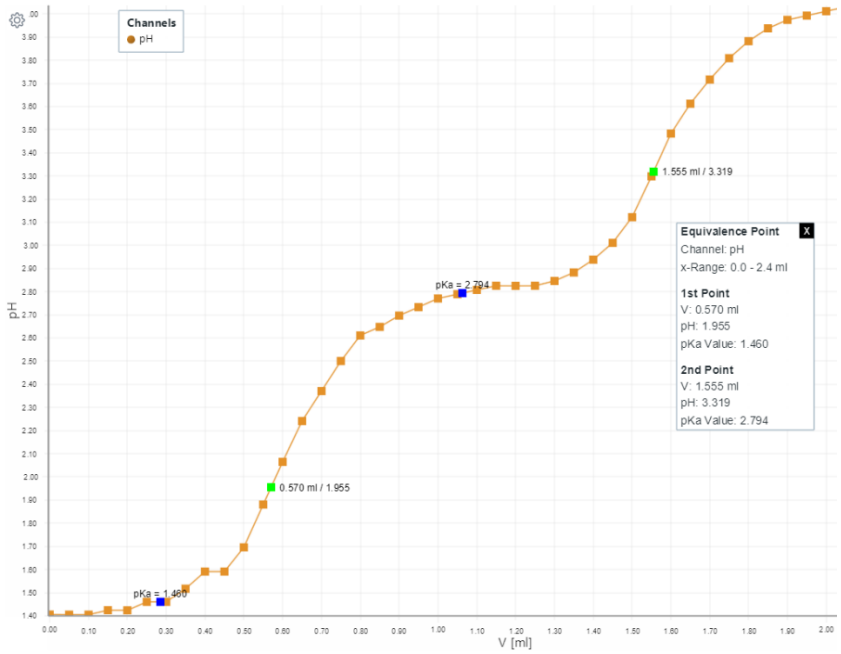


If there is no measuring range marker, the entire curve is derived.

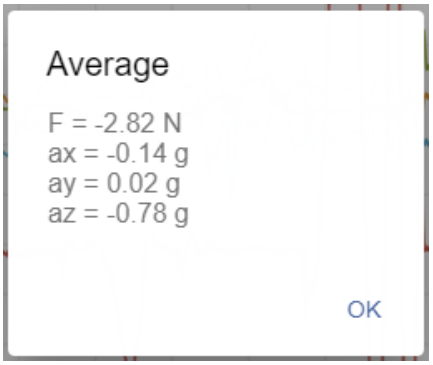
Equivalence point determination: The equivalence point determination function can be used to determine and display the equivalence points (point with the greatest gradient) and the corresponding pKs values.



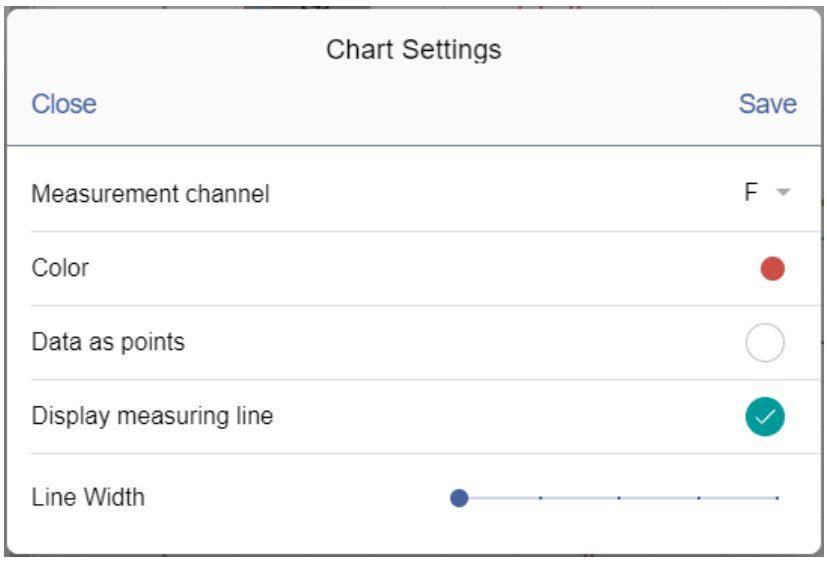
The measurement channel can be specified in the selection window, as can the option of displaying 1 or 2 equivalence points and pKs values. You can also decide whether the points should be plotted directly in the diagram.



Average value: Clicking on the button opens a window in which the average value of the various measurement channels is listed.



Curve settings: Colour, line width and type of display (measuring points or measuring line) can be selected here for various measuring channels.

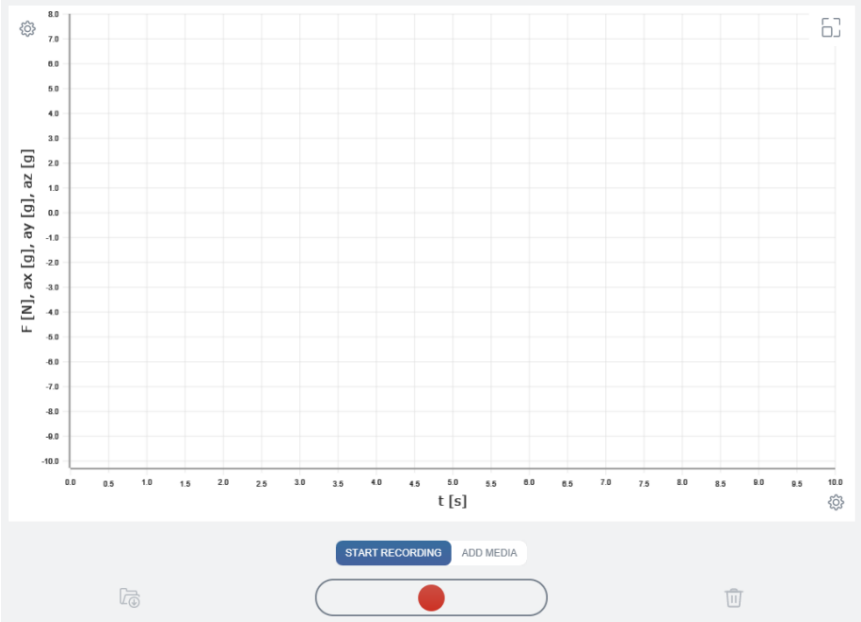


optimise the measurement: The button is used to display all recorded measurement data in as high a resolution as possible.

Legend ON/OFF: The button is used to show or hide the legend in the diagram.

4.2.5 Measured value diagram

There are various buttons in the measured value diagram and below it, which are explained below.



4.2.5.1 Y-axis setting

At the top left of the measured value diagram is the symbol, which is used to manage the settings for the Y-axis. Click on it to open the following screen.

Here you have the option of switching the Y-axis to a logarithmic display. In addition, the automatic scaling of the Y-axis can be switched off and a customised scaling of the Y-axis can be entered. If the measured value is outside the entered parameters during a subsequent measurement, the range is automatically enlarged so that all recorded measured values are displayed.

4.2.5.2 Full screen mode

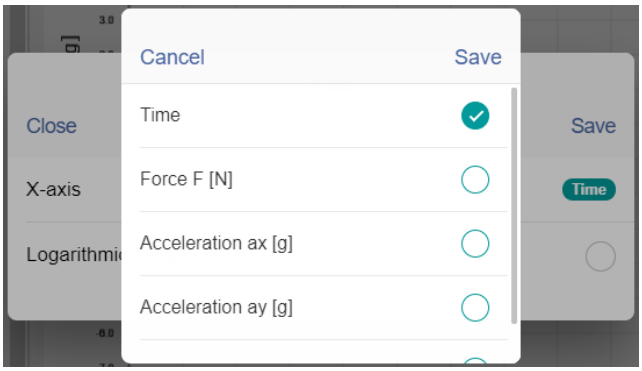
A symbol is displayed at the top right of the measured value diagram. Clicking on this symbol enlarges the diagram area to screen size. The enlarged display can be cancelled by clicking on the icon. ✕

4.2.5.3 X-axis adjustment

On the right below the measured value diagram is another symbol, which is used to manage the settings for the X-axis. Click on it to open the following screen. Here you have the option of displaying the X-axis logarithmically.

The assignment of the X-axis can also be changed. By default, the time is displayed on the X-axis. If only one measuring channel is available, the upper button is greyed out and is not available for selection. If more than

one measuring channel is available, one of these measuring channels can be assigned to the X-axis. Click on the X-axis button to open the following screen. The measurement channel can now be selected here. In the example shown, the voltage can be plotted against the current.

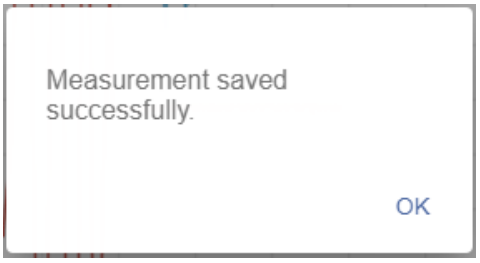


Below the measured value diagram there are two further buttons "Save measurement" and "Delete measurement".

4.2.6 Save and delete measurement

4.2.6.1 Save measurement

After clicking on this button, the following message appears.



And in the blue menu on the left, a red dot appears next to the "Manage" folder. This indicates that new data is available.

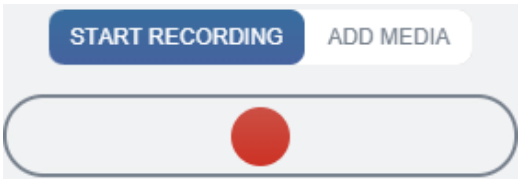
4.2.6.2 Delete measurement

The measurement in the diagram can be deleted here.

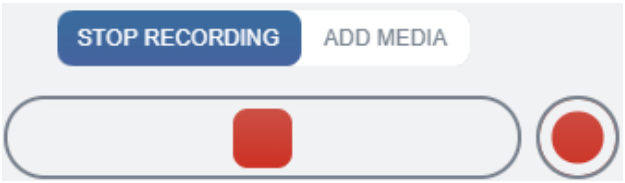
4.2.6.3 Start / stop measurement

The button for starting the measurement process is located in the centre below the measured value diagram. To do this, the "Start measurement" field must be selected (blue). Click on the red dot to start the measurement.

If the measured value recording is not continuous but selective, the button looks as follows after starting the measurement:

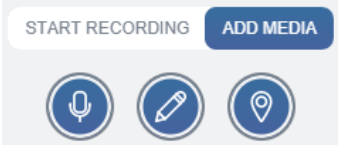


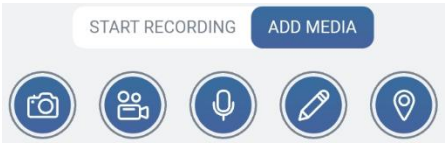
In punctual measurement, the next measured value is recorded by clicking on the round button. To end the punctual mode, the square button must be used. Continuous measurement recording can then be selected again.



4.2.6.4 Add media

If the "Add media" button is selected, it appears in blue and the microphone, pen and location recognition icons appear below it on the PC. In the measureAPP version for tablets and smartphones, two further icons appear: the photo camera and the video camera.





This function can be used to create media that add value to the measurement data. For example, a video or photo of the experiment set-up can increase understanding of the experiment and eliminate ambiguities. Outdoor experiments can also be carried out reliably at the same location using location recognition.

4.3 Manage menu item

The media created are saved under "My media".
The project folders created are listed under "My projects".

4.3.1 My measurements

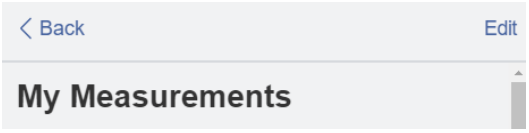
Important note: On mobile devices, the saved measured value diagrams are saved in the measureAPP; on PCs, this is done outside the measureAPP.

As a result, the saved data will be lost on mobile devices after deletion and subsequent reinstallation of measureAPP!

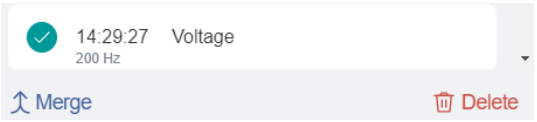
The measurements carried out are stored chronologically and displayed one below the other.

4.3.1.1 Edit measurements

If you click on 'Edit' above the list, you have the option of selecting files and deleting or adding the selected files.



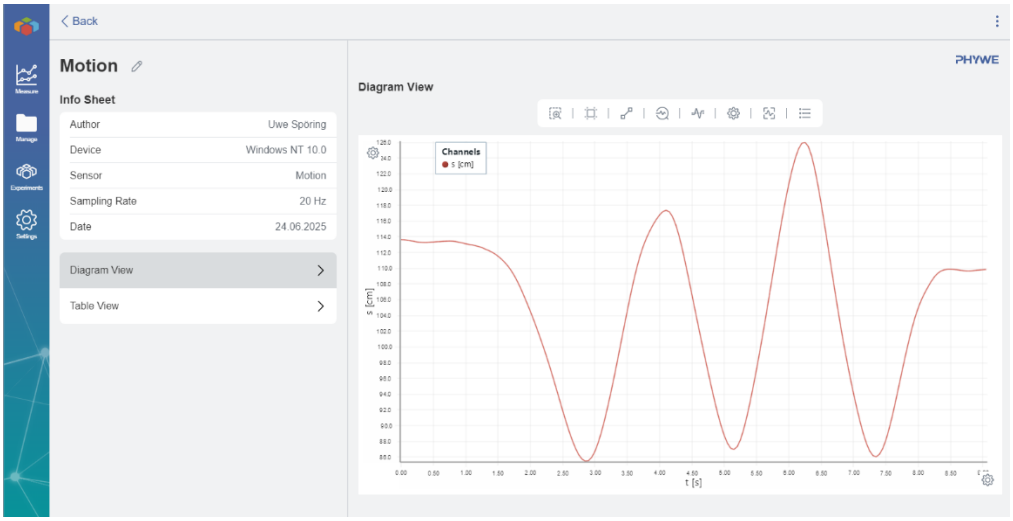
1) Deleting measurements
   - Select individual measurements or click on 'Select all'
   - Click on 'Delete' below the measurement list



2) Combining measurements
   - Select individual measurements or click on 'Select all'
   - Click on 'Merge' below the measurement list

     Measurements to be merged must have the same sampling frequency.

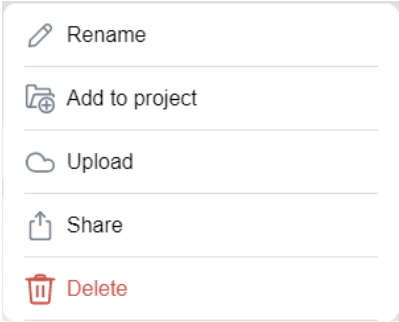
After clicking on a saved measured value file, various information can be taken from the display (see below), the diagram can be edited with the tools, data can be added to project folders and data can be sent.



Next to the name of the measurement on the left is a pencil symbol
The name of the measurement can be edited by clicking on the symbol.

The left-hand area contains information about the author, the terminal device used, the Cobra SMARTsense sensors used, the sampling frequency and the creation date. Below this are the buttons for the diagram display and the tabular display of the measured values.

At the top right is the three-dot menu
Clicking on this opens the menu selection as follows:

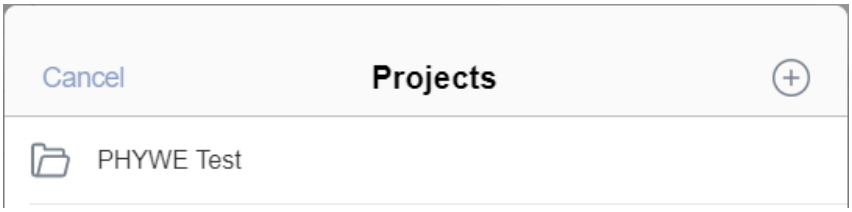


4.3.1.2 Rename

The name of the measurement can be edited here.

4.3.1.3 Add to project

The measurement can be assigned to an existing project or a new project can be created. A new project is created by clicking on the plus sign (see below).

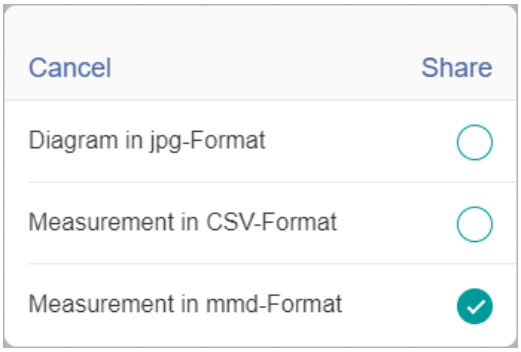


A new project is created by clicking on the plus sign (see above).

Click on an existing project folder to add the measured value file to the project folder. If the measured value file is already in the project folder, it is greyed out.

4.3.1.4 Share

Used to send/export measured value files. After clicking on the icon, the following selection window appears. There are three options for sharing data.



1. Share jpg format: If ‘Diagram in jpg format’ is ticked, the visible diagram area is photographed and sent as a .jpg or saved as a file on the PC. This is only possible in the diagram view.
2. Share CSV format: If ‘Measurement in CSV format’ is ticked, the measured value table is sent in CSV format or saved as a file on the PC.
3. Share mmd format: If ‘Measurement in mmd format’ is ticked, the measured value table is sent in mmd format or saved as a file on the PC.

Note: mmd is PHYWE's own format and can only be opened by measureAPP or measureLAB.

After clicking on ‘Share’, the measureAPP version for mobile devices offers all communication interfaces for sharing the measurement data that the respective end device has.
In the measureAPP version for PC, the measurement data must be saved after clicking on ‘Share’. The data can then be sent using all available communication interfaces.

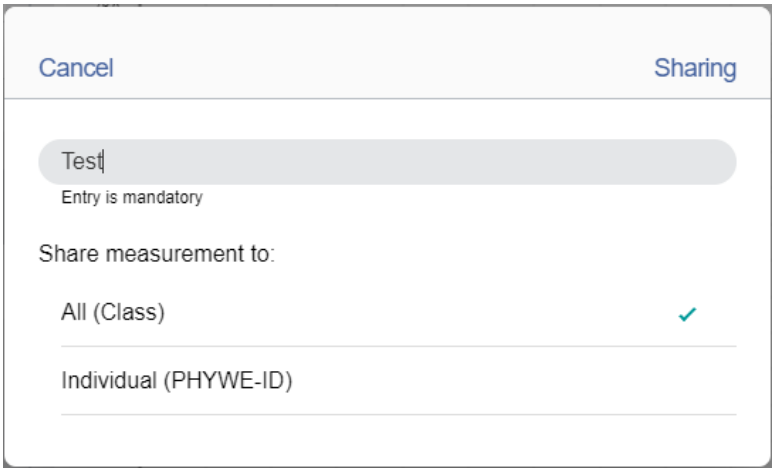
4.3.1.5 Upload

Measurement data can be shared quickly and easily with the help of curri-cuLAB.

Important note: A Phywe ID is required to use this function! This must be entered under the menu item ‘Settings’.

The measurement must be given a name (see below) and can then be sent to all participants (class) belonging to your own Phywe-ID list or also individually to a special Phywe-ID.

Please refer to the description of curricuLAB to find out how Phywe-ID lists are created. You can find this under www.curricuLAB.de.



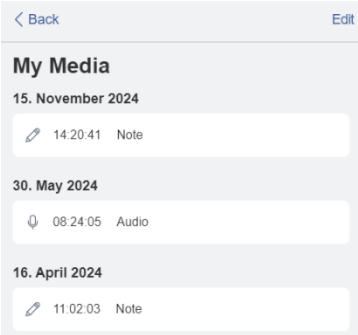
4.3.1.6 Delete

The measurement currently called up can be deleted here.

4.3.2 My Media

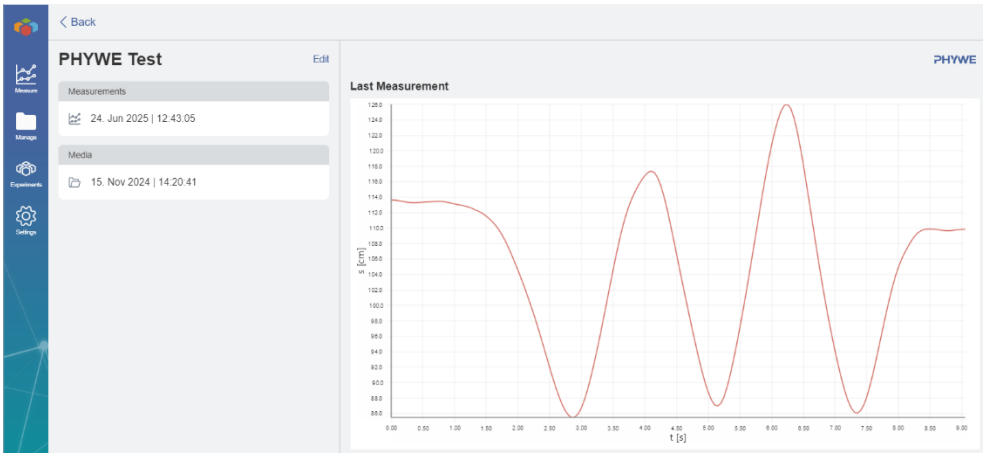
All recorded media such as images, audio, text and locations are stored under the ‘My media’ menu item.

If ‘Edit’ is clicked, individual or all media can be selected and deleted. When you click on the media, they are displayed to the right of the list.



4.3.3 My projects

All created project folders are saved under the menu item ‘My projects’. Click on a project folder to open it. Click on ‘Edit’ (top centre) to select and then delete it (see also 4.3.1.1), and thus also the measurements and media data it contains.



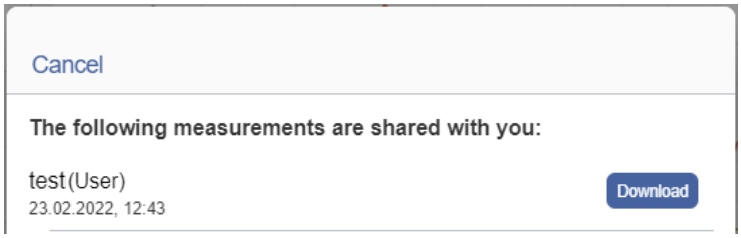
4.3.4 Load measurement

Click on the "Load measurement" button to open the download folder for mobile devices and the file explorer for the PC version. The file to be downloaded can be selected and opened in measureAPP.

Note: Opening files in measureAPP is only possible with mmd files!

4.3.5 Load shared measurement

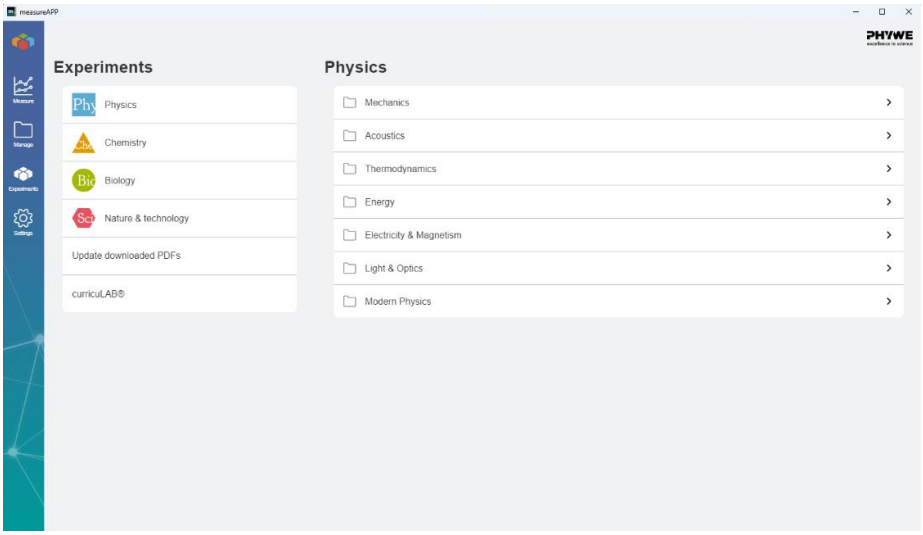
If measurement diagrams have been shared to your Phywe ID or to the entire Phywe ID list, they appear after clicking on the "Load shared measurement" button (see below).



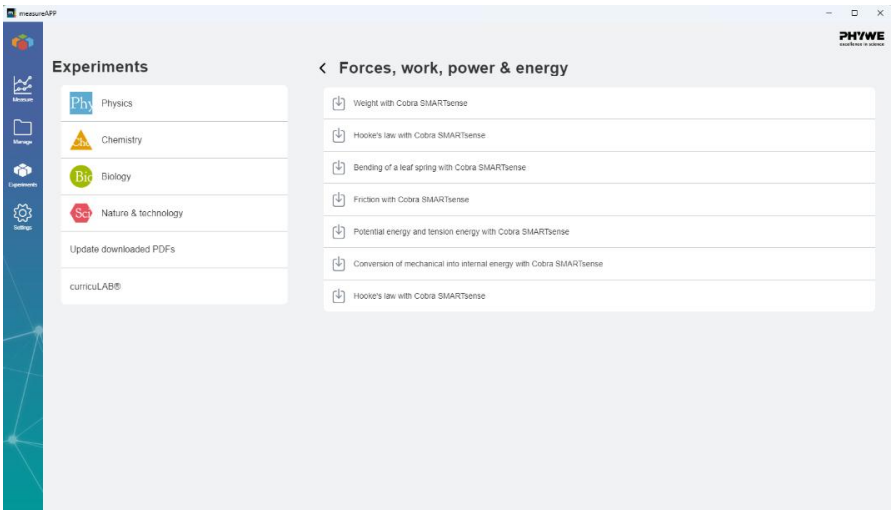
Click on "Download" to save the measurement data in "My measurements".

4.4 Menu item Experiments

This menu item contains experiments with Cobra SMARTsense sensors in PDF form and an interface to the curricuLAB teaching and learning platform. The experiments are not downloaded when the measureAPP is downloaded.
This must be done manually.



Click on "Physics/Mechanics/Forces, work, power & energy" to display the following image. In the example, the two upper files have already been downloaded, but the two lower files have not yet been downloaded. Click on the respective file to start the download. If the file has already been downloaded, it can be opened.
The "Update downloaded PDFs" button updates the experiments that have already been downloaded.



By clicking on the "curricuLAB" button, the user is redirected to the content provided via the curricuLAB teaching and learning platform.
Important note: A Phywe ID must be set up under the menu item "Setup" (blue menu)!

4.5 Set up menu item

The legal notice and privacy policy are stored under this menu item. The current version number is also displayed here. Whether an update is available can be found in the Google Play Store and the Apple App Store by entering "Phywe measureAPP". The current version for PCs can be found at www.phywe.com (see 2. Installing the measureAPP software).
This can be changed by clicking on the "User name" button.
The "PHYWE ID" button offers the option of entering the Phywe ID received and using the interfaces to curricuLAB presented.