

## Introduction

*measure* is a powerful measuring software for the capturing, visualisation, processing and evaluation of measuring data. The data can be captured via one or multiple channels and be evaluated at the same time. *measure* is available for different measuring instruments of PHYWE's product line, amongst others for PHYWE's Cobra interface system with different modules and sensors. Alternatively, entire experimental set-ups, like e.g. PHYWE's didactic X-ray instrument, can directly be linked to a computer so that the data stream can be controlled through *measure*.

This manual explains how to install the software and how to use the basic functions of the program. More complex questions will be answered by the detailed online manual.

Additionally, for most measuring instruments of PHYWE's product line literature with experiments, specifically designed for your device and teaching subject, is available.

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## 1. Working with *measure*

In the following, you will get to know the basic functions of *measure* and you will learn how to record, display, evaluate and save a measurement. For starters, this tutorial will give you an overview of the program functions and their utilisation. In the online manual you will find context related, specific information on certain program functions as well as general explanations on the functionality of the software. You will find the online manual when you select the menu *Help* → *Index* (or using *Shift+F1*) or when you press the key *F1* within dialog window or when you use the *Help* icon in the tool bar, if existing.

The most frequently used menu functions can be operated using the icons in the tool bar.



## 2. Recording data

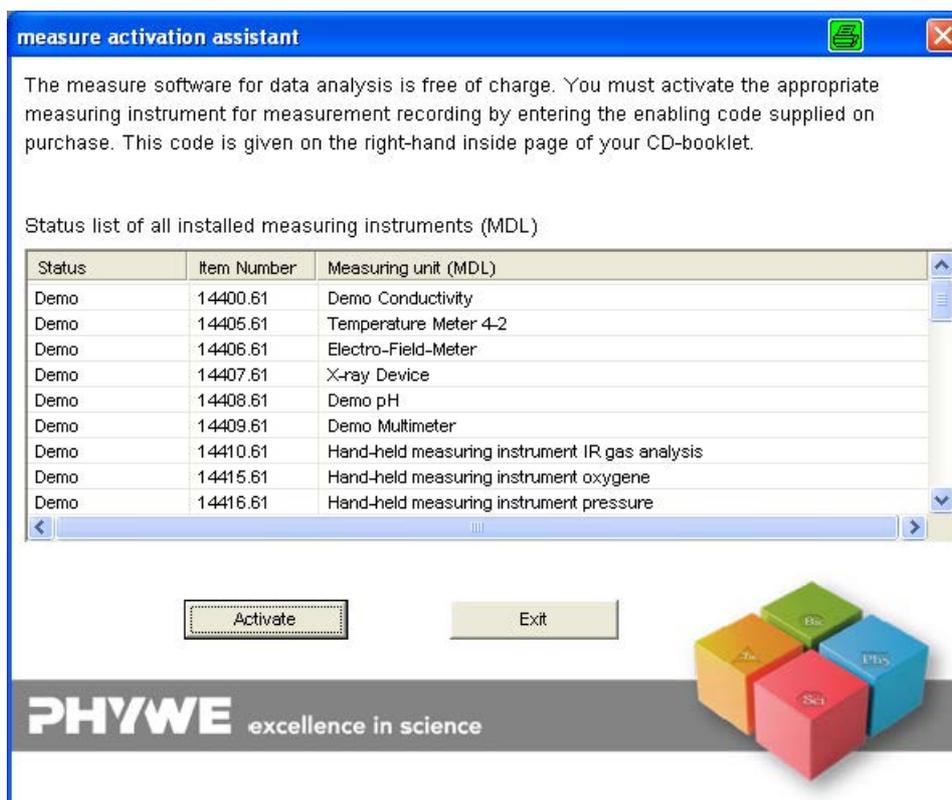
### 2.1 Creating a new measurement



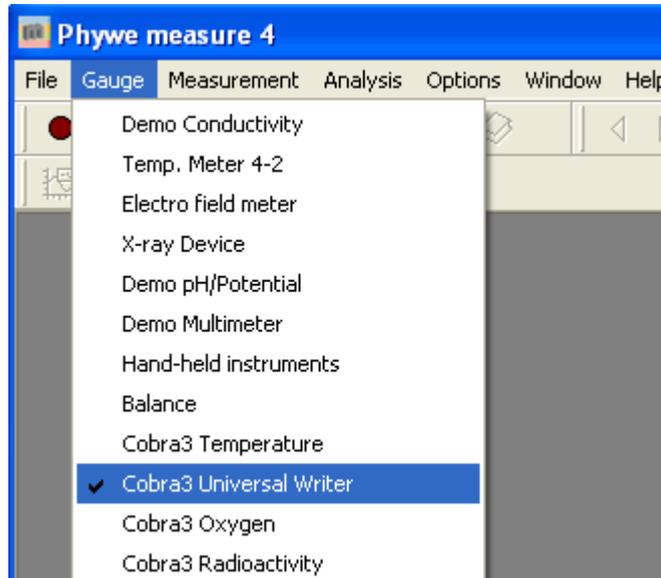
or menu *File* → *New measurement*

This will open different types of dialog windows depending on the instruments which you have connected. Upon first installation, the devices have to be activated in Activation Assistant, entering the activation key, which is delivered together with the software: *Options* → *Activation Assistant*.

However, all measuring instruments may be used with the trial version of the software for a limited period.

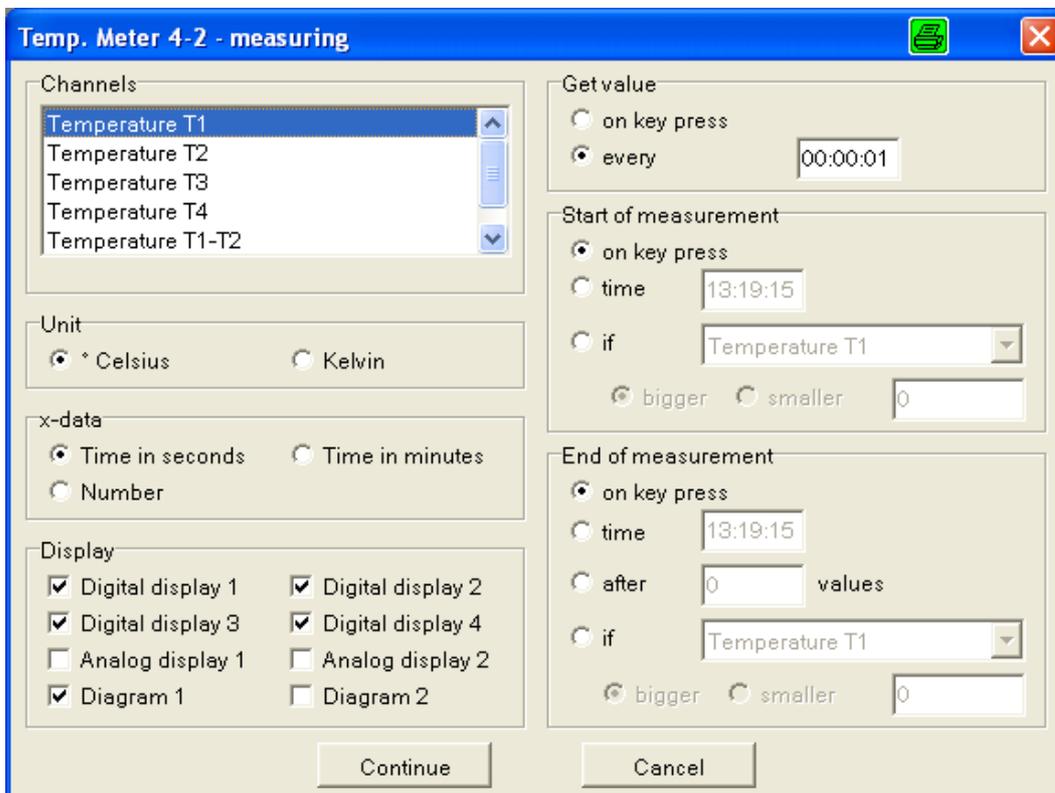


Always make sure that you have selected the correct instrument before pressing the icon for recording.



After you have selected the measuring instrument, you can create a new measurement via *File* → *New Measurement* or by pressing the red recording icon in the tool bar.

In the dialog window, which will open upon activation of the recording icon, you will be able to adjust many different options for your new measurement.



The highlighted channels will be captured during the measurement to come. Select the displays on which you like to view the measurement in progress with. In many cases you will be offered with a button for the calibration of your instrument or sensors.

When you have adjusted all options, you can proceed to the recording of the measurement by the button *Continue*. By pressing *Cancel* you will quit the measurement and return to the main menu, where you will find the last measurement, which you have recorded, displayed in a diagram.

To save the measured data, select the menu *File* → *Save measurement as*.

### 3. Basic Functions

#### 3.1. Data Table



or menu *Measurement* → *Data Table*

The data table will open in a new window. The open table will show the data of the measurement window, which is active in the background.

The data values in the table may be entered and deleted.

Zeit t / s	Druck p0 p / hPa	Druck p1 p / hPa
0	979,0	998,5
1	978,9	999,0
2	978,7	999,0
3	979,2	999,0
4	978,8	999,0
5	979,0	998,6
6	978,7	998,7

If the measuring data is changed by any analysis function, the displayed values will be updated automatically. Vice versa, if the data values in the table are changed, the plot in the measuring window will be adjusted.

If you mark any section of the measuring plot, the corresponding section of the measuring data will be highlighted in the table.

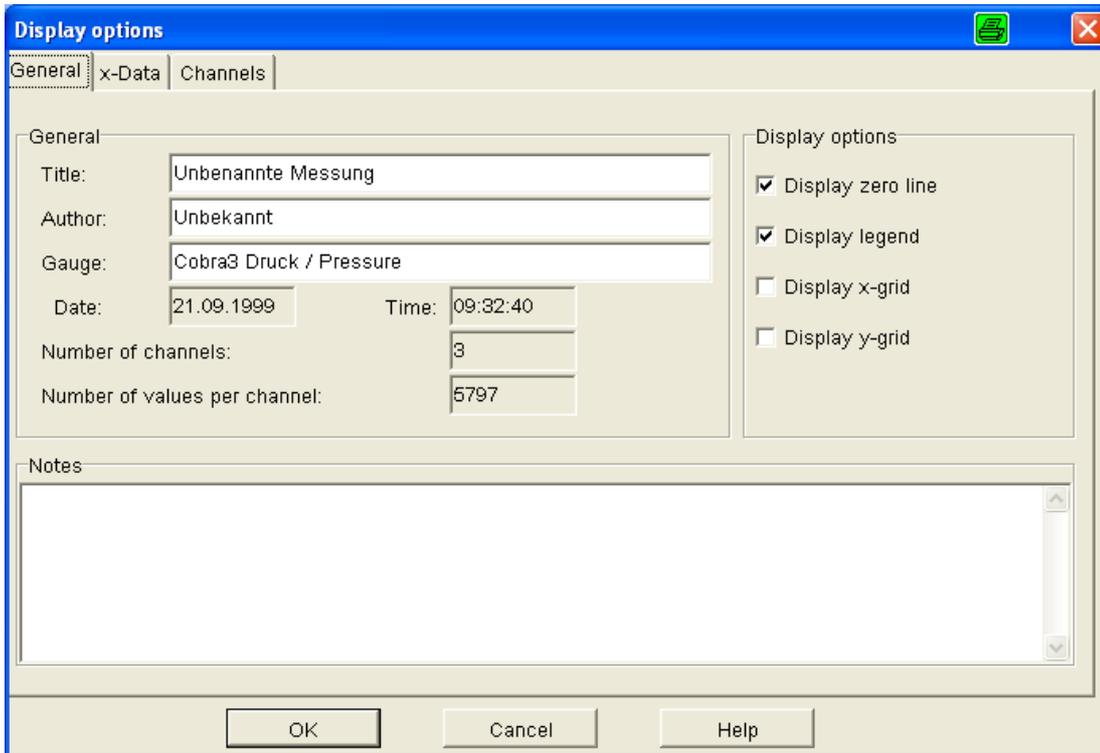
#### 3.2. Display Options



or menu *Measurement* → *Display options*

On the three tabs in this dialog window you may enter or change information on the measurement or you may change the look and the properties of the diagram.

*General:* Here you may e.g. label your measurement and file any information on it (*Notes*).



The screenshot shows the 'Display options' dialog box with the 'General' tab selected. The 'General' section contains the following fields:

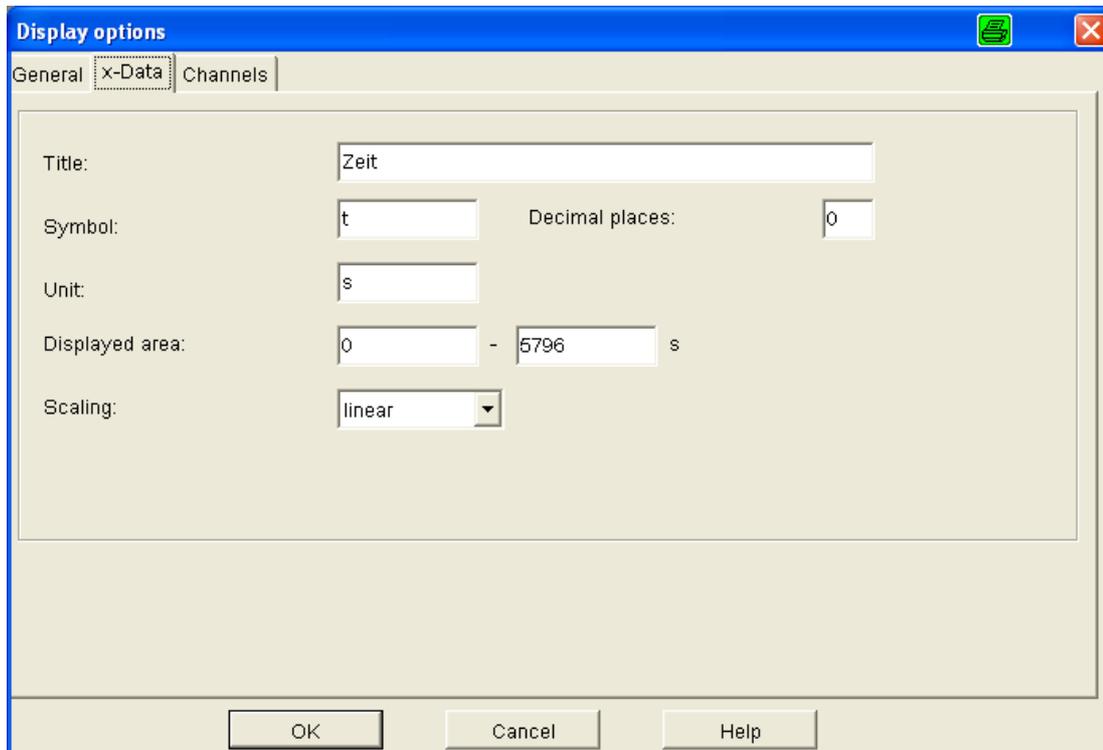
- Title: Unbenannte Messung
- Author: Unbekannt
- Gauge: Cobra3 Druck / Pressure
- Date: 21.09.1999
- Time: 09:32:40
- Number of channels: 3
- Number of values per channel: 5797

The 'Display options' section contains the following checkboxes:

- Display zero line
- Display legend
- Display x-grid
- Display y-grid

The 'Notes' section is an empty text area. At the bottom, there are 'OK', 'Cancel', and 'Help' buttons.

*X-Data:* You may e.g. change the title of the diagram's x-axis or activate the displaying of symbols for data points in the plot.

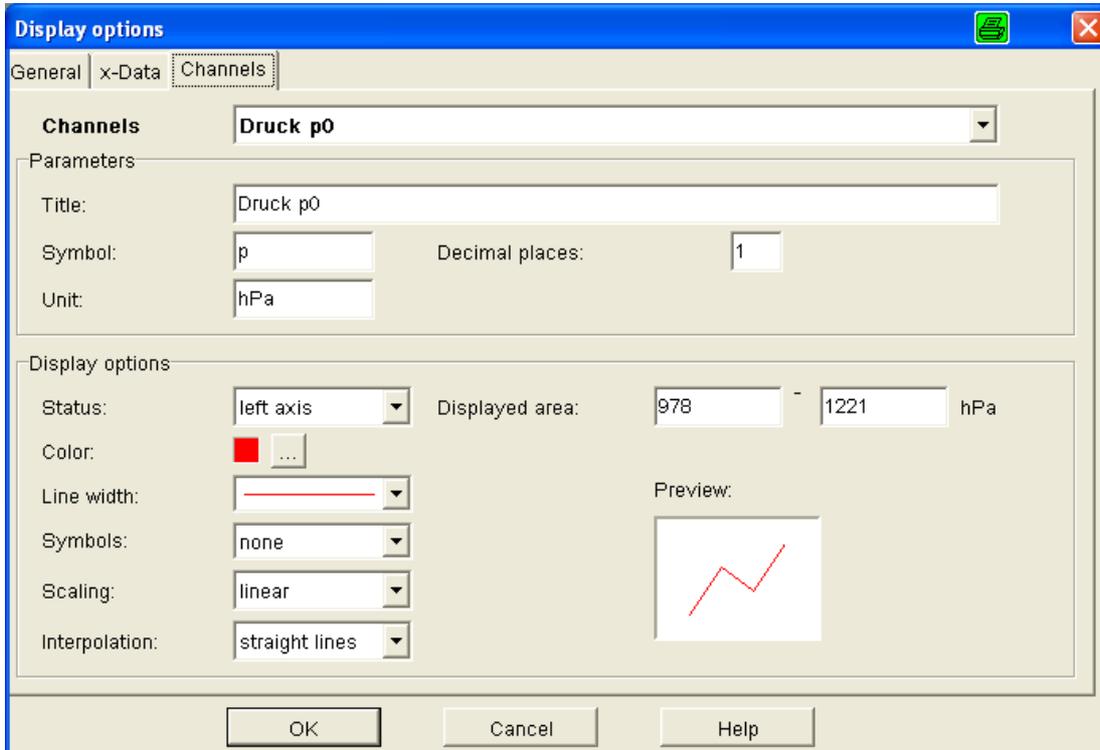


The screenshot shows the 'Display options' dialog box with the 'X-Data' tab selected. The 'X-Data' section contains the following fields:

- Title: Zeit
- Symbol: t
- Decimal places: 0
- Unit: s
- Displayed area: 0 - 5796 s
- Scaling: linear

At the bottom, there are 'OK', 'Cancel', and 'Help' buttons.

**Channels:** On this tab, you may relabel the measured quantities and adjust the display options of the diagram, e.g. the color of a plot or the scaling (linear or logarithmic) of the axis for the selected channel.



### 3.3. Show experiment documentation



or menu *Help* → *Index*, *File* → *Show experiment documentation*

The left icon will open the index of the online manual, where you will find additional, more specific information.

If you like to open an experiment created by PHYWE, use *File* → *Open experiment* to load the desired experiment. The right icon will be displayed as a yellow book. If you press this icon, Acrobat Reader™ will be opened and the documentation of the selected experiment will be viewed as a PDF file. (On the *measure-CD* you will find the current version of Acrobat Reader™.)

PHYWE experiments in *measure* consist of the experiment documentation in PDF format and, if existing, pre-settings for the measurement as well as measurement samples.

### 3.4. Scrolling



Scrolling

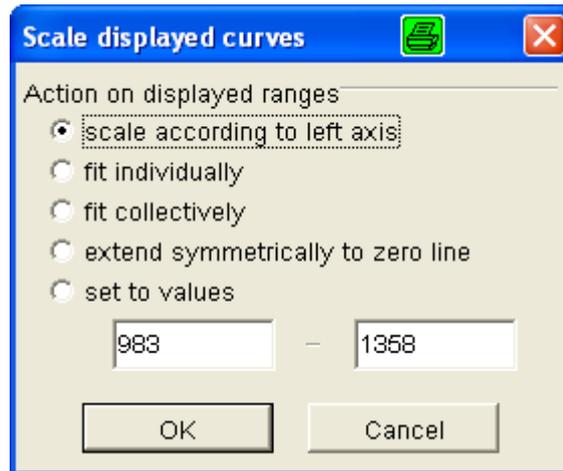
These four icons scroll the displayed section of the plot in the diagram.

### 3.5. Scale curves



Scale curves

The scaling function allows the alignment of the measuring curves according to five different criteria.



- *scale according to left axis*: for all curves the scale of the current y-axis is applied
- *fit individually*: for every curve an individual scale of its y-axis is applied to fill the diagram
- *fit collectively*: for all curves the same scale is applied, the y-axis being stretched to a maximum
- *extend symmetrically to zero line*: the zero crossings of all curves are matched
- *set to values*: custom scale of the y-axis

### 3.6. Fitting curves to the diagram



Fit in

Using this icon, you may align the diagram axes automatically. The whole curve (i.e. all values taken during measurement) will be displayed in the diagram. Please note, that the left and right axes can be given a completely different scaling when they display two channels simultaneously.

This feature is equivalent to the option *fit individually* in the menu *Scale curves*.

### 3.7. Mouse modes

The following icons show the active mouse mode. Thus one of these icons will be activated at any time and may not be deactivated.

#### 3.7.1. Arrow



Arrow

- Left mouse click on any curve: The left y-axis of the diagram will be scaled and the title of the axis will be adjusted.
- Left mouse click on any curve while pressing the *Ctrl* key: The right y-axis of the diagram will be activated/deactivated and scaled.
- Right mouse click on any diagram: The menus for the display options and the data table of this diagram may be opened.

### 3.7.2. Zoom

#### Zoom

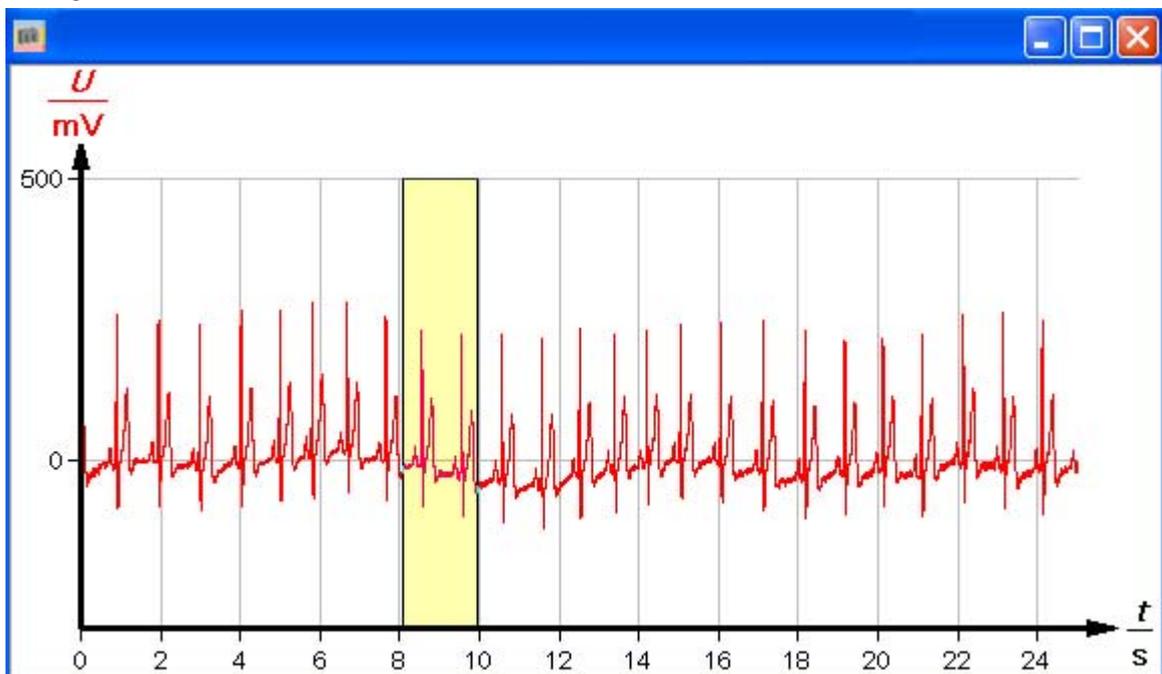
If you like to zoom into a diagram, mark the desired area while holding the left mouse button. A right mouse click will zoom back out.

To view the full diagram again, use the quadruple arrows icon .

### 3.7.3. Mark

#### Cross hairs/mark

Use the cross hairs icon to mark any x-interval by holding the left mouse button and moving the mouse from left to right.



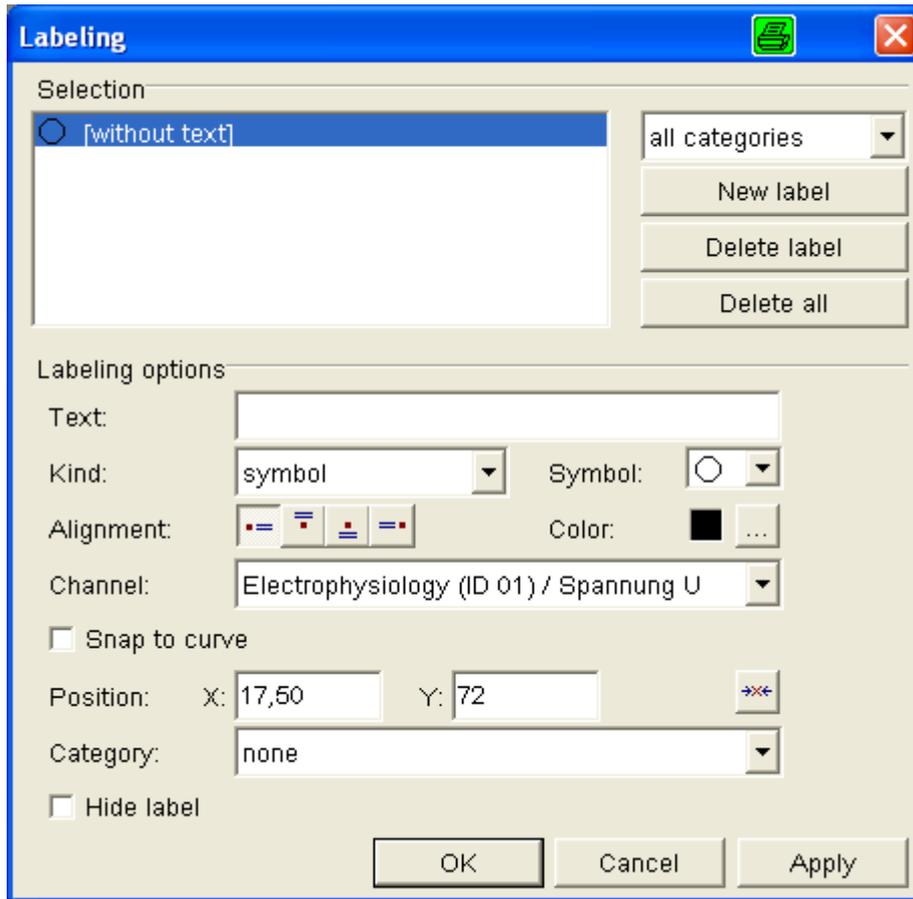
This data interval will also be highlighted in the data table if you open the corresponding dialog. You may then delete the marked interval (using *Ctrl+X* or the *Cut* icon in the tool bar or the menu *Analysis* → *Cut*).

What is more, all analysis functions and modification functions may be applied to the marked interval if the chosen option is reasonably applicable (for functions, not for relations).

### 3.7.4. Label

#### Label

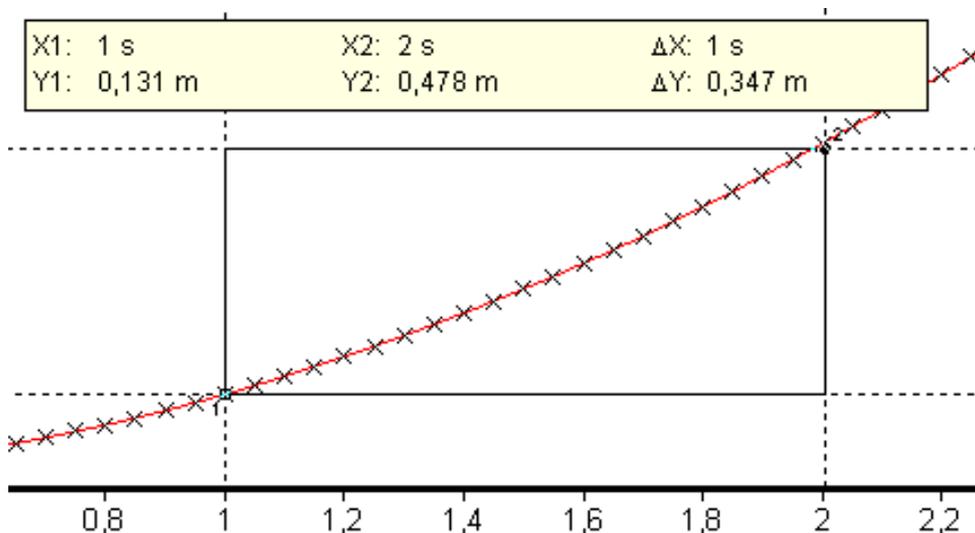
If the *Label* icon is activated, you may select a data point in the diagram which you like to label. Doing a left mouse click on the data point will open the dialog window *Labeling*, where you can choose between different options for the label and enter a text.



### 3.7.5. Survey mode

#### Survey

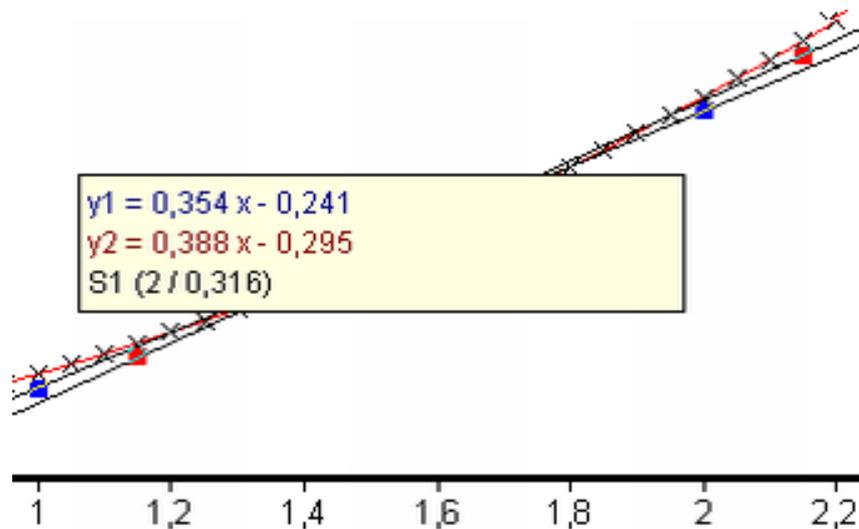
Using this rectangle icon, two data points will appear in the diagram defining a rectangle. The coordinates of the points are shown. The points may be moved arbitrarily within the diagram.



### 3.7.6. Regression

#### Regression

In the regression analysis mode up to three regression lines may be added to the diagram. The data interval, used for the regression, will be determined by the two markers. The position of the markers can be changed. The regression equation will be displayed automatically.



Additionally, points of intersection will be displayed if two or more regression lines are plotted. Doing a right mouse click, you will open a menu, where you may add or delete regression lines.

-  Add 3rd line
-  Remove 2nd line
-  Display options...
-  Data table...

### 3.8. Selecting the measuring channels

#### Boxes showing the selected measuring channels

These boxes in the tool bar show the selected measuring channels. Doing a right mouse click on one of the boxes, you may activate or deactivate a channel, display the channel on the right axis or open the menu for the display options.

### 3.9. Legend

#### Legend

If this icon is activated, the legend of the diagram with the titles and labels of up to 16 measuring channels will be displayed in a small diagram. The dots indicate the channels the scale of the left axis is adjusted to (view *Scale curves*).

### 3.10. Hot keys

The following hot keys are available for easier and faster handling of the software.

F2:	Display options
STRG + N:	New measurement
STRG + P:	Print measurement
STRG + O:	Open measurement
STRG + S:	Save measurement
STRG + C:	Export data
STRG + V:	Import data
STRG + X:	Cut selected data
SHIFT + F1:	Help index

Besides the options for moving and zooming of curves, a few more functions for the y- and x-axes are available, using the mouse:

- Holding the left mouse button in the region of any axis, the curves will be displaced when moving the mouse.
- Holding the right mouse button in the region of any axis, the curves will be stretched in or out.
- If you hold the *Ctrl* key while holding any mouse button, these actions will only be applied to the curve for which the y-axis is activated.
- If the mouse wheel is turned while the mouse cursor is in the region of any axis, a centred zoom will be performed.

## 4. Analysis functions

### 4.1. Analysis



oder Menüpunkt *Messauswertung*

Unlike the modification functions, the analysis functions do not change the original data. Use the mark mode  to analyse only a subset of the data. The analysis functions include:

- Peak analysis (display the x- and y-coordinates of curve peaks)
- Curve analysis (display the extrema and roots of a curve)

Also, the following information may be shown:

- average value
- slope
- integral
- extrema
- point of equivalence (determination of the equivalence point and, if applicable, pKs-values of titration curves)

## 5. Modification functions

### 5.1. Analysis



or menu *Analysis*

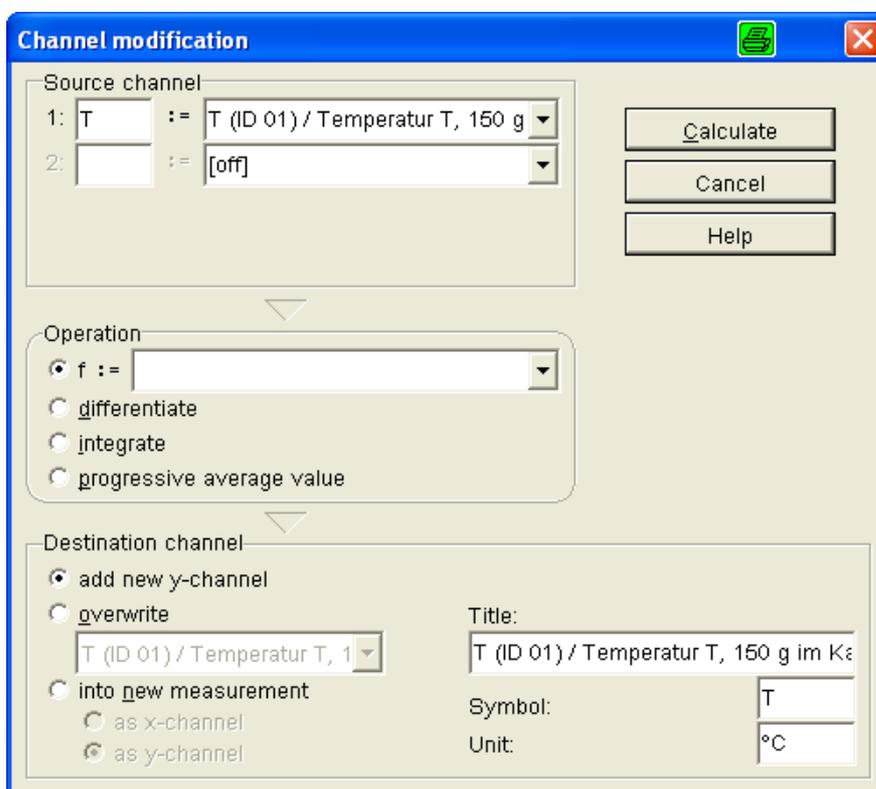
These functions change the original data.

### 5.2. Channel modification



Channel modification

With this function you may convert up to 4 measuring channels, using a mathematical function (e.g. differentiating, integrating or continuously averaging). You may apply this function not only to the y-channels but also to the x-channel so that you are able to use this function to convert measuring units (e.g. from s into ms).



This example for the application of a mathematical formula shows the conversion from degree Celsius to degree Fahrenheit:



### 5.3. Fourier analysis

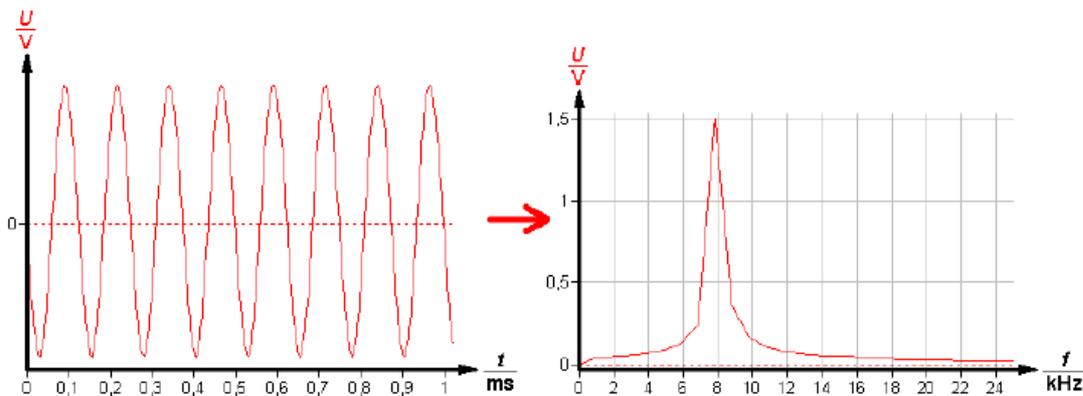
#### Fourier analysis

This function is a software-based frequency analysis tool. It provides analysis and synthesis tools. Also, data can be imported from other data capture solutions and may be analyzed by *measure's* Fourier analysis function.

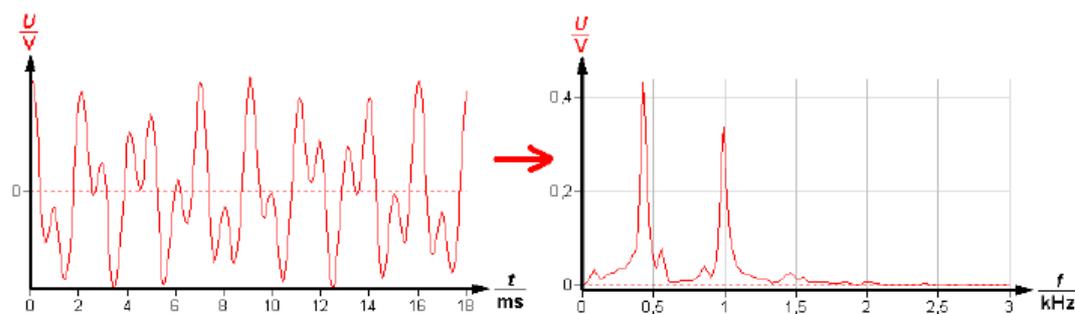
Opening the tab *Analysis*, a Fourier analysis may be performed.

Opening the tab *Synthesis*, a signal may be calculated from a given spectrum. The synthesis inverts the results of the analysis.

Example: Fourier spectrum of a simple sine wave



Example: Fourier spectrum of a wave with multiple sine components



### 5.4. Function fitting

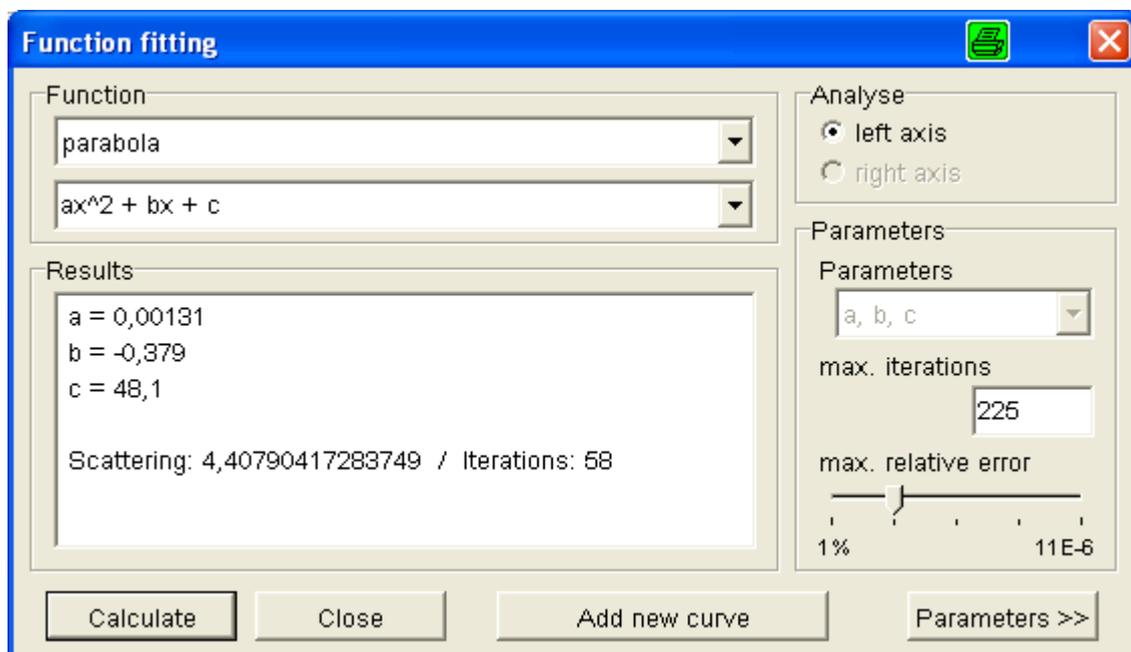
#### Function fitting

Using this tool, you may determine the equation of a mathematical function, which fits best the data points of a given curve (least deviation from the data points). Standard functions are already given as samples but any custom function may be fitted if the equation of the function is entered.

Fitting functions, which may be applied:

- Straight line
- Parabola
- 3<sup>rd</sup> degree polynom

- 4<sup>th</sup> degree polynom
- 5<sup>th</sup> degree polynom
- Sine oscillation
- Sine oscillation without offset
- Exponential function
- Exponential function
- Normal distribution
- Scaled normal distribution
- Scaled normal distribution with offset
- Poisson distribution
- Scaled Poisson distribution
- Scaled Poisson distribution with offset



### 5.5. Calculate average value



#### Calculate average value

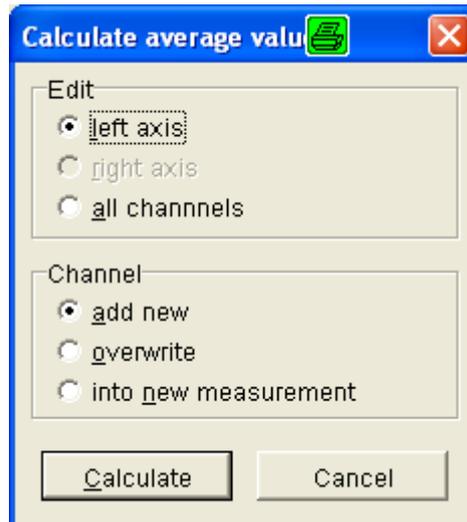
This function calculates the average value of a marked interval and adds a curve for this average value to the current or to a new diagram.

### 5.6. Smooth



#### Smooth

Simple smoothing function, which may e.g. smooth a curve if the measurement data is superposed with noise.



## 5.7. Cut



Cut

This function cuts/deletes a marked interval, e.g. if you want to delete outlying data from the diagram.

## 5.8. Play on soundcard



Play on soundcard

Using this icon, you may play the measuring curves on the soundcard of the computer.

## 6. Additional functions

In addition, the following functions are available in the menu *Measurement*.

### 6.1. Adopt channel

With this feature, data of different measurements can be merged into one data set.

Open all measurements with the measurement diagram active, into which the other datasets are supposed to be merged. Then select *Adopt channel* and select the measurements and measurement channels.

### 6.2. Export data

Data can be exported as numbers, bitmaps or metafiles. It will then be available for other applications, e.g. Excel.

### 6.3. Import data

Data, e.g. from Excel, may be imported through the clipboard (select and copy data in Excel).

6.4. Enter data manually

Settings for the manual input of data:

**Create new measurement**

General settings  
 Title:   
 Number of channels:  Number of values:

x-Data

Title	Symbol	Unit	Digits
Number	n	#	0

Channels

Title	Symbol	Unit	Digits
Channel 1			1

Continue Cancel

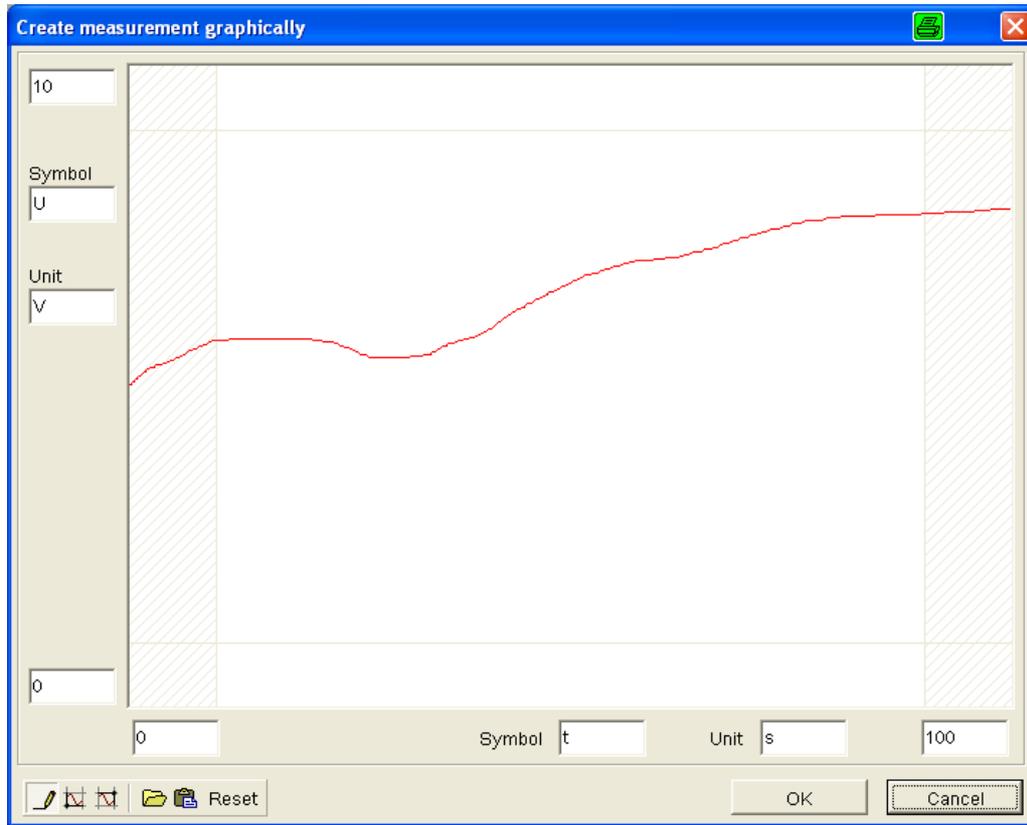
Enter the values into the data table:

**m Input of data**

Number n / #	Channel 1
1	5,0
2	13,0
3	5,7
4	4,1
5	6,2
6	8,4
7	2,2
8	0,5
9	9,1
10	1,45

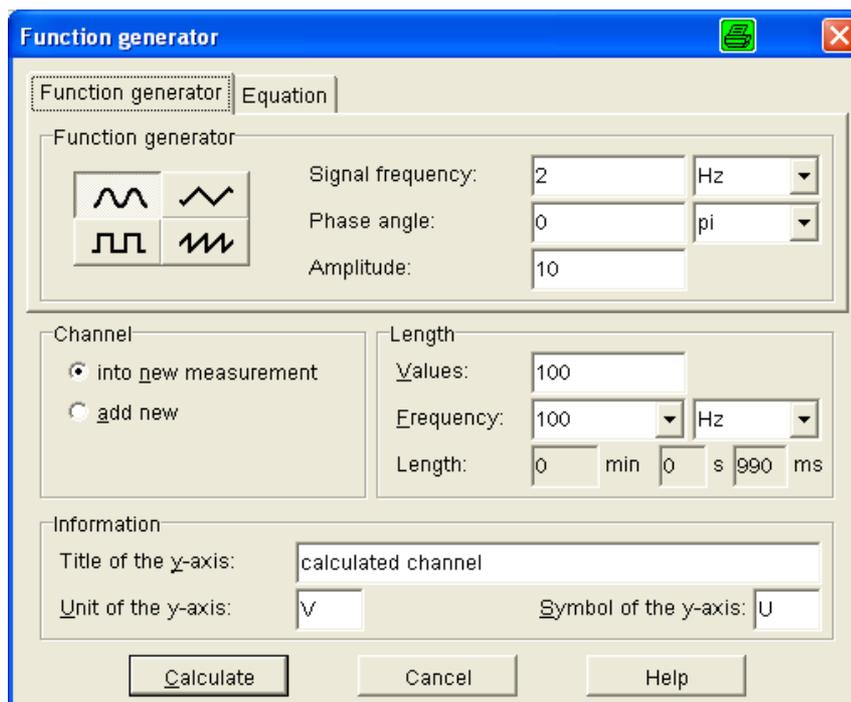
+ ✂ OK Cancel

## 6.5. Enter data graphically

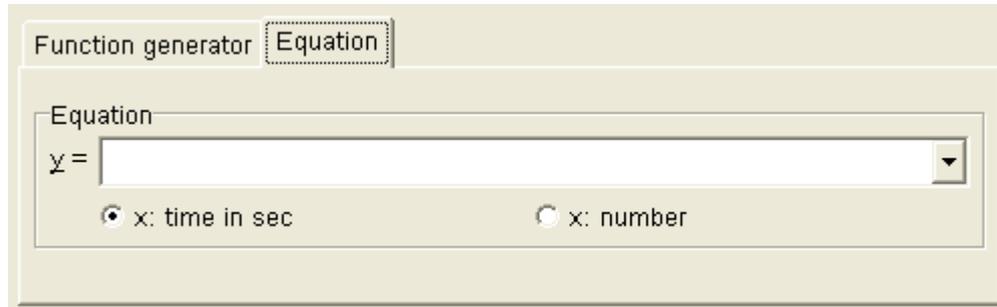


Draw a function by using the pencil tool. Enter the dimensions, symbols and units for the curve.

## 6.6. Function generator



With this function generator you may generate a measuring channel, providing a mathematical function. This allows you e.g. to compare a measured curve to a theoretical curve.



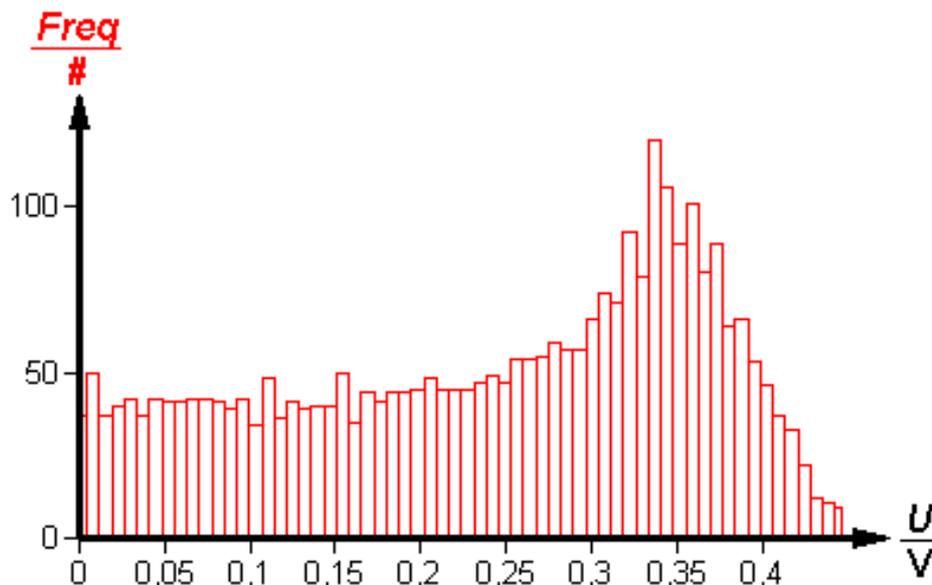
The following other functions are available in the menu *Analysis*.

#### 6.7. Show half-life/half-value thickness

If the active dataset represents a measurement of radioactivity, this function allows you to calculate the half-life  $t$ , or the half-value thickness  $d$ , respectively.

#### 6.8. Interval plot

With this function you may create histograms. A measuring curve is converted into a plot of absolute frequencies. The measuring values within defined y-intervals are counted. This interval plot may be used for the statistical evaluations, e.g. of radioactivity measurements.



#### 6.9. X-ray spectroscopy

This broad analysis tool may be used for the further analysis of data from PHYWE's didactic X-ray instrument.

The following functions are provided:

- Convert x-axis
- Spectrum conversion
- Dead time correction
- Duane-Hunt straight line
- Determine Planck-constant
- Moseley straight line
- Determine Rydberg-constant
- Compton experiment