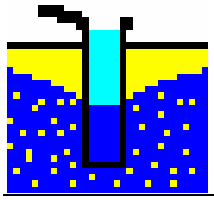
Evaluation and representation of pumping tests

GGU-PUMPTEST

VERSION 2



January 2001

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1 Preface

The GGU-PUMPTEST program allows the evaluation of pumping tests using the following methods:

- time-drawdown method;
- distance-drawdown method;
- distance-time-drawdown method;
- Theis recovery method;
- Theis type curve method.

Besides the evaluation of pumping tests, the program allows pumping test planning ("Test planning" menu). Here, you can simulate a pumping test using estimated values for permeability, etc. It is then possible, based on the simulation results, to estimate the measurement precision required and the time required for the pumping test.

Data input is in accordance with WINDOWS conventions and can therefore be learned almost entirely without the use of a manual. Graphic output supports the true-type fonts supplied with WINDOWS, so that excellent layout is guaranteed.

The results are graphically represented on a sheet consisting of a number of elements. These elements can be resized and repositioned to suit your requirements. In addition, you can add your own graphic elements using the integrated Mini-CAD module. You can insert stamp fields (e.g. company logos) in the same manner. The default format is an A4 sheet. If required the sheet format can be modified (e.g. A0).

The program has been thoroughly tested. No faults have been found. Nevertheless, liability for completeness and correctness of the program and the manual, and for any damage resulting from incompleteness or incorrectness, cannot be accepted.

2 Installation and language selection

For installation and subsequent registration of GGU software, please refer to the information in the "Installation notes for GGU Software", which are supplied with the program.

GGU-PUMPTEST (International version) is a bilingual program. You may choose to work in German or English. The international version is delivered with English as the default menu and graphics language.

If you would like to work with GGU-PUMPTEST (International version) in German, start the program and go to "File / New" in the initial menu bar. An expanded menu bar appears. Go to the "?" menu and there to the menu item "International version" and deactivate the switch for translating the menus and graphics (see also Section 10.6).

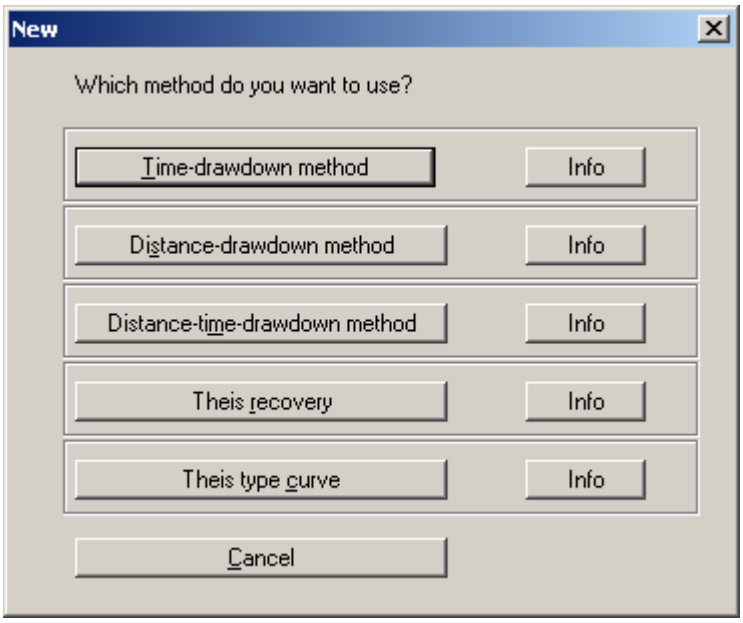
3 Theoretical principles

3.1 Overview

The program is based on the theoretical principals described in:

- **Langguth / Voigt**
  Hydrogeologische Methoden (Hydrogeological Methods)
  Springer-Verlag
  ISBN 3-540-10174-8
  ISBN 0-387-10174-8

You can also acquaint yourself very quickly with the data input methods without reading the user-manual by going directly to the “File / New” menu.



Then select the evaluation method of your choice. After this, go to the “Test planning” menu. Enter the required values according to the selected evaluation method. The program will then simulate a pumping test and you can subsequently view the simulated values in the corresponding menu items.

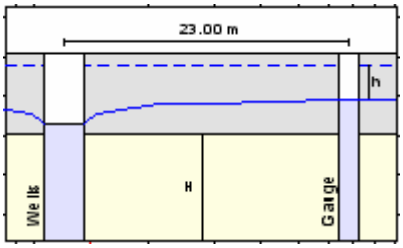
The individual methods will now be explained in more detail. In addition, an example will be described in each case. All examples are provided as files with the program and can be loaded and viewed.

You must enter a drawdown for all evaluation methods. These drawdown values are so-called depth-to-(ground)water values: That is, the values must be entered as positive downwards (measured from the at-rest water level).

3.2 Time-drawdown method

The theoretical principles are described in **Langguth / Voigt** on pages 165 to 167.

This method entails a drawdown in a well with a constant pumping rate. At the same time, the course of the drawdown is measured in a nearby monitoring well.



The graphical representation of the test results is in a semi-logarithmic scale (drawdown against time). The following data is required:

- distance between the extraction well and the monitoring well;
- the constant pumping rate in the extraction well;
- the aquifer thickness H;
- confined or unconfined aquifer and;
- the drawdown h against time in the monitoring well.

After defining the input values they are entered against time and the best-fit curve determined. The permeability can then be determined.

Example:

This is the example given for Gauge 3b in **Langguth / Voigt**. The following values were measured in Gauge 3b:

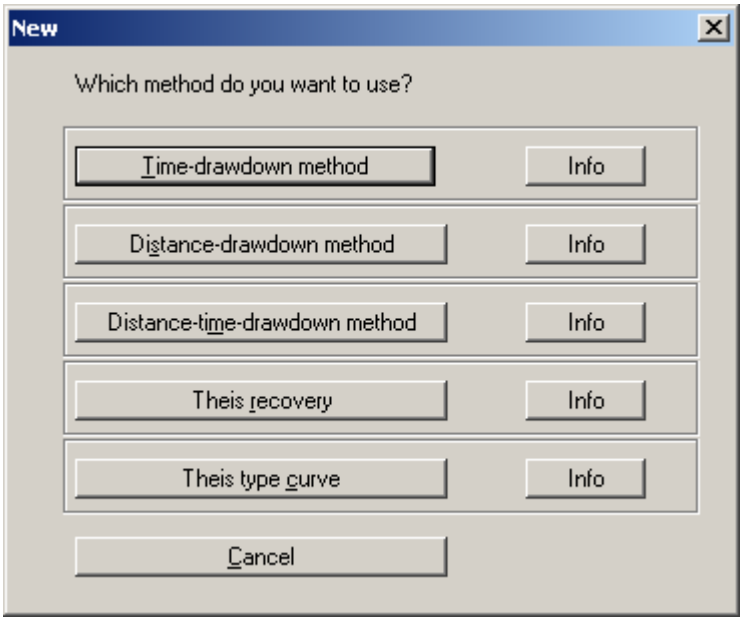
Time [s]	h [m]
12.0	0.050
18.0	0.100
22.0	0.150
36.0	0.250
54.0	0.350
81.0	0.450
122.0	0.550
226.0	0.700
346.0	0.800
434.0	0.850
549.0	0.900
689.0	0.950

Time [s]	h [m]
861.0	1.000
1080.0	1.050
1420.0	1.110
1800.0	1.150
2160.0	1.200
2760.0	1.250
3480.0	1.300
4380.0	1.350
5280.0	1.390
8100.0	1.480
11600.0	1.550
14150.0	1.580

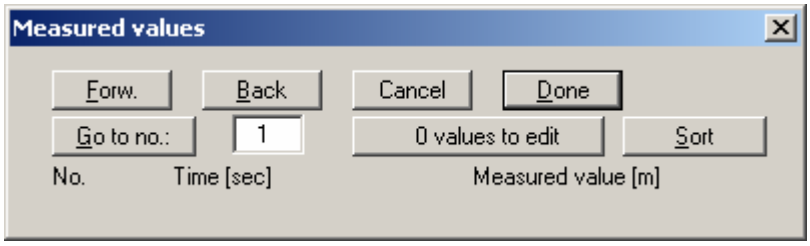
Table 1 Gauge 3b data

The pumping rate in the extraction well is 0.02667 m³/s. Gauge 3b is 23.0 m from the extraction well. The aquifer is 10.0 m thick. It is a confined aquifer.

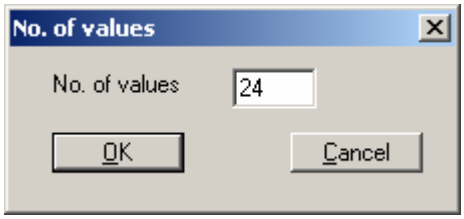
Go to the "File / New" menu item.



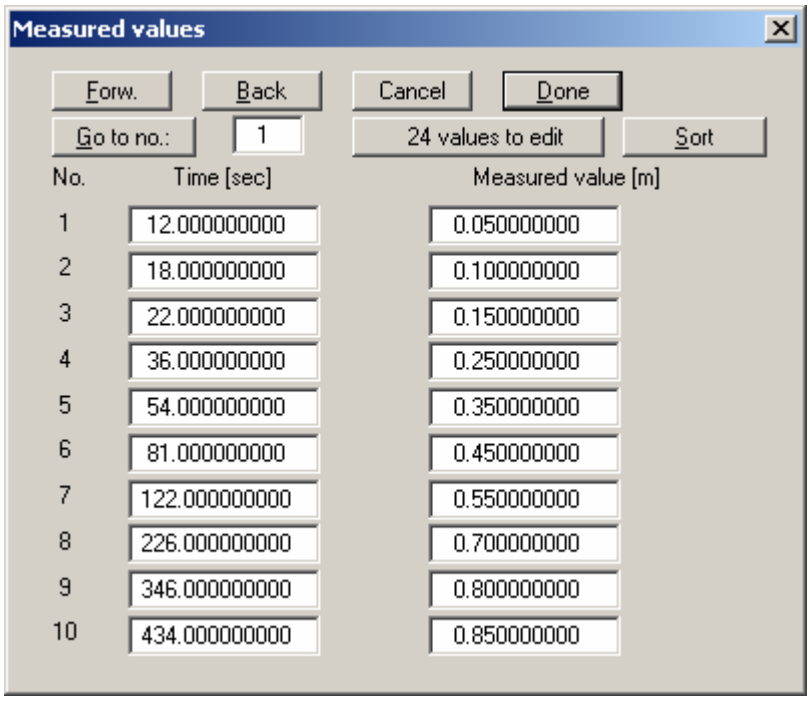
Select the “Time-drawdown method” button. Go to the menu item “Edit / Edit values”.



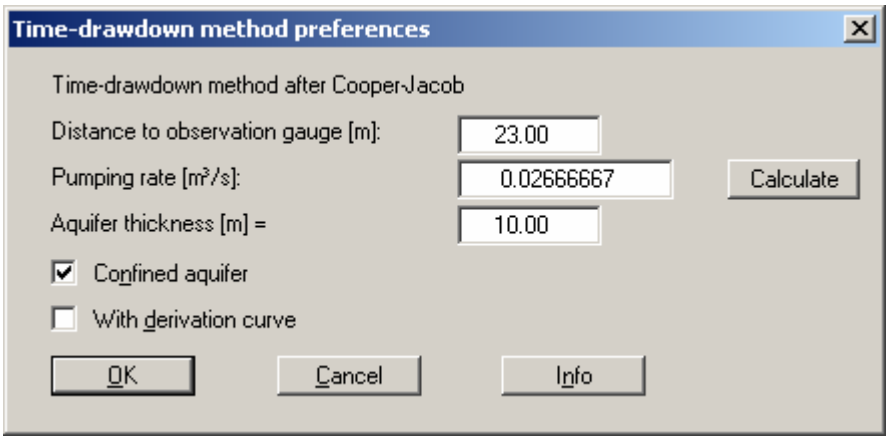
Choose the "0 values to edit" button



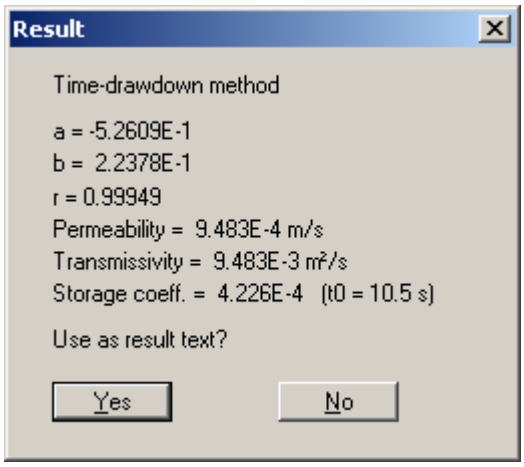
and enter “24”, because the test comprises 24 measured values. Enter the values given in Table 1 Gauge 3b data.



These values represent the times and corresponding drawdown in the monitoring well relative to the at-rest groundwater level. Navigate through the table using the “Forw.” Button in order to enter further values. Go to the “Evaluation / Time-drawdown method” menu item.



Enter the values in the dialogue box and confirm with “OK”.



The "a" and "b" values describe the course of the best-fit curve through the data. The "r" value is the correlation coefficient, representing the quality of the best-fit curve. Below this, the permeability, the transmissivity and the storage coefficient are given. The t_0 value describes the intersection of the best-fit curve with the time axis.

The solution given in **Langguth / Voigt** is:

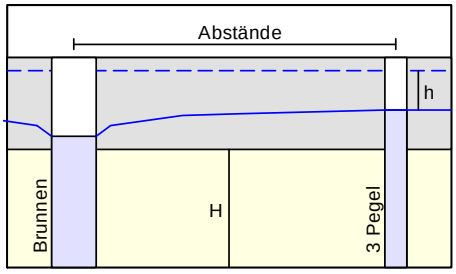
- $T = 9.4 * 10^{-3}$ m²/s;
- $S = 4.6 * 10^{-4}$ m²/s.

The minor differences are due to the purely visual evaluation employed by **Langguth / Voigt**.

3.3 Distance-drawdown method

The theoretical principles are described in **Langguth / Voigt** on pages 167 to 169.

This method entails a drawdown in a well with a constant pumping rate. At the same time, the drawdown at a given time is measured in at least two nearby monitoring wells.



The graphical representation of the test results is in a semi-logarithmic scale (drawdown against distance). The following data is required:

- distances between the extraction well and the monitoring wells (>= 2);
- the drawdown h in the monitoring wells at a given time;
- the constant pumping rate in the extraction well;
- the aquifer thickness H;
- confined or unconfined aquifer.

After defining the input values they are entered against the distances to the extraction wells and the best-fit curve determined. The permeability can then be ascertained.

Example:

This is the example for Gauges 3b, 11b and 6b in **Langguth / Voigt**.

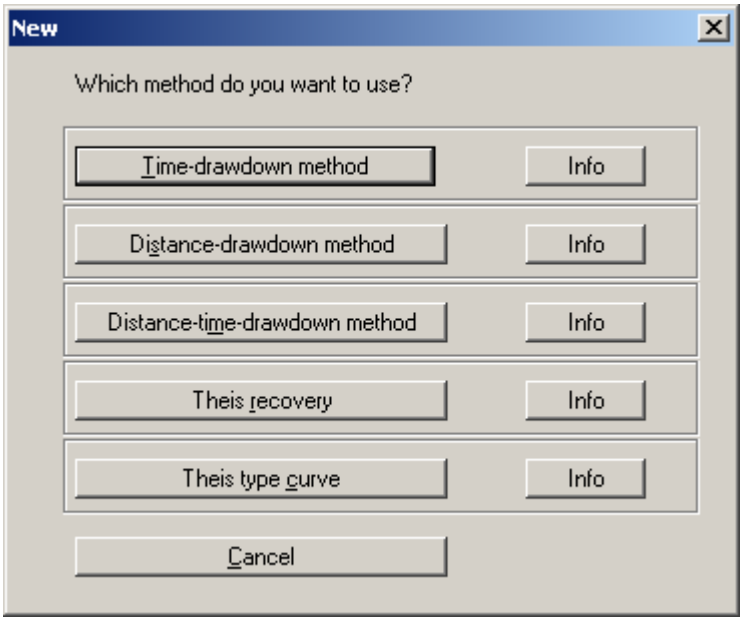
The pumping rate in the extraction well is 0.02667 m³/s. In Table 2 Gauges 3b, 6b and 11b data the distances of the three gauges to the extraction well and the drawdown at time t = 5400 seconds are given.

Gauge	Distance [m]	Drawdown h [m]
11b	7.40	1.990
3b	23.00	1.394
6b	139.60	0.611

Table 2 Gauges 3b, 6b and 11b data

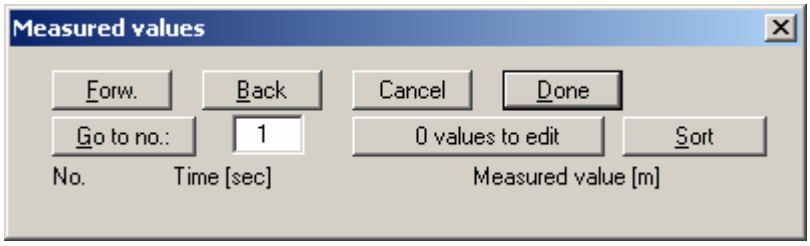
The aquifer is 10.0 m thick. It is a confined aquifer.

Go to the "File / New" menu item.

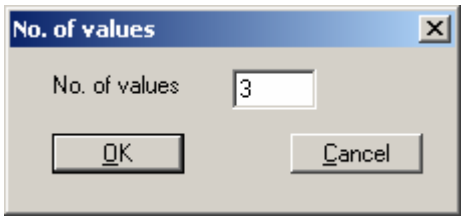


Select the “Distance-drawdown method” button.

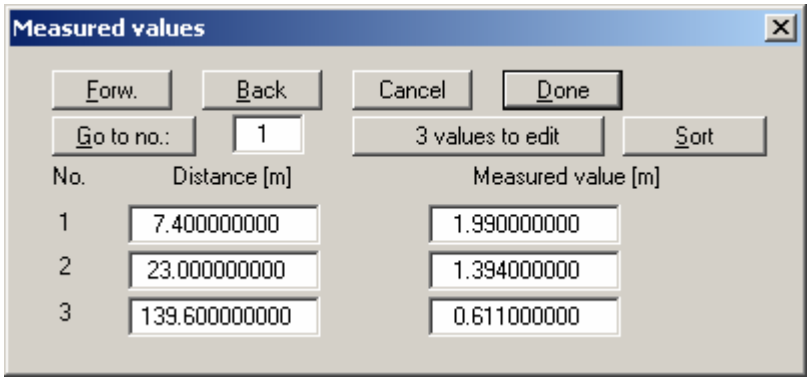
Go to the menu item “Edit / Edit values”.



Choose the "0 values to edit" button

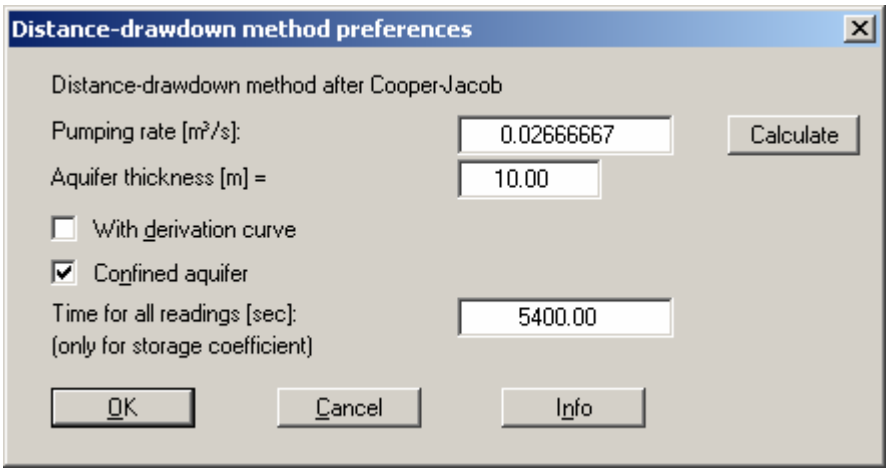


and enter “3”, because the test comprises measured values from 3 wells. Enter the following values:

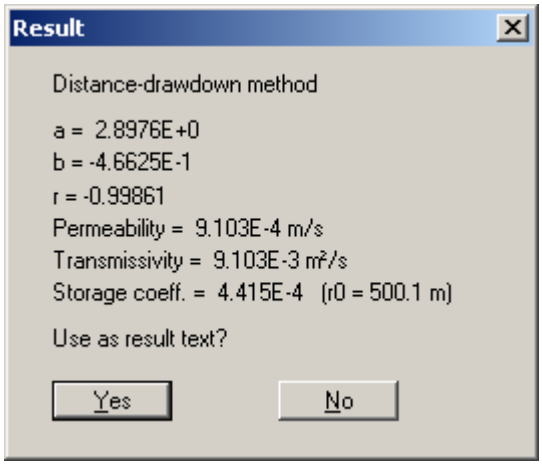


These values represent the distances of the monitoring wells to the extraction well and the corresponding drawdown relative to the at-rest groundwater level.

Go to the “Evaluation / Distance-drawdown method” menu item.



Enter the values in the dialogue box and confirm with “OK”.



The “a” and “b” values describe the course of the best-fit curve through the data. The “r” value is the correlation coefficient, representing the quality of the best-fit curve. Below this, the permeability, the transmissivity and the storage coefficient are given. The r_0 value describes the intersection of the best-fit curve with the distance axis.

The solution given in **Langguth / Voigt** is:

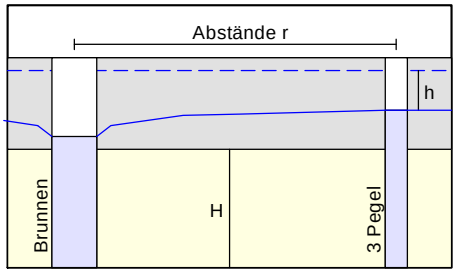
- $T = 9.0 * 10^{-3}$ m²/s
- $S = 4.8 * 10^{-4}$ m²/s.

The minor differences are due to the purely visual evaluation employed by **Langguth / Voigt**.

3.4 Distance-time-drawdown method

The theoretical principles are described in **Langguth / Voigt** on pages 169 to 171.

This method entails a drawdown in an extraction well with a constant pumping rate. At the same time, the course of the drawdown in this well is measured in at least two nearby monitoring wells.



The graphical representation of the test results is in a semi-logarithmic scale (drawdown against "Time / square of distance [t/r²]"). The following data is required:

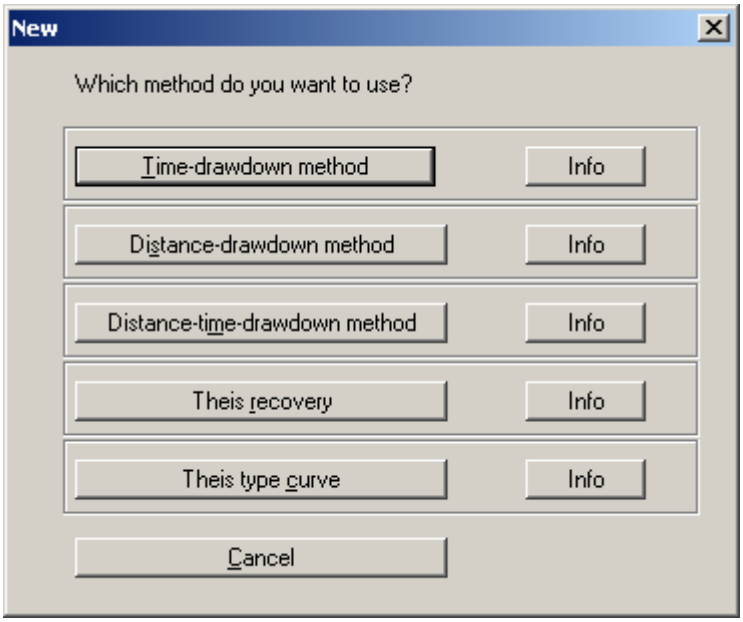
- distances (r) between the extraction well and the monitoring wells;
- the constant pumping rate in the extraction well;
- the aquifer thickness H;
- confined or unconfined aquifer and;
- the drawdown h against time in the monitoring wells.

After defining the input values they are entered against t/r² (t = time, r = distance to monitoring well) and the best-fit curve determined.

Example:

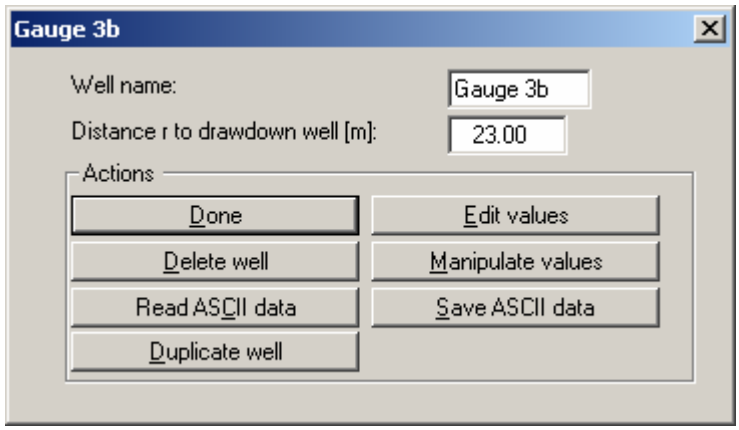
This is the example for Gauges 3b, 11b and 6b in **Langguth / Voigt**. The principal boundary conditions correspond to those of the previous two examples.

Go to the "File / New" menu item.

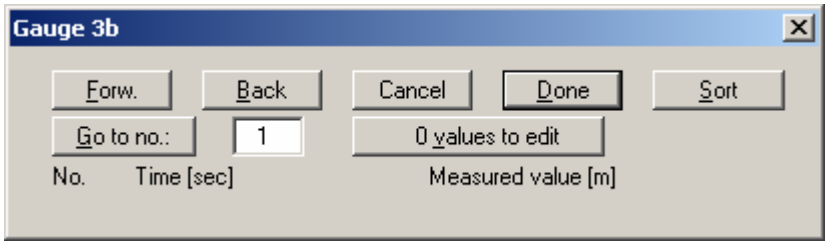


Select the "Distance-time-drawdown method" button. Go to the menu item "Edit / Edit values".

Click the “New” button.



Enter the well name and the distance to the extraction well. Select the “Edit values” button.



Enter “24” for the number of values, because the test comprises 24 measured values for the well “Gauge 3b”. Enter the values given in Table 1 Gauge 3b data.

Repeat this procedure for the other two gauges, “6b” and “11b”.

Gauge 6 b:

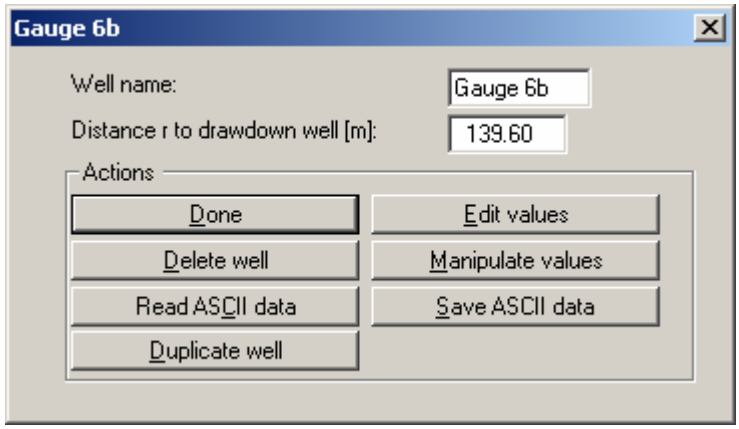
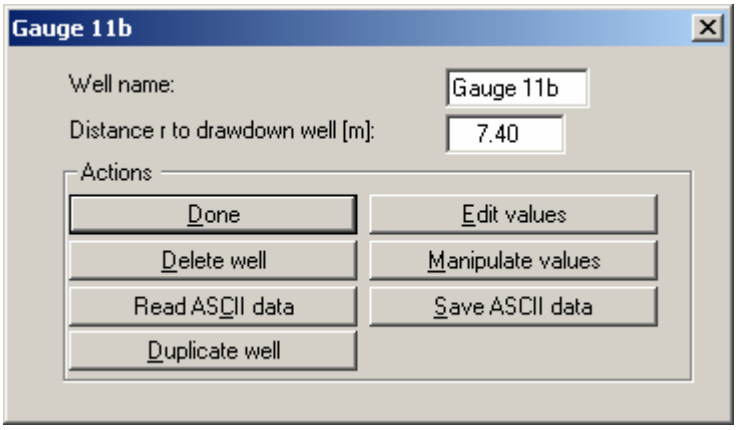


Table 3 Gauge 6b data

Time [s]	h [m]
240.0	0.140
360.0	0.200
600.0	0.250
780.0	0.290
1140.0	0.350
1500.0	0.400
2040.0	0.450
2760.0	0.500
3900.0	0.550
4800.0	0.590
6450.0	0.650
8650.0	0.710
11450.0	0.760
13900.0	0.800

Table 3 Gauge 6b data

Gauge 11 b:

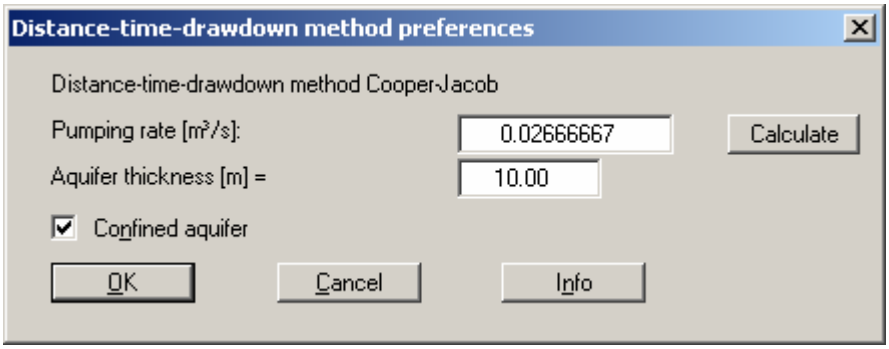


Enter the values given in Table 4 Gauge 11b data.

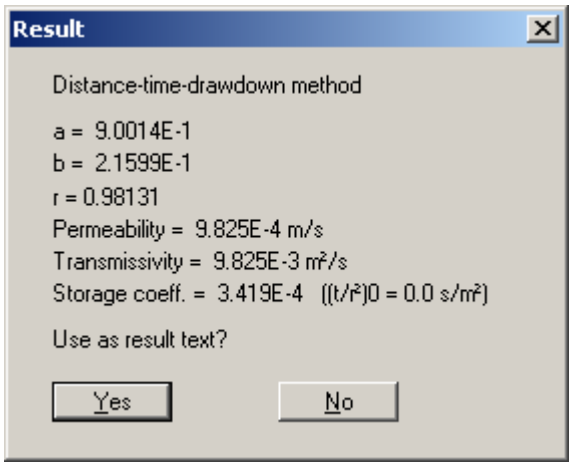
Time [s]	h [m]
17.0	0.300
21.0	0.400
27.0	0.500
35.0	0.700
53.0	0.930
85.0	1.030
168.0	1.200
220.0	1.280
281.0	1.350
330.0	1.400
450.0	1.470
540.0	1.500
720.0	1.560
1080.0	1.640
1440.0	1.710
2100.0	1.790
3000.0	1.860
3900.0	1.900
5400.0	1.990
8300.0	2.070
14600.0	2.180

Table 4 Gauge 11b data

Go to the “Evaluation / Distance-time-drawdown method” menu item.



Enter the values in the dialogue box and confirm with “OK”.



The "a" and "b" values describe the course of the best-fit curve through the data. The "r" value is the correlation coefficient, representing the quality of the best-fit curve. Below this, the permeability, the transmissivity and the storage coefficient are given. The $(t/r^2)_0$ value describes the intersection of the best-fit curve with the distance axis.

The solution given in **Langguth / Voigt** is:

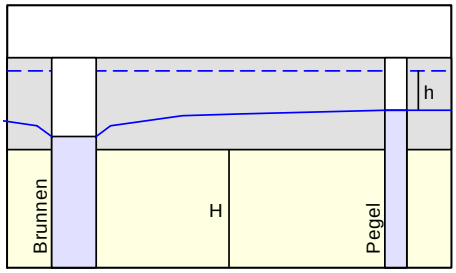
- $T = 8.9 * 10^{-3}$ m²/s
- $S = 4.6 * 10^{-4}$ m²/s.

The minor differences are due to the purely visual evaluation employed by **Langguth / Voigt**.

3.5 Theis recovery method

The theoretical principles are described in **Langguth / Voigt** on pages 171 to 175.

This method entails a drawdown in a well with a constant pumping rate. Recovery begins after switching off the pump in the extraction well. The recovery course is measured in a nearby monitoring well.



The following data is required for this method:

- the pumping duration until the pump is switched off;
- the constant pumping rate until the pump is switched off;
- the aquifer thickness H;
- confined or unconfined aquifer and;
- the course against time of the recovery h.

After defining the input values they are entered against

(dt + tp) / dt

dt = time difference until 1st measurement
tp = pumping duration

and the best-fit curve for this function determined; from this, the permeability can be calculated.

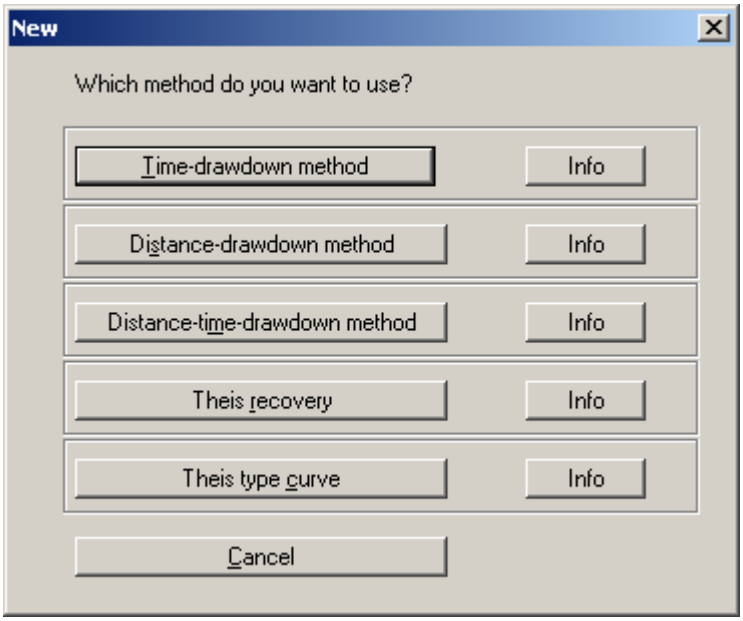
Example:

This is the example for Gauge 11b in **Langguth / Voigt**. After switching off the pump the following recovery is measured in Gauge 11b:

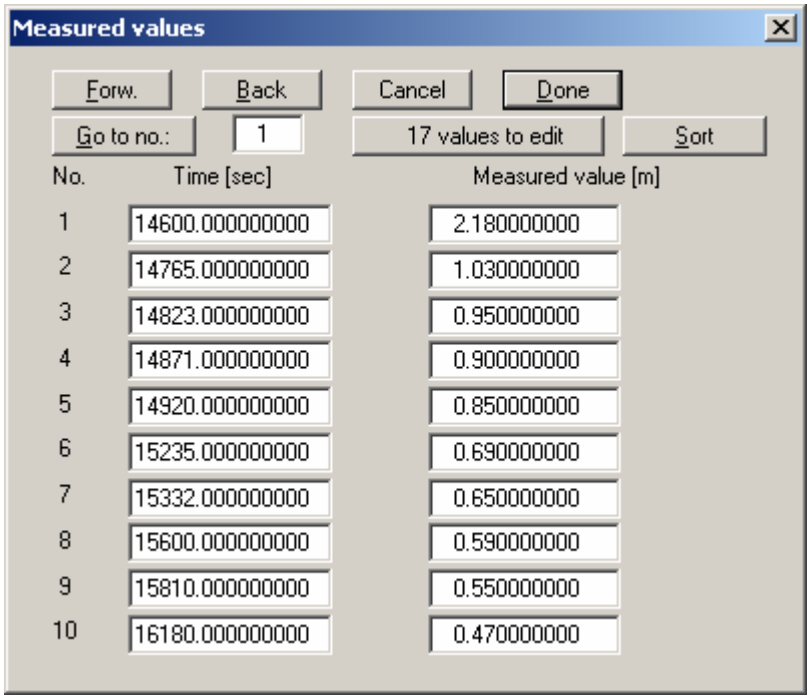
Time [s]	h [m]
14600.0	2.180
14765.0	1.030
14823.0	0.950
14871.0	0.900
14920.0	0.850
15235.0	0.690
15332.0	0.650
15600.0	0.590
15810.0	0.550
16180.0	0.470
16400.0	0.440
17300.0	0.350
17900.0	0.300
18560.0	0.260
19220.0	0.230
20700.0	0.170
23000.0	0.090

Table 5 Recovery in Gauge 11b

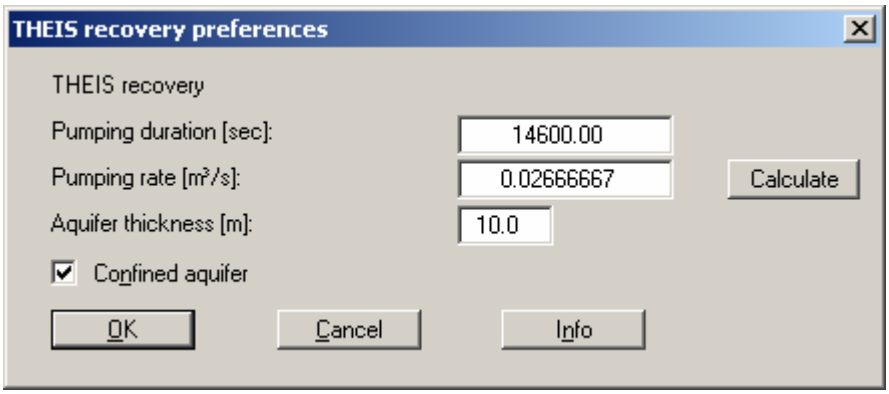
Go to the "File / New" menu item.



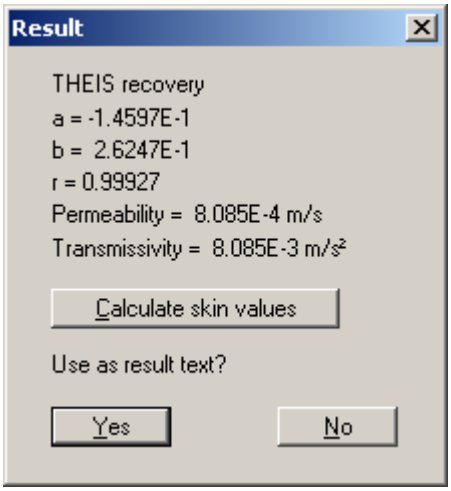
Select the “Theis recovery” button. Go to the “Edit / Edit values” menu item and enter the values from Table 5 Recovery in Gauge 11b.



Navigate through the table using the “Forw.” Button in order to enter further values. Go to the “Evaluation / Theis recovery” menu item:



Enter the values in the dialogue box and confirm with “OK”.



The “a” and “b” values describe the course of the best-fit curve through the data. The “r” value is the correlation coefficient, representing the quality of the best-fit curve. Below this, the permeability and the transmissivity are given.

The solution given in **Langguth / Voigt** is:

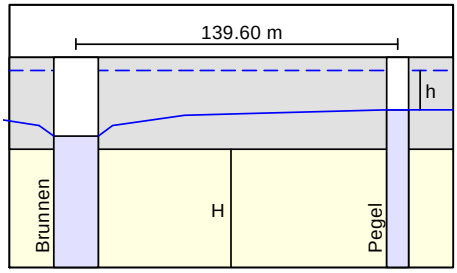
- $T = 8.4 * 10^{-3}$ m²/s

The minor differences are due to the purely visual evaluation employed by **Langguth / Voigt**.

3.6 Theis type curve method

The theoretical principles are described in **Langguth / Voigt** on pages 153 to 164.

This method entails a drawdown in a well with a constant pumping rate. At the same time, the course of the drawdown is measured in a nearby monitoring well.



The graphical representation of the test results is in a double-logarithmic scale (drawdown against t/r^2, t = time, r = distance between gauge and extraction well). The following data is required:

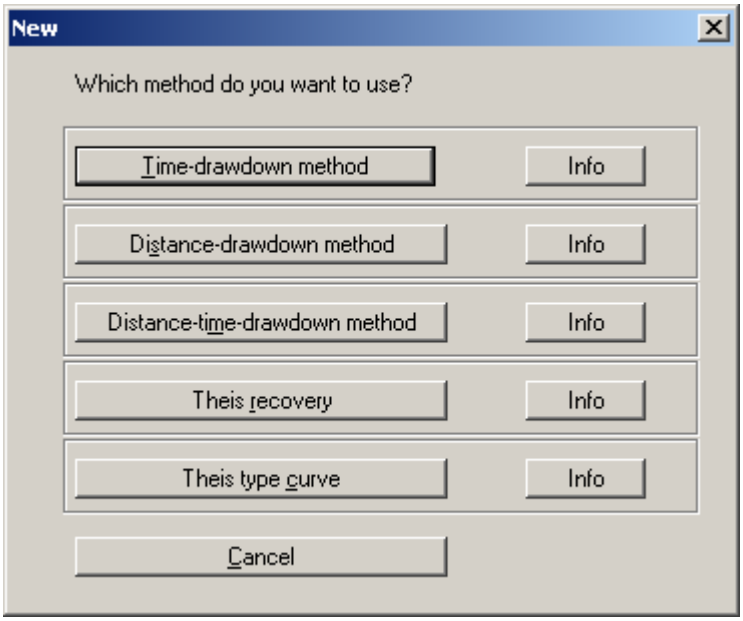
- distance between the extraction well and the monitoring well;
- the constant pumping rate in the extraction well;
- the aquifer thickness H;
- confined or unconfined aquifer and;
- the drawdown h in the monitoring well against time.

After defining the input values they are entered against time and the best-fit curve determined. The permeability can then be determined.

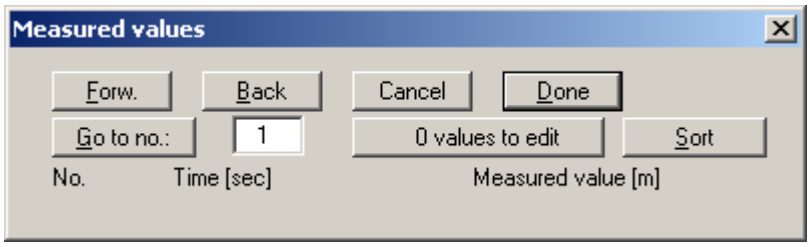
Example:

This is the example for Gauge 6b in **Langguth / Voigt**. The data for Gauge 6b are shown in Table 3 Gauge 6b data. The pumping rate in the extraction well is 0.02667 m^3/s. Gauge 6b is 139.60 m from the extraction well. The aquifer is 10.0 m thick. It is a confined aquifer.

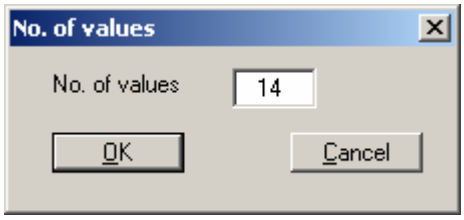
Go to the "File / New" menu item.



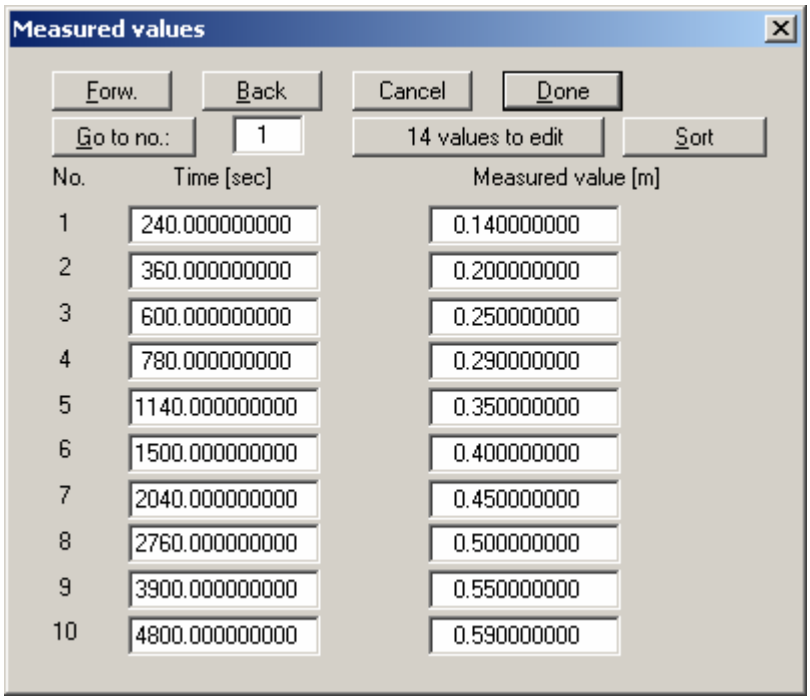
Select the “Theis type curve” button. Go to the menu item “Edit / Edit values”.



Choose the "0 values to edit" button

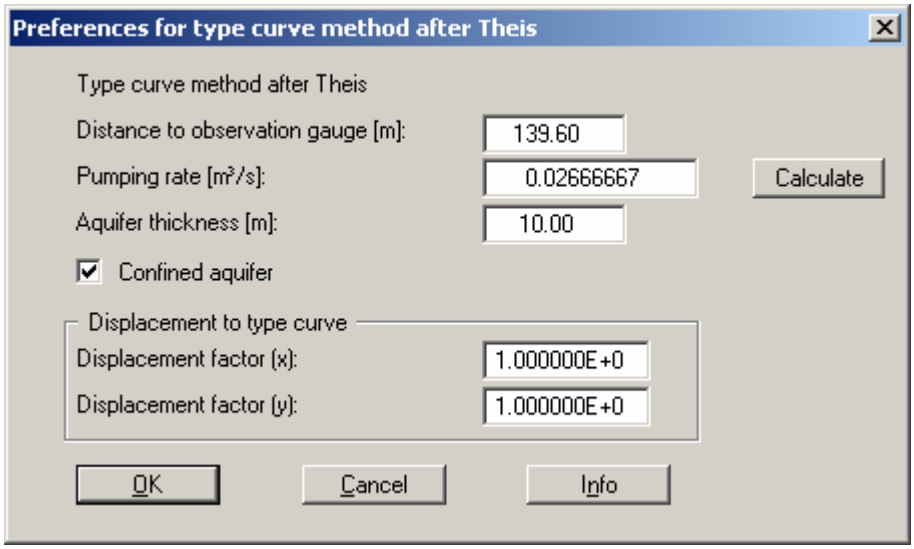


and enter “14”, because the test comprises 14 measured values. Enter the values given in Table 3 Gauge 6b data.



Navigate through the table using the “Forw.” Button in order to enter further values.

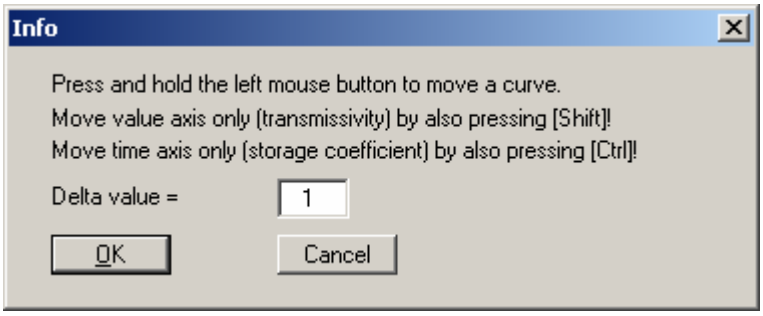
Go to the “Evaluation / Theis type curve” menu item:



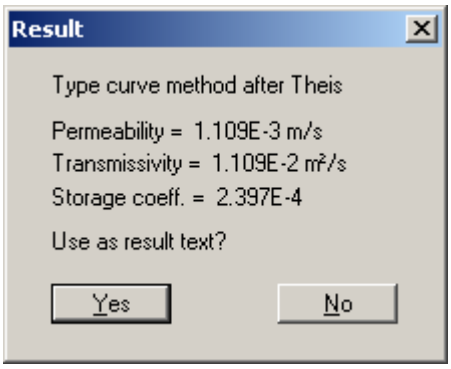
Enter the values in the dialogue box and confirm with “OK”. The “Displacement to type curve” values are determined automatically or “by hand” afterwards. After input, the measured curve must be made congruent with the type curve. Two methods can be used to do this:

- “by hand”;
- automatically.

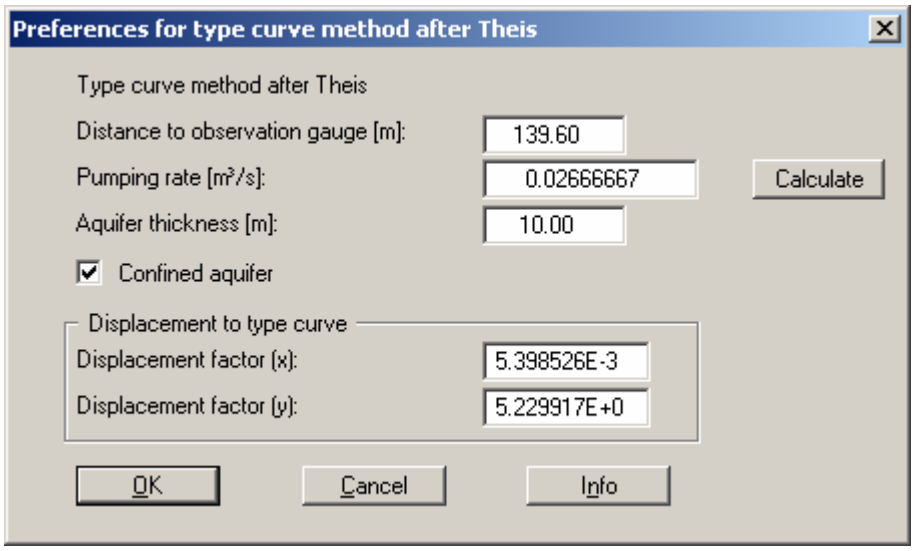
Go to the “Evaluation / Hand fit” menu item to select the “by hand” method.



Then click on the curve within the graphic with the left mouse button and hold the button pressed. Now displace the curve until the measured curve and the type curve are congruent. Now go to the “Evaluation / Permeability” menu item.

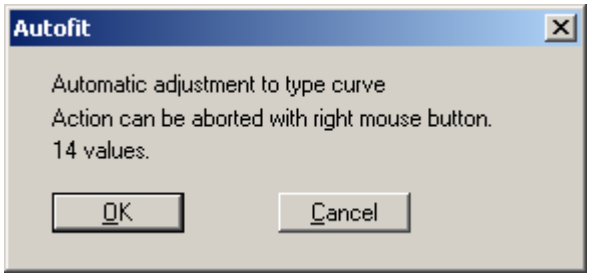


To check, you can select the menu item “Evaluation / Theis type curve” again.

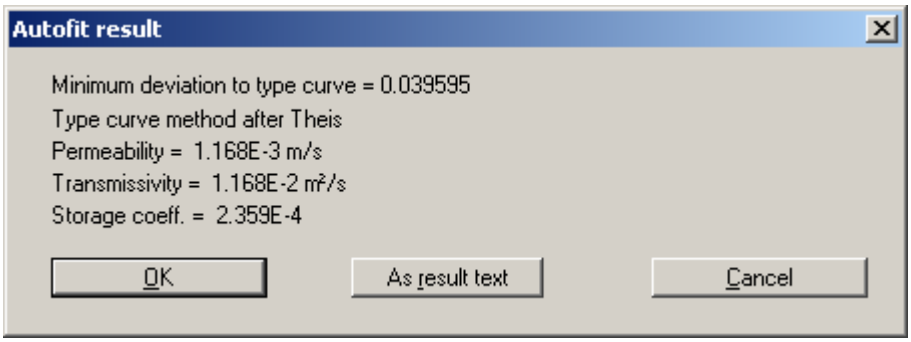


Because of the displacement of the curve, the displacement factors required for determination of permeability have now been determined.

Go to the “Evaluation / Auto fit” menu item to select the automatic method.



The program only requires a short time to determine the displacement factors.



The solution given in **Langguth / Voigt** is:

- $T = 1.1 * 10^{-3}$ m²/s
- $S = 2.4 * 10^{-4}$ m²/s.

The minor differences are due to the purely visual evaluation employed by **Langguth / Voigt**.

4 "File" menu

4.1 "New" menu item

You can evaluate a new pumping test using this menu item.

4.2 "Load" menu item

Here you can load a file previously created file containing test data and saved to disk in a previous session. This file can be edited, modified and re-evaluated, etc.

4.3 "Save" and "Save as" menu items

You can generate a file containing the current test data and have it available for a later session. Subsequent loading results in exactly the same representation as at the time of saving.

4.4 "Read datalogger" menu item

W.A.S. (Braunschweig) datalogger files can be imported directly (MDSII).

4.5 "Read ASCII" menu item

ASCII data can be imported using this menu item.

4.6 "Save ASCII" menu item

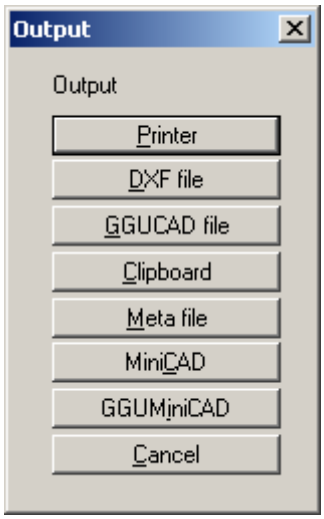
Values can be saved as ASCII data using this menu item.

4.7 "Output preferences" menu item

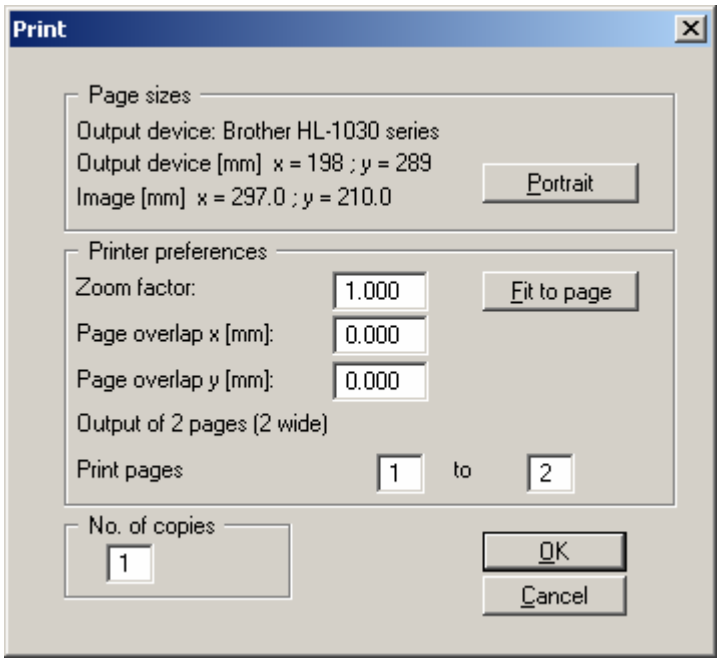
You can edit printer preferences or select another printer in accordance with WINDOWS conventions.

4.8 "Print and export" menu item

The following dialogue box appears:



"Printer"
allows graphic output of the current screen contents to the WINDOWS standard printer or to any other printer selected using the menu item "Output preferences". For direct output (printer), the following dialogue box appears:



In the upper part of the dialogue box, the maximum dimensions that the printer can accept are given. Below this you see the dimensions of the image to be printed. If the image is larger than the output format of the printer it will be printed to several pages (in the above example, 2). In order to facilitate better re-connection of the images, it is possible to enter an overlap for each page, in x and y direction. Alternatively, it is also possible to select a smaller zoom factor, ensuring output to one page ("**Fit to page**" button). Following this, you can enlarge to the original format on a copying machine, to ensure true scaling. Furthermore, you may enter the number of copies to be printed.

"DXF file"
allows output of the graphics to a DXF file. DXF is a common file format for transferring graphics between a variety of applications.

"GGUCAD file"
allows export of the current screen contents to a file, in order to enable further processing with the GGUCAD program.

"Clipboard"
The current screen contents are copied to the WINDOWS clipboard. From there, they can be imported into other WINDOWS programs for further processing, e.g. into a word processor.

"Metafile"
allows output of the current screen contents to a file, in order to be further processed with third party software. Output is as a standardised EMF file. Using the metafile format guarantees the best possible quality when transferring graphics.

„MiniCAD" / „GGUMiniCAD"
allows export of the graphics to a file in order to enable importing into different GGU applications with the MiniCAD modules (see menu).

4.9 "Exit" menu item

After a confirmation prompt, you can quit the program.

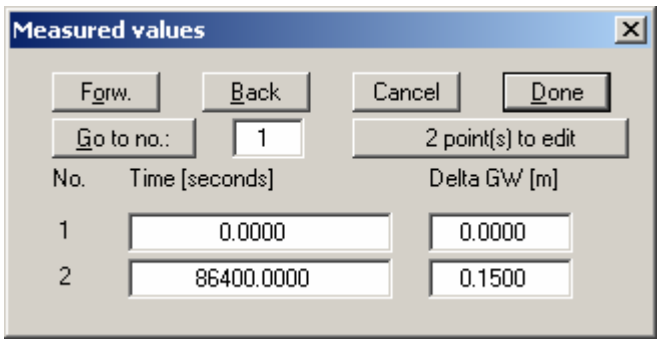
5 “Edit” menu

5.1 “Initial water level” menu item

Normally, the at-rest water level is the reference level and has the value “0.0”. If you need to enter your data with an at-rest water level <> “0.0”, enter the at-rest water level here (depth-to-water, measured from top, positive downwards).

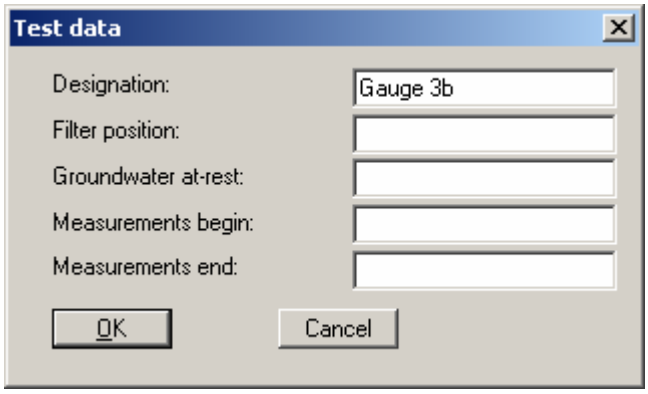
5.2 “At-rest groundwater” menu item

If, during a test, the at-rest groundwater level changes for reasons unconnected to the pumping test (e.g. tidal influence), but is superimposed upon it, you can define a polygon course here that describes this change as a function of time, e.g.:



5.3 “Test data” menu item

Using this menu item you can enter further test data.



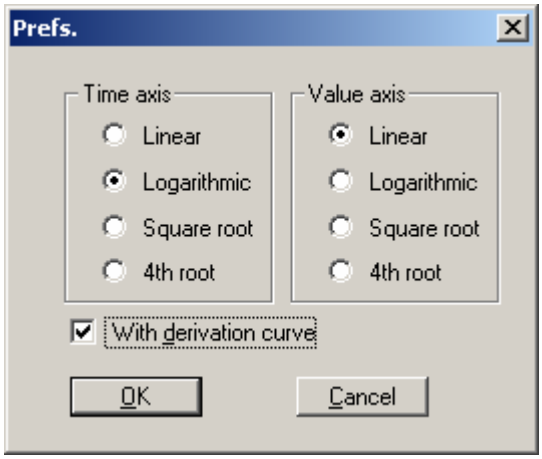
The data entered here have no influence on the test evaluation! They are descriptive only. Only if entries are made here is anything entered in the table at the bottom of the graphic.

5.4 “Edit values” menu item

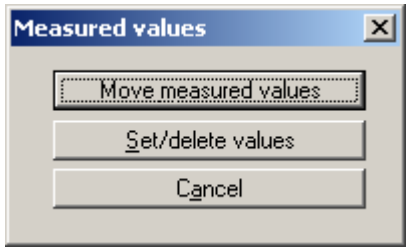
This is the central menu item for data input. Depending on the test evaluation method a dialogue box opens. The details are more thoroughly described in the examples in Section 3.

5.5 “Graphically” menu item

Using this menu item it is possible to edit values or to add and delete values. To do this, switch to diagnosis mode. Go to the “Evaluation / Diagnosis” menu item.

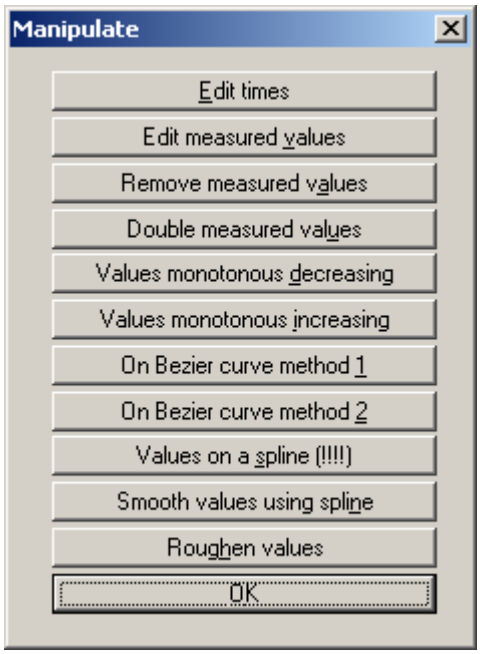


Then go to the menu item "Edit / Graphically".



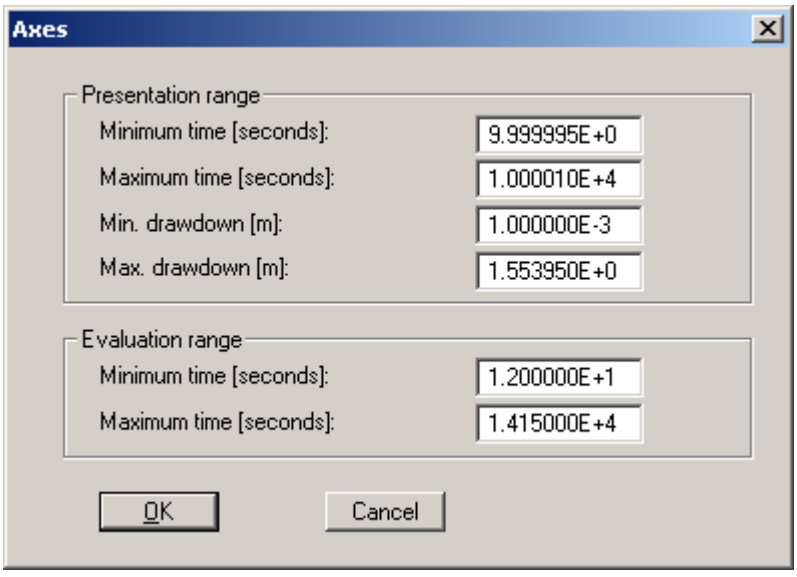
Now select the type of modification needed. You can then move, set or delete the values.

5.6 "Modify" menu item



You can modify the values in a wide variety of ways using this menu item. Using the "Roughen values" button, for example, you can roughen simulated values (see "Test planning" menu item) and thus give them an "impression of authenticity".

5.7 Value range "manually" menu item



You can define the representation range for the graphic, and the evaluation range. The representation range does not influence the test evaluation. Using the figures given for the evaluation range, it is possible to exclude test values at the beginning and end of the test from the evaluation. The evaluation range is marked by two vertical lines in the graphic.

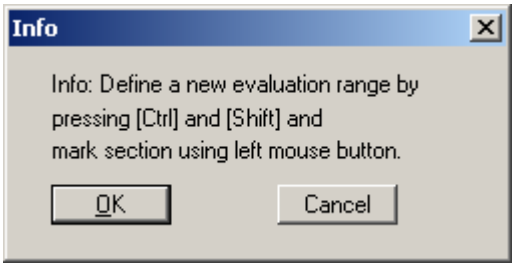
5.8 “All” menu item

After selecting this menu item the graphic is adjusted so that all data points are visible. In addition, the evaluation range is adjusted to include all values in the evaluation (also see Section 5.7).

5.9 “Fit in” menu item

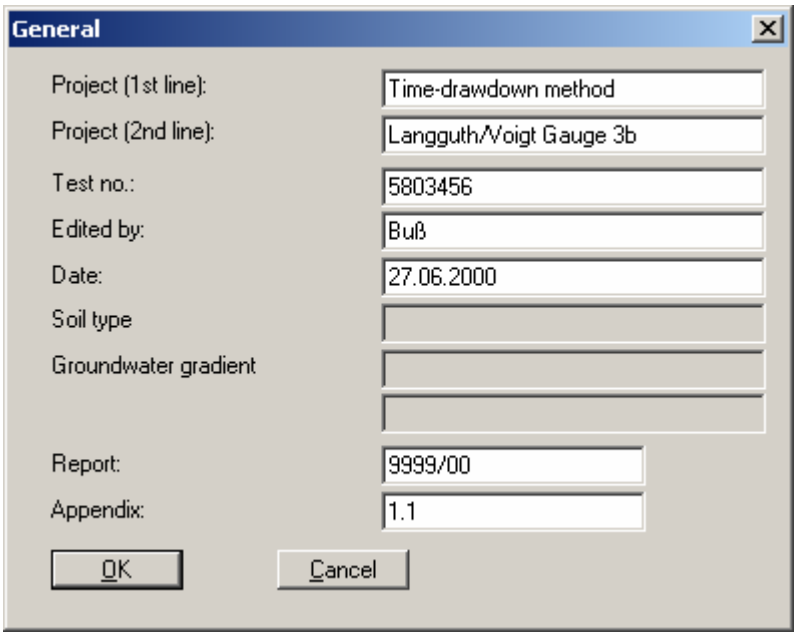
After selecting this menu item the graphic is adjusted so that all data points are visible. The evaluation range is not altered by this (also see Section 5.7).

5.10 “Graphically” menu item



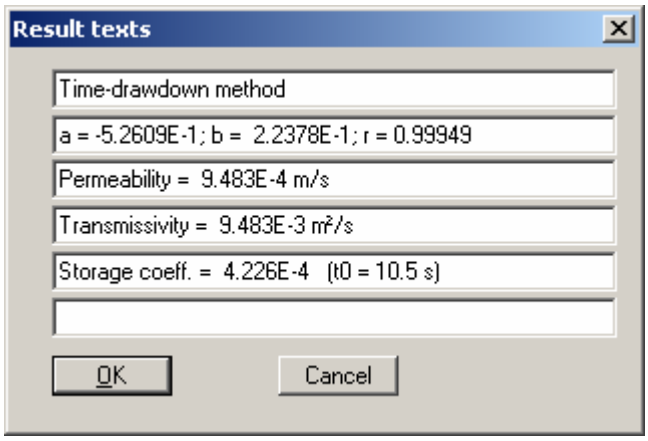
You can define a new evaluation range (also see Section 5.7).

5.11 "General" menu item



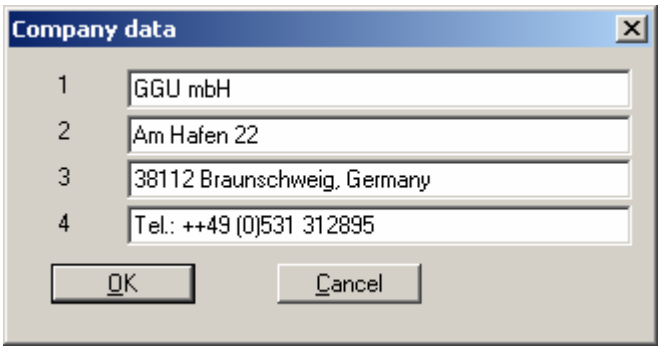
You can enter general information on the pumping test; these are displayed in the graphic. You can alter further settings by going to “Output preferences / Texts”; this also allows the descriptive texts to be edited (at the left of the dialogue box).

5.12 "Result text" menu item



Once the permeability has been calculated the program proposes a result text to be used in the graphic. You can edit the result text using this menu item. You can also open this dialogue box by double-clicking in the corresponding area of the graphic.

5.13 "Company" menu item

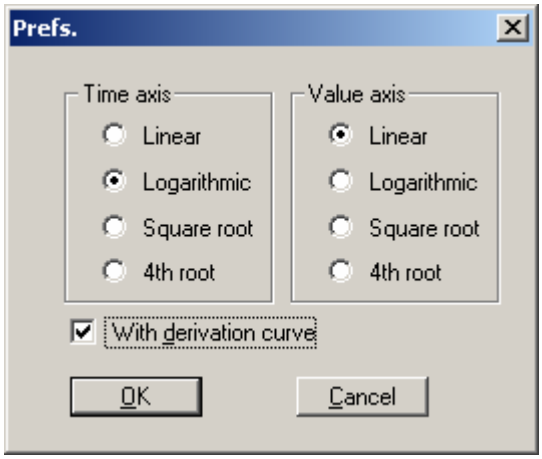


You can enter a four-lined text to be included in the graphic. You can also open this dialogue box by double-clicking in the corresponding area of the graphic. The integrated Mini-CAD module provides a far greater variety of options (with company logo) (see separate user-manual).

6 “Evaluation” menu

6.1 *“Diagnosis” menu item*

You can perform a data diagnosis using this menu item. However, the diagnosis is visual only.



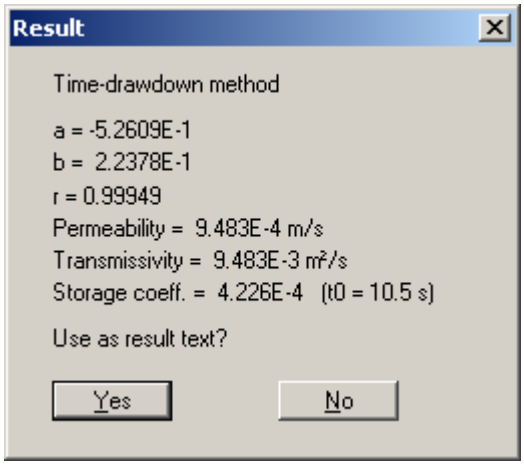
Each axis can be diagnosed using one of four options, independent of the other. A further speciality is the option of including the derivation of the curve in the graphic. Often, irregularities in the measurement data can be better identified on the basis of the derivation curve.

6.2 *“Time-drawdown method, distance-drawdown method, etc” menu items*

The title of this menu item varies according to the selected evaluation method. The details are more thoroughly described in the examples in Section 3.

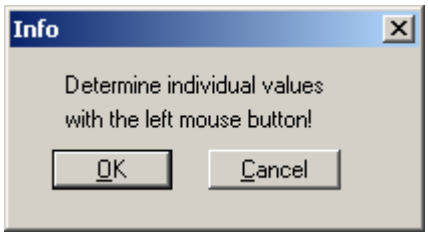
6.3 *“Permeability” menu item*

The program calculates the permeability.

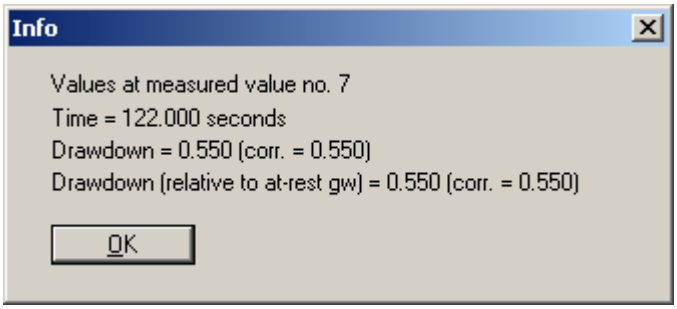


The dialogue box for this menu item varies according to the selected evaluation method. The proposed result text can be included in the graphic by clicking “Yes”.

6.4 “Individual values” menu item



You can determine information for individual data points, e.g.:



6.5 “Hand fit” menu item

This menu item is only accessible if you are using the “Theis type curve” method for evaluation. See Section 3.6 for details.

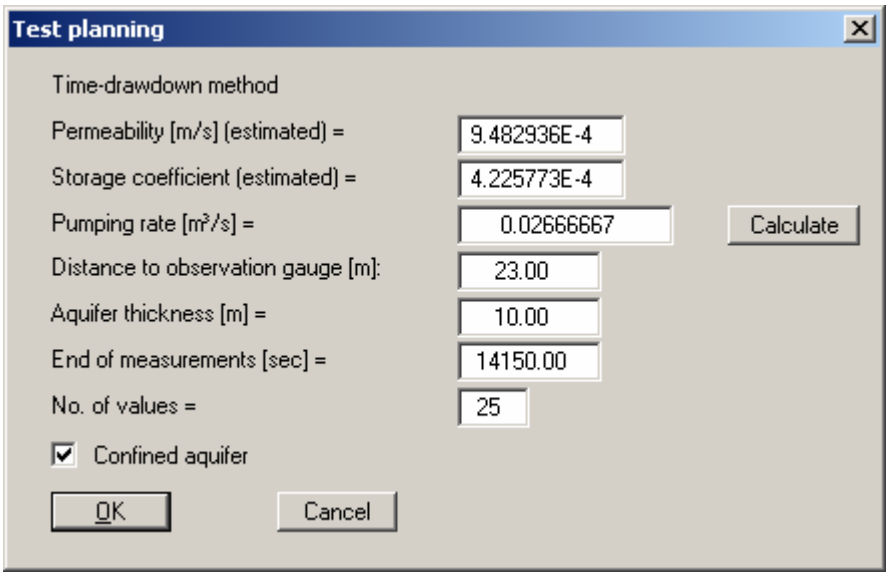
6.6 “Auto fit” menu item

This menu item is only accessible if you are using the “Theis type curve” method for evaluation. See Section 3.6 for details.

7 “Test planning” menu

Here, you can simulate a pumping test using estimated values for permeability, etc. It is then possible, based on the simulation results, to estimate the measurement precision required and the time required for the pumping test.

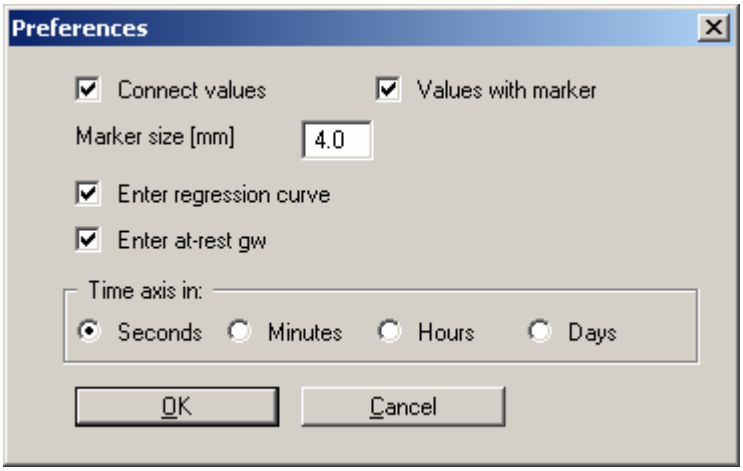
The dialogue box for this menu item varies according to the selected evaluation method, e.g. the time-drawdown method:



After confirming with “OK” the simulated values are displayed.

8 “Graphics preferences” menu

8.1 "Preferences" menu item



The dialogue box for this menu item varies according to the selected evaluation method. You can define preferences for the graphical representation of the measured values. If the at-rest groundwater level changes during the test (see Section 5.2), the level can be represented against time together with the values. If the test evaluation includes a regression calculation, the regression curve can also be represented. In addition, you can specify the units for the time axis (hours, minutes, etc.).

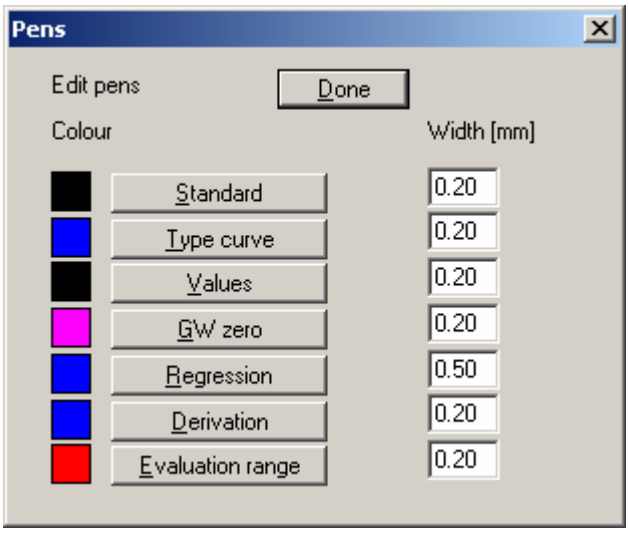
8.2 “Refresh and zoom” menu item

If, for example after using the zoom function (see below), only part of the image is visible, you can achieve a complete view using this menu item. The zoom factor may be user-defined. It is much simpler, however, to get a complete overview using [ESC]. Using the [F2] key, you can refresh the screen without altering the zoom factor.

8.3 “Zoom info” menu item

You will see information on activating the zoom function.

8.4 “Pen colour and width” menu item



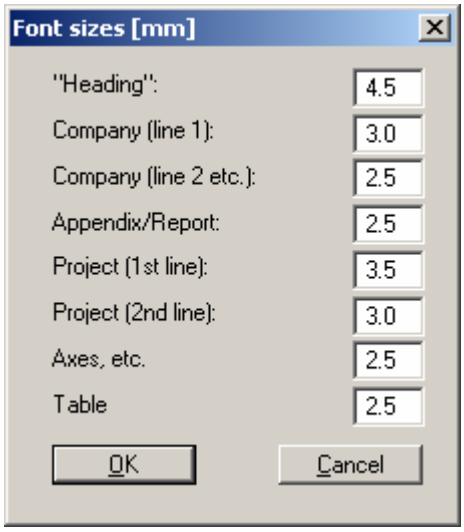
By selecting the buttons on the left of the dialogue box you can edit the pen colours. Furthermore, you can define pen widths.

8.5 “Legend font selection” menu item

With this menu item you can switch to a different True-type font. All available true-type fonts are displayed in the dialogue box.

8.6 “Font size selection” menu item

By choosing this menu item you can edit the font sizes for use in the graphic.

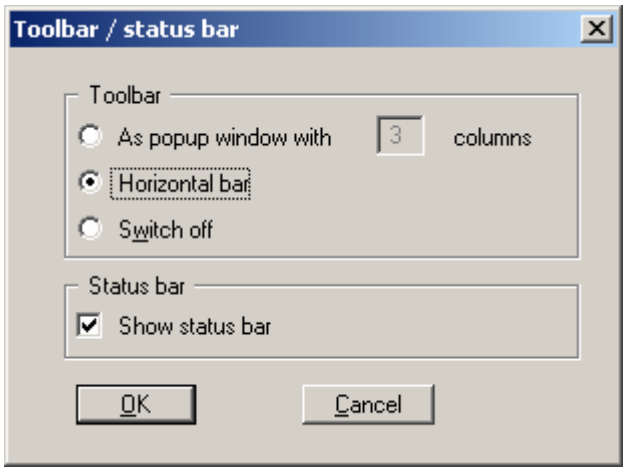


8.7 “Mini-CAD toolbar” menu item

Using this menu item you can annotate the graphic at will and add lines and bitmaps. For details please see the supplied “Mini-CAD” user-manual. A non-modal dialogue box opens, the functions of which are further explained in the “Mini-CAD” user-manual.

8.8 "Toolbar preferences" menu item

When the program starts a toolbar appears at the top right of the program window.



By clicking on these tools you can directly reach most of the program functions. If you would rather work with a horizontal popup window, you can specify your preferences using this menu item. The Smarticons can also be switched off. The preferences will be saved, among others, in the “PUMPTEST.alg” file (see menu item “Save preferences”), and will be active when the program is started next.

8.9 "Save preferences" menu item

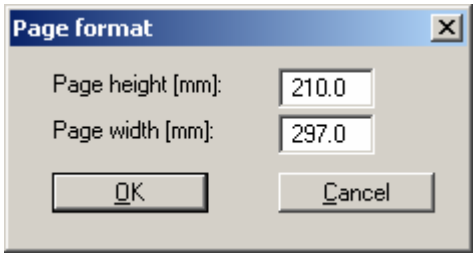
All data entered using the three previous menu items can be saved to a file. If you select GGU-PUMPTEST.alg as file name, and save the file on the same level as the program, the data will be automatically loaded the next time the program is started and need not be entered again.

8.10 “Load” menu item

You can reload a graphics preferences file into the program, which was saved using the “Save graphics preferences” menu item. Only the corresponding data will be refreshed.

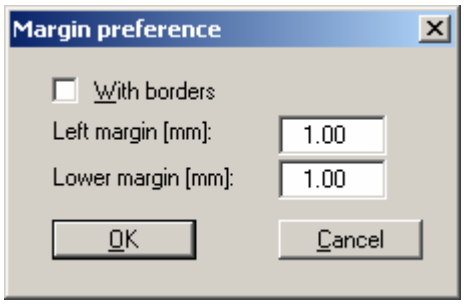
9 “Output preferences” menu

9.1 “Page size and margins” menu item



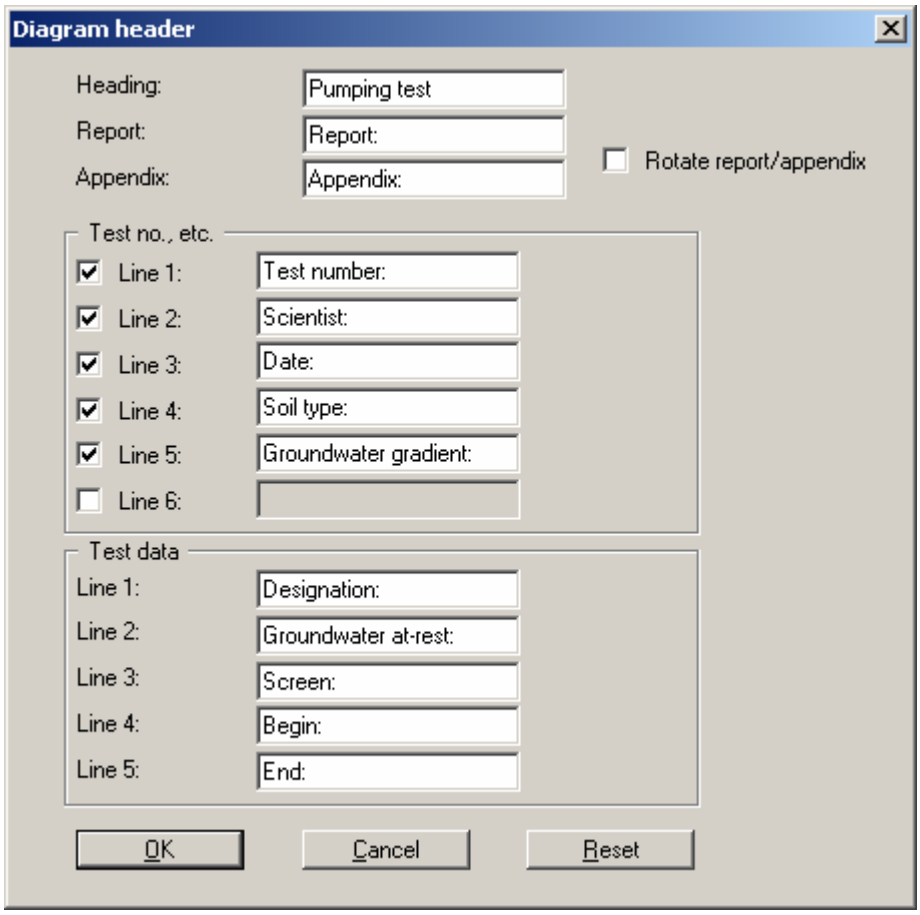
The graphic dimensions can be edited. The default sheet format is A4. If you need to use other dimensions to the default you may have to alter the positions of the individual graphic elements (see below).

9.2 “Margins” menu item



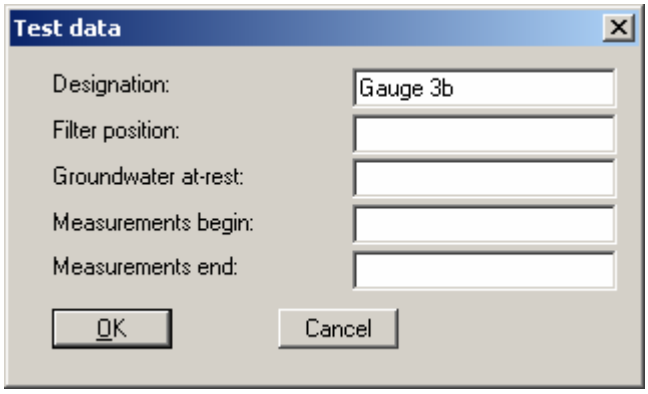
If the “With borders” switch is activated an additional border is drawn around the area defined in the “Page size and margins” menu item. This may occasionally be undesirable, particularly when printing on an A4 printer. With a little testing, the values for “Left margin” and “Lower margin” allow you to position the graphic optimally for your printer.

9.3 "Texts" menu item



You can edit a wide range of texts for use in the graphic. You can change the graphic heading and change “Report” to “Report no.”, for example.

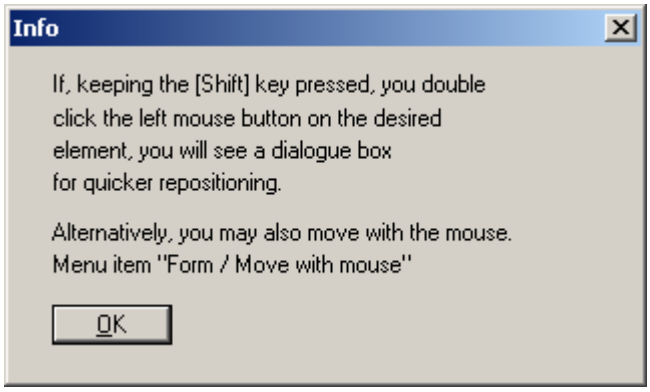
By activating or deactivating the checkboxes for “Line 1”, etc., the corresponding lines are either displayed or subdued in the graphic. The “Test data” text appears in the dialogue box in the menu item “Edit / Test data”.



Only if entries are made here is anything entered in the table at the bottom of the graphic.

9.4 "Position info" menu item

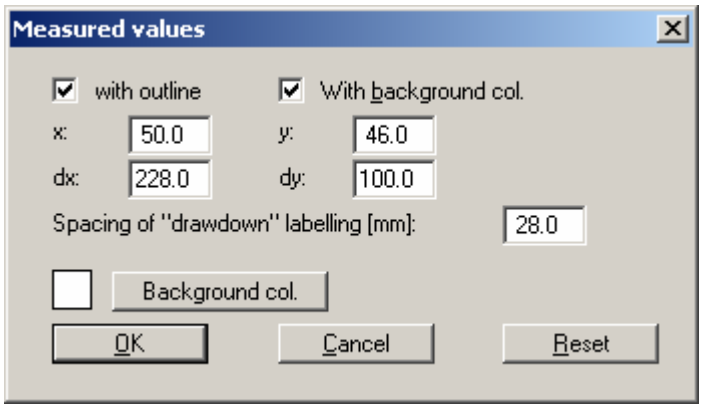
The graphic consists of a total of 10 freely positionable elements. The size of almost all the elements can also be modified.



The info box provides information on the positioning of the elements.

9.5 "Measured values" menu item

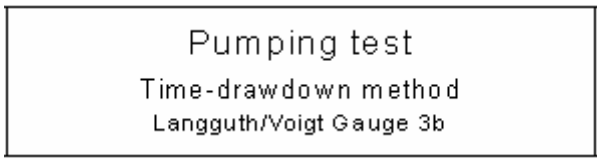
This refers to the graphic frame containing the representation of the test results.

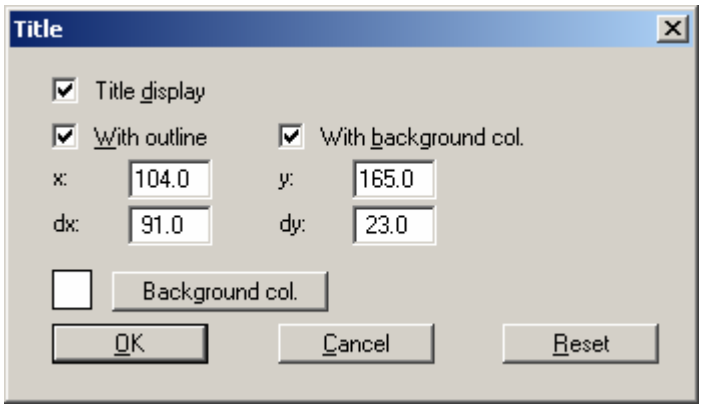


You can alter the position of this element using the x and y values. The dx and dy values define the width and height of the element. You can also specify a background colour. The default values are recalled using the “Reset” button.

9.6 "Title" menu item

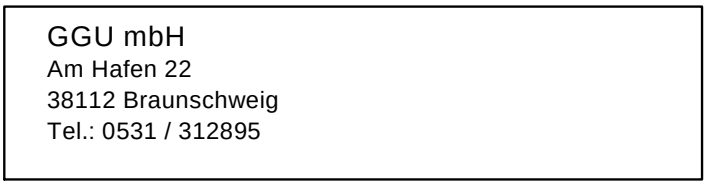
This refers to the graphic frame containing the representation of the diagram heading.





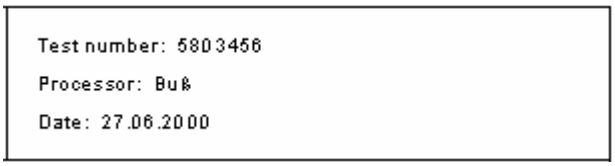
On the whole, the settings here correspond to the previous menu item. In addition, the title can be subdued by deactivating the “Title display” checkbox. If you deactivate the “With outline” checkbox, no frame will be drawn around the element. If you deactivate the “With background colour” checkbox, the element will be transparent. The “Background col.” Button allows you to select a different background colour for the element.

9.7 “Company” menu item



See Section 9.6 for details.

9.8 "Test no., etc." menu item



See Section 9.6 for details.

9.9 "Appendix and report" menu item

See Section 9.6 for details.

9.10 "Test data" menu item

Bezeichnung: Pegel 3b	Anzahl Brunnen = 3
Anzahl Messwerte: 59	
Aquifer ist gespannt	
Aquifermächtigkeit = 10.0 m	
Pumprate = 2.66667E-2 m³/s	

See Section 9.6 for details.

9.11 "Result texts" menu item

Time-drawdown method
a = -5.2609E-1; b = 2.2378E-1; r = 0.99949
Pertmeability = 9.483E-4 m/s
Transmissivity = 9.483E-3 m²/s
Storage coeff. = 4.226E-4 (t0 = 10.5 s)

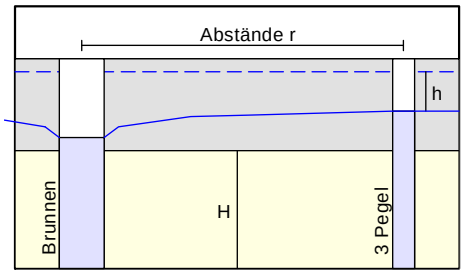
See Section 9.6 for details.

9.12 "Evaluation range" menu item

Evaluation range from 12.0 to 14150.0 seconds

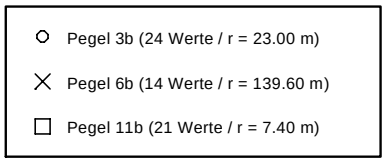
See Section 9.6 for details.

9.13 "System" menu item



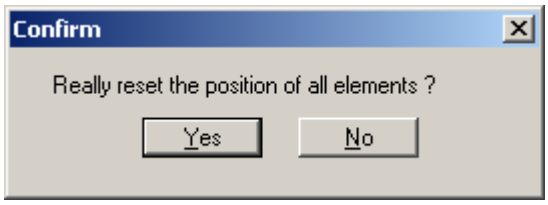
See Section 9.6 for details.

9.14 "Gauge" menu item



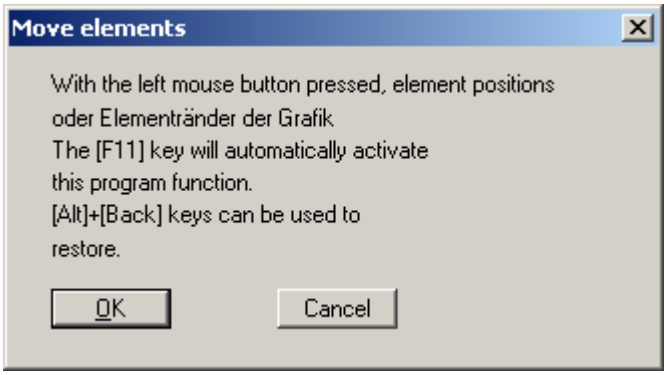
This menu item is only active in conjunction with the “distance-time-drawdown method”. This element serves as a legend for the values from the individual wells. See Section 9.6 for details.

9.15 "Reset all graphics to defaults" menu item



Using this menu item you can reset all elements to their original values.

9.16 "Move elements" menu item



You can position all elements using the mouse. Go to this menu item. Move the mouse over the element to be moved and press the left mouse button. Move the element with the left mouse button pressed. If you move the mouse across one of the four boundaries you can also alter the height or width with the mouse. If you move the mouse across one of the corners you can alter the height and width simultaneously.

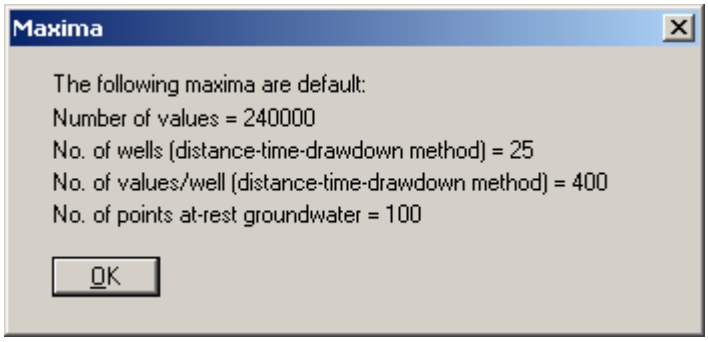
10 "?" menu

10.1 "Copyright" menu item

You will see a copyright message and the version number.

10.2 "Maxima" menu item

You will see the following information:



10.3 "Help" menu item

You will see this manual as a Windows Help file.

10.4 "GGU on the web" menu item

Using this menu item you can access the GGU Software website: www.ggu-software.com.
Keep in touch with new program versions and the regular "download" offers.

10.5 "What's new ?" menu item

You will see information on program improvements and bug fixes in comparison to older versions.

10.6 "Translation" menu item

In the international version of GGU-PUMPTEST, this menu item allows you to switch the menus and the graphics from German to English and vice versa. To work in German, activate the two switches "translate dialogs, menus" and "translate graphics".

Alternatively, you can work bilingually, e.g. with German dialogue boxes but with graphic output in English.

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