Works 2013

Water Hammer

Version 11.0.0

USER GUIDE

TECHNO logismiki
Advanced Technical Software

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Water Hammer

TechnoLogismiki

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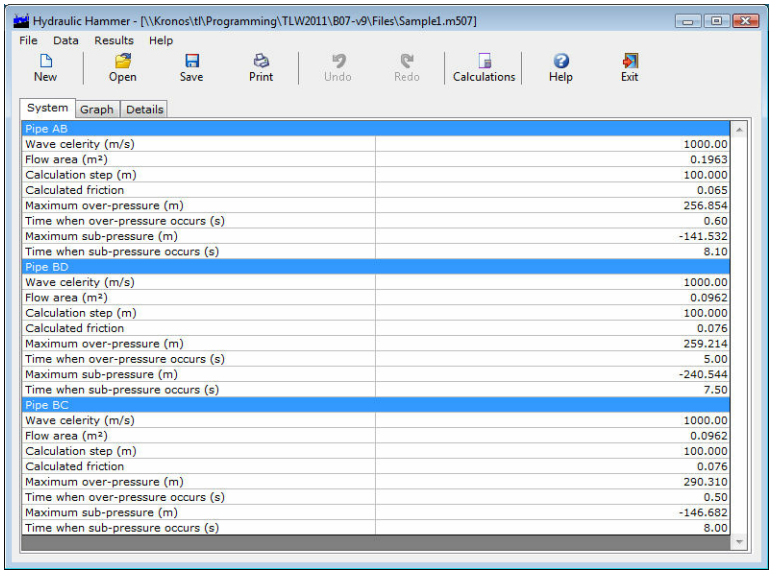
1 About the program

1.1 What does the program do?

This program calculates the water hammer caused by slow closing of a valve downstream. The water level of the tank is assumed constant.



For the friction calculation, one of 15 available formulas may be used. The solver is based on the method of characteristic lines which substitutes the hyperbolic partial differential equations with common ones.

The program can show the variation of the pressure, celerity and flow rate along the pipe in a visual and animated way, including the maximum over-pressure and sub-pressure. Alternatively, the results can be displayed in tabulated form.

1.2 Minimum requirements

The minimum requirements for the usage of the programs are the following:

- Windows 2000/ XP/ 2003/ Vista/ 7 (for each case, the latest service packs, updates & patches must be installed)
- Pentium III 800 MHz
- 800x600 with 256 color palette
- 700 MB free disk space
- CD-Rom

If your system does not meet one or more of the above requirements, it is highly recommended that you upgrade it before installing the programs. The recommended system configuration is the following:

- Windows 2000/ XP/ 2003/ Vista/ 7 (for each case, the latest service packs, updates & patches must be installed)
- Pentium IV 2.0 GHz
- 1280x768 with 16-bit color palette

- 1.2 GB free disk space
- CD-Rom
- Internet connection

1.3 Technical support

Support through the Internet

TechnoLogismiki offers technical support 24 hours per day, 365 days per year, through the web site where you can get information on the latest programs and services.

Support by e-mail

Please use the dedicated e-mail addresses for better customer service:

- for questions regarding sales: sales@technologismiki.com
- for questions regarding the usage of programs: support@technologismiki.com
- for any other question or comment: info@technologismiki.com

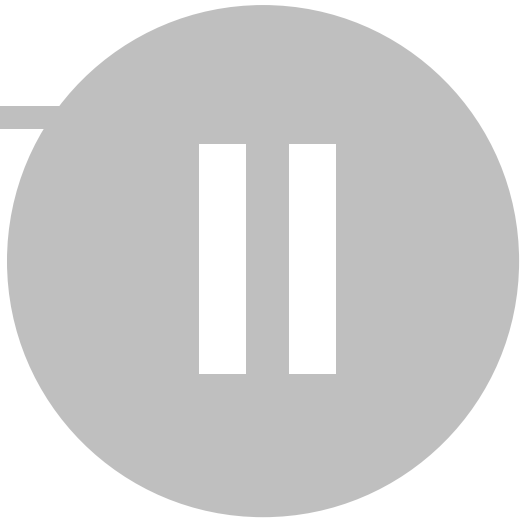
The normal response time is within two business days. If your inquiry cannot be answered by e-mail, a customer service representative will contact you by telephone.

Interactive Support

Business days, 09:00 - 17:00 Eastern European Time:

- Telephone [3 lines]: ++30-210-656-4147
- Fax: ++30-210-654-8461
- Address: 5, Imittou street, Cholargos, 15561, Athens, Greece.

Chapter



2 File

2.1 File menu

With this menu, you can perform file operations and print reports. In the **File** menu you can select one of the following options:

- New project
- Open project
- Save project
- Save project as
- Export
  - Export sketch
- Print setup
- Print
- Print to
  - Print to file
  - Print to Word
  - Print to Word (Formatted)
  - Print to Excel
- Exit

2.2 New project

With this option, a new project is started. All data, results, graphs, titles etc. of the previous project are erased.

To create a new project:

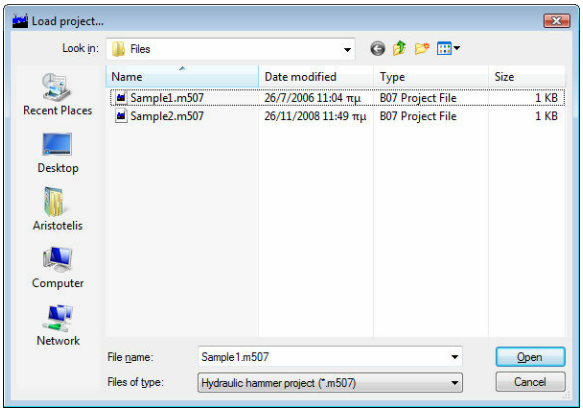
1. Select **New project** from the **File** menu.
2. If a project is already loaded and changes have been made, a warning message will appear that asks the user whether to save the changes or not.
3. The current project is erased and a new project is started.

2.3 Open project

With this option, an existing project is loaded. The project may be stored locally, in a network or in an external media device such as a CD-Rom. If a project is already loaded and changes have been made, a warning message will appear that asks whether to save the changes or not. When a project is loaded, all data of the previous project are lost.

To open an existing project:

1. Select **Open project** from the **File** menu.
2. Select the path of the file.
3. Select the file type from the **Files of type** drop-down list. The default option is "Hydraulic hammer project" with the extension .m02.
4. Select the file by clicking on it.
5. Select **Open** to open the selected file. Select **Cancel** to cancel the operation.



NOTE: You can find sample projects in the installation folder of the program:
C:\Program Files\TechnoLogismiki\TLW2013\Samples\WaterHammer

Supported file types

- **M07** (Water hammer project): Files created by version 2012 and 2013 of Water hammer.
- **M507** (Water hammer project): Files created by versions 2011, 2010, 2009, 2008, 2007 and 5.0 of Water hammer.
- **MB7** (Water hammer project v2.x, 3.x or 4.x.): Files created by versions 2.x, 3.x or 4.x of Water hammer.
- **BCK** (Backup files): If you have selected from program options the creation of backup copy when a file is loaded, then the file can be loaded by selecting Backup files (*.bck) from the Files of type drop-down list.
- ***.*** (All files): Displays all files in the current folder.

Backwards compatibility

This version implements full backwards compatibility; however, note that when a project is saved with the latest format, it cannot be used by previous versions.

NOTE: If the message "Could not load project. File may be corrupt or saved by an unknown or incompatible version of the program" appears, then either you are trying to load a project that does not belong to this program or the file is used (and locked) by another process in your computer.

2.4 Save project

With this option, you can save all data of a project into a file. The file can be saved locally, in a network location or in an external media device such as a disk.

The filename and path will be asked only the first time you attempt to save a project. When the filename and path are set, all subsequent saves will be made to the same file.

When you want to rename a file or save it in a new location, use Save project as... from the **File** menu.

To save the current project:

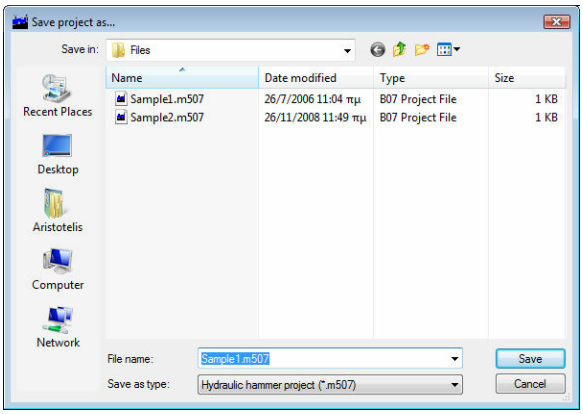
1. Select **Save project** from the **File** menu.
2. If the location of the file is already set, the project is saved to this file without any messages. If the filename is not set, a dialog box will appear that allows the selection of the filename and path.

2.5 Save project as

With this option, the current project is saved just as in the case of Save project, but with the difference that the name and/or location of the file can be changed. In this way, you can create backup files or move a project to another media device.

To save a project with another name and/or to another location:

1. Select **Save project as** from the **File** menu.
2. Select the path of the file.
3. Type the filename in the **File name** text box.
4. Select **Save** to save the project with the selected filename and path. Select **Cancel** to cancel the operation.



NOTE: If a file with the same name and in the same path already exists, a warning message will appear that asks whether to overwrite the file or not. If you answer Yes, then the existing file is erased and the new file takes its place. If you answer No, the existing file remains intact but NO changes of the current project are saved.

2.6 Export

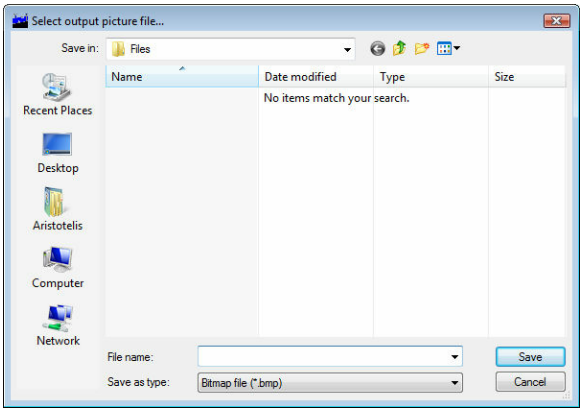
2.6.1 Export sketch

With this option, you can export (in BMP format) the sketch of the solution as it appears in the main form of the program.

To export the sketch of the solution:

1. Select the solution from the list of the main form in order to display the sketch.
2. Select **Export sketch** from the **File** menu.
3. Select **Graph** from the **Export sketch** menu.

4. Select the path of the file.
5. Type the filename in the **File name** text box.
6. Select **Save** to create the file. Select **Cancel** to cancel the operation.

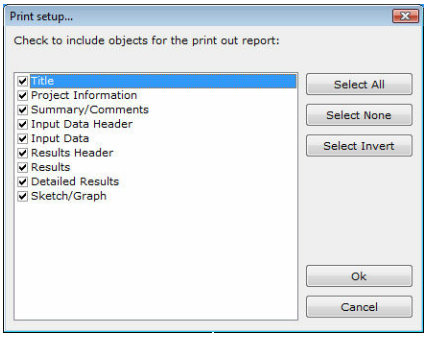


2.7 Print setup

With this option, you can select which parts of the project will be included in the printouts. When a new project is created, a full report is selected by default.

To modify the print setup:

1. Select **Print setup** from the **File** menu.
2. Select the **sections** (Title, Project information etc) that will be printed, from the list on the left.
3. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.



The quick keys (**Select all, Select None, Select Invert**) can be used to quickly select all objects, deselect all objects and invert the current selection of a list.

NOTE: The changes are saved with the project. The above preferences are used to all printouts, either to the printer or to other formats such as Word file, Excel file etc.

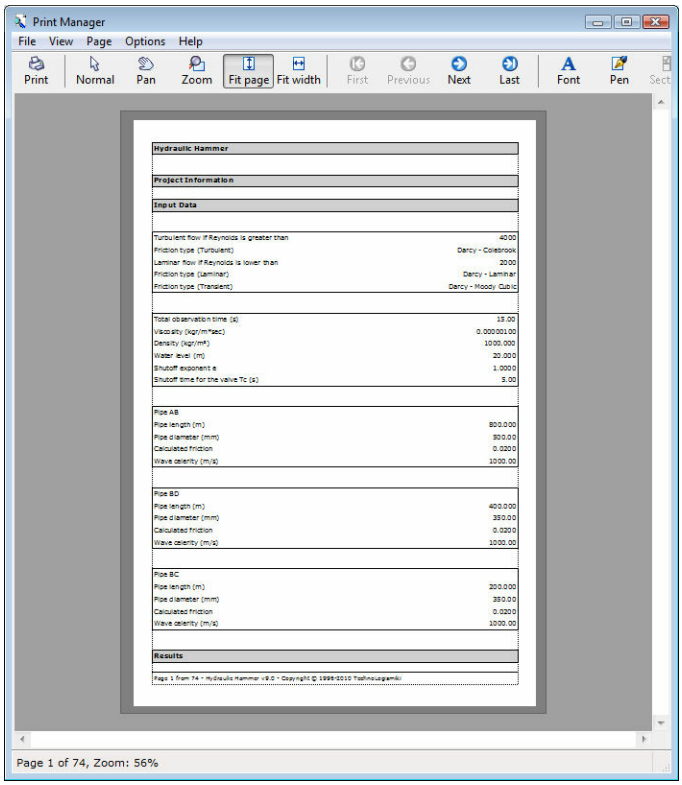
2.8 Print

With this option, you can prepare a report to be printed to a local, network or virtual printer such as Adobe PDF Writer. The parts of the project that will be included in the report are determined from print setup.

By selecting **Print**, the report is not printed directly; instead, a document is prepared and a preview of the printout is created by the **Print manager.** You can print the report by clicking the **Print** button of the toolbar of **Print manager.**

To create a report:

1. Select **Print** from the **File** menu.
2. A report is prepared and sent to **Print manager.** A preview of the document appears.
3. You can print the report by clicking the **Print** button of the toolbar.



NOTE: A complete user manual on the capabilities of **Print manager** can be found in the corresponding help file.

2.9 Print to

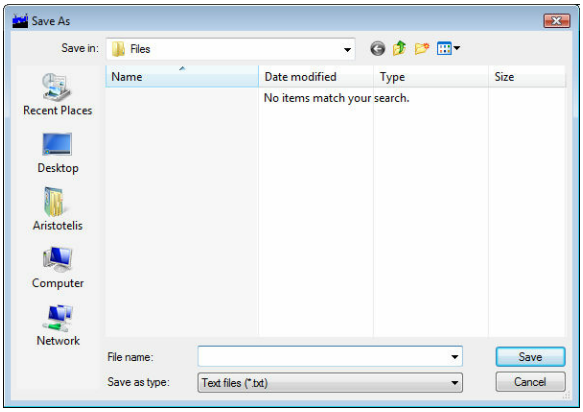
2.9.1 Print to File

With this option, you can create a simple text file containing a report of the project. This file is recognized and can be further modified by word processors such as Microsoft Word, OpenOffice Writer etc.

To print to a text file:

1. Select **Print to** from the **File** menu.
2. Select **Print to file** from the **Print to** menu.
3. Select the path of the file.
4. Type the filename in the **File name** text box.

5. Select **Save** to create the file.



The parts of the project that will be included in the report are determined from print setup.

NOTE: If a file with the same name and in the same path already exists, a warning message will appear that asks whether to overwrite the file or not. If you answer Yes, then the existing file is erased and the new file takes its place. If you answer No, the existing file remains intact but the report is NOT printed.

2.9.2 Print to Word

If Microsoft Word (version 97, 2000, XP, 2003 or later) has been installed in the system, then a Microsoft Word file containing the report can be created. Note that Microsoft Word is a separate program and it is not included in TechnoLogismiki's products. Moreover, no technical support is offered regarding the usage of Microsoft Word.

To print the report to a Microsoft Word file:

1. Select **Print to** from the **File** menu.
2. Select **Print to Word** from the **Print to** menu.

The parts of the project that will be included in the report are determined from print setup.

2.9.3 Print to Word (Formatted)

If Microsoft Word (version 97, 2000, XP, 2003 or later) has been installed in the system, then a Microsoft Word file containing the report can be created. Note that Microsoft Word is a separate program and it is not included in TechnoLogismiki's products. Moreover, no technical support is offered regarding the usage of Microsoft Word.

To print the report to a formatted Microsoft Word file:

1. Select **Print to** from the **File** menu.
2. Select **Print to Word (Formatted)** from the **Print to** menu.

The parts of the project that will be included in the report are determined from print setup. This operation is much slower than the regular print to word function. However,

the final output requires minimal user intervention as it comes fully formatted with tables, alignment, font styles, etc.

NOTE: Do not use Copy (CTRL+C) on any of the programs running during this operation. If you do so, it will most likely affect the communication between Microsoft Word and the clipboard and as a result the final document will be corrupt.

2.9.4 Print to Excel

If Microsoft Excel (version 97, 2000, XP, 2003 or later) has been installed in the system, then a Microsoft Excel file containing the report can be created. Note that Microsoft Excel is a separate program and it is not included in TechnoLogismiki's products. Moreover, no technical support is offered regarding the usage of Microsoft Excel.

To print the report to a Microsoft Excel file:

1. Select **Print to** from the **File** menu.
2. Select **Print to Excel** from the **Print to** menu.

The parts of the project that will be included in the report are determined from print setup.

2.10 Exit

With this option, you can exit the program. If there are changes in the current project that have not been saved then the program will:

- either ask the user to save the changes
- or save the changes
- or ignore the changes

depending on what you have selected in General preferences.

To exit the program:

1. Select **Exit** from **File** menu.
2. If you are asked whether to save the changes or not, you can save changes or ignore them.
3. The program is terminated.

Chapter

3 Data

3.1 Data menu

With this menu, you can add and modify data. In the **Data** menu you can select one of the following options:

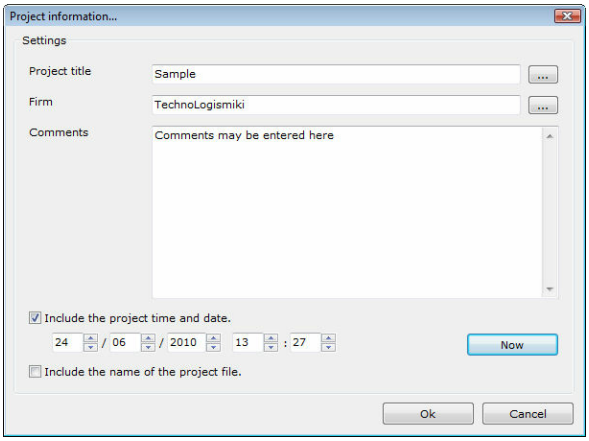
- Project info
- Undo
- Redo
- General data
- Layout
  - Layout
  - Pipe data
  - Tank data
  - Valve data
- Friction calculation
- Options
  - General preferences
  - Customize toolbar

3.2 Project info

With this option, you can add project information that include, optionally, title, author and comments. If you want, this information can be included in the reports. The empty fields are ignored.

To add or modify the project information:

1. Select **Project info** from the **Data** menu.
2. Type the project title, author and comments.
3. Check **Include project time and date** if you want to include the time and date in the project.
3.1. Type the day, month, year, hours and minutes in the corresponding text boxes. Alternatively, you may click on the up/down arrows to increase or decrease the respective value in the text box.
3.2. If you click on **Now** then all text boxes are filled with the current values automatically.
4. Check **Include the name of the project file** if you want the full path and filename of the project to be included in the report.
5. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.



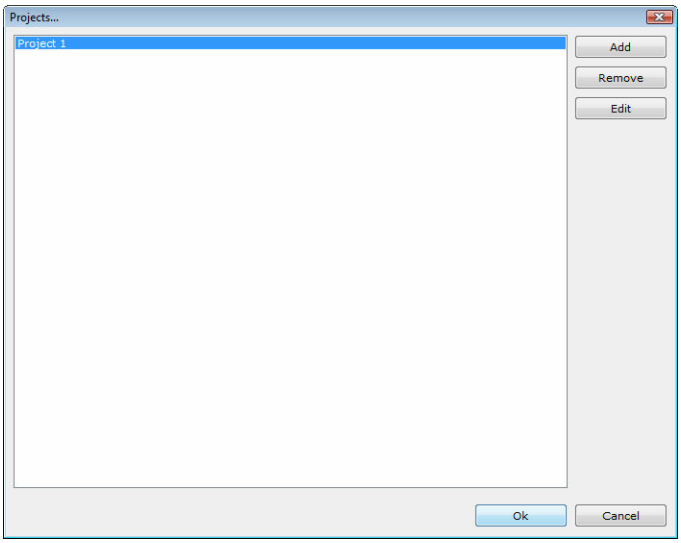
By selecting the buttons with the ellipses (...) next to the project title and author, you can access the corresponding databases.

Project title database

For the completion of a project, more than one programs may be needed. For convenience, you can add the project title to the database and retrieve it from all programs.

To use the project title database:

1. Select the button with the ellipses (...) next to the project title text box. The project title database appears.
2. Select **Add** to add a new title to the database.
3. Select **Remove** to remove the selected entry from the database. You will be asked for confirmation only if you have selected to confirm deletions in the General preferences tab.
4. Select **Edit** to modify the selected entry.
5. Select **Ok** to use the currently selected project title and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.

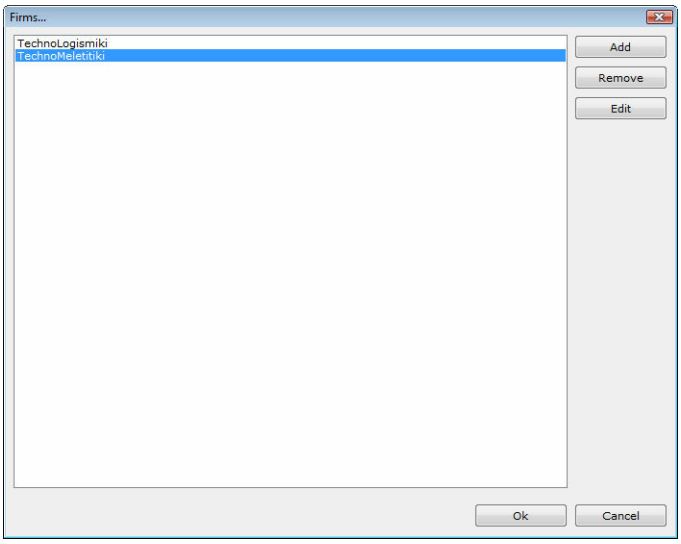


Author database

An engineer may be involved in multiple projects. For convenience, you can add the author name to the database and retrieve it from all programs.

To use the author database:

1. Select the button with the ellipses (...) next to the author text box. The author database appears.
2. Select **Add** to add a new author to the database.
3. Select **Remove** to remove the selected entry from the database. You will be asked for confirmation only if you have selected to confirm deletions in the General preferences tab.
4. Select **Edit** to modify the selected entry.
5. Select **Ok** to use the currently selected author and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.



3.3 Undo

Undo cancels the last committed change in the project.

To cancel the last committed change:

1. Select **Undo** from the **Data** menu.
2. The last committed change is canceled.

To cancel an undo command, you may use the redo function which is described below. Redo becomes available once undo is used.

It is possible to undo more than one recent changes and to redo them, by following the step described above. The number of actions that are kept in memory and may be undone or redone is 20 by default. This means that the program is able to keep track of up to 20 successive changes and undo them. This number may change for all programs, using the option in the main menu. For more information, please consult main menu user guide.

NOTE: Some changes cannot be undone like the new project or the save project

functions.

3.4 Redo

Redo cancels the latest undo command.

To redo the latest change that was undone:

1. Select **Redo** from the **Data** menu.
2. The latest undone change is redone.

To undo a redo, you may use the undo command.

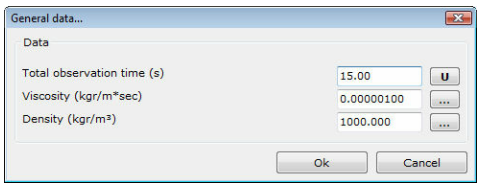
It is possible to redo more than one changes that were previously undone by following the steps described above. The number of actions that are kept in memory and may be undone or redone is 20 by default. This means that the program is able to keep track of up to 20 successive changes that are undone and redo them. This number may change for all programs, using the option in the main menu. For more information, please consult main menu user guide.

3.5 General data

With this option, you can input the general data.

To input the general data:

1. Select **General data** from the **Data** menu.
2. Enter the **total observation time** in s. The start of the closing of the valve is considered to take place at t=0.
3. Enter the **viscosity** of the fluid in kg/(m x sec). Click the button with the ellipses (...) to use the embedded fluid database.
4. Enter the **density** of the fluid in kg/(m^3). Click the button with the ellipses (...) to use the embedded fluid database.
5. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.



3.6 Layout

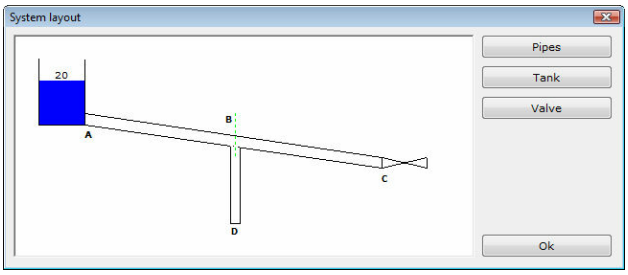
3.6.1 Layout

With this option, you can view the layout of the system and input additional data.

To view the layout of the system and input additional data:

1. Select **Layout** from the **Data** menu.
2. Click **Pipes** to input additional data regarding the pipes.

3. Click **Tank** to input additional data regarding the tank.
4. Click **Valve** to input additional data regarding the valve.
5. Select **Ok** to close the dialog box.

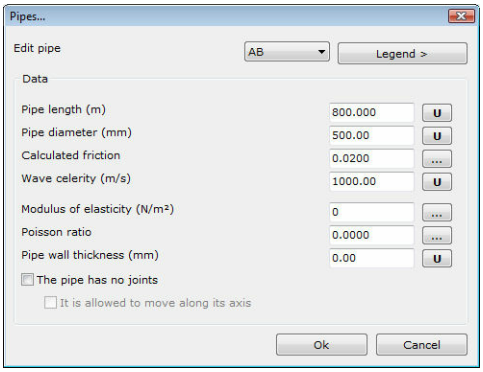


3.6.2 Pipe data

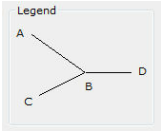
With this option, you can input additional data regarding the pipes.

To input additional data regarding the pipes:

1. Select **Layout** from the **Data** menu.
2. Click the **Pipes** button. The following form appears:



3. Optionally, you can click the **Legend >** button to display a sketch of the system.



4. Select the pipe from the drop-down list. It the length of the selected pipe is equal to zero, the program assumes that the pipe does not exist.

NOTE: At least two pipes are required. If the system consists of a single pipe, use two pipes with half the total length and the same other characteristics.

5. The required data for each pipe are the following:

- **Pipe length**: the pipe length in m.
- **Pipe diameter**: the internal pipe diameter in mm.
- **Friction factor**: it depends on the selected friction formula and the material of the pipe. Click the button with the ellipses (...) to use the friction coefficient database.

- **Wave celerity**: the wave celerity in m/s. It is depended mostly on the compressibility of the fluid and the modulus of elasticity of the material of the pipe. If it is known, it can be entered directly in this text box. If it is not known, enter zero in this field and the celerity will be calculated by other data.
- **Modulus of elasticity:** enter the modulus of elasticity of the material of the pipe in N/m^2. Click the button with the ellipses (...) to use the modulus of elasticity database.
- **Poisson ratio**: enter the Poisson ratio of the material of the pipe. Click the button with the ellipses (...) to use the Poisson ration database.
- **Pipe wall thickness**: the pipe wall thickness in mm. This is required only if the wave celerity is not known and must be calculated.
- **The pipe has no joints**: check this if the pipe has no joints. This is required only if the wave celerity is not known and must be calculated. It is used for the estimation of the anchorage coefficient of the pipe.
- **It is allowed to move along its axis**: check this if the pipe is allowed to move along its axis. This is required only if the wave celerity is not known and must be calculated. It is used for the estimation of the anchorage coefficient of the pipe.

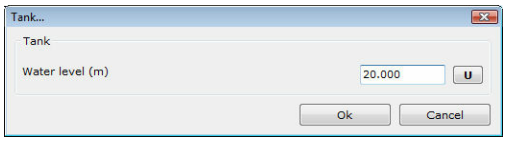
6. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.

3.6.3 Tank data

With this option, you can input additional data regarding the tank.

To input additional data regarding the tank:

1. Select **Layout** from the **Data** menu.
2. Click the **Tank** button. The following form appears:



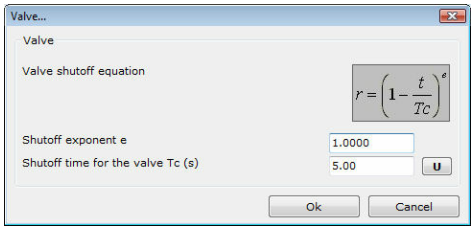
3. Enter the (constant) water level of the tank in m.
4. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.

3.6.4 Valve data

With this option, you can input additional data regarding the valve.

To input additional data regarding the valve:

1. Select **Layout** from the **Data** menu.
2. Click the **Valve** button. The following form appears:



3. Enter the shutoff exponent by typing into the text box.
4. Enter the shutoff time by typing into the text box.
5. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.

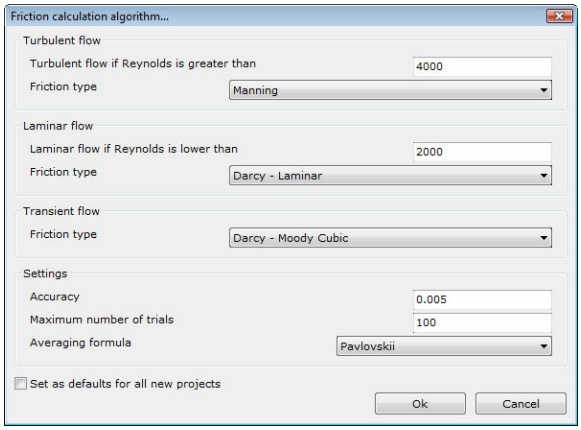
NOTE: If the shutoff exponent is equal to 1 then the closing of the valve is considered to be linear.

3.7 Friction calculation

With this option, you can select the formulas that will be used for the calculation of the friction losses and calibrate the solvers.

To select the friction formulas:

1. Select **Friction calculation** from the **Data** menu. The following form appears:



2. Make the appropriate changes. You can select up to three different friction formulas, depending on the type of flow (turbulent, transient, laminar). If you check **Set as defaults for all new projects** then these values will be preselected for all new projects.

First, you define the boundaries of turbulent and laminar flow. The use of Re>4000 for turbulent flow and Re<2000 for laminar flow is recommended. For intermediate values, the flow is considered to be transient. If you set the same friction formula for all types of flow, this analysis has no effect.

Note that different friction formulas need different friction coefficients. The first three choices are variations of the well-known Manning formula. The first, named **Manning,** assumes constant friction coefficient. The other two calculate the friction coefficient as a function of the fill ratio and the coefficient that corresponds to full flow. These three

formulas give the same results in flow under pressure; this is not the case for flow with free surface, where up to 30% difference may be observed.

The **Accuracy** and **Maximum number of trials** ensure the stability of the algorithm. The default values are 0.0005 for the accuracy and 1000 for the maximum number of trials. It is recommended that you do not change these values.

The averaging formula may take one of the following values:

- Pavlovskii
- Colebatch
- Horton
- Cox
- Lotter

The above formulas are used when there are different friction coefficients within the same section and an average friction coefficient is needed.

3. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.

3.8 Options

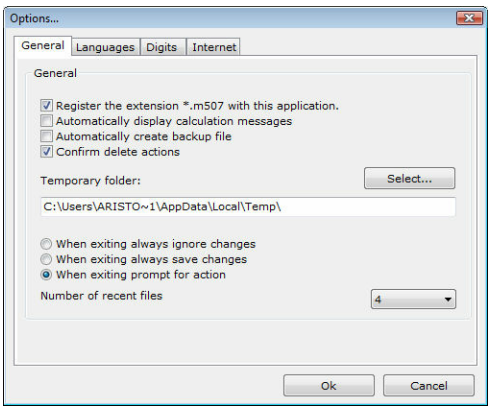
3.8.1 General preferences

With this option, you can modify the general preferences of the program.

To modify the general preferences:

1. Select **Options** from the **Data** menu.
2. Select **General preferences** from the **Options** menu.
3. The general preferences dialog box appears. The preferences are grouped into four tabs. You can select a tab by clicking on its name.

General Tab



This tab contains general preferences regarding the usage of the program.

Check **Register the extension *.m02 with this application** to associate the extension .m02 with this program. This extension is used by the program when saving

a project. In this way, you will be able to run the program and load a project by double-clicking on the project filename in Windows Explorer.

Check **Automatically display calculation messages** if you want the report details to be automatically displayed when you calculate the results.

Check **Automatically create backup file** if you want a backup file (with the extension .bck) to be created every time a project is loaded. By default, this file is created in the temporary folder of Windows.

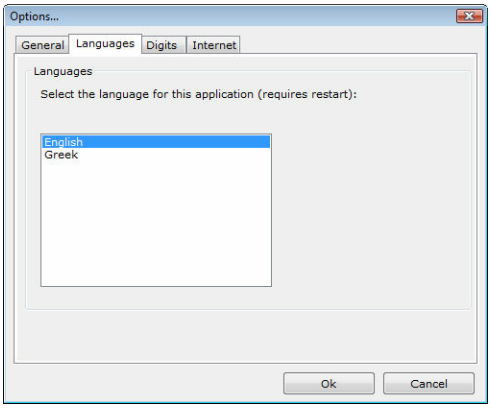
Check **Confirm delete actions** if you want to be asked for confirmation each time an object is about to be deleted. This setting affects the behavior of most delete actions.

You can also modify the temporary folder that will be used for the creation of backup files. By default, this folder is the temporary folder of Windows.

Finally, there are three options regarding the termination of the program:

- **When exiting always ignore changes** - All changes since the last save of the project are ignored.
- **When exiting always save changes** - All changes in the current project are automatically saved. If the filename of the project is not set, a dialog box will appear that allows the selection of the filename, as when selecting Save project as from the **File** menu.
- **When exiting prompt for action** - If there are changes in the current project, then a dialog box will appear. You can choose to save or ignore the changes. If the filename of the project is not set, a dialog box will appear that allows the selection of the filename, as when selecting Save project as from the **File** menu.

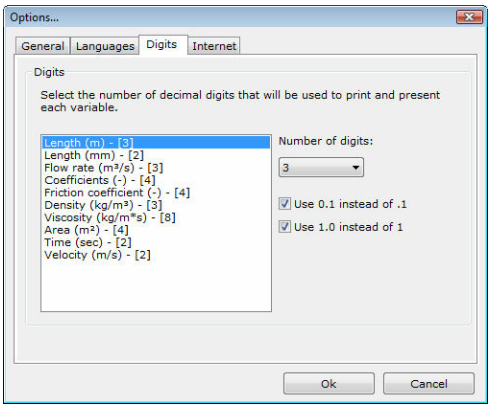
Languages Tab



If more than one language packs have been installed, then you can choose the language of the program. In the above case, there are two language packs; English (that are already selected) and Greek. If you change the language, all forms, menus, messages, help files will reflect the chosen language.

In order for the changes to take effect, you must restart the program.

Digits Tab



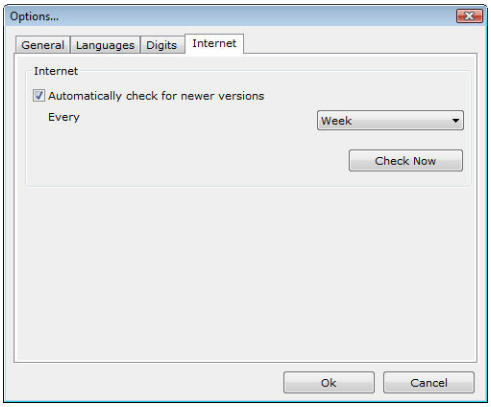
With this tab, you can modify the way the results are presented. All values used in the program are displayed in the list on the left.

For each value, you can select the number of decimal digits using the **Number of digits** drop-down list.

Check **Use 0.1 instead of .1** to use a preceding zero when displaying numbers between -1 and 1, for example -0.08 instead of -.08 and 0.98 instead of .98.

Check **Use 1.0 instead of 1** to use trailing zeros (when necessary) in order to display a number with the decimal digits selected in the **Number of digits** drop-down list, for example 1.1600 instead of 1.16 (when the number of digits is set to 4).

Internet Tab



The program can automatically check for newer versions over the Internet. Check **Automatically check for newer versions** to enable this feature. The check is automatically performed at an interval specified in the **Every** drop-down list. Select **Check now** to manually check for newer versions.

When a newer version is found, you will be prompted to download and install the latest version.

NOTE: TechnoLogismiki protects your privacy. During the check for newer versions, no data is transferred from your computer to the Internet.

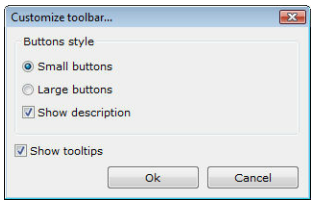
Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.

3.8.2 Customize toolbar

With this option, you can customize the toolbar of the main form.

To customize the toolbar of the main form:

1. Select **Options** from the **Data** menu.
2. Select **Customize toolbar** from the **Options** menu.
3. Make the appropriate changes.
4. Select **Ok** to apply the changes and close the dialog box. Select **Cancel** to close the dialog box without applying any changes.



The toolbar may contain small or large buttons.

Check **Show description** if you want a small description to be displayed under the buttons.

Check **Show tooltips** if you want tooltips to be displayed when the mouse pointer hovers over a button for 2-3 seconds.

NOTE: These preferences affect all projects, old and new.

Chapter

4 Results

4.1 Results menu

With this menu, you can perform calculations. In the **Results** menu you can select one of the following options:

- Perform calculations
- System
- Graph
- Details
- Pressure at station
- Velocity at station
- Flow at station

4.2 Perform calculations

With this option, you can perform calculations. The results are displayed in the main form.

To perform calculations:

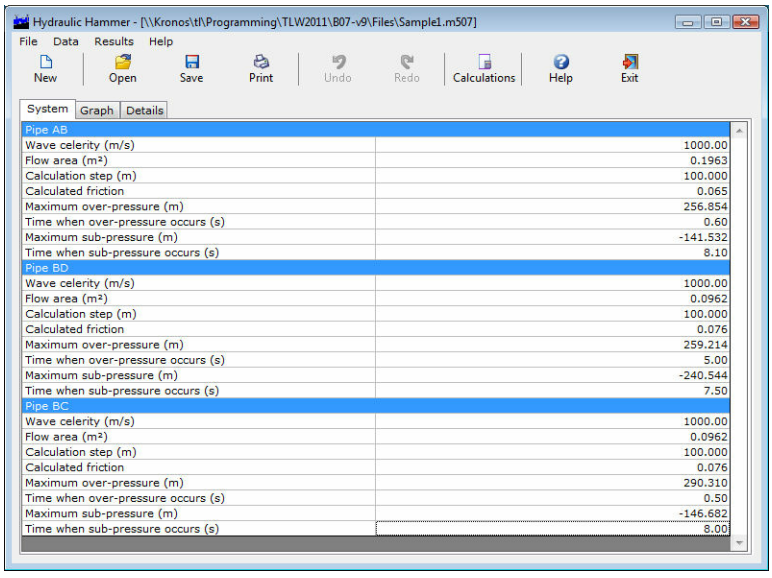
1. Select **Perform calculations** from the **Results** menu.
2. The calculations are performed and the results are displayed in the main form.

4.3 System

With this option, you can display the results regarding the system after the completion of the calculations.

To display the results regarding the system:

1. Select **System** from the **Results** menu.
2. The corresponding tab is displayed in the main form:

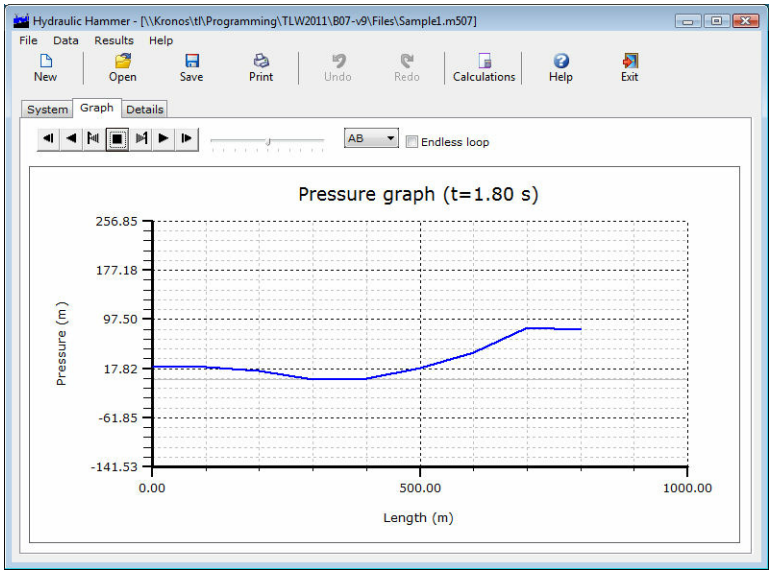


4.4 Graph

With this option, you can display the graph of the results after the completion of the calculations.

To display the graph:

1. Select **Graph** from the **Results** menu.
2. The corresponding tab is displayed in the main form:



3. Select the pipe from the drop-down list.
4. You can change the time instant by clicking the appropriate button:

- Click this button to go to the first time instant.
- Click this button to animate from the current time instant to the beginning.
- Click this button to go to the previous time instant.
- Click this button to stop the animation.
- Click this button to go to the next time instant.
- Click this button to animate from the current time instant to the end.
- Click this button to go to the last time instant.

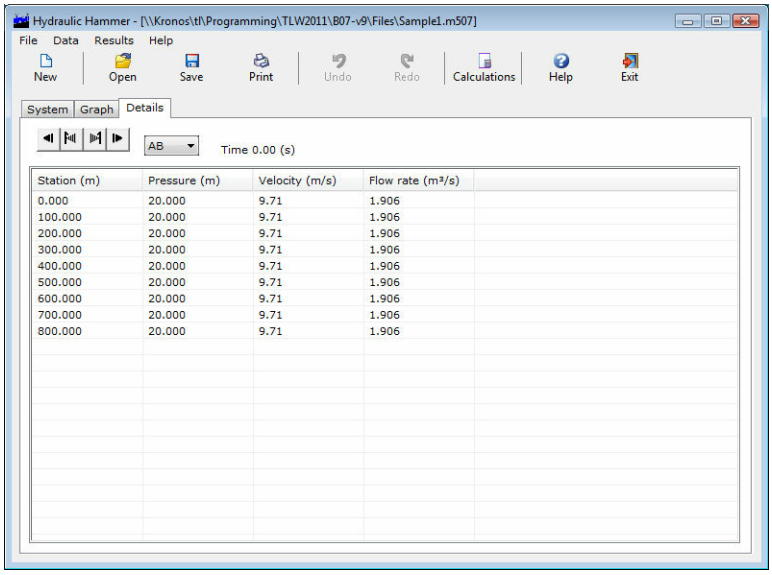
Check **Endless loop** to loop when animating. This option is effective when the animation is either normal or reverse.

4.5 Details

With this option, you can display the details of the results after the completion of the calculations.

To display the details:

1. Select **Details** from the **Results** menu.
2. The corresponding tab is displayed in the main form:



3. Select the pipe from the drop-down list.
4. You can change the time instant by clicking the appropriate button:

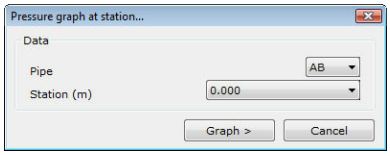
- Click this button to go to the first time instant.
- Click this button to go to the previous time instant.
- Click this button to stop the animation.
- Click this button to go to the next time instant.
- Click this button to go to the last time instant.

4.6 Pressure at station

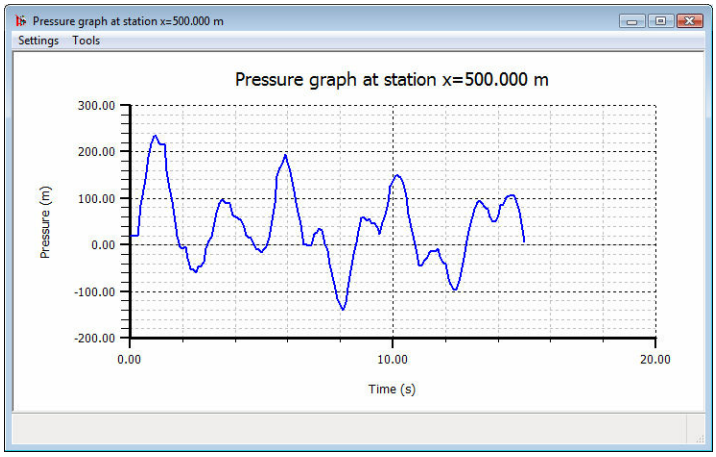
With this option, you can create a pressure graph at a specific station of a pipe.

To create a pressure graph:

1. Select **Pressure at station** from the **Results** menu. The following form appears:



2. Select the pipe from the drop-down list.
3. Enter the station as the distance from the start of the pipe in m.
4. Click **Graph >** to create the graph:



In the **Settings** menu, you can select one of the following options:

- **Customize**: you can customize the appearance of the graph (colors, axes, line styles, text etc).
- **Save settings**: the current settings are saved in a file.
- **Load settings**: the settings are loaded from a file.
- **Export to BMP**: the current image is saved in BMP format.

In the **Tools** menu, you can select one of the following options:

- **Copy to clipboard**: the current image is copied to the clipboard and becomes available to many programs such as Microsoft Word.
- **Set total graph width**: the total image width (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set total graph height**: the total image height (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set graph width**: the internal graph width (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set graph height**: the internal graph height (in pixels) is set. This is particularly useful when creating images with certain dimensions.

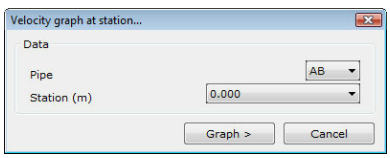
Click the **X button** at the top-right corner of the form to close the graph.

4.7 Velocity at station

With this option, you can create a velocity graph at a specific station of a pipe.

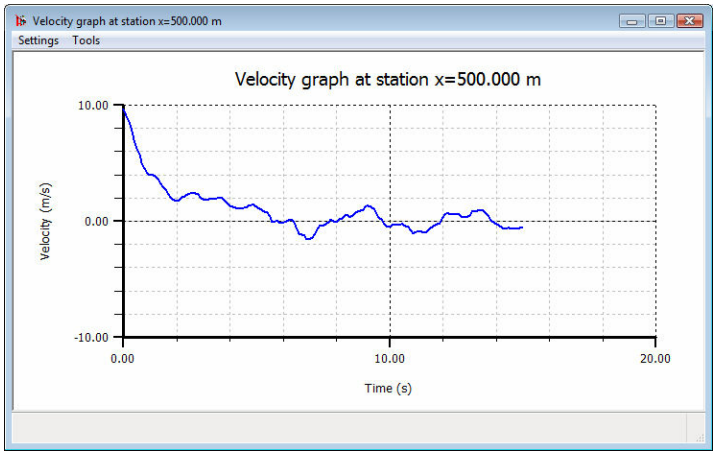
To create a velocity graph:

1. Select **Velocity at station** from the **Results** menu. The following form appears:



2. Select the pipe from the drop-down list.

3. Enter the station as the distance from the start of the pipe in m.
4. Click **Graph >** to create the graph:



In the **Settings** menu, you can select one of the following options:

- **Customize**: you can customize the appearance of the graph (colors, axes, line styles, text etc).
- **Save settings**: the current settings are saved in a file.
- **Load settings**: the settings are loaded from a file.
- **Export to BMP**: the current image is saved in BMP format.

In the **Tools** menu, you can select one of the following options:

- **Copy to clipboard**: the current image is copied to the clipboard and becomes available to many programs such as Microsoft Word.
- **Set total graph width**: the total image width (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set total graph height**: the total image height (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set graph width**: the internal graph width (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set graph height**: the internal graph height (in pixels) is set. This is particularly useful when creating images with certain dimensions.

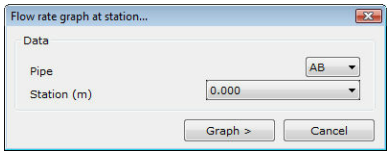
Click the **X button** at the top-right corner of the form to close the graph.

4.8 Flow at station

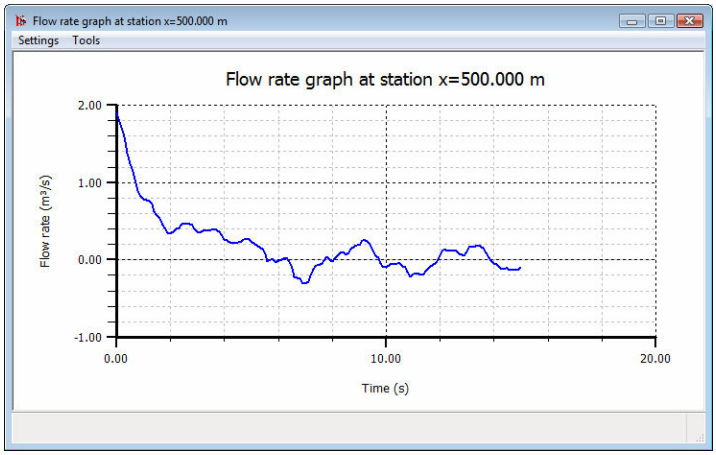
With this option, you can create a flow rate graph at a specific station of a pipe.

To create a flow rate graph:

1. Select **Flow at station** from the **Results** menu. The following form appears:



2. Select the pipe from the drop-down list.
3. Enter the station as the distance from the start of the pipe in m.
4. Click **Graph >** to create the graph:



In the **Settings** menu, you can select one of the following options:

- **Customize**: you can customize the appearance of the graph (colors, axes, line styles, text etc).
- **Save settings**: the current settings are saved in a file.
- **Load settings**: the settings are loaded from a file.
- **Export to BMP**: the current image is saved in BMP format.

In the **Tools** menu, you can select one of the following options:

- **Copy to clipboard**: the current image is copied to the clipboard and becomes available to many programs such as Microsoft Word.
- **Set total graph width**: the total image width (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set total graph height**: the total image height (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set graph width**: the internal graph width (in pixels) is set. This is particularly useful when creating images with certain dimensions.
- **Set graph height**: the internal graph height (in pixels) is set. This is particularly useful when creating images with certain dimensions.

Click the **X button** at the top-right corner of the form to close the graph.

Chapter

5 Help

5.1 Help menu

In the **Help** menu you can select one of the following options:

- Contents
- User guide
- Tutorials
- Tip of the day
- Unit conversion
- TechnoLogismiki website
- Buy products
- TechnoLogismiki NOMOS
- TechnoLogismiki Live!
- About the program

5.2 Contents

With this option, you can access the online help which contains detailed information regarding the usage of the program.

To view the online help:

1. Click **Contents** from the **Help** menu.
2. The online help appears.

NOTE: If an error message appears then the online help has not been installed. You can install the online help from the installation CD or the Internet.

5.3 User guide

With this option, you can access the user guide which contains detailed information regarding the usage of the program.

To view the user guide:

1. Click **User Guide** from the **Help** menu.
2. The user guide appears.

NOTE: If an error message appears then the online help has not been installed. You can install the online help from the installation CD or the Internet.

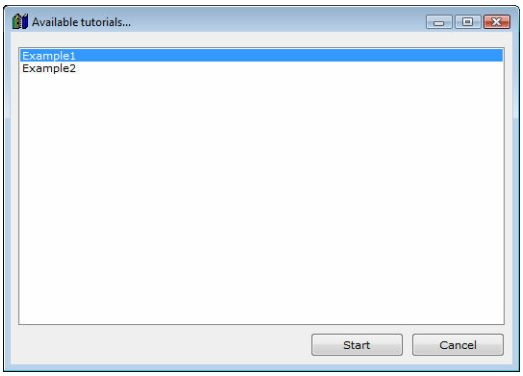
NOTE: Adobe Acrobat Reader or a similar program that can display pdf files is required in order to view or print the user guide.

5.4 Tutorials

With this option, you can access the tutorials of the program. The tutorials are step-by-step examples that allow you to decrease the learning cycle of the programs dramatically.

To access the tutorials:

1. Click **Tutorials** from the **Help** menu.
2. The tutorial selection dialog box appears.
2. Select the appropriate tutorial and click **Start** to proceed. Click **Cancel** to close the dialog box.



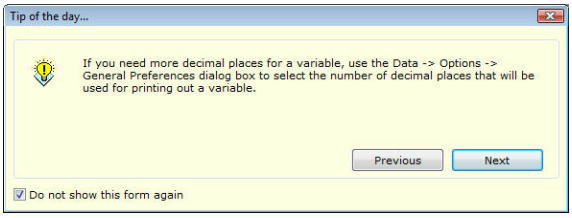
NOTE: The number and content of the tutorials is changed frequently. Use the live update system of TechnoLogismiki's products to download the latest tutorials.

5.5 Tip of the day

With this option, you can access the tip database of the program. The tips are short guidelines regarding the usage of the programs which may be of great help to the user.

To access the tips:

1. Click **Tip of the day** from the **Help** menu.
2. The tip of the day form appears.
3. Check **Do not show this form again** to prevent the program from showing the tip of the day when starting. Press the **Previous/Next** buttons to browse all available tips.
4. Press **Esc** to close the form.



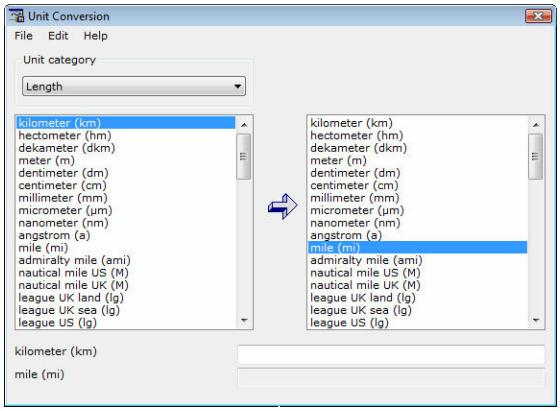
NOTE: The number and content of the tips is changed frequently. Use the live update system of TechnoLogismiki's products to download the latest tips.

5.6 Unit conversion

With this option, you can access the unit conversion tool. You can find more information about its usage in its help system.

To launch the unit conversion tool:

1. Click **Unit conversion** from the **Help** menu.
2. The unit conversion tool is launched.



NOTE: If an error message appears then the unit conversion tool has not been installed. You can install the unit conversion tool from the installation CD or the Internet.

5.7 TechnoLogismiki website

With this option, you can load on your Internet browser the website of TechnoLogismiki's.

5.8 Buy products

With this option, you can load on your Internet browser the main product page of TechnoLogismiki's website.

5.9 TechnoLogismiki NOMOS

With this option, you can load on your Internet browser the **NOMOS** service of Technologismiki.

5.10 TechnoLogismiki Live!

With this option, you can load on your Internet browser the **Live!** service of Technologismiki.

5.11 About the program

With this option, a form containing the name, version and licence information of the program appears.

To show this form:

1. From the **Help** menu, select **About the program**.
2. The form appears.
3. Click anywhere on the form or hit ESC to close the form.

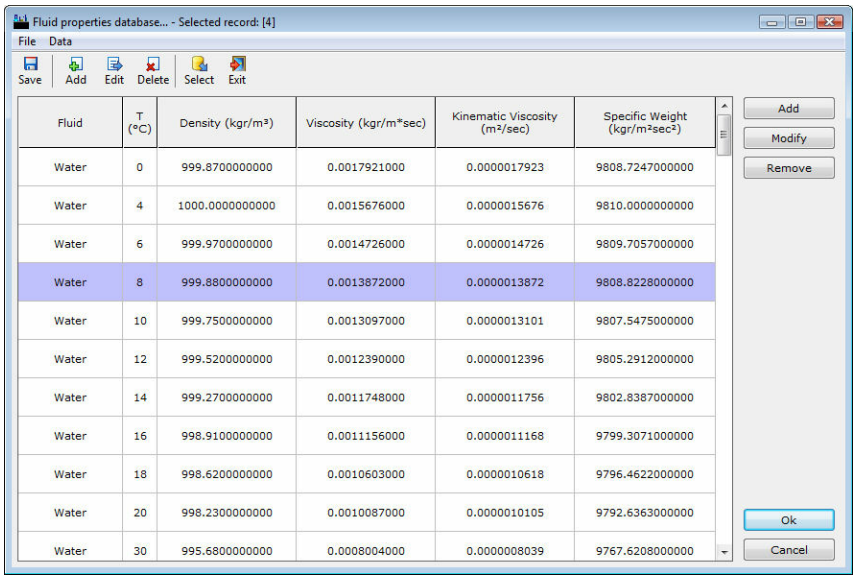
Chapter

6 Databases

6.1 Fluid database

For your convenience, a fully customizable fluid database is embedded in the program. The fluid database is invoked in various cases within the program. By selecting an appropriate fluid record and clicking **Ok**, the data is transferred to the corresponding fields. Select **Cancel** to close the database without transferring any data.

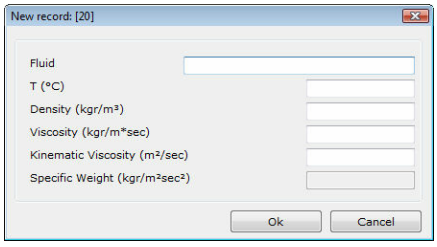
You will be asked to confirm any changes you have made to the database when exiting. The changes will be instantly available to other programs using the same database.



Fluid	T (°C)	Density (kgr/m³)	Viscosity (kgr/m*sec)	Kinematic Viscosity (m²/sec)	Specific Weight (kgr/m²sec²)
Water	0	999.8700000000	0.0017921000	0.0000017923	9808.7247000000
Water	4	1000.0000000000	0.0015676000	0.0000015676	9810.0000000000
Water	6	999.9700000000	0.0014726000	0.0000014726	9809.7057000000
Water	8	999.8800000000	0.0013872000	0.0000013872	9808.8228000000
Water	10	999.7500000000	0.0013097000	0.0000013101	9807.5475000000
Water	12	999.5200000000	0.0012390000	0.0000012396	9805.2912000000
Water	14	999.2700000000	0.0011748000	0.0000011756	9802.8387000000
Water	16	998.9100000000	0.0011156000	0.0000011168	9799.3071000000
Water	18	998.6200000000	0.0010603000	0.0000010618	9796.4622000000
Water	20	998.2300000000	0.0010087000	0.0000010105	9792.6363000000
Water	30	995.6800000000	0.0008004000	0.0000008039	9767.6208000000

To add a new record:

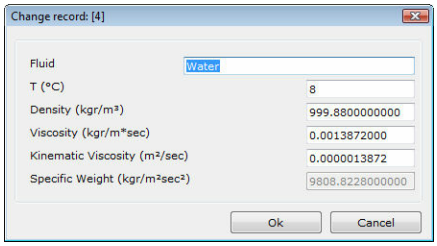
1. Click **Add** to open the new record dialog box.
2. Type the name of the fluid. This field is required.
3. Enter the temperature, density, viscosity and kinematic viscosity of the fluid.
4. The specific weight is calculated automatically.
5. Click **Ok** to close the dialog box and add a new record at the end of the list. Click **Cancel** to close the dialog box without making any changes.



To modify an existing record:

1. Click **Modify** to open the modify record dialog box.
2. Make the appropriate changes.

3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



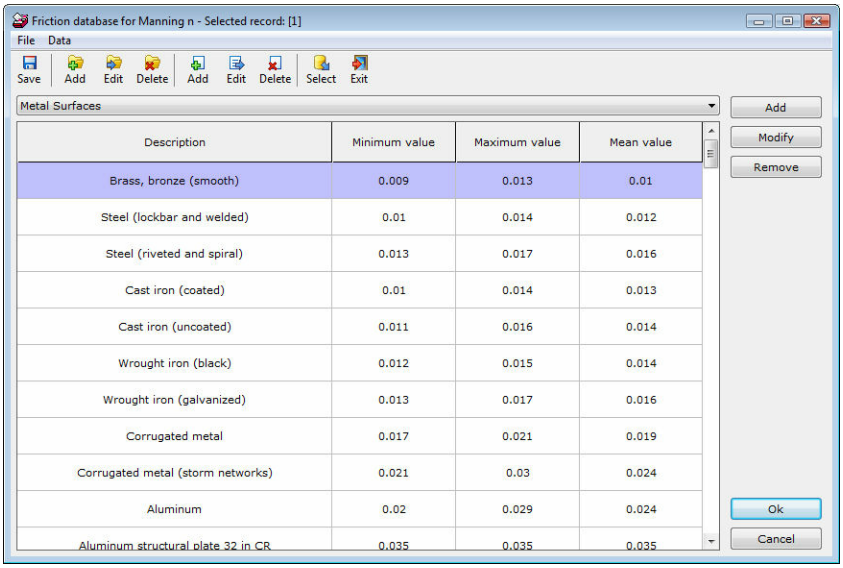
To remove an existing record:

1. Select the record you wish to remove.
2. Click **Remove** to remove the record. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.

6.2 Friction database

For your convenience, a fully customizable friction database is embedded in the program. The friction database is invoked in various cases within the program. By selecting an appropriate friction record (which is depended on the selected friction formula) and clicking **Ok**, the data is transferred to the corresponding fields. Select **Cancel** to close the database without transferring any data.

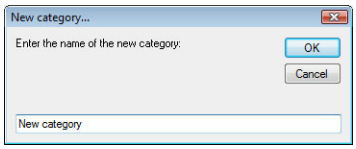
You will be asked to confirm any changes you have made to the database when exiting. The changes will be instantly available to other programs using the same database.



The database consists of several categories. Usually, the category defines the material of the surface (e.g. Metal surfaces).

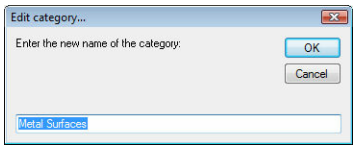
To add a new category:

1. Select **Add category** from the **Data** menu.
2. Type the name of the category in the text box. The name of the category must be unique.
3. Select **Ok** to add the category at the end of the list. Select **Cancel** to cancel the procedure.



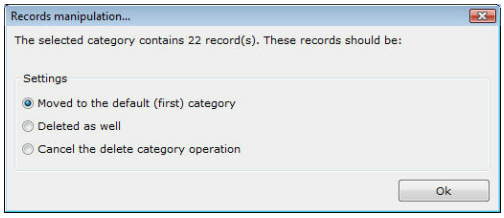
To modify the name of an existing category:

1. Click **Modify** to open the modify category dialog box.
2. Type the name of the category in the text box. The name of the category must be unique.
3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



To remove an existing category:

1. Select the category you wish to remove from the drop-down list.
2. Click **Remove** to remove the category. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.
4. If the category contains records, then the following dialog box appears:

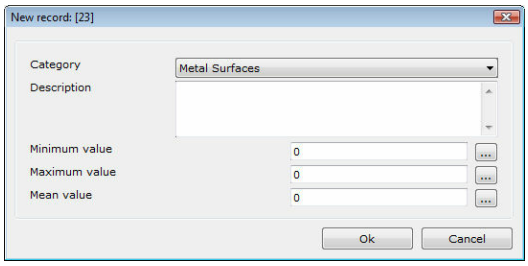


4.1. Select the first option to move the records of the category to the default (first category).
4.2. Select the second option to delete the records.
4.3. Select the third option to cancel the deletion.
5. Click **Ok** to proceed.

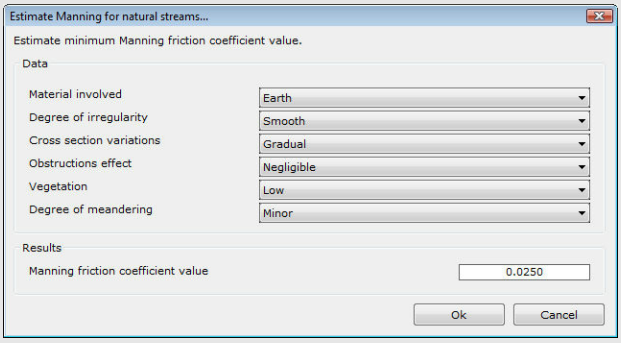
NOTE: The database must contain at least one category.

To add a new record:

1. Click **Add** to open the new record dialog box.
2. Select the category of the new record from the drop-down list.
3. Type the description of the record. This field is required.
4. Enter the minimum, maximum and mean value of the friction.
5. Click **Ok** to close the dialog box and add a new record at the end of the list. Click **Cancel** to close the dialog box without making any changes.



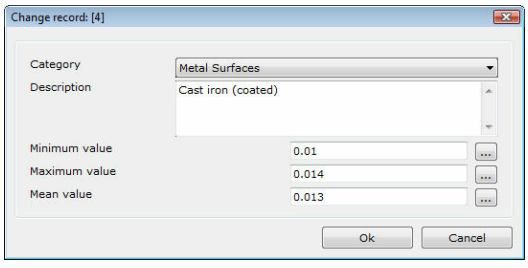
NOTE: In case of Manning friction coefficients in natural streams, you can estimate the values based on several characteristics of the stream. Click on the buttons with the ellipses (...) next to the text boxes to invoke the following dialog box:



Make the appropriate selections. Click **Ok** to close the dialog box and transfer the data to the corresponding text box. Click **Cancel** to close the dialog box without transferring any data.

To modify an existing record:

1. Click **Modify** to open the modify record dialog box.
2. Make the appropriate changes.
3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



To remove an existing record:

1. Select the record you wish to remove.
2. Click **Remove** to remove the record. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.

6.3 Manning friction coefficients

Surface / Material	Mean Value
Aluminum	0.024
Asbestos cement	0.013
Asphalt ditch	0.016
Asphalt pavement	0.016
Asphalt smooth	0.013
Asphalted cast iron	0.012
Natural ground	0.020
Best concrete	0.010
Brick in mortar	0.015
Brick sewer	0.015
Cast iron	0.012
CMP	0.024
Concrete	0.013
PVC	0.010
Centrifugal spun	0.013
Concrete (steel forms)	0.011
Concrete (wood forms)	0.015
Concrete gutter (broom finish)	0.016
Concrete gutter (troweled finish)	0.012
Copper	0.011
Fiber glass roving	0.011
Gravel riprap (D=25)	0.033
Gravel riprap (D=50)	0.041
Grouted riprap	0.030
Natural stream (clean)	0.030
Natural stream (stone)	0.050
Natural stream (weedy)	0.035

6.4 Bazin friction coefficients

Surface / Material	Max value	Min value	Mean value
Rough concrete	0.5	0.4	0.46
Smooth concrete	0.08	0.04	0.06
Brick in mortar	0.018	0.014	0.016
Sewer pipes (Greek regulations 696/74)	0.25	0.25	0.25
Storm pipes (Greek regulations 696/74)	0.46	0.46	0.46

6.5 Hazen - Williams friction coefficients

Surface / Material	Mean value
Asbestos cement	140
Asphalted cast iron	130
Best concrete	150
Centrifugal spun	135
Concrete (wood forms)	120
Concrete (steel forms)	140
Copper	135
Ductile iron	130
Galvanized iron	120
Glass	140
PVC	150
Riveted steel (new, rough)	80
Riveted steel (new, smooth)	110
Steel	120
Wood (new)	140

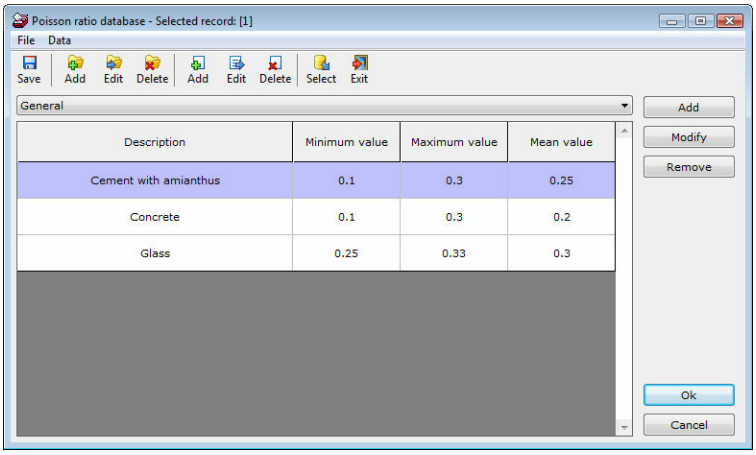
6.6 Darcy - Weisbach friction coefficients

Surface / Material	Mean value (mm)
Aluminum	0.300
Asbestos cement	0.002
Asphalted cast iron	0.120
Best concrete	0.366
Brick in mortar	0.610
Sewer brick	0.610
CMP	0.305
Concrete	0.122
Centrifugal spun	0.366
Concrete (steel forms)	1.829
Concrete (wood forms)	0.610
Copper	0.002
Galvanized steel	1.520
Glass	0.001
PVC	0.122
HDPE	0.150

6.7 Poisson ratio database

For your convenience, a fully customizable Poisson ratio database is embedded in the program. The database is invoked in various cases within the program. By selecting an appropriate record (which is depended on the selected friction formula) and clicking **Ok**, the data is transferred to the corresponding fields. Select **Cancel** to close the database without transferring any data.

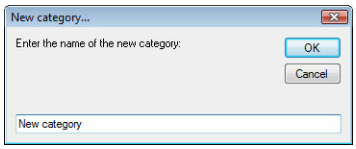
You will be asked to confirm any changes you have made to the database when exiting. The changes will be instantly available to other programs using the same database.



The database consists of several categories. Usually, the category defines the material of the surface (e.g. Metal surfaces).

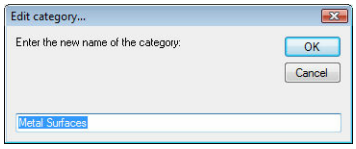
To add a new category:

1. Select **Add category** from the **Data** menu.
2. Type the name of the category in the text box. The name of the category must be unique.
3. Select **Ok** to add the category at the end of the list. Select **Cancel** to cancel the procedure.



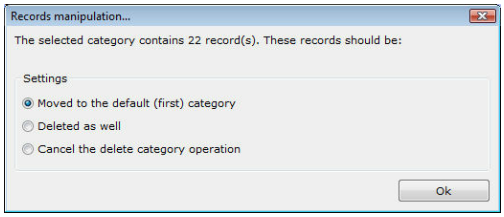
To modify the name of an existing category:

1. Click **Modify** to open the modify category dialog box.
2. Type the name of the category in the text box. The name of the category must be unique.
3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



To remove an existing category:

1. Select the category you wish to remove from the drop-down list.
2. Click **Remove** to remove the category. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.
4. If the category contains records, then the following dialog box appears:

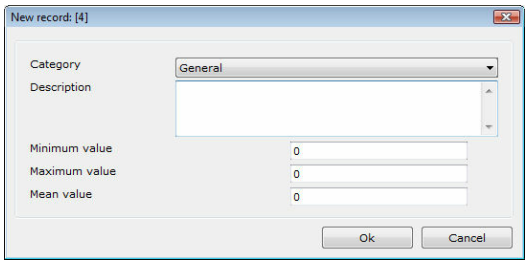


4.1. Select the first option to move the records of the category to the default (first category).
4.2. Select the second option to delete the records.
4.3. Select the third option to cancel the deletion.
5. Click **Ok** to proceed.

NOTE: The database must contain at least one category.

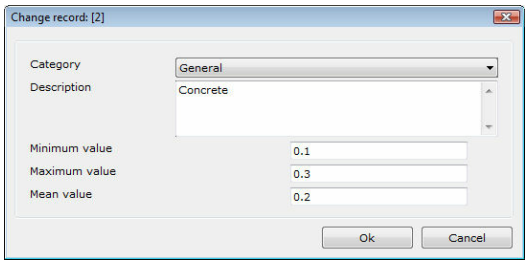
To add a new record:

1. Click **Add** to open the new record dialog box.
2. Select the category of the new record from the drop-down list.
3. Type the description of the record. This field is required.
4. Enter the minimum, maximum and mean value of the Poisson ratio.
5. Click **Ok** to close the dialog box and add a new record at the end of the list. Click **Cancel** to close the dialog box without making any changes.



To modify an existing record:

1. Click **Modify** to open the modify record dialog box.
2. Make the appropriate changes.
3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



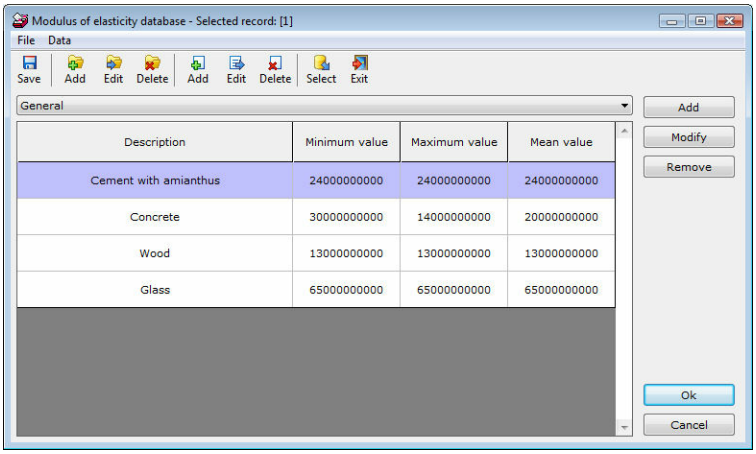
To remove an existing record:

1. Select the record you wish to remove.
2. Click **Remove** to remove the record. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.

6.8 Modulus of elasticity

For your convenience, a fully customizable Modulus of elasticity database is embedded in the program. The database is invoked in various cases within the program. By selecting an appropriate record (which is depended on the selected friction formula) and clicking **Ok**, the data is transferred to the corresponding fields. Select **Cancel** to close the database without transferring any data.

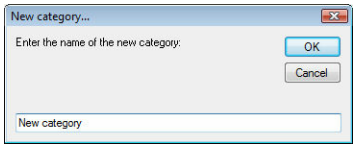
You will be asked to confirm any changes you have made to the database when exiting. The changes will be instantly available to other programs using the same database.



The database consists of several categories. Usually, the category defines the material of the surface (e.g. Metal surfaces).

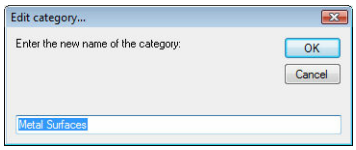
To add a new category:

1. Select **Add category** from the **Data** menu.
2. Type the name of the category in the text box. The name of the category must be unique.
3. Select **Ok** to add the category at the end of the list. Select **Cancel** to cancel the procedure.



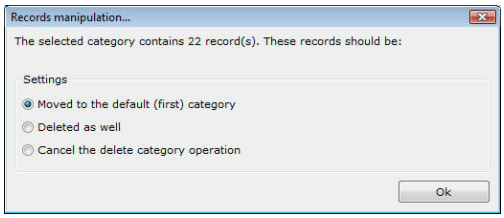
To modify the name of an existing category:

1. Click **Modify** to open the modify category dialog box.
2. Type the name of the category in the text box. The name of the category must be unique.
3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



To remove an existing category:

1. Select the category you wish to remove from the drop-down list.
2. Click **Remove** to remove the category. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.
4. If the category contains records, then the following dialog box appears:

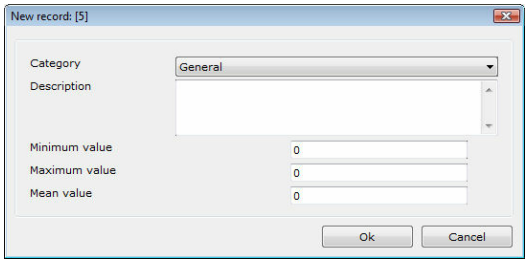


4.1. Select the first option to move the records of the category to the default (first category).
4.2. Select the second option to delete the records.
4.3. Select the third option to cancel the deletion.
5. Click **Ok** to proceed.

NOTE: The database must contain at least one category.

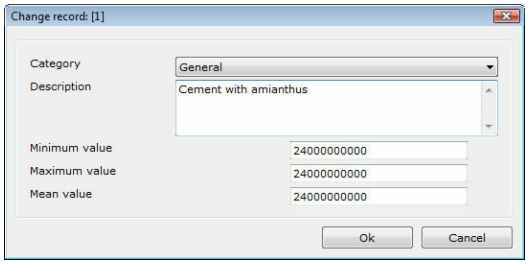
To add a new record:

1. Click **Add** to open the new record dialog box.
2. Select the category of the new record from the drop-down list.
3. Type the description of the record. This field is required.
4. Enter the minimum, maximum and mean value of the modulus of elasticity.
5. Click **Ok** to close the dialog box and add a new record at the end of the list. Click **Cancel** to close the dialog box without making any changes.



To modify an existing record:

1. Click **Modify** to open the modify record dialog box.
2. Make the appropriate changes.
3. Click **Ok** to save the changes and close the dialog box. Click **Cancel** to close the dialog box without saving the changes.



To remove an existing record:

1. Select the record you wish to remove.
2. Click **Remove** to remove the record. You will be asked to confirm the deletion.
3. Select Yes to proceed with the deletion. Select No to cancel the deletion.

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