Software Manual for NivuSoft

(Original Instruction Manual – German – Full Version)

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Translation
If the device is sold to a country in the EEA, this Software Manual must be translated into the language of the country in which the device is to be used.
Should the translated text be unclear, the original instruction handbook (German) must be consulted or the manufacturer contacted for clarification.

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2 Basics

The NivuSoft application serves as a tool for the visualisation of readings coming from the NIVUS device family. The data may be imported as TXT/CSV-files. Furthermore it is possible to set up a direct connection to NivuDat 32 in order to import measurement series from there.

NivuSoft can be used for hierarchical administration of projects, campaigns and measurement places. Furthermore it is possible to manage additional documents (Text-, Word-, Excel-, PDF-files, and photos) within the project tree.
NivuSoft contains modules to visualise readings (graphs, scatter-graphs, tables, and statistics). Moreover there are calculation modules available which allow to perform simple mathematical operations. There are additional options for measurement data processaing available which can be used in order to analyse complex mathematical/physical interrelationships (Chapter 13).

The following document describes installation as well as initial start-up and explains all functions provided by NivuSoft.

2.1.1 Notes to the user

The software manufacturer is assuming that the reader/user is familiar with the basics of the operating system (Windows XP, Windows Vista or Windows 7) and in particular how to operate it. Operational elements such as e.g. mouse, windows, buttons and similar will not be explained separately but knowledge about this is assumed.

The manufacturer is not responsible for faults, data loss or problems resulting from faulty knowledge about these basics.

3 Installation and Initial Start-Up

3.1 System requirements

Please make sure to have administrative rights in order to install NivuSoft.
The software requires Windows XP, Windows Vista or Windows 7 as OS for correct function.
The Microsoft .Net Framework as of version 3.5 or higher is additionally necessary. Download the .NET Framework either directly from the Microsoft homepage or simply use the installation package supplied with the CD.

3.2 Installation

Start the file “Setup.msi" which can be found on the CD “Tools and manuals" or alternatively download the application from the NIVUS homepage (http://www.nivus.com or HIER):

After the "Welcome" screen has been confirmed with "Next", a new window comes up (see Figure 1).

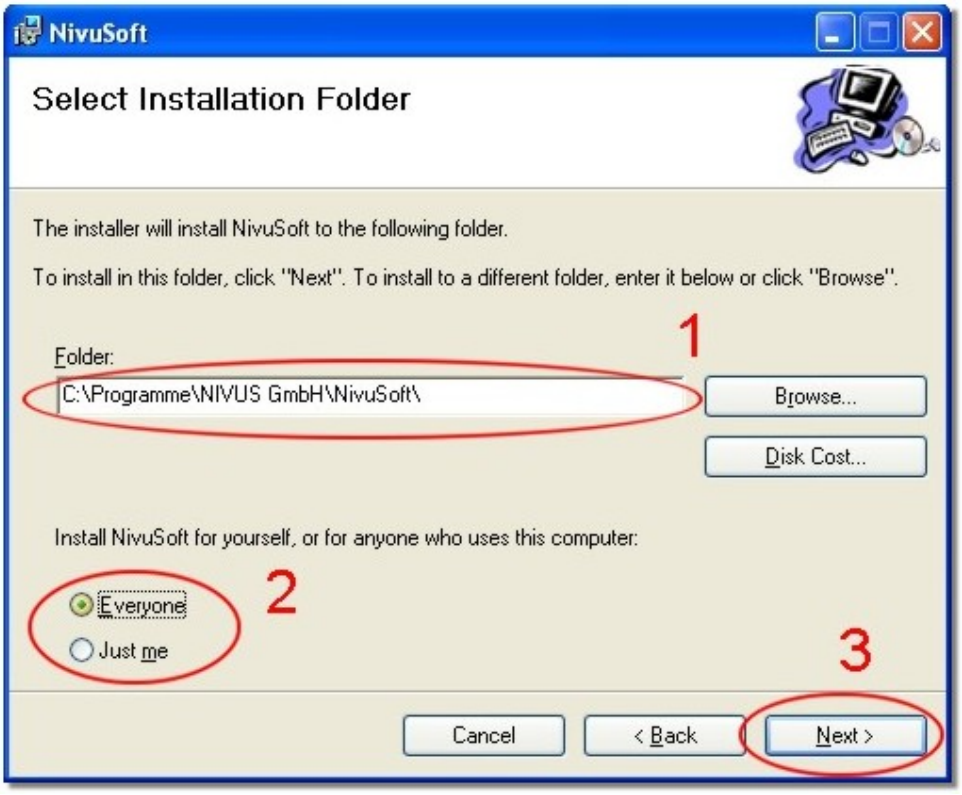


Figure 1 NivuSoft Installation Dialog

Section 1 is to specify the target folder for the application to be installed. Use the "Browse" to interactively select a destination directory.
In section 2 you can specify if the application can either be used by the user currently logged in or by all user working at the respective PC (if a system administrator is required for installation use the "All users“ option).
Clicking the "Next“ button (section 3) will start the actual installation process.

3.3 Uninstall

To uninstall NivuSoft, either start the "Setup.msi" file once more (see Figure 2). Selecting "Remove NivuSoft" (point **1**) and clicking the "Finish" (point **2**) will execute the uninstall process.

Figure 2: Uninstall NivuSoft

If the "Setup.msi" file is no longer available you can use the classic uninstall feature via "Control panel→Software→NivuSoft→Uninstall".

3.4 Initial start-up

After successful installation NivuSoft can be either launched via the Windows start menu or by clicking the respective desktop icon.

NivuSoft distinguishes between the application area (typically: `C:\Programs\NIVUS GmbH\NivuSoft`) and a folder to store measurement data. The folder intended for the storage of measurement data can be freely specified by the user. Initially launching the NivuSoft will bring up the dialog depicted in **Fehler! Verweisquelle konnte nicht gefunden werden.**. Select or create a destination folder by navigating within the directory tree of the file system. This information will be saved subsequently after clicking "OK" (section **1**).

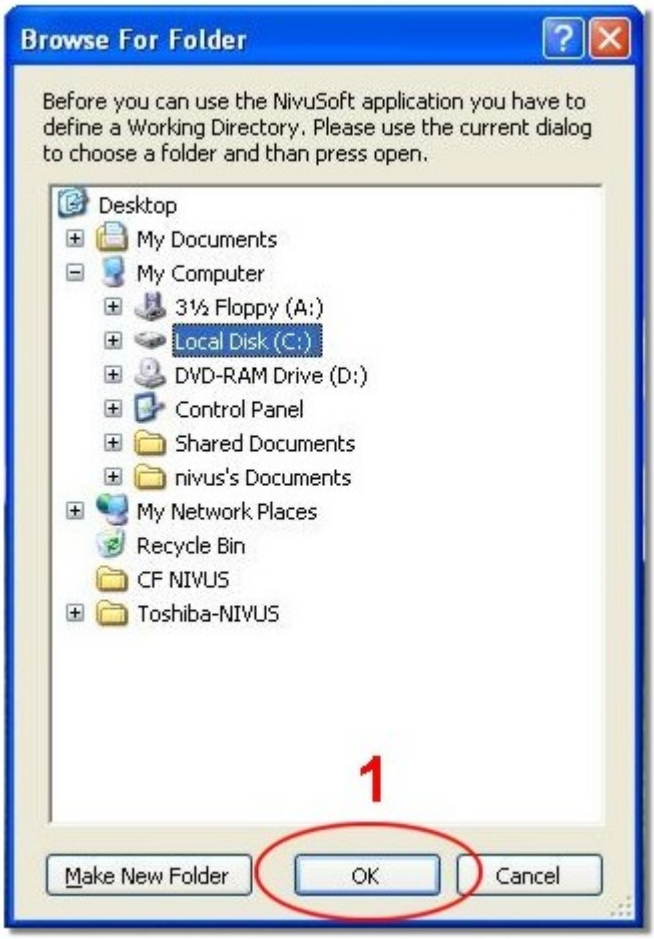


Figure 3: Selecting the workspace

4 NivuSoft Application

4.1 Start

The installation process creates a desktop icon which can be used to start the application. It is also possible to launch the software from the link located in the program dialog of the Windows system in the folder named "NivuSoft".

4.2 Exit

NivuSoft can be closed in two ways:

1. As known from other Windows applications by clicking the "X" in the top right hand corner of the window
2. Via the main menu (**1**) (click the NIVUS logo in the top left hand corner) and by selecting the option "Exit" (**2**) (see Figure 4).

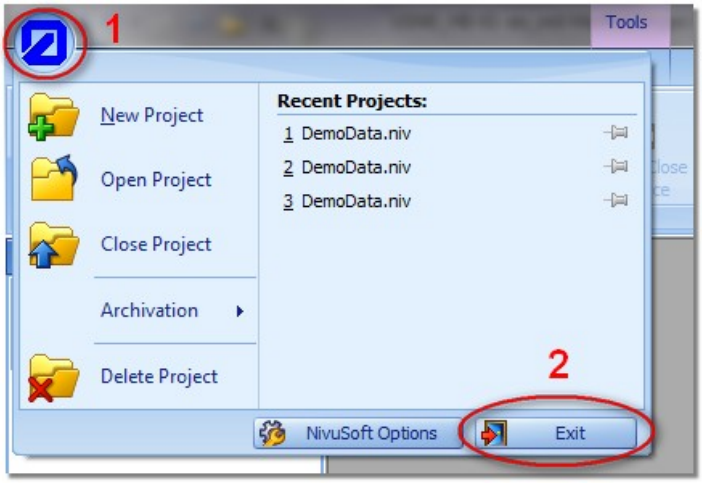


Figure 4 Exit via "Main menu"

4.3 Window management

The NivuSoft "Look & Feel" has been designed following the Microsoft Office 2007 products. Many procedures (e.g. moving and arrangement of windows, Drag & Drop etc.) can be found in NivuSoft as well. The main window of the application can be subdivided in two main areas (see Figure 5).

1. Area for the submenu functions (**1**) (start, workspace, add-ons, …)
2. Main area (**2**) to arrange individual "working windows" (see Chapter 4.3.1 to 4.3.5)

"Working windows" may be positioned freely in the NivuSoft application. These windows are used to indicate the additional information described in the Chapters 4.3.2 to 4.3.6 (project tree, properties etc.). Working with "Working windows" will be described in Chapter 4.3.1.

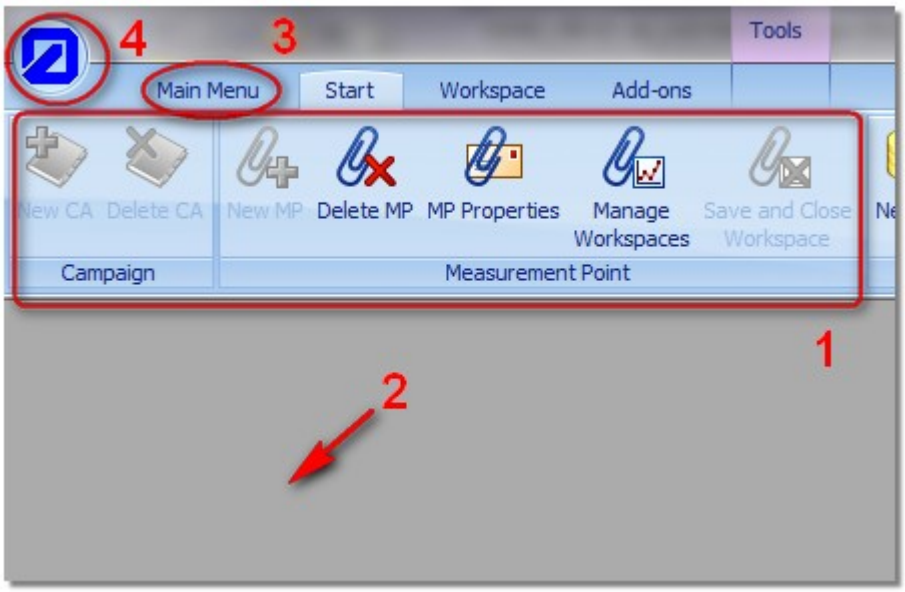


Figure 5: Main window areas

A double click with the left mouse key on a menu point (e.g. „Start“ (**3**)) will hide the entire menu bar (**1**). A new single click with the left mouse key will show the menu bar again temporarily. Double-clicking with the left mouse key in section **3** indicates the menu bar permanently.

Open the main menu by clicking on the NIVUS icon in the top left hand corner (**4**).

In order to open a "working window" including one of the desired functions call up "Panels” from the "Start" menu (see Figure 6).

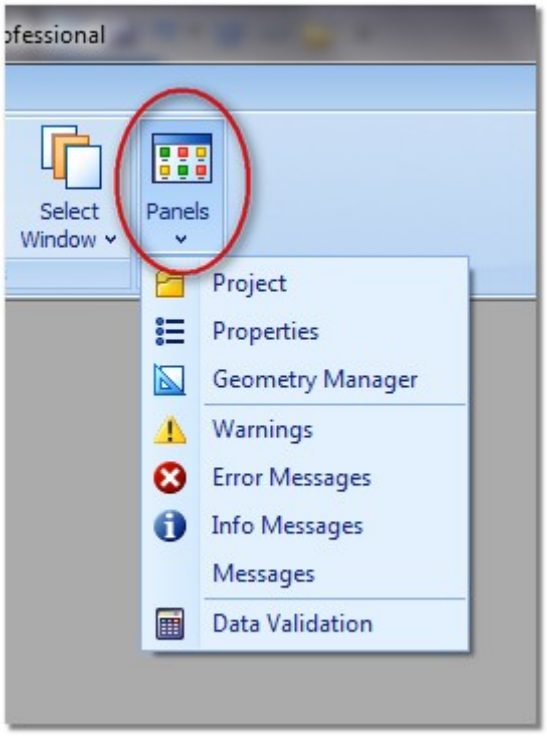


Figure 6: Opening a "Working window"

4.3.1 General functions of working windows

Working windows are so-called „Docking Panels“ and can be arranged freely within the main window area. Catch a window by clicking and holding the mouse key in the top window bar (see Figure 7 (**1**)): it can be moved freely to any position. The window can be docked by moving it to the margin area or the centre of the main window (e.g. (**2**) or (**3**)). Moving a window over an indicated docking position will highlight the presumed new position in light grey. By releasing the left mouse key the window will either be docked on the selected position or can be positioned freely anew.

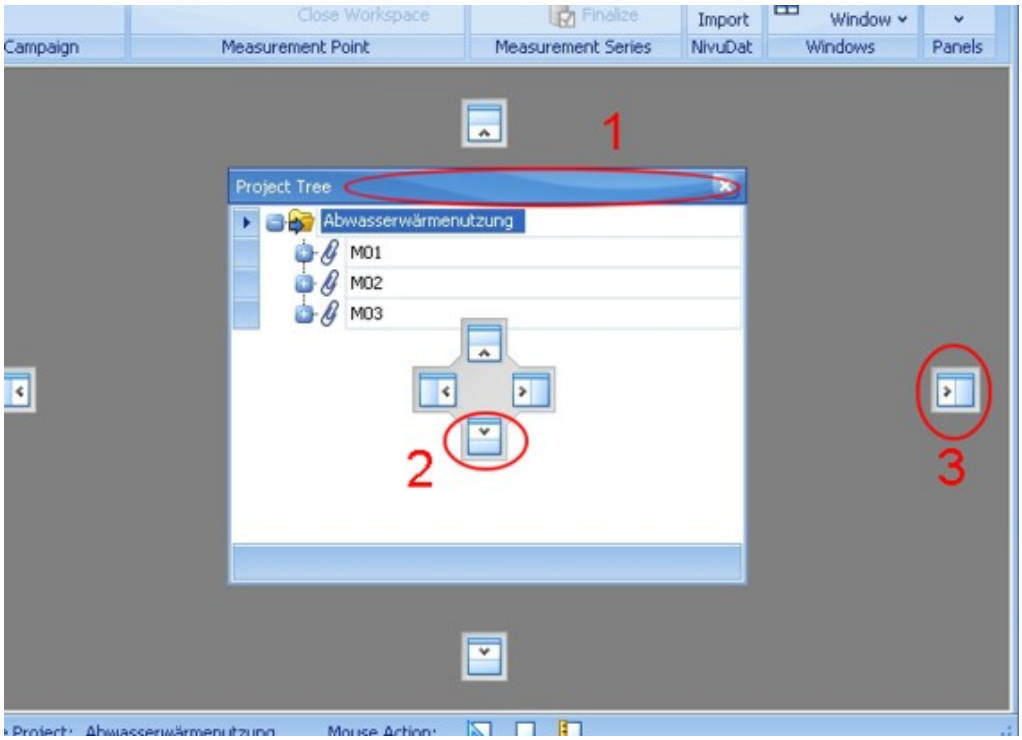


Figure 7: Arranging working windows

A working window can be temporarily hidden as soon as it is docked in a fixed position in the main window. Use the "pushpin" icon in the working window to do this (see Figure 8 left hand picture). Moving the mouse cursor out of the working window will hide the window. To show the window again click the according tab (see Figure 8 right hand picture). If the window is to be shown permanently again click the "pushpin" icon again.

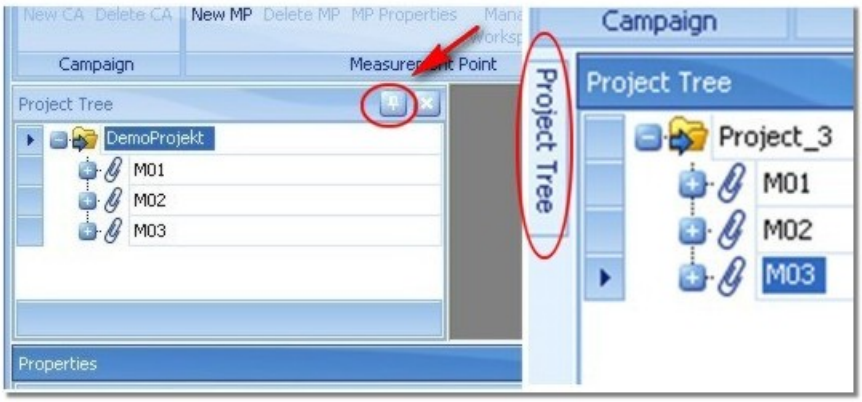


Figure 8: Hiding a "working window"

4.3.2 Project tree

Using the project tree it is possible to represent project structures. It furthermore serves for launching or calling up a vast number of functions. You can find respective hints and descriptions in the according chapters.
The standard position of the project tree is on the left hand side of the main area. However it may be repositioned by using one of the methods described in chapter 4.3.1.

4.3.3 Properties window

The properties window shows information on certain entries which have been selected in the project tree. Some values may even be edited, which will be specified if necessary in the following chapters.

4.3.4 Geometry Manager

The geometries of weirs and channels can be managed with NivuSoft independent from projects. The standard installation already contains several "standard geometries". After clicking the "Geometry Manager" button in the console section (see Figure 6) a window similar to Figure 9 will be shown in the bottom left area of the application window.

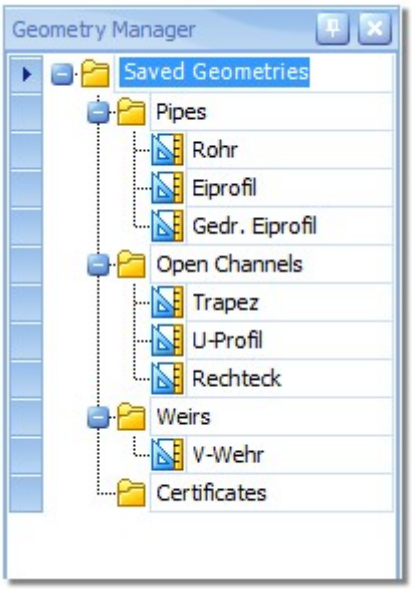


Figure 9 Geometry Manager

In the folder "Saved Geometries" there are two different types of elements available.

4.3.4.1 Folder

Use a folder to manage individual geometries of a similar type.
To create a new folder, use the right-click context menu of the geometry manager. Enter a folder name in the following dialog as well as an additional description if required. The folder will be added to the geometry manager by clicking the "Enter" button.

To remove a folder, select the respective element in the geometry manager first. Then use the “Remove geometry folder“ in the right-click context menu. Only folders created before by the user can be deleted, i.e. it is not possible to delete system folders.

In order to change or modify the name or description of folders, select the “Folder Properties” option in the right-click context menu of the selected folder. The following dialog allows to execute the desired modifications.

4.3.4.2 Geometry

In order to create new geometries select an appropriate folder, use the right-click context menu and select the "Add Geometry Configuration" option. Subsequently the "Flow Calculator" (see chapter 14) will open up which can be used to create and to configure geometries as well.
The right-click context menu can be used to delete or to modify existing geometry configuration similar to the procedure as described in section 4.3.4.

4.3.5 Message window

Since operating errors may occur during operation, more information and helpful hints will be shown in the message window. NIVUS recommends to have this window open at any time!
There are three types of messages indicated in the message window: warnings, errors and information. Open the respective working window (see Figure 6) if you wish to apply a filter function.

4.3.6 Data Validation

The NivuSoft data validation is indicated in a working window as well. You can find a detailed description of the functions in Chapter 13.

4.4 Configuration

There are many configuration options available in NivuSoft. The most important ones can be found in the program settings menu and can be shown using the "main menu" and by selecting "NivuSoft options" subsequently.

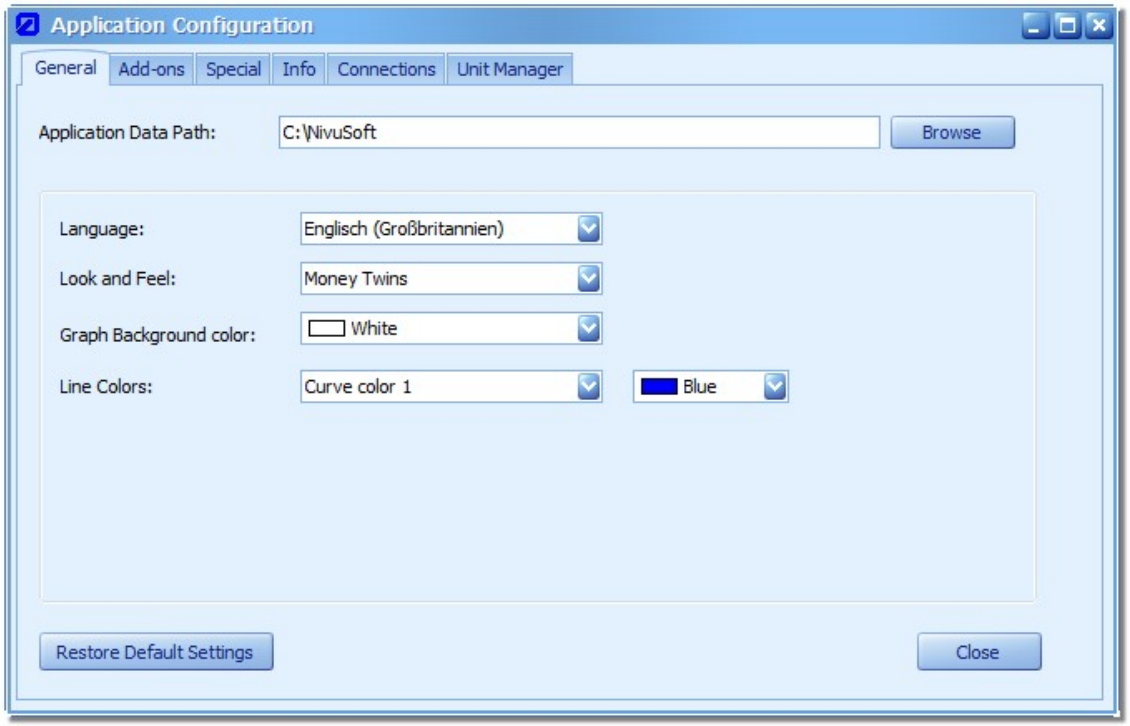


Figure 10: Application configuration dialog

The following sections describe the individual functions of the submenus which can be found in the program settings.

4.4.1 General

During the NivuSoft initial start-up a working directory had to be specified (see Chapter 3.4).
The "Application Data Path" menu allows modifying the path for the data directory.
Select your desire language in the "Language" section. A restart is NOT required.
There are various viewing options (colour constellations) available for NivuSoft. Select your desired design in the "Look and Feel" section.
The background colour (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**) can be selected under "Graph Background Colour".
Adding measurement series to the graph module causes the application to use colours in a certain sequence (any desired colour may be selected subsequently). The colours for this sequence can be modified in “Line colours” as desired.

Section "Application Code" can be used to switch between NivuSoft versions. According codes for the various versions (range of functions) can be ordered directly from NIVUS. The button "Registration" will be activated as soon as the code entered has been recongised as valid. After clicking this button and after successful registration restart the software to finally unlock the desired features.

4.4.2 Add-ons

The "Add-ons" submenu allows to install and to manage additional NivuSoft modules. Please contact the NIVUS support for more details on interface, handling and program examples.

4.4.3 Special settings

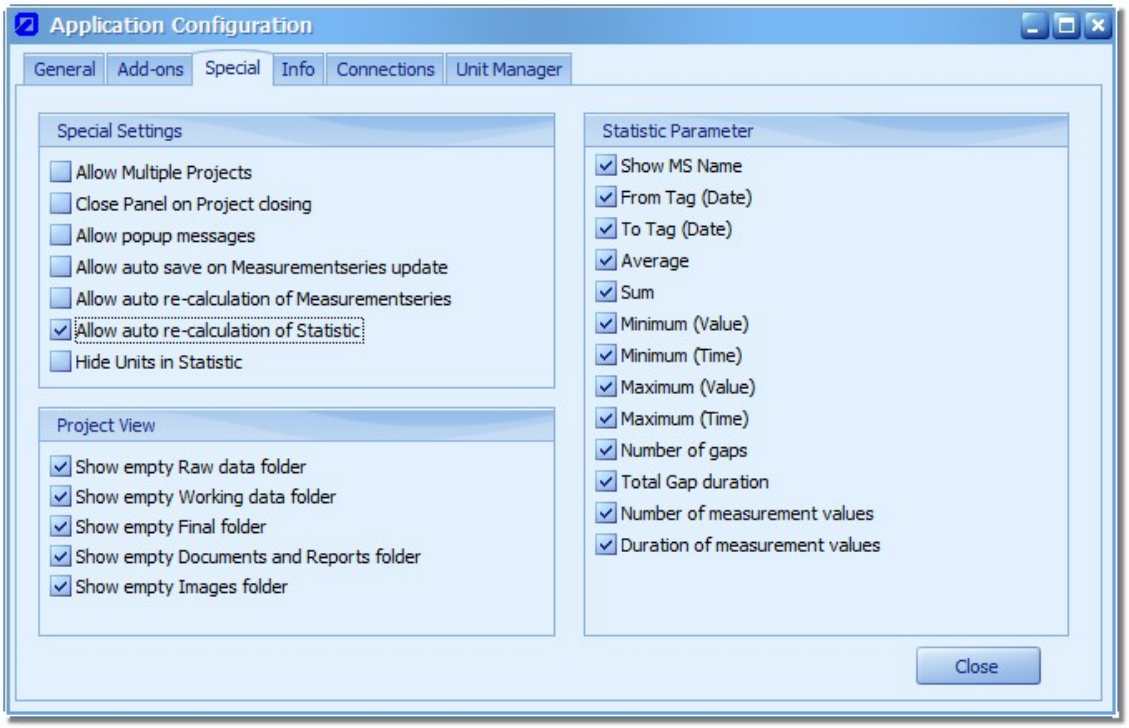


Figure 11: Special settings for NivuSoft application

This dialog menu is subdivided in three parts:

1. Special settings

a) The "Allow Multiple Projects" allows simultaneous processing of several projects.

b) "Close Panel on Project closing" is currently not used.

c) "Allow popup message" specifies if warnings are to be indicated as pop-ups or in the message window (see Chapter 4.3.5) exclusively.

d) NivuSoft provides an explicit save-dialog as soon as a measurement series has been modified. If "Allow auto save on Measurement series update" has been enabled data will be saved without any further request.

e) Modifications will not affect the results immediately if e.g. the calculator module is used in order to create a new series of results. Calculation results however will be updated automatically as soon as "Allow auto re-calculation of Measurement series" has been enabled.

f) Statistics will not be recalculated automatically as soon as the represented time range has been modified afterwards. Statistics however will be updated automatically if "Allow auto re-calculation of Statistic" has been selected.

g) "Hide units in Statistic": the physical units of measurement series are shown in the statistic graphs per default. The units can be hidden if desired by using this option.

2. Project view: all containers are shown in the project tree (see Chapter 0) per default, no matter if they contain elements or not. In the interests of clarity it may make sense to hide these containers. The according options can be found in this section.

3. Statistic parameter: The statistic module shows a vast number of parameters. Deselect parameters you do not wish to be indicated.

4.4.4 Info

The "Info" screen provides information on the software version used.
Updates can be downloaded from the according NIVUS server.

4.4.5 Connections

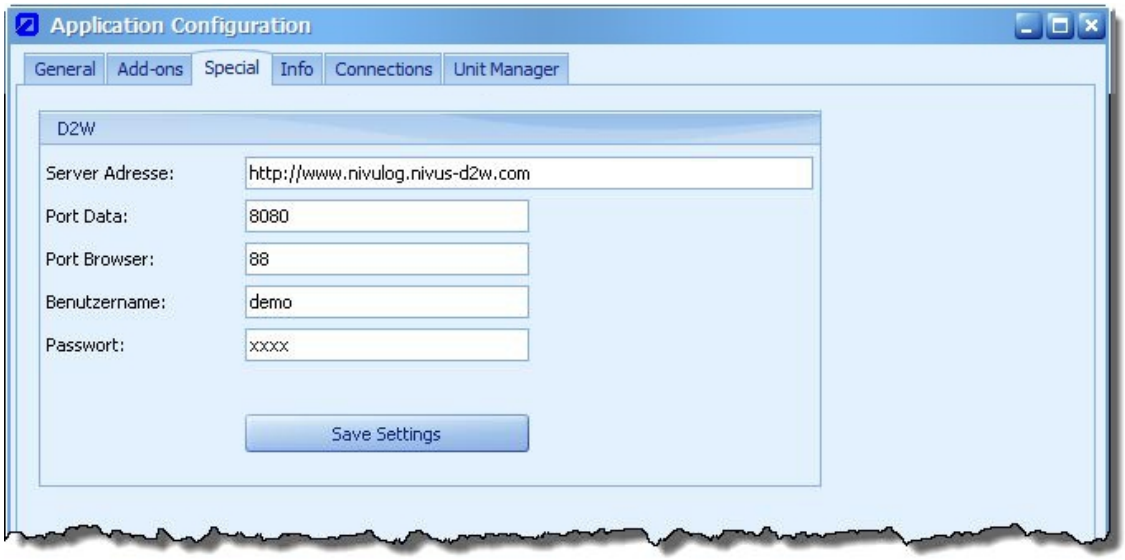


Figure 12 Settings for the connection with the D2W Server

For online-management of readings NIVUS provide the "D2W - Device to Web" Internet portal. Data saved there can be imported into NivuSoft projects. A detailed description can be found in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**.

A user account is required to set up a conection to the D2W Internet portal. This account can be requested from NIVUS.

The following parameters can be configured in the "Connection dialog":

- **Server Address**: if Internet address of the D2W server should change the new address can be saved here.
- **Server Port**: this port is used to set up the connection to the D2W server.
- **Port Browser**: NivuSoft provides a browser interface as well which can be used to to directly access the D2W portal. This option requires a separate communications port.
- **User Name**: the user name assigned to the portal access.
- **Password**: the password assigned to the user name.

All modifications must be saved using "Save settings". The settings are adopted directly for the tools described in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**.

4.4.6 Unit Manager

NivuSoft uses physical values such as level, flow velocity, flow rate etc. to perform various operations. All these values use physical units and are presented as set in Figure 13.

Figure 13: Representation of a physical value/size

By clicking the dropdown menu as shown in Figure 13 it is possible to adjust additional settings for the current unit. The options are depicted in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

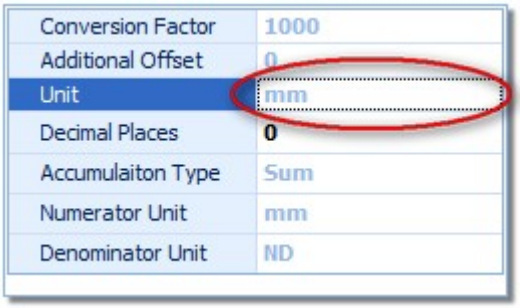


Figure 14: Configuration of a physical unit

Use the option "Decimal Places" to modify the number of decimal places currently indicated. The other parameters will be described later within this chapter.

IMPORTANT:

The number of decimal places is NOT valid for "0" values. If e.g. 3 decimal places have been set as shown in Figure 13, this will not ifluence the indication of "0.5, i.e. the display will not show "0.500".

The dropdown button shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** allows to select from various units for the current category (e.g. distinguisehd between linear, surface or volumetric measures). The indicated value is converted immediately. The preset categories of the input values within the NivuSoft dialogues cannot be changed or modified.
The physical units for measurement series are managed or configures in a similar way. The configuration can be carried out by using the properties window (see Chapter. 4.3.3) as soon as a project is opened and a messurement series has been selected. An example is shown in Figure 15. Measurement values are imported using the selected unit and will be indicated accordingly. Otherwise the measurement series will be shown without unit as [ND] ("Not Defined"). By selecting a new unit from the dropdown menu the values will be converted according to the basic unit of the respective category.

IMPORTANT:

As soon as the category is changed (e.g. from linear to volumetric measures), the conversion is executed 1:1 according to the basic unit. If e.g. a change is made from "mm" to "cm²" will first convert the value 1 mm to 0.001 m, then to 0.001 m² and finally to 10 cm². All values of the measurement series will be converted and saved according to the configuration!

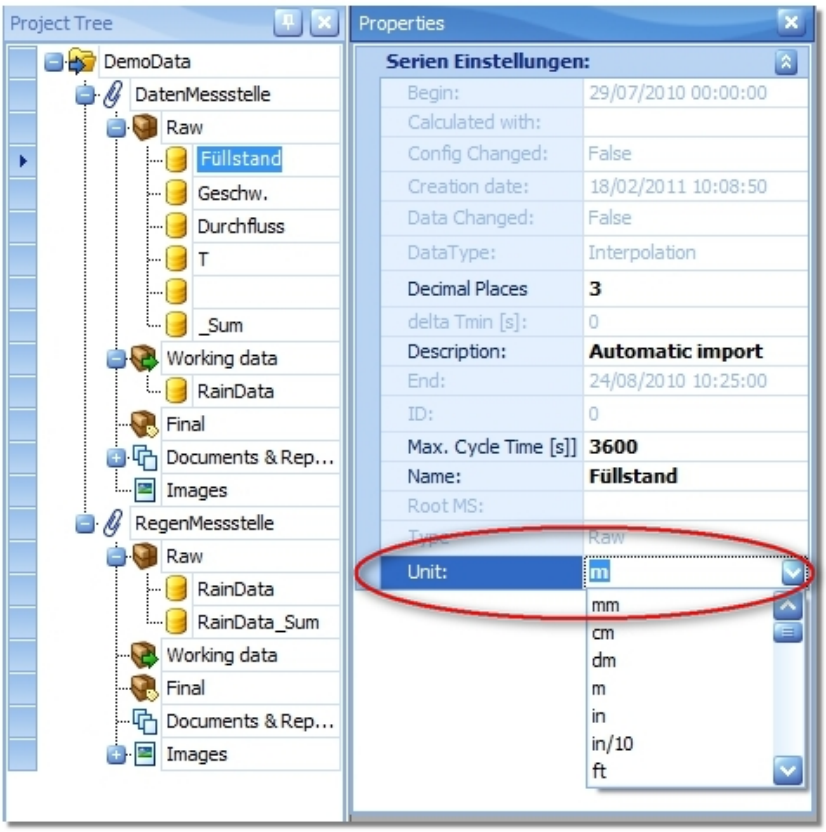


Figure 15: Configuration of the physical unit of a measurement series

It is possible to extend a category by one more unit or to create completely new categories. However it is not possible to modify or to change units and categories predetermined by the system.

The Unit Manager is as follows:

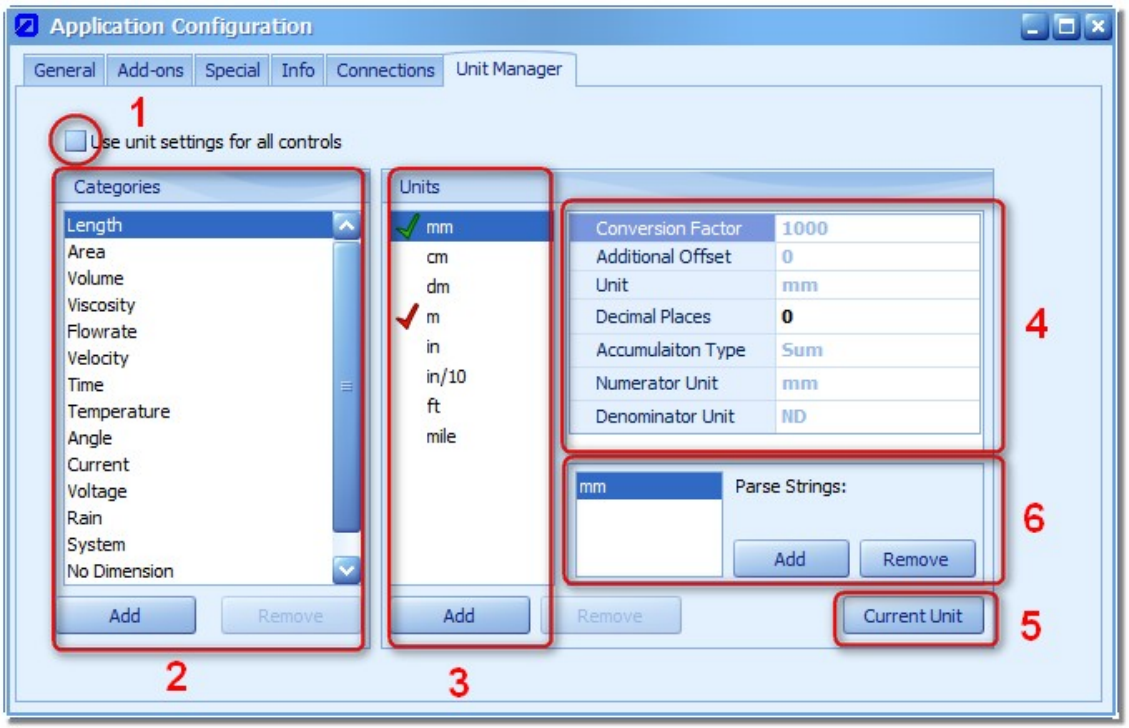


Figure 16: Unit Manager within the NivuSoft

1. „**Use unit settings for all controls**“
   The input fields within NivuSoft are permanently assigned to certain categories (e.g. Level → Category Length, channel width → Category Length, …). The respective indication can be determined and saved by the user independently. By selecting this option all units of a category will be indicated using the the configuration set in the units manager and hence cannot be changed.
2. „**Category Administration**“
   System categories cannot be modified or deleted. It is possible to create a new category by clicking the "Add" button. The name must be different from any existing category. User-created categories can be deleted again by using the "Remove" button. If the selected category however should not be empty first remove the units contained within.
3. „**Units Administration**“
   All physical units assigned to the category selected in section (**2**) are indicated. The unit ticked in red is the basic unit for the current category. All conversions will be performed based on this unit. The unit ticked in green is the standard unit shown for the according category. This unit will be used as soon as the option described in (**1**) has been selected.
4. This section shows the configuration os the units currently selected in section (**3**). The parameters have the following functions:
   a. Conversion Factor: The actual value is saved using the basic unit. In order to indicate the desired unit the saved value is multiplicated by this factor, e.g. "1m" to be indicated as "mm": 1 * 1000 = 1000 mm. This value is set to "1" per default.

b. For certain conversions it is necessary to add another value to the product from real value and conversion factor. This is the case e.g. if temperature values (°C → °F) are to be converted. This value is set to "0" per default.
c. Unit: Shows the name of the current unit. Cannot be changed.
d. Decimal Places: Determines the number of decimal places to be shown later
e. Accumulation Type: Total values can be processed in different ways regarding the statistics of measurement series. The total value will not be processed within the statistics as soon as the configuration has been set to "ND". If however the setting is "Sum" all values within the selected period will be totalised traditionally in the statistical sense. The unit remains the same. Apart from summation a weighting considering the time difference between end and beginning of the observation period is executed as soon as "Volume" is selected. A typical example is the volume calculation derived from flow [l/s]. The statistic result will be put out as [l] accordingly.
f. As a prerequisite for correct volume calculation according to point (e) it is necessary to determine a unit for the unit counter. In the context of the example described in (e) this would be [l].
g. One more prerequisite for correct volume calculation is a weighting with the time difference after totalising. For indication use the time difference in the unit selected here. For the unit [l/s] this would be unit [s].

5. „**Current Unit**“
   Clicking this button will cause the unit currently selected in section (**3**) to be used as indication unit. The unit then is ticked in green accordingly.
6. „**Parse Strings**“
   Due to restictions using different character sets some units may not be shown correctly. The unit "m³" e.g. may be indicated as "m^3" within a file. It is possible to add an alternative representation for the selected unit by using the button "Add". As soon as a unit with the text string (in this case "m^3") entered is detected the measurement series will be indicated using the respective unit (in this case "m³"). Please note that configuring identical text strings with varying units may induce undesired behaviour during the import procedure.

As mentioned before the units are managed by using so-called categories.
The following categories are availabe after installation:

Category	Units	Basic unit
Length	mm, cm, dm, m, in, in/10, ft, mile	m
Area	mm^2, cm^2, dm^2, m^2	m^2
Volume	mm^3, cm^3, dm^3, l, m^3, galGB, mgalGB, galUS, mgalUS, ft^3	m^3
Viscosity	m^2/s, dm^2/s, mm^2/s	m^2/s
Flowrate	l/s, l/h, m^3/s, m^3/h, m^3/d, m^3/min, ft^3/s, cfs, mgd, gpm, chf, gal/s, ft^3/h, ft^3/d	m^3/s
Velocity	m/s, cm/s, km/h, ft/s, fps, mph in/s	m/s
Time	s, 0.1s, min, h, d	s
Temperature	°C, °F, K, °K, °R	°C
Angle	°, rad	°
Current	A, mA, µA, kA	A
Voltage	V, mV, µV, kV	V
Rain	mm/T	mm/T
System	ND	ND
No Dimension	%, ‰	%
Other	pH, mS, dBm	pH

Table 1: Installed categories and units in the NivuSoft

The according basic unit is ticked in red in section 3 of Figure 16. The basic unit for system units cannot be changed. For standard indication the unit ticked in green will be used.

5 Project Administration

5.1 Idea

There are several levels of abstraction to organise measurement data within a NivuSoft project. An example of a project tree can be seen in Figure 17.

Figure 17: Project tree example

The project tree consists of the following components:

1. **Project**: the project is the topmost administration level. Measurement places or campaigns can not be set up without creating a project in advance.
2. **Measurement place**: a measurement place (physical metering instrument) can be arranged directly below a project. It is additionally possible to organise several measurement places below a measurement campaign (see following point).
3. **Container**: a measurement place provides various containers to administrate the actual readings.

a) **Raw data**: data will be saved in the respective container after being imported into NivuSoft (by using the file import function, NivuDat32 etc.). It is here where data are available for further processing. Readings in the "Raw data" container may be modified but cannot be saved in the same container subsequently. A copy will be created automatically instead in the "Working data" container. This is why data in the "Raw data" container are always equal to the originally imported data and can be therefore used as reference.

b) **Working data**: data saved here may be modified at any time and saved as desired.

c) **Final data**: finished data sets can be saved here. These data sets are excluded from automatic calculation methods specified by the user.

4. **Campaign**: Campaigns can be used for improved structuring and may be interpreted as containers for several measurement places.

5. **Measurement series**: actual measurement data are administrated below the measurement places. Individual time series are created automatically depending on the original data sets.

6. **Documents and images**: a range of files can be added to a measurement place for documentation purposes (files from all common MS Office programs can be used). Configurations for various reporting options can be saved additionally.

7. **Geometry Configuration**: Each geometry can be assigned to a measurement point. The geometry is required for the measurement point documentation as well as a basis for mathematical calculations using measurement series from the measurement point.

8. **Save Interval Statistics**: Calculating interval statistics (based on hour, day or month) may take some time under certain circumstances. Due to this reason the result can be saved in the project tree and can be visualised by double-clicking.

Single records and time series can be moved into the individual containers using "Drag & Drop".

5.2 Project

A project is the topmost instance for the administration of measurement places and measurement series. For this reason it is important to make sure that project names are used only once. Project functions can be selected from the main menu.

5.2.1 Create

Launch the dialog to create a new project by using the "New project" option from the main menu. Apart from entering a unique and distinct project name it is possible to additionally enter a project description in the according area.

5.2.2 Delete

To delete a project place the cursor either on the project itself in the project tree or on an element within the respective project. Use "Delete project" in the main menu in order to delete the project subsequently. Confirm the following dialog to actually delete the project.

5.2.3 Open

In order to open an existing project use the "Open project" dialog located in the start menu. The start directory is equal to the directory as specified in Chapter 3.4. An according folder has been created in this directory for each project. The desired project folder contains a file named "projectname.niv". Either double-click this file or use the "Open" option in the dialog to load the project.

NivuSoft saves the five previously modified projects and indicates them in the quick start dialog of the start menu (see Figure 18). The desired project can be opened just by selecting it.

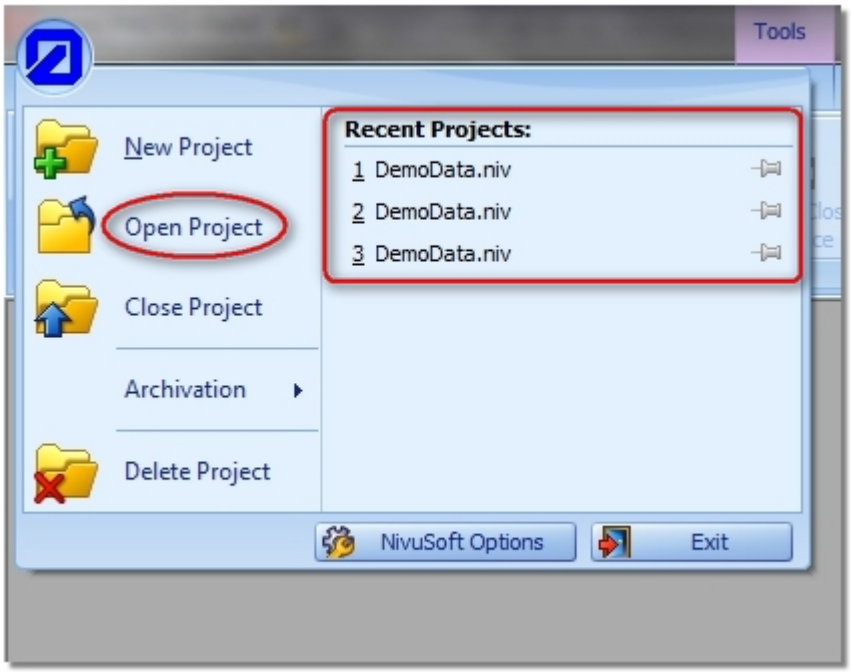


Figure 18: Recent projects

Moreover the previous five projects used can be selected from the dropdown list in the main menu (see Figure 19).

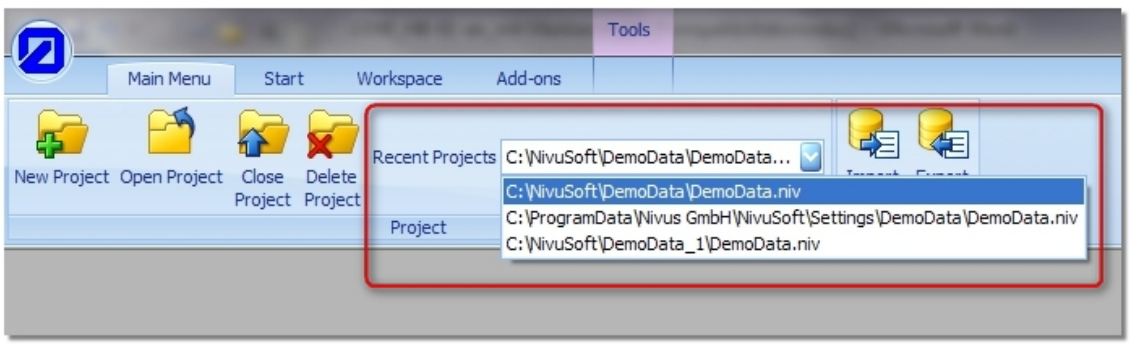


Figure 19: Recent projects section in main menu

5.2.4 Close project

To close the currently selected project click "Close Project" in the start menu.

5.2.5 Modify properties

Open the properties window (see Figure 20) to edit the properties of your project (see Chapter 4.3.3). Project description as well as the project name can be modified directly in the according fields of the properties dialog.

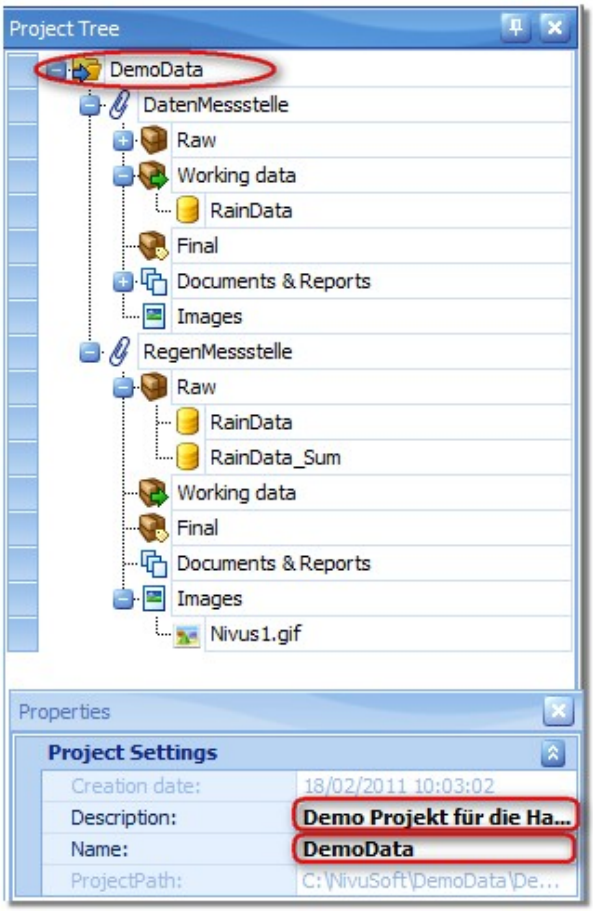


Figure 20: Project properties

5.3 Campaign

For improved structuring of measurement places so-called campaigns can be created.

5.3.1 Create

To create a campaign, select the root project in the project tree. In "Start" menu use the option "New campaign" to create a new campaign. The same can be achieved by right-clicking and utilising the accompanying context menu.
The following dialog allows to select a different root project if required. It is absolutely necessary to enter a campaign name. A description can be entered optionally.

5.3.2 Delete

Campaigns can be deleted in the same manner as described under "Create" (see chapter 5.3.1). The according option can be found in the "Start" menu as well as by using the right-click context menu of the respective project.

5.3.3 Modify properties

All properties of the campaign selected in the project tree are shown as depicted in Figure 20 The parameters "Name" and "Description" can be modified here too.

5.4 Measurement point

A measurement place is equal to a real metering instrument and represents the container instance for all measurement series assigned to this unit. Furthermore the measurement place provides options for the administration of working areas, documents and reports. Each of these points will be described comprehensively in the following sections. Measurement places can either be organised directly below projects or within campaigns as well.

5.4.1 Create

Determine if the measurement place is to be assigned directly to a project or to a campaign before you create a new measurement place and respectively select the according instance in the project tree. The dialog to create a new measurement place can be found either in the "Start" menu of the "Measurement point" group or by utilising the right-click context dialog.

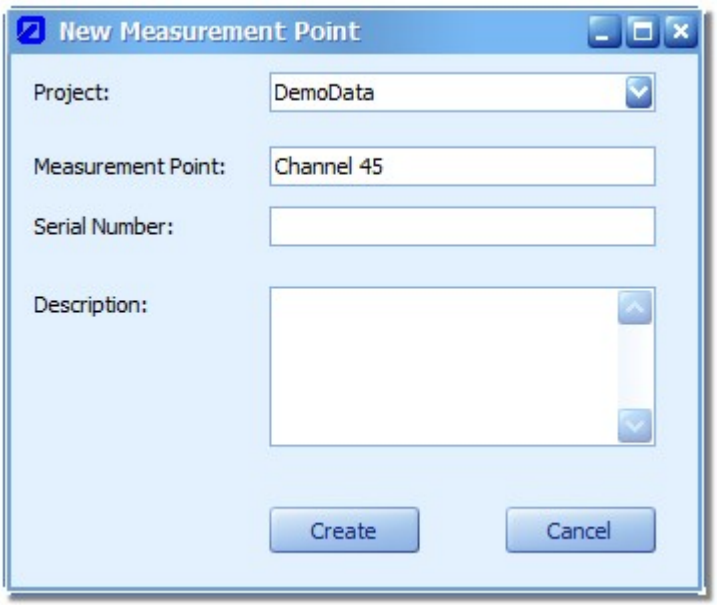


Figure 21: Dialog for creation of new measurement points

In the following dialog the specifications of the new measurement point must be entered. Select the "Project" menu to change the root project. Multiple projects are available only if the option "Multi project" (see Chapter 4.4.3 → listed under point 1a) has been enabled previously and several projects are opened. If you wish to choose a campaign as root-object select the constellation "`PROJECT NAME: CAMPAIGN NAME`" accordingly.

Names in the field "Measurement point" may be selected as desired, however do not leave the field empty. All available characters can be used. To achieve a better overlook of extensive projects it is recommended to specify unambiguous names.

Entering the "Serial Number" is optional.
To save and to manage additional information regarding measurement points enter the according information in the "Description" area.

5.4.2 Delete

Use either the icon depicted above from the "Start" menu or the right-click context dialog to delete the measurement point selected in the project tree. The following dialog needs to be confirmed to actually delete the measurement point.

5.4.3 Import data

A crucial step is to add readings to a new or previously existing measurement point. Due to the variety of the NIVUS product line there are different ways to achieve this as described in the following chapters.

5.4.3.1 From a readings file

It is possible to import readings from the text files created by NIVUS measurement units. To achieve this select the measurement point where the readings shall be added to in the project tree. Click the "Start" menu and choose the "Import text" option from the measurement series area. This can be obtained from the right-click context menu of the measurement point as well. The following dialog allows to choose a readings file from the list (see Figure 22).

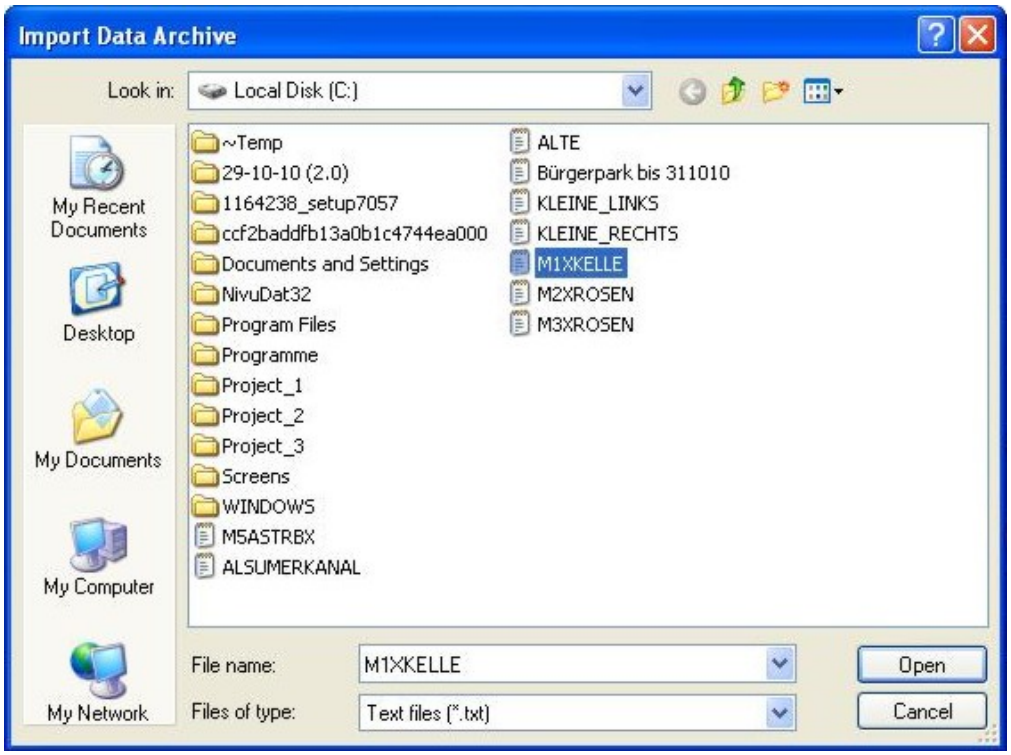


Figure 22: Selecting a readings file

The import wizard (see 5.4.3.2) will start automatically if the selected file should not meet the requirements of the defined format for PCM or OCM units.

The import configuration dialog opens up as depicted in Figure 23 and can be used as follows:

1. General area of import configuration. A detailed description of each parameter can be found later in this section.
2. Import preview for the selected measurement data file. As soon as a file can be opened or analysed using the options specified in area (**1**), this field shows a preview of the topmost data lines within the file.
3. Configuration options for each individual measurement series. A detailed description of these options can be found later in this section.

1. Individual measurement series can be either selected or de-selected.
2. Start import
3. Go to Import Wizard

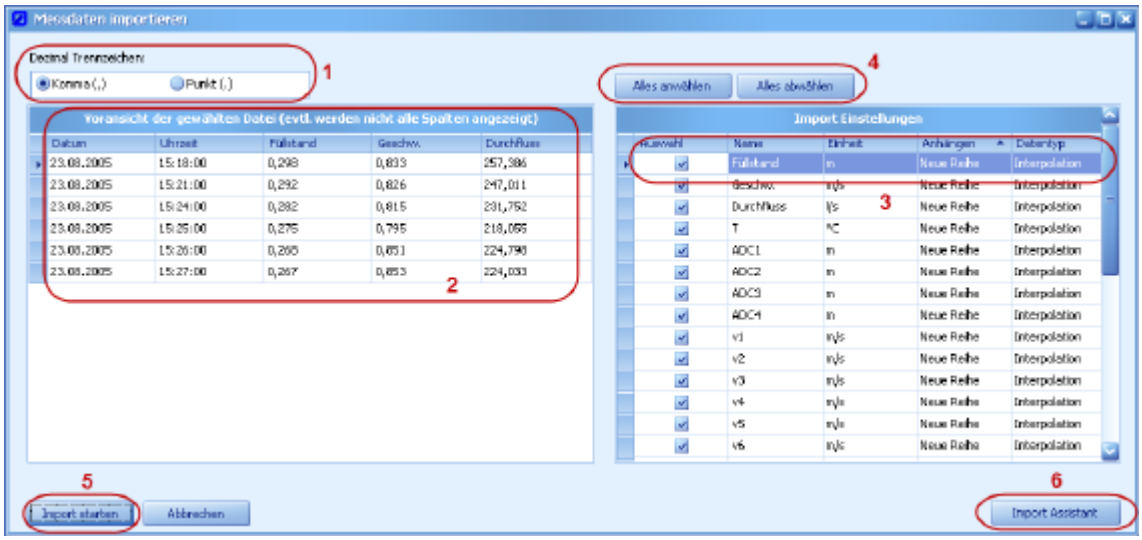


Figure 23 Configuration dialog for import of measurement data

Depending on the preview shown in section (**2**) the settings for decimal places can be modified in section (**1**).

Depending on the preview shown in section (**2**) it is possible to determine the import behaviour of each individual measurement series.

To achieve this for each measurement series in section (**3**) of Figure 23 there is a separate line in the table available. The configurable line options are shown in Figure 24.

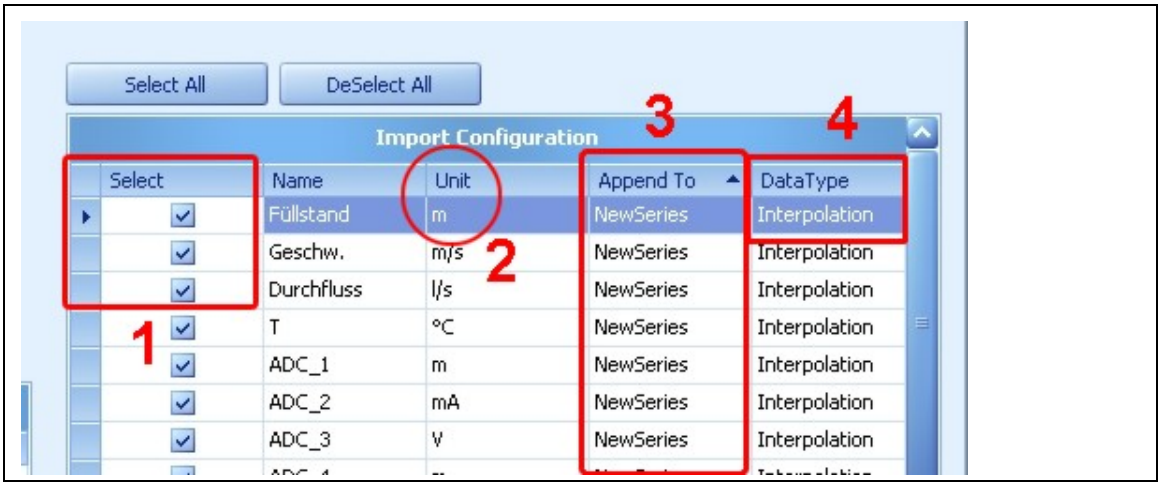


Figure 24: Configuration for import of measurement series

Further information on the options in Figure 24:

1. Selecting or de-selecting either includes a measurement series to be imported or not.
2. The software attempts to investigate the according units from the readings file. By entering a certain string of characters it is possible to set a different unit.
3. NivuSoft per default creates a new measurement series for each set of readings. The preset selection hence is "New series". However it is possible to add the data to a measurement series which previously exists in the working area. Please select the according measurement series.

IMPORTANT:

No data will be overwritten during the import process. Data with not referenced time stamps will be added exclusively.

4. Each measurement series within NivuSoft can be represented by a certain type:

a) **Interpolation (default setting):** this is a "normal" measurement series comprising continuous data. Interpolation between breakpoints is allowed.

b) **Binary**: this is a sequence of logic "0" / "1" signals.

c) **Counter**: the measurement series represents a volume signal (e.g. rainfall data) which is interpreted as an accumulating set of data within the software.

Start importing by clicking the "Start import" button. The measurement series are available in the project tree in the respective measurement point after the import process has been finished successfully.
If however you wish to use the import wizard rather than the "Quick Importer", start the wizard by using the "Import Wizard" (**6**) button. The path to the file selected will be held.

5.4.3.2 Import Assistant

If measurement data are to be importe from files which should not comply with the standard OCM or PCM format (e.g. NivuLog) it is necessary to use the import wizard. Start the wizard by clicking the respective option in the "Start" menu in the "Measurement Series" section. An according button is additionally availabe from the right-click context menu of the measurement point.
The wizard guides through the import procedure step by step. Once adjusted settings can be saved in so-called profiles for later use in conjunction with other files.
In Figure 25 the start window of the wizard is presented. The buttons relevant for navigation between the different screens are labeled with (**1**) and (**2**). If a configuration should be missing or inappropriate on the current page, an error message will be indicated and it is not possible to change to the next window. By clicking "Cancel" (**3**) it is possible to exit the import wizard at any time.

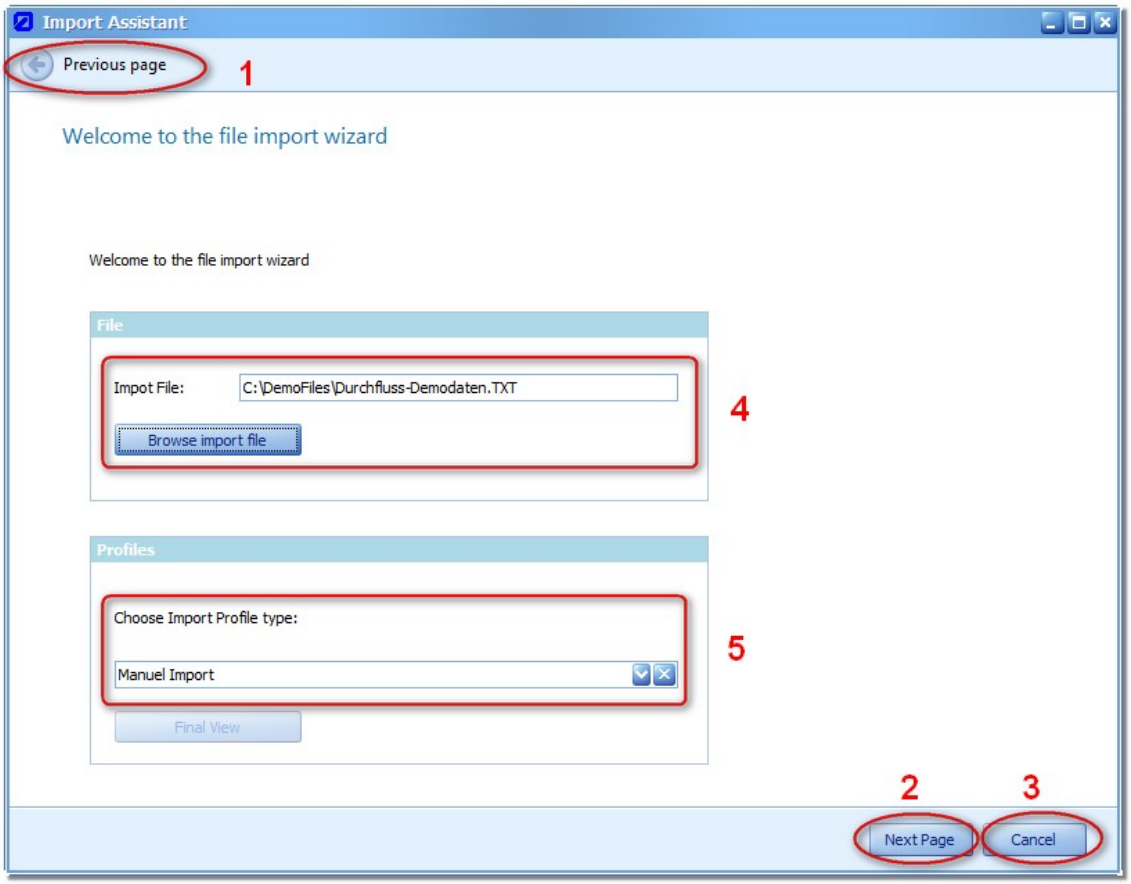


Figure 25: Import wizard start window

In section (**4**) use "Browse import file" and the follwing dialog to select a file for importing. The complete path is shown accordingly. As the wizard opens the dropdown menu (**5**) is set to auf "Manual Import". If a profile for the selected measurement data should already exist it can be selected here. Use the button "Final View" to skip the single steps and to directly get to the final window (Figure 29).
After selecting a file (**1**) and clicking the "Next Page" button (**2**) a dialog similar to Figure 26 will open.
Section (**1**) allows to define the column separator to be used within the measurement data file selected (NIVUS uses the tabulator per default). If you wish to use none of the four options "Tabulator", "Comma", "Semicolon" or "Space", it is possible to enter any text string in the input field by ticking the "Other" option.

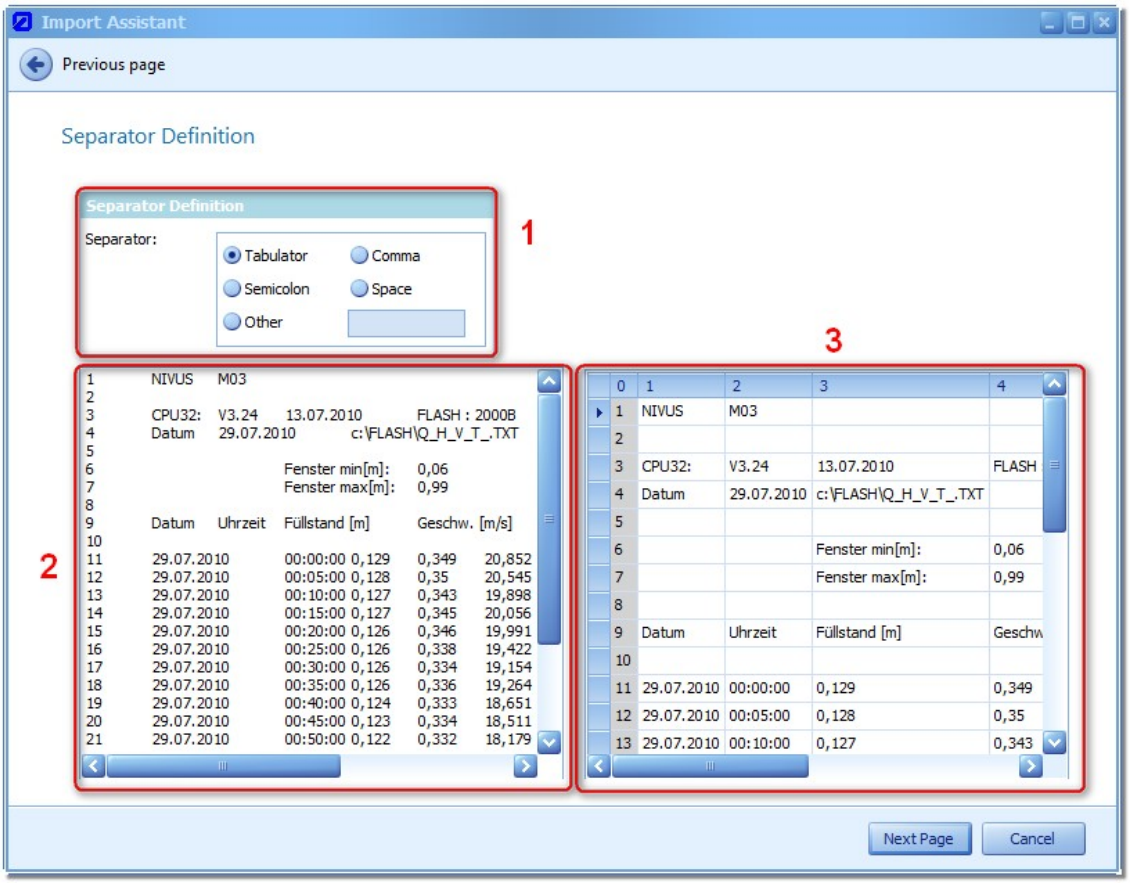


Figure 26: Defining the column separation within import wizard

Section (**2**) in Figure 26 directly indicates the content of the selected file (shown as text file). Modifications in the "Separator" section do not influence the window. The related import preview is shown in section (**3**). In this window the separation shown depends on the separation previously set. Please make sure that the indicated separation is equal to the desired separation.

In the following page (Figure 27) it is necessary to enter information on the configuration of individual measurement series, start of data within the file as well as the position of time stamps.

Define the line number for the „Position of Header“ in section (**1**). This line contains information (e.g. name or physical unit) on the individual measurement series. "Start Data" is required to define the line number for the first data set. NivuSoft is attempting to recognise both values automatically due to certain criteria.

IMPORTANT:

It is very important to verify both line numbers to ensure a correct import process.

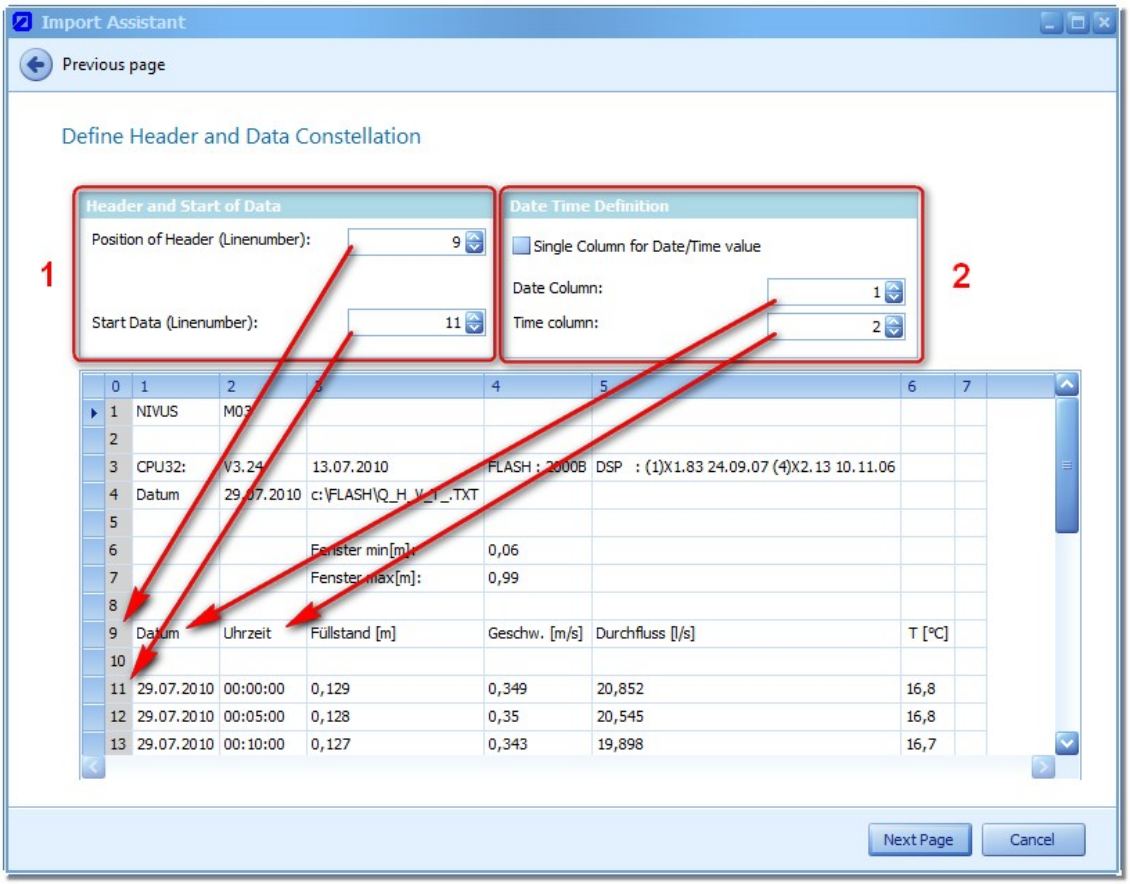


Figure 27: Defining data header, start data and date + time of measurement

Section (**2**) in Figure 27 is to set information on the time stamps. Tick "Single Column for Date/Time value" as soon as both values share the same cell in the preview. The number of the column then can be set using "Date Column". If date and time should be in different columns (NIVUS standard) it is necessary to specify the respective column number separately.

Figure 28 shows the configuration of date, time and values for the selected file.

Use section (**1**) to choose a Parse String for the date. The corresponding dropdown menu "" reveals a variety of common options. If the required format should not be available it is possible to create a new configuration by clicking on "". User-defined profiled can be deleted with "" or modified with "". If the selected format is equal to the one in the selected file can be verified in section (**5**). A valid configuration is confirmed by a green background.

The time representation can be selected similar to the procedure described in the chapter before. It is possible to create user formats as well. The correct interpretation of values will be indicated in section (**5**) as well.

Please observe to not designate the same numbers twice (5 and 6).

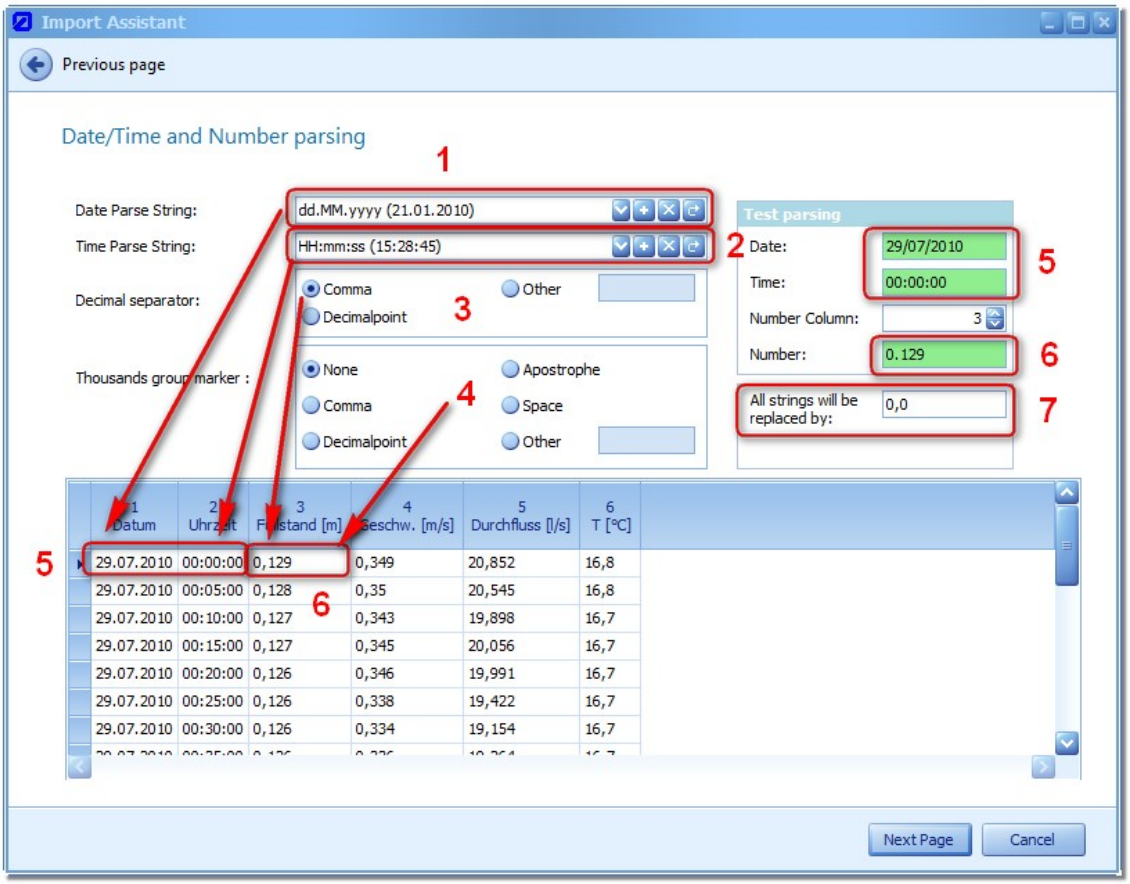


Figure 28: Defining date/time and representation of values in import wizard

Correct configuration shall be carried out in sections (**3**) and (**4**) for evaluation of the actual measurement values. Section (**3**) defines the decimal separator. Section (**4**) allows to set the thousands separator, if available. The correct configuration will be indicated in section (**6**) showing a green background.

Changing to the final view of the wizard is not possible before all required values for date, time and values can be interpreted correctly.

If the file to import should contain text strings (e.g. „#-1“, OL“, „SC“, …), these variables will be replaced using the value configured in section (**7**).

Based on the line containing the data header (Figure 27 section (**1**)), section (**1**) in Figure 29 displays all available measurement series. Section (**2**) allows to either activate or deactivate all measurement series relevant for import purposes.

Section (**3**) of the dialog shows accompanying information on the measurement series selected in section (**1**). The following configurations are possible:

- Unit: All options defined in the unit manager (see 4.4.6) can be selected from the dropdown menu. The values from the measurement data file will be converted and subsequently saved according to the basic unit.
- Type: Define the type of measurement series here. Interpolation represents the solid line (hydrograph) within the chart. "Counter" represents e.g. precipitation measurement data which are shown as bargraph. „Binary“ stands for divalent signals (ON/OFF, 0/1) and can be used e.g. for switching signals.

- Append to: The corresponding dropdown menu indicates all previously existing measurement series of the current measurement point. It is possible to append data from the current file to the previously existing data set: ***IMPORTANT*****: No existing values are overwritten**!
- „Use as rain data“: Interprets the respective measurement series as “Counter". In addition to the measurement series containing the counter values an accumulative measurement series is created.

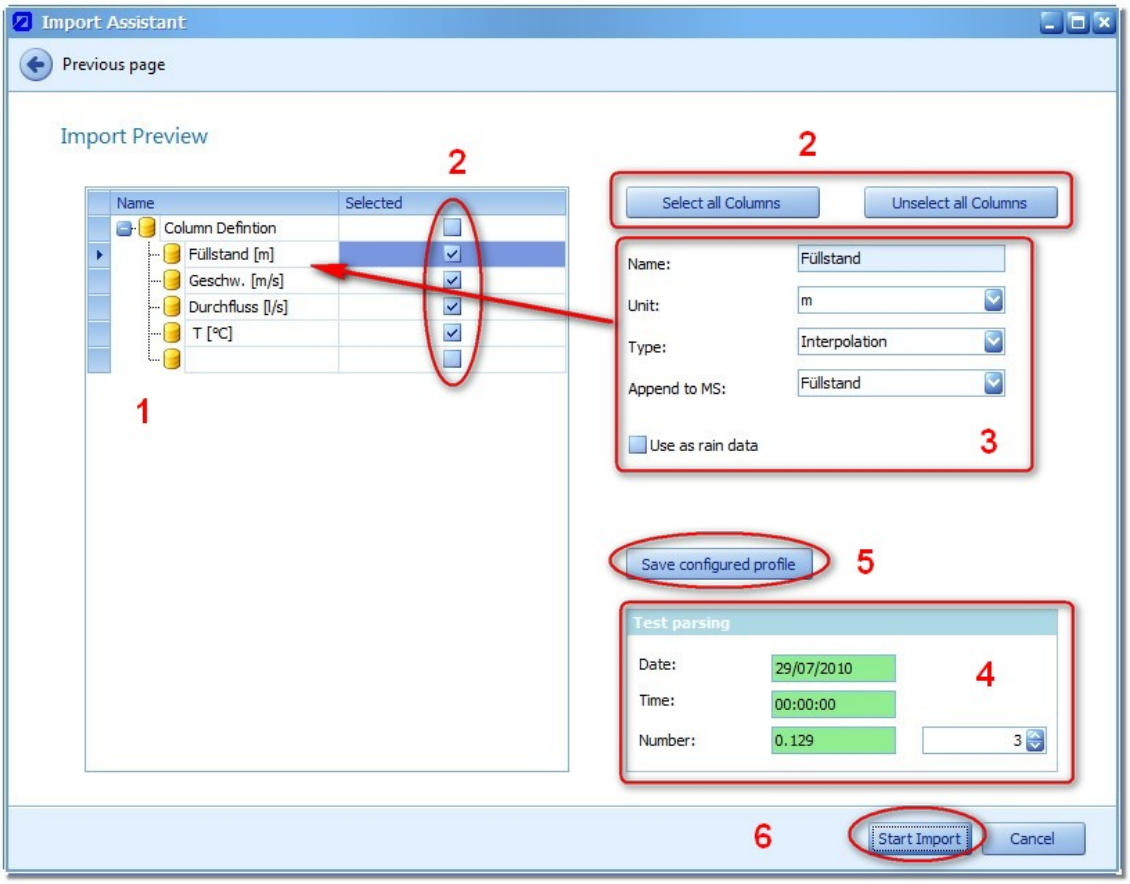


Figure 29: Final view of Import Assistant

The values shown in section (**4**) serve as control values. These values are particularly important as soon as a direct change to the final view has been executed by selecting a dedicated profile in Figure 25.

If the import wizard has been configured step by step all values can be saved as a profile. Click the button „Save configuration profile“ (**5**) to do this and create an according name by using the input fields „Name“, „Type“ and „Comment“ in the following dialog. The new profile is available in the dropdown menu of Figure 25 after a click on "OK".

Start the import process by clicking on „Start Import“ (**6**). After successful import the impoer wizard will close automatically.

5.4.3.3 From NivuLevel 150 readings file

Files containing readings can be imported quick and easy from a NivuLevel 150 by using the Import Assistant as well as the according profiles.

First open the Import Assistant and select the file to import, then select the preset profile "NIVUS – NivuLevel 150 – deutsch" (for German data files) or "NIVUS – NivuLevel 150 – english" (for English data files) in the "Profiles" window.

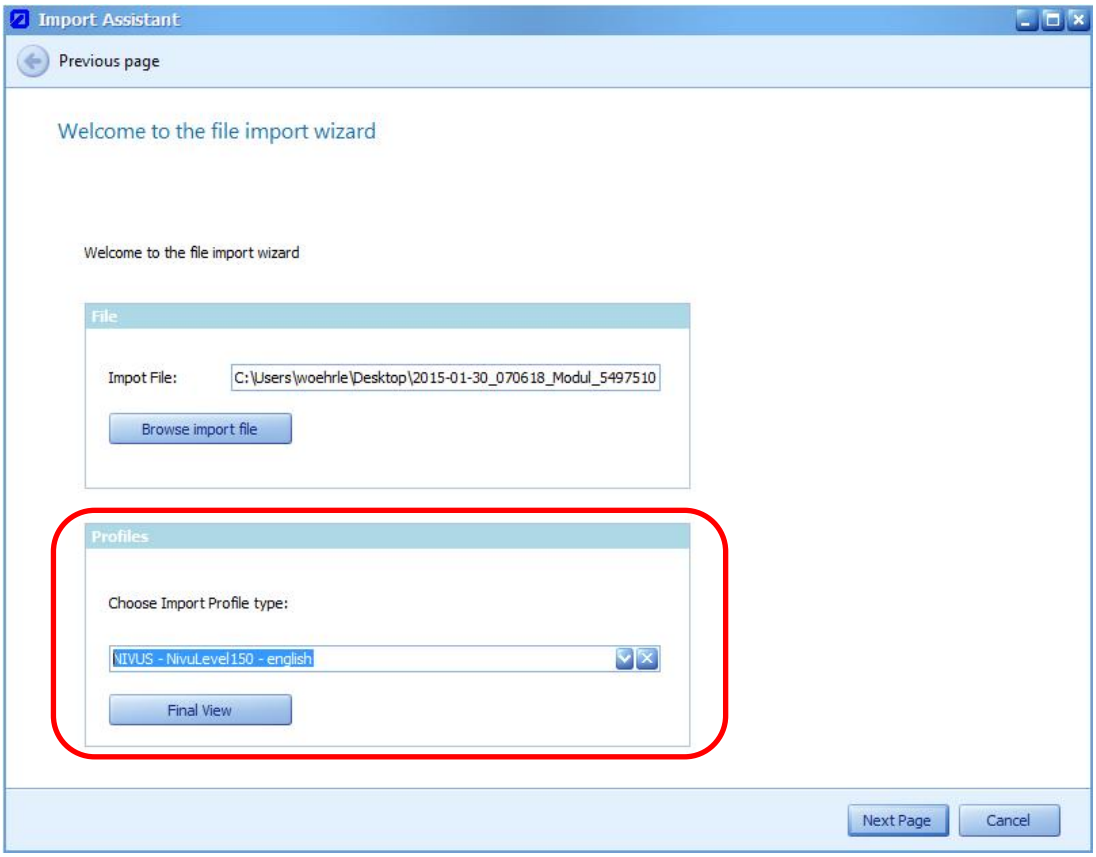


Figure 30: NivuLevel 150 Import

Use the "Final View" to skip the single steps of the assistant and to directly go to the final view (Figure 29).

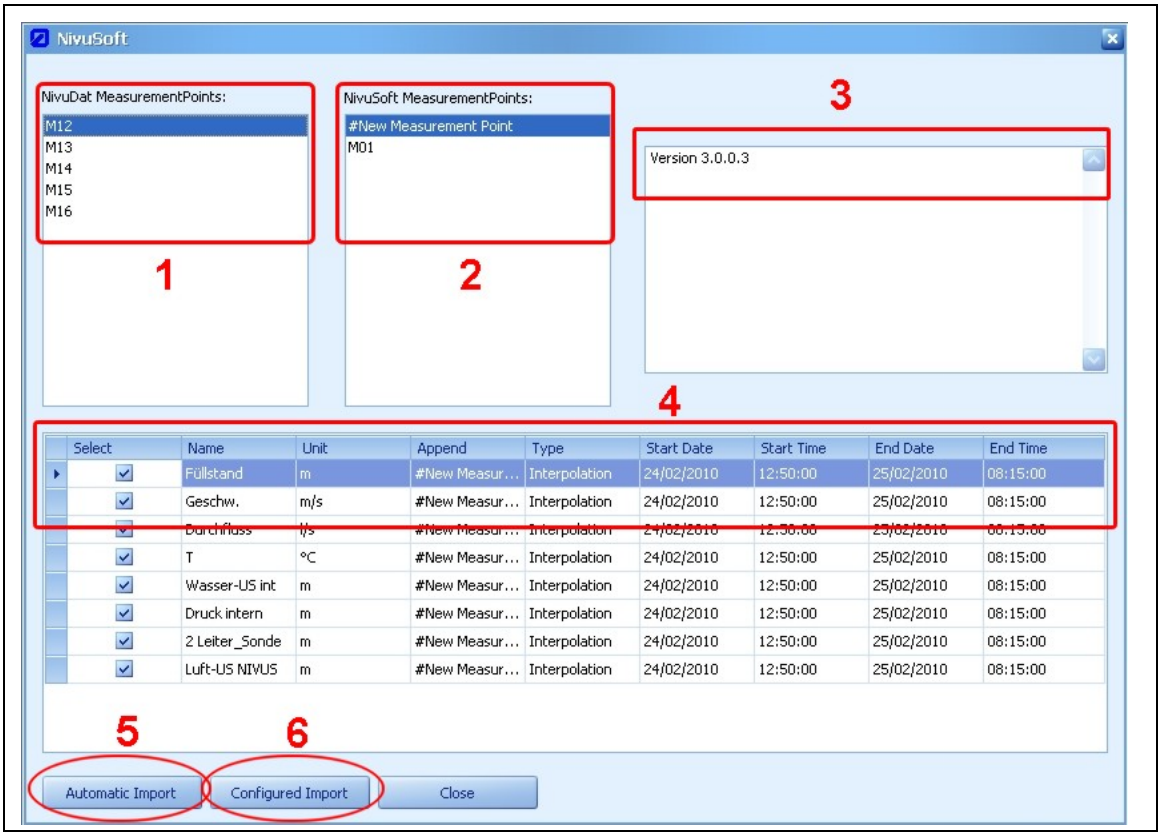
More settings (see 5.4.3.2. Import Assistant) can be adjusted here and data can be imported by clicking the "Start Import" button.

5.4.3.4 From NivuDat application

It is possible to import readings from the NivuDat 32 application directly. To do this first start the NivuDat 32 software. Then use the "NivuDat Import" icon in the " NivuDat 32" area of the working area menu (see Figure 30) to open the import configuration dialog.

Figure 31: Starting the NivuDat import dialog

An example can be seen in the following figure.



(**1**) Section shows all measurement points available within the NivuDat application. All available measurement points will be shown in section (**4**) by selecting (single click with the left mouse key).

(**2**) Section indicates all measurement points of the currently opened project within NivuSoft. Reading can be added by selecting.

(**3**) Any information during import or possible error messages are shown in this log area.

(**4**) The table dialog in this section can be used to individually configure the import process. Please find more detailed information in chapter "Configured import".

(**5**) Clicking the "Automatic import" button will analyse the structure of the NivuDat project and creates a respective image in the current NivuSoft project. New measurement points and measurement series will be created if required.

(**6**) A single measurement point can be imported based on the options selected in section (4) by using the function "Configured import". More detailed information on the options can be found in the according chapter below.

Figure 32: Example NivuDat import

Using one of the import options described below will indicate a button in the bottom right hand area of the dialog window which allows to abort the import process.

Automatic import

For every measurement point of the NivuDat project the software attempts to find a measurement point of the same name in the NivuSoft project. A new measurement point will be created if this is not the case.

In the next step the software attempts to select an equivalent in the NivuSoft measurement point of the same name for every measurement series within the NivuDat measurement point. If the measurement series exists the data will be attached to the available data set. Otherwise a new measurement series will be created and the data will be imported.
Area (**3**) of the dialog in Figure 31 shows information on the current import status.

Configured import

All available measurement series are shown in the configuration area (4) as soon as in section (**1**) a NivuDat-based measurement point has been selected. Each line is structured according to the same pattern and contains the following parameters:

- "Select": each line is selected per default and hence will be imported. De-select if you do not wish to import a line.
- "Name": the name of the measurement series cannot be modified.
- "Unit": a physical unit will be selected for the measurement series depending on the configuration within NivuDat. By clicking the cell with the left mouse key it is possible to choose any unit.
- "Append": it is possible to attach data to a previously existing measurement series. If there is no measurement point of the same name available the selection is set to "#New series" which causes NivuSoft to generate a new measurement series.
- "Type": a common measurement series is represented by the type "Interpolation". Furthermore the types "Counter" and "Binary" may be chosen.
- "From (date)" and "From (time)": determines the start of the import procedure.
- "To (date)" and "To (time)": determines the end of the import procedure.

Apply the modifications after the configuration has been finished successfully by clicking the "Configured import" button.

5.4.3.5 From Internet portal "D2W – Device to Web"

The dialog to import data from the D2W Internet portal can be activated in menu "D2W Functions" by using "D2W Connection". Both steps are depicted in Figure 32.

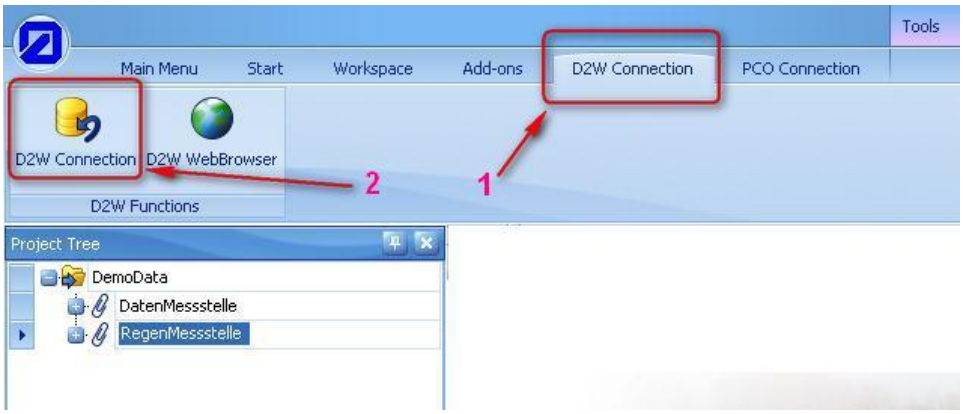


Figure 33: Starting the D2W connection dialogs

The following dialog is represented below.

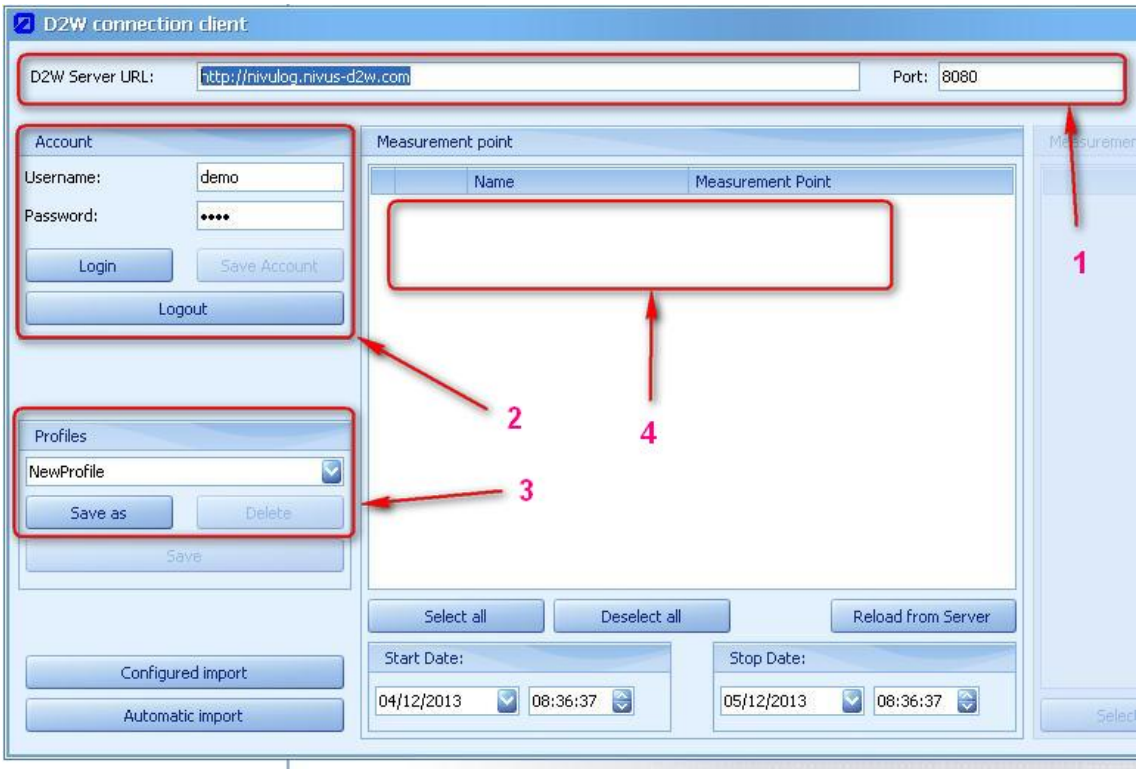


Figure 34: D2W connection dialog

Use section (**1**) to configure the connection information for the D2W server. The information indicated here corresponds to the parameters described in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**. The button "Save settings" is active as soon as settings have been modified. The new settings can be saved in the system now.

The user account can be edited by using the parameters in section (**2**). Clicking the "Login" button will trigger the attempt to set up a connection to the D2W server. According information on the connection status are indicated then. The measurement places available for the respctive user will be indicated in section (**4**) as soon as the connection has been set up successfully. Modifications oft he settings made in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** can be saved using the "Save" button.
The following chapter describes the configuration options required to synchronise individual measurement places and measurement series. Different configurations can be saved as profiles (section (**3**) in Figure 33). The configuration will be loaded automatically as soon as the corresponding profile name has been selected from the according dropdown menu. If the configuration should have been modified the changes can be transferred to the currently selected profile by clicking the "Save" button. Use "Save as" to create a new profile. Remove a selected profile from the system by clicking the "Erase" button.

Measurement place Configuration …

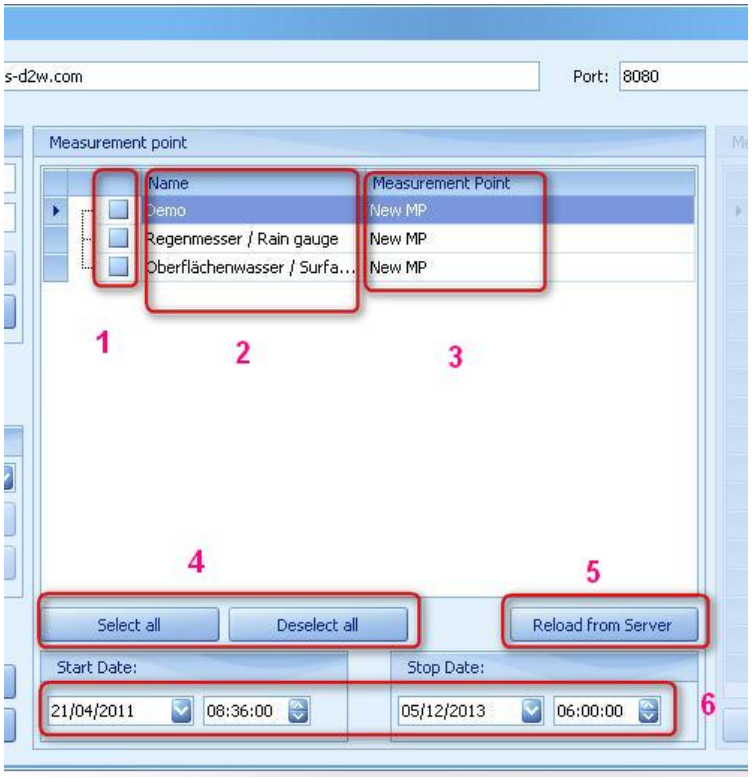


Figure 35: Measurement place configuration for D2W Import

Figure 34 presents the options available for the configuration of measurement places for import. All measurement places the registered user is authorised for will be displayed. Section (**1**) can be used to select the respective measurement place for import.
While setting up the list of measurement places (e.g. after user login) the system verifies if there are singular relations with a common denominator between two measurement places. If so, the according measurement places will be selected in the tree automatically. Possible conflicts between server-based and local measurement places are indicated after the list of measurement places has been refreshed. Such conflicts must be solved manually by the user.

If a measurement place is selected in section (2) the accompanying information are downloaded from the server (this may take a few moments). Section (6) automatically determines the data period available. Periods modified manually will retain even after switchin over between different measurement places. The actual period will be determined as soon as a measurement place is deselected again.
Section (3) allows to select a measurement place available within the current project for synchronisation. If there is a unique connection between local and server-based measurement places as described in the previous section, such measurement places are selected in the dropdown menu. The user may select or modify the image independently at any time. The according selection will be adopted as soon as a profile is saved.
Clicking the according buttons in section (4) allows to select or deselect all measurement places in the list (deselecting will replace the locally saved period (6) by the actual server-based information).
The list of measurement places can be updated manually by clicking button (5).

Configuration of Series of measurement

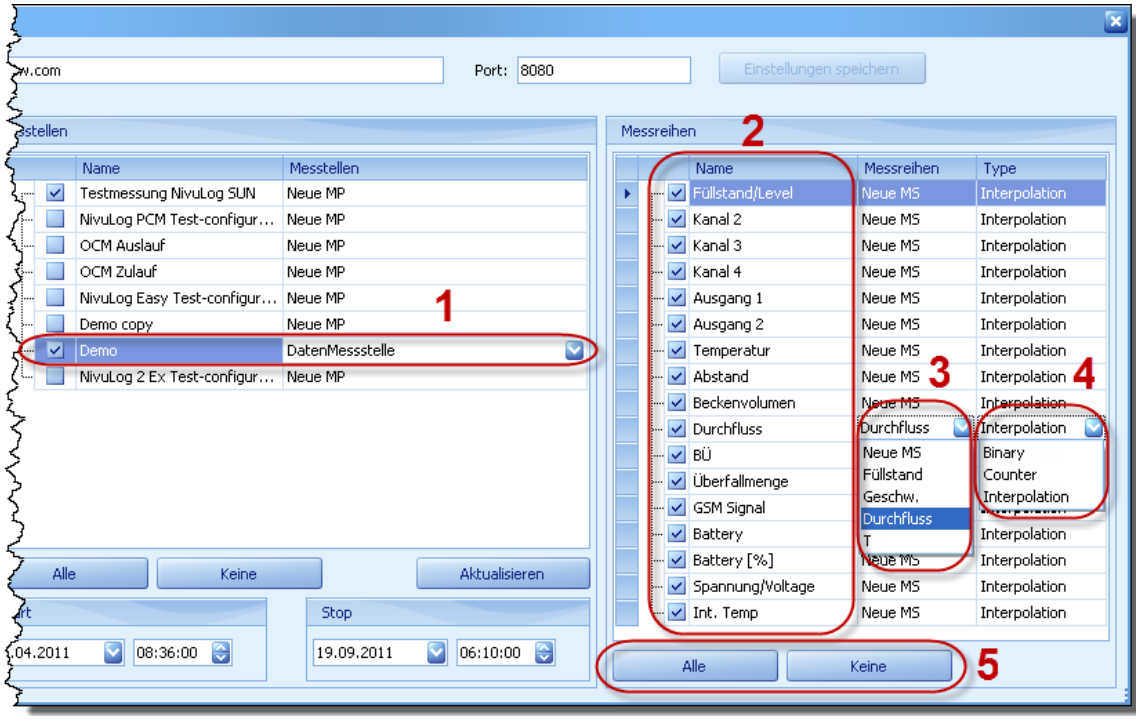


Figure 36: Configuration of Series of measurement for D2W Import

Figure 35 shows the configuaration options for individual measurement series on D2W import. As soon as in section (1) a measurement series is selected, all available series are indicated in the right-hand section ("Measurement series").
A measurement series can be selected for import by using the checkbox. Initially all measurement series are selected per default. Use the buttons in section (5) to either select or deselect all series. Depending on whether a synchronisation element has been chosen in the current project for the currently selected measurement place (in Figure 35 e.g. the measurement place named "Demo" → "DataMeasurementPlace") the dropdown menu in section (3) provides all local measurement places available.

As soon as singular measurement series with a common denominator are available for the configured interdependence, these measurement series are pre-selected. Select "New MP" if new measurement places shall be created during import. Select the according type for the individual measurement series in section (**4**). "Interpolation" in this case represents a classical measurement series such as flow. Select the "Counter" option as soon as the desired measurement series contains counter readings. These settings will affect the statistics calculation for the respective measurement series. The "Binary" option is for signals featuring dual status options.

Import

Figure 37: D2W Import possibilities

Figure 36 shows the two buttons for import.
(**1**) Import is executed depending on the configuration within the measurement places and the measurement series. Possible changes of the import period will be considered likewise.
(**2**) All measurement places as well as the according measurement series for the available period will be imported if the >Automatic Import< option is used. This may take a while depending on the extent.

From the PCO

It is possible to import measurement data directly from the portable flow meter PCO.
This requires to set up a USB connection to the PCO.
A detailed description of this procedure can be found in the PCO instruction manual.
To open the configuration dialog first select the measurement place in the parameter tree (**1**), then click the icon "PCO Connection" (**3**) in the "PCO Connection" menu (**2**).

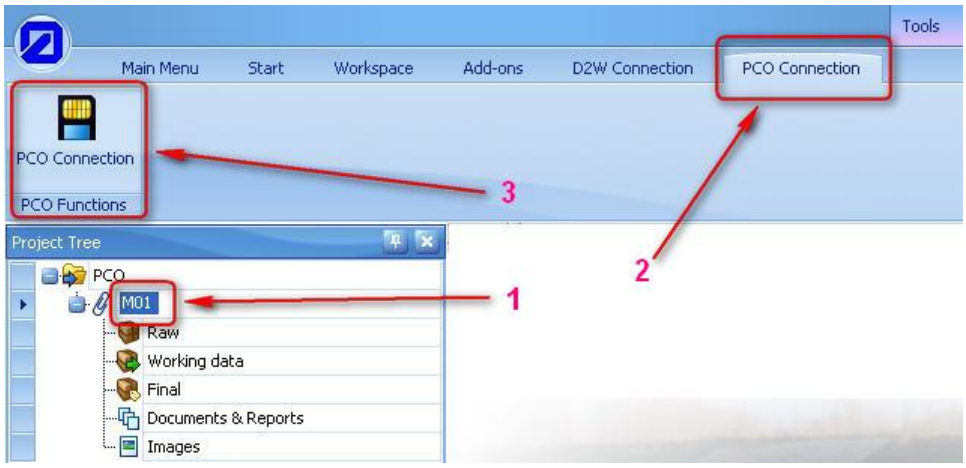


Figure 38: Start of PCO Import Dialog

Port Settings

This tab is to set the identical baud rate as well as the PCO parity.

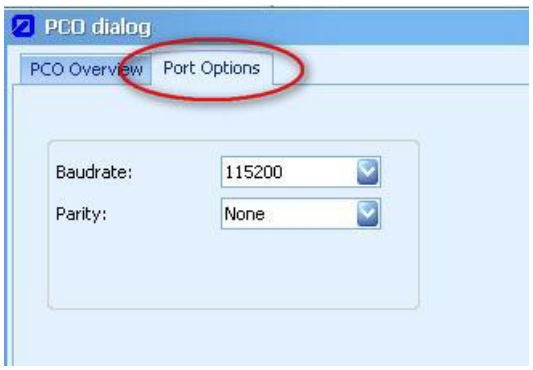


Figure 39: Port settings

PCO Overview

Choose allocated COM Port and start „surch PCO“.

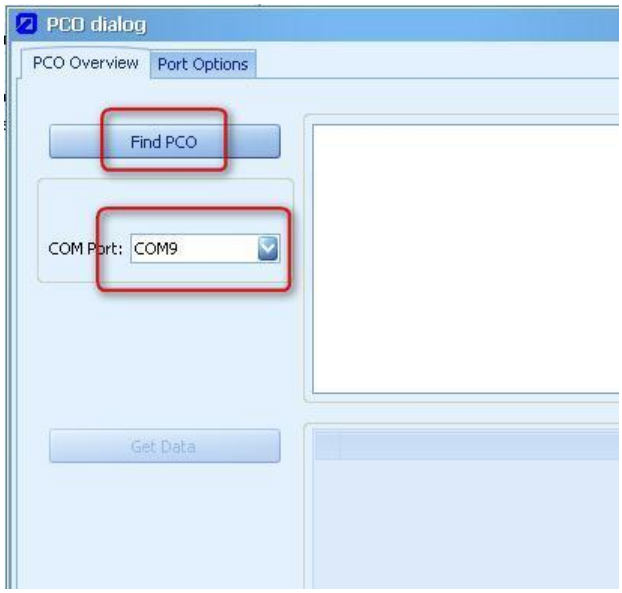


Figure 40: PCO Overview

The serial number of the unit will be indicated in the free space as soon as the PCO has been identified.

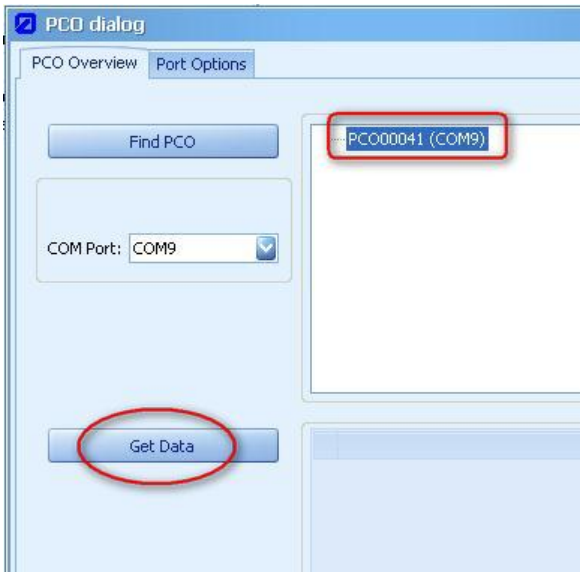


Figure 41 Secletion of serial number

Select the serial number and start the transmission by clicking "Get Data ".

The button "Import all" will read out all data sets. If only certain data sets are needed select the desired sets and download by using the "Import selected" button.

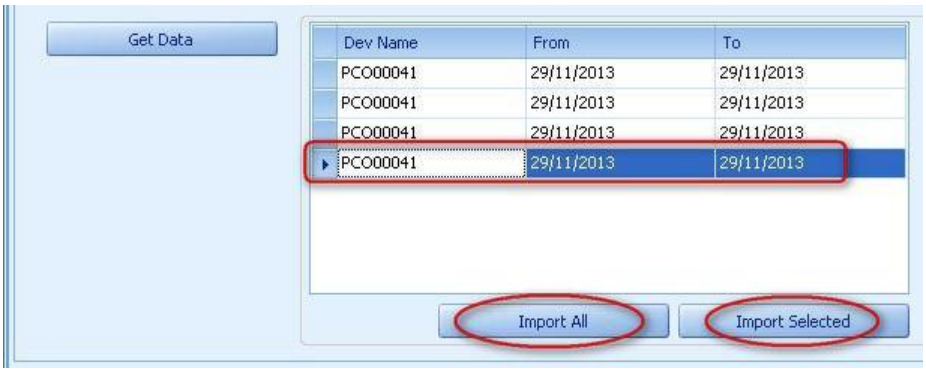


Figure 42 Import all data

Chapter Fehler! Verweisquelle konnte nicht gefunden werden. describes how to proceed further.

5.4.4 Export measurement data into File

Apert from the data import possibilities decribed in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** it is possible to export data likewise. To do so use the right-click context menu of the according project and select the "Export data" (see Figure 42) option.

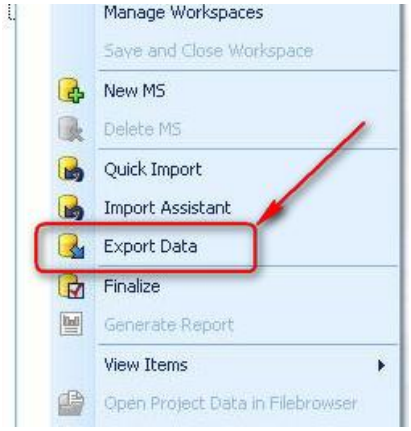


Figure 43: Start Export for measurement data

Then the export dialog opens up as depicted below.

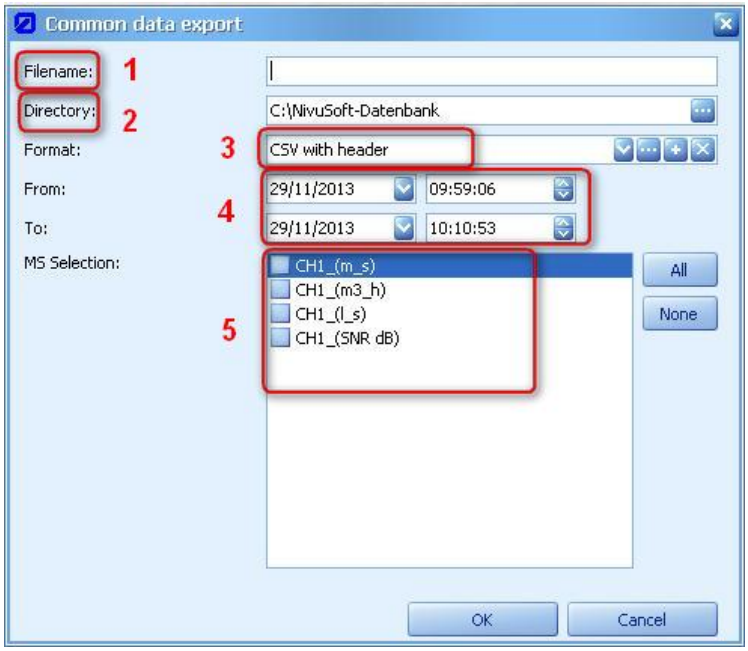


Figure 44: General export dialog

In section (**1**) specify the desired file name. The suffix ".txt" will be used automatically as long as no other suffix is specified. Ifo the specified file already exists it will be overwritten without prior request.

The destination folder (**2**) will be set to the configured "Data directory" automatically. A different destination folder can be chosen using "…".

Section (**3**) allows to select a profile for export procedure. The following functions are available:

- Select from preconfigured export profiles
- the actual selected profile is processed
- A new profile will be created
- The currently selected profile will be deleted.

Section (**5**) shows all available measurement series related to the selected measurement place. Selecting the measurement series accordingly defines the extent of export. Each measurement series selected creates a separate column in the resulting file.

To configure or to create a new profile use the dialog below.

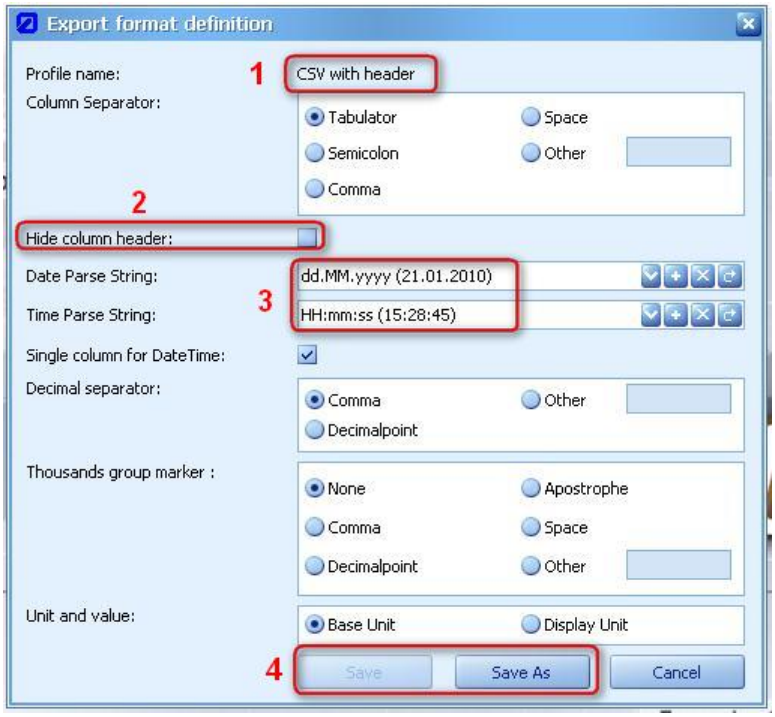


Figure 45: Configuration of an Export profile

Section (**1**) indicates the profile name. This space is left empty if a new profile is used.
The current profile can be overwritten in section (**4**) by using the "Save" button. This does not apply to the default profiles provided by NIVUS. Use "Save as" to create a new profile.
If it is not desired to create a "header" (information on the individual measurement series) during export, check the box in section (**2**).
Section (**3**) is to configure indication or the time and data format. The configuration options are described in chapter 5.4.3.2. However it is possible to dreate and to save user profiles as well.
Section (**4**) in Figure 43 can be used to determine the desired data period used for exporting. The complete time range covering all saved data is entered here once the dialog has been opened initially.

WebBrowser for D2W

Apart from the dialog described above, NivuSoft provides an integrated web browser for access to D2W. Start the browser in a separate window by using the "D2W Functions" and "D2W Web-

Browser" menus. The window can be docked within the application (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

5.4.5 Administrate

Measurement points can be described even more detailed apart from the parameter specified in Chapter 5.4.1. To open the properties dialog of the measurement point either select "Measurement point properties" from the "Start" menu or double-click the according measurement point icon in the project tree with the left mouse key. Both actions will open a window as depicted in Figure 45.

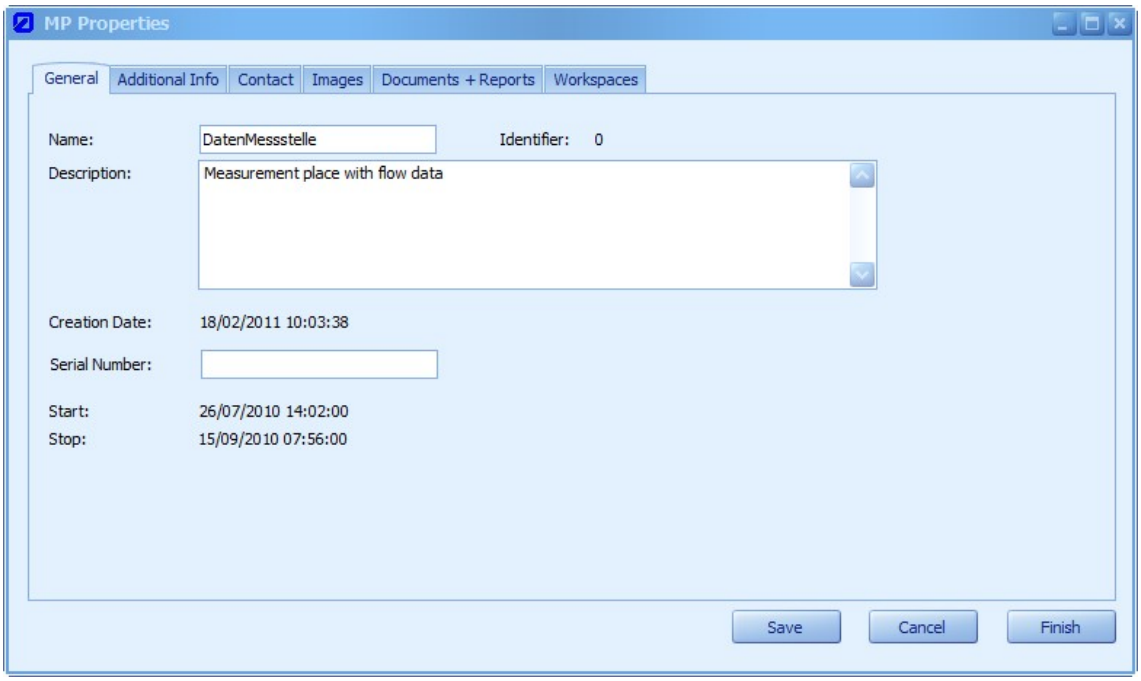


Figure 46: Editing the measurement point properties

5.4.5.1 General settings

The "General" section contains the parameters previously known from Chapter 5.4.1.
This dialog additionally provides information on the internal administrative number "ID" of the measurement point. Normally this ID is not too important. In case of service requests however it might be essential and helpful information.

"Created" indicates date and time the measurement point has been created.

The parameters "Start" and "End" do not contain values before readings have been added. Covering all measurement series, these parameters designate the point in time of the first and the latest reading of the measurement point.

5.4.5.2 Additional information

This section allows to hold additional information on the environment of the measurement point. Apart from basic information further details regarding measurement systems, available geometries and measurement cycles used can be saved here.

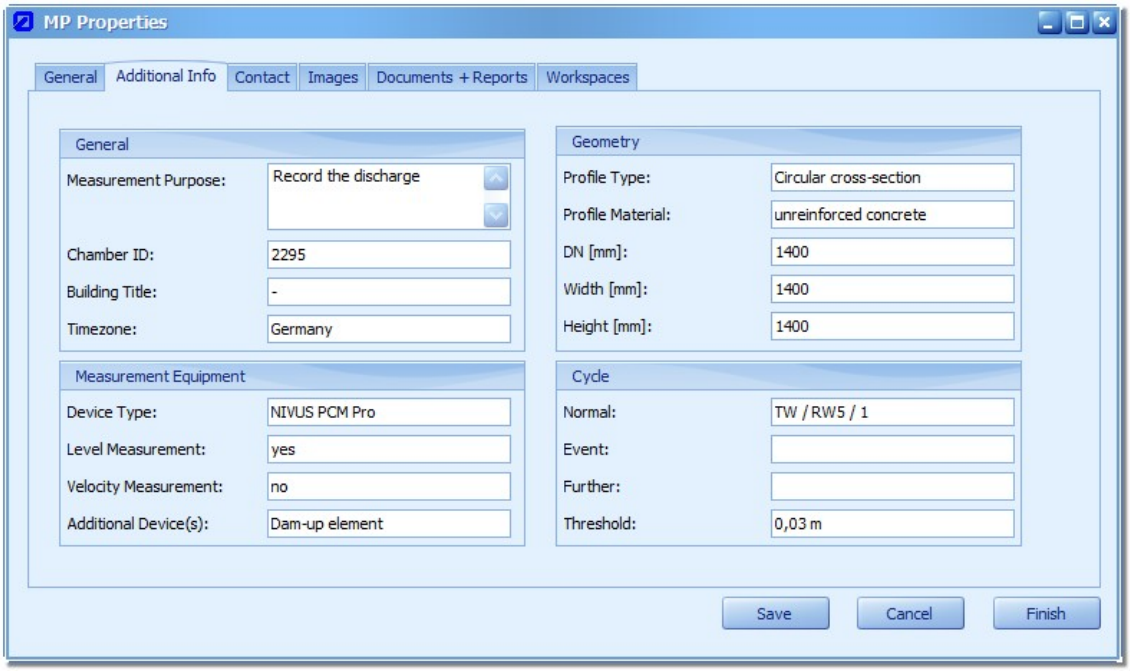


Figure 47: Additional Information of a measurement place

5.4.5.3 Contact

In order to localise the measurement point the section "Local" allows to save desired information. Currently supported are details on street, city, postal code, region and GPS information. In addition it is possible to save details on the contact person responsible for the measurement point.

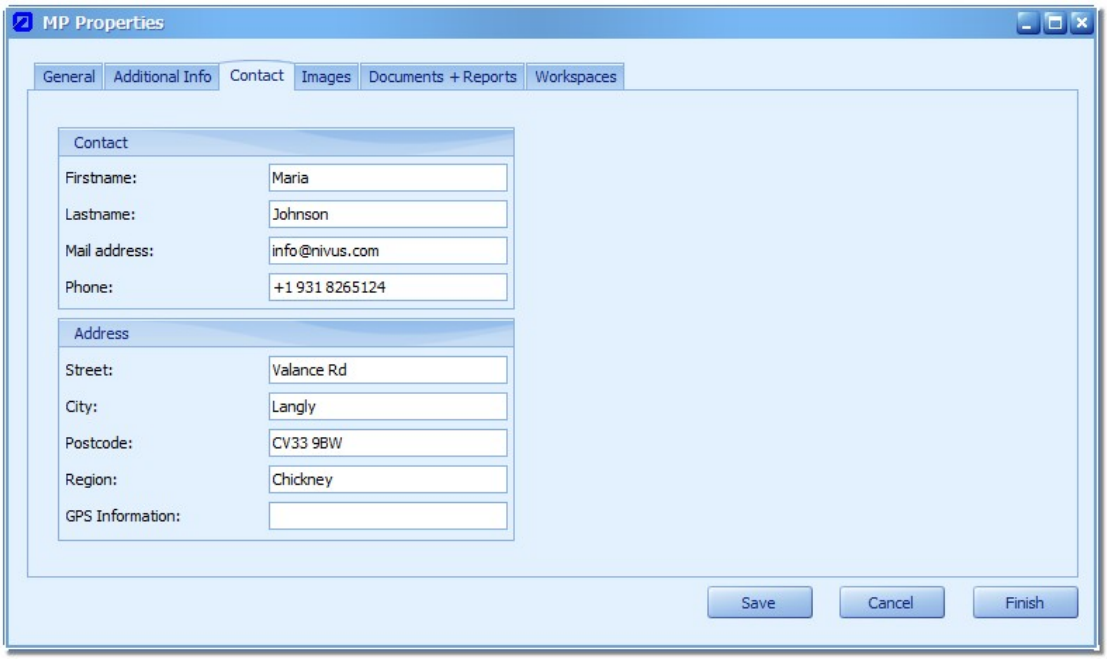


Figure 48: Contact information for a measurement place

5.4.5.4 Images

Photos can be assigned directly to the measurement points for documentation purposes. The supported formats are JPEG and PNG.

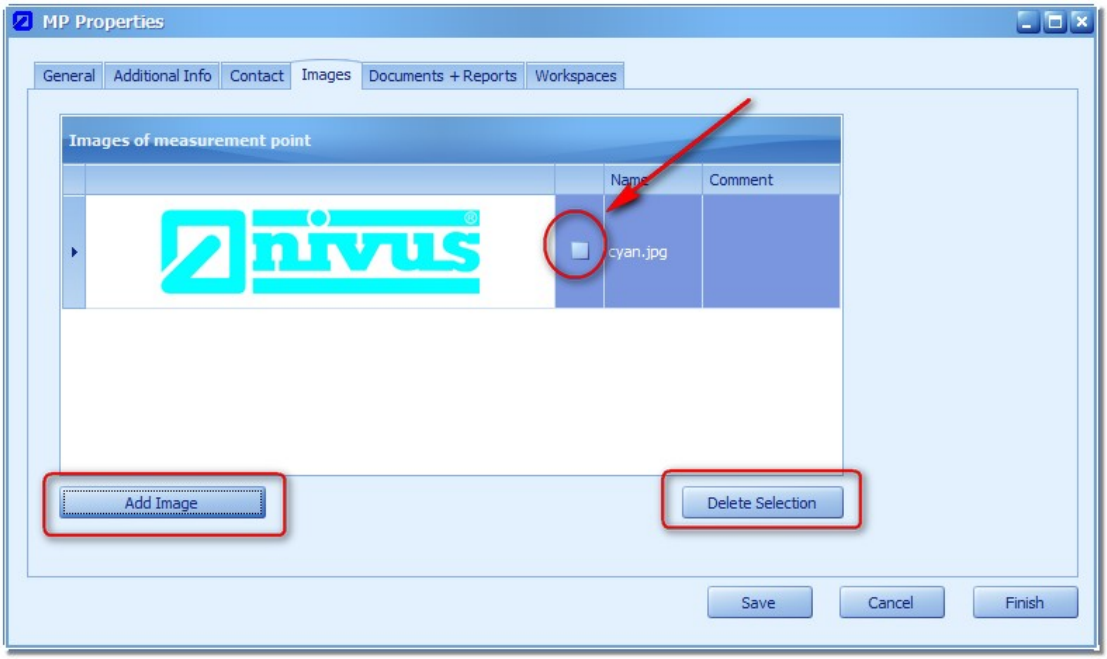


Figure 49: Administration of measurement point photos

Clicking the "Add photo" button opens a dialog which allows to select an according graphic file. The file type may be set either to *.jpeg or *.png. The selected photo is indicated in the table as thumbnail. Details entered in the "Comment" section will be indicated later as caption in the report wizard (Chapter 0).

In order to remove photos select as many photos as desired (see arrow in Figure 48. Click "Delete Selection" to remove the photos.

Added photos will be indicated in the project tree additionally (see Figure 49).

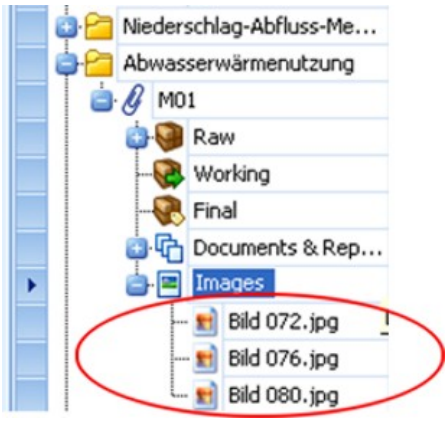


Figure 50: Photo files in the project tree

A double click on the file with the left mouse key will open the photo in its original size.

5.4.5.5 Documents and reports

Additional documents (e.g. maintenance protocols or reports) can be linked with the current measurement point in a similar manner.

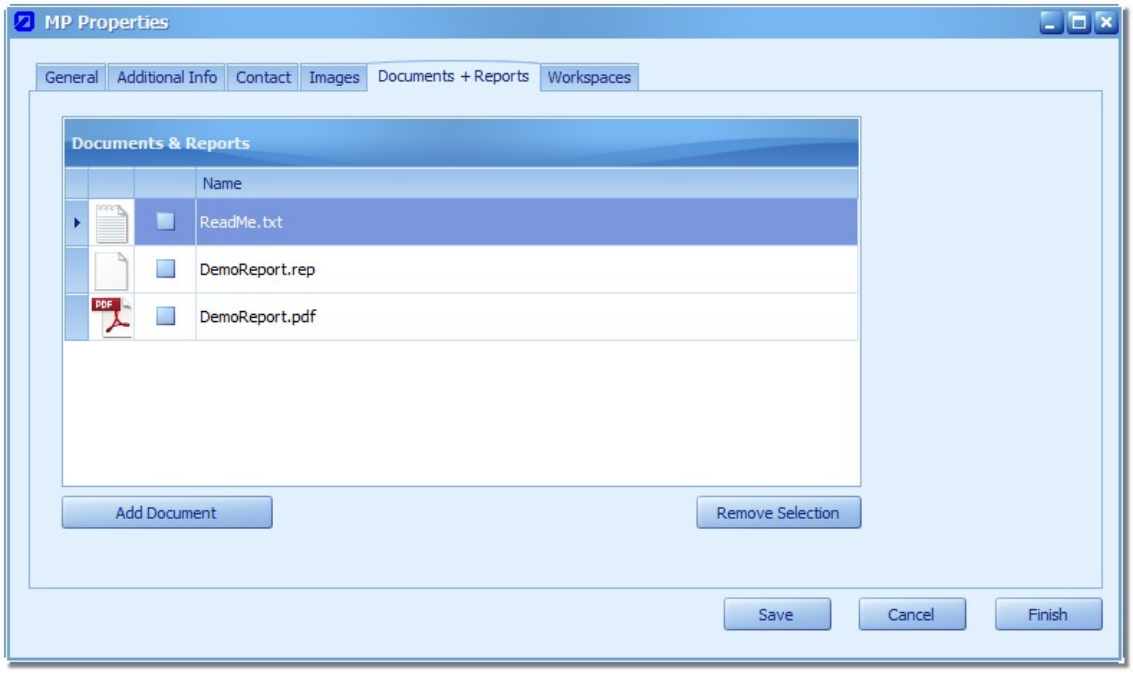
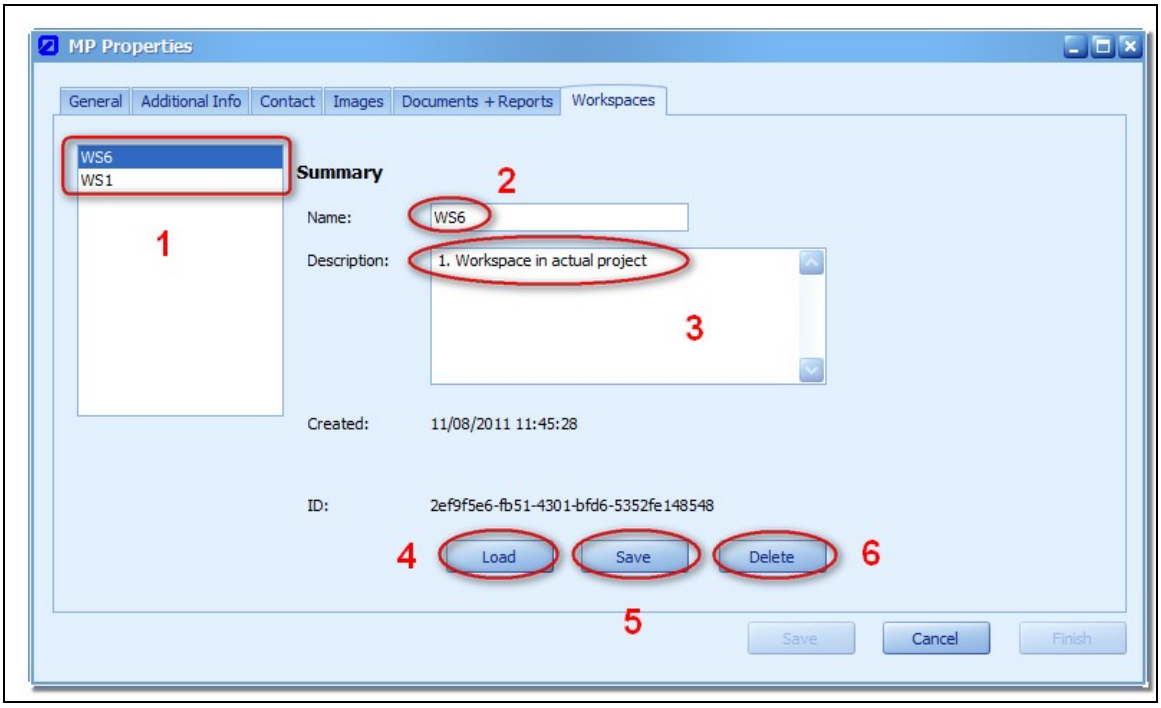


Figure 51: Documents management for a measurement point

The added files are indicated in the project tree as well. If the file suffix is associated with a Windows® application (e.g. Microsoft Word® or Acrobat Reader®), a left-click on the file will open the according application.
Apart from finished files report configurations (*.rep) can be administrated as well. Please find more details in Chapter 12.2.3.14.

5.4.5.6 Workspaces

Closing a working area (comprehensive definition and description in Chapter 6.1) by using the "Save and Close workspace" button in the "Start" menu will save the current settings in conjunction with date and time. This allows to reconstruct e.g. graphic settings, compilations of readings etc.
Working areas are administrated using the submenu of the same name.



(1) This area shows all available working areas for the chosen measurement point

(2) Name of the current workspace; must not be unique and can be modified by the user

(3) Add a description here in order to improve documentation

(4) "Load" will reconstruct the selected workspaces and opens all associated working components

(5) If "Name" or "Description" have been modified save your changes here

(6) Deletes the selected workspaces and removes it from the list (1)

Figure 52 Managing workspaces of a measurement point

5.5 Measurement series

A measurement series represents the readings of physical or calculated values such as level, velocity etc. A measurement series is interpreted as a continuous flow of data, i.e. all points within a chart will be connected to each other. This behaviour can be influenced by using the parameter ion the properties of a measurement series. As soon as the time between two readings exceeds the preconfigured value (in seconds) the point will not be connected showing a "gap".
To move measurement series within projects (e.g. between various containers or even between various measurement points) use the common "Drag & Drop" function. To do this select a measurement series in the project tree and move it to the desired position while holding the left mouse key. Release the left mouse key subsequently.
There are several ways to move or to copy measurement series:

Within the same measurement point:

Measurement series saved in "Raw data" or "Finished data": only one copy can be created since otherwise the reference to the origin will get lost.
Measurement series saved in "Working data": copying to "Raw data" is not possible. The measurement series can be either copied or moved to "Finished data".

Into a different measurement point:

The same principles are valid as described above. Data however cannot be moved but copied only.

5.5.1 Create

In most cases measurement series are created during the import process (from TXT files, NivuData link etc.) per default. The standard location for newly created measurement series is the "Raw data" container. The data will not be copied to the working data area before a measurement series has been modified.
Start the dialog to create a new measurement series either by clicking "Measurement series" from the "Start" menu or by using the right-click context menu of a measurement point. Names for new measurement series do not necessarily have to be unique. However it is advisable to use appropriate names. If automatic synchronisation (e.g. with D2W portal) should be desired later, please observe to use exactly the same spelling as used in the portal. Additionally it is possible to enter remarks describing the measurement series.

5.5.2 Delete

Select the measurement series you wish to delete in the project tree. Either use the "Start" menu in the measurement series area or the right click context menu to choose the "Delete series" option. Confirm the following request to actually delete.

5.5.3 Finish

Chapter 5.1 describes the idea of using three containers to administrate measurement series. To move a measurement series to the "Finished data" area select the according option from the "Start" menu or use the right-click context dialog of the measurement series.

5.5.4 Administrate

Double-click the respective entry in the project tree with the left mouse key to start the dialog to administrate measurement series. An example is shown in Figure 52.

5.5.4.1 General

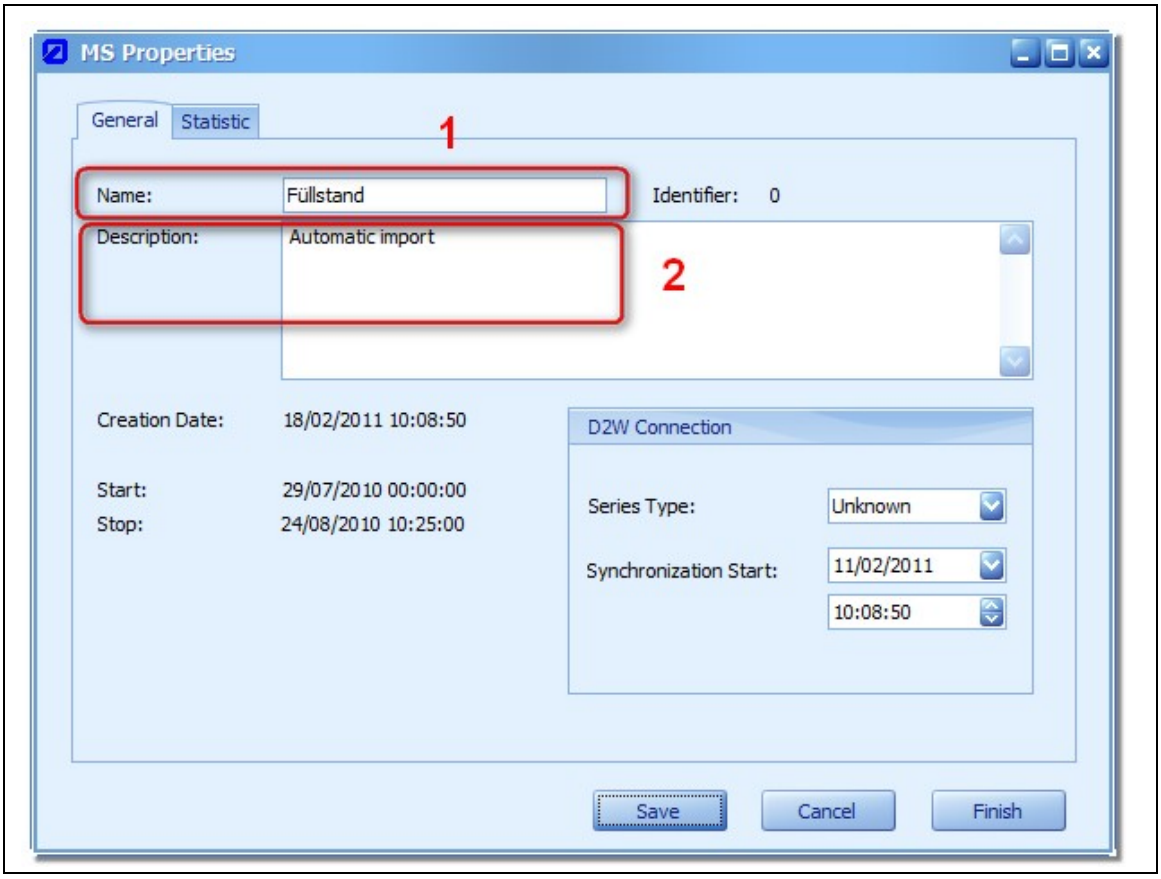


Figure 53: Properties dialog for measurement series

1. Name of measurement series: can be modified here or in the "Properties" window
2. Enter a description here if nothing has been entered while the measurement series has been created.

5.5.4.2 Statistics

This submenu shows statistics on the measurement series for the complete period containing readings. Determine the values to be indicated by using the menu described in Chapter 4.4.3.

6 Workspace

An essential feature of NivuSoft is the visualisation and evaluation of measurement series. In order to correctly interpret events it is necessary to view summarised data under various aspects in different ways.

NivuSoft provides the following options:

- Graphical presentation of measurement series based on a time scale
- Scatter-graphs where X- or Y-axis are each represented by individual separate measurement series
- View as tables
- Statistics comprising one or more measurement series covering various periods
- Pocket calculator function for combination or mathematical processing of measurement series

The basis for a common representation of measurement values is the so-called workspace.

6.1 Possibilities

Figure 53 shows an example of a possible workspace setup.

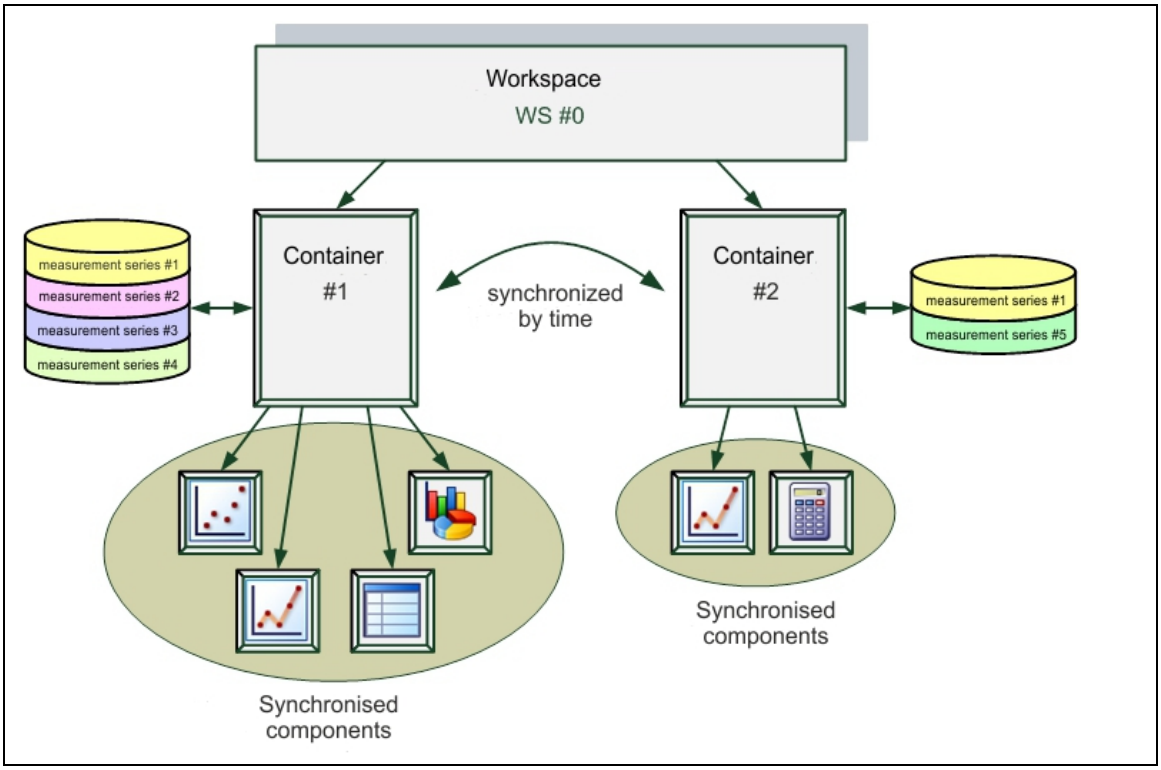


Figure 54: Workspace example

Opening a new component creates a new workspace and adds a new container automatically. The container features a reference to the according component.

Now it is possible to add as many measurement series as desired into the container or the component by using "Drag & Drop". Please observe to use unique names exclusively! Otherwise an according error message will appear. Adding a measurement series from a different measurement point will generate a copy of the measurement series.

The right-click context menu of each component under "Sync. components" contains a submenu, which may be used to create synchronised components (see Figure 54).

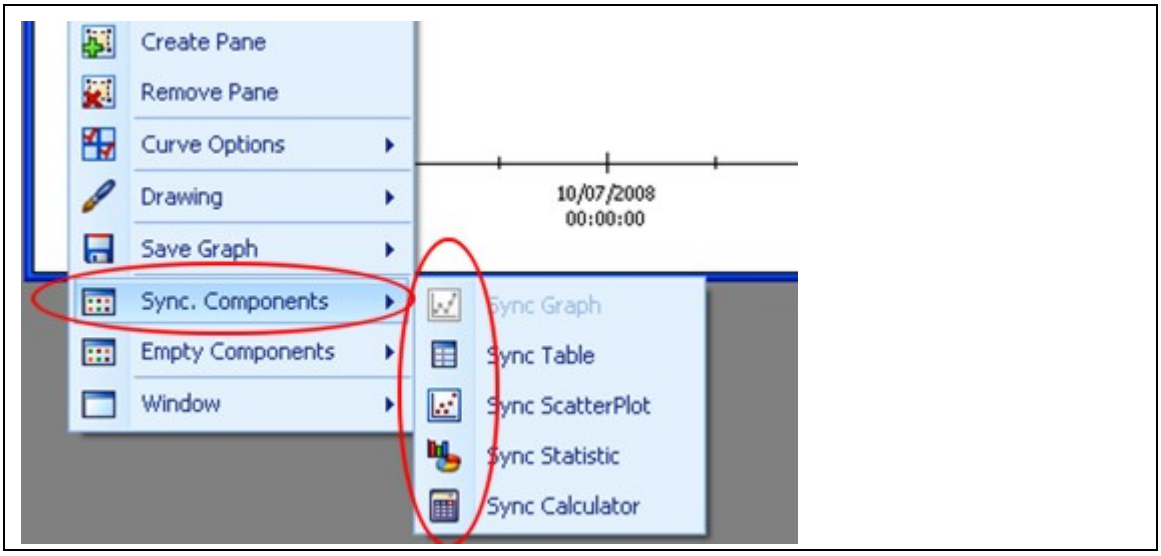
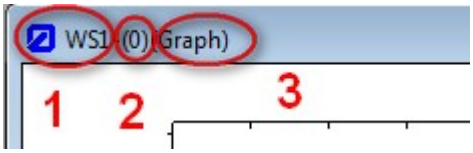


Figure 55: Creating synchronised components

Synchronisation in this case means that all actions (e.g. zoom, data modifications etc.) executed in a component will be immediately indicated in the synchronised components accordingly.

It is possible to generate another container within the workspace. Use the point "Empty component" in the right-click context menu to create a new component. This component is synchronised with the workspace regarding its time graph. This means that modifying the time graph of a component in container #1 will directly influence the time graph of all components in container #2 accordingly.
The relation between workspace, container and components can be identified from the component header as described below:



1 Name of Workspace
2 Container-ID
3 Type of component

Figure 56: Component header

6.2 Curve options

6.2.1 Add

Add measurement series to the workspace via the current component. Use the project tree and "Drag & Drop" to achieve this.

6.2.2 Change selected measurement series

All measurement series associated with the current workspace are entered in the series list ("Workspace menu → curves"). Selecting a different measurement series updates the selection in the project tree as well.

Figure 57: Selecting measurement series in the workspace

6.2.3 Remove

Use "Delete" from "Workspace → Curve options" to remove the selected measurement series (see Chapter 6.2.2) from the current workspace.

6.2.4 Move readings

The menu "Workspace → curve options“ contains the option "Move readings".
This function allows to visually move data of the currently selected measurement series in the graph. The look of the mouse cursor will change. Clicking and holding the left mouse key will "catch" the point next to the cursor. Moving the mouse will change the Y-value of the selected reading. Releasing the left mouse key will accept and transmit the changes to all components located in the workspace area. "Move readings" must be selected again in order to reset the mouse to the standard functions.

6.3 Modifications in workspace

6.3.1 Save

Opening a measurement series from the raw data area automatically creates a copy which will be saved in the "Working data" area subsequently. Enter any name for the measurement series.

Modifications will not be saved automatically.

While resaving a measurement series or saving a measurement series from the "Working files" area it is possible to either use the same name (existing measurement series will be overwritten) or to create a new measurement series by using a different name.

6.3.2 Undo/Redo

For almost all functions and actions carried out within the workspace there is an undo/redo function available. The according icon will be enabled as soon as a modification has been made.

6.4 Close

Closing a workspace means that the current status will be restored when opening NivuSoft the next time. In order to manually close the workspace select either the according measurement point in the project tree or one of the measurement series associated with the workspace. The option "Close workspace" can be called up from "Start menu → measurement point" subsequently. Unsaved modifications yet existing in the workspace will now be saved automatically.

6.5 Time Navigation

Switching between different components activates the according workspace automatically and shows the start and stop times last set in the menu bar of the workspace.
If the workspace contains several measurement series (which do not necessarily must contain measurement data in the same area) the start date of the workspace will be set to the earliest start of all measurement series. The same applies regarding the stop date.

The display range will be set to the first or last valid date within the data set during the first configuration of a workspace (by adding the first measurement series). The figure below shows the "Time navigation" in the workspace menu.

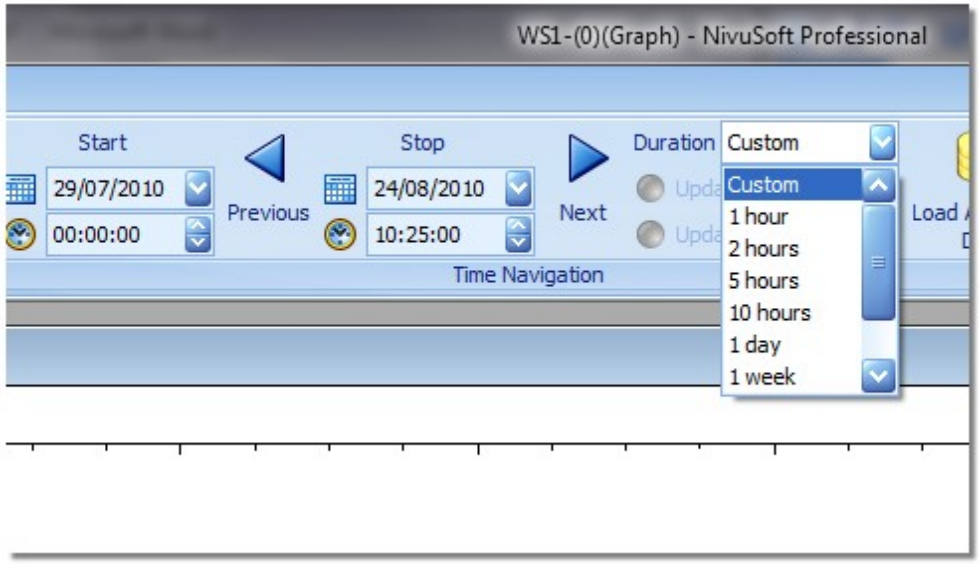


Figure 58: Time navigation in workspace

The "Duration" menu provides the following options:

User

- Start and stop date can be selected freely
- The "Back" or "Next" keys will accept and either increment or decrement the respective start or stop dates by the time difference

X-hours, 1 day, 1 week, X-months

- Deactivates the entry fields for start and stop date
- The navigation keys allow to jump by the selected increment within the time range based on the start date

Complete range

- Start or stop date will be set to the borders of the workspace

6.6 Redefine Time Range

When loading additional data the current worskpace the period for the data to be loaded is specified. If you wish to modify this period later you can do so by clicking the respective button in the workspace menu.

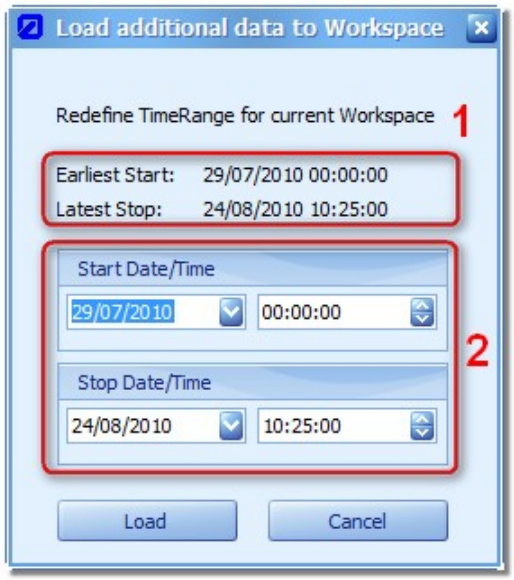


Figure 59: Adjusting the period for a workspace

Section (**1**) shows the period containing available data for the current measurement series. The earliest start and latest stop dates will be indicated as soon as the workspace contains more than one measurement series. The desired period can be entered in section (**2**). A click on "Load" executes the desired action.

7 Graphics Component

The graphics component represents a comprehensive collection of functions to visualise measurement series, to mark sections, to add bookmarks etc.
Create a new graphics component b clicking on the according icon found in "Workspace → Components" menu. As described in chapter 6.1, it is possible to generate an empty or a synchronised graph by using the right-click context menu as well.

The standard mouse function is "Select measurement series". This means that the hydrograph as well as the respective measurement series next to the mouse cursor will be selected by a single click of the left mouse key. The active hydrograph is always indicated in "Workspace → Curve options" under "Series" (see Figure 56).

For the functions described below either the right-click context menu of the graph or the Graphic Tools (see Figure 59) are available. The Graphic Tools menu is available only if the currently selected working element is a graph or a chart.

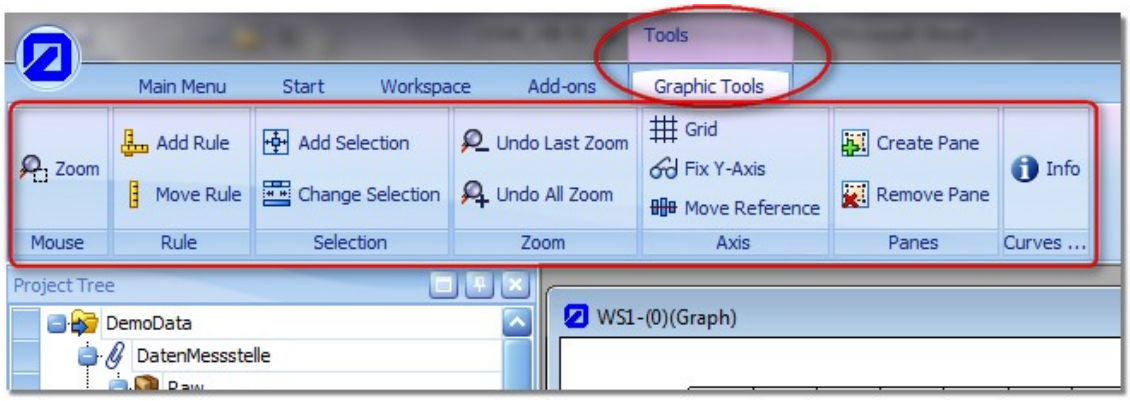


Figure 60: Graphic Tools

7.1 Graph window

Per default the graphics module opens up showing a coordinate system which allows to add as many hydrographs as desired from the project tree by using "Drag & Drop" (see Figure 60 left hand section).

The graphics component however supports the indication of multiple coordinate systems in one window (see Figure 60 right hand section).

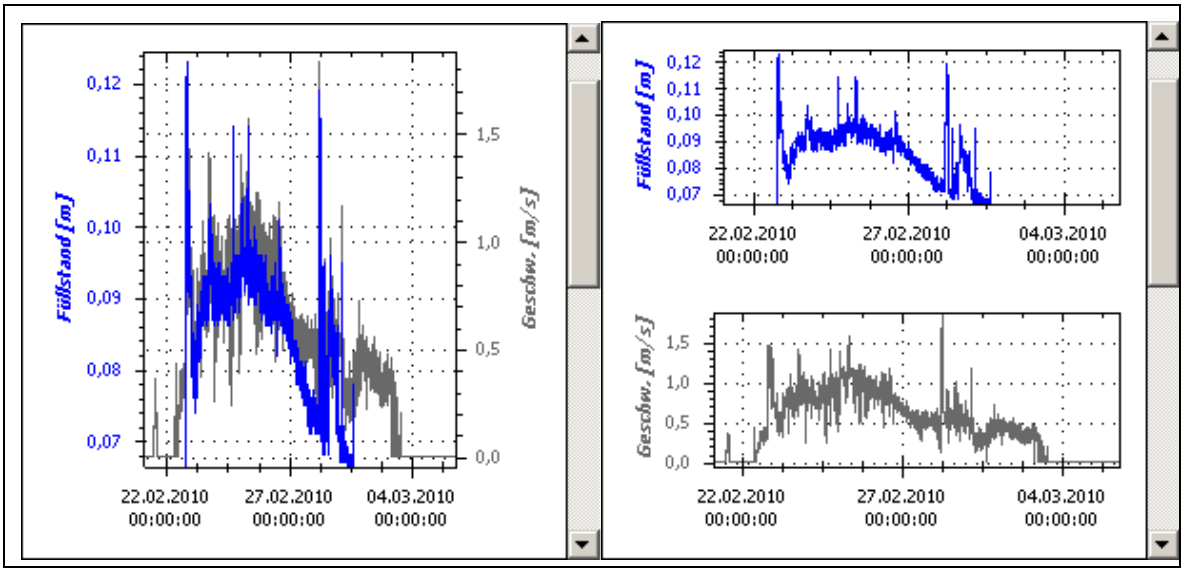


Figure 61: Graph windows in graphics component

7.1.1 Create Pane (graphic window)

At least one hydrograph must have been added to the graphics component previously in order to generate a new coordinate system. A new coordinate system can be registered by using the right-click context menu ("Generate pane") of the graphics component. This will cause an empty area to come up in the bottom section of the window initially. Use "Drag & Drop" to add the desired measurement series from the project tree.

IMPORTANT:

A measurement series is unique within the workspace area (see Chapter 6.1) and hence can be shown only once.

7.1.2 Remove Pane (graphic window)

Call up the right-click context menu right on the respective coordinate system/graph window in order to remove it. Using the button "Remove graph window" will delete the coordinate system and removes as all the measurement series from the workspace accordingly.

7.2 Ruler

A rule is availble for better analysis of measurement series within charts. The rule is always in the centre of the currently visible area. When zooming into an area out of the rule range, the rule will be centered in the new range.

7.2.1 Add Ruler

Clicking the „Add Ruler“ buttom in the graphic tools menu will center the rule wihin the active chart (see example in Figure 61).

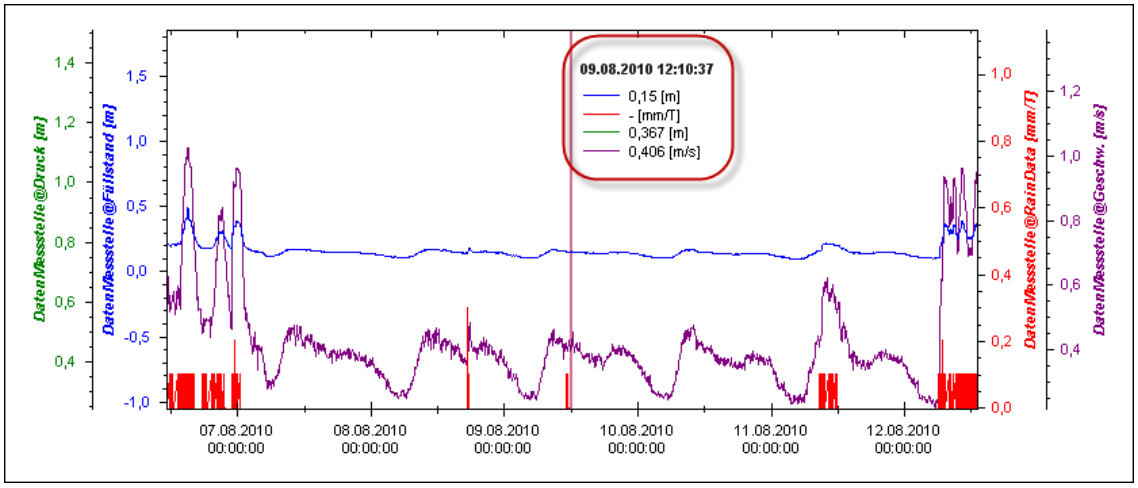


Figure 62: Ruler representation in charts

The marked area shows the current position (date/time) of the rule. Additionally the value of each measurement series at this position is indicated. Should the measurement values not be synchronous (not each measurement series has a value available at this position) a linear interpolation between the most adjacent data points is carried out!

7.2.2 Remove Ruler

After adding the rule (see Abschnitt 7.2.1) the button is labeled "Remove Ruler". A click removes the ruler accordingly. The position however will not be held, i.e. the ruler will be centered again in the currently indicated period when adding the next time.

7.2.3 Move Ruler

Click the according button if you wish to move the ruler. The mouse function will be switched within the chart element. By permanently holding the left mouse key and moving the mouse it is possible to move the position of the ruler. The ruler can be moved additionally by pressing the arrow keys on the keyboard. To reset the function simply activate the "Zoom" function in the graphic tools.

7.3 Selection

To process measurement data (see chapter 13) it is necessary to select a certain time range for processing. This can be done by using the range functions.

7.3.1 Add Selection

A click on the respective button will add a standard period to the graph. The period is equal to the currently indicated period and will be highlighted in blue.

7.3.2 Remove Selection

After a period has been added (see chapter 7.3.1) the button label will change to "Remove Selection". Clicking the button removes the selection accordingly. The positions of the left and right edges will not be saved. Hence the selection will include the complete period in case of being added the next time.

7.3.3 Change Selection

To adjust the indicated period, select the respective button in the graphic tools menu. Wihtin the charts area the mouse cursor will change its shape. Move either the left or right edge of the area by clicking and holding the left mouse key. To reset the function simply activate the "Zoom" function in the graphic tools.

7.4 Grid

Grid lines can be indicated in the coordinate system. This option applies to all graph windows within a graphics component. Select the respective option from the right-click context menu to show or hide the grid lines. The horizontal guiding lines will be shown for each Y-axis separately.

7.5 Zoom

Use the zoom function in order to zoom into certain sections from the current graph. There are various methods which allow to change the values of the X- or Y-axis.
Changing the scale of the X-axis applies for all components associated with the current workspace (see chapter 6.1 and Figure 53).

7.6 Mouse Zoom

Moving the cursor within the graph window with the left mouse key pressed allows to define a new virtual display range (indicated by a rectangle with dashed lines). Releasing the left mouse key scales X- and Y-axis accordingly.

7.6.1 Mouse wheel

Using a wheel mouse allows to modify the scale of the Y-axis of all measurement series shown in the graph window.

7.6.2 Single zoom

If the Y-axis of one particular measurement series within the graph window is to be modified, use "Single zoom" found in the "Curve properties" dialog of the right-click context menu. The new virtual display range has the colour of the hydrograph to be zoomed. After applying this function once the mouse returns to standard zoom again (see Chapter 7.6).

7.6.3 Undo zoom

Select the "Undo last zoom" function from the right-click context menu if you wish to restore the screen before the zoom. Alternatively use the "Undo" key in the "Workspace menu".
If you wish to undo all axis scaling actions performed during the current session select "Undo all zooms" from the right-click context menu.

7.7 Y-Axis

The Y-axis is a powerful tool to modify the current graph representation. The following chapter thoroughly describes the available possibilities.

7.8 Change Reference

The borders of the Y-axis of the currently selected measurement series can be set using the right-click context menu. The current graph will accept the changes immediately.

Values may be either entered directly or in steps of "0.01" by using the navigation keys.

7.8.1 Move Reference

If you wish to move the currently selected hydrograph regarding its zero point choose "Move zero point" from the right-click context menu. Please note that the mouse cursor changes its look in the graphics component. Move the hydrograph with the left mouse key pressed. The graph window immediately accepts the modification and the cursor returns to its original state after the movement has been finished.

7.8.2 Fix Y-Axis

In most cases multiple Y-axes within the graph window have different scales. In order to really "overlay" hydrographs select the "Fix Y-axes" from the right-click context menu. The Y-axes remain unchanged even if additional actions will be performed within the graph. Select this option once more to "release" the axes again.

7.8.3 Show Titel

If many hydrographs are indicated in a window it might be helpful to hide the names of Y-axes due to reasons of restricted space. To achieve this select "Show title" from "Curve properties" in the right-click context menu. Select the function once more to show the names again.

7.8.4 Show Scale

One more option to save space is to hide the scale. In the right-click context menu choose "Show scale" from the "Curve properties" dialog to hide the scale and select it once more to show the scale again.

7.9 Hydrograph (Curve Options)

Hydrographs represent measurement series within the graphics component. Depending on preferences or general requirements it is possible to configure the line representation very individually.

7.9.1 Colour

The hydrograph colour can be changed by clicking the according icon in the "Curve properties" dialog from the right-click context menu.

7.9.2 Marker

For better identification of the real data points it may be advisable to particularly mark them. In the "Curve properties" dialog from the right-click context menu select between solid circles or solid rectangles.

7.9.3 Strength

The strength of the selected hydrograph can be selected freely within a range from 1pt to 10pt. Choose the according symbol in the "Curve properties" dialog from the right-click context menu.

7.9.4 Connect points

In order to avoid measurement values to be connected with each other in the graph select "Connect points" in the "Curve properties" dialog from the right-click context menu.

IMPORTANT:

The selected hydrograph will be removed from the current graph window if no marker has been chosen (see Chapter 7.9.2) This option hence may be chosen to specifically hide certain hydrographs.

7.9.5 Tilt Curve

For certain physical values and the associated measurement series it may be advisable to invert the Y-axis scaling. Select "Tilt curve" in the "Curve properties" dialog from the right-click context menu. Choose this option once again to return to the original representation.

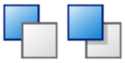
IMPORTANT:

Note the inverted direction in case of Moving the zero point of an inverted Y-axis (see Chapter 7.8.1).

7.9.6 Bar format

Rainfall readings may be visualised best by using a bar graph instead of a hydrograph (data points connected by lines). Select "As bar graph" in the "Curve properties" dialog from the right-click context menu. "As line graph" will be indicated accordingly if the current measurement series is shown as bar graph.

7.9.7 Arrange



As soon as multiple hydrographs are shown, particularly if the "Fill" option has been selected additionally (see Chapter 7.10.2), it might be necessary to change the position of the current hydrograph. For this reason the options "To foreground" and "To background" are available. To achieve the desired results it may be necessary to adjust the position of more than one hydrograph. The options can be found in the right-click context menu under "Curve properties".

7.10 Drawing

Apart from adding measurement series it is possible to add even more graphic elements to the graph window such as:

- Lines defined by two points
- Highlighted area between a measurement series and the X-axis
- Tags

7.10.1 Draw line

To add a line the current graphics component must contain one hydrograph at least. To start the dialog, select "Draw line" from the "Draw" submenu in the right-click context dialog. The new dialog opens as a free floating window acting like a "Dock-Panel" (see Chapter 4.3.1).
This dialog may remain opened permanently. Jumping to a "non-graphics-component" will disable the input fields of the dialog. The dialog however will be updated accordingly as soon as a graph from another workspace has been selected. The dialog depicted below can be opened only once.

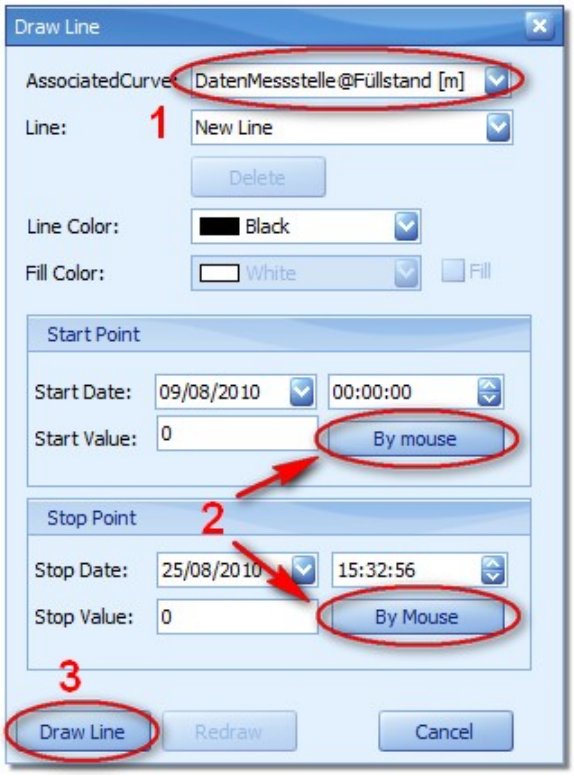


Figure 63: Configuration dialog to draw lines

A drawn line will be associated to a previously added measurement series since it has no individual Y-axis (mark (**1**) in Figure 62). This means that start and stop values refer to this Y-axis as well.

The start and stop points can be either entered manually or can be selected in the graph by using the mouse. Use button (**2**) to do this. Points can now be selected by a simple left click with the mouse. The values of the point are shown in the dialog and can be adjusted manually if required.
Start and stop values shall be entered the same unit as previously defined for the associated curve.
The line can be added to the graph window by using the "Draw line" (**3**) button as soon as all points have been defined.
The drawn line can be adjusted using the "Redraw" (**4**) button.
To insert additional lines choose the "New line" option in the "Line" menu.
Line objects already available the current graphics component can be selected in the dialog below (see Figure 63). The respective configuration will be represented accordingly.

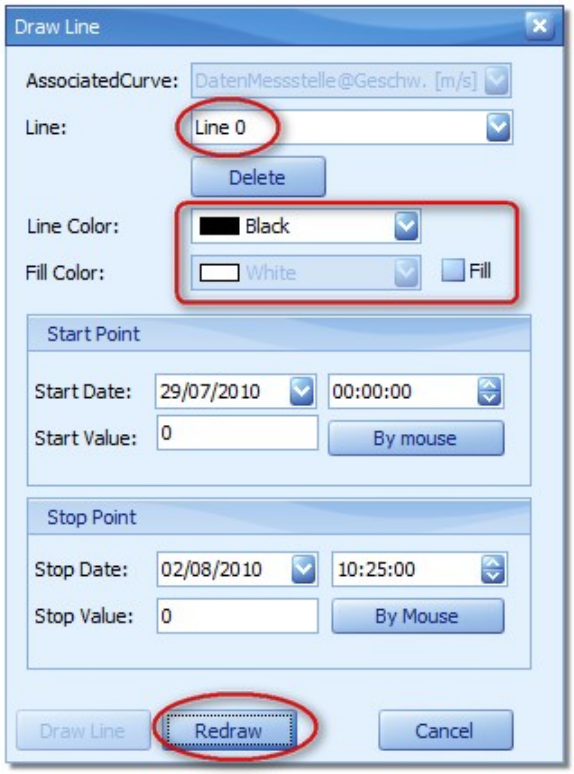


Figure 64: Edit line dialog

A click on the "Delete" button deletes the selected line from the graphics component. Modified line colours will be accepted in the graph immediately. Clicking the "Fill" option fills the area between X-axis and the line with the selected colour. Changes in this area will be indicated in the graph instantly.

If you wish to modify the values at the beginning or the end of the current line this can be executed in the according dialog windows. The graphic component will not accept the new values before the "Redraw" button has been clicked. The "By mouse" function can be used here as well.

7.10.2 Fill areas

The area between a measurement series and the X-axis can be filled with any colour. Select "Fill" from the "Draw" menu in the right-click context menu. The indicated dialog is similar to the one shown in Figure 64.
"Curve" indicates the currently selected measurement series. This field allows to choose any of the other measurement series in the current workspace.

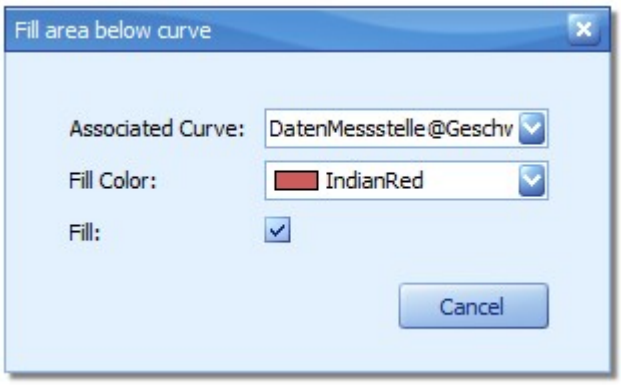


Figure 65: Fill area between hydrograph and X-axis

Select your desired colour here and click "fill" in order to fill the selected area of the graphic.

7.10.3 Text Label

To describe specific events and for documentation purposes it is possible to add bookmarks to graphs.

Figure 66: Defining bookmarks

Similar to defining a line (see Chapter 7.10.1), bookmarks are associated with a previously existing measurement series. This is necessary since the coordinates and hence a defined Y-axis is required in order to restore a workspace.

A new bookmark will be defined as soon as "New name" has been selected. Otherwise an existing bookmark will be edited.
Any text message can be entered in the "Label text" input field. Line breaks are shown as the bookmark is presented. The "Delete" button in Figure 66 refers to all entries in the dialog. A click on it will reset the input mask to its default state. Select the desired bookmark position within the graphics component by clicking the "Place" button (the cursor changes its look).

Figure 67: Modifying bookmarks

The desired bookmark can be selected by opening the dialog a second time and by using the "Name" tab accordingly. The graphics component accepts modifications in the "Label text" field as soon as "Update" has been pressed. "Delete" serves to remove the bookmark from the graph window again.

7.11 Save Graph (Export)

There are various methods to save the current graph on the system or to have it available in other applications.

7.11.1 Clipboard

A common method is to copy graphs into the Windows® system clipboard, which then can be added to other applications (such as Microsoft Word®, …) directly. To achieve this select from the right-click context menu the option "Clipboard" under "Save graph". This dialog does not require confirmation.

7.11.2 Graphics-File

Another method is to directly save the graph as graphics file. The file format in this case is PNG. The dialog below will be shown after the option "File" has been chosen from the "Save graph" menu in the right-click context menu.

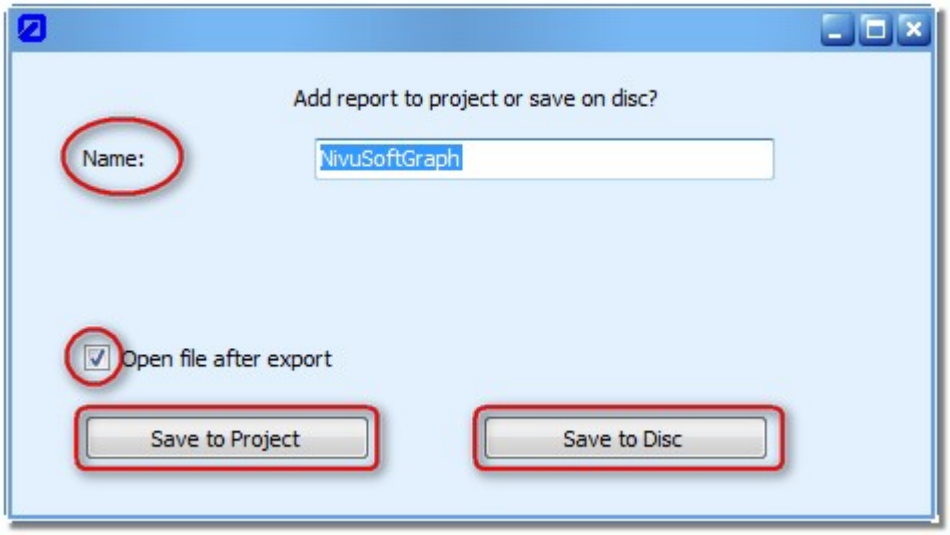


Figure 68: Save graphics file dialog

The standard "Name" entered is „`NivuSoftGraph`“. However it is possible to enter any desired name. It is recommended to avoid blank spaces and special characters (the entered text is equal to the later file name).

As set by default the graphics file will be opened in the standard viewer as soon as it has been saved successfully. Tick the respective option in the dialog if this should not be the case.

Basically it is possible to directly add the file to the project tree, i.e. it is available in the "Images" section within the project tree of the current measurement point. From there it can be opened by double-clicking. If you wish to save the file on your file system select "Save to disc" and choose the destination directory in the following dialog.

7.12 Hydrograph Info

Measurement series can be copied and moved between different measurement points or projects by using the project tree. To identify the origin of a measurement series later use the "Info" option from the graphic tools. The following dialog appears.

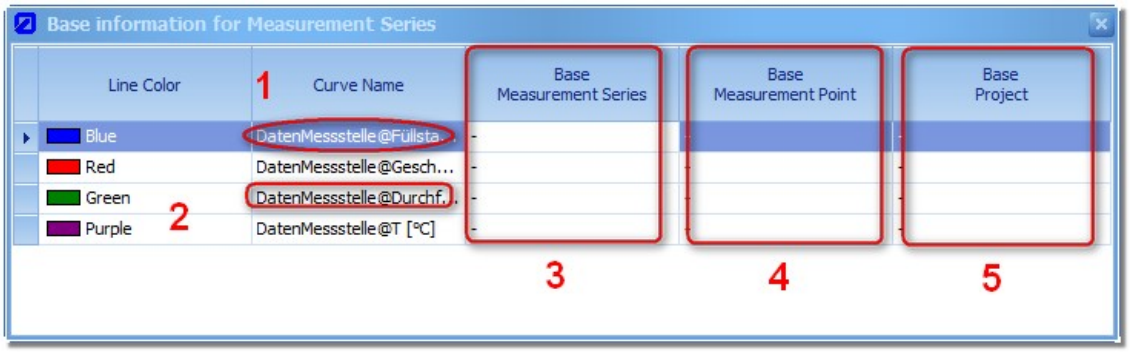


Figure 69: Curve Information

Section (**1**) shows the name of the current measurement point. (**2**) shows a combination from the current measurement point and the name of the current hydrograph. If a hydrograph has been assigned to the curren measurement point directly from a file or a communication, sections (**3**), (**4**) and (**5**) contain " – ". In other cases section (**3**) shows the name of the original measurement series, (**4**) the name of the source measurement point and (**5**) the base project.

8 Table Component

The table component can be used to visualise measurement series within a workspace.
To generate a new table component by clicking on the according icon in the "Workspace → Components" menu. As described in Chapter 6.1 a synchronised or an empty table can be created by using the right-click context menu. All functions described below can either be accessed from the right-click context menu within the table component or from the table tools menu.

8.1 Idea

Basically the table view is structured as follows:
The first column contains the time stamp (date / time) of the individual measurement series.
The adjoining columns contain the measurement data as they have been added.

There may be gaps or empty lines within the tables as not all measurement series necessarily must contain the same time stamp (see Figure 69).

WS5-(0)(Table)

Date / Time	DatenMessstelle@Füllstand [m]	DatenMessstelle@Geschw. [m/s]	DatenMessstelle@Durch
29/07/2010 00:00:00	0.129	0.349	20.85
29/07/2010 00:05:00	0.128	0.350	20.55
29/07/2010 00:10:00	0.127	0.343	19.90
29/07/2010 00:15:00	0.127	0.345	20.06
29/07/2010 00:20:00	0.000	0.000	0.00
29/07/2010 00:25:00	0.000	0.000	0.00
29/07/2010 00:30:00	0.000	0.000	0.00
29/07/2010 00:35:00	0.126	0.336	19.26
29/07/2010 00:40:00	0.124	0.333	18.65
29/07/2010 00:45:00	0.123	0.334	18.51
29/07/2010 00:50:00	0.122	0.332	18.18
29/07/2010 00:55:00	0.122	0.328	17.95
29/07/2010 01:00:00	0.121	0.317	17.25
29/07/2010 01:05:00	0.120	0.319	17.04
29/07/2010 01:10:00	0.120	0.318	17.03
29/07/2010 01:15:00	0.119	0.319	16.84

Figure 70: Table view for asynchronous measurement series

8.2 Editing measurement values

Each value within a table except from the time stamp can be edited. To do this simply select the desired cell with the mouse. The system will switch to the edit mode (flashing cursor in the cell) and any numeric value can be entered subsequently. Please observe to correctly enter the local decimal character (comma or decimal point). After modifications the "Save" icon (see Chapter 6.3.1) will be activated and the changes can be actually saved. The saving process can be executed in the end of an editing session as well if many values are to be modified.

8.3 Add Measurement Values

It is possible to add a new pair of values (comprising time stamp and reading) to a previously existing data set. Select "Add Data Point" from the right-click context menu in the table component. The following dialog provides the option to generate a new measurement value. The time preset depends on the line selected in the table component (Figure 70, point (**2**)) and is incremented by exactly one minute.

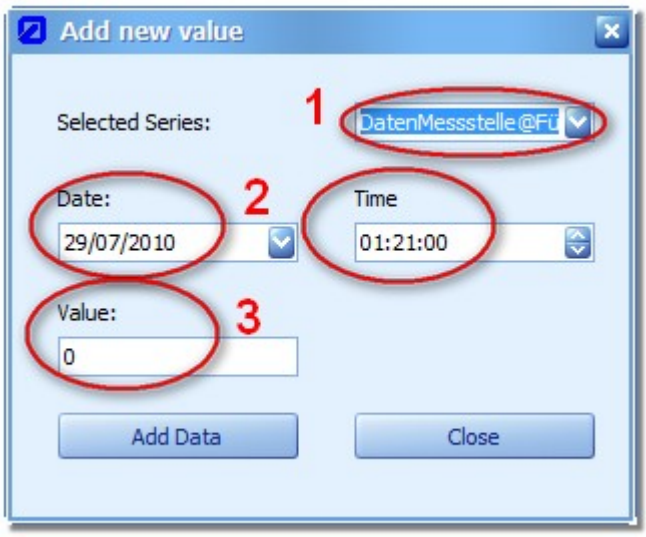


Figure 71: Dialog for generate a new measurement values

Choose the desired measurement series in area (**1**) if multiple series are available in the workspace. Per default the measurement series chosen in the workspace is selected in the menu. Use field (**3**) to enter the new value. The decimal digit depends on country-specific settings or on the selected application language.
The synchronised components are updated automatically as soon as the measurement value has been added.

8.4 Remove Data Point

"Remove Data Point" can be found in the right-click context menu as well.

IMPORTANT:

This function refers to all measurement series within the workspace, i.e. all measurement values associated with the selected time stamp will be removed from the workspace. To remove only one single measurement value from a measurement series, create a new table containing the desired measurement series to subsequently remove.

8.5 Find and Replace

As commonly known from other applications the "Find and replace" function has been integrated the NivuSoft. Start the dialog by selecting it from the right-click context menu in the table component.
Select the measurement series to edit using section (**1**) in Figure 71. Only measurement series available in the workspace can be chosen.

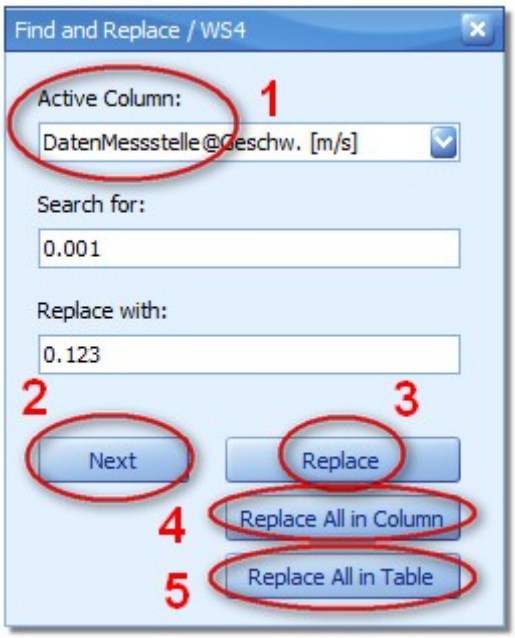


Figure 72: Find & replace dialog

The "Search for" value can be considered as follows: all values beginning with the stated sequence of numbers will be integrated into the search results. Therefore "0.0010" as well as "0.0016" are valid results for the pattern "0.001".
The "Next" button starts the search in the respective column and marks cells which might have been found. A click on "Replace" will replace the value in the currently selected cell by the value indicated in the "Replace with" field.
Use the option "Replace All In Column" (**4**) to carry out this action for the complete column selected.
To find and replace an entire table use the "Replace all In Table" (**5**) button.

8.6 Export to Excel

Data from tables can be exported directly to Excel workbooks in order to be used in other applications. Select the according "Export to Excel" dialog from the right-click context menu in the table component.

Figure 72 shows an example of this dialog.

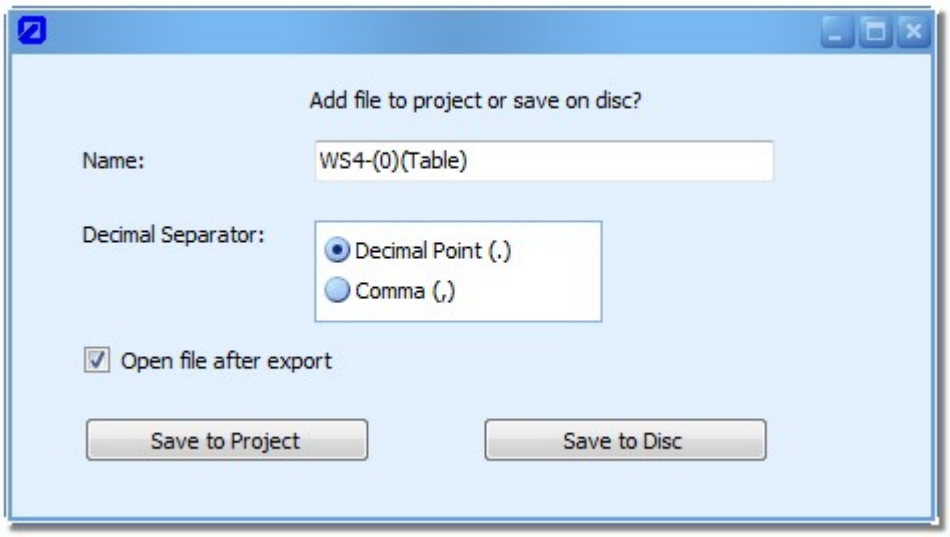


Figure 73: Export tables to Excel

The name for the newly generated file can be chosen freely. However it is recommended not to use blank spaces or special characters (same as file name). The decimal separator can be selected freely as well since the language set for Excel must not necessarily be the same as the language set for NivuSoft.
The resulting Excel file can be either associated with the accompanying measurement point (see Documents and Reports) or can be stored anywhere on your file system. Ticking the "Open the file after export" option will launch the Excel application (or similar) installed and opens the saved file.

8.7 Export to CSV

As described in the previous chapter the table contents can be saved as CSV-compliant files as well.
The configuration options are equal to the ones stated in the Excel export dialog (Chapter 8.6).

9 Scatter Graph

Scatter graphs serve to indicate the relation between two measurement series. A common format in hydraulics is the velocity / level ratio. Please find an example below.

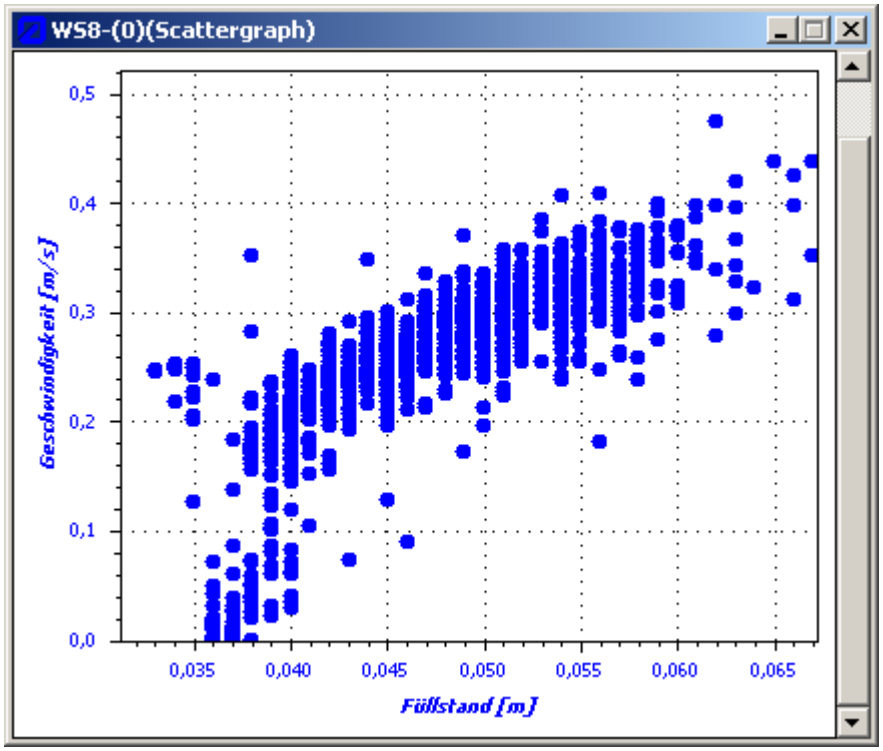


Figure 74: Scatter graph example

9.1 Generate

Two measurement series are required to generate a graph.
Create an empty scatter graph component by using the "Workspace → Components“ menu.
Two measurement series can be added to the new graph one after the other from the project tree by using "Drag & Drop" (the series must be parts of the same measurement point).
The scatter graph can be generated from table or a graph as well.
Select X- or Y-axis in the following dialog.

9.2 Scaling

The scale of a scatter graph can be modified similar to the method described in the graphics-component section. Apart from using direct mouse functions, it is possible to use also functions from the right-click context menu.

9.2.1 Zoom using the mouse

Define a virtual new display range (indicated by a rectangle featuring dashed lines) by clicking the left mouse key within the scatter graph. Releasing the mouse key will automatically fit Y- and X-axis scales mouse key to the new range accordingly.

In contrast to the graphics-module, using the mouse wheel will affect X- as well as Y-axis scales.

9.2.2 X-Axis scale

Set the borders of the X-axis in the right-click context menu of the scatter graph component. Modifications will instantly affect the current graph.

Enter values either directly or use the navigation keys to enter the values in steps of "0.01"

9.2.3 Y-Axis scale

See Chapter 7.8

9.3 Tilt axes

In some cases it may be advisable to change the display format of the current scatter graph or to switch the axes. This action can be executed by using the "Tilt curves" option from the "Curve properties" dialog found in the right-click context menu as described in Chapter 7.9.5.

10 Statistics Component

To evaluate or to assess measurement data it is an advantage to have a compact overview on the most important parameters available. The statistics-component provides two distinctive formats featuring functions as described in Chapter 6.1.
All functions described below can either be accessed from the right-click context menu within the statistics component or from the statistics tools menu.

10.1 Possibilities

Statistic-components can be generated from the "Workspace → components" menu. The measurement series can be now added to the new statistics-component one after the other from the project tree by using "Drag & Drop".
Statistics-components can be created from tables and graphs as well (see Figure 54).
On the one hand it is possible to compute "Total statistics" covering the period selected in the workspace and for each measurement series. The indication depends on the selected mode (see Chapter 10.2).
On the other hand it is possible to subdivide the chosen period in so-called intervals.
Interval statistics can be enabled optional since this function features increased computing requirements. This statistics will not be computed per default.

The following parameters can be shown within interval statistics:

- Average
- Total
- Minimum
- Minimum time
- Maximum
- Maximum time

These parameters have to be selected explicitly in the "Settings" dialog to be shown in the overview table in the "Interval" section.
Parameters regarding "Total statistics" can be configured using the NivuSoft options (see Chapter 4.4.3).

10.2 Table / tab view

"Total statistics" can be indicated in two different formats. The default setting is "Tabs", grouping all statistic parameters for a measurement series. The table mode represents the parameters of the individual measurement series in two dimensions.

10.3 Interval statistics

As described in Chapter 10.1 "Total statistics" can be subdivided in intervals. Select an interval prior to activating the "Interval statistics" option. The following parameters are available:

- 1 Hour: interval begins every hour on the hour
- 1 Day: statistics periods start at 00:00 o'clock and end at 23:59 o'clock on the same day
- 1 Month: statistics always refer to a calendar month

The following steps are required to indicate interval statistics:

1. The statistics component must contain one measurement series at least.
2. An interval period must be selected in the "Settings" tab.
3. The option "Activate" must be selected subsequently. Depending on size of the measurement series and the chosen interval computing may take a while. Clicking the "Abort" button in the progress bar allows to stop the computing process.
4. After computing has been finished (progress bar disappears) select the desired parameters to be compiled in the "Interval parameters" section.
5. The result will be shown in the "Interval" tab as soon as the desired parameters have been selected.

Since it may take a while to compute interval statistics the results can be saved. To do this click the "Save Interval Statistics" button from the statistics tools while the interval statistcs view is selected. Subsequently specify a name for the file in the following dialog. Depending on the type of statistics (hour, day or month) the new object will be assigned to the project tree in the according folder (see Figure 74).

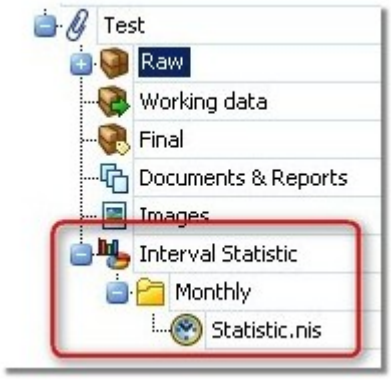


Figure 75: Saved interval statistics in the project tree

A double-click on saved interval statistics in the project tree generates a respective table. This table can be exported either as Excel or CSV format. The according functions can be found in the right-click context menu or in the statistics tools.

10.4 Export to Excel

Statistic results can be saved to Excel format using a method similar to the one described in the section "Table-Component". In the "Save" dialog you can choose between saving the Excel file in the "Documents and images" section of a project and saving it in the general file system of your PC. Ticking the "Open" option will open the file in Excel immediately after it has been saved.

10.5 Export to CSV

Chapter 10.4 basically describes the same functions applicable for CSV export as well.

11 Pocket Calculator Component

The pocket calculator component allows to perform simple arithmetic operations as well as complex calculations using Higher Mathematics.
To launch a new pocket calculator component select "Pcket Calculator" from the "Tools" menu in the workspace (see Figure 75).
A synchronised or empty calculator can be generated as well using the right-click context menu as described in Chapter 6.1.

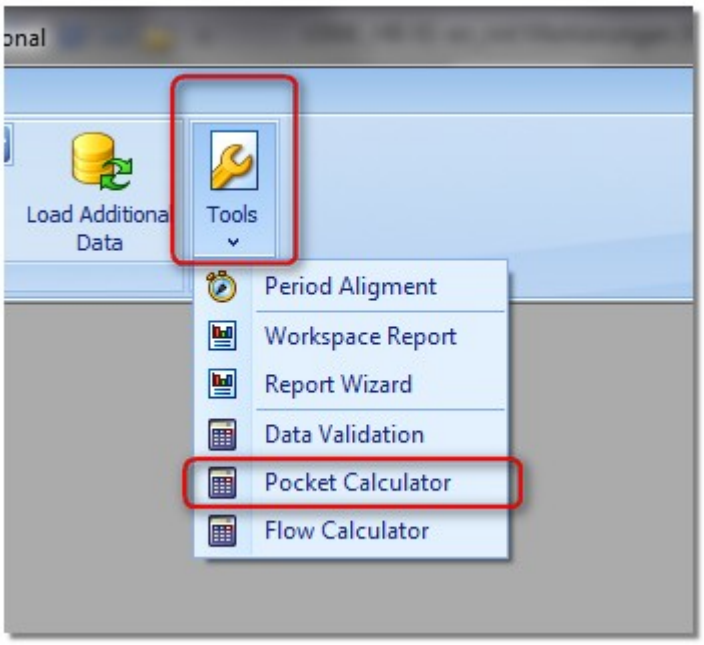


Figure 76: Starting the pocket calculator component

The pocket calculator can be used in two respects. On the one hand calculations using scalar values can be implemented. The result therefore is a scalar too and is indicated in the respective section of the calculator.
Moreover the calculator can be used to execute modifications or to perform calculations using measurement series (e.g. level offset + 1 cm).
The time series are available as variables within the calculator as soon as the calculator has been generated as synchronised component from a table or a graph. Results will be shown in the respective tables or graphs directly.

11.1 Calculator sections

Figure 76 presents the most important calculator sections:

1. Measurement series: indication or selection of all measurement series available in the workspace
2. Formula: enter calculation rules here
3. History: select preset formulas or recently used formulas here
4. Calculation result: this selection menu allows to specify a target for the results. It is possible to either generate a new measurement series or to save the result in a previously existing measurement series.
5. Calculation period: Enter the calculation period in the current workspace here. The input fields are connected to the graphic selection (see 7.3). Changes directly influence the following components of this workspace accordingly.
6. Standard-Arithmetic: visually enter numbers and simple arithmetic operations
7. Higher Mathematics: Visual entry module for advanced mathematic operations or trigonometric functions
8. Button to start computing

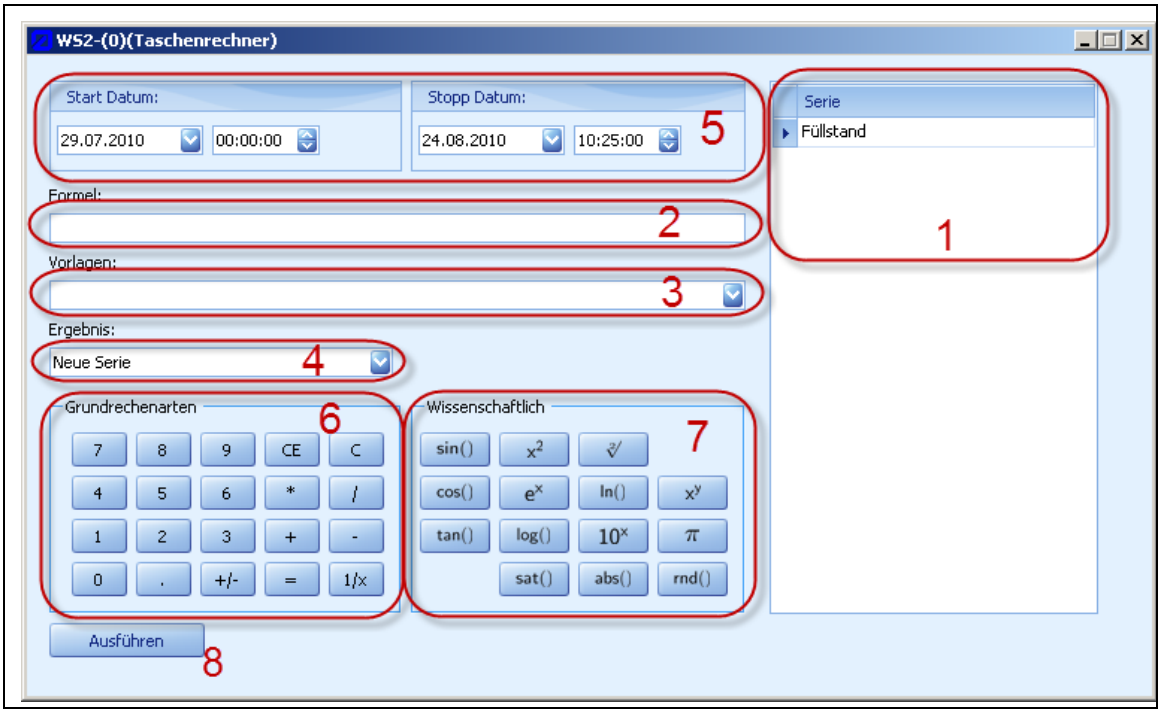


Figure 77: Sections of the calculator component

The standard-arithmetic section furthermore features the following functions available for more comfortable operation:

- „**CE**“: activates the formula editor and cancels the character at the rightmost position of the formula
- "**C**": cancels the contents of the formula field completely

11.2 Add Measurement Series

The measurement series are already available as soon as the calculator has been generated as a component synchronised to a previously existing workspace.
Measurement series can be added from the project tree to the according area (see Figure 76) using "Drag & Drop" if an empty pocket calculator component has been generated.

11.3 Syntax

The syntax to define calculation rules is very intuitive and is moreover supported by particular mouse actions.
To associate a measurement series with the current calculation rule enclose the name of the measurement point into '**<**' or. '**>**' tags. A double-click on a measurement series in the "Series" section ("Measurement series" in Figure 76) will add the according series to the formula field (see Figure 77) at the cursor position using the correct syntax.

The calculation result per default generates a new series using the name "*mx$*". If the result shall be applied to to a measurtement series already existing, select the desired series in section 4 found in Figure 76. Using an equal sign "=" in the formula field is not allowed. Other wise the message window will show an error message.

A possible formula might be as described below:

- `<Seriesname> * 9`

Possible arithmetic operations and the according syntax are:

- '**+**': plus operator can be entered directly
- '**-**': minus operator can be entered directly
- '*****': multiplication operator can be entered directly
- '**/**': division operator can be entered directly
- '**+/-**': inverts the sign of all values in a series
- '**1/x**': inverts each value of a measurement series

Manual calculation might be represented in the formula field of the calculator as shown below:

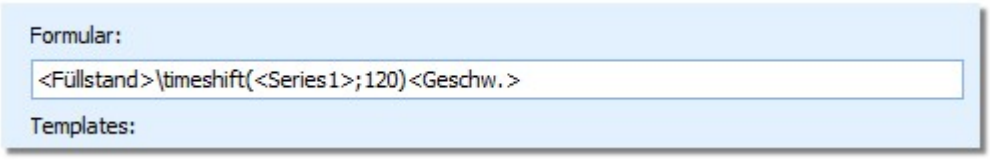


Figure 78: Formula syntax example

IMPORTANT:

The user is responsible for the conversion of physical values since automatic conversion is not available.

Advanced mathematic functions are:

- `\sin(x)`: sine of value or series x
- `\cos(x)`: cosine of value or series x
- `\tan(x)`: tangent of value or series x
- `\x2(x)`: square of x or each element of series x
- `\pow(x;y)`: x to the y (scalar as well as series)
- `\exp(x)`: value of exponential function for value or series x
- `\log(x)`: logarithm of 10 of value or series x
- `\sqrt(x)`: root of value or series x
- `\ln(x)`: natural logarithm of value or series x
- `\10e(x)`: 10 to the x
- `\abs(x)`: amount of value or series x
- `\sat(x;y)`: saturation of value or series x on the amount of y
- `\rnd(x;y)`: rounding of value or series x on the number of decimal places y

The following methods may be used in addition to the methods found in the "Higher Mathematics" section to be entered directly in the "Formula" field:

- `\asin(x)`: arc sine of value or series x
- `\acos(x)`: arc cosine of value or series x
- `\atan(x)`: arc tangent of value or series x
- `\u_fts(x)`: converts value x from m³/s to ft³/s
- `\u_ft(x)`: converts value x from m to ft
- `\u_fps(x)`: converts value x from m/s to ft/s
- `\u_f(x)`: converts value x from °C to °F
- `\u_m3s(x)`: converts value x from ft³/s to m³/s
- `\u_m(x)`: converts value x from ft to m
- `\u_mps(x)`: converts value x from ft/s to m/s
- `\u_c(x)`: converts value x from °F to °C
- `\timeshift(x;y)`: all time values from measurement series x are shifted by y seconds

11.4 Execute

A click on the "Execute" button will check the characters in the "Formula" field. An according message will be shown (see Chapter 4.3.5) if syntax errors or unknown characters should be detected.

The result will be applied to the selected measurement series temporarily and will be not saved actually before the workspace has been closed. Alternatively use the button "Save" in the workspace menu (see Chapter 6.3.1) to save results.

12 Tools

12.1 Period alignment

Use the function "Period alignment" in order to reduce the data volume of measurement series in NivuSoft. To apply this function, first select one measurement series in the workspace at least. Start the function from the "Workspace" menu under "Tools".
Select or set any value you wish to use in the "Time" field to be considered as fixed period between all measurement values after computing. Only whole numbers can be used.

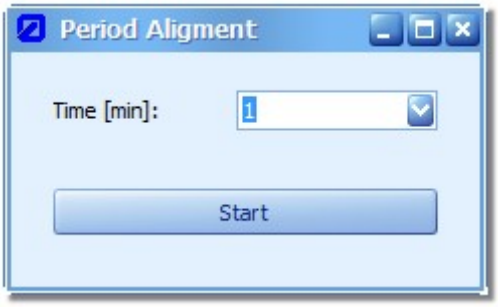


Figure 79: Entering the target measurement value distance

The linear interpolation approach is used in order to compute the data points.

12.2 Reporting

The integrated NivuSoft reporting function can be used for documentation of current workspaces or for standardised representation of certain recurring events.

12.2.1 General report wizard

The general report wizard can be used independent from a workspace (there is no need to have a workspace open as well).
Launch the wizard from the "Tools" option in the "Workspace" menu (see Figure 79).

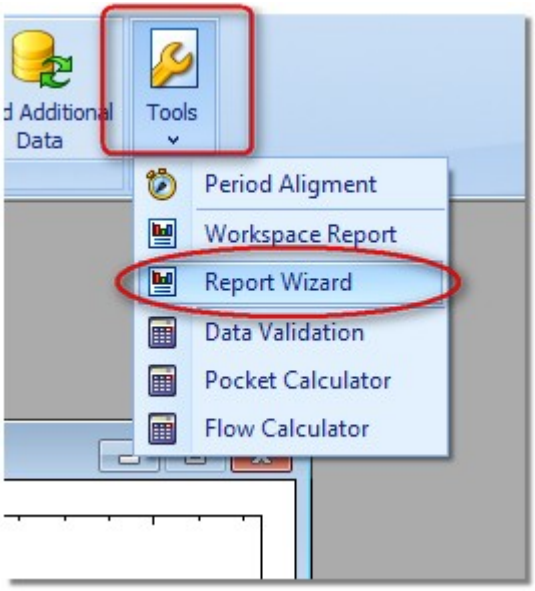


Figure 80: Starting the general report wizard

After the start of the report wizard a dialog (similar to Figure 82) appears. Apart from "Global report settings" the report structure already contains a measurement place and a container.

Execute the following steps for report configuration:

1. The configuration of workspace views can be implemented by selection in the report structure and the options described in Chapter 12.2.3.
2. The range as well as the look of a report can be defined by choosing "Global report settings" (see Chapter 12.2.3.2).
3. The container serves for the administration of measurement series and components as described in Chapter 6. Measurement series from the project tree can be added to the current container in the "MS" section as soon as the container has been selected by using the "Drag & Drop" function in the report structure (see Figure 80). Please find a thorough description of the container functions in Chapter 12.2.3.4.
4. Components such as graphs, tables, statistics or text labels can be added to each container. To do this, first select the container in the report structure. The currently chosen component can now be added by using the "**+**" icon in the "Components" area. Please observe that each container can contain always only one component of the same type. The one exception is the text label.
5. The properties of the currently selected component may be modified by choosing in the report structure and using the options described in Chapter 12.2.3.7 to Chapter 12.2.3.10.
6. Clicking on "Create report" after the configuration has been finished generates a preview.

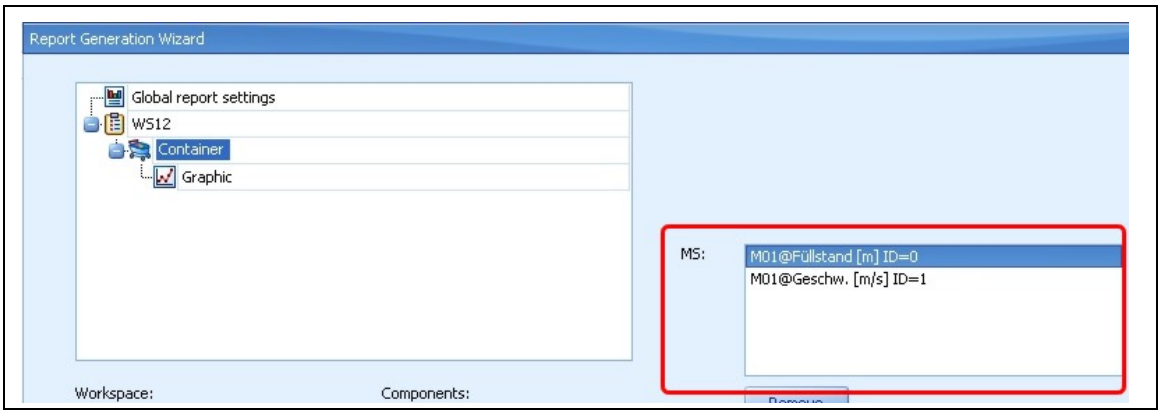


Figure 81: Adding a measurement series to the container

12.2.2 Report for current workspace

A workspace can be shown in the report wizard using his structure as soon as it has been generated previously (see Chapter 6). To achieve this select a component of the desired workspace and utilise the option "Report workspace" from the "Workspace → Tools" menu subsequently.

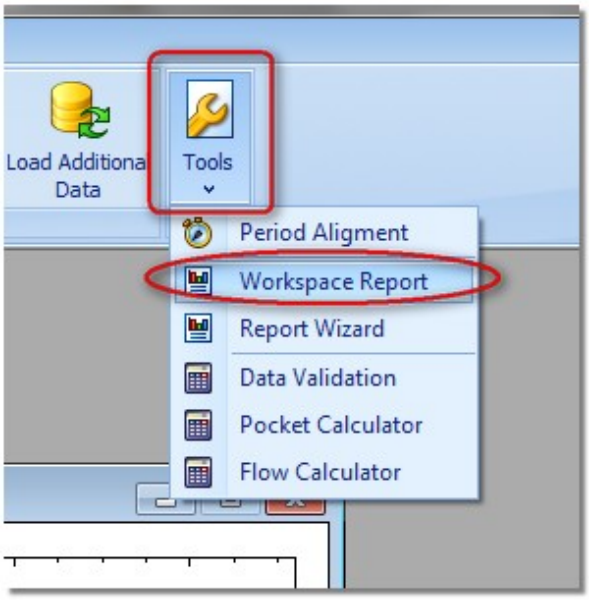


Figure 82: Starting the workspace report wizard

For further processing or report generation the methods described in this chapter can be used.

12.2.3 Elements of the report wizard

Basically all templates to create standard reports feature the same structure. Figure 82 presents the basic sections of the report wizards.

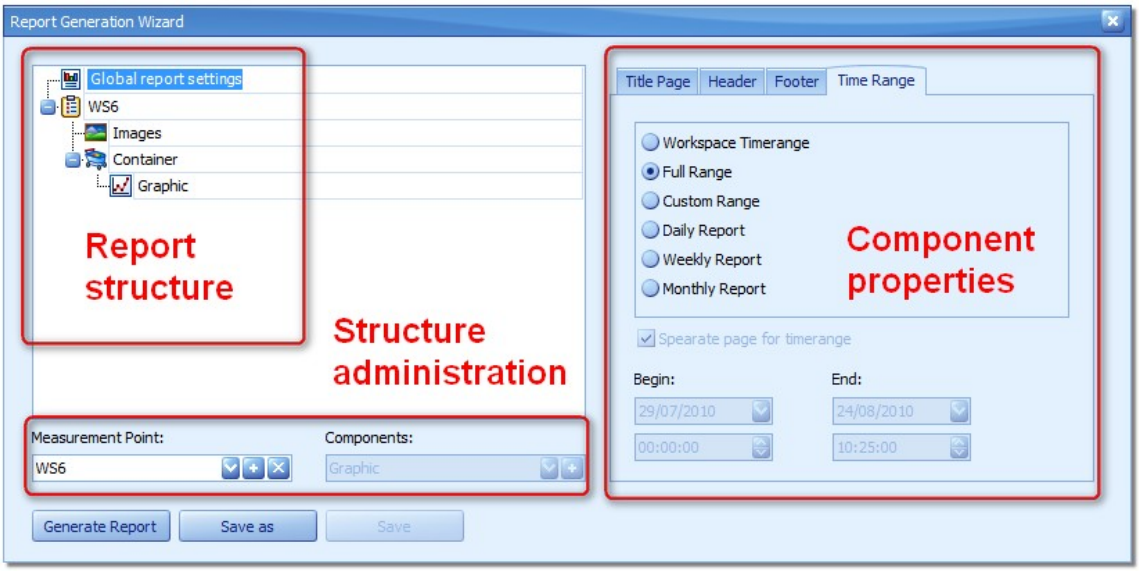


Figure 83: General structure of all report wizards

The structure of the current report is indicated in the "Report structure" section. The structure corresponds with the structure of a workspace (see Chapter 6.1).
Section "Component properties" shows all possible configuration options depending on the element selected within the report structure.
Use the buttons in the "Structure management" section in order to add new elements to the report structure.

12.2.3.1 Report structure elements

The following steps explain the functions as well as the configuration options for the elements selected in the report structure.

12.2.3.2 Global report settings

Global settings refer to general settings regarding the report.
The first tab in the "Component properties" section allows to define the options for the presentation of the report front page.

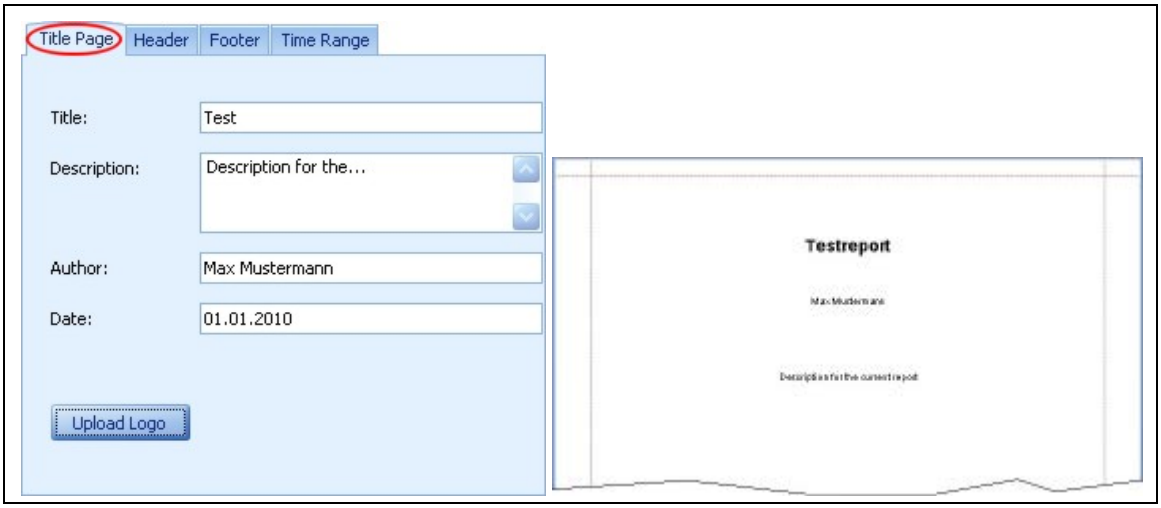


Figure 84: General report configuration

The sections "Title", "Description", "Author“ and "Date" allow to enter any sequence of characters. Use the "Upload logo" button to present a company logo on the front page.
Figure 83 shows the title page configuration dialog on the left hand side. The right hand side presents the according title page after the report has been generated.

Headers and footers of the reports are subdivided in the parts left, center and right. By completing the respective input fields the text will be indicated accordingly.

IMPORTANT:

The area "Footer → Right" is used for page numbering per default. Entering values here will overwrite the page number which hence will not be shown in this case.

The "Time range" section can be used to determine the range or the format of the report.

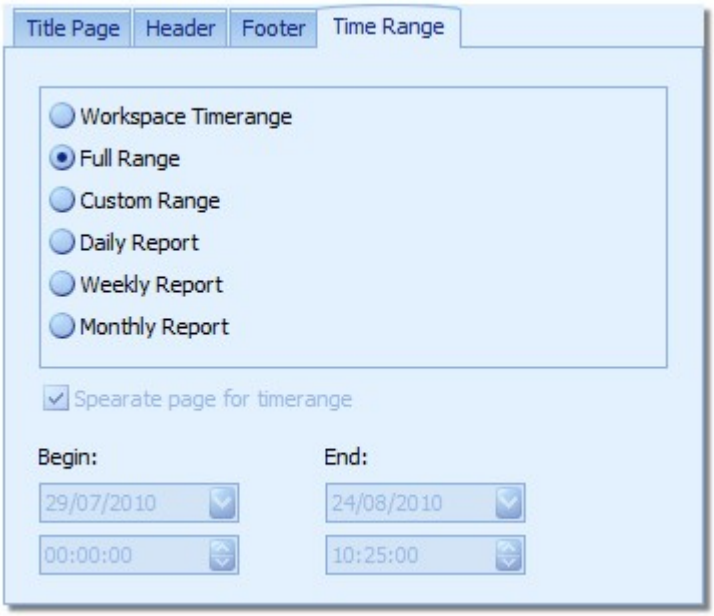


Figure 85: Configuration of report time rang

The available options are as follows:

- Time range of workspace: the dates from section "Workspace → Time navigation“ (see Figure 57) will be used
- Full range: the earliest as well as the latest date of all measurement series within the workspace are used
- Custom range: Settings can be defined by the user
- Daily report: Data output in 24 h-groups based on the start date
- Weekly report: Data output in 7-day-groups based on the start date
- Monthly report: Reports are based on calendar months
- For the options daily, weekly or monthly report at the beginning of each period the documented time range is indicated. Use the option „Separation page for time ranges“ to add an additional page. If this option has not been selected the respective time range will be shown on the first page of the documented component.

12.2.3.3 Measurement Point

The Measurement Point is the central component to manage all data which are to be visualised and documented commonly.
Use the "**+**" option (see Figure 85Figure 85) in the structure management area to generate a new workspace within the report structure. Select the respective workspace in the structure management section and press "X" to remove the workspace.

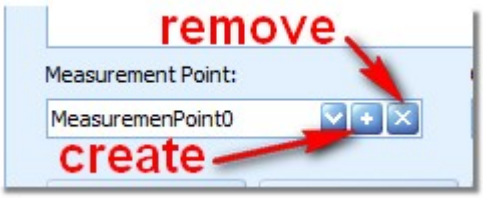


Figure 86: Create and remove a measurement point

The beginning of a new measurement point within a report can be highlighted by using a separate front page. Select the respective measurement point and enable the "Separate title page" option from the component properties menu. Enter the front page title in the active input mask subsequently (see Figure 86).

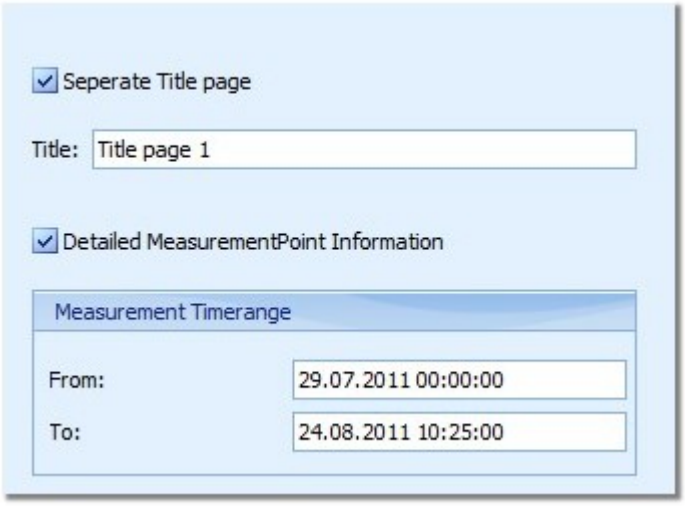


Figure 87: Configuration parameter for a measurement point

Use the option "Detailed Measurement Point Information" to add information managed under Chapter 5.4.5.2 to the report. This information is shown on an extra page at the beginning of the according report section.

12.2.3.4 Container

Multiple containers can be generated within a measurement point as described in Chapter 6.1. The container contents may differ however the containers are synchronised regarding temporal respects.
Containers can be created by using the Components menu. To do this, select the type "Container" from the dropdown menu (see Figure 87). The basis for this action is to select the desired measurement point within the report structure.

Figure 88: Adding a container to the current report

To delete a container select the desired element in the report structure. In the options section of the report structure the container can be deleted by clicking the "x".

Figure 89: Removing containers in the options section

A container can be shifted within the structure (and hence within the report) by using the arrow keys in the options section.
All associated measurement series of the currently chosen container are indicated in the "Component properties" window. Add measurement series to "MS" from the project tree using the "Drag & Drop" method. The currently selected measurement series can be removed from the container again by clicking the "Remove" button.

12.2.3.5 Geometry

A geometry can be assigned to each measurement point. The properties of the geometry can be entered by using the components menu.
To set how the geometry is to be represented within reports first select the geometty in the report structure. The according configuration dialog will be shown subsequently.
The geometry documentation basically consists of four subgroups:

1. Geometry summarised as table als Tabelle
2. Schematic representation of the shape of the geometry
3. Duscharge curve (based on the configured values)
4. Table of breakpoints (based on the configured values)

The single subgroups can be shown or hidden in the report (see Figure 89).

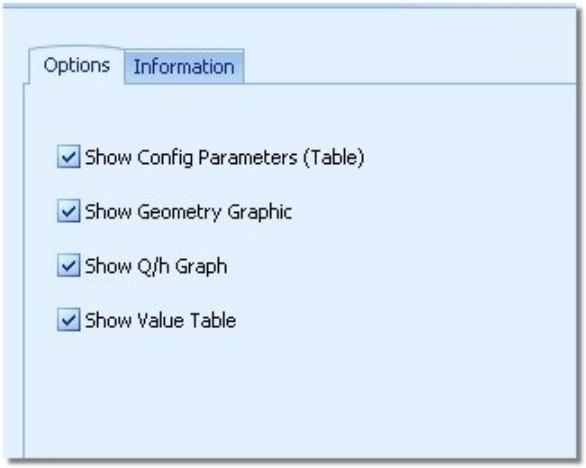


Figure 90: Geometry options within a report

In addition to the subgroups described before it is possible to create a title page for the geometry documentation. The title page will be indicated only as soon as a text has been entered in on of the input fields in Figure 90.

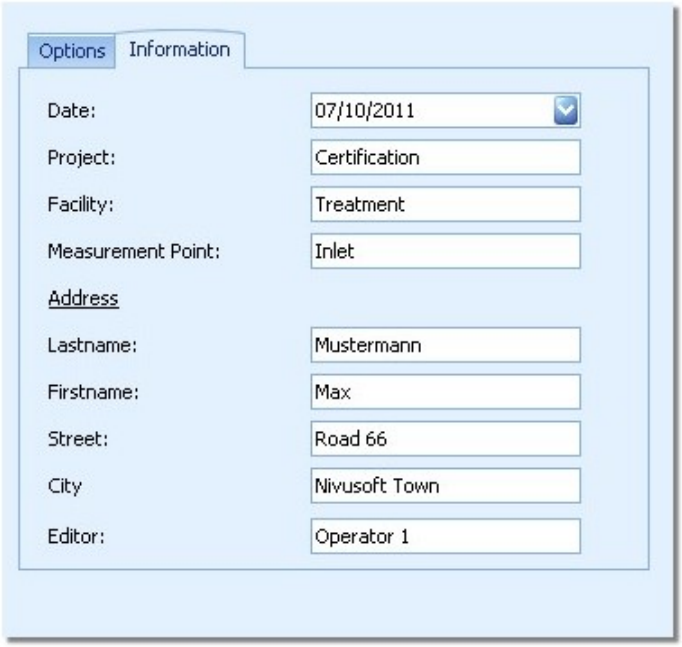


Figure 91: Configuring the title page of the geometry documentation

12.2.3.6 Images

Images for documentation purposes can be assigned to each measurement point. It is possible to add images of all measurement points in the current project to an according report. Select the image icon in the report structure for configuration. The accompanying dialog will be shown in the componets properties area.

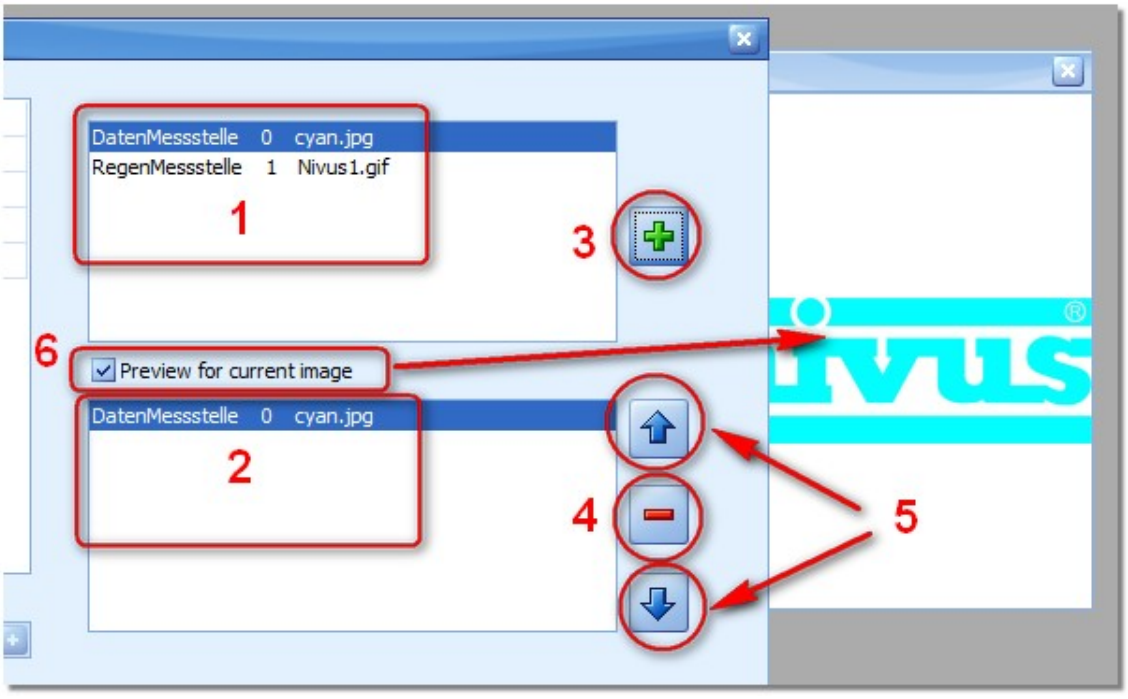


Figure 92: Configuration options for images within reports

The sections marked in the figure above have the following functions:

1. All images of the active project (of all measurement points) are shown here. The entry consists of three elements: the first part indicates the name of the original measurement point, part two indicates the internal ID of the measurement point and part three specifies the image file name.
2. Here all images used in the current report are shown.
3. Using the "Plus" button it is possible to add the image selected in section (**1**) to the current report (section (**2**)).
4. Use the "Minus" button to remove the image selected in section (**2**) from the current report.
5. Use the arrow buttons to change the position of the image selected in section (**2**) within the report.
6. Ticking the option "Preview for current image" will show the image selcted in section (**1**) in a separate preview window. The preview window can be positioned freely and will be closed as soon as the option will be unticked.

12.2.3.7 Graphs

In order to add graphs to the container, choose the desired container within the report structure. Select the graphics-component in the "Structure management" section and add the graph by using the "**+**" icon.

Figure 93: Creating a graphics-component

A graph can be removed from the report structure by selecting and using the "X" icon from the options area. Use the arrow keys in the options section to move graphs.

The following options are available for the documentation of graphs:

- Scaling: The following options are available to scale the respective Y-axes in the chart:
  - „Min/Max scaling“: The Y-axes of a measurement series are scaled to the minimum or maximum values of the complete measurement in all generated charts.
  - „Auto scaling“: The Y-axis of a measurement series will be scaled to the according minimum or maximum value contained within.
  - „Workspace scaling“: The scaling options of the graphs from the workspace area will be used.
- "Rotate graph": Graphs are presented in portrait format as standard. This option allows to shift to landscape format
- "Use caption": Each graph within a report is consecutively numbered. The text entered in the "Caption" field will be shown additionally as soon as this option has been chosen.

12.2.3.8 Table

Tables can be managed within the report structure using the same methods as described in the "Graphs" section in Chapter 12.2.3.7.
The following options are available for the documentation of tables:

- "Use caption": Each table within a report is consecutively numbered. The text entered in the "Caption" field will be shown additionally as soon as this option has been chosen.

12.2.3.9 Statistics

Statistics can be managed within the report structure using the same methods as described in the "Graphs" section in Chapter 12.2.3.7.
The indicated parameters of the "Total statistics" can be configured by using the global NivuSoft settings (see Chapter 4.4.3).
The following options are available for the documentation of tables:

- In addition to the overview statistics for each measurement series within the workspace it is possible to configure interval statistics. For configuration options please refer to Chapter 10.3.
- "Use label": Each statistic within a report is consecutively numbered. The text entered in the "Caption" field will be shown additionally as soon as this option has been chosen.

12.2.3.10 Text field

Text fields can be created in order to define individual text messages within reports. Text fields can be managed within the report structure using the same methods as described in the "Graphs" section in Chapter 12.2.3.7.
The text field has the following configuration options available:

- "Text": Text field content
- "Use caption": Each text field within a report is consecutively numbered. The text entered in the "Caption" field will be shown additionally as soon as this option has been chosen.

12.2.3.11 Generate report

A report preview can be created as soon as the report configuration has been executed successfully. A click on the "Generate report" button initiates the generation process and the current status is shown in the according window (see Figure 93). The generation process can be aborted by pressing the “cancel” button.

Figure 94: Status bar during report generation

12.2.3.12 Report preview

The report preview mode is launched automatically as soon as the report has been generated successfully. Check here of the report has been generated as expected or if you wish to modify configuration settings.

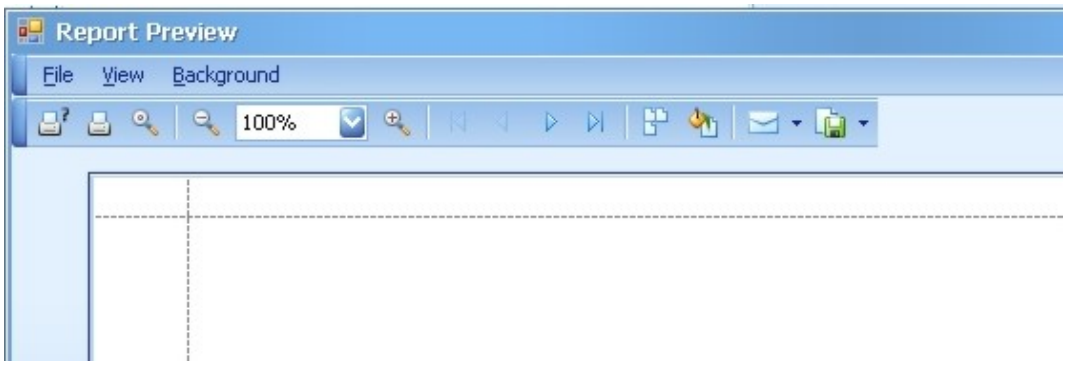


Figure 95: Possible options in report preview

The range of functions in the preview manager mainly is self-explanatory. Reports can be either printed directly or saved as PDF files. Reports can be sent directly via e-mail as PDF files by simply clicking the "Mail" button.

12.2.3.13 Save as

A report can be overwritten after it has been possibly modified if it has been opened from the project tree (double click) (Chapter 12.2.3.14). To create a new report file use the "Save as" button.

12.2.3.14 Save

Initially generated reports (which have not been opened from the project tree) can be saved. To achieve this press the "Save configuration" button in the bottom left hand dialog area after the report configuration has been finished. A name for the report template can be entered in the following dialog. The configuration will be saved in the "Documents and reports" section of the measurement point, whose measurement series has been added first. The measurement point of the workspace is used therefore for workspace documentation.

12.2.3.15 Open

Previously saved report configurations can be reopened from the project tree with a double click on the according file in the "Documents and reports" section of the respective measurement point. The report wizard opens up directly by selecting the time range for the report. Recurring reports hence can be generated very quickly.

12.3 Data Validation

See Chapter 13.

12.4 Pocket Calculator

See Chapter 11.

13 Data Validation

Apart from the pocket calculator component (see Chapter 11) used for general mathematic operations there is a hydraulic calculator at your disposal. This component covers essential hydraulic standard calculations and furthermore provides a vast number of additional options.

13.1 Start

Start the Data Validation from the "Workspace → Tools“ menu (see Figure 95). In contrast to the previously introduced components (see Chapter 6) the hydraulic calculator is not associated with a workspace but switches the according input masks depending on the selected workspace.

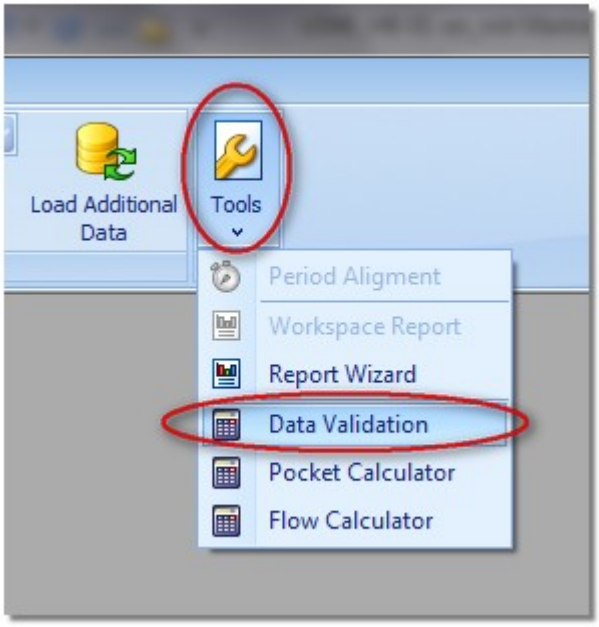


Figure 96: Starting the Data Validation

The Data Validation opens in a dock panel (see Chapter 4.3) and can be placed freely on the NivuSoft interface.

13.2 Idea

The implementation of the Data Validation is based on a three-step approach. The functions behind the "Validation" and "Apply" tabs can be used to process single measurement series (normally level or flow velocity).
The "Quantity Calculations" menu provides the possibility to perform volume calculations by utilising weir functions or by selecting the channel shape and entering the level and flow velocity measurement series.
In order to effectively operate the Data Validation first define a workspace (a graph is best) which contains all measurement series required for computation. The workspace can be modified later at any time.
Figure 96 shows the essential sections of the Data Validation.
Choose the required measurement series depending on the selected method (e.g. Manning – Strickler). The pull-down menus in the "Basic measurement series" section provide the measurement series available in the workspace.

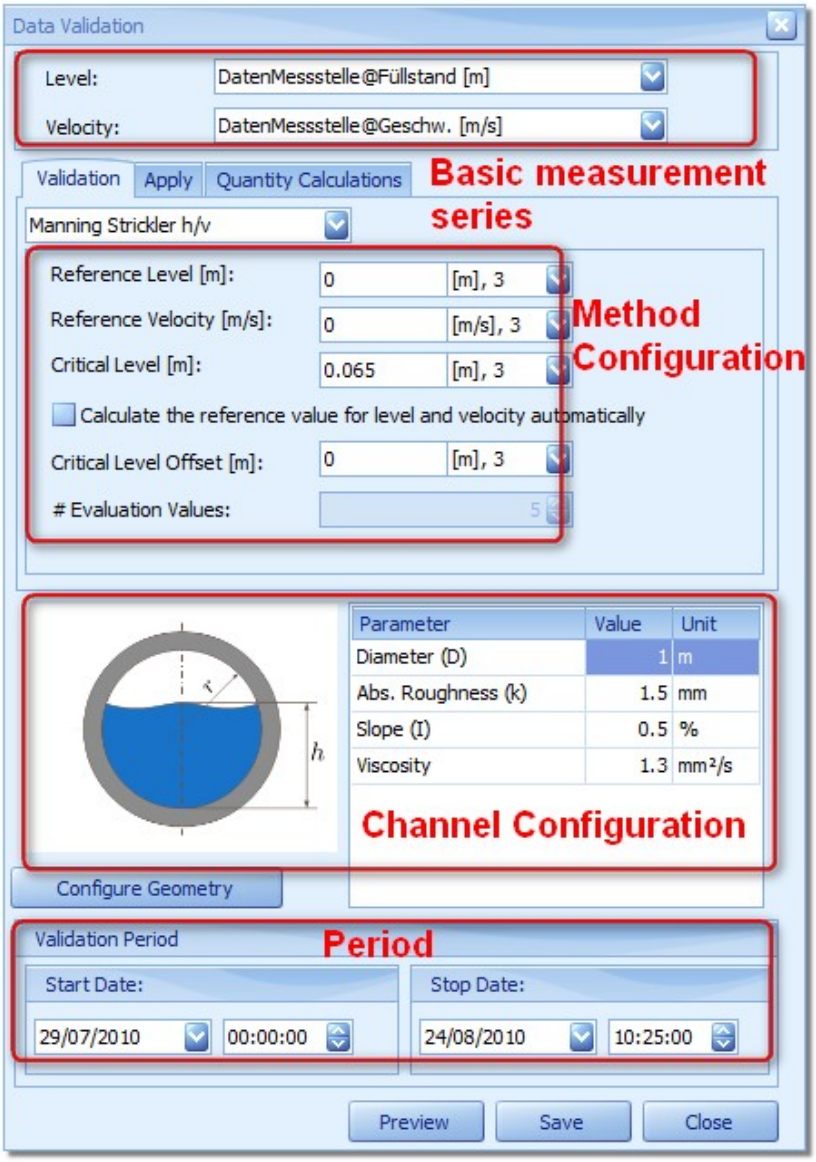


Figure 97: Essential sections of the hydraulic calculator

Independent from the selected function (validation or quantity calculation), the required parameters are shown in the "Method configuration" area depending on the chosen method. In many cases there are initial values available in the fields.
Depending on the selected method it may be necessary to set values for the corresponding dimensions of the measurement point, which can be carried out in the "Channel configuration" area. If dimensions of the measurement point within the workspace should have been set previously, the respective measurement point will be preset in all corresponding dialogs.

In the "Validation Period" section it is possible to determine values regarding the preview or the application of the configured methods. To graphically select the period use the functions from the "Range" (see Chapter 7.3) group.

13.2.1 Validation

The "Validation" section provides options to validate, to smooth or to complete current data sets. Available options are:

- Replace values
- Linear Interpolation
- Peak processing
- Scatter graph
- Manning-Strickler
- Automatic Manning-Strickler
- Dynamic Manning- Strickler

The tasks or the available configuration parameters will be described in the following chapters. In the hydraulic calculator choose the "Validation" tab (see Figure 97) and subsequently select one of the available options for data validation.

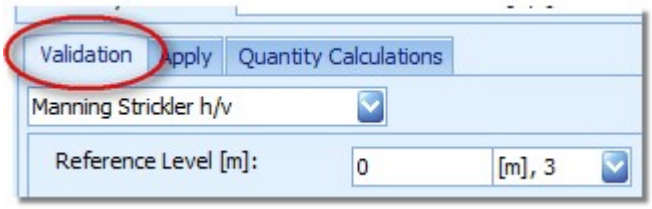


Figure 98: Validation configuration

Computation will be carried out after the desired parameters have been set and the "Preview" button has been pressed. The temporary result is shown in all active working components of the current workspace. The results can now be validated visually.

If the results should be as expected save the parameters in the hydraulic calculator by using the "Save" button. To generate new measurement series from the results or to modify existing series switch to the "Apply" dialog (Chapter 13.2.2).

13.2.2 Apply

An according entry can be found in the list as soon as a method in the "Validation" section has been configured and saved successfully. Each entry provides information on the selected method as well as the period the method has been configured for.

IMPORTANT:

*The period in the line of the according method is **NOT** the period of application! This period must be determined separately in the time range dialog.*

The result can be optionally saved either in a new measurement series or in a previously existing series. Choose a respective series in the "Target" section.

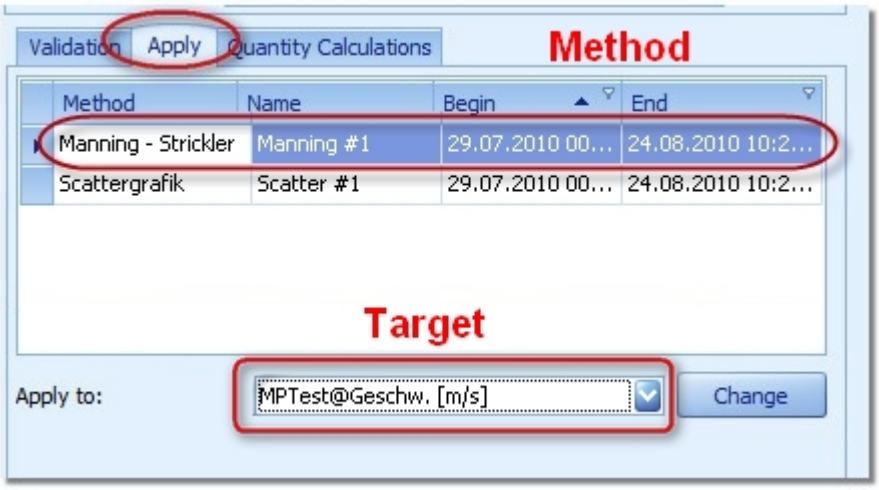


Figure 99: Apply configuration

The button "Calculate" enables the configuration and causes the temporary result to be indicated in the workspace.

Pressing the "Change" button opens the "Validation" dialog. The corresponding settings of the chosen calculation method made in the "Apply" section are entered automatically.

IMPORTANT:

Modifications are not available in the "Apply" section before they are saved again.

13.3 Possible Channel Configurations

Configuring a geometry as a calculation basis is described in Chapter 14.

13.4 Validation

The following sections describe the different methods used for "Validation" and explain the possible configuration parameters as well as the according relevance.

13.4.1 Replace values

This function allows to 'replace' certain sections of data within a series by previously existing measurement data. Choose the desired measurement series from the "Working Series" selection. The period selected in the "Validation" section represents the source for replacement. Select the target period where data shall be copied to in the "Apply" dialog. The following situations arise if source and target period should not exactly correspond with each other:

- Target period longer than source period: only data within the source period will be replaced as of the start date.
- Target period shorter than source period: only data within the target period will be replaced as of the start date.

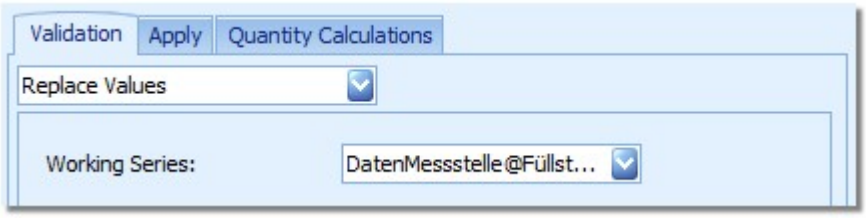


Figure 100: Dialog for data replacement within measurement series

13.4.2 Interpolation

Gaps occurring within measurement series can be filled thanks to the aid of the interpolation method. In this case, it is a linear interpolation approach to investigate values at certain point in time.

IMPORTANT:

To define a measurement series up to three spaces between measurement data will be investigated without being interpreted as gaps. These sections are not going to be changed through the interpolation algorithm.

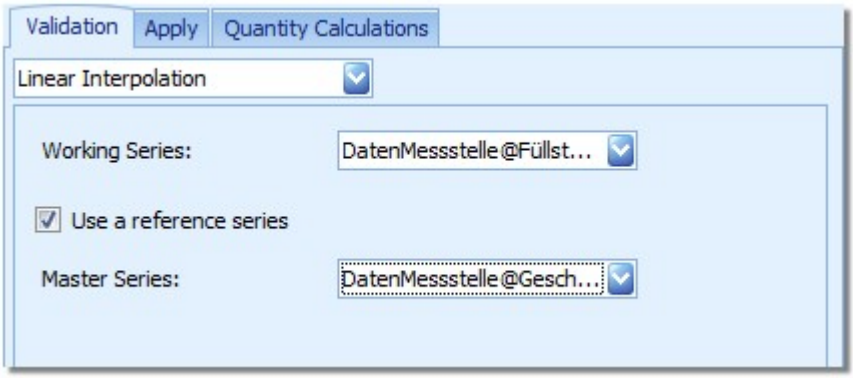


Figure 101: Interpolation dialog

Ticking the "Use a reference series" option allows to use the time axis of a different measurement series as interpolation reference.

If for example the measurement series "M01@Geschw. [m/s]" in Figure 100 should contain gaps which can be filled up by using the measurement series "M01@Füllstand [m]", the time stamp will be inserted into "M01@Geschw. [m/s]" and the interpolation will be carried out with the aid of the both nearest data points. In this example "M01@Füllstand [m]“ serves as time axis reference only! The real measurement values here are not important.

13.4.3 In-Band Validation

This method allows to smooth out measurement data fluctuations within measurement series. In the "Working series" section choose the measurement series to be checked. The values "Δ Max Abs" or "Δ Min Abs" indicate the maximum/minimum permissible changes between two consecutive measurement values. The algorithm activates if the change overshoots the value set.

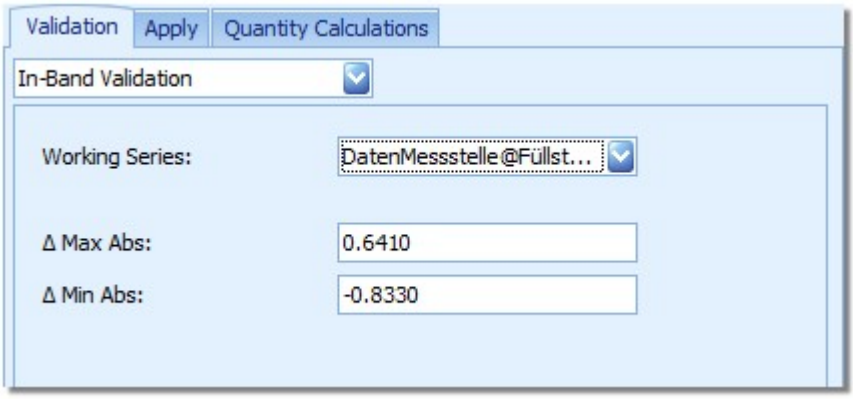


Figure 102: Configuration of in-band validation

The following action will be carried out as soon as the algorithm has detected a point higher than the value set:

An average will be computed from the three values right before the point of overrun. The determined average value then will replace the point of overrun.

13.4.4 Scatter graph

The ratio between filling level and flow velocity is a significant hydraulic relation. An accumulation of constellation points along a certain line can be observed while plotting each characteristic in a scatter graph as long as reliable readings have been used.

The scatter graph method by using the regression analysis creates a polynomial graph for a closed function, which approximates closest to the trend line.

The following regression approaches are available:

- Logarithmic approach: $v = a*\ln(h) + b$
- Linear approach (1st order): $v = a*h + b$
- Square approach (2nd order): $v = a*h^2 + b*h + c$
- Cubic approach (3rd order): $v = a*h^3 + b*h^2 + c*h + d$

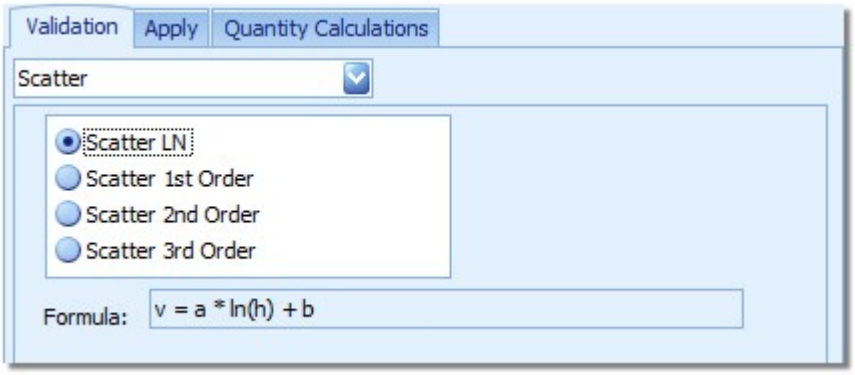


Figure 103: Dialog for scatter graph method

The results are shown in the "Formula" field after the equation has been solved by clicking "Preview". The formula indication serves for documentation purposes or for further processing in external applications

The results of the regression analysis will be indicated also visually as soon as the current workspace contains a scatter graph including the measurement series "Filling level" and "Velocity".

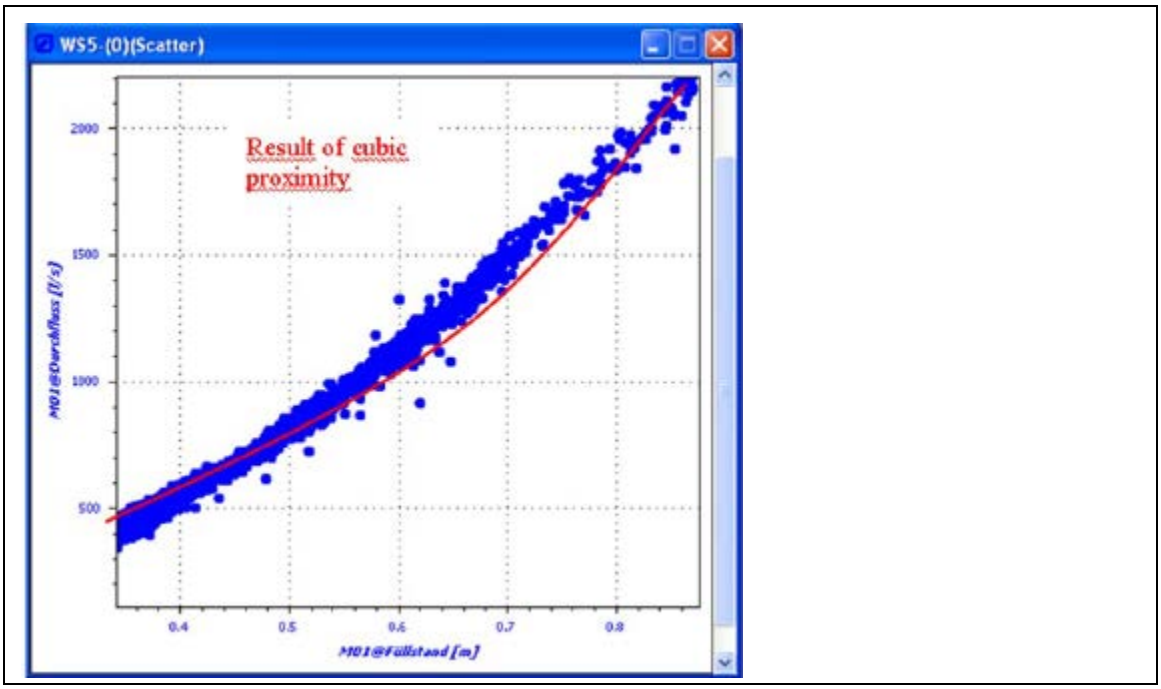


Figure 104: Graphic result of cubic scatter graph method

13.4.5 Manning-Strickler

A theoretical velocity is determined by means of the classic Manning-Strickler approach, which uses the current filling level and the channel shape as well as the according dimensions.

Parameters required for configuration are:

- Slope
- standard values for certain channel types
- Channel geometry: see 14.1.5 to 14.1.10. The selection contains the nesaccary information for slope and Manning-Strickler coefficient or roughness

Figure 105: General Manning-Strickler approach

13.4.6 Manning-Strickler h/v

The automatic Manning-Strickler function derives the product of the factors slope and Strickler-coefficient from actual measurement values. The method provides two different approaches to achieve this:

- Directly enter a pair of values for filling level and velocity
- To determine the factors, from a configurable number of measurement values out of the current measurement series the average value is calculated. The sum of "Critical Level Offset" and "Critical Level“ defines the point required for averaging. This allows to use more stable velocities from upper level areas for calculation purposes.

All values of the complete level measurement series are scanned now. A theoretical velocity value, which replaces the according value in the velocity measurement series, is determined utilising the Manning-Strickler formula and the respective coefficient as soon as a value below the "Critical Level" has been found.

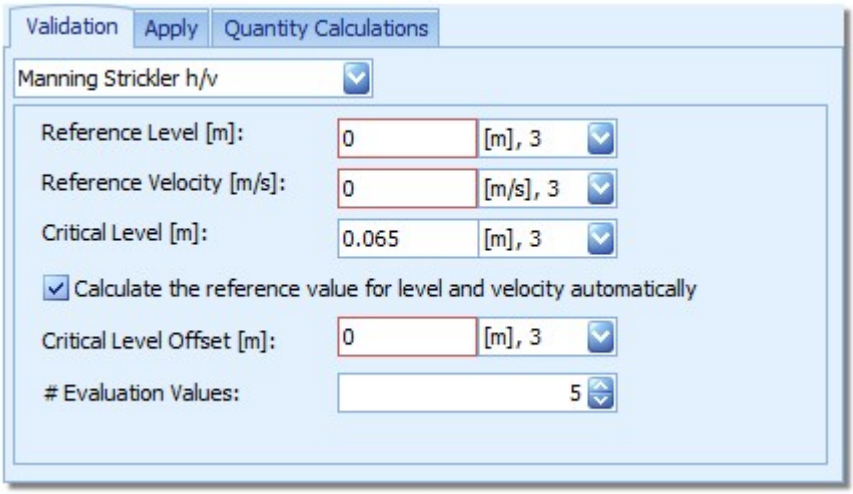


Figure 106: General Manning-Strickler approach

13.4.7 Dynamic Manning-Strickler (DMS)

The dynamic Manning-Strickler (DMS) is a highly innovative algorithm. The inner conditions are adapted permanently while being applied during the further processing of measurement data, which results in smoothed or filtered flow velocity measurement data.

Parameters required for calculation are:

- "#Values for start condition": number of values for determination of the start conditions for the iterative process
- "#Values damping": number of breakpoints needed to quantise the height indication within the damping
- "#Values for abort": if the filling level falls below the critical level set, the calculation will abort after the number of following measurement values determined here

- "#Gaps for abort": the algorithm will be terminated after n gaps if multiple gaps should be contained within the data set
- "Hmin": Value for possible termination of algorithm
- "Threshold": Percentage deviation for algorithm trigger point
- "Hcrit": Adaptation of Hmin

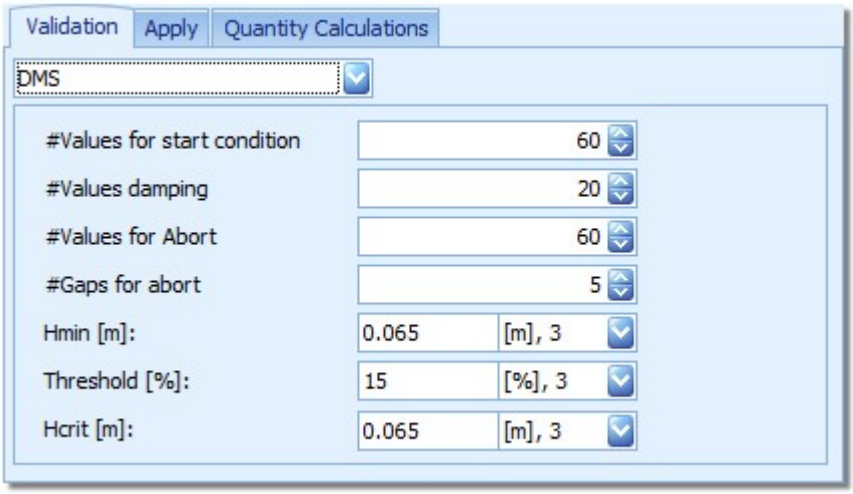


Figure 107: Configuration dialog for dynamic Manning-Strickler approach

13.5 Flow calculations

Regarding the active geometry the flow will be calculated based on the selected measurement series for the filling level and the velocity. A click on "Apply" will add the result to the current workspace. The result will be also shown within the workspace components.

14 Flow Calculator and Geometry Adminitration

The Flow Calkulator takes several important tasks within the NivuSoft. These are:

- Definition and Configuration of Channel and Weir geometries
- Q/h Data
- Pocket Calculator
- Adjustment Certification

Prior to detailed information on the individual functions please find the sections and general functions of the flow calculator below.

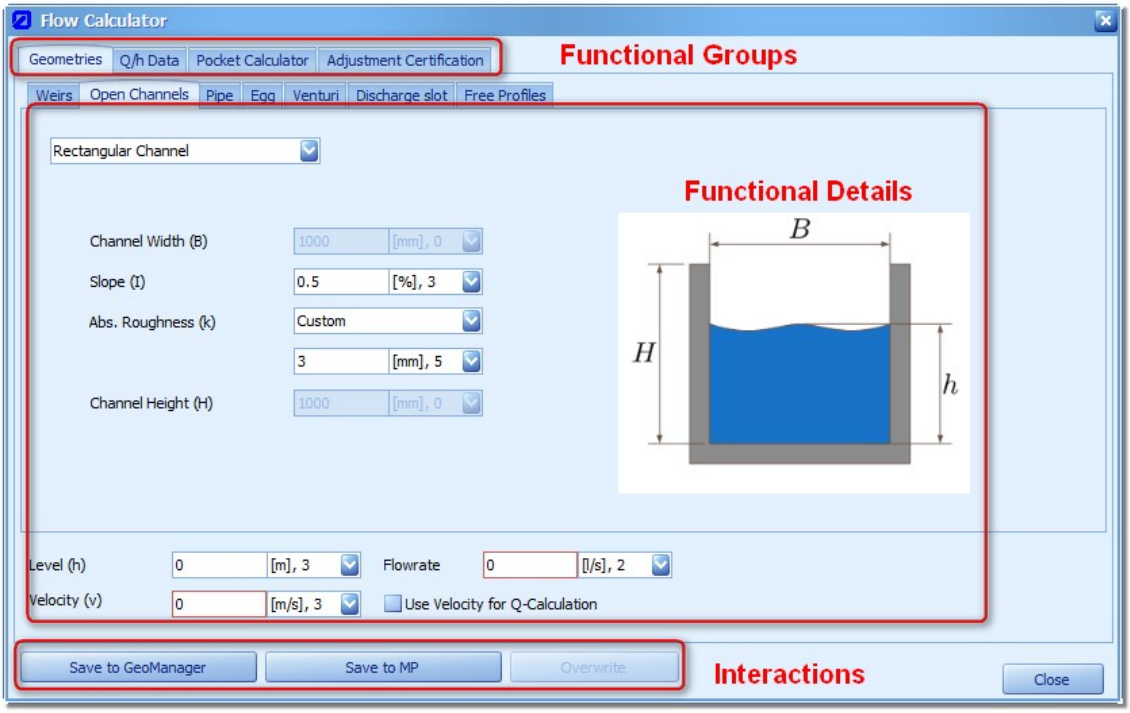


Figure 108: Structure of the flow calculator

The section „Functional Groups“ allows to toggle between the basic functions of the flow calculator mentioned before. The view presented will change depending on the functions selected. The functional details have astructure of their own and will be describe in the Chapters 14.1.1 to 14.1.15. Using the "Interactions" it is possible to transfer configurations and results of the flow calculator to NivuSoft.

Physical parameters can be entered or configured at many points of the flow calculator. These values are handled following the description in Chapter 4.4.6.

14.1 Geometry Administration

The functional details for all geometries are structured in the same way as described in Figure 108.

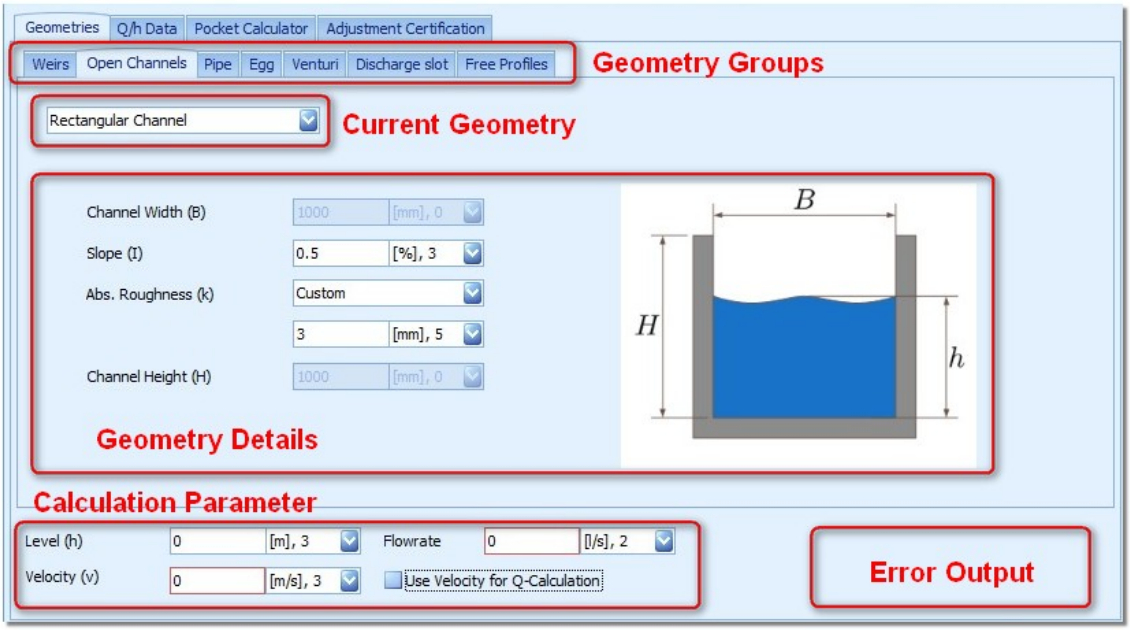


Figure 109: Structure of geometry ddministration

The geometry groups serve as containers for particular configurations from the according environment and are named:

- Weirs
- Open Channels
- Pipe
- Egg
- Venturi
- Discharge Slot
- Free Profiles

Within a group it is possible to select a special geometry from the „Current Geometry“ dropdown menu if required.
The "Geometry Details" will be indicated based on the geomatry selected. Here all necessary parameters can be configured. Per default all parameters have practice-related start values.
The "Calculation Parameters" for all geometries apply the same way. Changing between different groups or geometries hence does not directly influence the parameters. Depending on the "Level" enterd the flow will be calculated for the current geometry. In some cases the calculation can be executed by entering a flow velocity certain value. To achieve this the option „User Velocity for Q-Calculation“ must be activated. If not, the calculation will be performed by using the Manning-Strickler equation.
An error will be shown in the respective area as soon as configuration values should be out of the physically valid range.

14.1.1 Sharp Edge Weir (Poleni)

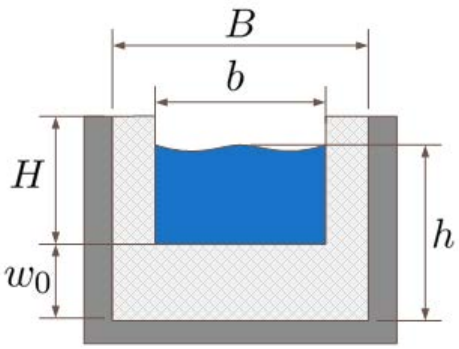


Figure 110: Diagram of a Sharp Edge Rectangular Weir

The necessary parameters for the correct configuration of a Sharp Edge Rectangular Weir are:

- Channel Width (B)
- Width at Weir crest (b)
- Weir Height (w_0)
- Max. Overfall Heigt (H)

14.1.2 Overflow Weir (Poleni)

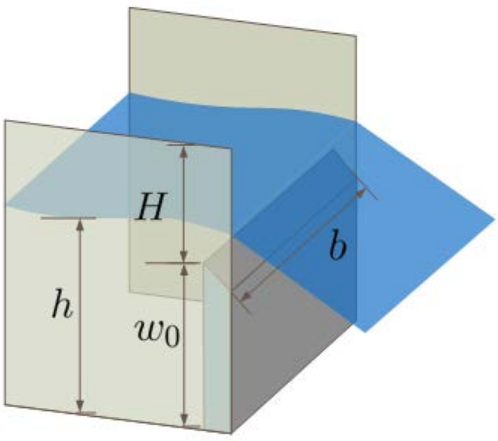


Figure 111: Diagram of an Overfall Weir

The necessary parameters for the correct configuration of an Overfall Weir are:

- Width at Weir crest (b)
- Weir Height (w_0)
- Overfall Coefficient (μ)
- Channel Width (B)

Typical overflow coefficients can be taken from the illustration below (also available from the dialog).

Figure 112: Examples for typical Overfall Coefficients

14.1.3 V-Weir (Gourley)

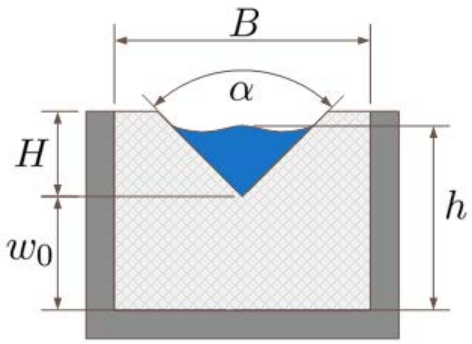


Figure 113: Diagram of a V-Weir

The necessary parameters for the correct configuration of a V-Weir are:

- Opening Angle (α)
- Weir Height (w_0)
- Channel Width (B)
- Channel Width (B)

14.1.4 Trapezoid Weir

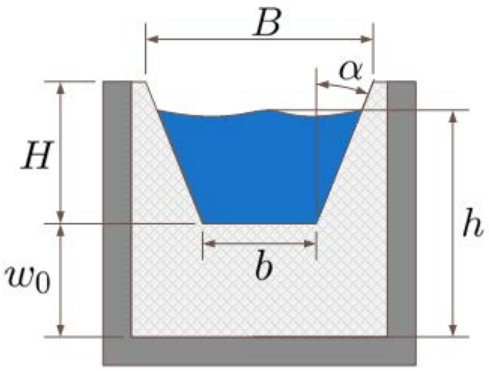


Figure 114: Diagram of a Trapezoid Weir

The necessary parameters for the correct configuration of a Trapezoid Weir are:

- Top width (B)
- Bottom width (b)
- Beginning of overflow (w_0)
- Maximum overflow height (H)

By using the option "Maximal width is on the bottom" an "inverted" trapezoidal shape can be entered.

14.1.5 Rectangular Channel

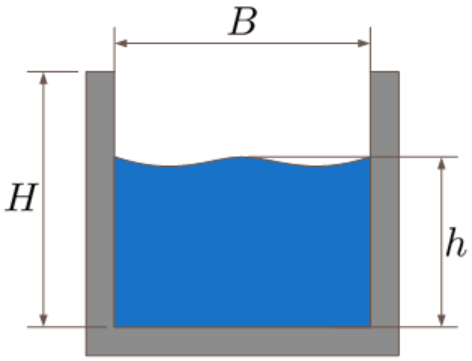


Figure 115: Diagram of a Rectangular Channel

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. The parameters for the rectangular channel are:

- Channel Width (B)
- Slope (I)
- Abs. Roughness(k)
- Channel Height (H)

14.1.6 U-Profile

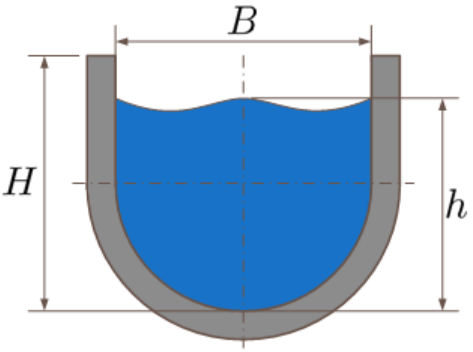


Figure 116: Diagram of a U-Profile

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. The parameters for the U-Profile are:

- Channel Width (B)
- Slope (I)
- Abs. Roughness (k)
- Channel Height (H)

14.1.7 Trapeoidz Channel

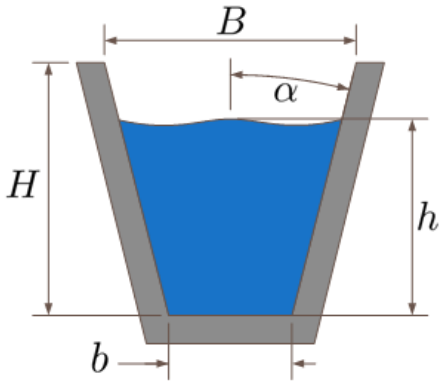


Figure 117: Diagram of a Trapezoid Channel

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. The parameters for the Trapezoid Channel are:

- Top Width (B)
- Bottom Width (b)
- Slope (I)
- Abs. Roughness (k)
- Channel Height (H)

14.1.8 Trapezoid-Rectangular Channel

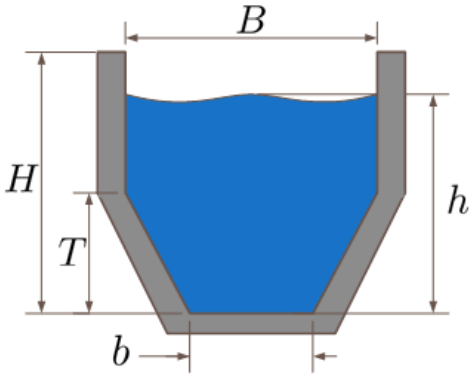


Figure 118: Diagram of a Trapezoid-Rectangular Channel

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. The parameters for the Trapezoid-Rectangular Channel are:

Trapezoid Channel are:

- Channel Width (B)
- Bottom Width (b)
- Trapeziod Height (T)
- Slope (I)
- Abs. Roughness (k)
- Channel Height (H)

14.1.9 Pipe

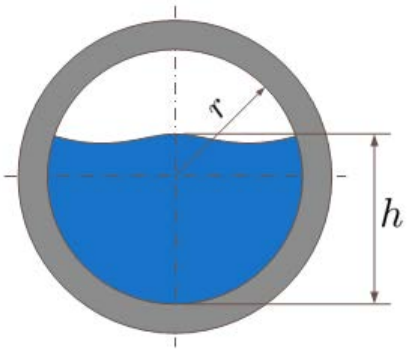


Figure 119: Diagram of a Pipe

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. Hence the pipe parameters are:

- Diameter (D)
- Viskosity
- Slope (I)
- Abs. Roughness (k)
- Channel Height (H

14.1.10 Egg 1:1,5

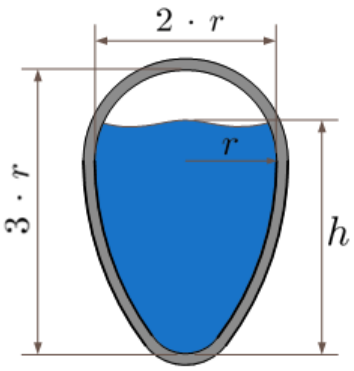


Figure 120: Diagram of an Egg profile 1:1,5

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. Hence the parameters for the 1:1.5 egg profile are:

- Radius (r)
- Slope (I)
- Abs. Roughness (k)

14.1.11 Copressed Egg

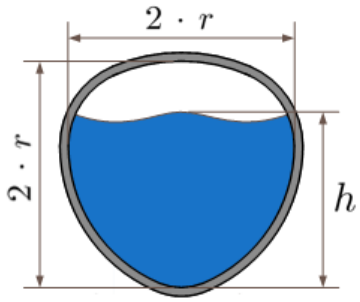


Figure 121: Diagram of a compressed Egg

Depending on the flow velocity option described in Chapter 14.1 the parameters „Abs. Roughness“ and „Slope“ will be used or not. Hence the parameters for the compressed egg profile are:

- Radius (r)
- Slope (I)
- Abs. Roughness (k)

14.1.12 Venturi DIN 19559 Part II

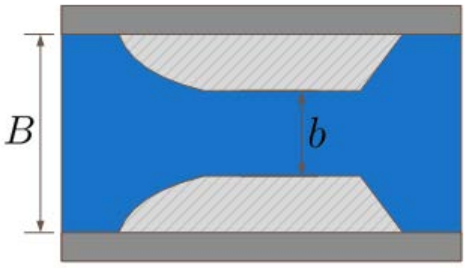


Figure 122: Diagram of a Venturi according to DIN 19559 Part II

The necessary parameters for the correct configuration of a Venturi according to DIN 19559 Part II are:

- Cheek Height (H)
- Channel Width (B)
- Contraction Width (b)

14.1.13 Venturi Khafagi

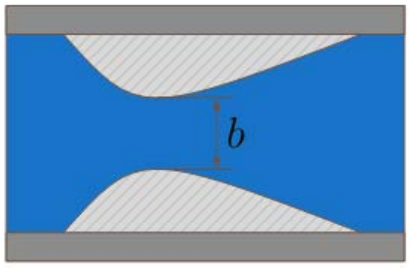


Figure 123: Diagram of a Khafagi Venturi

The necessary parameters for the correct configuration of a Khafagi Venturi are:

- Cheek Height (H)
- Contraction Width (b)

14.1.14 Discharge Slot

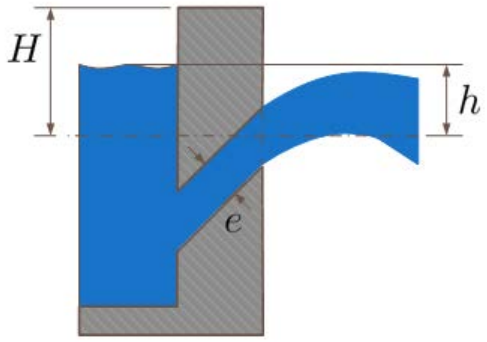


Figure 124: Diagram of a Discharge Slot

The necessary parameters for the correct configuration of a Discharge Slot are:

- Slash Width (ls)
- Slash Height (e)
- Max. Height until top of building (H)
- Overflow value at slash border (μ)

14.1.15 Free Profiles h/B and h/A

This Free Profile is a management of breakpoints which either are specified by the height-width ratio (h/B) or by the height-area ratio (h/A) angegeben. Figure 124 shows the complete dialog to determine the Free Profile.

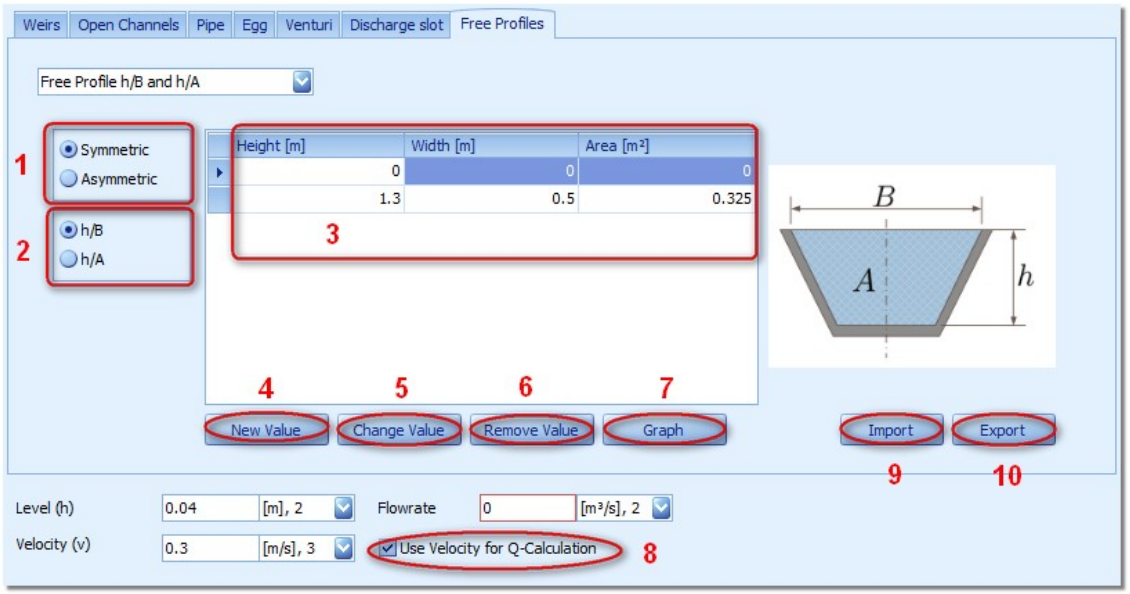


Figure 125: Configuration dialog for a free profile

Use section (**1**) to toggle between symmetric and asymmertic view. In symmetric mode input or view always relate to the total channel width (B) at the respective height. In asymmetric mode lefthand (B_l) and righthand (B_r) width are handled separately.

In case of using the h/B configuration the area from the bottom up to the current height value is calculated and and indicated automatically in the breakpoint table (**3**).

New breakpoints can be added to the profile by using button (**4**). Depending on the profile configuration in section (**1**) it is necessary to specify the the current width(s) in addition to the height. The values in the table will be automatically sorted upwards according to the heights. A pair of values can be modified by using button (**5**) as soon as it has been selected. The selected pair can be deleted as well using button (**6**). A graph can be generated with button (**7**) in order to visualise the entire profile. Figure 125 shows an according example.

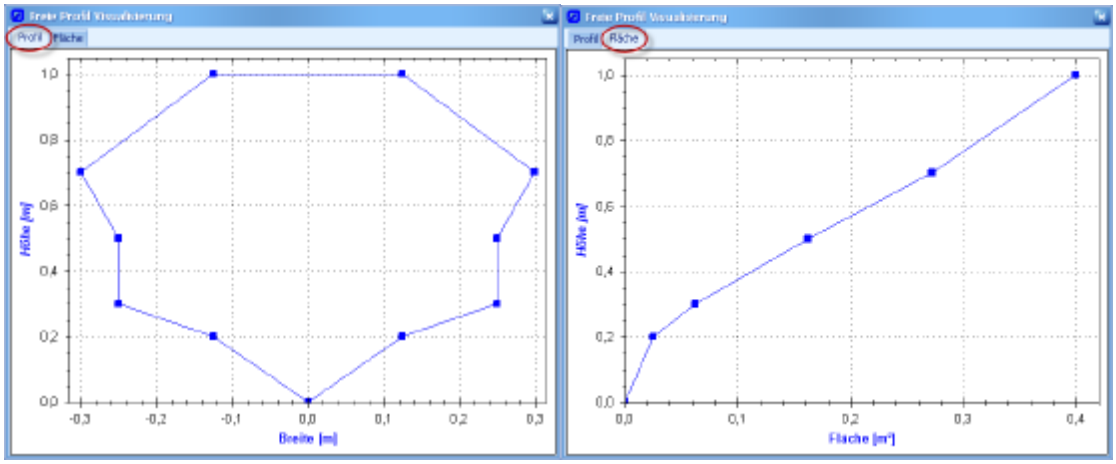


Figure 126: Diagram of a configured profile

In the lefthand section of Figure 125 the widths are plotted using the heights. The righthand area indicates the course of the wetted profile area above the height (Level).
To compute flow values covering the entire profile the option "Use velocity for Q-Calculation" (**8**) must be activated. Based on the values set for „Level“ and „Velocity“ with the aid of the continuity equation the flow is determined and then indicated in the respective field.
Export free profiles as .CSV files by using the „Export“ (**10**) button, import profiles via "Import" (**9**).
In case of symmetric configuration (**1**) option h/A (**2**) can be set. Now it is possible to manage value pairs for the height (level) and the wetted area. The other functions of this dialog correspond with the description before

14.1.16 Free Profile h/Q

Following Chapter 14.1.15 administrative functions for h/Q breakpoints are integrated additionally. The functions correspond with the previous chapter as well.

14.1.17 Inshore Waters

This geometry allows to analyse and to manage free profiles of water bodies. Basically the dialog is structured in the sam manner as Free Profile (Chapter 14.1.15) and hence can be operated accordingly.
The "Reference Position" section allows to set the water bank in order to view the profile. The schematic profile representation in the righthand section alters depending on the selection.
The Reference Position coordinates are always B = 0 m and h = 0 m. The position of each point of the water profiles entered hence is relative to the reference position.

IMPORTANT:

We recommend to always enter closed profiles, i.e. the depth of the breakpoint featuring the largest distance from the reference position should be 0 m!

After entering the breakpoints the profile can be visualised by clicking the "Graph" button. Depending on the reference position the breakpoints are represented as dot or cross (depending on the flow direction).

IMPORTANT:

To compute the flow rate it is necessary to enter a filling level and a flow velocity as usual. The filling level always refers to the lowest point of the profile!

The values of a profile can be saved as CSV file and reloaded again by using the "Export" and "Import" buttons.

14.2 Q/h Data

Geometries can be analysed regarding their flow behaviour by using the "Q/h Data" function. This function can be selected from the Flow Calculator by clicking the respective tab.

Figure 127: Start of Q/h Data Analysis

The evaluation in the following dialog always refers to the currently selected geometry. The active geometry can be identified from the diagram in section (**1**) of Figure 127.

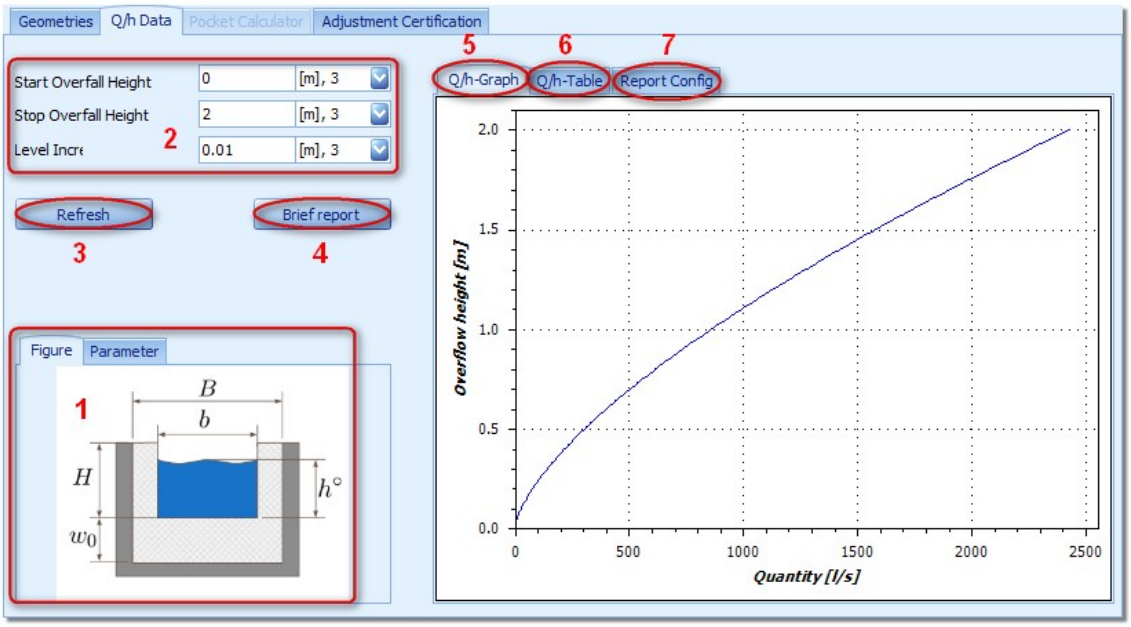


Figure 128: Q/h Analysis of a Geometry

Section (**1**) furthermore allows a compact representation of the configured parameters by clicking the tab "Parameter".

IMPORTANT:

In this kind of analysis the "Level" of weirs is named as overflow height (h°) and begins with "0 m" at the overflow crest, i.e. as from w_0.

The Q/h data analysis for the values selected in section (**2**) is based on "h" or "h°". To refresh the data in the graph (5) or the table (**6**) after modifying input values click the "Refresh" (**3**) button.

Create a brief report on the Q/h data analysis by clicking button (**4**). The preview can be either saved as PDF file or printed directly depending on the configuration applied in tab (**7**). No separate title page is shown if all configuration fileds in (**7**) should be empty.

14.3 Pocket Calculator

The following geometries can be calculated based on the continuity equation of the Manning-Strickler equation using the pocket calculator:

- Rectangular Channel
- U-Profile
- Trapeziod Channel
- Trapeziod-Rectangular Channel
- Pipe

By entering one or two parameters all following parameters of the geometry can be computed depending on the configuration.

14.3.1 Continuity equation

The Continuity equation is as be known:

$$Q = v \cdot A(h)$$

The option "Continuity equation" in section (**1**) of Figure 128 must be selected as basis for the calculation model.

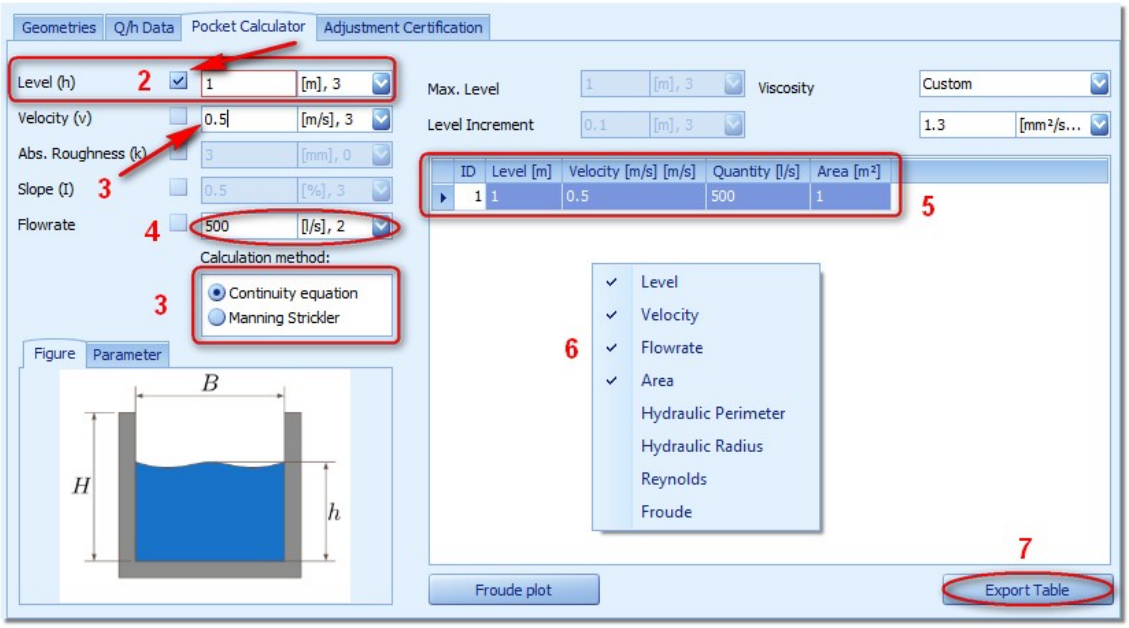


Figure 129: Pocket Calculator for continuity equation

The related equation contains three independent variables where the wetted area directly depends on the current level.
The dialog is structured as follows. For calculation the parameter value (h, v, Q) must be entered and fixed. Fix the value by ticking the according checkbox on the lefthand side of the respective variable. The value can not be modified once it has been fixed (in Figure 128 (**2**) the level).

As soon as a value for one of the remaining parameters (here v (**3**)) is entered, the third value (here Q (**4**)) will be calculated and indicated. The result or more parameters will be shown in table (**5**) as well. Here parameters can be shown or hidden by using the right-click context menu (**6**). Export the table shown with a click on button (**7**).

14.3.2 Manning Strickler equation

The basis is the the Manning Strickler equation. Option „Manning Strickler“ in section (**1**) of Figure 128 must be selected.

$$Q = A(h) \cdot R(h)^{2/3} \cdot \sqrt{I} \cdot {}^{26}\!/_{k^{1/6}}$$

The function contains four variables where the wetted area and the Hydraulic Radius can be combined.

As described in chapter 14.3.1 two parameters must be defined or fixed for calculation. The fourth parameter will be computed automatically by entering the third parameter. In table (**5**) based on the parameters (k, I) and a varying level h=0 the respective parameters are calculated and indicated up to the maximum level set.

Apart from the table export function as described in Chapter 14.3.1 it is possible to create a graph for the Froude or Reynolds number. To do this click the button "Froude plot". The result is shown as graph as depicted in Figure 129.

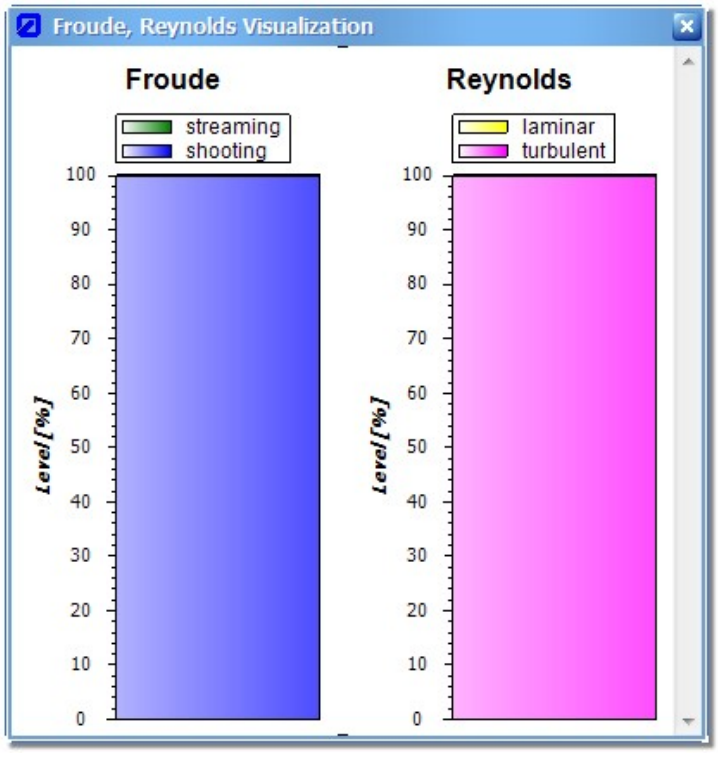


Figure 130: Representation of Froude and Reynolds number for Manning-Strickler evaluation

14.4 Issuing of Adjustment Certification

While assessing a measurement point it may be necessary to perform a calibration. The adjustment certification of the flow calculator can be used for detection of the measured data and to create a protocol. The following description mentions setpoint values and actual values. Actual values in this case refer to values measured with the non-portable instruments. Setpoint values are provided by additionally installed portable units.

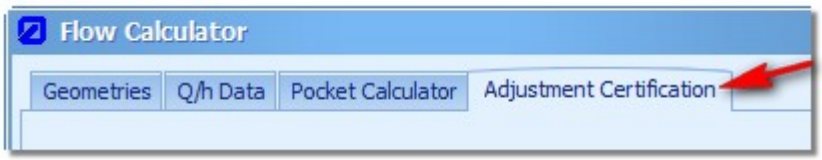


Figure 131: Issuing of Adjustment Certification within the Flow Calculator

The dialog to create the adjustment certification is depicted below:

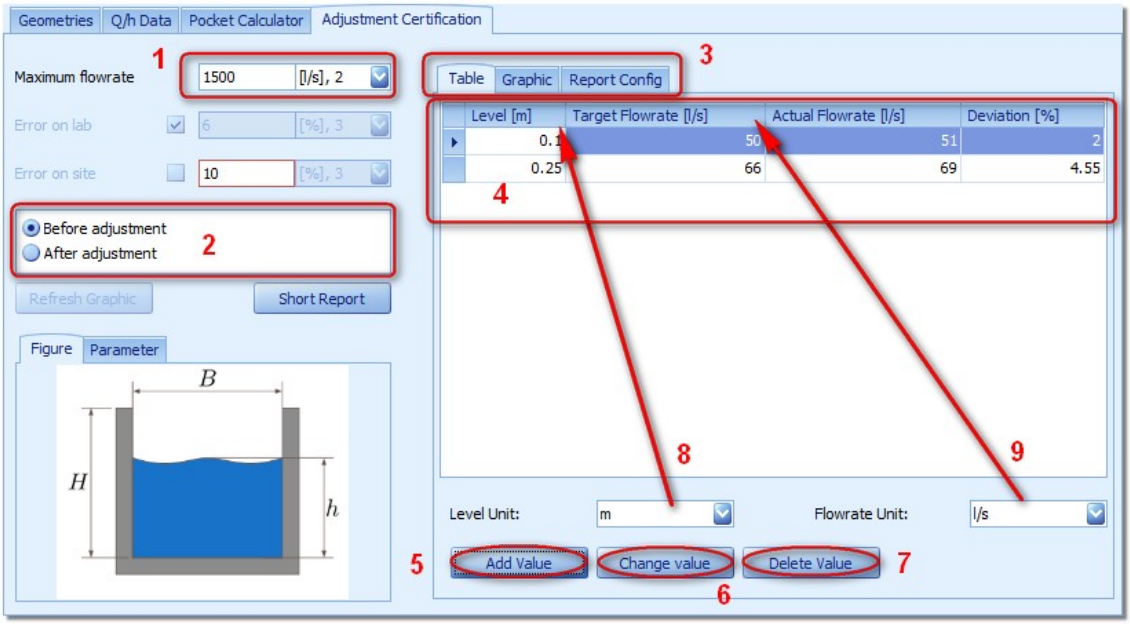


Figure 132: Input mask of Adjustment Certification

In section (**1**) the maximum flow for the currently selected geometry can be entered. The graph is scaled accordingly.
The certificate can be created using measurement values before or after the calibration (**2**). Depending on the option selected here the respective values are indicated in table (**4**). The tables are independent from each other. Start the dialog to enter a new measurement value by clicking on button (**5**). Apart from entering the filling level used for the measurement it is moreover necessary to enter the setpoint or the actual value of the flow. The deviation will be calculated automatically. Defined measurement values can be processed similar to the procedure described under free profile (Chapter 14.1.15). The value currently selected in the table can be edited by using the button "Change value" (**6**). The changes will be applied with a click on "OK". Use the button "Delete Value" (**7**) to delete the currently selected value.

The displayed unit of values within the table can be modified by using the dropdown menus (**8**) and (**9**). A modification here will directly influence the values within the table.

Section (**3**) allows to change the display format of the readings entered. Selecting "Graphic" shows a window as depicted in Figure 132.

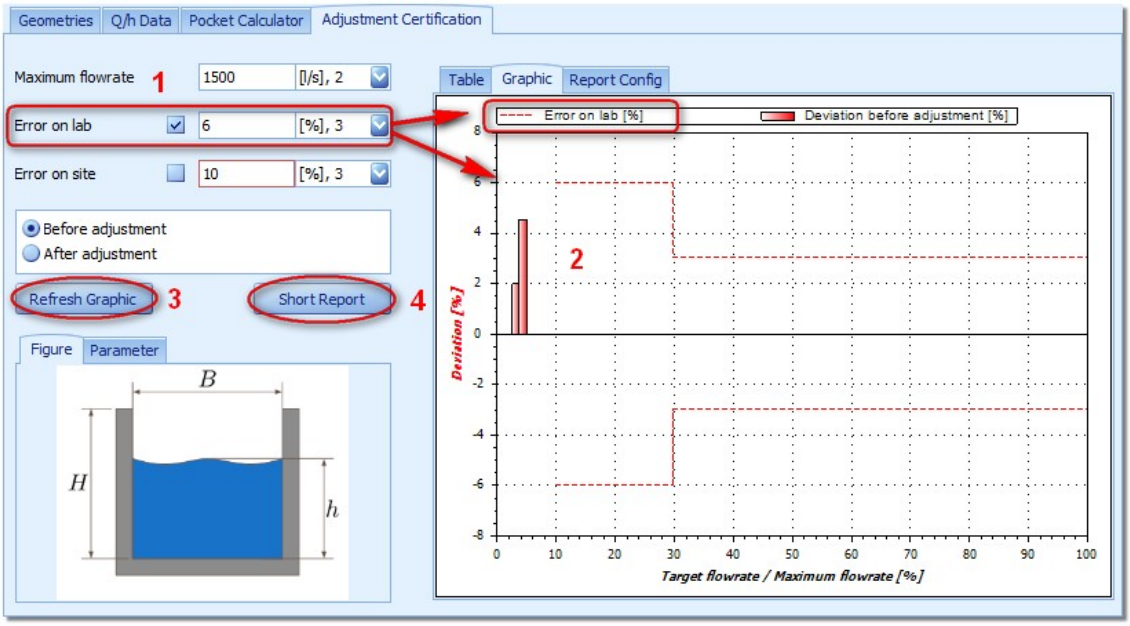


Figure 133: Graphic representation of measurement values in adjustment certification

The X-axis indicates the relative ratio between the predetermined flow value and the maximum flow value. The Y-axis shows the relative ratio between predetermined flow and actual flow from table (**4**) in Figure 132. Depending on the mode of verification either „Error on lab" or „Error on site" is set. The respective reference lines are added to the chart accordingly (**2**) (red = warranty error, green = operational error). Switching between the error modes requires the button „Refresh Graphic" (**3**) to be used in order to apply the modifications to the graph.

Once the adjustment certification has been configured completely use the button "Short Report" (**4**) to create a report which either can be saved as PDF file or can be directly printed. The values for the title page can be entered in the "Report Config." tab.

Each verification report can be saved using the "Save" button of the flow calculator. An according entry can be added to the geometry manager (Chapter 4.3.4). The configuration dialog of the adjustment certification can be opened again by double-clicking on the saved entry.

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[1] **ATV-DWA-A 110:** Hydraulische Dimensionierung und Leistungsnachweis von Abwasserkanälen und –leitungen. Regelwerk, Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall, September 2006

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Glossary

Project	A project is the topmost administrative level. Without projects no measurement places or measurement campaigns can be generated.
Campaign	A campaign represents a collection of measurement places and is for administrative purposes only. Contents cannot be indicated directly and measurement data cannot be modified.
Measurement Place	Equivalent to the actual metering instrument. Measurement places serve for the administration of measurement series.
Measurement Point	Combination of a measurement place and the according equipment.
Measurement Series	Represents a measured quantity (e.g. filling level) in NivuSoft
Workspace	Is the topmost instance for representation and processing of measurement series. Each workspace may comprise multiple containers. All containers within a workspace are synchronised in time with each other.
Container	Serves for the grouping of components. Only one component type can be managed within each container. The container is not visible for users (except from using the report wizard). Container administration is executed in the background.
Component	Superordinated instance representing measurement series (graph, table, scatter graph, statistics, pocket calculator).
Panel	Indicates additional information (project tree, message window, properties).
Working Window	Serves to indicate panels and can be positioned freely within the main area ("docking window").
Main Area	Section of the NivuSoft main window within which working windows can be arranged.

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