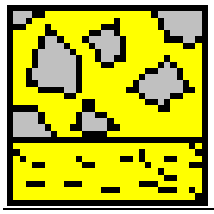
Analysis of the Filter Stability of Soils
After Cistin/Ziems

GGU-FILTER-STABILITY

VERSION 1



Last revision: September 2011
Copyright: Prof. Dr. Johann Buß
Technical implementation and sales: Civilserve GmbH, Steinfeld

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1 Preface

The **GGU-FILTER STABILITY** program system allows analysis of the filter stability of soils after Cistin/Ziems.

Analysis of the filter stability of cohesionless soils is performed using the Cistin/Ziems chart. This shows the allowable interval ratio between filter and protected soil as a function of the uniformity coefficient. The theoretical principles are described in Busch/Luckner [Busch/Luckner, Geohydraulik für Studium und Praxis, Ferdinand Enke Verlag, Stuttgart].

Data input is in accordance with conventional WINDOWS operations and can therefore be learned almost entirely without the use of a manual. Graphic output supports the true-type fonts supplied with WINDOWS, so that excellent layout is guaranteed. Colour output and any graphics (e.g. files in formats BMP, JPG, PSP, etc.) are supported. DXF files can also be imported by means of the integrated Mini-CAD module (see the "**Mini-CAD**" manual).

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

2 Licence protection and installation

In order to guarantee a high degree of quality, a hardware-based copy protection system is used for the **GGU-FILTER-STABILITY** program.

The GGU software protected by the ***CodeMeter*** copy protection system is only available in conjunction with the ***CodeMeter stick*** copy protection component (hardware for connection to the PC, "***CM stick***"). Because of the way the system is configured, the protected software can only be operated with the corresponding CM stick. This creates a fixed link between the software licence and the CM stick copy protection hardware; the licence as such is thus represented by the CM stick. The correct Runtime Kit for the CodeMeter stick must be installed on your PC.

Upon start-up and during running, the **GGU-FILTER-STABILITY** program checks that a CM stick is connected. If it has been removed, the program can no longer be executed.

For installation of GGU software and the CodeMeter software please refer to the information in the ***Installation notes for GGU Software International***, which are supplied with the program.

3 Language selection

GGU-FILTER-STABILITY is a bilingual program. The program always starts with the language setting applicable when it was last ended.

The language preferences can be changed at any time in the "**?**" menu, using the menu item "**Spracheinstellung**" (for German) or "**Language preferences**" (for English).

4 Starting the program

After starting the program, you will see two menus at the top of the window**:**

- File
- ?

After clicking on the "**File**" menu, a previously saved file can be loaded by means of the "**Load**" menu item, or a new one created using "**New**". If "**File/New**" is clicked, the diagram containing the standard curves for the uniformity coefficients for the Cistin/Ziems filter is displayed on the screen. Six menus are visible in the menu bar:

- File
- Edit
- System
- Output preferences
- Graphics preferences
- ?

After clicking one of these menus, the so-called menu items roll down, allowing access to all program functions.

The program works on the principle of ***What you see is what you get***. This means that the screen presentation represents, overall, what you will see on your printer. In the last consequence, this would mean that the screen presentation would have to be refreshed after every alteration you make. For reasons of efficiency and as this can take several seconds for complex screen contents, the **GGU-FILTER-STABILITY** screen is not refreshed after every alteration.

If you would like to refresh the screen contents, press either [**F2**] or [**Esc**]. The [**Esc**] key additionally sets the screen visualisation back to your current zoom, which has the default value 1.0, corresponding to an A4 format sheet.

5 Description of menu items

5.1 File menu

5.1.1 "New" menu item

A new analysis using a new file name can be started.

5.1.2 "Load" menu item

You can load a file with system data, which was created and saved at a previous session, and then edit the system.

5.1.3 "Save" menu item

You can save data entered or edited during program use to a file, in order to have them available at a later date, or to archive them. The data is saved without prompting with the name of the current file.

5.1.4 "Save as" menu item

You can save data entered during program use to an existing file or to a new file, i.e. using a new file name. For reasons of clarity, it makes sense to use "**.ggu_fil**" as file suffix, as this is the suffix used in the file requester box for the menu item "**File/Load**". If you choose not to enter an extension when saving, "**.ggu_fil**" will be used automatically.

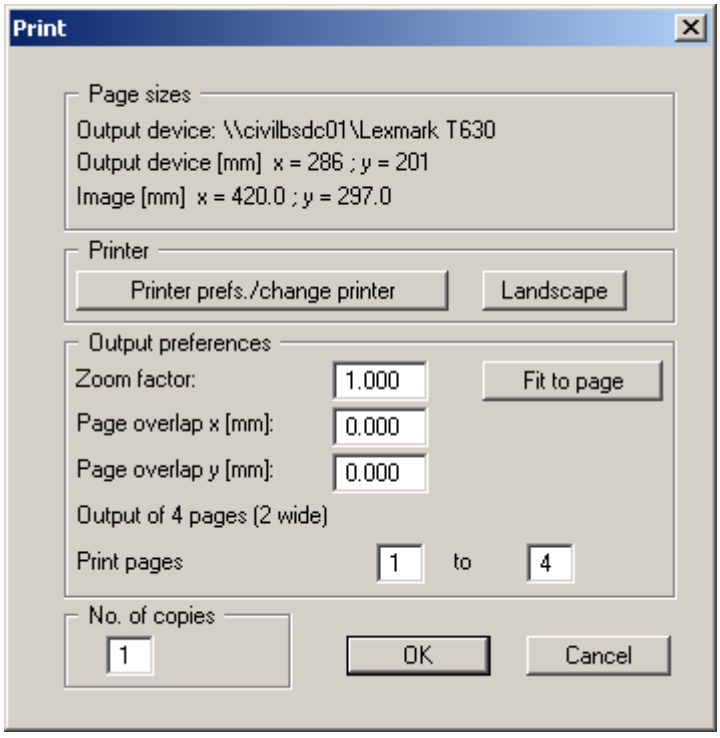
5.1.5 "Printer preferences" menu item

You can edit printer preferences (e.g. swap between portrait and landscape) or change the printer in accordance with WINDOWS conventions.

5.1.6 "Print and export" menu item

You can select your output format in a dialog box. You have the following possibilities:

- "**Printer**"
  allows graphic output of the current screen contents. to the WINDOWS standard printer or to any other printer selected using the menu item "**File/Printer preferences**". But you may also select a different printer in the following dialog box by pressing the "**Printer prefs./change printer**" button.



  In the upper part of the dialog box, the maximum dimensions which the printer can accept are given. Below this, the dimensions of the image to be printed are given. If the image is larger than the output format of the printer, the image will be printed to several pages (in the above example, 4). In order to facilitate better re-connection of the images, the possibility of entering an overlap for each page, in x and y direction, is given. Alternatively, you also have the possibility of selecting a smaller zoom factor, ensuring output to one page ("**Fit to page**" button). Following this, you can enlarge to the original format on a copying machine, to ensure true scaling. Furthermore, you may enter the number of copies to be printed.

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

- "**GGUCAD file**"
  allows output of the graphics to a file, in order to enable further processing with the **GGUCAD** program. Compared to output as a DXF file this has the advantage that no loss of colour quality occurs during export.

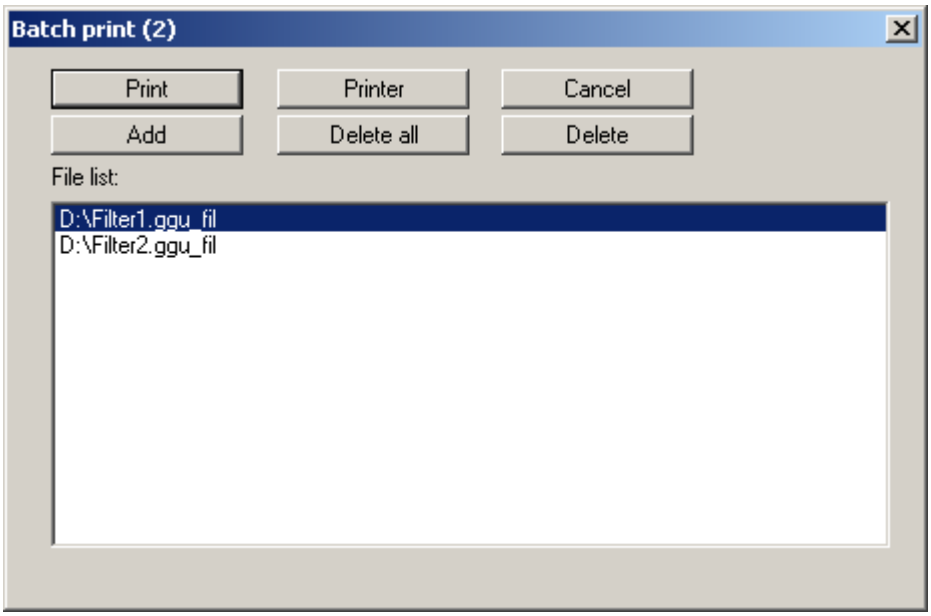
- "**Clipboard**"
  The graphics are copied to the WINDOWS clipboard. From there, they can be imported into other WINDOWS programs for further processing, e.g. into a word processor. In order to import into any other WINDOWS program you must generally use the "*Edit/Paste*" function of the respective application.
- "**Metafile**"
  allows output of the graphics to a file in order to be further processed with third party software. Output is in the standardised EMF format (Enhanced Metafile format). Use of the Metafile format guarantees the best possible quality when transferring graphics.

> If you select the "**Copy/print area**" tool from the toolbar, you can copy parts of the graphics to the clipboard or save them to an EMF file. Alternatively you can send the marked area directly to your printer (see "**Tips and tricks**", Section 6.3).
>
> Using the "**Mini-CAD**" program module you can also import EMF files generated using other GGU applications into your graphics.

- "**MiniCAD**"
  allows export of the graphics to a file in order to enable importing to different GGU applications with the **Mini-CAD** module.
- "**GGUMiniCAD**"
  allows export of the graphics to a file in order to enable processing in the **GGUMiniCAD** program.
- "**Cancel**"
  Printing is cancelled.

5.1.7 "Batch print" menu item

If you would like to print several appendices at once, select this menu item. You will see the following dialog box:



Create a list of files for printing using "**Add**" and selecting the desired files. The number of files is displayed in the dialog box header. Using "**Delete**" you can mark and delete selected individual files from the list. After selecting the "**Delete all**" button, you can compile a new list. Selection of the desired printer and printer preferences is achieved by pressing the "**Printer**" button.

You then start printing by using the "**Print**" button. In the dialog box which then appears you can select further preferences for printer output such as, e.g., the number of copies. These preferences will be applied to all files in the list.

5.1.8 "Exit" menu item

After a confirmation prompt, you can quit the program.

5.1.9 "1, 2, 3, 4" menu items

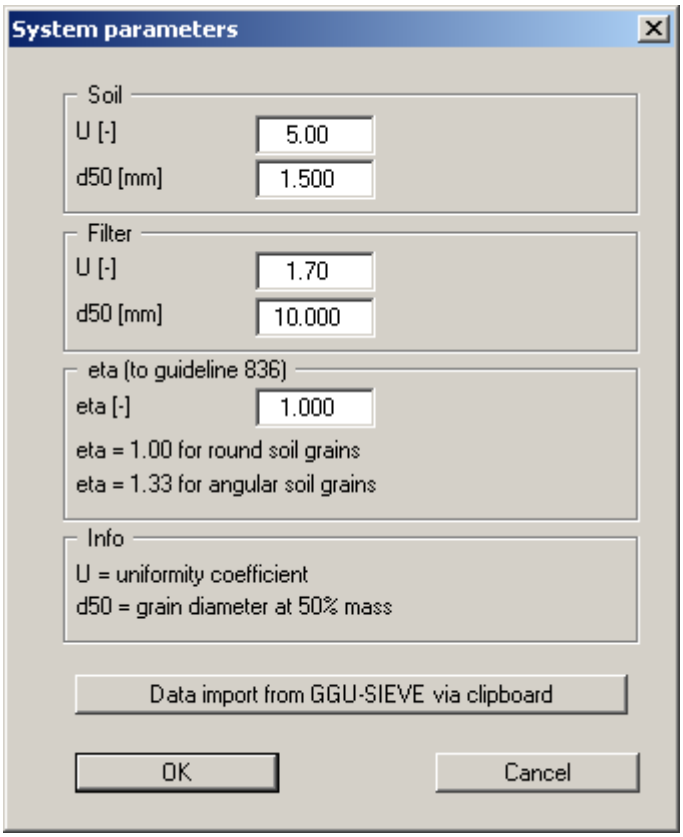
The "**1, 2, 3, 4**" menu items show the last four files worked on. By selecting one of these menu items the listed file will be loaded. If you have saved files in any other folder than the program folder, you can save yourself the occasionally onerous ***rummaging*** through various sub-folders.

5.2.1 "Project identification" menu item

A description can be entered; it will then be included in the ***General legend*** (see Section 5.4.1).

5.2.2 "System parameters" menu item

This is the program's central menu item, allowing input of the fundamental system parameters for the analysis. The following dialog box opens:



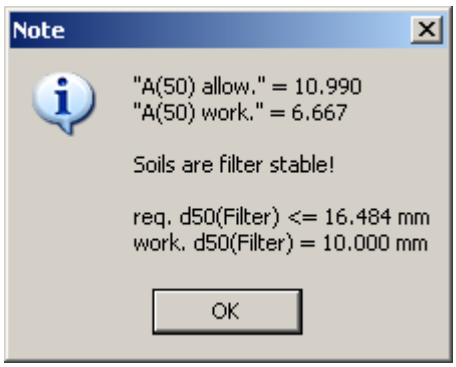
The respective uniformity coefficient U and grain diameter at 50% mass d50 must be entered for the soil and the filter. Additionally, the soil grain shape can be taken into consideration by entering a value for eta in accordance with DB guideline 836 (Module 836.4602A01: *Tiefenentwässerungen, Nachweise der Filterstabilität von Filtern/Dräns*, 1st revision, 01 October 2008).

If a grain size analysis was previously performed using the **GGU-SIEVE** software application (Version 14 and upwards), the required values for U and d50 can be copied to the Windows clipboard from the **GGU-SIEVE** application by using the "**Edit/Filter stability**" menu item provided there. Then click the "**Data import GGU-SIEVE via clipboard**" button in the dialog box shown above to transfer the data from the clipboard to the dialog box.

The data entered for the soil and filter are displayed in the ***General legend*** on the output sheet (see Section 5.4.1).

5.3.1 "Analyse" menu item

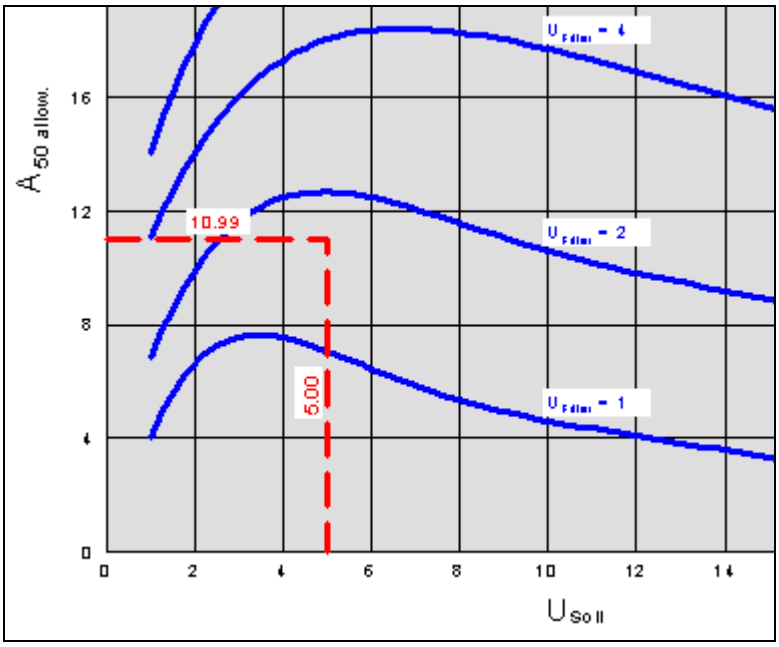
This menu item starts the analysis of filter stability. Alternatively, press the [**F5**] function key or click the ***calculator*** in the tool bar. Once the analysis is complete the analysis result is displayed in a message box.



After confirming with "**OK**" the input and result data are shown in the ***General legend*** on the screen. (see Section 5.4.1).

Filter stability to Cistin/Ziems
U_{Soil} = 5.000
$d_{50\,(Soil)}$ = 1.500 mm
U_{Filter} = 1.700
$d_{50\,(Filter)}$ = 10.00 mm < req. $d_{50\,(Filter)}$ = 16.48 mm
$A_{50work.}$ = $d_{50\,(Filter)}$ / $d_{50\,(Soil)}$ = 6.667
$A_{50allow.}$ = 10.99
Soils are filter stable!

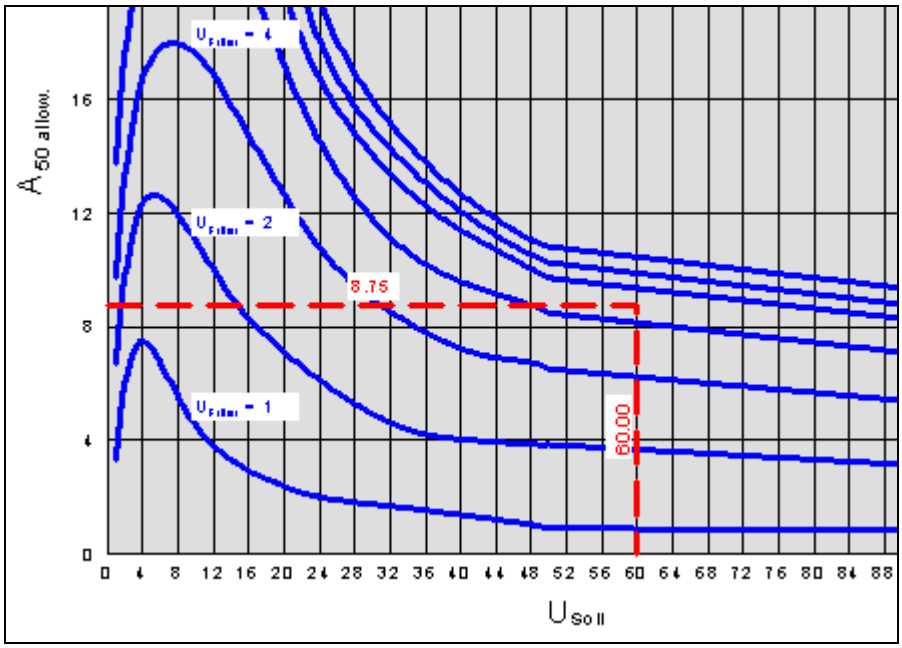
The analysis result is additionally evaluated graphically in a Cistin/Ziems chart. Preferences for the chart are defined via the menu item "**Output preferences/Diagram**" (see Section 5.4.2). The following diagram results for the values given above.



The allowable grain diameter interval ratio A_{50} is marked on the y-axis (= 10.99) via the intersection of the value for U_{Soil} (= 5.00 on the x-axis) and the value for U_{Filter} (= 1.70 between uniformity curves). The soils are filter stable if the existing interval ratio A_{50} (= $d_{50(Filter)}/d_{50(Soil)}$) is smaller than the allowable value A_{50}.

The uniformity curves for the filter shown in the diagram correspond to the diagram after Cistin/Ziems, taken from *Merkblatt Anwendung von Kornfiltern an Wasserstraßen (MAK)* (Fact Sheet for the Application of Grain Filters on Waterways) published by *Bundesanstalt für Wasserbau* (*BAW*) in Karlsruhe, 1989, Annex 1, Figure 1.

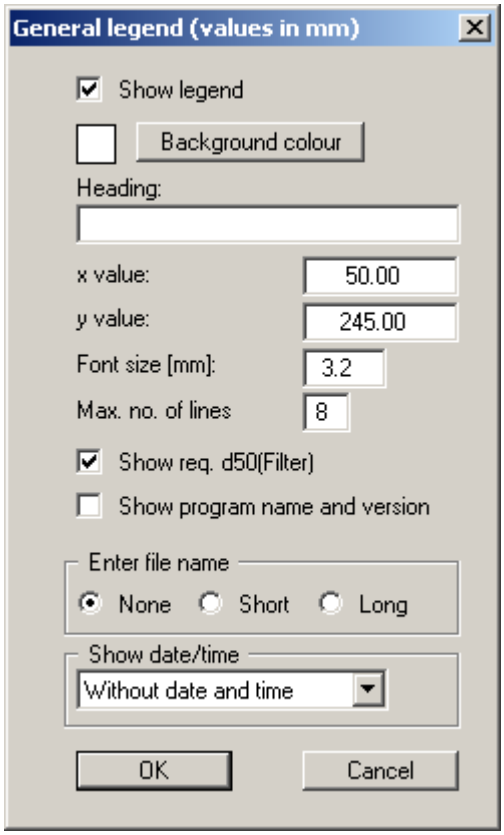
For values of $U_{(Soil)} > 50$ the uniformity curves in Figure A 1.1 of DB guideline 836 (module 836.4602A01: *Tiefenentwässerungen, Nachweise der Filterstabilität von Filtern/Dräns*, 1st revision, 01 October 2008) are displayed in the diagram.



5.4.1 "General legend" menu item

After selecting this menu item a dialog box opens allowing graphics preferences to be selected for displaying a legend containing the input data and the analysis result. The legend is activated by the "**Show legend**" check box.

In addition to the input in the dialog box the legend also contains the project identification, if it was entered using the corresponding menu item "**Edit/Project identification**" (see Section 5.2.1). The display of the required value d_{50} of the filterof the filter can be activated via the corresponding check box.



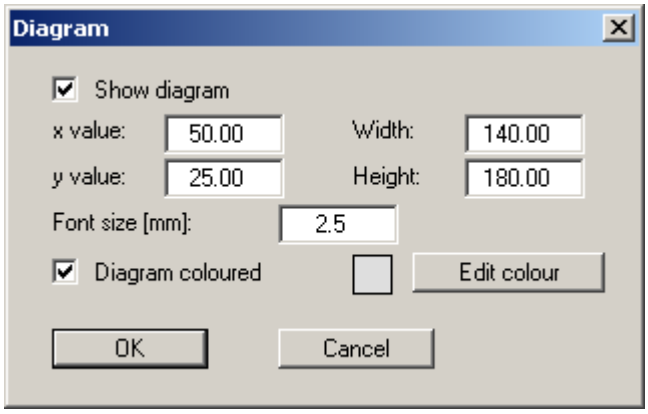
You can define and edit the position of the legend using the values "**x**" and "**y**". You control the size of the legend using "**Font size**" and "**Max. no. of lines**"; where necessary, several columns are used. The legend background can also be given a colour fill.

> The fastest way to modify the position of the legend is to press the [**F11**] function key and then to pull the legend to the new position with the left mouse button pressed.

In the general legend you can, if wished, display information on the program (name and version) and on the current file. By activating the "**Short**" or "**Long**" option buttons the current file name can be shown in the legend, either with or without the path. Date and/or time can be displayed, too.

5.4.2 "Diagram" menu item

Following the filter stability analysis the output sheet will contain a diagram with a graphical representation of the allowable interval ratio A_{50}, assuming the "**Show diagram**" check box is activated. The format and appearance of this diagram can be edited in this menu item's dialog box.



The position and size of the diagram can be defined or edited by means of the variables "**x value**" and "**y value**", "**Width**" and "**Height**". The font size can be varied as required.

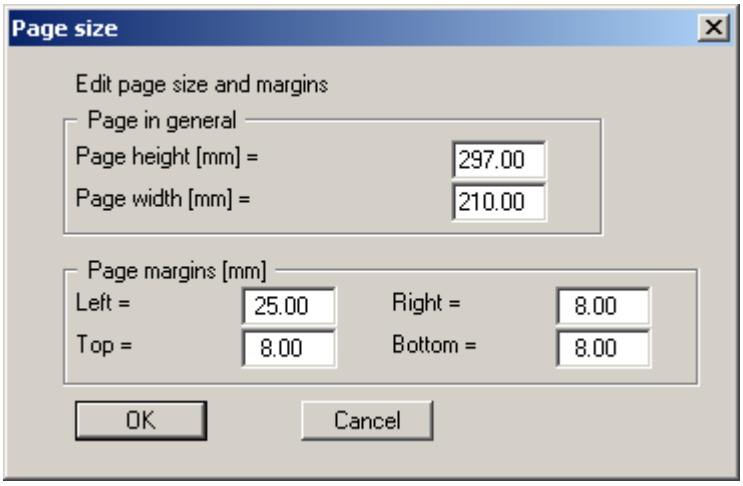
> The fastest way to modify the position or size of the diagram is to press [**F11**] and then to either drag the diagram to the new position or move the sides of the diagram to their new size holding the left mouse button pressed.

The area below the graphs of the uniformity degree is backed using the colour defined by clicking the "**Edit colour**" button if the "**Diagram coloured**" check box is activated.

The colours of the uniformity curves and analysis result lines can be defined in the menu item "**Graphics preferences/Pen colour and width**" (see Section 5.5.5).

5.4.3 "Page size and margins" menu item

The program uses A4 format as default. You can edit the page format in the following dialog box.



Enter the values to be adopted for "**Page height**" and "**Page width**". The program automatically draws thin borders around the page, which are required when using paper rolls on a plotter. "**Page margins**" defines the position of a thickly drawn frame as a distance to these borders.

In order to achieve 1:1 output on an A4 printer the borders must be switched off (see menu item "**Graphics preferences/With borders**", Section 5.5.4) and the page height and page margins be adapted to the printable area of the printer.

5.4.4 "Move objects" menu item

Select this menu item in order to position the legend or the diagram at the desired position on the output sheet. You can also move objects by pressing [**F11**] and then positioning the legend box or diagram with the left mouse button pressed. In that case an info-box appears no more.

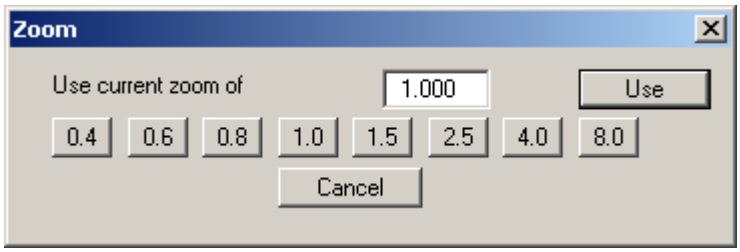
After going to this menu item the mouse pointer changes to a move pointer (four-headed arrow, points simultaneously ***left-right*** and ***up-down***) when located within the legend or diagram. The selected element can then be moved to a different position on the sheet. This menu item must be reactivated after each movement to carry out further alterations.

The size of the diagram can also be altered using this menu item or the [**F11**] function key. To change the size move the pointer to the upper or right diagram boundary. If the pointer is located above the edge it changes to a simple double arrow, which points either ***left-right*** or ***up-down***. Move the corresponding boundary while holding the left mouse button.

5.5.1 "Refresh and zoom" menu item

The program works on the principle of ***What you see is what you get***. This means that the screen presentation represents, overall, what you will see on your printer. In the last consequence, this would mean that the screen presentation would have to be refreshed after every alteration you make. For reasons of efficiency and as this can take several seconds for complex screen contents, the screen is not refreshed after every alteration.

If, e.g., after using the zoom function (see below), only part of the image is visible, you can achieve a complete view using this menu item.



A zoom factor between 0.4 and 8.0 can be entered in the input box. By then clicking on "**Use**" to exit the box the current factor is accepted. By clicking on the "**0.4**", "**0.6**", etc. buttons, the selected factor is used directly and the dialog box closed.

It is much simpler, however, to get a complete overview using [**Esc**]. Pressing [**Esc**] allows a complete screen presentation using the zoom factor specified in this menu item. The [**F2**] key allows screen refreshing without altering the coordinates and zoom factor.

5.5.2 "Zoom info" menu item

By clicking two diametrically opposed points you can enlarge a section of the screen in order to view details better. An information box provides information on activating the zoom function and on available options.

5.5.3 "Legend font selection" menu item

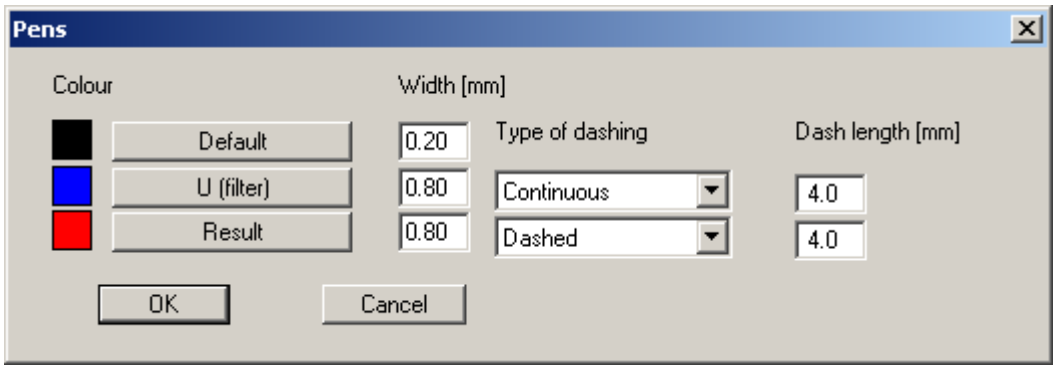
With this menu item you can switch to a different true-type font. All available true-type fonts are displayed in the dialog box.

5.5.4 "With borders" menu item

The program automatically draws thin cutting borders around the page, which are required when using a plotter on paper rolls. You can switch off the lines by deactivating this menu item.

5.5.5 "Pen colour and width" menu item

In order to enhance the clarity of the graphics you can edit the pen settings for various graphic elements.



The pen width and the dashing can be specified for the elements listed in the dialog box. After clicking the appropriate button the pen colours can be adapted.

5.5.6 "Mini-CAD toolbar" menu item

Using this menu item you can add free text to the graphics and add lines, circles, polygons and images (e.g. files in formats BMP, JPG, PSP, etc.). A pop-up menu opens, the icons and functions used are described in more detail in the **Mini-CAD** manual provided.

Objects created with the "**Mini-CAD**" tool are based on the page format (in mm). This makes you independent of the coordinate system and keeps you in the same position on the page. You should select the "**Mini-CAD toolbar**" if you wish to place general information on the drawing (company logo, report numbers, plan numbers, stamp etc.). Once you have saved the header information to disk (see **Mini-CAD** user manual), you can load it into completely different systems (with different system coordinates). The saved header information will appear in exactly the same position on the page, which greatly simplifies the creation of general page information.

5.5.7 "Toolbar preferences" menu item

After starting the program a horizontal toolbar for selected menuitems appears below the program menu bar. If you would rather work with a popup window with several columns, you can specify your preferences using this menu item. The smarticons can also be switched off.

At the bottom of the program window you find a status bar with further information. You can also activate or switch off the status bar here. The preferences for the smarticons and the status bar will be saved in the "**GGU-Filter-Stability.alg_fil**" file (see menu item "**Graphics preferences/Save graphics preferences**") and will be active at the next time the program is started.

By clicking on the tools for the menu items (smarticons) you can directly reach most of the program functions. The meaning of the smarticons appears as a text box if you hover with the mouse pointer over the tools. Some of the tool functions cannot be activated from the normal menu items.

"**Zoom out**"
If you have previously ***zoomed in***, this tool returns to a full screen display.

"**Zoom (-)**"/"**Zoom (+)**"
With the zoom functions you can zoom in or out of parts of the image, by clicking the left mouse button.

"**Copy/print area**"
Use this tool to copy only parts of the graphics in order to paste them, e.g. to a report. You will see information on this function and can then mark an area, which is copied to the clipboard or can be saved in a file. Alternatively you can send the marked area directly to your printer (see " **Tips and tricks**", Section 6.3).

"**Colour on/off**"
Use this on/off switch to quickly colour the area behind the uniformity degree graphs.

5.5.8 "Load graphics preferences" menu item

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

5.5.9 "Save graphics preferences" menu item

Some of the preferences you made with the menu items of the "**Graphics preferences**" menu can be saved to a file. If you select "**GGU-Filter-Stability.alg_fil**" as file name, and save the file on the same level as the program, the data will be automatically loaded the next time the program is started and need not be entered again.

> If you do not go to "**File/New**" upon starting the program, but open a previously saved file instead, the preferences used at the time of saving are shown. If subsequent changes in the general preferences are to be used for existing files, these preferences must be imported using the menu item "**Graphics preferences/Load graphics preferences**".

5.6.1 "Copyright" menu item

You will see a copyright message and information on the program version number.

The "**System**" button shows information on your computer configuration and the folders used by **GGU-FILTER-STABILITY**.

5.6.2 "Help" menu item

The **GGU-FILTER-STABILITY** manual is opened as a PDF document. The help function can also be accessed using the [**F1**] function key.

5.6.3 "GGU on the web" menu item

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

If you would like to be automatically notified about program innovations, please register for the Newsletter in our Knowledge Base. Go to the following website: http://kbase.civilserve.com.

5.6.4 "GGU support" menu item

This menu item takes to the GGU-Software Support area at www.ggu-software.com.

5.6.5 "What's new?" menu item

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

5.6.6 "Language preferences" menu item

This menu item allows you to switch the menus and the graphics from German to English and vice versa. To work in German, deactivate the two check boxes "**Dialoge + Menüs übersetzen (translate dialogues, menus)**" und "**Graphiktexte übersetzen (translate graphics)**".

Alternatively, you can work bilingually, e.g. with German dialog boxes but with graphic output in English. The program always starts with the language setting applicable when it was last ended.

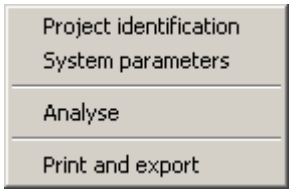
6 Tips and tricks

6.1 Keyboard and mouse

You can scroll the screen with the keyboard using the cursor keys and the [**Page up**] and [**Page down**] keys. By clicking and pulling with the mouse, with [**Ctrl**] pressed, you activate the zoom function, i.e. the selected section will fill the screen. Furthermore you can use the mouse wheel to zoom in/out or scrolling the screen presentation. The following mouse wheel functions are available:

- Mouse wheel up = move screen image up
- Mouse wheel down = move screen image down
- [**Ctrl**] + mouse wheel up = enlarge screen image (zoom in)
- [**Ctrl**] + mouse wheel down = shrink screen image (zoom out)
- [**Shift**] + mouse wheel up = move screen image right
- [**Shift**] + mouse wheel down = move screen image left

If you click the right mouse button anywhere on the screen a context menu containing the principal menu items opens.



By double-clicking the left mouse button on legends, diagrams or **Mini-CAD** objects, you will immediately move to the editor for the selected object and can then edit it.

6.2 Function keys

Some of the function keys are assigned program functions. The allocations are noted after the corresponding menu items. The individual function key allocations are:

- [**Esc**] refreshes the screen contents and sets the screen back to the given format (A4). This is useful if, for example, you have used the zoom function to display parts of the screen and would like to quickly return to a complete overview.
- [**F1**] opens the manual file.
- [**F2**] refreshes the screen without altering the current magnification.
- [**F3**] opens the menu item "**Edit/System parameters**".
- **F5**] opens the menu item "**System/Analyse**".
- [**F11**] activates the menu item "**Output preferences/Move objects**".

6.3 "Copy/print area" icon

A dialog box opens when the "**Copy/print area**" icon in the menu toolbar is clicked, describing the options available for this function. For example, using this icon it is possible to either copy areas of the screen graphics and paste them into the report, or send them directly to a printer.

In the dialog box, first select where the copied area should be transferred to: "**Clipboard**", "**File**" or "**Printer**". The cursor is displayed as a cross after leaving the dialog box and, keeping the left mouse button pressed, the required area may be enclosed. If the marked area does not suit your requirements, abort the subsequent boxes and restart the function by clicking the icon again.

If "**Clipboard**" was selected, move to the MS Word document (for example) after marking the area and paste the copied graphics using "*Edit/Paste*".

If "**File**" was selected, the following dialog box opens once the area has been defined:

The default location of the file is the folder from which the program is started and, if several files are created, the file is given the file name "**Image0.emf**" with sequential numbering. If the "**Rename**" button in the dialog box is clicked, a file selector box opens and the copied area can be saved under a different name in a user-defined folder. Saving can be aborted by pressing the "**Delete**" button.

If the "**Printer**" button was pressed in the first dialog box, a dialog box for defining the printer settings opens after marking the area. Following this, a dialog box for defining the image output settings opens. After confirming the settings the defined area is output to the selected printer.

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