

GGU-VIBRATION manual

Analysis of structural vibrations

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Table of contents

1 Preface

2 Licence protection

3 Language selection

4 Starting the program

5 Tips and tricks

5.1 Function keys

5.2 Keyboard and mouse

5.3 "Copy/print area" icon

6 File menu

6.1 "New" menu item

6.2 "Load" menu item

6.3 "Save" menu item

6.4 "Save as" menu item

6.5 GGU-VIBRATION "Output preferences" menu item

6.6 GGU-VIBRATION "Print and export" menu item

6.7 GGU-VIBRATION "Batch print" menu item

6.8 GGU-VIBRATION "Exit" menu item

6.9 GGU-VIBRATION "1, 2, 3, 4" menu items

7 Edit menu

7.1 "Project identification" menu item

7.2 "Choose equipment" menu item

7.3 "System parameters" menu item

7.3.1 General note

7.3.1.1 Vibrating pile driver

7.3.1.2 Driving ram (diesel hammer)

7.3.1.3 Driving ram (drop hammer)

7.3.1.4 Vibrating plate

7.3.1.5 Vibratory roller

7.3.1.6 Deep vibrator

7.3.1.7 Selecting and managing equipment

8 System menu

8.1 "Analyse" menu item

9 Output preferences

9.1 "General legend" menu item

9.2 "Diagram" menu item

9.3 GGU-VIBRATION1: "Page size and margins" menu item

9.4 GGU-VIBRATION1: "Move objects" menu item

10 Graphics preferences menu

10.1 "Refresh and zoom" menu item

10.2 "Zoom info" menu item

10.3 "Legend font selection" menu item

10.4 "With borders" menu item

10.5 "Pen colour and width" menu item

10.6 "Mini-CAD toolbar" and "Header toolbar" menu items

10.7 "Toolbar preferences" menu item

10.8 "Load graphics preferences" menu item

10.9 "Save graphics preferences" menu item

11 Info menu

11.1 "Copyright" menu item

11.2 "Help" menu item

11.3 "GGU on the web" menu item

11.4 "GGU support" menu item

11.5 "What's new?" menu item

11.6 "Language preferences" menu item



Theorie. Und Praxis.

Geotechnische Softwarelösungen können so einfach sein. Denn Theorie und Praxis lassen sich mit **GGU-Software** und den neuen Angeboten der **civilserve Academy** prima kombinieren: Knackige theoretische Aufgaben lösen und als Sahnehäubchen Ihr

**Know-how durch
Praxisseminare
vertiefen!**

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1 GGU-VIBRATION: Preface

The **GGU-VIBRATION** program system facilitates the analysis of vibrations in structures after Achmus, Kaiser and tom Wörden ('*Bauwerksserschütterungen durch Tiefbauarbeiten*' in Bulletin 61, IGBE, Hannover University). Example 1 (vibration roller) and Example 2 (driving ram (diesel hammer)) from Prof. Achmus' article are provided as files.

The theoretical principles are included in Bulletin 61 (IGBE, Hannover University). They will therefore only be repeated for this manual as far as necessary to describe the input.

The program includes convenient data input. The system is permanently displayed on the screen. Every change to the data is displayed on the screen, so that optimum control of the input data is guaranteed.

There are "?" and "Info" buttons in the dialog boxes for many technical and program-specific questions. Click on the "?" buttons or "Info" buttons to obtain the necessary information.

The graphic output supports the true type fonts provided by WINDOWS, so that an excellent layout is guaranteed. Colour output and numerous graphic formats (BMP, TIF, JPG etc.) are supported. PDF and DXF files can also be imported via the integrated **Mini-CAD** system (see "**Mini-CAD**" manual).

The program has been extensively tested. No errors 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 GGU-VIBRATION: Licence protection

To protect the GGU software from unauthorised access, each GGU program is equipped with the **CodeMeter software protection system** from WIBU-Systems. Each GGU program is bound to a so-called **CmContainer** via a licence with the corresponding product code.

To be able to use the GGU licences in a CmContainer, a runtime environment, the **CodeMeter Runtime Kit**, must be installed on your computer via driver software. You can obtain the current version from [Software for Users - Wibu-Systems](#) (CodeMeter User Runtime for Windows).

You can work with the following CmContainer types on your PC with the CodeMeter Runtime Kit installed (= **CodeMeter licence server**):

- **CmStick**
The licence for your GGU program is stored in a USB dongle.
- **CmActLicense** (soft licence, not for virtual PC/servers)
The licence for your GGU program is stored in a licence file that is linked to the hardware of a computer.
- **CmCloudContainer**
The licence is located on a CmCloud server of WIBU-Systems and is mirrored to your CodeMeter licence server. The advantages of this type of licence binding are described on the following website: [Licence binding | GGU Software](#).

The GGU programs check at start-up and during runtime whether a corresponding license is available in a CmContainer.

3 GGU-VIBRATION: Language selection

The GGU programs can be used in German and English. The program always starts with the language in which it was terminated.

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

4 GGU-VIBRATION: Starting the program

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

- File
- Info

After clicking on the "**File**" menu, a previously analysed system can be loaded by means of the "**Load**" menu item, or a new one created using "**New**".

After clicking "**New**" the program automatically jumps to the option box, which can also be opened by going to the "**Edit/Choose equipment**" menu item. Once the equipment has been selected a dialog box opens for system parameter input (also see the menu item "**Edit/System parameters**"). After closing the dialog box the start-up screen containing the general legend for the system data already entered is displayed. Six menus are visible in the menu bar:

- File
- Edit
- System
- Output preferences
- Graphics preferences
- Info

After clicking one of these menus, the so-called menu items roll down, allowing you 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 screen is not refreshed after every alteration.

If you would like to refresh the screen contents, press either **[F2]** or **[Esc]**. The **[Esc]** key also resets the screen display to your current image zoom, which is usually preset to 1.0, which corresponds to an A3 or A4 sheet in most GGU programs (see menu item "**Graphics preferences/Refresh and zoom**").

5 Tips and tricks

5.1 GGU-VIBRATION: 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 content and resets from a screen section to your current image zoom, which is usually preset to 1.0 (see “
- **[F1]** opens the manual file.
- **[F2]** refreshes the screen without altering the current magnification.
- **[F11]** activates the menu item "**Move objects**", which appears in the GGU programs under various menu titles, e.g. "**Page size + margins**", "**Graphics preferences**" or "**Output preferences**".

In this GGU program, the following function keys are also assigned to program functions:

- **[F3]** activates the menu item "**Edit/System parameters**".
- **[F5]** opens the menu item "**System/Analyse**"

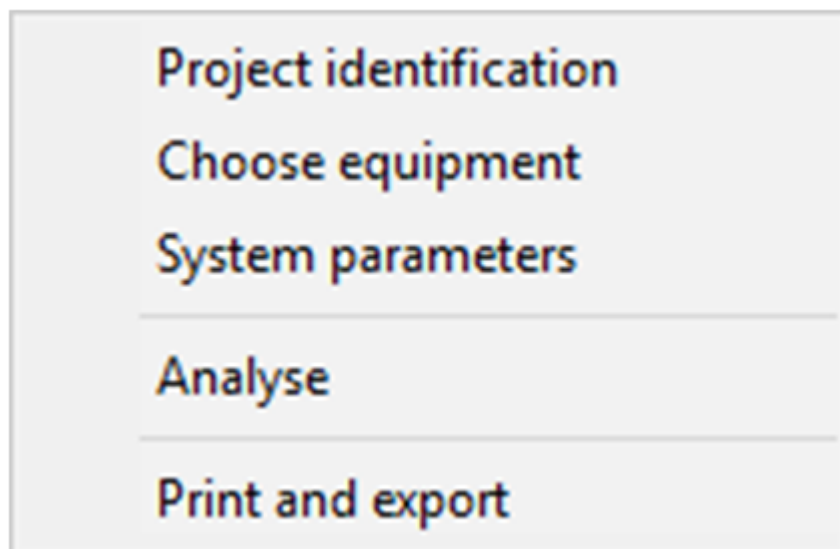
5.2 GGU-VIBRATION: Keyboard and mouse

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:

Change screen coordinates:

- 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, dimension lines or **Mini-CAD** objects, the editor for the selected object immediately opens, allowing it to be edited.

5.3 GGU-VIBRATION: "Copy/print area" icon

A dialog box opens when the **"Copy/print area"** icon

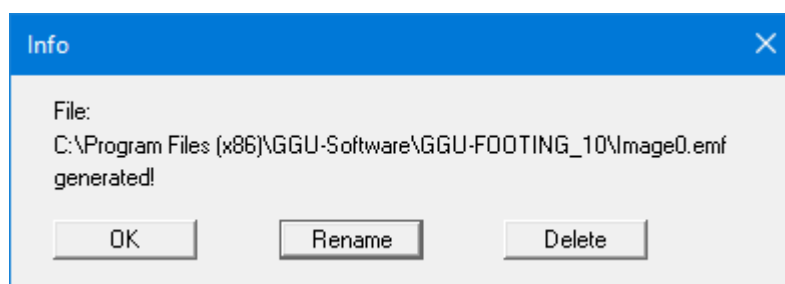


in the menu toolbar is clicked, describing the options available for this function. For example, using this icon it is possible to either copy areas of the screen graphics and paste them into the report, or send them directly to a printer.

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 appears after defining the area, shown here as an example for the **GGU-FOOTING** program:



The default location of the file is the folder from which the program is started (here: GGU-FOOTING_10) 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.

6 File menu

6.1 GGU-VIBRATION: "New" menu item

A new analysis using a different vibration generator can be started. After going to this menu item the option box opens to allow selection of the equipment (see menu item "**Edit/Choose equipment**"). Once a different piece of equipment has been selected the dialog box for the "**Edit/System parameters**" menu item opens and the system parameters can be entered.

6.2 GGU-VIBRATION: "Load" menu item

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

6.3 GGU-VIBRATION: "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.

6.4 GGU-VIBRATION: "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_vib**" 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_vib**" will be used automatically.

6.5 GGU-VIBRATION "Output preferences" menu item

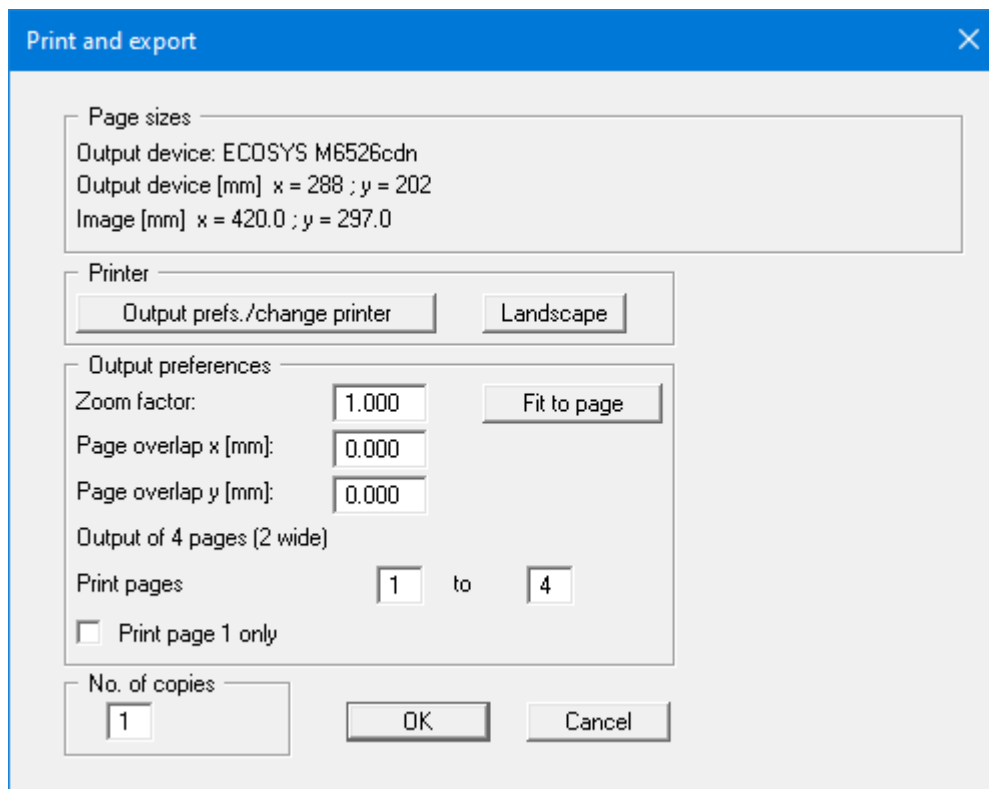
You can edit output preferences (e.g. swap between portrait and landscape) or change the printer in accordance with WINDOWS conventions.

6.6 GGU-VIBRATION "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 (graphical representation) to the WINDOWS standard printer or to any other printer selected using the menu item **"File/Output preferences"**. But you may also select a different printer in the following dialog box by pressing the **"Output prefs./change printer"** button.



In the upper group 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). 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. You can also print only the 1st page with zoom factor = 1.0, in which case the bottom left-hand area is printed. Furthermore, you may enter the number of copies to be printed.

|

- **"DXF file"**

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

- **"GGU-CAD file"**

allows output of the graphics to a file, in order to enable further processing with the **GGU-CAD** 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"**).

Using the **"Mini-CAD"** program module you can also import EMF files generated using other GGU applications into your graphics (see menu item **"Graphics preferences/Mini-CAD"**).

- **"Mini-CAD"**

allows export of the graphics to a file in order to enable importing to different GGU applications with the Mini-CAD module.

- **"GGUMiniCAD"**

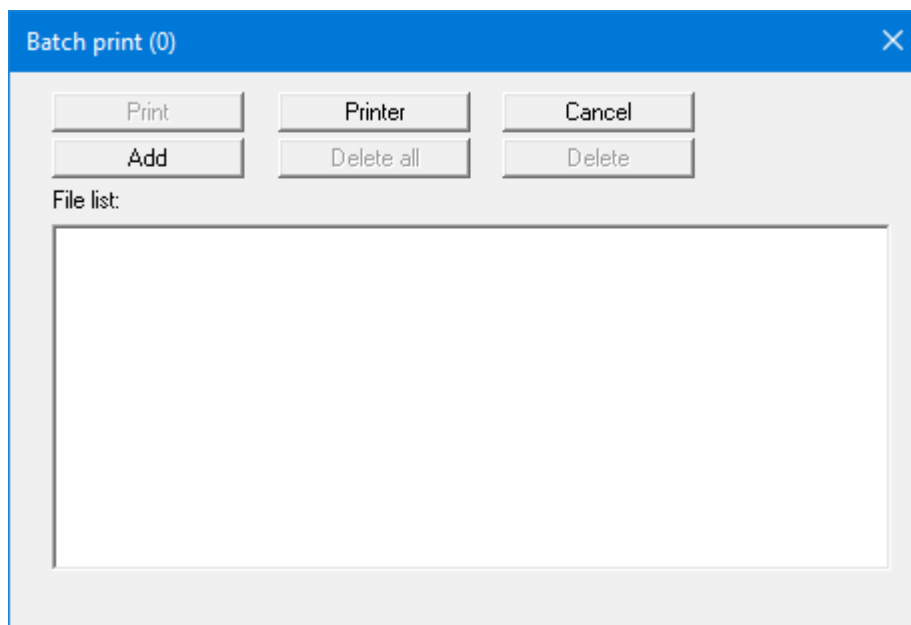
allows export of the graphics to a file in order to enable processing in the GGUMiniCAD program.

- **"Cancel"**

Printing is cancelled.

6.7 GGU-VIBRATION "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.

6.8 GGU-VIBRATION "Exit" menu item

After a confirmation prompt, you can quit the program.

6.9 GGU-VIBRATION "1, 2, 3, 4" menu items

If you have not stored a working directory for the program icon, the program jumps to the program directory after starting to load or save a file.

Under the menu items **"1,2,3,4, ..."**, the most recently edited files are displayed with the respective storage path. Selecting one of these files loads the selected file. The next time you call up the menu items **"File / Load"** or **"File / Save"**, the program is automatically located in the directory of the last file loaded.

7 Edit menu

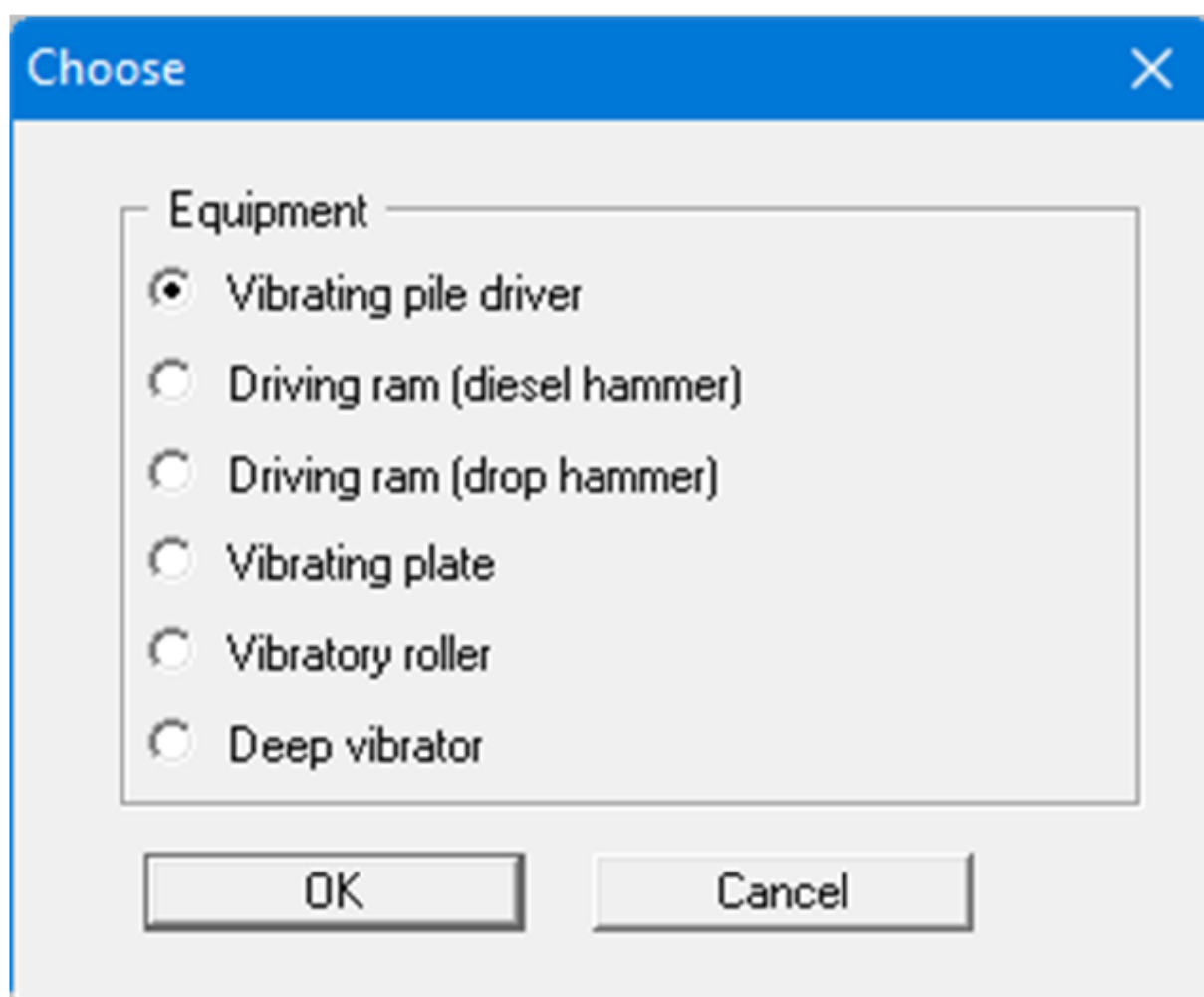
7.1 GGU-VIBRATION: "Project identification" menu item

You can enter a description of the current system; this will then be used in the **General legend** (see "Graphics preferences/General legend" menu item).

The equipment adopted is entered automatically and does not need to be entered via this menu item.

7.2 GGU-VIBRATION: "Choose equipment" menu item

This menu item opens a dialog box allowing the user to choose between five different pieces of vibration generating equipment.



This dialog box opens automatically when a new analysis needs to be started, i.e. when starting the program or clicking the menu item "File/New".

7.3 "System parameters" menu item

7.3.1 General note

7.3.1.1 GGU-VIBRATION: Vibrating pile driver

For a vibrating pile driver the following "Edit/Systemparameters" dialog box opens:



One of three building types can be selected for investigation of the vibration impact in the "**Type of building**" box:

- Commercial and industrial buildings
- Residential buildings
- Particularly sensitive buildings.

Based on the investigated building type the program determines the allowable vibration velocities according to Table 7.1 in Bulletin 61 (IGBE, Hannover University), which are then compared to the existing vibration velocities once analysis is complete. The program issues a warning message if the allowable values are exceeded.

"**Analyse for**" specifies whether the analysis is carried for "**Unfavourable values**" or for "**Probable values**". "**Unfavourable values**" in this context means that only 2.25 % of the measurements evaluated by ACHMUS et al. showed no damage (2.25 % exceeding probability). "**Probable values**" have an exceeding probability of 50%.

The resulting ground vibration acceleration $a_{\text{Ground,R}}$ is calculated using Equation 7.2 in Bulletin 61:

$$a_{\text{Ground,R}} = 2 \cdot$$

$$\pi$$

$$\cdot f \cdot v_{\text{Ground,R}}$$

The variable f represents the working frequency of the equipment.

The building settlement hazard can be assessed using the resulting ground vibration acceleration $a_{\text{Ground,R}}$. The allowable value, including for soils susceptible to collapse, is:

$$a_{\text{Ground,R}}^{1/3} \cdot g = 3,300 \text{ mm/s}^2 = 3.3 \text{ m/s}^2$$

The program issues a warning message if the allowable values are exceeded.

The distance of the selected equipment to the building is given in "**Distance to building**". Of course, the greater the distance, the lower the impact on the building.

The power [kW] and frequency [1/s] or [Hz] of vibrating pile drivers must be given. The maximum component of the footing vibration velocity $v_{F,i,max}$ according to Table 9.3 in Bulletin 61 is computed using these values. In the central area of the dialog box the equipment name and the corresponding data can be entered manually. Alternatively, the required equipment can be selected from a list of common commercial appliances and be adopted by the program by pressing the "**Equipment data**" button at the bottom of the "**Vibrating pile driver**" dialog box.

The transmission coefficients only need now be entered in the lower group box of the dialog box "**Vibrating pile driver**". The maximum component of the footing vibration velocity $v_{F,i,max}$ computed above is multiplied by these factors. The resulting values can be compared to the allowable values given in Table 7.1 in Bulletin 61 in order to assess the impact on the selected building type. Two message boxes provide information on the required input.

7.3.1.2 GGU-VIBRATION: Driving ram (diesel hammer)

For a driving ram (diesel hammer) the following "**Edit/Systemparameters**" dialog box opens:



The input corresponds to the input for vibrating pile drivers.

The predominant soil type is entered for "**Soil**". Three soil types are differentiated:

- Cohesive soils
- Gravels, sands
- Stones.

This input is important for analysis of the resulting ground vibration acceleration $a_{Ground,R}$ according to Equation 9.1 and Table 9.2 in Bulletin 61. The building settlement hazard can be assessed using the resulting ground vibration acceleration $a_{Ground,R}$. The allowable value, including for soils susceptible to collapse, is:

$$a_{Ground,R} \frac{1}{3} \cdot g = 3,300 \text{ mm/s}^2 = 3.3 \text{ m/s}^2$$

The program issues a warning message if the allowable values are exceeded.

For computation of the resulting ground vibration acceleration $a_{Ground,R}$ "**soft or loose ground**" and "**very firm or dense ground**" are differentiated according to Table 9.2. This setting is made in "**Ground is**".

In the **"Equipment"** group box in place of power and frequency, however, the energy per stroke [kN·m] and vibration frequency [Hz] or [1/s] are entered. Vibration frequency input is only required for determining the allowable values according to Table 7.1 in Bulletin 61. Resonant frequencies are not anticipated for impact driving.

Here, too, the equipment data can be selected and adopted from a list of common commercial appliances using the button of the same name. Equipment selection and editing of the equipment list are described separately in Section **"Selecting and managing equipment"**.

7.3.1.3 GGU-VIBRATION: Driving ram (drop hammer)

For a driving ram (drop hammer) vibrating plate the following **"Edit/Systemparameters"** dialog box opens:



The input corresponds to the input for driving ram with diesel hammer .

Here, too, the equipment data can be selected and adopted from a list of common commercial appliances using the button of the same name. Equipment selection and editing of the equipment list are described separately in Section **"Selecting and managing equipment"**.

7.3.1.4 GGU-VIBRATION: Vibrating plate

For a vibrating plate the following **"Edit/Systemparameters"** dialog box opens:



The input corresponds to the input for vibrating pile drivers. However, in addition to power and frequency the service weight of the vibrating plate must be given.

Here, too, the equipment data can be selected and adopted from a list of common commercial appliances using the button of the same name. Equipment selection and editing of the equipment list are described separately in Section **"Selecting and managing equipment"**.

7.3.1.5 GGU-VIBRATION: Vibratory roller

For a vibratory roller the following **"Edit/Systemparameters"** dialog box opens:



The input corresponds to the input for vibrating pile drivers. However, in addition to power and frequency the service weight of the vibratory roller must be given.

Here, too, the equipment data can be selected and adopted from a list of common commercial appliances using the button of the same name. Equipment selection and editing of the equipment list are described separately in Section “**Selecting and managing equipment**”.

7.3.1.6 GGU-VIBRATION: Deep vibrator

For a deep vibrator the following “**Edit/Systemparameters**” dialog box opens:



The input corresponds to the input for vibrating pile drivers.

Here, too, the equipment data can be selected and adopted from a list of common commercial appliances using the button of the same name. Equipment selection and editing of the equipment list are described separately in Section “**Selecting and managing equipment**”.

7.3.1.7 GGU-VIBRATION: Selecting and managing equipment

In all of the system data input dialog boxes for the various appliances described above the required equipment can be selected from a list of common commercial appliances and the data be adopted by the program by pressing the “**Equipment data**” button. Below you can see an example of a dialog box for vibrating pile drivers (vibratory attachments):



After clicking an equipment button the corresponding power and frequency are adopted and entered into the main dialog box. If you hover for a moment over an equipment button with the mouse pointer the corresponding data will be briefly displayed.

The data for the existing appliances can be edited or new appliances added by pressing the “**Edit**” button. The following dialog box for vibrating pile drivers (vibratory attachments) opens:

Vibratory attachments [X]

Forw. Back Cancel OK Save Load Sort

21 Vibratory attachments to edit Info

No.	Name	Power [kW]	Frequency [1/s]
1	ABI HVR 100	180.0	40.0
2	ABI HVR 20	24.0	50.0
3	ABI HVR 30	45.0	50.0
4	ABI HVR 45	65.0	41.0
5	ABI HVR 60	95.0	41.0
6	ABI HVR 75	130.0	41.0
7	ABI MRZV 500 V	130.0	46.0
8	Müller MS-1 HFB	60.0	56.0
9	Müller MS-10 HFB	150.0	39.0
10	Müller MS-17 HFB	158.0	30.0
11	Müller MS-2 HFB	61.0	53.1
12	Müller MS-3 HFB	70.0	50.0
13	Müller MS-4 HFB	100.0	47.5
14	Müller MS-4 HFBS	100.0	47.5
15	Müller MS-5 HFBV 3	95.0	45.0
16	Müller MS-6 HFB	119.0	52.5
17	Müller MS-6 HFBS	119.0	42.5
18	Müller MS-7 HFB	130.0	46.7
19	Müller MS-7 HFBS	100.0	46.7
20	Müller MS-8 HFBV 3	165.0	43.0
21	Tünkers HVB 16	67.0	35.0

New equipment can be added by clicking the "**x Vibratory attachments to edit**" button. Enter the required number and then edit the equipment name and the data in the newly added rows. If there are more than 25 rows, navigate between the boxes using "**Forw.**" and "**Back**".

The appliances can be stored in a file using the "**Save**" button. If the edited file is saved in the program folder using the name "**GGU-Vibration.ggu_vib_db**", it is automatically imported when the program is started. Otherwise, a different appliance file can be opened by pressing the "**Load**" button. The default file suffix for diesel hammers is "**.ggu_die_db**", for drop hammers "**.ggu_fre_db**", for vibrating plates "**.ggu_pla_db**", for vibration rollers "**.ggu_wal_db**" and for deep vibrators "**.ggu_tie_db**".

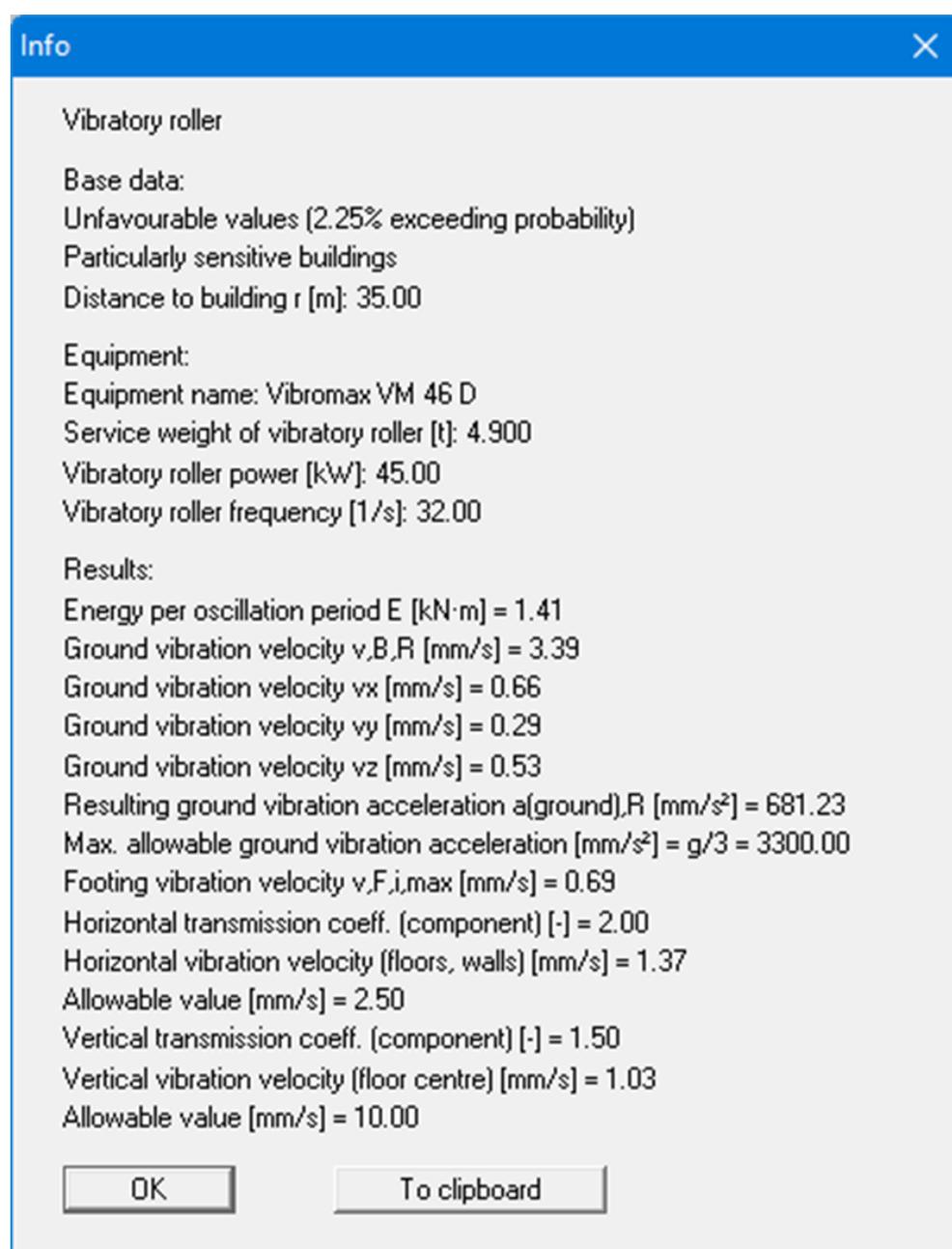
The equipment list can be sorted in ascending or descending order for the name, power or frequency (for vibrating pile drivers) by pressing the "**Sort**" button. The setting is also stored in the "**.ggu_vib_db**" file. To delete a piece of equipment, sort the required row to the end of the list and then reduce the number of rows using the "**x Vibratory attachments to edit**" button.

8 System menu

8.1 GGU-VIBRATION: "Analyse" menu item

This menu item starts the analysis of building vibrations. Alternatively, press the [F5] function key or click the **calculator** in the tool bar. First, the input data are checked. A warning message is produced if errors or special features are identified.

Once the analysis is complete information on the data entered and on the analysis results is displayed, as shown in the following box.



If the results shown in the box are to be used in a report, for example, click the **"To clipboard"** button. The data 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. The *"Edit/Paste"* function of the respective application must generally be used in order to import into any other WINDOWS application.

After confirming with **"OK"** the input and result data are shown in a legend on the screen. In addition, the analysis results are graphically evaluated in a diagram .

9 Output preferences

9.1 GGU-VIBRATION: "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 results. 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"**. The vibration generating equipment is also filled in automatically. The display of the ground vibration velocity can be activated via the corresponding check box.

General legend (values in mm) [X]

☒ Show legend

☐ Background colour

Heading:
[Bulletin 61, IGBE, Hannover University]

x value: [60.00]

y value: [260.00]

Font size [mm]: [2.8]

Max. no. of lines [25]

☐ Show program name and version

☒ With ground vibration velocity

Enter file name

☒ None ☐ Short ☐ Long

Show date/time

[Without date and time] [v]

OK Cancel

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 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.

9.2 GGU-VIBRATION: "Diagram" menu item

A diagram is shown on the output sheet containing the footing vibration velocity drawn against the distance to the endangered buildings. The format and appearance of this diagram can be edited in this menu item's dialog box, if the "Show diagram" check box is activated.

Diagram

☒ Show diagram

x value: 50.00 Width: 140.00

y value: 24.00 Height: 140.00

Font size [mm]: 2.5

User-defined axes

☐ x axis logarithmic

☐ With vz (ground) ☐ With vx, vy (floors) ☐ With vz (floors)

☒ With individual values

☐ Diagram coloured Edit colour

Visualise curve(s) from min. to max. distance

Min. distance [m]: 5.0 Max. distance [m]: 36.0

OK Cancel

The position and size of the diagram can be defined or edited by means of the variables "X" and "Y", "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 program automatically selects a sensible axes scale for graph visualisation. If the **"User-defined axes"** button is clicked a dialog box opens allowing the **"Use the following axes values"** check box to be activated. The required minimum and maximum distances and velocities can then be given. The x-axis can be displayed on a logarithmic scale by activating the appropriate check box.

Beside the automatic display of the footing vibration velocity in the diagram, the vertical ground vibration velocity and the horizontal and vertical vibration velocity for floors and walls can also be shown. Activate the required check boxes.

The resulting vibration velocity value for the distance to the building entered in **"Edit/System parameters"** is displayed in the diagram if the **"With individual values"** check box is activated in the dialog box. The area behind the graph of the footing vibration velocity is backed using the colour defined by clicking the **"Edit colour"** button if the **"Diagram coloured"** check box is activated.

The distance at which the vibration velocity graphs begin is defined using the input in the **"Min. distance [m]"** box and to which distance on the x-axis using **"Max. distance [m]"**. The total length of the x- and y-axes is automatically adapted if the specified distances are altered or are defined by the user using the **"User-defined axes"** button (see above).

9.3 GGU-VIBRATION1: "Page size and margins" menu item

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

Page size

Edit page size and margins

Page in general

Page height [mm] = 297.00

Page width [mm] = 210.00

Page margins [mm]

Left = 25.00 Right = 8.00

Top = 8.00 Bottom = 8.00

OK Cancel

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**") and the page height and page margins be adapted to the printable area of the printer.

9.4 GGU-VIBRATION1: "Move objects" menu item

If you select this entry, you can then use the mouse to move the various objects and legends. Move the mouse over the object of your choice. If you are over a movable object, the mouse pointer will take on the shape of a cross. Now press the left mouse button and drag the object to the desired position while holding down the button.

After going to this menu item **only one object** at a time can be moved using the mouse or its size be altered.

If you want to edit several objects, you can also activate the function more quickly by pressing the [F11] key or the symbol



. An info box will then no longer appear.

In many GGU programs you can also alter the size of an object using this menu item or the [F11] function key. If you are positioned over the frame of a resizable object after activating the function, the mouse takes on the shape of a double arrow. Hold down the left mouse button and drag the frame until the object has reached the desired size. Drag a corner to maintain the aspect ratio of the sides. If you drag on one side, the object becomes taller or wider.

Using the [Back] key or by clicking on the icon



you can undo the last change to the position or size of an object.

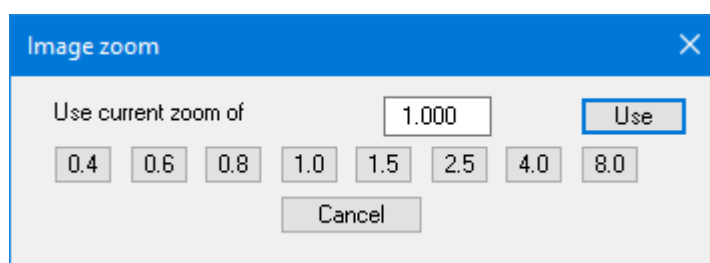
In programs in which you can position the diagrams yourself (menu item "**System/Graph positioning preferences**"), the result diagrams can also be moved using this function if you have switched to "**Manual graph positioning**".

10 Graphics preferences menu

10.1 GGU-VIBRATION: "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.

10.2 GGU-VIBRATION: "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.

10.3 GGU-VIBRATION: "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.

10.4 GGU-VIBRATION: "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.

10.5 GGU-VIBRATION: "Pen colour and width" menu item

In order to enhance the clarity of the graphics you can preset the pen settings for various graphic elements in the GGU programs

You can change the pen widths for the elements listed in the dialog box and adjust the pen and/or fill colours by clicking on the button with the element name. In some GGU programs you can also define a line colour for selected elements.

For the graphic output of colours on **monochrome printers** (e.g. laser printers), colours are replaced by an equivalent shade of grey. In the case of very light colours, the corresponding graphic elements are then barely visible on the printer. In such cases, it makes sense to change the colour setting to darker colours.

10.6 GGU-VIBRATION: "Mini-CAD toolbar" and "Header toolbar" menu items

Using this menu item you can add free text, lines, circles, polygons and images (e.g. files in formats BMP, JPG, PSP, TIF, etc.) to the main program graphics. PDF files can also be imported as images. A pop-up menu opens, the icons and functions used are described in more detail in the **Mini-CAD** manual saved in the "**C:\Program Files (x86)\GGU-Software\Manuals**" folder during installation. The differences between the Mini-CAD and Header CAD are as follows:

- Drawing objects created with **Mini-CAD** refer to the coordinate system (generally in [m]) in which the drawing is created and are displayed accordingly. You should therefore select this menu item if you wish to enter additional information on the system. These objects can be saved in a **".mcd"** file using the



icon in the pop-up menu and loaded as such in other GGU programs using the



icon in the pop-up menu.

- Drawing objects created with the **Header CAD** refer to the sheet format (in [mm]). They therefore always remain at the same sheet position, regardless of the coordinate system of the measuring points. You should select this menu item if you want to enter general information on the drawing (e.g. company logo, report number, system number, stamp). If you save this so-called header data in a ".kpf" file using the icon



in the pop-up menu, you can reload this header data for a completely different system (with different system coordinates) and also in other GGU programs using the icon



in the pop-up menu. The saved header data can then be found in the same position. This considerably simplifies the creation of general sheet information.

10.7 GGU-VIBRATION: "Toolbar preferences" menu item

After starting the program a horizontal toolbar for menu items 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 smart icons 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 will be saved in the "GGU-3D-SSFLOW.alg" 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 (smart icons) for the menu items you can directly reach most of the program functions. The meaning of the smart icons appears as a text box if you hover with the mouse pointer over the tools. Some of the tool functions cannot be called up via normal menu titles and menu entries.

Not all of the icons described below are available in all GGU programs.



"Next page"/"Previous page"

You can use these icons to scroll forwards and backwards between individual pages. In many GGU programs, you can use this in the **output table representation**.



"Select page" or "Diagram/Output table"

If you are in the **output table representation**, you can use this symbol to jump to a specific page or switch back to the normal display, i.e. your graphic display.

**"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"**).

**"Colour on/off" or "Colour/hatching"**

If you want to remove the colour from the system display, e.g. to create a black and white printout, you can do this using this on/off switch.

In several GGU programs, 4 colour and hatching settings are possible via this icon, which you can click through in sequence. A colour filled representation is the default setting, the next click shows the hatching, then coloured and hatched. The fourth click shows a representation with neither colour nor hatching. The next click starts again.

**"Move object"**

Use this icon to position legends and diagrams at the desired position on the output sheet.

**"Undo move object"**

By clicking this icon the last performed movement of graphical elements made using the [F11] function key or the menu item **"Output preferences/Move objects"** can be undone.

**"Restore move object"**

By clicking this symbol, the last object movement undo carried out using **"Undo move object"** can be restored.

**"Construction phase back"/"Construction phase forward"**

If you are in the display of construction phases, you can use these icons to scroll back and forth between the individual construction phases.

10.8 GGU-VIBRATION: "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.

10.9 GGU-VIBRATION: "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-VIBRATION.alg**" as file name, and save the file on the same level as the program, the data will be automatically loaded the next time the program is started and need not be entered again.

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**".

11 Info menu

11.1 GGU-VIBRATION: "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 the GGU program.

11.2 GGU-VIBRATION: "Help" menu item

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

11.3 GGU-VIBRATION: "GGU on the web" menu item

Using this menu item, you can access the [GGU Software website](#).

Check the page of your program module at regular intervals for information about updates and changes. On the "**Changelogs**" subpage, you can also subscribe to an e-mail notification that informs you of all changes on a monthly basis.

11.4 GGU-VIBRATION: "GGU support" menu item

This menu takes you directly to the [GGU Software Support Portal](#).

Here you can enter your support request directly and upload your edited GGU program file.

11.5 GGU-VIBRATION: "What's new?" menu item

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

11.6 GGU-VIBRATION: "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.