

5. GeneralProgram Description

This chapter describes the single programs. The description in general has the same design for all programs. Each description is divided up in three main parts. In the first part the program purpose is described in order to make clear what the program will calculate and what it can be used for or even in some cases what it should not be used for. In the second part the input and output variables are described within their limits. In the third part the program form is shown. The main function items are labeled with a comment text. By this it is shown how the program can be operated in detail.

In general the sequence for program operation is as shown in the sketch below. Each program can be selected via the menu. After this the values for the corresponding variables can be entered and different selections are possible depending on the activated program. For each program it is possible to make personal notes as well as to save and restore them. Beside this the general program information can be called by clicking the Info-Button. After calculation it is possible to print the values. For this a form can be filled with the corresponding project data. These data will be shown in the headlines of the calculation report. All values can be erased at once by clicking the Erase-Data-Button. For some programs there is an extra hint beside the program information, which will be shown if the Hint-Button is clicked.

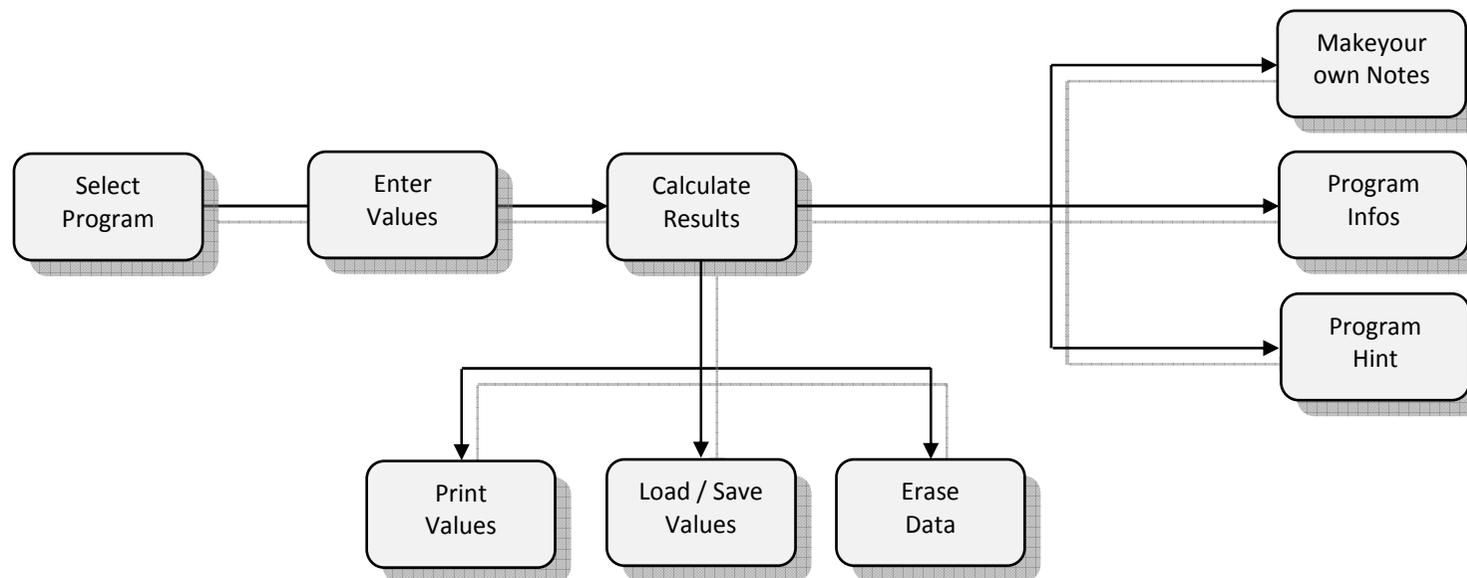


Figure 14: overview program selection

Following up in the first the general control elements are explained by short descriptions. On the next page the program command buttons are explained.

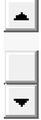
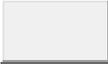
	<p><u>TextBox:</u> <i>TextBoxes</i> are used for the input and output of calculation variables. The <i>TextBoxes</i> for input variables are have a white background and those for the output variables have a grey background.</p>		<p><u>ComboBox:</u> The <i>ComboBoxes</i> are provided for selections. By clicking on the arrow a menu with the corresponding items will scroll down. Afterwards the item that should be focus for the calculations can be selected by clicking the left mouse button.</p>
	<p><u>NumericUpDown:</u> These elements are used primary for the adjustment of the decimal places or in case if amounts have to be adjusted where they are multiple of whole numbers.</p>		<p><u>ListBox:</u> The <i>ListBoxes</i> are provided for selections. The item that should be focus for the calculations can be selected by clicking the left mouse button. If the number of items increases the lines of the <i>ListBox</i> a <i>ScrollBar</i> is arranged on the side of the <i>ListBox</i>.</p>
	<p><u>RadioButton / OptionButton:</u> This element is used in order to pick one exclusive item out of a group of associated items. Primary it is for choosing the variable that should be calculated. By selection it is defined as an output variable. The residual variables become input variables.</p>		<p><u>ScrollBar:</u> A <i>ScrollBar</i> can generally be arranged on the side of <i>ListBoxes</i>, <i>TabPage</i>s, <i>TextBoxes</i> and <i>Forms</i>. It will be the case whenever one of the element measures (e.g. height or width) is not big enough to display all the containing information. The arrangement can also be horizontal.</p>
	<p><u>CheckBox:</u> This element is used in order to include the selected items of a group of associated items. Primary it is for activating or deactivating functions. Beside this is also used to include or exclude a field of variables for the corresponding calculations.</p>		<p><u>GroupBox:</u> The purpose of the <i>GroupBox</i> is primary to get a clear separation between different program parts or to enclose elements which belong to one group. The <i>GroupBoxes</i> can be also formed in lines to separate program parts or program steps.</p>
	<p><u>CommandButton:</u> The <i>CommandButton</i> is used to execute internal program codes by clicking on the button. The general buttons are described on the next page.</p>		<p><u>TabPage(s):</u> <i>TabPage</i>s are used, whenever the program scope is divided up into several parts or additional respectively auxiliary calculations or selections are required. Only one <i>TabPage</i> can be displayed at a time. It is possible to switch over between the <i>TabPage</i>s by clicking the buttons above the box.</p>

Figure 15: table general program control elements

Following up the program command buttons are explained.

	<p><u>Calculate-Button:</u> Clicking this button will execute a calculation that is corresponding to the actual activated program. Before the calculation starts, all the input values are checked by an internal routine. If the value limits for the input variables are disrespected, the routine will automatically enter plausible values.</p>		<p><u>Info-Button:</u> For each program there is an info button provided. Clicking the info button will open a form on the left side where the program purpose, the variables and the functions are described. Further from this form it is possible to open the user manual and to get explanations about the upcoming program steps.</p>
	<p><u>Transfer-Button:</u> For some variables it is possible either to enter the value by keypad or to select an item from a list and transfer the coherent value (e.g. a coefficient or factor) into the corresponding input field by clicking the transfer button.</p>		<p><u>Notes-Button:</u> Sometimes it is helpful to write down small notes in order to keep things in mind or to inform other people in advance. These notes can refer to the theoretical background of the program subject or to special project or to anything else. Clicking the button opens a form where saving and restoring of texts is possible.</p>
	<p><u>Print-Button:</u> After the calculation was executed successfully, a calculation protocol can be printed out. Before the printout is started a calculation is executed again automatically. After this the project information can be entered and the printing can be continued.</p>		<p><u>Values-Button:</u> It is possible to save and restore values from carried out calculations. Therefore files are created, which are directly dedicated to the activated program. Therefore a name prefix is set automatically which is preceded to the user defined name that has to be entered for saving the file. It is also possible to delete already stored files.</p>
	<p><u>Erase-Data-Button:</u> Clicking the Erase-Data-Button will generally empty all the <i>TextBoxes</i>, set a predicted number of decimal places and reset the calculation. The values for the input variables have to be entered, before a new calculation is started.</p>		<p><u>Hint-Button:</u> This button is not provided for all the programs. It is included, if either some kind of hint is helpful for a better general understanding regarding the program handling or in order to remind the user of circumstances which are important for the subject.</p>

Figure 16: table program command buttons

The forms that are coming up in combination with the above displayed buttons are shown and further explained on the next pages.

5.1. Calculate-Button

For executing a calculation a proper dongle is required. In case if no proper dongle is detected, calculating, printing and saving or restoring values is not possible. This is also relevant for functions (e.g. selection, value transfers) that call a calculation due to internal routines, automatically. Without a proper dongle every program can be opened and displayed, variables can be entered, options can be chosen, filled data can be erased, program information can be called, notes can be saved and restored and hints can be shown. The table below gives an overview of the possible functions with and without detection of a proper dongle.

	TextBoxes	NumericUpDowns	RadioButtons / OptionButtons	CheckBoxes	Calculate-Buttons	Transfer-Buttons	Print-Buttons	Erase-Data-Buttons	Info-Buttons	Notes-Buttons	Values-Buttons	Hint-Buttons	ComboBoxes / Listboxes
with proper dongle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
without proper dongle	✓	✓	✓	✓	X	✓	X	✓	✓	✓	X	✓	✓

Figure 17: table dongle requirements

Whenever a calculation is triggered, an internal routine will initiate the detection of a dongle, automatically. For a full access to all the program functions a proper dongle is required to be available via one of the USB-slots. A calculation can be triggered either directly by clicking the calculate button or indirectly by the subroutine of another function (e.g. the print command or the change of an item selection). If no proper dongle can be detected via one of the USB-slots, the window above will be shown, the calculation will be interrupted and the output variables will be blank. Executing calculations is only allowed with a proper dongle!

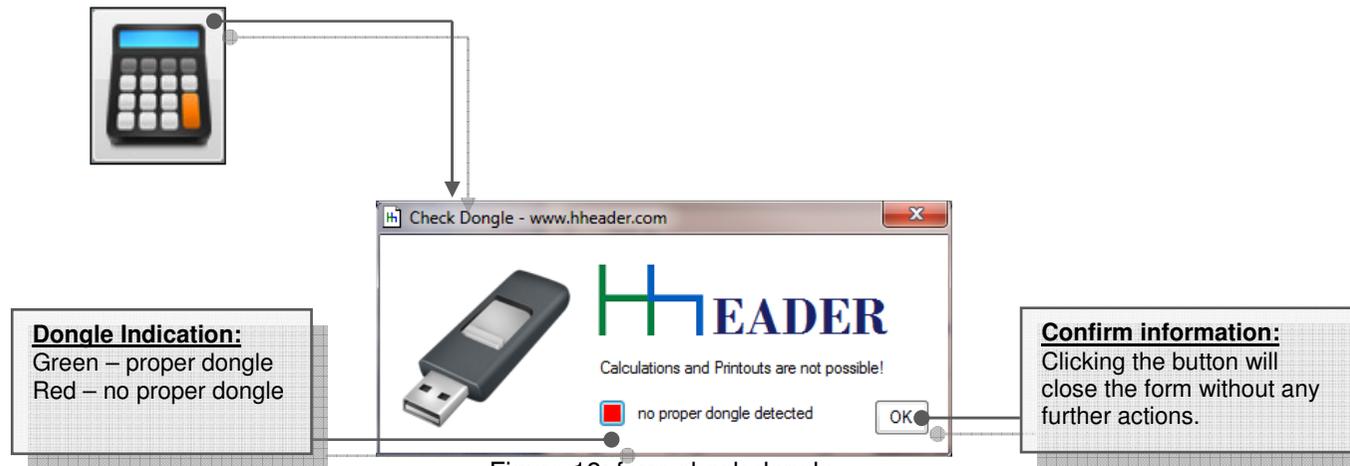


Figure 18: form check dongle

For each program there is an indicator light provided, which is showing the actual state of the calculation. The color of this indicator light will also be red, in case if a calculation was initiated and no proper dongle could be detected. The color of the indicator light is yellow, if a value or a unit or a setting has been changed and a calculation has not been initiated afterwards. The color of the indicator light is green, if a calculation has been carried out successfully. The indicator light cannot be seen directly after loading the program form, but it will appear after a value or a unit or a setting has been changed or new calculation has been initiated. In the last case beside the indicator light also two new buttons (“<” and “>”) will appear on the program form. By these buttons the user can step forwards or backwards through the already carried out calculations. So that it can be used as some kind of undo function. If the first value set is reached the back button “<” will be disabled and if the last value set is reached, the fore button “>” will be disabled. A new value set will be added automatically with every successful calculation. The value sets are reset whenever the corresponding program form is closed.

After a calculation was triggered and a proper dongle has been detected via one of the USB-slots, all the input values are checked by an internal routine. Whenever entered values decrease the corresponding min-limits or increase the corresponding max-limits or are not numeric, there will be a message according to the fault. The values will be corrected automatically by the internal routine. The user is requested to check the values regarding their plausibility before and after every calculation. For each input variable there are three kinds of limits defined. These are the min-limit, the max-limit and the numeric replacement value. The limit values for the variables are described in the corresponding chapter of the program documentation. They are also included in the program information which is shown by clicking the Info-Button for the actual program. Whenever one of the limits is disrespected the window shown below appears.



Values and indications:

For each of the displayed positions there is an indication provided. The positions that have been disrespected have a red indication. It is the value of the actual variable and the limit that has been disrespected. Beside this the entered value for the actual variable is shown beside the actual limit values. The entered value for the actual variable has to be numeric and in range between the min-limit and the max-limit. In case if the value decreases the min-limit, the actual value will be set equal to the actual min-limit. In case if the value increases the max-limit value, the actual value will be set equal to the actual max-limit. In case if the entered value is not numeric, the actual value will be set equal to the replacement value.

actual form	Safety_Distance_hyd	<input type="checkbox"/>
actual variable	pressure	<input type="checkbox"/>
actual value	abc	<input type="checkbox"/>
numeric value	2	<input type="checkbox"/>
min limit	0.01	<input type="checkbox"/>
max limit	999	<input type="checkbox"/>

first aid kit for values

Entered value is not valid. This value is set automatically to its corresponding limit value. CONTINUE

Figure 19: form checkinput

Continue:

Every detected limit error has to be confirmed by clicking the button.

The form includes the following information:

- the actual form (the program) where the input error occurred,
- the designation actual variable where the limits have been disrespected,
- the value actual variable where the limits have been disrespected,
- the numeric replacement value for the actual variable,
- the minimum limit value for the actual variable,
- the maximum limit value for the actual variable.

The internal routine will check all the input variables, one by one. After the routine has run through, a new calculation can be triggered. The results will be shown, if the input variables are in the ranges and with it plausible for a practical calculation.

5.2. Print-Button

Clicking the Print-Button will trigger a calculation first. In case if the calculation is executed successfully the project information form will appear. Finally the variables that are relevant for the calculation will be printed into a calculation protocol. There are five fields for information provided in the header of the calculation protocol. They can be entered in the form shown below. The information is divided up into project name, subsection, user name, date and comment. For the date there are two options provided: it can be entered as a string variable, if the *CheckBox* to the right side from the *TextBox* is deactivated or the actual date will be filled automatically, if the *CheckBox* to the right side from the *TextBox* is activated. Be aware that the minimum screen resolution for an accurate printing is "Extended VGA" (EVGA) with x = 1024 pixels by y = 768 pixels (width x height)!

Step 2: Fill the information (option)
I can fill the information for project name, subsection, user name, date and comment.

Step 1: Set date(option)
For the date there are two options provided. I can enter it as a string variable, if the *CheckBox* is deactivated or the actual date will be filled automatically, if the *CheckBox* is activated.

Step 3: Set default printer (option)
I can select the printer via the button with the designation "Set default printer". The selected printer will be set as default printer.

Step 4: Load / Save(option)
I can load and save entries for the project information.

Step 5: Print to printer(option)
The Print-Button starts the printing to the selected printer. The printer can be selected via the button with the designation "Set default printer".

Step 5: Print to file (option)
The button with the designation "to file" starts the printing into a file. The file will be stored in the folder "\hh_Prints". The filename, that will be generated automatically, consists out of three sections: the prefix "Print_", the program name plus a date and time code. The format of the date and time code is YYYY_MM_DD_hh_mm_ss.

Step 6: Further actions
After the calculation I can have the following options: Erase Data, Program Information, Notes. Clicking the Erase-Button will empty all the *TextBoxes* at once.

The screenshot shows a window titled "Project Information" with the following fields: Safety Distance, project name: Water Treatment Plant, subsection: Piping, name: Mr. Comm, date: 28.08.2019, and comment: ferretic steel. There is a checkbox labeled "Set actual date as report date" which is checked. At the bottom, there are buttons for "to file", "set", and "Print".

Figure 20: form project infos

After clicking the Print-Button a calculation report will be generated automatically. There are three different types of calculation reports provided. Depending on the actual activated program the convenient calculation report will be selected automatically by an internal routine. The calculation reports are built up as follows. The reports have a headline. Below the headline the program name is given. Beside this the subsection and the date can be displayed. The next part is the project data. The project data consist of project name, subsection, user name and a line for comments. Below the project data the calculated results are given. This includes the relevant variables. The variable information consists in general of four positions: the designation, the value, the unit and the type of the variable. For the variable types there are different abbreviations defined. They can be shown on a form that can be opened by the terminal command "types". The form with the variable types is shown below.

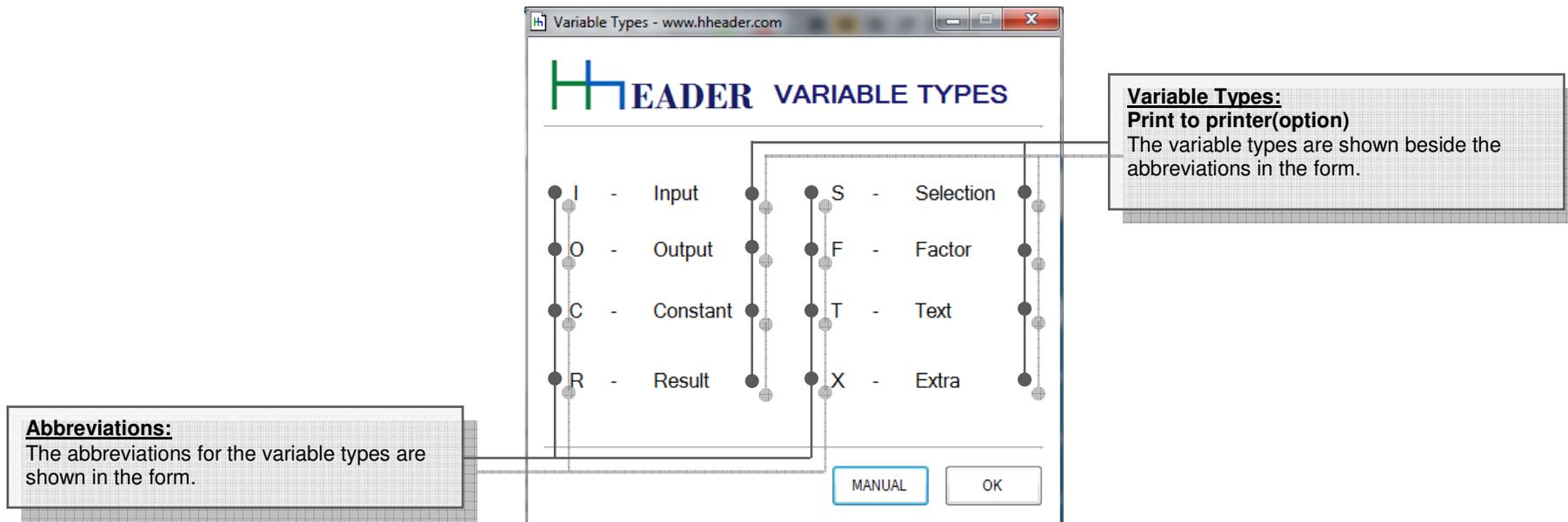


Figure 21: form variable types

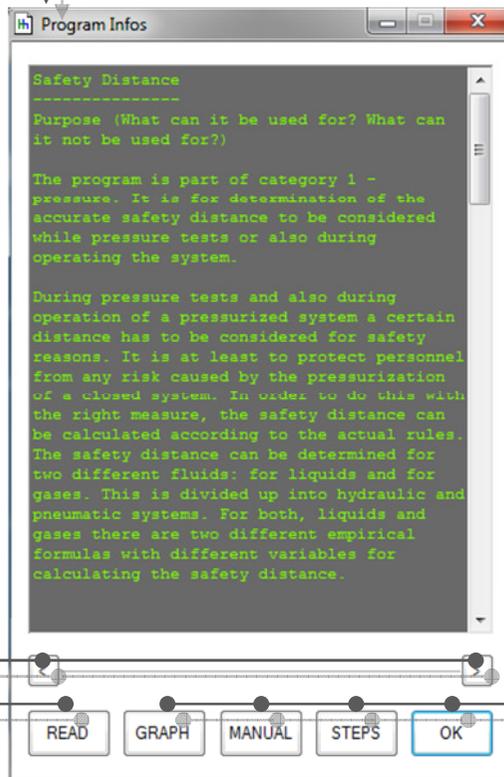
5.3. Info-Button



For each program there is an info button provided. Clicking the info button will open a form on the left side where the program purpose, the variables and the functions are described. Further from this form it is possible to open the user manual and to get explanations about the upcoming program steps.

Zoom-functions:
(option)
By the buttons "<" and ">" the size of the font can be changed. As font size 8 or 10 or 12 can be adjusted.

READ:
(option)
It is possible to read and hear the text. Therefore the parts that should be read have to be marked! After clicking the button with the indication "READ", the text is read by the synthesized voice of the operating system. The corresponding language adjustments have to be done in the windows control panel accordingly. Usually there is a basic voice provided by the system. Be aware that the language of the text has to be in coherence with the installed and selected synthetic voice.



Commands:
(options)

GRAPH:
A small subprogram is provided that can display the graphs for the mathematical functions that are relevant for the program subject. The displayed graphs are a qualitative analysis, what means that it is not possible to read reliable values from the diagram. The general course of the graph is shown in order to allow further considerations and evaluations.

MANUAL:
Clicking this button will open the user manual as a PDF-file with the software that actually set as standard PDF-viewer.

STEP:
This button will open the next form where hints for the steps for using the program are given.

OK:
This button will just close the form. Alternatively the Exit-Button with the designation "X" on the right side in the top of the form can be used.

Figure 22: form programinfos

From the program info form another form can be called where a robot can lead the user through the single steps which are required respectively possible for the calculation. Therefore buttons with the numbers 1 to 10 are provided. These buttons show the upcoming steps for the calculation. Further there are common hints and true conclusions given for the subject.

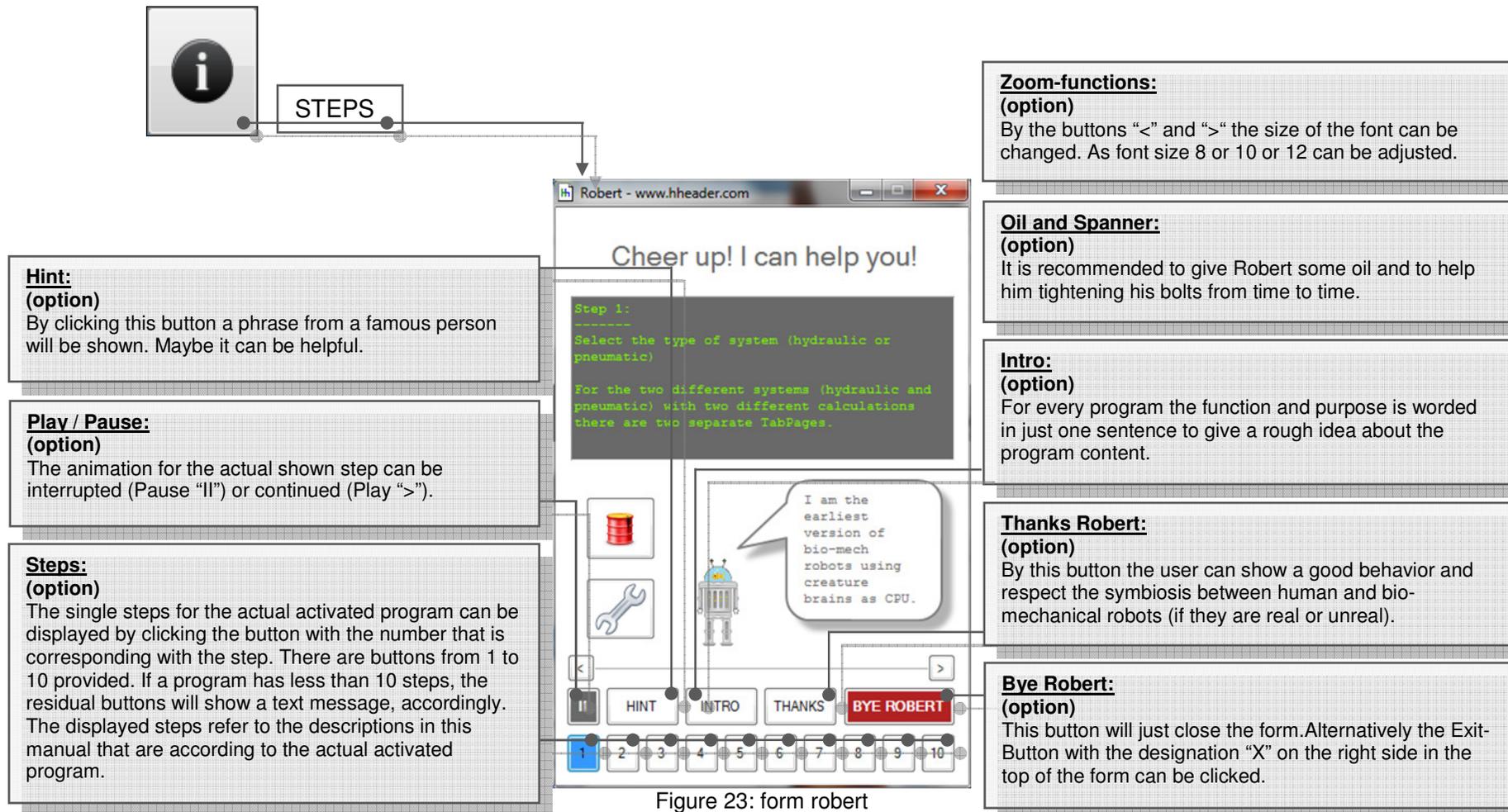


Figure 23: form robert

From the program info form another form can be called where it is possible to draw the curves that are corresponding to the calculations for the equations for the program “Pressure Surge”. Two points are important regarding this function:

- 1.) Up to now the curves have a qualitative characteristic, only! 2.) Up to now this function is available only for the program “Pressure Surge”!

Step 1:
Select the curve to be displayed
Depending on the actual activated program a selection of curves that are corresponding to the calculations are provided. The curve will be displayed after selection.

Step 2:(option)
Zoom the curve
I can zoom in (+) and out (-) of the graph. Direct after loading the form the zoom factor is 1. From this position it is possible to click the Plus- or the Minus-Button once.

Step 3:(option)
Set the step width for the curve movement along the axes
The step width that is relevant for moving the graph along the axes can be set separately for the x-axis and the y-axis. The measures of the window are in total 660 pixels (width) by 440 pixels (height).

Step 4:(option)
Move the curve along the axes
I can move the curve along the axes by clicking the provided buttons with the arrows.
→ will move the whole graph to the left, so that the curve right side of the window can be examined.
← will move the whole graph to the right, so that the curve left side of the window can be examined.
↑ will move the whole graph downwards, so that the curve topside of the window can be examined.
↓ will move the whole graph upwards, so that the curve downside of the window can be examined.

Step 5:
Evaluate the curve
When the curve is displayed and the position and zoom factor are adjusted, it can be examined and evaluated according to the use case.

Step 6:(option)
Consider the position
The *TextBox* shows the actual cursor position, whereupon the first number is x-value and the second number is the y-value. Be aware that the displayed graphs are a qualitative analysis, what means that it is not possible to read reliable values from the diagram. The general course of the graph is shown in order to allow qualitative evaluations.

Figure 24: form graph

5.4. Notes-Button

Sometimes it is helpful to write down small notes in order to keep things in mind or to inform other people in advance. These notes can refer to the theoretical background of the program subject or to a special project or to anything else. Clicking the button opens a form where saving and restoring of texts is possible.

Save and Restore: (option)
It is possible to save and restore the notes for the actual activated program. The file name will be defined automatically. For each program there is one sheet of notes provided. The files will be stored in the folder `\hhHEADER\hh_Notes`.

Further actions: (option)
It is possible to erase the note sheet or to get more information about the notes form.

MANUAL: (option)
Clicking this button will open the user manual as a PDF-file with the software that actually set as standard PDF-viewer.

Zoom-functions: (option)
By the buttons "<" and ">" the size of the font can be changed. As font size 8 or 10 or 12 can be adjusted.

READ: (information)
It is possible to read and hear the text. Therefore the parts that should be read have to be marked! After clicking the button with the indication "READ", the text is read by the synthesized voice of the operating system. The corresponding language adjustments have to be done in the windows control panel accordingly. Usually there is a basic voice provided by the system. Be aware that the language of the text has to be in coherence with the installed and selected synthetic voice.

OK: (option)
This button will just close the form. Alternatively the Exit-Button with the designation "X" on the right side in the top of the form can be used.

Figure 25: form notes

The location for the stored files is set automatically in order to ensure an organized file management. So that it is possible to exchange the notes easily with the colleagues at work and teammates. Therefore just the files in the folder `\hhHEADER\hh_Notes\` have to be exchanged. Because of these reasons, the normal load and save dialogs of the operation system have not been implemented here. The programming would have been easier in this case, but the file management would not be predetermined explicitly.

5.5. Values-Button

It is possible to save and restore values from carried out calculations. Therefore files are created, which are directly dedicated to the activated program. A name prefix is set automatically which is preceded to the user defined name that has to be entered for saving the file. It is also possible to delete already stored files.

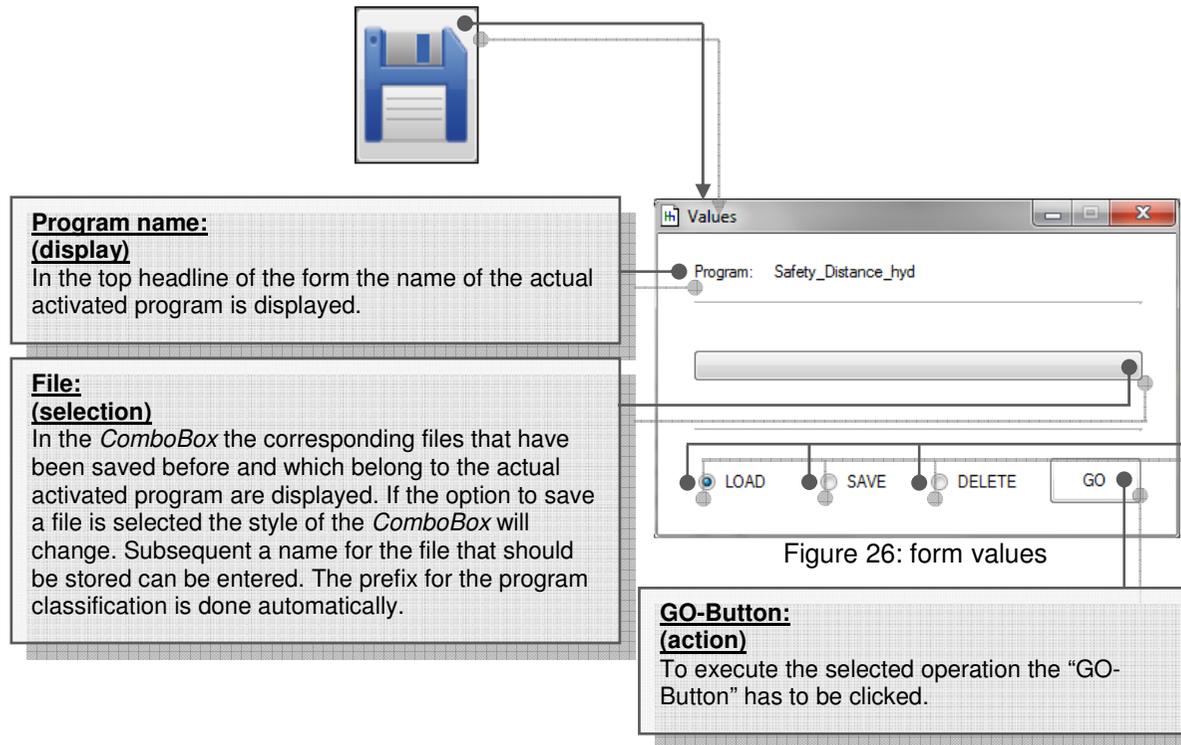


Figure 26: form values

Step 1:

Select file operation

There are three different file operations provided: to load a previously saved file, to save a new file and delete a previously saved. The first step is to select which operation should be carried out next.

LOAD:

If the option to load a file is selected the files that have been saved before and which belong to the actual activated program are displayed in the *ComboBox* in the center of the form. One of these files can be selected. To execute the operation the "GO-Button" has to be clicked. Afterwards the values that are stored in the file will be loaded into the corresponding *TextBoxes* of the actual activated form.

SAVE:

If the option to save a file is selected the style of the *ComboBox* will change. Subsequent a name for the file that should be stored can be entered. The prefix for the program classification is done automatically.

DELETE:

If the option to delete a file is selected the files that have been saved before and which belong to the actual activated program are displayed in the *ComboBox* in the center of the form. One of these files can be selected. To execute the operation the "GO-Button" has to be clicked. Afterwards the action has to be confirmed once more and then the selected file will be deleted. Attention: the file will not be send to the recycle bin!

The location for the stored files is set automatically in order to ensure an organized file management. So that it is possible to exchange the value sets easily with the colleagues at work and teammates. Therefore just the files in the folder `\\hhHEADER\hh_Values\` have to be exchanged. Because of these reasons, the normal load and save dialogs of the operation system have not been implemented in this program. The programming would have been easier in this case, but the file management would not be predetermined explicitly.

5.6. Hint-Button

This button is not provided for all the programs. It is included, if either some kind of hint is helpful for a better general understanding regarding the program handling or in order to remind the user of circumstances which are important for the subject. The message form will also appear in case if the internal calculation rules are disrespected (e.g. division by zero). The actual message text is displayed in the dark area.

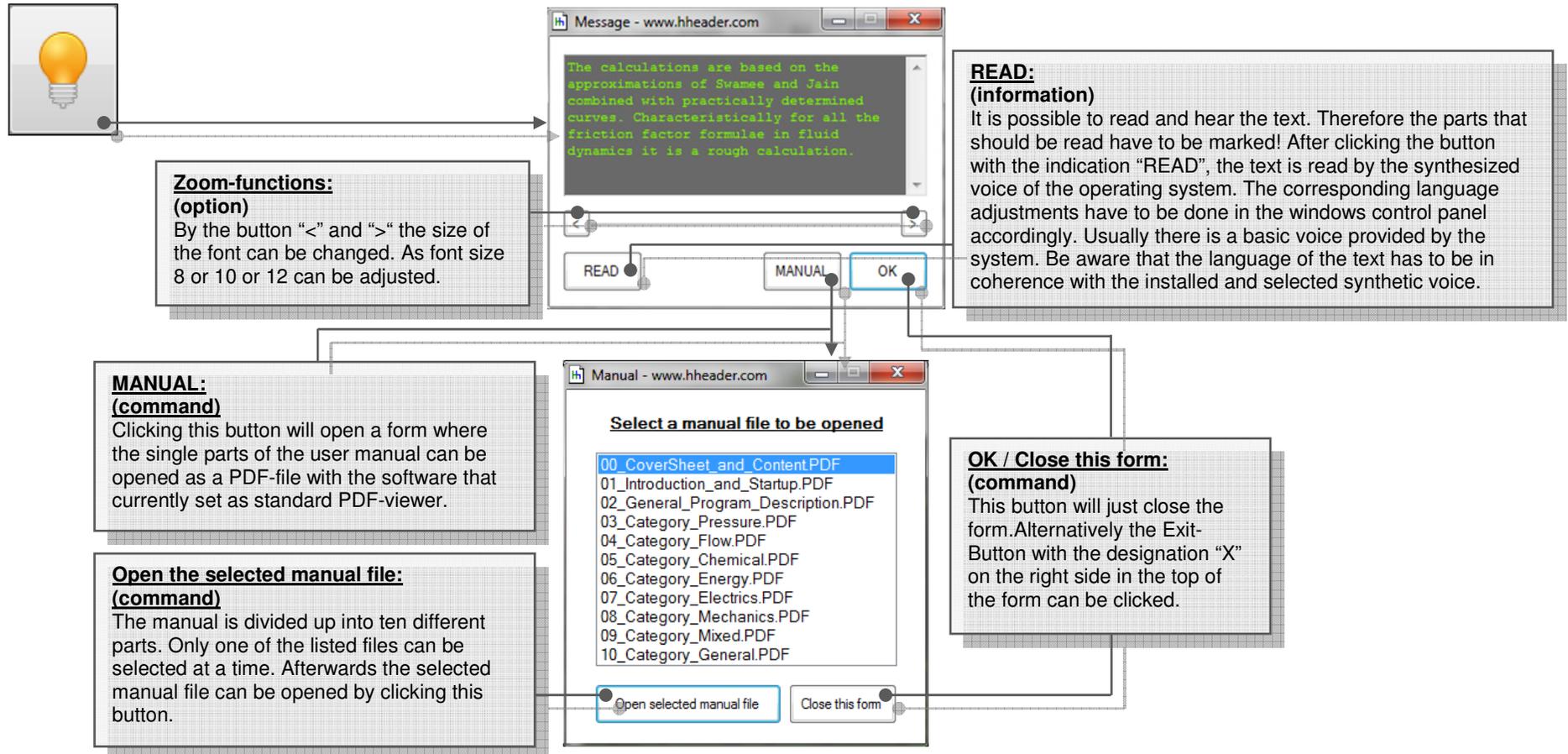


Figure 27: forms message and manual