

eAssistant

the engineering assistant

A calculation example Parallel Keys according to DIN 6892

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1 Example: Parallel keys according to DIN 6892

The calculation example shall support you with a fast start into the parallel key calculation module with its numerous possibilities. We prepared the following example for an introduction to this calculation module (see DIN 6892, Example E.2).

1.1 Start the calculation example

Please login with your user name and your password. Select the module 'Parallel key' through the tree structure of the Project Manager by double-clicking on the module or clicking on the button 'New calculation'.

The calculation module is opened in a new window.

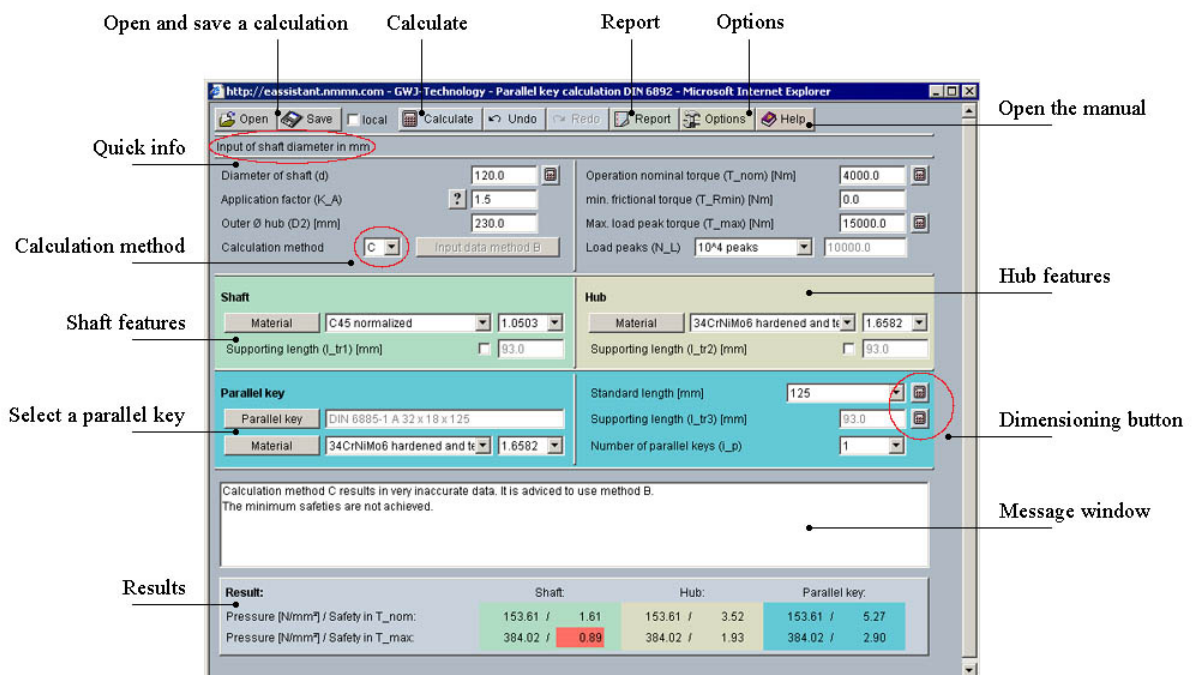


Figure 1: A general overview

1.2 The input values

A strength calculation for the following shaft-hub-connection has to be accomplished. Please enter the following values into the input fields:

Diameter of shaft = 60 mm
 Application factor = 1.75
 Outer diameter hub D_2 = 120 mm
 Calculation method = B

Input data method B:

Kind of load = Alternating torque with a slow torque increase
 Changes of load direction = 10^6
 Max. reverse torque T_{maxRev} = 3900 Nm
 Small outer diameter of stepped hub D_1 = 120 mm
 Big outer diameter of stepped hub D_2 = 120 mm
 Width of hub with D_2 internal l_{tr} (c) = 91 mm
 Axial distance between load in and output position a_0 = 45.5 mm

Chamfer or radius on the shaft keyway edge s_1	= 1.0 mm
Chamfer or radius on the hub keyway edge s_2	= 1.0 mm
Operation nominal torque T_{nom}	= 1.950 Nm
Min. frictional torque T_{Rmin}	= 1.250 Nm
Max. load peak torque T_{max}	= 3.900 Nm
Load peaks N_L	= 500
Material shaft	= C45 hardened and tempered
Material hub	= 34CrNiMo6 hardened and tempered
Parallel key	= DIN 6885.1 AB 18 x 11 x 100
Material parallel key	= 34CrNiMo6 hardened and tempered
Standard length parallel key	= 100 mm
Number of parallel keys	= 1

1.3 The calculation

Please note: While you enter the data into the input fields, the calculations are accomplished. Thereby it can happen that the input fields are marked in red. Nevertheless, continue to enter the complete input data.

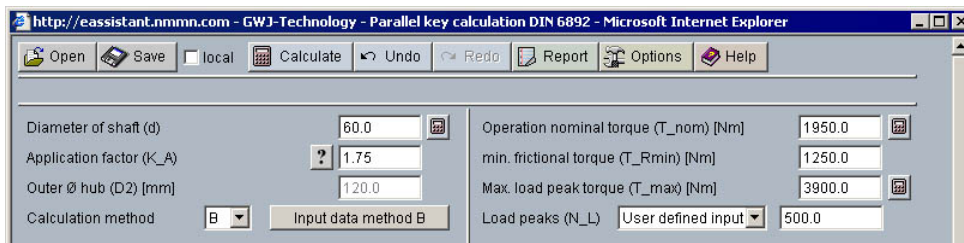
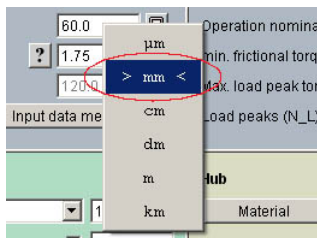


Figure 2: Input value



Please note: If you right-click into an input field, you can change the unit of measurement. A context menu is opened. The both arrows mark the current setting. The current field value will be converted automatically into the selected unit.

Calculation method B

Because of the reversal of the direction, a rough calculation according to method C is not possible. Select the calculation method B.



Figure 3: Calculation method B

When selecting the calculation method for the first time, the window 'Input data method B' opens immediately.

Enter the further values here and confirm your inputs with 'OK'. If you would like to change your input values later, please click on the button 'Input values method B' and the input mask appears again.

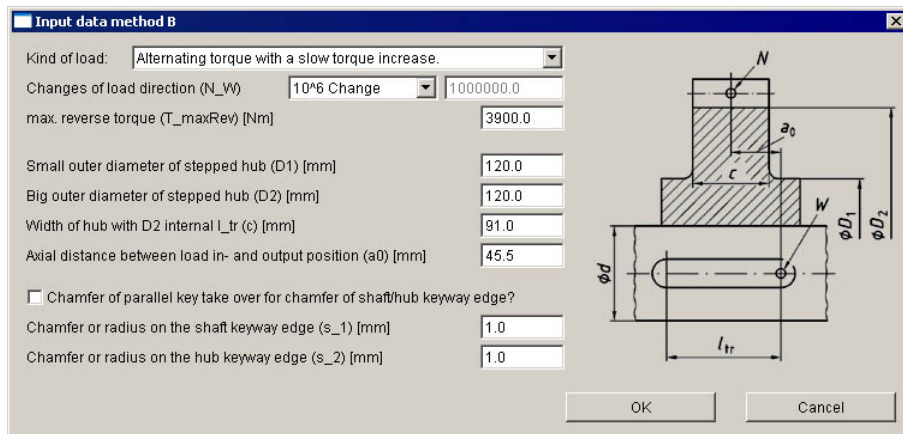


Figure 4: Values for the calculation method B

Input of load peaks

The number of load peaks is '500'. Select 'User defined input' from the listbox and enter the value '500'.

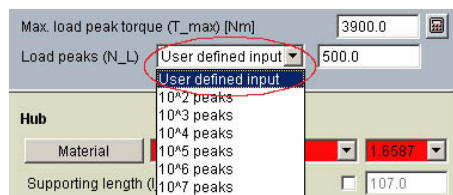


Figure 5: Specification of load peaks

Inputs for the shaft

Define a material for the shaft. For our example the material 'C45 hardened and tempered' is required.

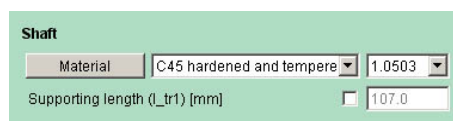


Figure 6: Shaft

The calculation module offers an easy possibility to choose the material directly from the listbox. But if you click on the button 'Material', you will get to the material database. Here you will receive further information about the material source, kind of material, yield point, hardness factor f_H as well as the support factor f_H . After you have selected the material 'C45 hardened and tempered', please confirm with the button 'OK'. Then you will get to the main mask.



Figure 7: Material database

User defined material

Use the possibility to specify your own defined material. Select the entry 'User defined' from the listbox. You can add a comment or change the kind of material. Enter your own input values for the hardness factor f_H or for the support factor f_S .

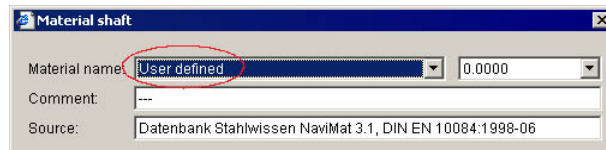


Figure 8: User defined inputs

Inputs for the hub

Determine the material of the hub. The required material is here '34CrNiMo6 hardened and tempered'. You can select the material directly from listbox. In case you need further information, please click on the button 'Material'. Then you get to the material database of the hub. Select the material '34CrNiMo6 hardened and tempered' and confirm with the button 'OK'.

The material is taken over to the main mask.



Figure 9: Hub

The button 'Material' allows you to define your own material.

Input data for the parallel key

For a comfortable working, a parallel key selection according to DIN 6885 sheet 1 to 3 is available. Here you can choose the parallel key geometry as well as the size. Find all appropriate standardized lengths for the parallel keys. The dimensions of the parallel key are as follows:

Parallel key: DIN 6885.1 AB 18 x 11 x 100

Standard length

To determine the standard length of the parallel key, select the value '100' from the listbox.

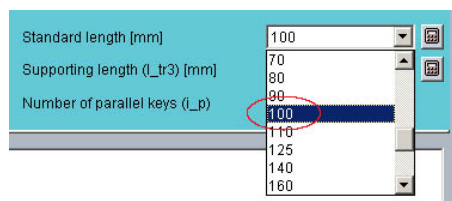


Figure 10: Standard length

The length is taken over to the geometry of the parallel key.



Figure 11: Geometry

Selection of the parallel key geometry

Click on the button 'Parallel key' to select the shape of the parallel key.



Figure 12: Button 'Parallel key'

A new window is opened. The appropriate parallel key will be displayed immediately.

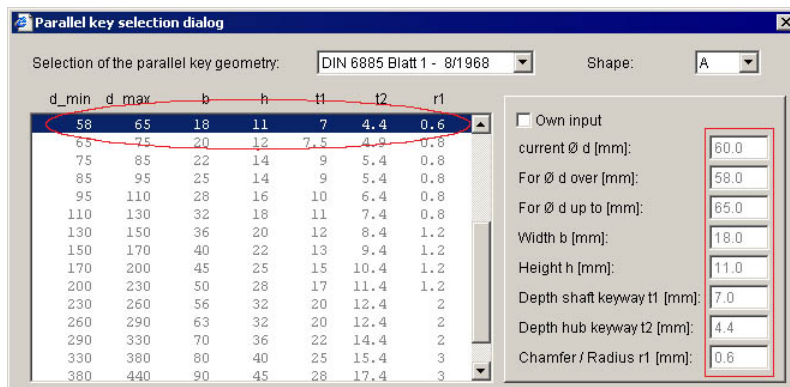


Figure 13: Selection dialog for the parallel key

Select the parallel key geometry 'DIN 6885 sheet 1-8/1968' as well the shape 'AB' from the appropriate listbox.



Figure 14: Selection of the parallel key

Confirm with the button 'OK' to take over the values into the main mask.

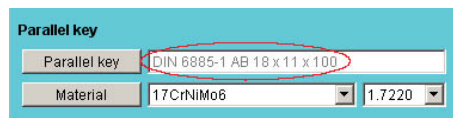


Figure 15: Dimensions of the parallel key

Please note: The input of non-standard parallel keys

You have got the possibility to calculate non-standard parallel keys. You can define parallel keys different from the standard. The parallel keys A to J are also available here. In case you would like to define a non-standard parallel key, click on the button 'Parallel key' and you will get to the selection dialog again. Now activate the option 'Own input' and choose the appropriate dimension from the list or enter the dimensions directly.

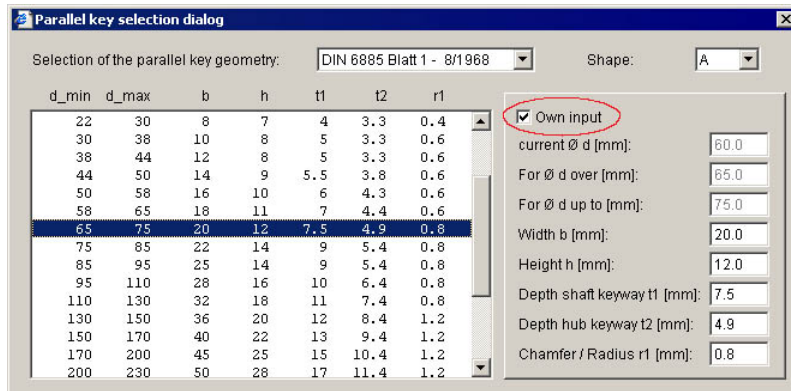


Figure 16: Option 'Own input'

Selection of a material

Select the material '34CrNiMo6 hardened and tempered' directly from the listbox.

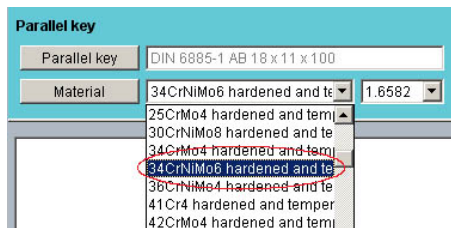


Figure 17: Material for the parallel key

If you need further information on the material, click on the button 'Material' and you will get to the material database.



Figure 18: Button 'Material'

The supporting length l_{tr} is calculated automatically from the already specified standard length. You can use the listbox to select the number of parallel keys. For our calculation example we specify one parallel key.

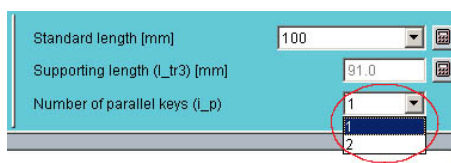


Figure 19: The supporting length and number of parallel key

Please note: The supporting length for non-standard parallel keys

It is possible to define a supporting length for non-standard parallel keys. Select the option 'User defined input' from the listbox for the standard length. Now you can enter your own value into the input field for the supporting length.



Figure 20: User defined input

It is possible to specify different supporting lengths for the shaft and for the hub. Activate the input field for the supporting length for shaft and hub.

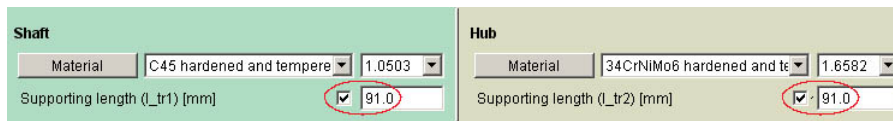


Figure 21: The supporting length for shaft and hub

1.4 The calculation results

The safeties of the operation load and at the maximum load for all three components (shaft, hub, and parallel key) are determined and displayed immediately in the result panel during the input. Which means that after every input of data, the results are calculated again. You will get the results for the equivalent pressure and for the pressure at load peak as well as the safety at operation load and the safety at peak load.

Result:	Shaft:	Hub:	Parallel key:
Pressure [N/mm ²] / Safety in T _{nom} :	432.92 / 0.32	387.54 / 0.86	432.92 / 0.66
Pressure [N/mm ²] / Safety in T _{max} :	432.92 / 1.54	387.54 / 4.06	432.92 / 3.12

Figure 22: The calculation results

You can find also some additional information about your results in the message window.

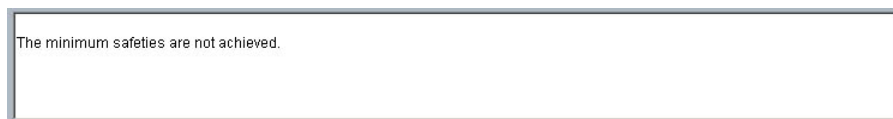


Figure 23: The message window

In our calculation example the safeties for the shaft, the hub and the parallel key are marked in red. This means that the minimum safeties are not fulfilled. In addition, you get also an appropriate message in the message window. The parallel key is not suitable for our calculation example.

1.5 The documentation: The calculation report

Use the button 'Report' to generate the calculation report very fast. This report contains the calculation method, all input values as well as the detailed results.



Figure 24: The button 'Report'

The calculation report contains a table of contents. You can navigate through the report via the table of contents that provides links to the input values, results and figures. The report is available in HTML and PDF format. Calculation reports, saved in HTML format, can be opened in a web browser or in Word for Windows.

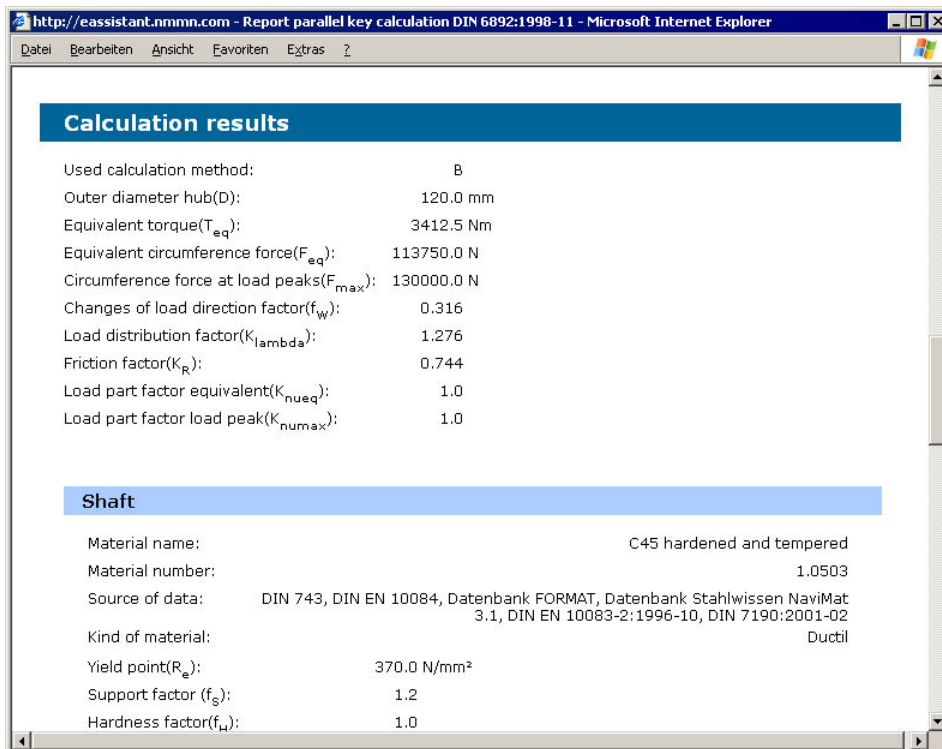


Figure 25: The calculation report for the parallel key

- To save the report in the HTML format, please select 'File' → 'Save as' from your browser menu bar. Select the file type 'Webpage complete', then just click on the button 'Save'.
- If you click on the symbol 'Print', then you can print the report very easily.
- If you click on the symbol 'PDF', then the report appears in the PDF format. If you right-click on the PDF symbol, you should see the 'Save Target As' option. Click on that option and you will see the dialog box for saving the report.

1.6 How to save the calculation

After the accomplishment of your calculation, save the calculation either on the eAssistant server or on your own workstation locally. Click on the button 'Save'.



Figure 26: The button 'Save'

If you have activated the option 'Enable file save local' in the Project Manager and the option 'Local' in the calculation module, a standard Windows dialog for saving the file on your workstation appears.

Please note: You must not forget that the calculation module has to be closed to activate the option 'Enable file save local.'

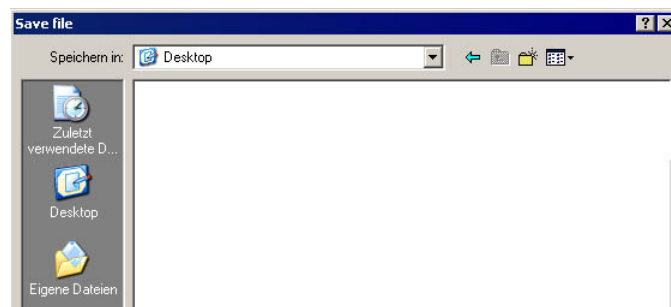


Figure 27: Windows dialog to save the file

In case you have not activated this option, a new window is opened and you can save the calculation on the eAssistant server (find further information in the chapter 'The general functions').

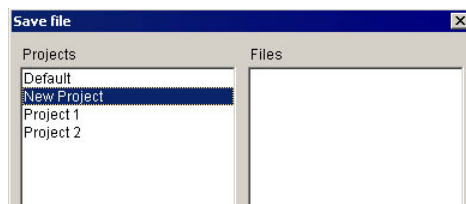


Figure 28: Save the calculation

Please enter a name into the input field 'Filename' and click on the button 'Save'. Then click on the button 'Refresh' in the Project Manager. Your saved calculation file is displayed in the window 'File'.


1.7 The dimensioning functions

The button for the dimensioning functions is marked by a calculator symbol and is located next to the input fields. If you click on the dimensioning buttons, you get a suggestion for an appropriate input value. There the calculation of the value takes place that the given minimum safety is just fulfilled.

By the following dimensioning buttons you are optimally supported:



Dimensioning of the shaft diameter

- Operation nominal torque (T_nom) 1950.0  Dimensioning of the operation nominal torque
- Max. load peak torque (T_max) [Nm] 3900.0  Dimensioning of the maximum load peak torque
- Standard length [mm] 100  Dimensioning of the standard length
- Supporting length (l_tr3) [mm] 91.0  Dimensioning of the supporting length

Minimum safety: The dimensioning of the shaft diameter

The shaft diameter has to be determined so that the given safety of '1.2' for the parallel key connection is achieved. Click on the dimensioning button (calculator) for the shaft diameter.

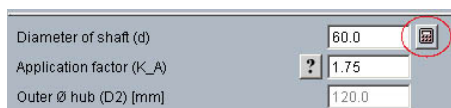


Figure 29: The dimensioning button for the shaft diameter

Now the new shaft diameter is determined.

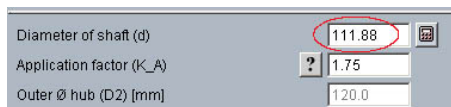


Figure 30: New shaft diameter

The shaft diameter is now $d = 111.88$ mm. With it the minimum safety of '1.2' is achieved and the parallel key is suitable for this application.

The parallel key is suitable for the given data.
There are no material data for the reference diameter of the shaft. Please check!

Result:	Shaft:	Hub:	Parallel key:
Pressure [N/mm ²] / Safety in T _{nom} :	116.74 / 1.20	97.53 / 3.40	116.74 / 2.44
Pressure [N/mm ²] / Safety in T _{max} :	116.74 / 5.70	97.53 / 16.15	116.74 / 11.56

Figure 31: The result

Because of its larger diameter, a new parallel key size is determined automatically.

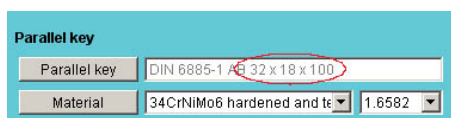


Figure 32: Parallel key

In case you click on the button 'Parallel key', the larger parallel key is displayed automatically.

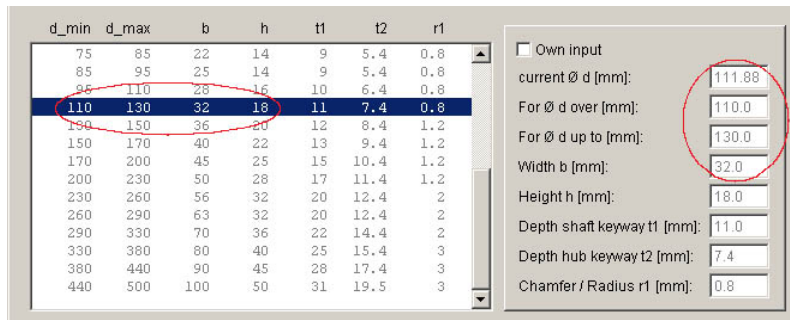


Figure 33: New parallel key

1.8 The button 'Redo' and 'Undo'

The button 'Undo' allows you to reset your input to an older state. The button 'Redo' reverses the undo.

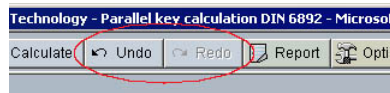


Figure 34: The 'Redo' and 'Undo' button

1.9 The button 'Options'

Click on the button 'Options'.

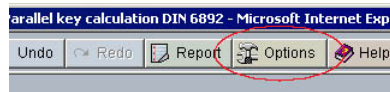


Figure 35: The 'Options' button

The 'Options' button allows you to change some general settings such as the minimum safety as well as the number of decimal places.

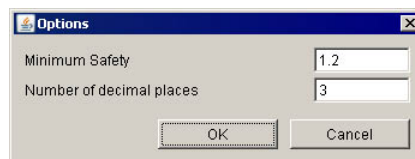


Figure 36: Options

Our manual is improved continually. Of course we are always interested in your opinion, so we would like to know what you think. We appreciate your feedback and we are looking for ideas, suggestions or criticism. If you have anything to say or if you have any questions, please let us know via telephone +49 (0) 531 129 399-0 or email eAssistant@gwj.de.