# **GEO CENTER**

Online help

Version: 1.0 Edition: 10.2017

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## Introduction

#### **Welcome to GEO CENTER**

#### What is GEO CENTER

GEO CENTER is a software application used to measure and analyze geometric shapes. Measurement and analysis are based on Straightness and Flatness applications.

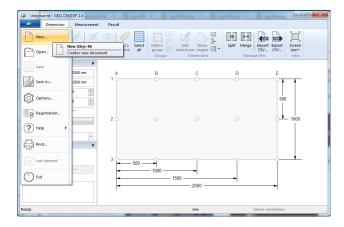
GEO CENTER measurements are made using the application and one of the following hardware combinations:

		sensALIGN sensor ALI 4.900	LEVALIGN expert sensor ALI 6.940	INCLINEO ALI 18.200
sensALIGN laser ALI 4.910		✓	×	×
LEVALIGN expert laser ALI 6.930-LIB / ALI 6.960-LI		<b>✓</b>	<b>✓</b>	×
LEVALIGN laser ALI 6.910-IS Long range laser ALI 4.100		✓	×	×
INCLINEO ALI 18.200	<u></u>	×	×	<b>√</b>

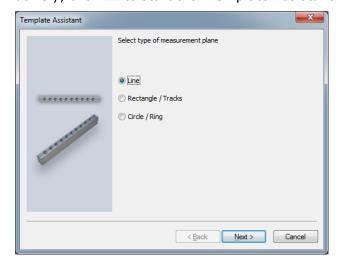
## **Starting GEO CENTER**

After <u>installation</u>, the application may be started by by double-clicking the

GEO CENTER icon (if available as a desktop shortcut) or accessed via the Start menu. On starting the application, a blank unnamed file opens.



Click the application icon then select the menu item "New..." from the drop-down menu. Create the desired file using the "Template Assistant" wizard which opens. Alternatively, click to start the "Template Assistant" to create a new file.



The wizard offers the following shapes for measurement:

- >> Line (uses Straightness application)
- >> Rectangle / Tracks (uses Flatness application)
- >> Circle / Ring (uses Flatness application)

Select desired shape then click "Next" and proceed to define the object to be measured or analyzed.

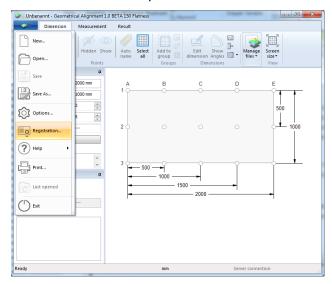
## Activating trial version to full version

#### **Trial version**

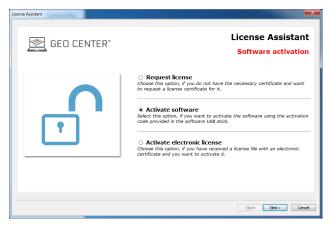
On installation, GEO CENTER runs in a trial version until the software is registered and activated. The trial version does not allow saving of measurement files.

#### **Activation and registration**

1. After starting GEO CENTER, click application icon [ ] then the menu item "Registration" from the drop-down menu.



2. The license assistant opens offering three options that may be used to activate the full version of GEO CENTER software.



#### The three options are:

- >> **Activate software** This is the default option and should be selected if the software has been delivered via the purchased USB thumb drive. In this case, the activation code required for activation is printed on the packaging of the supplied installation USB thumb drive.
- >> **Request licence** This option should be used when no activation code is available. This could be the case if the software is downloaded via the PRUFTECHNIK website.
- >> **Activate electronic license** This option is used if a license request has already been made and the electronic certificate received via email.

#### Proceed with activation

1. Select the option "Activate software" then click "Next". The following window appears.



2. Enter the activation code in the provided box then tap "Next".



#### **Note**

The activation code is printed on the supplied USB packaging.

3. Enter all necessary company details in the "Contact" window that appears then click "Next".





#### Note

All fields are mandatory except "State".

- 4. In the screen that appears, there is a choice between "Online activation" and "Email activation".
  - >> **Online activation** If Internet connection is available this option may be used to activate the software online by automatically downloading the license file.
  - >> **Email activation** If no Internet connection is available, this option may be used to later send via email, the software activation request ( which includes user information and address) to PRÜFTECHNIK Condition Monitoring This information may also be saved then printed and sent to PRÜFTECHNIK Condition Monitoring via post. After the information is processed, PRÜFTECHNIK Condition Monitoring will send an electronic license via email.

#### Proceed with online activation

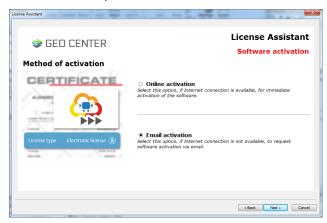
1. Select the option "Online activation" then click "Next". The "Activation status" window appears.



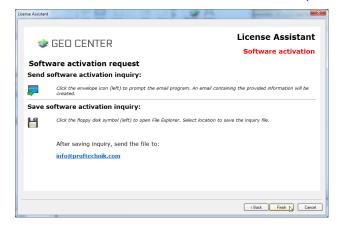
2. Click "Next" to complete activation.

#### Proceed with email activation

1. Select the option "Email activation".



2. Click "Next". The "Software activation request" window appears.



Two options are available for requesting the activation via email.

>> **Send software activation inquiry** — When using this option, click  $\boxtimes$ .

GEO CENTER tries to automatically send an email message containing the user information and address previously entered.

>> Save software activation inquiry — When using this option, click  $\square$ . Windows

Explorer will open, and then the activation inquiry file is saved in the desired location. This .txt file is then sent to the given email address: activation@pruftechnik.com.



#### **Note**

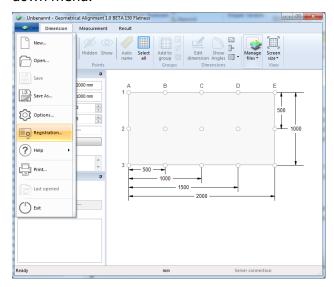
After sending the activation inquiry, a <u>license to complete activation</u> will be received via email.

#### **Activation with electronic license**

After sending the activation inquiry via email, an electronic license will be received via email. Save the electronic license file in the desired location. This file will now be used to complete the software activation.

## Select "Activate elctronic license" option

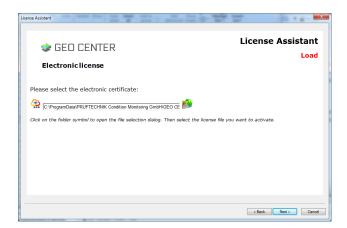
- Start GEO CENTER by double-clicking the GEO CENTER icon.
- 2. Click the application icon then select the menu item "Registration" from the drop-down menu.



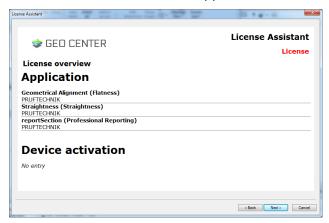
3. Select the option "Activate electronic license" in the license assistant then click "Next".



4. Click the folder icon to browse for the location where the electronic license file was saved. Select the file then click "Next".



5. The license overview will appear. Click "Next" to proceed.



6. Click "Finish" to complete the activation.

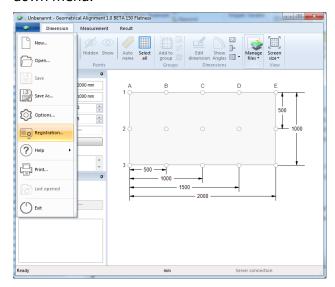


## Requesting license

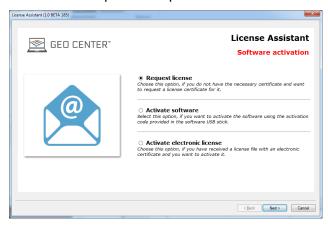
For full functionality, GEO CENTER measurement software must be registered and activated. If neither the activation code nor an electronic license are available, then a license must be requested.

## Select "Request license" option

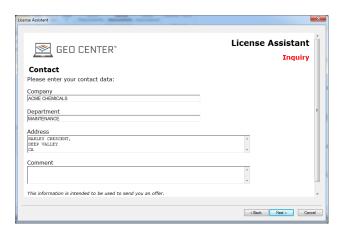
- 1. Start GEO CENTER by double-clicking the GEO CENTER icon.
- 2. Click the application icon then select the menu item "Registration" from the drop-down menu.



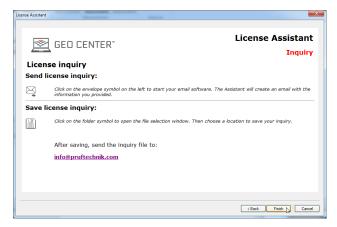
3. Select the option "Request license" in the license assistant then click "Next".



4. Enter the requested company details in the "Contact" window that appears then click "Next".



5. The "License inquiry" window provides two options with which the license request may be made.



>> **Send license inquiry** — When using this option, click ... GEO CENTER tries to automatically send an email message containing the information previously provided.
>> **Save license inquiry** — When using this option, click ... Windows Explorer will open, and then the license inquiry file is saved in the desired location. This .txt file is then



#### Note

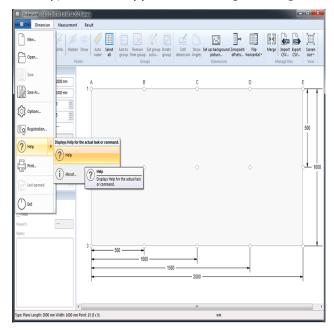
After sending the license inquiry, PRÜFTECHNIK Condition Monitoring will contact you via email.

sent to the given email address: activation@pruftechnik.com.

#### Using GEO CENTER online help

Comprehensive information regarding operation of GEO CENTER measurement software may be found in its online help. The online help contains the complete user documentation. The online help may be called up at any time by pressing the F1 key on the keyboard. Altern-

atively, click the application icon [ then use the drop-down menu item "Help".



All help topics can be accessed via the table of contents. Click on an entry in the tree structure to display the content. Use "Back" and "Forward" to navigate in already opened help topics. Topics may also be located using the "Index" and "Search" tabs. Within the help topics, links and cross-references lead to relevant information or related topics.

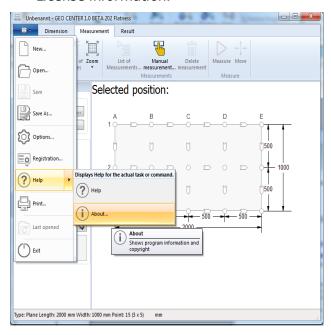


A PDF file of the complete online help and separate software installation instructions are to be found on the GEO CENTER USB thumb drive. If necessary, both files may be printed out.

#### Support

The application icon [ drop-down menu item "About" is used to access the following information:

- >> Manufacturer's physical and online address
- >> Conatct to PRÜFTECHNIK Sales department
- >> Contact to Technical Support
- >> Information on the measurement software
- >> License information.



Click "About..." to open the "About" window.



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## **Settings**

## Application icon menu item "Options"

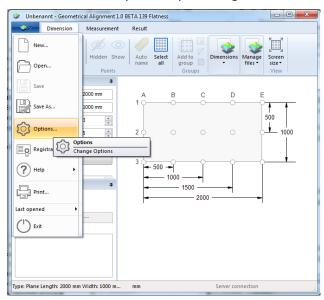
The application icon [ menu item "Options" is used to select the <u>language</u> for the user interface and the online help. It is also used to set the <u>units</u> to be used.

Other items that may be set under the "Options" menu item include:

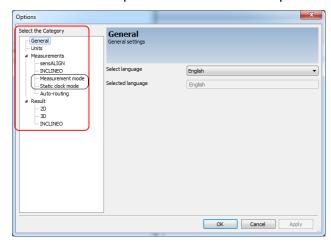
- >> Laser measurement settings
- >> Results settings

These settings can be changed at any time, and become available immediately.

Access the item Options by clicking



Click the item "Options" to access the "Options" dialog window.





#### Note

The two measurement options "Measurement mode" and Static cloke mode" are only available when the selected measurement plane is "Line".

Click desired item to change the settings as required.

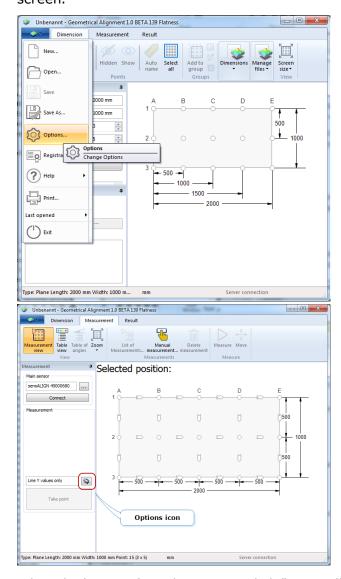


## Note

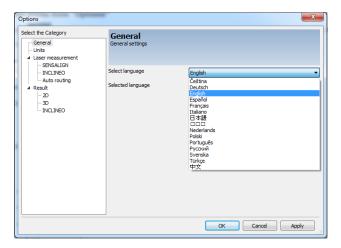
The "Options" dialog window may also be accessed anytime by clicking (the options icon) that appears in the "Measurement" screen.

## Setting up language

The user interface and report langauge is set under the application icon [ menu item "Options". The 'Options' window may also be accessed by clicking in the 'Measurement' screen.



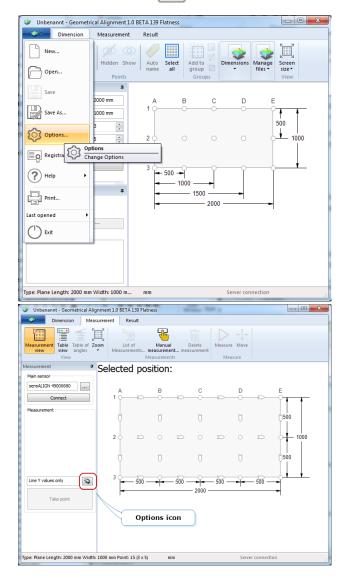
When the 'Options' window opens, click "General" then use the "Select language" drop-down menu to select desired language.



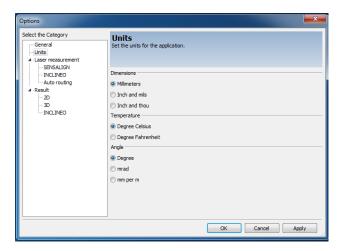
Click "Apply" to confirm selection.

## **Setting the units**

The units of length, temperature and angular measurement used in GEO CENTER are set under the application icon [ menu item "Options". The 'Options' window may also be accessed by clicking in the 'Measurement' screen.



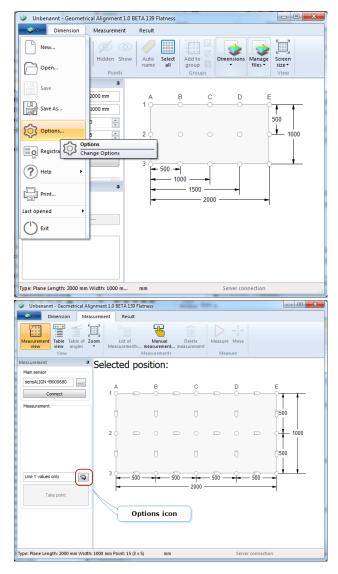
When the 'Options' window opens, click "Units" then select desired units for dimensions, temperature and angular measurement.



Click "Apply" to confirm selection.

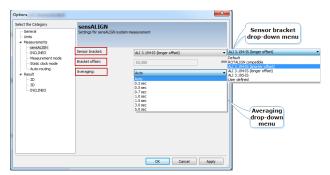
## **Measurement settings**

Depending on the measurement system used, the "Options" window allows the setting of specific system related items such as type of bracket to be used, measurement averaging, type of filter, auto-routing and measurement method and mode.



The "Options" window may be used to set specific items for sensALIGN system, INCLINEO system, auto-routing and measurement modes and methods.

#### sensALIGN system



With the "Options" window open, click "sensALIGN" then use the 'Sensor bracket' drop-down menu to **select desired bracket**.



#### **Note**

The sensor offset is calculated automatically for the listed brackets. If a user defined bracket is used, then the corresponding sensor offset must be measured and entered in the "Sensor offset" value box.

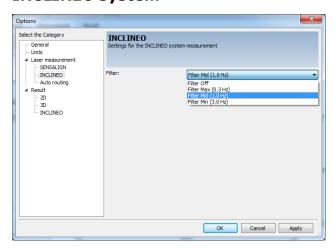
#### **Averaging**

Averaging is the process of combining several individual readings at any measurement point so as to attain the desired accuracy.

The "Averaging" drop-down menu is used to set desired averaging time.

After selecting desired sensor bracket and setting the averaging, click "Apply" to confirm selection.

#### **INCLINEO** system

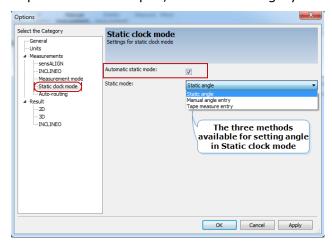


With the "Options" window open, click "INCLINEO" then use the 'Filter' drop-down menu to select desired type of filter. Filters are used to smoothen the readings taken.

Click "Apply" to confirm selection.

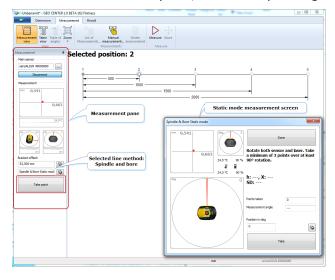
## Static clock mode settings

Static clock measurement mode is available for "line" measurements. The mode is used to measure line applications in both horizontal and vertical orientation. Settings for static clock mode are accessed via the application icon [ ] drop-down menu item "Options". With "Options" window open, select the category "Static clock mode".



#### **Automatic static mode**

When the "Automatic static mode" box is checked, vertical orientation measurements for bore and spindle methods are taken in static clock mode. In this case, when "Take point" is selected in the "Measurement" pane, the corresponding line method static mode window opens.

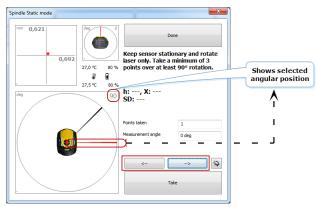


#### Static mode

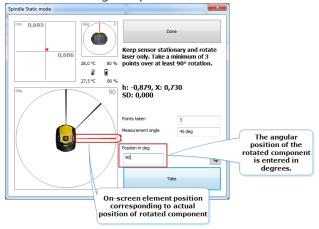
When using static mode, rotational angle information from both laser and sensor is not automatically available and therefore must be provided to facilitate measurement. The "Static mode" drop down-menu displays the three methods which may be used to provide angular information for measurement using static mode. The three methods are:

**Static angle** – With this method, measurement is possible in any of the eight 45° positions ((i.e. 12:00, 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 or 10:30 o'clock position viewed from sensor towards laser). Click or to position the on-screen element at the same angular position as the rotated component — which could be sensor

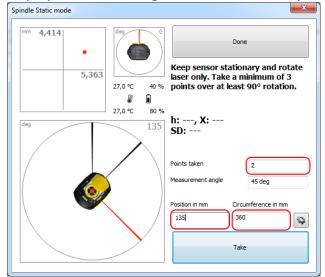
or laser or both.



**Manual angle entry** – In this method, the angular position of the rotated component is entered in the "Position in degrees" box. The on-screen element will then be displayed at the entered angular position.



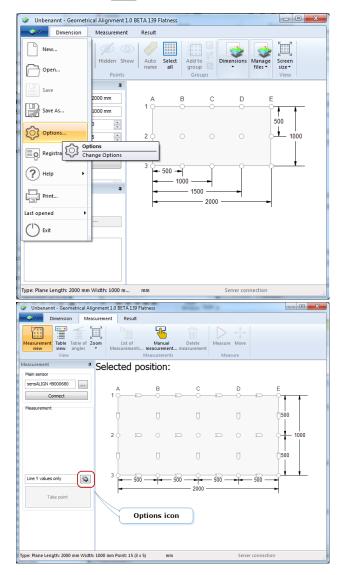
**Tape measure entry** – When using this method, the outer circumference of the bore to be measured is entered. The first measurement is taken at the reference position (this position has the reference value 0 mm). The component is then rotated to the next measurement position. The length of the arc (distance from the reference 0 mm position to the current component position) is then entered in the "Position in mm" box to determine and display the current angle of the rotated component.



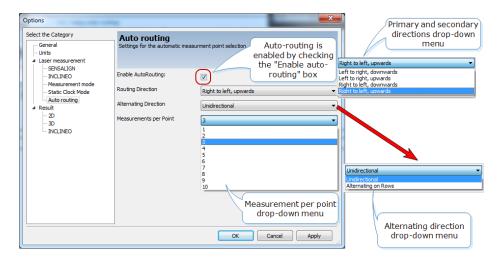
## **Auto-routing**

The auto-routing function enables the intelligent and automatic selection of the next measurement point. Auto-routing is accessed via the "Options" window.

The "Options" window may be accessed via the application icon [ end of the measurement or by clicking in the 'Measurement' screen.



With the "Options" window open, click "Auto-routing" then use the three drop-down menus to set the desired auto-routing parameters.



The turn-by-turn navigation is determined by the selected primary and secondary directions, and the selected alternating direction item.

#### Primary and secondary directions (Routing direction)

This drop-down menu offers four options. The primary direction of taking measurements on a grid is either left to right and vice versa. The secondary direction is either downward or upward.

### **Alternating direction**

This drop-down menu offers two options.

"Unidirectional" – measurements on a grid are taken in the selected primary direction.

"Alternating rows" – measurements on a grid are taken consecutively from row to row.

#### Measurements per point

This drop-down menu is used to set the number of measurements to be taken at the grid points. If auto-routing is enabled, the next measurement point will be highlighted auto-matically only after the set number of measurements has been attained. The "Take point" button on the measurement screen must be clicked for every set number of measurements.



#### **Note**

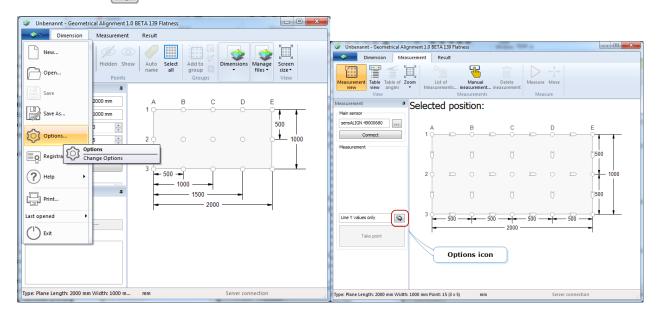
The auto-routing settings are valid only when auto-routing is enabled.

Click "Apply" to confirm selection.

## **Results settings**

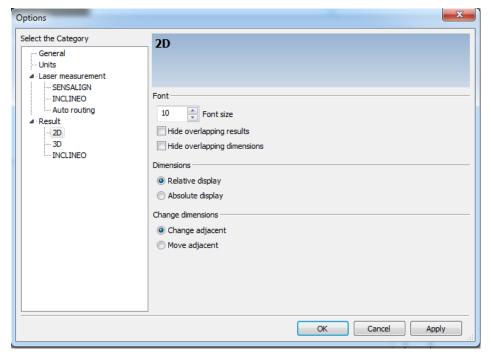
Specific 2D, 3D and INCLINEO results view settings are made via the "Options" window.

The "Options" window may be accessed via the application icon [ end of the measurement or by clicking in the 'Measurement' screen.



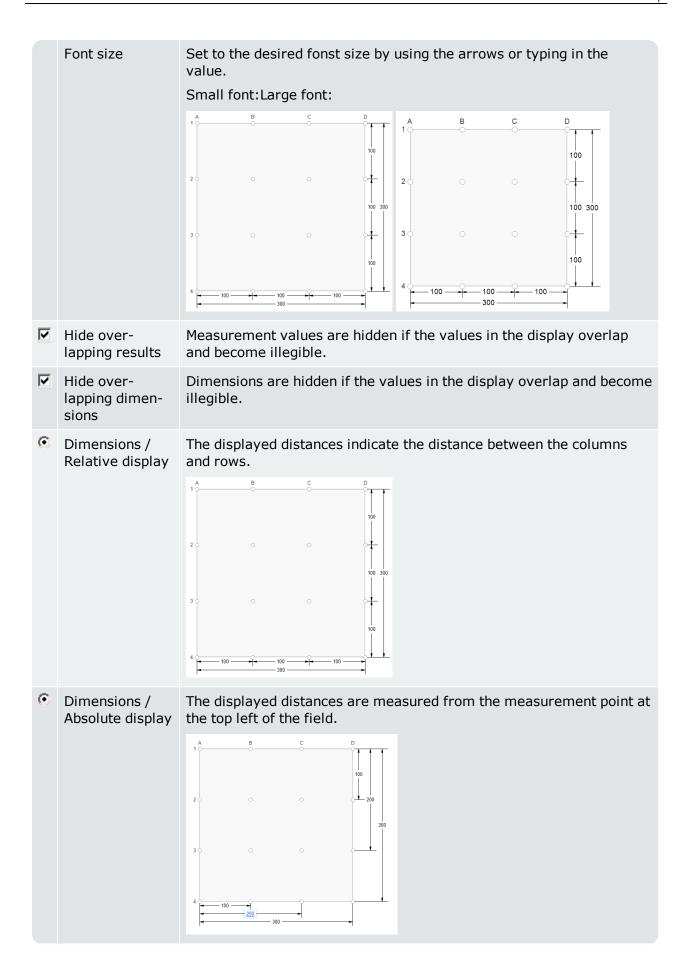
#### 2D settings

With the "Options" window open, click "2D" then select the desired 2D view settings.

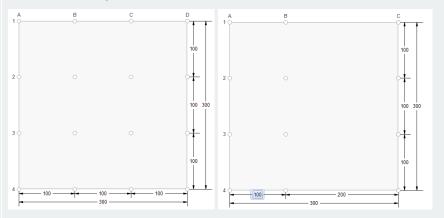


Menu item

Function

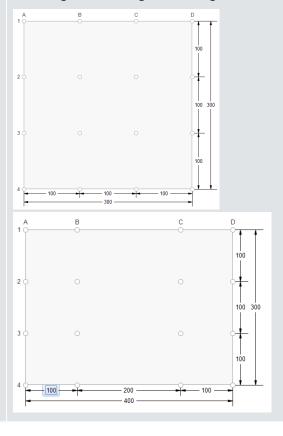


 Change dimensions / Change adjacent If a given dimension is changed, the adjacent dimension changes to accommodate the new change resulting in NO change to the total distance of the object.



Change dimensions / Move adjacent

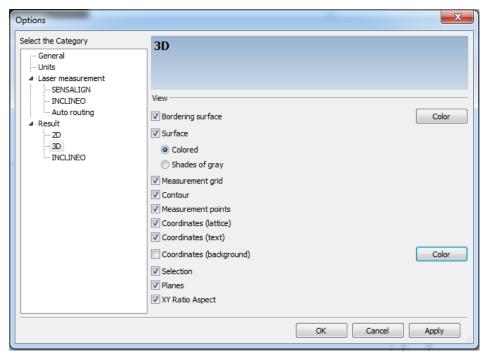
If a given dimension is changed, the adjacent dimension remains unchanged resulting in a change to the total distance of the object.

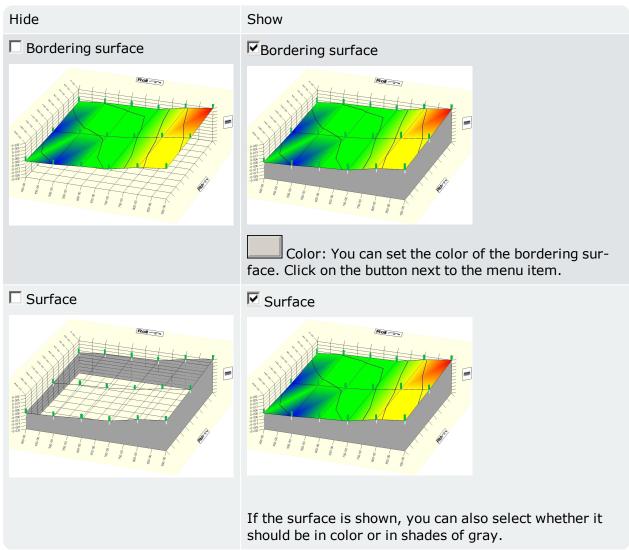


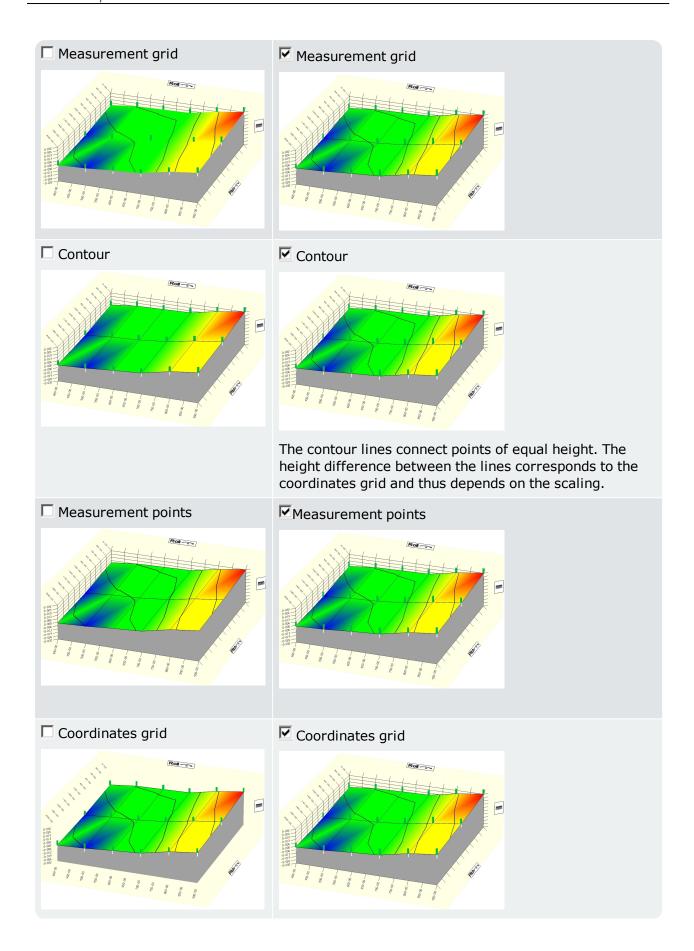
#### 3D settings

The 3D view can be adjusted by showing or hiding various elements. You can also specify the color of the bordering surface and background. In addition, the X-Y ratio of the view can be adjusted.

With the "Options" window open, click "3D" then select the desired 3D view settings by checking or unchecking the respective checkbox.

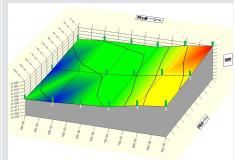




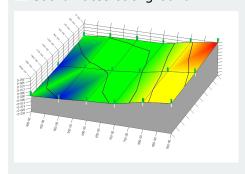


# Coordinate labeling

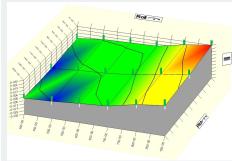
# 



☐ Coordinates background

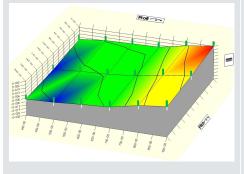


# 

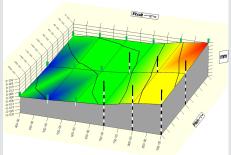


Color: You can set the color of the background. Click on the button next to the menu item.

# ☐ Selection



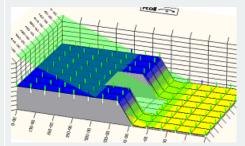
# ▼ Selection



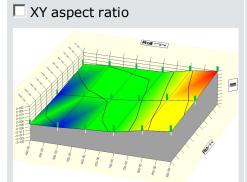
The selected measurement points are highlighted if the checkbox is activated. The measurement points are selected in the Dimensions view or in the 2D view.

# Planes

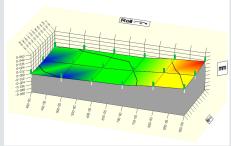
# ✓ Planes



If the checkbox is activated, the planes though groups of measurement points are displayed, provided that this function is activated. See Displaying plane through group of measurement points. In this example, the plane is light green (light gray).



# ▼XY aspect ratio



If the checkbox is activated the XY ratio is changed. The Y-axis (depth) shrinks in relation to the X-axis (width).

#### sensALIGN sensor brackets

For straightness and flatness measurements, sensALIGN sensor may be mounted on a bracket assembly consisting of the following items:

Magnetic base adapter ALI 4.501-IS

Plunger holder ALI 6.773

Multipurpose adapter ALI 3.194-IS

The multipurpose adapter ALI 3.194-IS may be used in a variety of ways resulting in different offsets between the measured palne and the sensor plane. This offset is entered in the "Bracket offset" box.

# Multipurpose adapter with smaller offset

The following image shows a typical sensALIGN sensor mounting with "ALI 3.194-IS (shorter offset)" selected from the "Sensor bracket" drop-down menu.





#### Note

In the above configuration, sensALIGN sensor is mounted on the rear holes of the multipurpose adapter ALI 3.194-IS.

#### Multipurpose adapter with larger offset

The following image shows a typical sensALIGN sensor mounting with "ALI 3.194-IS (longer offset)" selected from the "Sensor bracket" drop-down menu.





#### Note

In the above configuration, sensALIGN sensor is mounted on the front holes of the multipurpose adapter ALI 3.194-IS.

#### **User defined offset**

The following image shows sensALIGN sensor mounted on the magnetic base adapter ALI 4.501-IS using a different type of adapter. In this case, the type of mounting slected from the "Sensor bracket" drop-down menu would be "User defined".





In the above configuration, the value entered in the "Bracket offset" box would be 0 mm.

# The ribbon

The GEO CENTER user interface uses a ribbon layout. The ribbon layout consists of the application icon [ ] drop-down menu with common tasks such as creating new measurement files, as well as opening and saving measurement files. This is followed by the "Dimension", "Measurement" and "Result" ribbon tabs. Each tab contains the most frequently used commands in the selected view.

#### **Dimensions ribbon tab**

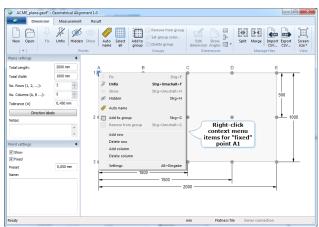
This tab is used to access Dimensions view to view the dimensions, columns and rows of the measurement points and set them up.



The dimensions ribbon contains commands for the following topics:

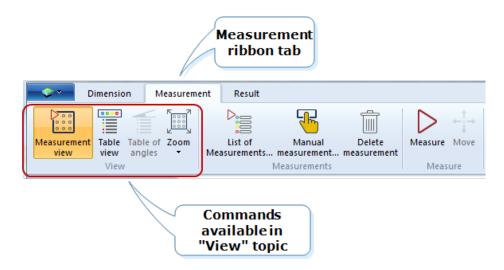
- >> File
- >> Points
- >> Groups
- >> Dimensions
- >> Manage Files
- >> View

The commands appear as icons. Active commands are colored while inactive ones are grayed out. By placing the cursor over any command icon, a hint text that explains the function of the command appears. Active commands are dependent on the type of action being taken on the current measurement file. For example, if a measurement point has been "fixed" and the point selected, the command "Fix" is inactive but the command "Unfix" is active. The status of the relevant command icons may also be seen in the right click context menu.



# **Measurement ribbon tab**

This tab is used to access Measurement view. In this view, measurement values of the individual points are displayed. The values may also be changed manually in this view.

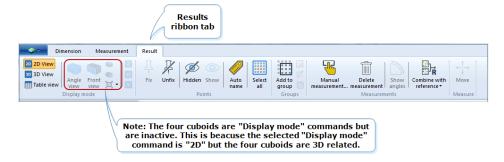


The measurement ribbon contains commands for the following topics:

- >> Measurements
- >> View
- >> Measure

# Results ribbon tab

This tab is used to access Results view. Here the measurement values are evaluated and displayed in the form of tolerances. 2D and 3D views are available.



The results ribbon contains commands for the following topics:

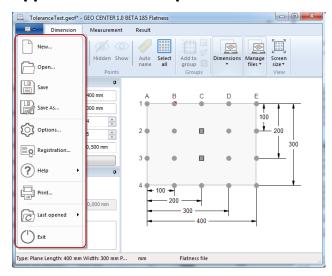
- >> Display mode
- >> Edit points
- >> Groups
- >> Measurements
- >> Measure



#### Note

To hide the ribbon commands in order to gain space on any particular view, double-click the corresponding ribbon tag. The commands may be shown again by double-clicking the ribbon tag once again.

# Application icon drop-down menu



The following items are to be found in the application icon [ drop-down menu.

New		Creates a new document. See "Creating a new measurement file".
Open		Opens a previously saved document. See "Opening a measurement file".
Save		Saves a template or measurement file under the same name. This button is only active if the file was modified. See "Saving a measurement file".
Save As		Saves a template or measurement file under a specified name. See "Saving a measurement file".
Options	(c)	Used to adjust GEO CENTER settings. See "Settings".
Registration	<u> </u>	Starts the license wizard. See "Activating trial version to full version".
Help	?	Used to access the online help and information about the version of the software.
Print		Used to print the report.
Last opened		Shows the last five files recently opened.
Exit		Used to exit GEO CENTER. A hint to save current file appears.

# **Dimension ribbon commands**

# File

Command	Function
New 🕒	Creates a new document. See "Creating a new measurement file".
Open	Opens a previously saved document. See "Opening a measurement file".

The following commands are to be found under the topic "File".

# **Points**

The following commands are to be found under the topic "Points".

Command	Function
Fix T	Fix the selected measurement point. This command is only active if an unfixed measurement point is selected. See Fixing/unfixing measurement points.
Unfix	Unfix the selected measurement point. This command is only active if a fixed measurement point is selected. See Fixing/unfixing measurement points.
Hide 🌠	Make the selected measurement point invisible. This command is only active if a visible measurement point is selected. See Hiding measurement points .
Show O	Make the selected measurement point visible. This command is only active if a hidden measurement point is selected. See Hiding measurement points .

# Groups

The following commands are to be found under the topic "Groups".

Command	Function
Add	Join points together in a group. This command is only active if a measurement point is selected. See Grouping and ungrouping measurement points.
Remove	Remove points from a group. This command is only active if a measurement point is selected. See Grouping and ungrouping measurement points.
Color	Set group colour. This command is only active if a defined group is selected and highlighted.
Delete	Deletes selected group. This command is only active if a defined group is selected and highlighted.

#### **Dimensions**

The following commands are to be found under the topic "Dimensions".

Command	Function
Edit	Used to edit selected dimension. This command is only active when a dimension is selected.
Show angle	Shows angles of measurement points on circular surfaces. This command is only active when the shape of the surface to be measured is circular.
Background	Adds a background image to the "Dimension" screen for only rectangular and circular object shapes
Plane offset	Applies the desired offset at point A1
Flip	Used to flip measured surface in either the horizontal or vertical plane, or rotate surface through 90°.

# Manage files

The following commands are to be found under the topic "Manage Files".

Command	Function
Merge (Splice)	Combine several separate measurements to one large measurement file. See Splicing measurement files .
Import CSV	Import measurement data available as raw data. You can choose between CSV Flatness and CSV Raw Values See Importing a measurement file.
Export CSV	Export measurement data to the CSV format.

# View

The command "Zoom" is found under the topic "View". The following four zoom options may be accessed via the "Zoom" command drop-down menu.

Command	Function
Zoom in	This command enlarges the size of the measurement object on the screen.
Zoom out	This command decreases the size of the measurement object on the screen.

Fit screen	This command scales down the size of the measurement object to fit the window.
Auto scale	This command scales the size of the measurement object to automatically to window size when the window changes.

# **Measurement ribbon commands**

#### Measurements

The following commands are to be found under the topic "Measurements".

Command		Function
List of meas- urements		Used to dispay the measurement method(s) used at the selected point. This command is only active when a measurement point is selected. See <b>Measurement list</b> .
Manual	<b>₹</b>	Used to enter the measurement value at the selected point manually. This command is only active when a measurement point is selected. See "Modifying measurement values manually" on page 57.
Delete		Used to delete the value at the selected measurement point.

# View

The following commands are to be found under the topic "View".

Command		Function
Measure	000	Calls up the measurement screen where the sensor is connected and measurement taken. This command is always active.
Point list	0000	Displays measurement values in tabular form. The command is always active.
Inclination list		Displays INCLINEO measurements in tabular form. The command is only active when INCLINEO is connected to the measurement software. See <b>Measurements using INCLINEO</b> .
Zoom	<u> </u>	The command 'Zoom' in the measurement ribbon is found under the topic 'View', and has four zoom options which may be accessed via the 'Zoom' command drop-down menu. The command is always active. See Adjusting the view .
Zoom in		This command enlarges the size of the measurement object on the screen.
Zoom out	5	This command decreases the size of the measurement object on the screen.
Fit screen	K 3	This command scales down the size of the measurement object to fit the window.
Auto scale	000	This command scales the size of the measurement object to automatically to window size when the window changes

# Measure

The following commands are to be found under the topic "Measure".

Command		Function
Take	$\triangleright$	This command is used to take measurement at the selected point on the grid and is only active when the measuring sensor is connected to the measurement software.
Move	<b>←</b> ;	This command is used to reposition the measured point if desired and only active when the measuring sensor is connected.

# **Results ribbon commands**

# Display mode

The following commands are found under the topic "Display mode".

Command		Function
2D	2D	Displays results in 2D. The command is always active.
3D	3D	Displays results in 3D. The command is always active.
Table		Displays results in tabular form. The command is always active.
3D – Skewed		Positions the object at the best possible angle to enable all the three views – front, side view and plan – be viewed with ease. The command is only active when '3D' is selected.
3D – Front		Displays the front view of the object. The command is only active when '3D' is selected.
3D – Top		Displays the plan view of the object. The command is only active when '3D' is selected.
3D – Side		Displays the side view of the object. The command is only active when '3D' is selected.
Screen size	N 0000	The command 'Screen size' in the results ribbon is found under the topic 'Display mode', and has seven zoom options which may be accessed via the 'Screen size' command drop-down menu. The command is always active. See <b>Zooming in/out of the dimensions</b> view.
Increase	<b>1</b>	Increases scaling; available in 2D only; zooms the view in
Decrease		Decreases scaling; available in 2D only; zooms the view out
Screen size		Fits screen; available in both 2D and 3D
Automatic	000	Fits screen automatically; available in 2D only
Enlarge	<u> </u>	Display object as a model; available in 3D only
Flatten	₩.	Flattens object; available in 3D only

Default scale	<u> </u>	Scales to twice the tolerance value; available in 3D only
VH	V	Displays vertical and horizotal views in 2D in "Line" measurements only
Н	H	Displays horizotal view in 2D in "Line" measurements only
V	V	Displays vertical view in 2D in "Line" measurements only

# **Edit points**

The following commands are to be found under the topic "Points".

Command		Function
Fix	耳	Fix the selected measurement point. This command is only active if an unfixed measurement point is selected. See <a href="Fixing/unfixing">Fixing/unfixing</a> <a href="measurement points">measurement points</a> .
Unfix	1/2	Unfix the selected measurement point. This command is only active if a fixed measurement point is selected. See <a href="Fixing/unfixing">Fixing/unfixing</a> measurement points.
Hide	Ø	Make the selected measurement point invisible. This command is only active if a visible measurement point is selected. See <a href="Hiding">Hiding</a> <a href="measurement points">measurement points</a> .
Show	0	Make the selected measurement point visible. This command is only active if a hidden measurement point is selected. See <a href="Hiding measurement points"><u>Hiding measurement points</u></a> .
Auto naming		Assigns a name to the selected point automatically. The name is based on the position of the selected point on the grid. See <a href="Naming">Naming</a> a measurement point.
Select all	0000	Select all measurement points.

# Groups

The following commands are to be found under the topic "Groups".

Command		Function
Add	0000	Join points together in a group. This command is only active if a measurement point is selected. See <b>Grouping and ungrouping measurement points</b> .
Remove	×	Remove points from a group. This command is only active if a measurement point is selected. <b>See Removing measurement points from a group</b> .

Color	Set group colour. This command is only active if a defined group is selected and highlighted.
Delete	Deletes selected group. This command is only active if a defined group is selected and highlighted.

#### Measurements

The following commands are to be found under the topic "Measurements".

Command		Function
Manual	<b>₹</b>	Used to enter the measurement value at the selected point manually. This command is only active when a measurement point is selected. See <b>Modifying measurement values manually</b> .
Delete		Used to delete the measurement value at the selected measurement point. This command is only active when a measurement value exists at the selected point.
Show angle		Shows angles of measurement points on circular surfaces. This command is only active when the shape of the surface to be measured is circular.
Combine with reference		Merges the selected point with the reference.

# Measure

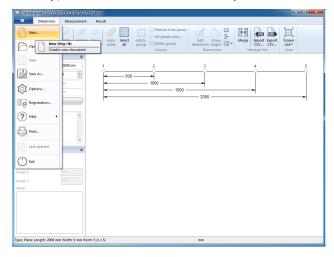
The command 'Move' is found under the topic "Measure".

This command is used to reposition the measured point if desired and only active when the measuring sensor is connected.

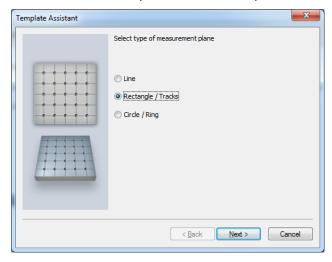
# Creating, opening and saving measurement files

# Creating a new measurement file

1. Click the application icon then select the menu item "New..." from the drop-down menu. Create the desired file using the "Template Assistant" wizard which opens. Alternatively, click to start the "Template Assistant" to create a new file.



2. The wizard "Template Assistant" opens.



3. Select desired shape – "Line"; "Rectangle/Tracks"; "Circle/Ring" – then click "Next". In this example, "Rectangle/Tracks" has been selected.



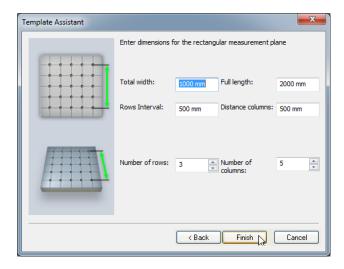
#### Note

If "Line" is the selected plane for measurement, an additional window to select the desired  $\frac{\text{measurement method}}{\text{measurement method}}$  appears.

- 4. Enter the required dimensions:
  - >> When you click in a particular field, the respective dimension is shown in the diagram in the window on the left.
  - >> For "Line": Enter the total length of the object, then specify the desired interval between the measurement points. The total number of measurement points will be

automatically displayed. Altering either the interval or the number of measurement points alters the total length automatically.

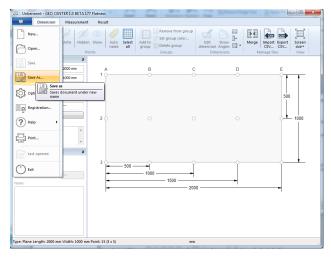
>> For "Rectangle / Tracks": Enter the total width and length of the surface, then specify the desired interval between the measurement points in each row and column. The total number of rows and columns will be automatically dispalyed. Altering either the number of rows or columns, alters the total width or length automatically. If you want a single line of measurement points, enter a one under "Number of rows" or "Number of columns". >> For "Circle / Ring": Enter the inner diameter ("Min. Diameter") and the outer diameter ("Max. Diameter"). These dimensions remain constant. Specify either the interval between circles or number of circles. The dimension not set adjusts automatically to the appropriate value when its value field is clicked. Altering points per circle alters the angle between points automatically. If you want a single ring of measurement points, enter a one under "Number of circles".



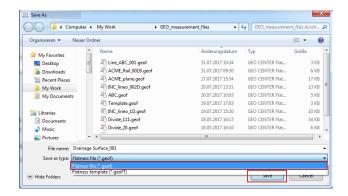
5. Click "Finish". The Dimensions view appears.

#### Saving a measurement file

1. After creating the measurement file, save it using the application icon [ drop-down menu item "Save as...".



2. Specify the location where the file is to be saved then enter the desired name in the "File name" box, or select an existing name from the specified folder.





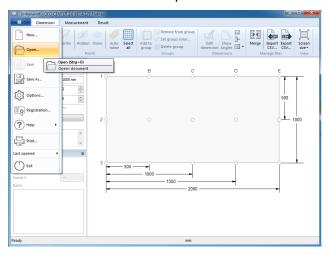
#### Note

When saving the measurement file, note the file name extension for measurement files is .geof.

3. Click "Save". The measurement file is now available at the sepcified location.

#### Opening a measurement file

1. Click the application icon then select the menu item "Open...". Alternatively, click to browse for the required folder.



2. Use the "Open file" window to browse for the appropriate folder then select desired file. Click "Open".



# Exporting a measurement file as a CSV file

The measurement data can be exported as a CSV file. This format can be read by database programs such as Microsoft Excel.

- 1. After opening file to be exported, click "Dimension" to change to the Dimensions view.
- 2. Click the "Export CSV" command.
- 3. Specify the location where the file is to be saved then enter the desired name in the "File name" box, or select an existing name from the specified folder.
- 4. Click "Save". The .csv file is now available at the sepcified location.

# Deleting a measurement file

Browse for the file in Windows Explorer, then right-click its name or icon. Click "Delete" in the pop-up menu that appears.

# Working with measurements

This section contains the following topics:

- 1. Opening a measurement file
- 2. Importing a measurement file
- 3. Modifying measurement values manually
- 4. Entering measurement values manually

#### Opening a measurement file

### Importing a measurement file

Measurement data that is only available as raw data must be imported to be able to use it. It must be stored in CSV format (character separated values). Importable data is a .CSV measurement file.

- 1. If you already have a file open, save it before continuing. The imported data will overwrite existing data.
- 2. Click "Dimension" to change to the Dimensions view.
- 3. Click the "Import CSV" command.
- 4. Use the "Open file" window to browse for the appropriate folder then select desired .csv file. Click "Open".



#### Note

As an option, you can activate "Read-only" in file properties. This will protect the file from being overwritten unintentionally. You will be able to make changes but must then store the file under a different name.

#### Modifying measurement values manually

The result values of a measurement point consist of one or more individual measurements. These measurement values are either generated by the measuring device or can be entered manually.

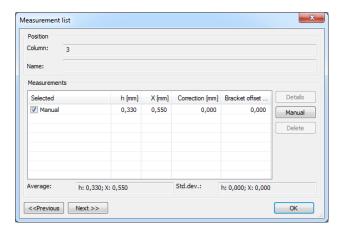
Manual entry of measurement values can be useful for following reasons:

- The measurement profile is only available in printed form. The measurement values of the profile can be entered manually and compared with the current measurement.
- A surface is imprecisely measured with the tape measure. The measurement values can then be entered manually.

Entering measurement values manually

- 1. Click "Measurement" or "Results" to change to the desired view.
- 2. Select the measurement point to be edited.
- 3. Right-click the selected measurement point.
- 4. Select "Manual measurement .." from the context menu that appears.
- 5. Enter the measurement value into the field. The measurement value is interpreted with respect to the laser plane.
- 6. Click "OK".

For measurement points that have been changed manually, the entries are shown in the "Measurement list".

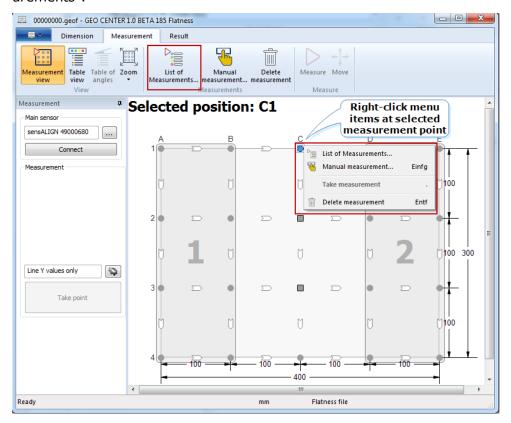


It is possible that the displayed result value is not be equal to the entered value. Possible causes are:

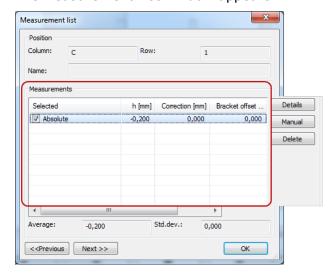
- 1. The active reference plane is not the laser plane. The measurement point already has additional measurement values. The average is taken of the older values and the new value. See ""Details on selected measurement " on page 59".
- 2. The new measurement value is automatically activated and included in the calculation of the result value, unless it is deactivated. See ""Details on selected measurement " on page 59".

#### **Details on selected measurement**

- 1. Click "Measurement to change to the Measurement view.
- 2. Click the measurement point that you would like to edit. Then click the "List of measurements icon. Alternatively, right-click required measurement point then select "List of measurements".



The Measurement List window appears.



All measurement values for this point are displayed in the Measurements field.

You can now view and perform the following:

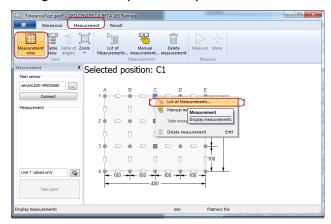
Menu item Function

Position / Row Row that contains the measurement point

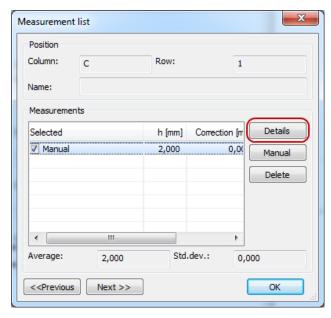
Position / Column Column that contains the measurement point Position / Name Measurement point name - A name only appears if it was previously entered in the "Dimensions" screen. See Naming a measurement point. Measurements The field displays all measurement values of the point. Measurements / Valid You can activate the measurement value so that it is included in the calculation of the result value. Measurements / Y Measurement value with respect to the laser plane Measurements / Average Average of all activated measurement values Measurements / Std. dev. Standard deviation of the activated measurement values Measurements / Details Details on the selected measurement value — Click on the desired measurement value to activate this button. See "Calling up details on measurement values" on page 61. Manually enter a new measurement value — See Entering Measurements / Manual measurement values manually. Measurements / Delete Delete the selected measurement value — Click on the measurement value to activate this button. << Previous Click to call up the data on the previous measurement point Next >> Click to call up the data on the next measurement point

# Calling up details on measurement values

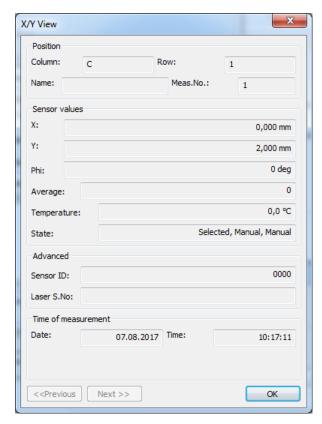
- 1. Click "Measurement" then "Measurement view" to display measured plane.
- 2. Right-click the point that you would like to view.



- 3. Click "List of Measurements..."
- 4. From the "Measurement list" dialog window that appears, select the measurement value whose details are desired.



5. Click "Details". The Details window opens.



You are given the following information:

Position / Row Row that contains the measurement point Position / Column that contains the measurement point

Column

Position / Name Measurement point name — A name only appears if it was previously

entered in the "Dimension" screen. See Naming a measurement point.

Position / Meas.no.

Position of the measurement value in the list of measurement values

Meas.no.

Sensor read- Information: Indicates whether the laser beam hits the middle of the sensor.

ings / X1

Sensor read- Measurement value with respect to the laser plane

ings / Y1

Sensor read- Information: Indicates the angle of the sensor with respect to the laser

ings / Phi beam, i.e. whether the sensor is vertically positioned.

 $0\ensuremath{^{\circ}}$  indicates that the sensor is vertically positioned.

Advanced / Sensor ID ID of sensor used for measurements

Temperature Ambient temperature during measurement.

Averaging Averaging of measurement values during measurement

State The setting of the select measurement value, e.g. "Valid" and "Manual" Time of meas
Date on which the measurement value was recorded or entered manually

urement / Date Format: Day.Month.Year

Time of meas- Time at which the measurement value was recorded or entered manually

urement / Time

<< Previous Click to call up the data on the previous measurement point Next >> Click to call up the data on the next measurement point

#### Creating and saving a new template

### Working with templates

A template is a file in which the measurement grid of the object has already been set up. It contains the dimensions and any relevant preset values. Every time you measure the object, you can use this file as a template. This is useful for the following reasons:

- >> The measurements are always taken at exactly the same measurement points.
- >> Using a template saves time because you do not have to set up a new measurement file every time you measure the same object.

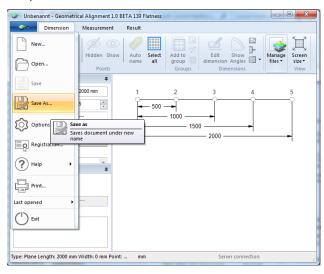
To be able to work with a template, it is first necessary to create a template.

# Creating a new template

Templates are created in the same manner as <u>creating a new file</u>. The only difference being that templates are saved uisng the file extension .geofT.

#### Saving a template

1. Save the template using the menu item "Save as..." from the application icon [ drop-down menu.

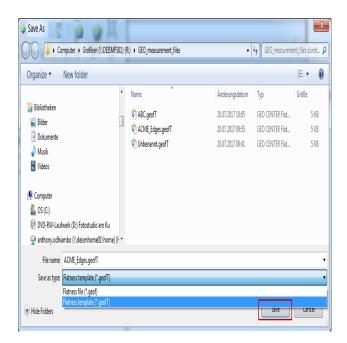


2. Specify the location where the file is to be saved then enter the desired name in the "File name" box, or select an existing name from the specified folder.



#### **Note**

When saving the template file, note the file name extension for templates is .geofT.



3. Click "Save". The template is now available for future use.

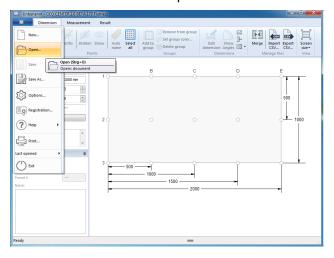


#### **Note**

When saving the template file, note the file name extension for templates is .geofT. If a measurement file with actual measurement data is saved as a template, a hint appears advicing that the measurement values will be deleted. If the measurement values are still required, then the file must first be **saved as a measurement file**.

# Opening a template

1. Click the application icon then select the menu item "Open...". Alternatively, click to browse for the required folder.



2. Use the "Open file" window to browse for the appropriate folder then select desired template. Click "Open".





# Note

The file name extension for templates is .geofT.

# **Deleting a template**

Browse for the template in Windows Explorer, then right-click its name or icon. Click "Delete" in the pop-up menu that appears.

# Setting up templates and measurement files

This section contains the following topics:

- · Adding and deleting measurement points
- Selecting measurement points and dimensions
- Changing the dimensions
- · Hiding measurement points
- Fixing/unfixing measurement points
- Grouping and ungrouping measurement points
- Setting tolerances

Information on specifying presets is found under Working with differences in height and unevenness.

#### Adding and deleting measurement points

The arrangement of the measurement points and the size of the measurement surface can be set up as required.

Rectangle/tracks: adding rows/columns

Adding a row/column in the middle between existing rows/columns:

1. Right-click a point next to which you want to insert a new row/column.

A context menu appears.

2. Click "Add row" or "Add column".

An additional row is added below the selected point, or an additional column is added to the right of the selected point.

Adding a row/column at a defined location:

- 1. Right-click on the measurement surface.
- A context menu appears.
- 2. Click on Add row or Add column.

An entry window appears.

3. Enter the position of the new row/column. It is measured from measurement point A1. In split measurement files, the new row/column is likewise inserted with respect to measurement point A1.

Adding a row/column at the end:

Increase or decrease the number of rows or columns in the "Plane settings" tool bar. To do so, click the up or down arrows.



Rectangle/tracks: deleting rows/columns

Deleting the selected row/column:

1. Right-click a point in the row/column that you want to delete.

A context menu appears.

2. Click "Delete row" or "Delete column".

The selected row/column is deleted.

Deleting a row/column at the end:

Increase or decrease the number of rows or columns in the "Plane settings" tool bar. To do so, click the up or down arrows.



Circle/ring: Adding circles/angles

Adding a circle/angle in the middle between existing circles/angles:

1. Right-click a point next to which you want to insert a new circle/angle.

A context menu appears.

2. Click on "Insert circle" or "Insert angle".

An additional row is added outside of the selected point, or an additional angle is added clockwise of the selected point.

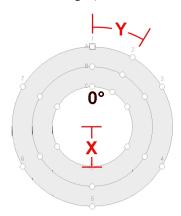
Adding a circle/angle at the end:

In the "Plane settings" tool bar, increase or decrease the number of circles or number of points in a circle. To do so, click the up or down arrows.



For the circle, enter radius X of the new circle.

For the angle, enter the angle Y of the new row of points measured clockwise from 0°.



Circle/ring: deleting a circle/angle

Deleting a selected circle/angle:

1. Right-click a point in the circle/angle that you want to delete.

A context menu appears.

2. Click "Remove circle" or "Remove angle".

The selected circle/angle is deleted.

Deleting a circle/angle at the end:

In the "Plane settings" tool bar, increase or decrease the number of circles or number of points in a circle. To do so, click the up or down arrows.



#### Selecting measurement points and dimensions

To edit measurement points or dimensions, they must first be selected.

Selecting a measurement point or dimension

Click on the point that you want to edit.

Selecting several measurement points or dimensions

- 1. Press the left mouse key and drag the mouse over the desired points or
- 2. With the <Ctrl> key pressed, click on each of the desired points.

#### Changing the dimensions

Changing individual dimensions

1. Double-click on the dimension that you want to change.

An entry window appears.

2. Enter the new dimension.

The diagram is refreshed to show the new distance.

Changing several dimensions at once

- 1. Select the distances that you want to change. See Selecting measurement points and dimensions.
- 2. Double-click on one of the selected values.

An entry window appears.

3. Enter the new dimension.

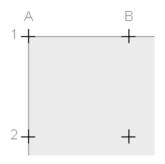
The diagram is refreshed to show all of the new distances.

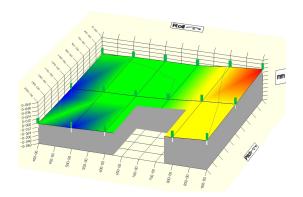
#### **Hiding measurement points**

This function can be used to hide areas that cannot be measured. These can arise where objects such as pillars or machine parts prevent the collection of measurements.

Hidden measurement points cannot be measured with the equipment and are skipped when moving to the next measurement point.

A gap appears in the 3D view where the hidden measurement points are located.





Hidden measurement points are replaced by a plus sign.

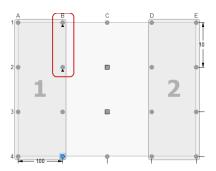
Area that was not measured is hidden.

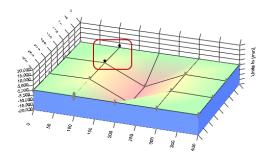
- 1. Click "Dimension" to change to the Dimensions view.
- 2. Select the point/points that you want to edit (see Selecting measurement points and dimensions), then click the "Hidden" command.
- 3. The selected measurement points become invisible or are replaced by a plus sign.
- 4. To view the hidden area in 3D click "Results"  $\rightarrow$  100 Miles | 100 Miles |

#### Fixing/unfixing measurement points

Measurement points must be fixed for the following operations:

- For finding the best possible plane through the fixed points. See ""Working with planes " on page 111".
- For comparing measurement files: If there are points on the measurement surface that cannot be modified, these measurement points can be fixed in the measurement file. The fixed measurement points then define the zero plane. See ""Comparing measurement surfaces" on page 118".



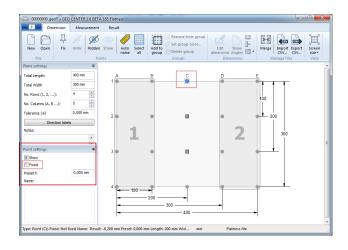


In 2D fixed measurement points are indicated In 3D fixed measurement points are also by a black arrow head. shown in black.

- 1. Click "Dimension" to change to the Dimensions view.
- 2. Select the point/points that you want to edit (see Selecting measurement points and dimensions), then click the "Fix" command.

Alternative: If you only want to edit a single point, double-click the point to fix or unfix it.

3. A selected measurement point may be fixed by checking the "Fixed" box in the "Point setting" tool bar.



# Grouping and ungrouping measurement points

Measurement points can be grouped for the following purpose:

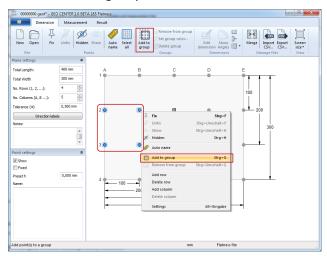
- Splitting measurement templates into several sections. See ""Measuring large surfaces " on page 106".
- Displaying the best possible plane through a group of points. See "Displaying plane through group of measurement points".
- Displaying the roll and pitch of a group. See "Displaying roll and pitch of a group".

Creating a new group

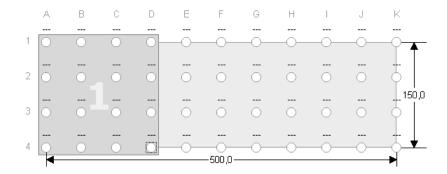
- 1. Click "Dimension" or "Result" to change to the respective view.
- 2. Select the points that you want to edit (see Selecting measurement points and dimensions),

then click the "Add group" command.

Alternative: After selecting points to be edited, right-click and one of the selected points. Select "Add to group" from the context menu that appears.



A new group is created. The group is identified by a number.



Adding measurement points to a group

- 1. Click "Dimension" or "Result" to change to the respective view.
- 2. Select the existing group by clicking it on the outside border.
- 3. With the <Ctrl> key pressed, click the points to be added.
- 4. Right-click any one of the selected points.
- 5. Select "Add to group" from the context menu that appears.

The group is extended by the additional point/points.

Removing measurement points from a group

- 1. Click "Dimension" or "Result" to change to the respective view.
- 2. Click on the outside border of the group.
- 3. With the <Ctrl> key pressed, click on the points to be removed.
- 4. Right-click any one of the selected group points.
- 5. Select "Remove from group" from the context menu that appears.
- 6. The points are removed from the group

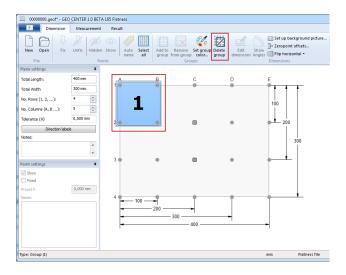


#### Note

The points will only appear to have been deleted if an entire column or row of points is being removed. Otherwise, the point will continue to be shaded as part of the group, although it has in fact been deleted.

#### Deleting a group

- 1. Click "Dimension" or "Results" to change to the Dimensions or Results view.
- 2. Select the desired group by clicking it on the outside border or dragging the mouse pointer over the whole group.
- 3. Click the "Delete group" command.



# **Setting tolerances**

You can enter a tolerance with which the measurement points will be displayed. Enter the tolerance value in the Tolerance tool bar. To automatically set the tolerance to the largest measurement value (plus or minus), activate the Auto checkbox.

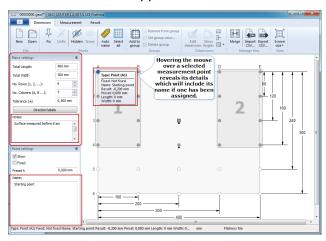
For more information on tolerances, see ""Tolerances" on page 101".

# Entering a comment on the file

You can add a comment to help identify the file.

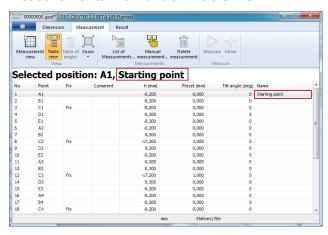
Enter a comment in the "Notes" field of the "Plane settings" tool bar. Use the arrow keys on your keyboard to scroll up and down.

This comment will appear in the measurement report.



# Naming a measurement point

To help with orientation, each measurement point can be assigned a name. Points with a name are identified by a red triangle (refer to previous screen). The names of points appear in the Measurements view under "Table view.



Naming individual points

- 1. Click "Dimension" to call up the Dimensions view.
- 2. Select the point/points that you want to edit. See Selecting measurement points and dimensions.
- 3. Enter the name in the "Name" field in the "Point settings" tool bar under Selected Point(s).

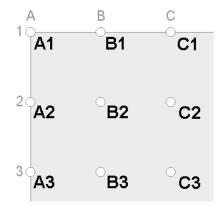
Naming several measurement points automatically

- 1. Click "Dimension" to call up the Dimensions view.
- 2. Select the point/points that you want to edit. See Selecting measurement points and dimensions.
- 3. With the point/points highlighted, right-click any one of the points.
- 4. In the context menu that appears, click "Auto name".

Alternative: Click the "Points" command "Auto name".

All selected points are automatically assigned an ID that identifies the column and row of the

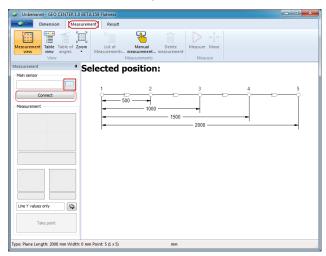
All selected points are automatically assigned an ID that identifies the column and row of the point. If a point already has a name, the new ID is placed in front of the name, e.g. "A1: Center".



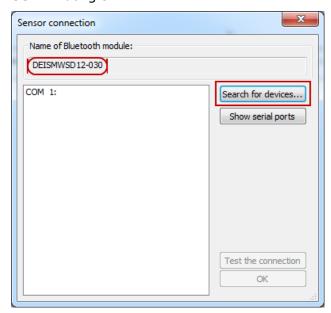
# Establishing communication between measurement system and GEO CENTER

Measurement is established in the measurement screen.

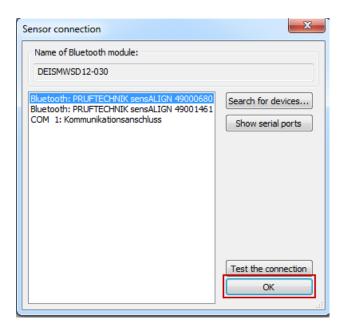
With the measurement system switched on, click ... on the measurement pane. The "Sensor connection" window opens.



The name of the Bluetooth functionality used appears on the screen. This could be either the built-in Bluetooth functionality, or a compatible Bluetooth USB dongle, or the PRÜFTECHNIK USB RF dongle.



Click "Search for devices..." to make the measurement system discoverable. Once the measurement system is discovered, it is displayed in the window.



Select the measurement system from the window then click "OK". You may now click "Connect" on the measurement pane to finalize connection, and proceed to take measurements.

# **Testing the connection**

If desired, the connection between the measurement system and the measurement software may be tested before connection is finalized. After searching and selecting measurement system, click "Test the connection". If the connection is tested "OK", a corresponding hint appears.



# Line measurements

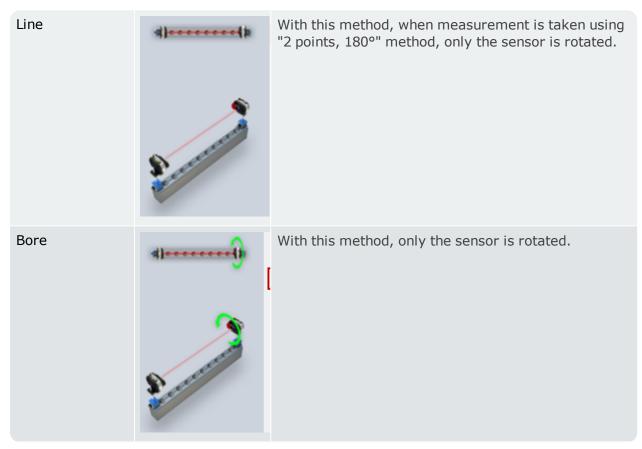
# Typical line applications

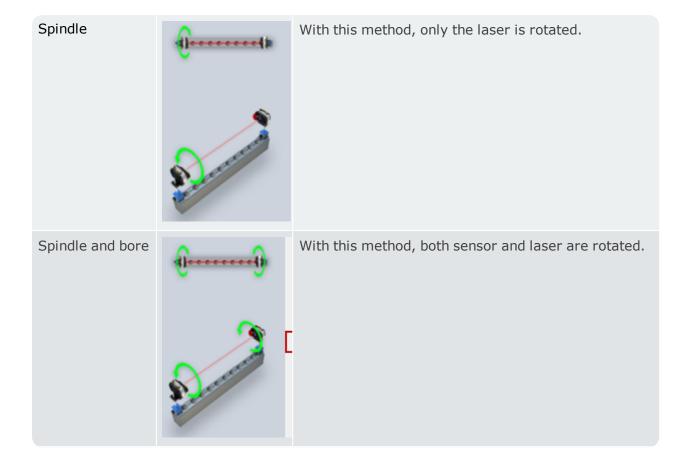
These include:

- Measuring straightness of long machine beds
- Checking for runout on moving slides, tables and stages
- Measuring bend and straightness in tracks and guide rails
- · Aligning shafts and drive trains
- Positioning bearings and shaft supports over long runs
- Monitoring surface deflections and bending in long structures
- Aligning long rail and track sections
- Measuring deflections on rams, actuators, and extrusion presses
- Measuring bore alignment such as diesel engine journal bearings
- Measuring linear deflections
- Checking roll flatness and crown profiles

## **Measurement methods**

Depending on the application, GEO CENTER provides the following four measurement methods:



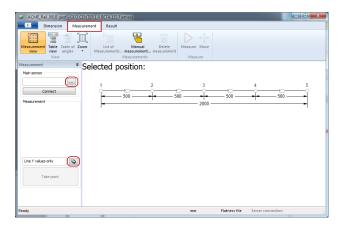




#### Note

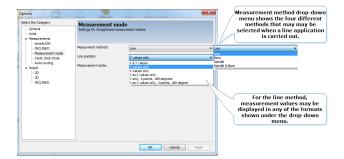
The desired measurement method is selected when creating a template of the line to be measured.

# Line method



Click "Measurement" to open the measurement screen. Once in the measurement screen, click "Measurement view", then proceed to connect the measurement system to GEO CENTER. Click to <u>establish communication</u>.

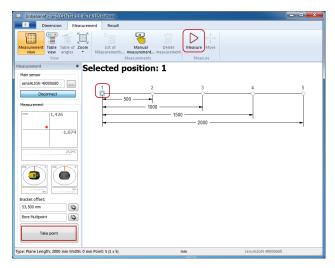
If desired, after establishing communcation, the laser measurement parameters may be set by clicking or using the application icon [ menu item "Options".



# Options for displaying measurement values for line measurement

Displayed values	Measurement system		
X and Y values	sensALIGN sensor		
Y values only	sensALIGN sensor, LEVALIGN expert sensor, INCLINEO		
X values only	sensALIGN sensor		
Y as X values	LEVALIGN expert sensor		
Y values only (for 2 points, 180° measurement)	sensALIGN sensor, LEVALIGN expert sensor		
Y as X values only (for 2 points, 180° measurement)	LEVALIGN expert sensor		

Once communication has been established, click the first measurement point. Both the command "Measure" and the "Take point" pane become active, and either may be clicked to take measurement at the selected point.



Take all measurement points on the grid or line by moving the measurement system to the desired position, allowing the reading to settle then clicking either the "Measure" command or the "Take point" pane.



#### Note

The command "Measure" and the "Take point" pane are only active, when the reading has stabilized.

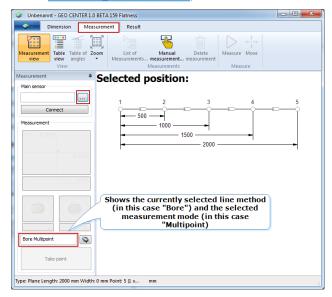
#### **Bore method**

This method is suitable in determining the centreline of bores. Measurement may be carried out using one of the following three modes:

- Multipoint
- Static mode
- Two points at diametrically opposite positions ("2 points, 180 degrees")

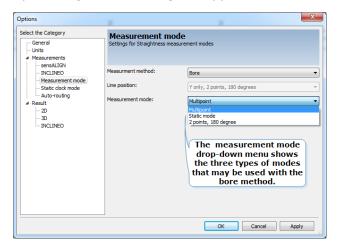
#### **Multipoint measurement**

After creating a new file, click "Measurement" to access the measurement screen.

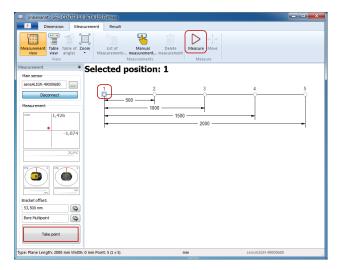


Once in the measurement screen, click "Measurement view", then proceed to connect the measurement system to GEO CENTER. Click ... to <u>establish communication</u>.

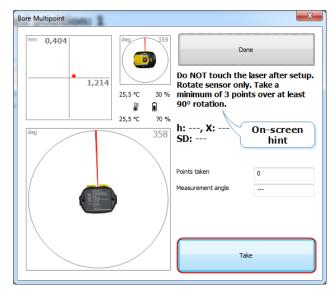
If desired, after establishing communcation, the laser measurement parameters may be set by clicking or using the application icon [ menu item "Options".



Once communication has been established, click the first measurement point. Both the command "Measure" and the "Take point" pane become active.



Click either "Measure" or "Take point" to start measurenment at the selected point. The "Bore Multipoint" screen opens. In 'Multipoint', measurement must be taken in at least 3 points over a minimum rotation of 90°.

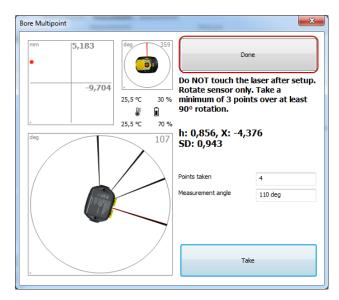


Click the "Take" button to record first measurement point at the selected position. Take as many measurement points, through as wide an angle, as possible.



#### Note

Observe the on-screen hints and the necessary expertise for such measurements.



After taking enough measurement points through as wide an angle as possible, at the selected grid position, click "Done", then proceed to take measurement at all positions on the grid or line as described above.

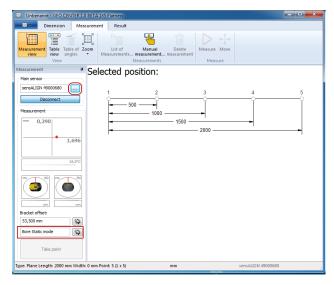


#### Note

After completion of the static laser setup, the laser must never be touched during measurement.

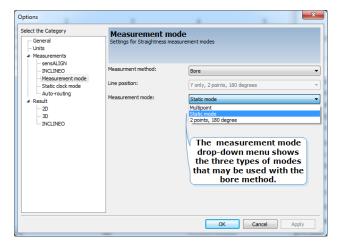
### Static mode measurement

In the following example, a <u>new file</u> has been created, <u>communication established</u>, and 'Static mode' measurement selected.

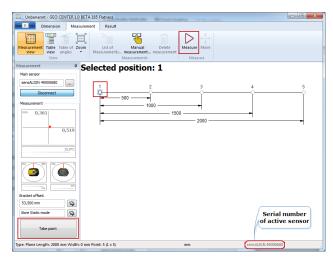


Once in the measurement screen, click "Measurement view", then proceed to connect the measurement system to GEO CENTER. Click .... on the measurement pane to **establish communication**.

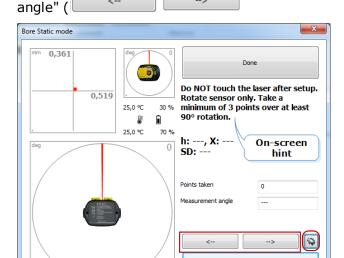
If desired, after establishing communcation, the laser measurement parameters may be set by clicking or using the application icon [ menu item "Options".



Once communication has been established, click the first measurement point. Both the command "Measure" and the "Take point" pane become active.



Click either "Measure" or "Take point" to start measurenment at the selected point. The "Bore Static mode" dialog window opens. In this example, the selected static mode method is "Static



In "Static mode", rotational angular information from both laser and sensor are not automatically available. The on-screen sensor must therefore be positioned to correspond with actual sensor angular position. This may be done using any one of the following static mode methods:

Static angle Manual angle entry Tape measure entry

To select desired static mode method, click [SS] in the "Bore Static mode" dialog window to

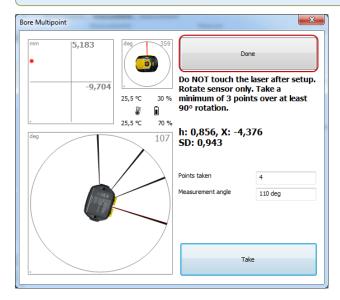
access the <u>static clock mode settings</u>. After selecting the desired method of determing the rotational angular position of the measuring components take measurement in at least 3 points over a minimum rotation of 90°.

Click the "Take" button to record first measurement point at the selected position. Then position the on-screen sensor at the next angular position using the method selected previously. Refer to "Static clock mode settings" and take as many measurement points, through as wide an angle, as possible.



#### Note

Observe the on-screen hints and the necessary expertise for such measurements.



After taking enough measurement points through as wide an angle as possible, at the selected grid position, click "Done", then proceed to take measurement at all positions on the grid or line as described above.



## Note

After completion of the static laser setup, the laser must never be touched during measurement.

# Spindle method

This method is used to analyse the geometry of lathe machines, spindle beds, and other spindle-spindle applications with respect to a rotational axis.



#### Note

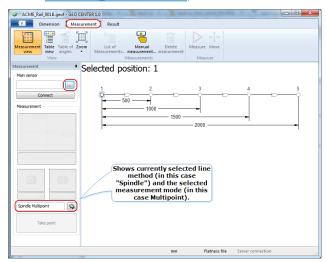
In this method, only the laser is rotated. The sensor must never be touched during measurement.

Measurement may be carried out using one of the following three modes:

- <u>Static</u> This method is the same as described for the bore method with the difference being that only the laser is rotated in the spindle method.
- Multipoint
- Two points at diametrically opposite positions ("2 points, 180 degrees")

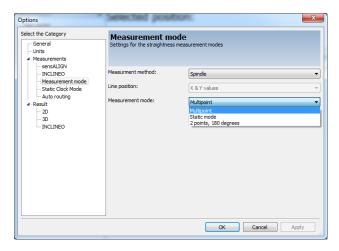
# **Multipoint measurement**

After creating a new file, click "Measurement" to access the measurement screen.

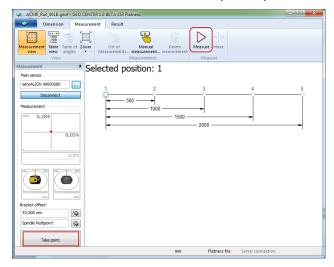


Once in the measurement screen, click "Measurement view", then proceed to connect the measurement system to GEO CENTER. Click .... to establish communication.

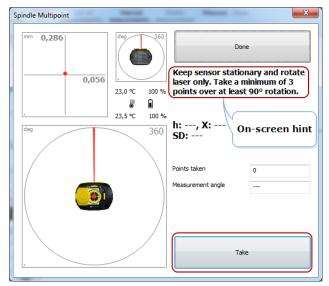
If desired, after establishing communcation, the laser measurement parameters may be set by clicking or using the application icon [ menu item "Options".



Once communication has been established, click the first measurement point. Both the command "Measure" and the "Take point" pane become active.



Click either "Measure" or "Take point" to start measurenment at the selected point. The "Spindle Multipoint" screen opens. In 'Multipoint', measurement must be taken in at least 3 points over a minimum rotation of 90°.

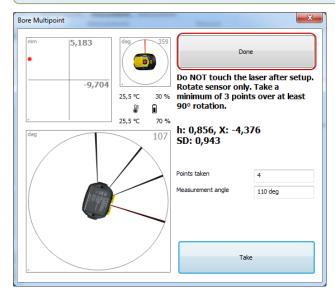


Click the "Take" button to record first measurement point at the selected position. Rotate the laser to next angular point then click "Take" to take measurement. Take as many measurement points, through as wide an angle, as possible.



#### Note

Observe the on-screen hints and the necessary expertise for such measurements.



After taking enough measurement points through as wide an angle as possible, at the selected grid position, click "Done", then proceed to take measurement at all positions on the grid or line as described above.

# Spindle-bore method

This method is used to analyse the geometry of CNC and lathe machines as well as other other spindle-bore applications with respect to a rotational axis.



#### Note

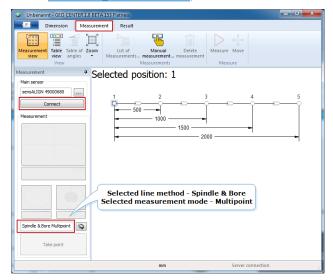
In this method, both the laser and sensor are rotated.

Measurement may be carried out using any one of the following three modes, but paying attention to the hints on respective measurement mode dialog window.

- Static This method is the same as described for the bore method with the difference being that both laser and sensor are rotated in the spindle method.
- Multipoint
- Two points at diametrically opposite positions ("2 points, 180 degrees")

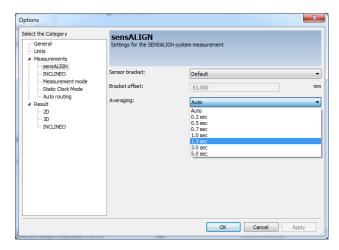
## **Multipoint measurement**

After creating a new file, click "Measurement" to access the measurement screen.

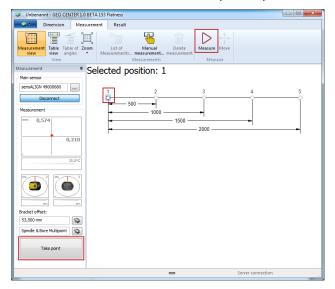


Once in the measurement screen, click "Measurement view", then proceed to connect the measurement system to GEO CENTER. Click .... to <u>establish communication</u>.

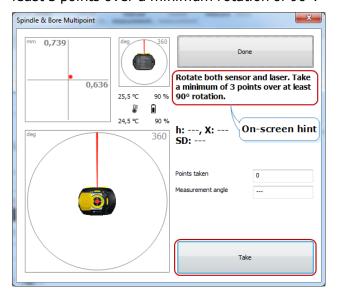
If desired, after establishing communcation, the laser measurement parameters may be set by clicking or using the application icon [ menu item "Options".



Once communication has been established, click the first measurement point. Both the command "Measure" and the "Take point" pane become active.



Click either "Measure" or "Take point" to start measurenment at the selected point. The "Spindle & Bore Multipoint" screen opens. In 'Multipoint', measurement must be taken in at least 3 points over a minimum rotation of 90°.

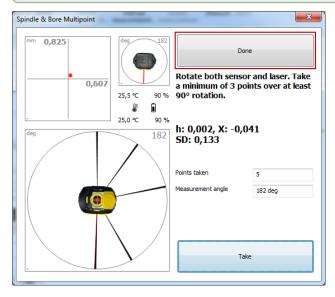


Click "Take" to record first measurement point at the selected position. Rotate both laser and sensor to next angular point then click "Take" for measurement. Take as many measurement points, through as wide an angle, as possible.



#### **Note**

Observe the on-screen hints and the necessary expertise for such measurements.



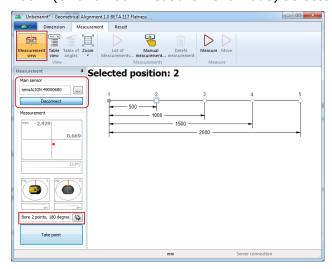
After taking enough measurement points through as wide an angle as possible, at the selected grid position, click "Done", then proceed to take measurement at all positions on the grid or line as described above.

#### 0° and 180° measurement mode

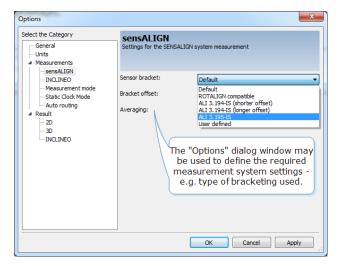
This measurement mode involves taking two measurements at diametrically opposite positions. The normal measurement positions being at 0° and at 180°. This measurement mode is available in the following three measurement methods:

- Line With this method, only the sensor is rotated when taking measurements.
- Bore With this method, only the sensor is rotated when taking measurements.
- Spindle With this method, only the laser is rotated when taking measurements.
- Spindle and bore With this method, both laser and sensor are rotated when taking measurements

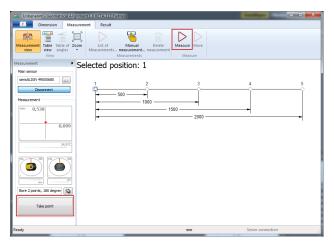
In the following example, a <u>new file</u> has been created, "Measurement view" selected, <u>communication established</u>, and the line method "Bore" and the measurement mode "2 points, 180°" (0° and 180° measurement mode) selected.



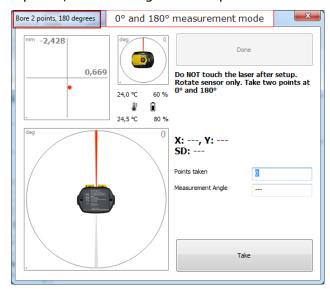
If desired, after establishing communcation, the laser measurement parameters may be set by clicking or using the application icon [ menu item "Options".



Once all necessary settings have been applied, click the first measurement point. Both the command "Measure" and the "Take point" pane become active.



Click either "Measure" or "Take point" to start measurenment at the selected point. The "Bore 2 points, 180°" dialog window opens.

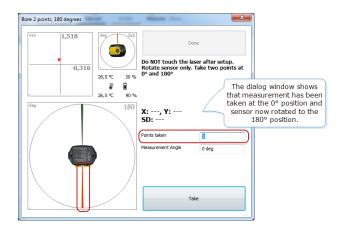




#### Note

The measurement mode dialog window provides the necessary hints for measurement using either a rotating laser, or a static laser, or where both laser and sensor are rotating.

With the sensor at the 0° position, click the "Take" button to record the measurement at this position. Rotate the sensor assembly such that it is diametrically opposite to its original position, then click "Take" to take measurement at the 180° position.





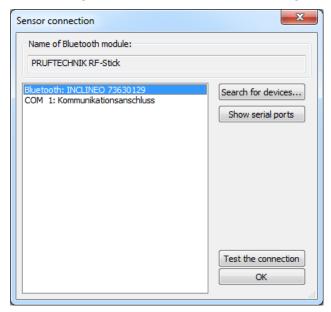
# Note

The sensor must be rotated through exactly  $180^{\circ}\pm1^{\circ}$  otherwise no further readings will be recorded. In such a case, a hint indicating "wrong angle" appears on the dialog window.

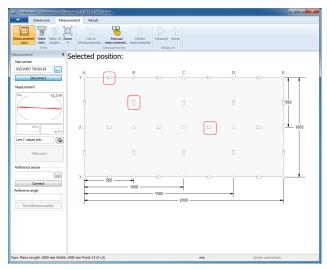
After taking the two measurements at diametrically opposite positions (0° and 180°), click "Done", then proceed to take measurements at all desired positions on the grid or line as described above.

# **Measurements using INCLINEO**

In the following INCLINEO measurement example, a rectangle surface <u>measurement file</u> <u>has been created</u> and <u>communication established</u> between INCLINEO and GEO CENTER. In the following example, communication between INCLINEO and GEO CENTER has been established using the PRUFTECHNIK USB RF dongle.

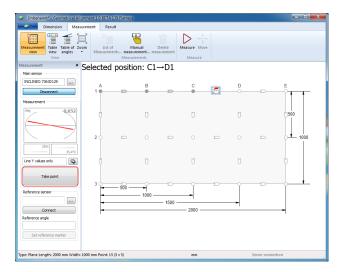


Once INCLINEO has been connected, INCLINEO measurement points icon ( $\stackrel{\longleftarrow}{\longrightarrow}$ ) appear on the grid.



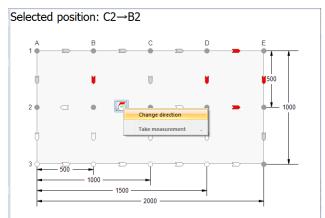
Place INCLINEO on the grid marked on the surface to be measured. Place INCLINEO so that the red tip of the handle points in the direction that measurement will be carried out with the display in view. The direction of measurement is clearly shown in GEO CENTER. With INCLINEO correctly placed on the location to be measured, click the corresponding pos-

ition on the GEO CENTER measurement grid. An INCLINEO icon  $\Box$  appears on the GEO CENTER grid.



Click the "Take point" button to take measurement at current grid position. The recorded value takes the two adjacent points within an axis into consideration.

The direction of INCLINEO on the grid may be changed using a right mouse click.





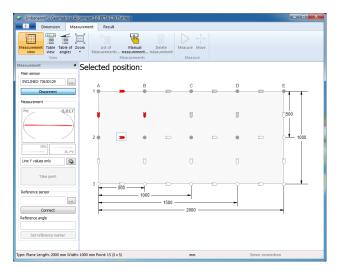
#### Note

Using right mouse for direction change in INCLINEO measurements is not recommended. If at all used, measurement should be only in absolute measurement mode.



## Note

If the option "Check for deviations" has been activated in INCLINEO results settings, measured values will be automatically checked to see if they deviate from the should the defined "Maximum deviation". Should such a deviation be detected, all adjacent measurement points will turn red.



Repeat the steps above and take all necessary measurement points progressing through the grid in the specified direction.

# Reporting

You can create reports that contain all data available on a measurement: file information, dimensions, statistics, measurements and results. You can define which content should be included in the report and in what order.

The report can be viewed, saved and printed out.

In addition, the window can be stored as a graphic or placed into the clipboard.

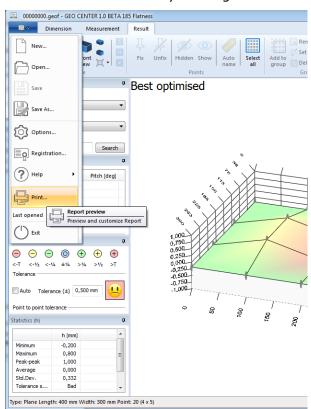
This section contains the following topics:

- 1. Defining the report contents
- 2. Report preview
- 3. Printing the report
- 4. Saving the report

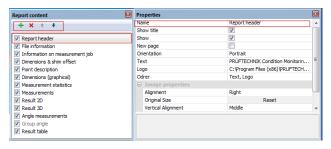
## **Defining the report contents**

The application icon [ menu item "Print" is used to adjust all necessary report settings.

Access the item "Print" by clicking



Use the "Report content" and "Properties" windows to adjust all desired settings.





#### Note

Each section in "Report content" has its own specific properties. Click each item individually to view its related properties. You may use the navigation bar to scroll through the "Report content" sections. is used to add new sections to the report. is used to delete section highlighted in "Report content".

# Report preview

Before you print or save the report, you can view it in a preview.

Viewing a preview of the printout

1. Click "Print".

The report is displayed. You can use the following options to adjust the preview:

Function Purpose

Scroll bar on right Scroll through the pages using the scroll bar on the

right.

Print... The Print menu opens and you can print out the doc-

ument. This is the standard Windows<sup>®</sup> print menu. For information on using this menu, please turn to

your Windows® manual.

Next Page The preview changes to the next page.
Prev Page The preview changes to previous page.
Two Page Two pages appear in print preview.
One Page One page appears in print preview.

Zoom In Zoom in to print preview.
Zoom Out Zoom out of print preview .
Close The preview is closed.

#### Printing the report

Before printing the report, you can view it in a preview. You can also print out the report from the preview.

1. Click "Print" → "Print".

The Print menu opens and you can print out the document. This is the standard Windows® print menu. For information on using this menu, please turn to your Windows® manual.

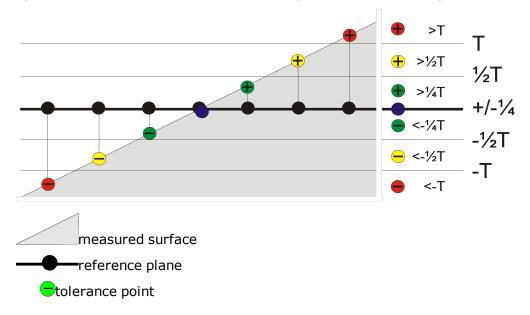
#### Saving the report

The report may be saved as a PDF file by setting the local printer settings to PDF (refer to the local printer user guide).

#### **Tolerances**

The Flatness application is able to determine how far a measured surface deviates from a reference plane. The maximum acceptable deviation between the two surfaces is known as the tolerance T. This value is adjustable.

Measurement points on the measured surface that lie above the reference plane are identified by a +. Those that lie below the reference plane are identified by a -.



# Example

The following example shows the tolerance values if the maximum permissible deviation between the reference plane and the measured surface is equal to 0.016 mm.

Tolerance point	Tolerance value (T=0.016 mm)		
	Т	Outside of tolerance	> 0.016 mm
	>1/2T	Greater than 50% up to 100%	0.008 - 0.016
	>1/4T	Greater than 25% and up to 50%	0.004 - 0.008
	+/-1/4T	+/-1/4T	< 0.004

#### Setting the tolerance value

- 1. Click "Dimensions" or "Results" to change to the Dimensions or Results view.
- 2. Enter or change the tolerance T in the Tolerance field on the left in the tool bar.

Alternative: To automatically set the tolerance to the largest measurement value (plus or minus), activate the Auto checkbox.

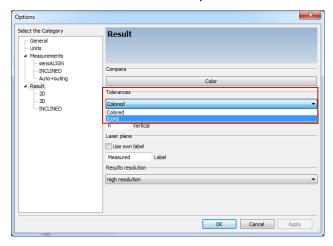
# Selecting a tolerance display

You can specify whether the tolerances should appear in color or as a symbol. If you intend to print out the report on a black-and-white printer, the tolerances should be represented as symbols, since it would otherwise be difficult to differentiate them.

Tolerances in color: Tolerances as icons:



- 1. Select "Options..." → "Results"
- 2. Click the "Tolerances" drop-down menu then select desired tolerance display type.



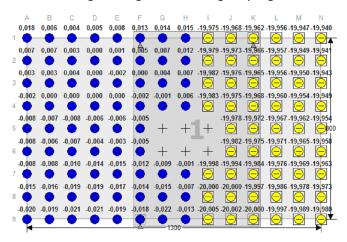
# Working with differences in height and unevenness

Some surfaces have a large intentional difference in height, or are very uneven, so much so that they can only be measured with certain aids. In this case, plates or pipes are placed under the sensor to raise it. These plates or pipes are referred to as shims and their height is given as presets.

#### **Using Presets**

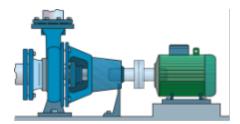
Presets are used in a number of applications, examples of which are given below. The required settings are described at the end of this topic.

The following arrangement and grouping of measurement points is used in the examples:



Intentional height difference between two surfaces

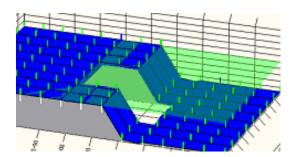
If there is an intentional difference in height between two objects, e.g. between a pump and a motor, shims are placed beneath the sensor to compensate. Enter the height of the shims as a preset value in the Flatness application.



The Flatness application now assumes that the height difference is present but is not relevant for the result. The tolerances are displayed as if both surfaces were on a single plane. The height difference is still displayed, both in the 2D and 3D view. However, the tolerance colors are set as if the surfaces were on the same plane.

Measurement points in groups or reference planes with a preset value are treated as if they were located on the same plane as measurement points without shims.

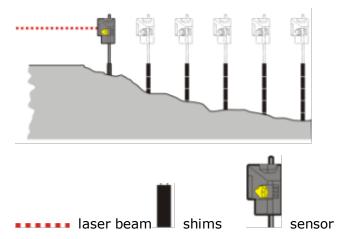
#### Example A:



This example shows two surfaces of differing height. The height difference is intentional, which is why both surfaces appear in the same tolerance color. The light green (light gray) plane shows the plane that passes through the group of points. All measurement points of the group are treated as if they were at the same height.

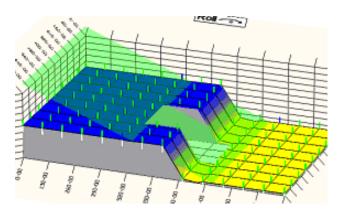
Extending an uneven measurement range

If a surface is so uneven that the laser no longer hits the sensor at some measurement points, shims can be used to extend the measurement range. The shims raise the sensor to a height in which its position is again measurable.



In this application, the height difference at various points is a significant value and is incorporated in the display of tolerances. For example, if a shim of 20 mm is placed under the sensor, the result is a value that lies 20 mm lower than the measured value.

As well, the preset value is included in calculations involving groups and reference planes. Example B:



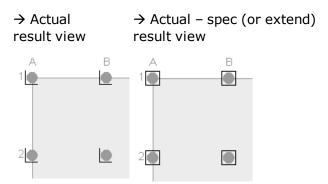
This example shows two surfaces of different height. The surface on the right is too low and cannot be measured unless the sensor is raised using shims. The tolerance, however, is of interest and is therefore displayed in color. The light green (light gray) surface shows the plane that passes through the group of points. The measurement points of the group are included in the calculation with their actual height.

## **Entering Presets**

Manually enter the height by which you raised a surface prior to measurement.

- 1. Click "Dimensions" to change to the Dimensions view.
- 2. Select the point/points that you want to edit. See "Selecting measurement points and dimensions" on page 68.
- 3. In Preset under Selected Point(s) on the left, enter the preset value.

Measurement points with preset values are identified in both the Dimensions and the Results View as follows:



Presets not used Presets used

#### Using Presets in the result calculation

Specify whether or not the presets should be included in the result calculation.

- 1. Click Options
- 2. Click Results in the navigation window on the left .
- 3. Select one of the following options:

#### Actual

The preset values are not included in the results. The actual measurement values are displayed without the presets.

# • Actual - Spec

The preset values are included in the results calculation. The actual height of the measurement plane is displayed and appears in the 3D view. However, the preset values are not included in the tolerance calculations. Also, they are not included in calculations of the best possible plane and the reference plane.

# Extend

All preset values are used for extending the measurement range. In the calculation, the preset values are added to the measurement values.

# Measuring large surfaces

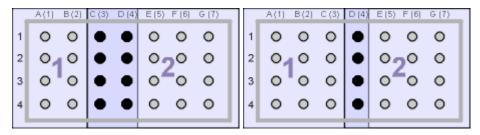
## Splicing measurement files

Conditions for splicing split measurements

To be able to splice split measurements, the following conditions must be met. If not, it will not be possible to join them in some cases.

## At least three overlapping points

At least three points that are not in a straight line must overlap. A message appears if this is not the case.



Can be spliced.

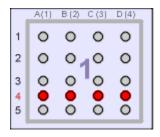
Cannot be spliced.

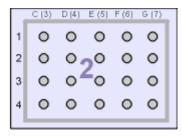
#### Same number of columns and rows

The number of columns and rows must agree. Otherwise, the measurements will shift as shown in the following example. There is no warning message.

Split measurements prior to being spliced

Row 4 has been added to split measurement 1.

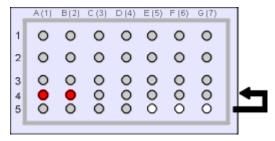




new row

# Measurement after being spliced

The measurement values are shifted. Therefore, the number of rows/columns must be corrected prior to being spliced.



new row

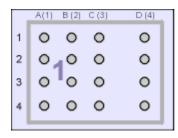
opints without measurement value

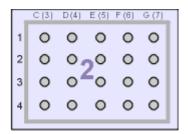
# Same distance between overlapping columns/rows

The distance between the overlapping columns/rows must be the same. Otherwise the measurements will shift as shown in the following example. There is no warning message.

Split measurements prior to being spliced

In split measurement 1, the distance between columns C and D is larger than in split measurement 2.

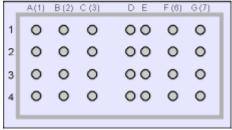




# Measurement after being spliced

The measurement values are shifted. Therefore, the distance between the rows/columns must be corrected prior to being spliced.



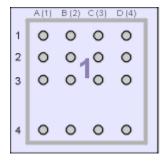


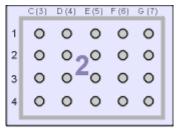
## Same distance between columns/rows

The distance between the columns/rows that cross into both split measurements must be the same. Otherwise the measurements will shift as shown in the following example. There is no warning message.

### Split measurements prior to being spliced

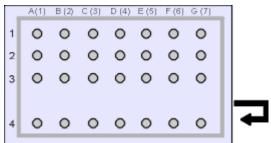
In split measurement 1, the distance between rows 3 and 4 is larger than in split measurement 2.





#### Measurement after being spliced

The measurement values are shifted. Therefore, the distance between the rows/columns that cross over into both split measurements must be corrected prior to being spliced.



Splicing split measurements

In the following, "xxx" stands for the file name.

- 1. Open the first split measurement, xxx-1. To open measurement files, see Opening a measurement file.
- 2. Click the "Merge" command. The Open file window appears.
- 3. Select the second split measurements, xxx-2. The combined surface is displayed.
  - The file name in the bar at the top of the window has a \*.
  - The overlapping points are fixed.
  - If the hint "The dimensions of the two surfaces do not agree" appears, the two split measurements do not fit together.
  - There are no overlapping points OR
  - The overlapping points are in a straight line. At least three points that are not in a straight line must overlap, i.e. the points must lie in at least two rows or columns.
- 4. Repeat step 3 if there are additional split measurements.
- 5. Now save the file under the file name xxx.

Making split measurements coincide

If the wrong template was inadvertently used for a measurement, the measurements do not have to be repeated. Instead, the dimensions of this split measurement can be adjusted to match the other measurements.

- the application icon then select the menu item "Open...", then open the file to 1. Click be adjusted. The second measurement, i.e. xxx-2, should always be adjusted to the first.
- 2. Click "Zeropoint offsets..."
- 3. Enter the following values. See also the next examples.

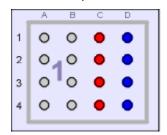
Element Function Offset / Number of rows from the top left measurement point of the split measurement Row to the top left measurement point of the total measurement. Number of columns from the top left measurement point of the split meas-Offset / urement to the top left measurement point of the total measurement. Column Dimensions Horizontal distance from the top left measurement point of the split measurement to the top left measurement point of the total measurement. / Row Dimensions Vertical distance from the top left measurement point of the split measurement

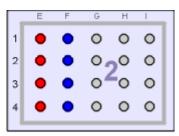
to the top left measurement point of the total measurement

4. Now save the file under the file name xxx.

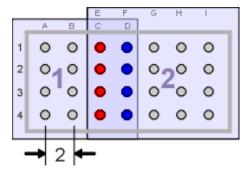
#### Example 1

In this example, there are two split measurements in which split measurement 2 does not coincide with split measurement 1. There are no overlapping points.





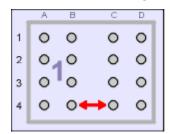
However, columns C and E are the same physical measurement points, as are columns D and  $\sf F.$ 

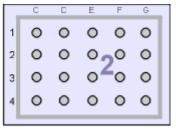


Therefore, split measurement 2 is adjusted to coincide with split measurement 1 by entering a value of 2 for Offset/Column.

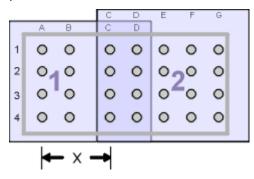
## Example 2

In this example, there are two split measurements in which split measurement 2 does not coincide with split measurement 1 because the distance between columns B and C in split measurement 1 has changed.





However, columns C and D of both split measurements are the same physical measurement points.



Therefore, split measurement 2 is adjusted to coincide with split measurement 1 by entering value x for Dimensions/Column.

## Working with planes

To display the contours of a surface, each measurement point is compared to a reference plane that passes through the measurement surface. The measurement point either lies above, on or below this plane. You can select the type of reference plane.

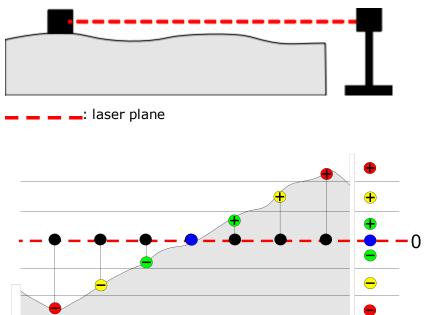
This section contains the following topics:

- Available reference planes
- Displaying plane through group of measurement points
- Specifying color and transparency of the plane
- Displaying roll and pitch of a group

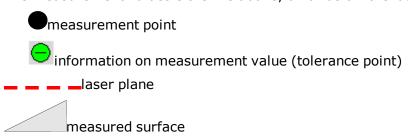
## **Available reference planes**

Laser plane

The plane at the height of the laser.

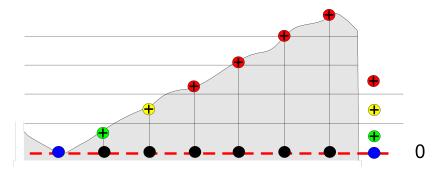


The measurement values either lie above, on or below the laser plane.



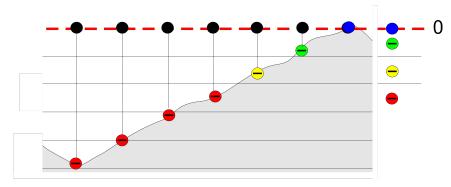
Laser plane, all positive

The plane is parallel to the laser plane but runs through the lowest point on the surface. All other points receive a positive value.



## Laser plane, all negative

The plane is parallel to the laser plane but runs through the highest point on the surface. All other points receive a negative value.



## Best possible plane

This is the best possible plane through the fixed measurement points. Fixed measurement points are points measured at locations that cannot be changed and thus cannot be corrected. For more information on fixed points, see Fixing/unfixing measurement points.

(Optimization procedure: Gaussian principle of least squares)

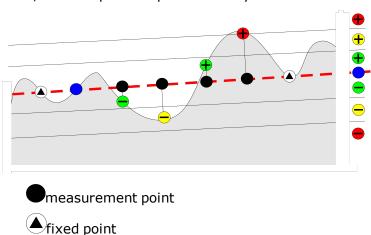
1 or 2 fixed points: The plane runs exactly through the fixed points and is optimized for all other points.

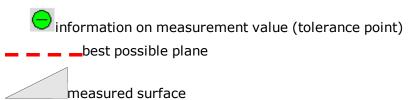
3 fixed points: The plane is exactly defined by three points.

> 3 fixed points: The position of the plane is optimized for all fixed points.

No fixed point: The position of the plane is optimized for all fixed points.

This principle is illustrated in the following diagram with an exaggerated scale. In the Results view, the best possible plane is always shown in a horizontal position.

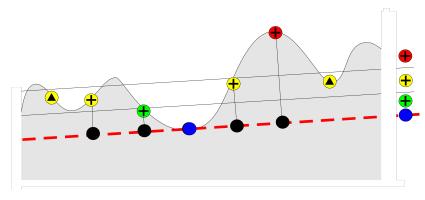




## Best possible plane, all positive

The plane is parallel to the best possible plane but runs through the lowest point on the surface. All other points receive a positive value.

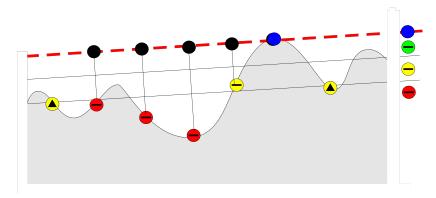
This principle is illustrated in the following diagram with an exaggerated scale. In the Results view, the best possible plane is always shown in a horizontal position.



# Best possible plane, all negative

The plane is parallel to the best possible plane but runs through the highest point on the surface. All other points receive a negative value.

This principle is illustrated in the following diagram with an exaggerated scale. In the Results view, the best possible plane is always shown in a horizontal position.



## Best possible plane, minimal corrections

The plane is parallel to the best possible plane but runs through the middle between the point with the highest and lowest variation. Therefore, if seen absolutely minimal corrections are necessary.

#### Reference measurement

The current measurement can be compared to a reference measurement. You must specify the reference measurement to be used. It will then serve as the reference plane. This function is identical to the Compare function described under File  $\rightarrow$  Compare. For more information, see "Comparing measurement surfaces" on page 118.

Inner to outer (only Cirlce)

The points of the inner circle will be used as reference. For every distinct angle, the points of the outer circles will be displayed in reference to the inner point. This function is only available with the circle template.

Outer to inner (only Cirlce)

The points of the outer circle will be used as reference. For every distinct angle, the points of the inner circles will be displayed in reference to the outer point. This function is only available with the circle template.

## Selecting the reference plane

Here you can select the plane with which the measured surface is to be compared.

- 1. Click "Results" to change to the Results view.
- 2. Select the reference plane at the top left in the Results tool bar. To do so, click on the arrow to the right of the Reference field and select the desired plane from the list.

If you select Reference measurement, the Open file menu appears in which you can select the desired file. See "Opening a measurement file". The files must have the same dimensions and the same number of rows and columns. An error message will appear if they do not.

The selected file then appears in the Reference measurement field.

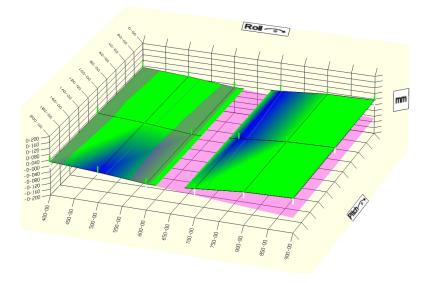
If you would like to select a different file after that, click on Load.

## Displaying plane through group of measurement points

You can display the best possible plane through a group of measurement points. The displayed planes can be used to clearly illustrate the inclination of different regions of the surface.

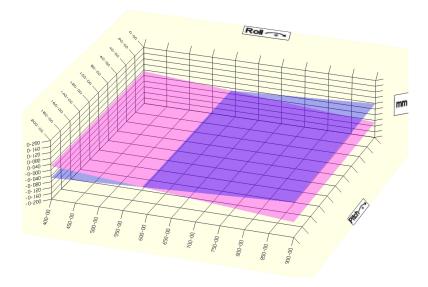
#### Example 1

In the following diagram, the left surface was grouped. The pink (light gray) surface is the best possible plane through the grouped measurement points.



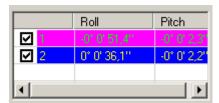
## Example 2:

In the following diagram, the left and right surfaces were grouped and then hidden. The pink (light gray) surface is the best possible plane through the left group, and the blue (dark gray) surface is the best possible plane through the right group.

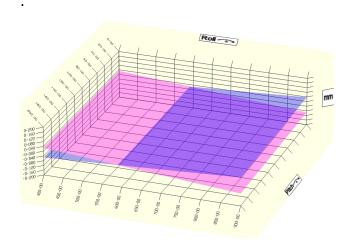


#### Procedure

- 1. Group the measurement points whose planes you want to display. See Grouping and ungrouping measurement points.
- 2. In "Options..."  $\rightarrow$  3D, activate the "Projection planes" checkbox. See 3D settings
- 3. Click "Results" to change to the Results view. In the Reference field on the left, select the reference plane. See The points of the outer circle will be used as reference. For every distinct angle, the points of the inner circles will be displayed in reference to the outer point. This function is only available with the circle template.
- 4. Selecting the reference plane.
- 5. In the Groups tool bar, activate the group whose plane you would like to display. Groups 1 and 2 are activated in the following example.



6. If desired, deactivate the surface and the bordering surface of the graphic to make the planes visible. These settings can be made in " Options..."  $\rightarrow$  3D. See 3D settings



## Specifying color and transparency of the plane

1. In the Groups tool bar, double-click on the group whose appearance you want to change. Alternatively you can perform these functions by clicking with the right mouse key.

The Select Color window appears.

Alternatively, click on the border of the group with right mouse key. The Select Color window appears.

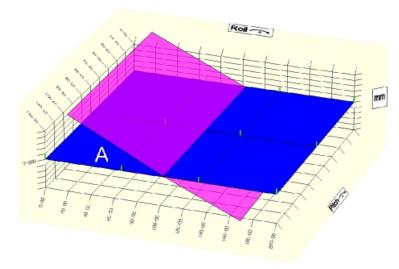
- 2. Click on the desired color in the Color field.
- 3. Enter a transparency value in the Transparency field. The lower the value, the more transparent the plane.

## Displaying roll and pitch of a group

Roll and pitch describe the inclination of the best possible plane through a group with respect to a reference plane.

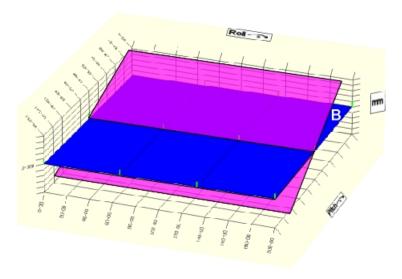
#### Roll:

The angle A between the best possible plane (pink/light gray) and the reference plane (blue/dark gray). A positive angle denotes an ascending inclination along the axis.

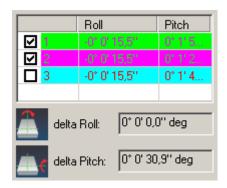


## Pitch:

The angle B between the best possible plane (pink/light gray) and the reference plane (blue/dark gray). A positive angle denotes an ascending inclination along the axis. Note the direction of the axis for the pitch angle.



- 1. Click "Results" to change to the Results view.
- 2. In the Groups tool bar, activate the groups whose inclination you would like to display. Groups 1 and 2 are activated in the following example.



Roll and pitch are displayed for each group.

Delta Roll and delta Pitch appear in the lower part of the panel. These values represent the maximum difference in roll and pitch between the activated groups.

## **Comparing measurement surfaces**

You can compare similar surfaces or surfaces on counterparts such as two objects that fit together.

In the following explanation, the open file is referred to as the "Measurement file". The file used as comparison is referred to as the "Reference measurement" or "Reference file".

This section contains the following topics

- Comparing similar measurement surfaces
- Comparing counterparts

## Comparing similar measurement surfaces

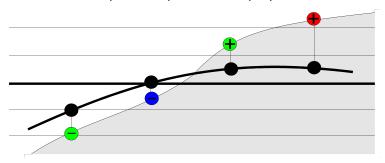
Comparing similar measurement surfaces means measuring the same object twice for the purpose of identifying changes in the object.

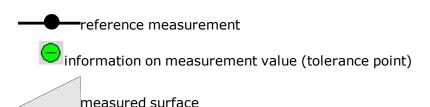
Preconditions for the comparison

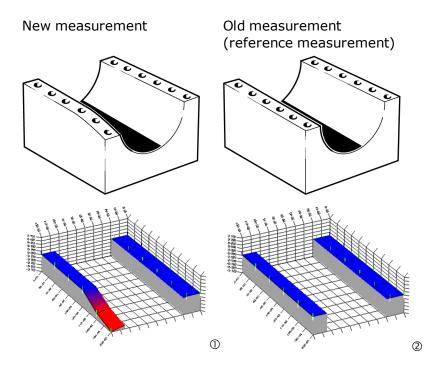
- The files to be compared must have the same dimensions and the same number of rows and columns. If not, an error message will appear.
- If there are any points on the measurement surface that cannot be changed, these measurement points can be fixed in the measurement file. The fixed measurement points define the zero plane.

Displaying the comparison

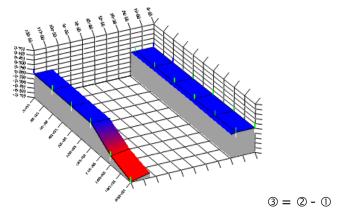
To display the comparison, all fixed points of the measurement are also fixed on the reference measurement. Then the best possible plane is established for each. The difference between these two best possible planes is displayed.







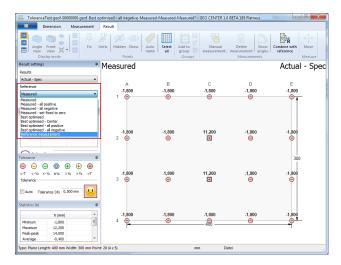
The new measurement is opened and compared to the reference measurement.



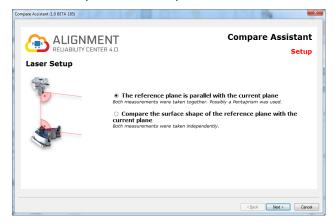
The comparison shows that all measurement results except for the measurement at the bottom left are the same. The deviating measurement points of the new measurement are lower than those of the reference measurement and are displayed as a depression. They receive a negative tolerance value.

#### Procedure

- 1. Open the measurement file that you want to compare. See Opening a measurement file.
- 2. Click "Results" to open results view, then select the item "Reference measurement" from the "Reference" drop-down menu.



3. The compare wizard opens.



3. Follow the compare wizard instructions step-by-step.



### Note

If the dimensions of the two files are not the same you will receive an error message.

## Comparing counterparts

Counterparts are two surfaces that fit together, such as a base and a cover. Measurement files of such surfaces can be compared to determine how well the surfaces fit together.

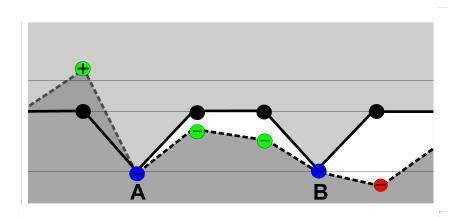
Preconditions for the comparison

- The files to be compared must have the same dimensions and the same number of rows and columns. If not, an error message will appear.
- Two measurement points of your choice in the measurement file must be assigned names. These names must also be assigned to the corresponding point in the reference measurement. Please note that depending on how the cover is opened, the points lie in a different location on the reference measurement than on the measurement file.
- If there are any points on the measurement surface that cannot be changed, these measurement points can be fixed in the measurement file. The fixed measurement points define the zero plane.

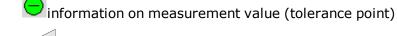
## Displaying the comparison

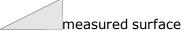
To display the comparison, all overlapping locations are given positive values (appear as a raised area). All hollow spaces are given negative values (appear as a depression).

In this example, measurement points A and B are fixed since these points should make contact.

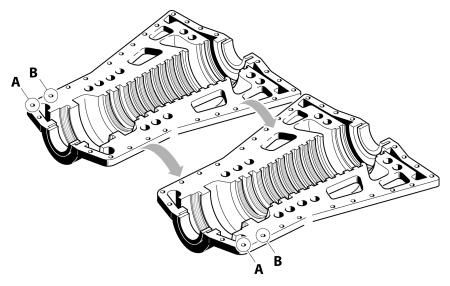


reference measurement, in this example the cover -----measurement file, in this example the base

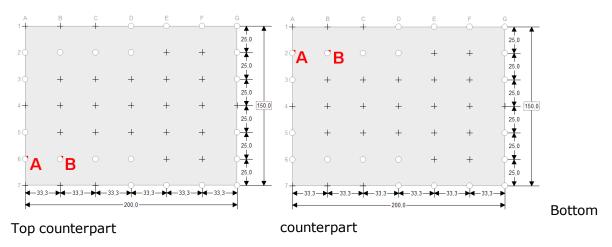




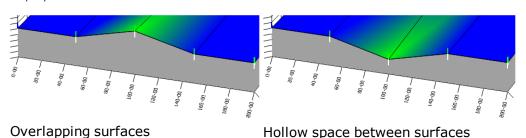
Example of two counterparts



### Measurement points



## Display of results



## Procedure

- 1. Open the measurement file of one of the counterparts that you want to compare. See "Opening a measurement file".
- 2. Assign names to at least two measurement points of your choice and save the file again. See ""Entering a comment on the file " on page 73".
- 3. Repeat steps 1 and 2 for the other counterpart.
- 4. Click "Results" to open results view, then select the item "Reference measurement" from the "Reference" drop-down menu.
- 5. The compare wizard opens.
- 6. Follow the compare wizard instructions step-by-step.



### Note

If the dimensions of the two files are not the same you will receive an error message.

#### **Dimensions view**

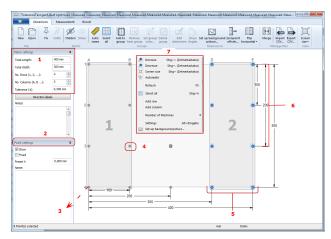
In this view, you can view and modify the arrangement of the measurement points. Also, various settings can be made involving the measurement points.

This section describes the contents of the view and how to adjust them.

This section contains the following topics:

- · View elements
- · Adjusting the view

#### View elements



1 Dimensions and settings: Measurement surface settings

## For rectangle and tracks:

Element Meaning

Total Length Total length of measurement surface (horizontal)

Total Width Total width of measurement surface (vertical)

Rows Interval Average distance between rows
Columns Interval Average distance between columns

No. Rows (1, 2...) Set the number of rows. Rows are added/deleted at the bottom of the dia-

gram.

No. Columns (1, Set the number of columns. Columns are added/deleted at the right of the

2...) diagram.

Tolerance Enter the tolerance.

Direction labels

Name Enter the tolerance.

See <u>Direction labels</u>

Information on file

# For circle/ring:

Element Meaning

Circles (A,B...) Set the number of circles. Circles are added/deleted on the inside.

Points per Circle (1, Set the number of points per circle. Points are added/deleted to the left

2...) of the top point.

Angle Between Average angle between points

Points

Min. Diameter Diameter of smallest circle.

Max. Diameter Diameter of largest circle

Tolerance Enter the tolerance.

Direction labels

Name Enter the tolerance.

See <u>Direction labels</u>

Information on file

## 2 Selected Point(s)

### **Element Function**

Show Check to show the selected measurement point. See Hiding measurement points .

Fixed Check to fix the selected measurement point. See Fixing/unfixing measurement

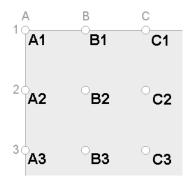
points.

Preset Enter the preset value of the selected measurement point. See Entering Presets.

Name Name of the selected measurement point. See Naming a measurement point.

#### 3 Axes

The rows and columns are numbered on the axes. This numbering is used as a designation by which each measurement points can be identified. See Naming a measurement point.



Measurement points can also be assigned a specific name. See Naming a measurement point.

### 4 Measurement points

Measurements are taken at the measurement points. Various settings can be made for each measurement point and these settings are indicated by specific symbols. The symbols are described under **Measurement point symbols**.

### **5** Groups:

How and why measurement points are grouped is described under Grouping and ungrouping measurement points.

#### 6 Dimensions:

The dimensions of the rows and columns and the total measurement surface are displayed. A number of settings can be made.

#### **7** Context menu:

Clicking the right mouse key anywhere in the window calls up a context menu that makes important functions readily accessible. Many of these functions are also available in the commands.

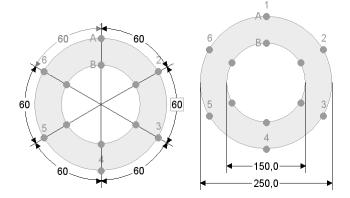
## Adjusting the view

Zooming in/out of the dimensions view

Adjustment	Icon	Menu item
Zoom in	5	Screen size → Increase
Zoom out	5	Screen size → Decrease
Scale view to window size	K 3	Screen size →Screen Size
Automatically scale view to win dow size when window changes	-000	Screen size → Automatic

Showing angles on circular surfaces

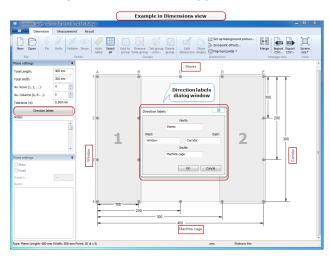
Click the "Show Angles" icon. To return to the Diameter view, click the icon again.

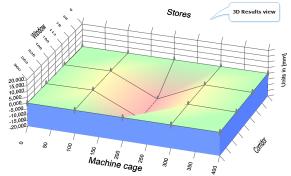


## **Direction labels**

Direction labels are intended to assist in familiarizing with actual local conditions. The four cardinal compass directions (North, South, East and West) may be designated as appropriate.

The designated names will appear in both dimensions and results displays.

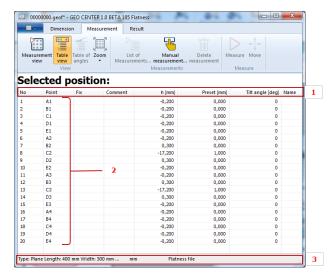




## Further settings

Setting Size	Menu item Options → 2D	More information "2D settings" on page 32
Hide overlapping results Show relative or absolute dimensions	Options $\rightarrow$ 2D options $\rightarrow$ 2D	"2D settings" on page 32 "2D settings" on page 32
Units Show and hide commands Refresh view	Options → Units Double-click ribbon tag Press F5	Setting the units "The ribbon" on page 42

#### View elements



### 1 Columns:

Header	Meaning
No	Index number of measurement point.
Point	Designation of measurement point consisting of column and row numbers.
Fix	Information on whether or not the measurement point is fixed. See Fixing/unfixing measurement points.
Comment	Information on whether or not the measurement point has values that were changed manually. See Modifying measurement values manually.
h	Height of the measurement point with respect to the laser plane. The unit can be set in the Options menu. See Setting the units.
Preset	Information on the preset value. See Working with differences in height and unevenness.
Tilt angle	
Name	Name of the measurement point if assigned. See Naming a measurement point.

## 2 Measurement points:

## 3 Status bar:

Adjusting columns

You can adjust the column width or fully hide entire columns.

1. The columns are separated by dividing lines that are visible in the table header. Hold the mouse pointer over the dividing line whose position you wish to change. The pointer turns into horizontal arrows.



2. Keeping the left mouse key pressed, move the dividing line to the left or right as required. Hiding column: By moving the dividing line all the way to the left, the column to the left of the dividing line disappears.

Refreshing the view

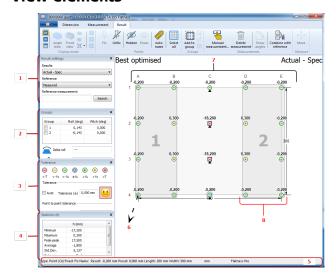
To refresh the view to make changes visible, press F5.

#### 2D results view

This view shows the arrangement of the measurement points. Each measurement point appears with tolerance information. Also, various settings can be made for the reference plane and the measurement points. Instructions on this function are found under the section "Functions".

This section describes the contents of the view and how to adjust them.

### View elements



#### 1 Results bar:

Reference plane settings — see ""Selecting the reference plane" on page 114" If the shape of the plane is circular, the points of the outer circle will be used as reference. For every distinct angle, the points of the inner circles will be displayed in reference to the outer point. This function is only available with the circle template.

### 2 Group bar:

Activate the plane through the group, view the roll and pitch of the group. See Displaying plane through group of measurement points or Displaying roll and pitch of a group.

### **3** Tolerance bar:

Set tolerance — see "Tolerances" on page 101.

#### 4 Statistics bar:

All statistical values are in relation to the currently selected reference plane.

Size Meaning

Minimum Height of lowest measurement point
Maximum Height of highest measurement point

Peak – Peak Height difference between lowest and highest

measurement point

Average Average height of all measurement points

Standard Deviation Standard deviation of all measurement points

#### 5 Status bar:

#### 6 Axes:

The rows and columns are numbered on the axes. See "Axes" under Dimensions view .

# 7 Measurement points:

Measurements are taken at the measurement points. Various settings can be made for each measurement point and these settings are indicated by specific symbols.

Symbo	l Meaning	More information
	Measurement point without settings	
	Selected measurement point	Selecting measurement points and dimensions
+	Hidden measurement point	Hiding measurement points
	Fixed measurement point	Fixing/unfixing measurement points
	Measurement point with name	Naming a measurement point
	Measurement point with preset value, not used (left) and used (right)	Working with differences in height and unevenness
E	Measurement point with manually changed value	Modifying measurement values manually
•	Point above reference plane and outside of tolerance	Tolerances
$\oplus$		
<b>⊕</b> ,	Point above reference plane and more than ½ tolerance	
<b>⊕</b> , +	Point above reference plane and more than ¼ tolerance	
<ul><li>,</li></ul>	Point within tolerance	
<b>⊝</b> ,	Point below reference plane and less than ¼ tolerance	
<u> </u>	Point below reference plane and more than ½ tolerance	
<u> </u>	Point below reference plane and outside of tolerance	
0,055	The value above the point is the height of the point with respect to the reference plane.	

## 8 Groups:

How and why measurement points are grouped is described under Grouping and ungrouping measurement points.

## Adjusting the view

Zooming in/out of the 2D results view

Adjustment	Icon	Menu item
Zoom in		Screen size → Increase
Zoom out		Screen size → Decrease
Scale view to window size	K	Screen size →Screen Size
Automatically scale view to window size when window changes	000	Screen size → Automatic

In 3D view, the "Screen size" ( ) drop-down menu contains different settings for adjusting the scaling only in the 3D view.

## Further settings

Setting	Menu item	More information
Size	Options → 2D	2D settings
Hide overlapping results	Options → 2D	2D settings
Show relative or absolute dimensions	Options → 2D	2D settings
Units	Options → Units	Setting the units
Include presets in the results	Options → Results	Entering Presets
Tolerance display, in color or black-and- white	Options → Results	Selecting a tolerance dis-
		play
Show, hide commands	Double-click ribbon tag	The ribbon
Refresh view	F5	

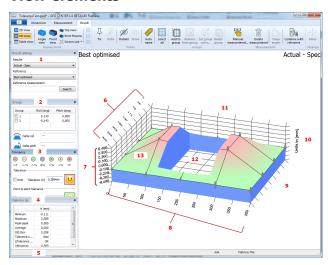
#### 3D results view

This view shows a three dimensional graphic of the measurement surface. The deviations of the measurement surface from a reference plane are shown in color. Various settings can be made for the reference plane. Instructions on this function are found in the chapter.

This section describes the contents of the view and how to adjust them, and contains the following topics:

- 1. View elements
- 2. Adjusting the view

#### View elements



### 1 Results bar:

Reference plane settings — see ""Selecting the reference plane" on page 114"
The points of the outer circle will be used as reference. For every distinct angle, the points of the inner circles will be displayed in reference to the outer point. This function is only available with the circle template.

## **2** Group bar:

Activate the plane through the group, view the roll and pitch of the group. See Displaying plane through group of measurement points or Displaying roll and pitch of a group.

#### **3** Tolerance bar:

Set tolerance — see "Tolerances" on page 101.

#### 4 Statistics bar:

Statistics on measurement points, see "Statistics" under "2D results view" on page 130.

## 5 Status bar:

### 6 Scaling of lateral axis:

The total width divided by 10.

## **7** Scaling of the Z axis:

This scaling can be adjusted. See below.

## 8 Scaling of longitudinal axis:

The total length divided by 10.

#### 9 Pitch:

Inclination of surface in the direction of the width.

#### 10 Units in mm:

Units of height — see Setting the units.

### **11** Roll:

Inclination of surface in the direction of longitude.

#### 12 Empty area:

Here the measurement points have been hidden, see "Hiding measurement points ".

### 13 Measurement points:

Measurements are taken at the measurement points. Various settings can be made for each measurement point and these settings are indicated by specific symbols.

Symbol Meaning
Fixed measurement point. See "Fixing/unfixing measurement points."

(black)
Unfixed measurement point

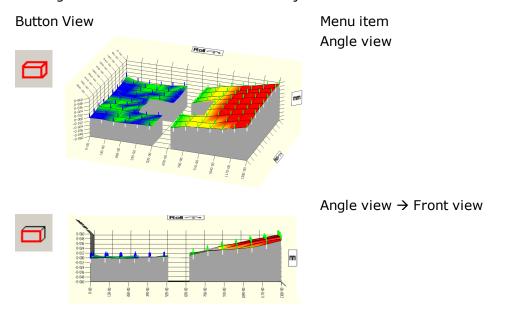
(gray)
Unmeasured measurement point

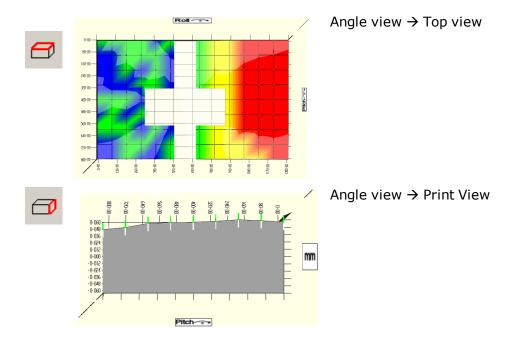
(white)
Selected measurement point. Change to one of the other views to deselect the measurement point if desired.

## Adjusting the view

Changing the angle of view in fixed intervals

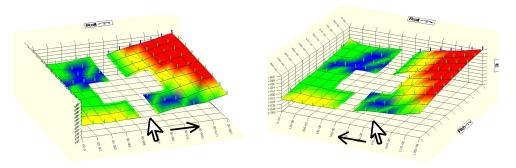
The angle of view of the 3D view can be adjusted.





Changing the angle of view continuously

Place the cursor anywhere on the image window, then hold down the mouse button. Drag the cursor back and forth to adjust the angle as required.



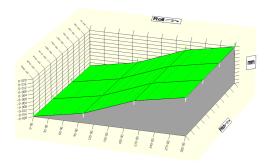
Adjusting the Z axis scaling

The scaling of the vertical axes can be changed using the following buttons in the button bar.

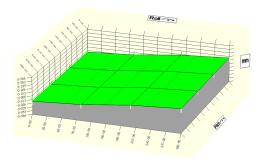
The scaling of the Z axis may not be smaller than the largest displayed measurement value. If a smaller scaling is selected anyway, the value is automatically limited to the largest measurement value.

Button View Menu item









Reset the scaling to the standard set-Screen size  $\rightarrow$  Default scale ting.

The "Screen size" menu also contains additional settings that are only effective in the 2D view.

## Further settings

Setting Show/hide elements in dis- play	Menu Options → 3D	More information 3D settings
Adjust color of background and border	Options → 3D	3D settings
Change ratio between longitudinal and lateral axes (XY ratio aspect)	Options → 3D	3D settings
Include presets in the results	Options → Results	Entering Presets
Units	Options → Units	Setting the units
Display plane through a group of measurement points	Add group → Set group color	Displaying plane through group of measurement points
Show, hide commands	Double-click ribbon tag	"The ribbon " on page 42
Refresh view	F5	

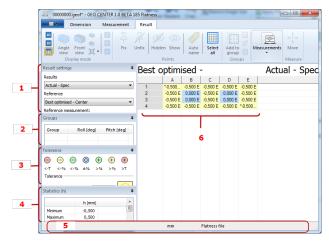
#### Tabular results view

This view shows the arrangement of the measurement points in table form. Each measurement point appears with colored tolerance information. Fixed measurement points are marked with \*. Also, various settings can be made for the reference plane and the measurement points.

This section describes the contents of the view and how to adjust them and contains following topics:

- 1. View elements
- 2. Adjusting the view

#### **View elements**



## 1 Results bar:

Reference plane settings — see ""Selecting the reference plane" on page 114". The points of the outer circle will be used as reference. For every distinct angle, the points of the inner circles will be displayed in reference to the outer point. This function is only available with the circle template.

### 2 Group bar:

Activate the plane through the group, view the roll and pitch of the group. See Displaying plane through group of measurement points or Displaying roll and pitch of a group.

#### 3 Tolerance bar:

Set tolerance — see "Tolerances" on page 101.

#### 4 Statistics bar:

Statistics on measurement points — see "Statistics" under "2D results view" on page 130.

### 5 Status bar:

#### 6 Columns & Rows:

The rows and columns.

### Adjusting the view

Further settings

Setting Menu item More information Units Options  $\rightarrow$  Units Setting the units

Include presets in the results	Options → Results	Entering Presets
Show, hide commands	Double-click ribbon tag	"The ribbon " on page 42
Refresh view	F5	

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