

# LEVALIGN®

## Flatness application with ROTALIGN® Ultra

### Overview:

#### Part 1

ROTALIGN® Ultra  
System operating instructions

#### Part 2

ROTALIGN® Ultra  
Shaft alignment  
operating instructions

#### Part 3

ROTALIGN® Ultra  
Flatness operating instructions

## Operating Instructions

### Dear Customer,

If you have any suggestions for improvement or corrections (not only to this manual, but also to software or hardware), please drop us a line! We would be glad to make improvements wherever possible. We look forward to hearing from you!



Edition January 2006  
Flatness firmware v.1.1x  
ALI 9.847.G

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**Foreword**

Thank you for acquiring LEVALIGN. This rotating laser system is used to measure surface flatness precisely and easily. This guide is designed to help you quickly get familiar with the flatness application in ROTALIGN Ultra. Please acquaint yourself with the ROTALIGN Ultra system operating instructions (Part 1) ALI 9.845.G.

This guide provides an overview of the LEVALIGN Ultra packages and the flatness measurement operating principle. A separate capital has been assigned to the powerful PC software LEVALIGN Editor. A comprehensive description of the Windows PC software is available in the online help. At the end of this guide is the appendix where you will find the LEVALIGN laser emitter technical data.

With this system you are in possession of a geometrical alignment system that can be used in industries such as petrochemical, processing, paper mills, shipping, glass, marine engine builders, mobile crane manufacturers, and power generation. Service companies and OEMs should also find this system extremely useful.

We hope this information is presented in a clear readable form and should give insight to the subject flatness measurement.

Ismaning, Germany  
November 2005  
PRÜFTECHNIK Alignment Systems

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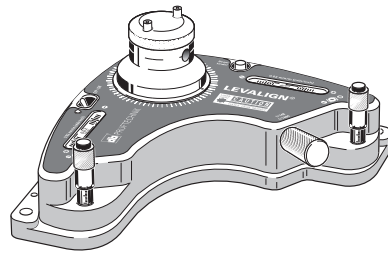
## Chapter 1: Introducing LEVALIGN

### LEVALIGN Ultra packages

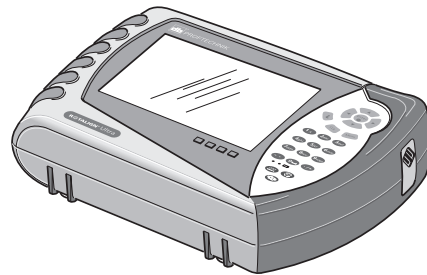
LEVALIGN Ultra is available either as a stand alone or an add-on to ROTALIGN Ultra.

### LEVALIGN flatness package with ROTALIGN Ultra ALI 4.010

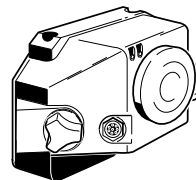
**ALI 4.809** LEVALIGN case with  
Ultra insert  
(Contents not included)



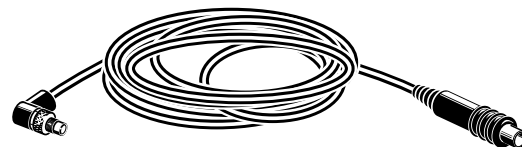
**ALI 6.910** LEVALIGN laser  
single laser plane  
including 9V  
battery **90109**



**ALI 4.200** ROTALIGN Ultra  
computer  
including stand  
**ALI 4.201** and  
rechargeable  
battery **ALI 4.603**



**ALI 3.600** Receiver  
including dust cap  
**ALI 3.606**



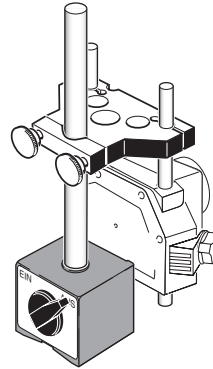
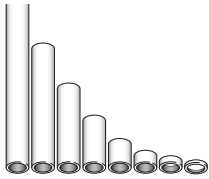
**ALI 3.581-5** Receiver cable

**ALI 4.502-2 ROTALIGN Ultra  
USB cable (PC)**



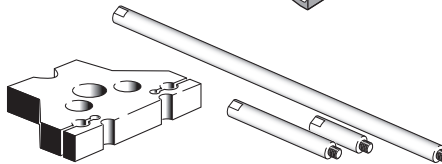
**ALI 4.503 ROTALIGN Ultra  
USB cable (peripheral  
devices) - (not shown)**

**ALI 6.953 Distance sleeves**

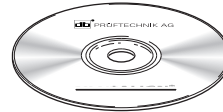


**ALI 4.501 Magnetic foot**

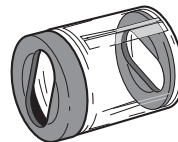
**ALI 6.952 Magnetic foot  
accessories**



**ALI 6.970 CD  
LEVALIGN Explorer CD**



**ALI 6.951 LEVALIGN  
adjustment tube**



**ALI 3.588 Tape measure**



**ALI 4.723 LEVALIGN Reader for Ultra registration  
certificate (not shown)**

**ALI 4.744 LEVALIGN Ultra flatness firmware  
registration certificate (not shown)**

**ALI 4.451 SET  
USB memory stick, 128 MB  
LEVALIGN Ultra flatness firmware  
registration certificate (not shown)**

**ALI 2.905 Lens cleaning cloth (not shown)**

**ALI 9.845.G ROTALIGN Ultra pt.1** (not shown)

**ALI 9.847.G ROTALIGN Ultra pt.3** (this manual)

**ALI 9.364.DG**

**ROTALIGN Ultra product sheets** (not shown)

**ALI 9.965.DG**

**LEVALIGN product catalog** (not shown)

**0 0739 1054**

**Allen key for laser battery compartment**

(not shown)

**0 0739 1056**

**Allen key for laser assembly head**

(not shown)

### **LEVALIGN flatness 'Add-on' package for ROTALIGN Ultra ALI 4.012**

Contents of the add-on package include:

LEVALIGN laser single plane including battery 9 V battery	ALI 6.910 90109
LEVALIGN case with Ultra insert	ALI 4.809
LEVALIGN Explorer CD	ALI 6.970 CD
Magnetic foot adapter	ALI 4.501
Magnetic foot accessories	ALI 6.952
Distance sleeves (offset shims)	ALI 6.953
LEVALIGN adjustment tube	ALI 6.951
LEVALIGN Reader for Ultra voucher	ALI 4.724
LEVALIGN Ultra flatness firmware voucher	ALI 4.734
Allen key (2 mm) - for laser battery compartment	0 0739 1054
Allen key (2 mm) - for laser assembly head	0 0739 1056
ROTALIGN Ultra part 3 operating instructions	ALI 9.847.G
LEVALIGN product catalog	ALI 9.965.DG

## LEVALIGN flatness compact package for ROTALIGN Ultra ALI 4.011

Contents of the compact package include:

LEVALIGN laser single plane including battery	ALI 6.910
9 V battery	90109
LEVALIGN compact case	ALI 6.981
LEVALIGN Explorer CD	ALI 6.970 CD
Magnetic foot adapter	ALI 4.501
Magnetic foot accessories	ALI 6.952
Distance sleeves (offset shims)	ALI 6.953
LEVALIGN adjustment tube	ALI 6.951
LEVALIGN Reader for Ultra voucher	ALI 4.724
LEVALIGN Ultra flatness firmware voucher	ALI 4.734
Allen key (2 mm) - for laser battery compartment	0 0739 1054
Allen key (2 mm) - for laser assembly head	0 0739 1056
ROTALIGN Ultra part 3 operating instructions	ALI 9.847.G
LEVALIGN product catalog	ALI 9.965.DG

### Safety notes

LEVALIGN is to be used in industrial environments only for flatness measurements. Care must be taken to ensure that the instrument is not subjected to mechanical knocks. LEVALIGN and its accessories must be operated only by properly trained personnel. No liability will be assumed when components or operating procedures as described in this manual are altered without permission of the manufacturer.

### Safety symbols

The following symbols are used in this manual in order to draw the reader's attention to especially important text, such as that regarding possible dangers or useful operating tips.

This symbol denotes general information and tips regarding operation of LEVALIGN.

This symbol denotes information which must be followed in order to avoid damage to equipment.

This symbol denotes information which must be followed in order to avoid personal injury.



WARNING!



ATTENTION



Note

## CE compliance and laser safety

Flatness measurements are carried out using the rotating laser LEVALIGN, ALI 6.910 in conjunction with the ROTALIGN Ultra computer, ALI 4.200.

The laser equipment LEVALIGN fulfills the EC Guidelines for electric devices (73/23/EWG) and electromagnetic compatibility (EMC) (89/336/EWG), and has been tested to the scope of:

- DIN EN 55022 Edition 2003-09
- EN 55011 Edition 1991
- EN 50082-2 Edition 1995
- prEN 50140 Edition 1993
- ENV 50141 Edition 1993
- ENV 50204 Edition 1995

<h1>CERTIFICATE</h1>	
<b>Declaration of conformity in accordance with ISO/IEC Guide 22</b>	
This is to certify that the following product:	
	
Equipment / designation:	<b>LEVALIGN laser</b>
Type / Order-no(s):	<b>ALI 6.910</b>
Configuration:	<b>Laser-optical system for precision measurement of surface flatness</b>
corresponds to the fundamental safety requirements as laid down in the guidelines of the advice for the approximation of laws of the member states on electro-magnetic compatability (89/336/EWG) and electrical resources for application within specific voltage limits (73/23/EWG).	
For the appraisal of this certification the following standards were consulted:	
<ul style="list-style-type: none"> <li>• DIN EN 50022, Edition 09/2003</li> <li>• EN 55011, Edition 1991</li> <li>• EN 50082-2, Edition 1995</li> </ul>	<ul style="list-style-type: none"> <li>• prENV 50140, Edition 1993</li> <li>• ENV 50141, Edition 1993</li> <li>• ENV 50204, Edition 1995</li> </ul>
The party responsible for this declaration is	
PRÜFTECHNIK Alignment Systems GmbH Oskar-Messter Str. 15 D - 85737 Ismaning	
issued by:	
Ismaning, 26 July 2004	
Place and date of issue	<b>Bernhard Stephan Wagner</b> - Board of Directors -
	



The ROTALIGN Ultra computer fulfills the EC Guidelines for electric devices (73/23/EWG) and electromagnetic compatibility (EMC) (89/336/EWG), and has been tested to the scope of:

- EN 61326 Edition 2004-05
- EN 61000-4-2 Edition 2001-12
- EN 61000-4-3 Edition 2003-11
- EN 61000-4-4 Edition 2002-07
- EN 61000-4-5 Edition 2001-12
- EN 61000-4-6 Edition 2001-12
- EN 61000-4-11 Edition 2001-12
- EN 55022 Edition 2003-09

# CERTIFICATE

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## Declaration of conformity in accordance with ISO/IEC Guide 22

This is to certify that the following product:



**Equipment / designation:** ROTALIGN Ultra Computer with accessories

**Type / Order-no(s):** ALI 4.200, ALI 4.603, SYS 3.651, ALI 3.600, ALI 3.610

**Configuration:** Laser-optical system for shaft alignment

corresponds to the fundamental safety requirements as laid down in the guidelines of the advice for the approximation of laws of the member states on electro-magnetic compatability (89/336/EWG) and electrical resources for application within specific voltage limits (73/23/EWG).

For the appraisal of this certification the following standards were consulted:

- DIN EN 61326, Edition 05/2004
- DIN EN 61000-4-2, Edition 12/2001
- DIN EN 61000-4-3, Edition 11/2003
- DIN EN 61000-4-4, Edition 07/2002
- DIN EN 61000-4-5, Edition 12/2001
- DIN EN 61000-4-6, Edition 12/2001
- DIN EN 61000-4-11, Edition 12/2001
- DIN EN 50022, Edition 09/2003

The party responsible for this declaration is

**PRÜFTECHNIK Alignment Systems GmbH**  
Oskar-Messter Str. 15  
D - 85737 Ismaning

issued by:

Ismaning, 21. September 2004

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Place and date of issue




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**Bernhard Stephan Wagner**  
- Board of Directors -





Laser hazard



WARNING!

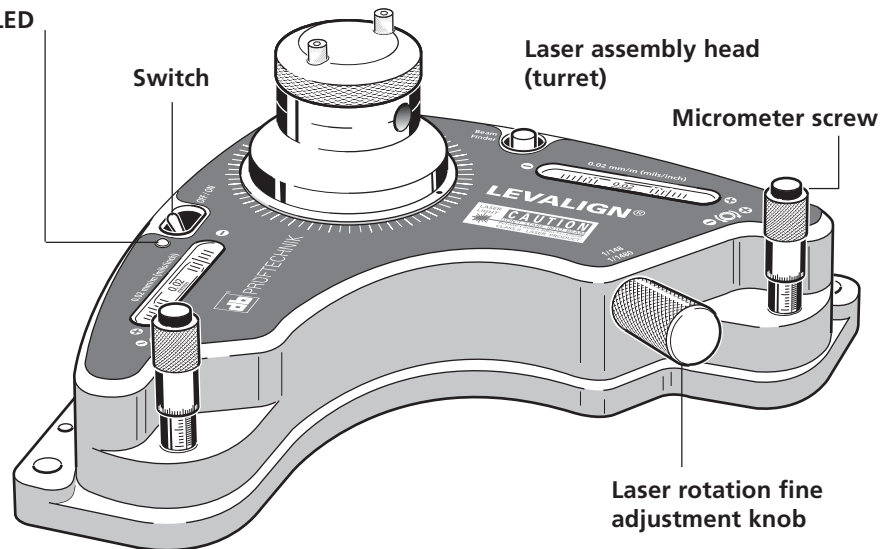
### Laser safety

LEVALIGN, the rotating laser system, uses a class II laser beam. The class II laser operates at a wavelength of 675 nm, with a maximum pulse duration of 128  $\mu\text{s}$ , maximum radiant power of 0.8 mW and maximum radiant energy per pulse of 0.1  $\mu\text{J}$ .

- Do not look directly into the laser beam at any time.
- Do not insert any optical devices into the beam path.
- The red LEVALIGN 'laser active' LED on the top surface of the instrument blinks whenever the laser beam is emitted.

### Getting to know the LEVALIGN laser

LEVALIGN 'active laser'  
LED



ATTENTION

Care must be exercised when moving the LEVALIGN laser. Avoid holding the laser assembly head (turret) when moving the LEVALIGN laser during and after measurement.

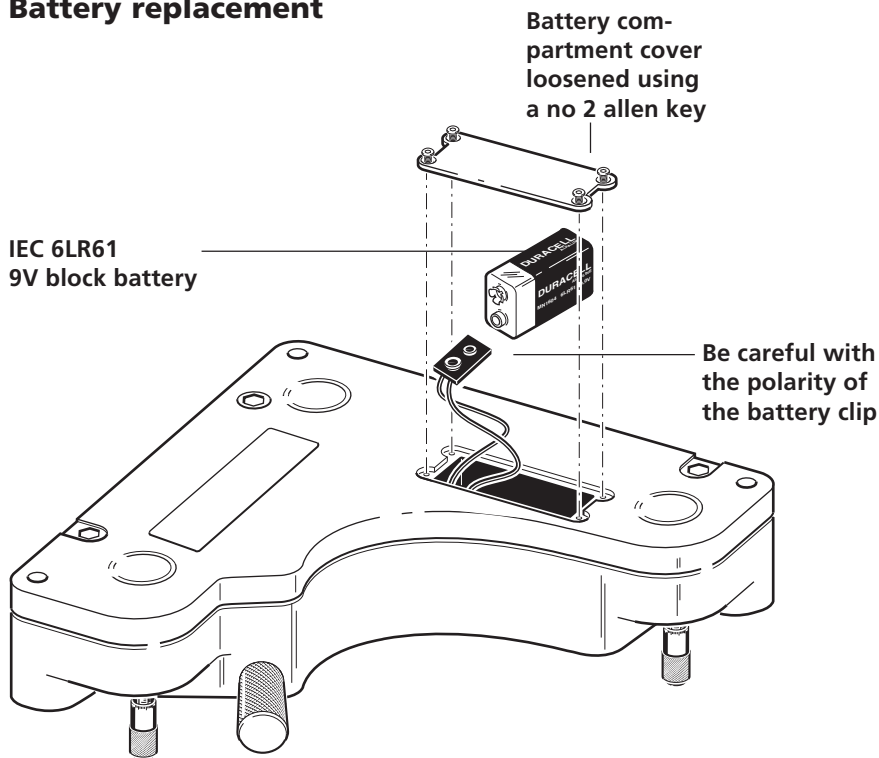
The rotating laser LEVALIGN is powered by a single 9 V battery (type IEC 6LR61) which, depending on battery make and operating patterns, provides a typical operating duration of 80 hours. Lithium batteries of this size can also be used, increasing operation up to 150 hours.



Note

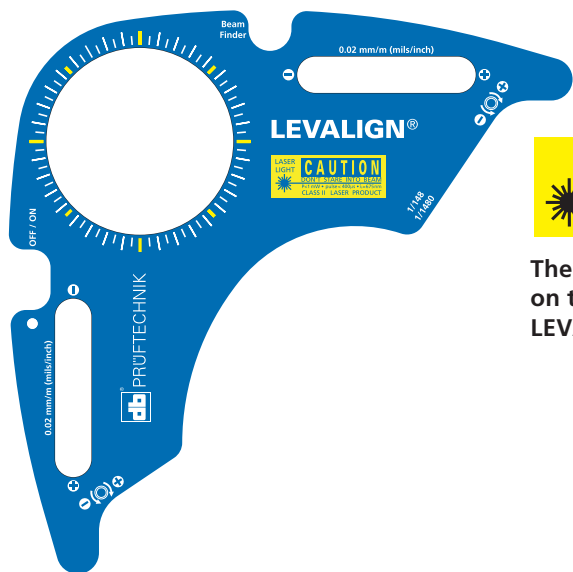
As the battery becomes depleted, the color of the 'laser active' indicator LED changes from red to amber. When this occurs, the battery should be replaced by removing the four countersunk screws on the battery compartment located on the base of the LEVALIGN laser using a no. 2 allen key (see next page).

### Battery replacement



### LEVALIGN laser labelling

The labels shown below are to be found on the LEVALIGN laser in compliance with various international standards.



The above label is located on the top surface of the LEVALIGN laser.

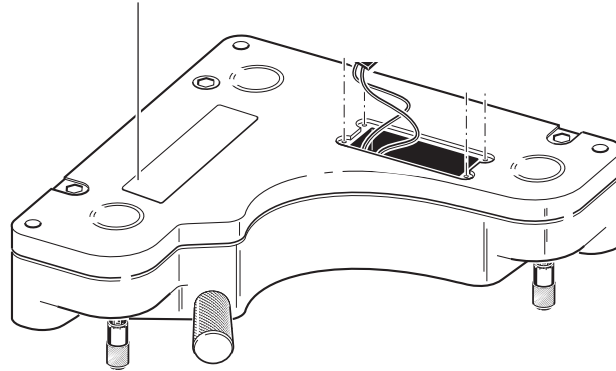


The above label is stuck on the LEVALIGN assembly head (turret).

**Installing flatness firmware**

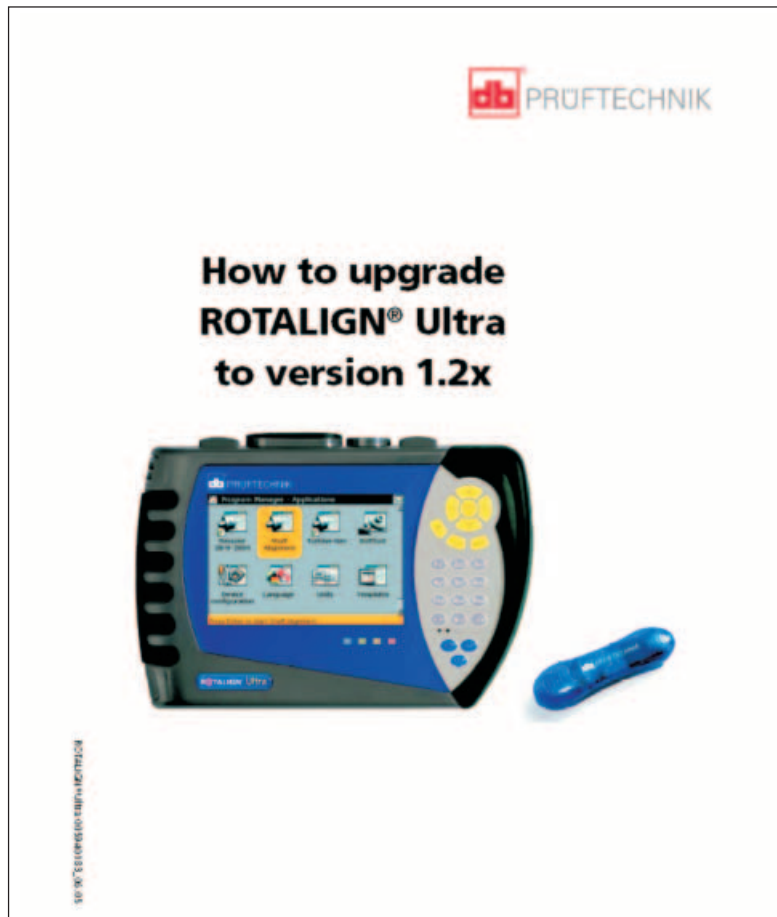


The above label is located on the bottom surface of the LEVALIGN laser.



**Installing flatness firmware into ROTALIGN Ultra**

The LEVALIGN stand alone package ALI 4.010 is delivered with the flatness firmware already installed in the ROTALIGN Ultra computer and is ready for use. With the add-on and compact packages, the flatness firmware needs to be installed. For firmware installation, please refer to the ROTALIGN Upgrade info sheet 0 0594 0183 which is supplied together with this manual.

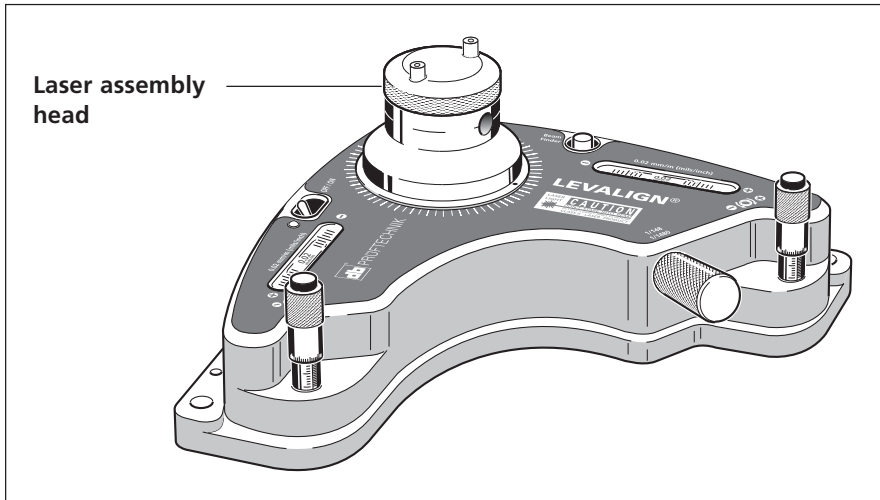


**Chapter 2: Flatness measurement**

This chapter describes flatness measurement procedure using LEVALIGN in conjunction with ROTALIGN Ultra.

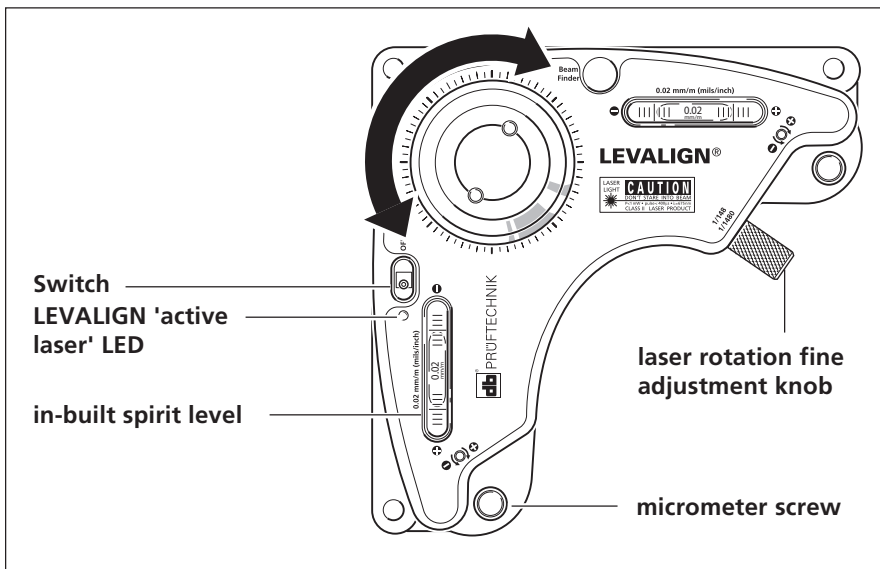
**LEVALIGN laser**

**ALI 6.910**



Exercise care when moving the LEVALIGN laser. Avoid holding the laser assembly head when moving the LEVALIGN laser during and after measurement.

The laser uses a diode that emits a ray of red light which is visible where it strikes a surface.

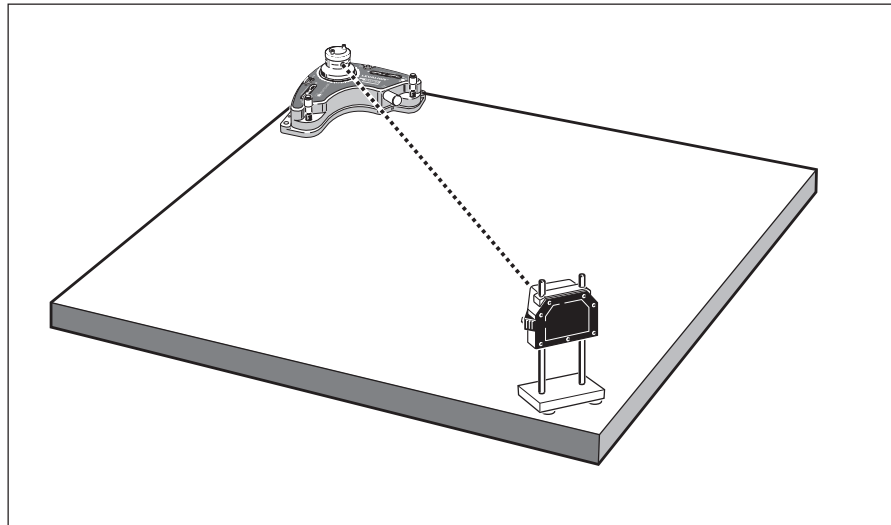


The in-built spirit levels are used to set the laser plane parallel to the earth's surface or perpendicular to the earth's gravity field. This adjustment is achieved using the micrometer screws.

The laser assembly head can be rotated through a full circle. This enables the laser beam be used as a reference plane.

## 2.1 Operating principle

Surface flatness measurement is essential to any industry concerned with the manufacture of precision flat components. LEVALIGN used in conjunction with ROTALIGN Ultra is used to determine surface flatness - or more precisely changes in surface flatness.



### Levelness and flatness

The LEVALIGN rotating laser is used to determine the levelness and flatness of surfaces.

When measuring levelness, the LEVALIGN laser beam forms the reference plane. In this case, the laser beam is levelled using the in-built spirit levels. The micrometer (adjustment screws) are used to level LEVALIGN to the horizontal plane. The air bubble in both vials should be in the center. The receiver is positioned at different points of the surface and measurements taken.

Flatness on the other hand is measured by creating a flat plane using the "buck-in" (making parallel to) procedure. The "buck-in" procedure allows the user to establish a laser plane that is parallel to three points in space; the three points forming a plane. This procedure is described fully under set-up in section 2.2.

The receiver uses a semiconductor position detector to precisely measure the position of the beam. As the receiver is moved across the workpiece, the laser beam changes its position in the receiver according to the depth deviation.

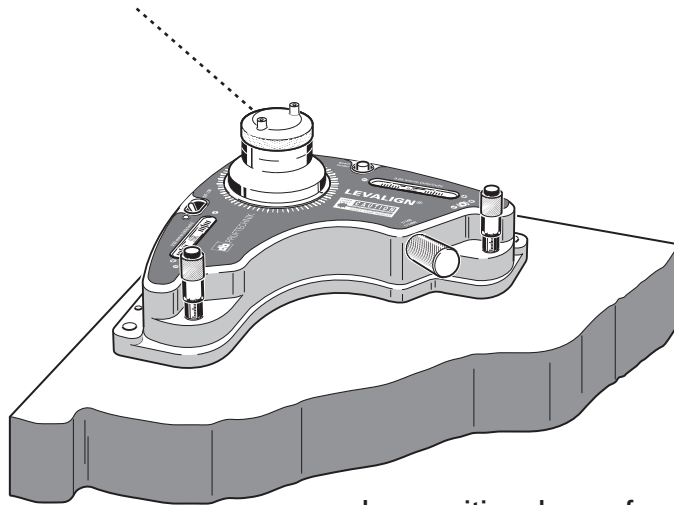
The ROTALIGN Ultra computer uses the laser beam coordinates from the receiver to display the flatness diagram showing the deviation at each measurement position.

Different brackets allow this principle to be used on a wide range of applications.

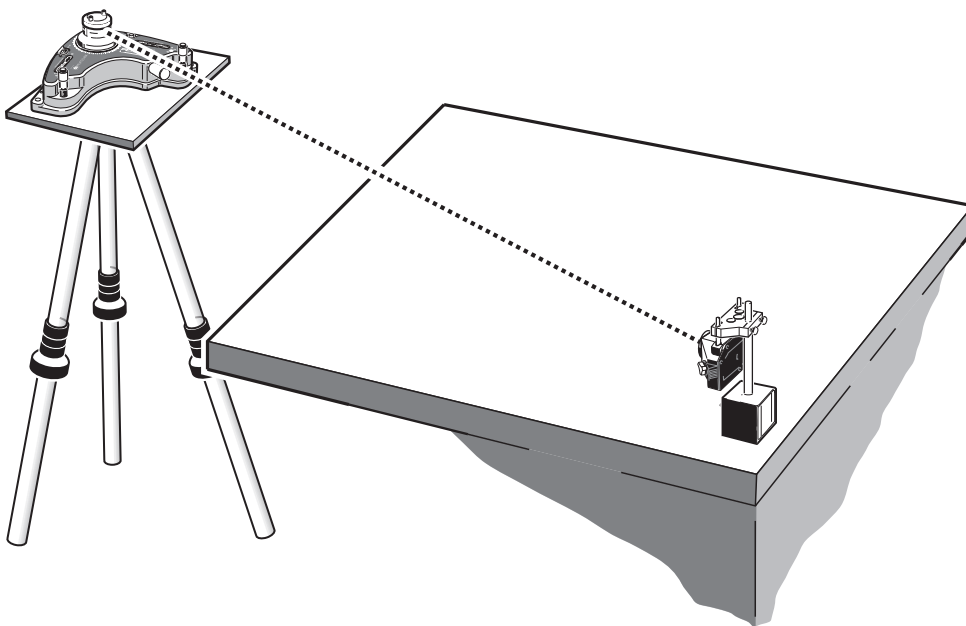
## 2.2 Set-up

### Mounting laser and receiver

Due to its design, LEVALIGN does not require any special mounting. The unit sits firmly on any horizontal surface. This can either be the surface being measured or an outside one. The LEVALIGN industrial tripod stand ALI 6.956 may also be used.

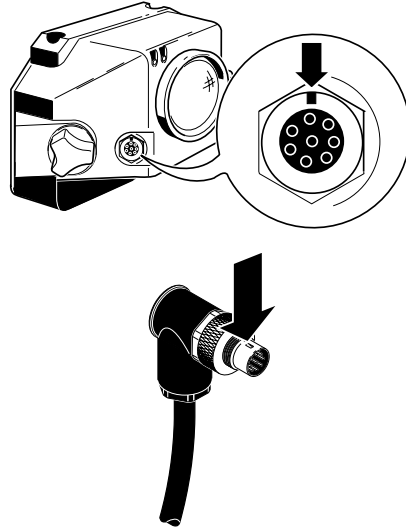


laser positioned on surface  
to be measured



laser positioned outside  
surface being measured

1. If not already done, insert the angled cable end into the receiver socket, noting the keyway orientation, and screw the plug fitting into place.



Do not twist the cable when disconnecting it. This may damage the conductor pins.

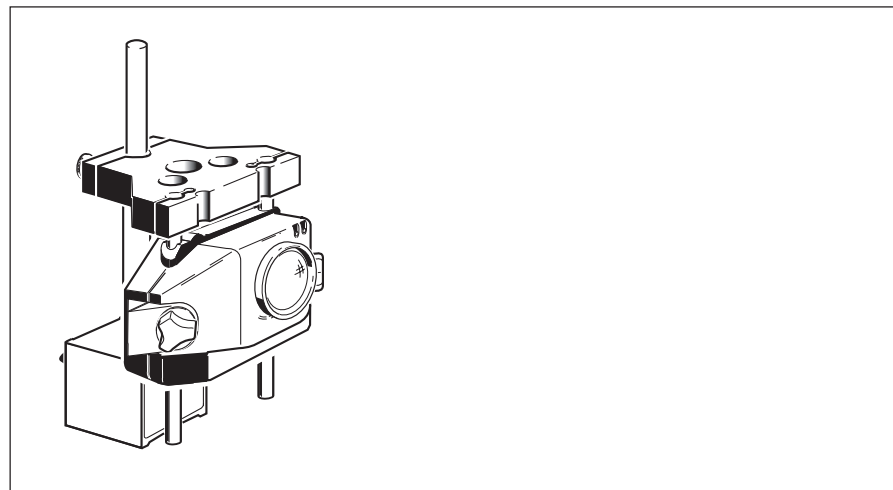
The angled plug should be permanently left connected to the receiver, even during storage in its case, as this will help avoid damage to cable pins, plugs and sockets.

2. The receiver is mounted on the magnetic foot ALI 4.501.



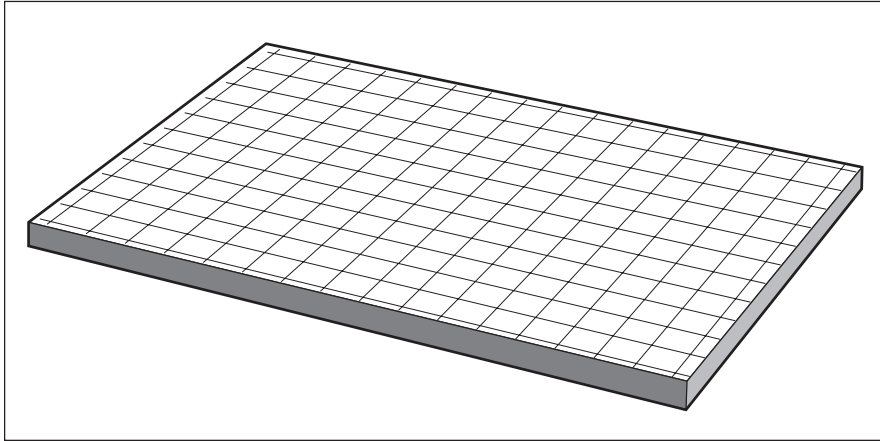
The receiver can also be mounted on specialized PRÜFTECHNIK brackets such as the magnetic rotatable bracket for flatness measurement ALI 6.954. See the LEVALIGN product catalog ALI 9.965.DG or consult your local representative for details.

The receiver is mounted on support posts fixed to the adapter ALI 3.199. The magnetic foot accessories are used to customize the magnetic adapter.

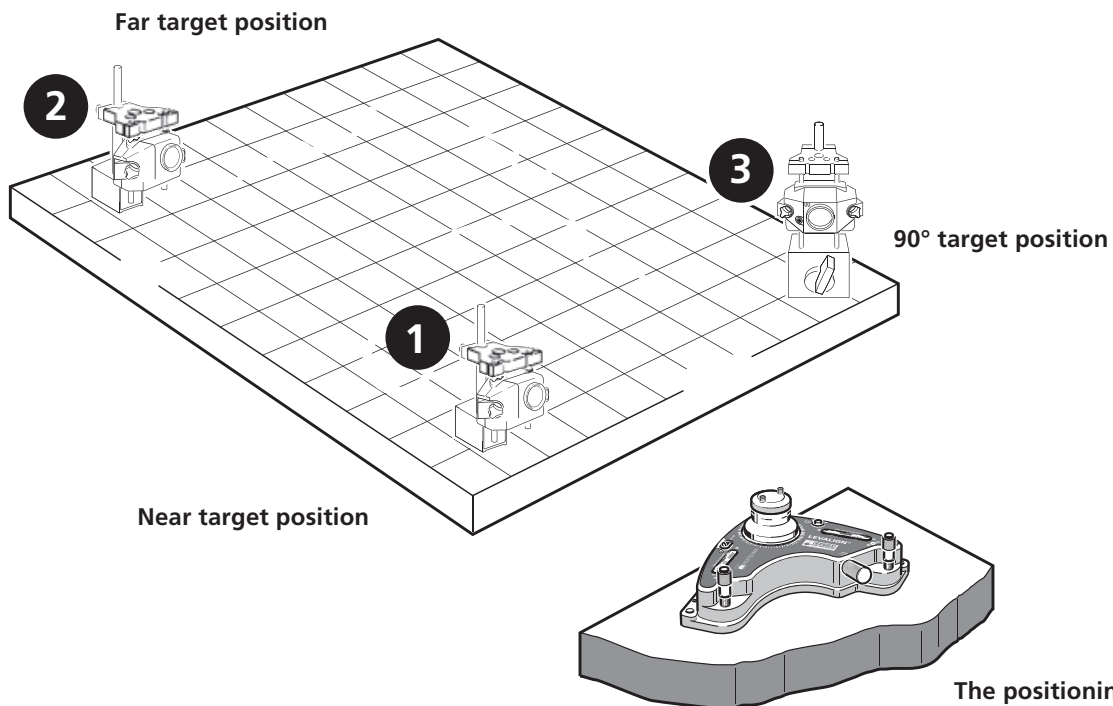




- Determine the points to be measured by marking a grid on the object surface.

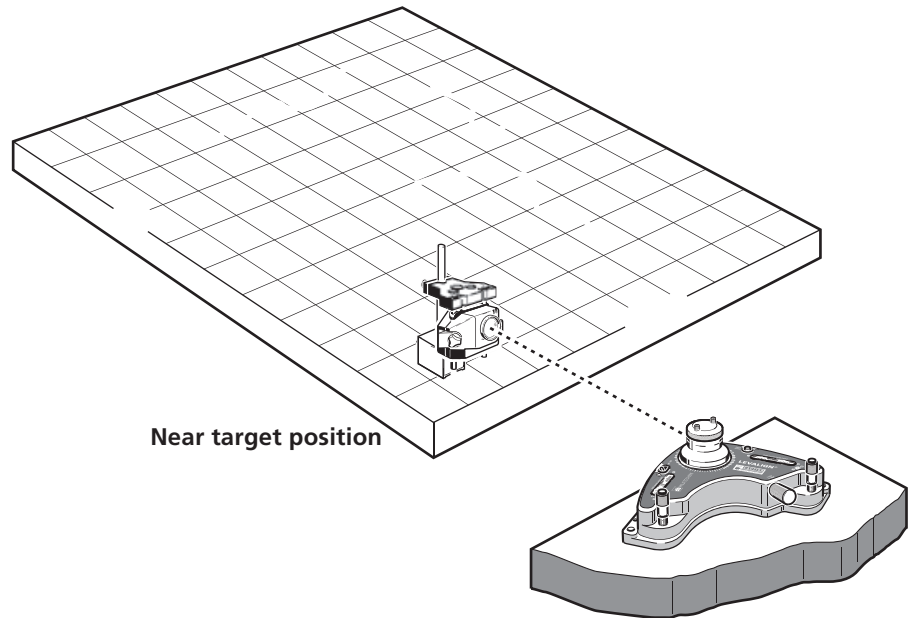


- Select three points on the surface to be measured that are going to be reference points for the laser plane. The three points are selected such that one is as near the laser as possible, a far position (preferably in a straight line from the near position), and a third point at  $90^\circ$  to the laser. The three points will determine a plane.

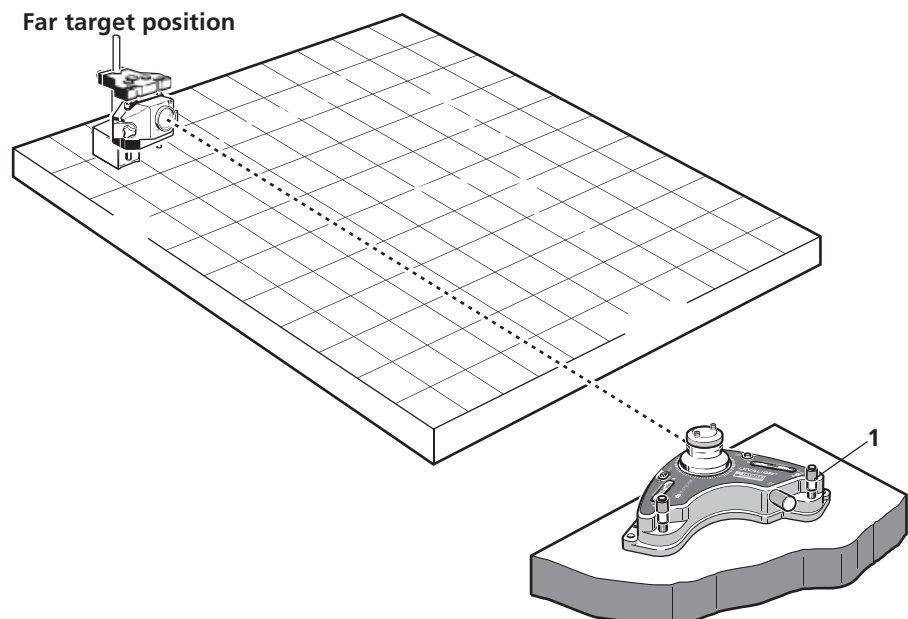


The positioning of LEVALIGN determines which and by what magnitude, the micrometer adjustment screws are to be moved.

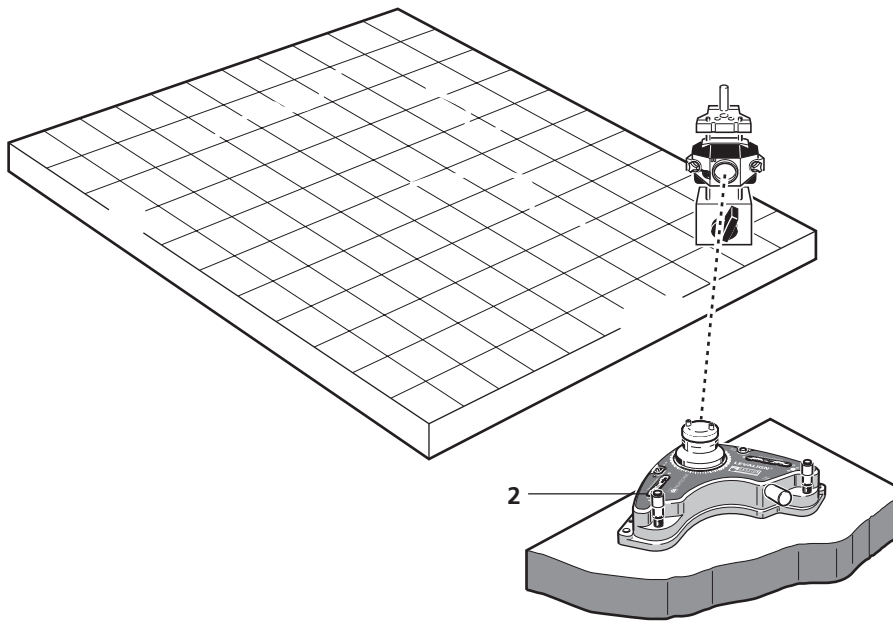
5. With the dust cap on, place the receiver assembly at the near target position.



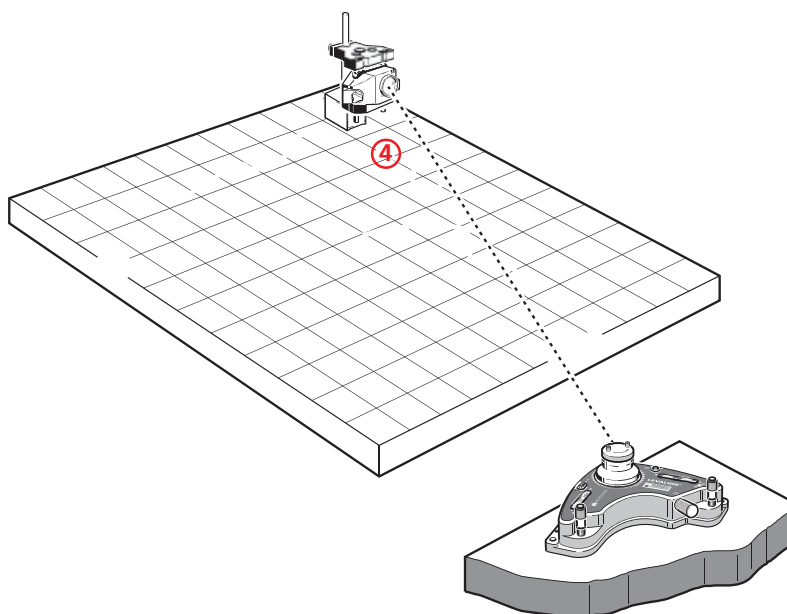
6. Switch on the laser.
7. Loosen the yellow receiver locking knobs and move the receiver vertically, to center the laser beam on the receiver dust cap. This adjustment defines the height of the receiver when close to the laser.
8. Now move the receiver assembly to the far target position and center the laser beam on the dust cap using the micrometer adjustment screw positioned on the opposite end of the laser assembly head aperture (in this case labelled 1).



9. Now move the receiver assembly to the 90° target position, and using using the micrometer adjustment screw positioned on the opposite end of the laser assembly head aperture (in this case labelled 2), center the laser beam on the receiver dust cap.



10. Move the receiver assembly back to near target position. The laser should strike the center of the dust cap. If it does not, repeat steps 5-9. If however, the beam strikes the center of the dust cap, then the laser plane has been formed. As a final confirmation, move the receiver assembly to the diagonal position (labelled 4). The laser beam should strike the center of the receiver dust cap.



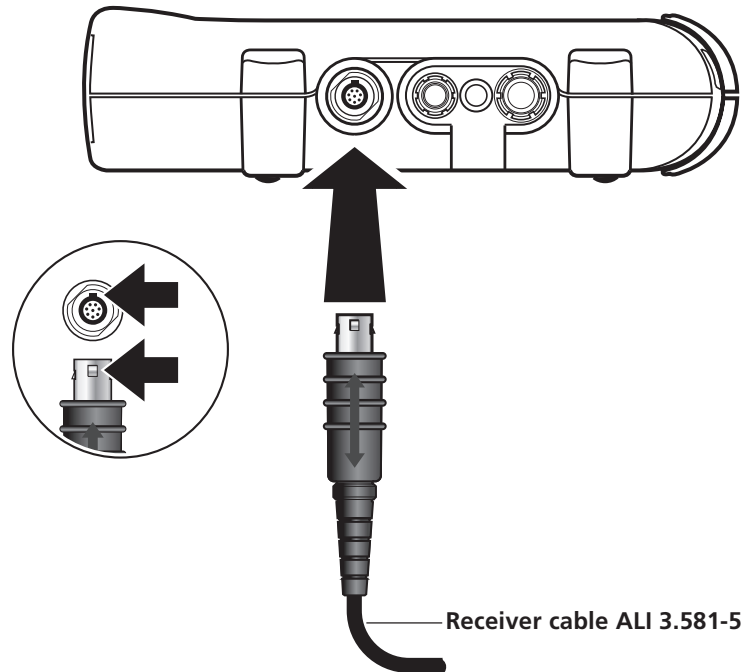
The micrometer adjustment screws and the fine adjustment knob should never be adjusted when the receiver is in the diagonal position.



Note

**Connecting the receiver to ROTALIGN Ultra**

11. Insert the quick fit straight-ended receiver cable plug into the eight-pin socket on the top of the computer housing with the red dot at the front. A gentle push is required until the plug clicks into place.

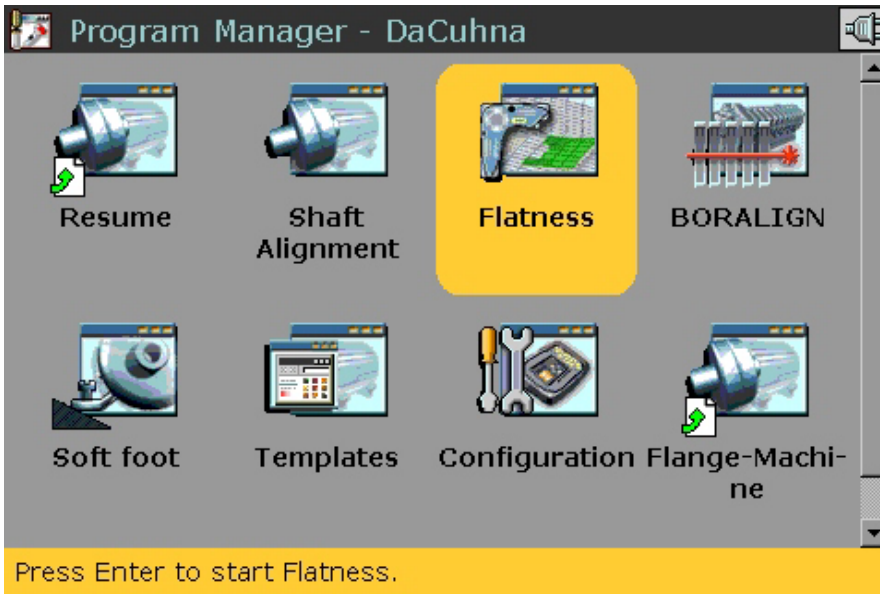


Match the double-sided arrow head on the plug to the red marking on the socket to ensure proper plug orientation; otherwise the pins inside the plug may be damaged.

To disconnect, grasp the ribbed collar of the plug on the receiver cable (ALI 3.581-5) and carefully pull it out of the ROTALIGN Ultra RS232 sensor socket.


### Switch on ROTALIGN Ultra computer

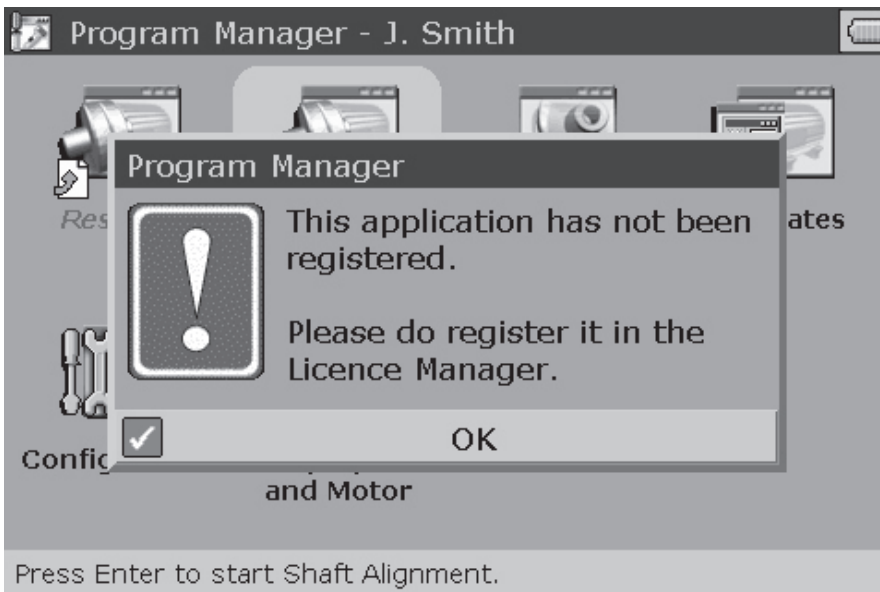
Press  and hold for approximately 1-2 seconds. The opening screen shown below appears:



Use the navigation keys to highlight the 'Flatness' icon. Press  to start the application.




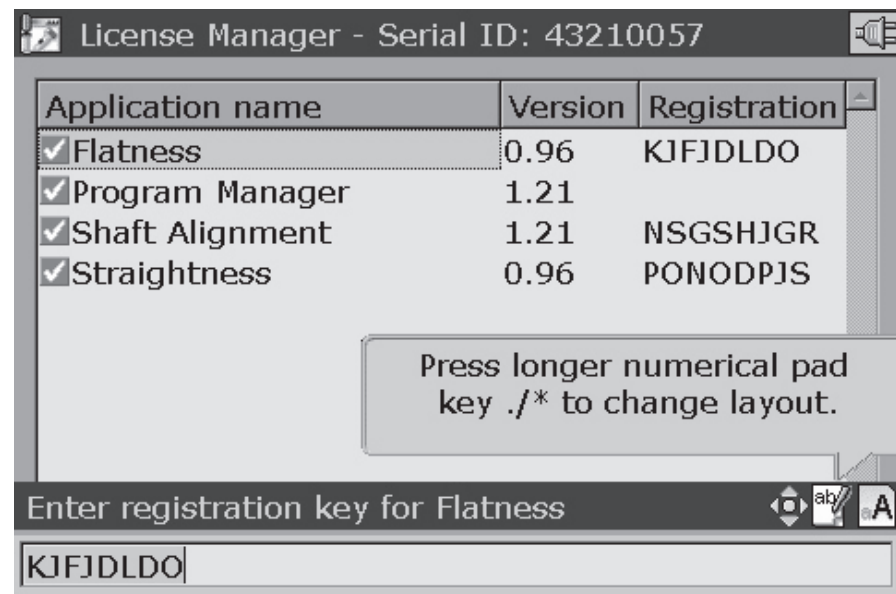
If the flatness firmware has not been licenced, on pressing , a hint to enter the registration key through the licence manager will appear as shown below.



Press  to access the licence manager.

The required **registration key (licence code)** is obtained after filling out and returning the LEVALIGN Ultra firmware voucher ALI 4.734 to PRÜFTECHNIK Alignment Systems or your local representative.

Use the navigation keys to highlight 'Flatness'. Press  and proceed to enter the application registration key in the editing box. The registration key (license code) is contained in the LEVALIGN Ultra flatness firmware registration certificate ALI 4.744.



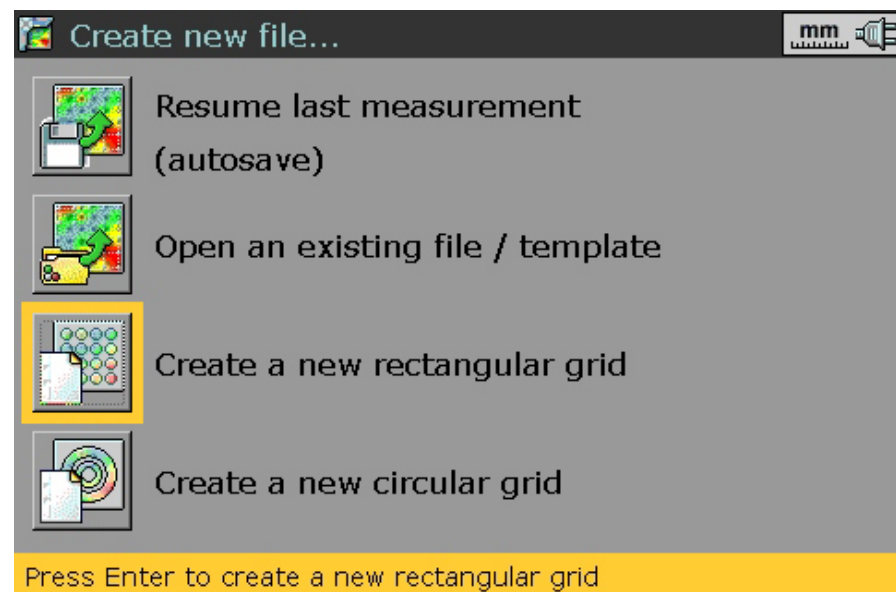
After successful registration, a green tick appears next to the application and flatness can be started.

## 2.3 Dimensions

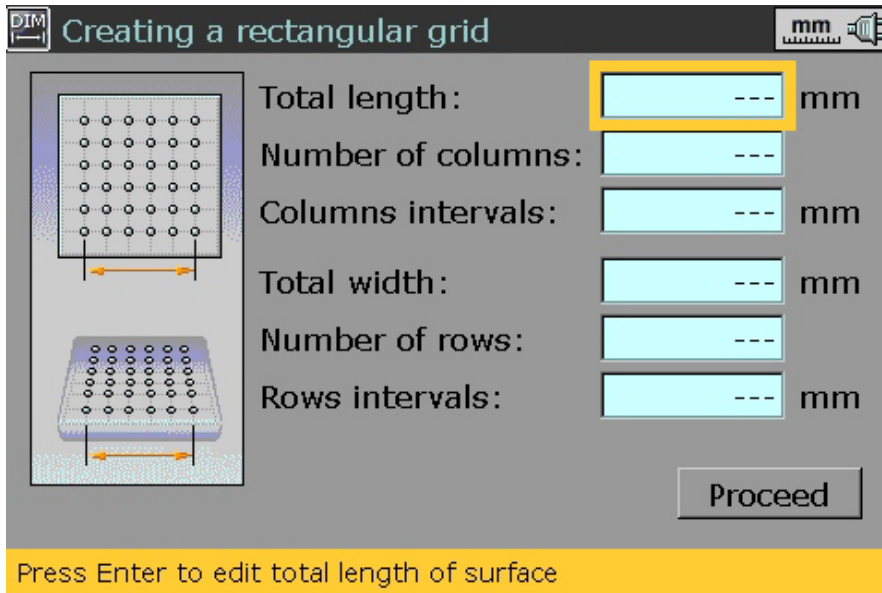
### Selecting type of surface to be measured


After starting the flatness application, the screen to select form of surface to be measured appears.

Use the navigation keys to select surface form or choose a template.



Press  to confirm selection. The surface configuration screen appears.



**Creating a rectangular grid** mm 

Total length:  mm

Number of columns:

Columns intervals:  mm



Total width:  mm




Number of rows:

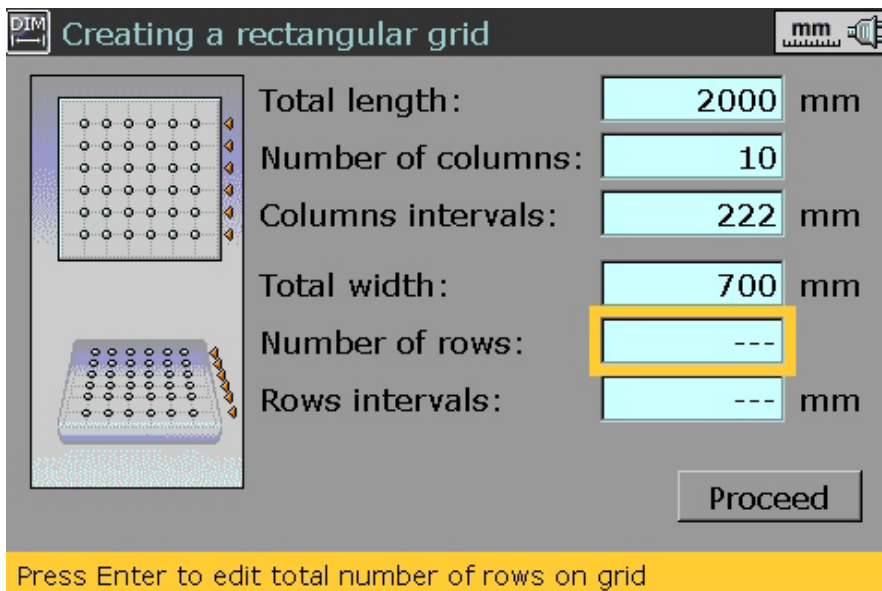
Rows intervals:  mm


**Proceed**

Press Enter to edit total length of surface

Use the navigation keys to select item to be edited. Enter the required value using the data entry keys. Press either  or  to confirm entry.

Alternatively, after selecting item to be edited, press . The editing box appears. Edit values using the data entry keys, pressing either  or  to confirm entries.



**Creating a rectangular grid** mm 

Total length:  mm

Number of columns:

Columns intervals:  mm

Total width:  mm

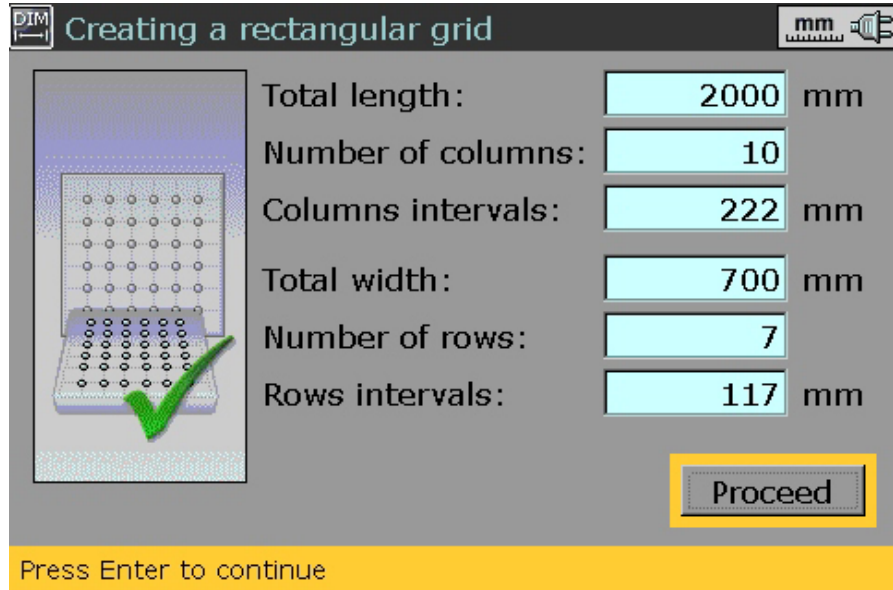
Number of rows:

Rows intervals:  mm

**Proceed**

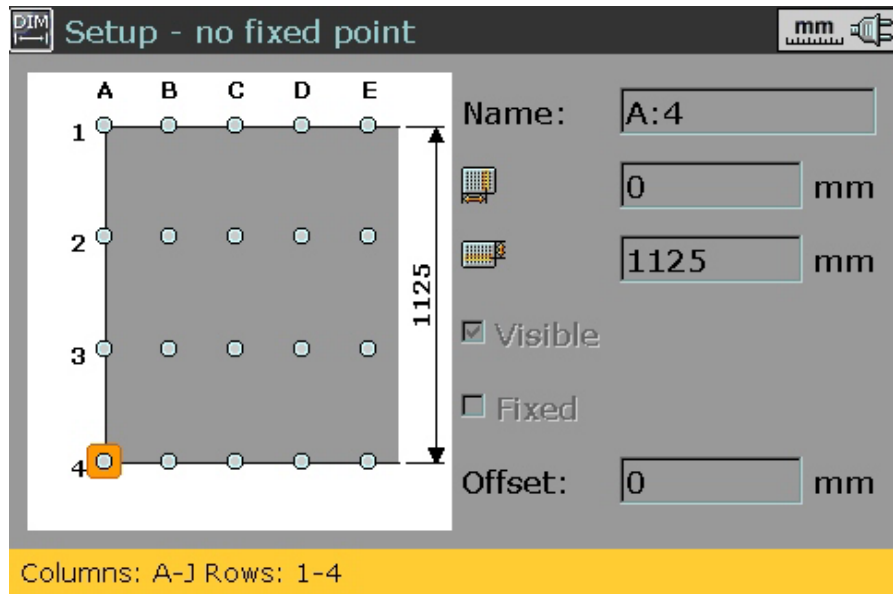
Press Enter to edit total number of rows on grid

Use the navigation keys to move through the items.



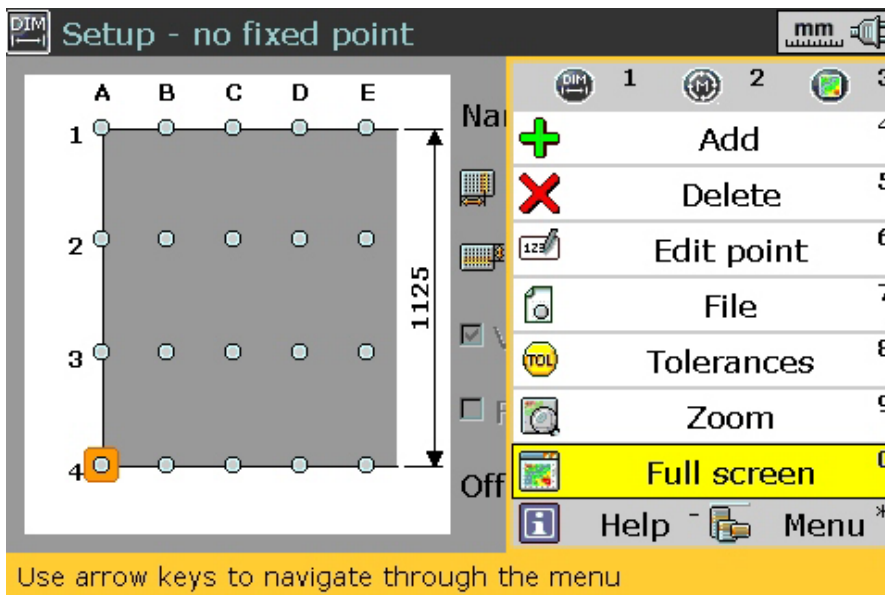
After all required grid values have been entered, use the navigation keys to select 'Proceed'. Press **Enter** to confirm selection. An overview screen of the configuration appears.

This overview screen is also accessed by pressing **DIM**.



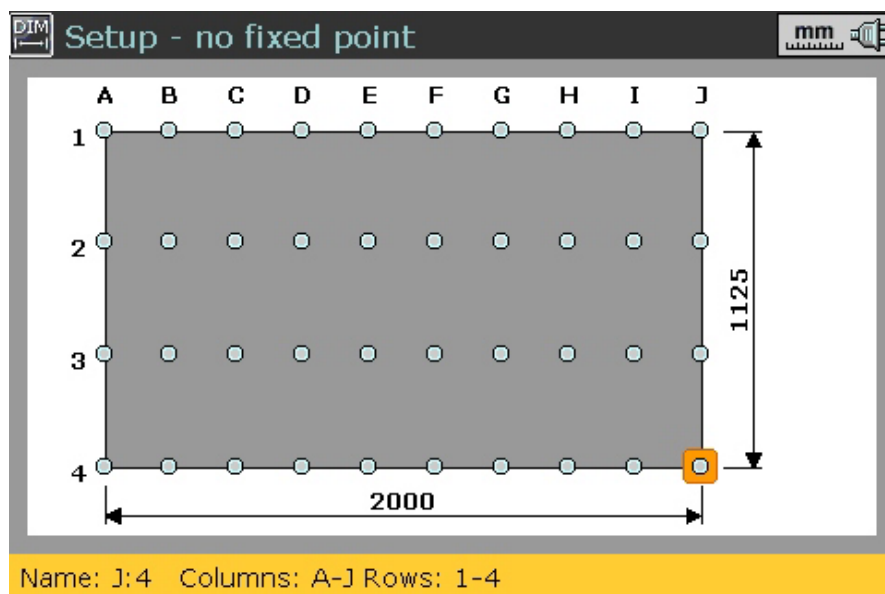
The full screen mode is accessed via the context menu. To access the context menu press **Menu**.





Use  $\downarrow$ / $\uparrow$  to highlight 'Full screen'. The full screen mode appears when selection is confirmed by pressing  $\text{Enter}$ .

After highlighting 'Full screen', confirm selection by pressing  $\text{Enter}$ . The full screen mode shown below appears.

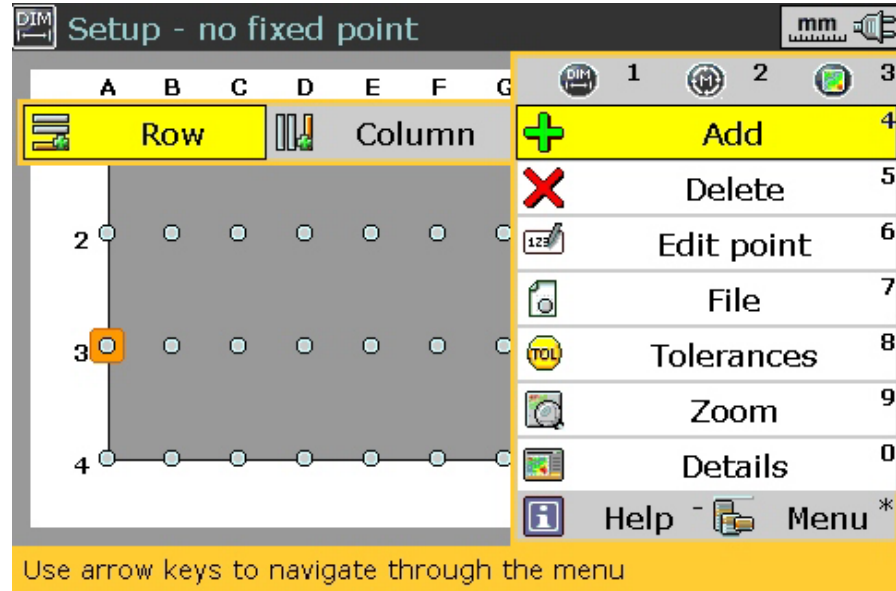


Use the navigation keys to move through the points of interest, accessing any desired point by pressing  $\text{Enter}$ . Selected point of interest in this case is J4.

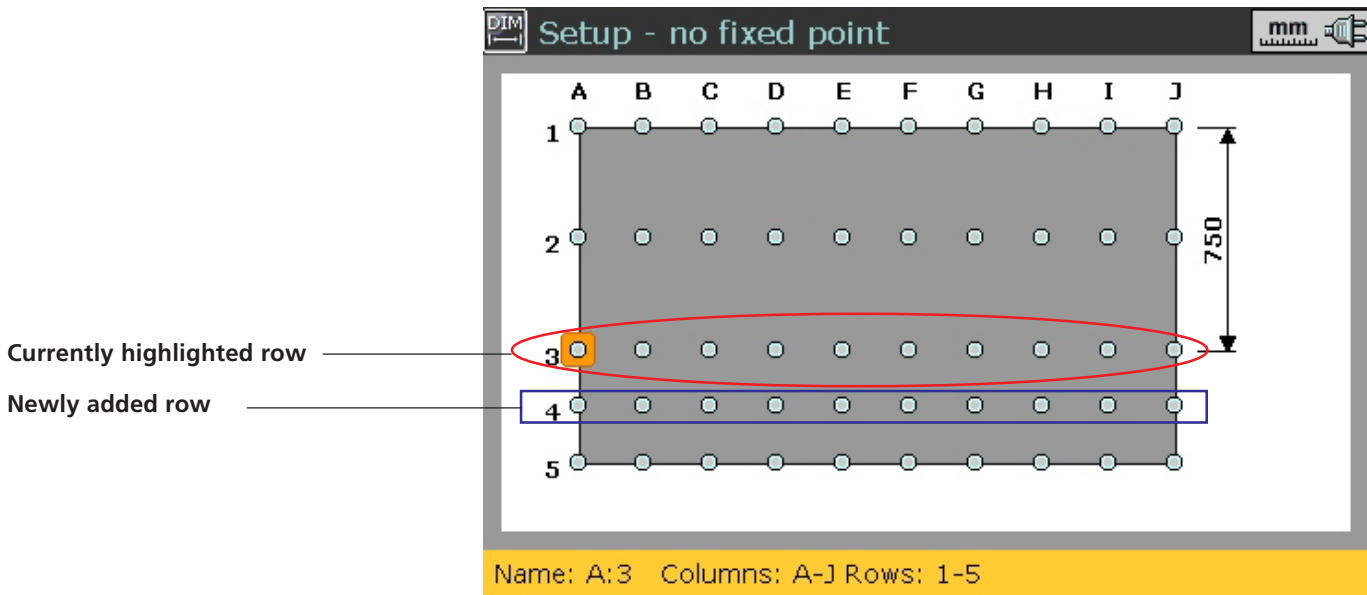
To edit points of interest on the grid, use the appropriate context menu item. The context menu is accessed by pressing  $\text{Menu}$ .

### 2.3i Editing grid points

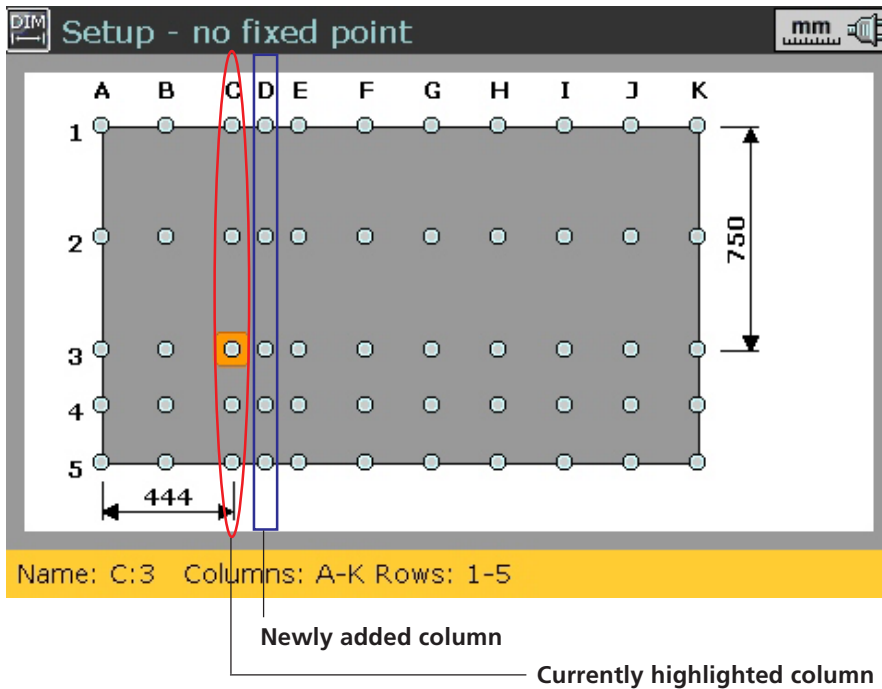
#### Adding new rows and columns



The context menu item 'Add' is used to add complete rows or columns to the existing grid. Use the navigation keys to highlight 'Add' followed by either 'Row' or 'Column'. Press **Enter**. If 'Row' was selected, a new row appears below the one currently highlighted.



If however 'Column' was selected, a new column appears to the right side of the one currently highlighted.



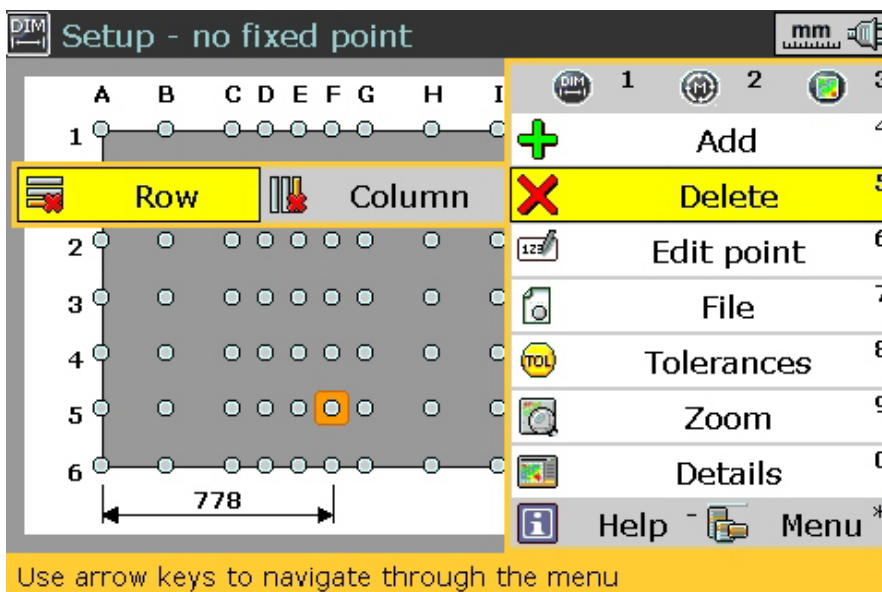
The newly added column or row is always equidistant from the two neighbouring columns or rows.


After pressing , rows and columns are added without further confirmation.



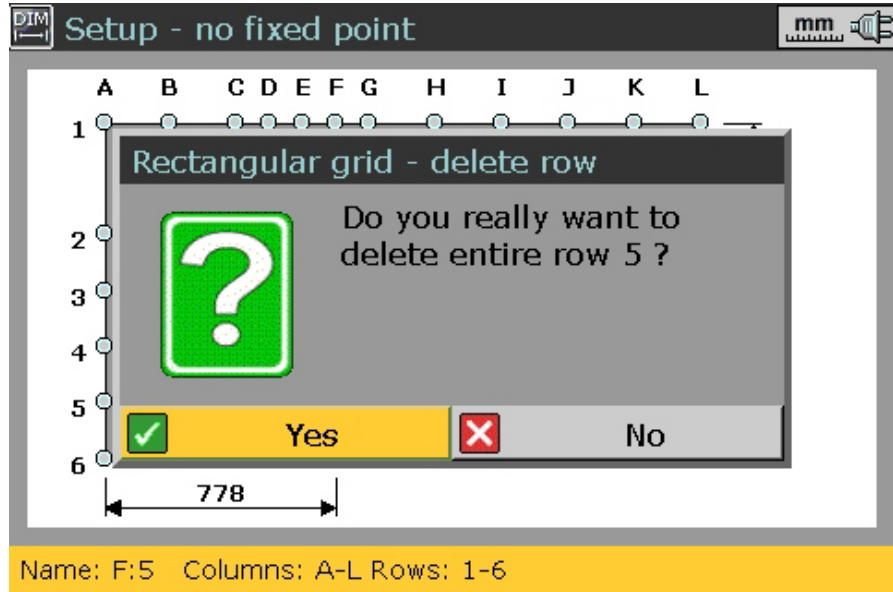
Note

### Deleting rows and columns



The context menu item 'Delete' is used to delete complete rows or columns to the existing grid. Use the navigation keys to highlight 'Delete' followed by either 'Row' or 'Column'. Press . The confirm delete dialog appears.

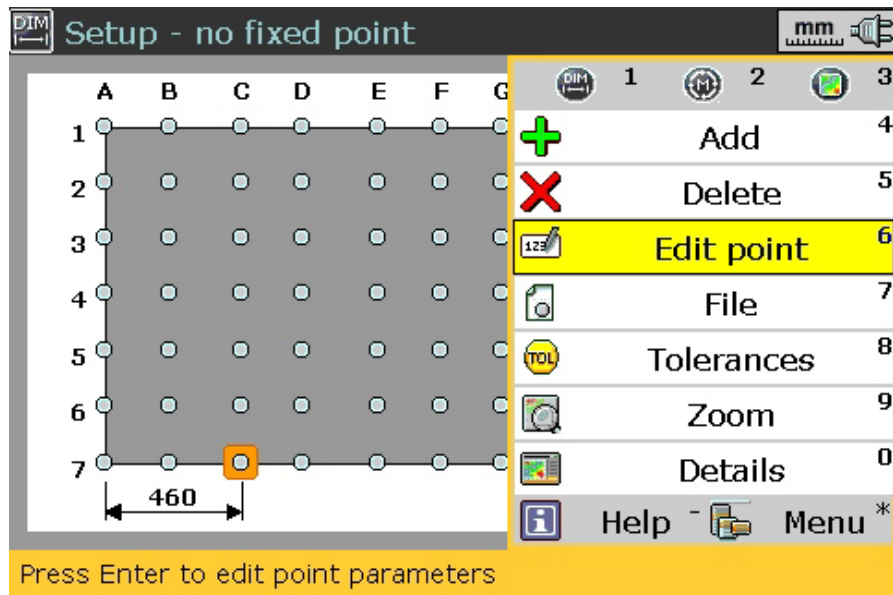
Editing points



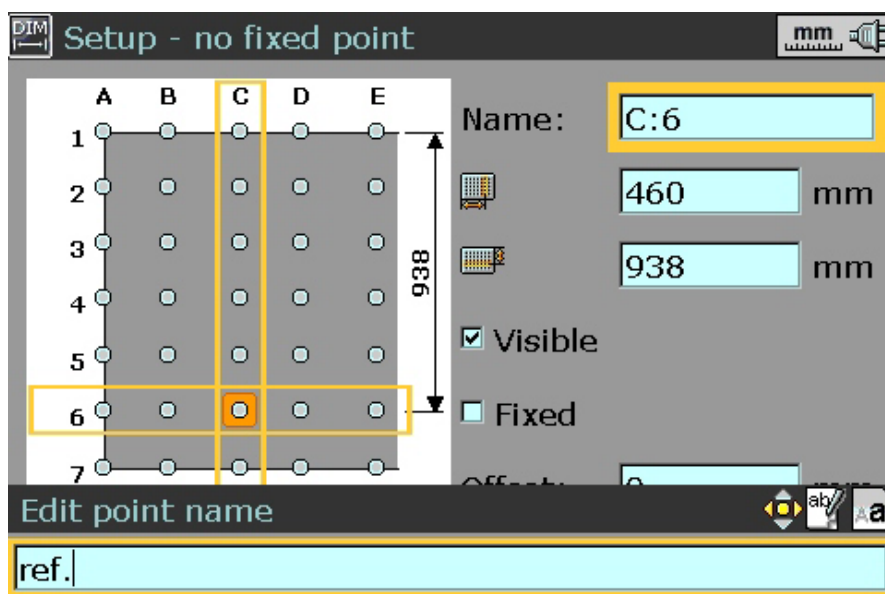
Confirm row/column deletion by pressing either **t** or **Enter**.

**Editing measurement points**

From the set-up screen, use the navigation keys to highlight the measurement point to be edited. Press **Menu**. The context menu appears. Highlight the context menu item 'Edit point' using either **▲** or **▼**.






Press **Enter** to edit highlighted measurement point. The following screen appears.



In the shown example, the measurement point C6 has been assigned the name 'ref.'

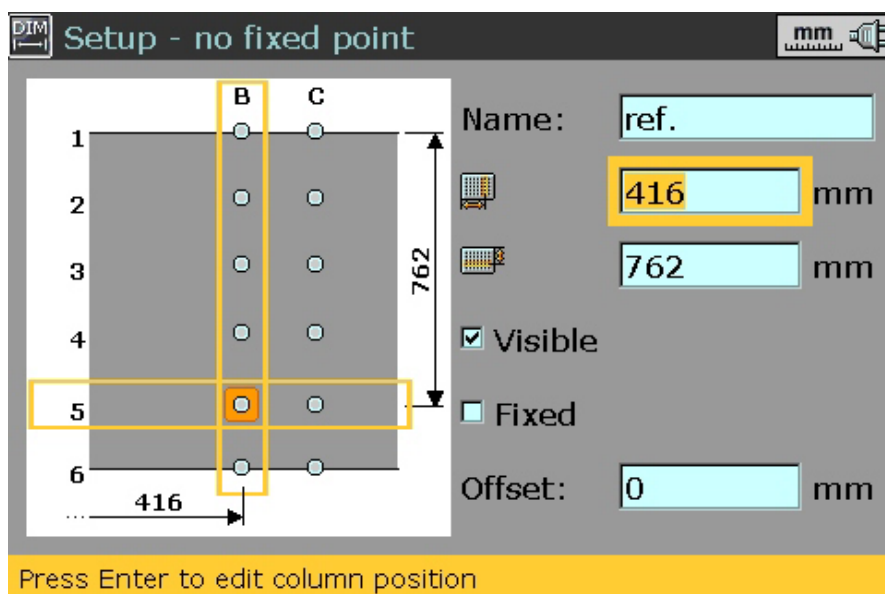
The name and the position of the selected measurement point is edited as follows:

1. Highlight the name or dimension box using the navigation keys.
2. Either press  to access the editing box or edit the name or position directly using the data entry keys.
3. Confirm changes by pressing either  or .
4. Use the navigation keys to select item to be edited next.

If either the x or y position of a measurement point is edited, the entire column or row changes. Before changes can be effected, a 'confirm change' dialog appears.

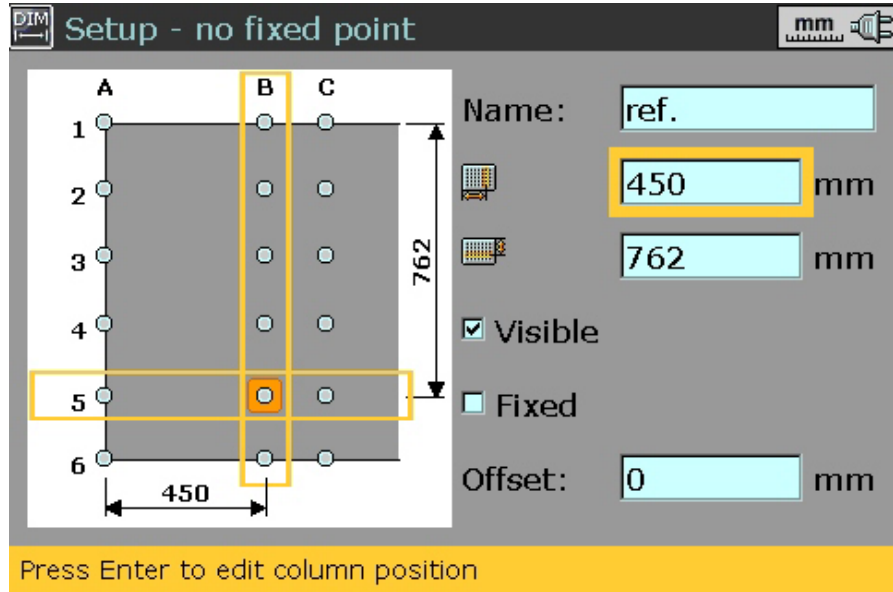


Note



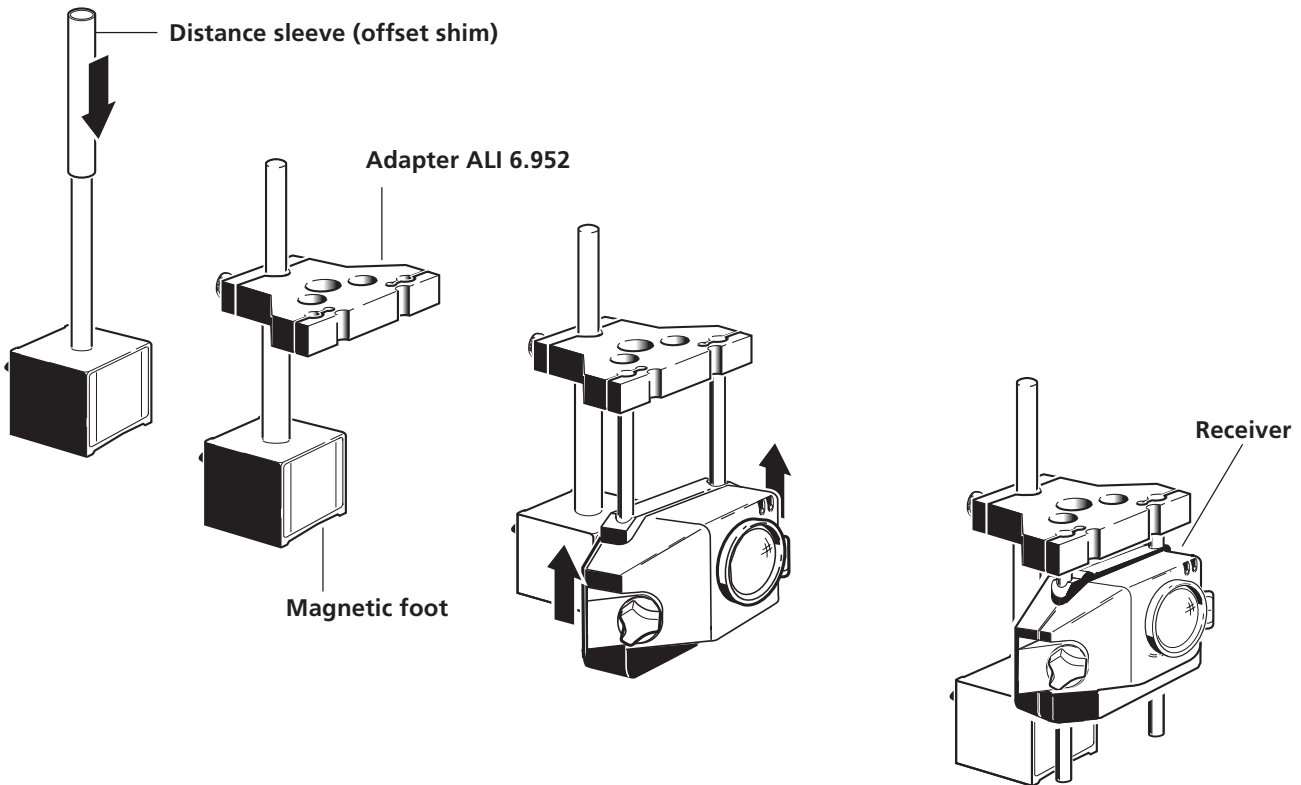
Offset values

By editing the measurement point B5 and confirming the changes, all measurement points in column B are affected as seen in the diagram opposite.



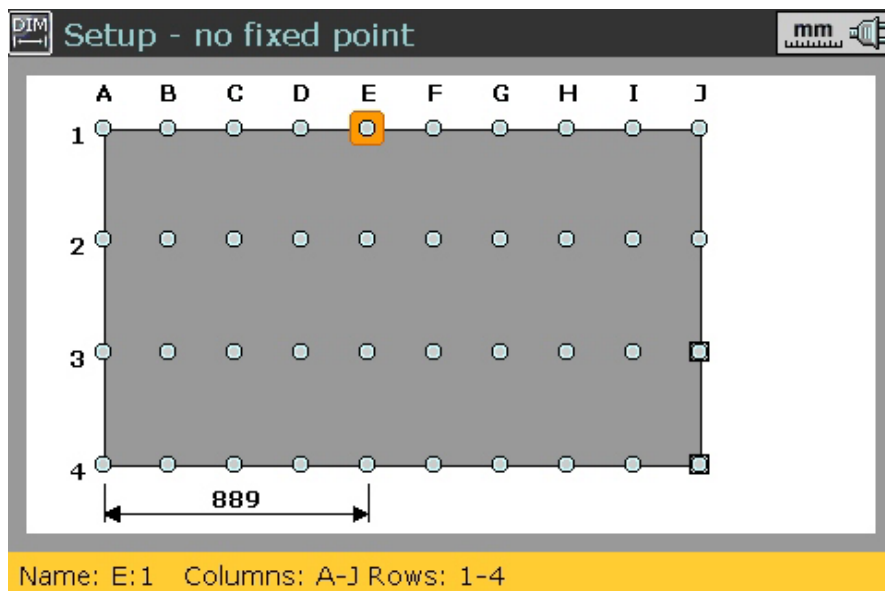
Adding offset values

If the object being measured has different levels, the offset must be taken care of without moving LEVALIGN. This offset is compensated by applying offset tubes and shims on the receiver bracket assembly.

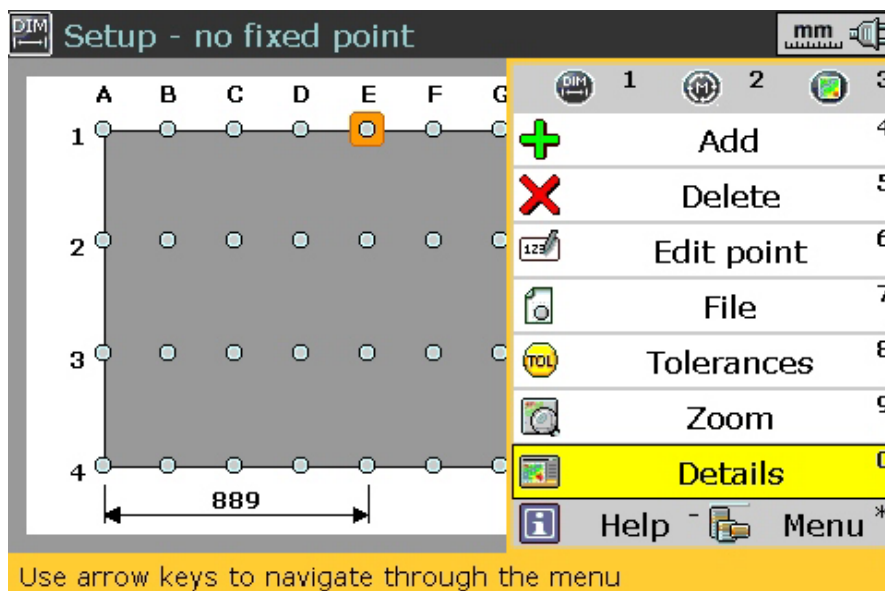


The added value is accounted for in the calculation as follows:

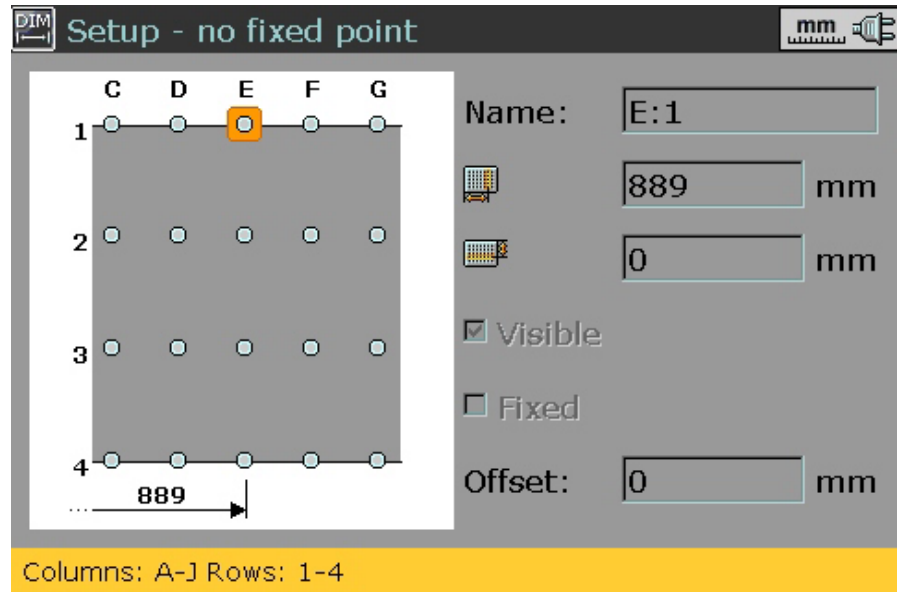
1. From the full screen in set-up, use the navigation keys to select grid point that requires shimming.



2. Press **Menu**. From the context menu that appears, use the navigation keys to highlight the menu item 'Details'.

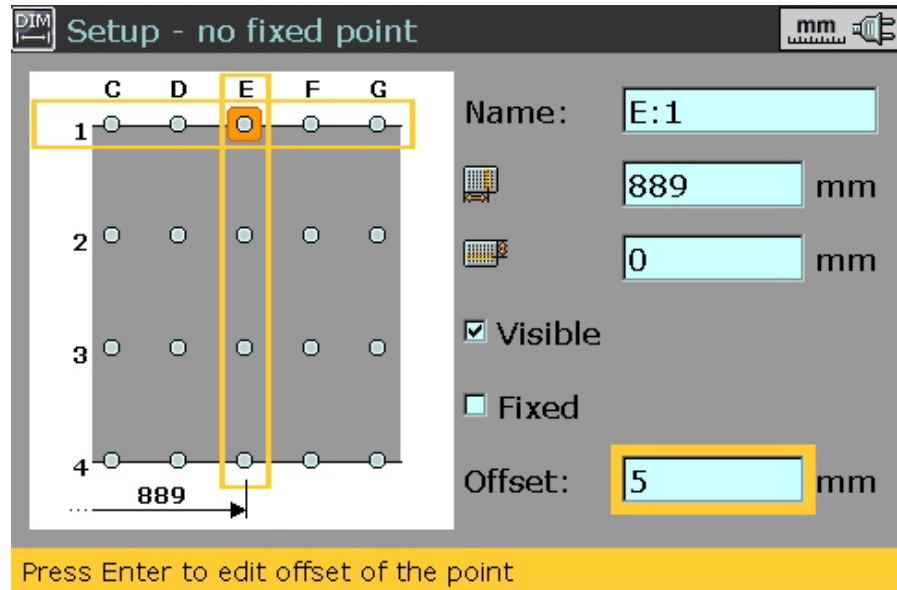


Press **Enter** to confirm selection. The following dialog screen showing the grid point details appears.



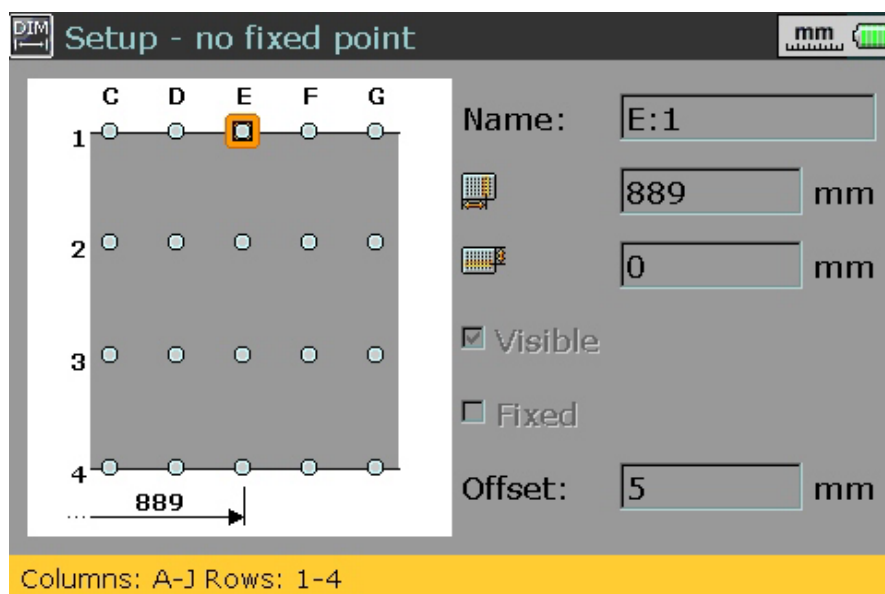
3. Press **Enter** to edit highlighted point.

On pressing **Enter**, the highlighting box moves to the details frame. Use the navigation keys to cycle through the grid point details.



4. Use the navigation keys to highlight the 'Offset' value box and enter offset value using the data entry keys. Confirm entry by pressing **t**.



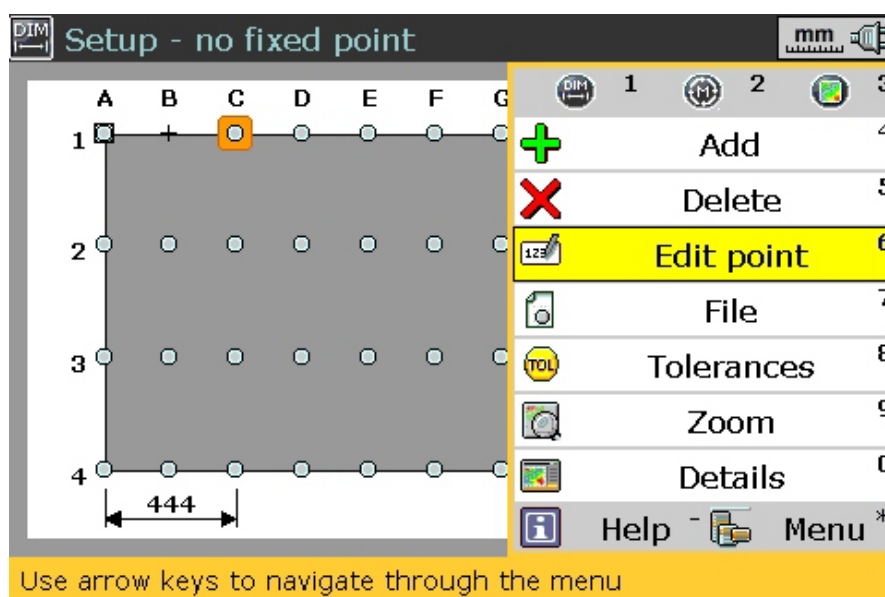


The diagram opposite shows grid point E1 with an offset symbol.

### Defining non-existing and fixed points

Depending on the surface being measured, it may be necessary to define the state of certain grid points. These could either be physically non-existent or fixed in order to act as reference points. The definition of grid points is carried out in set-up as follows.

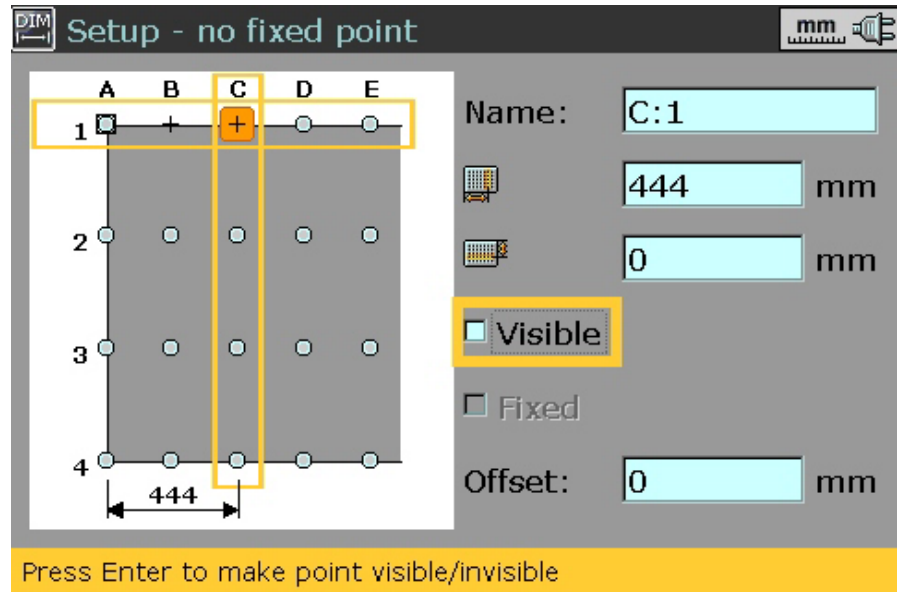
1. From the overview screen of the configuration, press **Menu**. The context menu appears. Highlight the context menu item 'Edit point' using either **▲** or **▼**.



2. Press **Enter** to confirm selection. The following screen appears.

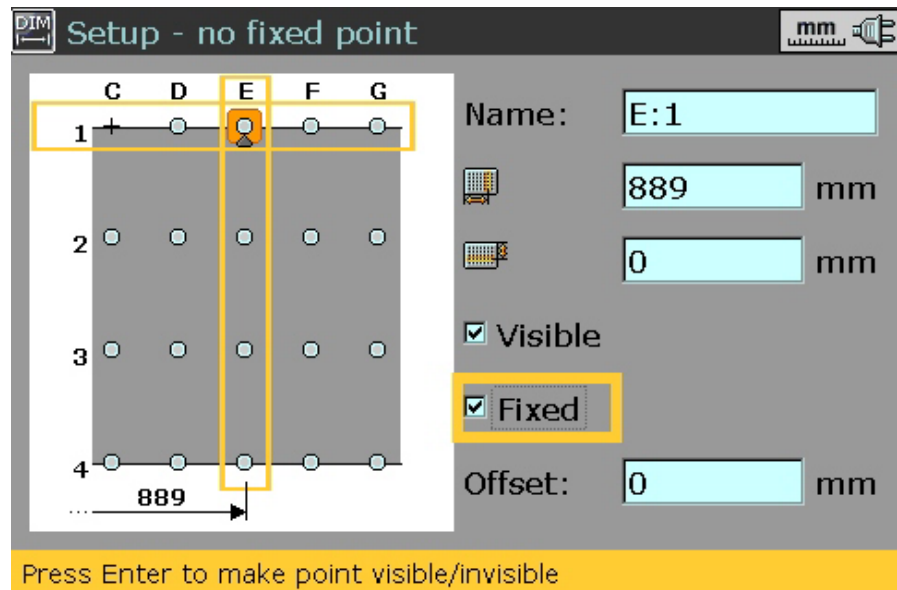
## Defining points

The diagram opposite shows grid point C1 as non-existent (+ appears).



- Use the navigation buttons to highlight 'Visible'. The default setting is 'Visible'. Press **Enter** to make the grid point non-existent. The check mark next to 'Visible' disappears, and a + symbol appears at the grid point.
- Press **↑** to proceed to define the next grid point. Use the navigation keys to select the grid point. Press **Enter**. The grid point details frame appears. Use the navigation keys to highlight 'Fixed'. Press **Enter** to fix the grid point. A check mark appears next to 'Fixed', and a triangular symbol appears at the grid point.

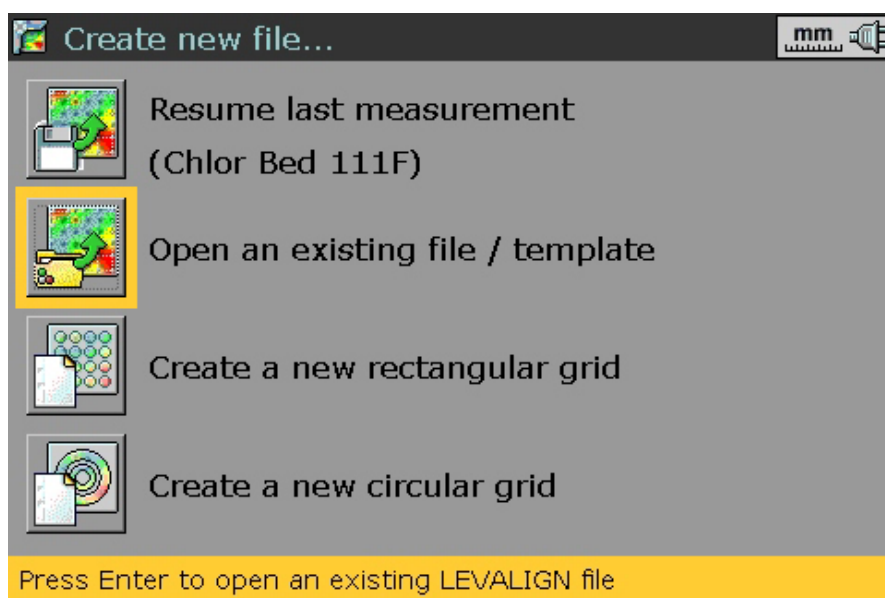
The default setting for all grid points is unfixed. The grid point E1 is in this case fixed (triangular symbol appears).



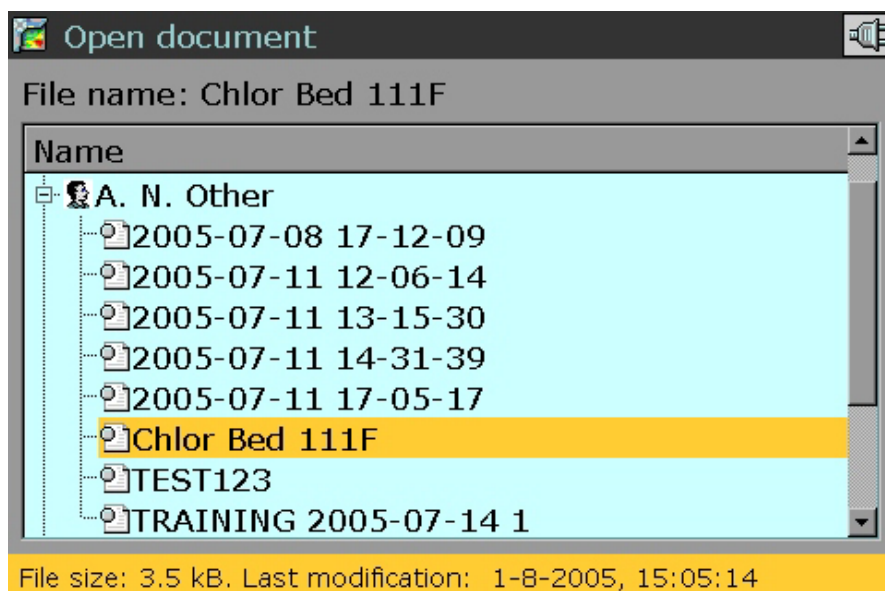
### 2.3ii Laser beam adjustment

#### The principle

1. With the laser set up as described in section 2.2, proceed to place the receiver assembly at a point of interest on the marked grid.
2. Switch LEVALIGN Ultra on, and start the flatness application as described on page 2-9.
3. If a measurement file has already been prepared, use the navigation keys to select the option to 'Open an existing file/template'.




4. Press  to confirm selection. The 'Open document' screen shown below appears. Use  or  to highlight the required measurement file.

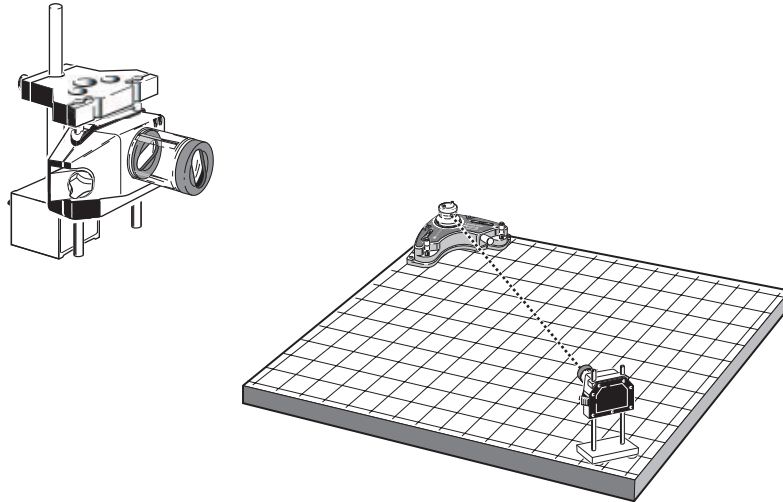


## Laser beam adjustment

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5. Press  to confirm selection.
6. Remove receiver dust cap and if necessary, mount the LEVALIGN adjustment tube on the aperture of the receiver.

The LEVALIGN adjustment tube ALI 6.951 is used to facilitate the adjustment of the laser beam on the center of the position detector.



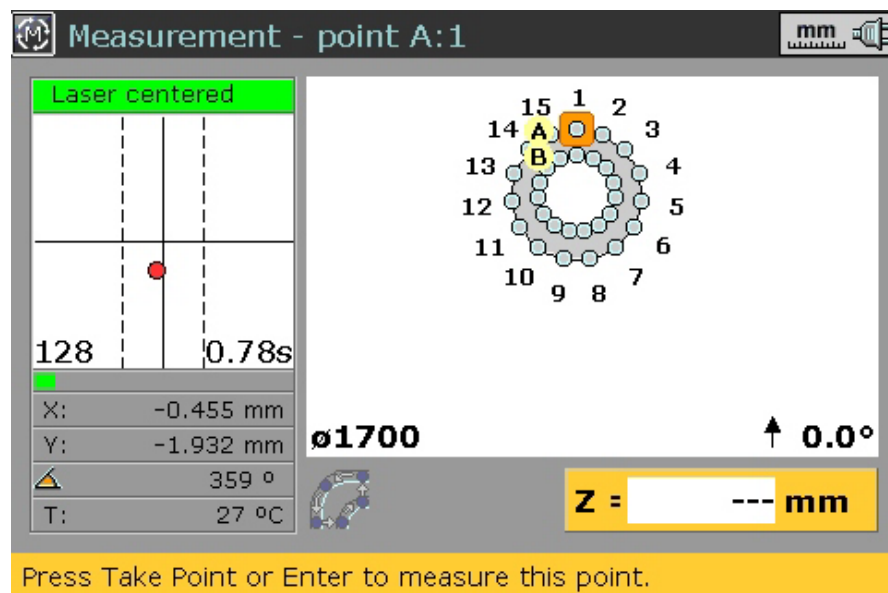
7. Adjust the depth of the receiver to ensure that the laser beam strikes the receiver position detector.



Use the LEVALIGN fine adjustment knob to position the laser beam in the center of the position detector. The intensity of the beam can be regulated by pressing the LEVALIGN beam finder switch.

## 2.4 Taking measurements

1. With the measurement file opened, press  the measure key.

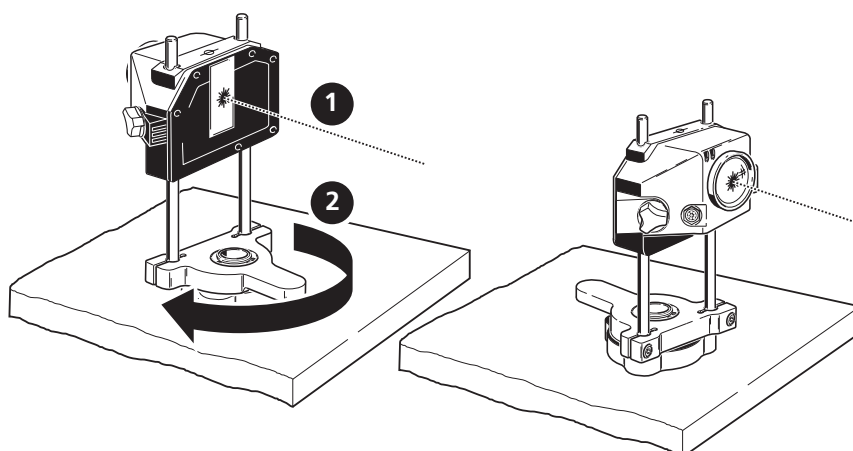


2. Center the laser beam using the LEVALIGN fine adjustment knob.  
For measurement accuracy, the bolted dot must lie between the two vertical dotted lines.

The centering of the laser beam is facilitated when using the specialized magnetic rotatable bracket ALI 6.954 together with the adjustment target ALI 6.955.



Note



The target strip is attached vertically at the symmetrical center of the back of the receiver. If the laser beam is accurately centered on the back of the receiver, it strikes the first position detector when the receiver is rotated and the laser beam passes through the receiver lens.

The LEVALIGN laser must not be moved after measurement has commenced.

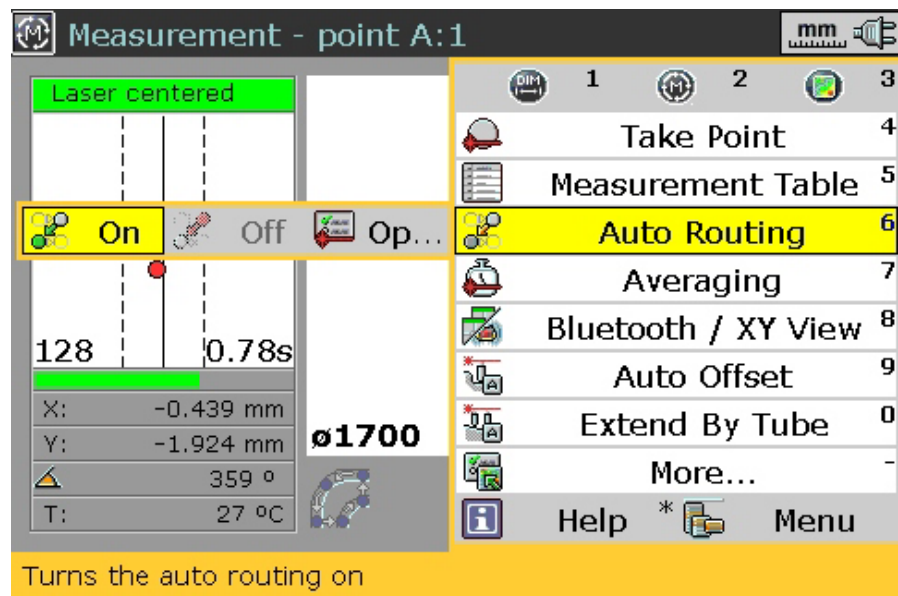


Note

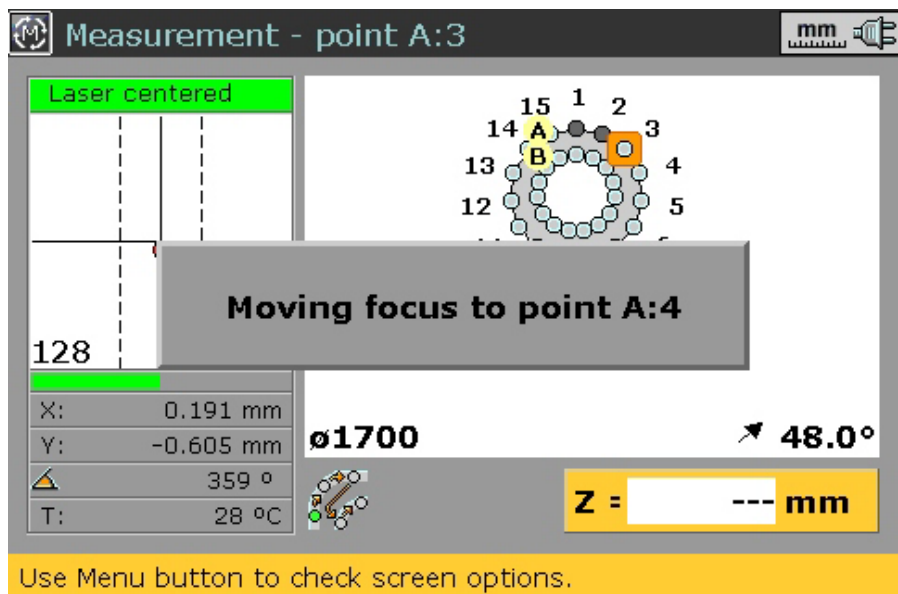
3. Use either the navigation keys or the auto-routing function to select the measurement position on the display grid.

**Using auto-routing**

- 3i. The auto-routing function enables the intelligent and automatic selection of the next measurement point. Auto-routing is accessed via the measurement screen.
- 3ii. While in the measurement screen press **Menu**. The context menu as shown below appears.



- 3iii. Use the navigation keys to select 'Auto Routing' /'On', and confirm selection by pressing **Enter**.
4. Proceed to take measurement for the highlighted point by pressing **Enter**. After taking point, move the receiver assembly to the next measurement point. If using auto-routing, this point will be assigned automatically.



The navigation keys can be used to override the auto-routing function.

Routing details will be discussed in measurement options.



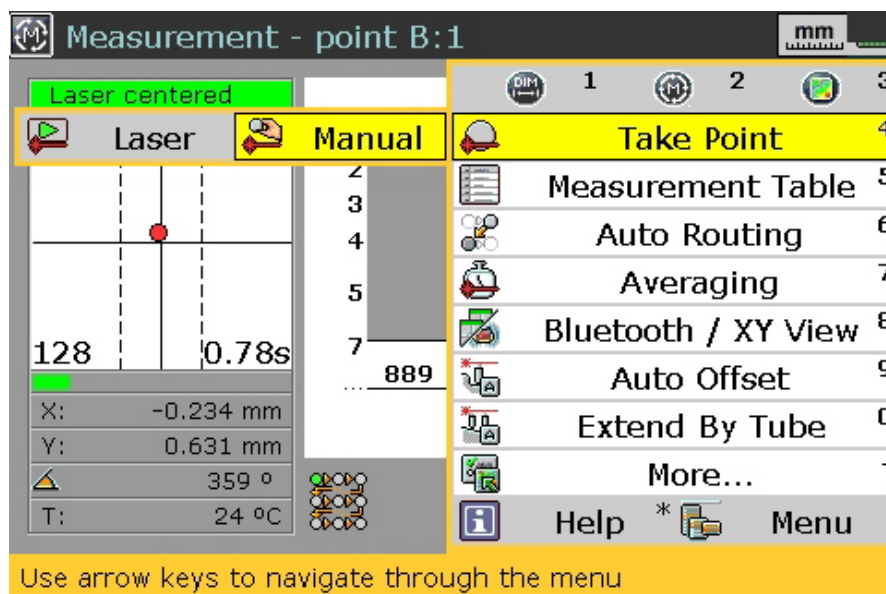
Note

- Repeat steps 3 and 4 for each remaining measurement position marked on the grid. If selecting measurement points manually, move successively through the rows and columns.

## 2.5 Measurement context menu items

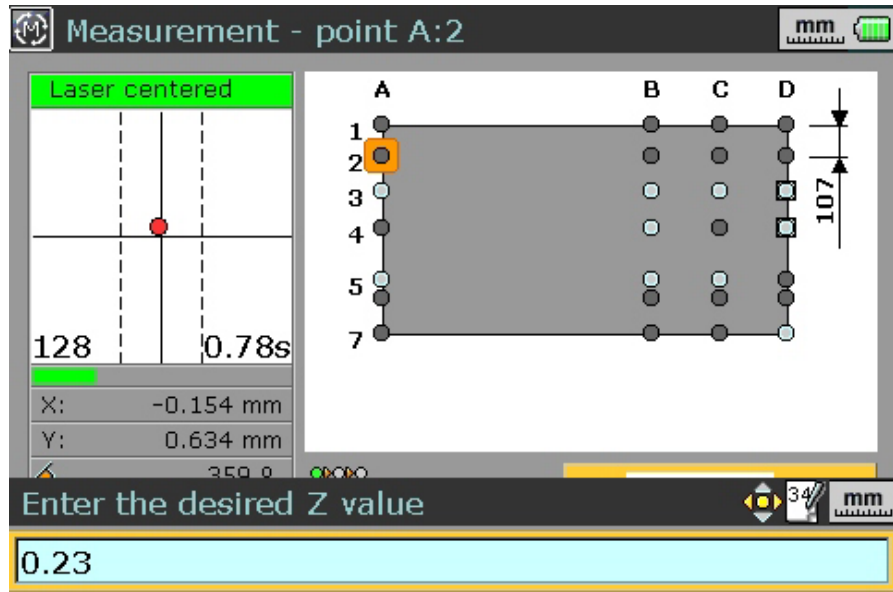
The measurement context menu items provide commands that facilitate measurement procedures. The context menu is accessed by pressing **Menu** while in the measurement screen.

- The context menu item 'Take point' has the submenu items 'Laser' and 'Manual'. Use **◀** or **▶** to toggle between these two submenu items. When 'Laser' is highlighted, the selected point is measured when **Enter** is pressed.



The submenu item 'Manual' can be used to compare readings taken using conventional methods. Highlighting 'Manual' and confirming selection using **Enter** reveals the dialog window with the Z value editing box ( see following screen).

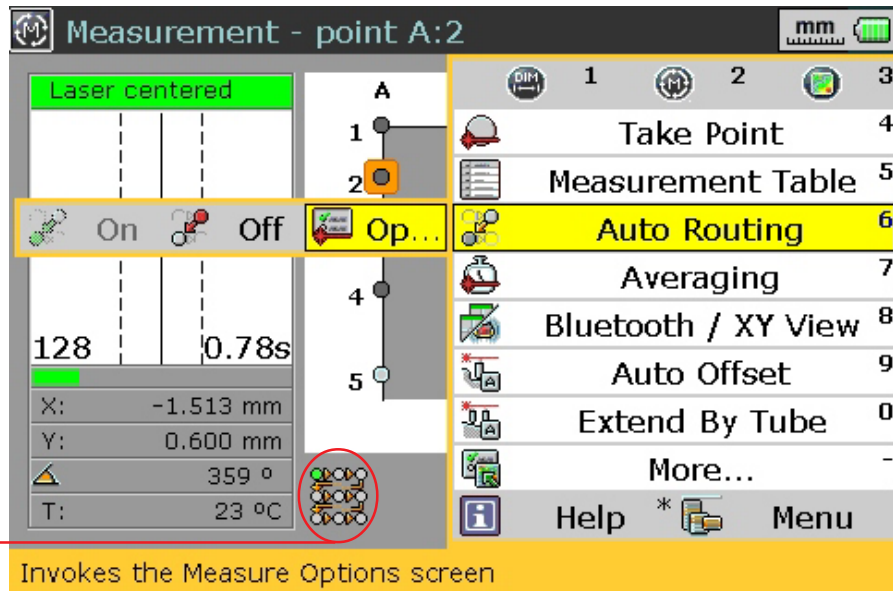
Auto-routing



After entering the Z value using the data entry keys, confirm change by pressing either or .

2. The context menu 'Auto-routing' has the submenu items 'On', 'Off' and 'Options'.

In the example opposite, the submenu item 'On' appears greyed out indicating that auto-routing has been selected for the current measurement. Auto-routing is turned off by highlighting 'Off' using and confirming selection by pressing .



This symbol shows that auto-routing is active and the measurement routing is left to right going downwards as appearing on the screen.

Highlighting 'Options' using and confirming selection by pressing reveals the measurement options dialog window (see following screen).



**Measurement options** mm

Auto routing:

Primary move: Left to right

Secondary move: Left to right

Measurements per point: 78 s

Averaging: 78 s

Auto offset

Offset value: mm

Left to right  
 Right to left  
 Downwards  
 Upwards  
 Vertical starting down  
 Vertical starting up  
 Horizontal starting right  
 Horizontal starting left

Press Enter to select option or CLR to get previous one.

The 'Primary move' drop down menu shows the available turn-by-turn directions.

In the above screen, auto-routing can be further defined in terms of the turn-by-turn directions. Measurements to be made per point can also be defined from this screen.

If auto-routing is selected, the next measurement point will be highlighted automatically only after the set measurements per point have been attained. During the taking of these measurements, the message 'focus will move after taking "x" measurements..' appears with each measurement.



Note

The screen can also be used to set the averaging and the auto offset value (see screen below).

**Measurement options** mm

Auto routing:

Primary move: Downwards

Secondary move: Left to right

Measurements per point: 20

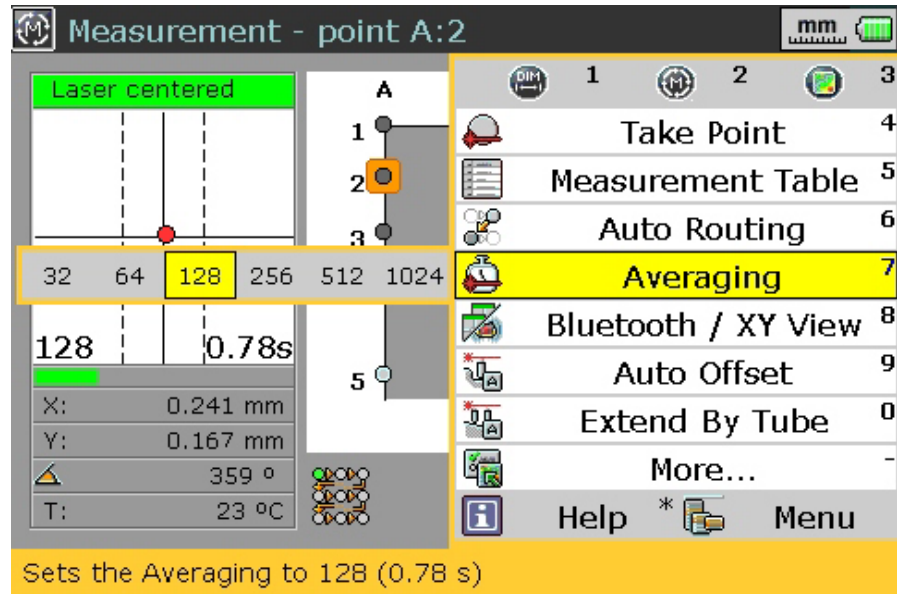
Averaging: 128 Time = 0.78 s

Auto offset

Offset value: 0 mm

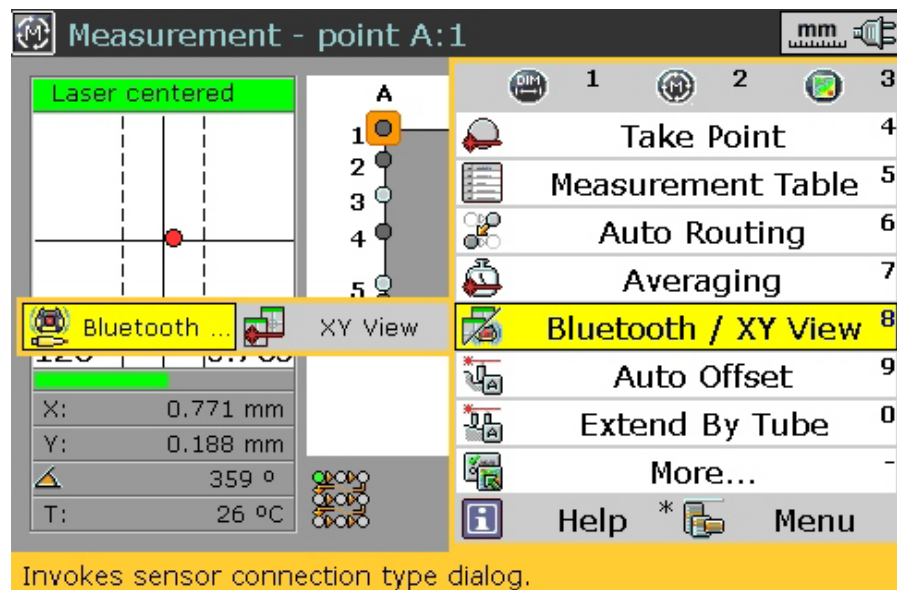
Set number of averaged measurements per point

- The context menu 'Averaging' is used to adjust the number of individual detector readings for averaging into a single measurement. The greater the number of readings, the longer each measurement takes. This duration is indicated in seconds on the 'center laser' frame.

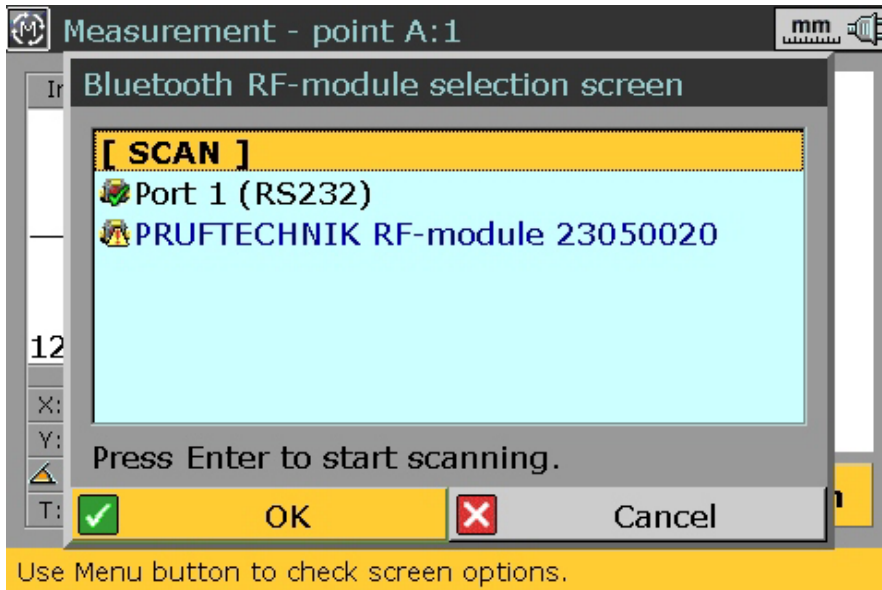


Use to highlight the desired averaging, then confirm by pressing .

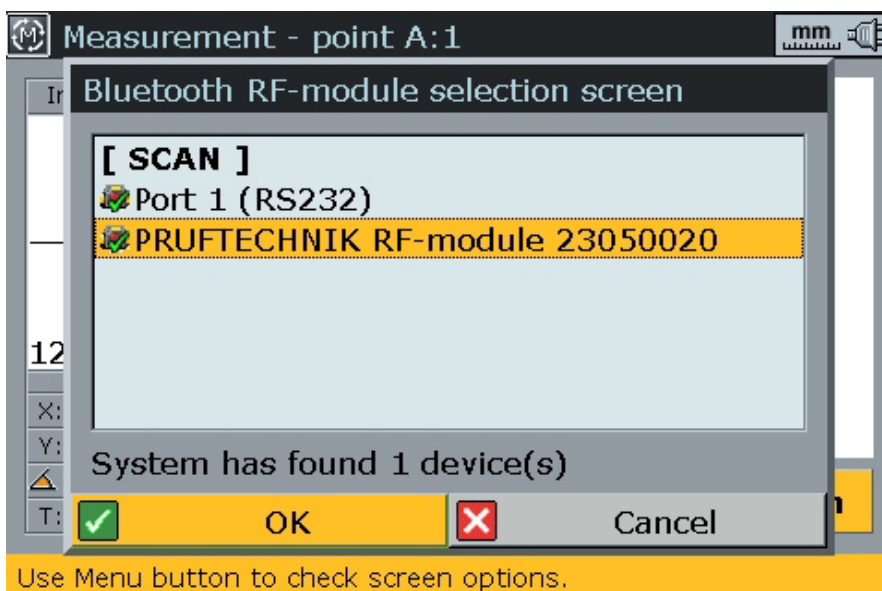
- The context menu 'Bluetooth/XY view' is used for setting up wireless communication and centering the laser beam during measurement respectively.






To carry out wireless measurement, use to highlight the submenu item 'Bluetooth'. Press to confirm selection. The Bluetooth RF-module selection screen appears.

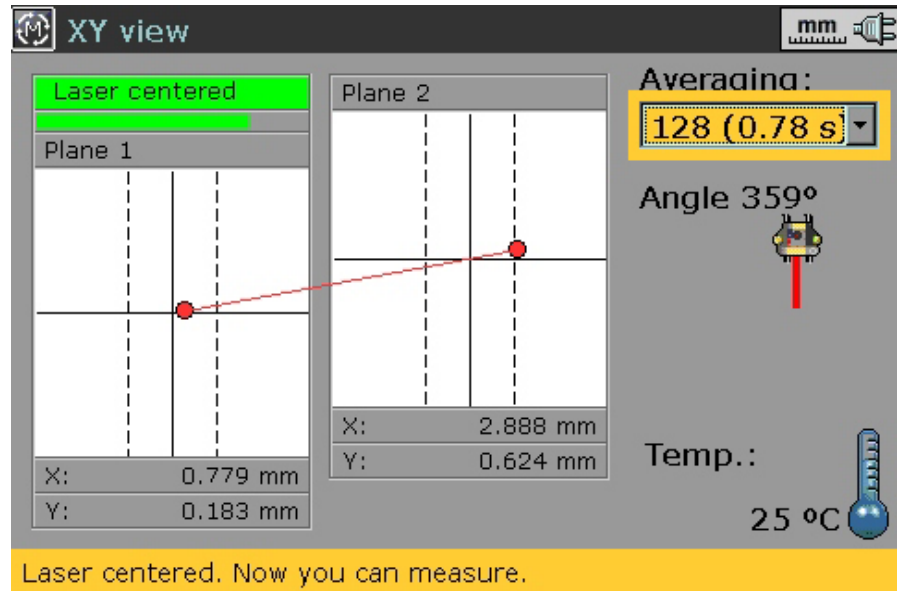


Use / to highlight 'Scan' and then press . With this step, the neighbourhood is scanned for Bluetooth devices. After the scanning process is completed, any RF modules detected will be listed with a green tick on the side as can be seen in the diagram below.

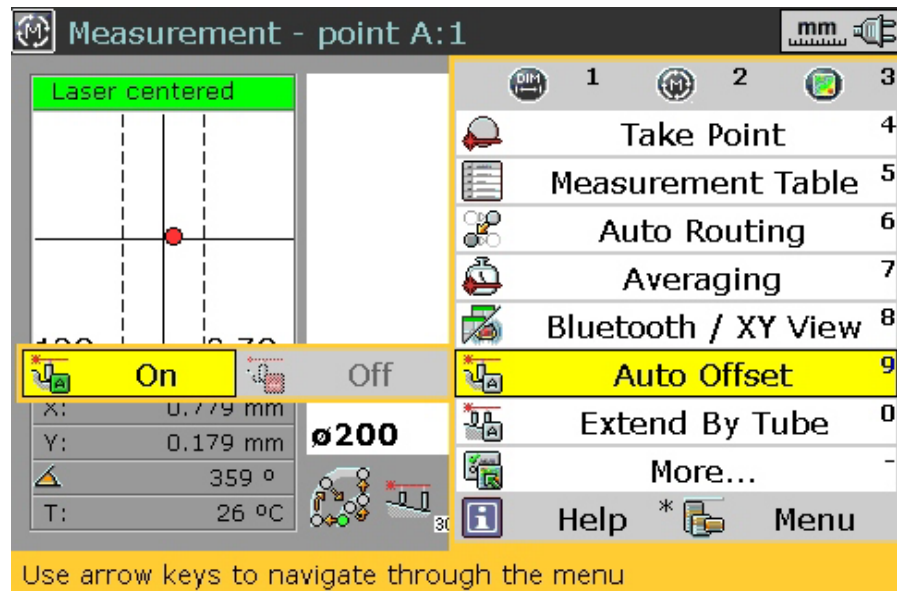


Use / to select the appropriate RF module (e.g. 'PRUFTECHNIK RF-module 23050020'). Press to confirm selection and proceed with measurement.

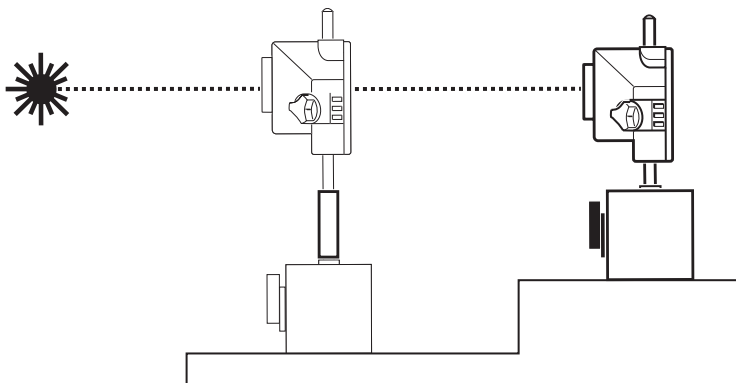
The submenu item 'XY view' is used to assist in centering the laser beam. Use   to highlight the submenu item 'XY view'. Press  to confirm selection. The XY view screen appears.




5. The context menu 'Auto offset' has the submenu items 'On' and 'Off'.

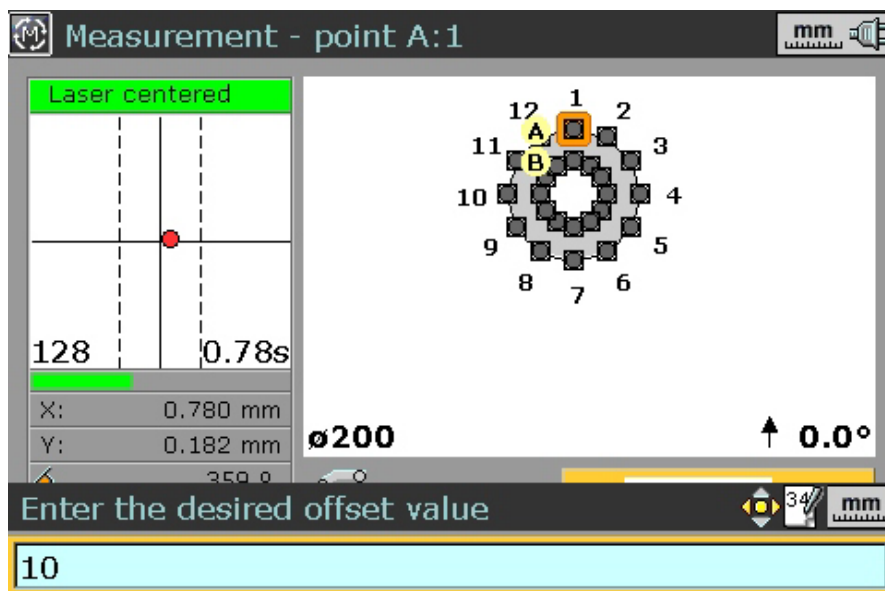


If there is an intentional difference in height between two surfaces, e.g. between a pump base plate and a motor foundation, offset shims are placed beneath the receiver to compensate the depth difference.

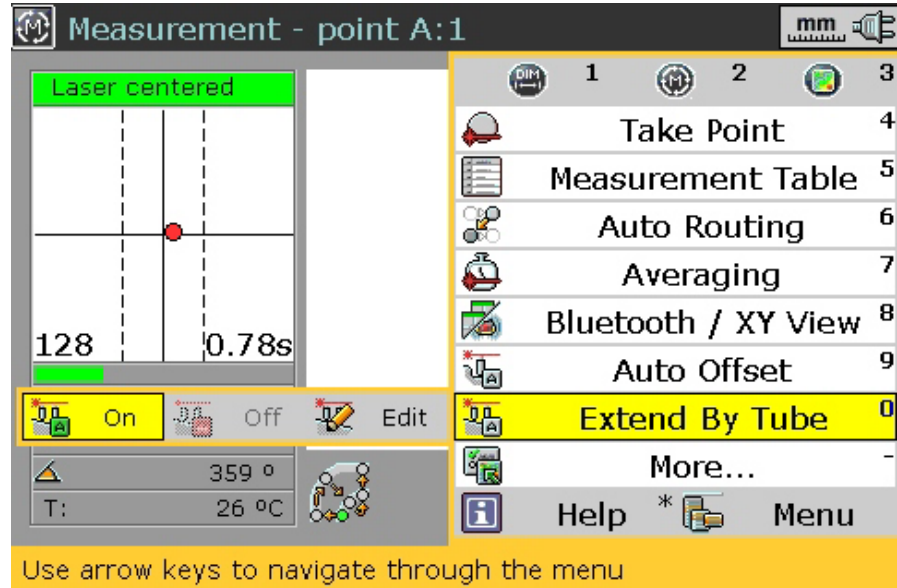


Auto offset is used to automatically enter predefined offset values for effected positions during measurement without then need of manually editing individual points.

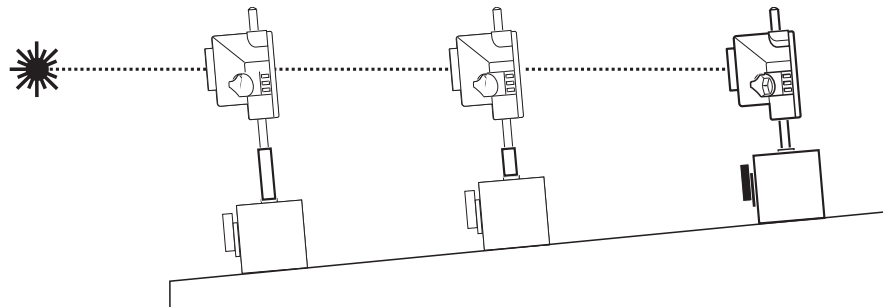
If auto offset has been selected, the submenu item 'On' appears greyed. If not selected, 'On' is automatically highlighted. Press  to confirm selection. The following screen appears, and the offset value is entered in the editing box.



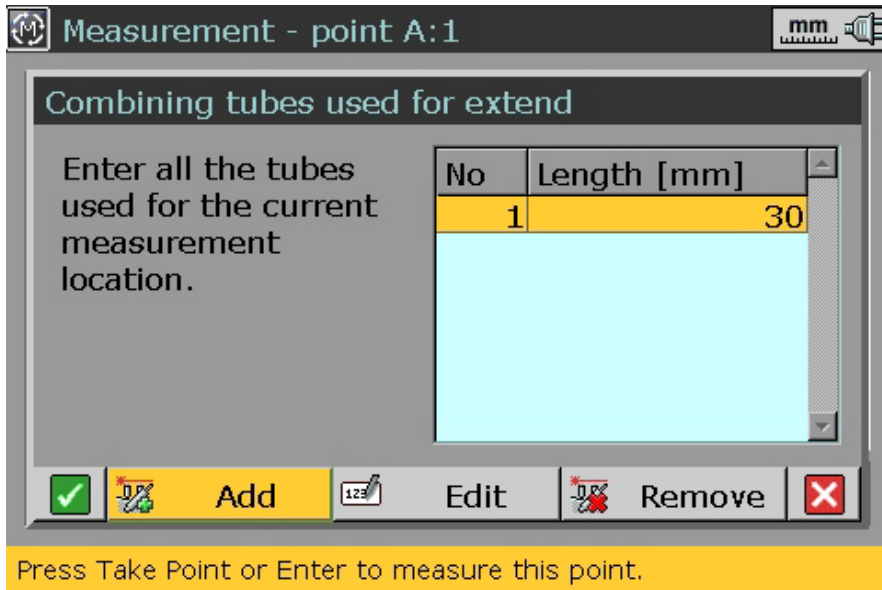
6. The context menu 'Extend by tube' has the submenu items 'On', 'Off' and 'Edit'.



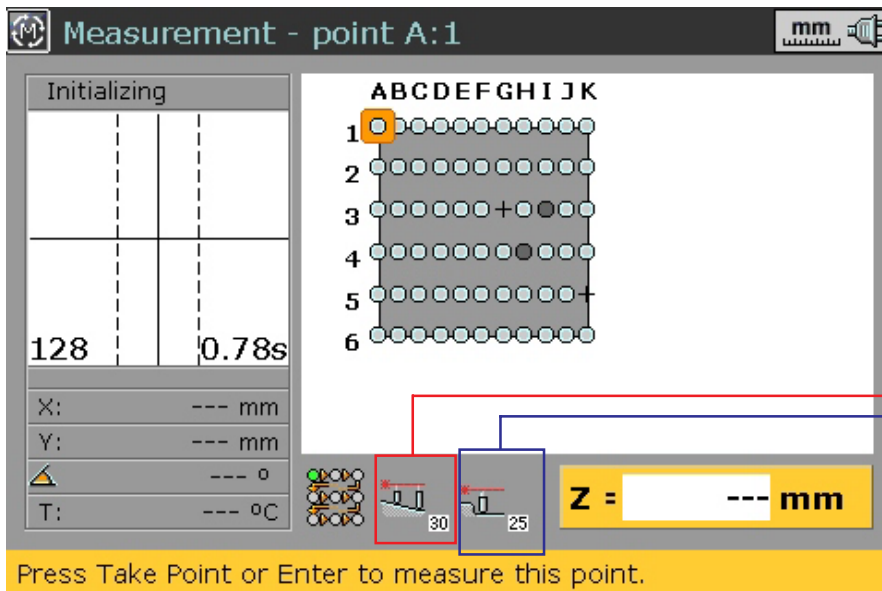
If a surface is so uneven that the laser no longer strikes the receiver at some measurement points, shims can be used to raise the receiver to a height in which its position is again measurable.



The context menu item 'Extend by tube' is used to edit the value of extension tubes used in raising the receiver height. Use  $\leftarrow/\rightarrow$  to highlight either the submenu 'On' or 'Edit'. Press  $\text{Enter}$  to access the editing screen.



The above screen is used to edit the depth of the tubes used in the extension of the receiver at the given location – in this example, measurement point A1. After editing depth value, press  $\uparrow$  to proceed with measurement.



This symbol shows that the measurement point A1 utilises a 30 mm extension tube.

This symbol shows that the measurement point A1 is offset by 25 mm.

## Measurement table

7. The context menu 'Measurement table' shows a detailed history of measurements for each individual position. Use ▲/▼ to highlight 'Measurement Table'. Press **Enter** to confirm selection. The table below showing all measurements taken at the given point – in this case A2

	Z[mm]	Avg	T[°C]	Date
1	0.29	128	25	8-8-2005, 14:03:31
2	0.27	128	27	8-8-2005, 15:00:31
3	0.27	128	27	8-8-2005, 15:00:36
4	0.28	128	27	8-8-2005, 15:02:19
5	0.23	---	---	9-8-2005, 10:45:04

Measurement selected for averaging

Averaging used

Temperature at time of reading

Composite reading

Use Menu button to check screen options.

Scroll page

Selected measurements are averaged into a composite reading for graphic depiction and recording in the Results display. To select/deselect a measurement, use ▲/▼ to mark the desired measurement line, then press **Enter** to place (or remove) a checkmark on that line.

	Avg	T[°C]	Date	Sensor No	
1	9	128	25	8-8-2005, 14:03:31	xxxx5589
2	7	128	27	8-8-2005, 15:00:31	xxxx5589
3	7	128	27	8-8-2005, 15:00:36	xxxx5589
4	8	128	27	8-8-2005, 15:02:19	xxxx5589
5	3	---	---	9-8-2005, 10:45:04	---

This page shows the date, time and sensor used for a particular measurement

Press Enter to switch on/off entry from averaging



Pressing **Menu** while viewing the measurement table prompts the context menu shown below.

The context menu items are highlighted using **▲/▼** and selection confirmed by pressing **Enter**.

	Z[mm]	Avg	T[c]
1	0.29	128	
2	0.27	128	
3	0.27	128	
4	0.28	128	
5	0.23	---	---

Average 0.27

Accepts changes



- i) Toggle – used to place (or remove) a checkmark on the selected measurement
- ii) Check – used to place (or remove) all checkmarks on the table
- iii) Delete – used to delete highlighted measurement
- iv) Extend details – used to show depth of extension tubes used
- v) Details – used for the graphic depiction of the measurement point

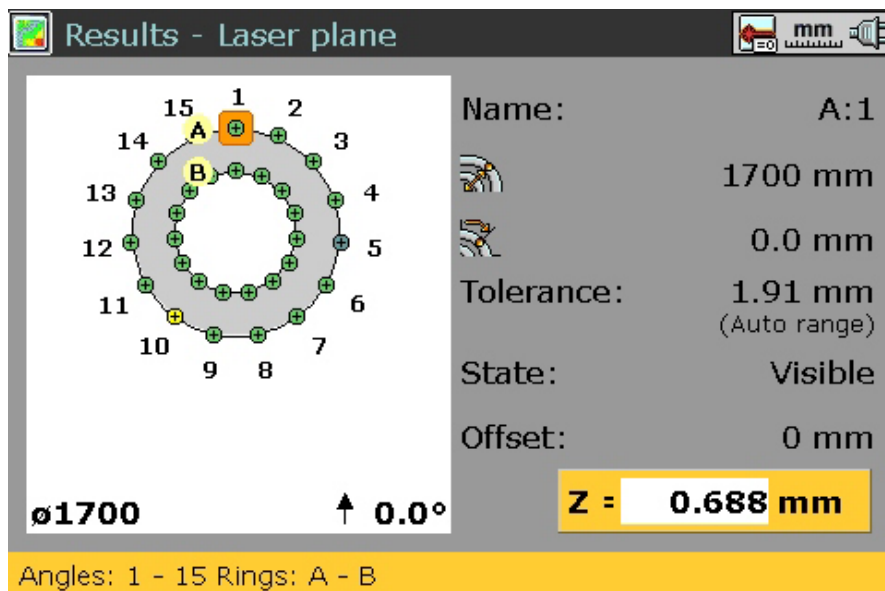
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## 2.6 Evaluating results

After taking measurements, press  to display results.

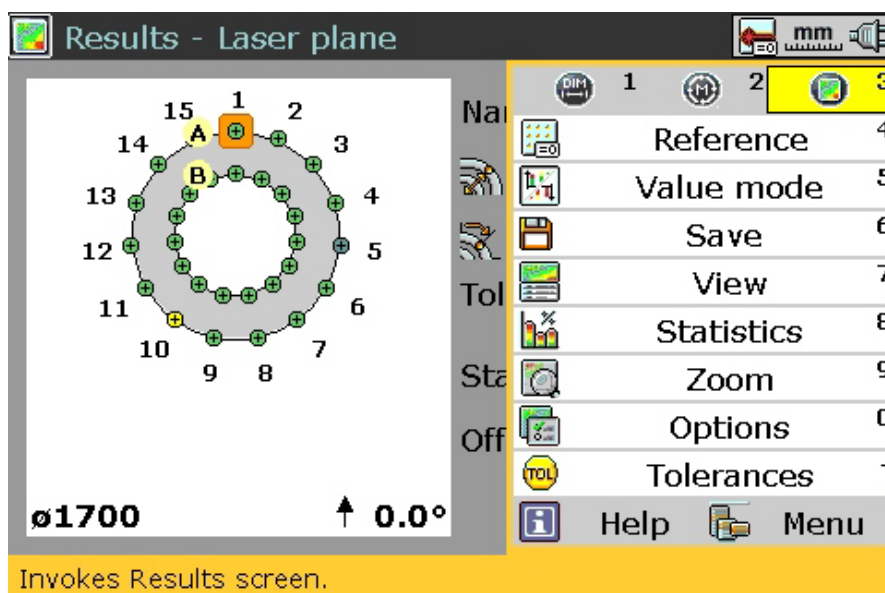


While in this screen, the grid can be zoomed in and out using  and  respectively.

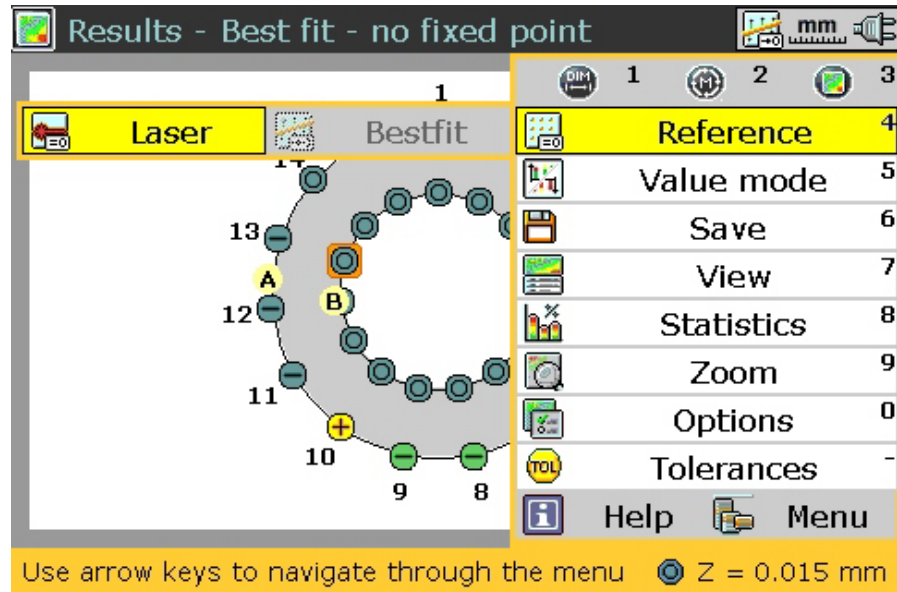


### Context menu items

To help interpret the results, press  to prompt the result screen context menu.

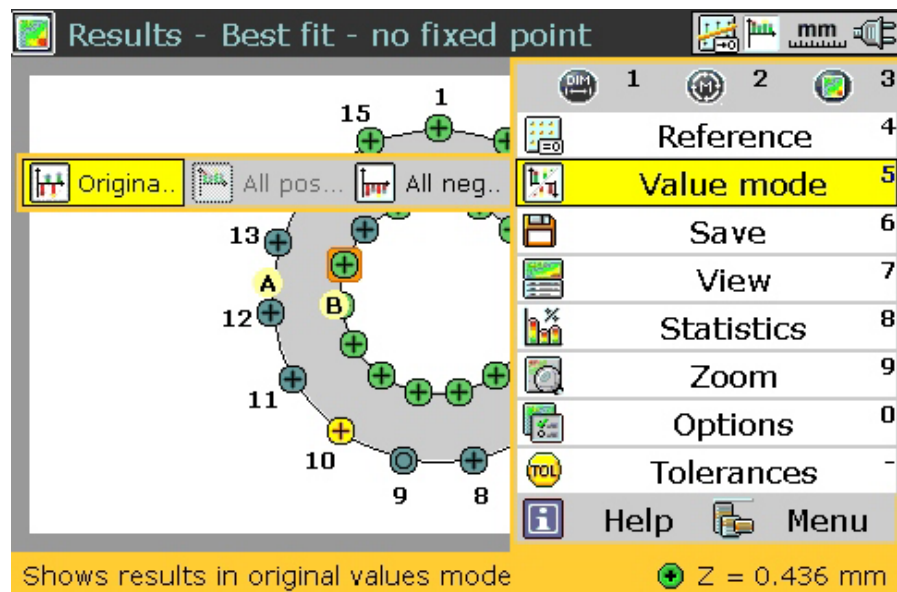


- The context menu item 'Reference' has two submenu items – 'Laser' and 'Best fit'.  
With Laser as reference, the grid shows the depth of the measured points with respect to the laser beam.



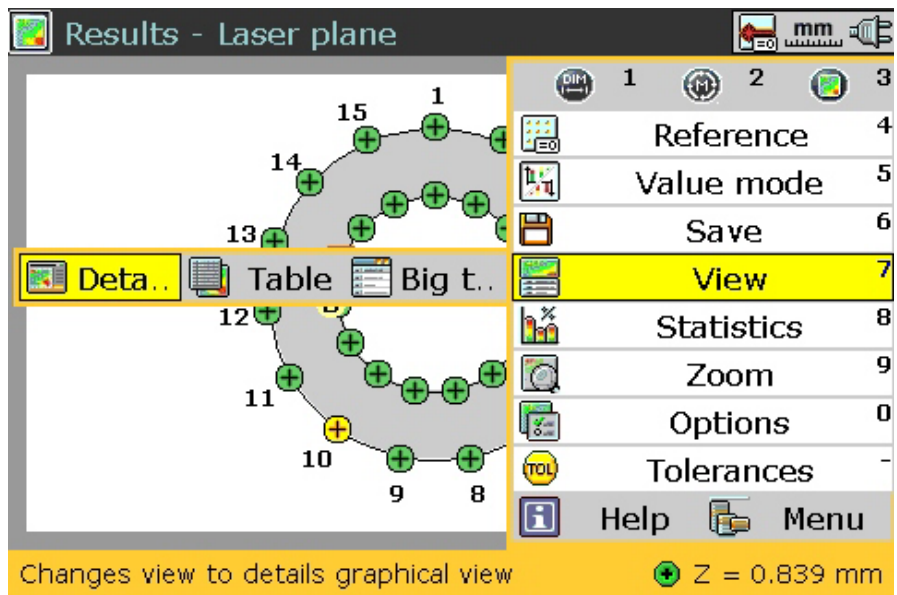
The screen above shows that the selected reference is 'Best fit'. In this case, the the grid shows the depth of the measured points with respect to the best possible plane.

- The context menu item 'Value mode' has three submenu items – 'Original', 'All positive' and 'All negative'.



The value mode takes the reference plane into consideration.  
 Original values – values with reference to the selected plane  
 All positive – the reference plane has the lowest depth  
 All negative – the reference plane has the highest depth

3. The context menu item 'Save' is used to save the measurement files.
4. The context menu item 'View' has three submenu items – 'Details', 'Table' and 'Big Table'.



Selecting 'Details' displays the entire grid and the measurement details of the highlighted point.

Selecting 'Table' displays measured points in a tabular format and measurement details of the selected point.

	Ring A	Ring B
<b>1</b>	0.688	0.743
2	0.603	0.744
3	0.605	0.746
4	0.641	0.813
5	0.224	0.818

Name: B:1 State: Visible  
 Offset: 0 mm Tolerance: 1.91 mm (Auto range)  
 0.0 mm  
 1000 mm

Angles: 1 - 15 Rings: A - B

The selected view submenu here is 'Table'.

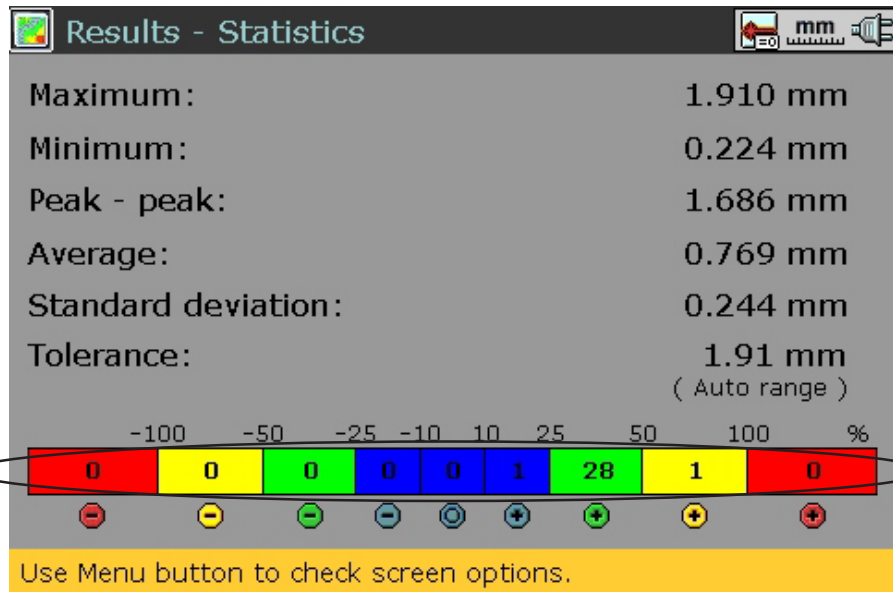
## Results

The selected view submenu here is 'Big table'. The table shows the results of all measured points in tabular form.

	Ring A	Ring B
1	0.688	0.743
2	0.603	0.744
3	0.605	0.746
4	0.641	0.813
5	0.224	0.818
6	0.805	0.823
7	0.723	0.832
8	0.617	0.842
9	0.617	0.819
10	1.910	0.844
11	0.730	0.848

B:1,  $\varnothing$ 1000 mm, <0.0  $\varnothing$

5. The context menu item 'Statistics' displays the statistical data related to the entire measurement.



The tolerance bar within the statistics shows the number of measured falling within the specified tolerance categories.

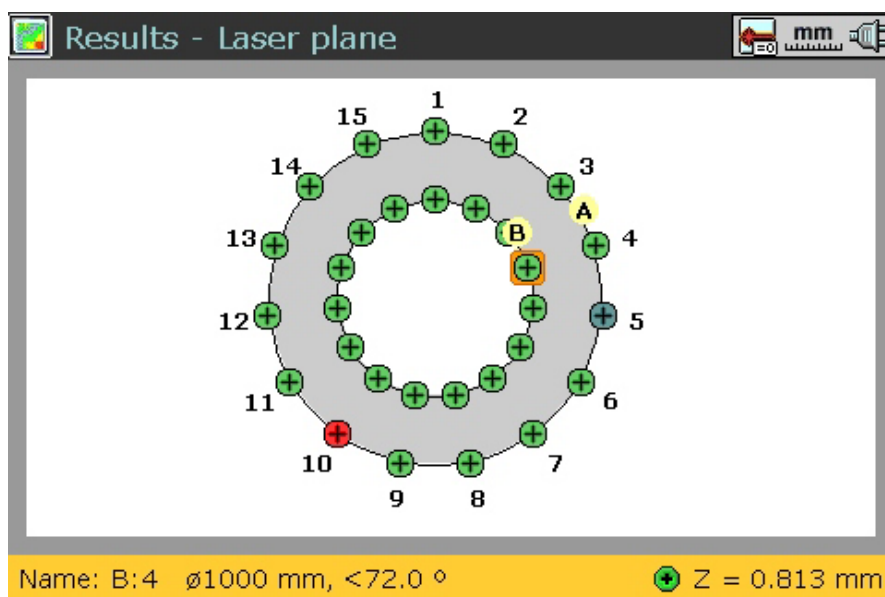
6. The context menu item 'Zoom' is used to zoom the screen in and out. The submenu item 'View' displays the entire grid.



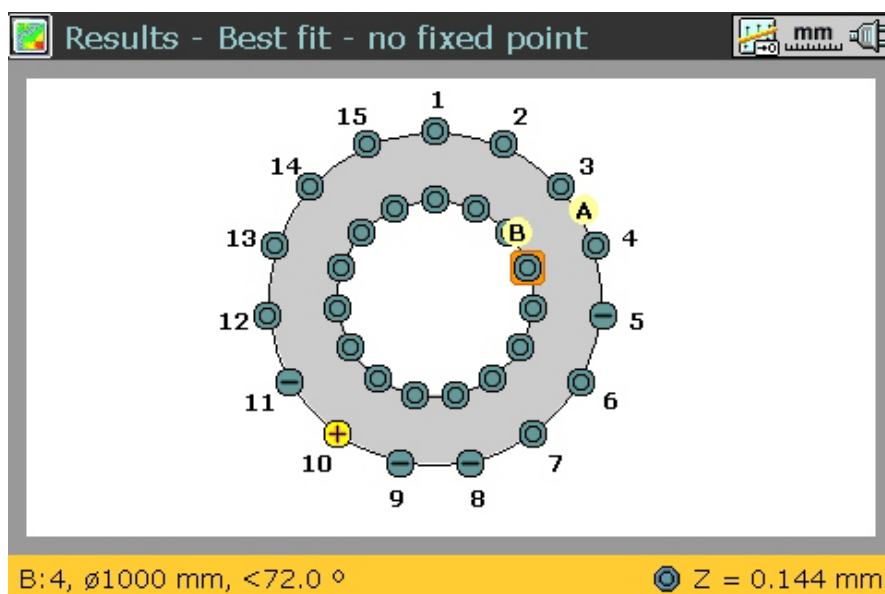
Note

The grid is also zoomed in and out using  $\ominus$  and  $\oplus$  respectively.

7. The context menu item 'Options' is used to set the reference value mode and the default reference.
8. The context menu item 'Tolerances' is used to set the tolerance value.



The result screen opposite has the laser beam as the reference plane with reference value mode set to 'original'.



The result screen opposite has the best fit plane as the as the reference with reference value mode set to 'original'.

## Switching system off



Note

As the file system uses its own identification, the same file name can be used more than once without overwriting the older file. However, files with identical names can be distinguished only by their detailed information such as creation date, last measurement, etc.

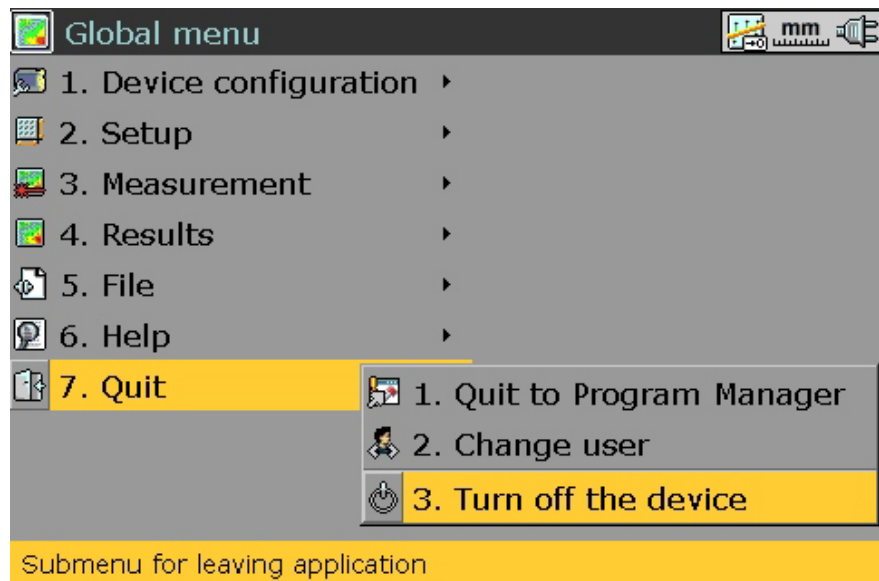


ATTENTION

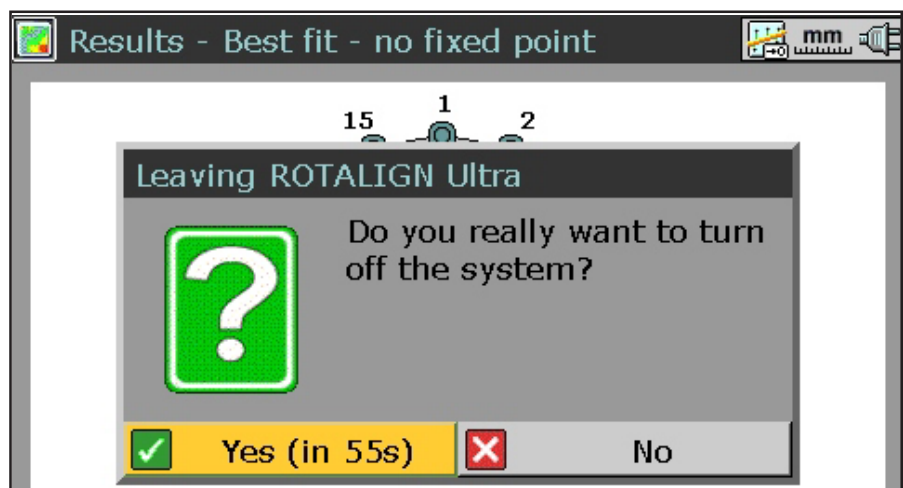
Always make a copy of important files (measurement files can be transferred to a PC using the Alignment Explorer) and on paper. PRÜFTECHNIK AG can assume no liability for lost or altered data!

### Switch off


- To switch the ROTALIGN Ultra computer off, press **Menu**. The context menu appears.
- Use the navigation keys to highlight 'Menu'. Press **Enter** to confirm selection. The global menu screen appears.

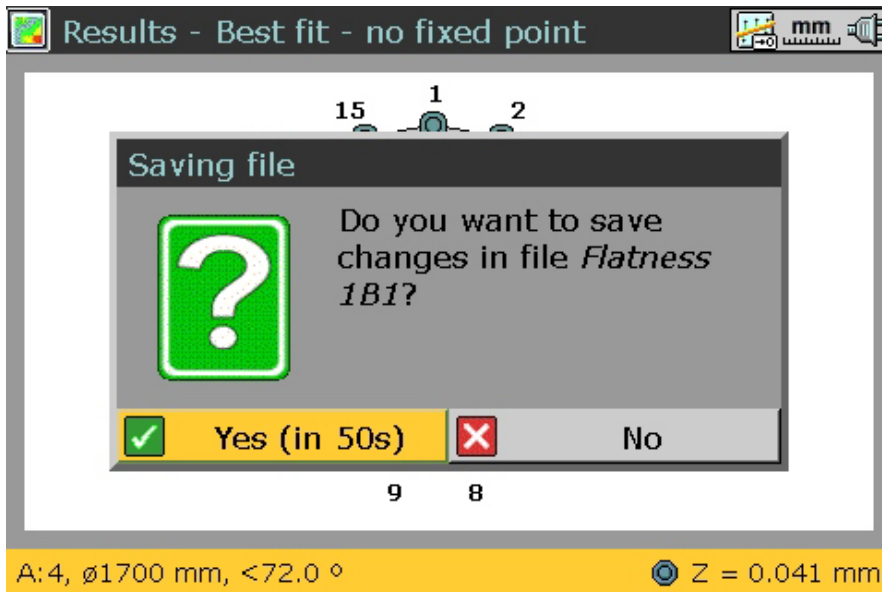


- Use the navigation keys to select 'Quit'/'Turn off device' (alternatively use the data entry keys 7/3). The following screen appears.





- Press  to confirm turning off system. If results have not been saved, the following screen appears.



- You have approx. 60 seconds to decide whether to 'save', 'save as' (under a different file name), 'don't save' or 'cancel' (i.e. do not switch off) before the computer saves all changes to the suggested file name and switches itself off.  
The current measurement data remains in the working memory and can be loaded directly after the computer is restarted.
- Remove the components from the object that was being measured.
- Ensure LEVALIGN laser is switched off before storing it in its case.

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## Chapter 3: Introducing LEVALIGN Editor

All LEVALIGN Ultra packages ALI 4.010, ALI 4.011 and ALI 4.012 come with the LEVALIGN Explorer CD ALI 6.970 CD which contains the LEVALIGN Windows PC software. The PC software is in two levels. LEVALIGN Reader is used to view and save measurement files in a PC. The software allows the printing of measurement reports.

LEVALIGN Editor is the complete version of the Windows PC software. LEVALIGN Editor requires a paid for registration key. Use the License Manager to order and/or register the LEVALIGN Editor.

### Installing the PC software

Please refer to the Windows PC software installation section in the LEVALIGN Explorer CD.

### Establishing communication between PC and ROTALIGN Ultra

Please refer to the device communication section located under Registration in the LEVALIGN Explorer CD.

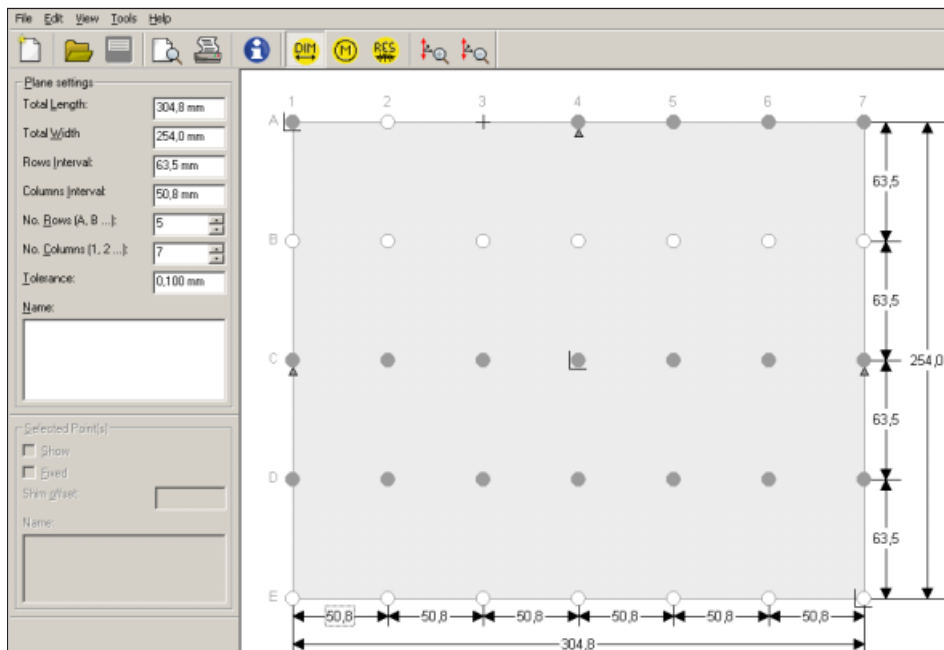
### LEVALIGN Editor overview


A comprehensive description of the LEVALIGN Editor including how to transfer files from the instrument to a PC is in the Windows online help.



Note

When you double-click on a flatness file in the Alignment Explorer display, LEVALIGN Editor is launched and the selected measurement file is displayed.



The toolbar icon selected in this display is  the 'Dimensions' icon. The display shows the length and breadth of the surface measured, the interval between the points taken, and the number of rows and columns in the plane set-up.

## 3-2 Overview



The 'Measurement' display screen shows all measurements taken, the standard deviation, the maximum and minimum values taken.

No.	Point	Fix	Manual	Z	Shim	Name
1	A1			4,000 mm	1,500 mm	
2	A2			--- mm		
3	A4	Fix		-5,000 mm		
4	A5			0,000 mm		
5	A6			3,000 mm		
6	A7			3,000 mm		
7	B1			--- mm		
8	B2			--- mm		
9	B3			--- mm		
10	B4			--- mm		
11	B5			--- mm		
12	B6			--- mm		
13	B7			--- mm		
14	C1	Fix		1,000 mm		
15	C2			-2,000 mm		
16	C3			-4,000 mm		
17	C4			5,000 mm	2,000 mm	
18	C5			-1,000 mm		
19	C6			0,000 mm		
20	C7	Fix		1,000 mm		
21	D1			-2,139 mm		
22	D2			2,138 mm		

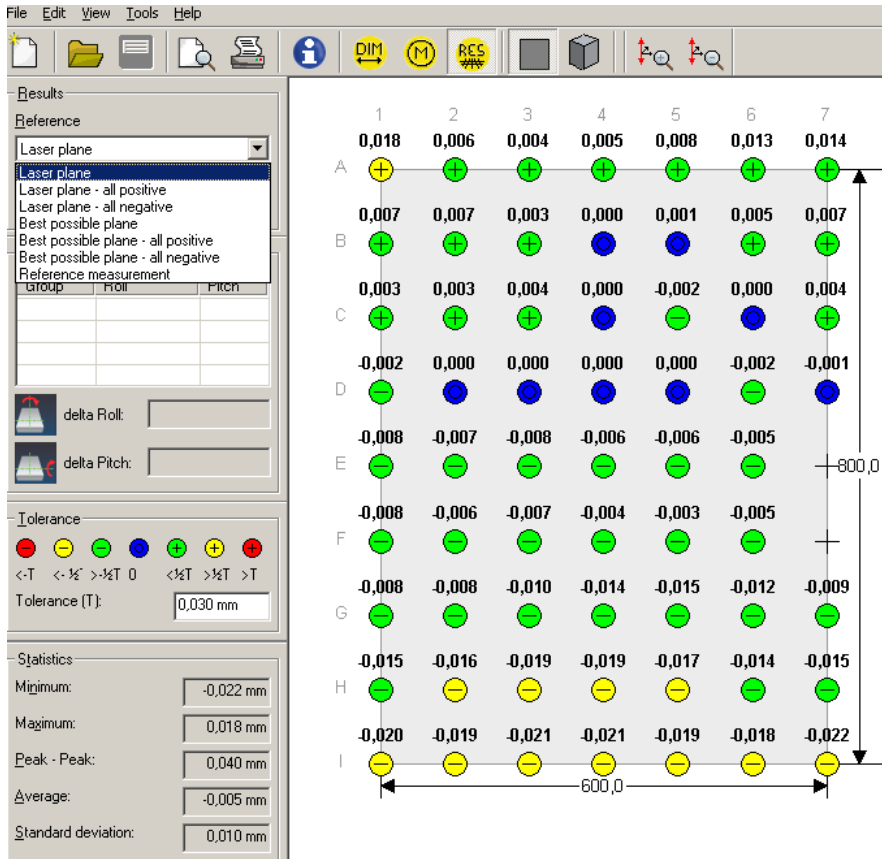
Statistics	
Minimum:	-5,000 mm
Maximum:	5,000 mm
Peak - Peak:	10,000 mm
Average:	-0,150 mm
Standard deviation (SD):	2,740 mm



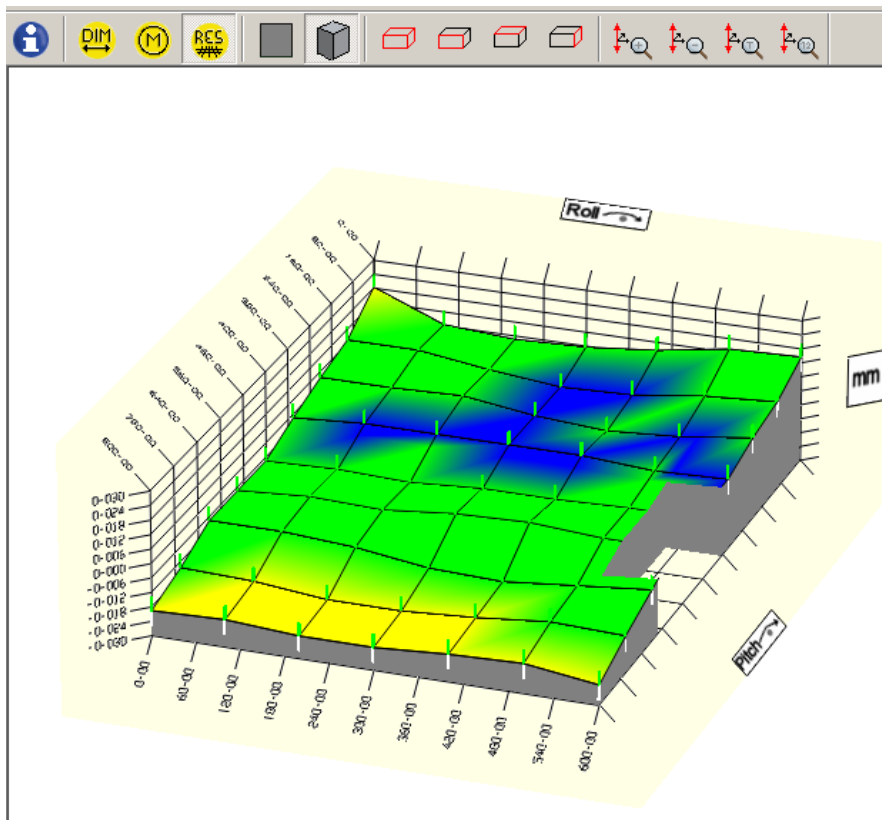
Measurement results can be displayed in both 2-D and 3-D graphics. A reference plane can also be defined in the 'Results' display. The graphic displays show colored tolerance codes and the sign relative to the reference plane. It is also possible to alter the scale of the graphics as required.

The 3-D display can be rotated to show different views. This is done by placing the cursor on the display window and moving the cursor with the left mouse held down.

The display toolbar can also be used to select the front, top, and side views.



The 2-D 'Results' display shows the points with colored tolerances and surface height relative to the chosen reference plane. In this display screen, the scaling can either be increased or decreased in both the X and Y directions.



In the 3-D 'Results' display, the scale can be increased or decreased by clicking the appropriate scaling button. The scale can also be adjusted by entering values manually. The scale can also be set to correspond to the tolerance value.

### Symbols used in the 'Dimensions' and 'Results' displays



A shaded circle on the 'Dimensions' display indicates that the point has been measured. Such a point appears in the 'Results' screen colored and enclosing either a +, - or 0 depending on the selected reference plane.



A white circle indicates that the displayed point has not been measured.



A shaded circle enclosed within a square indicates that the measured point has shim offset values taken into consideration. The shim offset values are included in the calculation of results when under 'Tools'/'Options'/'Results' the item 'Incorporate shim offset in results' is checked.



An L-shaped symbol beneath the shaded circle indicates that although the measured point has a shim offset value, this will not be taken into consideration when calculating the result - the item 'Incorporate shim offset in results' remains unchecked.



Indicates that point is fixed.



Indicates recorded value was manually entered.



Indicates that a comment has been inserted to the measured point.



Points marked with a plus do not appear in the 2-D and 3-D graphic results. This is a useful option when measuring the flatness of machine half casings.

**Dimensions screen menu overview**



The dimensions screen has the following set of menus: 'File', 'Edit', 'View', 'Tools' and 'Help'.

The 'File' menu has the following menu items:

File	Edit	View	Tools	Help
New...				Ctrl+N
Open...				Ctrl+O
Save				Ctrl+S
Save As...				
Information...				
Send to ...				
Import				
Export				
Splice				
Compare				
Divide				
Report				
Report Preview				
Page Setup...				
1 Part 1				
2 RECTEX7				
3 RECT5X7				
4 Flange				
5 Reference measurement				
Exit				

Used to save file as either a template or a measurement file

Used to import CSV (comma-separated values) flatness and CSV raw data files

Used to export flatness files in CSV format.

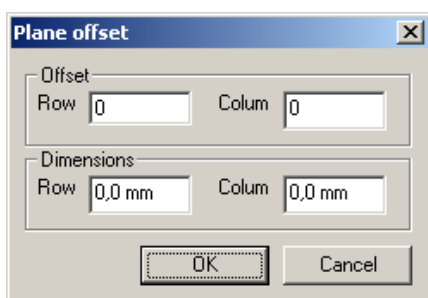
Used to set printing options

The menu items under the 'Edit' menu are shown below.

File	Edit	View	Tools	Help
	Fix			F
	Unfix			Shift+F
	Show			Shift+H
	Hidden			H
	Add to group			G
	Remove from group			Shift+G
	Place dimension			
	Plane offsets			
	Select all			Ctrl+A

Used to select points that should appear hidden

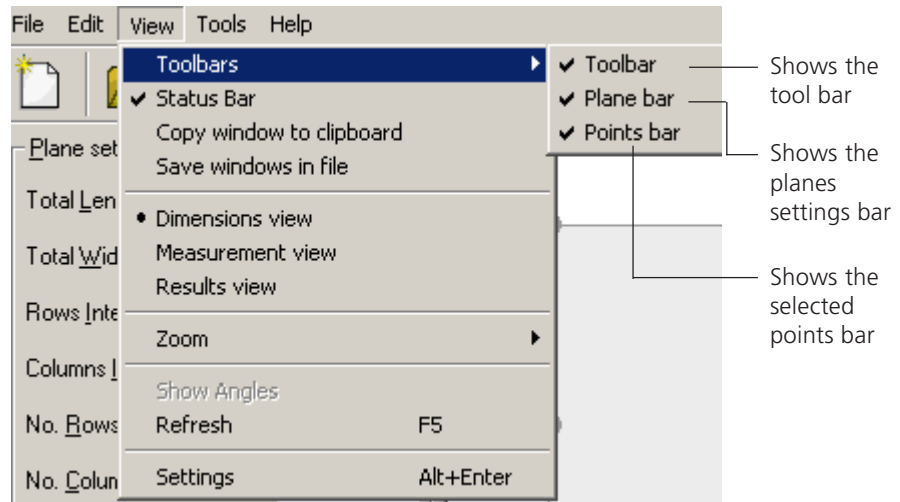
Used to group together selected points. This is done by selecting the points using the mouse cursor with the left mouse held down and then pressing the short cut key 'G'



The plane offset dialog window which is useful in splice appears when the menu item 'Plane offsets' is selected

## Dimension screen menu items

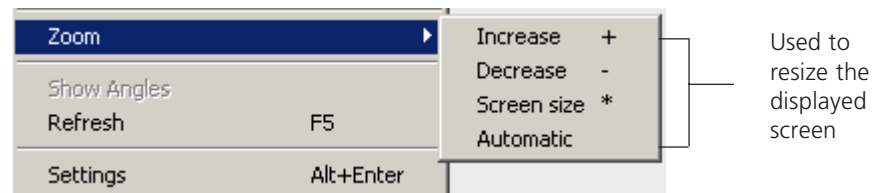
The 'View' menu has the following menu items:



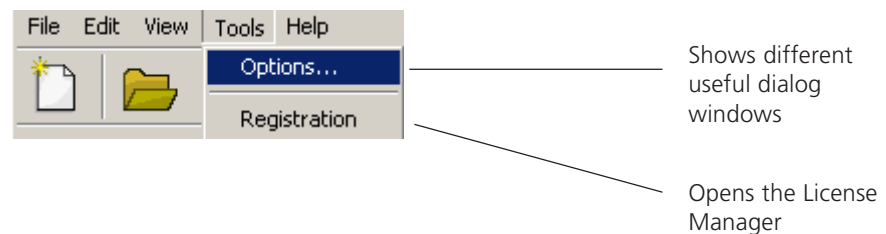
Deselecting any of the 'Toolbar' submenu item hides the corresponding control bar.

The 'Save windows in file' is used to save the displayed window as either a .png or .jpeg or .tiff file.

The menu item 'Zoom' expands to show the submenu shown below.



The 'Tools' menu has the following menu items:

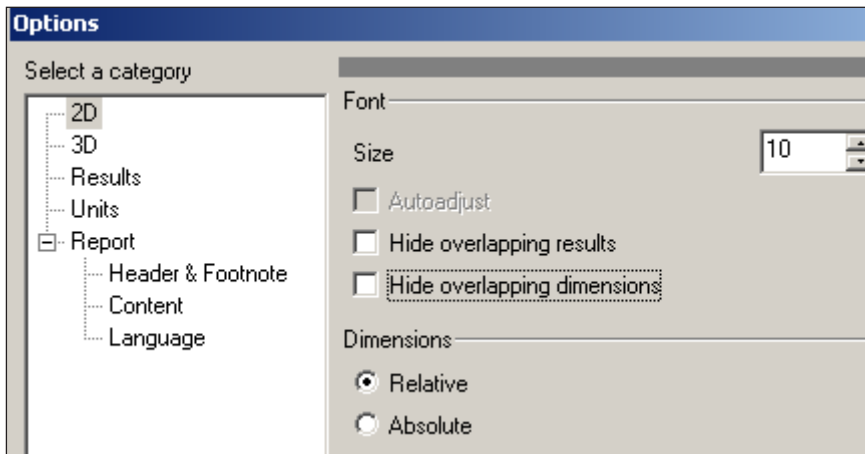




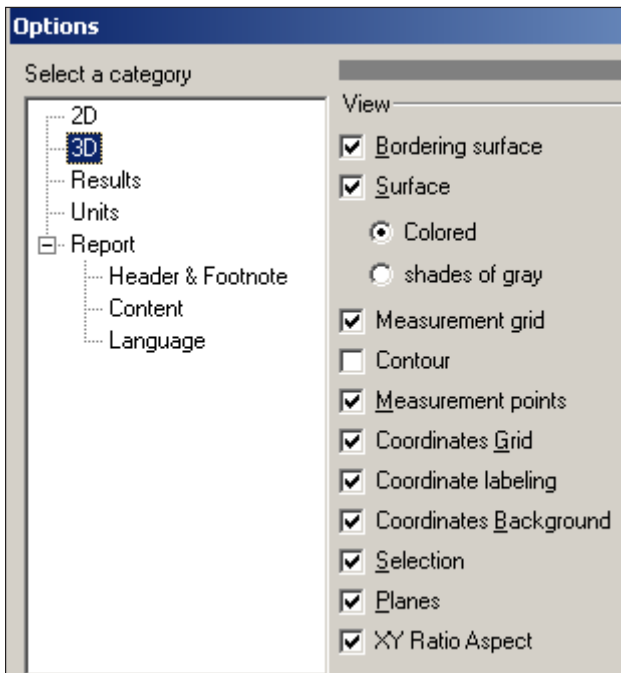
### Menu item 'Options'

This menu item is used to set the font size used on the displayed screens, 3-D graphic parameters, shimming influence, mode of interpreting tolerances, measurement units and measurement report parameters.

The dialog window below appears when '2D' is selected.



This dialog window is used to set font size used in the dimensions and 2-D results graphics. By checking the appropriate box, overlapping results or dimensions are hidden. 'Relative' dimensions show the dimension between each column and row while 'absolute' dimension shows composite dimensions.

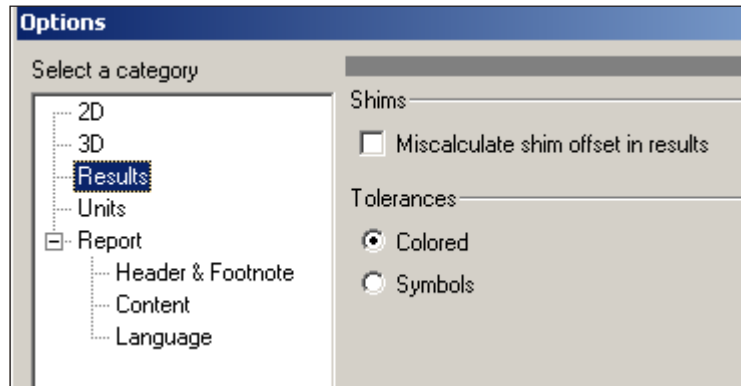


Selecting the 3D category allows the changing of a variety of 3-D results graphic characteristics.

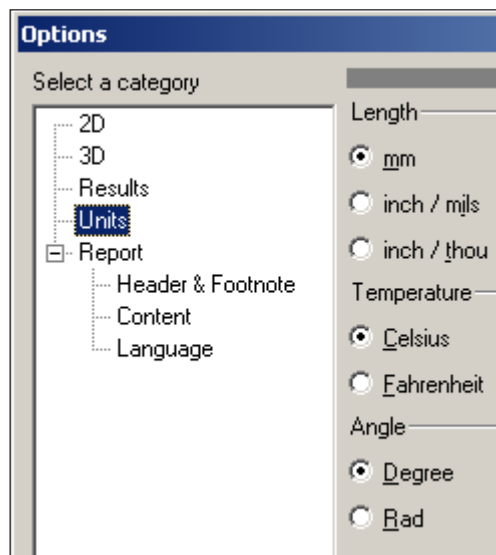
## Menu item – Options

---

The category 'Results' can be used to show tolerances in colour or as symbols. If offset shims have been used, they may be incorporated into the measurement results by checking the shim offset box.

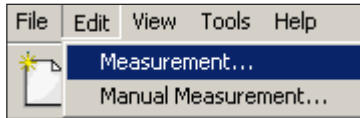


The 'Units' category is used to set units of measurement.

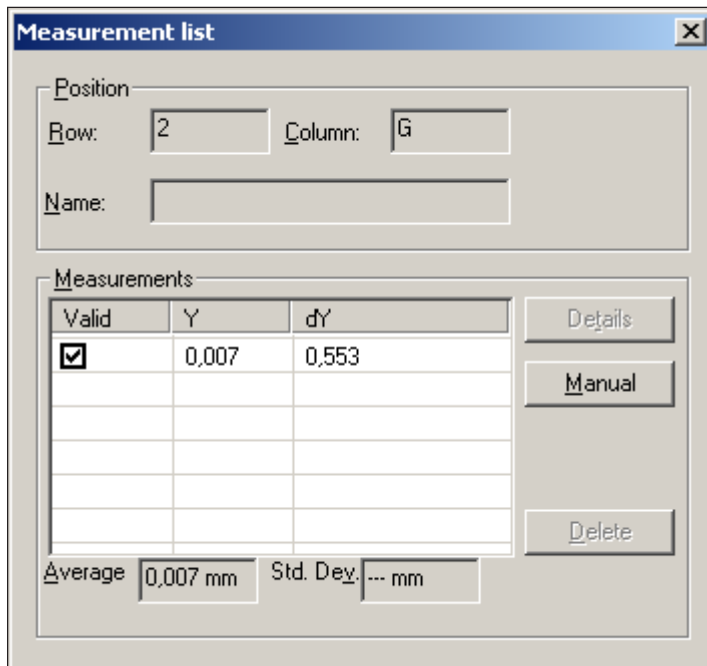


'Report' option category – This category is used to format the the measurement report. It is used to position the company logo, header, and report language. Items to be included in the report can also be selected using this option.

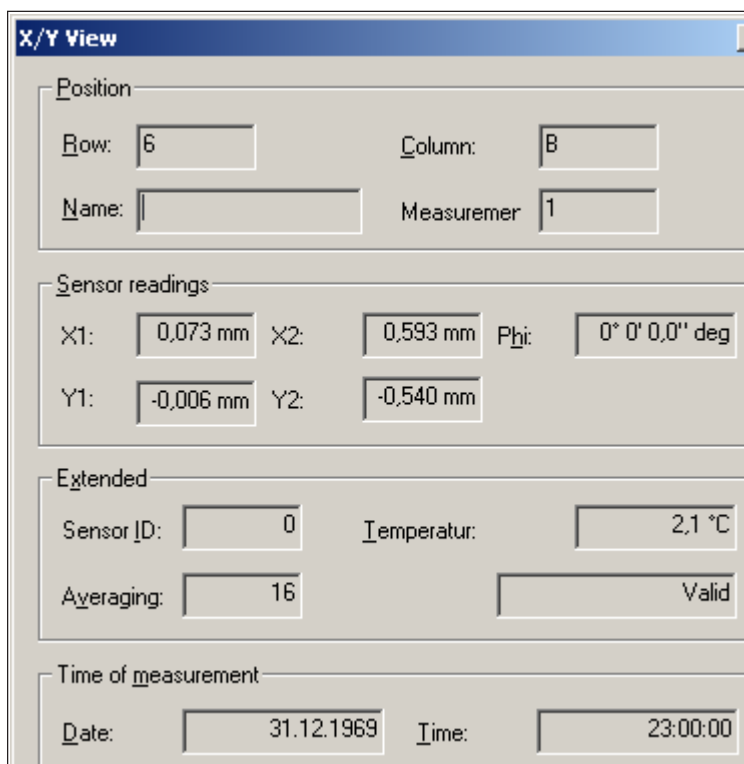
Measurement menu items



The measurement menu 'Edit' has two submenus: 'Measurement...' and 'Manual Measurement...'



Selecting the 'Measurement' submenu reveals a measurement list of the point currently highlighted. Selecting the 'Details' button reveals the contents to the measurement.



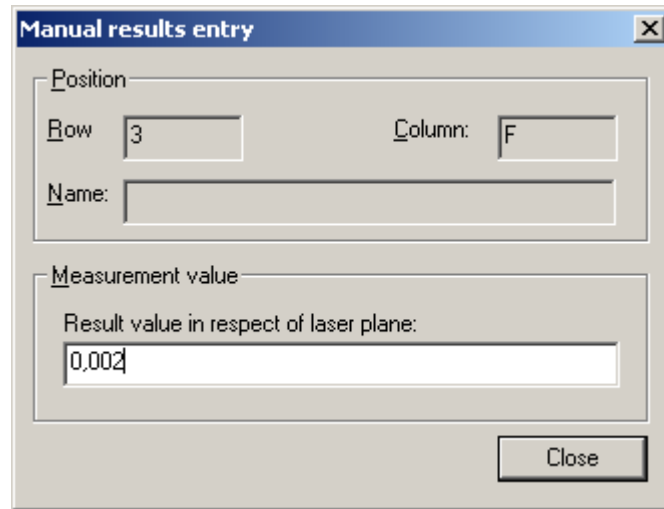
Details shown include the number of measurements taken at the selected point, readings from both detector planes, the sensor temperature, the averaging and the date and time.  
 NB. Y1 - Y2 = dY (shown in the measurement list)

## 3-10

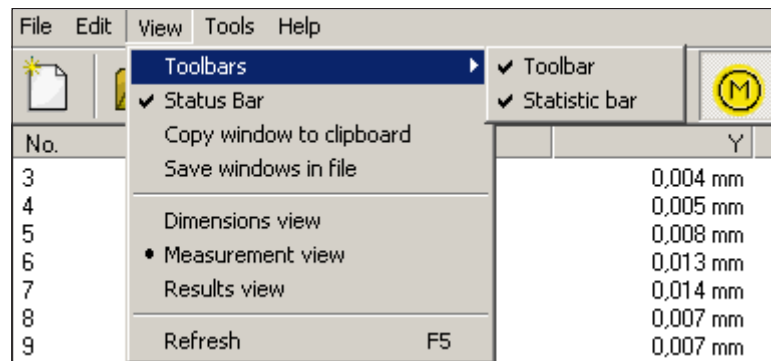
### Measurement screen menu items

Manual entry of measurement values is possible by one of the following methods:

- i) From the measurement menu item 'Edit' select 'Manual Measurement...' OR
- ii) Highlight a measurement point and then right-click. Select the 'Manual Measurement' submenu OR
- iii) From the 'Measurement list' dialog window select the 'Manual' button.

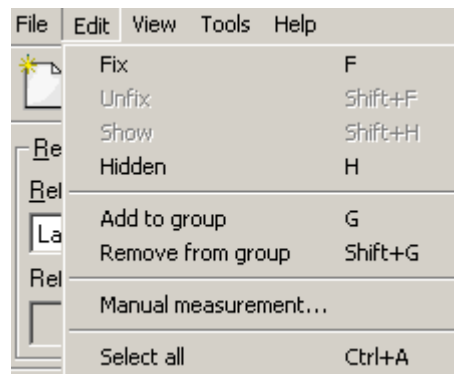


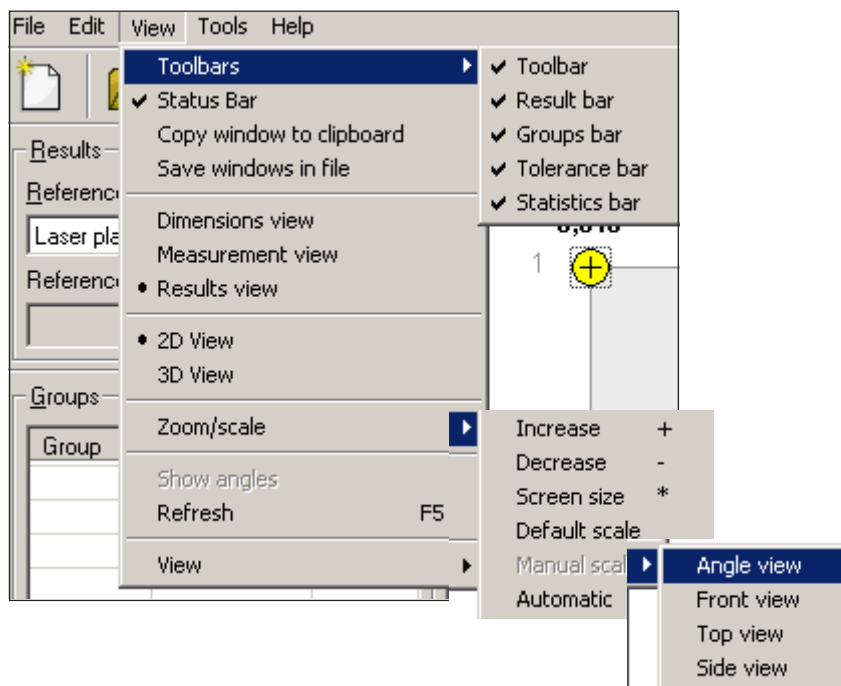
The measurement 'View' menu is used to select the shown submenu items.



### Results menu items

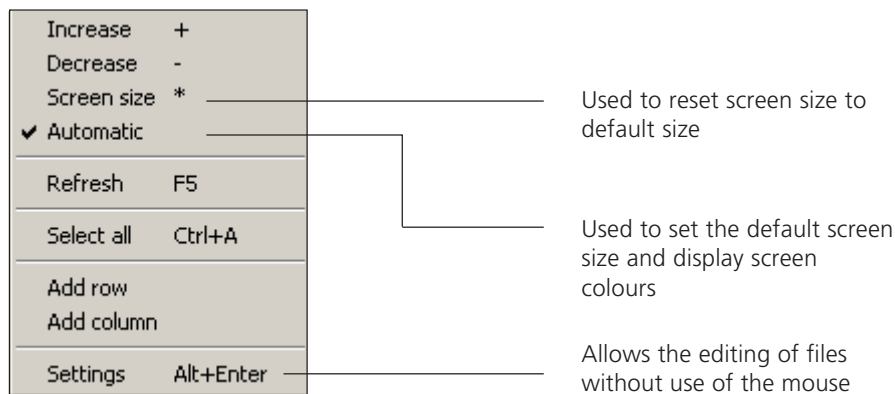
The results menu 'Edit' can be used to fix, unfix, show, hide, and group measurement points. To edit a measurement point, simply right-click the point and select item required.



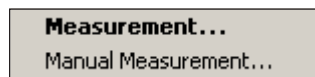


The result menu 'View' can be used to select the items shown.

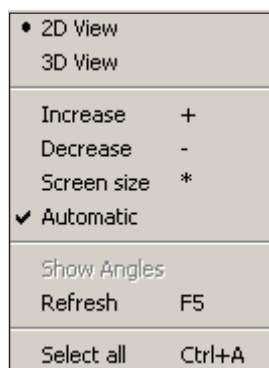
**Right mouse click menus**



The listed menu items appear when the right mouse is clicked while in the dimensions screen.



This menu appears when the right mouse is clicked while in the measurement screen.



The menu items are similar to those appearing with the right mouse click in the dimensions screen

The listed menu items appear when the right mouse is clicked while in the 2-D results screen.

## Using the menu items 'Divide', 'Splice' and 'Compare'

These three menu items are important features of the LEVALIGN Editor and are available via the dimensions screen menu 'File'.

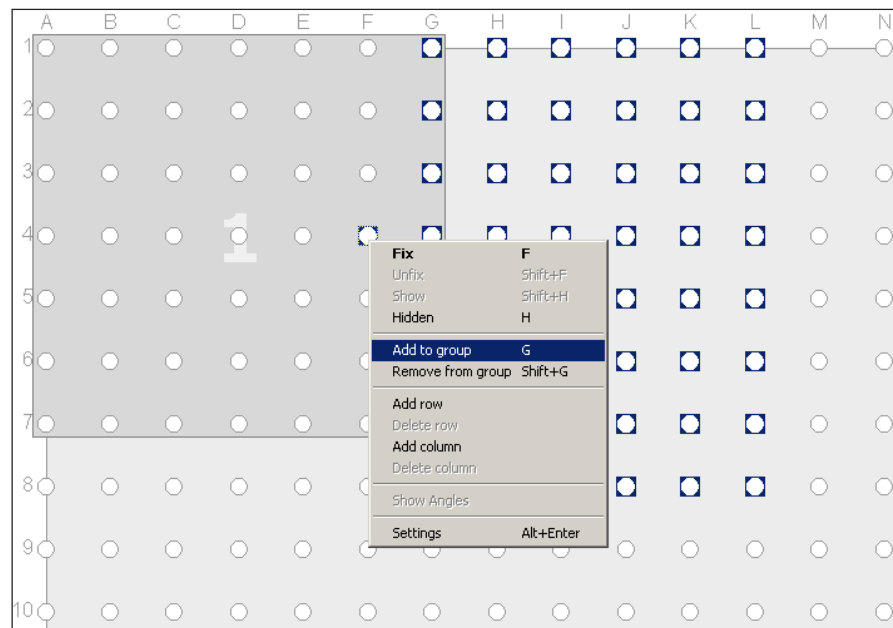
### 'Divide'

This function is used to create manageable ROTALIGN Ultra flatness files. If the surface to be measured is extremely large such that the number of points exceed the allowed maximum of 144 measurement points, it is necessary to divide the surface appropriately.

After setting up the surface using the LEVALIGN template assistant, proceed to divide the surface using the wizard or manually.

To manually divide the surface, proceed as follows:

- i) Select points to be grouped together by moving the mouse with the left click button held down.



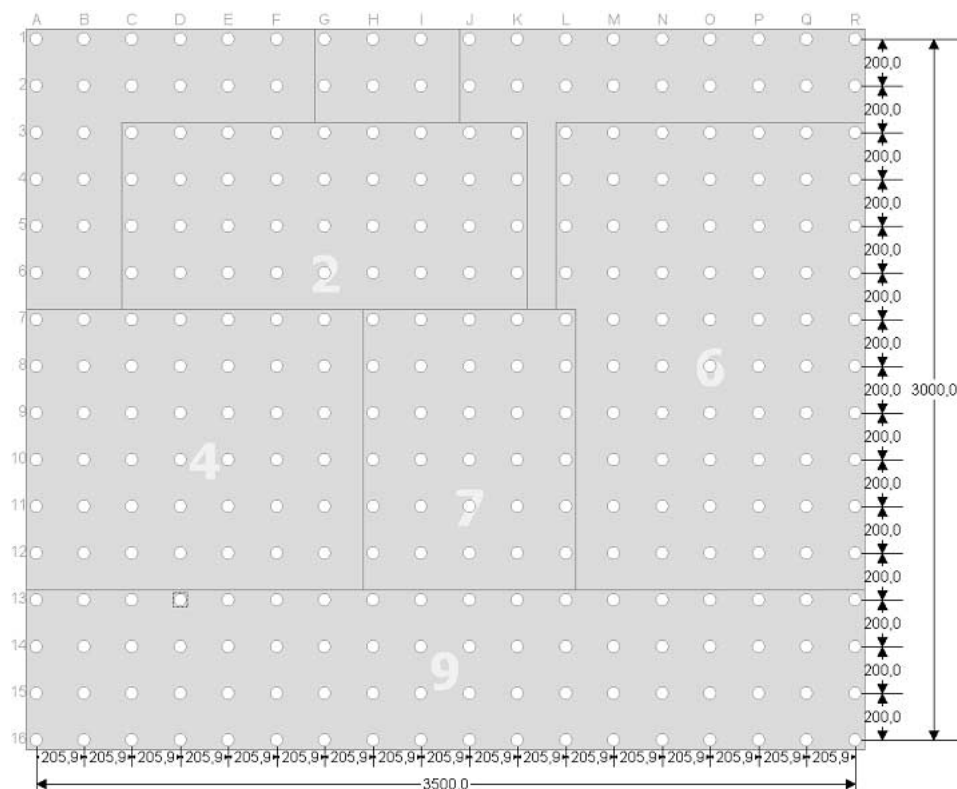
- ii) Right click the mouse with the mouse cursor placed on one of the selected points.
- iii) Select 'Add to group' from the pop-up menu that appears.
- iv) The group number appears on the background of the screen.
- v) Select the next points to be grouped together by moving the mouse with the left click button held down.



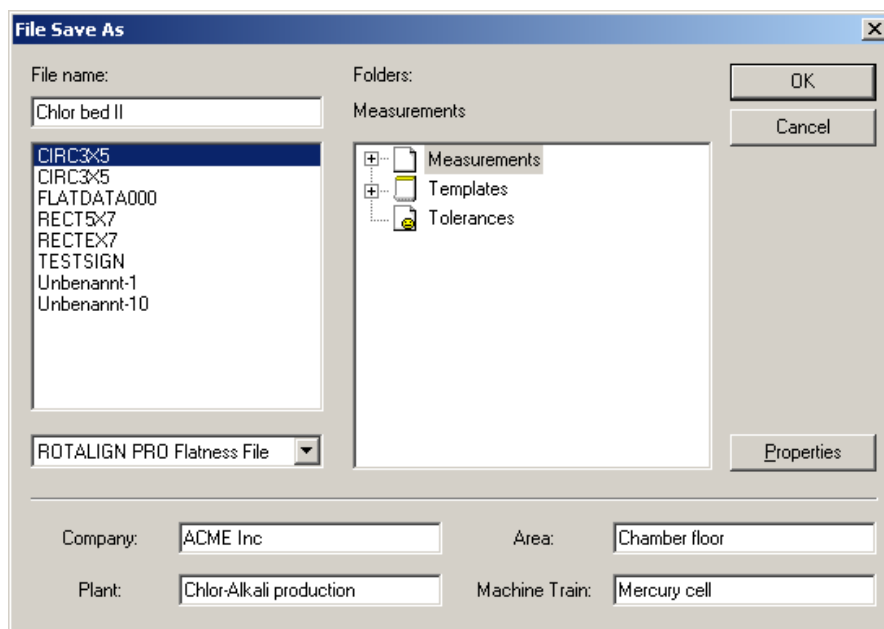
**Note**

This group of points must overlap the the first group of points. If the overlapping points are on a single line, an extra point must be added to the group to ensure that the overlapping points form a plane. The added point should be located well away from the intersecting points.

- vi) This point is added to the group by selecting it with the 'Ctrl' key held down.
- vii) Right click the point to be added and select 'Add to group' from the pop-up menu that appears.
- viii) Repeat the steps outlined above until all points are included in the respective groups.



- ix) From the dimension menu 'File' select 'Divide' and enter file characteristics in the dialog window that appears.



- x) Click 'OK'.



**Note**

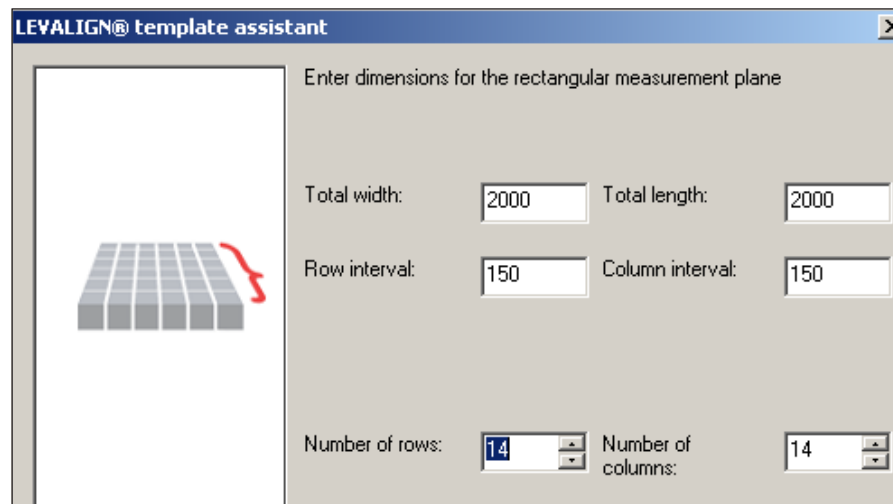
The measurement overview report that appears should be printed out and kept safely as it shows all the points and locations within a group and will be extremely useful during measurement.

- xi) After printing, close the overview/printing dialog window.  
 xii) The composite (LEVALIGN Editor file) and the divided files (ROTALIGN Ultra flatness files) can now be located on the Alignment Explorer and transferred to ROTALIGN Ultra for actual measurement.

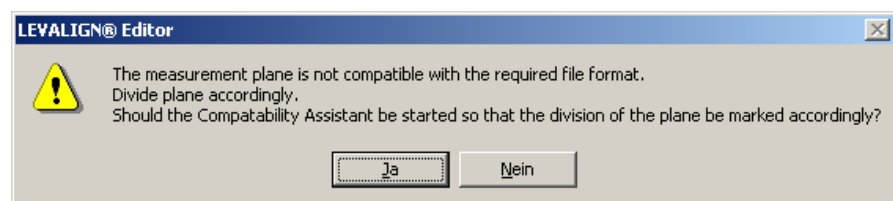
### File division using the wizard

- i) Use the LEVALIGN template assistant to define the dimensions of the surface to be measured.

As this surface consists of more than the maximum 144 points, it requires dividing up before it can be measured using ROTALIGN PRO.

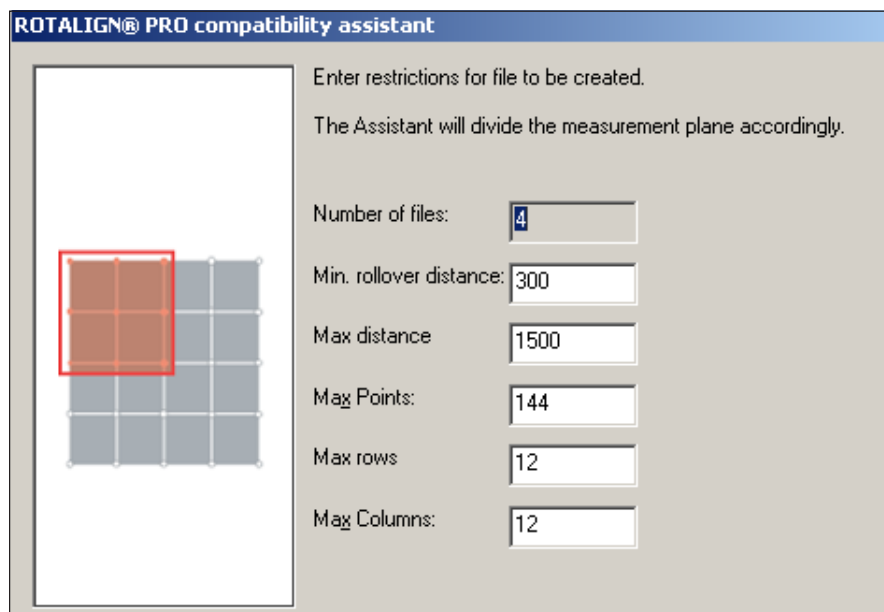


- ii) After entering the dimensions, select 'Finish'. The dimensions screen showing the surface to be measured appears.  
 iii) Select 'File'/'Save as'. The 'File Save as' dialog window appears. Proceed to save the file as a ROTALIGN Ultra flatness file.  
 iv) Click the 'OK' button to save file.



- v) On clicking the 'OK' button, the message above appears. Click the 'Yes' button to start the ROTALIGN Ultra compatibility assistant.





- vi) Enter file requirements to determine the number of times file is to be divided. Click 'Finish' to complete creation of the files.
- vii) The measurement overview report appears and this should be printed out and stored safely for use during the actual measurement.
- viii) After printing, close the overview/printing dialog window.
- ix) The divided ROTALIGN Ultra flatness files can now be located on the Alignment Explorer and transferred to ROTALIGN Ultra for actual measurement.

### 'Splice'

The LEVALIGN 'Splice' function is used for the addition of new measurement points onto an existing series of measurement points. This function is used when measuring an extremely large surface area with many measurement points.

Any two surfaces being 'spliced' must share three common measured points. Preferably, the points must form a plane and be positioned as far apart as possible.

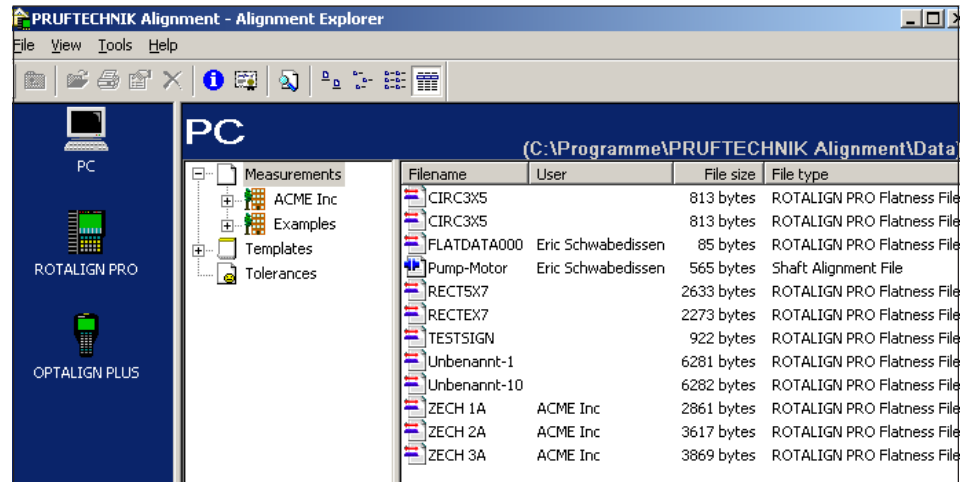


**Note**

ROTALIGN Ultra measures a maximum of 144 points. A large surface area will normally have more than this permitted number of points. After setting up the grid, measure group of points until the entire surface is complete. Each measured group must be saved in the instrument as a separate file. When measurement is complete, transfer the files from ROTALIGN Ultra to a PC as described in the online help.

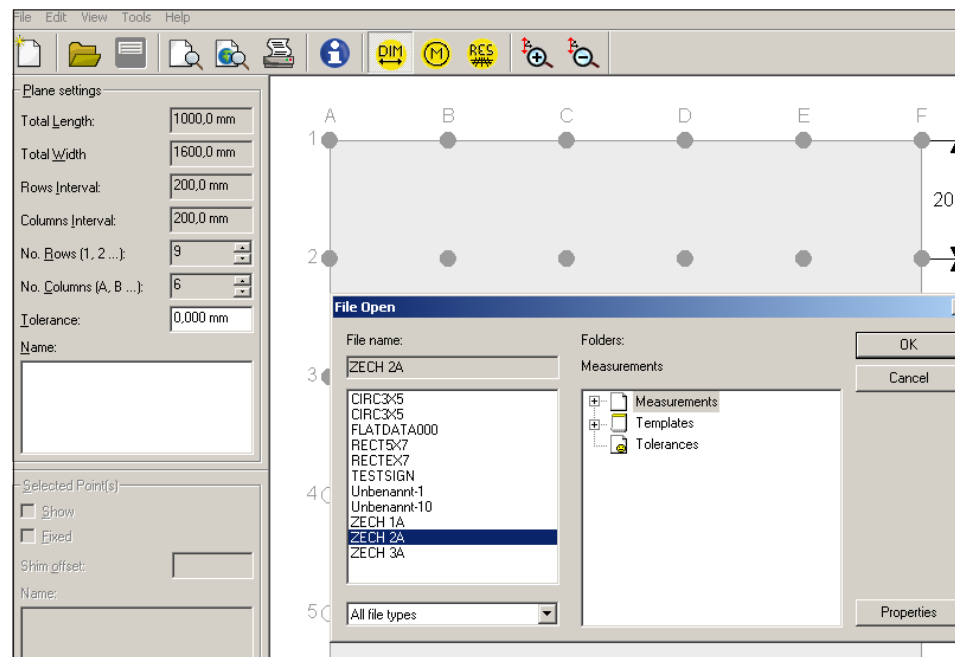
- i) From the Alignment Explorer open a file to be 'spliced' by double-clicking on the file.

## 3-16 Splicing files



- ii) Select 'File'/'Splice'. The 'Open File' dialog window appears and file to be 'spliced' to the already opened file is selected.

If a file is 'spliced', the name on the window title appears with an asterisk.



- iii) Click 'OK' to complete the 'splicing'. Measurement points which are common to both measurements, are automatically set as fixed points and appear shown with a triangular base.
- iv) After 'splicing' any two measurement files select 'File'/'Save as' and use the 'Save as' dialog window to save the new file accordingly.




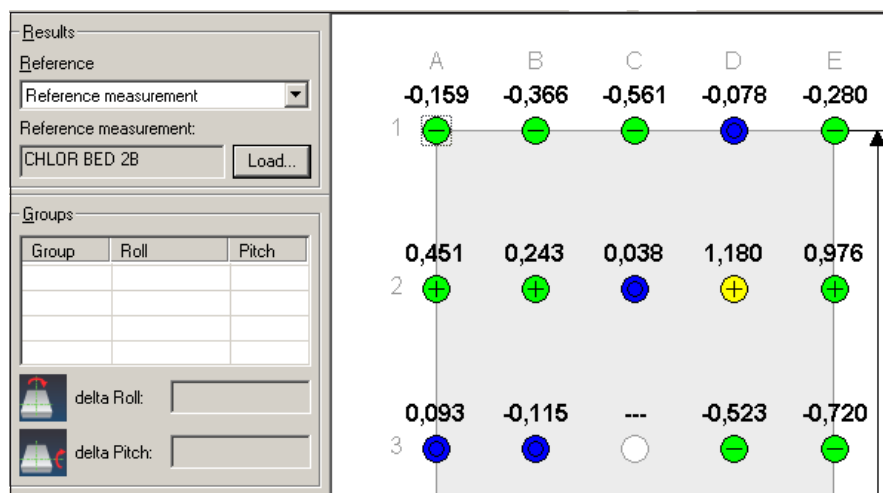
**Note**

As a crosscheck, the result obtained after measuring a surface must be identical to the result displayed when the same surface is split and then merged again.

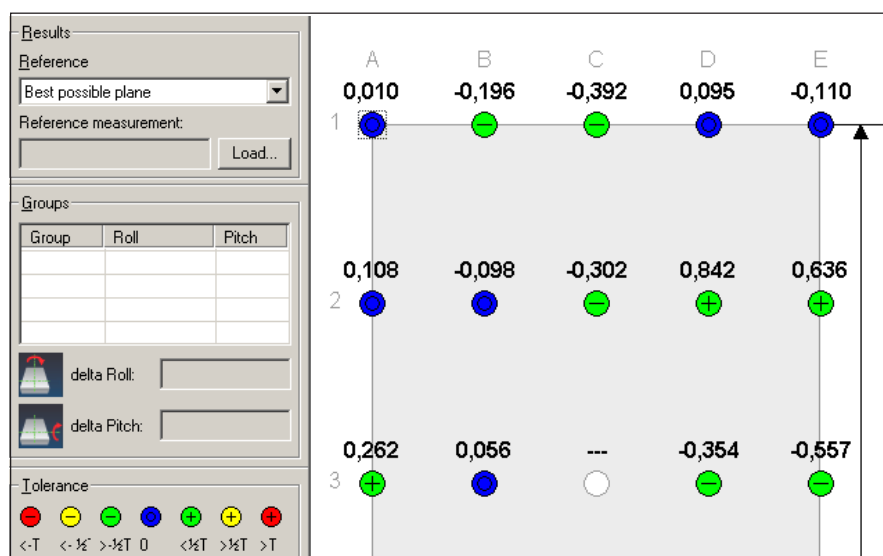
### 'Comparing'

The menu item 'Comparing' is used to compare any pair of results obtained from measuring a given surface. Compare results as follows:

- i) After a given surface has been measured severally and the data transferred to a PC via the Alignment Explorer, open the first measurement file to be compared by double clicking the file from the Alignment Explorer.
- ii) From the LEVALIGN Editor menu select 'File'/'Compare'. The 'Open File' dialog window opens and the second file to be compared is selected.
- iii) Click 'OK' to confirm selection.
- iv) Click  the results button. This reveals the comparison.



The 2-D graphic display shows the comparison between the 'best possible planes' of the two results. This is referred to as the reference measurement.

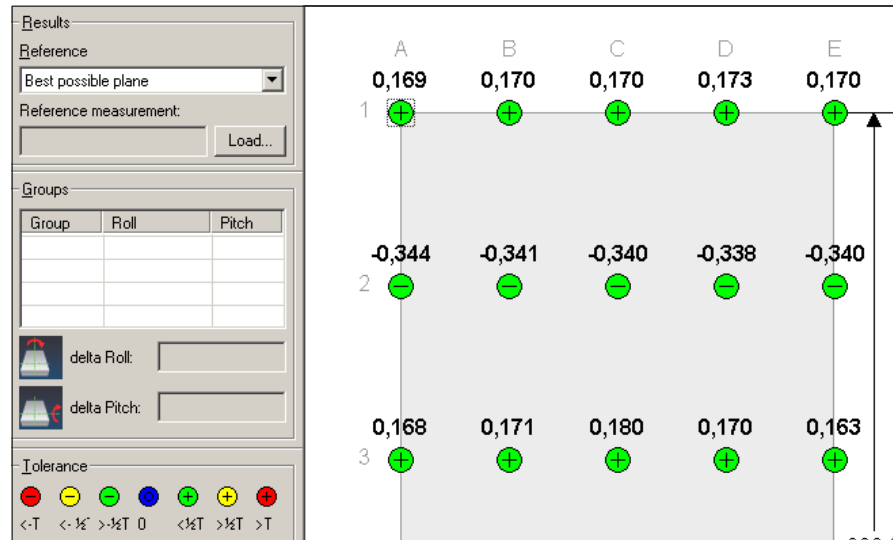


This 2-D graphic display shows the 'best possible plane' result of the first measurement of the results to be compared.

## 3-18

### Interpreting results

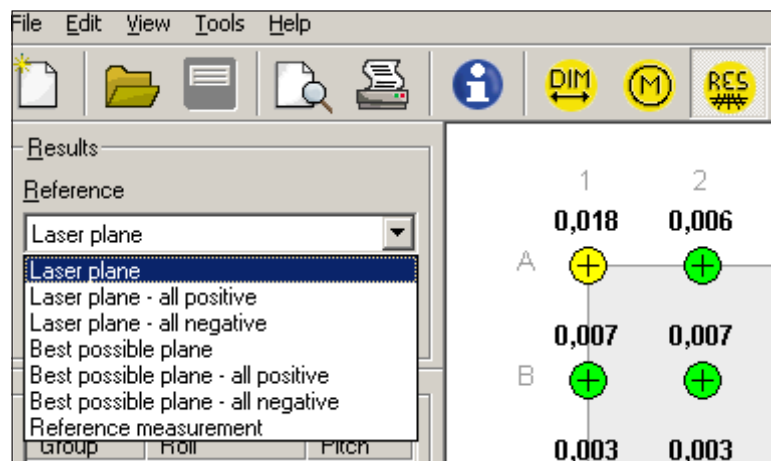
This 2-D graphic display shows the 'best possible plane' result of the second measurement of the results to be compared.



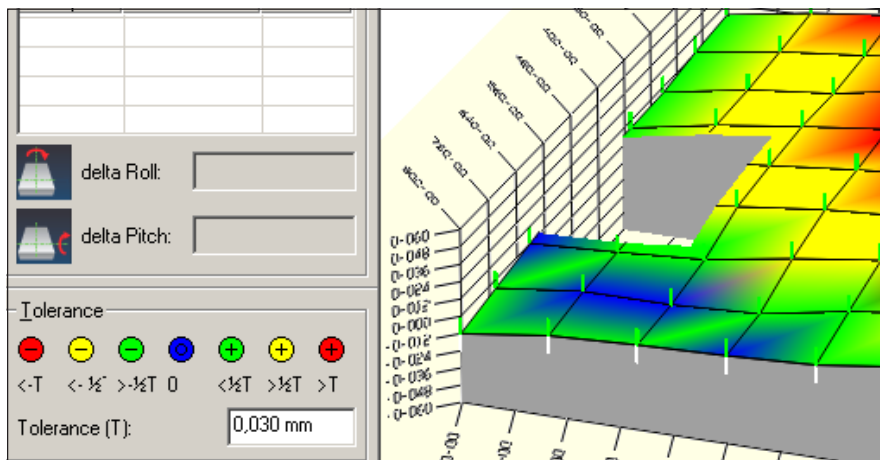
### Interpreting results

LEVALIGN Editor presents measurement results in 2-D cross-sectional graphic display along X and Y profiles and in 3-D graphic display showing the heights of measured surface. The results can be analyzed by selecting a variety of ideal references.

The reference can be set as laser plane, laser plane with all values positive, laser plane with all values negative, best possible plane, best possible plane with all values positive and best possible fit with all values negative.



The displayed results are always dependent on the selected reference. The colored tolerances with the respective sign show the deviation from the selected tolerance.



In this 3-D graphic display, the chosen reference is the laser plane. With the tolerance given as 0.030 mm, the area shaded blue are to with 1/6 th of the tolerance value. Areas shade green fall to with half the tolerance value. The areas shaded yellow have a value greater than 1/2 the tolerance value. Areas shaded red are with respect to the laser plane well outside the defined tolerances.

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## Appendix

### LEVALIGN laser emitter technical data

Laser	GaAlAs semiconductor laser
Wavelength	670 nm (typical)
Beam diameter	approx. 5 mm
Beam divergence	< 0.2 mrad
Beam power	< 1 mW
Accuracy	< 0,02 mm/m
Measurement range	20 m radius; range has no limit when using InfiniSplice™ from the LEVALIGN Editor
Offset @ 360°	≤ 10 μm
Offset @ 90°	< 5 μm (calculated as offset @ 360° / 2)
Cone error	< 15 μrad
Bubble error	< 20 μrad
Protection	IP 52
Laser safety class	Class 2; FDA 21CFR 1000 and 1040
Safety precautions	Do not look into laser beam
Power supply	9V block battery, IEC 6LR61 (alkaline or lithium)
Operating time	50 hours continuous depending upon battery type
Temperature range	-5°C – 50°C (23°F – 122°F)
Weight	approx. 2,8 kg

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