CENTRALIGN®
Ultra
Standard

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!

C E

Preface

Bore and bearing shell alignment in combustion engines and similar machinery is a lengthy procedure whichever way you look at it. But the bore alignment application CENTRALIGN Ultra Standard makes the process much easier. CENTRALIGN Ultra Standard will help you achieve the following:

› Determine the bore centerline
› Set the centerline relative to any fixed bores
› Calculate the minimum corrections required
› Align the bores or a boring machine to the centerline

The CENTRALIGN Ultra Standard bore alignment application guides the user in a step-by-step manner through laser set-up, taking measurements then viewing of results. The ROTALIGN Ultra computer finally calculates the optimum corrections. The on-screen display guides the user through the process of carrying out the corrections.

This manual gives a full description of how to use CENTRALIGN Ultra Standard. For information about the general operation of the ROTALIGN Ultra computer please refer to the ROTALIGN Ultra Shaft alignment operating handbook (ALI 9.855.G).

BORALIGN is licenced under US Patent 5,717,491.

We welcome your feedback and suggestions.

PRÜFTECHNIK Alignment Systems

Ismaning, Germany

Contents

Chapter 1: Introduction

1.1 CENTRALIGN Ultra Standard packages

Depending upon the type of bore and application, a variety of configurations are available. The standard bore alignment packages are ALI 4.030-0, ALI 4.030-1 and ALI 4.030-2. The suffixes 0,1 and 2 denote the respective bore diameter range that can be measured using the given package. Please contact PRÜFTECHNIK Alignment Systems or your local representative for details of all available packages, which also include packages for nonmagnetic bores, as well as customer engineered packages.

1.1.1 The bore alignment package   ALI 4.030/2-0

This package has been designed to handle bore diameters ranging from 120 mm – 400 mm. The package consists of the following parts:
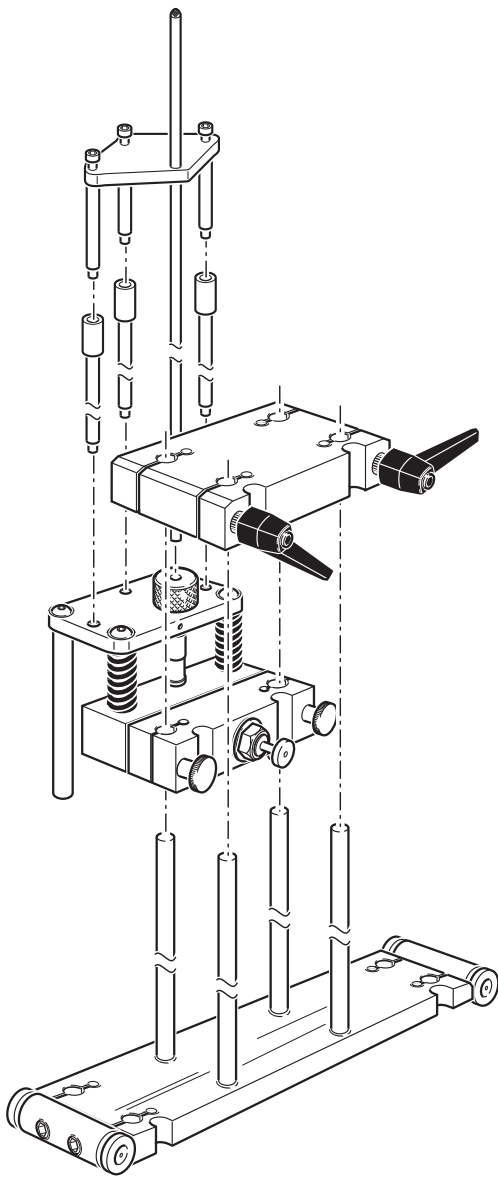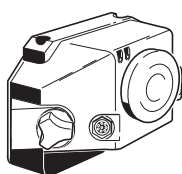
ALI 2.720 SET Universal pointer bracket set for magnetic bores with diameters ranging from 120 mm – 400 mm. The brackets are supplied in a separate case

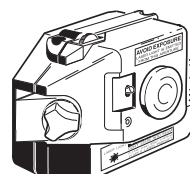**ALI 4.800** ROTALIGN Ultra case with insert (contents not included)
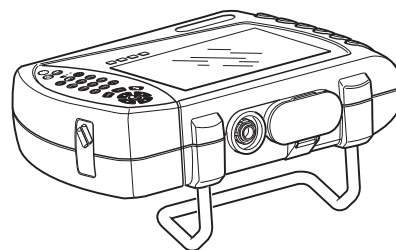
ALI 4.202   ROTALIGN Ultra computer including stand **ALI 4.201** and rechargeable battery **ALI 4.603**
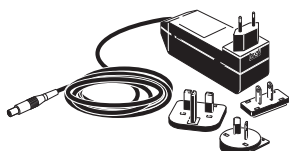
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ALI 3.600   Sensor with dust cap

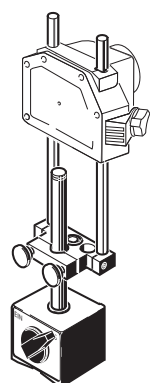**ALI 3.581-2** Sensor cable

ALI 3.610   Laser

ALI 12.651.I AC power supply/charger

ALI 12.502-2 PC/USB cable

ALI 12.503 USB/peripheral devices cable

ALI 3.588 Tape measure mm/inch

ALI 13.700 CDS ALIGNMENT CENTER CD/ Resources CD
ALI 13.701 CD ALIGNMENT REPORTER CD

ALI 4.501 Magnetic foot adapter

ALI 2.905 Lens cleaning cloth

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Package items not shown include:

›	CENTRALIGN Ultra Standard firmware registration certificate	ALI 4.746
›	USB memory stick	ALI 4.451
›	ROTALIGN Ultra part 1 operating instructions	ALI 9.845.G
›	CENTRALIGN Ultra Standard operating instructions (this manual)	ALI 9.849.G
›	Universal pointer brackets operating instructions	ALI 9.850.G
›	ROTALIGN Ultra product catalogue	DOC 4.900.de/en
›	Allen key (2.5 mm) for laser battery compartment	0 0739 1055

1.1.2 The bore alignment package   ALI 4.030/2-1

This package has been designed to handle bore diameters ranging from 390 mm – 800 mm. The package consists of the same parts as ALI 4.030/2-0 with the exception of the universal pointer bracket set. The universal pointer bracket set used in this package is ALI 2.721 SET. For details of this pointer bracket set, please refer to ALI 9.850.G the universal pointer bracket operating instructions.

1.1.2 The bore alignment package   ALI 4.030/2-2

This package has been designed to handle bore diameters ranging from 120 mm – 810 mm. The package consists of the same parts as ALI 4.030/2-0 with the exception of the universal pointer bracket set. The universal pointer bracket set used in this package is ALI 2.722 SET. For details of this pointer bracket set, please refer to ALI 9.850.G the universal pointer bracket operating instructions.

1.2 Before you begin

This instruction manual should be used in conjunction with ALI 9.855.G ROTALIGN Ultra Shaft operating handbook and ALI 9.850.G the universal pointer brackets operating instructions. Users should acquaint themselves with the general and safety notes given in ROTALIGN Ultra Shaft operating handbook and pocket guide.
Follow the step-by-step instructions in this manual to carry out bore alignment measurements.

1.2.1 Area of application

CENTRALIGN Ultra Standard is intended to be used exclusively in industrial environments for the purposes specified in the respective application instructions published by PRÜFTECHNIK Alignment Systems.

1.2.2 Safety symbols used in this manual

The following symbols are used throughout this handbook to help the user quickly identify safety-related and crucial sections of text. These sections of text provide useful information for operating CENTRALIGN Ultra Standard, and in some instances point out possible dangers.

This symbol denotes general information and tips regarding operation of CENTRALIGN Ultra Standard.

Note

This symbol warns of potential hazards.

ATTENTION

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

WARNING!

PRÜFTECHNIK Alignment Systems assumes no liability when components or operating procedures as described in this manual are altered without permission of the manufacturer.

Note

1.3 Licencing the CENTRALIGN Ultra Standard bore alignment application

CENTRALIGN Ultra Standard bore alignment packages are delivered with the bore alignment firmware already installed in the ROTALIGN Ultra computer and is ready for use. As for add-on packages, the bore alignment firmware may need to be installed in the ROTALIGN Ultra computer.

The licencing process is carried out using the licence manager. Access the licence manager via the "Program Manager" screen. Use the navigation keys to highlight the icon 'Configuration'.

With the 'Configuration' icon highlighted, press (Enter) to access the "Configuration" screen, then use the navigation keys to highlight the 'Licence Manager' icon.

With the 'Licence Manager' icon highlighted, press (Enter) to access the "Licence Manager" screen, then use (△)/(▽) to highlight the application 'Bore Alignment'. With 'Bore Alignment' highlighted, press (Enter) then proceed to enter the registration key for the application in the editing box. The registration key (license code) is contained in the CENTRALIGN Ultra Standard firmware registration certificate ALI 4.746.
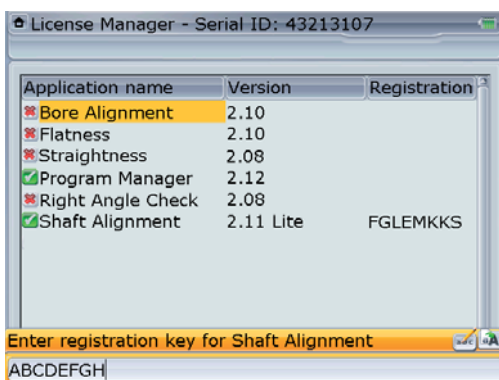
Confirm entry by pressing (Enter) or (t). After successful registration, a green tick appears next to 'Bore Alignment' and the CENTRALIGN Ultra Standard application can now be started.

Chapter 2: CENTRALIGN Ultra Standard set-up

This chapter describes the preparation and CENTRALIGN Ultra Standard set-up procedure.

2.1 Operating principle

CENTRALIGN Ultra Standard uses a visible laser beam to determine the relative centerline of a series of bores or a long bore. The laser emitter is mounted at one end of the machine and is aimed at the sensor, which is mounted near the centre of each bore in turn.

The sensor is mounted on a special bracket which allows the sensor to be freely rotated within the bore. Inside the sensor, the semiconductor position detector measures precisely the position of the incident beam. As the sensor is rotated, the laser beam traces a small circular path in the sensor.

CENTRALIGN Ultra Standard calculates the best-fit centre of the circular paths for each measured bore and calculates the best line through the bores. It then displays the minimum corrections required to realign each bore. A 'live' on-screen move indicator allows you to accurately realign each bore.

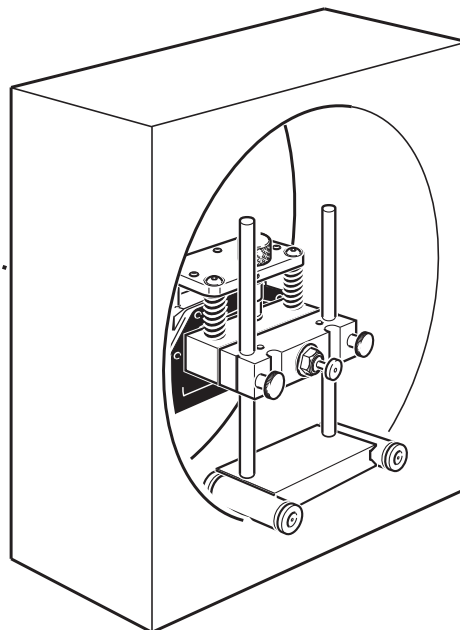The bracket assembly is configured depending upon the bore diameter.

The sensor and the corresponding bracket are positioned in a bore

The laser can also be mounted on a boring machine tool head in 'Rotating LASER' mode. See next page for details.
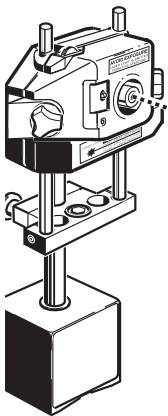
The 'static' laser is mounted on a magnetic bracket

2.2 Preparation

a. Thoroughly clean the bores / channels to be measured.
b. If required, ensure that the boring machine or bores are readily moveable horizontally and vertically.

2.3 Laser set-up

There are two laser set-up options:

2.3.1 Static laser set-up

This set-up is used when the centerline is later calculated as the best-fit line or using reference points. The laser is mounted on a solid base at one end of the machine, as shown on the previous page. This method calculates the alignment of the bores relative to each other, and determines the best centerline through the measured bores. The bores are then adjusted by moving them into position.

2.3.2 Rotating laser set-up

This set-up is used when the laser rotational axis is used as the centerline. For example when you intend to recut the bores with a cutting machine - the laser is mounted on the cutting machine tool head, which then gives you the alignment of bores relative to the cutting machine. Setup and measurement are slightly more complicated than with the Static Laser method, as they require positioning and rotation of the cutting machine. The results will indicate the ideal position for the cutting machine, in order to recut the bores.

2.3.3 Summary

	Static laser set-up	Rotating laser set-up
Application	For most alignment jobs where individual bores are reworked	For use when the bores will be recut with a cutting machine
Time required	Rapid set-up and measurement possible, if needed, to obtain a general alignment overview	Set-up and measurement involve extra time positioning and rotating the cutting machine
Set-up	Laser simply mounted on a solid base, and the beam aligned close to the bore centerline	Laser mounted on cutting machine tool head, and the beam aligned close to the bore centerline
Measurement	Laser not touched during entire measurement	Laser must be rotated to the same angles as the sensor during measurement. The laser can be readjusted for each bore.
Results	Results show alignment of bores relative to each other or to a centerline defined on the basis of reference points	Results show alignment of bores relative to the rotational axis of the cutting machine that serves as the centerline

2.4 Setting up the laser beam

Before actual measurement can begin, the laser beam must be adjusted to the approximate centerline determined by the nearest and furthest bores. This step ensures that the laser beam remains within the sensor measurement range over the entire measurement process.

2.4.1 Procedure for static laser set-up

a. The laser is mounted on a bracket to the 'left' of the machine, and at least 300 mm (12") from the nearest bore to be measured, and roughly central to the bore axis.

> PRÜFTECHNIK Alignment Systems has a wide selection of magnetic brackets that can be used to mount the laser. Please contact your local representative for other options.

☞

Note

Make sure the surface on which the bracket is mounted is clean, de-greased and stable. For large machines, an adjustable stage will give more precise positioning.

b. Switch the laser on, but leave the dust cap on, and allow the laser to warm-up (minimum recommended warm-up time is 20 minutes).

> Do not stare into the laser beam!

⚠

WARNING!
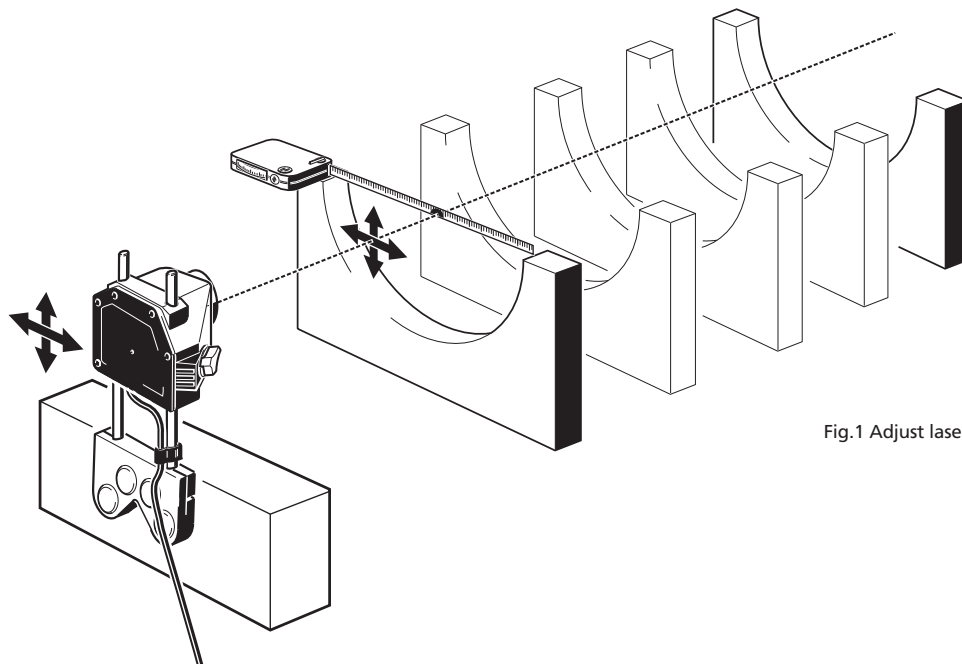
Fig.1 Adjust laser X/Y position

You may want to refer to the built-in laser adjustment wizard on section 3.11.3.

Some examples of brackets available
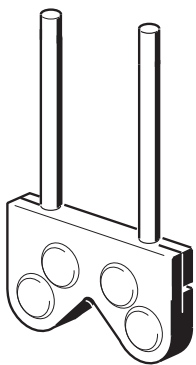
ALI 2.112 compact magnetic bracket
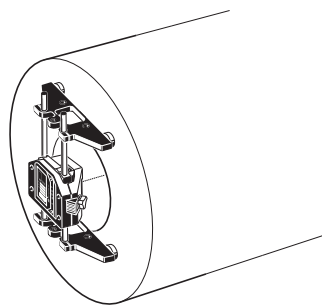
ALI 2.106 SET magnetic bolt hole bracket
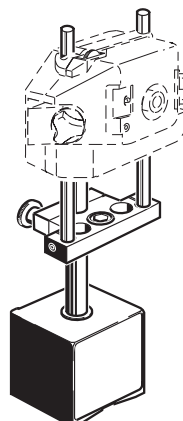
ALI 4.501 magnetic foot
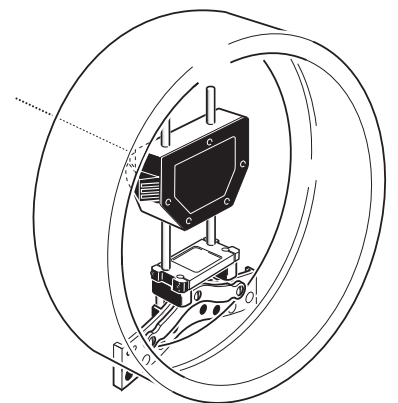
ALI 2.240 pocket magnetic sliding bracket

c. Adjust the laser thumbwheels so that they are approximately in the middle of their travel ranges.

d. Use a tape measure to find the center of the farthest bore.
    Remove the laser dustcap and adjust the laser angle horizontally and vertically using the yellow thumbwheels so that the beam strikes the tape measure at the center (fig. 2).

e. Now move tape measure to the bore nearest to the laser, and find its center by moving the laser housing horizontally and vertically (fig. 1).

f. Repeat steps d – e until the beam is within 0.5 mm of center at each end.

Do not touch the laser once it is set up! Note that the beam line is not necessarily the exact centerline of the bores — the bore alignment program will calculate the centerline from the measurements.
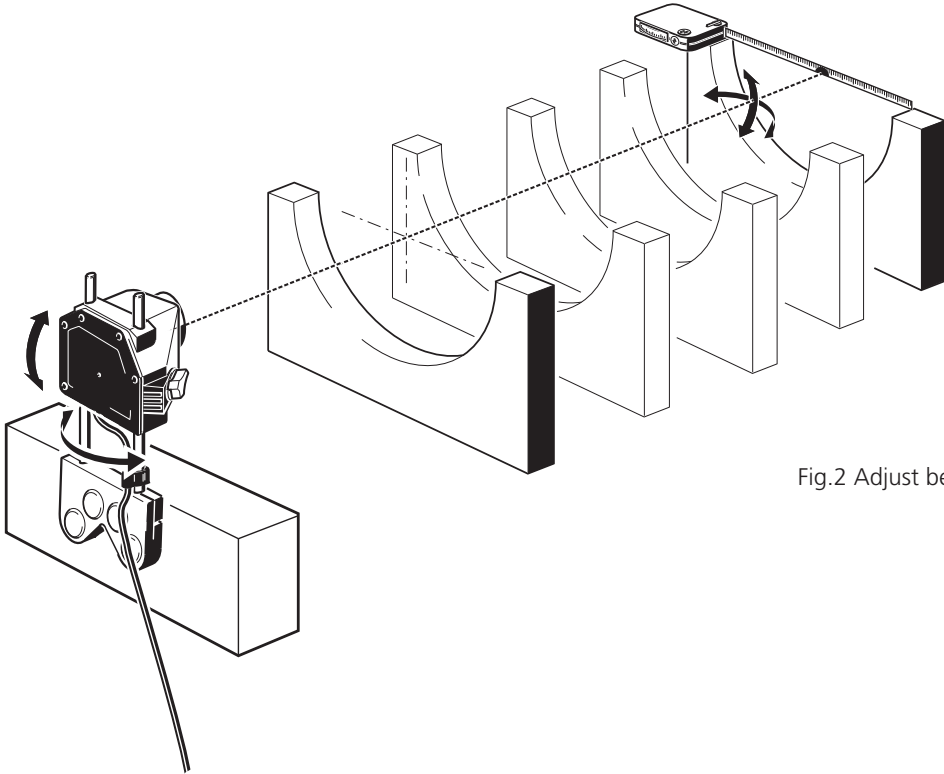
Note

You may want to refer to the built-in laser adjustment wizard on section 3.10.3.

Fig.2 Adjust beam angle
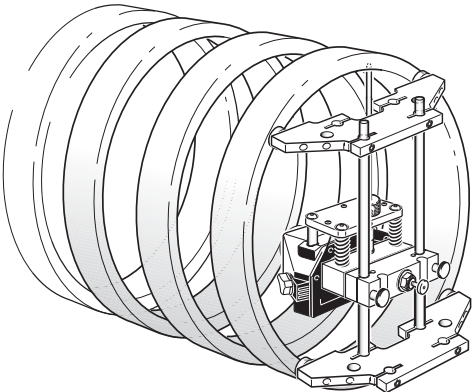
ALI 2.761 SET magnetic bracket set for shaft and bore alignment

2.4.2 Procedure for rotating laser set-up

a. Mount the laser on the boring machine tool head using a suitable bracket (standard and customized brackets are available from PRÜFTECHNIK Alignment Systems).

b. Switch the laser on, but leave the dust cap on, and allow the laser to warm-up (minimum recommended warm-up time is 20 minutes).

c. Align the laser with the boring machine axis by rotating it and observing the beam on a piece of paper at each end of the machine. The beam will trace a circle – adjust the laser by use of the vertical and horizontal beam position adjustment thumbwheels to make this circle less than 5 mm diameter at the plane to be measured.

> Do not stare into the laser beam!

d. Then align the boring machine with the bore centerline. Use a similar procedure to the static laser method, but this time, do NOT touch the laser. Instead, shift the rotational axis of say the boring machine horizontally and vertically, and adjust its angle e.g. with shims under the feet.

e. During measurement the laser is rotated to the same angles as the sensor. If possible, mount an inclinometer to the tool head, otherwise arrange some means of using a protractor to indicate the boring machine rotational angle.

⚠ **WARNING!**

You may want to refer to the built-in laser adjustment wizard on section 3.11.3.

Laser

Target (white paper surface)
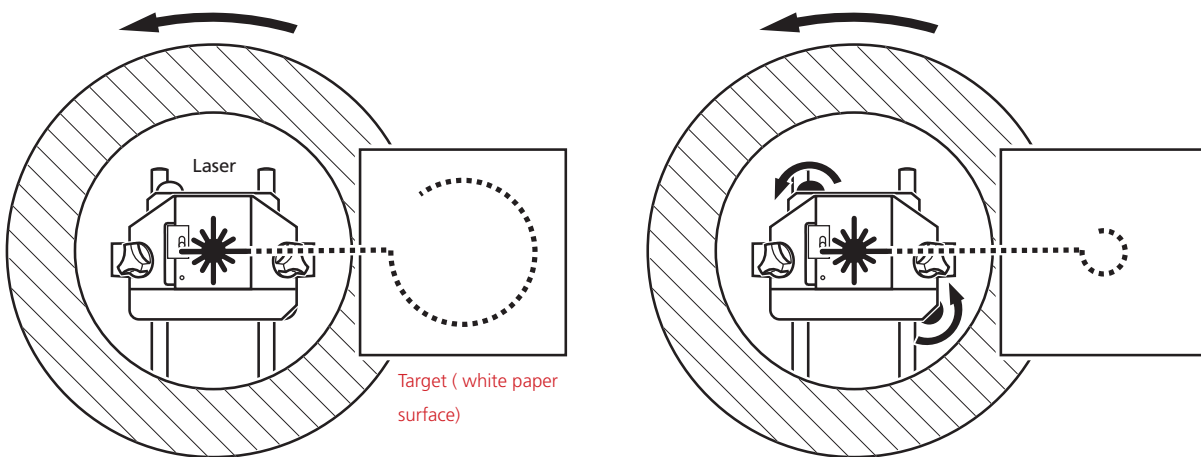
The laser beam strikes the target. The position the beam strikes is marked. The laser is rotated and further positions marked. The beam strikes are joined together to form an "approximate" circle.

You may find **correction points** useful when aligning the cutting machine to the bores.

2.5 Connecting the sensor

a. If not already done, insert the angled end of the sensor cable ALI 3.581-2 into the sensor socket, noting the keyway orientation, and screw the plug fitting into place.

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

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b. Plug the quick fit straight end of the sensor cable ALI 3.581-2 into the eight-pin socket at the top of the ROTALIGN Ultra computer. Note the keyway indicating proper plug orientation. 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 sensor cable ALI 3.851-2 and carefully pull it out of the ROTALIGN Ultra RS 232 sensor socket.
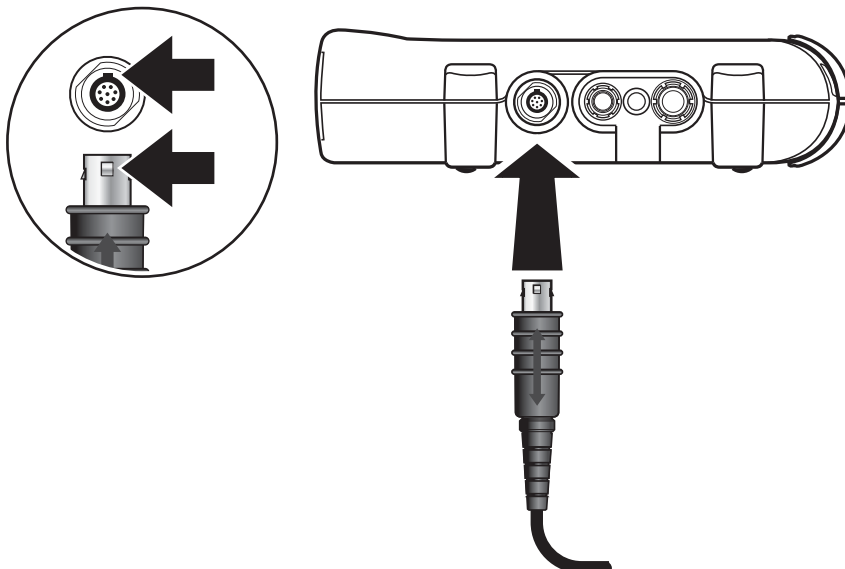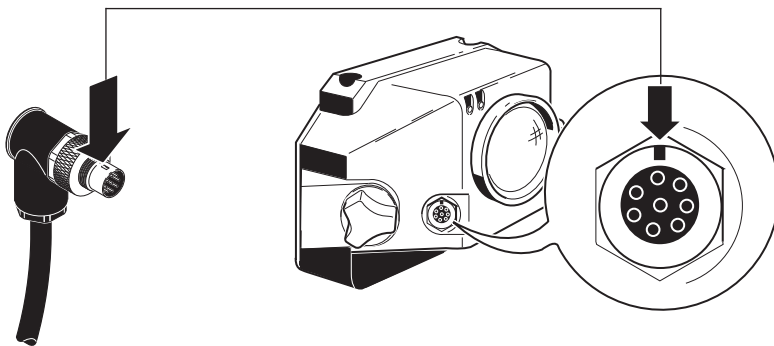
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2.6 Mounting and setting up the sensor

The universal pointer bracket system [delivered as ALI 2.720 SET / ALI 2.721 SET / ALI 2.722 SET / ALI 2.720 FSET / ALI 2.721 FSET / ALI 2.722 FSET] is used to mount the sensor on either magnetic or nonmagnetic bores.

Note

2.6.1 A brief description of how to mount the sensor for measurement

a. To mount the sensor for measurement, select the appropriate bore mounting base (for detailed information refer to the Universal pointer bracket ALI 9.850.G).

b. Mount the pre-assembled sensor holder onto the magnetic base.

c. Insert the appropriate plunger through the top of the sensor holder. Make sure it does not stick too far out, then hold it in place using the thumbwheel.

d. Slide the sensor onto the sensor holder then tighten the locking knobs. Leave the sensor dust cap on for now. The assembly is now ready to be inserted into the bore to be measured.

It is important that the magnetic base seats properly on the bore. To ensure this, at least half of the cylindrical magnetic base should be positioned in the bore.

Note

e. It is recommended you make the first measurement on the bore that is furthest from the laser. This will minimise the influence of laser beam drift during the course of the complete measurement process.

f. Press the top of the sensor holder against the loaded spring then engage the locking pin. Engaging the locking pin enables the centring of the rotation axis.

g. With the locking pin still engaged set up the sensor by moving only the sensor holder, such that the laser strikes the sensor dust cap in the centre.

Check to ensure that the laser always strikes the centre of the dust cap when the sensor is rotated through 360°. If not, readjust the height of the sensor holder. If this does not help, carry out a new laser set-up. Repeat this quick laser set-up check procedure at the closest bore and any other bore further down the line to ensure that the laser is properly adjusted along the assembly.

Note

Detailed mounting procedures are to be found in the Universal pointer bracket operating instructions ALI 9.850.G.

Chapter 3: CENTRALIGN Ultra Standard application

3.1 Switching on ROTALIGN Ultra computer

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

Use the navigation keys to highlight the 'Bore Alignment icon. With the icon highlighted, press (Enter) to start the application.

If the bore alignment firmware has not been licenced, on pressing (Enter), a hint to enter the registration key through the licence manager will appear as shown below.
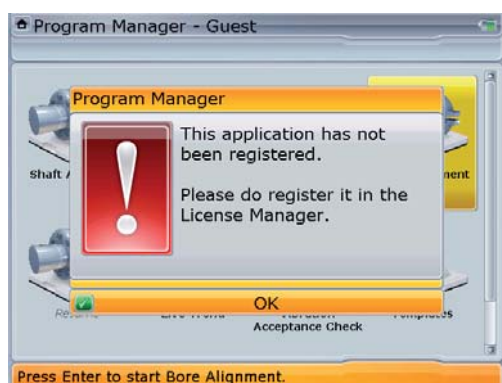
Press (Enter) to access the licence manager.

Use (△) / (▽) to highlight 'Bore Alignment'. Press (Enter) then proceed to enter the registration key for the application in the editing box. The registration key (license code) is contained in the CENTRALIGN Ultra Standard firmware registration certificate ALI 4.746.
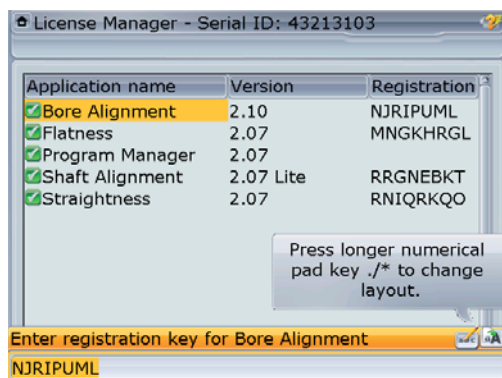
The required registration key (licence code) is obtained after filling out and returning the CENTRALIGN Ultra Standard firmware voucher ALI 4.736 to PRÜFTECHNIK Alignment Systems or your local representative.

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

The "bore alignment" firmware is available in three different levels depending on option purchased and licenced. The three levels are CENTRALIGN Ultra Standard, Advanced and Expert. The CENTRALIGN Ultra Advanced and Expert licences are valid for one year and can be renewed, free of charge, by your approved PRÜFTECHNIK representative. For more details on the CENTRALIGN Advanced and Expert functionalities please refer to the CENTRALIGN Ultra Expert Getting started DOC 04.800.en.

Note

3.2 Set up machine

After starting the bore alignment application, the screen below appears. Use the navigation keys to highlight action to be carried out. To create a new file, select 'Bores setup...'.
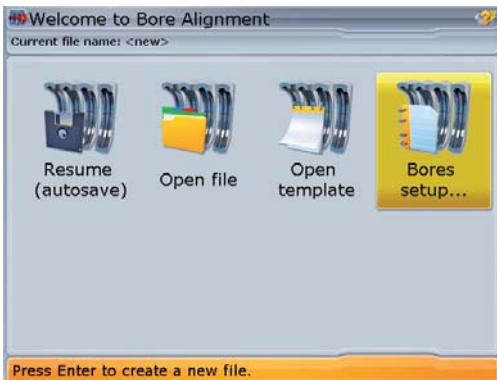
Press ⊙ to confirm selection. An empty file to be used to set-up a machine appears.
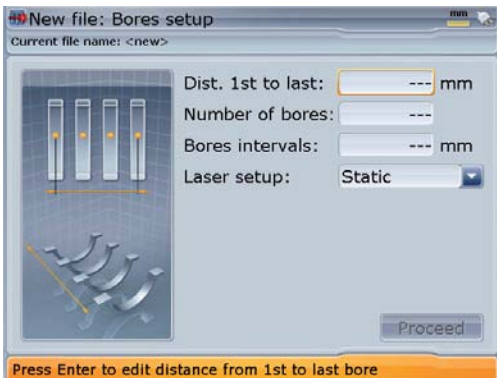
Enter the total length over which measurements are to be made on the workpiece, then enter the number of locations to be measured along the total length.
The computer calculates the interval between the locations.

Alternatively, 'total length and interval' or 'interval and number of locations' may be entered. The computer then calculates the missing entry.
The maximum number of locations that can be measured is 60.

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 value using the data entry keys then press either ⊙ or ⓣ to confirm entry.

After all fields required to create a new machine have been completed out, the highlighting box jumps automatically to 'Proceed'. Press ⊙ to confirm selection. An overview screen of the configuration appears.
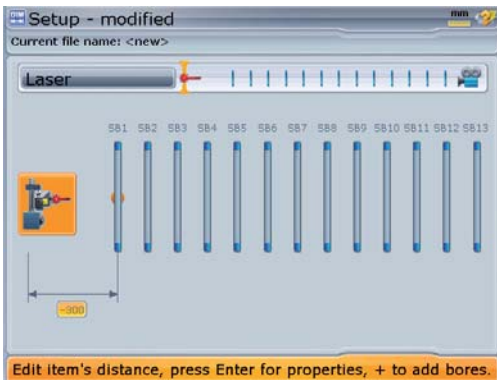
3.3 Defining the measurement locations

For clarity, measurement locations can be labelled and defined appropriately. To carry this out, proceed as follows:

a)   Use the navigation keys to highlight location to be defined.

b)   Press (Enter). The 'Element properties' screen appears.
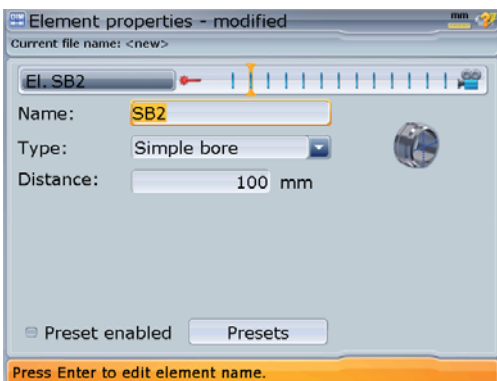
c)   The properties – 'Name', 'Type of bore', 'Distance from the reference position' 'Presets' are selected using the navigation keys.

d)   To allocate a name to the location, use the navigation keys to highlight the 'Name' box and then press (Enter).
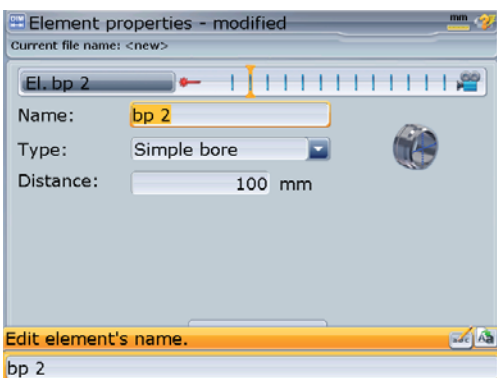
e)   The editing box appears and the name is entered using the data entry keys. Press either (t) or (Enter) to confirm the new name. On confirmation, the new name appears in the 'Name' box.

f)   To select type of bore, use the navigation keys to highlight the 'Type' box then press (Enter). The drop-down menu appears.

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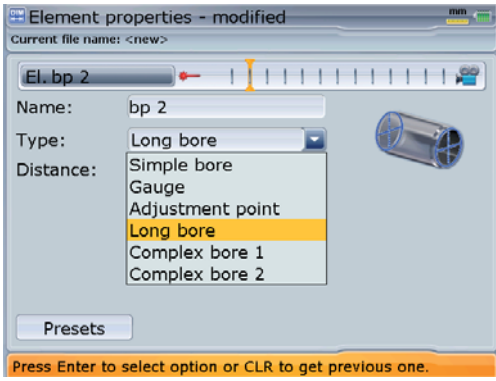
g) Use either △/▽ to select type of bore. Confirm selection by pressing either ① or (Enter).

h) To edit the distance between the measurement location and the laser reference line, use the navigation keys to highlight the 'Distance' box. Enter the distance in the editing box that appears, using the data entry keys. Press either ① or (Enter) to confirm entry.

3.4 Presets

Presets are used to compensate for thermal growth in bearing shells, or shaft sag in bores. Since the machines are aligned cold and stationary, it is quite common for the alignment to change when the machine is hot and running. The manufacturer may supply the required values.
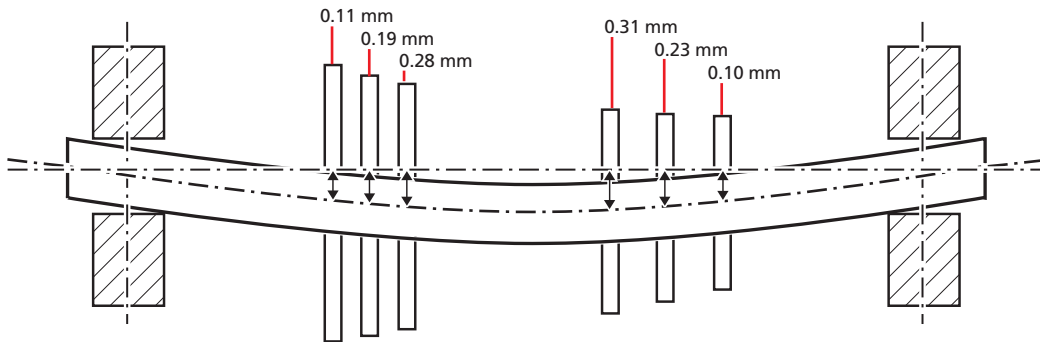
In this example, shaft sag is known precisely for all gas turbine diaphragm locations.

a) If presets are used and the values are to be entered for calculation, use the navigation keys to highlight the button 'Presets'.
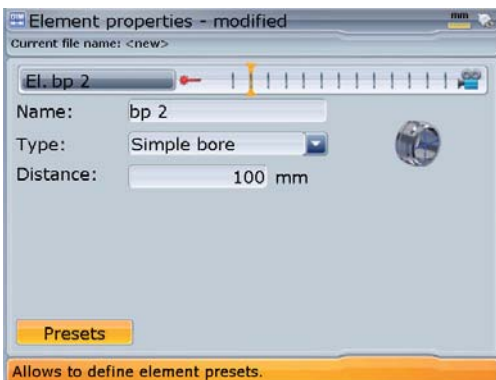
b) Confirm selection by pressing (Enter). This action opens the 'Element presets' screen, where the appropriate vertical and horizontal preset values are entered.
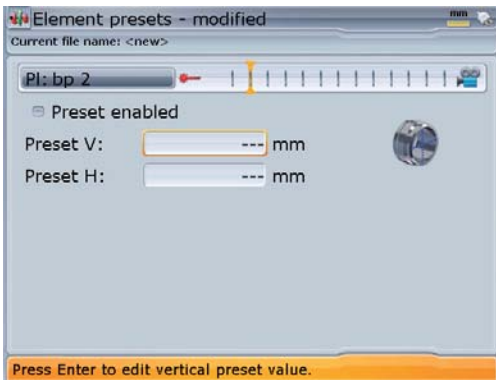
Presets are disenabled by unchecking the 'Preset enabled' box. Use the naviagtion keys to highlight 'Preset enabled' then press (Enter).

3.5 Types of bores

3.5.1 Simple bore
This is a normal bore with one measurement plane.
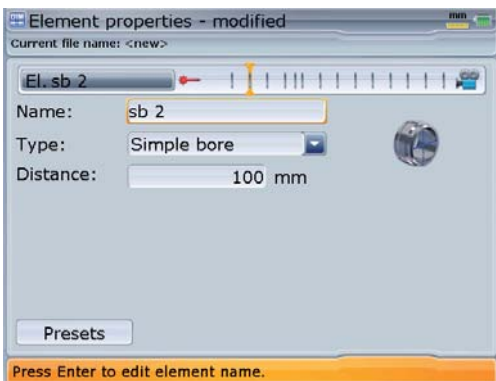
3.5.2 Gauge
A gauge is a machined reference surface e.g. workpiece split line. It has a vertical (Y) measurement value only.

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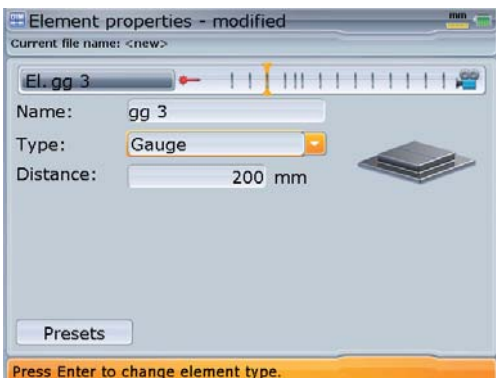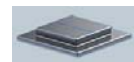
3.5.3 Adjustment point
An adjustment point that is not physically measured but used for correction purposes. This could be a jacking point. When displaying results, the value at an adjustment point indicates the distance between an optimised line (a line joining the bores you have fixed) and the rotating centerline. This distance can then be used for aligning the cutting machine with the block being measured.

Adjustment points are shown on the dimensions screen as this symbol (▮).
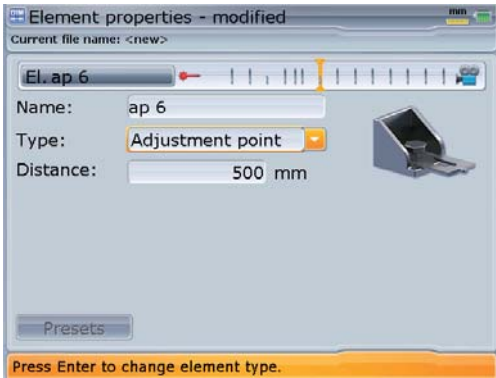
3.5.4 Long bore
A long bore is defined as two rigidly joined simple bores a short distance apart, such a cylindrical bore that can be measured at both ends.
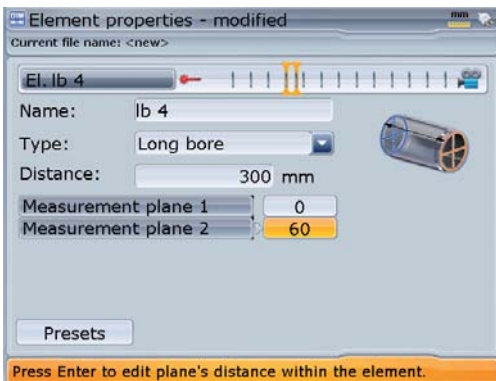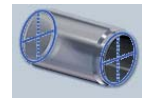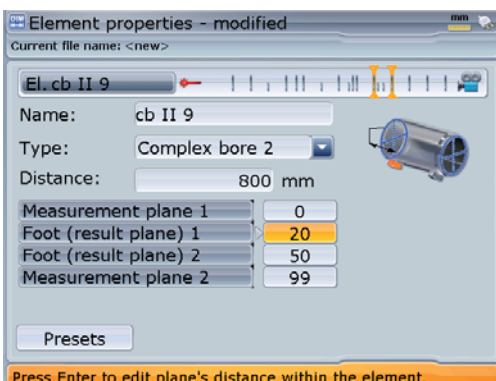

3.5.5 Complex bore
A complex bore is a 'long' bore with freely definable adjustment points (usually jacking points). The adjustment point can also be referred to as a results plane.
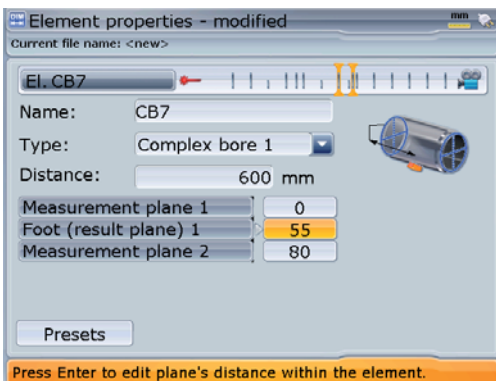
The complex bore shown has a single result plane (RP). The result plane is 55 mm from the first measurement plane (MP). The second measurement plane is 80 mm from the first MP, which is always designated the value 0 and cannot be edited.

The complex bore shown opposite has two result planes. The first results plane (RP) and the second are RP are 20 mm and 50 mm from the first measurement plane (MP) respectively.

The second measurement plane is 99 mm from the first MP, which is always designated the value 0 and cannot be edited.

3.6 Creating a multi-element machine block

It may be necessary to consider several bore elements as a single block. To create such a unit proceed as follows:

i) Set up the elements as described in section 3.2.
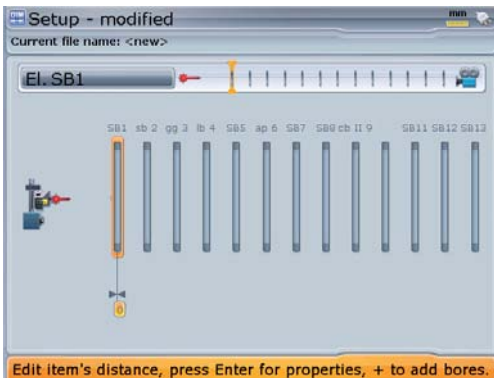
ii) Press (Menu) to prompt the set-up screen context menu.
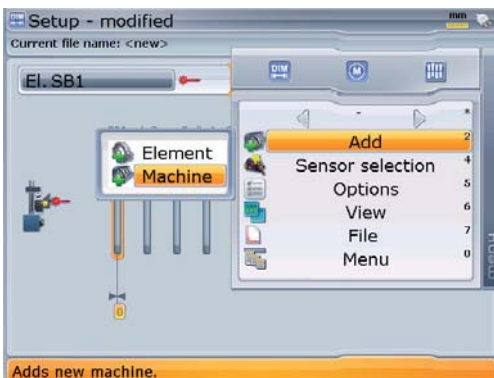
iii) Use the navigation keys to highlight 'Add' -> 'Machine'. Press (Enter) to confirm selection. The 'Group properties' screen appears. Proceed to edit the machine block name and the elements that form the block.
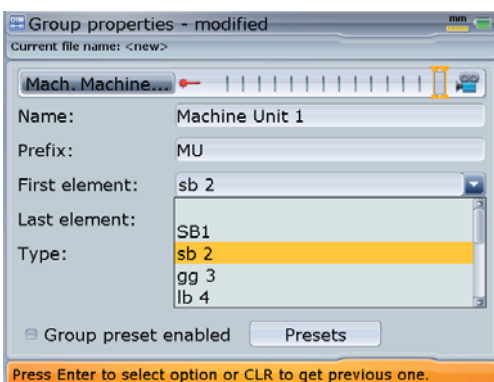
iv) After selecting the first and last element, press (t). A screen with an overview highlighting the configured block appears.
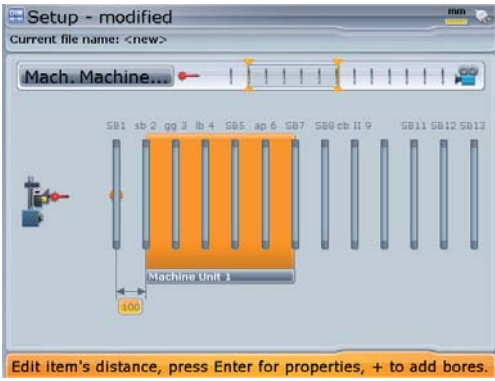
The screen opposite shows all the machine elements with the block elements sb2, gg3, lb4, ap6 und SB7 highlighted.
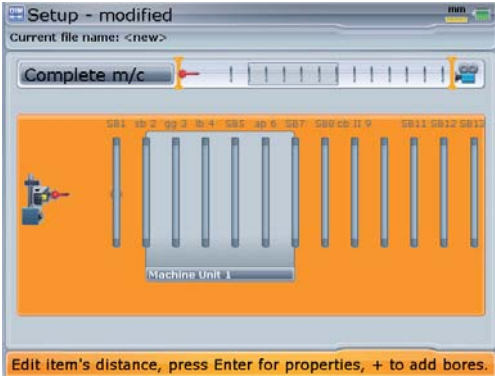
The screen opposite shows all the machine elements including Unit 1, highlighted. Unit 1 is a block comprising the elements sb2, gg3, lb4, ap6 und SB7.
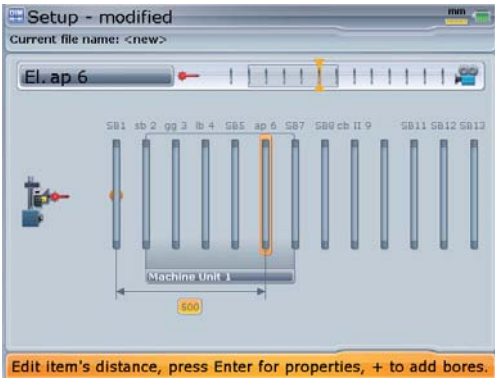

The screen opposite shows the element ap6 highlighted. The element belongs to the block Unit 1.

3.7 Using predefined machine templates

Predefined machine set-ups may be used if available. To create machine templates, please refer to the section 'Creating templates' in the ROTALIGN Ultra Shaft handbook ALI 9.855.en.

Templates if available may be opened as followings:

i)   After starting the bore alignment application, use the navigation keys to highlight the icon 'Open template'.
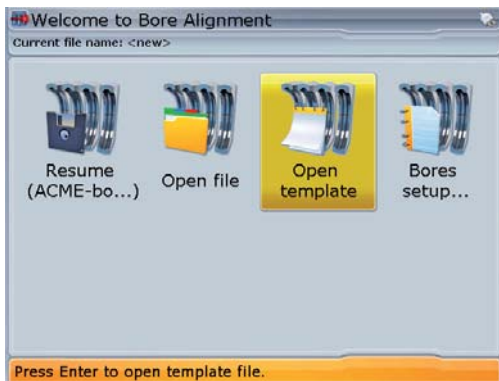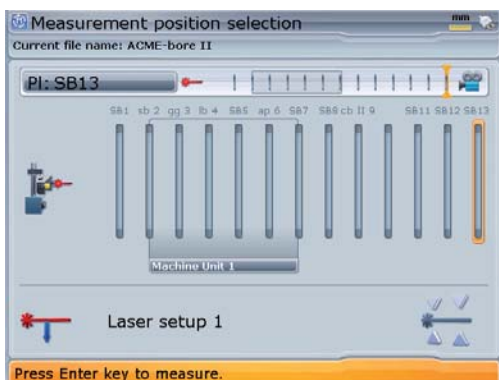

ii)   Press (Enter) to confirm selection. The 'Open template' screen appears, and the desired template may be selected.
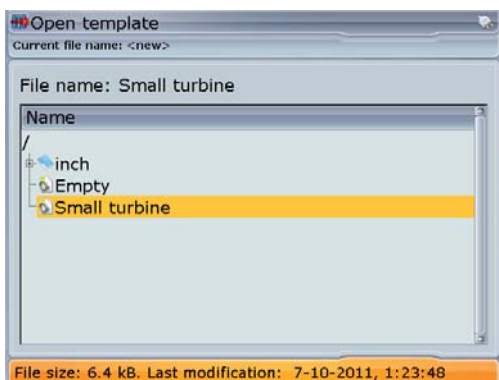
3.8 Selecting method to collect measurement data

After setting up machine configuration, press (M) to enter the measurement screen. Use ▷/◁ to highlight the element farthest from the laser.
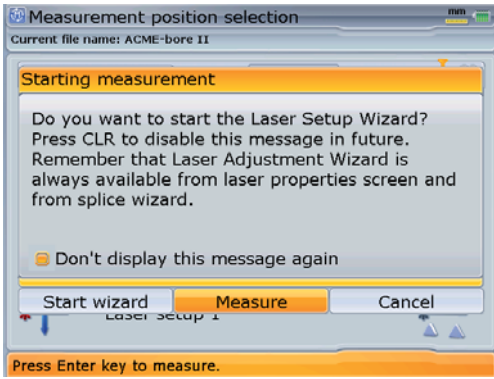

To minimize potential laser drift, start by measuring the farthest bore and progress towards the direction of the closest bore.

Press (Enter) to start measurement.

If the 'Start Laser set-up Wizard' has not been suppressed, the screen with the 'Start wizard' hint (see next page) appears. If however, the message has been suppressed, then the laser adjustment screen appears.

Checking the 'Don't display this message again' suppresses permanently, the automatic starting of the laser adjustment wizard.

If proceeding from the 'Start measurement' hint screen, use ▷/◁ to highlight 'Measure'. Press (Enter); the laser adjustment screen appears.
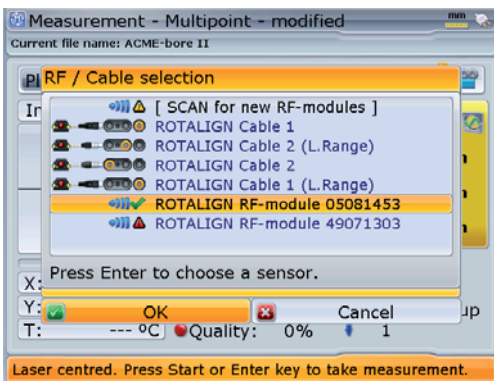
> If the laser beam had already been set up as described in chapter 2 section 2.4, please ensure that the laser remains untouched.

Note

While in the laser adjustment screen, press (Menu). The context menu appears. Use △/▽ highlight the menu item 'RF/Cable'.
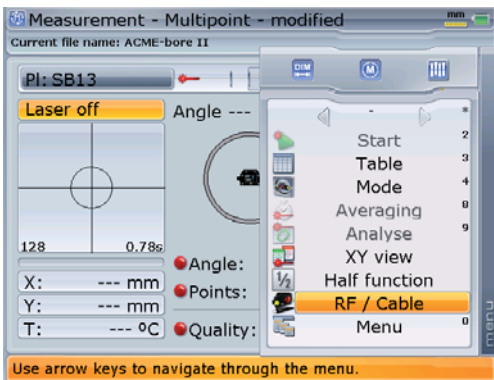
With the menu item 'RF/Cable' highlighted, press (Enter) to confirm selection. The 'RF-module selection' screen appears.

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If using an RF module that is not listed, highlight 'SCAN' using △/▽ then press (Enter) to scan the neighbourhood for any PRÜFTECHNIK RF modules. If using an RF module that appears on the list, simply highlight it using △/▽ then press (Enter).
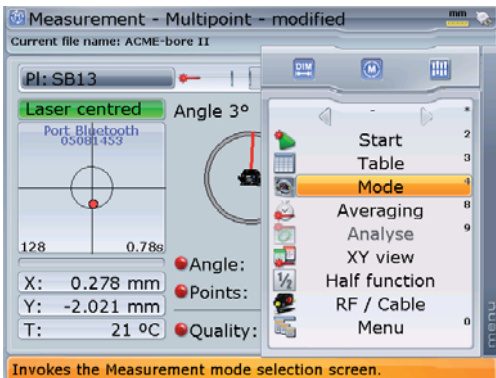
Use △/▽ to highlight the method to be used in collecting data. The default data collection method is using the RS 232 port.

After highlighting required data collection method, press (Enter) to confirm selection.

3.9 Selecting the measurement mode

While in the laser adjustment screen, press (Menu). The context menu appears. Use (△)/(▽) to highlight the menu item 'Mode'.

With the context menu item 'Mode' highlighted, press (Enter) to confirm selection. The 'Measurement modes' screen appears. Use the navigation keys to highlight the desired measurement mode. Multipoint mode is the default mode.
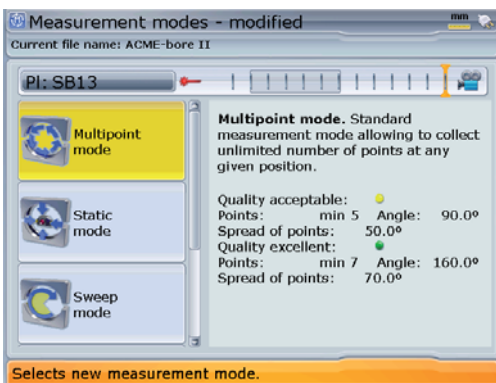
Confirm selection by pressing either (t) or (Enter).

3.9.1 Measurement modes

Multipoint measurement mode is the default setting, and is suitable for most measurements. In this mode, the sensor is manually positioned and measurements taken by pressing (Enter). The measurement angle is determined by the built-in electronic inclinometer.

Sweep mode is suitable for applications where the surface to be measured allows the continuous rotation of the tip of the bracket plunger through a large enough angle.

Static mode is used for vertically mounted applications. In this mode, the sensor is positioned manually at 0°, 90°, 180° and 270° locations. The measurement angle is determined manually.

Absolute mode is intended for 'Straightness' type measurements and also to compare split lines to bore centerlines. The laser beam is measured directly without calculating bore centerpoints.

Manual measurement involves the inputting of V and H values relative to the reference centerline.

Note that you can mix measurements from the first three modes, but ABSOLUTE can only be selected for the first measurement for a given laser set-up.

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3.10 Taking measurement

With the sensor mounted on the universal pointer bracket, ensure that the bracket is fixed properly on the farthest bore, and the sensor dust cap is removed. If the laser set-up was carried correctly as described in chapter 2, the measurement screen as shown below, with the laser beam centred, appears.
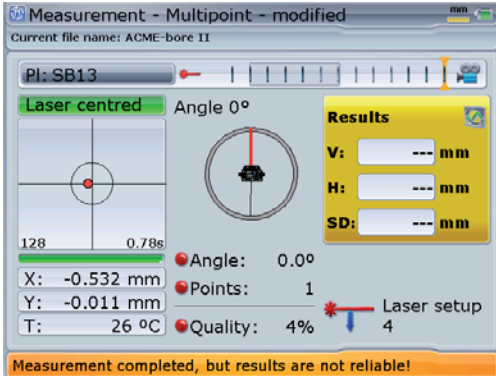
To minimize potential laser drift, start by measuring the farthest bore and progress towards the direction of the closest bore.

Check to ensure that the laser remains centred [laser OK, sensor LED blinks green] when the sensor is rotated through 360°. Repeat this quick laser set-up check procedure at any other bore further down the line to ensure that the laser is properly adjusted along the assembly. If not, readjust the height of the sensor holder. If there is no improvement, carry out a new laser set-up as described in section 2.3.

Remember to reposition the sensor assembly in the farthest bore before starting measurement.

Note

Position the plunger such that its tip touches the bore to be measured at the 12 o'clock position and secure. Disengage the locking pin. The sensor must not be moved. The first measurement point may now be taken.
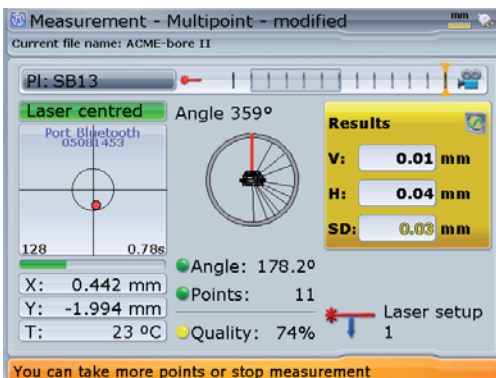
Actual bore measurement

Ensure the laser remains untouched.

This particular measurement will be carried out using the 'Multipoint' measurement mode and data will be collected via the Bluetooth RF module.

Note

a. With the bracket assembly placed properly in the bore to be measured (bore farthest from laser to be measured first), and the plunger touching the first point to be measured (please refer to ALI 9.850.G 'Universal pointer bracket operating instructions'), press (Enter 0). The first measurement is noted.
b. Rotate the assembly to the next point of measurement as described in ALI 9.850.G. Check that the beam is still on screen. Press (Enter 0) to take measurement.
c. Repeat step b until the angle covered is wide enough (this is determined by the colour of the circle next to 'Angle'), and enough measurement points are taken (denoted by the colour of the circle next to 'Points').

Note that the V and H values displayed in the measurement results frame indicate the bore centre in relation to the laser. As in most of the cases, the laser is not the reference for the results, these values must not be used as final results but only for information. The final results will be displayed in the results screen.

Note that quality is depicted with following colour codes:
● — good
● — acceptable
● — poor

> **Note**
>
> The standard deviation (SD) and quality of measurement are factors to be observed during measurement. The two factors are displayed on the measurement screen using the following colour codes: green [good], yellow[acceptable] and red[poor]. It is also important that the standard deviation be at least acceptable (yellow). Quality of measurement is a combination of all measurement factors and should also be at least acceptable (yellow). For details on measurement quality please refer to section 3.11.2.

d. After taking enough measurements, press ⓣ to stop measurement. Alternatively, press ⓜₑₙᵤ to prompt the context menu, then use △/▽ to highlight the menu item 'Stop'.
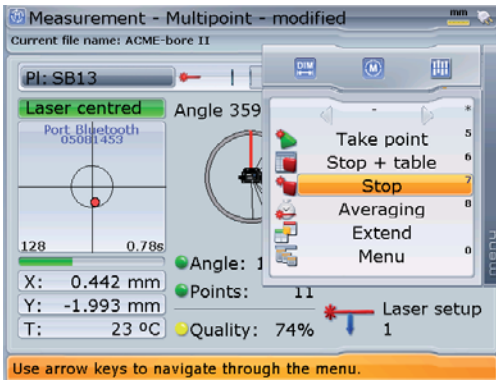
e. Press ⓔₙₜₑᵣ to confirm stopping measurement.

> **Note**
>
> If a hint appears stating that measurement is of poor quality, check the stability of the brackets holding the sensor. It may be necessary to carry out the laser set-up once again.

f. After stopping measurement, select the next bore by pressing ▷/◁ long enough.
    Alternatively, press ⓜ to return to the 'Measurement position selection' screen and use the navigation keys to select the next bore.
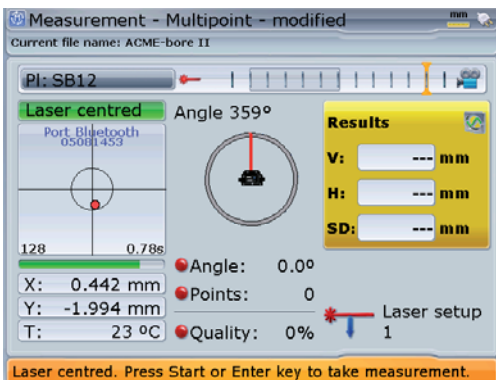

g. Remount the sensor on the selected bore and repeat the measurement procedure. Repeat for each bore.

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Extend function

This function is used to ensure that bores are measured regardless of the degree of ovality. In extreme cases, when the sensor bracket is rotated, the laser dot may travel outside the detector central circle, but remain within the detector outer square. In such cases, use is made of the 'Extend' function.

i)   Press (Menu) to open the 'Measurement' screen context menu. Use △/▽ to highlight the menu item 'Extend'.
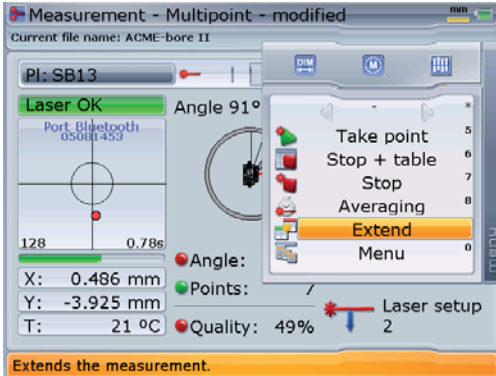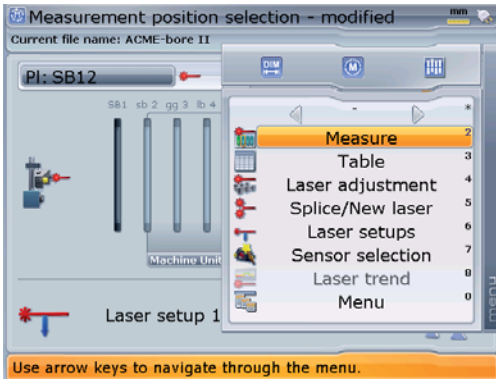

ii) Confirm selection by pressing (Enter).
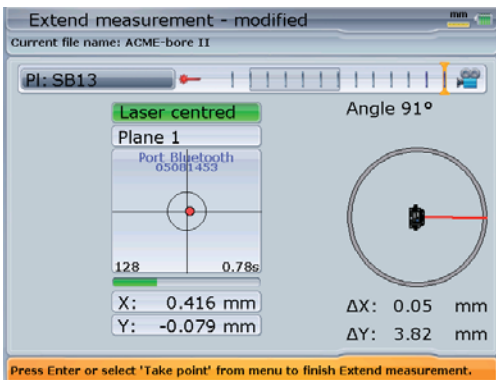
iii) Move the sensor so that the laser dot is at the centre of Plane 1.

iv) With the laser dot centred, press (Enter) to take measurement at the extended position.

v)   Their is no physical limit to the number of times the Extend function may be applied.

3.11 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.
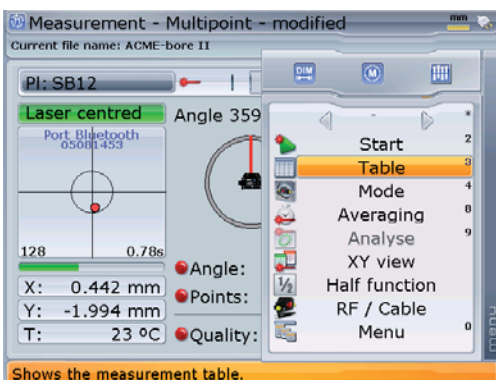

3.11.1 'Measure'

a) Use (△)/(▽) to highlight the menu item 'Measure'. Confirm selection by pressing (Enter). The laser adjustment screen shown below appears.
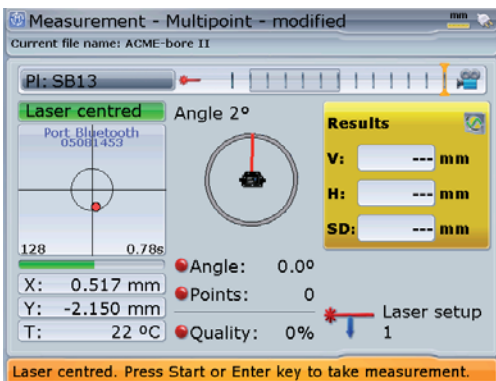
3.11.2 'Table'

a) Use (△)/(▽) to highlight the menu item 'Table'. Confirm selection by pressing (Enter). The measurement table appears.

Measurement mode — Measured (V,H) beam coordinates — Standard deviation — Quality of measurement — Averaging setting used — Date & time of reading

	Mode	Points	V[mm]	H[mm]	Std.dev.[mm]	Quality[%]	Laser stability	V drift	H drift	Averaging	Laser setup	Sensor	Date
1		10	-0.26	-0.04	0.54	49		---	---	128	Laser setup 1	5402	5-12-
2		11	0.07	0.05	0.06	49		---	---	128	Laser setup 1	5402	5-12-
3		15	-0.00	0.00	0.03	49		---	---	128	Laser setup 1	5402	5-12-
4	✓	11	0.01	0.04	0.03	74		---	---	128	Laser setup 1	5402	5-12-

Measurement points taken

| Avg: | | | 0.01 | 0.04 | 0.03 | 74 | Composite reading | | | | | | |

Press Enter to select/unselect measurement for averaging. Enter to select/unselect measurement for averaging.
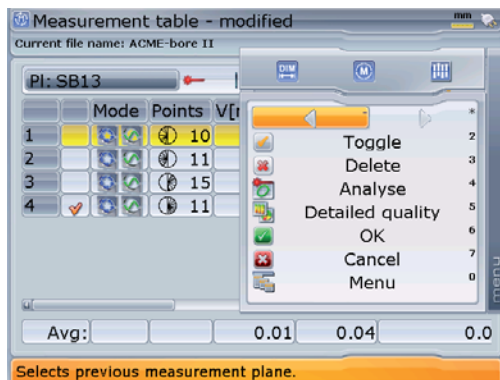
Measurements selected for averaging

Laser set-up number — Last 4 serial number digits of sensor used

The table can be scrolled from top to bottom and vice versa using △/▽, or from left to right and vice versa using ▷/◁.

b) The measurement table has the important function to check measurement repeatabilty. It shows a list of measurements taken, and the measurement mode used at the given plane. The measurements can be averaged for greater accuracy. A check mark appears next to all measurements selected for averaging. This composite reading appears in the bottom row of the table.

c) The measurement table context menu allows the checking, unchecking and deletion of measurements. Raw measurement data can be analyzed, and measurement quality reviewed.
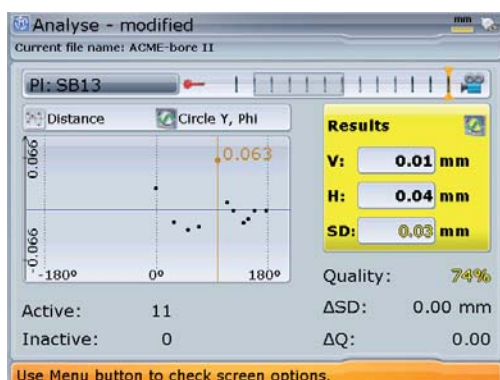
Measurement table - modified
Current file name: ACME-bore II

PI: SB13

	Mode	Points	V[
1		10	
2		11	
3		15	
4	✓	11	

Toggle
Delete
Analyse
Detailed quality
OK
Cancel
Menu

Avg: 0.01 0.04 0.0

Selects previous measurement plane.

The context menu items 'Toggle', 'Delete', 'Analyse' and 'Detailed quality' are accessed by highlighting the respective item using either △/▽ then pressing Enter.

The context menu item 'Toggle' is used to check or uncheck the selected measurement, an action that influences the average reading.

The context menu item 'Delete' is used to delete the highlighted measurement. On pressing Enter, a dialog window with the hint to confirm deletion appears. Use ▷/◁ to highlight 'Yes' and the press either ⊥ or Enter to complete deletion.

The context menu item 'Analyse' opens the measurement ellipse which is a deviation diagram showing the roughness of the measured surface. To improve the quality of the measurement, it may be necessary to deactivate measurement points that deviate severely from other measurements taken.

Analyse - modified
Current file name: ACME-bore II

PI: SB13

Distance   Circle Y, Phi

0.063

Results
V: 0.01 mm
H: 0.04 mm
SD: 0.03 mm

-180°   0°   180°

Quality: 74%
Active: 11   ΔSD: 0.00 mm
Inactive: 0   ΔQ: 0.00

Use Menu button to check screen options.

The deviation diagram shows the measurements on the bore circumference. The blue horizontal line represents the best fit circle. The brown vertical line indicates measurement currently selected. The value is 0.063 mm and the SD is 0.03 and the measurement quality is 74%.

Measurement points that may be deactivated often include welded surfaces. Points to be deactivated are highlighted using ▷/◁. With the point highlighted, press (Enter) to confirm deactivation.
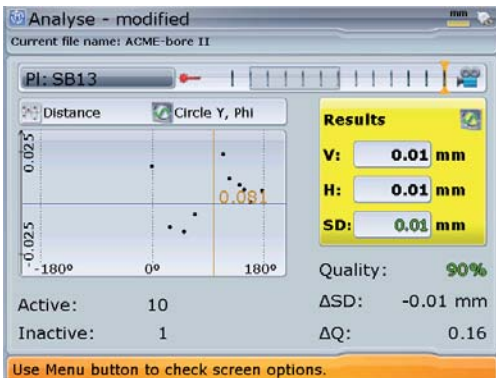

The point selected in the previous screen has been deactivated. Both the SD and the measurement quality have improved to the green zone. If the deactivated point falls within the scale of the deviation diagram, it appears as a tiny "o" and not a dot.

The "Analyse" screen context menu item 'Sensor on/Sensor off' may be used to activate the sensor in order to establish bore angular positions that may require detailed analysis. Such locations may possess extremely rough surfaces.
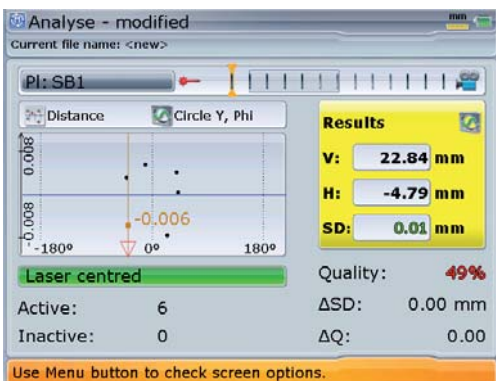
With the sensor activated, the red position marker appears on the screen to show the current position of the plunger on the bore surface. By rotating the sensor one is able to track back to the exact angular position that needs examining.

The context menu item 'Detailed quality' is used to view a detailed description of the quality of the measurement currently selected. This may be displayed as either bar charts or in table format.
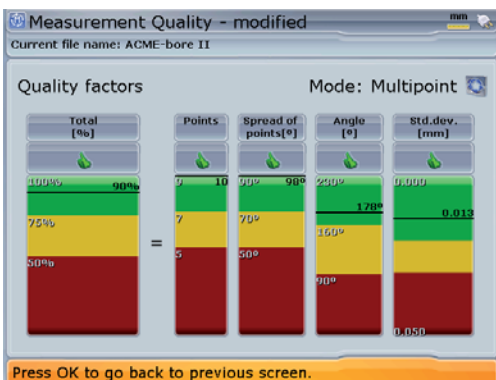
The bar chart displays all the factors considered in determining measurement quality. The factors are categorized in three colour-coded degrees – red [poor], yellow [acceptable] and green [good]. The actual influence of each factor is indicated by the black line across the bar, with the corresponding value appearing above the line.

The measurement quality table displays the same information as the bar chart. The categories of the factors are in this case numerically displayed. To change from table to bar chart and vice versa, use the "Measurement Quality" screen context menu item 'Type'.

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3.11.3 'Laser adjustment'

a) The context menu item 'Laser adjustment' is used to start the laser beam adjustment wizard. Use △/▽ to highlight the context menu item 'Laser adjustment'.
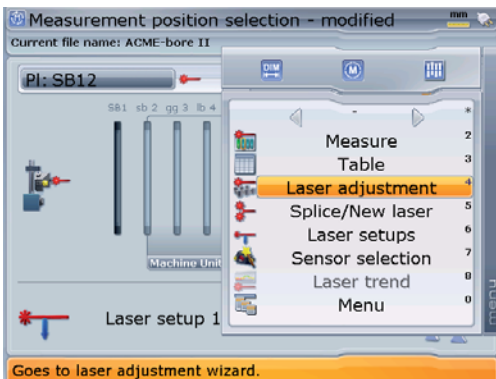
If the context menu item 'Laser adjustment' is selected for a measurement file that already has measurements, a hint will appear requesting use of the splice function.

b) With the item 'Laser adjustment' highlighted, confirm selection by pressing (Enter). The laser beam adjustment wizard opens.

c) Start the wizard by pressing (Enter) with the 'Start' button highlighted.

> The steps within the laser beam adjustment wizard are to be found also in chapter 2 section 2.4 of this manual as well as in the universal pointer bracket manual ALI 9.850.G.

Note

3.11.4 'Splice / New laser'

a) The context menu item 'Splice/New laser' is used start the splicing function or start new measurement should the type of laser set-up change.
The splicing function allows new measurements to be added to existing ones should the sensor be moved or measuring be interrupted.
Use △/▽ to highlight the menu item 'Splice/New laser'.
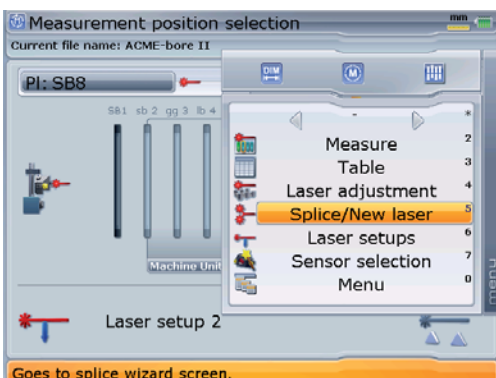
For more information on the splice function see page 40.

b) With the context menu item 'Splice/New laser' highlighted, pressing (Enter) to confirm selection starts the splicing wizard.

3.11.5 'Laser set-ups'

a) The context menu item 'Laser set-ups' is used to display the number of laser set-ups used in the measurement.
Use ⟨△⟩/⟨▽⟩ to highlight the context menu item 'Laser set-ups' the confirm selection by pressing ⟨Enter⟩.
You may refer to chapter 2 section 2.3 for details about laser set-ups.

3.11.6 'Sensor selection'

a) The context menu item 'Sensor selection' is used to access the screen where the measurement sensor
properties may be edited. Use ⟨△⟩/⟨▽⟩ to highlight the menu item 'Sensor selection'. Confirm selection by
pressing ⟨Enter⟩. The "Sensor selection" screen opens.
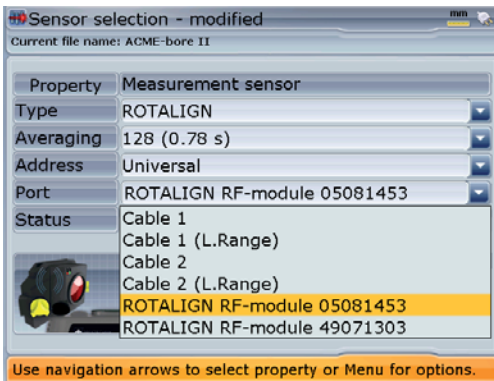
3.12 Evaluating results

RES

After all bores have been measured, press (RES) to view and analyse the alignment condition of the assembly. The results are displayed either as a graphic display or in a tabular format.

To be able to effectively analyse the measurement results, it is important to comprehend the symbols and context menu items used in the results screen.
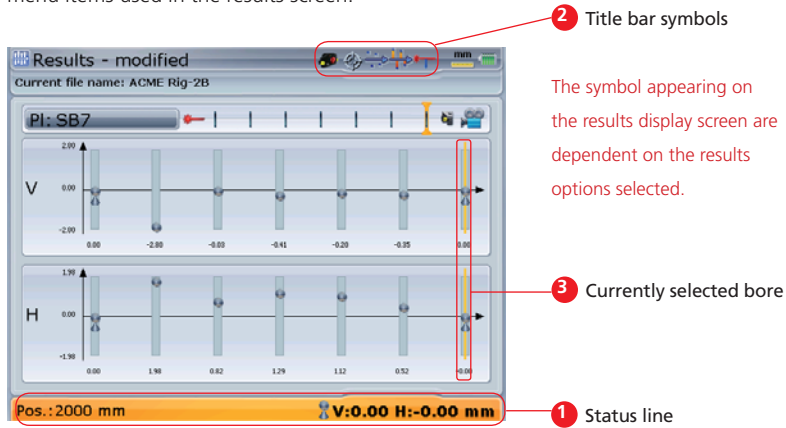
2 Title bar symbols

The symbol appearing on the results display screen are dependent on the results options selected.

3 Currently selected bore

1 Status line

3.12.1 Results screen symbols

1 The **Status line** shows the bore position currently highlighted and its distance from the defined 0 reference position. It also shows the status of the bore (whether fixed or moveable), and the vertical and horizontal bore centre values relative to the chosen reference axis. The status line symbols are defined as follows:

▶ measured moveable element

▶ measured fixed element

▶ moveable element (no measurements)

▶ fixed element (no measurements)

Any two elements may be fixed to zero to set a reference. To fix or unfix an element, highlight the element using ▷/◁ then confirm by pressing (Enter ⊙).

In practice, the most useful display is obtained by fixing the first and last bores to zero. The centerline will be the line joining the two fixed points.

If more than two points are fixed, the centerline is the line best fitting the fixed points.

If the laser is used as the reference axis, the centerline does not necessarily pass through the fixed points.

2 The **Title bar symbols** show whether the highlighted element has been measured, or if the displayed results take presets into account, the manner which the results have been displayed, or the results have been optimized, or the laser set-up used. The title bar symbols are defined as follows:

▶ indicates that actual measurements have been taken into account

▶ indicates that presets have taken into consideration

▶ denotes that the results have been displayed using the absolute format. This shows the actual position of each plane

▶ denotes that the results have been displayed using the differential format. This view displays the alignment of every three successive bores. In a succession of three bores, the first and the last bores are joined together by a straight line. The distance between the middle bore and this straight line is displayed. If the three bores are aligned, the value is zero. This view is used for checking bending tolerances on diesel engine crankshafts

▶ denotes that the results have been displayed using the long bore angles format. This format is used to determine how a long bore element is aligned respective to other elements within the configuration

▶ the displayed results are scattered about the reference line which happens to be the laser beam

▶ the displayed results have been optimized and form the best-fit line through all points

▶ denotes that the reference axis is a static laser line

▶ denotes that the reference axis is a rotating axis

> The title bar symbols do not all appear at the same time but depending upon the results options selected.

❸ If an element is **currently selected** the measurement results and the element's characteristics appear on the status line.
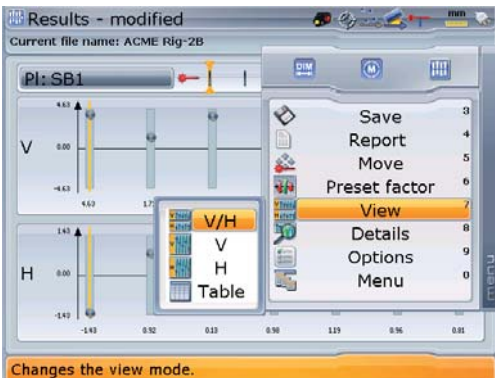
3.12.2 Results context menu items

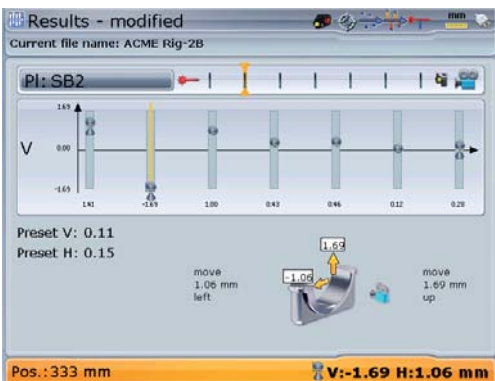The context menu items are accessed by pressing (Menu) while in the results screen. Use (△)/(▽) to highlight the required menu item.
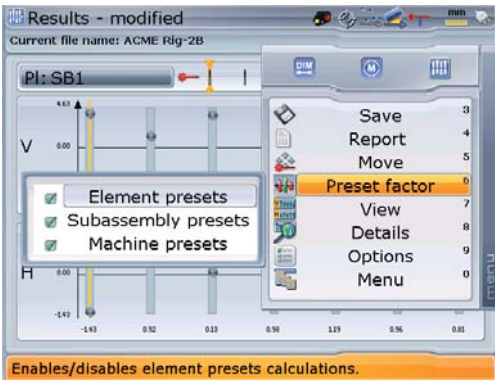
The context menu item 'Preset factor' is used to assign type of presets taken into consideration when displaying results. Any combination of presets is possible.

The context menu item 'Save' is used to save the measurement file or save it under a new name.
The context menu item 'Report' is used to print either the short or long form of the measurement report. If PDF printer is selected, the report is saved as PDF.

The context menu item 'View' is used to display the results in a zoomed single plane or both planes or in tabular format.

The context menu item 'Details' toggles with the context menu item 'No details'. When 'Details' is selected, the name of the selected element/ sub assembly or entire machine is displayed as well presets.

The displayed details depend on the set results options which are accessed via the context menu item 'Options'.

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The 'Options' menu item opens the "Results options" screen, and is used to set results relative to presets, specify points used to calculate a best-fit reference line, the display format and the reference centerline.
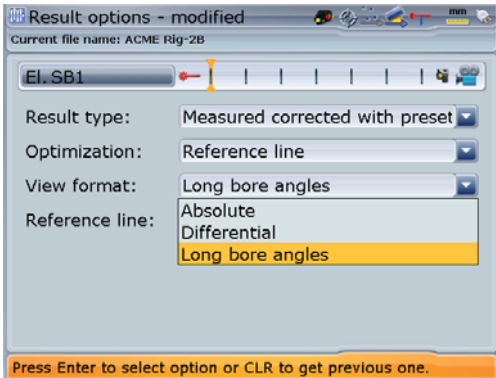
The following are the options available for displaying results:

Results type:

Presets are values used to compensate for thermal growth, and are entered when configuring bore dimensions. Results may be displayed with one of the following taken into consideration:

▶ Measured values only : Displays the 'cold' alignment without presets

▶ Preset data only : Displays just the preset values

▶ Measured values minus presets : Displays the 'hot' alignment

Optimization:

▶ Optimise – calculates the best fit line through all points.

▶ Reference line – the laser line is the centreline

View format:

▶ Absolute – displays the bore centres as read directly using the centerline optimization mode selected

▶ Differential – shows bore centre relative to a straight line between its two adjacent bores. This is for checking bending tolerances on diesel engine crankshafts

▶ Long bore angles – (long/complex bores only) On the left hand bore plane, the V/H coordinates are displayed as usual. For the right hand bore plane, the vertical and horizontal angular misalignment is calculated and displayed

Reference line:

Static laser line – the centerline is the static laser beam line [see static laser set-up in section 2.4.1]

Rotating laser axis – the centerline is the same as the shaft axis to which the laser is attached [see rotating laser set-up in section 2.4.2]

3.13 The live MOVE

After all bores have been measured and results analysed, it may be necessary to correct misalignment. Corrections are performed with the help of CENTRALIGN Ultra Standard Live Move mode. Proceed as follows:

a. After determining the position of the configuration elements relative to the selected reference centerline, use ⊳/⊲ to highlight the element to be moved for correction.
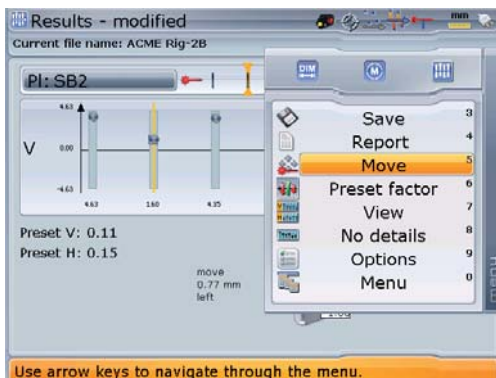

> The sensor must be placed centred on the bore moved using a magnetic base (and not the pointer bracket). The laser beam is centred on the red dust cap which is then removed before starting Move.

Note

b. Press (Menu). The context menu appears. Use △/▽ to highlight the context menu item 'Move'.

c. Press (Enter ⊙) to confirm selection. The move screen appears. Ensure the laser beam is centred.
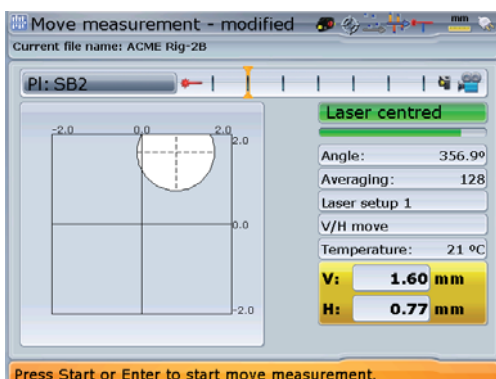
If the laser beam is not centred, press (Menu) to access the context menu item 'XY View', and use this option to centre the laser beam.

d. With the laser beam centred, press (Enter ⊙) to start live Move. Alternatively, press (Menu) then use △/▽ to highlight 'Start' from the context menu that appears (see next screen).
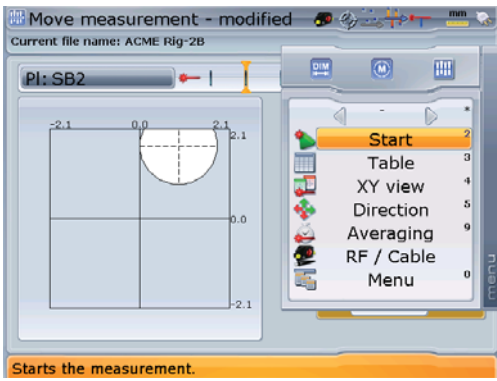
e. With the menu item 'Start' highlighted, press (Enter) to confirm selection. The 'Live Move' screen appears.
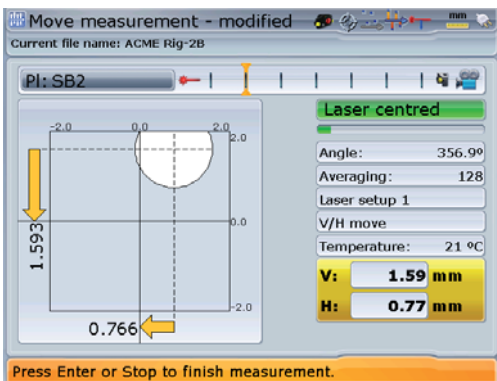

f. You may now start correcting the positioning of the element, by moving it in accordance with the vertical and horizontal adjustment arrows displayed on the screen. The element should be moved in both the horizontal and vertical planes as near to zero as possible.
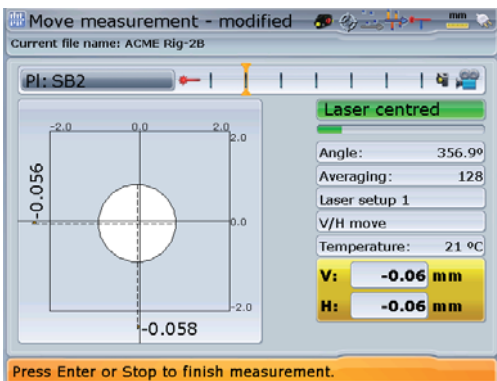
In the screen opposite, Move has been performed and the element centerline lies at -0.06 mm with respect to the chosen reference centerline.

It is possible to move to the next bore position from this screen by pressing ▷/◁ long enough.
One may return to the results screen by pressing (t).

g. After carrying out the necessary adjustments and satisfied with the correction, press (Enter) to finalize current measurement. Alternatively, press (Menu) then use (△)/(▽) to highlight 'Stop' from the context menu that appears.
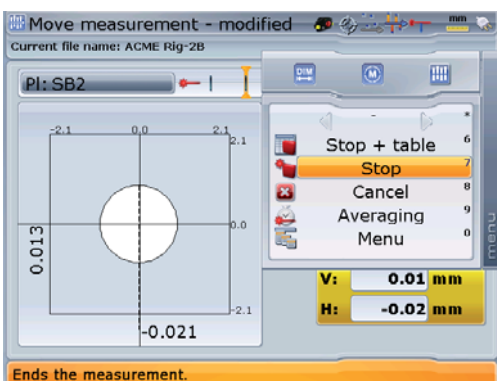
h. On returning to the results screen to review the results, the 'moved' plane is indicated by a rhombus as shown in the screen below.

One may return to the results screen from the live Move screen by pressing (t).

i. Repeat steps a-h for all elements whose positions require correction.

Complete the entire procedure by taking a final set of measurements to ensure that the results are acceptable.

Note

3.14 Saving files

3.14.1 Saving a measurement file

A measurement file can be saved at any time using the global menu. Open the global menu by pressing (Menu) twice. Use the navigation keys to highlight either 'File'/'Save as' or 'File/'Save' [depending on whether you are saving the file for the first time or saving it with changed particulars]. Confirm selection by pressing (Enter).
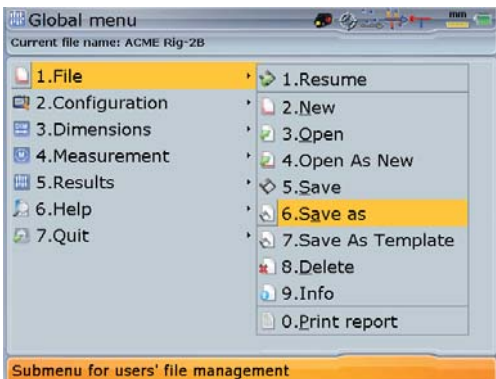
The save function may also be accessed via "Results" screen. While in "Results" screen, press (Menu) then use the navigation keys to highlight 'Save' followed by either of the two submenu options 'Save' or 'Save as' depending on whether you are saving the file for the first time or saving it with changed particulars.
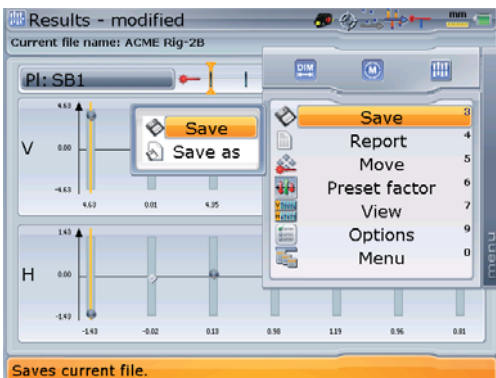
3.14.2 Saving report as PDF on a USB stick

i) Independent of screen currently open, press (Menu) twice to open the global menu.

ii) With the global menu open, use the navigation keys to highlight 'File'/'Print report'. Confirm selection by pressing (Enter). The "Report" screen opens.

> Ensure at this stage that the 'short' ROTALIGN Ultra USB/ peripheral devices cable ALI 12.503 is connected to the ROTALIGN Ultra USB port. Attach the especially approved PRÜFTECHNIK Alignment Systems memory stick (aka jumpdrive) ALI 4.451 into the 'short' USB cable.

Note

iii) With the "Report" screen open, press (Menu). The context menu appears.
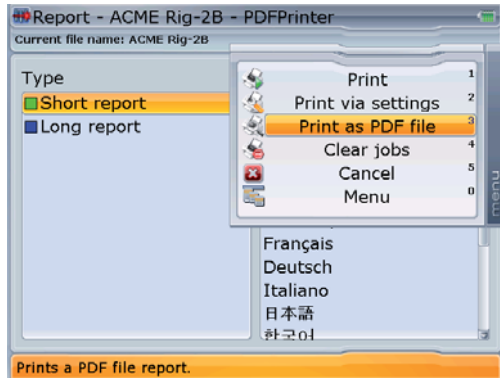
The system gives the option of generating a simplified or complete report, in different languages, regardless of the language in use. The PDF file may also be saved directly by pressing (3def) with the context menu open.

iv) Save the measurement report as PDF on a memory stick by using (▽) / (△) to highlight the context menu item 'Print as PDF file' then confirming by pressing (Enter).

Splice function

The CENTRALIGN Ultra splice function lets the user change the laser set-up without necessarily having to re-measure all bores once again. This could be prompted by any one of the following situations:

▶ The laser is accidentally moved during measurement

▶ The measurement scope is extended

▶ Use of the sensor extend range

▶ Changing the measurement sensor

This means that for extremely long machines, you can extend the measurement path along the same reference line with no appreciable loss of repeatability. The reference line is re-established by re-measuring at least two previous measurement points of greatest separation, so you should always take particular care to measure these points as accurately as possible.
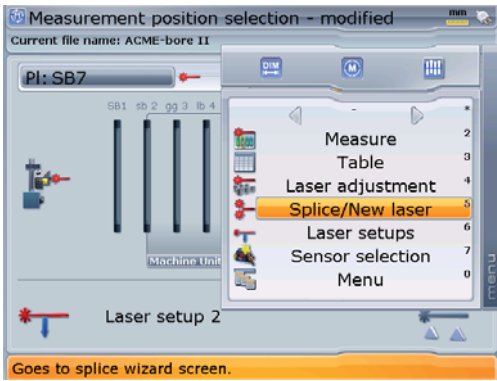
Procedure

i) With the measurement file opened, press (M) to access the "Measurement position selection" screen.
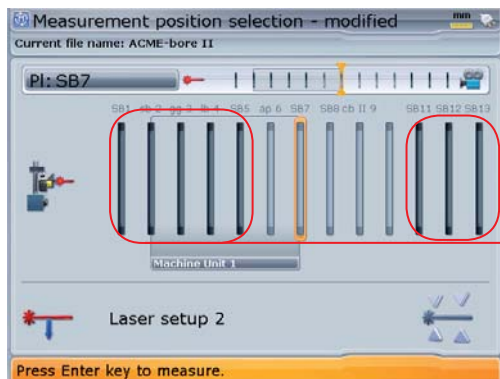

The bores that were measured using an initial set-up are shown marked dark.

ii) While on the measurement screen, press (Menu) to open the context menu then use (△)/(▽) to highlight the context menu item 'Splice/New laser'.

Goes to splice wizard screen.

iii) With 'Splice/New laser' highlighted, press (Enter) to confirm selection.

iv) The "Splice wizard step" screen appears with a hint screen to choose type of laser set-up.

v) After selecting type of laser set up, a further hint requesting any changes on the type, position and properties of both the laser and sensor appears.

vi) After finalizing the laser and sensor properties, the splice assistant box opens with the initial hint to select the two planes that must be measured for the second set-up.
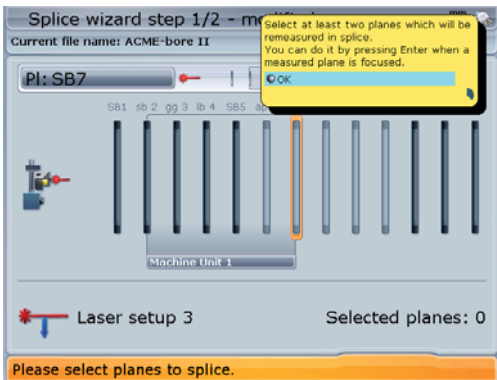
Note that the splice assistant box only appears if the application option 'Assistant on splice' has been activated. This is done through the "File overview" screen context menu item 'Settings'->''Application options'.

vii) Follow the steps appearing in the splice assistant box. After selecting the two planes that were measured in the initial set-up, and which must lie farthest from one another, the next hint to proceed with the splice appears.
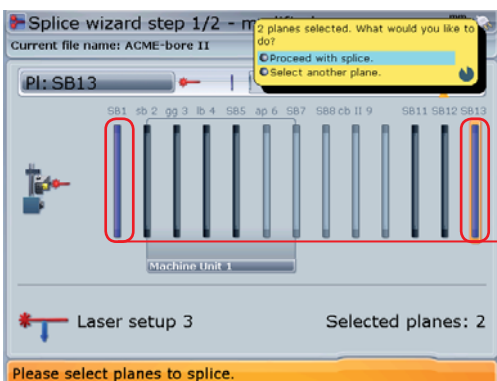
The two planes selected for splice measurement

viii) Press (Enter) to confirm selection and proceed with measuring the two planes. Follow the hints appearing on the splice assistant box.

ix) After measuring both planes, a hint to finish the splice appears.
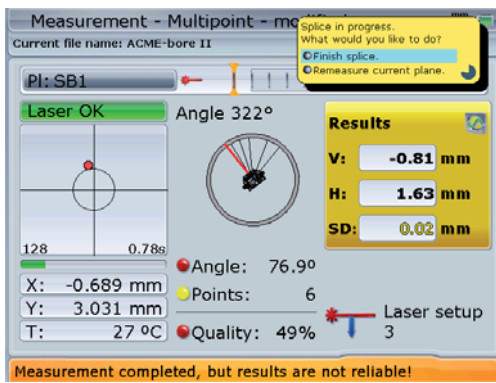
x) Press (Enter) to confirm selection and finish splice measurement. You may now proceed to measure the bores that had not yet been measured prior to the splice measurement.

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