E920
E930
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MANUAL

English

EASY-LASER®

05-0685 Revision 3.0
System version 6.0

CONTENT

INTRODUCTION

Damalini AB

Damalini AB develops, manufactures and markets Easy-Laser® measurement and alignment equipment based on laser technology.

We have more than 25 years of experience from measurement tasks in the field and product development. We also provide measurement service, which means that we ourselves use the equipment we develop, and continuously improve it. Because of this we dare to call ourselves measurement specialists.

Do not hesitate to contact us about your measurement problems. Our expertise will help you solve it in an easy way.

Declaration of conformity

Equipment: Easy-Laser® product range

Damalini AB declares that the Easy-Laser® product range is manufactured in conformity with national and international regulations. The system complies with, and has been tested according to the following requirements:

CE

EMC Directive	2004/108/EG
Low Voltage Directive	2006/95/EC
Laser Classification	EN-60825-1 and complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.
RoHs Directive	2002/95/EG
WEEE Directive	2002/96/EG

For Bluetooth® devices: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference

(2) this device must accept any interference received, including interference that may cause undesired operation.

Disposal of old electrical and electronic equipment (Applicable throughout the European Union and other European countries with separate collection programs)

This symbol, found on product or on its packing, indicates that this product should not be treated as household waste when disposed of.

It should be handed over to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed correctly, you will help to prevent potential negative consequences to the environment and human health. For more detailed information about the recycling of this product, please contact your local city office, household waste disposal service or the retail store where you purchased this product.

Quality certificate

Damalini AB is ISO 9001:2008 certified. Certificate number 900958.

Damalini AB confirm, that our products are produced according to applicable national and international regulations and standards. All components are checked before assembly and final products are tested in functionality and visually checked before delivery

The calibration of the equipment fully complies with ISO9001: 2008 #7.6

Limited warranty

This product is manufactured under Damalini's strict quality control system. Should the product fail within two (2) years from the date of purchase under normal usage conditions, Damalini will repair or replace the product free of charge.

1. Using new or refurbished replacement parts.
2. Exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product.

Proof of purchase date should be confirmed, and sent together with a copy of the original purchase document.

Warranty is valid under normal usage described in the user's manual appended with the product. The warranty comprises failure on Easy-Laser® product that could be related to material and/or fabrication errors. The warranty is valid only in the country of purchase.

The warranty is not valid in the following cases:

- If the product is broken due to mishandling or incorrect operation
- If the product has been exposed to extreme temperature, calamity, chock or high voltage.
- If the product has been modified, repaired or disassembled by unauthorized personnel.

Compensation for possible damage due to failure on Easy-Laser® product is not included in the warranty. Freight cost to Damalini is not included in the warranty.

Note!

Before delivery of the product for warranty repair, it is the responsibility of the buyer to backup all data. Data recovery is not included in the warranty service and Damalini is not responsible for data that may be lost or damaged during transit or repair.

Lithium Ion battery limited warranty

Lithium ion batteries inevitably lose power during their lifetimes, depending on usage temperatures and the number of charging cycles. Therefore, the internal rechargeable batteries used in the E-series are not included in our general 2-year warranty. There is a 1 year warranty for the battery capacity not to fall below 70 % (a normal change means that the battery must have more than 70 % capacity after more than 300 charging cycles). A 2 year warranty applies if the battery becomes unusable because of a manufacturing fault or factors that Damalini AB could be expected to have control of, or if the battery displays abnormal loss of capacity in relation to use.

Extended warranty

Easy-Laser® Measurement and Alignment Systems meet the highest quality standards! For this reason, we have extended the warranty to you to a total of 3 years — free of charge!

The prerequisite for a warranty extension is that you register your system parts on the Internet within 6 months of purchase. The warranty period begins on the date of purchase. The warranty extension applies to all products in accordance with the Easy-Laser® Warranty requirements.

Safety precautions

Easy-Laser® is a laser instrument in laser class II with an output power less than 1 mW, which requires the following safety precautions:

- Never stare directly into the laser beam
- Never aim the laser beam at anyone else's eyes.

Note!

Opening the laser units can result in hazardous radiation, and will invalidate the manufacturer warranty.

If starting the machine to be measured would result in injuries, the possibility to unintentionally start it must be disabled before mounting the equipment, for example by locking the switch in the off position or removing the fuses. These safety precautions should remain in place until the measurement equipment has been removed from the machine.

Note!

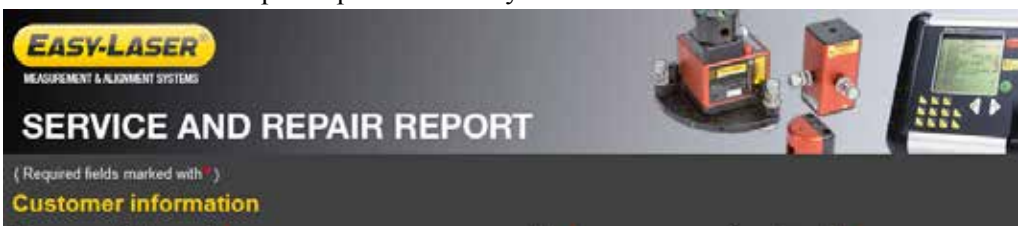
The system should not be used in explosive risk areas.

Service and calibration

Our Service centres will quickly assist you if your measurement system need to be repaired or when it is time for calibration.

Our main Service centre is located in Sweden. There are several local Service centres that are certified to carry out limited service and repair. Contact your local Service centre first before sending your equipment for service or repair. All Service centres are listed on our web site under Service and Calibration.

Before sending your measuring system to our main Service centre, please fill in the online Service and Repair report. www.easy-laser-service.com



Manuals as PDF

You can download our manuals in pdf format from our website. The pdf's are also available on the USB memory stick that is delivered with most systems.

EasyLink

The new version of our database program EasyLink is available on the USB memory stick that is delivered with most systems. You can always download the latest version from damalini.com>download>software.

Travelling with your measurement system

When travelling by airplane with your measurement system we strongly recommend that you check which rules apply for each airline company. Some companies/countries have limitations for checked baggage when it comes to items including batteries. For information about Easy-Laser® batteries, please see system unit details in the end of this manual. It is also good practice to remove the batteries from the equipment, when possible, e.g. D22, D23 and D75.

Compatibility

The E-series is not compatible with previous analogue units from the D-series. You can however continue to use previous brackets.

Disclaimer

Damalini AB and our authorized dealers will take no responsibility for damage to machines and plant as a result of the use of Easy-Laser® measurement and alignment systems.

Copyright

We might change and correct the manual in later issues without further information. Changes to the Easy-Laser® equipment may also affect the accuracy of the information.

September 3 2013

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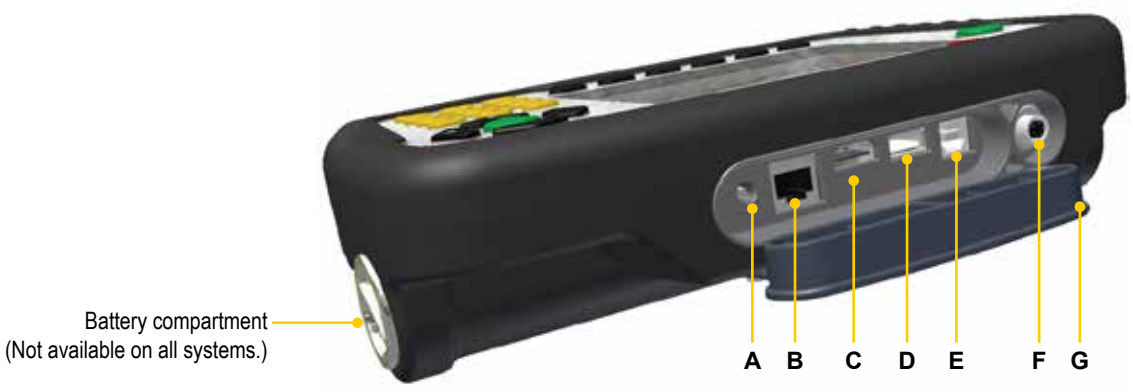
DISPLAY UNIT

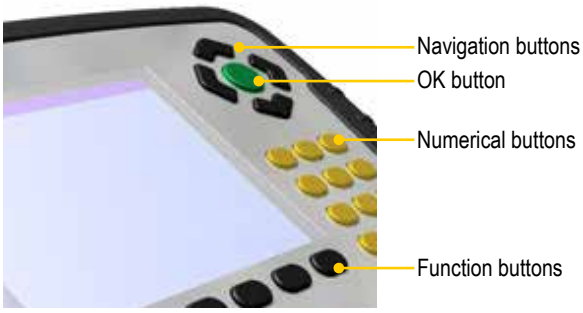
Press and hold the On/Off button to reset the Display unit.

A Connection for external power.
B Network connection. (Not available on all systems.)
C External connection. Use for projector for example. (Not available on all systems.)
D USB A (master). Use for USB memory.
E USB B (slave). Use for connecting to a PC.
F Connection for Easy-Laser® equipment.
G Protective cover.



Navigation buttons

To navigate on the screen, use the navigation buttons. The selected icon is marked with a yellow frame. The navigation buttons are also used to move between the icons in a submenu and to change the values in the fields.



OK buttons

There are two green **OK** buttons and they both work in the same way. Press to select the currently selected icon for example.

Function buttons

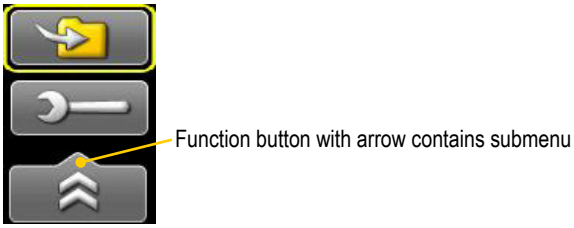
The icons above the function buttons change depending on which view is currently displayed on screen.

Below is a list of the most common icons.

	**Back** to previous view. Press and hold to leave current program.
	**Back**. There is no “previous view”. Leave the current program.
	**More**. Contains a submenu with general functions, such as  (Control panel) and  (Save file).

Submenus

The icons formed as an arrow contain a submenu. Use the navigation buttons to navigate in a submenu. Press to select.



Status bar

The Status bar contains additional information such as warning icon, current time and Bluetooth® connection.

There are also text messages regarding:

- The selected icon.
- Hints on what information you are expected to fill in.

Status bar icons

	**Warning**. Select the function button  to get additional information regarding the warning.
	**Warning**. Displayed when the coordinates has been rotated in the detector. Go to Control panel to rotate coordinates.
	**Display unit charging**. Indicating that a power adaptor is plugged in.
	**Hourglass**. The Display unit is in the middle of a task.
	Measurement progress. Time is depending on which filter you have selected.
	Selected filter.
	**Peripheral**. Indicates that a peripheral device is plugged in, such as a projector.
	**Bluetooth®**. Indicates that the Bluetooth® functionality is activated. The number beside indicates the number of Bluetooth® units connected.
	Printing report on thermal printer. The thermal printer is optional equipment.
	Printing performed OK.
	Printing problem.

Screen dump

It is possible to take screen dumps of what is currently displayed on screen. You can e-mail the screen dump or use it for reports.

Take a screen dump

1. Press and hold the numeric button period (.) for 5 seconds.
2. An hour glass is displayed on the status bar.
3. The screen dump is saved in the file system as a .jpg file. It is named with current date and time. Select  to open saved files. *See "Measurement file handling" on page 11*.

LED lights

Right indicator

Yellow	Flashing: The internal battery in the Display unit is charging.

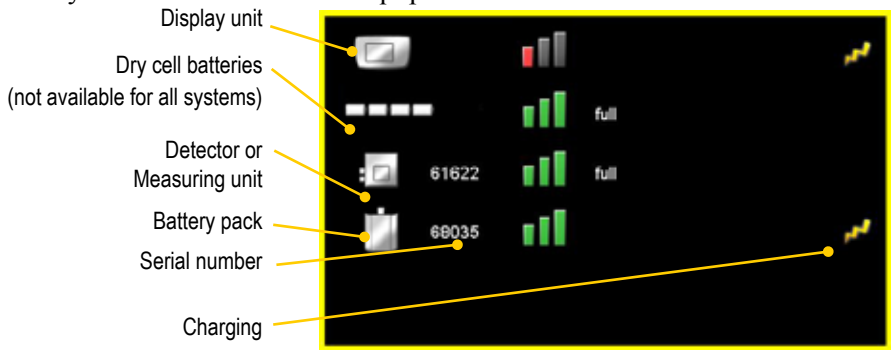
Left indicator

Left indicator has several functions and colours:

Red/Blue	Quick flashing: Reprogramming the system.
Red	Flashing: Warning, for example low battery.
Blue	Flashing: Searching for detectors equipped with Bluetooth®. Fixed light: Connected to detectors equipped with Bluetooth®.
Green	Flashing: Display unit is starting. Fixed light: The internal battery in the Display unit is fully charged.
Light blue	Flashing: Backlight is off, but the Display unit is still on. Press any button to activate the Display unit.

Battery

Select  to display the Battery view. This view gives you a good overview of the battery status of all connected equipment.



The E-series is **not** compatible with units from the D-series.

Note!

When finished working for the day, charge the whole system. Plug in the power adaptor to the Display unit and connect the measuring units by using cable.

Charge the Display unit

The Display unit can be used from -10ºC to +50ºC. Charge the Display unit within the temperature range of ±0ºC to +40ºC.

Note!

If you shut the Display unit off while charging, it will charge faster.

Power adaptor

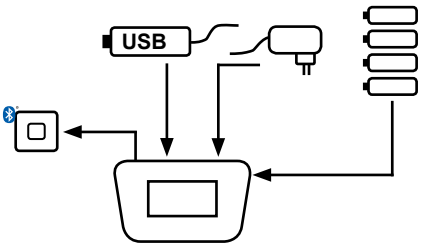
With the power adaptor plugged in, you can keep on working.

A PC via USB cable

While you have this connection, you can open the files in the Display unit via the explorer in your PC. However, the Display unit is locked.

Dry cell batteries

When you get a battery warning, insert four R14 dry cell batteries in the battery compartment. This will prolong the power of the Display unit so that you can finish your measurement. However, if the internal battery is completely empty, the dry cell batteries do not have enough power to start up the Display unit.



Charge the Detector/Measuring units

The Detectors and Measuring units are charged by the Display unit when connected by cable. If you are using Bluetooth® units, switch to cable when the battery in the Detector/Measuring unit is low.

Charge the Bluetooth® units

The Bluetooth® units are powered by the Detector/Measuring units. To save energy, the Bluetooth® units will only connect when you are using a measurement program. There is no power switch on the unit. To switch off, simply unplug the unit.

See "Bluetooth® set up" on page 20.

Calculator

The calculator is found on the Start view and Control panel ( ).

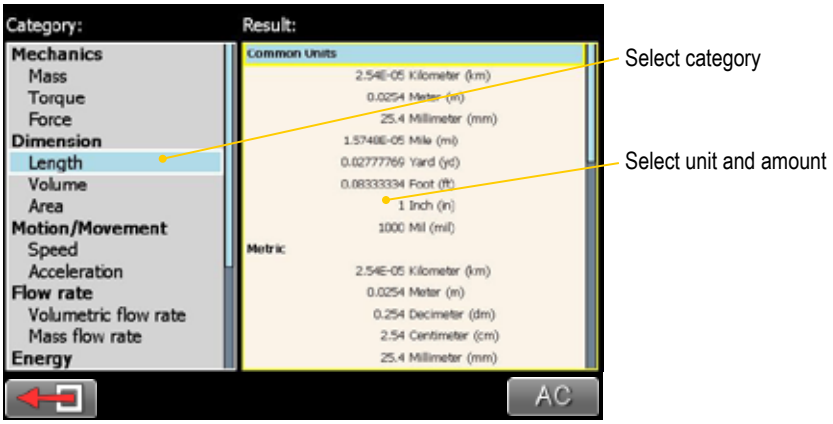
1. Select and to open the calculator.
2. Use the numerical buttons and function buttons to enter values.
3. Use the button to compute.

Unit converter

The unit converter is found on the Start view and Control panel ( ).

1. Select and to open Unit converter.
2. Select a category. Move using the navigation buttons up and down.
3. Press navigation button right. The result column is activated.
4. Select a unit to convert from.
5. Enter an amount. The other units are recalculated.

In the example below, one inch is selected.



Measurement file handling

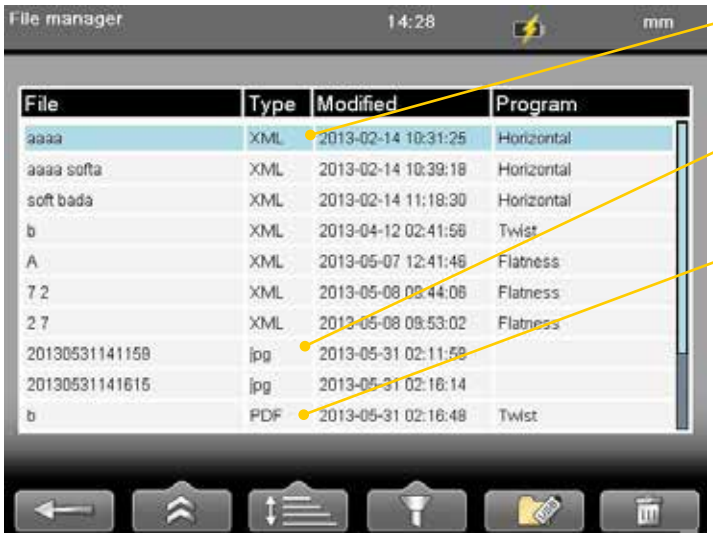
Save file

1. Select  and  to save your measurement.
2. Enter a file name. The date and time will automatically be added to the file name. The measurements that you save will be available to other users as well.
3. Press  to save the file.

File manager

Select  (found on the start view and Control panel) to open saved measurements. The File manager is displayed. Here you can easily when and from which program the file was saved.

Press  to open a measurement file.

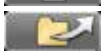


xml
A measurement file.

jpg
"Screen dump" on page 8

PDF
A report. The PDF report can not be opened in the Display unit.
PDF is not available for E420.

Function buttons

	**Back** to previous view.
	 *"Report" on page 13.*  *"Open file as template" on page 12.*  *"Print file (Optional)" on page 13.*
	 Sort files alphabetically.  Sort files by measurement program.  Sort by time.
	 Show all files.  Show only xml files.  Show only pdf files.  Show only jpg files.
	*"Copy file to USB memory" on page 12.*
	Delete files. Delete all **displayed** files or only selected file.

Open file as template

You can open a saved measurement and use it to make a new measurement. This is very useful when you have many flanges or machines with the same dimensions for example. This way you do not have to enter the same distances every time.

1. Select  (found on the Start view and Control panel). The File manager is displayed.
2. Select a file in the list and select  . The Edit distance view is displayed.
3. Change distances if needed and proceed to measuring view.

Copy file to USB memory

You can easily copy a saved measurement or other files to a USB memory.

1. Insert a USB memory.
2. Select the file you want and select  .
3. A folder is automatically created on the USB memory. The file is saved in the folder `\Damalini\archive\`.

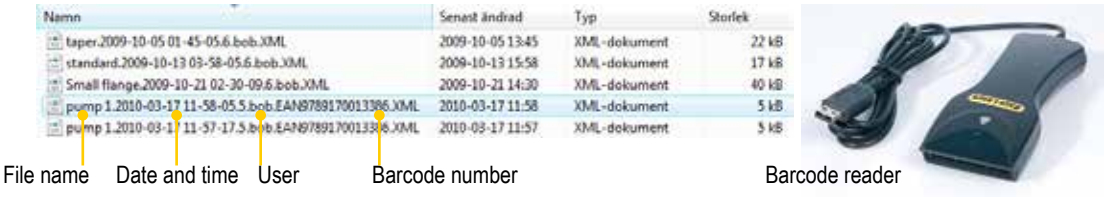
Barcode

Save file with barcode

The barcode scanner is not included in all systems. The first time you measure a machine, you stick a barcode on the machine and save the measurement together with the scanned barcode. Next time you align the same machine, all you need to do is scan the barcode and all machine data is read.

1. Scan the barcode on the machine.
2. Enter a file name.
3. Press  to save the file. All measurement data is saved together with the barcode.

The barcode number is added to the file name.
When you connect the Display unit to a PC the whole file name is shown:



Open file with barcode

- Start the Display unit and scan the barcode. The **latest** measurement that was made and saved with this barcode is automatically opened.

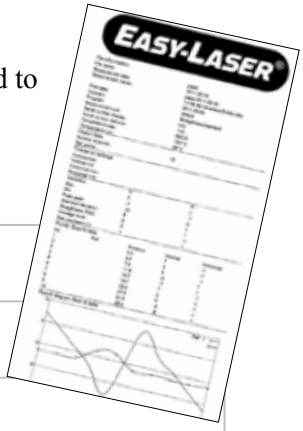
  OR

- Select  to open File view. Scan the barcode on the machine. **All** measurements saved with this barcode are shown.

Print file (Optional)

Part no. 03-1004

The thermal printer is optional equipment.



1. Save the measurement. To print from a Shaft program, you need to open a saved measurement before you can print a report.
2. Connect the thermal printer and select and .
3. The progress is displayed on the status bar.

	Printing report on thermal printer.
	Printing performed OK.
	Printing problem.

You can also save a measurement, download the pdf-report to your PC and print the pdf-report.

Report

A report is generated and saved in the filing system. You can not open an old measurement and save it again (program Machine train is an exception to this). You can however generate a new report from an opened file. This means you can for example change the language and make a new report from the opened measurement. You can download the report to a PC and print it.

Company logo

You can replace the logo on the report with your own .jpg file.

1. Name your logo `logo.jpg`. The default logo has the proportions of 230x51 pixels.
2. Connect the Display unit to your PC using the USB-cable.
3. Place your image in the Display unit's folder `Damalini/custom/reports/logo`.

File extensions (for example .jpg) are often hidden in the Explorer window. To display file extensions do the following: Open an Explorer window and press Alt to show menu. Select Tools > Folder options. Click the View tab > Advanced settings > Clear the Hide extensions for known file types check box.

Date format

By default, the date and time format is set to Central European Time (CET).

You can change the date and time format used in your PDF reports.

See "Date and time" on page 15.

Download file to PC

1. Start the Display unit.
2. Connect the USB cable between the Display unit and PC.
3. While you have this connection, the Display unit is blocked.
4. View and/or copy the files to the PC.

EasyLink

You can also use our database program EasyLink to view the files on your PC. EasyLink is available on the USB memory stick that is delivered with most systems. You can always download the latest version from damalini.com>download>software.

Control panel

Select and to open the Control panel. Some of the settings are personal and will be default next time you start the system.

Note!
All settings are not available for all systems.

Filter

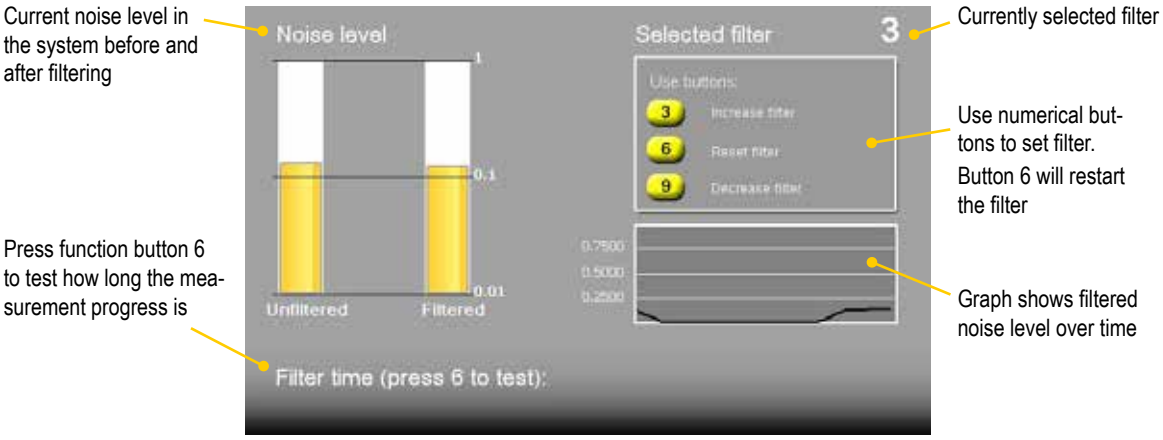
Select to open the Filter view.

If the laser beam passes through air with varying temperature, this may influence the direction of the laser beam. If measurement values fluctuate, this could mean unstable readings. Try to reduce air movements between laser and detector by, for instance, moving heat sources, closing doors. If the readings remain unstable, increase the filter value (more samples will become available to the statistical filter).

Select filter

Use as short a time as possible that still produces acceptable stability during the measurement. Default is set to **1**. Normally you will use a filter value of 1-3. If you set the filter type to 0, no filter will be used.

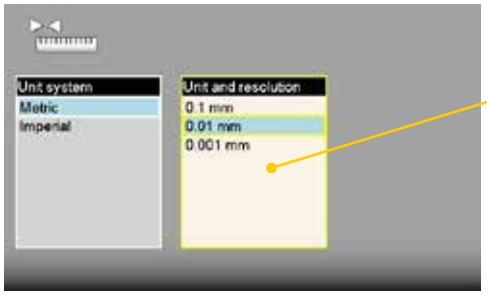
Use the numerical buttons 3, 6 and 9 to set the filter. In the Filter view but also when you are using a measuring program.



Unit and resolution

Personal setting

Select  to open the Units and resolution view. Use the navigation buttons to move between the fields. Set Metric or Imperial and which resolution you want to use. Default is set to 0.01 mm (0.4 mil). The selected unit is shown on the Status bar.



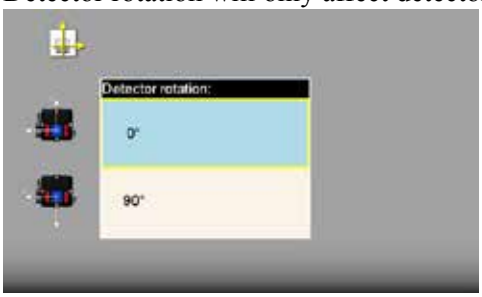
Note!

It is possible to select 0.0001mm only in the E940 system. For E420, only 0.01mm is possible.

Detector rotation

Personal setting

The coordinate system can be rotated 90º. Select  to open the Detector rotation view. When you have rotated the coordinates, a warning is displayed on the Status bar. Detector rotation will only affect detectors with two axis.

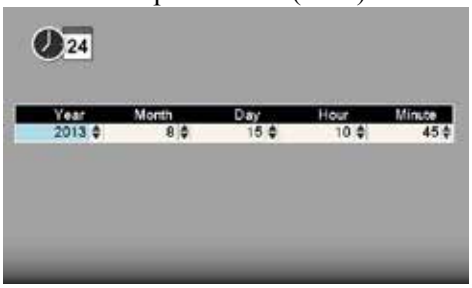


Detector rotation view

Warning displayed on Status bar

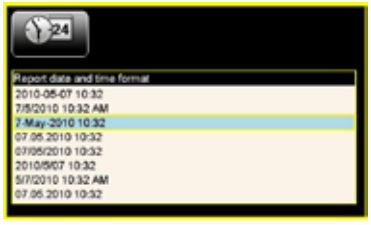
Date and time

Select  to open the Date and Time view. Set the date and time. Default is set to Central European Time. (CET)



Date and time view

Select  to set the date format used in your PDF reports.



Date and time used in PDF reports

Language

Personal setting

Select  to open the Language view. Default is set to English. Use the navigation buttons to select a language. Press  to save changes.

Language view

User

Select  to open the Users view. A user account is used for storing your personal settings.

Use the function buttons  to add or remove users. To switch user, simply select the user you would like to switch to and press  .

User view

Backlight

Personal setting

Select  to open the Backlight view. Use the navigation buttons to move between the fields. Press  to save changes. When backlight is off, the left LED signal will flash to indicate that the Display unit is still on.

Backlight level

Adjust the backlight to make it easier to read in bright sunlight. Remember however that a high contrast consume more battery power. Default is set to 50%.

Reduce after

Set time before backlight reduction as a way to save energy. The Display unit will be dimmed, but is still on. Default is set to Never.

Off after

Set time before backlight off. Default is set to Never.

Backlight view

Automatic power off

Personal setting

Select  to open the Automatic off view. Select how much time before automatic power off. Use the navigation buttons to select. Press  to save changes.

Automatic power off view

Note!

Measurements in progress will not be saved in the event of an Automatic power off.

Information

Select  to display the information regarding serial number and version of the equipment.

Information view

VGA

(Not available on all systems.)

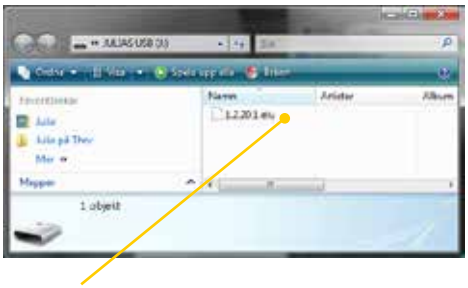
Makes it possible to show display unit screen image with a projector, for example in a training context. Must be factory installed on order.

Select  to open the VGA view.

System update

Download update file

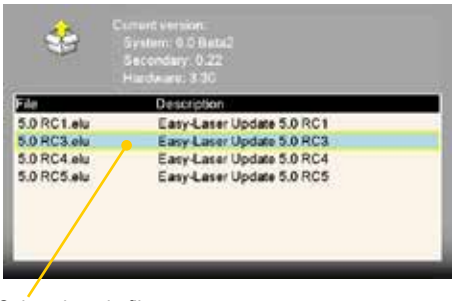
1. Go to www.damalini.com > Download > Software > E series Display unit Firmware Update.
2. Download the update file to your PC.
3. Unzip the file.
4. Copy the .elu file to the root of a USB memory.



Save .elu file on a USB memory.

Install update file

1. Start the Display unit. Make sure that the internal battery of the Display unit is charged. The battery symbol should be at least yellow.
2. Insert the USB memory in the Display unit. Do not remove the USB memory until the update is finished.
3. Select  and  to display the System update view.
4. Select the update file and press  .
5. Select  . The installation starts.
6. The Display unit will automatically restart when the installation is finished and the Main menu is displayed.



Select the .elu file.

Note!

During restart, the screen turns black for up to one minute. When the main menu is displayed, it can "freeze" (no response when you press buttons). If this happens, press the On/Off button for at least 15 seconds to restart the Display unit.

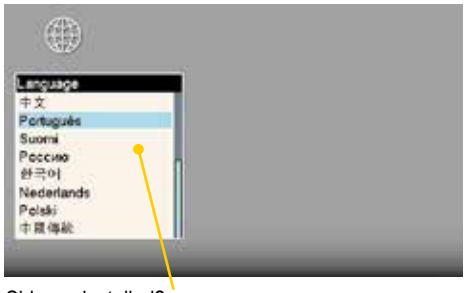
Main menu is automatically displayed after restart.

Font package

Some of the early E-series systems was not installed with Unicode fonts. To install the latest system updates, you need to install the font package with Unicode fonts.

Check if you need to install:

1. Select  and  to display the Language view.
2. Check if you have Chinese installed. **If Chinese is installed, you already have the correct Font package**. If not, please go to www.damalini.com > Download > Software > Eseries Display unit Font package update and follow the instructions above to install.



Chinese installed?
No need to update with Font package.

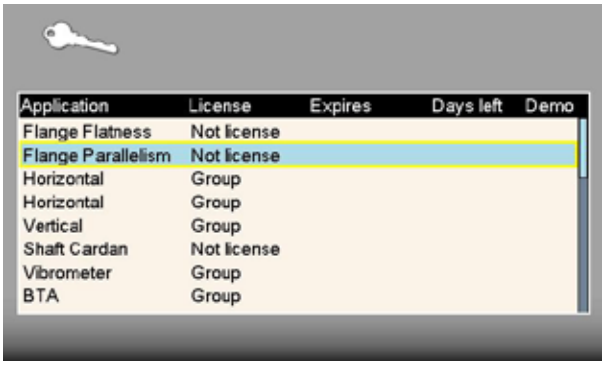
License

It is easy to upgrade your Display unit.

1. Contact your Easy-Laser® distributor if you wish to upgrade your Display unit.
2. An e-mail will be sent to you with information on how to download the update file.
3. Save the file to the root of the file system to a USB memory stick or directly to the Display unit.

Save file on USB

1. Save the downloaded license file to a USB memory stick.
2. Insert the USB memory stick in the Display unit.
3. Select  and  to display the License view.



4. Select  to search for licenses.
5. Press  to import license.

Save file to Display unit

1. Connect the Display unit to a PC.
2. Save the license file to the root of the Display unit's storage.

3. Select  and  to display the License view.
4. Select  to search for the new license file. A window is displayed.
5. Disregard the text and select  . The license file is installed and full functionality is achieved.

Bluetooth® set up

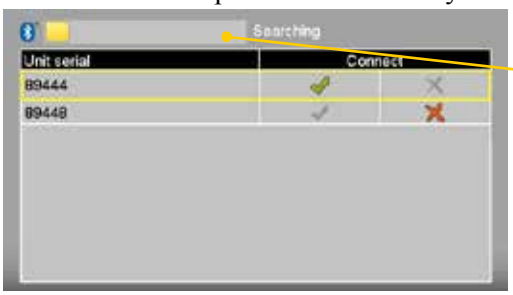
Bluetooth® wireless technology makes it possible for Display unit and Detector to exchange data without using cables.

Some detectors have built-in Bluetooth®, others have a separate Bluetooth unit that you attach to the detector. *Please see Technical data for more information*.

Set up

This is only necessary when adding new Bluetooth® units to the list.

1. Select  to open the Bluetooth® view.
2. Select  to search for Bluetooth® units.
3. The view is updated with the Easy-Laser® Bluetooth® units you can connect to.



Searching for Bluetooth® units

4. Select the unit you want to connect to and select  . The unit will automatically be connected when you start a measurement program.
5. Press  to save changes and to leave the Bluetooth® view.
6. Enter a measurement program. The Display unit will connect to the selected units. While connecting, the left LED indicator is flashing with a blue light which will turn to a fixed blue light once connected.
7. An icon on the status bar will indicate how many Bluetooth® units are connected.

One Bluetooth® unit connected

Function buttons

	Back to Control panel. Changes made in the table are saved.
	Search for Bluetooth® units.
	Cancel search. Use if your Bluetooth® unit is already found.
	Remove a Bluetooth® unit from the list.
	Connect the unit. The unit will automatically be connected when you start a measurement program.
	Disconnect the unit. The unit will still be in the list.

Use only one Bluetooth® unit

Many of our systems are delivered with two Measuring units. In some cases you might want to use only one unit together with a laser transmitter. By default both units are set to “Connect ”. If the unused unit is set to “Connect ”, the system will keep on trying to connect to it, even if it is not plugged in.

1. Attach the Bluetooth unit to the detector.
2. Select to open the Bluetooth® view.
3. Set the Bluetooth® unit you want to use to .
4. Make sure that the other units are set to .
5. Enter a measuring program.

The Display unit will connect to the selected unit. This may take a couple of minutes.

Note!

Remove Bluetooth® unit from the Measuring unit before putting the equipment in the carrying case. If attached, it will discharge the Measuring unit.

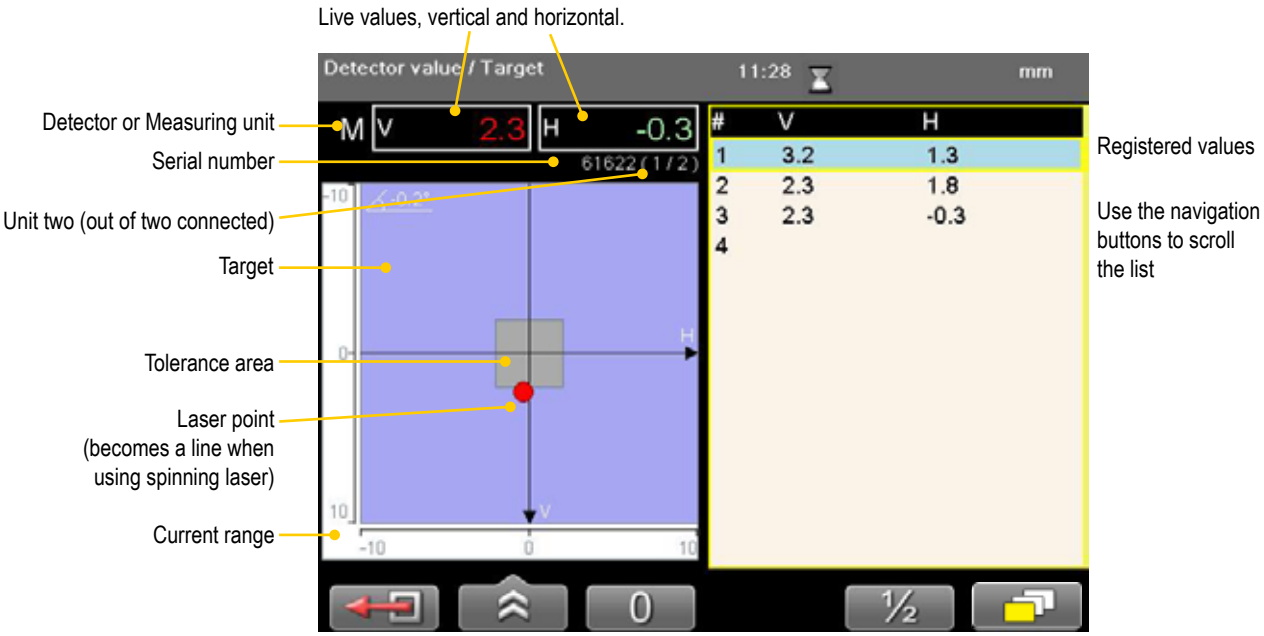
Bluetooth® information

This device contains
FCC ID: PVH0925
IC: 5325A-0925
This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions;
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

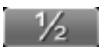
PROGRAM VALUES

With the program Values, you can see live readings from the detectors. As default, a target and a table is displayed.

Press **OK** to register values.

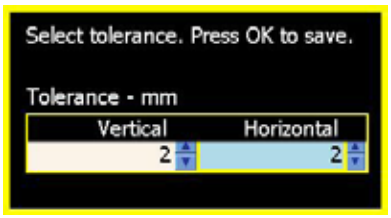


Function buttons

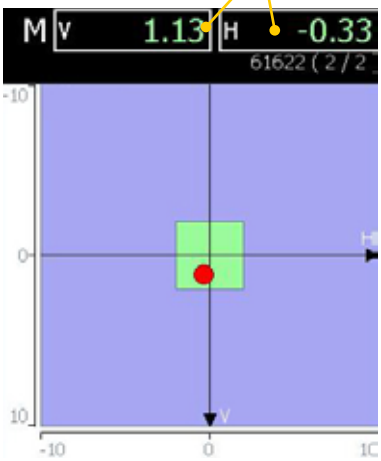
	Back, leave program.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 24.*  *See "Zoom" on page 24.*  Save file. *See "Measurement file handling" on page 11.*  *See "Automatic recording" on page 26.*  Delete registered values.  Print report on thermal printer (optional equipment).  *See "Streaming values" on page 27.*
	Set current value to zero.
	Half displayed value.
	Return to absolute value. Only available after zeroing or halving.
	Choose how to display values. Use left and right navigation button to switch between two or more detectors when only one target is displayed.

Tolerance

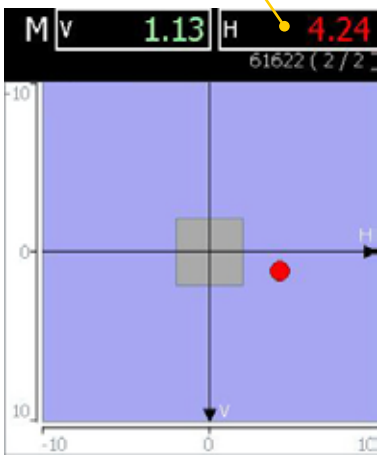
1. Select  and  to set tolerance.
   It is possible to set different tolerance in vertical and horizontal direction.
2. Use navigation buttons to move between the fields and to change the tolerance.
3. Press **OK**.



Live values and marking displayed in green when within tolerance.

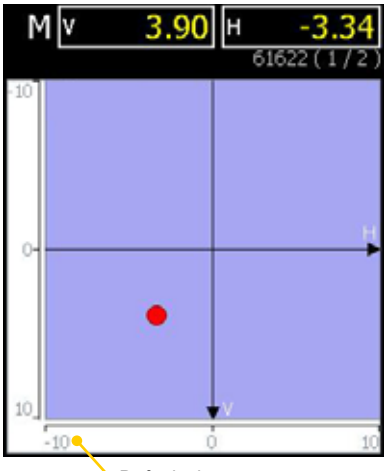


Live values displayed in red when outside tolerance.

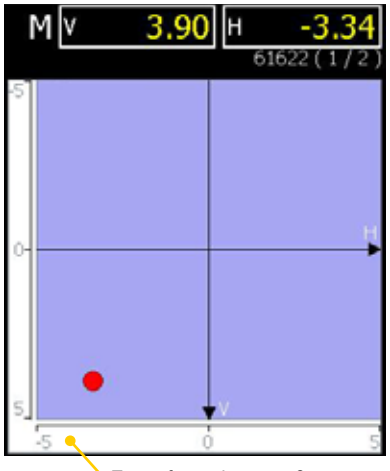


Zoom

1. Select  and  to zoom.
2. Select a zoom factor between 1–5. Use navigation buttons to increase or decrease zoom factor.
3. Press **OK**.



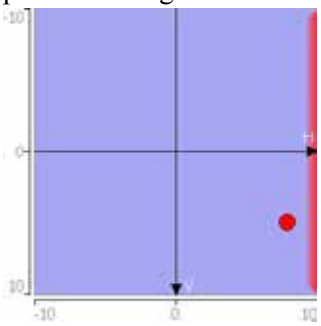
Default view



Zoom factor is set to 2

Edge warning

When the laser beam is close to the edge, the edge is “lit up” as a warning. It is not possible to register values when you see the edge warning.



Half or Zero set value

Half value

Select ½ to half displayed value.

Zero point of the PSD moves halfway towards the laser point.

Zero set value

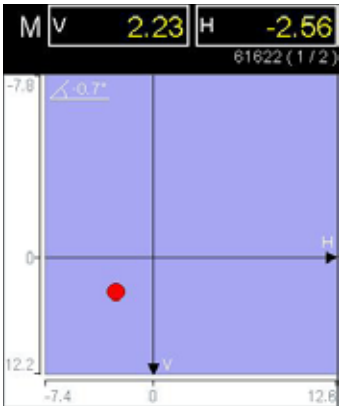
Select 0 to zero set displayed value.

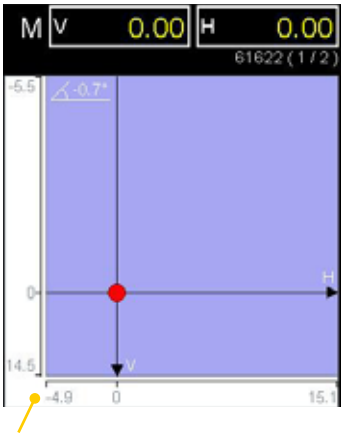
Zero point of the PSD moves to the laser point.

Absolute value

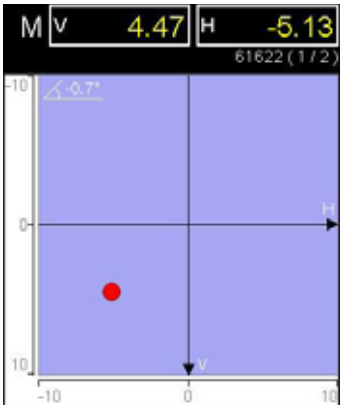
Select ¼ to return to the absolute value.

Zero point of the PSD returns to the PSD centre.





Note the change of the current range



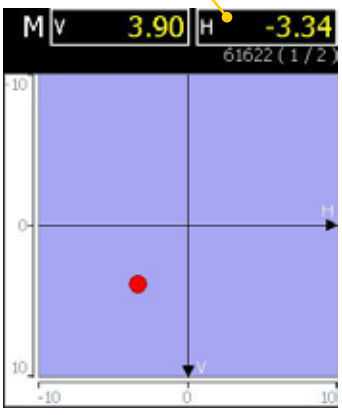
Live values – colours

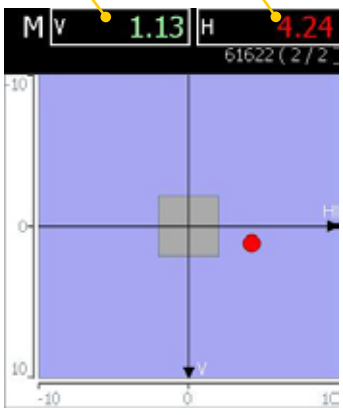
Live values are normally yellow

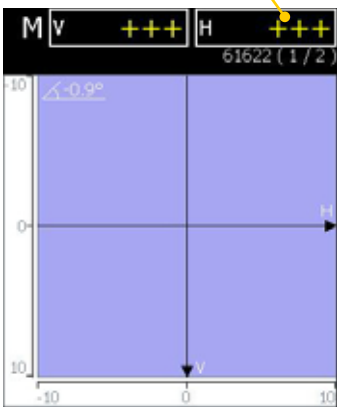
Green when within tolerance

Red when outside tolerance

Loss of signal, laser beam interrupted for example



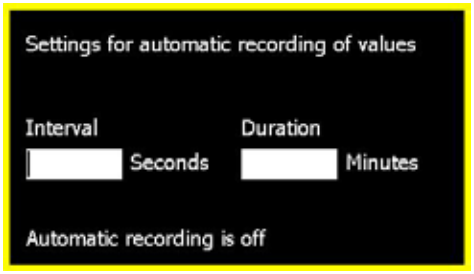




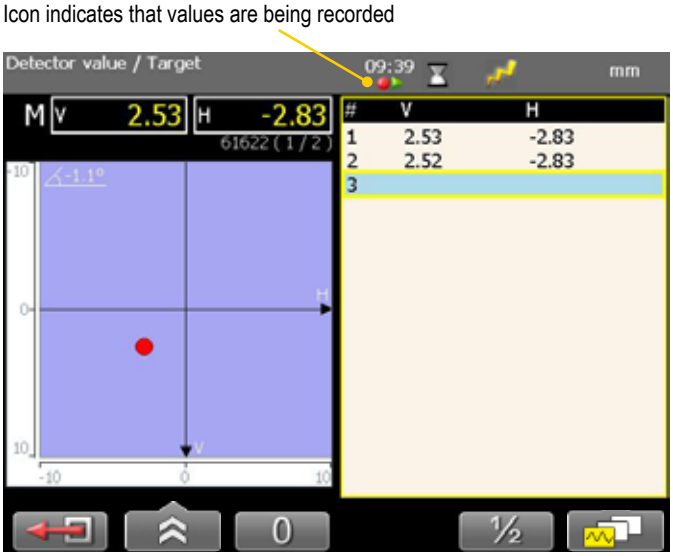
Automatic recording

In Values, it is possible to make automatic recording of values. This is very useful when you want to register values during a longer time period for example.

1. Select  and  to start automatic recording.
2. Set Interval.
3. Press navigation button “right”.
4. Set Duration.
5. Press **OK**. The recording will start and you can follow the progress on screen.



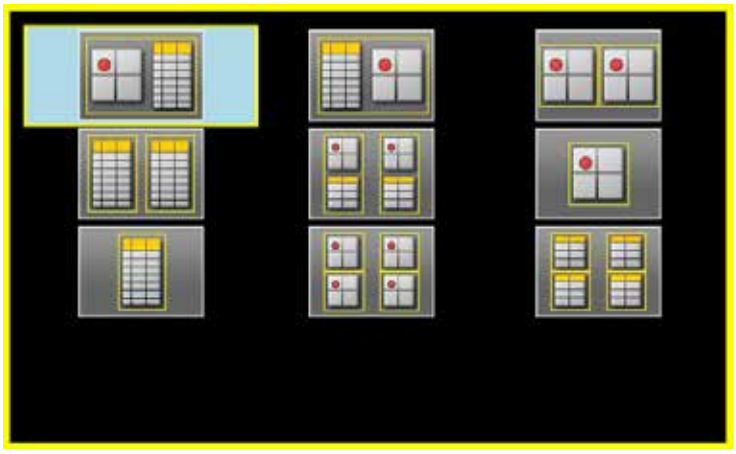
Icon indicates that values are being recorded



Views

You can decide how to display the current values. As default a target and a table is displayed, but you can choose to show only target for example.

Select  to display the different layout options, see image below.



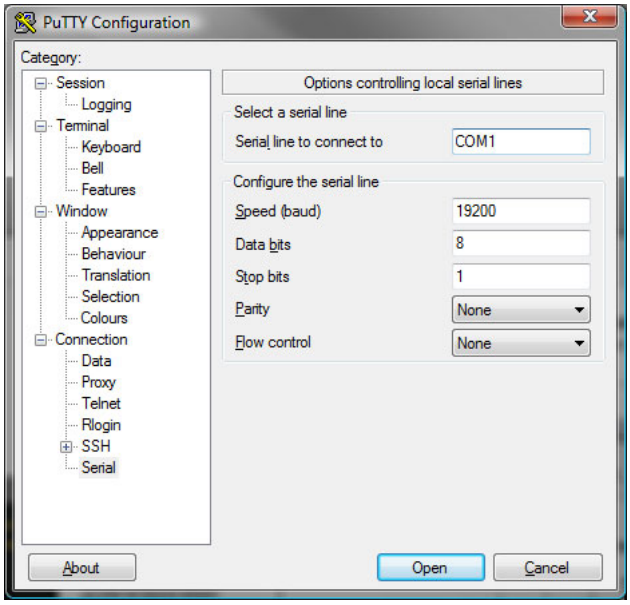
Note!

Use left and right navigation button to switch between two or more detectors when only one target is displayed.

Streaming values

With the Streaming value functionality, you can transfer data from the Display unit. For this to work, you need a USB to USB Null Modem Cable, the USB cable delivered with the system does not work for streaming values.

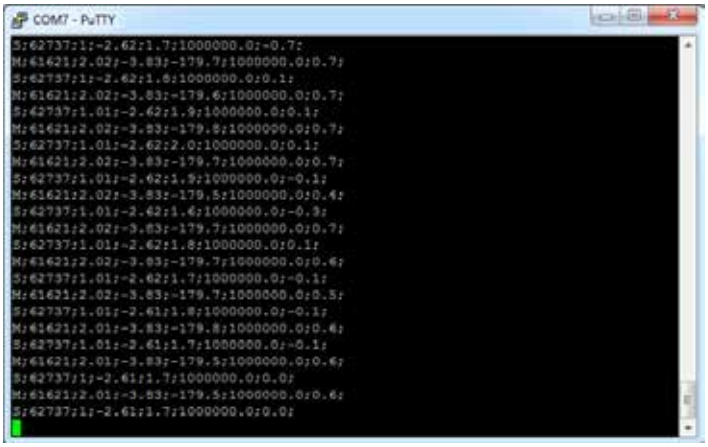
1. Connect the Display unit to the PC using a USB to USB Null Modem Cable.



The USB-to-USB null modem cable shows up as a Virtual Serial Port with the following properties:
19200 bps, 8n1 without flow control.

The port number can, for example, be found using the Device Manager. See ‘USB Serial Port’ under ‘Ports (COM and LPT)’.

2. Click Open.
3. Start the program Values in the Display unit.
4. Select  and  to start streaming values.
5. To stop, select  .



In this example, PuTTY is used to show the streamed data

Data format

The data is sent as lines with semi colon separated values. Each line begin with a detector identification, S, M, Vib or BTA, followed by the detector serial number. The unit and resolution depends on the settings in the user profile.

Data from Vib: Vib;serial;LP;HP;G;

Data from BTA: BTA;serial;PSD1X;PDF2X;PDF3X;X axis angle;Y axis angle;Z axis angle;

Data from S: S;serial;PSD X; PSD Y; X axis angle;Y axis angle;Z axis angle;

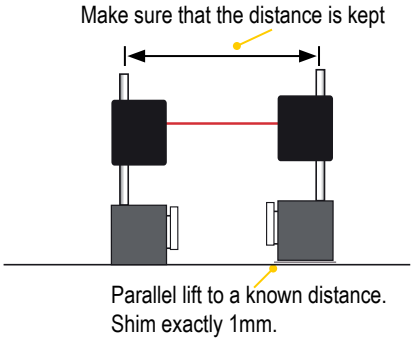
Data from M: M;serial;PSD X; PSD Y; X axis angle;Y axis angle;Z axis angle;

Calibration check

Use the program Values to check if the detector readings are within specified tolerances.

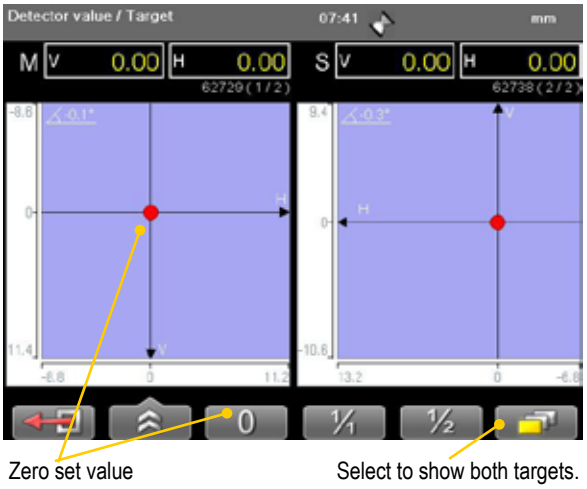
Quick check

1. Set the tolerance to 0.01 mm (0.5mil).
2. Select  and show targets for both M- and S-unit.
3. Select  to zero set value.
4. Place a shim under the magnet base to lift the M-unit 1mm (100mils). The M-unit's reading shall correspond to the movement within 1% (1mil ± 1digit) (0.01mm ± 1 digit).
5. Remove the shim from the M-unit.
6. Select  to zero set value.
7. Make a mark to mark out the position of the detector.
8. Place the shim under the magnet base of the S-unit. The S-unit's reading shall correspond to the movement within 1% (1mil ± 1digit) (0.01mm ± 1 digit).



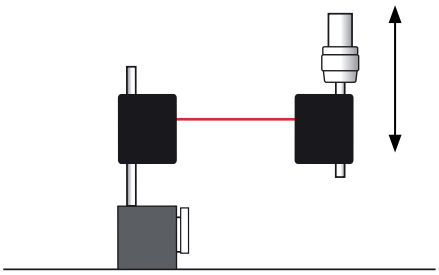
Note!

The shim must be exactly 1 mm. In this example it is only the M-unit that is checked.



Precision check

1. Fasten one unit in a machine tool.
2. Select  to zero set value.
3. Move the units a known distance is to use the movement of a machine tool spindle.
4. The fastened unit's reading shall correspond to the movement within 1% (1mil ± 1digit) (0.01mm ± 1 digit).



Note!

In this example it is only the unit fastened in the machine that is checked.

STRAIGHTNESS

The program Straightness is used for machine foundations, shafts, bearing journals and machine tools for example.

The basic principle for straightness measurement is that all measurement values will show the position of the detector unit relative to the laser beam. First, the laser beam is roughly aligned along the measurement object. The detector is then positioned on the selected measuring points and the values registered.

Work flow

Select  and  to start the Straightness program.

Preparations

Mount units

Rough align

 Show target

 Show reference target

Measure

Press **OK** to register values.

Measurement table view

Measurement position view

Result

 Set tolerance

 Save

 Print report

 Set offset for reference point

 Set reference point

 Best fit around zero

 Best fit all positive

 Best fit all negative

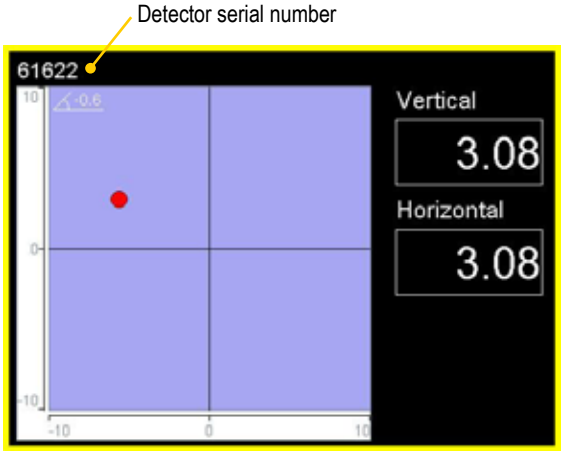
 Waviness

Show target

Select  and  to display a target. This is a quick way to see where the laser beam hits the target and how the detector is positioned. Select  to close the target, or press **OK**.

Calculated and raw values

The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points.

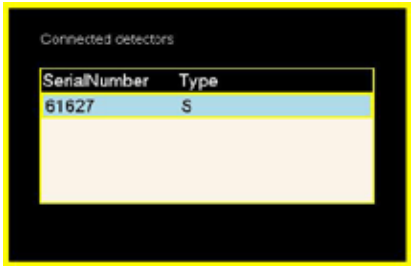


Function buttons

	Zero set displayed value. Only zeroes the value while the target is opened.
	Return to the absolute value.
	Half displayed value. Only zeroes the value while the target is opened.
	Close target. (Or press **OK**).

Show reference target

Select  and  to display the reference target. The first time you select the command, a window is displayed. Select which detector you want to use as reference detector and press **OK**.



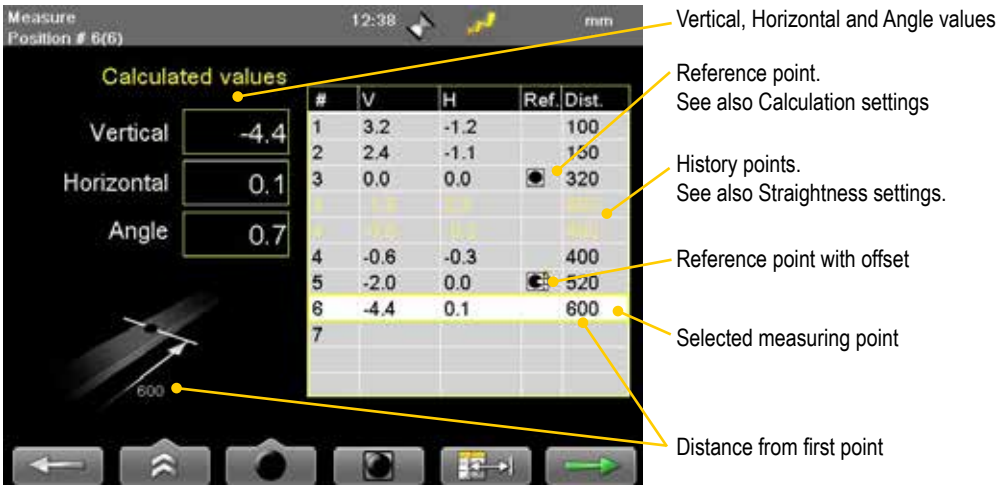
Function buttons

	Zero set displayed value.
	Return to the absolute value.
	Close target. You can also close by pressing **OK**.

See "Half or Zero set value" on page 25.

Measure

1. Press **OK**. A window is displayed where you can enter the distance for the measurement point. If you leave the field empty, you can measure using “quickmode”.
2. Press **OK** to register a value. An hourglass is displayed while the value is registered.
3. Select  to continue to Result view.

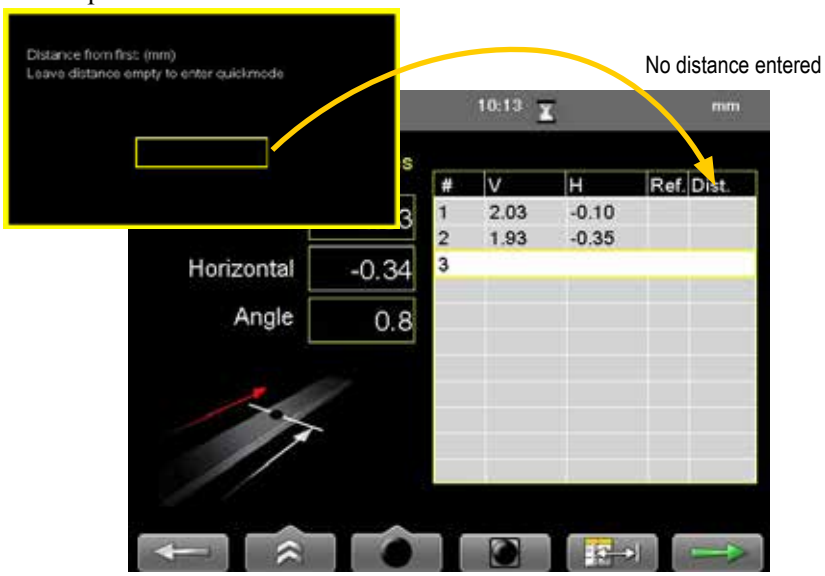


Function buttons

	Leave program.
	 *See “Control panel” on page 14.*  *See“Straightness settings” on page 42*  **Show target**.  **Show reference target**.
	 **Edit distance**. Edit distance for selected point.  **Add measuring point**.  **Delete measuring point**.  **Go to measuring point**. A window is displayed. Enter the point to which you want to go.  **Set offset**. Set offset for selected reference point.  Zero set displayed value. Only available before registering the first point. (Or press numerical button zero.)  Return to the absolute value. Only available before registering the first point. (Or press numerical button 1.)
	Set reference point. *See “Result” on page 34.*
	Open Distance view, *see “Enter distances” on page 32.*
	Continue to Result view. Available when you have registered two points.

Quickmode

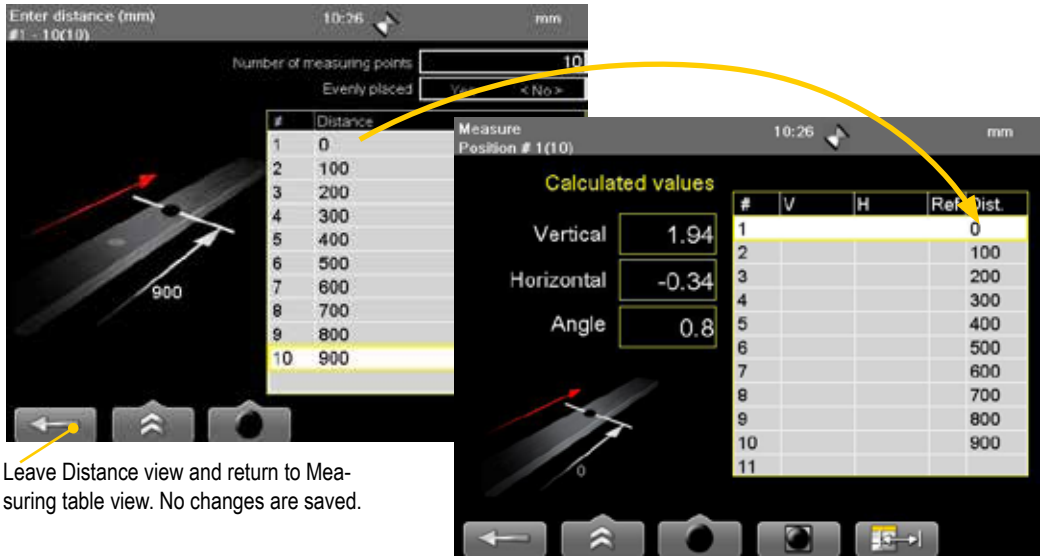
Quickmode means that you measure without entering any distances. Leave field empty to use quickmode.



Enter distances

Select  to open the Distance view. This is an easy way to fill in many distances. Do this before you have registered a value.

1. Enter number of measuring points. Press **OK**.
   - Select if the points are evenly placed or not. Use navigation buttons left and right. If set to <YES>, you are prompted to fill in the distance between point 1 and 2.
   - If set to <No>, fill in each distance in the table.
2. Select  to save changes and return to Measuring table view.

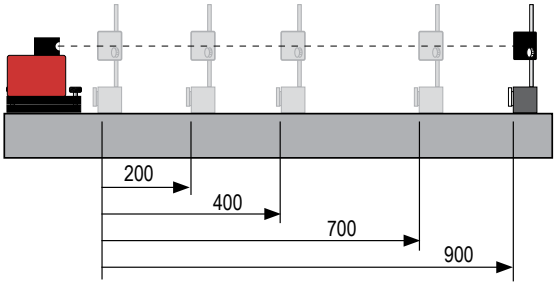


Note!

If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

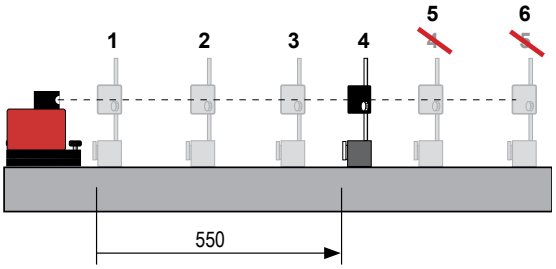
Add and delete points

Distances are always measured from the same point.



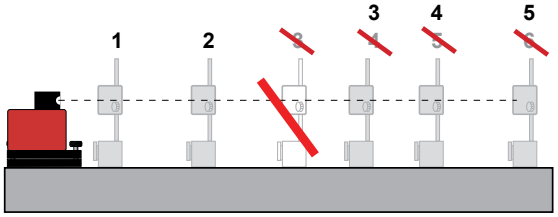
Add measuring point

Adding points between renumbers the existing following points. In this example, we add a new point after point number three.



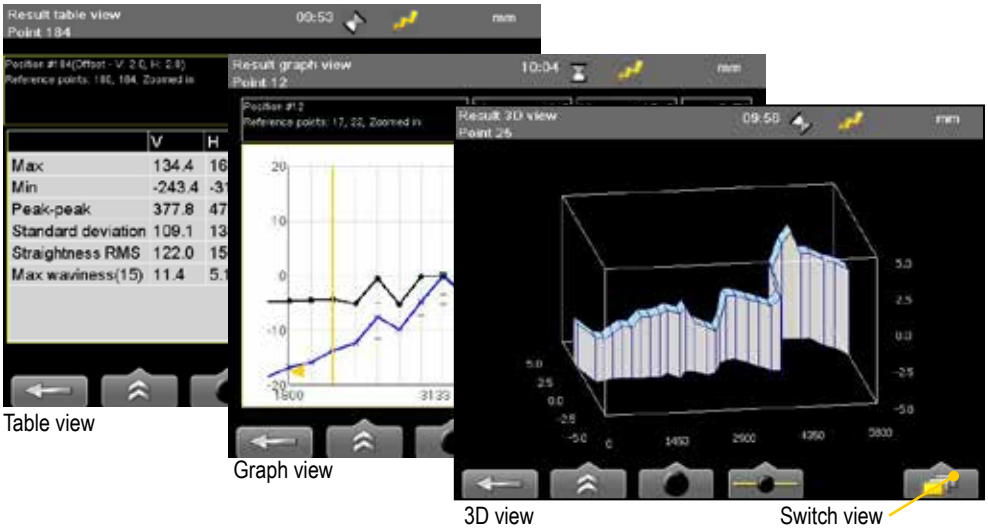
Delete measuring point

Deleting points between renumbers the existing following points. In this example, we delete point number three.



Result

The result can be displayed as graph, table or a 3D view. By default the table view is displayed. The function buttons are almost the same for all three views. Zoom is only available in Graph view. See following pages for more information regarding each view and its functions.

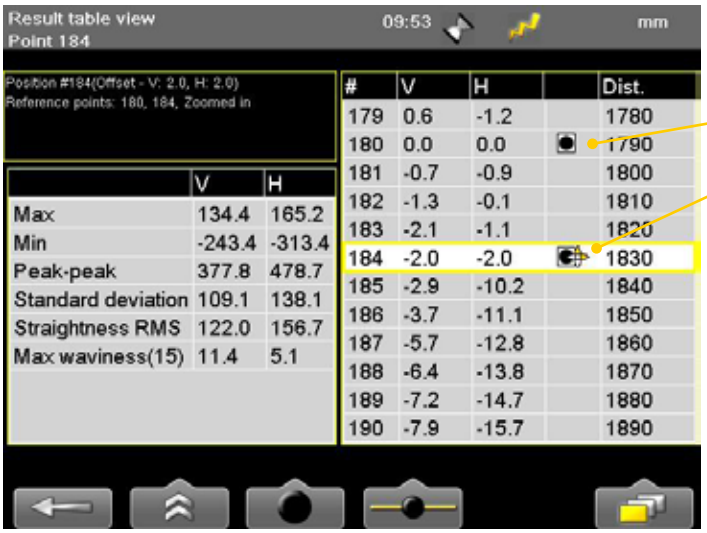


Function buttons

	Back to measure. To remeasure, select a point and then  .
	Contains a sub-menu:  *See "Control panel" on page 14.*  *See "Straightness settings" on page 42.*  **Save file**. *See "Measurement file handling" on page 11.*  **Print report**. Save file and plug in printer (optional equipment).  **Set tolerance**. It is possible to set different vertical and horizontal tolerance. *See "Tolerance" on page 37.*  **Zoom**. Only available in Graph view.
	Contains a sub-menu:  **Go to measuring point**. A window is displayed. Enter the point to which you want to go.  **Set offset for reference point**. *See "Calculation settings" on page 38.*
	Contains a sub-menu. *See "Calculation settings" on page 38.*  **Raw data**. Return to original data.  **Set as reference point**.  **Remove as reference point**. The point itself is **not** removed.  **Best fit around 0**.  **All positive**. The best fit with all measurement points **above** zero.  **All negative**. The best fit with all measurement points **below** zero.  **Show waviness**.
	**Views**. Switch between table, graph and 3D view.

Result table view

Navigate using the navigation buttons. To remeasure, select a point in the list and select  .

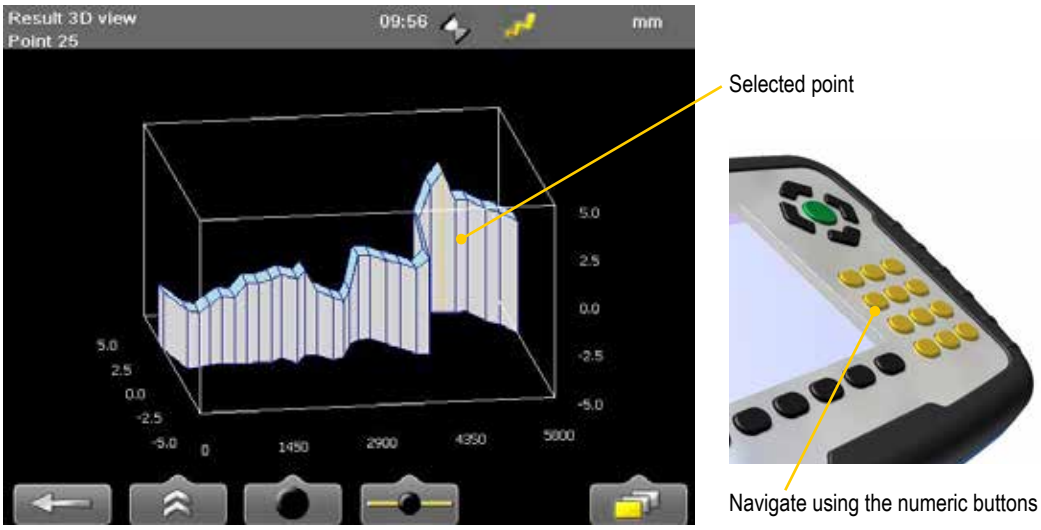


Max	The highest value.
Min	The lowest value.
Peak-peak	Difference between Max and Min value
Standard deviation	Average difference between Max and Min value.
Straightness RMS	Root Mean Square (Numerical Flatness)
Max waviness	Set waviness is shown in bracket. *See "Waviness" on page 41.*

Result 3D view

Navigate using the numeric buttons.

- Buttons 2, 4, 6 and 8 rotates the 3D view.
- Button 5 returns to the initial view.



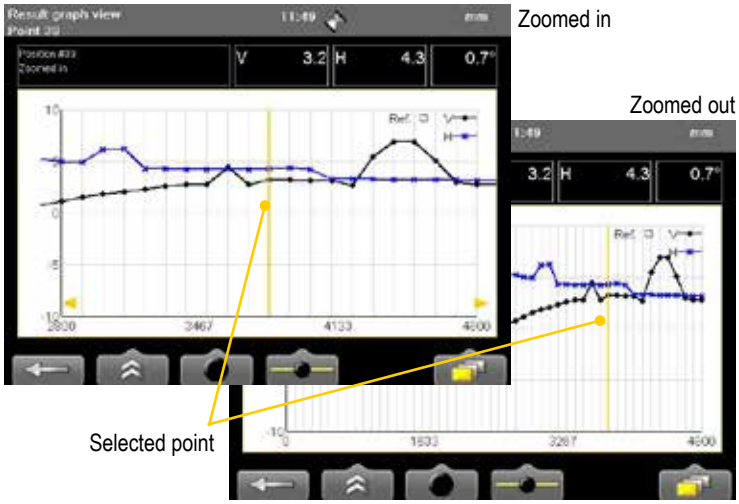
Result graph view

Navigate using the navigation buttons.

Zoom

It is possible to zoom in the graph view if you have registered more than 20 points.

Select a measurement point and select  and  . The graph is zoomed in around the selected point.

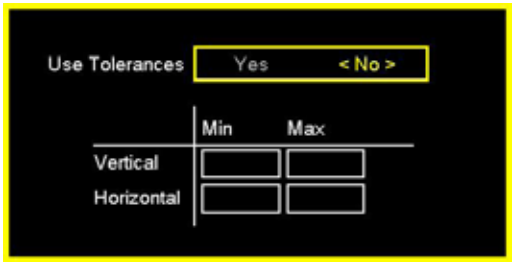


Scale using navigation buttons

Press navigation button “Up” and “Down” to scale the result graph view.

Tolerance

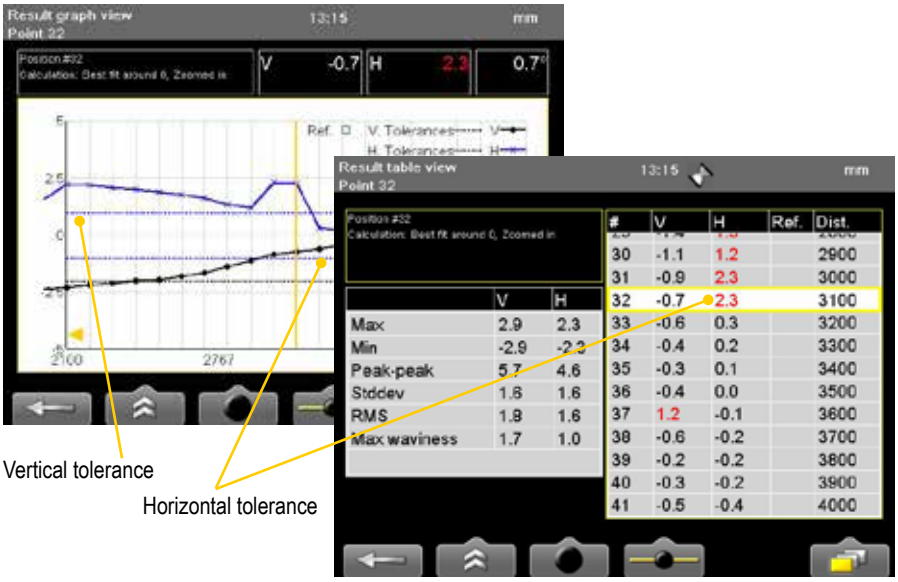
1. Select  . A the tolerance window is displayed.
2. Set use tolerance to <YES>. Navigate using the navigation buttons. Press **OK**.
3. Set vertical and horizontal tolerance. Press **OK** to confirm each tolerance. The tolerance is shown in the result view.



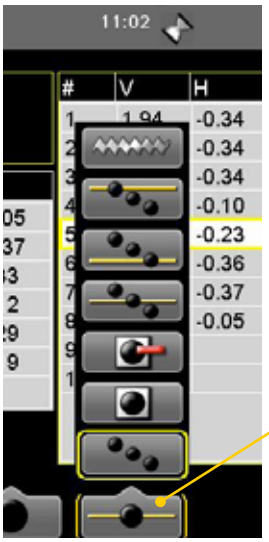
Enter tolerance

Tolerance in graph and table view

- In the Table view, the values within tolerance are shown in black, values not within tolerance are red.
- In the Graph view, vertical and horizontal tolerances are colour coded.



Calculation settings



Select to display sub-menu with different calculation settings.

Select  to revert to original data. All calculations and reference points are removed.

Reference points

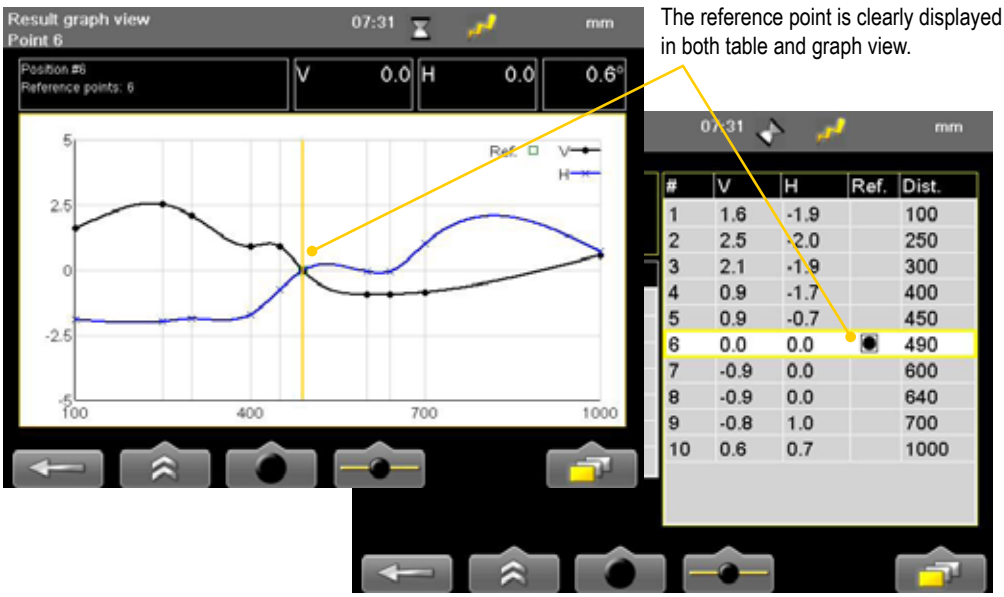
Select  and  to set selected point as reference point. You can set one or two reference points. To remove a reference point, select it in the table or graph and then select  . The point itself is **not** removed. The reference points are clearly displayed in both table and graph.

Note!

You can also set and remove reference points by pressing the green **OK** *button.*

One reference point

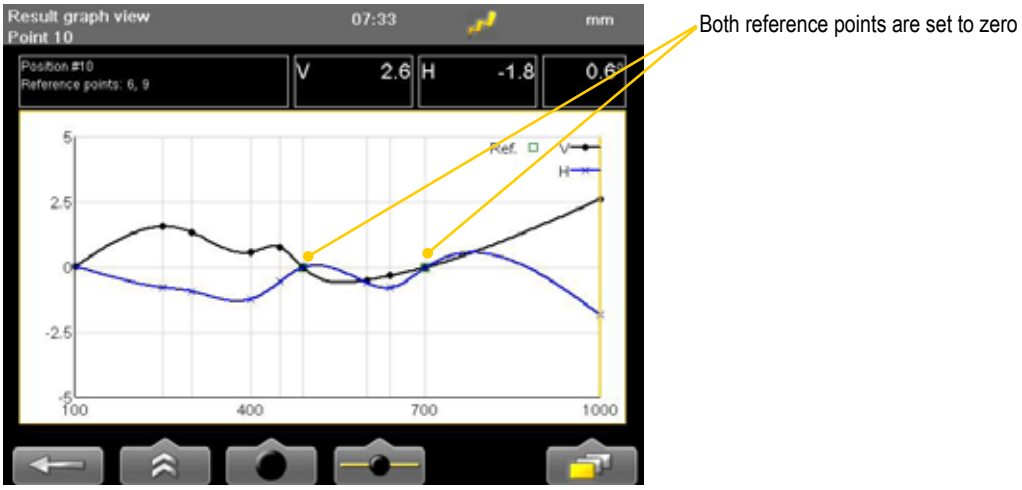
Setting a single reference point will offset all other measurement points based on the set reference point.



The reference point is clearly displayed in both table and graph view.

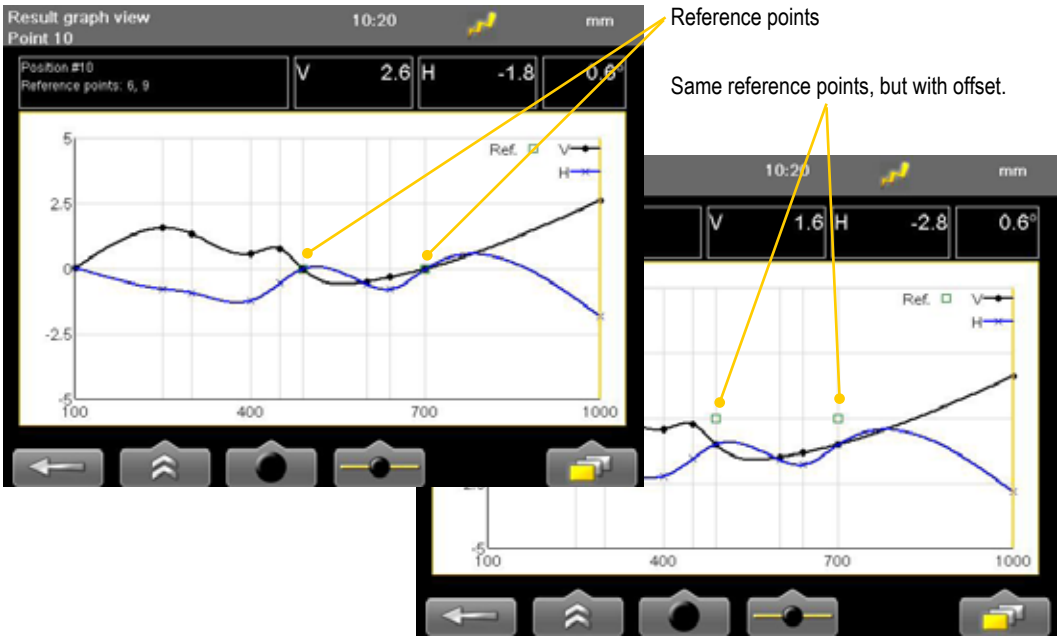
Two reference points

Setting two reference points will offset all other measurement points based on a reference line drawn between the two set reference points.



Reference point with offset

By using reference point offset it is possible to move the position of a reference point. This can be used for instance in turbine measurements to compensate for thermal expansion.



Best fit operations

All best three best fit operations will try to find a reference line where the peak to peak value of the measurement points is minimized. This can be used for instance to see if a surface is within given tolerances. The difference between the best fit operations is the offset that is set.

Best fit – around 0

This operation removes all reference points. Centre the values so that the maximum and minimum values are equally large.

Best fit – all positive

Removes all reference points.

The best fit with all measurement points above zero.

Best fit – all negative

Removes all reference points.

The best fit with all measurement points below zero.

Waviness

It may be insufficient to interpret the quality of a measurement by looking only at the measurement peak to peak value. Waviness is often used to detect large deviations. In some applications there might not be a problem with many small deviations, but one large will cause great problems. Bearings in diesel engines is one example.

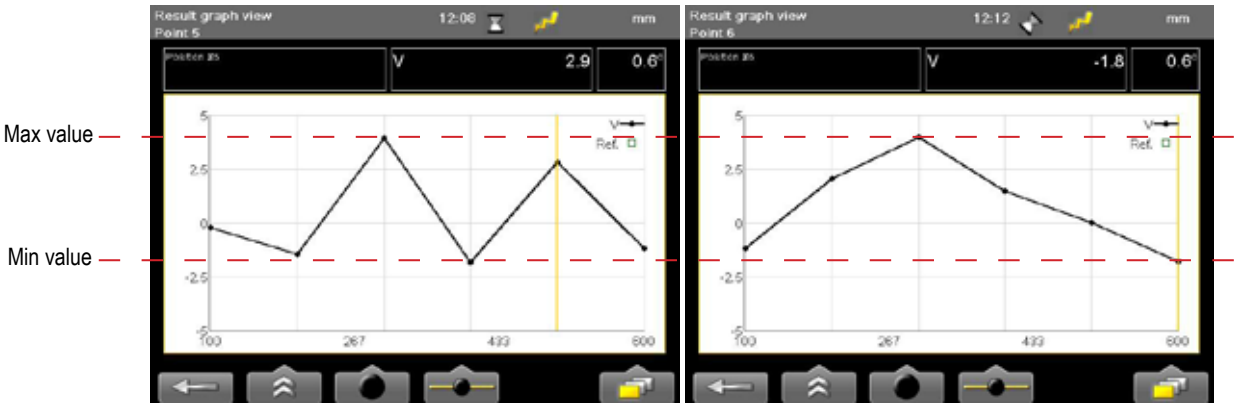
To set waviness, select  and  .

To show waviness graph, select  and  .

Example

The two surfaces in the example below have the same peak to peak value. However the first measurement is rougher than the second.

In many applications a smooth measurement is desired. Using waviness it is possible to indicate the smoothness of a measurement. In this example, the rougher measurement will get a waviness graph with higher values.



Two surfaces with same peak-to-peak value

Waviness calculation

The waviness number is calculated by letting a sliding set of reference points traverse the measurement values. The maximum absolute value between the reference points will determine the waviness number at the given position.

Waviness factor 1 checks the deviations between three measurement points. For example between points 1-3, 2-4 and 3-5 etc.

Waviness factor 2 checks the deviations between four measurement points.

Straightness settings

Select  and  to open Straightness settings.
For global settings, see "Control panel" on page 14.

Show/hide horizontal values

It is possible to hide the horizontal values. The horizontal values will still be registered, but not visible.

1. Select  . A window is opened.
2. Select Yes or No. Navigate using the navigation buttons.
3. Press **OK** to confirm choice.

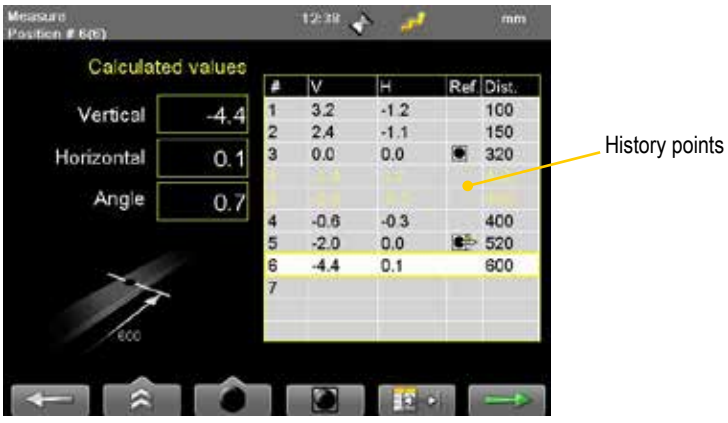
Note!

Only available when you use the program Straightness with a two axis detector.

Show history

If you remeasure a point, the old values are saved as history points. You can select to show or hide these points while measuring. It is only possible to select the latest registered value, not the history points. If you delete a point with history points, all its history is deleted as well. Default is set to hide. Even when set to "hide", the history points are saved and can be viewed later.

1. Select  . A window is opened.
2. Select Yes or No. Navigate using the navigation buttons.
3. Press **OK** to confirm choice.



Smooth/sharp graph

1. Select  . A window is opened.
2. Select Yes or No. Navigate using the navigation buttons.
3. Press **OK** to confirm choice.

When set to Smooth, the graph will find a smooth path between the measurement points.

Sharp

Smooth

Waviness settings

1. Select  . A window is opened.
2. Select waviness factor. Navigate using the navigation buttons.
3. Press **OK** to confirm choice.

To show waviness in the result view, select  and  .

Graph view

Same measurement but with waviness

See "Waviness" on page 41.

HALF CIRCLE

Values are registered at three positions in a half bore. Used for turbines for example.

Work flow

Select  and  to start program Half circle.

Preparations

Mount units

Rough align

 Show target

 Show reference target

Measure

Press **OK** to register values.

Measurement table view

Measurement position view

Adjust position view

Result

 Set tolerance

 Save

 Print report

 Set offset for reference point

 Set reference point

 Best fit around zero

 Best fit all positive

 Best fit all negative

 Waviness

Rough align

Select  and  to open the target. Adjust laser point to the centre of the target.

The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points.

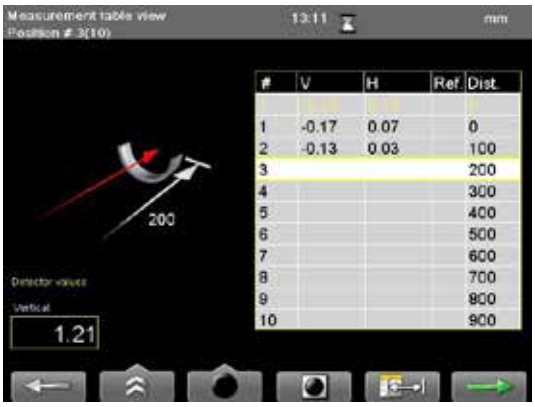
See "Show target" on page 30.

Measure

The measuring phase consists of three different views:

- Measurement table view
- Measurement position view
- Adjustment view.

See following pages for more information regarding each view and its functions.



Measurement table view

Select which position to measure. The table shows the calculated values for all measured positions.

Measurement position view

Measure points for selected position

Adjustment view

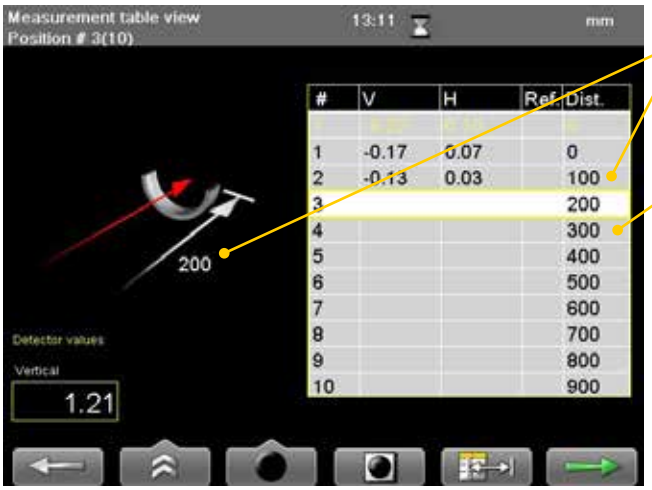
Adjust position. When you have adjusted a position, you need to remeasure it.

Adjustment ready

Measurement table view

The table shows the calculated values for all measured positions.

Press **OK** to register a value. You are redirected to Measurement position view.

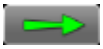


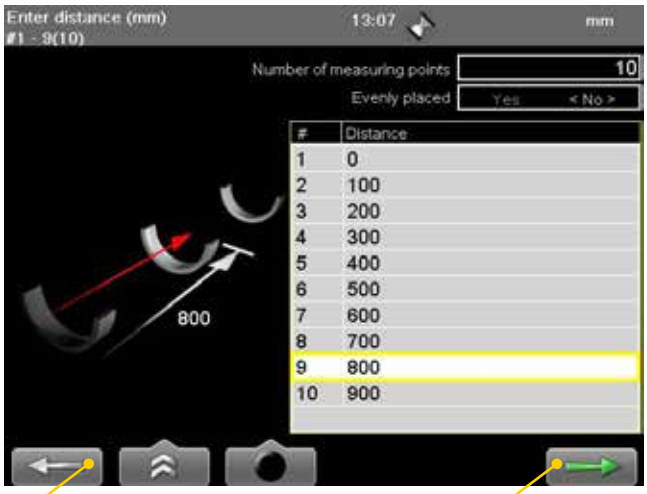
Function buttons

	Leave program.
	See *"Control panel" on page 14*. See *"Straightness settings" on page 42*. See *"Show target" on page 30*. **Show reference target**.
	Edit distance. Edit distance for selected point. **Add measuring point**. **Delete measuring point**. *See "Add and delete points" on page 33*. **Go to measuring point**. A window is displayed. Enter the point to which you want to go. **Set offset**. Set offset for selected reference point.
	Set reference point. *See "Result" on page 34*.
	Open Distance view, *see "Enter distances" on page 32*.
	Continue to Result view. Available when you have registered two positions.

Enter distances

Select  to open the Distance view. This is an easy way to fill in many distances.

1. Enter number of measuring points. Press **OK**.
   - Select if the points are evenly placed or not. Use navigation buttons left and right. If set to <YES>, you are prompted to fill in the distance between point 1 and 2.
   - If set to <No>, fill in each distance in the table.
2. Select  to save changes and return to Measuring table view.



Leave Distance view and return to Measuring table view. No changes are saved.

Save changes and return to Measuring table view.

Note!

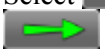
If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

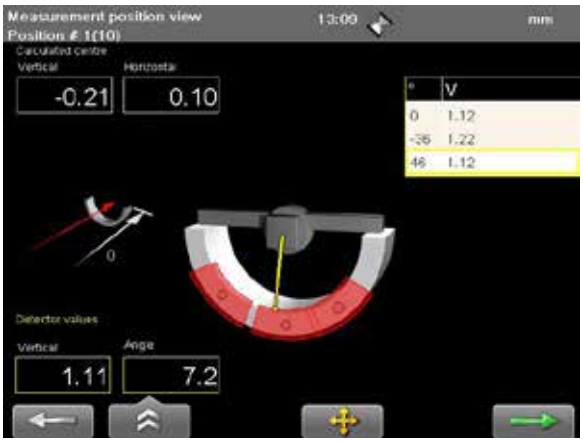
Measurement position view

In this view, you measure points on the selected position.

With inclinometer values

The inclinometer values are displayed. It is possible to register points anywhere.

1. Press **OK** to register first position. A red marking is displayed.
2. Turn outside of the red marking.
3. Press **OK** to register second position.
4. Turn outside of the red markings.
5. Press **OK** to register third position.
6. Select  to adjust position, or  to measure next position.



Inclinometer values on

Without inclinometer values

With the inclinometer values hidden, you are prompted to register points at three positions. Press **OK** to register values.

Calculated values. Available when you have registered three points on current position.

Inclinometer values off

Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Only available before registering the first position.  Zero set displayed value.  Return to the absolute value.  Half displayed value. *See "Half or Zero set value" on page 25*.
	Toggles between showing and hiding inclinometer values.
	Adjust position. Available when you have registered three points.
	Continue to next position. Available when you have registered three points on current position.

Adjustment view

The function button  is available when you have registered three points on current position. In the Adjustment view, you adjust current position according to live values. When you are done, you need to remeasure the position.

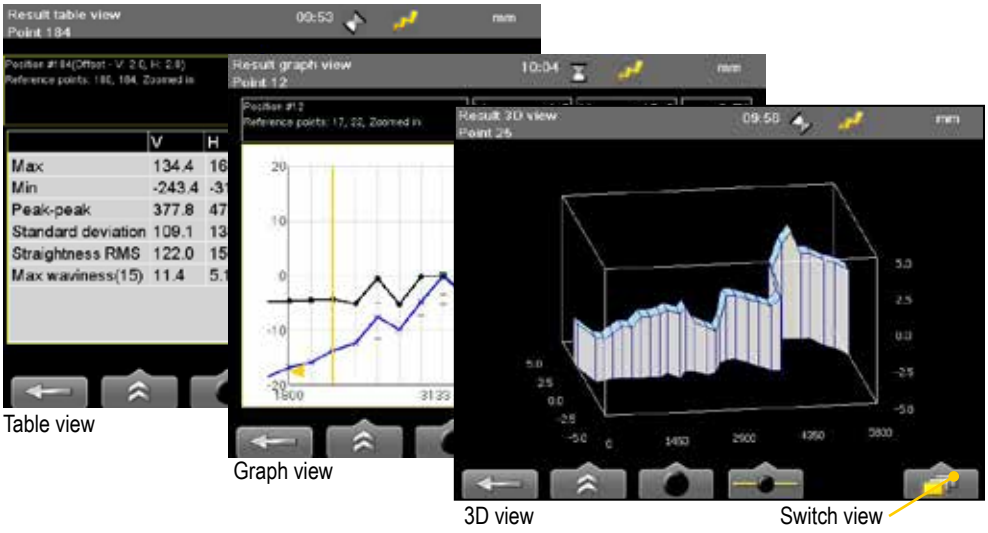
1. Select  . The Adjustment view is displayed.
2. Move to within the live adjustment areas.
   - **With inclinometer**: Move the detector until the marker is within the adjustment areas.
   - **Without inclinometer**: Move the detector and use the navigation buttons to move the marker to the adjustment areas.
3. Make adjustment.
4. Select  when you are done.
5. Remeasure the position.

Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Adjustment ready. Returns to Measurement table view. You need to re-measure the position.

Result

The result can be displayed as graph, table or a 3D view. By default the table view is displayed. The function buttons are almost the same for all three views. Zoom is only available in Graph view.



Note!

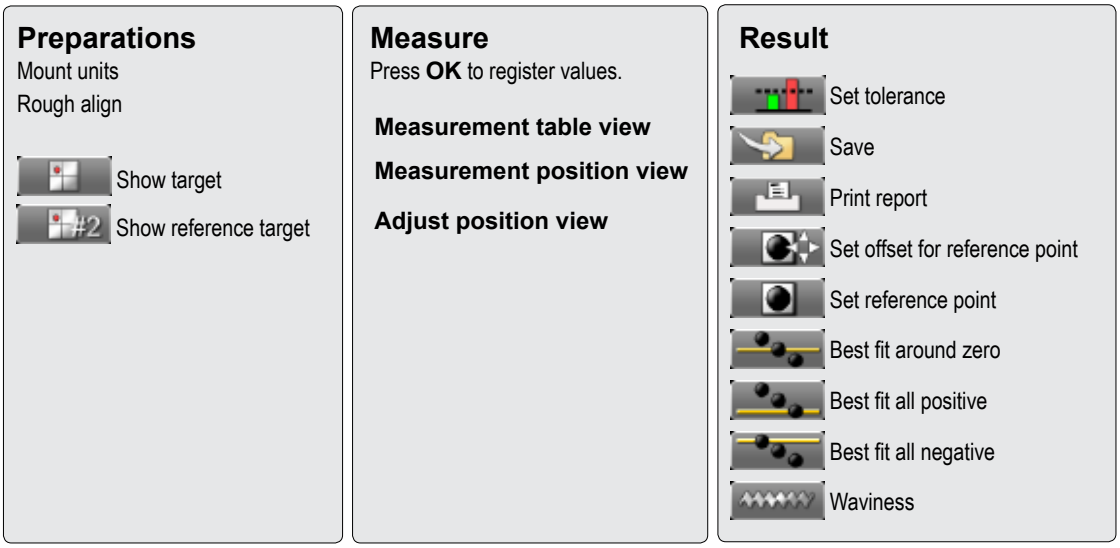
For more information regarding the result views and its functions, *see "Result" on page 34*.

FOURPOINTS


Values are registered at four positions in a full bore.

Work flow

Select  and  to start the Fourpoints program.



Rough align

Select  and  to open the target. Adjust laser point to the centre of the target.

The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points.

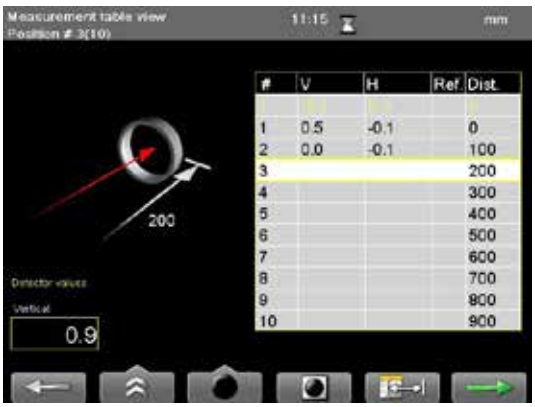
See "Show target" on page 30.

Measure

The measuring phase consists of three different views:

- Measurement table view
- Measurement position view
- Adjustment view.

See following pages for more information regarding each view and its functions.



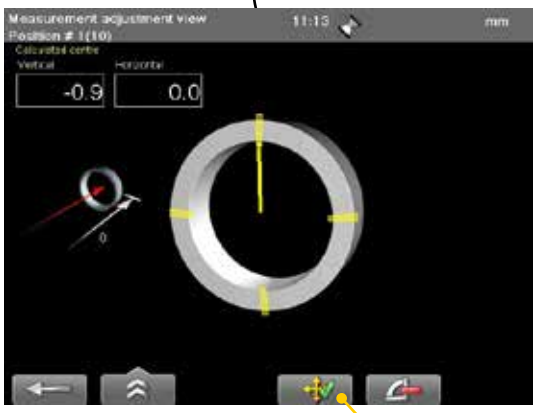
Measurement table view

Select which position to measure. The table shows the calculated values for all measured positions.

Measurement position view

Measure points for selected position

Measure next position



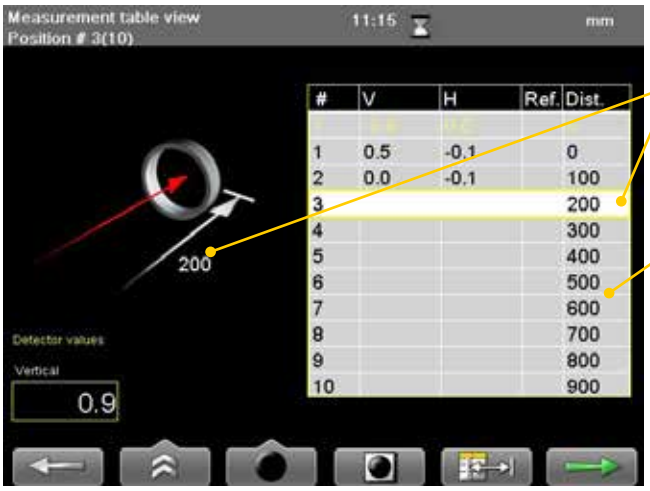
Adjustment view

Adjust position. When you have adjusted a position, you need to remeasure it.

Adjustment ready

Measurement table view

The table shows the calculated values for all measured positions. Press **OK** to register a value. You are redirected to Measurement position view.



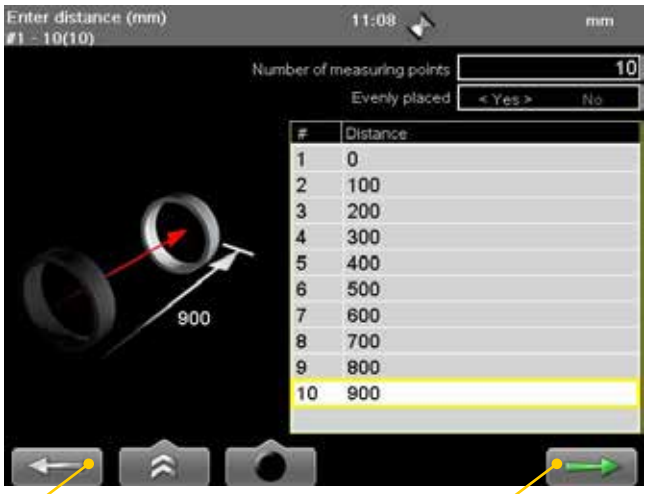
Function buttons

	Leave program.
	See *"Control panel" on page 14*. See *"Straightness settings" on page 42*. See *"Show target" on page 30*. **Show reference target**.
	Edit distance. Edit distance for selected point. **Add measuring point**. **Delete measuring point**. *See "Add and delete points" on page 33*. **Go to measuring point**. A window is displayed. Enter the point to which you want to go. **Set offset**. Set offset for selected reference point.
	Set reference point. *See "Result" on page 34*.
	Open Distance view, *see "Enter distances" on page 32*.
	Continue to Result view. Available when you have registered two positions.

Enter distances

Select  to open the Distance view. This is an easy way to fill in many distances.

1. Enter number of measuring points. Press **OK**.
   - Select if the points are evenly placed or not. Use navigation buttons left and right. If set to <YES>, you are prompted to fill in the distance between point 1 and 2.
   - If set to <No>, fill in each distance in the table.
2. Select  to save changes and return to Measuring table view.



Leave Distance view and return to Measuring table view. No changes are saved.

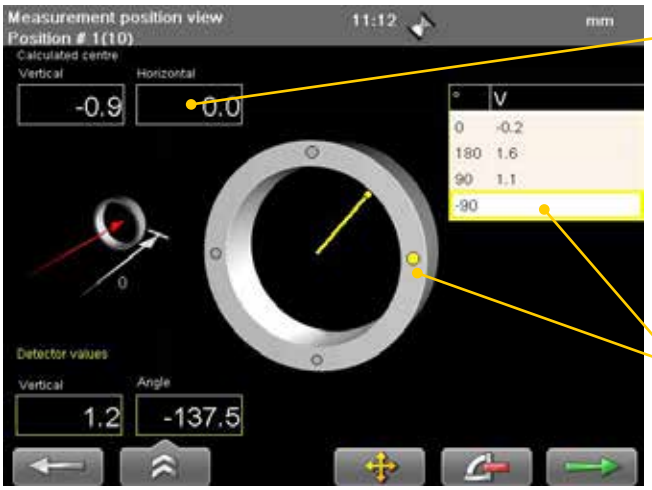
Save changes and return to Measuring table view.

Note!

If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

Measurement position view

In this view, you measure points on the selected position. Press **OK** to register a value.



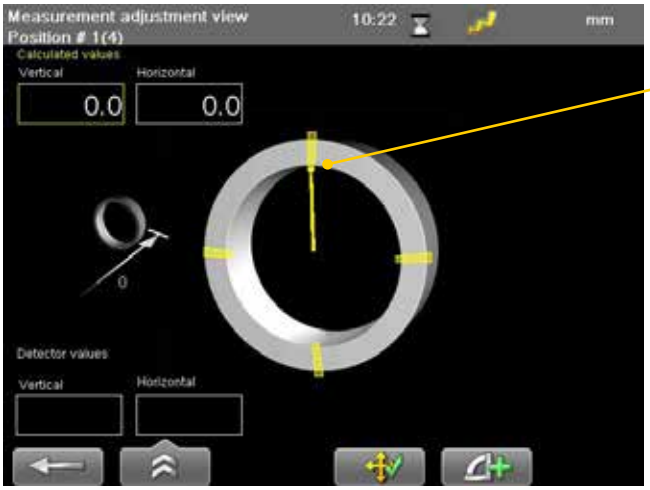
Function buttons

	Back to Measurement table view.
	Show target. See *"Show target" on page 30*. **Show reference target**.
0½	Only available before registering the first position. 0 Zero set displayed value. 1/1 Return to the absolute value. ½ Half displayed value. *See "Half or Zero set value" on page 25*.
	Toggles between showing and hiding inclinometer values.
	Open adjustment view. Available when you have registered at least both horizontal or vertical values.
	Continue to next position. Available when you have registered at least both horizontal or vertical values.

Adjustment view

Select  to open the Adjustment view. Here you can adjust current position according to live values. When you are done, you need to remeasure the position.

1. Select  . The Adjustment view is displayed.
2. Move to within the live adjustment areas.
   - **With inclinometer**: Move the detector until the marker is within the adjustment areas.
   - **Without inclinometer**: Move the detector and use the navigation buttons to move the marker to the adjustment areas.
3. Make adjustment.
4. Select  when you are done.
5. Remeasure the position.



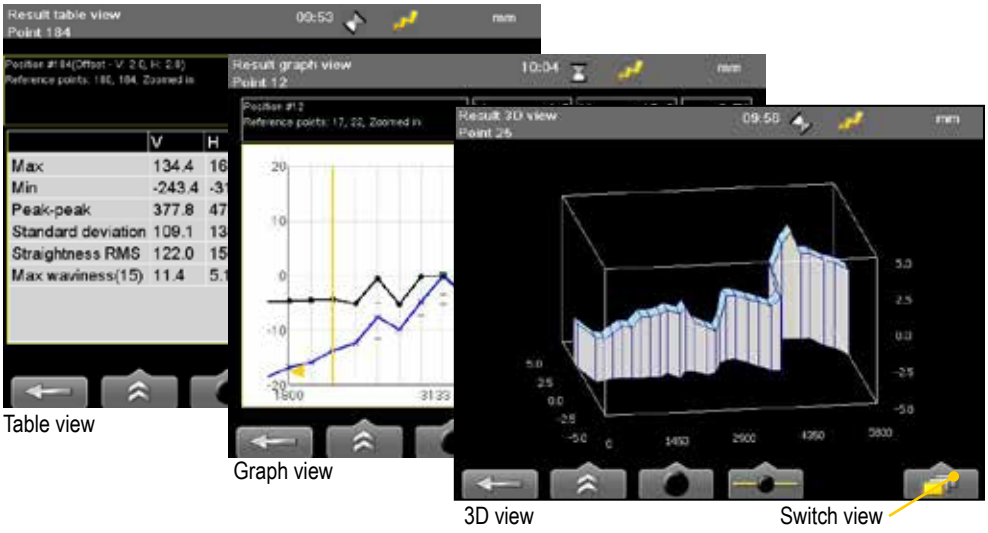
Horizontal or vertical values are live when arrow is within the yellow live marks.

Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Adjustment ready. Returns to Measurement table view. You need to remeasure the position.
	Toggles between showing and hiding inclinometer values.

Result

The result can be displayed as graph, table or a 3D view. By default the table view is displayed. The function buttons are almost the same for all three views. Zoom is only available in Graph view.



Note!

For more information regarding the result views and its functions, *see "Result" on page 34*.

MULTIPOINTS

Values are registered at three or more points at optional positions.
Used in both half and full bores.

Work flow

Select  and  to start the Multipoints program.

Preparations

Mount units

Rough align

 Show target

 Show reference target

Measure

Press **OK** to register values.

Measurement table view

Measurement position view

Adjust position view

Result

 Set tolerance

 Save

 Print report

 Set offset for reference point

 Set reference point

 Best fit around zero

 Best fit all positive

 Best fit all negative

 Waviness

Rough align

Select  and  to open the target. Adjust laser point to the centre of the target.

The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points.

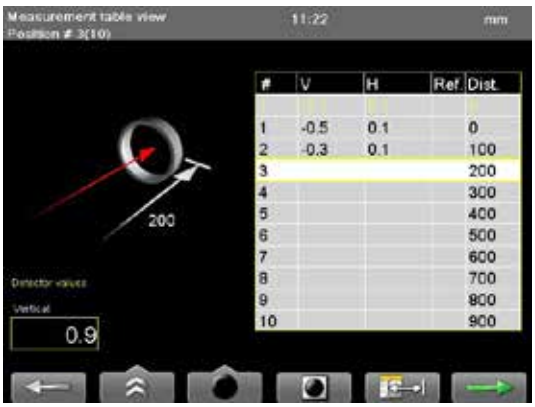
See "Show target" on page 30.

Measure

The measuring phase consists of three different views:

- Measurement table view
- Measurement position view
- Adjustment view.

See following pages for more information regarding each view and its functions.



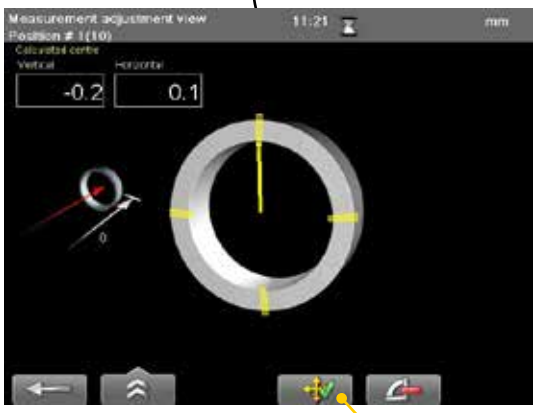
Measurement table view

Select which position to measure. The table shows the calculated values for all measured positions.

Measurement position view

Measure points for selected position

Measure next position



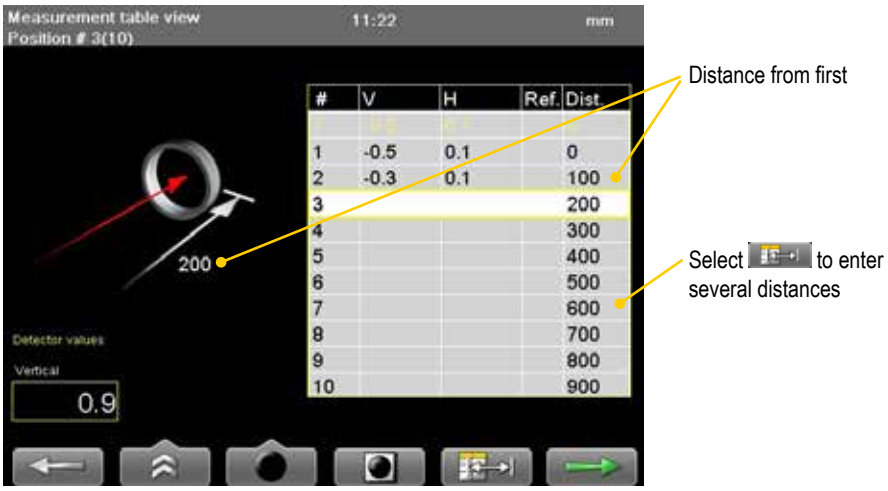
Adjustment view

Adjust position. When you have adjusted a position, you need to remeasure it.

Adjustment ready

Measurement table view

The table shows the calculated values for all measured positions. Press **OK** to register a value. You are redirected to Measurement position view.

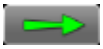


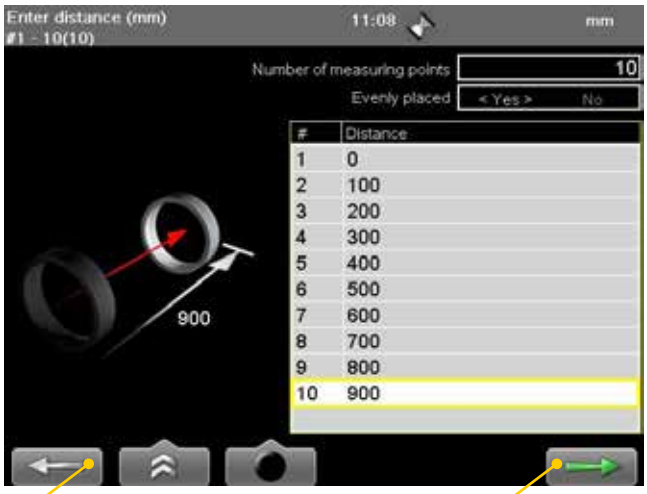
Function buttons

	Leave program.
	See *"Control panel" on page 14*. See *"Straightness settings" on page 42*. See *"Show target" on page 30*. **Show reference target**.
	Edit distance. Edit distance for selected point. **Add measuring point**. **Delete measuring point**. *See "Add and delete points" on page 33*. **Go to measuring point**. A window is displayed. Enter the point to which you want to go. **Set offset**. Set offset for selected reference point.
	Set reference point. *See "Result" on page 34*.
	Open Distance view, *see "Enter distances" on page 32*.
	Continue to Result view. Available when you have registered two positions.

Enter distances

Select  to open the Distance view. This is an easy way to fill in many distances.

1. Enter number of measuring points. Press **OK**.
   - Select if the points are evenly placed or not. Use navigation buttons left and right. If set to <YES>, you are prompted to fill in the distance between point 1 and 2.
   - If set to <No>, fill in each distance in the table.
2. Select  to save changes and return to Measuring table view.



Leave Distance view and return to Measuring table view. No changes are saved.

Save changes and return to Measuring table view.

Note!

If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

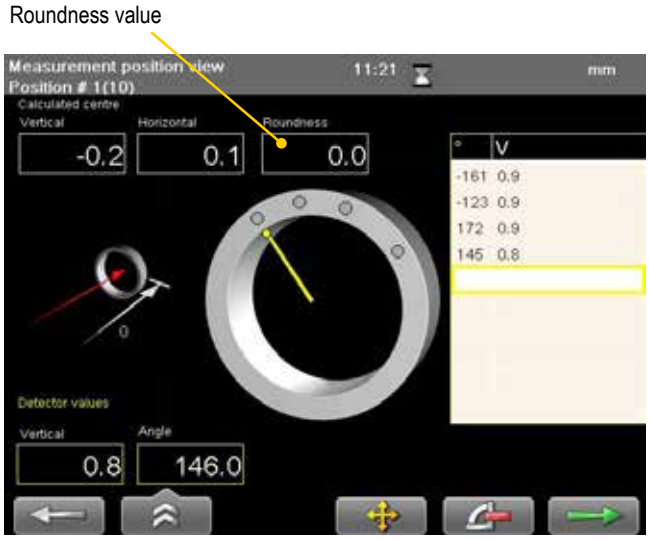
Measurement position view

In this view, you measure points on the selected position.

1. Turn detector to any position.
2. Press **OK** to register points.

For a more reliable measurement, spread out the measuring points as much as possible.

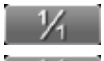
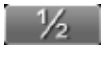
When you have registered three points, calculated values for current position are displayed. When you have registered four points, a roundness value is displayed.



Without inclinometer values

1. Select  to hide the inclinometer value.
2. Press **OK.** A window is displayed.
3. Enter the angle where you want to measure and press **OK**.

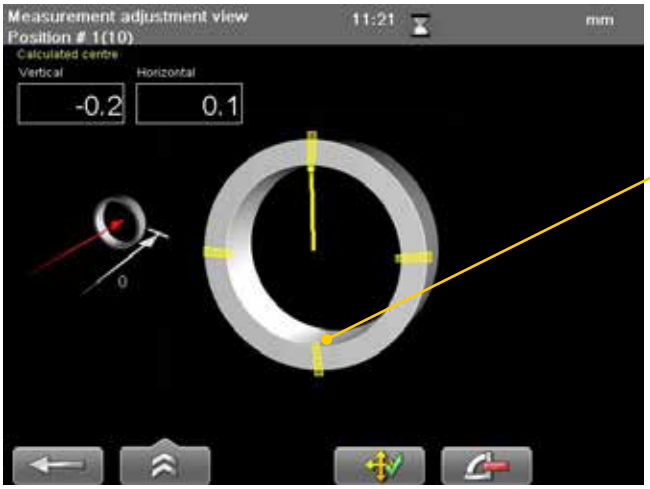
Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Only available before registering the first position.  Zero set displayed value.  Return to the absolute value.  Half displayed value. *See "Half or Zero set value" on page 25*.
 	Toggles between showing and hiding inclinometer values.
	Adjust position. Available when you have registered three points.
	Continue to next position. Available when you have registered three points on current position.

Adjustment view

The function button  is available when you have registered three points on current position. In the Adjustment view, you adjust current position according to live values. When you are done, you need to remeasure the position.

1. Select  . The Adjustment view is displayed.
2. Move to within the live adjustment areas.
   - **With inclinometer**: Move the detector until the marker is within the adjustment areas.
   - **Without inclinometer**: Move the detector and use the navigation buttons to move the marker to the adjustment areas.
3. Make adjustment.
4. Select  when you are done.
5. Remeasure the position.

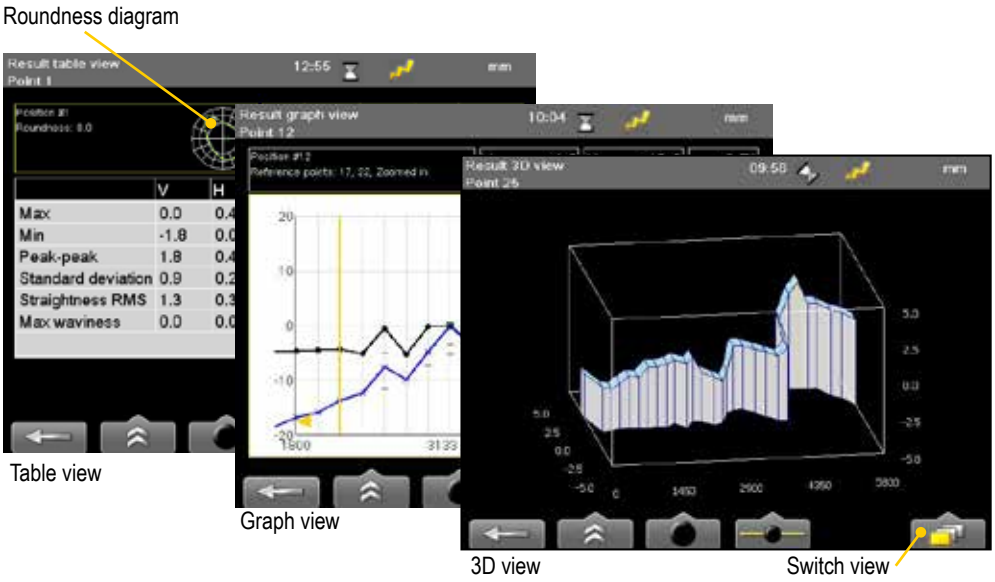


Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Adjustment ready. Returns to Measurement table view. You need to re-measure the position.
	Toggles between showing and hiding inclinometer values.

Result

The result can be displayed as graph, table or a 3D view. By default the table view is displayed. The function buttons are almost the same for all three views. Zoom is only available in Graph view.



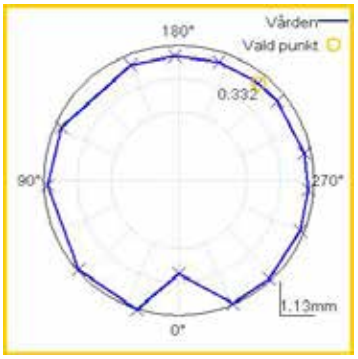
Note!

For more information regarding the result views and its functions, *see "Result" on page 34*.

Roundness

Roundness is calculated when you have registered at least four points on current position. A small roundness diagram is displayed in the table view. The roundness number is defined as the peak to peak difference between the taken measurement points and a circle fit adjusted to the measurement values.

Select  and  to display a polar diagram for the selected position.



CENTRE OF CIRCLE

Values are registered at two positions in a full bore.
Used for diesel engines, propeller shaft installations for example.

Note!

The Centre of circle program is not available in the USA.

Work flow

Select  and  to start the Centre of circle program.

Preparations

Mount units

Rough align

 Show target

 Show reference target

Measure

Press **OK** to register values.

Measurement table view

Measurement position view

Adjust position view

Result

 Set tolerance

 Save

 Print report

 Set offset for reference point

 Set reference point

 Best fit around zero

 Best fit all positive

 Best fit all negative

 Waviness

Rough align

Select  and  to open the target. Adjust laser point to the centre of the target.

The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points.

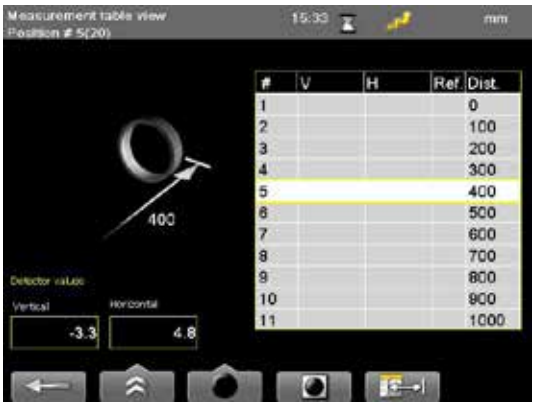
See "Show target" on page 30.

Measure

The measuring phase consists of three different views:

- Measurement table view
- Measurement position view
- Adjustment view.

See following pages for more information regarding each view and its functions.



Measurement table view

Select which position to measure. The table shows the calculated values for all measured positions.

Measurement position view

Measure points for selected position

Measure next position

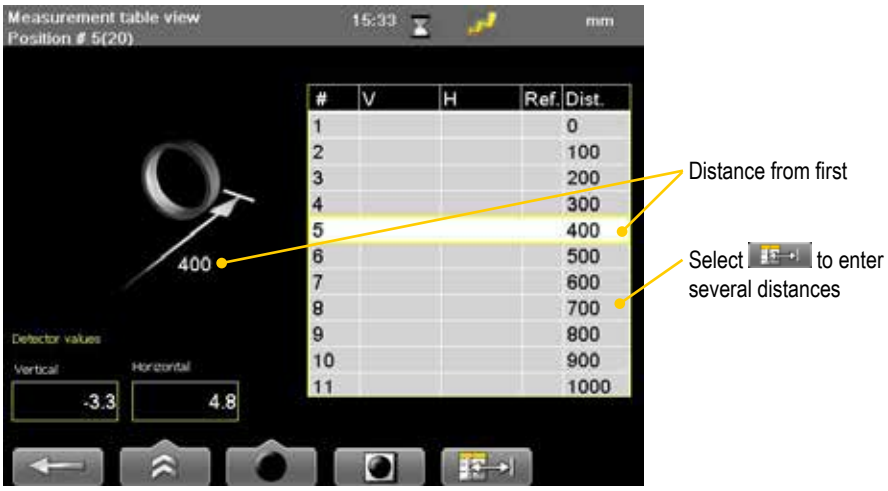
Adjustment view

Adjust position. When you have adjusted a position, you need to remeasure it.

Adjustment ready

Measurement table view

The table shows the calculated values for all measured positions. Press **OK** to register a value. You are redirected to Measurement position view.



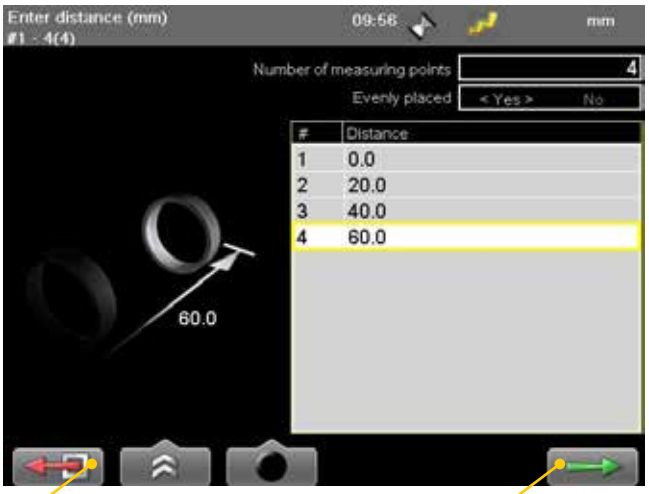
Function buttons

	Leave program.
	See *"Control panel" on page 14*. See *"Straightness settings" on page 42*. See *"Show target" on page 30*. **Show reference target**.
	Edit distance. Edit distance for selected point. **Add measuring point**. **Delete measuring point**. *See "Add and delete points" on page 33*. **Go to measuring point**. A window is displayed. Enter the point to which you want to go. **Set offset**. Set offset for selected reference point.
	Set reference point. *See "Result" on page 34*.
	Open Distance view, *see "Enter distances" on page 32*.
	Continue to Result view. Available when you have registered two positions.

Enter distances

Select  to open the Distance view. This is an easy way to fill in many distances.

1. Enter number of measuring points. Press **OK**.
   - Select if the points are evenly placed or not. Use navigation buttons left and right. If set to <YES>, you are prompted to fill in the distance between point 1 and 2.
   - If set to <No>, fill in each distance in the table.
2. Select  to save changes and return to Measuring table view.



Leave Distance view and return to Measuring table view. No changes are saved.

Save changes and return to Measuring table view.

Note!

If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

Measurement position view

In this view, you measure points on the selected position. Press **OK** to register a value.

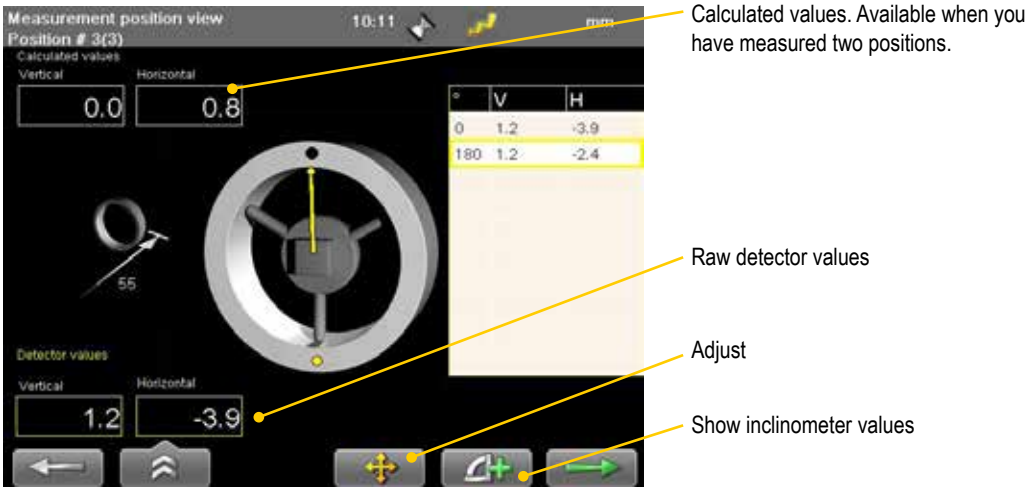
With inclinometer values

The inclinometer values are displayed. The yellow dot indicates where to register the value.

1. Turn to the yellow dot.
2. Press **OK** to register the position.
3. Turn outside of the red markings.
4. Press **OK** to register third position.
5. Select  to adjust position, or  to measure next position.

Without inclinometer values

With the inclinometer values hidden, you are prompted to register points at three positions. Press **OK** to register values. Move the marker using the navigation buttons.



Function buttons

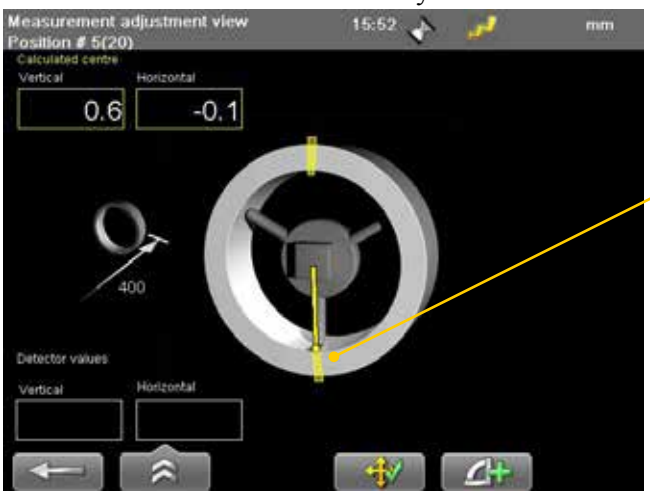
	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Only available before registering the first position.  Zero set displayed value.  Return to the absolute value.  Half displayed value. *See "Half or Zero set value" on page 25*.
	Toggles between showing and hiding inclinometer values.
	Adjust position. Available when you have registered both points on current position.
	Continue to next position. Available when you have registered both points on current position.

Adjustment view

The function button  is available when you have registered three points on current position. In the Adjustment view, you adjust current position according to live values. When you are done, you need to remeasure the position.

1. Select  . The Adjustment view is displayed.
2. Move to within the live adjustment areas.
   - **With inclinometer**: Move the detector until the marker is within the adjustment areas.
   - **Without inclinometer**: Move the detector and use the navigation buttons to move the marker to the adjustment areas.
3. Make adjustment.
4. Select  when you are done.
5. Remeasure the position.

Calculated values are marked with yellow. Live values.



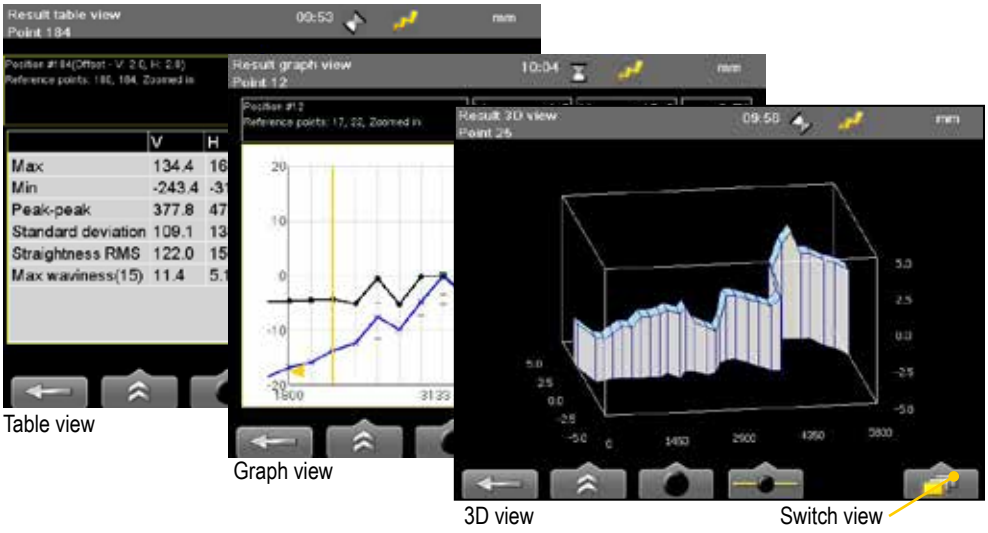
Horizontal or vertical values are live when marker is within the yellow adjustment areas.

Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 30*.  **Show reference target**.
	Adjustment ready. Returns to Measurement table view. You need to re-measure the position.
	Toggles between showing and hiding inclinometer values.

Result

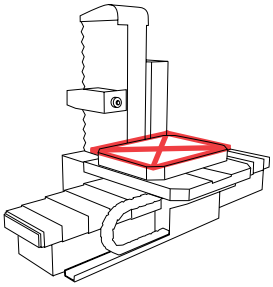
The result can be displayed as graph, table or a 3D view. By default the table view is displayed. The function buttons are almost the same for all three views. Zoom is only available in Graph view.



Note!

For more information regarding the result views and its functions, *see "Result" on page 34*.

FLATNESS

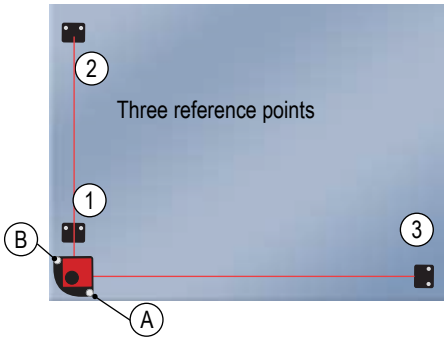


Program to measure flatness of machine bases, machine tables, etc.

Preparation

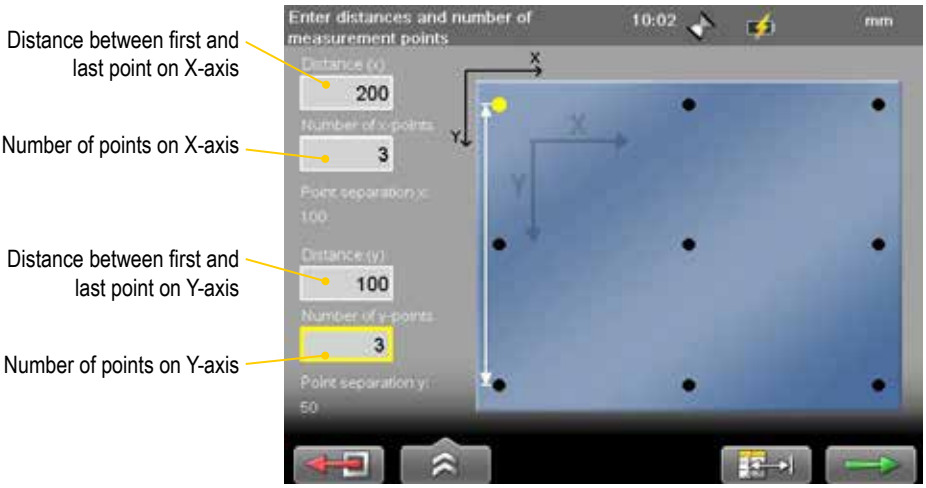
1. Mount the laser transmitter on the table.
2. Mount the detector close to the transmitter on the table (**1**).
3. Select  to open the program Flatness and enter distances.
4. Select  to open the target.
5. Select  to zero set the value. This is now reference point number one.
6. Move the detector to reference point number two (**2**).
7. Adjust the laser beam by using the screw (**A**) on the tilt table. Level to ± 0.1 mm.
8. Move the detector to reference point number three (**3**).
9. Adjust the laser beam by using the screw (**B**) on the tilt table. Level to ± 0.1 mm.

Repeat procedure until you have all three reference points within ± 0.1 mm.



Enter distances

Up to 500 measurement points can be handled.



Function buttons

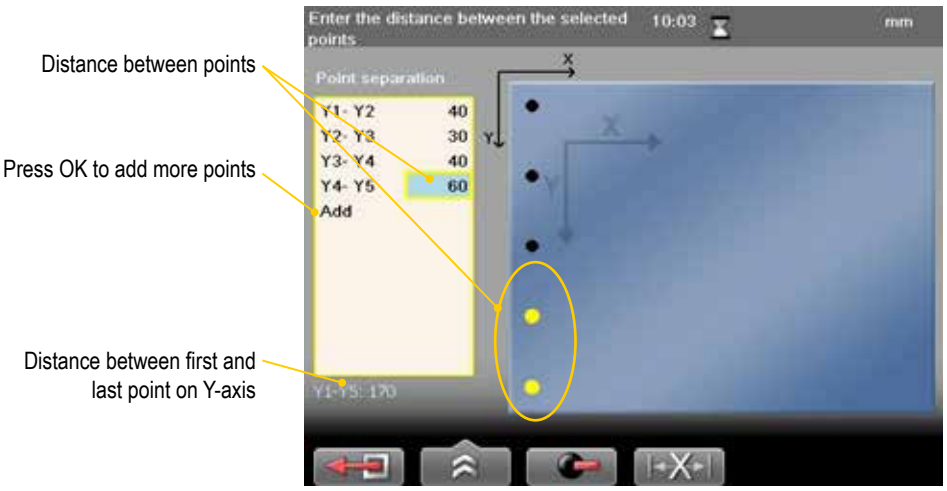
	**Back**. Leave program.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 79.*
	Open distance table view. *"Distance table view" on page 78.*
	Continue to Measure view.

Note!

If one of your axis has more than six measurement points, make that the Y-axis. This will give you a better pdf-report.

Distance table view

Select  to open Distance table view. Use if the distances between points vary in X or Y axis.

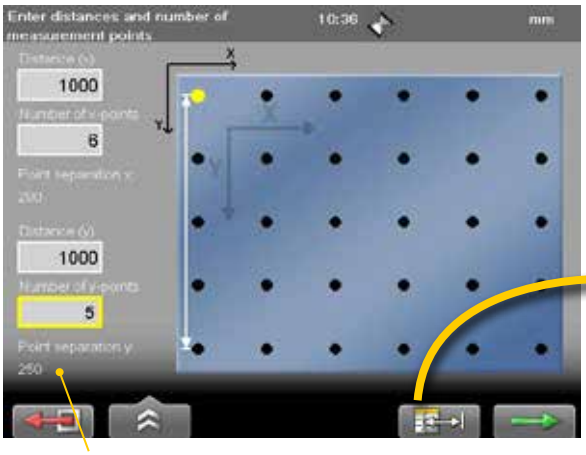


Function buttons

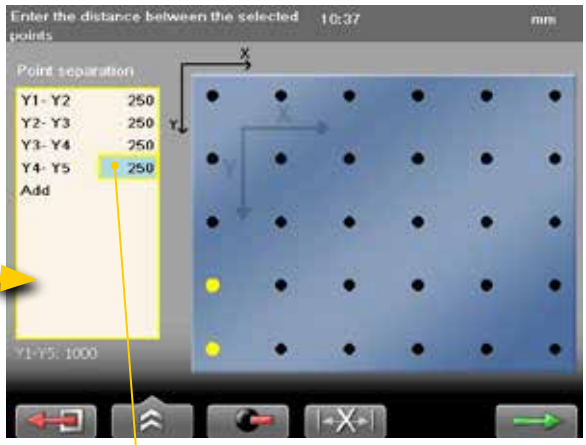
	Leave Distance table view and return to Distance view. No changes are saved.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 79.*
	Delete point. It is only possible to delete the last point in the list.
	Toggle button. Enter distances for X or Y-axis.
	Continue to Measure view.

Note!

It is also possible to enter distances in the default distance view and switch to Distance table view. This is a fast way if you only need to change one out of many distances



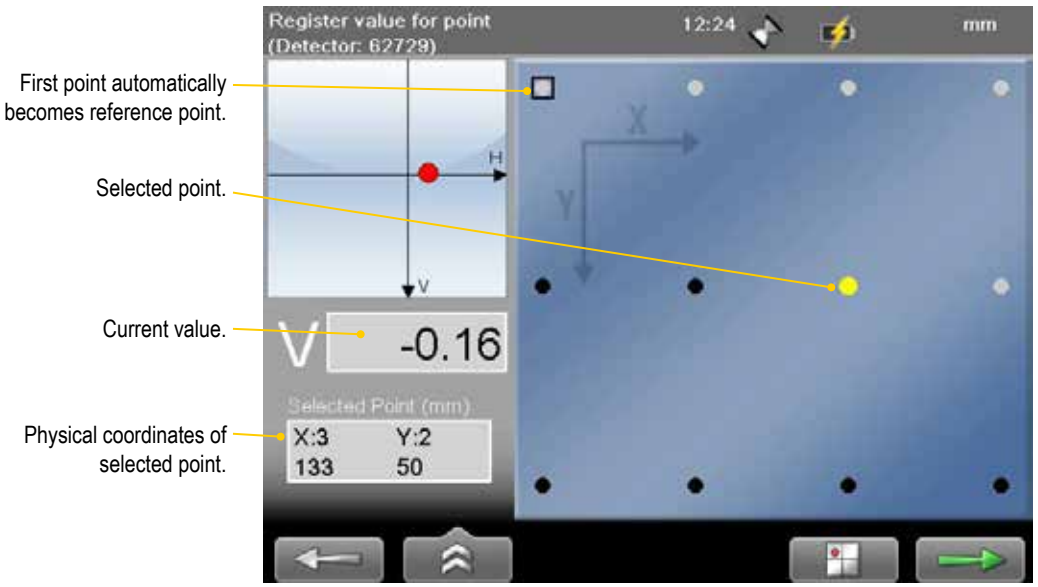
Distance view (default)
Point separation is the same for all points



Distance table view
Change point separation if needed

Measure

Press to register values. It is possible to measure the points in any order. First measured point is set as reference point. When you have measured all points, the Result view is displayed.



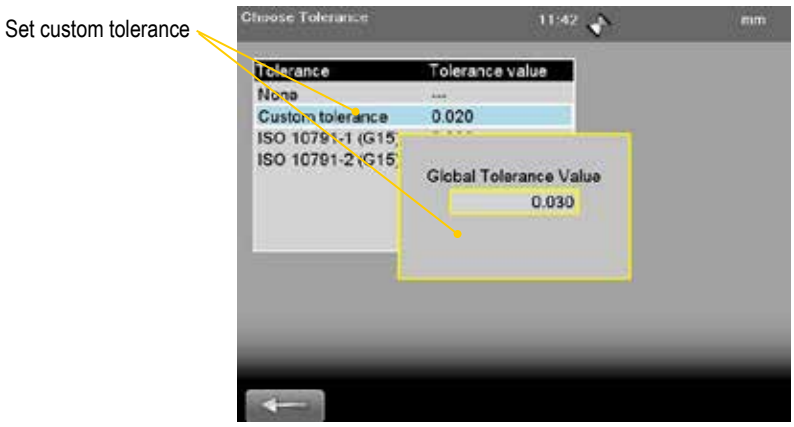
Function buttons

	**Back**. Return to enter distances.
	 *See "Control panel" on page 14.*  *See "Tolerance" below.*
	Measuring direction. Measure left to right or up and down.
	Show target. Useful if you want to rough align for example.
	Continue to Result view. Available when you have measured three positions.

Tolerance

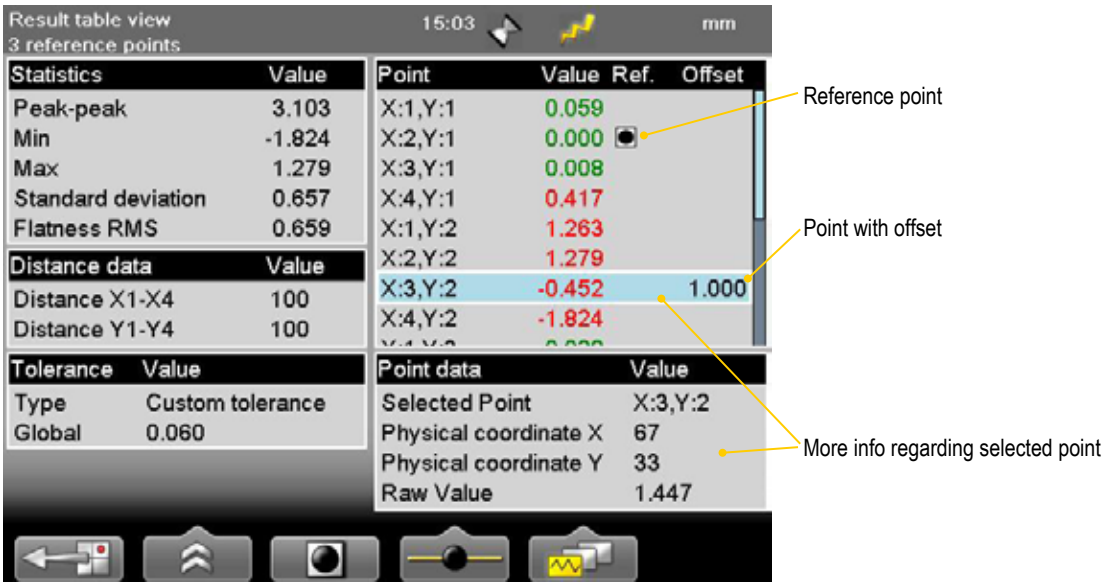
By default, the ISO standard is used. The ISO tolerance is calculated automatically depending on which distances you have entered. Only global tolerance is available.

Select  to set custom tolerance.



Result table

Select  to open table view. Values outside the tolerance are displayed with red.



Function buttons

	Remeasure selected point.
	 *See "Control panel" on page 14.*  Set offset for selected point.  *See "Tolerance" on page 79.*  Save file, see *"Measurement file handling" on page 11.*
	Toggle button. Set selected point as reference point. Remove as reference.
	See *"Calculation settings" on page 82.*  Raw data. Revert to original data.  Three reference points are automatically set to zero.  Best fit around 0.  All positive. The best fit with all measurement points above zero.  All negative. The best fit with all measurement points below zero.
	 See *"Result 3D" on page 81.*  See *"Result grid" on page 81.*  See *"Result table" on page 80.*

Note!

To remeasure: select a measurement point and select  .

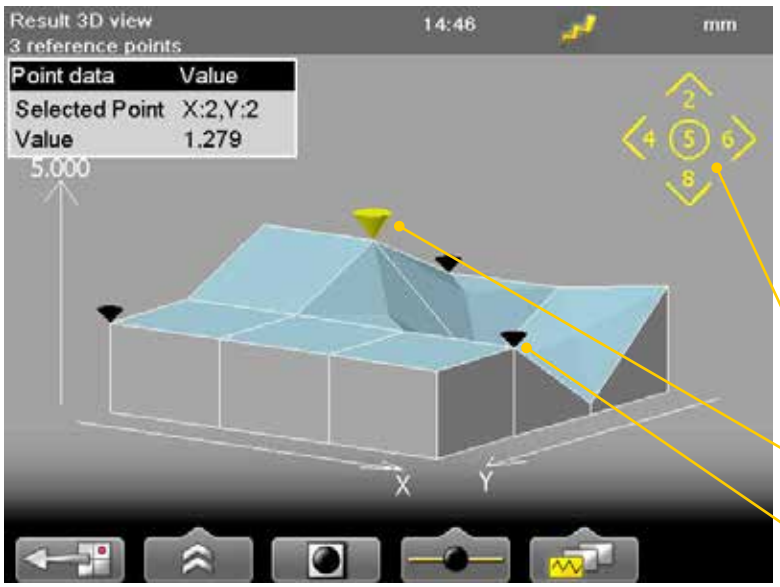
Result grid

Select  to open table view.

Result 3D

Select  and  to open 3D view. Only available when all points have been measured.

- Use the navigation button to select measurement points.
- Navigate using the numeric buttons.
  - Buttons 2, 4, 6 and 8 rotates the 3D view.
  - Button 5 returns to the initial view.



Use numerical buttons to rotate the image.

Calculation settings

Select  to display calculation settings. You can try different settings to see which one suits the best and analyze the measurement result directly in the Display unit. You can also save reports with different settings to analyze further later.

Reference points

The measurement values can be recalculated so that any three of them become zero references, with the limitation that a maximum of two of them are in line horizontally, vertically or diagonally in the coordinate system. (If there are three in line, it is just a line, and not a plane!). Reference points are needed when you are going to machine the surface.

Custom reference points

1. Select  to set currently selected point to zero.
2. Select one or three reference points. When you select a second reference point, the values are not recalculated. Set a third reference point to recalculate the values.
3. Select  if you want to return to raw data.

Set three reference points

1. Select  to set three reference points.
2. Select  if you want to return to raw data.

Best fit

Best fit around 0

When you perform a best fit calculation, the measurement object is tilted to the lowest peak to peak value. It is fitted as flat as possible between two planes where the average value is zero. Select  and  to calculate best fit around 0.

All positive

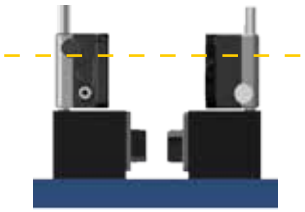
The measurement object is tilted as in a Best fit calculation, but the reference line is moved to the lowest measurement point. Select  and  to calculate the best fit with all measurement points above 0.

All negative

The measurement object is tilted as in a Best fit calculation, but the reference line is moved to the highest measurement point. Select  and  to calculate the best fit with all measurement points below 0.

Measure twist on an object by taking two diagonal measurements. If you want to measure a machine foundation made of two beams you can build a temporary reference block at the centre point.

Preparations


Same height

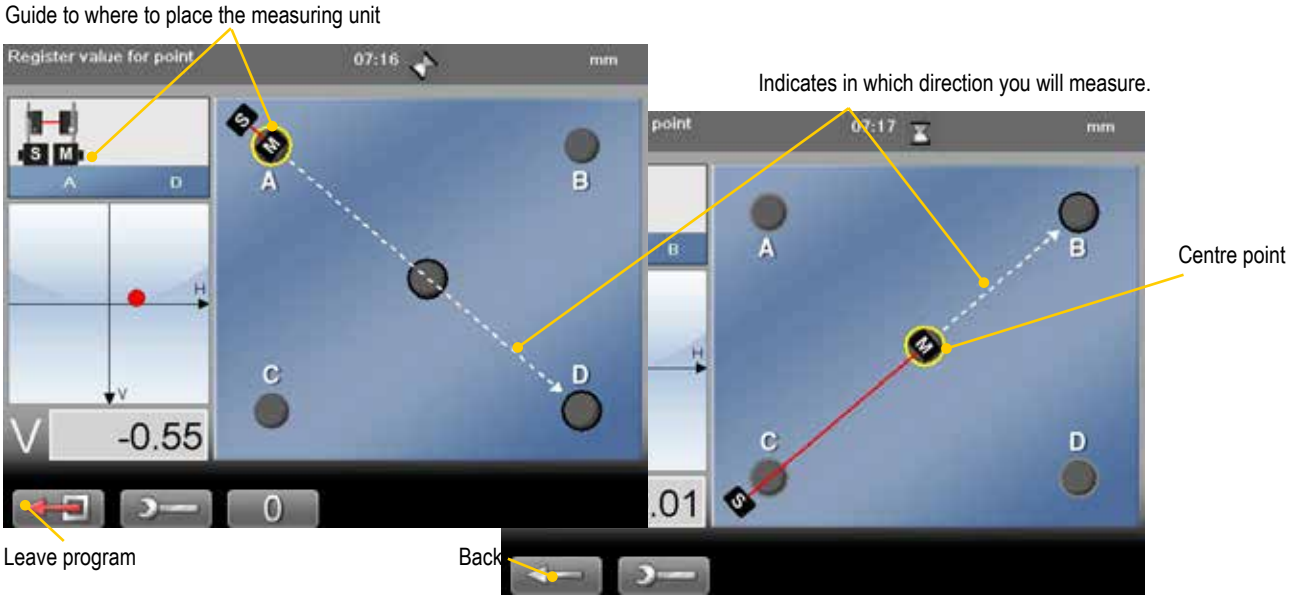
Select and to start the program Twist.

1. Place the S-unit as shown on the screen. Make sure that the S- and M-unit are on the same height. Especially important when you are using a tilt table.
2. Mark where the positions A, B, C and D are on your measurement object. Make sure to place the centre point exactly in the middle.
3. Place M-unit on position **D**. Make sure that the laser beam hits the detector target.
4. Place the M-unit on the centre point. Make a mark to ensure that you place the detector exactly on the same position each time.
5. Place the M-unit on measurement position **A**.
6. Select 0 to zero set the value.
7. Move the M-unit to measurement point **D**. Adjust the laser beam to zero (± 0.1).

Measure

1. Place the S-unit as shown on the screen.
2. Place the M-unit on measurement position **A** and press .
3. Follow the instructions on screen and register values on all measurement points.

When you have registered a value on point **B**, the Result view is automatically displayed.

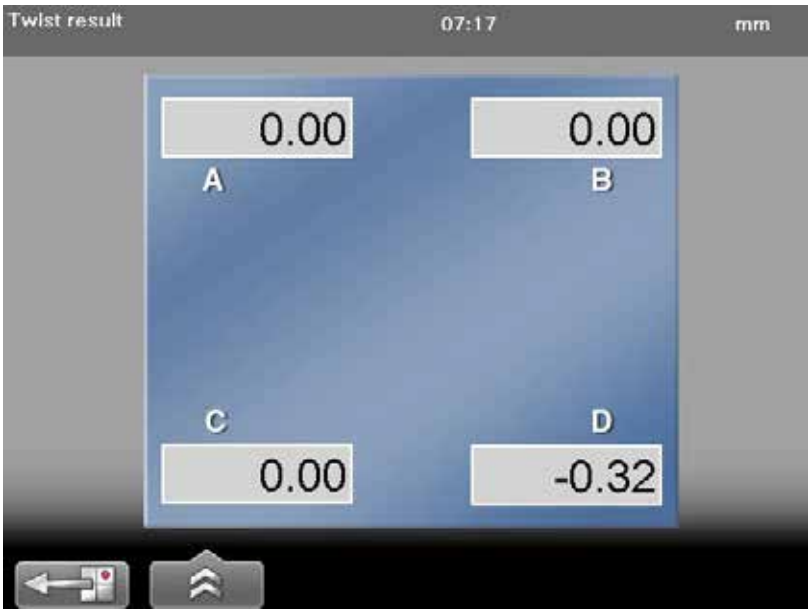


Function buttons

	Back. Leave program.
	See "Control panel" on page 14.
0	Zero set the displayed value. Only available before registering the first value.
1/1	Return to absolute value. Only available before registering the first value.

Result

Three measurement points are automatically set to zero.

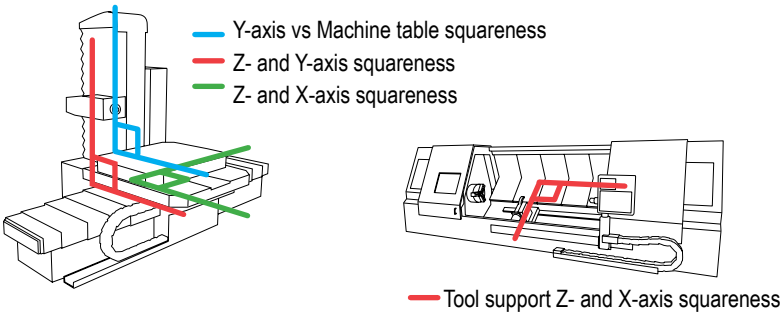


Function buttons

	Remeasure.
	 Save file, *"Measurement file handling" on page 11.*  *See "Control panel" on page 14.*

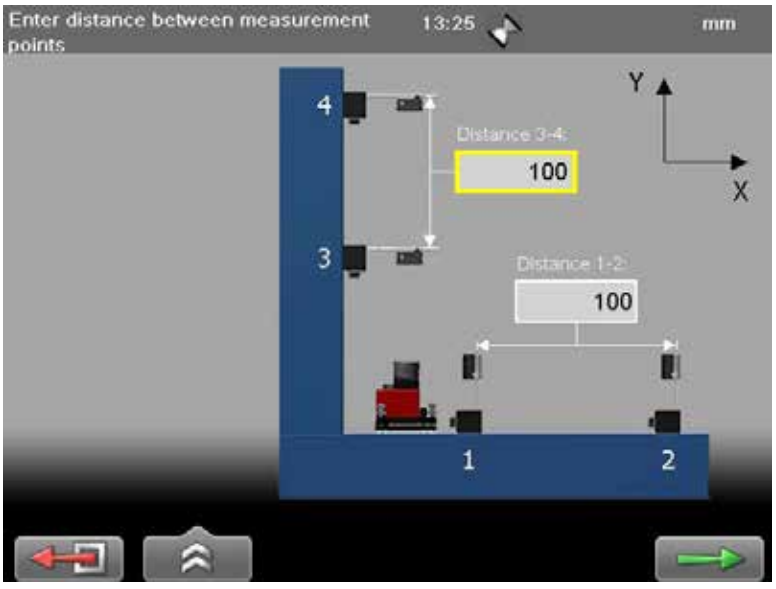
SQUARENESS

For measurement of squareness in machines and installations. Two of the measurement values on one of the surfaces are compared to the measurement values on the other surface. The values are recalculated to an angular value that shows any deviation from 90° that may occur.



Enter distances

1. Enter the distance between the measurement points.
2. Select  to continue to Measure view.



Function buttons

	**Back**. Leave program.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 87.*
	Continue to Measure view.

Measure

1. Place the detector on the X- or Y-axis. Use the navigation buttons to change the active measurement position.
2. Measure both positions on the first axis. Press  to register positions.
3. Move the detector to the second axis and deflect the laser beam.
4. Measure both positions on the second axis. The result is automatically displayed.

Function buttons

	**Back**. Leave program.
	Delete measurement point.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 87.*
	Show target. Useful if you want to rough align for example.

Result

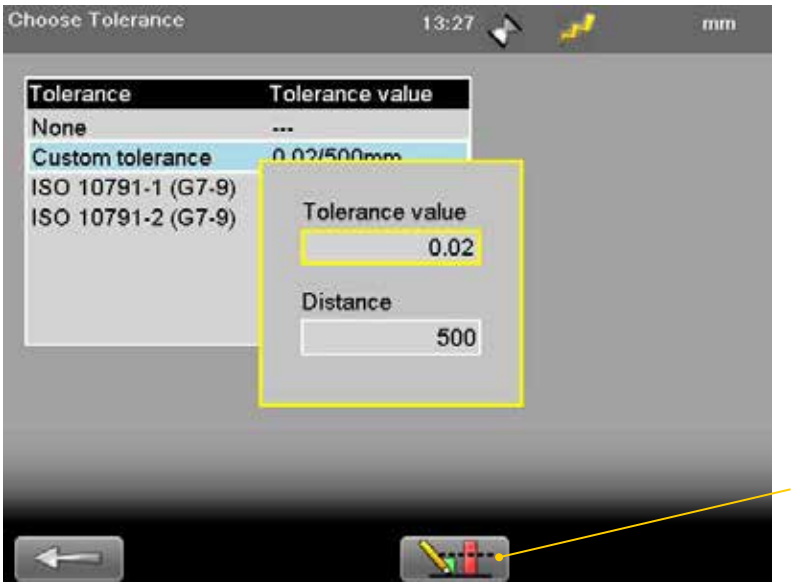
The measurement values are converted into an angular value, showing any deviation from 90° in the second object.

Function buttons

	Remeasure.
	 *See "Control panel" on page 14.*  Alter distance.  *See "Tolerance" on page 87.*  Save file, see *"Measurement file handling" on page 11.*

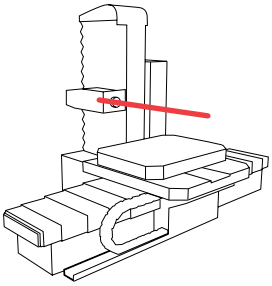
Tolerance

Select  to open Tolerance view. By default, the ISO standard is used.

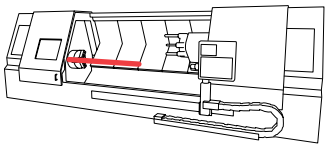


SPINDLE DIRECTION

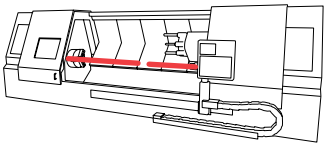
For measurement of the pointing direction of machine spindles in machine tools, drilling machines, etc.



Z-axis spindle direction



Z-axis spindle direction



Main spindle towards sub-spindle/tail stock

Note!

Do not start the machine when the S-unit is attached.

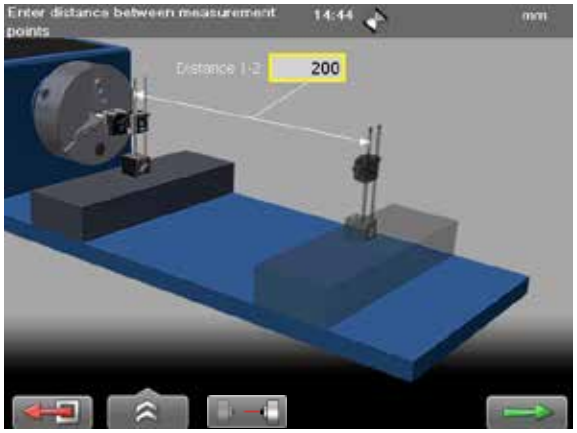
Mount the units

You need two axis detectors.

1. Mount the S-unit on the bracket and secure it in the spindle.
   Do not start the machine.
2. Place the detector at the part of the machine that can be moved along the working area of the machine.
3. Select  to start the program Spindle.

Enter distances

1. Enter the distance between the measurement points.
2. Press  or  to continue to Measure view.



Note! Place the S-unit in the spindle.

Function buttons

	**Back**. Leave program.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 90.*
	Toggle button. Show spindle to the right or to the left.
	Continue to Measure view.

Preparations

Rough alignment

1. Place the detector on the first position, close to the laser.
2. Select  to open a large target.
3. Adjust the detector in both H and V directions. Adjust until within ± 1 mm.
4. Move the detector to the second position. If needed, cone the laser beam, see information below.
5. Adjust the laser transmitter in both H and V direction using the adjustment screws on the laser. Adjust until within ± 1 mm.

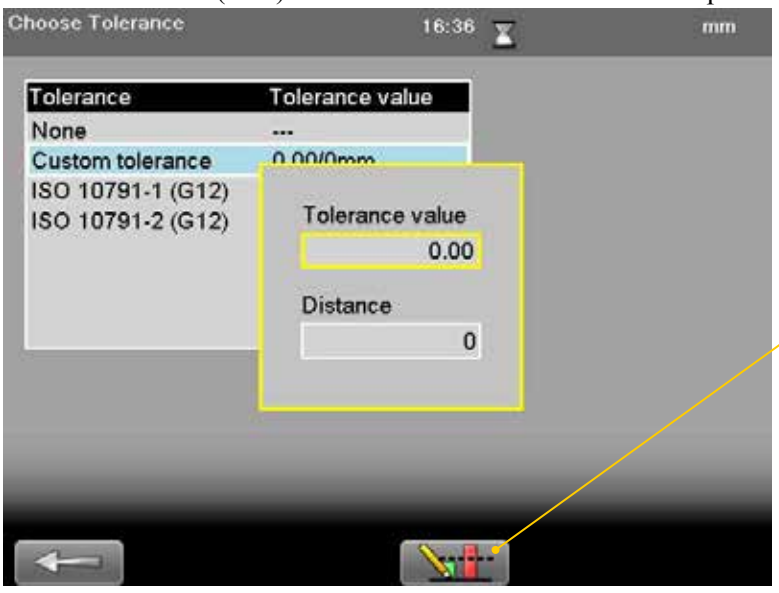
Cone laser beam

1. Place a piece of paper in front of the detector.
2. Make a mark where the laser beam hits the paper.
3. Turn the laser 180º.
4. Make a mark where the laser beam hits the paper.
5. Adjust the laser beam to the centre between the two marks. Use the adjustment screws on the laser.
6. Turn the shaft again. If the laser beam does not move when you turn, the laser beam is correctly coned.

Tolerance

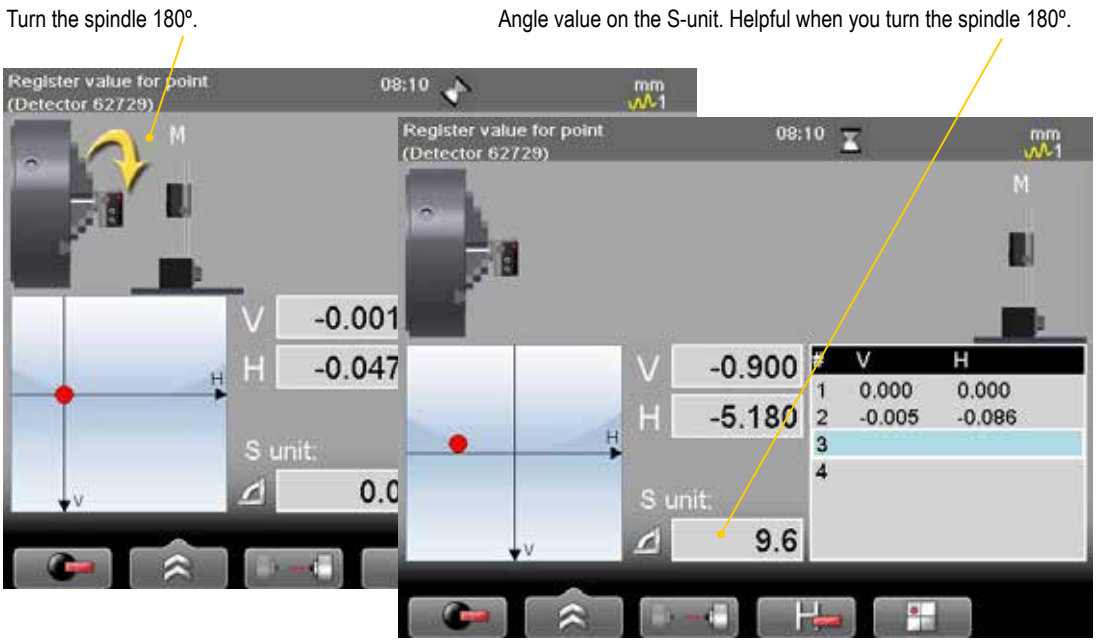
Select  to set a tolerance.

- ISO 10791-1 (G12) is used for machines with horizontal spindle (horizontal Z-axis) This is set as default.
- ISO 10791-2 (G12) is used for machines with vertical spindle (vertical Z-axis)



Measure

1. Place the detector close to the spindle. Press ● to register the first position.
2. Turn 180º and press ● to register the second position.
3. Move the detector far away from the spindle and press ● to register the third position.
4. Turn 180º and press ● to register the fourth position.

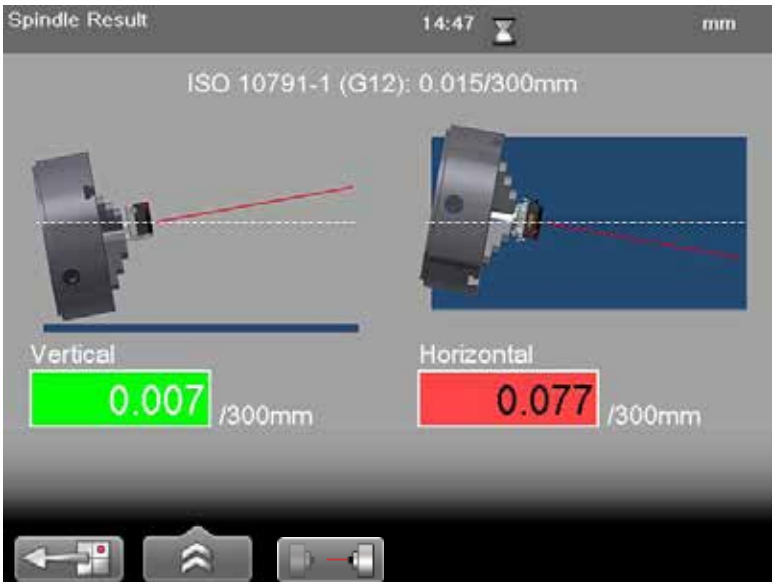


Function buttons

	Back to enter distance view.
	Delete measurement point.
	 *See "Control panel" on page 14.*  *See "Tolerance" on page 90.*
	Toggle button. Show spindle to the right or to the left.
	Toggle button. Show/hide horizontal value.
	Show target. Useful if you want to rough align for example.

Result

Values within tolerance are green.

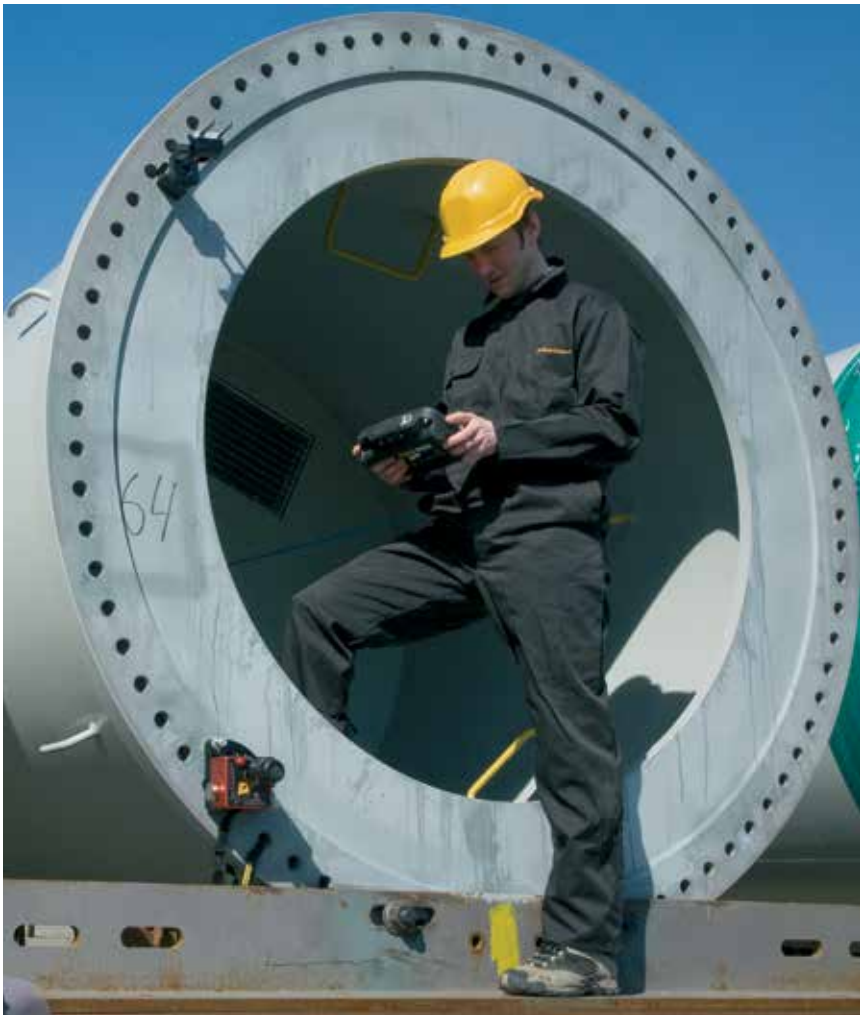


Function buttons

	Remeasure.
	 *See "Control panel" on page 14.*  Alter distance.  *See "Tolerance" on page 90.*  Save file, see *"Measurement file handling" on page 11.*
	Toggle button. Show spindle to the right or to the left.

FLANGE FLATNESS

Easy-Laser® Flange systems can be used on flanges up to 40m in diameter. You can measure 1 to 5 circles of measurement points, for example inner, middle and outer circles, in order to see the taper of the flange. Each circle can have 3–180 measurement points. The program guides you graphically step-by-step through the entire measurement.



Preparations

Use the program Values, Flange flatness or targets for the set up.

Point one

1. Place the laser transmitter (D22 or D23) on the flange. Notice the direction, see image.
2. Place the detector close to the transmitter.
3. Make a mark to mark out the position of the detector.
4. Adjust the detector or target so the laser beam hits the centre.
5. If you use a measurement program, select 0 to zero set point number one.

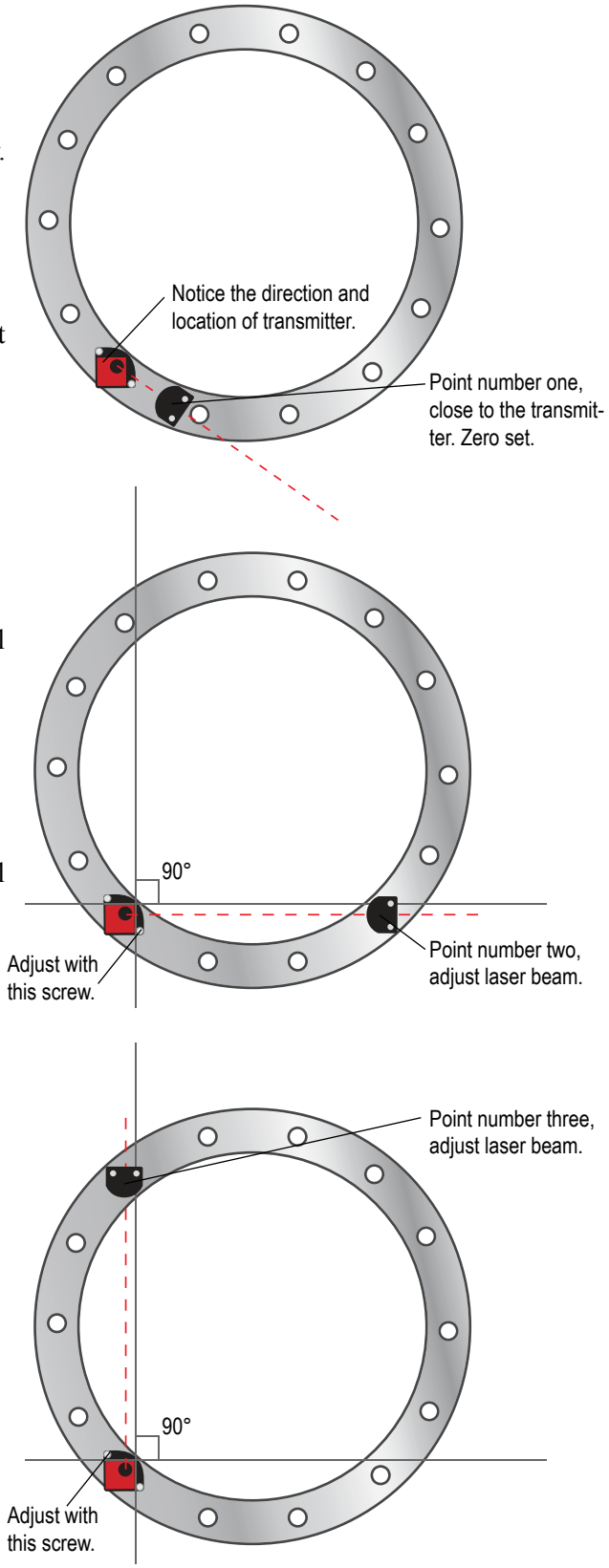
Point two

6. Move the detector to point number two, see image.
7. Aim the detector straight towards the laser.
8. Adjust the laser beam by turning the screw on the transmitter's tilt table. Level to ± 0.05 mm or better.

Point three

9. Move the detector to point number three, see image.
10. Adjust the laser beam by turning the screw on the transmitter's tilt table. Level to ± 0.05 mm or better.

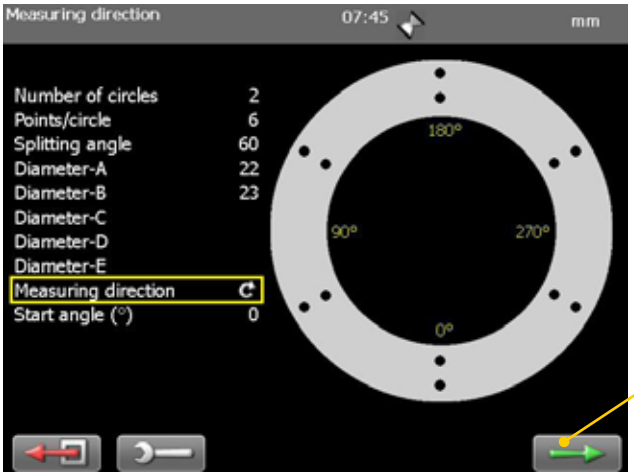
Repeat procedure until you have all three reference points within ± 0.1 mm.



Measuring procedure

Enter distances

1. Select  and  to open the Flange flatness program.
2. Enter distances, confirm all data with the green **OK** button.

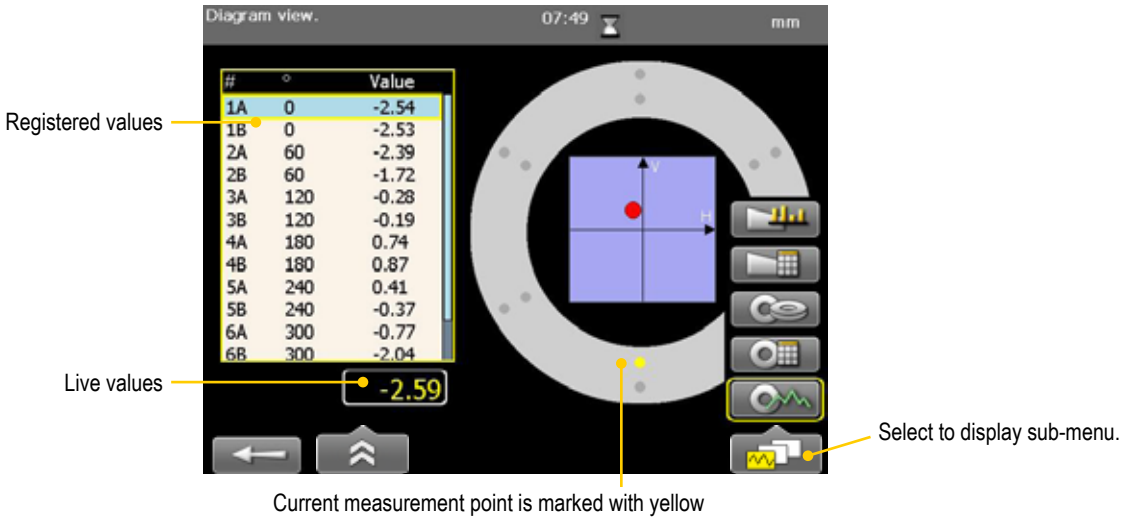


Number of circles	Enter number of circles, up to five circles is possible.
Points/circle	Enter 3-180 points.
Splitting angle	The splitting angle is automatically calculated. If you know the splitting angle, it is possible to enter this and get the number of measuring points.
Diameter	Enter the diameter of each circle.
Measurement direction	You can measure clockwise or anti clockwise. Use Navigation buttons to change direction.
Start angle	As default, the first measurement point is set to 0º. Select a start angle if you want to start anywhere else.

3. Select  to continue to measuring.

Measure

1. The first measurement point is marked with yellow.
2. Press **OK** to register measurement values. The measurement points you have registered are greyed out.



Function buttons

	**Back.** Press and hold to leave program completely.
	Contains a sub-menu.  **Open Control panel**.  **Save**. *See "Measurement file handling" on page 11*.  **Generate report**.  **Print on thermal printer** (Optional equipment).
	Zero set. Set current value to zero. Only available before you have registered the first value.
	**Views**. Available when you have registered all points. Contains a sub-menu.  Open Graph view.  Open 3D view.  Open Table view.  Open Taper table.  Open Taper graph.

Flange result

The result can be displayed in several ways; graph, 3D or table. If you have measured two or more circles, you can view the taper graph and taper table.

Flange graph view

Select  and  to display the Graph view. In this view, you have a good overview of the result.

Navigation

Use the navigation buttons to move in the table. Button left and right will move between the columns.

Max	The highest value.
Min	The lowest value.
Peak-peak	Difference between Max and Min value
Standard deviation	Average difference between Max and Min value.
Flatness RMS	Root Mean Square (Numerical Flatness)

Function buttons

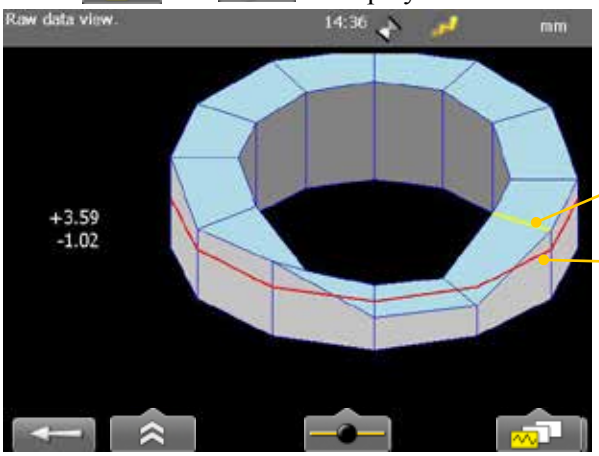
	**Back.** Press and hold to leave program completely.
	Contains a sub-menu.  **Open Control panel**.  **Save**. *See "Measurement file handling" on page 11.*  **Generate report**.  **Print on thermal printer** (Optional equipment).
	*See "Calculation settings" on page 100.*
	**Views**. Contain a sub-menu with different flange and taper views.

Note!

Press and hold  *to leave program completely.*

Flange 3D view

Select  and  to display the 3D view.



Same function buttons as in Flange Graph view.

Flange table view

Select  and  to display Table view.

Select if you only want to see the table. Use navigation buttons to move in the table.

Same function buttons as in Flange Graph view.

Note!

The calculation settings under  *is made on the circle (column) currently selected in the table.*

Taper table

Select  and  to display Taper table. Here you get a good overview of the inclination of the flange, between the measured circles. Taper values are displayed both as graph and table. Use navigation buttons to move in the table.

Taper graph

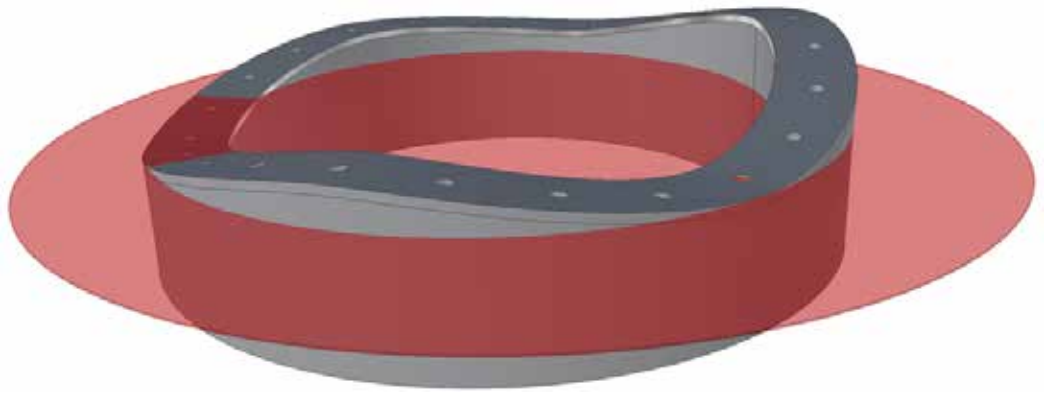
Select  and  to display Taper graph. Use the navigation buttons to move around in the graph.

Calculation settings

Select  to display calculation settings. You can try different scenarios to see which one suits the best and analyze the measurement result directly in the Display unit. You can also save reports with different settings for best fit to analyze further later.

	**Reference point.** Set custom reference points.
	**Raw data.** Revert to original data.
	**1 ref point.** Measurement point #1 is automatically set to zero.
	**3 ref points.** Three reference points are automatically set to zero.
	**Best fit around 0.** Calculated on the selected circle or measurement points.
	**All positive.** The best fit with all measurement points above zero. Calculated on selected circle or measurement points.
	**All negative.** The best fit with all measurement points below zero. Calculated on selected circle or measurement points.

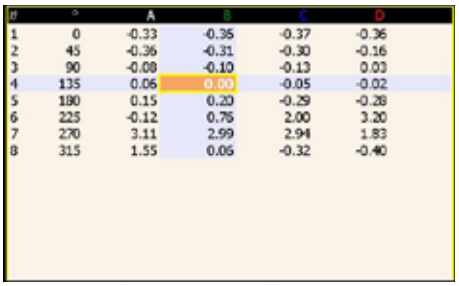
In the following examples, we show a flange with much exaggerated surface.
See image below. Red indicates reference plane.



Custom reference points

Reference points are needed when you are going to machine the surface.

1. Select a measurement point in the Table view or Graph view.
2. Select  to set currently selected point to zero.
3. Select one or three reference points. When you select a second reference point, the values are not recalculated. Set a third reference point to recalculate the values.
4. Select  if you want to return to raw data.



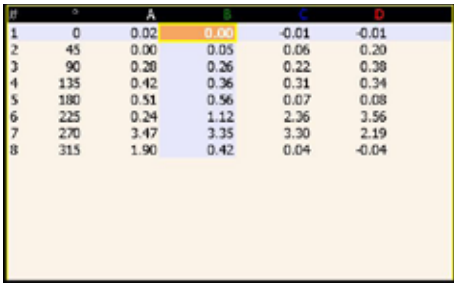
#	°	A	B	C	D
1	0	-0.33	-0.35	-0.37	-0.36
2	45	-0.36	-0.31	-0.30	-0.16
3	90	-0.08	-0.10	-0.13	0.03
4	135	0.06	0.00	-0.05	-0.02
5	180	0.15	0.20	-0.29	-0.28
6	225	-0.12	0.76	2.00	3.20
7	270	3.11	2.99	2.94	1.83
8	315	1.55	0.06	-0.32	-0.40

One reference point selected

One reference point

Select a measurement point in the Table view or Graph view.

1. Select  to select first point as reference.
2. Select  if you want to return to raw data.

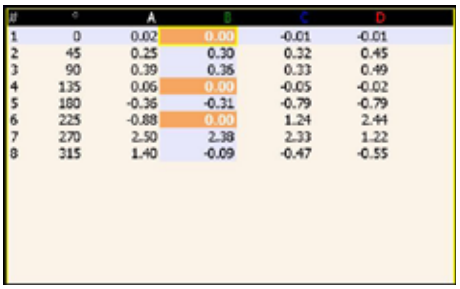


#	°	A	B	C	D
1	0	0.02	0.00	-0.01	-0.01
2	45	0.00	0.05	0.06	0.20
3	90	0.28	0.26	0.22	0.38
4	135	0.42	0.36	0.31	0.34
5	180	0.51	0.56	0.07	0.08
6	225	0.24	1.12	2.26	3.56
7	270	3.47	3.35	3.30	2.19
8	315	1.90	0.42	0.04	-0.04

First point set as reference.

Three reference points

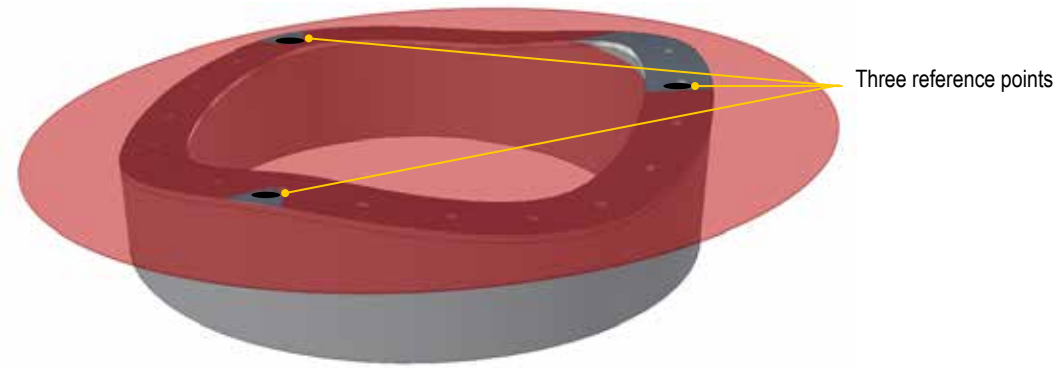
1. Select  to set three reference points. One is set on measurement point #1 and the other are distributed evenly on 120º.
2. Select  if you want to return to raw data.



#	°	A	B	C	D
1	0	0.02	0.00	-0.01	-0.01
2	45	0.25	0.30	0.32	0.45
3	90	0.39	0.36	0.33	0.49
4	135	0.06	0.00	-0.05	-0.02
5	180	-0.36	-0.31	-0.79	-0.79
6	225	-0.88	0.00	1.24	2.44
7	270	2.50	2.38	2.33	1.22
8	315	1.40	-0.09	-0.47	-0.55

Three points set as reference.

Reference plane is resting on three reference points. Here you can clearly see what is below and above the reference plane.



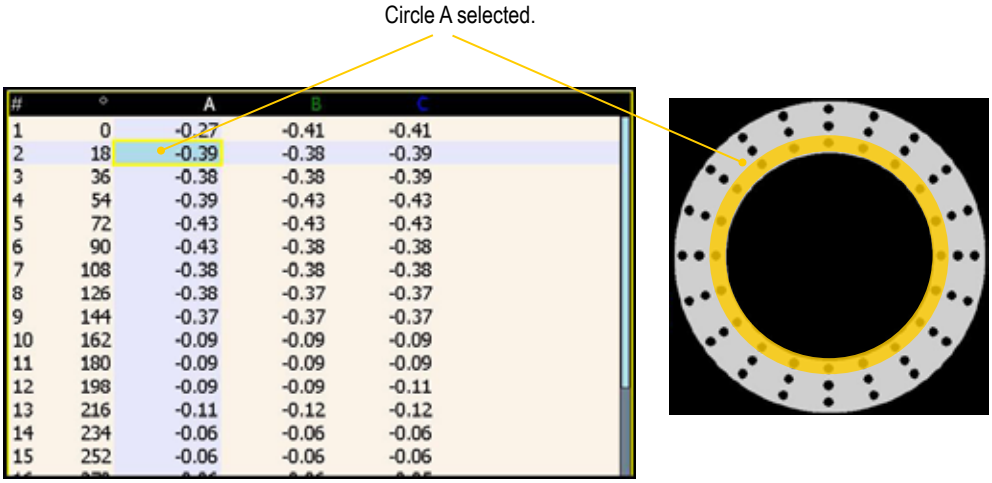
Best fit – select circle or points

By default best fit is calculated on the selected circle in the table. You can also select all measurement points on a certain position.

1. Select  and  or  .
2. Select a circle or measurement points in the table. See below.
3. Select one of the best fit options.
4. The calculation is made on the selected circle/measurement points. To make the same best fit calculation on another circle, repeat step 1–3.

Select circle

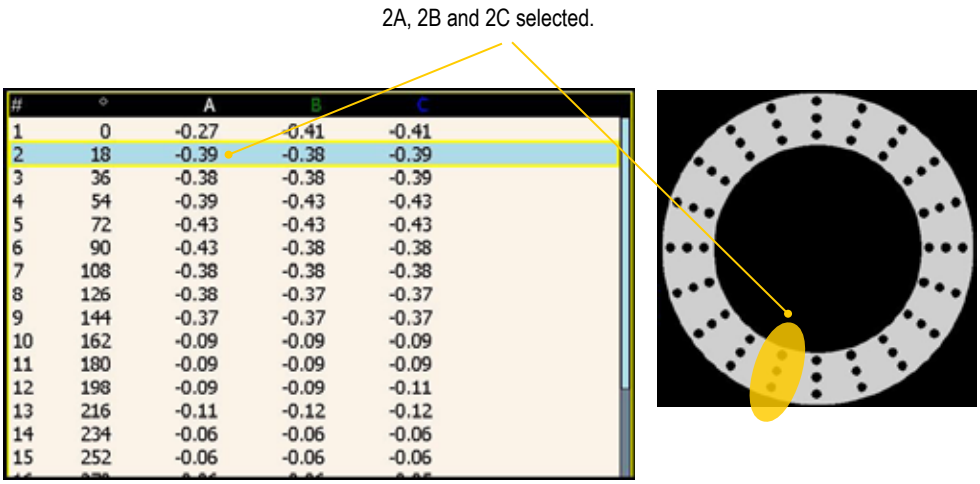
By default the best fit calculation is made on the currently selected circle. Use navigation buttons left and right to select another circle in the table.



Select measurement points

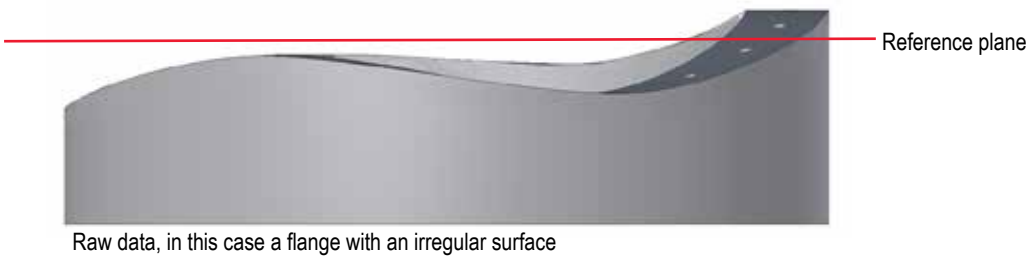
You can make best fit calculations on all measurement points on a certain position.

1. Select circle A in the table.
2. Press left navigation button to select the whole row.
3. Use navigation buttons to move up and down in the table.

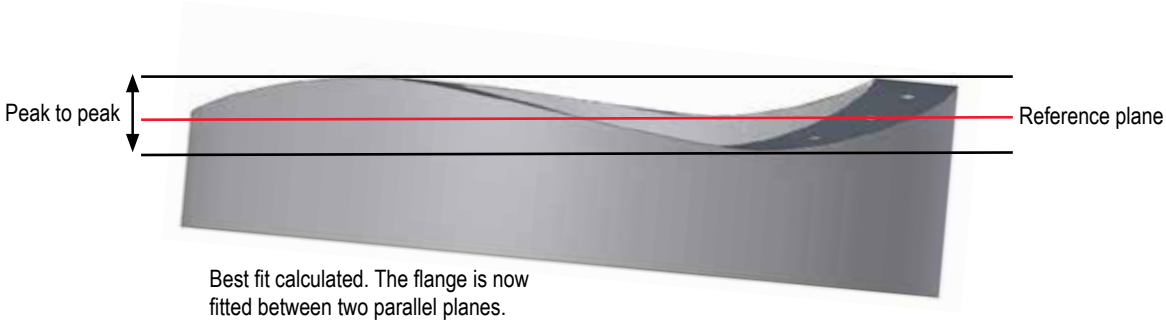


Best fit

When you perform a best fit calculation, the flange is tilted to the lowest peak to peak value. It is fitted as flat as possible between two planes where the average value is zero. See example below:

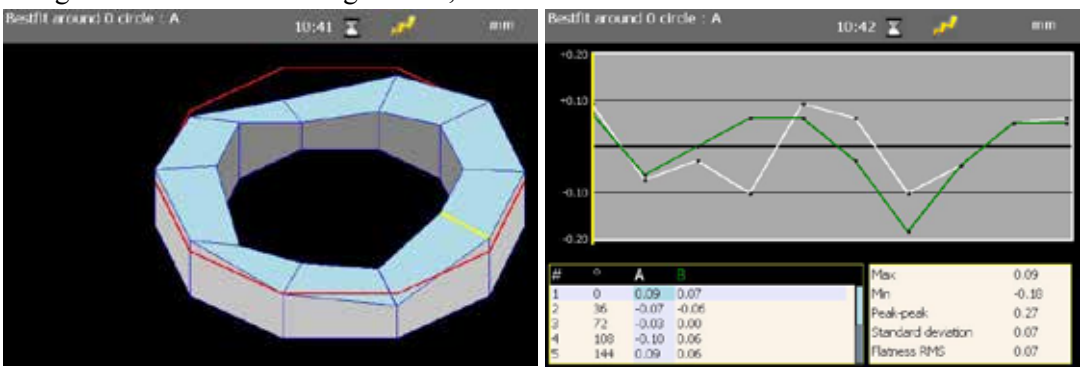


Raw data, in this case a flange with an irregular surface



Best fit calculated. The flange is now fitted between two parallel planes.

Select  and  to calculate best fit around 0. Select a circle or measurement points in the table. Below is the same calculation displayed in Flange 3D view and Flange table view. In the image below, calculation is made on circle A.

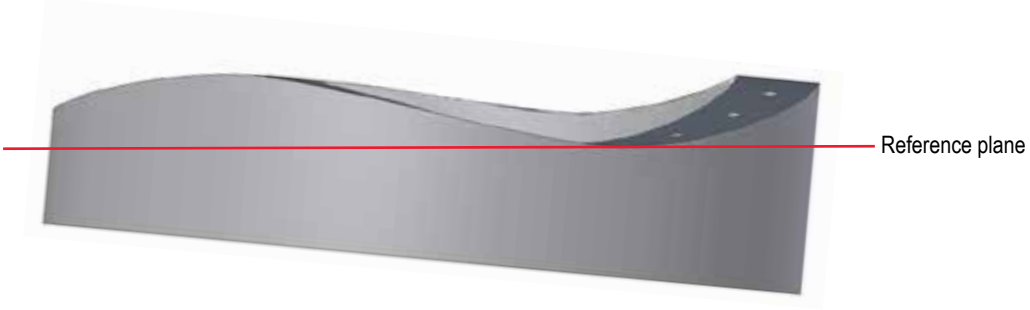


Note!

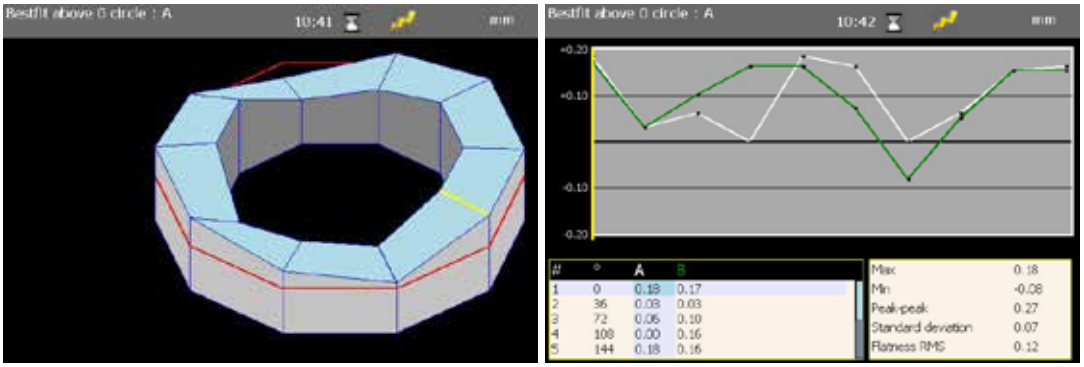
You can save reports with different settings for best fit to analyze further later.

All positive

The flange is tilted as in a Best fit calculation, but the reference line is moved to the lowest measurement point. See example below:



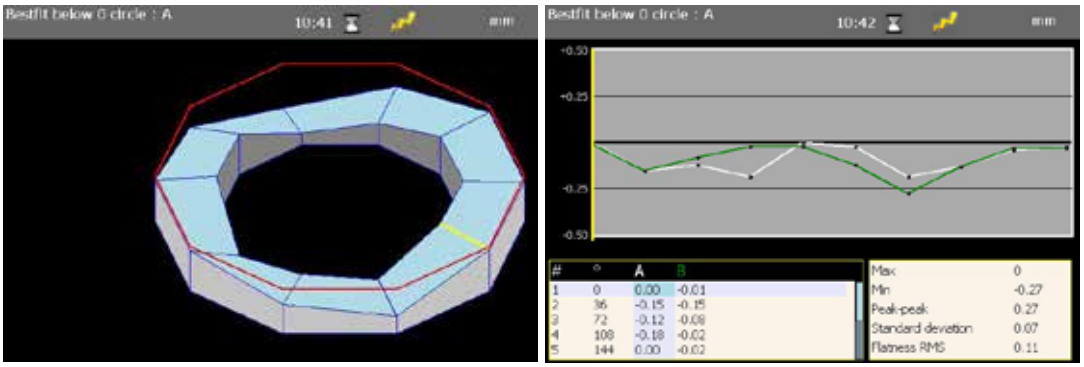
Select  and  to calculate the best fit with all measurement points above 0. Select a circle or measurement points in the table. In the image below, calculation is made on circle A.



All negative

The flange is tilted as in a Best fit calculation, but the reference line is moved to the highest measurement point. See example below:

Select  and  to calculate the best fit with all measurement points below 0. Select a circle or measurement points in the table. In the image below, calculation is made on circle A.

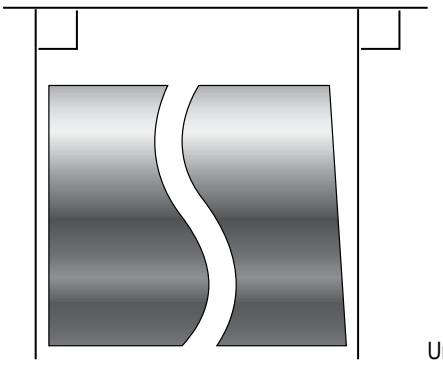


FLANGE PARALLELISM

Easy-Laser® enables you to measure and check the parallelism of the flanges. In addition to the standard equipment, two tripods and an angular prism are required. For this kind of measurement you need the D22 laser transmitter which is included in the E910 system.

Tripod for use with angular prism D46 and laser transmitter D22/D23.

Angular prism D46 is used for parallelism measurement of the flanges. It deflects the laser beam 90°.

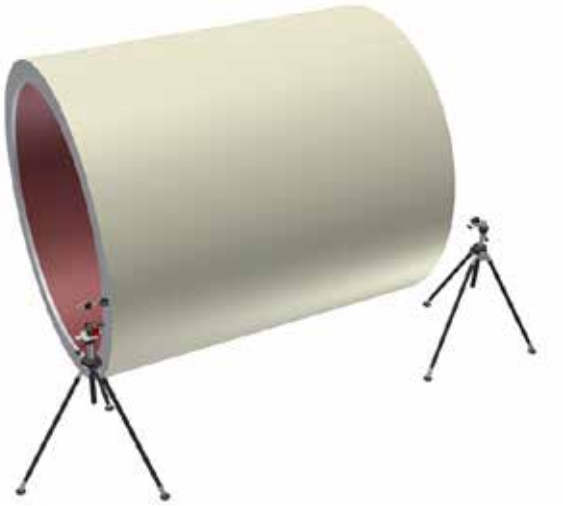


Unparallel flanges

Set up

Laser set up

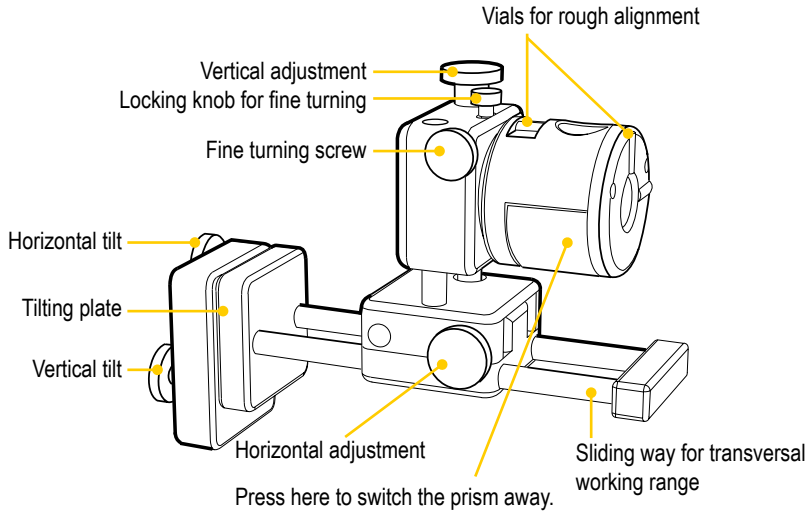
1. Mount the laser on the tripod, on the same height as centre of tower.
2. Place the detector close to the transmitter.
3. Adjust the detector on the rods so that the laser beam hit the centre of detector target (within ±0.5 mm).
4. Move the detector to the other side of the flange. Adjust laser beam by using the tilt screw on the transmitter.
5. Move the detector to the lowest position on the flange.
6. Turn the laser beam towards the detector and adjust by using the other tilt screw on the transmitter.
7. Repeat 1 to 6.

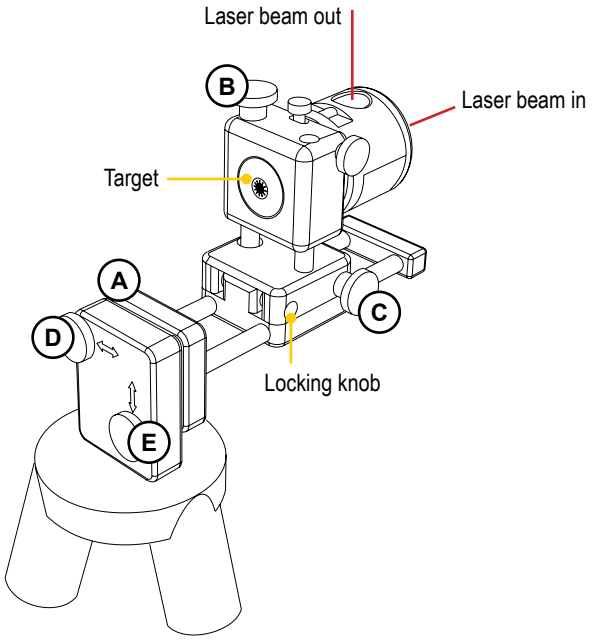


Prism set up

1. Place an angular prism (D46) on a tripod beside the other flange.
2. Switch the laser beam to point alongside the tower.
3. Switch the prism on the D46 away to let the beam hit the target.
4. Slide the prism toward **A** and adjust with **B** and **C** until the target is concentric to the laser beam.
5. Slide the prism away from **A** and adjust with **D** and **E** until the target is concentric to the laser beam.
6. Repeat 4 and 5.
7. Switch the prism in, tighten the locking knob and measure.

Now the angular prism can be moved to a new position on the sliding way to aim the laser beam to the detector.



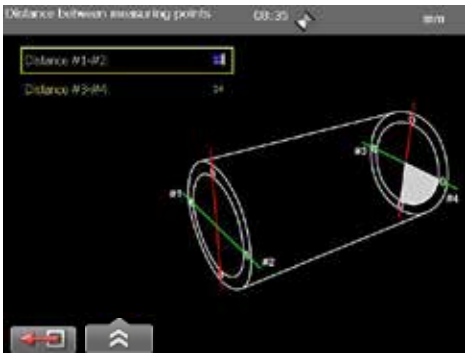


Angular prism mounted on tripod

Measure

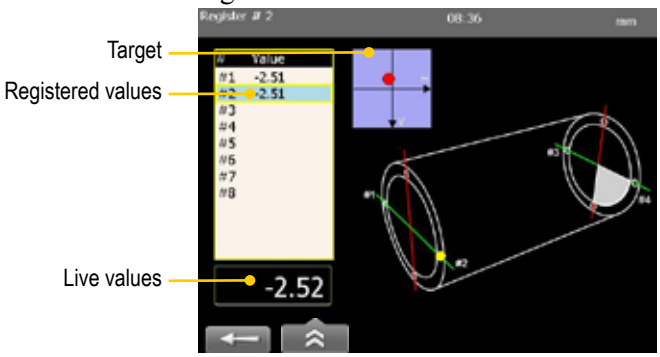
Enter distances

1. Select  and  to open the Flange parallelism program.
2. Enter distances between the measurement points.
3. Press **OK**.



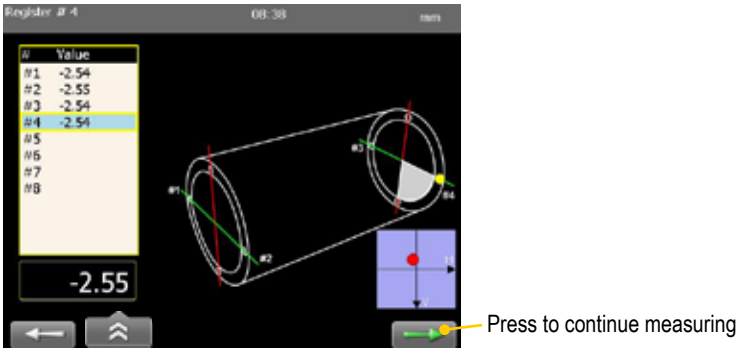
Measure point 1 to 4

1. Press **OK** to register values on #1 and #2 on the first flange. The yellow marker on the screen guides you where to put the detector.
2. Switch beam 90º. Use the angular prism to angle the laser beam.
3. Press **OK** to register values on #3 and #4 on the second flange.



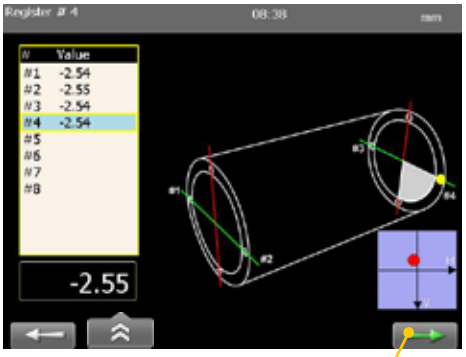
Result

When you have registered #1 to #4, a result is displayed.



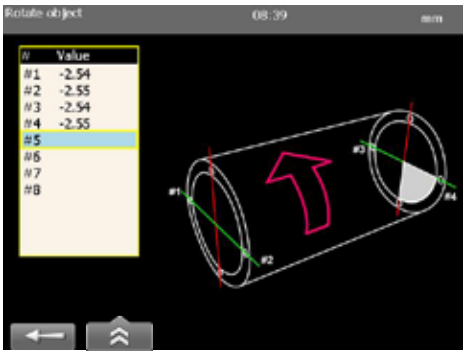
Measure point 5 to 8

1. Press  to continue measuring.



Press to continue measuring

2. Rotate the tower section 90º.

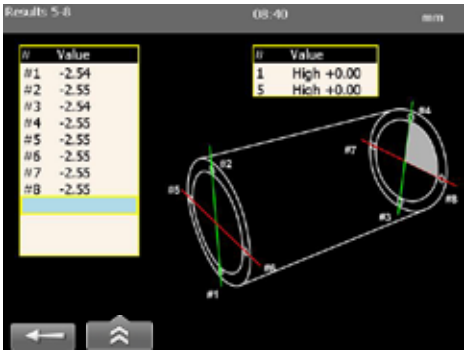


Rotate tower section

3. Switch beam back to first flange.
4. Measure point #5 and #6 on the first flange.
5. Switch beam 90º to second flange.
6. Measure point #7 and #8 on the second flange.

Result

Press OK again to display the measurement result.



Function buttons

	**Back**.
	Contains a sub-menu.  **Open Control panel**.  **Save**. *See "Measurement file handling" on page 11*.  **Generate report**.  **Print on thermal printer** (Optional equipment).
	**Zero set**. Set current live value to zero. Only available before you have registered the first value.
	**Absolute**. Return to absolute value.
	**Continue**. Continue measuring point 5 to 8.

HORIZONTAL

For horizontally mounted machines.

Select between three different measuring methods:

EasyTurn™

Start anywhere on the turn. The three measuring positions can be registered with as little as 20º between positions. By default, the EasyTurn program is shown.

See "Measure using Easy Turn™" on page 115.

Horizontal Multipoint

Start anywhere on the turn. Register as many points as you wish.

See "Thermal compensation" on page 121

9-12-3

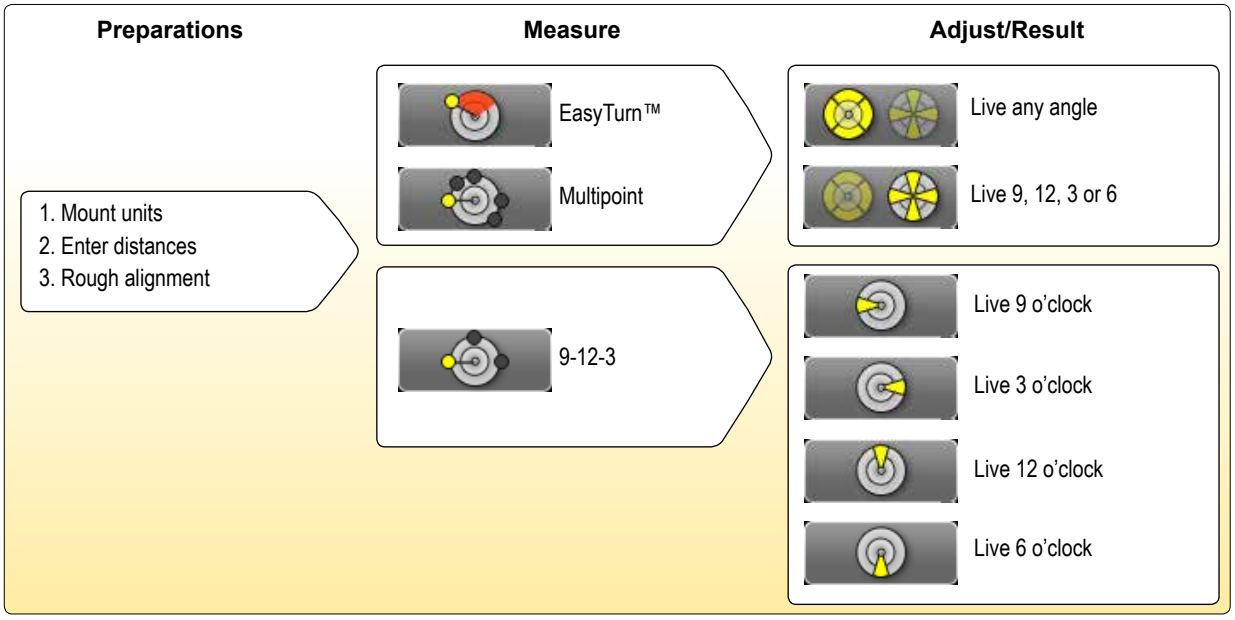
The measuring positions are registered at positions 9, 12, 3 o'clock. The inclinometers are not used.

"Measure using 9-12-3" on page 117.

Note!

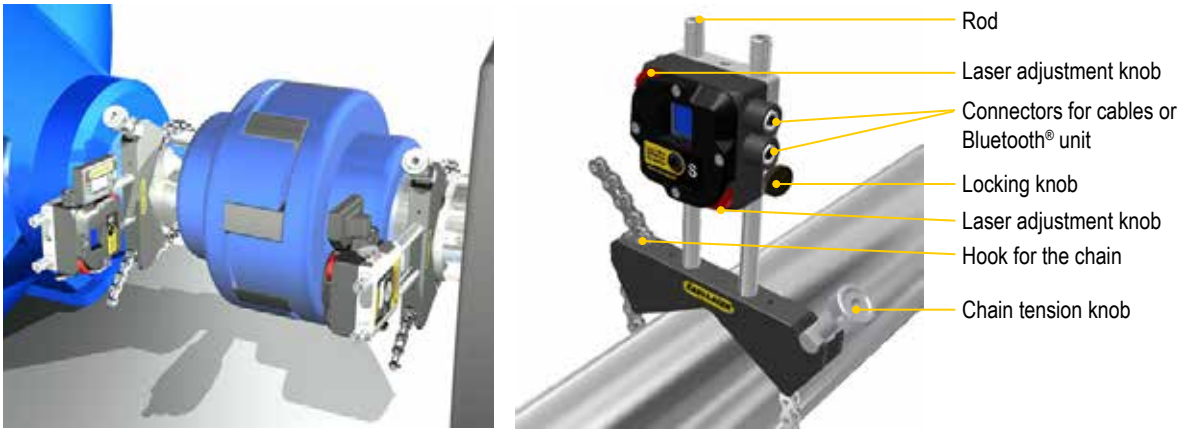
Measurements made with older versions of the Horizontal program are opened with the older version of the program. For information regarding the previous program version, please see corresponding manual.

Work flow



Mount the units

1. Mount the S-unit on the stationary machine and the M-unit on the movable machine.
2. Mount the units facing each other. Make sure they are at the approximately same rotational angle and radius.



Mounted measuring units

Connect cables or Bluetooth® units

Cable

The measuring units has two connectors that are used for cables or Bluetooth® units.

1. Connect a cable to the Display unit. Connect the other end to any of the measuring units.
2. Connect the second cable between the measuring units.

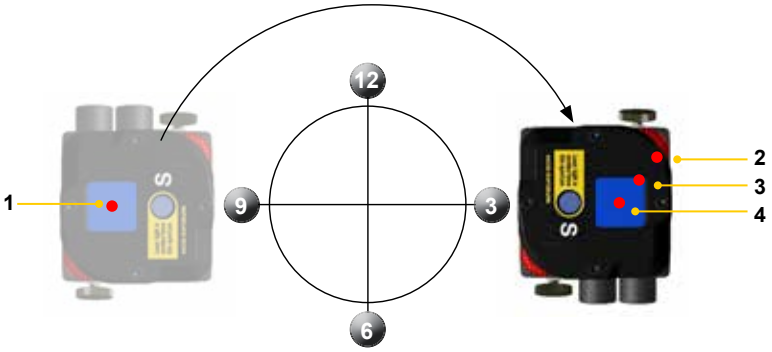
Bluetooth®

The Display unit is equipped with Bluetooth® wireless technology, which makes it possible for the Display unit to receive data without using cables. For more information, see *"Bluetooth® set up" on page 20*.

Adjust measuring units

When making a new installation, a rough alignment can be necessary. Place the Measuring units on the rods, make sure they are at the approximately same rotational angle and radius. Also make sure that the adjustment knob is adjustable in both directions.

1. Place the Measuring units at 9 o'clock. Aim the laser beams at the centre of the targets.
2. Turn the shaft to position 3 o'clock. Note where the laser beams hit.
3. Adjust the laser beams half way to the centre of targets. Use the adjustment knobs.
4. Adjust the movable machine until the laser beam hits the centre of targets.

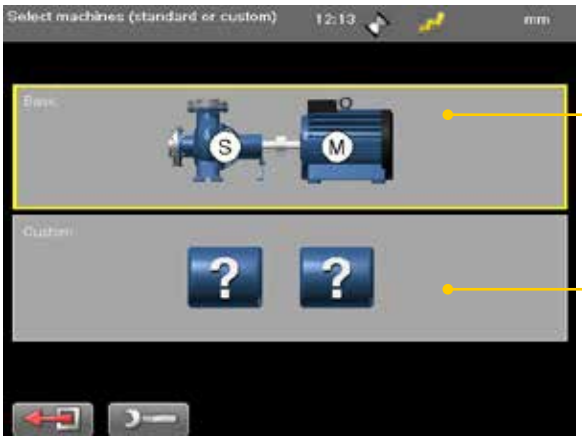


The example shows the S-unit, but the procedure is made on both units.

Select machines

Before measuring your machines, you need to define what kind of machines you have.

1. Use navigation buttons to select Basic or Custom.
2. Press .

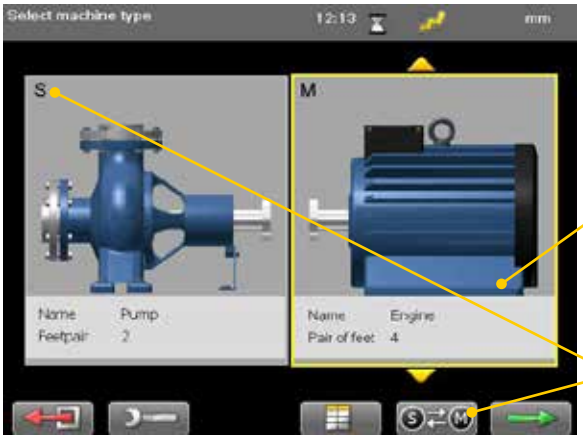


Basic: Contains a pump and a motor. These predefined machines have two feet pair each.

Custom: Select this option if you want to select machine types.

Custom

Select this option if you want to select machine types. There are several machine types to choose from. You can also define as many feet pairs as you need on the machines.



More than three feet pairs are visualized as one solid foot on the machine.

Switch M and S

1. Use navigation buttons up and down to find the machine you want.
2. Press . The next machine becomes active.

When you are done, select to continue to Enter distance view.

Select number of feet pair

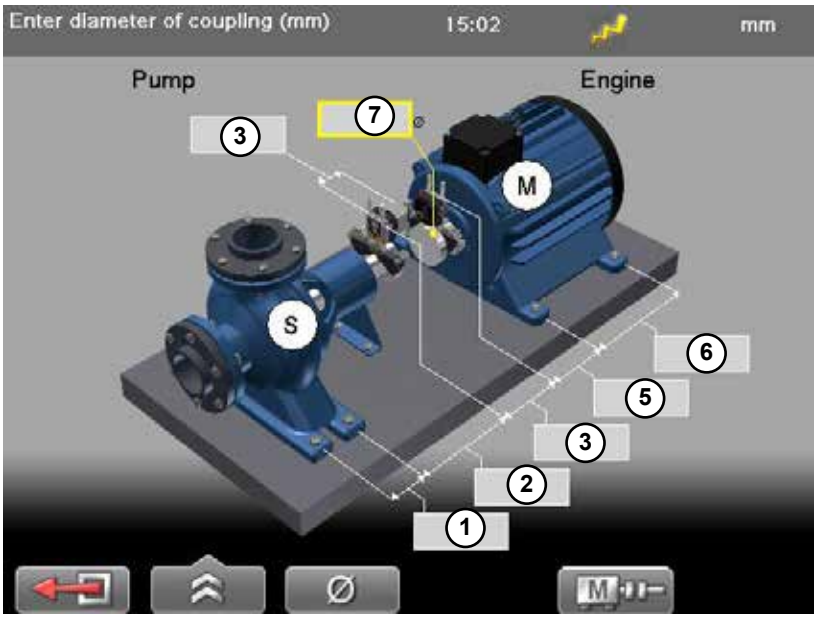
If you want to change the number of feet pair on the machine, simply enter the number you want on the numerical buttons.

Function buttons

	Leave program.
	See "Control panel" on page 14.
	Open table to rename the machines and change the number of feet pairs.
	Switch on which machine you will place the S (stationary) and M (movable) measuring unit.
	Continue to Measure view.

Enter distances

Confirm each distance with .



1. Distance between first and second feet pair. Optional, select to activate field.
2. Distance between second feet pair and S-unit. Optional, select to activate field.
3. Distance between S-unit and M-unit. Measure between the rods.
4. Distance between S-unit and centre of coupling.
5. Distance between M-unit and feet pair one.
6. Distance between feet pair one and feet pair two.
7. Coupling diameter. Optional, select to activate field.

Function buttons

	Leave program.
	See "Control panel" on page 14. *See "Tolerance" on page 123.* *See "Thermal compensation" on page 121.* Select to enter distances of the S-machine. 3D 2D Toggle between showing Distance view in 3D or 2D.
Ø	**Diameter**. Select to enter coupling diameter. This is necessary if you want the result based on the gap of the coupling instead of angle.
M M	Toggle button. Show movable machine to the left or the right.
	Continue to Measure view. Available when you have entered the mandatory distances.

Measure using Easy Turn™

Preparations

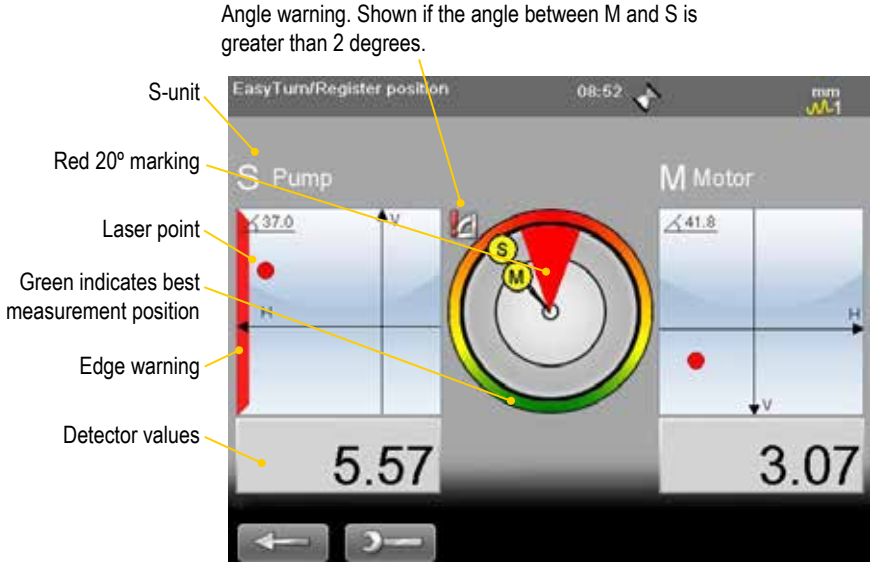
Follow the preparations as described in the previous pages.

1. Mount the measuring units.
2. Enter distances, confirm each distance with **OK**.
3. If needed, perform a rough alignment.
4. If needed, perform a Softfoot check.

Measure

It is possible to measure with as little as 40º spread between the measurement points. However, for an even more accurate result, try to spread the points as much as possible. The colours indicates where the optimum positions to measure are.

1. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
2. Press to register first position. The first position is automatically set to zero. A red marking is displayed.
3. Turn shafts outside of the red 20º marking.
4. Press to register second position.
5. Turn shafts outside of the red markings.
6. Press to register third position. The Result and adjust view displayed.



Edge warning
When the laser beam is close to the edge, the edge is "lit up" as a warning. It is not possible to register values when you see the edge warning.

Function buttons

	Back. Measure previous position or back to Distance view.
	See "Control panel" on page 14.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See "SOFTFOOT" on page 45.

Measure using Multipoint

Preparations

Follow the preparations as described in the previous pages.

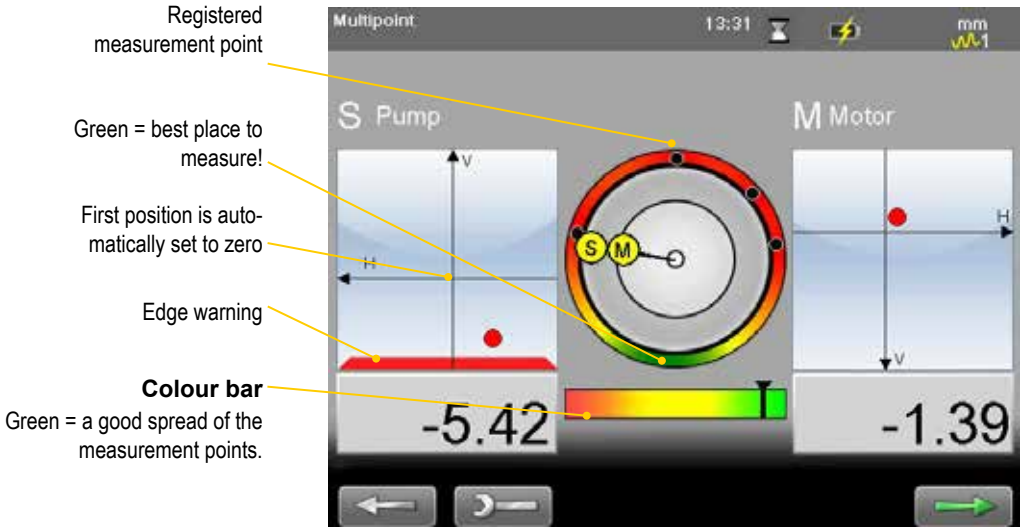
1. Mount the measuring units.
2. Enter distances, confirm each distance with **OK**.
3. If needed, perform a rough alignment.
4. If needed, perform a Softfoot check.

Measure

1. Select  and  to switch to Horizontal Multipoint.
2. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
3. Press  to register first position. The first position is automatically set to zero.
4. Press  to register as many points as you wish. After three points a result is available.
5. Select  to display the Result and adjust view. See *"Result and adjust" on page 118*.

Spread the measurement points

For a more accurate result, try to spread the points as much as possible. The colours indicates where the optimum positions to measure are. The colour bar indicates a statistical accuracy of the measurement.



Edge warning
When the laser beam is close to the edge, the edge is "lit up" as a warning. It is not possible to register values when you see the edge warning.

Function buttons

	**Back**. Measure previous position or back to Distance view.
	*See "Control panel" on page 14.*
	 Switch to the EasyTurn™ method.  Switch to the 9-12-3 method.  Switch to the Horizontal Multipoint method.
	*See "SOFTFOOT" on page 45.*
	Continue to the Result and adjust view. Available after registering three positions.

Measure using 9-12-3

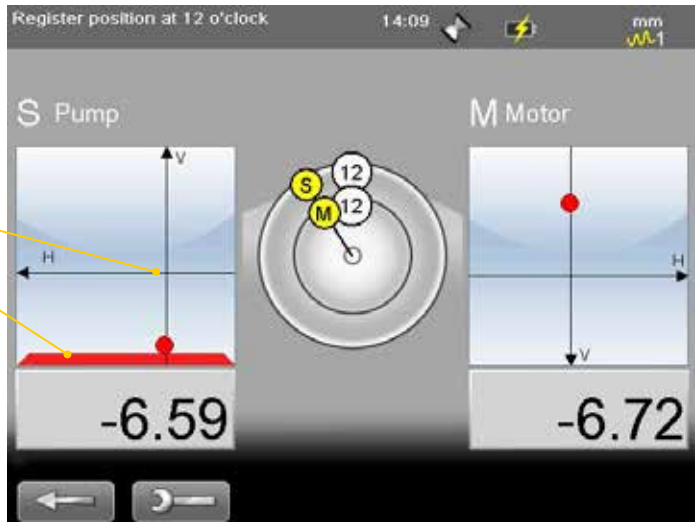
Preparations

Follow the preparations as described in the previous pages.

1. Mount the measuring units.
2. Enter distances, confirm each distance with **OK**.
3. If needed, perform a rough alignment.
4. If needed, perform a Softfoot check.

Measure

1. Select  and  to switch to 9-12-3.
2. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
3. Turn shafts to 9 o'clock.
4. Press to register first position. The first position is automatically set to zero.
5. Turn shafts to 12 o'clock.
6. Press to register second position.
7. Turn shafts to 3 o'clock.
8. Press to register third position. The Result and adjust view is displayed. See *"Result and adjust" on page 118*.



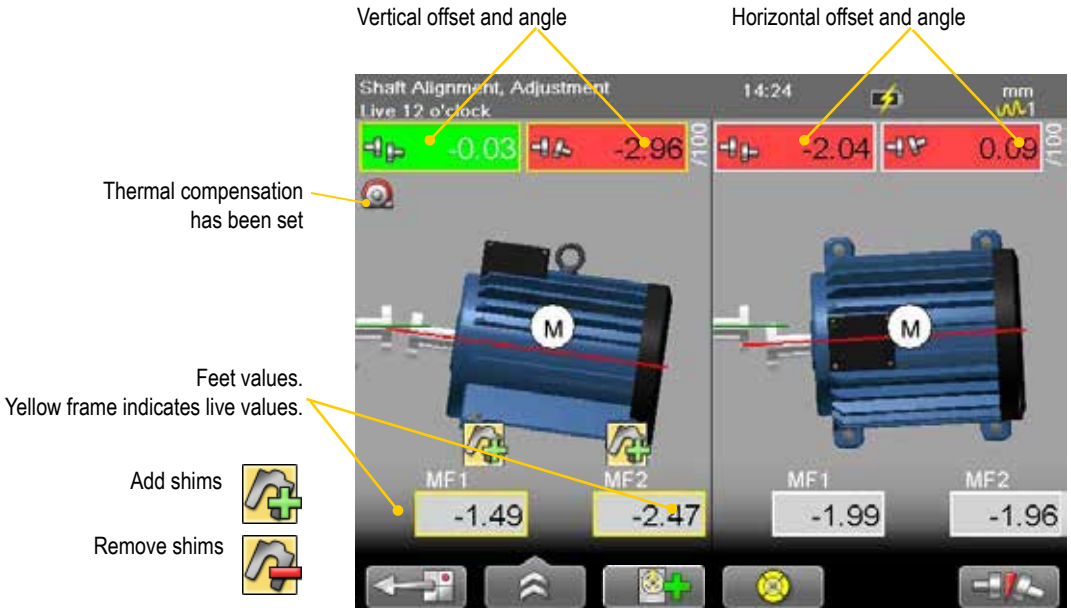
Edge warning
When the laser beam is close to the edge, the edge is "lit up" as a warning. It is not possible to register values when you see the edge warning.

Function buttons

	**Back**. Measure previous position or back to Distance view.
	*See "Control panel" on page 14.*
	 Switch to the EasyTurn™ method.  Switch to the 9-12-3 method.  Switch to the Horizontal Multipoint method.
	*See "SOFTFOOT" on page 45.*

Result and adjust

Offset, angle and feet values are clearly displayed. Both horizontal and vertical direction are shown live, which makes it easy to adjust the machine. Values within tolerance are green.

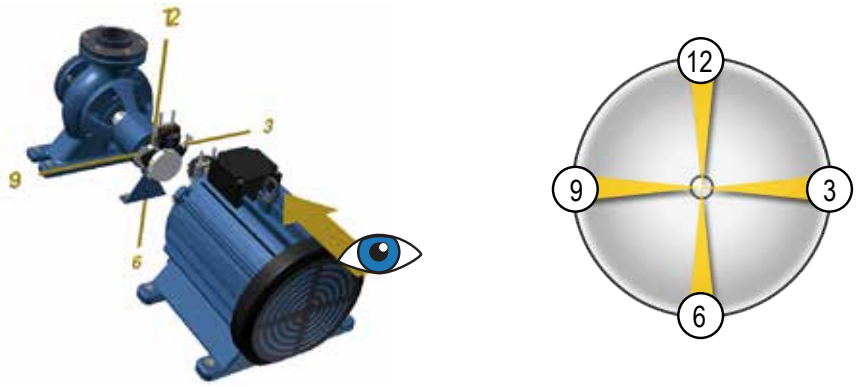


Function buttons

	Back to measure view.
	See "Control panel" on page 14. Save, *see "Measurement file handling" on page 11.* *See "Tolerance" on page 123.* *See "Thermal compensation" on page 121.* RefLock, lock feet. *Note! Not available for E420.* Show target. This is a quick way to see where the laser beam hits the target and how the measuring units are positioned. Print report on thermal printer (optional equipment). Available when you open a saved measurement. **Edit distances**. Press **OK** to confirm changes. The result is recalculated.
	Toggle button. Show/hide Position indicator. See *"Position indicator" on page 120.*
	See *"Live values" on page 119.*
/100	Toggle button. Switch between to show gap and show angular error per 100 mm. For this to work you need to set the coupling diameter.

Live values

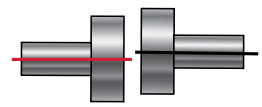
When reading the values, face the stationary machine from the movable machine.
Positions for measuring units as seen from the movable machine.
Live values are marked with yellow frame.



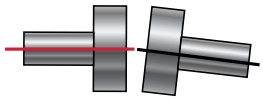
Face the stationary machine (S) from the movable machine (M). Then 9 o'clock is to the left, as in the measuring programs.

Offset and angle values

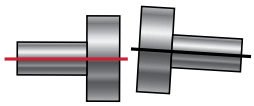
The offset and angle value indicate how well the machine is aligned at the coupling.
They appear in both horizontal and vertical direction.
These values are important to get within tolerance.



Offset
The centre lines of two axis are not concentric but parallel.
This is measured at the coupling centres.
In this example, a positive offset is shown.



Angular misalignment
The centre lines of two axis are not parallel.
In this example, a negative angle is shown.



Offset and angular misalignment
Misalignment is often a combination of both offset and angular misalignment.

Show live values for EasyTurn™ and Multipoint

The inclinometer can be used to show live values at all angles.

	Show live values at any angle.
	Inclinometer controls when to show live values.

Show live values for 9-12-3

The inclinometer is not used. You can manually show in which position your measurement units are.

Select  to show the live options.

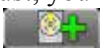
	Force live to 6 o'clock.
	Force live to 12 o'clock.
	Force live to 3 o'clock.
	Force live to 9 o'clock.

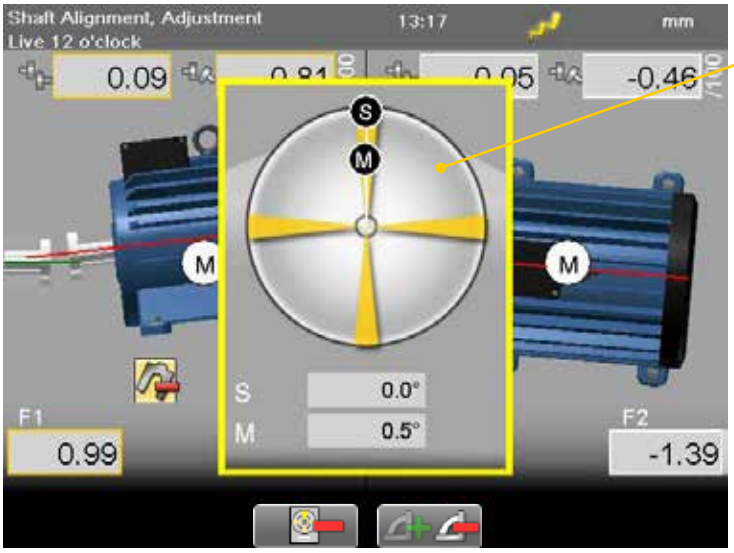
Adjust

Adjust the machine if needed.

1. Shim the machine according to the vertical feet values.
2. Adjust the machine sideways according to the live horizontal values.
3. Tighten the feet.
4. Select  to remeasure.

Position indicator

To adjust, you need to place the measuring units in live position (9, 12, 3 or 6 o'clock). Select  to show the Position indicator.



Function buttons

	Toggle button. Show/hide position indicator manually.
	Toggle button. Select  to display the position indicator automatically when you move the measuring units.

Save

You can save a measurement and open it later to continue to measure. When you save the measurement again, it will **not** overwrite the earlier version.

When you save a measurement, a pdf is automatically generated.

See "Measurement file handling" on page 11.

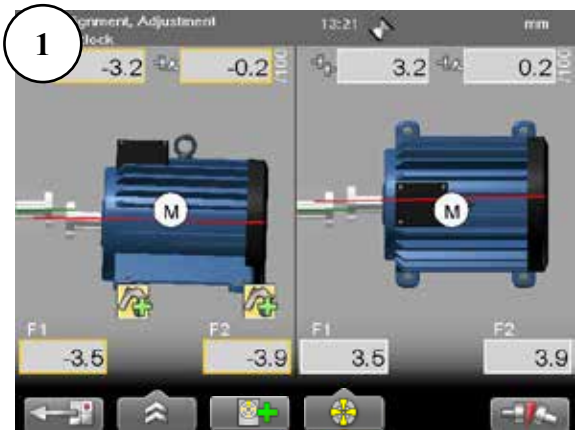
Thermal compensation

During normal operation, machinery is influenced of different factors and forces. The most common of these changes is the change in the temperature of the machine. This will cause the height of the shaft to increase. This is called thermal growth. To compensate for thermal growth, you enter values for cold condition compensation.

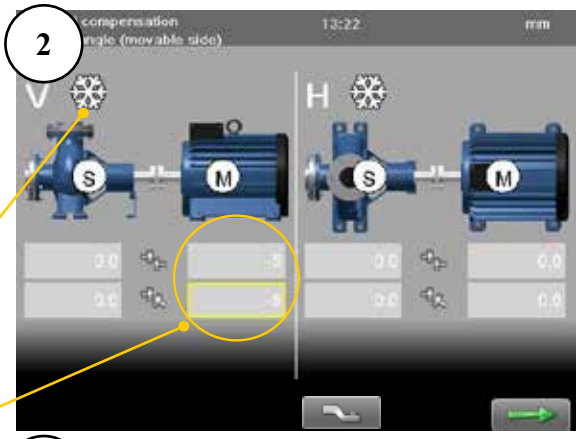
Select  and  from the result and distance view. The Thermal compensation view is displayed.

Example

It can be necessary to place the cold machine a bit lower to allow thermal growth. In this example we set -5mm as vertical compensation, both offset and angle.

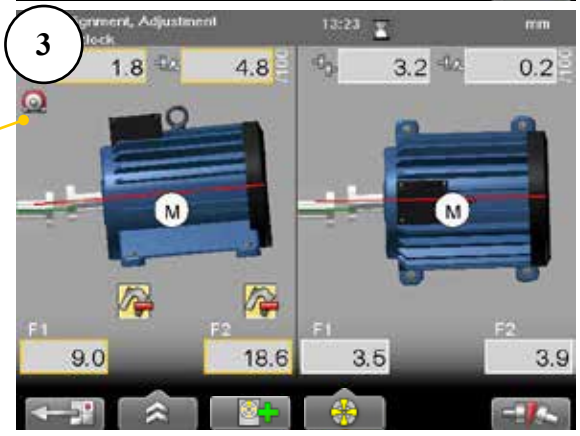


1. Before thermal compensation.
2. Set thermal compensation.
3. Thermal compensation set. When you have set thermal compensation and return to the result view, the values have changed. When the machine becomes warm, the thermal growth will make it perfectly aligned.



Indicates that the compensation values are set for cold (offline) condition.

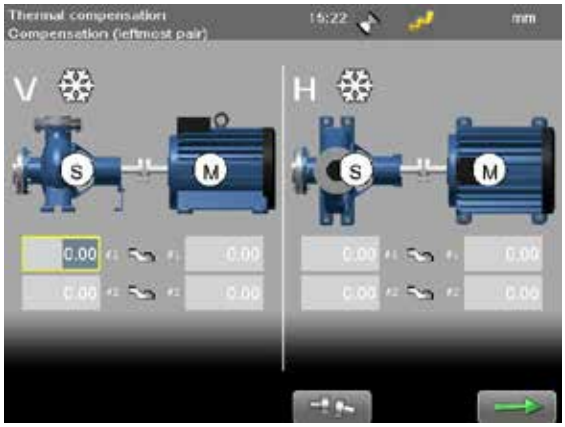
Vertical offset and angle for movable machine.



Indicates that thermal compensation has been set

Feet values

1. On the distance view, enter distances for the S-machine.
2. Select  .
3. Set thermal compensation values based on feet values. The coupling values are recal-calculated. If there are more than two feet pairs, you enter values for the first and last feet pair.



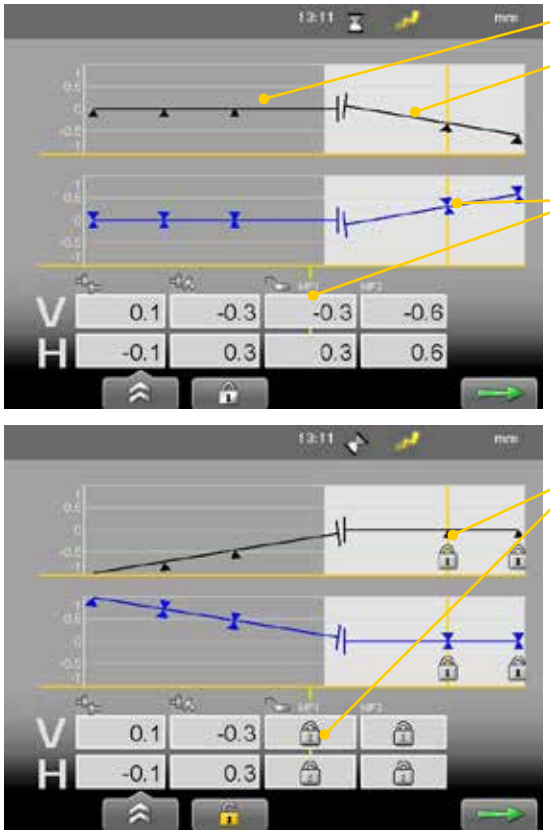
Note!

Only the coupling values are visible in the PDF report and the printed report.

RefLock™

From the result view, you can select the function RefLock™. Here you can choose any two feet pairs as locked and thus choose which machine is to be used as stationary and which as adjustable. If you want to lock feet pair on the stationary machine, you need to enter distances.

1. Select  and  .
2. The RefLock graph view is displayed. Navigate using the left and right navigation button.
3. Select  to lock the selected feet pair or  to unlock.
4. Select  to continue to the result view.

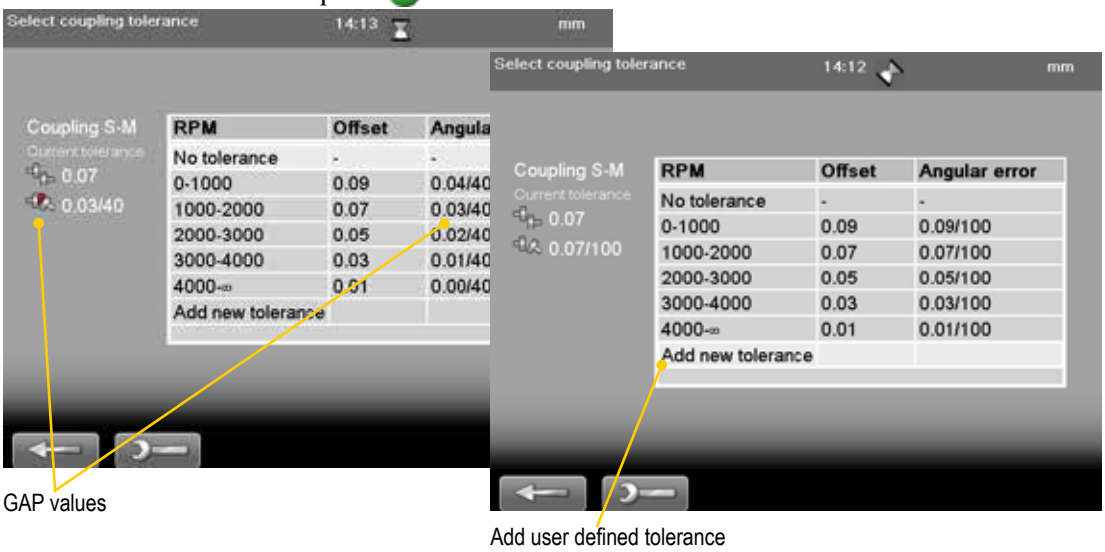


Note!

RefLock™ *is available when using the program Horizontal. Not available for programs Vertical or Cardan.*

Tolerance

1. Select  and  . The tolerance window is displayed.
2. Select a tolerance and press  .



Function buttons

	Close Tolerance view.
	*See "Control panel" on page 14.*
	Edit user defined tolerance.
	Delete user defined tolerance.

Add new tolerance

You can add your own user defined tolerance.

1. Select the row "Add new tolerance". Press  .
2. Enter name and tolerance.
3. Press  . The new tolerance is added to the list.

Tolerance in result views

The tolerances are clearly displayed in the result views.

Green = within tolerance

Red = not within tolerance

Tolerance table

The rotation speed of the shafts will decide the demands on the alignment. The table on this side can be used as a guidance if no other tolerances is recommended by the manufacturer of the machines.

The tolerances is set to the maximum allowed deviation from accurate values, with no consideration to if that value should be zero or compensated for thermal growth.

Offset misalignment

	Excellent		Acceptable	
rpm	mils	mm	mils	mm
0000-1000	3.0	0.07	5.0	0.13
1000-2000	2.0	0.05	4.0	0.10
2000-3000	1.5	0.03	3.0	0.07
3000-4000	1.0	0.02	2.0	0.04
4000-5000	0.5	0.01	1.5	0.03
5000-6000	<0.5	<0.01	<1.5	<0.03

Angular misalignment

	Excellent		Acceptable	
rpm	mils/”	mm/100mm	mils/”	mm/100mm
0000-1000	0.6	0.06	1.0	0.10
1000-2000	0.5	0.05	0.8	0.08
2000-3000	0.4	0.04	0.7	0.07
3000-4000	0.3	0.03	0.6	0.06
4000-5000	0.2	0.02	0.5	0.05
5000-6000	0.1	0.01	0.4	0.04

The higher the rpm of a machinery is, the tighter the tolerance must be. The acceptable tolerance is used for re-alignments on non-critical machinery. New installations and critical machines should always be aligned within the excellent tolerance.

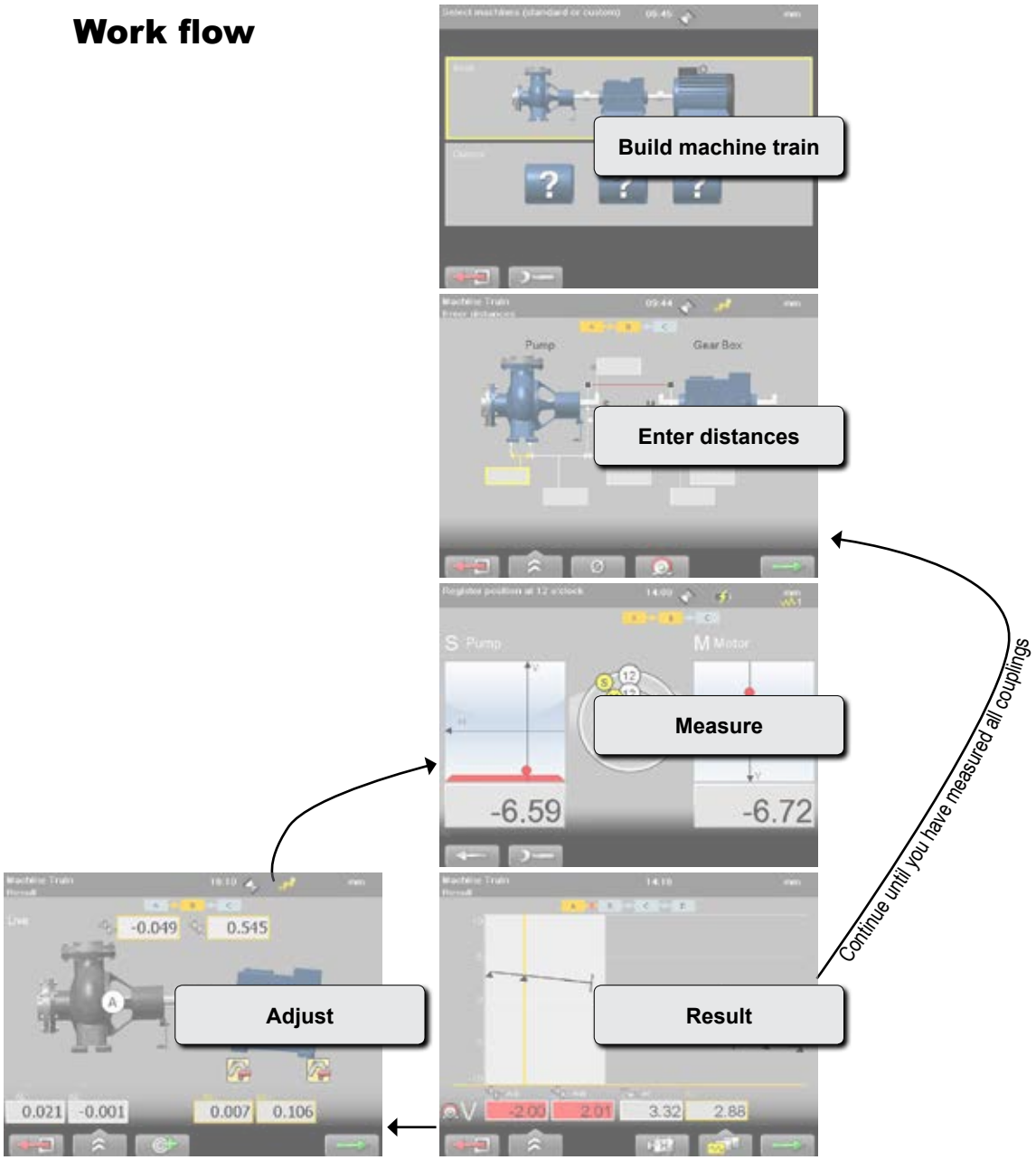
Note!

Consider these tables as guidelines. Many machines must be aligned very accurately even if they have a lower rpm. For example gearboxes.

MACHINE TRAIN

Use for machines mounted in a train with two or more couplings.

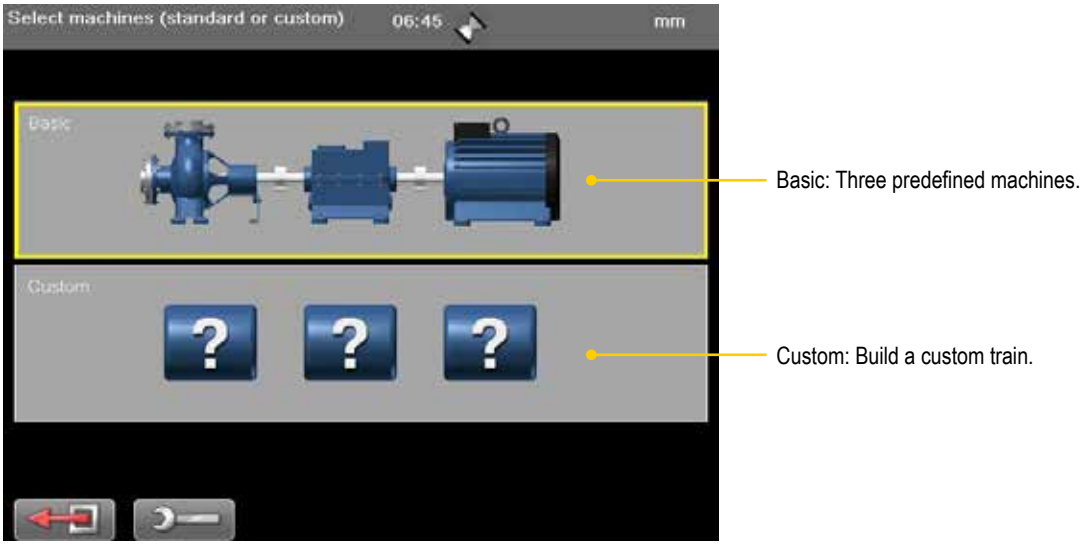
Work flow



Build machine train

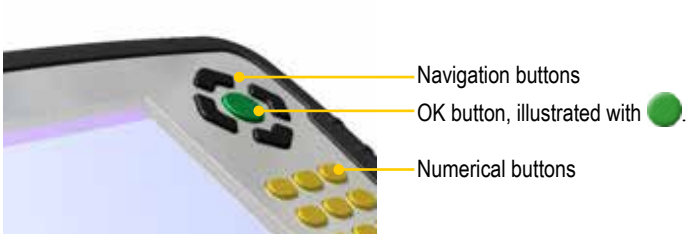
Before measuring your machines, you need to define what kind of machines you have.

1. Use navigation buttons to select Basic or Custom.
2. Press .



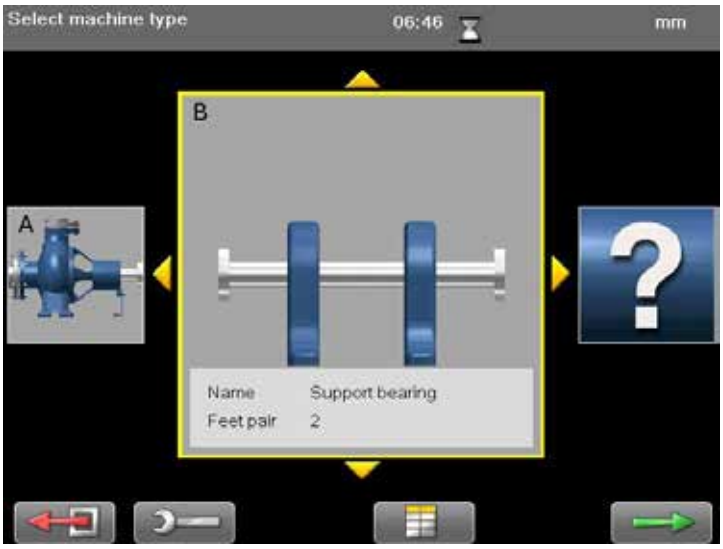
Basic

The basic machine train contains a pump, a gearbox and a motor. These three predefined machines all have two feet pair each.



Custom

Select this option if you want to build a custom machine train. You build the train from left to right. There are several machine types to choose from and you can add as many as you need to your machine train. You can also define as many feet pairs as you need on the machines.

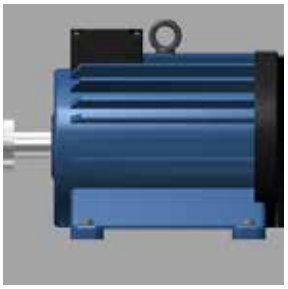


Select machine

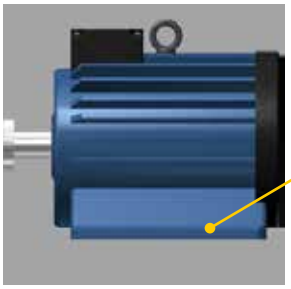
1. Use navigation buttons up and down to find the machine you want.
2. Press . The next machine becomes active.
3. Add as many machines as you need. When you are done, select to continue to Measure view.

Select number of feet pair

If you want to change the number of feet pair on the machine, simply enter the number you want on the numerical buttons.



Machine with two feet pairs



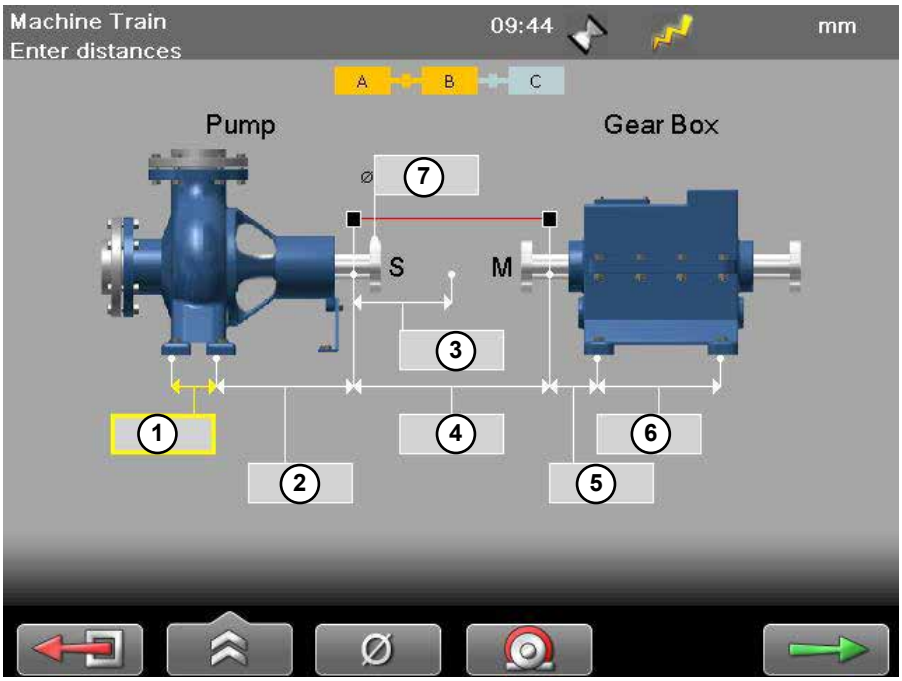
Build train table

Select to open a table view. In this table you can rename the machines and change the number of feet pairs.

#	Name	Feetpair
1	Engine	2
2	New gearbox.	2
3	Support bearing	2
4	Gear Box	3

Enter distances

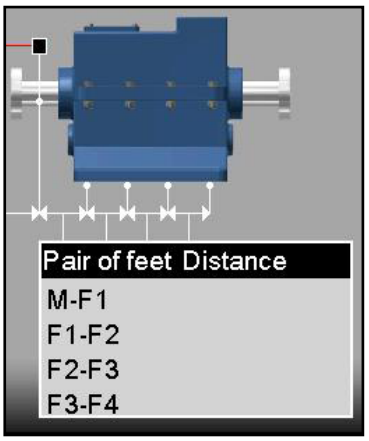
Confirm each distance with .



1. Distance between first and second feet pair.
2. Distance between second feet pair and S-unit.
3. Distance between S-unit and centre of coupling.
4. Distance between S-unit and M-unit. Measure between the rods.
5. Distance between M-unit and feet pair one.
6. Distance between feet pair one and feet pair two.
7. Coupling diameter. Optional, select Ø to activate field.

Function buttons

	Leave program.
	See "Control panel" on page 14. *See "Thermal compensation" on page 139.*
Ø	**Diameter**. Select to enter coupling diameter. This is necessary if you want the result based on the gap of the coupling instead of angle.
	Continue to Measure view.



When there are more than three feet pairs, a table is displayed where you enter the distances.

Measure using EasyTurn™

It is possible to measure with as little as 40º spread between the measurement points. However, for an even more accurate result, try to spread the points as much as possible. The colours indicates where the optimum positions to measure are.

1. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
2. Press to register first position. The first position is automatically set to zero. A red marking is displayed.
3. Turn shafts outside of the red 20º marking.
4. Press to register second position.
5. Turn shafts outside of the red markings.
6. Press to register third position. The Result and adjust view displayed.
7. The result is displayed. You can show the result as graph, table or machine view. *See chapter Result*.
8. From the result view, select to measure next coupling. If you want to adjust the coupling, select the machine you want to adjust and press . *See chapter Adjust*.

Edge warning
When the laser beam is close to the edge, the edge is “lit up” as a warning. It is not possible to register values when you see the edge warning.

Function buttons

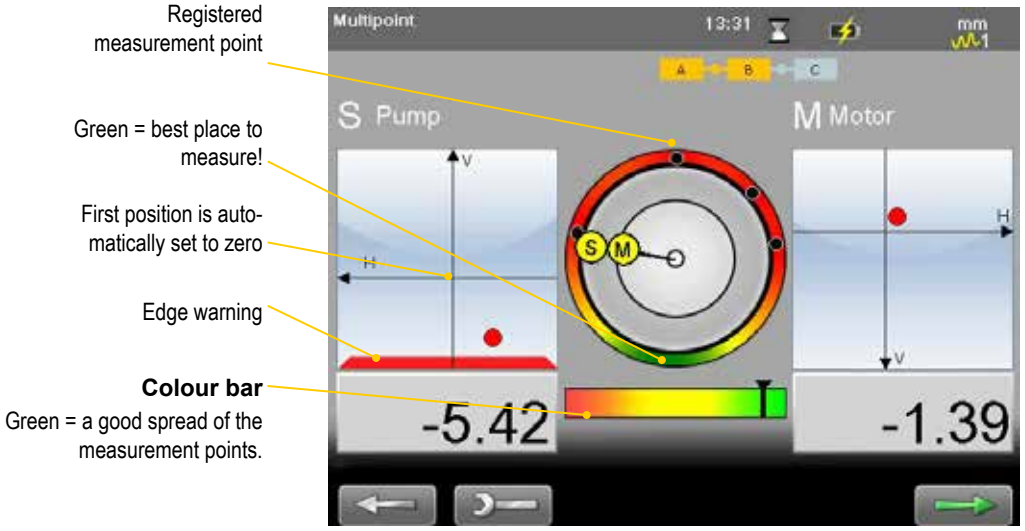
	Back. Measure previous position or back to Distance view.
	See “Control panel” on page 14.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See “SOFTFOOT” on page 45.

Measure using Multipoint

1. Select  and  to switch to Horizontal Multipoint.
2. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
3. Press to register first position. The first position is automatically set to zero.
4. Press to register as many points as you wish. After three points a result is available.
5. Select  to display the Result and adjust view. You can show the result as graph, table or machine view. *See "Result" on page 132.*
6. From the result view, select  to measure next coupling. If you want to adjust the coupling, select the machine you want to adjust and press . *See "Adjust" on page 136.*

Spread the measurement points

For a more accurate result, try to spread the points as much as possible. The colours indicates where the optimum positions to measure are. The colour bar indicates how statistical accurate the measurement is.



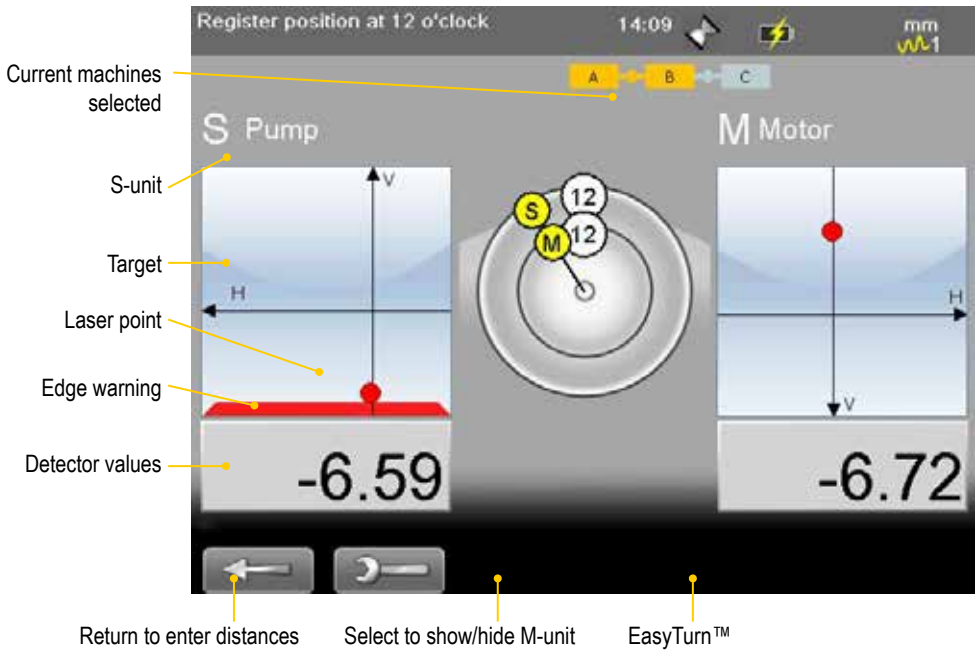
Edge warning
When the laser beam is close to the edge, the edge is "lit up" as a warning. It is not possible to register values when you see the edge warning.

Function buttons

	**Back**. Measure previous position or back to Distance view.
	*See "Control panel" on page 14.*
	 Switch to the EasyTurn™ method.  Switch to the 9-12-3 method.  Switch to the Horizontal Multipoint method.
	*See "SOFTFOOT" on page 45.*
	Continue to the Result and adjust view. Available after registering three positions.

Measure using 9-12-3

1. Select  and  to switch to 9-12-3.
2. Adjust laser to the centre of the targets. If needed, adjust the units on the rods, then use laser adjustments knobs.
3. Turn shafts to 9 o'clock.
4. Press to register first position. The first position is automatically set to zero.
5. Turn shafts to 12 o'clock.
6. Press to register second position.
7. Turn shafts to 3 o'clock.
8. Press to register third position.



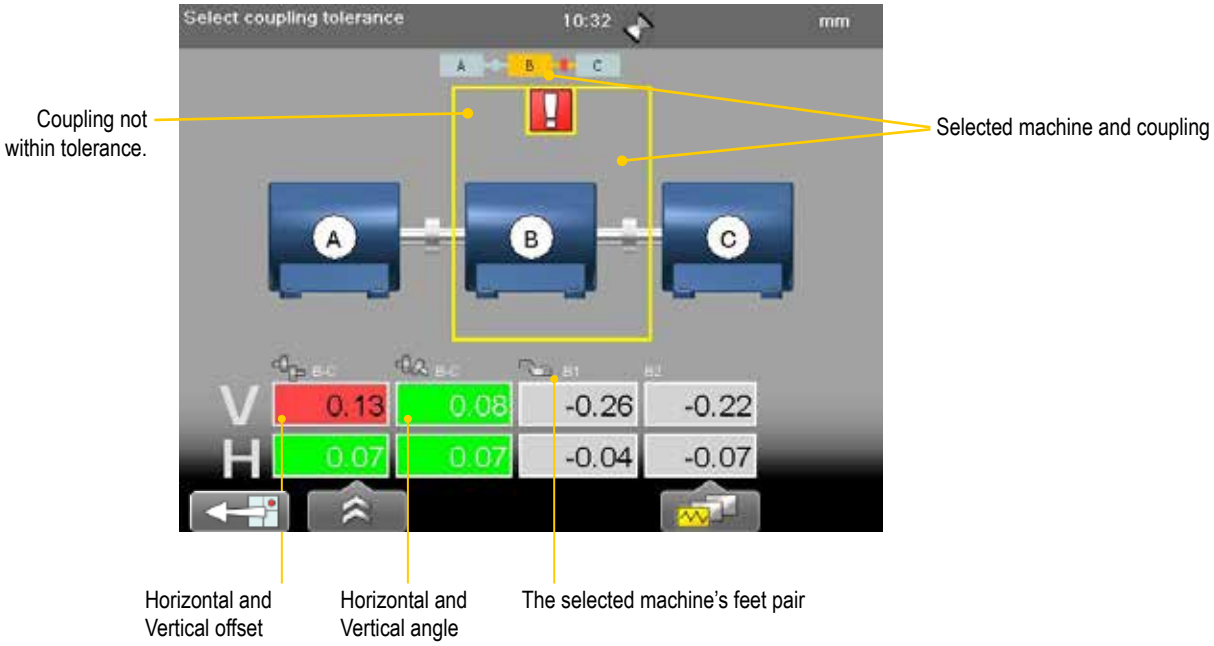
9. The result is displayed. You can show the result as graph, table or machine view. *See "Result" on page 132*.
10. From the result view, select  to measure next coupling. If you want to adjust the coupling, select the machine you want to adjust and press . *See "Adjust" on page 136*.

Result

You can show the result as graph, table or machine view.
By default the machine view is displayed. Navigate in the result views by using the navigation buttons.

Result Machine view

Select  and  . The Machine view is displayed.



Feet pair

If there are more than three feet pairs, values are only displayed for the first three pairs in this view. To view values for all feet pairs, switch to Table view.

Adjust coupling

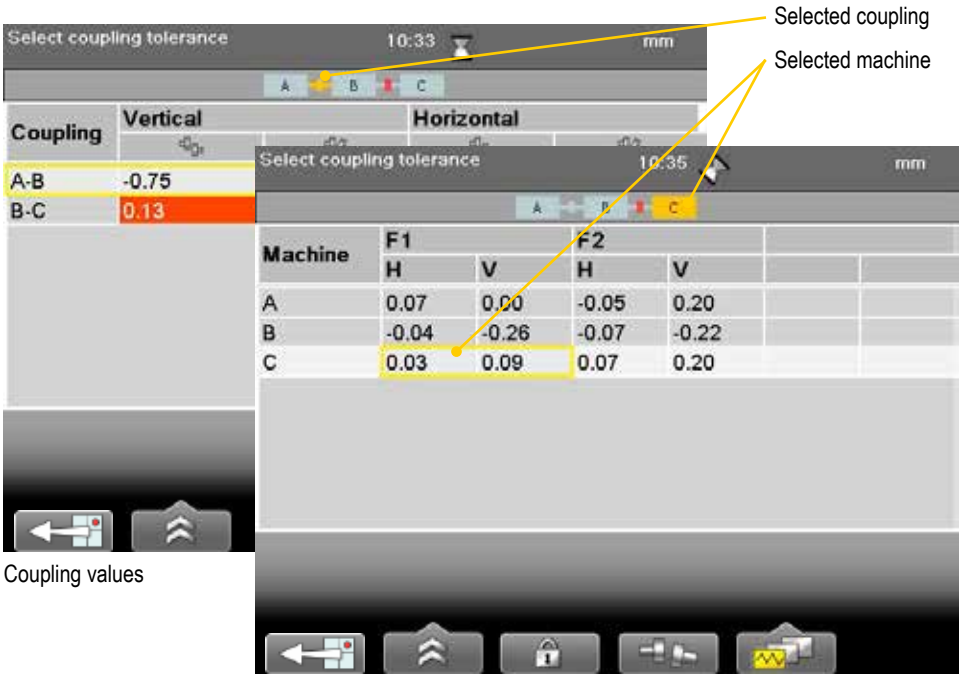
Select the machine you want to adjust and press . *See "Adjust" on page 136.*

Function buttons

	Remeasure the coupling. Press and hold to leave program.
	 *See "Control panel" on page 14.*  **Save file**. *"Measurement file handling" on page 11.*  *See "Tolerance" on page 138.*  *See "Thermal compensation" on page 139.*  View and edit distance.  **Print**. *"Measurement file handling" on page 11.*   Toggle button. Show Gap or Angle values.
	Switch result view.
	Measure next coupling.

Result Table view

Select  and  . The Result Table view is displayed.
Navigate using the navigation buttons.



Coupling values

Feet values

Function buttons

	Remeasure the coupling. Press and hold to leave program.
	 *See "Control panel" on page 14.*  **Save file**. *"Measurement file handling" on page 11.*  *See "Tolerance" on page 138.*  *See "Thermal compensation" on page 139.*  View and edit distance.  **Print**. *"Measurement file handling" on page 11.*   Toggle button. Show Gap or Angle values.
	Lock / unlock feet pair. Available when you show feet values. *See "Lock feet pair" on page 135.*
	Toggle between showing feet or coupling values.
	**Switch result view**.

Save

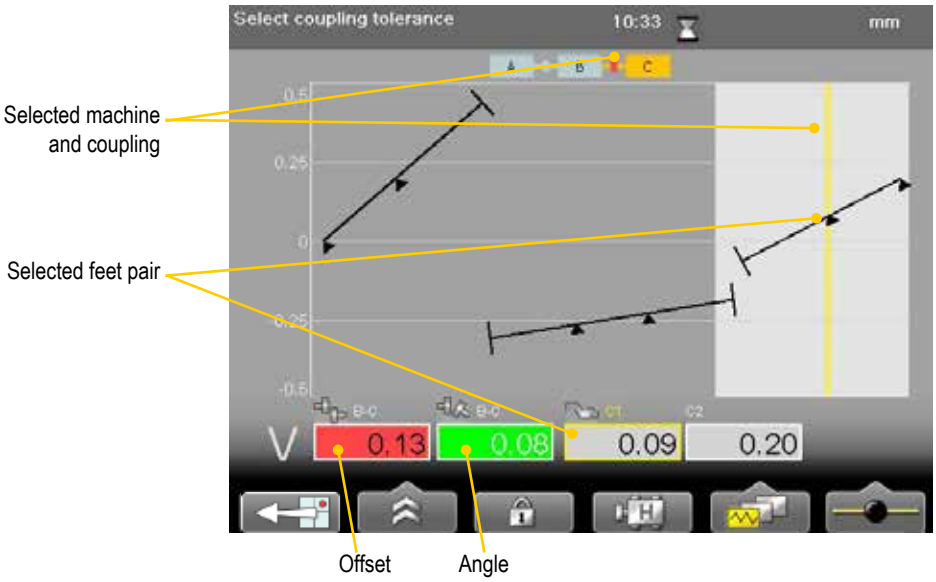
You can save a measurement and open it later to continue to measure. When you save the measurement again, it will **not** overwrite the earlier version.

When you save a measurement, a pdf is automatically generated only when the whole train has been measured.

See "Measurement file handling" on page 11.

Result Graph view

Select  and  . The Graph view is displayed.



Function buttons

	Remeasure the coupling. Press and hold to leave program.
	*See "Result Machine view" on page 132.*
	Lock / unlock feet pair. If you can not adjust a feet pair, use the lock function. *See "Lock feet pair" on page 135.*
	Toggle between showing horizontal or vertical graph.
	**Switch result view**.
	Available when you have measured the whole train. *See "Best fit and Manual fit".*  **Best fit**  **Manual fit**
	Select to measure next coupling.

Lock feet pair

This function is available in graph and table view. We recommend that you lock two feet pair to get the most accurate calculated reference line as possible. If you choose to lock only one feet pair, the tilt of the train is maintained and the coupling is offset.

Best fit and Manual fit

By default, an average best fit is calculated on the measured machine train. This means that the train is tilted to the flattest possible plane. If no feet pairs are locked, the system assumes that all machines are possible to move in all directions. For each coupling that you measure, the best fit is recalculated. When you have made adjustments on a coupling, the best fit is no longer recalculated.

Manual fit

Only available when you have measured the whole train, and only in graph view. Use this function when you know that you for example can move a machine a little in one direction, but not at all in another direction.

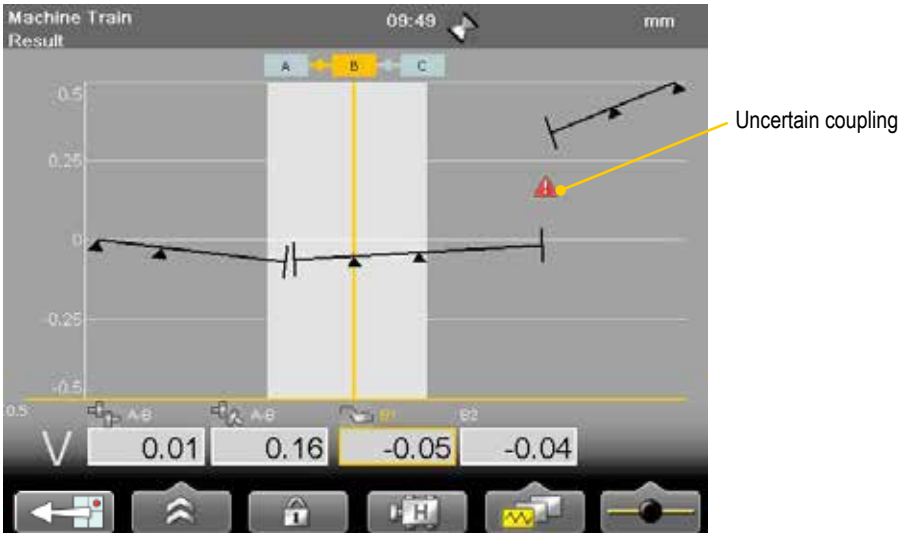
1. Select  and  to activate the Manual fit function. If there are locked feet pair, these are unlocked.
2. Use the numerical buttons to move the graph.

- Buttons 1 and 4 move the left part of the train
- Buttons 2 and 5 moves the whole train.
- Buttons 3 and 6 moves the right part of the train.
- Button -+ will change the scale.

To return to average best fit, select  and  .

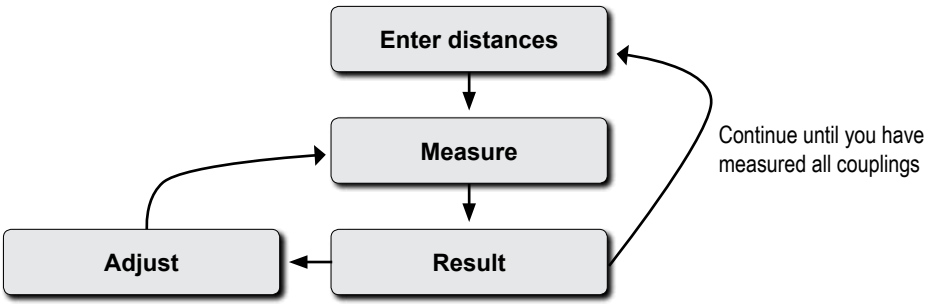
Uncertain coupling

When you adjust one coupling, it might affect the next coupling in the machine train. In the example below, the coupling A -B has been adjusted, which might have an affect on the coupling B - C. This is indicated with the symbol  . When you remeasure or adjust the coupling, the warning is removed.

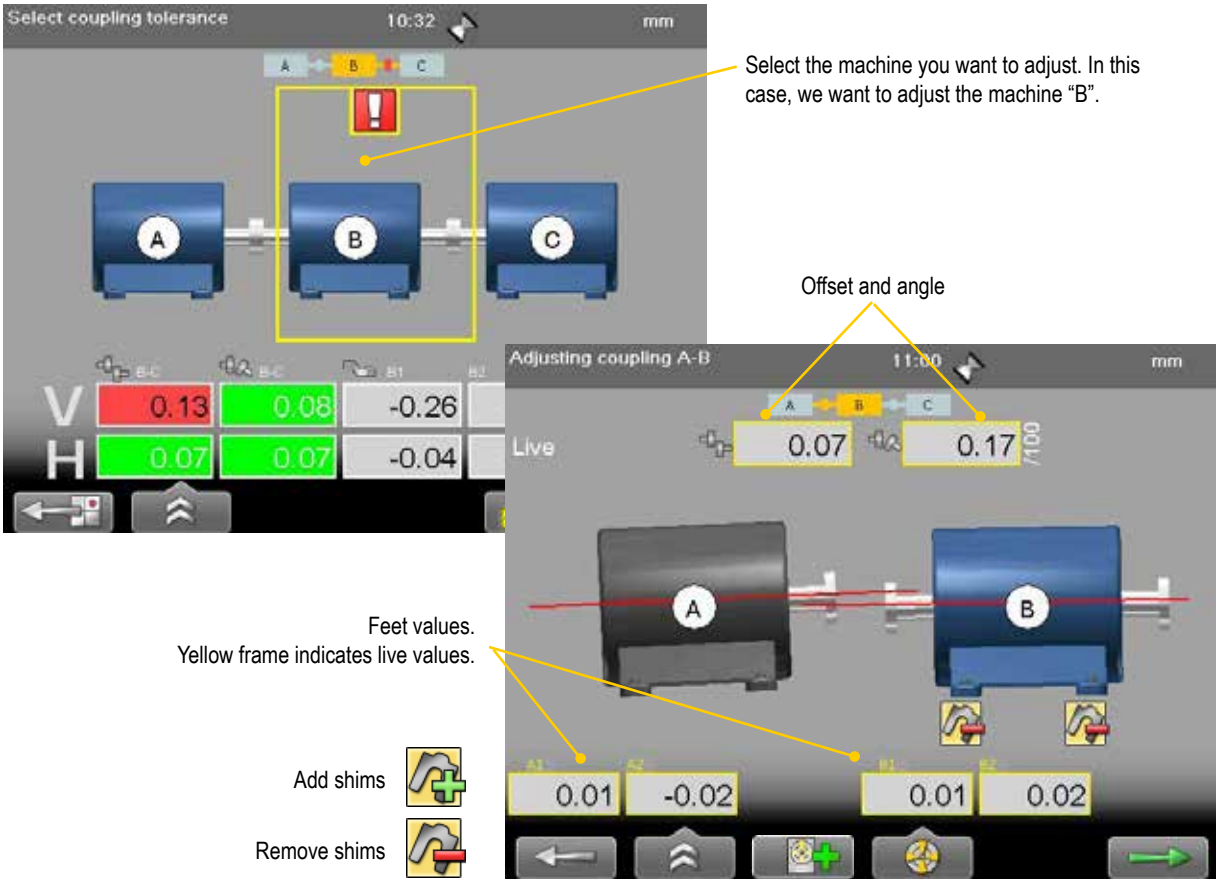


Adjust

You can adjust a machine even though you have not measured the whole train.



1. Select the machine you want to adjust and press .
   If you just measured the coupling, the Adjustment view is displayed. If not, you need to remeasure the coupling first and the Measure view is displayed.
2. Adjust the machine.
3. Select when you are done. The Measure view is displayed.
4. Remeasure the coupling to confirm the adjustment.



Function buttons

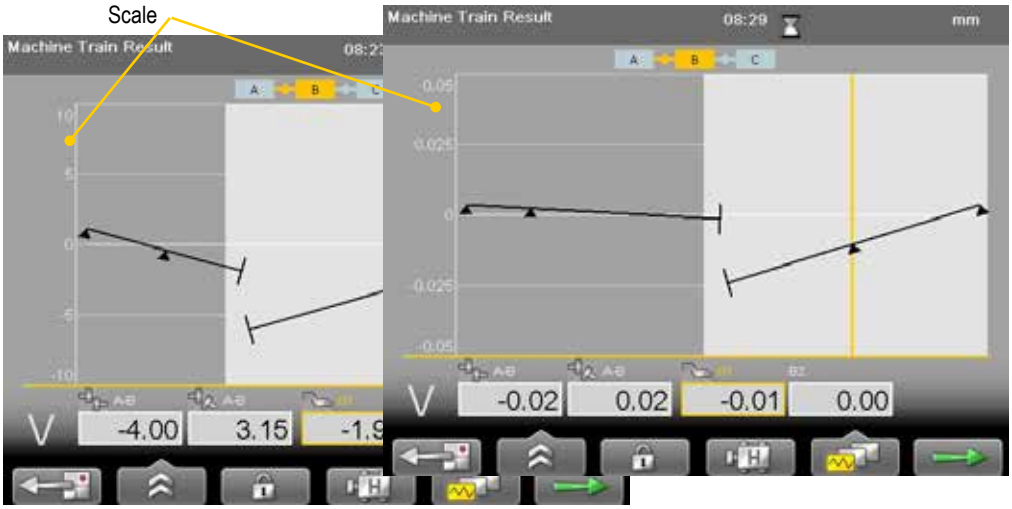
	Back to result view.
	*See "Control panel" on page 14.*
	Toggle button. Select to show/hide Position indicator. *See "Position indicator" on page 120.*
	*See "Live values" on page 119.*
	Continue. You need to remeasure the coupling to confirm the position of the measuring units.

Uncertain coupling

When you adjust one coupling, it might affect the next coupling in the machine train. This is indicated with the symbol  .

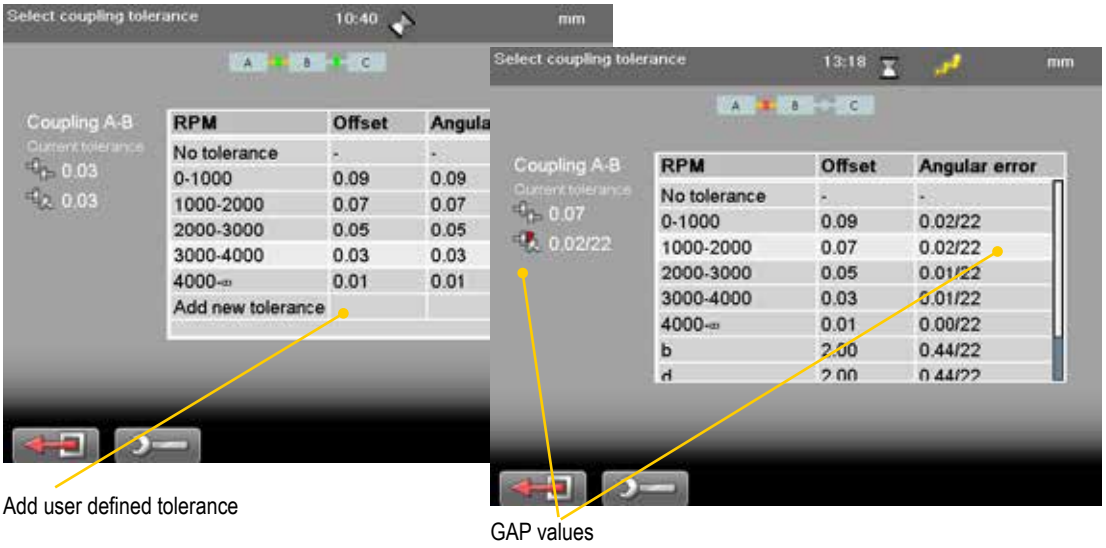
Scale

The scale of the graph might change when you have made adjustments.



Tolerance

1. Select  and  . The tolerance window is displayed.
2. Select a tolerance and press . **The next coupling in the train is selected**.



Function buttons

	Close Tolerance view.
	*See "Control panel" on page 14.*
	Edit user defined tolerance.
	Delete user defined tolerance.

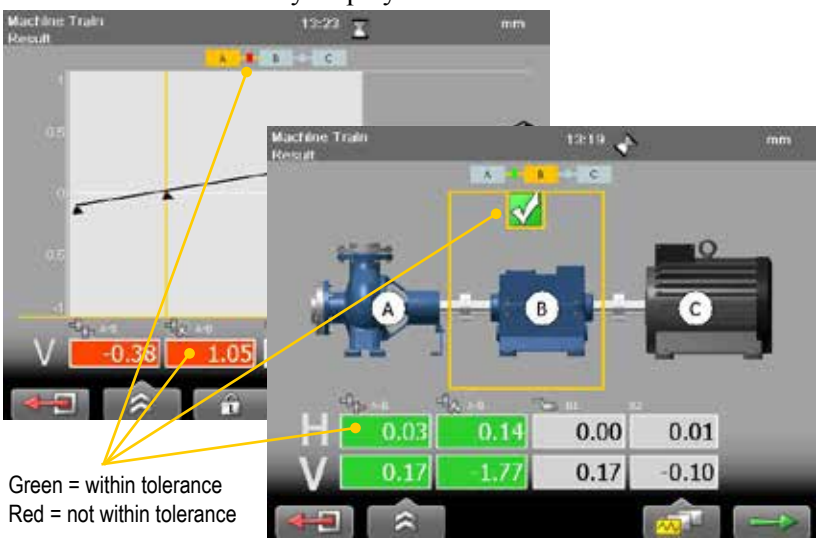
Add new tolerance

You can add your own user defined tolerance.

1. Select the row "Add new tolerance". Press .
2. Enter name and tolerance.
3. Press . The new tolerance is added to the list.

Tolerance in result views

The tolerances are clearly displayed in the result views.



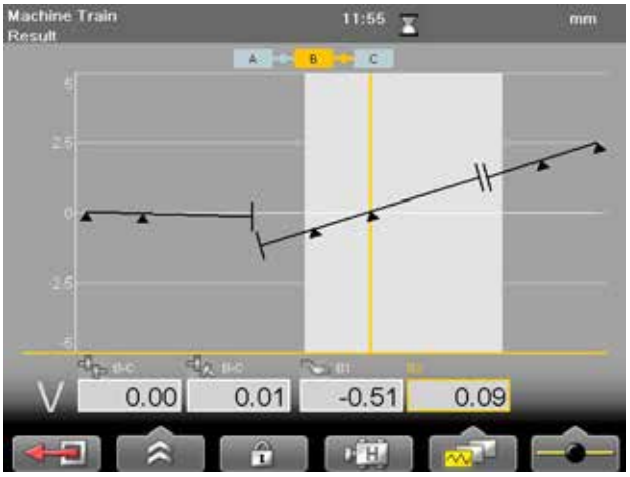
Thermal compensation

During normal operation, machinery is influenced of different factors and forces. The most common of these changes is the change in the temperature of the machine. This will cause the height of the shaft to increase. This is called thermal growth. To compensate for thermal growth, you enter values for cold condition compensation.

Select  and  from the result and distance view. The Thermal compensation view is displayed.

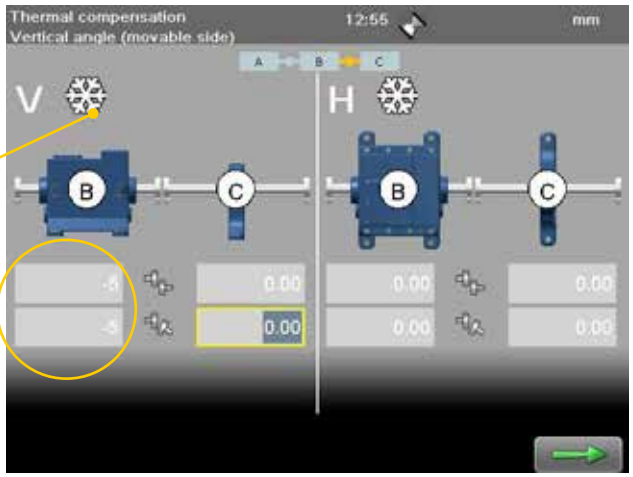
Example

Some machine manufacturers can inform you how much their machines need to be compensated.
For example, it can be necessary to place the cold machine a bit lower to allow thermal growth.



Thermal compensation view

In this example we set -5mm as vertical compensation, both offset and angle.



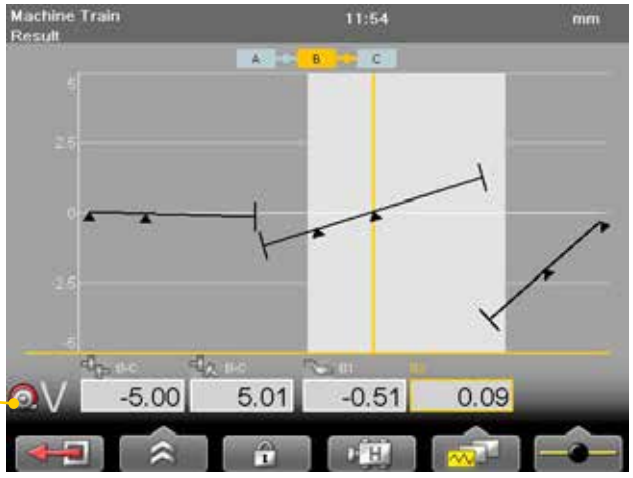
Indicates that the compensation values are set for cold condition

Vertical offset and angle for machine A

Thermal compensation set

When you have set thermal compensation and return to the result view, the values have changed.

When the machine becomes warm, the thermal growth will make it perfectly aligned.



Indicates that thermal compensation has been set

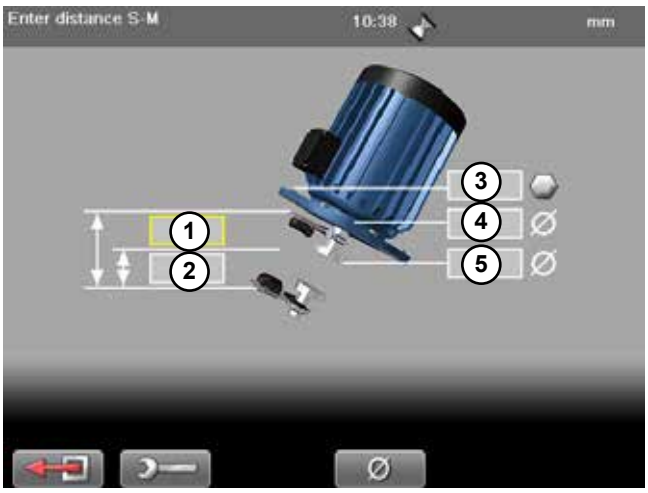
VERTICAL

The program Vertical is used for vertical and/or flange mounted machines.

Preparations

1. Mount the M-unit on the movable machine and the S-unit on the stationary machine.
2. Select  and  to open Vertical program.
3. Enter distances. Confirm each distance with  .

If you have a barcode reader, simply scan the barcode and all machine data is read.
See "Measurement file handling" on page 11.



1 Distance between S-unit and M-unit.
Measure between the rods. **Mandatory**.

2 Distance between S-unit and centre of coupling. **Mandatory**.

3 Number of bolts (4, 6 or 8 bolts).

4 Bolt circle diameter (centre of the bolts).

5 Coupling diameter. Select  to activate field.

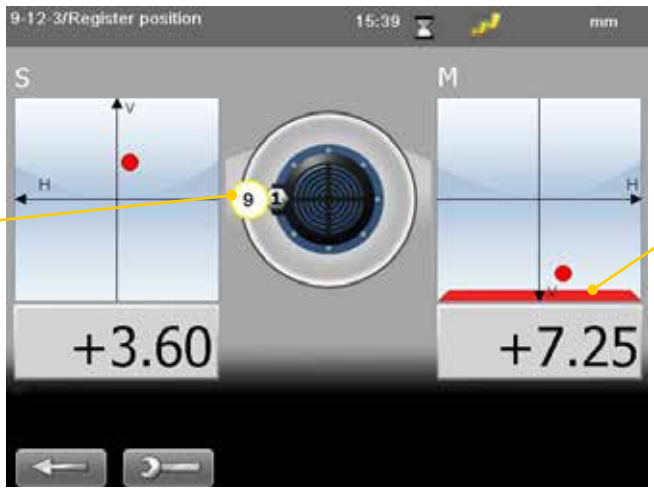
Function buttons

	**Leave program**.
	*See "Control panel" on page 14.*
	Select to enter diameter of coupling.
	Forward to measure view.

Measure

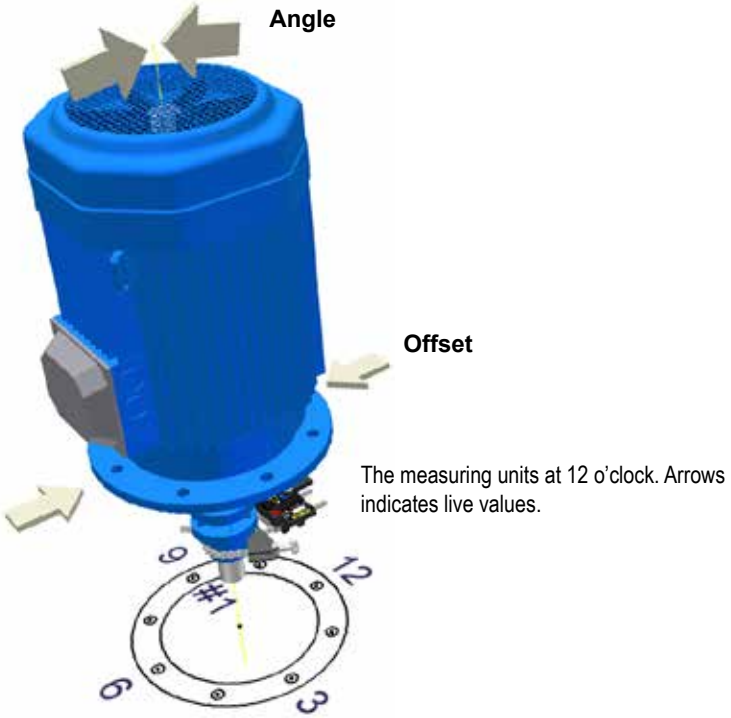
The program Vertical uses the 9-12-3 method.

1. Position the units at 9 o'clock, at bolt number one. Make sure that it is possible to also position the units at 12 and 3 o'clock.
2. Press to register first position. The first position is automatically set to zero.
3. Turn units to position 12 o'clock.
4. Press to register position.
5. Turn units to position 3 o'clock.
6. Press to register position. Measurement result is displayed.



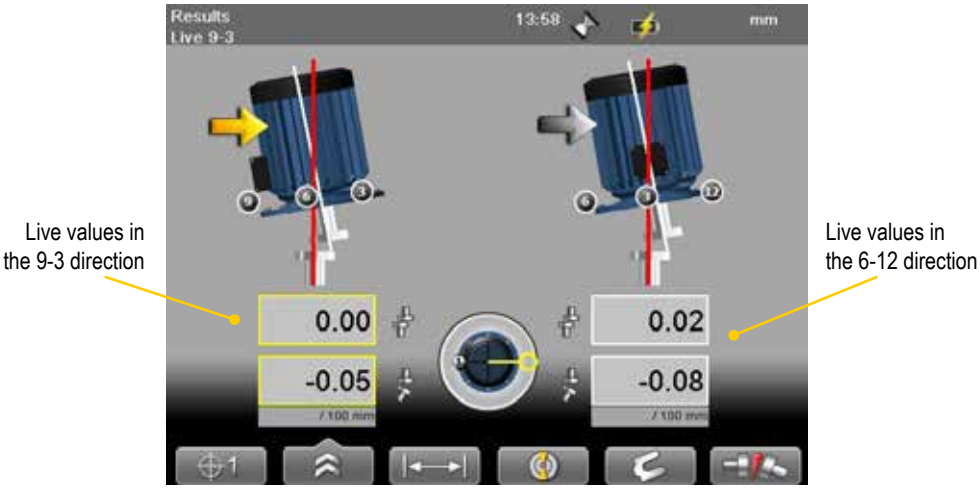
Edge warning

When the laser beam is close to the edge, the edge is "lit up" as a warning. It is not possible to register values when you see the edge warning.



Result

The result is displayed as sideways offset in the coupling and angular error between shafts.



Live values

The values can be displayed live in two directions:

- Live in the 9-3 direction.
  Select  and position the measuring units at 3 o'clock.
- Live in the 6-12 direction.
  Select  and position the measuring units at 12 o'clock.

Function buttons

	Back, remeasure from first position.
	 *See "Control panel" on page 14.*
	 Save, *see "Measurement file handling" on page 11.*
	 **Set tolerance**.
	 **Show target**. This is a quick way to see where the laser beam hits the target and how the measuring units are positioned.  Print report on thermal printer (optional equipment). Only available when you open a saved measurement.
	Adjust distances. Press to confirm changes. The result is recalculated.
	Toggle button. Switch between showing live values in the direction 9-3 or 6-12.
	*See "Shim result view" on page 144.*
	Toggle button. Switch between to show gap and show angular error per 100 mm. For this to work you need to set the coupling diameter.

Shim result view

To view this, you need to enter number of bolts and diameter of bolt circle.

1. Select  to open Shim value view. The values are not live.
2. Read values. The highest bolt is calculated as 0.00. Values below zero indicates that the bolt is low and need shimming.
3. Select  to return to Result view.

Note!

If you shim the machine, remeasure from position 9 o'clock to update all measurement values.

Adjust machine

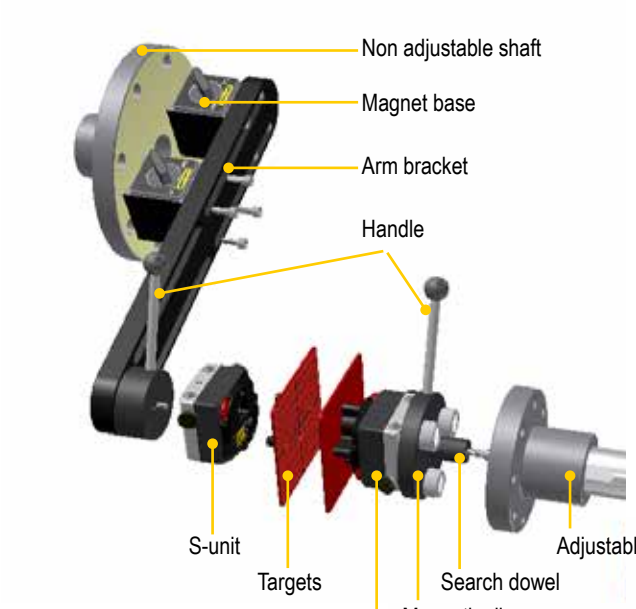
1. Compare the offset and angular error to the tolerance demands.
2. If the angular error need to be adjusted, please shim the machine first, then adjust the offset.
3. Tighten the bolts and remeasure.

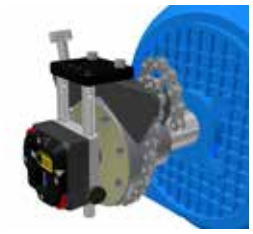
CARDAN

The Cardan program is used for alignment of cardan-shaft-coupled/centre-offset machines.

Mount the units

1. Mount the arm bracket on the non adjustable shaft. You can use the magnet bases or the mount the bracket directly on the flange.
2. Mount the S-unit on the arm bracket.
3. Mount the M-unit on the magnetic disc. If the adjustable shaft has a thread, use suitable search dowel. This makes the centering easier.
4. Mount the targets.



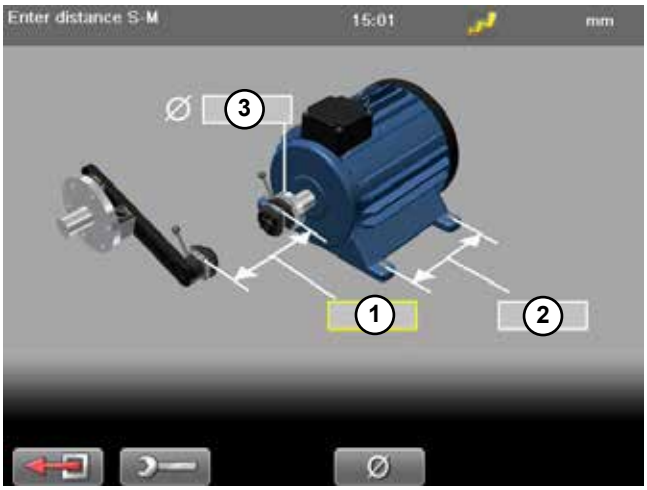


Alternative mounting with offset bracket and chain.

Joined arm brackets for large offset

Enter distances

1. Select and to open Cardan program.
2. Enter distances. Confirm each distance with **OK**.



1 Distance between S-unit and M-unit.
Measure between the rods. **Mandatory**.

2 Distance between feet pair one and feet pair two. Optional.

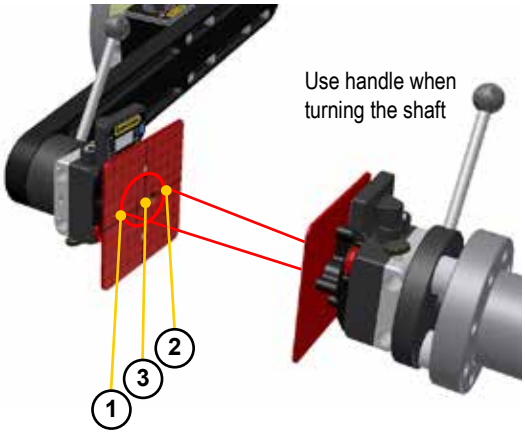
3 Coupling diameter. Optional, select Ø to activate field.

Function buttons

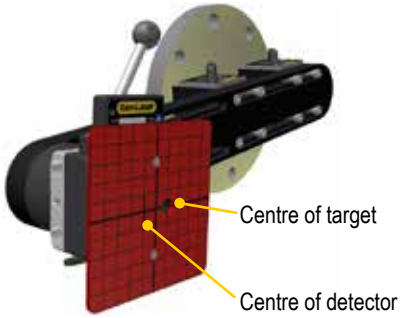
	Leave program.
	See "Control panel" on page 14.
Ø	**Diameter**. Select to enter coupling diameter. This is necessary if you want the result based on the gap of the coupling instead of angle.
	Continue. Available when you have entered the mandatory distances.

Cone laser beam

When you turn the shaft, the laser beam will draw a circle on the target. If the distance between S and M is small (<300 mm or 12 inch), it can be difficult to cone the laser beam. If this is the case, proceed to *Rough alignment*.

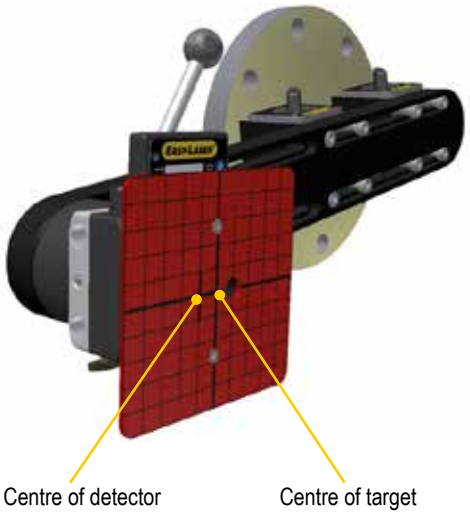


1. Note where the laser beam hit the target at position **1**.
2. Turn one of the shafts 180º. Note the position **2**.
3. Adjust the laser beam halfway towards position **1**, to position **3**.
4. Turn the shaft again. If the laser beam does not move when you turn, the laser beam is correctly coned.
5. Repeat step 2–5 with the opposite unit.
6. Position both units at 9 o'clock.
7. Move the arm bracket until the laser hits the centre of the target on the M-unit.
8. Adjust the S-unit laser beam until it hits the centre of the detector. Adjust using the red screws.
9. Adjust the arm bracket until the laser from the M-unit hits the S-unit in the centre of the target.
10. Adjust the laser beam on the M-unit until it hits the centre of the detector.
11. Remove the targets.



Rough alignment

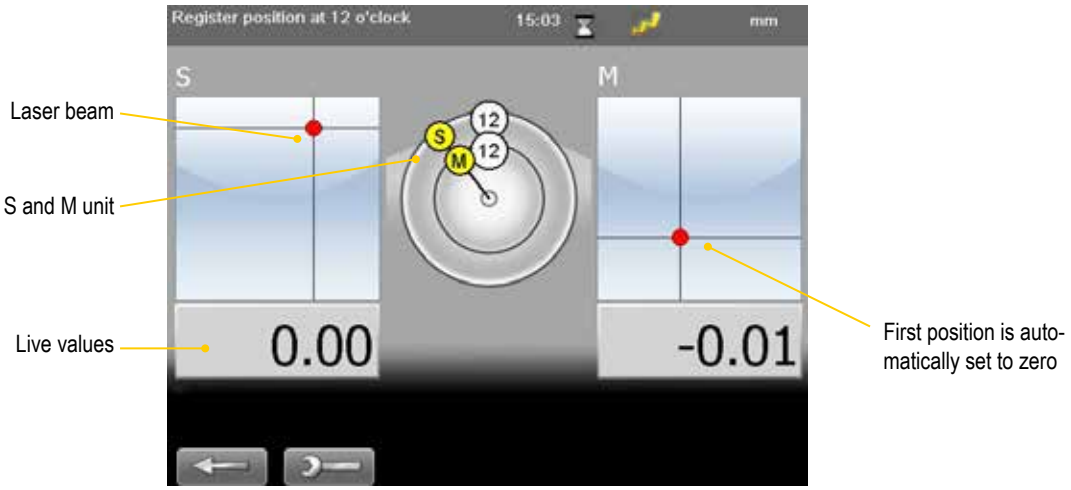
1. Adjust the arm bracket until the laser beam from the M-unit hits the centre of the target.
2. Adjust the movable machine until both laser beams hit **centre of the targets**.
3. Adjust the arm bracket if the adjustment of the machine is not enough.
4. Turn the shafts to 9 o'clock.
   Connectors pointing upwards.
5. Adjust the laser beams to the marking for **centre of detector**.
6. Remove the targets. The Display unit shows the position of the laser beams.



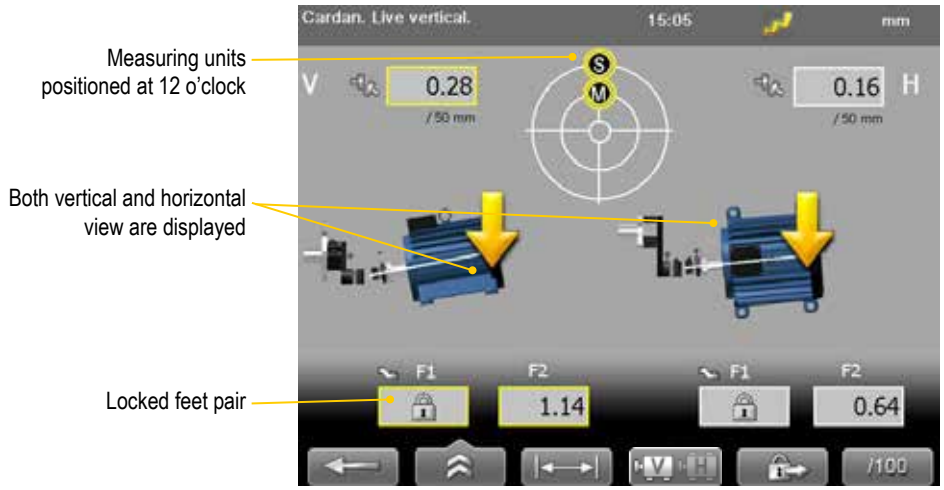
Measure

The shafts are positioned at 9 o'clock.

1. Press **OK** to register first position. The first position is automatically set to zero.
2. Turn the shafts to 12 o'clock.
3. Press **OK** to register position.
4. Turn the shafts to 3 o'clock.
5. Press **OK** to register position.
6. The result for the angular error is displayed.



Result



Function buttons

	**Back**
	 *See "Control panel" on page 14.*  *See "Measurement file handling" on page 11.*  **Show target**. This is a quick way to see where the laser beam hits the target and how the measuring units are positioned.  Print report on thermal printer (optional equipment). Available when you open a saved measurement.  Generate report. Available when you open a saved measurement.
	Toggle button. Show vertical or horizontal live values.
	Toggle button to move the lock. By default, the feet pair with the **highest value** is set to zero and locked.
	Toggle button. Switch between to show gap and show angular error per 100 mm. For this to work you need to set the coupling diameter.

Adjustment

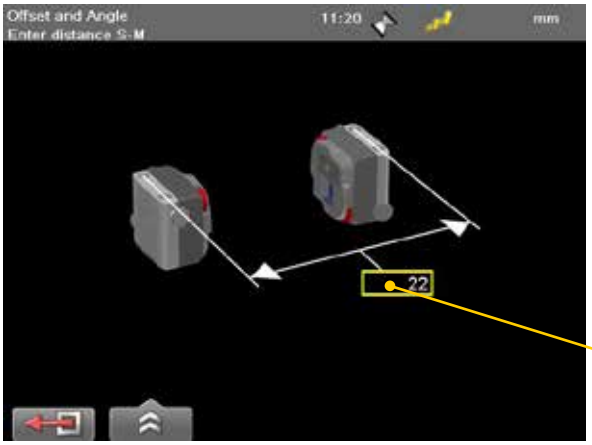
Check the machine according to the tolerance and adjust the machine if needed. No offset adjustment is made.

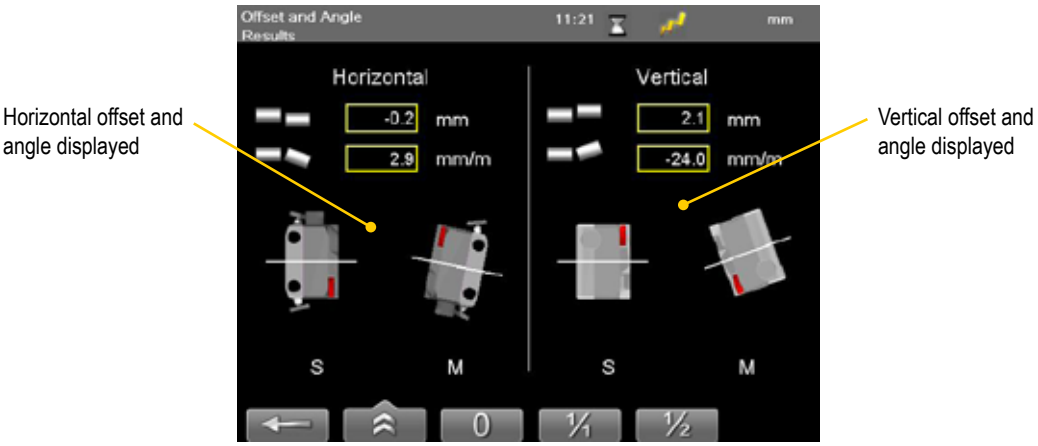
1. Adjust the machine vertically by shimming according to the vertical feet values.
2. Adjust the machine sideways according to the live horizontal values.
3. Tighten the feet.
4. Select  to remeasure.

OFFSET AND ANGLE

The Offset and Angle program displays measurement values from measuring units S and M. The measurement values can be zeroed and any offset and angular changes between the units that may occur are displayed.

1. Enter distance between measuring units.
2. Press **OK**.





Function buttons

	Leave program.
	 *See "Control panel" on page 14.*  Show target. This is a quick way to see where the laser beam hits the target and how the measuring units are positioned.  *See "Streaming values".*
0	**Zero set**. Set current value to zero.
1/1	**Absolute**. Return to absolute value.
1/2	**Half**. Half displayed value.

BTA

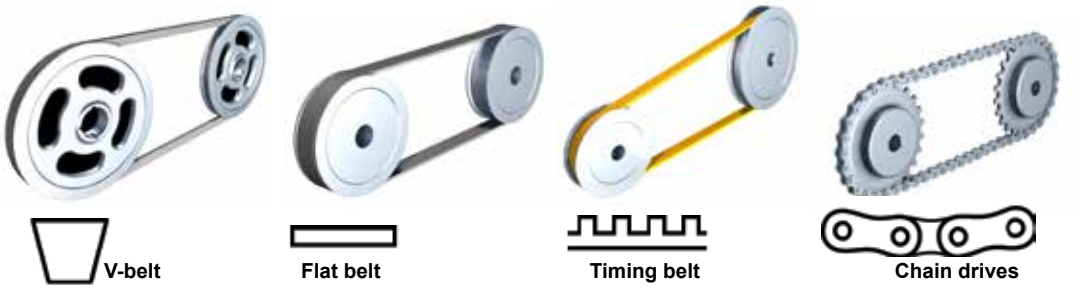
Easy-Laser® BTA system consists of a laser transmitter and a detector. Magnetic mountings on laser and detector make it easy to mount the equipment. Non-magnetic sheave/pulleys can be aligned as the units are very light and can be mounted using double-sided tape.

Note!

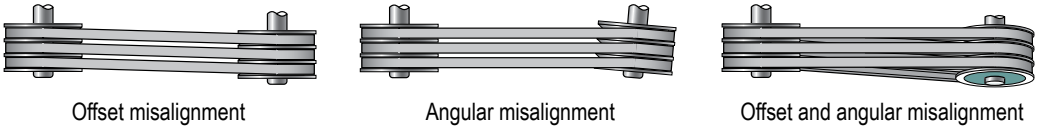
BTA is not included in all Shaft systems.

See "BTA (Optional)" on page 124.

All types of sheave/pulleys can be aligned, regardless of belt type. You can compensate for sheaves of varying widths.



The misalignment can be offset or angular. It can also be a combination of both.



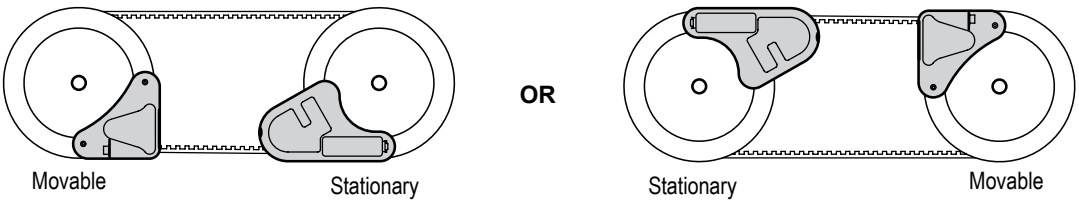
Preparations

- Check the sheaves for radial runout. Bent shafts will make it impossible to perform an accurate alignment.
- Check the sheaves for axial runout. If possible, adjust with the mounting screws of the bushings.
- Make sure that the sheaves are clean from grease and oil.

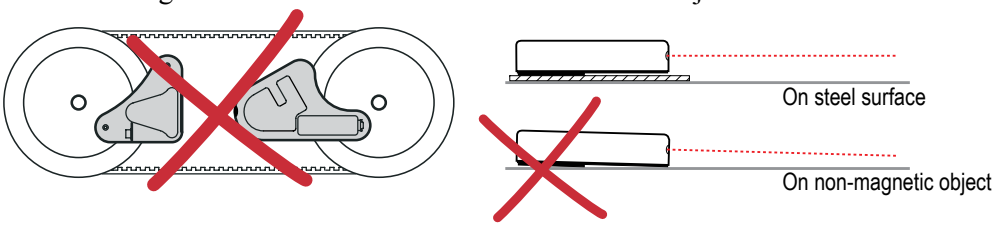
Mount the units

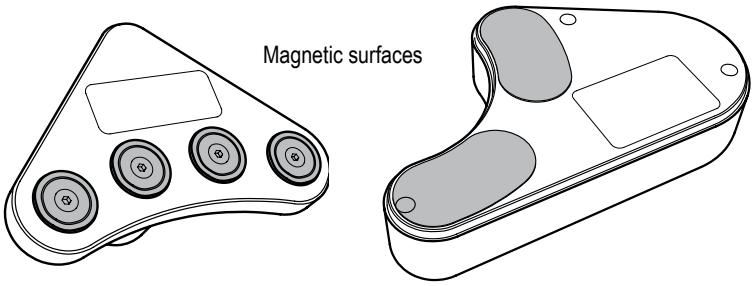
The units are mounted on a flat machined surface with magnets. The magnets are very strong, try to soften the touch by putting just one magnet to sheave first, then turning the other ones in.

1. Mount the laser transmitter on the stationary machine.
2. Mount the detector on the movable machine.
3. Make sure all magnetic surfaces are in contact with the sheave.



All of the magnetic surfaces must be in contact with the object.



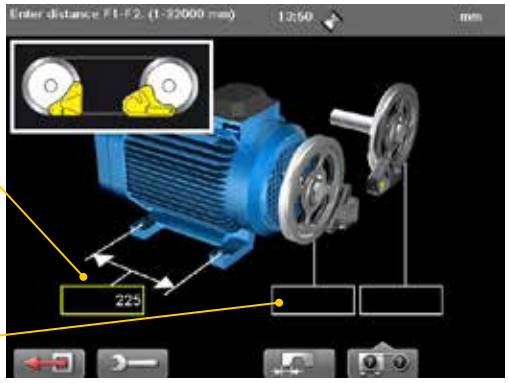


Enter distances

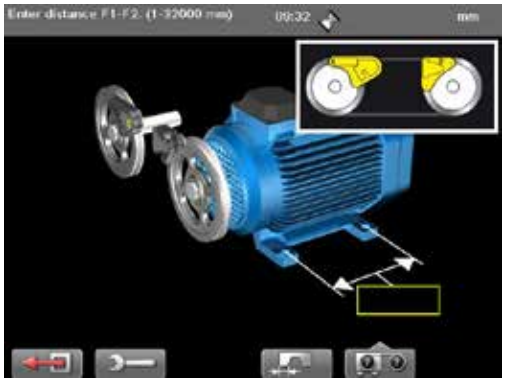
1. Connect to the Display unit via cable or use Battery pack with Bluetooth®.
2. Press the ON button on the laser transmitter.
3. Select  to open the BTA program.
4. Select  if you want to enter sheave face width. Press **OK**.
5. Enter distance between feet pairs. Press **OK**.

Distance between feet pairs **Mandatory**

Sheave face width **Optional**



Movable machine is to the left.



Movable machine is to the right.

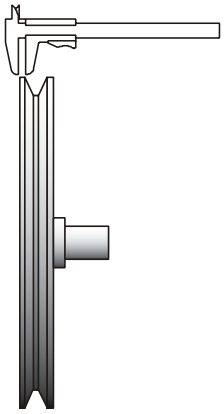
Function buttons

	**Leave program**.
	*See "Control panel" on page 14.*
	**Sheave face width**. Select to activate fields if the sheaves have different face widths.
	Contains a sub menu. The Display unit automatically recognize where the units are placed. However, you can do this manually as well.  Set M-unit to the left.  Set M-unit to the right.  Return to Automatic configuration.

Sheave face width

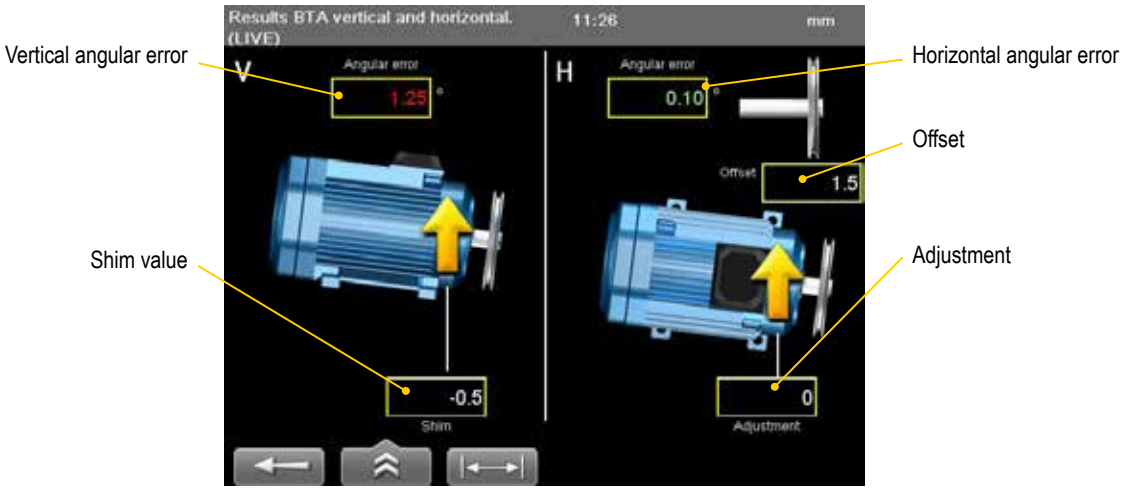
The distance from the belt to the axial face of the sheave can be different on the two sheaves. To calculate a possible offset the system requires both sheave face widths.

1. Measure the distance from the belt to the axial face of the sheave.
2. Select  to activate fields and enter distances.



Measure

Make sure that the laser line hits the detector aperture. The Display unit shows the offset and angular misalignment.



Function buttons

	Back. Return to enter distances.
	See "Control panel" on page 14. Save, *see "Measurement file handling" on page 11.* **Set tolerance**. *See also Tolerance on next page.* **Print on thermal printer** (Optional equipment). Available when you have saved the measurement.
	Edit distance.

Values – colours

White	No tolerance set.
Green	Value within tolerance.
Red	Value outside tolerance.
++++	Loss of signal, laser beam interrupted for example.

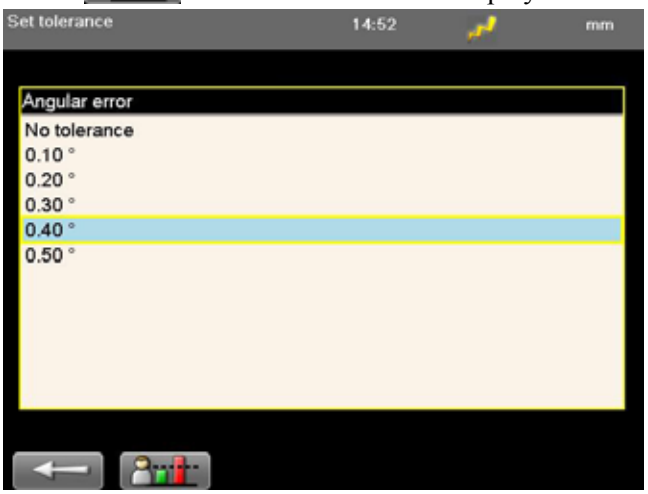
Note!

The laser transmitter flashes when the battery is low. Change the batteries before you continue to measure.

Tolerance

Recommended maximum tolerances from manufacturers of belt transmissions depends on type of belt, usually between 0.25–0.5°.

1. Select  . The tolerance view is displayed.



2. Select  to set user defined tolerance.

Adjust

Start by adjusting the sheave, and then the machine.

- Correct offset by moving the movable machine with axial jackscrews, or by repositioning one of the sheaves on its shaft.
- Correct vertical angular error by shimming the movable machine.
- Correct horizontal angular error by adjusting the movable machine with lateral jackscrews.

When you adjust the machine one way, it often affects the machine's other alignment conditions. Which means this process may have to be repeated several times.

Note!

If not using the system for a long period of time, remove the batteries.

VIBROMETER

Easy-Laser® Vibrometer is used in preventive as well as active maintenance work on rotating machinery. It measures the vibration level and bearing condition of machinery.

When measuring vibration level, Easy-Laser® Vibrometer is measuring the effective velocity (mm/s or inch/s RMS) in the frequency range between 2 and 3200 Hz. This range covers most of the frequencies that will occur for the majority of mechanical malfunctions and imperfections, for example unbalance and misalignment.

When used to measure bearing condition the Easy-Laser Vibrometer is measuring the effective acceleration (RMS) in the frequency range between 3200 and 20000 Hz. Trend analysis of the bearing condition value can be used to determine wear and tear of machine bearings.

See "Vibrometer (Optional)" on page 125.

Mount directly on machine

It is possible to remove the magnetic tip and mount the probe directly to the machine, using the M6 threaded stud.

Measuring tip

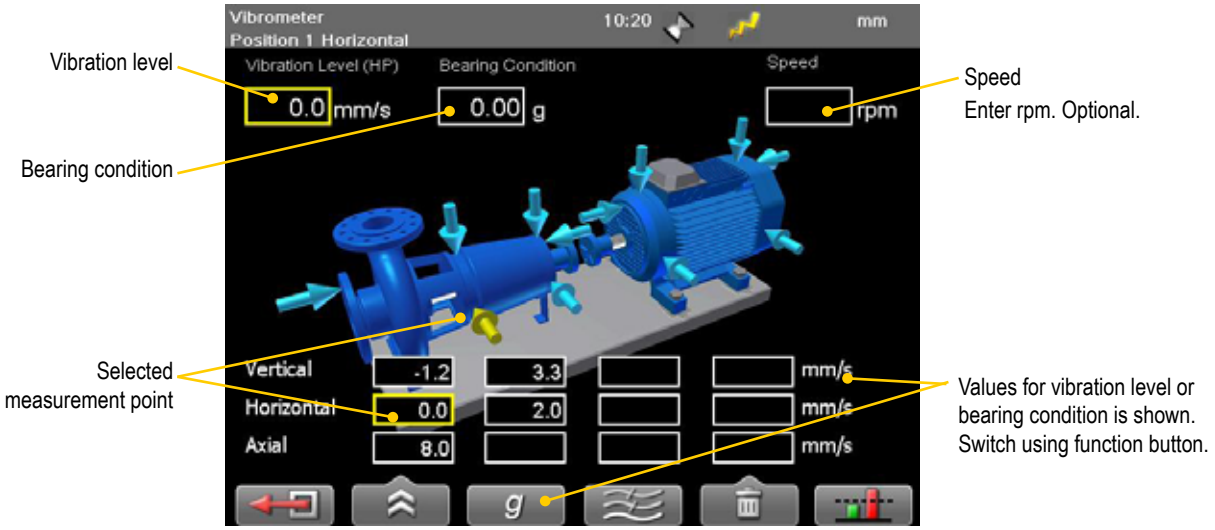
For measuring points that are hard to reach, use the measuring tip. Simply unscrew the magnetic tip and replace with the measuring tip. When measuring with the measuring tip, place it firmly against the measurement point and hold it as vertical, horizontal or axial as possible. When the measuring tip is used the frequency range is reduced to about 800 to 1500Hz.

Note!

Vibrometer is not included in all Shaft systems.

Measure

1. Use the standard red cable to connect the Vibrometer directly to the Display unit. Wireless units cannot be used.
2. Select  to open the Vibrometer program.
   - Enter rpm. Optional.
   - Use the navigation buttons if you want to register another point than is selected by default.
3. Place the vibrometer against the measurement point. Pressing more firmly should not change the reading. If this happens, adjust the measuring point.
4. Wait a few seconds for the value to stabilize.
5. Press **OK** to register value.



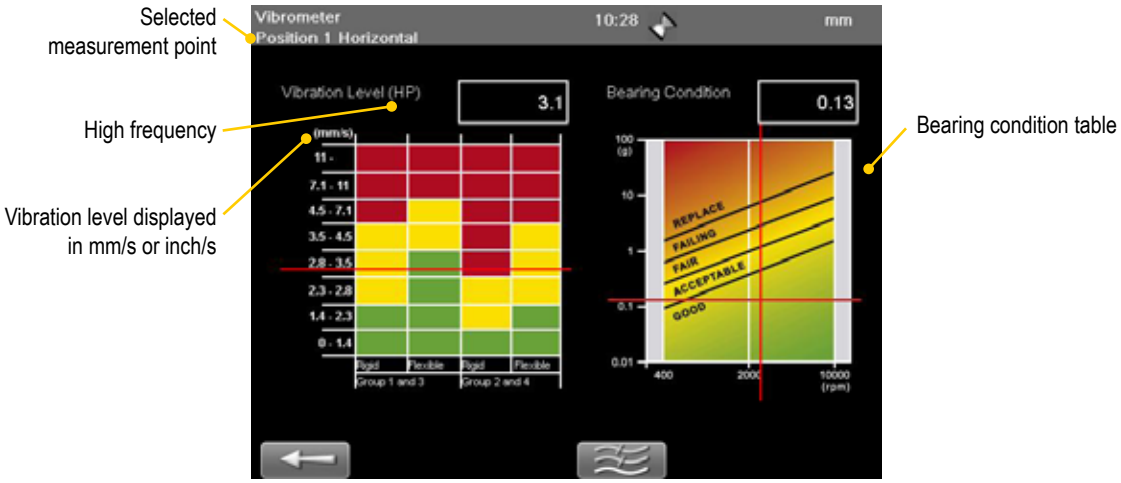
Function buttons

	**Leave program**.
	 *See "Control panel" on page 14.*  Save, *see "Measurement file handling" on page 11.*  Print report on thermal printer (optional equipment).  Generate report. Available when you open a saved measurement.
	Toggle button. Show values for bearing condition or vibration level.
	Toggle button. Show high frequency (10–3200 Hz) or low frequency (2–3200 Hz).
	Contains a submenu  Clear selected measurement point.  Clear all measurement points.
	**Tolerance**. Show tolerance table for vibration level and bearing condition value.

Vibration level

In the Display unit, a table from ISO 10816-3 standard is shown. This standard is used for machines with power above 15kW and nominal speeds between 120–15000 rpm.

1. Use navigation buttons to select a measurement point.
2. Select  to open the tolerance table. It displays the values for the selected point.



Rigid or flexible

The ISO standard is classifying the machines differently if the machines have flexible or rigid foundations. Usually this is determined from drawings and calculations of the machine.

Groups

- Group 1. Large machines with rated power above 300kW. Electrical machines with shaft height H > 315mm. Operating speed ranges from 120 to 15000 rpm
- Group 2. Medium-sized machines with a rated power above 15kW up to and including 300kW. Electrical machines with shaft height between 160 < H < 315 mm. Operating speed normally above 600 rpm.
- Group 3. Pumps with multivane impeller and with separate driver with rated power above 15kW.
- Group 4. Pumps with multivane impeller and with integrated driver with rated power above 15kW.

Guideline

Another standard you can use is ISO 2372 class 4, for large machines on flexible foundations.

0 – 3 mm/s 0 – 0.12inch/s	Small vibrations. None or very small bearing wear. Low noise level.
3 – 7 mm/s 0.12 – 0.27 inch/s	Noticeable vibration levels often concentrated to some specific part as well as direction of the machine. Noticeable bearing wear. Seal problems occur in pumps etc. Increased noise level. **Plan action during next regular stop**. Keep the machine under observation and measure at smaller time intervals than before to detect a deterioration trend if any. Compare vibrations to other operating variables.
7 – 18 mm/s 0.27 – 0.71 inch/s	Large vibrations. Bearings running hot. Bearing wear-out cause frequent replacements. Seals wear out, leakage of all kinds evident. Cracks in weldings and concrete foundations. Screws and bolts are loosening. High noise level. **Plan action soonest**.
> 18 mm/s > 0.71 inch/s	Very large vibrations and high noise levels. This is detrimental to the safe operation of the machine. **Stop operation** if technically or economically possible considering the plant stop cost.

Bearing condition value

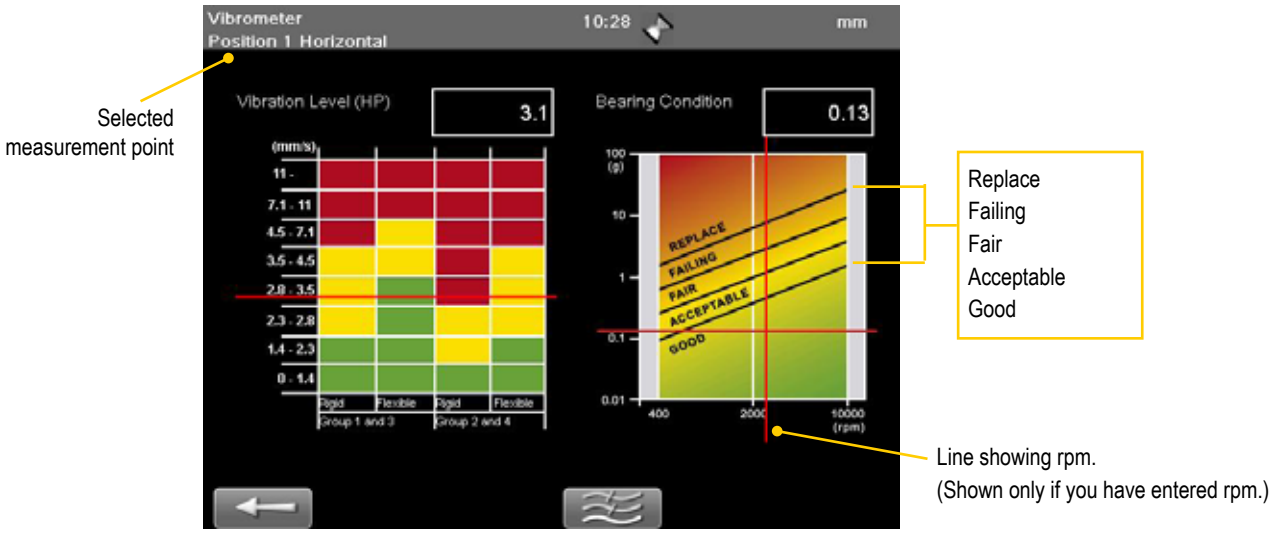
Bearing condition value is used for trend analysis. If the bearing condition value increases over time, it can be a sign that the bearing is poorly lubricated, overloaded due to misalignment or has a damaged surface. A high bearing condition value can however appear in gearboxes, converting machines with cutters and similar machines without any bearing fault. This is because this type of machinery naturally produces high frequency vibrations that are similar to the vibrations produced by a machine with a bearing fault.

The bearing condition value is the quadratic mean, RMS value, of all high frequency vibrations between 3200 Hz to 20000 Hz. This value is an acceleration average measured in multiples of the standard gravity constant, g.

The diagram below is only a guide to interpret the bearing condition value. A high bearing condition value should always be used as a request to make detailed frequency analysis. Do not change bearings before this is done.

Open tolerance table for bearing condition

1. Select a measurement point.
2. Select  to open the tolerance table.



BATTERY PACKS

When not using cable to the measuring units, you can use our chargeable battery pack. The battery pack comes in two versions, with or without built-in Bluetooth®.

Battery pack

(Part No. 12-0617)

1. Place the battery pack on the rods.
2. Plug in the red cable to the measuring unit.

The measuring unit will charge and you can continue measuring.

This Battery pack does **not** have a built-in Bluetooth®, you can however connect a Bluetooth® unit to the Detector/Measuring unit. To save energy, the Bluetooth® units will only connect when you are using a measurement program. There is no power switch on the Bluetooth® unit. To switch off, simply unplug it. The Bluetooth® unit have a serial number that is shown in the Bluetooth view in the Display unit.

Battery indicator*
The battery indicator only shows the battery status of the Battery pack.

On/Off
Diode green when Battery pack is active.
Diode yellow when no unit is connected. The Battery pack will automatically shut off.

Bluetooth® unit
Optional
Diode yellow when attached correctly.
Diode blue when Bluetooth® connection is established.

Battery pack with Bluetooth®

(Part No. 12-0618)

This Battery pack has built-in Bluetooth® functionality. For more information on how to set up and search for Bluetooth® units, *see "Bluetooth® set up" on page 20*.

The Battery pack's serial number is placed on the backside. This serial number is shown in the Bluetooth view in the Display unit.

When the Battery pack run empty, the lights for Battery indicator and On/Off are switched off. However, the built-in Bluetooth® will still function as long as the Detector has some power left.

Battery indicator*

On/Off
Diode green when Battery pack is active.
Diode yellow when no unit is connected. The Battery pack will automatically shut off.

Bluetooth® (only 12-0618)
Built-in functionality.
Diode yellow when attached correctly.
Diode blue when Bluetooth® connection is established.

*** Battery indicator**

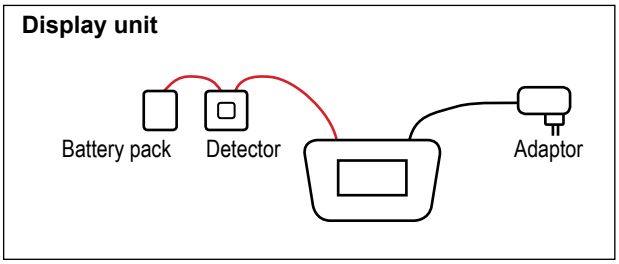
- Constant green light
  Battery pack full.
- Flashing green light
  Battery pack OK
- Flashing red light
  Battery pack low. Approx. 15 min. left to empty.
- Battery pack empty and will shut down.

Charge battery pack

Using Display unit

It is possible to charge battery packs **without** Bluetooth® via the Display unit, one at a time. You can charge both a Detector and a battery pack by connecting the equipment as described in the image. If the Display unit is turned off while charging, the equipment will charge faster.

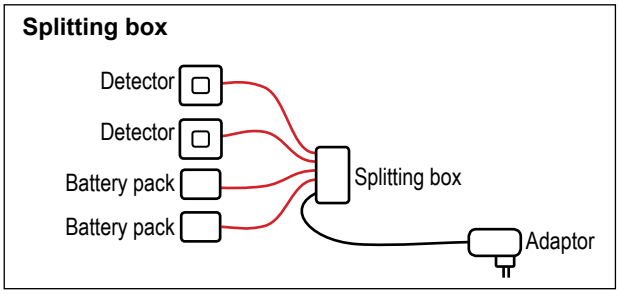
1. Connect the Display unit with the adaptor. The Display unit itself does not have enough power to charge the battery pack.
2. Use standard red cable to connect battery pack to the Display unit.



Using splitting box

When you have two battery packs or battery packs with Bluetooth®, you can use our splitting box (Part No. 12-0597).

1. Plug in the power adaptor to the splitting box. Use the standard power adaptor delivered with your system. All lights are lit up on the splitting box.
2. Plug in the battery pack and Detectors to the splitting box. Corresponding light is switched **off**.
3. When the battery pack is fully charged, the light is switched **on** again.

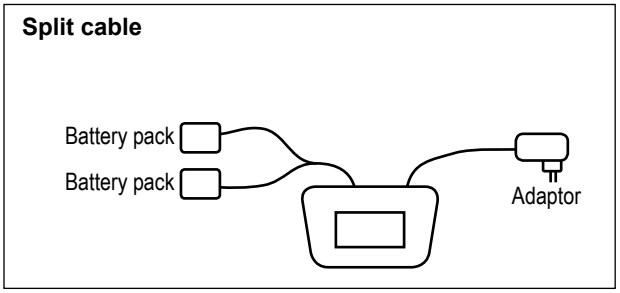


Using split cable

For two Battery packs or Battery packs with Bluetooth®, you can also use our split cable (Part No. 12-0725).

The split cable can only be used to charge the Battery packs, not as a “red cable”.

1. Plug in the power adaptor and split cable to the Display unit.
2. Plug in the battery packs.
3. When the battery packs are fully charged, the light is constant green on the Battery pack.



Before starting a measurement, there are several things that are good to check to ensure a good and accurate measurement.

- Ensure a good measurement environment. Strong sunlight, warning lights, vibrations and temperature gradients can affect the readings.
- Make sure the surface is clean from iron filings etc.
- Ensure that the foundation of the machine is stable.

Mount laser transmitter

The laser should be placed on a stable and rigid place, free from air flow, vibrations and sunshine. A welded structure fixed to the ground or the turning gear bearing may be suitable locations.

Check the following:

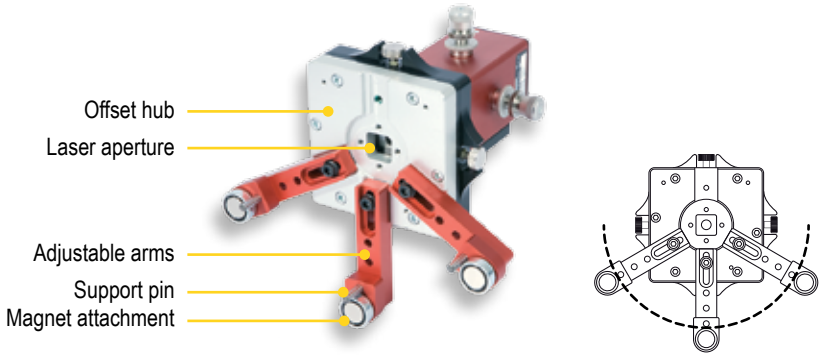
- Magnets are seated a machined surface, without tension.
- All magnets have full contact with the surface. If not, release and tighten screws.
- All screws on the bracket are properly tightened (but do not overtighten).
- Make sure that the laser transmitter battery is replaced to avoid interrupting the measurement.

Using support beam

1. Select a horizontal support beam, long enough to rest on both sides with good margin.
2. Use as short bracket as possible to maintain stability. Use the third vertical beam to increase stability if the horizontal beam is extended with one or more sections.
3. Mount the laser transmitter approximately at the middle of the support beam using the square nuts.
4. Slide the magnets onto the support beam.

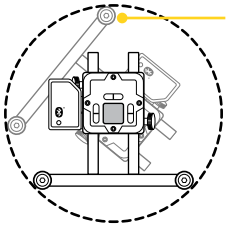
Using arms

If needed, you can use extension arms to mount the laser transmitter. The arms are 500–1000 mm [19.68”–39.36”].



Mount detector

Sliding bracket



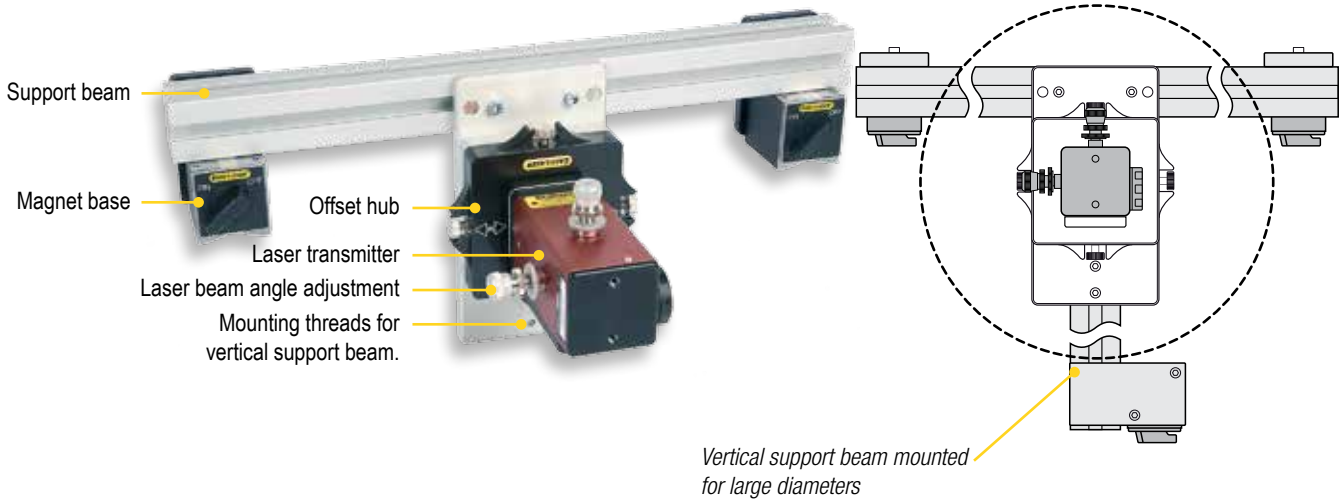
The magnetic feet holds the bracket perfectly in any position around the bore

Set of three slide brackets with extendable rods for different bore diameters.

Slide bracket min. Ø120 mm [4.72”]
Part No: 12-0455
For bores Ø120–250 mm [4.72”–9.84”], width Min. 60 mm [2.36”].

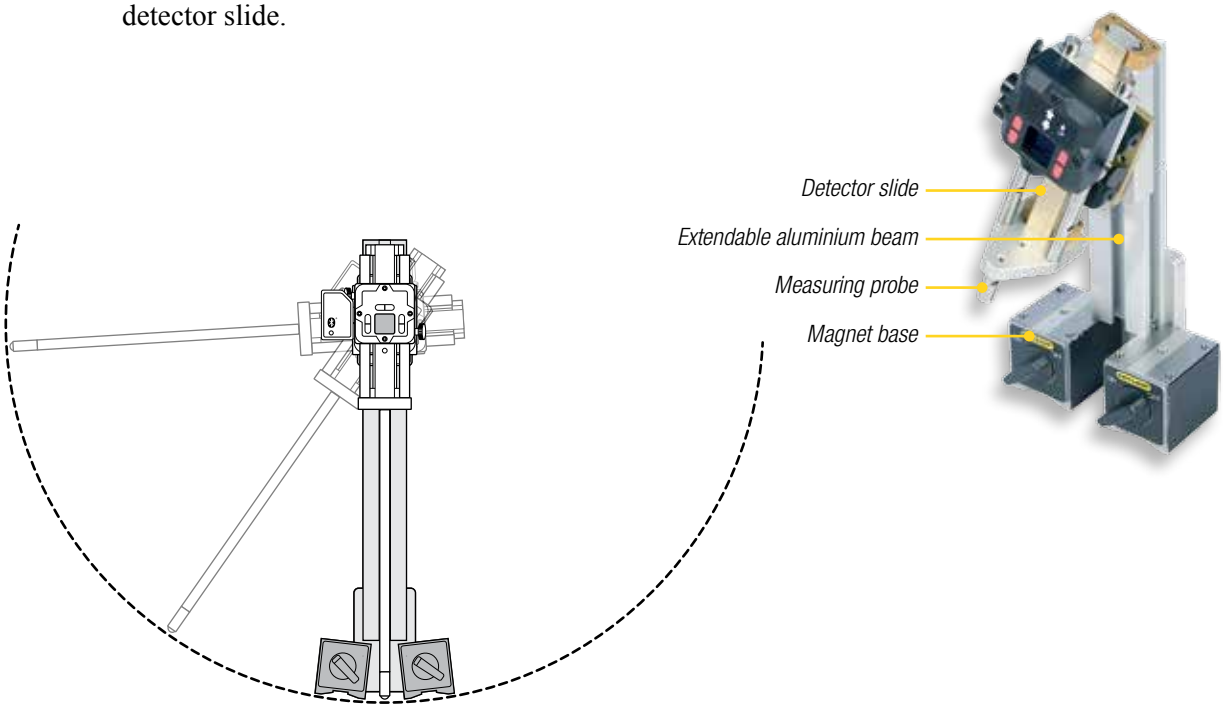
Slide bracket min. Ø200 [7.87”]
Part No: 12-0543
For bores Ø200–350 mm [7.87”–13.78”], width Min. 80 mm [3.15”].

Slide bracket min. Ø300 mm [11.81”]
Part No: 12-0510
For bores Ø300–500 mm [11.81”–19.68”], width Min. 100 mm [3.94”].

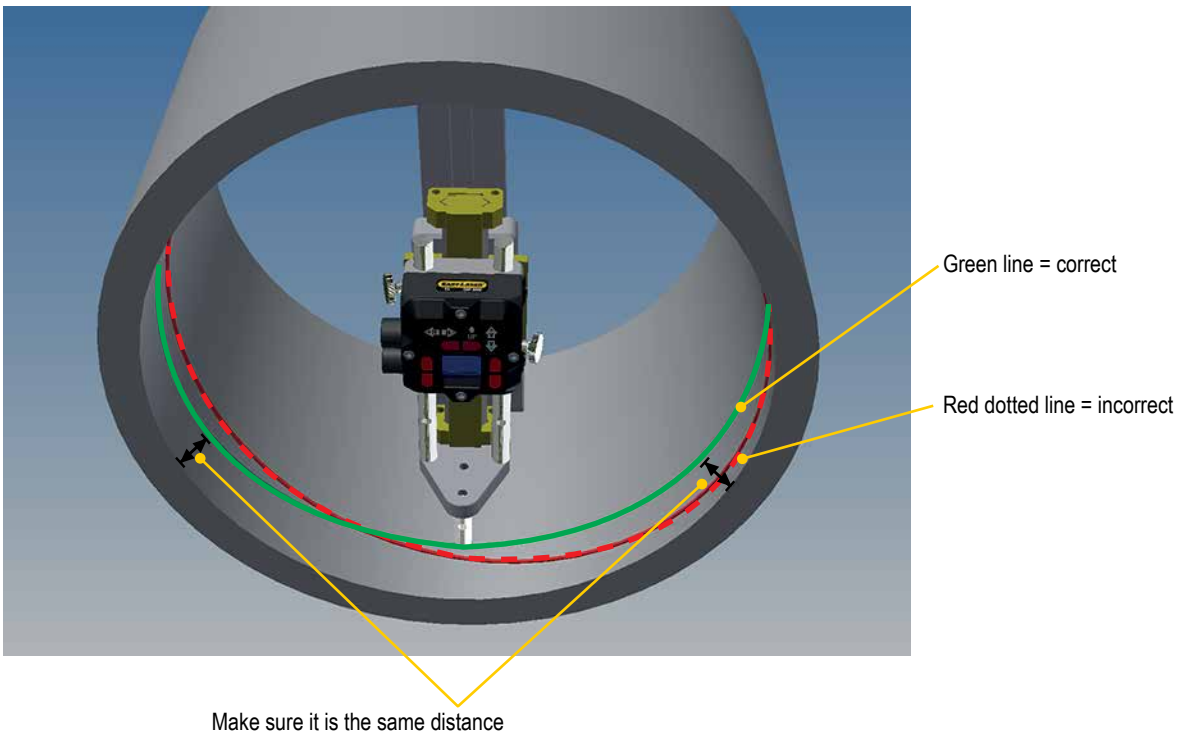


Self centering bracket

Bracket with magnet bases. Comes with extension beams for large diameters and extension rods for the measuring probe. The detector is rotated and moved with the detector slide.



Before measuring, please check that you have mounted the bracket and probe correctly. If the bracket has been mounted skewed, the values will be incorrect.



Mount laser transmitter

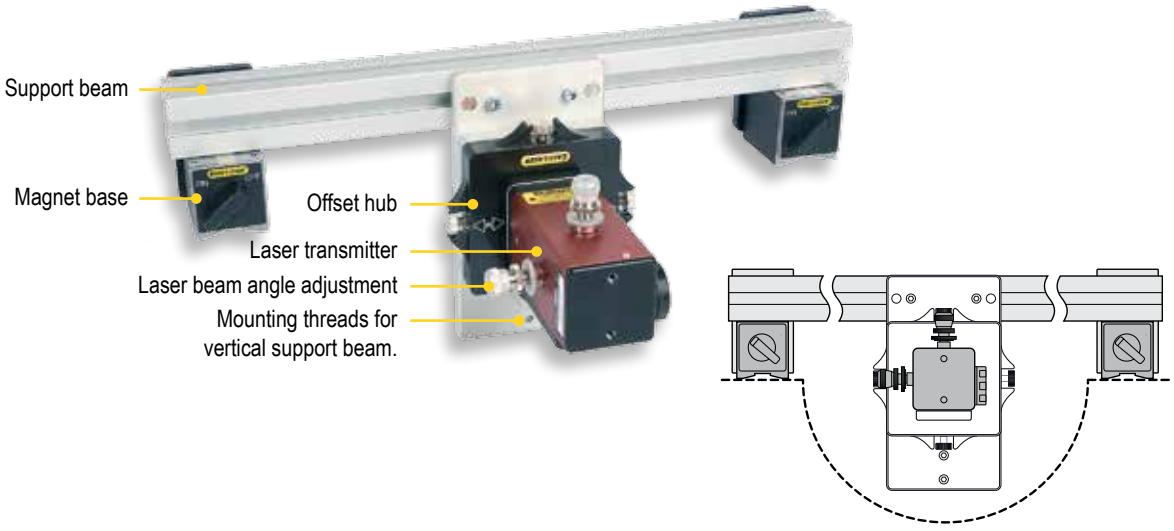
The laser should be placed on a stable and rigid place, free from air flow, vibrations and sunshine. A welded structure fixed to the ground or the turning gear bearing may be suitable locations.

Check the following:

- Magnets are seated a machined surface, without tension.
- All magnets have full contact with the surface. If not, release and tighten screws.
- All screws on the bracket are properly tightened (but do not overtighten).
- Make sure that the laser transmitter battery is replaced to avoid interrupting the measurement.

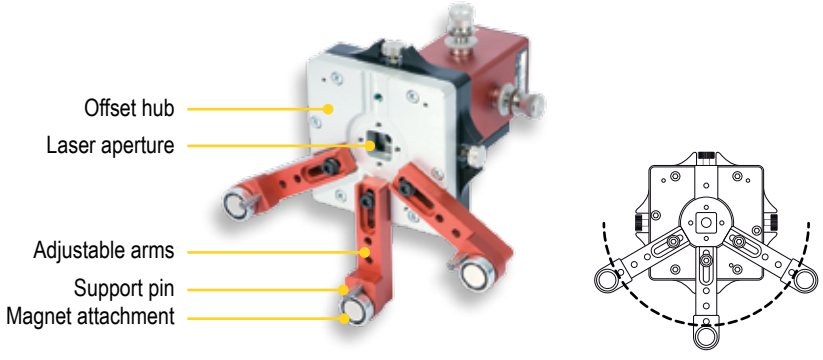
Using support beam

1. Select a horizontal support beam, long enough to rest on both sides with good margin.
2. Use as short bracket as possible to maintain stability. Use the third vertical beam to increase stability if the horizontal beam is extended with one or more sections.
3. Mount the laser transmitter approximately at the middle of the support beam using the square nuts.
4. Slide the magnets onto the support beam.



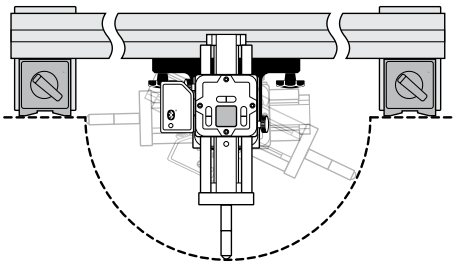
Using arms

If needed, you can use extension arms to mount the laser transmitter. The arms are 500–1000 mm [19.68”–39.36”].



Mount detector

1. Select a horizontal support beam and extensions, long enough to rest on both sides with good margin.
2. Mount the detector in the middle (± 25 mm).
3. Attach probe with extension rods (approximately measuring radius – 120mm).
4. Slide the magnets in place. When using long support beams (>2.5m) it may be necessary to readjust the magnet fixation screws in order to maintain the laser beam vertically in center.
5. Place the detector in the middle of the rods of the movable slide.

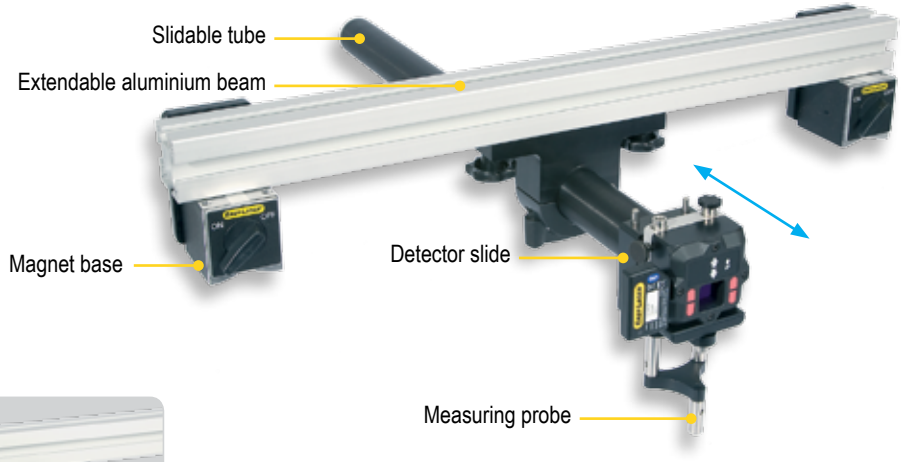


The measuring principle is the same for both long and short stroke bracket. The probe rod is very easily adapted to each diameter with extensions of different length.

Short stroke bracket

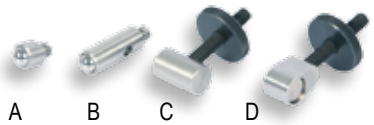
Part no. 12-0438

Measuring probe with a stroke of 10 mm. The slidable tube makes it possible to measure several positions in a row without moving the bracket. Suitable for gas turbines and smaller steam turbines.



Detector slide mounted without tube (left).

Detector mounted to receive laser beam from opposite side (right). Also possible with tube.

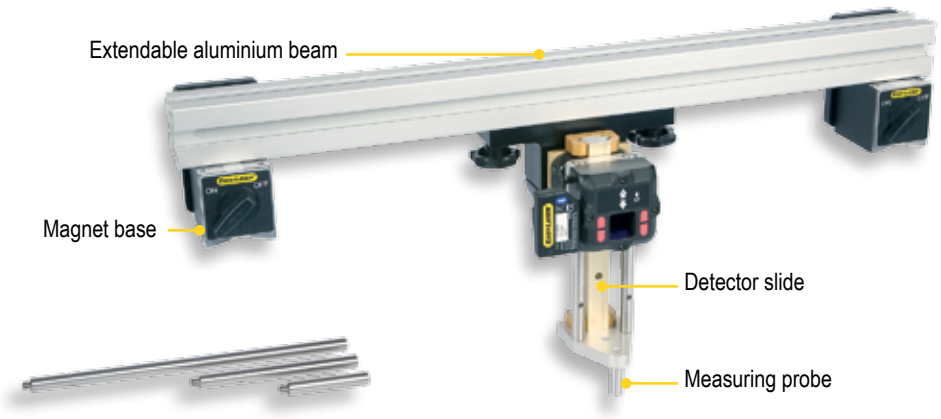


Included measuring probes:
A: Short ball top
B. Ball top
C. Cylinder top
D. Magnetic cylinder top

Long stroke bracket

Part no. 12-0715

Measuring probe with a stroke of 60 mm. Suitable for larger turbines.



Sliding bracket

When measuring in tops-on condition, use a sliding bracket.

Slide bracket min. Ø120 mm [4.72”]
Part No: 12-0455
For bores Ø120–250 mm [4.72”–9.84”], width Min. 60 mm [2.36”].

Slide bracket min. Ø200 [7.87”]
Part No: 12-0543
For bores Ø200–350 mm [7.87”–13.78”], width Min. 80 mm [3.15”].

Slide bracket min. Ø300 mm [11.81”]
Part No: 12-0510
For bores Ø300–500 mm [11.81”–19.68”], width Min. 100 mm [3.94”].

Visual targets

Part no. 12-0443

The visual targets are used for laser beam prealignment and should be placed at the first and last bearing seating.

1. Place the ruler at the bearing pocket and move the adjustable side to fit the diameter.
2. Read the diameter and divide by two.
3. Switch on the laser.
4. Adjust the laser beam to the far target center. Use the angular adjustment screws on the laser transmitter.
5. Adjust the laser beam to the target close to the laser. Adjust beam using the offset adjustments.
6. Repeat until beam passes both target centers as accurate as possible. The laser bracket may have to be moved if the parallel offset adjustment screws reach the limit.
7. Remove targets.

System Easy-Laser® E920 Geometric

Part no. 12-0771

A complete E920 contains	
1	Display unit E51
1	Laser transmitter D22 incl. tilt table
1	Detector E7
1	Bluetooth® unit
1	Cable 2 m
1	Cable 5 m, extension
1	Machine/magnet base pin for D22
1	Magnet base with turnable head
2	Targets for rough alignment
1	Offset bracket
6	Rods 60 mm
6	Rods 120 mm
1	Safety strap for laser transmitter
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Hexagon wrench set
1	Shoulder strap for Display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	Weight: 12.3 kg [27.1 lbs]
Carrying case	WxHxD: 550x450x210 mm [21.6x17.7x8.3”]

System Easy-Laser® E930 Extruder

Part no. 12-0788

A complete E930 contains	
1	Display unit E51
1	Laser transmitter D75
1	Detector E9*
1	Cable 2 m
1	Cable 5 m, extension
1	Bracket for D75 with magnets
1	Set of brackets for detector
1	Set of extension rods for detector
1	Target for extruder
1	Shoulder strap for Display unit
1	Manual
1	Measuring tape 5 m
1	USB Memory stick
1	USB Cable
1	Battery charger (100–240 V AC)
1	Hexagon wrench set
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

*For the US market the system is delivered with detector E8.

System Easy-Laser® E940 Machine tools

Part no. 12-0761

For measuring and aligning machine tools. You can measure straightness, flatness, squareness, spindle pointing direction, level and much more.

A complete E940 contains	
1	Laser transmitter D22 incl. tilt table
1	Measuring unit ESH (HyperPSD™)
1	Measuring unit EMH (HyperPSD™)
1	Display unit E51 (With HyperPSD™ support)
1	Bluetooth® unit
1	Cable 2 m
1	Cable 5 m (extension)
1	Machine/magnet base pin for D22
2	Spindle bracket for measuring unit
1	Magnet base
1	Magnet base with turnable head
2	Offset bracket
1	Rods (8x120 mm)
1	Set of Rods 4x60 mm
1	Shoulder strap for Display unit
1	Manual
1	Measuring tape 5 m
1	USB memory stick with EasyLink™ PC software
1	USB cable
1	Battery charger (100–240 V AC)
1	Hexagon wrench set
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	15 kg [33 lbs]
Carrying case	WxHxD: 550x450x210 mm [21.6x17.7x8.3”]

System Easy-Laser® E950-A

Part no. 12-0677

Mainly for diesel engines, compressors, gearboxes and similar applications. Measures bores Ø140–800 mm [4.72”–19.68”].

A complete E950-A contains	
1	Laser transmitter D75
1	Detector E7 (For the US market, the one-axis detector E4)
1	Display unit
1	Bluetooth® unit
1	Cable 2 m
1	Cable 5 m (extension)
1	Offset hub for D75
1	Set of offset hub arms, with magnets
1	Set of rods A
1	Slide bracket Small, Part No. 12-0455
1	Slide bracket Medium, Part No. 12-0543
1	Slide bracket Large, Part No. 12-0510
1	Magnet base
1	Large target
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Toolbox
1	Shoulder strap for Display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	14 kg [30.8 lbs]
Carrying case	WxHxD: 550x450x210 mm [21.6x17.7x8.3”]

System Easy-Laser® E950-B

Part no. 12-0676

Mainly for propeller shaft drive lines with sterntube. Align sterntube, support bearings, gearbox and engine. Measures bores Ø 250–1200 mm [9.84”–47.24”], or up to 4000 mm [13.12’] with extension beams (accessories). You can also add the slide brackets from system E950-A to get a more versatile system.

A complete E950-B contains	
1	Laser transmitter D75
1	Detector E7 (For the US market, the one-axis detector E4)
1	Display unit
1	Bluetooth® unit
1	Cable 2 m
1	Cable 5 m (extension)
1	Offset hub for D75
1	Transmitter bracket, with 3 magnet bases
1	Set of rods B
1	Self centering detector bracket, with 2 magnet bases
1	Large target
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Toolbox
1	Shoulder strap for display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	27 kg [59.5 lbs]
Carrying case	WxHxD: 1220x460x170 mm [48.0x18.1x6.7”]

System Easy-Laser® E950-C

Part no. 12-0772

Mainly for diesel engines, compressors, gearboxes and similar applications. One of the brackets has a width of 25 mm [0.99”] to fit in narrow bearing journals. Measures bores B 80–500 mm [3.15”–19.68”] as standard, and down to 50 mm [2.00”] with customized brackets.

A complete E950-C contains	
1	Laser transmitter D75
1	Detector E9 (For the US market, the one-axis detector E8)
1	Display unit E51
1	Cable 2 m
1	Cable 5 m (extension)
1	Offset hub for D75
1	Set of offset hub arms, with magnets
1	Set of rods C
1	Rod adapter for detector, with built in target
1	Slide bracket, width 25mm, Part No. 12-0768
1	Slide bracket Small, Part No. 12-0455
1	Slide bracket Large, Part No. 12-0510
1	Magnet base
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Toolbox
1	Shoulder strap for Display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	Weight: 14.3 kg [31.5 lbs]
Carrying case	WxHxD: 550x450x210 mm [21.6x17.7x8.3”]

System Easy-Laser® E960-A

Part no. 12-0710

This system is suitable for gas turbines and smaller steam turbines. Measures diameters 150–1700 mm [5.9”–67”]. The detector bracket comes with a slidable tube, making it possible to measure several positions in a row without moving the bracket.

A complete E960-A contains	
1	Laser transmitter D75
1	Detector E7
1	Display unit
1	Bluetooth® unit
1	Cable 2 m
1	Cable 5 m (extension)
1	Offset hub for D75
1	Transmitter bracket, with 3 magnet bases
1	Detector bracket **Short stroke**, with 2 magnet bases
1	Detector probe top set
2	Target for centering of brackets
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Toolbox
1	Shoulder strap for display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case (with wheels)

System	
Relative humidity	10–95%
Weight (complete system)	30.3 kg [66.8 lbs] (complete system)
Carrying case	WxHxD: 1220x460x170 mm [48.0x18.1x6.7”] Drop tested. Water and dust tight. With wheels

System Easy-Laser® E960-B

Part no. 12-0711

System suitable for larger turbines. Measures diameters 200–1700 mm [7.8”–67”] as standard, and up to 4500 mm [177”] with accessory brackets. The detector bracket has a probe stroke of 60 mm [2.4”], which is convenient when nearby bore diameters vary a lot.

A complete E950-B contains	
1	Laser transmitter D75
1	Detector E7
1	Display unit
1	Bluetooth® unit
1	Cable 2 m
1	Cable 5 m (extension)
1	Offset hub for D75
1	Transmitter bracket, with 3 magnet bases
1	Detector bracket Long stroke, with 2 magnet bases
2	Target for centering of brackets
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Toolbox
1	Shoulder strap for display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case (with wheels)

System	
Relative humidity	10–95%
Weight (complete system)	31.5 kg [69.4 lbs] (complete system)
Carrying case	WxHxD: 1220x460x170 mm [48.0x18.1x6.7”] Drop tested. Water and dust tight.

System Easy-Laser® E980 Sawmill

Part no. 12-0727

Easy-Laser® E980 is a laser based measurement and alignment system that helps sawmills to make optimal use of their machines.

A complete E980 contains	
1	Display unit E51
1	Laser transmitter D23
1	Detector E5
1	Bluetooth® unit
2	Electronic target
1	Cable 2 m
1	Cable 5 m, extension
1	Magnet base with turnable head
1	Shaft bracket
2	Bracket for electronic target
1	Rod bracket with turnable head
1	Magnet bracket long, with turnable head
1	Magnet bracket short, with turnable head
1	Bracket for tilt table
1	Index table 90°
1	Set of Rods 4x60 mm
1	Rods (8x120 mm)
2	Large targets
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	USB cable
1	Battery charger (100–240 V AC)
1	Hexagon wrench set (incl. with 12-0168)
1	Rod tightening tool 4 mm (incl. with 12-0168)
1	Shoulder strap for Display unit
1	Cleaning cloth for optics
1	CD with documentation
1	Carrying case

Display unit E51

Part. no 12-0418

In the Display unit you are guided through the measurement procedure and can save and analyze the results.

A Connection for charger
B Network connection
C Expansion port
D USB A
E USB B
F Easy-Laser® measurement equipment

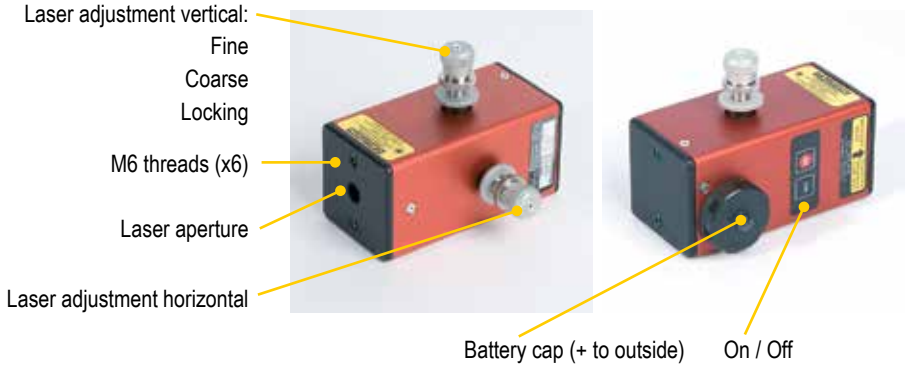
Display unit	
Type of display/size	VGA 5.7” colour
Displayed resolution	0.001 mm / 0.05 thou
Power management	Endurio™ system for unbroken power supply
Internal battery (stationary)	Li Ion, Not restricted PI967, 3.7 volt, 43Wh, 11600 mAh
Battery compartment	For 4 pcs R 14 (C)
Operating time	Appro. 30 hours (Normal operating cycle)
Connections	USB A, USB B, External, Easy-Laser® units, Network
Storage memory	>100,000 measurements
Help functions	Calculator, Converter
Environmental protection	IP Class 65
Housing material	PC/ABS + TPE
Dimensions	WxHxD: 250x175x63 mm [9.8x6.9x2.5”]
Weight (without batteries)	1030 g [2.3 lbs]
Cables	
Type	With Push/Pull connectors
System cable	Length 2 m [78.7”]
Extension system cable	Length 5 m [196.8”]
USB cable	Length 1.8 m [70.8”]
EasyLink™ data base software for PC	
Minimum requirements	Windows® XP, Vista, 7. For the export functions, Excel 2003 or newer must be installed on the PC.

Laser transmitter D75

Part no. 12-0075

For measuring straightness and spindle direction. M6 threads on ends and sides offer alternative mounting options. Measurement distance 40 m [130’].

Use tilting screws for laser beam adjustment.

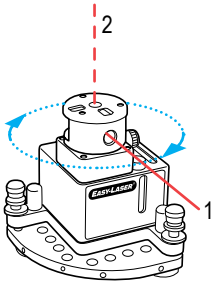


Laser transmitter D75 (with offset hub)	
Type of laser	Diode laser
Laser wavelength	635–670 nm, visible red light
Laser Safety Class	Class 2
Output	< 1 mW
Beam diameter	6 mm [1/4”] at aperture
Working distance	40-metre [130´]
Type of battery	1 x R14 (C)
Operating time/battery	approx. 15 hours
Operating temperature	0–50 °C
Laser adjustment	D75: 2 ways ±2° (± 35 mm/m), Hub: ±5 mm in two axes
Housing material	Aluminium
Dimensions D75	WxHxD: 60x60x120 mm [2.36x2.36x4.72”]
Dimensions D75 with Hub	WxHxD: 135x135x167 mm [5.31x5.31x6.57”]
Weight	2385 g [84.13 lbs]

Laser transmitter D22

Part no. 12-0022

Laser transmitter D22 can be used to measure flatness, straightness, squareness and parallelism. The laser beam can sweep 360° with a measurement distance of up to 40 metres [130´] in radius. The laser beam can be angled 90° to the sweep, within 0.01mm/m [0.5 mils/INCH].



Option 1: the laser beam is used for a 360° sweep.
Option 2: the laser beam is angled at 90° to the sweep.

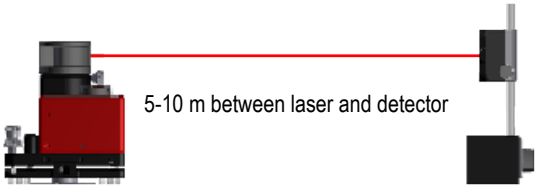
Note!

The tilting screws on the levelling table of the D22 and D23 transmitter have to be operated carefully and according to instructions. See "Tilting screws".

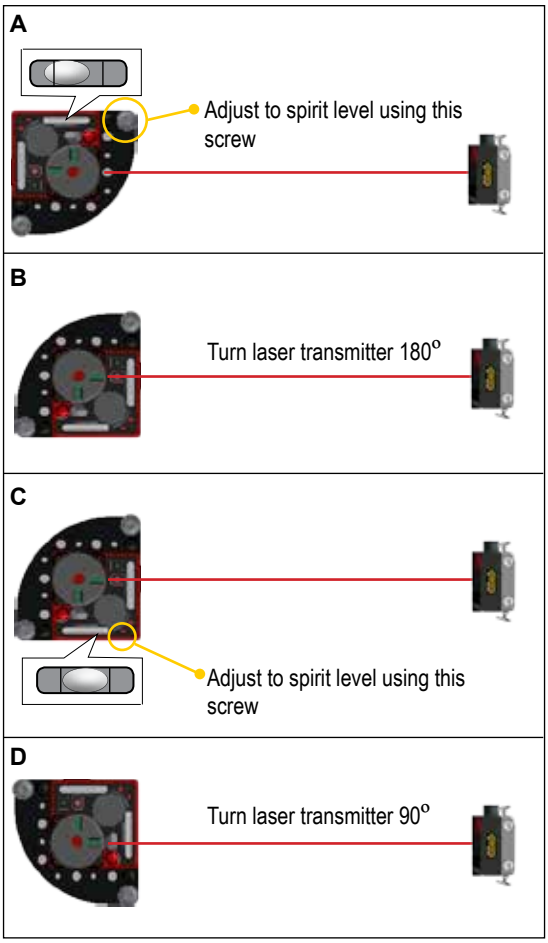
Laser transmitter D22	
Type of laser	Diode laser
Laser wavelength	635–670 nm, visible red light
Laser safety class	Class 2
Output	< 1 mW
Beam diameter	6 mm [1/4"] at aperture
Working area, range	40-metre radius [130´]
Type of battery	1 x R14 (C)
Operating temperature	0–50° C
Operating time/battery	appro. 24 hours
Levelling range	± 30 mm/m [± 1.7°]
3 x spirit vials' scaling	0.02 mm/m
Squareness between laser beams	0.01 mm/m [2 arc sec.]
Flatness of sweep	0.02 mm/m
Fine turning	0.1 mm/m [20 arc sec.]
2 x spirit vials for rotation	5 mm/m
Housing material	Aluminium
Dimensions	WxHxD: 139x169x139 mm [5.47"x6.64"x5.47"]
Weight	2650 g [5.8 lbs]

Calibrate spirit levels on D22

You can calibrate the spirit levels on the D22 laser transmitter. This is done at factory, but should be redone prior to a job. The spirit levels are scaled to 0.02 mm/m [4 arc sec.]. Accurate levelling to the spirit levels will achieve a repeated levelling better than the scaling of the spirit levels, approximately 0.005 mm/m [1 arc sec.].



1. Place the D22 laser transmitter on a stable surface. Place the detector at a distance of 5-10 metres.
2. Adjust the spirit level using the screw, see image **A**.
3. Select V 0.00 H 0.00 to open the program Values.
4. Select 0 to zero set.
5. Rotate the D22 180º and turn the laser beam to the detector, see image **B**.
6. Adjust laser beam until it is within detector target.
7. Select ½ to half the value.
8. Adjust to 0.00.
9. Adjust the spirit level using the screw, see image **C**.
10. Rotate the D22 90º and turn the laser beam to the detector, see image **D**.
11. Repeat step 2–10.



Mount D22 in a spindle

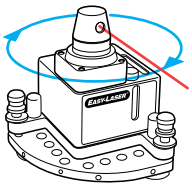
With the laser transmitter mounted in the spindle, you will have a stable laser beam position. You can mount the D22 in two different directions, see images below.

1. Block the spindle.
2. Adjust the laser beam using the adjustment screws on the tilt table.

Laser transmitter D23 Spin

Part no. 12-0168

Laser transmitter D23 has a motor driven, rotating head that gives a 360° laser plane. Measurement distance up to 20 metres [65´] in radius. Pressing the On button once turns on the laser, next press starts rotation.



The laser beam is used for a 360° sweep.

Laser transmitter D23 Spin	
Type of laser	Diode laser
Laser wavelength	635–670 nm, visible red light
Laser safety class	Class 2
Output	< 1 mW
Beam diameter	6 mm [1/4”] at aperture
Working area, range	20 metre radius [65´]
Type of battery	2 x R14 (C)
Operating time/battery	approx. 15 hours
Operating temperature	0–50° C
Levelling range	± 30 mm/m [± 1.7°]
3 x spirit vials’ scaling	0.02 mm/m
Flatness of sweep	0.02 mm/m
Housing material	Aluminium
Dimensions	WxHxD: 139x169x139 mm [5.47”x6.64”x5.47”]
Weight	2650 g [5.8 lbs]

Tilting screws

The tilting screws on the levelling table of the laser transmitter have to be operated carefully and according to instructions.

Visual rough alignment to (detector) target

Check the position of the fine adjustment screw. It should be in its nominal position appro. 2.5 mm.

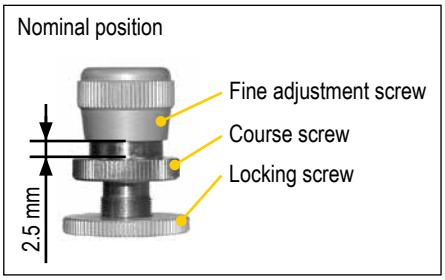
1. Loosen the locking screw.
2. Adjust with the course screw to wanted position.
3. Tighten the locking screw.

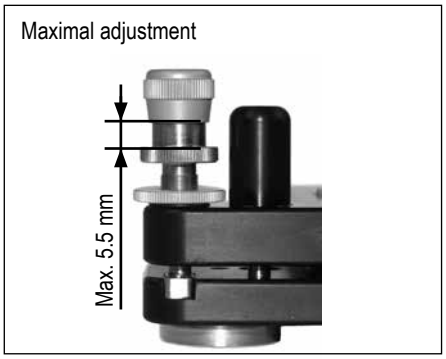
Digital fine adjustment to detector and read values

1. Check so that the locking screw is tightened.
2. Adjust with the fine adjustment screw to wanted value.

Note!

The fine adjustment screw must not exceed its maximum position. That might damage the threads of the screw.

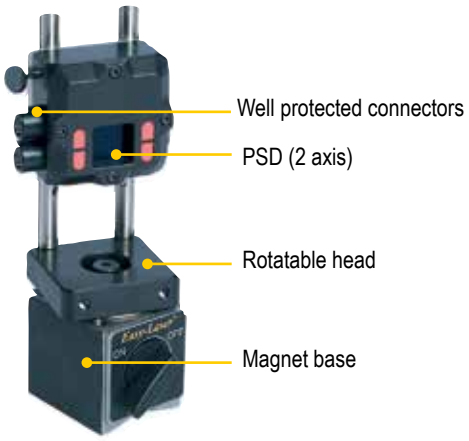




Detector E5

Part no 12-0509

Detector E5 can work with both stationary and rotating lasers thanks to our Dual Detection Technology™. Connect to the display unit via cable or wireless via Bluetooth® (accessory). The magnet base has a rotating head to align the detector to the laser transmitter.



Detector	
Type of detector	2 axis PSD 20x20 mm [0.78” sq]
Dual Detection Technology™	Can detect both spinning and stationary laser beam
Resolution	0.001 mm [0.05 mils]
Measurement error	± 1% +1 digit
Inclinometers	0.1° resolution
Thermal sensors	± 1° C accuracy
Environmental protection	IP Class 66 and 67
Operating temperature	- 10–50° C
Internal battery	Li Po
Housing material	Anodized aluminium
Dimensions	WxHxD: 60x60x42 mm [2.36”x2.36”x1.65”]
Weight	186 g [6.6 oz]
Internal battery	LI-Po, 3.7 volt, 2.5Wh, 680mAh
Wireless connection unit (optional)	
Wireless communication	Class I Bluetooth® Wireless Technology
Operating temperature	-10–50 °C
Housing material	ABS
Dimensions	53x32x24 mm [2.1x1.2x0.9”]
Weight	25 g [0.9 oz]
Magnet base with turnable head (for detector)	
Holding power	800 N
Rods for detector	
Length	60 mm / 120 mm (extendable) [2.36”/4.72”]

Detector E7

Part no. 12-0752

Built-in 360° electronic inclinometer. Two connectors for making it possible to connect two detectors or more in series. Normally mounted on rods, but has many additional mounting possibilities thanks to threads on two sides.

Detector E7	
Type of detector	2 axis PSD 20x20 mm [0.78” sq]
Resolution	0.001 mm [0.05 mils]
Measurement error	<1% +1 digit
Inclinometers	0.1° resolution
Thermal sensors	± 1° C accuracy
Environmental protection	IP Class 66 and 67
Operating temperature	-10–50 °C
Internal battery	Li Po
Protection	No influence from ambient light
Housing material	Anodized aluminium
Dimensions	WxHxD: 60x60x42 mm [2.36x2.36x1.65”]
Weight	186 g [6.6 oz]

Note!

For the US market, the one-axis detector E4 is standard.

Detector E9

Part no. 12-0759

Built-in 360° electronic inclinometer. Built-in Bluetooth® wireless communication and rechargeable battery. There is also a connector on the back side for standard “red cable” (charging and data transfer). Mounting threads on both ends.

A. Built-in Bluetooth® unit and rechargeable battery
B. PSD
C. Mounting threads (four on each end)

Detector E9	
Wireless communication	Built-in Class I Bluetooth® wireless technology
Type of detector	2 axis PSD 20x20 mm [0.78” sq]
Resolution	0.001 mm [0.05 mils]
Measurement error	<1% +1 digit
Thermal sensors	± 1° C accuracy
Environmental protection	IP 67
Internal battery	Li Po
Protection	No influence from ambient light
Housing material	Anodized aluminium
Dimensions	Ø 45 mm, L=100 mm [Ø 1.77”, L=3.94”]
Weight	180 g [6.3 oz]

Note!

For the US market, the one-axis detector E8 is standard.

Measuring units EMH and ESH

Part no. 12-0789

Part no. 12-0790

Measuring units EMH / ESH (HyperPSD™)	
Type of detector	2-axis PSD 20x20 mm [0.78” sq]
Resolution	0.0001 mm [0.000005”/0.005 mils]
Measuring errors	±0.5% +1 digit
Measurement range	Up to 20 m [66 feet]
Type of laser	Diode laser
Laser wavelength	635–670 nm
Laser class	Safety class II
Laser output	<1 mW
Electronic inclinometers	0,1° resolution
Thermal sensors	± 1° C accuracy
Environmental protection	IP class 66 and 67
Temperature range	-10–50 °C
Internal battery	Li Po
Housing material	Anodized aluminium
Dimensions	WxHxD: 60x60x42 mm [2.36”x2.36”x1.65”]
Weight	202 g [7.1 oz]

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