EASY-LASER®

E720
E920
E930
E940
E950
E960
E970
E975
E980

English

MANUAL

05-0685 Revision 10.0
System version 12.9

CONTENT

INTRODUCTION

Easy-Laser AB

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

Intended use for the equipment is described in the technical data for each system. You find the technical data in the end of the manual.

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

Limited warranty

This product is manufactured under Easy-Laser's strict quality control system. Should the product fail within three (3) years from the date of purchase under normal usage conditions, Easy-Laser 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 Easy-Laser 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 Easy-Laser 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 Easy-Laser AB could be expected to have control of, or if the battery displays abnormal loss of capacity in relation to use.

Safety precautions

Easy-Laser® is a laser instrument in laser class 2 with an output power normally 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

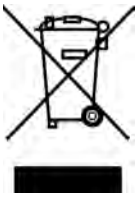
Easy-Laser products should only repaired or calibrated by a certified service centre.

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.

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.

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 easylaser.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.

Specifications for built-in rechargeable batteries

Easy-Laser Part No.	Type	Voltage	Output	Capacity	Included in Part No.
03-0757	Li-Ion	3.65 V	41.61 Wh	10600 mAh	12-0418, 12-0700, 12-0748
03-0765	Li-Ion	3.7 V	2.5 Wh	660 mAh	12-0433, 12-0434, 12-0509, 12-0688, 12-0702, 12-0738, 12-0752, 12-0759, 12-0758, 12-0799, 12-0846
03-0971	Li-Ion	3.6 V	9.36 Wh	2600 mAh	12-0617, 12-0618, 12-0823, 12-0845
03-1052	Li-Ion	3.7 V	1.22 Wh	330 mAh	12-0746, 12-0747, 12-0776, 12-0777, 12-0791, 12-1054
12-0953	Li-Ion	3.7 V	7.4 Wh	2000 mAh	12-0944, 12-0943, 12-1028, 12-1029
12-0952	Li-Ion	7.3 V	41.61 Wh	5300 mAh	12-0961 (2 pcs)
12-0983	Li-Ion	3.7 V	7.4 Wh	2000 mAh	12-1026, 12-1027
N/A	Li-Ion	3.8 V	16.91 Wh	4450 mAh	12-1086

Compatibility

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

Disclaimer

Easy-Laser 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. If the system is not used as explained in this manual, the protection provided by the equipment may be impaired.

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.

June 2019

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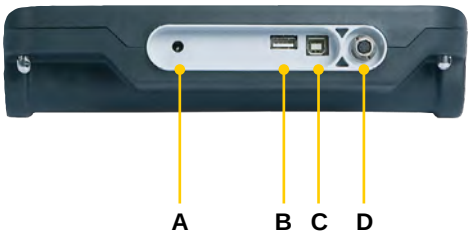
DISPLAY UNIT



A Connection for charger
B USB A
C USB B
D Easy-Laser® measurement equipment

Reset the Display unit

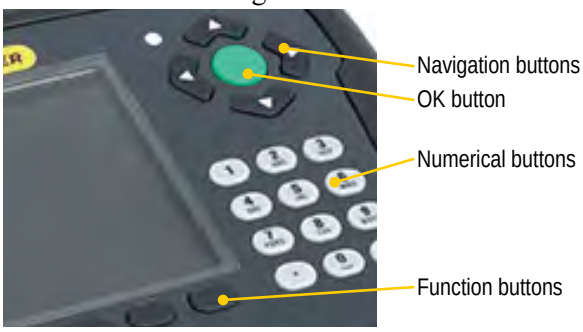
Press and hold the On/Off button to reset the Display unit.

Charger

Only the charger supplied by Easy-Laser may be used.
For more information, see *"Charger" on page 55.*

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

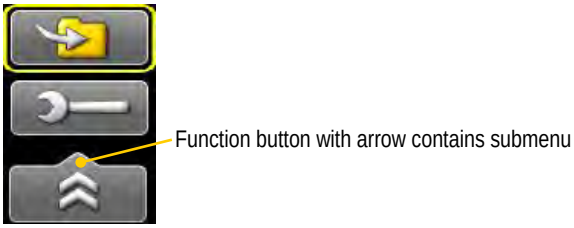
The icons above the function buttons change depending on which view is currently displayed on screen.

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 wireless 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.
	Hourglass. The Display unit is in the middle of a task.
	Display unit charging. Indicating that a power adaptor is plugged in.
	Display unit is low in battery.
	Measurement progress. Time depending on which filter you have selected.
	Selected filter.
	Peripheral. Indicates that a peripheral device is plugged in, such as a projector.
	Indicates that the wireless functionality is activated. The number beside indicates the number of wireless 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 wireless functionality. Fixed light: Connected to detectors equipped with wireless functionality.
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.

When finished working for the day, charge the whole system. Plug in the power adaptor to the Display unit and connect the measuring units (**maximum two**) by using cable. If you use a split box, it is possible to charge up to eight units at a time.

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

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

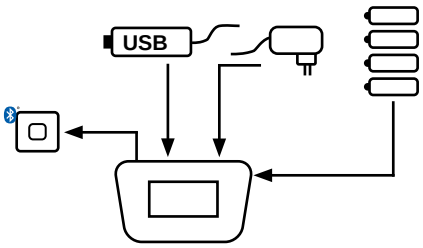
With the power adaptor plugged in, you can keep on working.

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 wireless units, switch to cable when the battery in the Detector/Measuring unit is low.

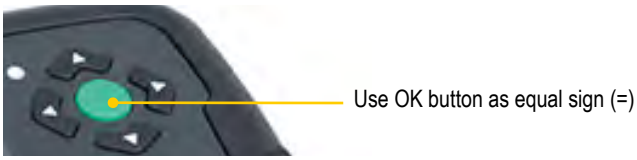
Charge the wireless units

The wireless units are powered by the Detector/Measuring units. To save energy, the wireless 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.

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.

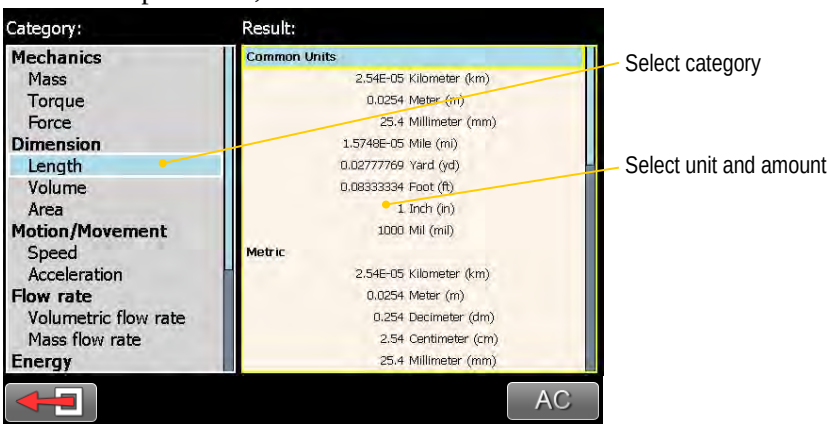


Unit converter

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**

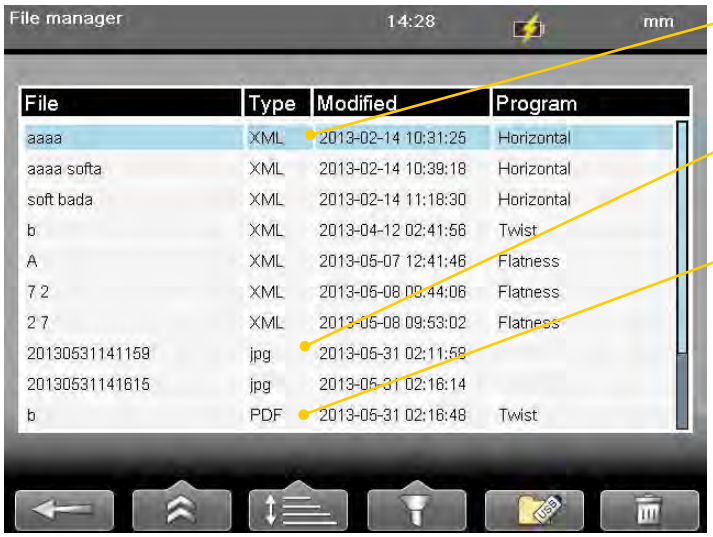
Save file

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 see 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

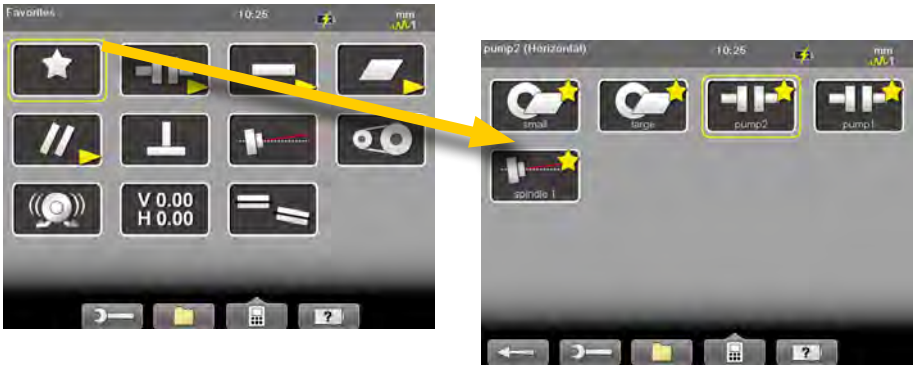
	Back to previous view.
	"Report" on page 14. *"Open file as template" on page 13.* *"Print file (Optional)" on page 14.*
	A...Z Sort files alphabetically. Sort files by measurement program. Sort by time.
	xml pdf jpg Show all files. xml Show only xml files. pdf Show only pdf files. jpg Show only jpg files. Show only Favourites. See *"Favourites" on page 12.*
	"Copy file to USB memory" on page 13.
	Delete files. Delete all **displayed** files or only selected file.

Favourites

It is possible to save a measurement as a Favourite. A Favourite can be used for example when you have many flanges or machines with the same dimensions. This way you do not have to enter the same distances or tolerances every time. When you have saved as Favourite, a new icon is displayed on the start screen.

Create a favourite

1. Select to open the File manager and select a file.
2. Select and to save the selected file as a Favourite.
3. Go to the start screen and select to see all favourites.
4. Press to open a Favourite. All distances are filled in.



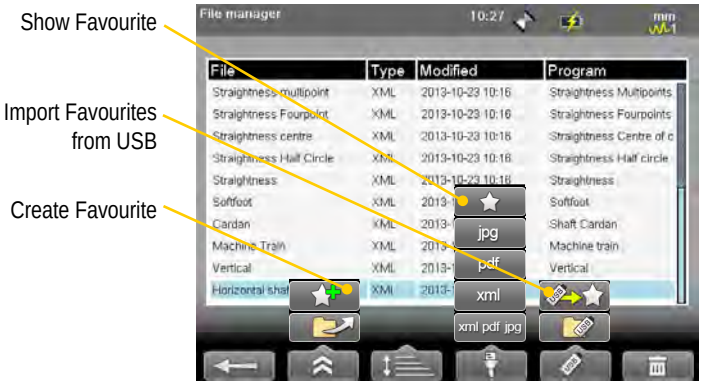
Import favourites

The favourite files are saved in the folder Favourites in the Display unit.

1. Plug in the Display unit to a PC and open the Favourites folder.
2. Copy the .FAV (favourite) file to the root of an USB memory stick.
3. Connect the USB stick to a Display unit and select and to import.

Delete favourite

1. Select to open the File manager and select a file.
2. Select and to show all Favourite files.
3. Select a file and .



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.

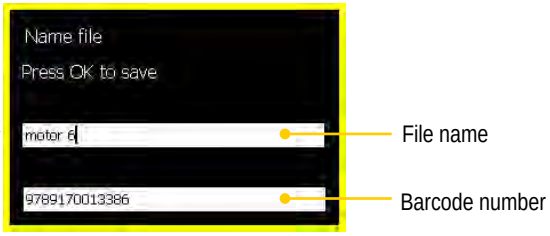
1. Insert a USB memory.
2. Select the file you want and select .
3. A folder is automatically created on the USB memory. The file is saved in the folder `\Damalini\archive\`.

Barcode

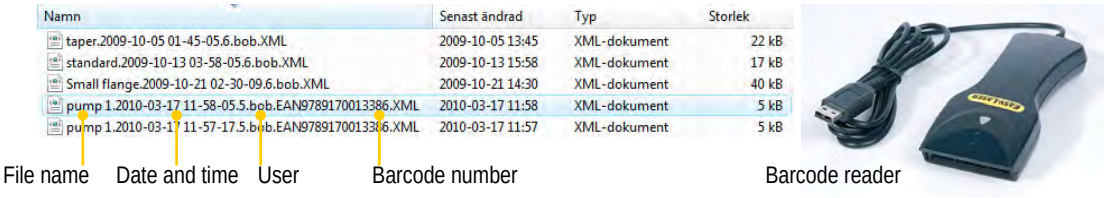
Save file with barcode

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.

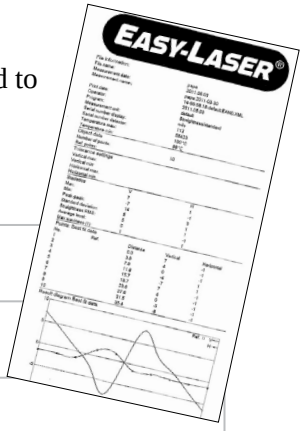
  OR

- 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.

Download file to PC

1. Start the Display unit. It is important to let it start fully before connecting the cable.
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 easylaser.com>lifecycle support>software download.

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.

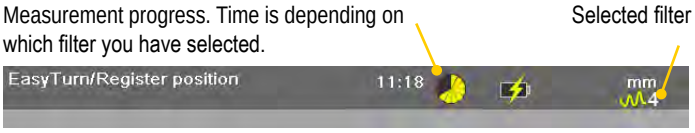
Note!
All settings are not available for all systems.

Filter

Select to open the Filter view.

The filter you select on the Filter view will be saved as a personal setting.

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).

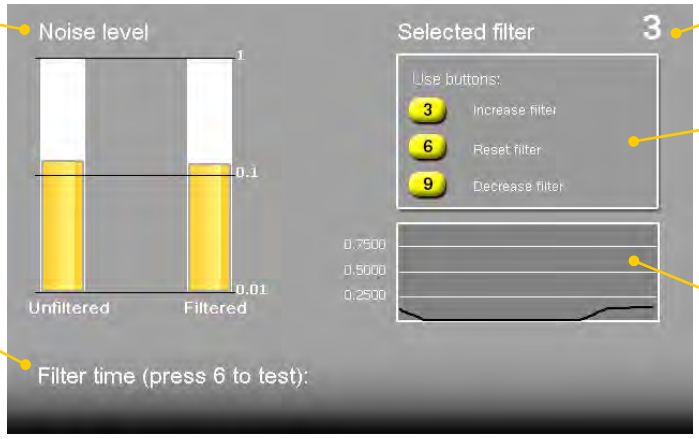


Select filter

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.

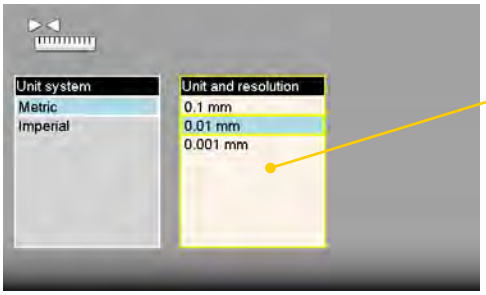
Use numerical buttons to select filter



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.



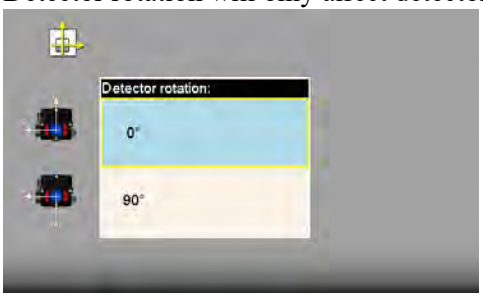
Note!

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.

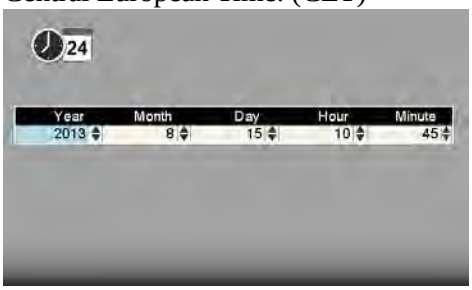



Warning displayed on Status bar

Detector rotation view

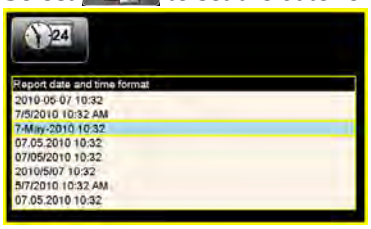
Date and time

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.

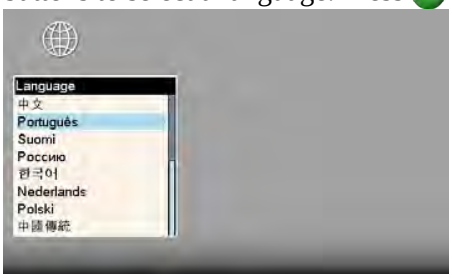


Date and time used in PDF reports

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.

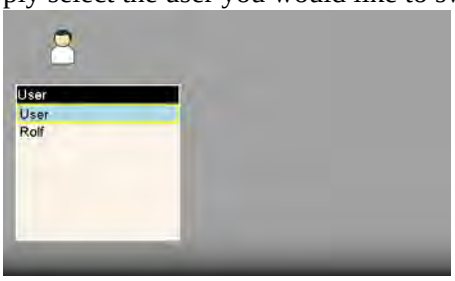


Language view

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

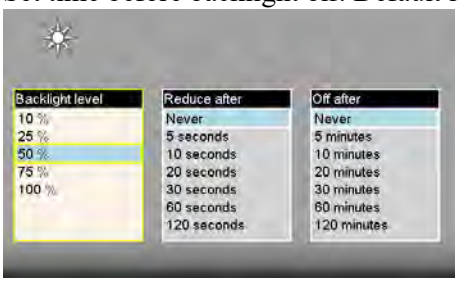
Adjust the backlight to make it easier to read in bright sunlight. Remember however that a high contrast consume more battery power. Default is set to 50%.

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.

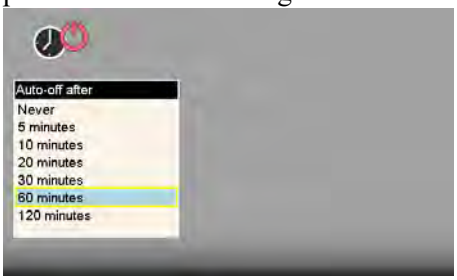


Backlight view

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.



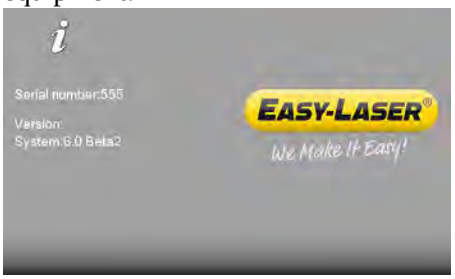
Automatic power off view

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.)

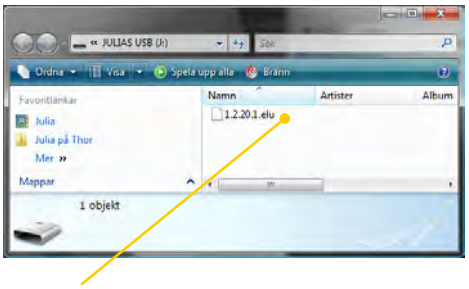
Makes it possible to show display unit screen image with a projector, for example in a training context. Must be factory installed on order.

Select to open the VGA view.

System update

Download update file

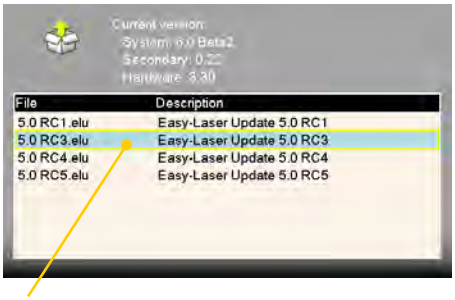
1. Go to easylaser.com>lifecycle support>software download.
2. Download the update file to your PC.
3. Unzip the file.
4. Copy the .elu file to the root of a USB memory.



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.

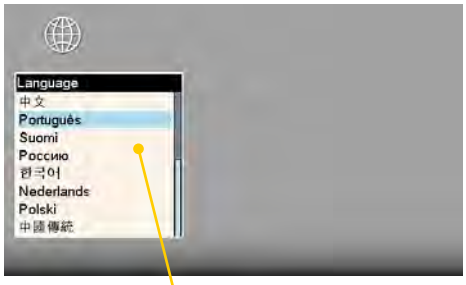
Main menu is automatically displayed after restart.

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 easylaser.com>lifecycle support>software download and follow the instructions above to install.



Chinese installed?
No need to update with Font package.

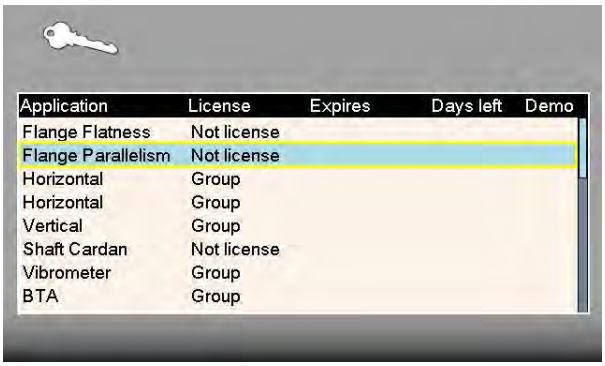
License

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

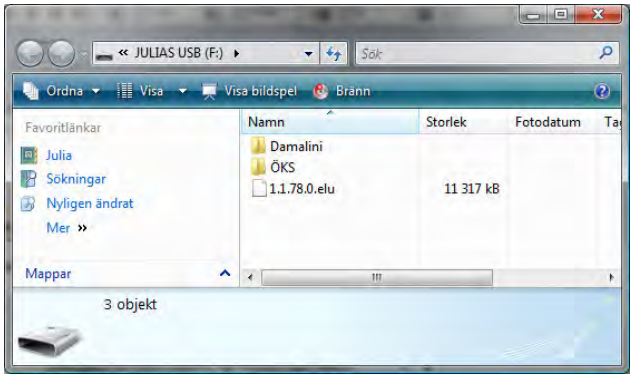
1. Save the downloaded license file to a USB memory stick.
2. Insert the USB memory stick in the Display unit.
3. Select and to display the License view.



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.

Set up wireless connection

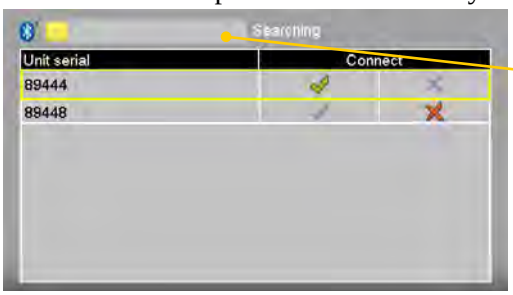
Wireless technology makes it possible for Display unit and Detector to exchange data without using cables.

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

Set up

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

1. Select to open the wireless view.
2. Select to search for units.
3. The view is updated with the units you can connect to.



Searching for wireless 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 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 wireless units that are connected.

One unit connected

Function buttons

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

Note!

Do not use a wireless unit and a cable at the same time.

Use only one wireless 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 wireless unit to the detector.
2. Select to open the wireless view.
3. Set the 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 the wireless unit from the Measuring unit before putting the equipment in the carrying case. If attached, it will discharge the Measuring unit.

Wireless information

This device contains

FCC ID: PVH0946

IC: 5325A-0946

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions;

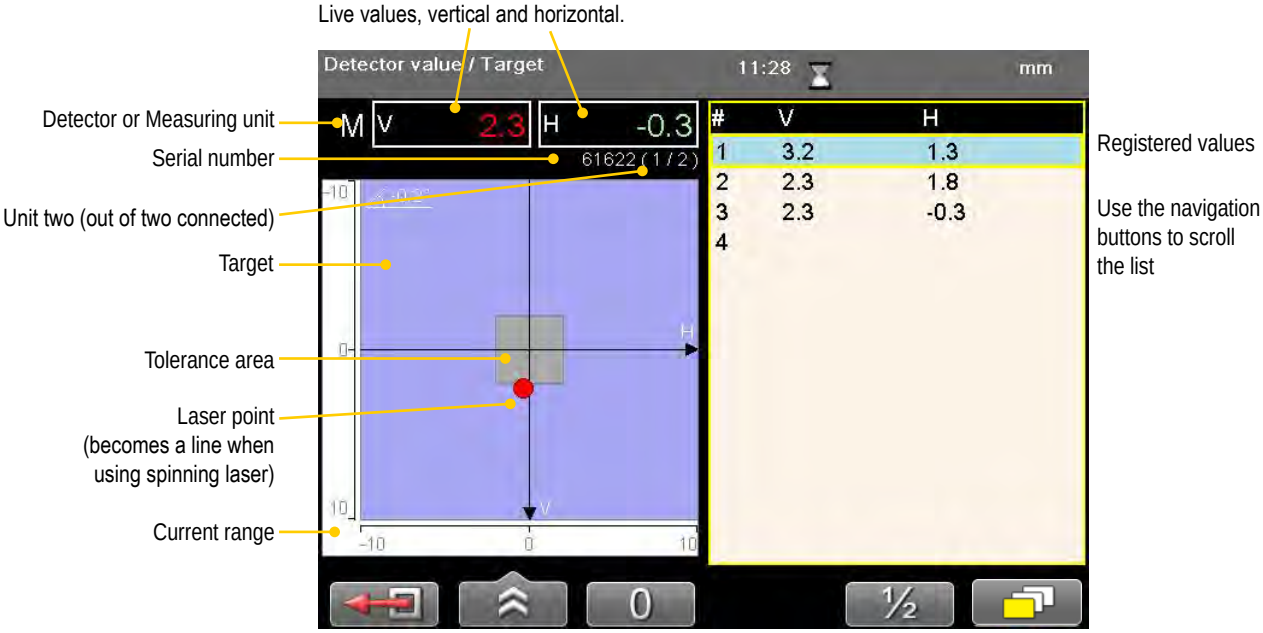
(1) this device may not cause harmful interference, and

(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

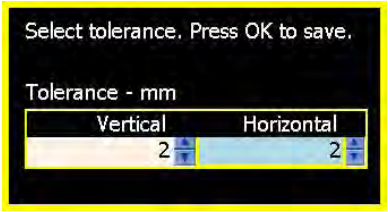
	Back, leave program.
	See "Control panel" on page 15. *See "Tolerance" on page 24.* *See "Zoom" on page 24.* Save file. *See "Measurement file handling" on page 11.* *See "Automatic recording" on page 26.* Delete registered values. Print report on thermal printer (optional equipment). *See "Streaming values" on page 27.*
0	Set current value to zero.
½	Halve displayed value.
1/1	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.

Note!

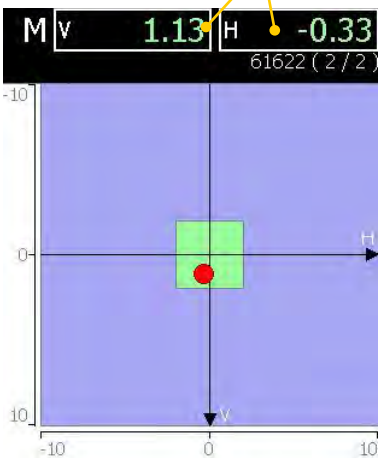
The M-unit can be used as a detector together with a laser transmitter. Do not use the S-unit for this.

Tolerance

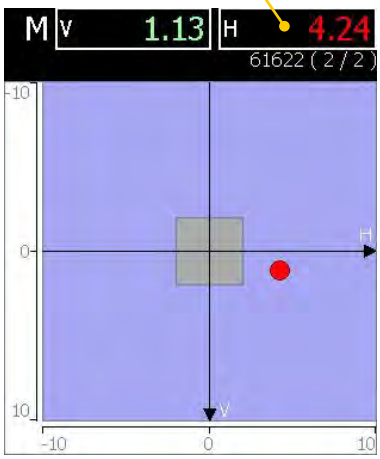
1. Select and to set tolerance.
   It is possible to set different tolerance in vertical and horizontal direction.
2. Use navigation buttons to move between the fields and to change the tolerance.
3. Press **OK**.



Live values and marking displayed in green when within tolerance.

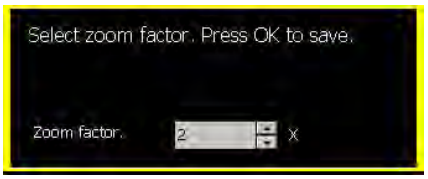


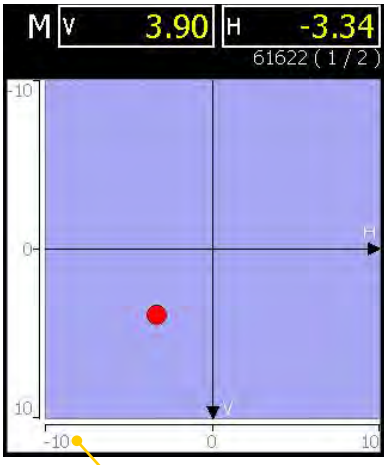
Live values displayed in red when outside tolerance.



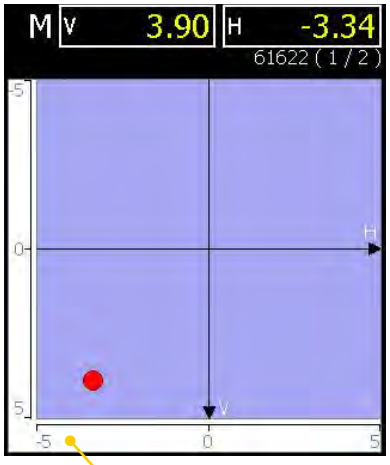
Zoom

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**.





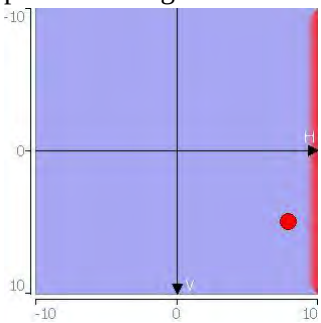
Default view



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.



Halve or Zero set value

Halve value

Select ½ to half displayed value.

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

Zero set value

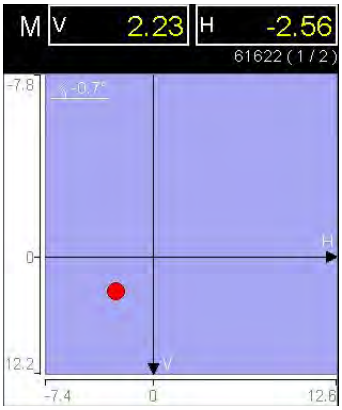
Select 0 to zero set displayed value.

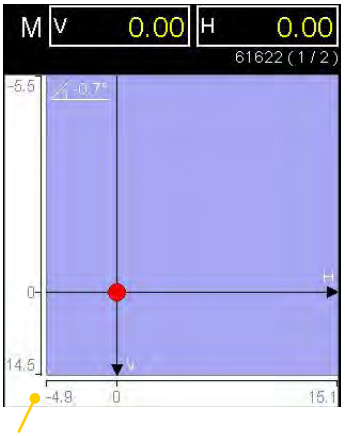
Zero point of the PSD moves to the laser point.

Absolute value

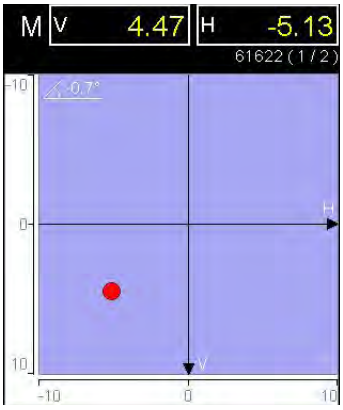
Select ¹⁄₁ to return to the absolute value.

Zero point of the PSD returns to the PSD centre.





Note the change of the current range



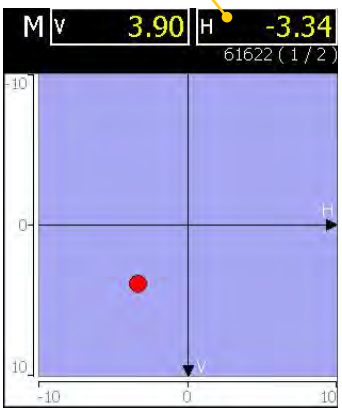
Live values – colours

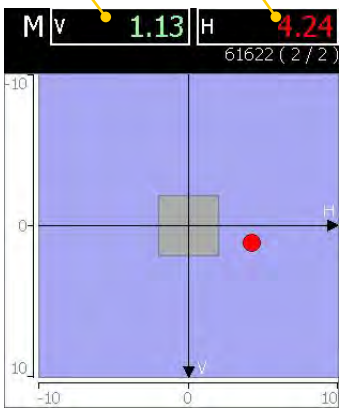
Live values are normally yellow

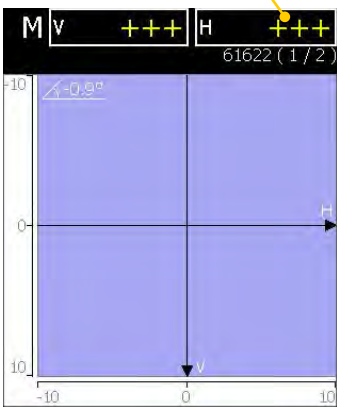
Green when within tolerance

Red when outside tolerance

Loss of signal, laser beam interrupted for example



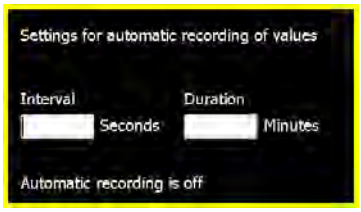




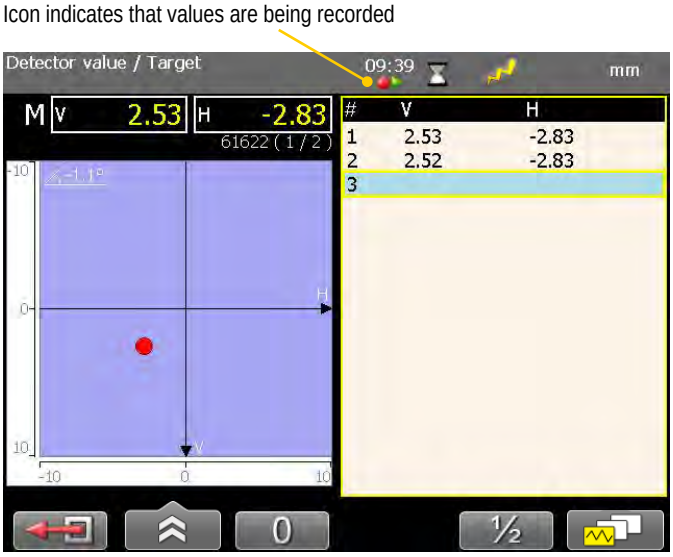
Automatic recording

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.

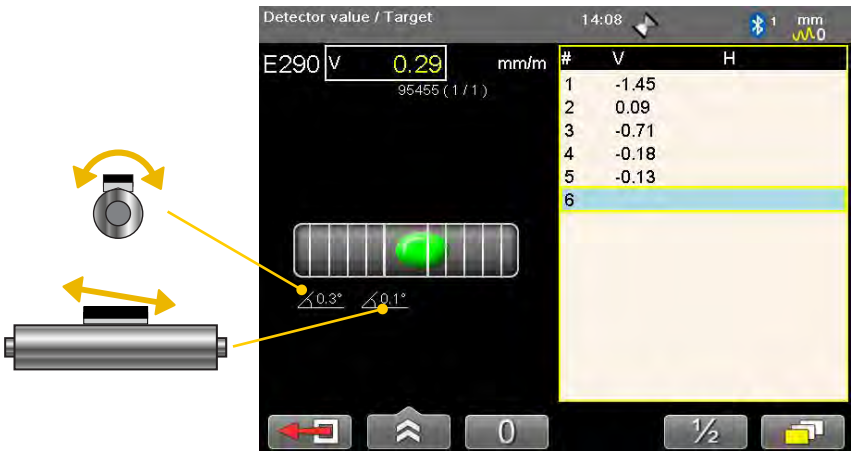
Select to display the different layout options, see image below.

Note!

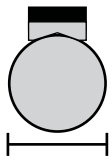
Use left and right navigation button to switch between two or more detectors when only one target is displayed.

Precision level E290 (Optional equipment)

Connect the Precision level, see *“Set up wireless connection” on page 21*.



When measuring a shaft using the Precision level, we recommend that the shaft is no larger than 100 mm in diameter.

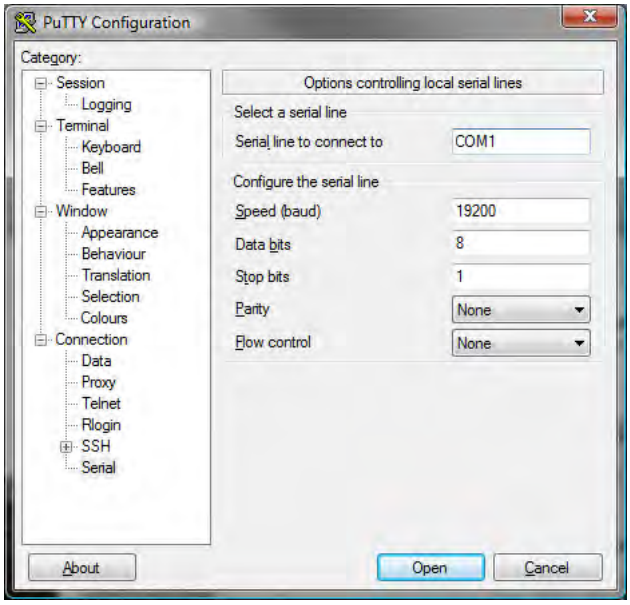


Max Ø100 mm

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.

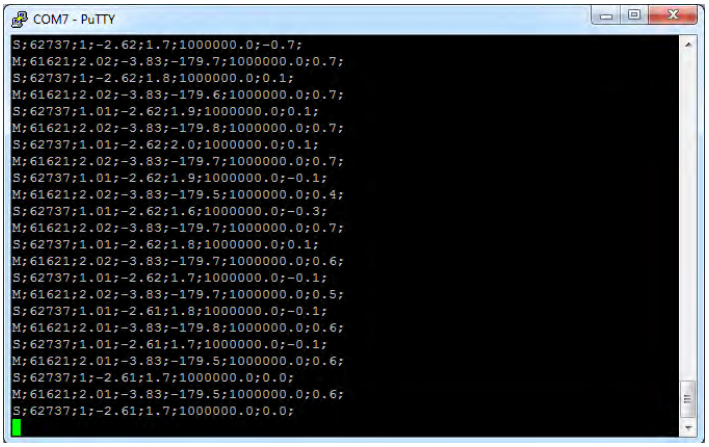
1. Connect the Display unit to the PC using a USB to USB Null Modem Cable.



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;

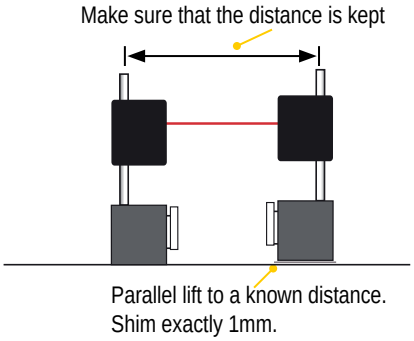
Data from M: M;serial;PSD X; PSD Y; X axis angle;Y axis angle;Z axis angle;

Calibration check

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

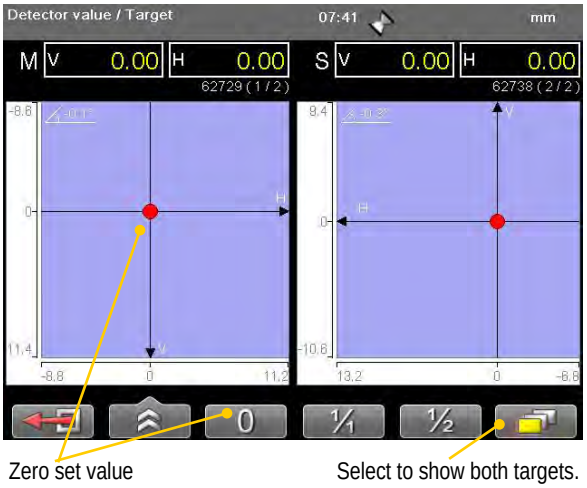
Quick check

1. Set the tolerance to 0.01 mm (0.5mil).
2. Select and show targets for both M- and S-unit.
3. Select 0 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 0 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).

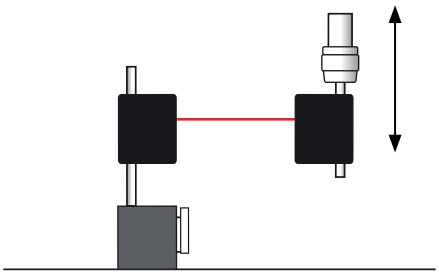


Note!

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 0 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

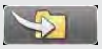
Press to register values.

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

Note!

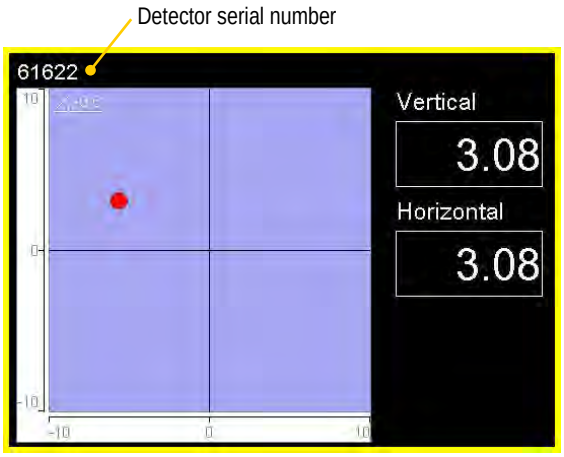
The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

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 .

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.

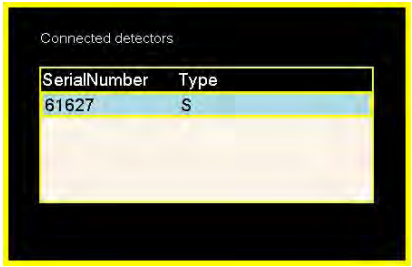


Function buttons

0	Zero set displayed value. Only zeroes the value while the target is opened.
1/1	Return to the absolute value.
1/2	Halve displayed value. Only zeroes the value while the target is opened.
	Close target. (Or press).

Show reference target

Select and #2 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 .



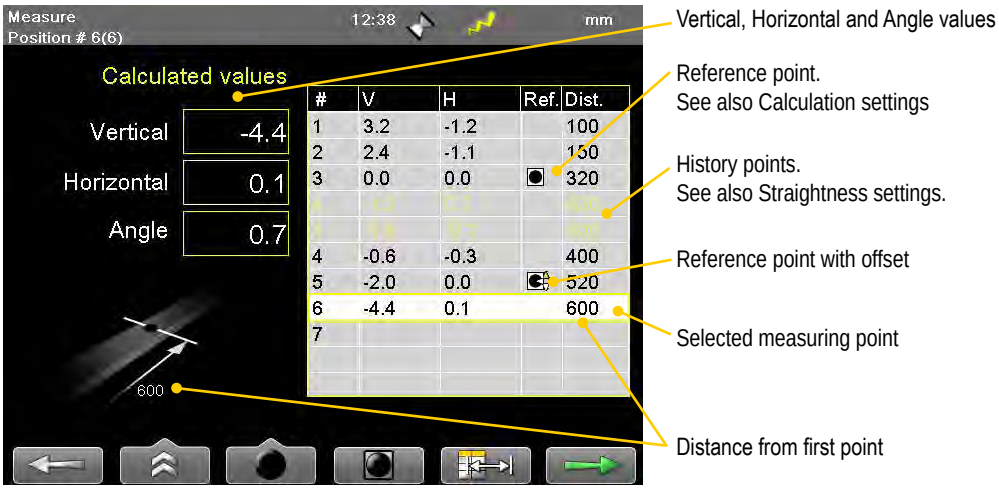
Function buttons

0	Zero set displayed value.
1/1	Return to the absolute value.
	Close target. You can also close by pressing .

See “Halve or Zero set value” on page 25.

Measure

1. Press . 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 to register a value. An hourglass is displayed while the value is registered.
3. Select to continue to Result view.

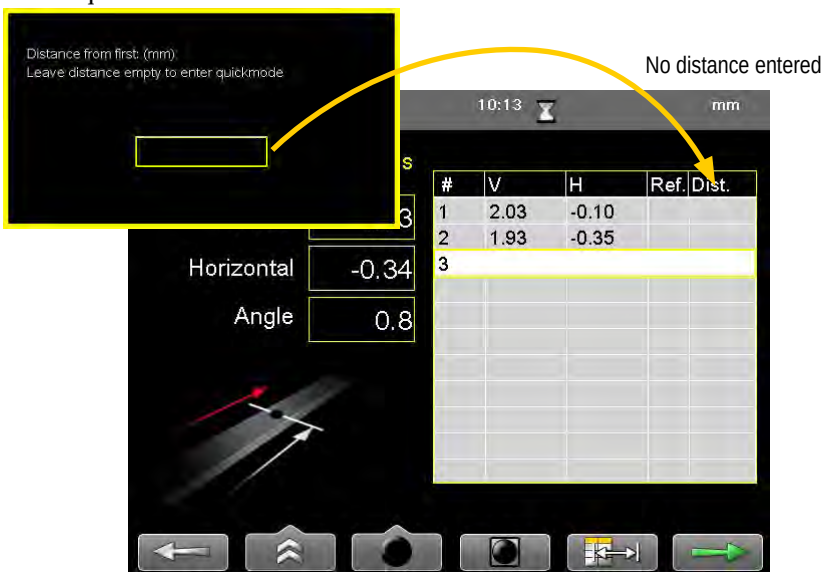


Function buttons

	Leave program.
	See “Control panel” on page 15. *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.

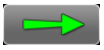
Quickmode

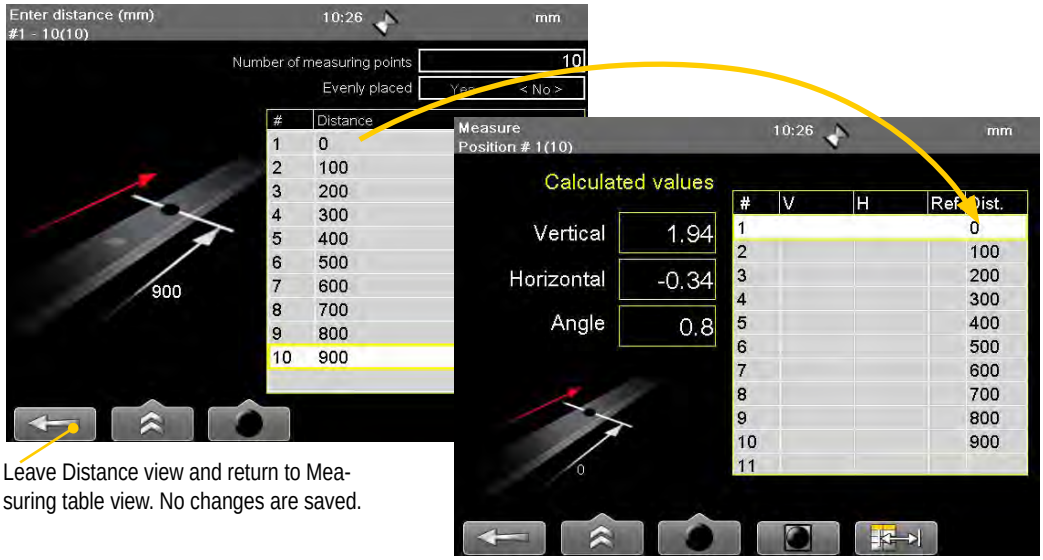
Quickmode means that you measure without entering any distances. Leave field empty to use quickmode.



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  .
   - 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.

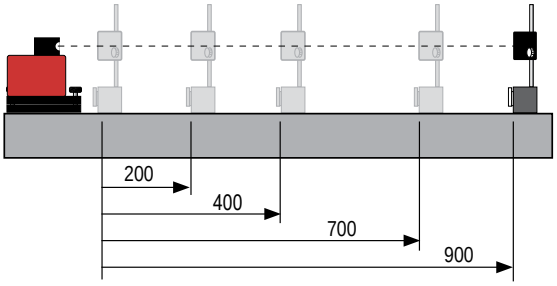


Note!

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

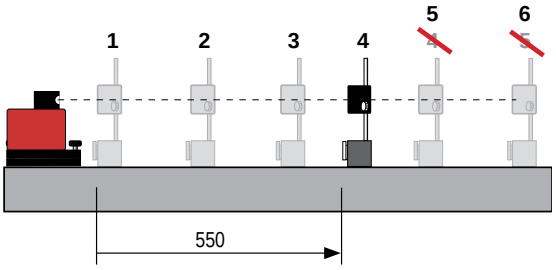
Add and delete points

Distances are always measured from the same point.



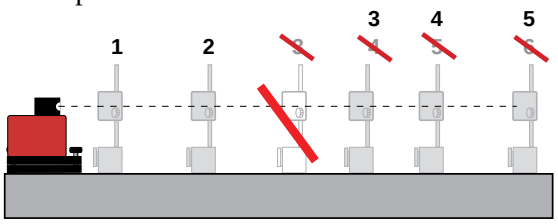
Add measuring point

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



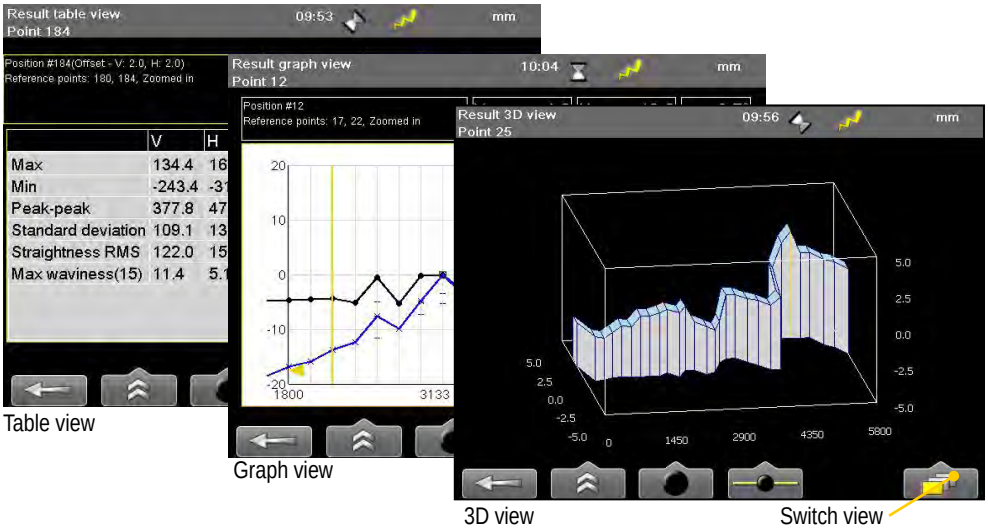
Delete measuring point

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.

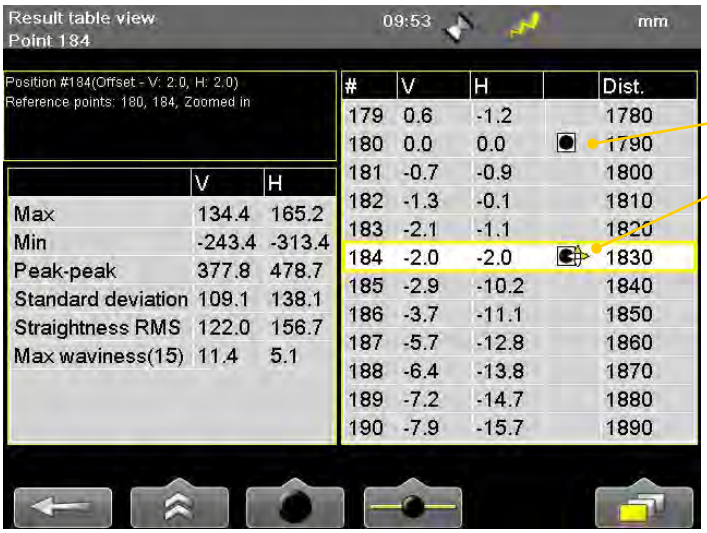


Function buttons

	Back to measure. To remeasure, select a point and then .
	Contains a sub-menu: *See "Control panel" on page 15.* *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). **Save report** (only when you have opened a saved measurement). **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  .

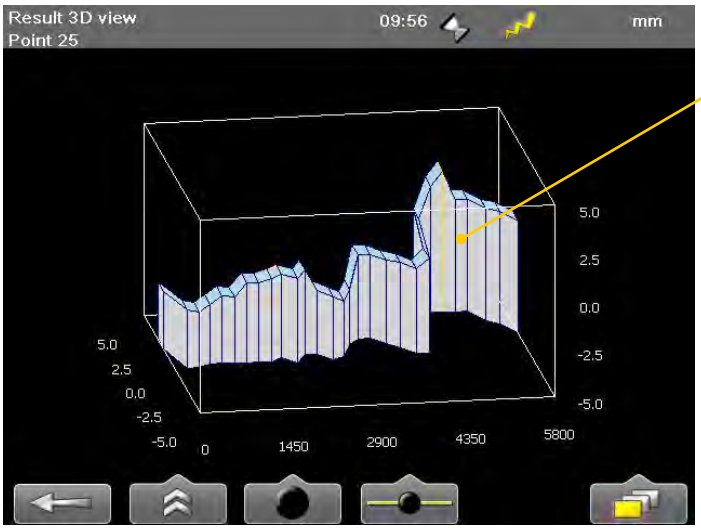


Max	The highest value.
Min	The lowest value.
Peak-peak	Difference between Max and Min value
Standard deviation	Average difference between Max and Min value.
Straightness RMS	Root Mean Square (Numerical Flatness)
Max waviness	Set waviness is shown in bracket. *See "Waviness" on page 41.*

Result 3D view

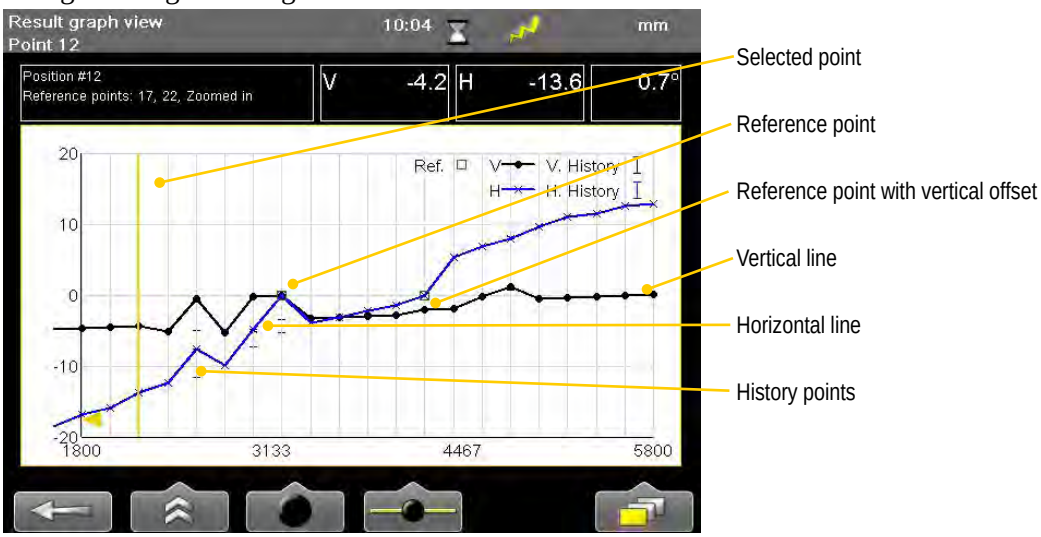
Navigate using the numeric buttons.

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



Result graph view

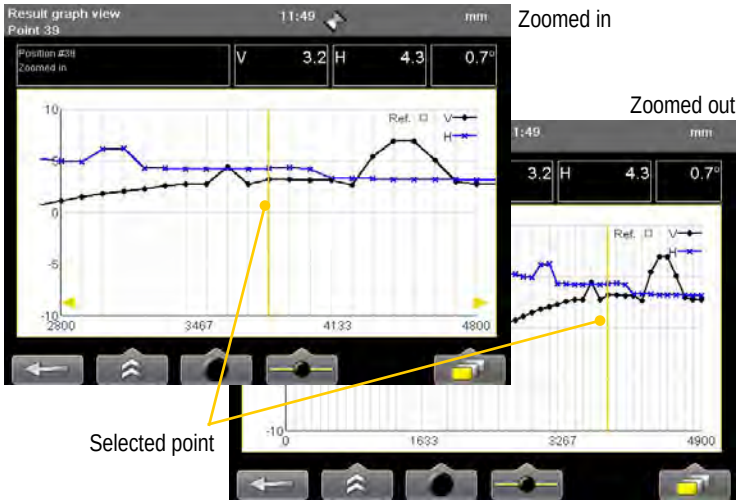
Navigate using the navigation buttons.



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

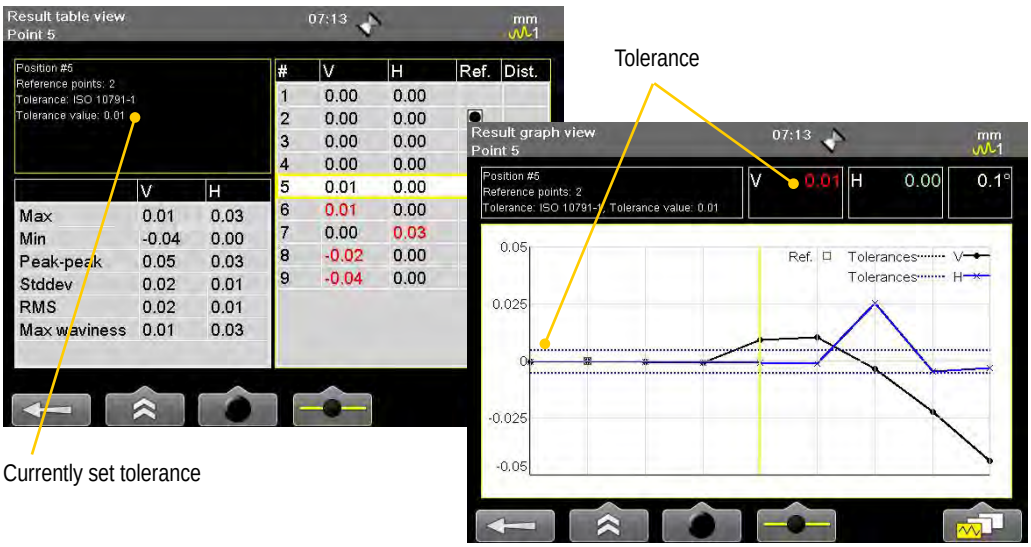
Press navigation button “Up” and “Down” to scale the result graph view.

Tolerance

1. Select  and  .
2. Select a predefined tolerance or create a custom tolerance. Press  .

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.



Predefined tolerance

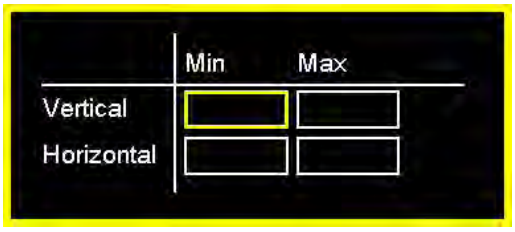
There are two ISO standard tolerances. The ISO tolerance is calculated automatically depending on which distances you have entered and interpreted in the same way as our custom tolerance.

Tolerance	Vertical Min	Max	Horizontal Min	Max
None				
Custom tolera				
ISO 10791-1	-0.005	0.005	-0.005	0.005
ISO 10791-2	-0.005	0.005	-0.005	0.005

Predefined tolerances

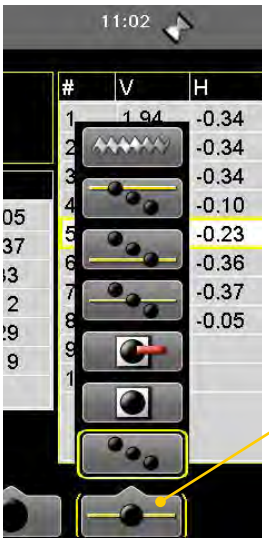
Custom tolerance

- Set vertical and horizontal tolerance. Press  to confirm.
- Select  to edit a custom tolerance



Enter custom tolerance

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

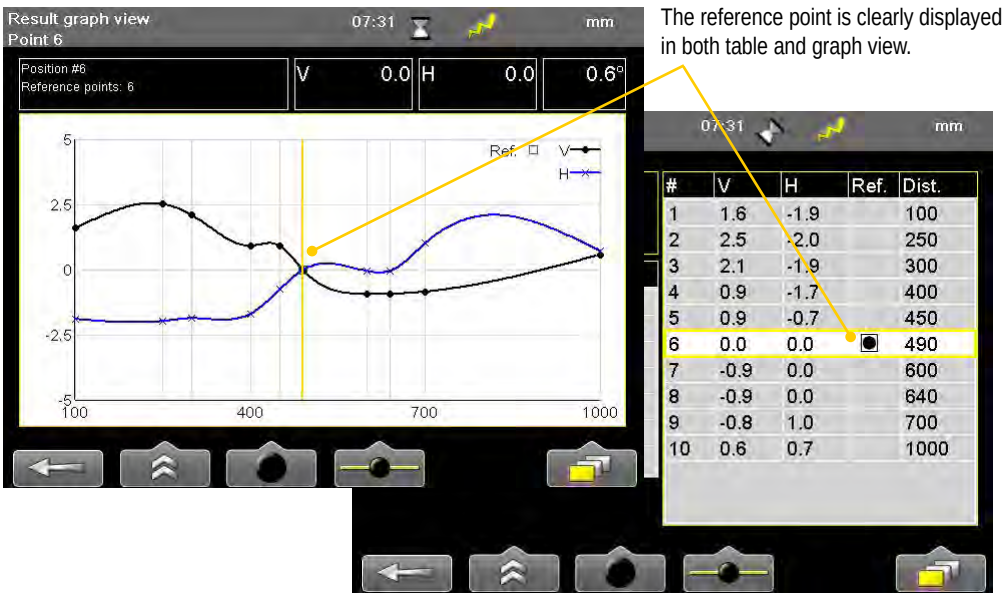
Select and to set selected point as reference point. You can set one or two reference points. To remove a reference point, select it in the table or graph and then select . The point itself is **not** removed. The reference points are clearly displayed in both table and graph.

Note!

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

One reference point

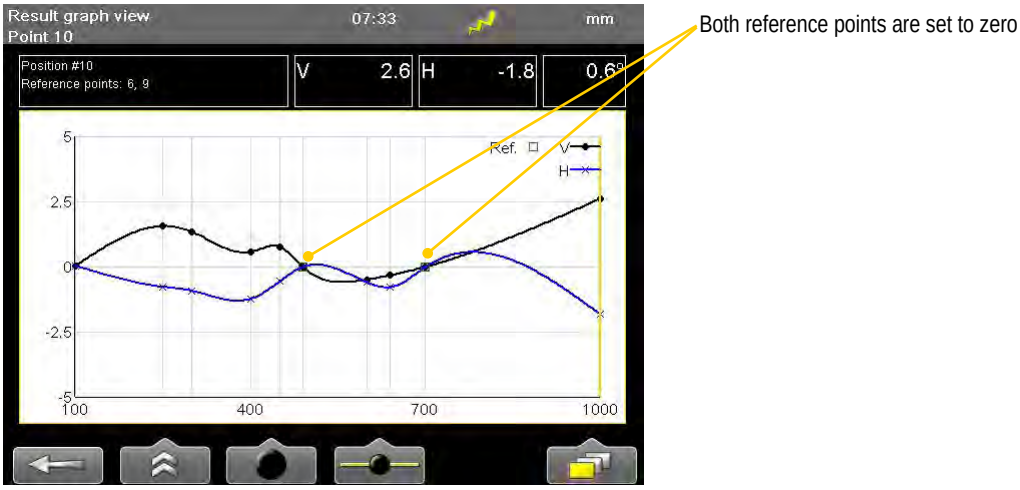
Setting a single reference point will offset all other measurement points based on the set reference point.



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

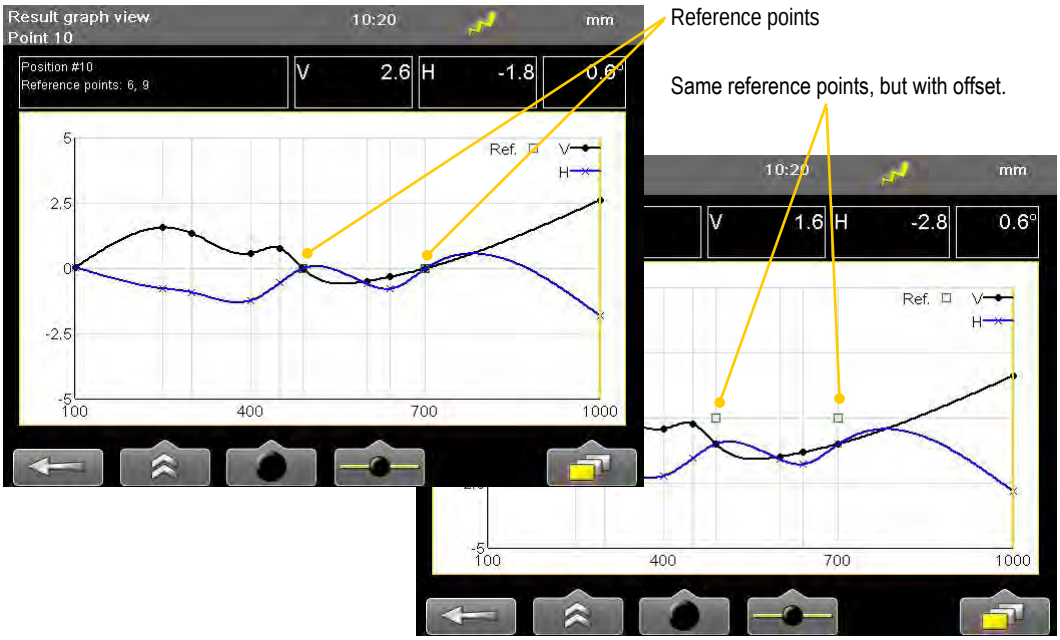
Two reference points

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.

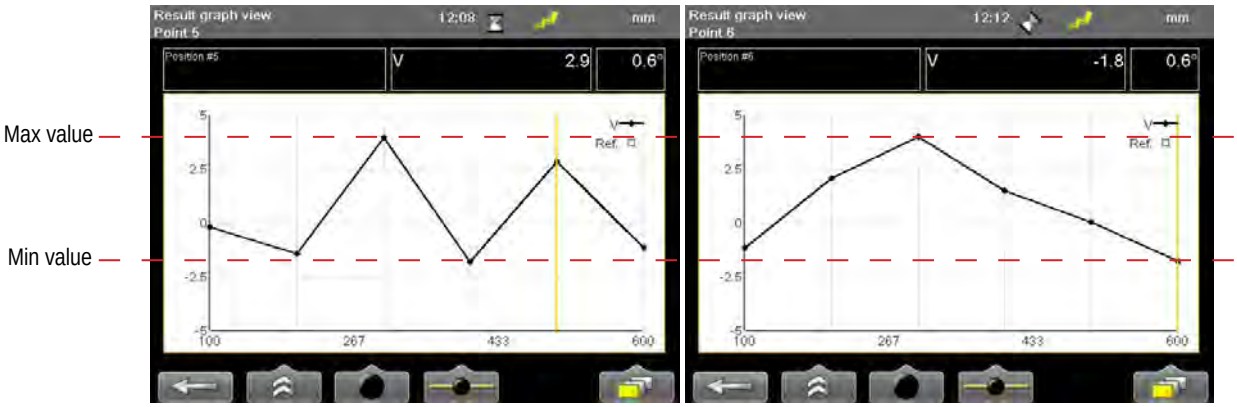
To set waviness, select  and  .

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 15.

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 to confirm choice.

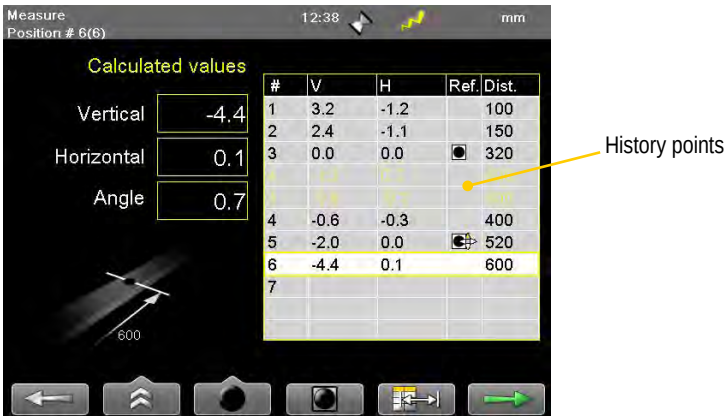
Note!

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.

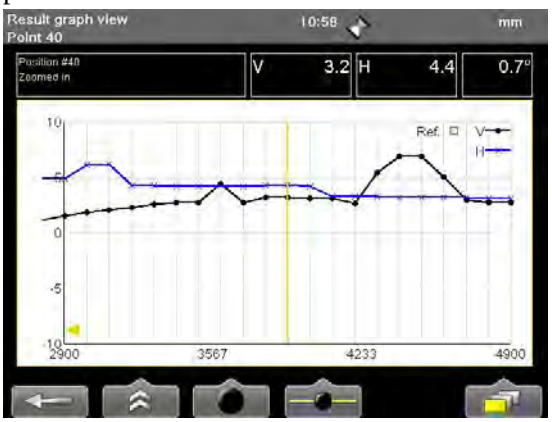
1. Select . A window is opened.
2. Select Yes or No. Navigate using the navigation buttons.
3. Press to confirm choice.



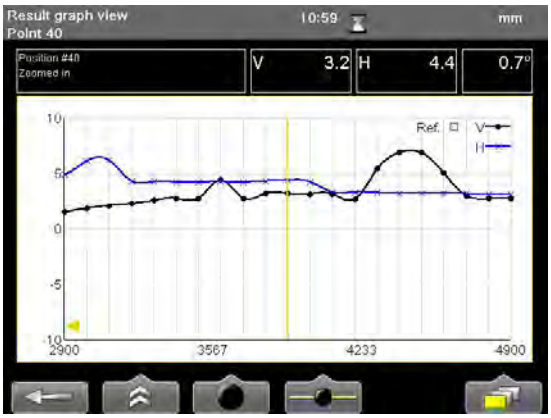
Smooth/sharp graph

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

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



Sharp

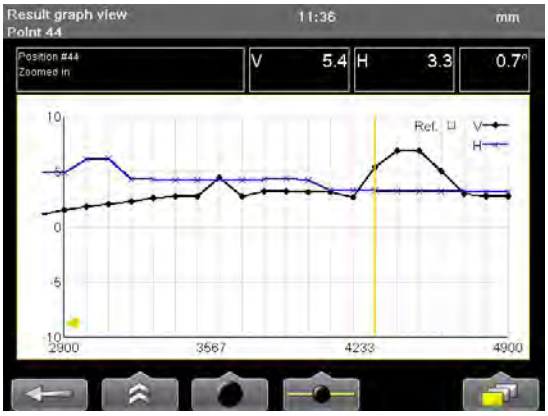


Smooth

Waviness settings

1. Select . A window is opened.
2. Select waviness factor. Navigate using the navigation buttons.
3. Press 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.

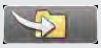
Measurement table view

Measurement position view

Adjust position view

Result

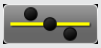
 Set tolerance

 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.

Note!

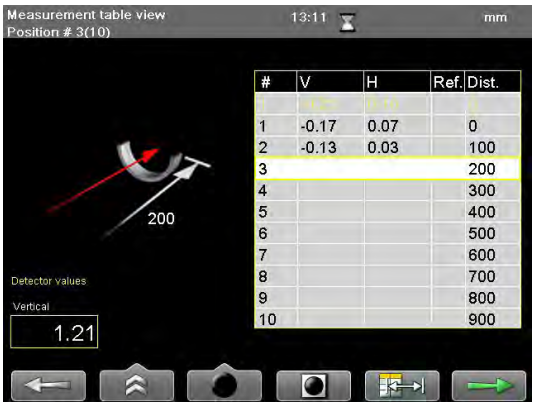
The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

Measure

The measuring phase consists of three different views:

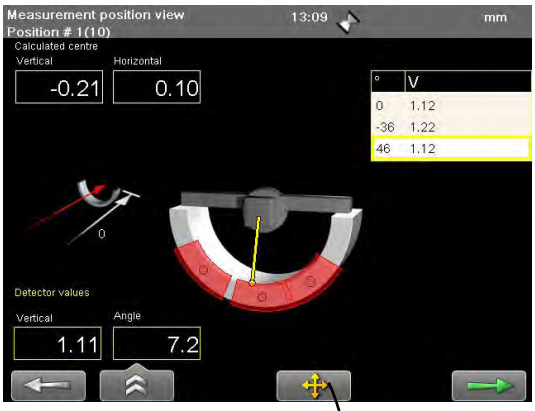
- Measurement table view
- Measurement position view
- Adjustment view.

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



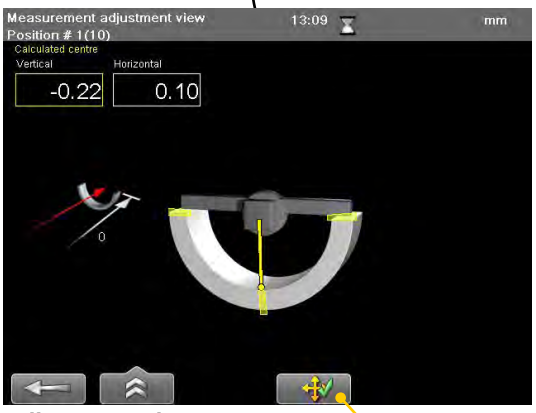
Measurement table view

Select which object to measure. The table shows the calculated values for all measured objects.



Measurement position view

Measure points for selected object



Adjustment view

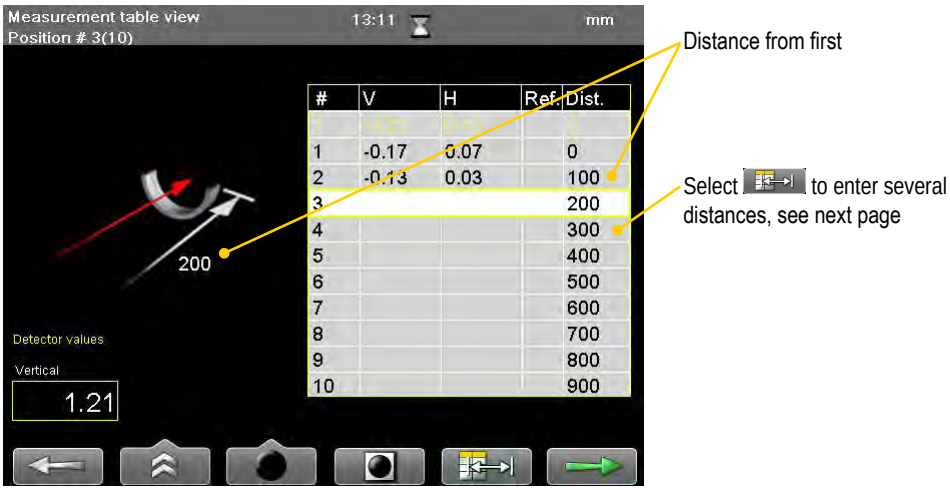
Adjust object. When you have adjusted an object, you need to remeasure it.

Adjustment ready

Measurement table view

The table shows the calculated values for all measured objects.

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

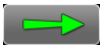


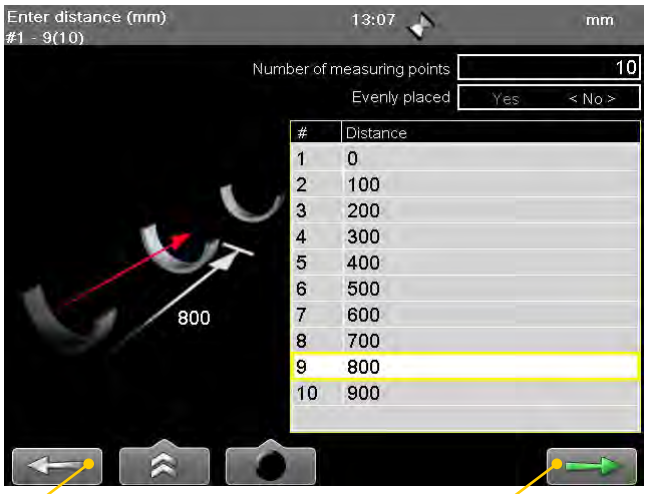
Function buttons

	Leave program.
	See *"Control panel" on page 15*. 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 objects.

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  .
   - 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.

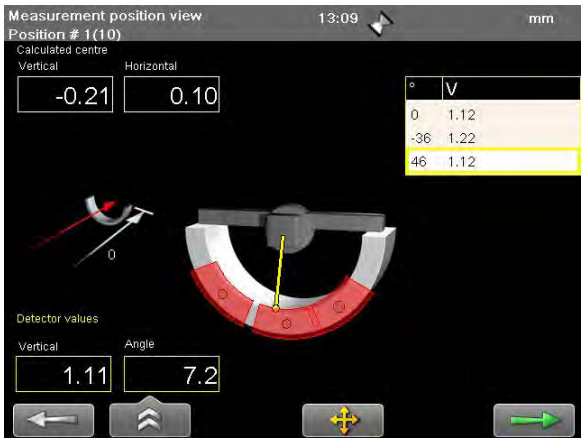
Measurement position view

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

With inclinometer values

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

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

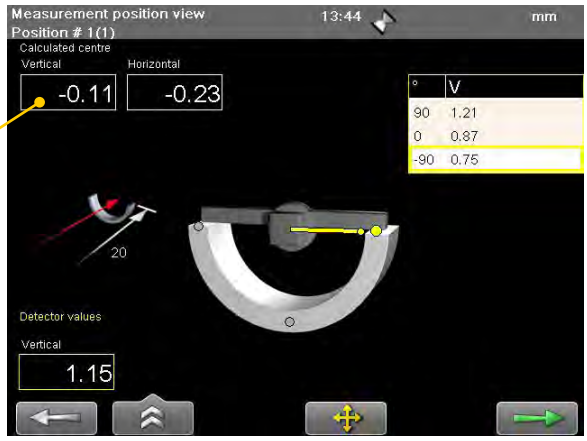


Inclinometer values on

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 object.



Inclinometer values off

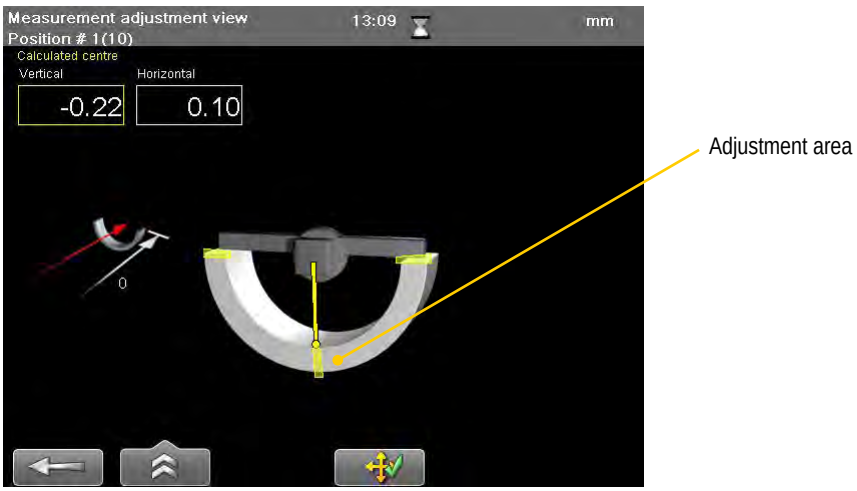
Function buttons

	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 Halve displayed value. *See “Halve or Zero set value” on page 25*.
	Toggles between showing and hiding inclinometer values.
	Adjust object. Available when you have registered three points.
	Continue to next object. Available when you have registered three points on current object.

Adjustment view

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

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 object.

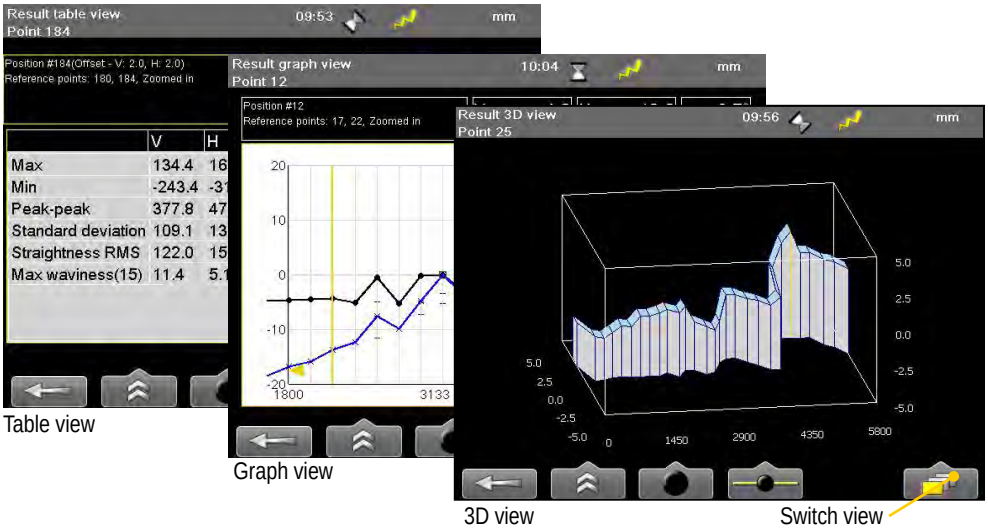


Function buttons

	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 object.

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.

Preparations

Mount units

Rough align

 Show target

 Show reference target

Measure

Press **OK** to register values.

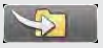
Measurement table view

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.

Note!

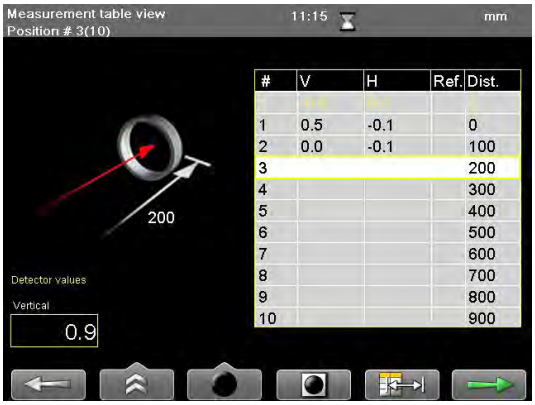
The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

Measure

The measuring phase consists of three different views:

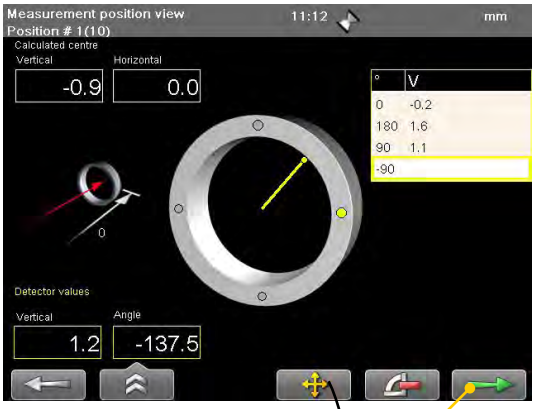
- Measurement table view
- Measurement position view
- Adjustment view.

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



Measurement table view

Select which object to measure. The table shows the calculated values for all measured objects.



Measurement position view

Measure points for selected object

Measure next object

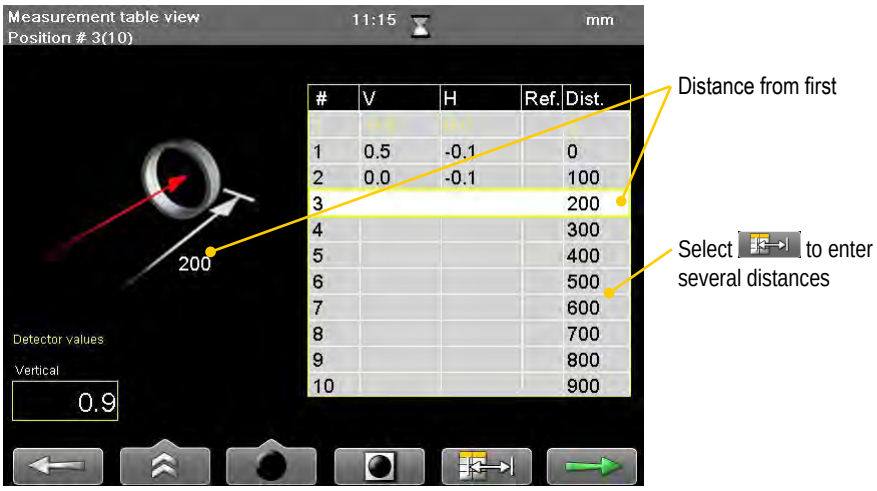
Adjustment view

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

Adjustment ready

Measurement table view

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

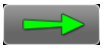


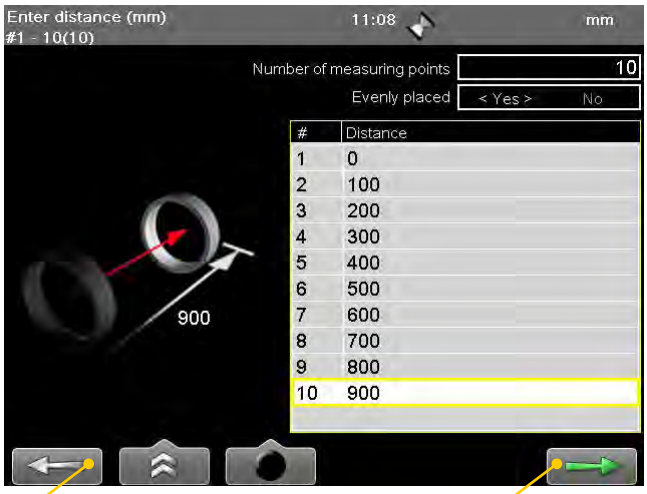
Function buttons

	Leave program.
	See *"Control panel" on page 15*. 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 objects.

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  .
   - 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.

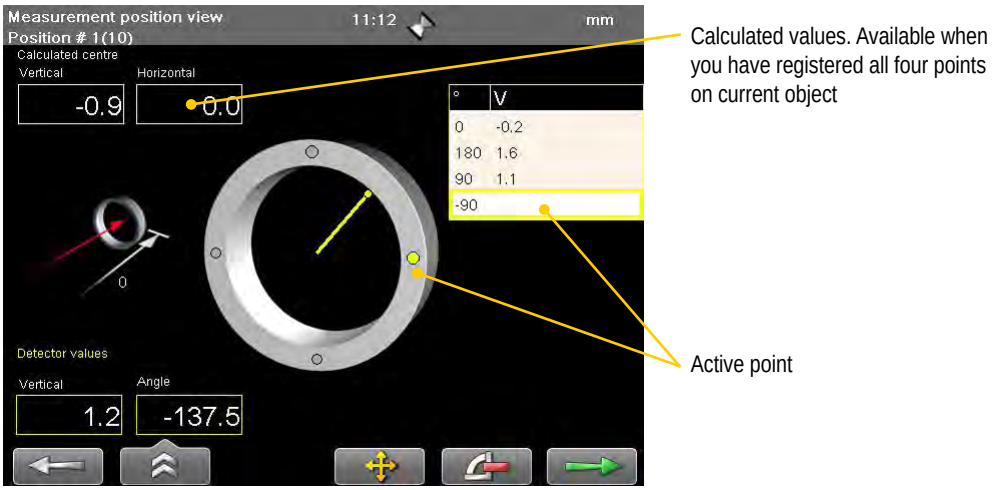
Save changes and return to Measuring table view.

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 object. Press to register a value.



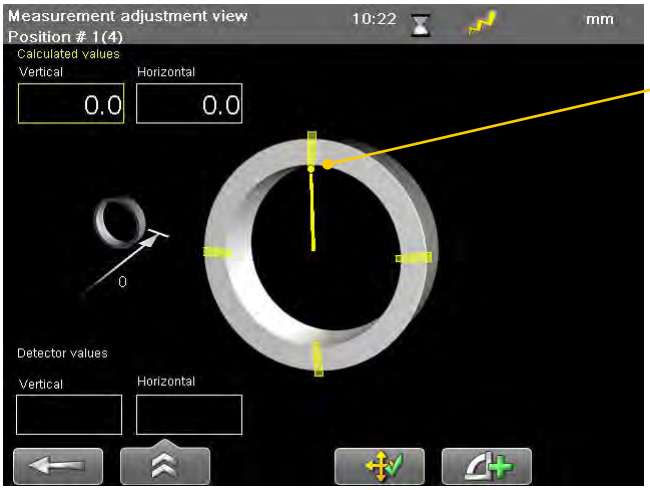
Function buttons

	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. Halve displayed value. *See "Halve or Zero set value" on page 25*.
	Open adjustment view. Available when you have registered at least both horizontal or vertical values.
	Toggles between showing and hiding inclinometer values.
	Continue to next object. 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 object according to live values. When you are done, you need to remeasure the object.

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 object.



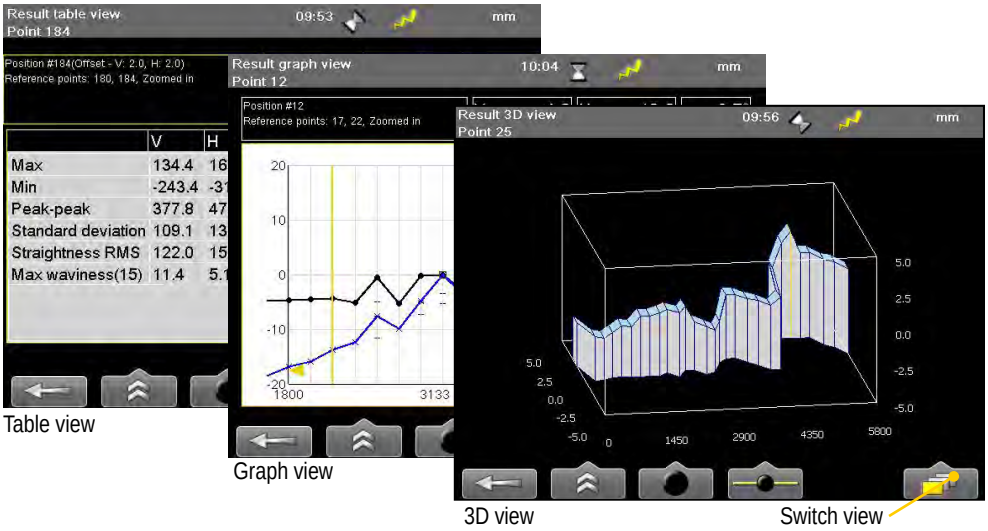
Horizontal or vertical values are live when arrow is within the yellow live marks.

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 object.
	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.

Rough align

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

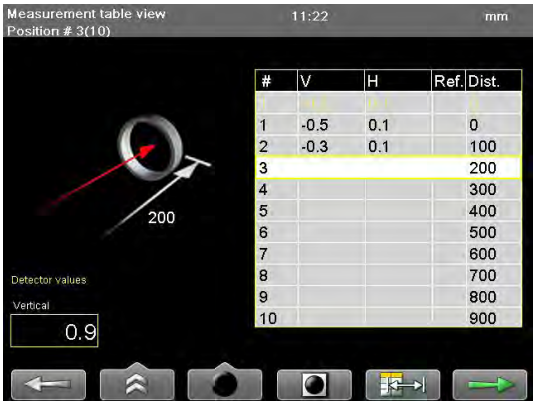
The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points. *See also "Show target" on page 30.*

Measuring views

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.



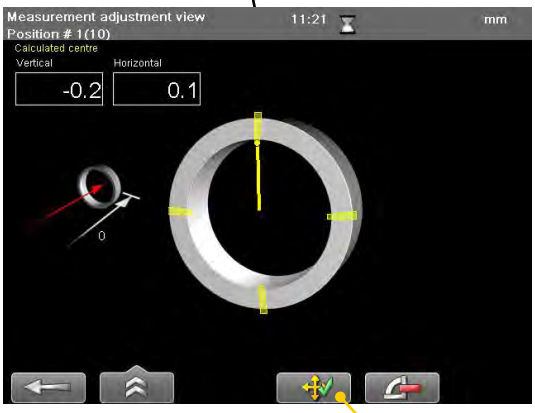
Measurement table view

Select which object to measure. The table shows the calculated values for all measured objects.

Measurement position view

Measure points for selected object

Measure next object



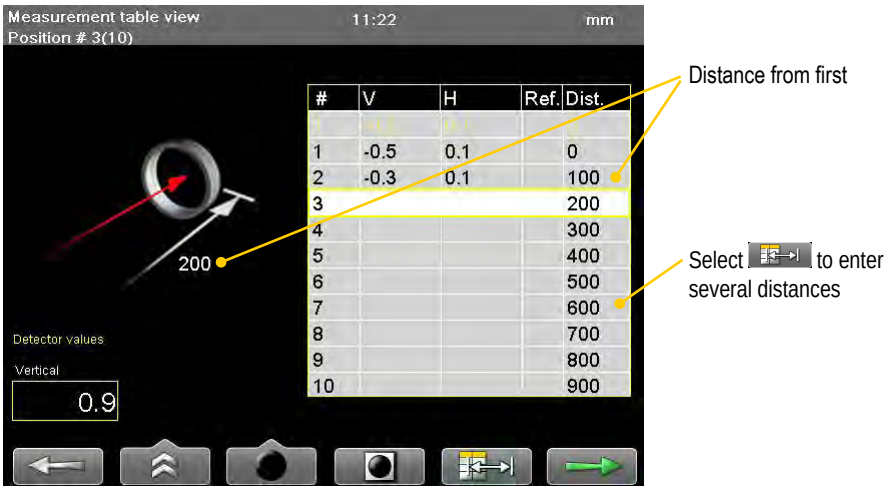
Adjustment view

Adjust object. When you have adjusted an object, you need to remeasure it.

Adjustment ready

Measurement table view

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

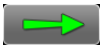


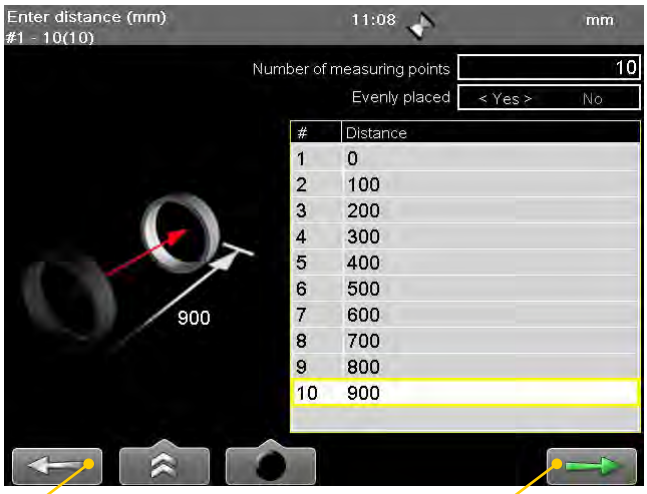
Function buttons

	Leave program.
	See *"Control panel" on page 15*. See *"Straightness settings" on page 42*. See *"Show target" on page 30*. Show reference target. Select to enter nominal mean diameter of measurement object #1. See *"Roundness view" on page 67*.
	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 objects.

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  .
   - 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!

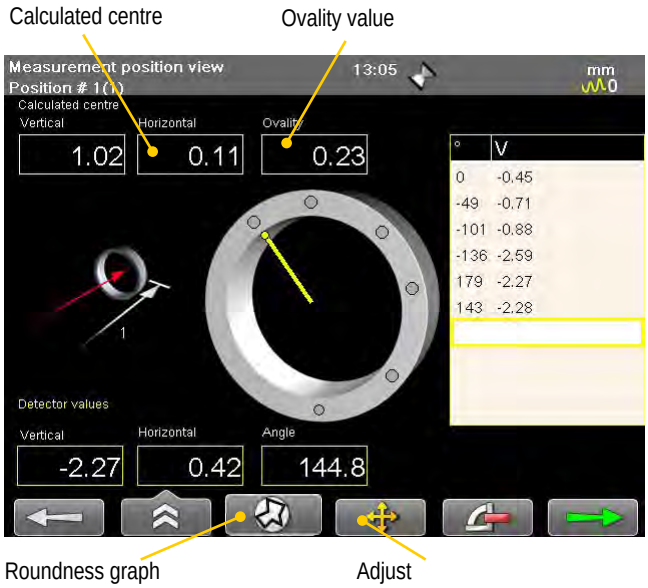
If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

Measurement position view

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

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

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



- When you have registered three points with at least 20º between them, the **calculated centre** for the current object is displayed.
- To display an **ovality value**, you must have measured a sector large enough and at least five points.
- To **delete a value**, press the left navigation arrow.

Measure without inclinometer

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

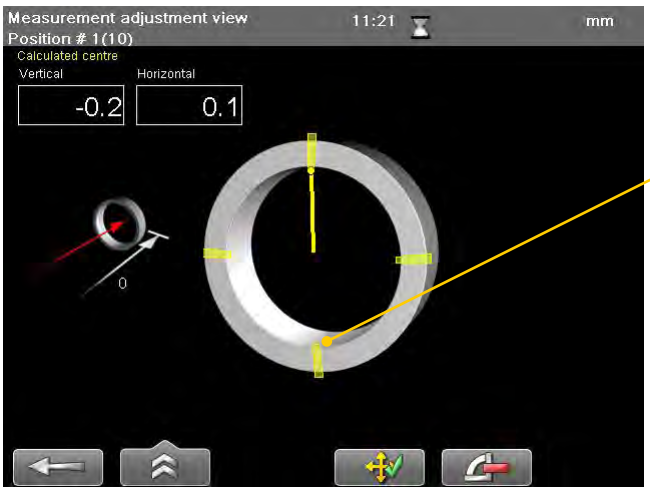
Function buttons

	Back to Measurement table view.
	Show target. See *"Show target" on page 30*. **Show reference target**. Select to enter nominal mean diameter of measurement object #1. See *"Roundness view" on page 67*.
	Show roundness graph. Available when you have registered three points.
	Only available before registering the first position. Zero set displayed value. Return to the absolute value. Halve displayed value. *See "Halve or Zero set value" on page 25*.
	Toggles between showing and hiding inclinometer values.
	Adjust object. Available when you have registered three points.
	Continue to next object. Available when you have registered three points on current object.

Adjustment view

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

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 object.



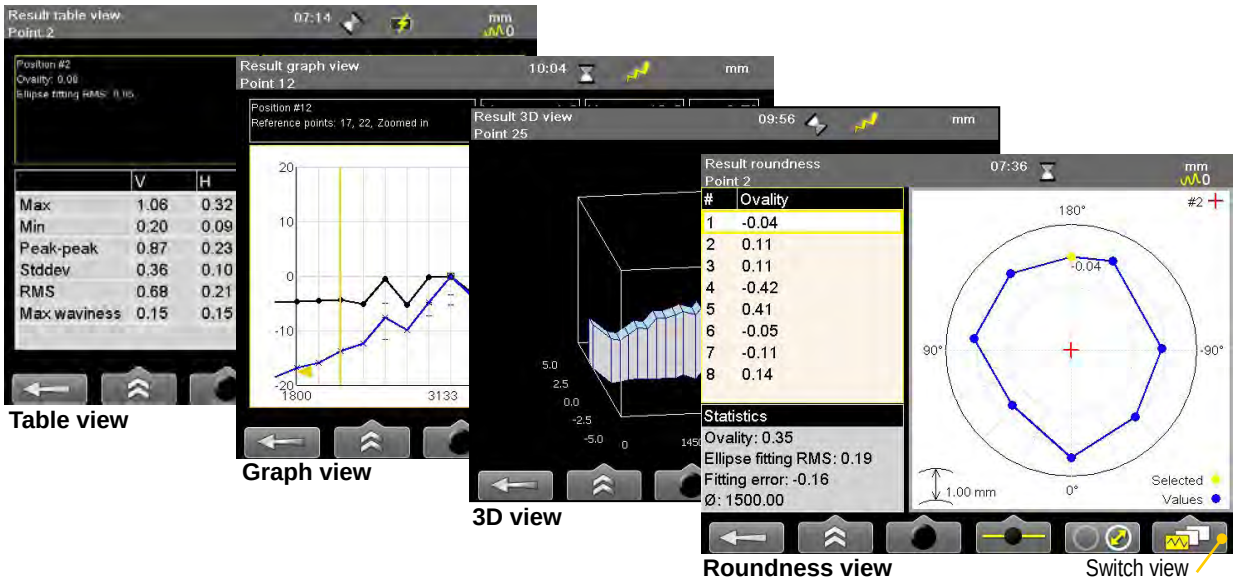
Horizontal or vertical values are live when marker is within the yellow adjustment areas.

Function buttons

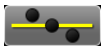
	Back to Measurement table view.
	Show target. See *"Show target" on page 30*. **Show reference target**.
	Adjustment ready. Returns to Measurement table view. You need to remeasure the object.
	Toggles between showing and hiding inclinometer values.

Result

The straightness result is displayed as a graph, table or 3D view, *see "Result" on page 34*. Roundness is displayed in a separate view, see *"Roundness view" on page 67*.



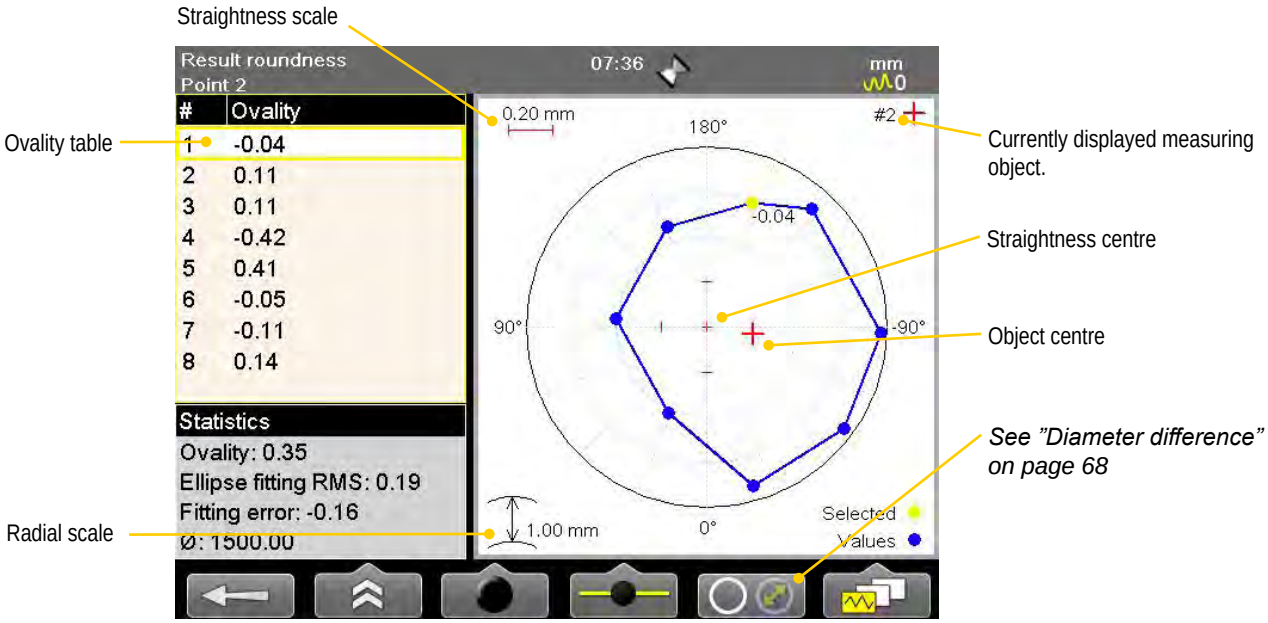
Function buttons

	Back to measure. To remeasure, select a point and then  .
	 *See "Control panel" on page 15.*  *See "Straightness settings" on page 42.*  **Save.** You are asked if you would like to include Roundness graphs in the report. Default is set to No. *See "Measurement file handling" on page 11.*  **Print report**. Save file and plug in printer (optional equipment).  **Save report** (only when you have opened a saved measurement).  **Set tolerance**. *See "Tolerance" on page 37.*  **Zoom**. Only available in Graph view.
	 **Go to measuring point**.  **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**.
	Graph, table and 3D views are described in *"Result" on page 34*.

Roundness view

Select  and  to display the Roundness view.

Use navigation buttons left/right to navigate between the measuring objects.



Ovality table

The number indicates how much the measured point differs from the ideal circle.

Use the navigation buttons up/down to move navigate in the table. The corresponding point is marked yellow in the graph.

Statistics

Ovality:

Ovality of the measured object. The difference between the largest and smallest radius.

To display a value, you must have measured a sector large enough and at least five points.

Ellipse fitting RMS:

Root Mean Square error of all points with respect to the fitted ellipse. To display a value, you must have measured a sector large enough and at least five points.

Fitting error:

The error for the selected point compared to the fitted ellipse.

To display a value, you must have measured a sector large enough and at least five points.

Ø (Diameter):

Mean diameter of the object. First object has Ø = 0.

Subsequent objects will have diameters relative to the first object. For example: an object with the Ø = - 1.00 mm will be 1mm smaller than the object #1.

If a nominal diameter has been entered for the first object, this diameter will be shown here. Subsequent objects will have diameters relative to the diameter of the first object.

Note!

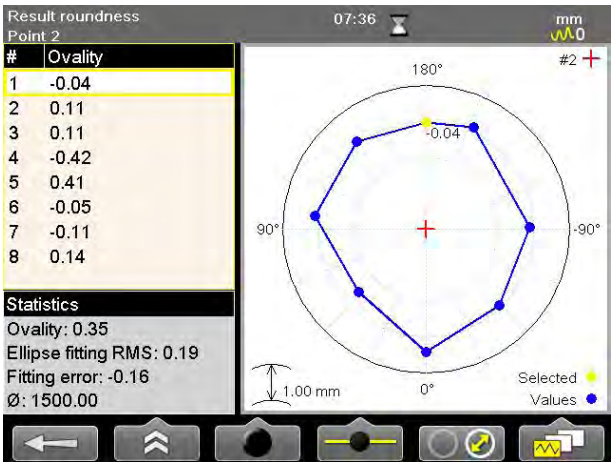
To measure roundness, you can also use the program Roundness. It is used to measure roundness on one measuring object.

Diameter difference

Select  to show/hide diameter difference. When you show the diameter difference, it will scale the size of the measured object according to measuring data. This way, a smaller object will be scaled so that it appears as a smaller circle in the graph. When measuring for example a turbine where the bearings have very different diameters, no common diameter reference exists. In this case the diameter scaling must be switched off.

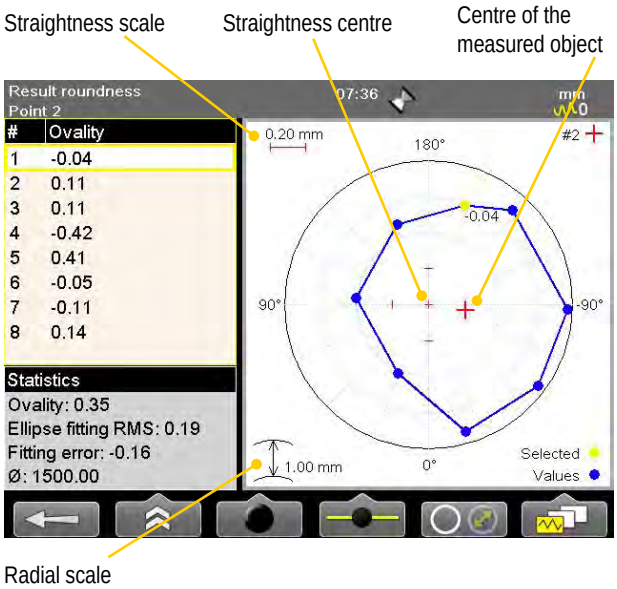
Hide diameter difference

- Each object is shown centred in the diagram.
- Radial scale is set for each object individually, so that the shape is clearly visible.
- All objects are displayed as equally large.



Show diameter difference

- Objects are offset from the straightness centre according to their V and H straightness results.
- Straightness scale and radial scale are identical for all objects.
- The object is scaled according to its size.



Note!

The selection you make here (Show or hide diameter difference) is saved in the XML and will also appear in the pdf-report.

CENTRE OF CIRCLE

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

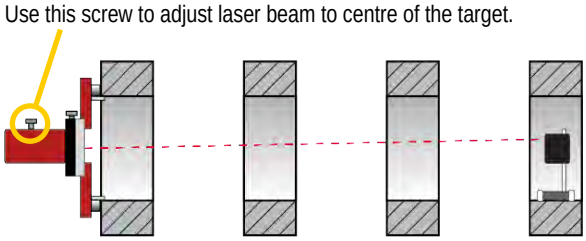
Rough align

Use the program Values or a target.

Adjust to target

1. Place the detector in the position furthest away from the laser transmitter.
2. Select  and  to open the target. Adjust laser point to the centre of the target.

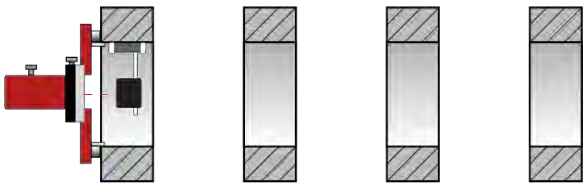
Use this screw to adjust laser beam to centre of the target.



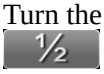
Zero set

3. Place the detector close to the laser transmitter. In the 12 o'clock position.
4. Select  to zero set the value.

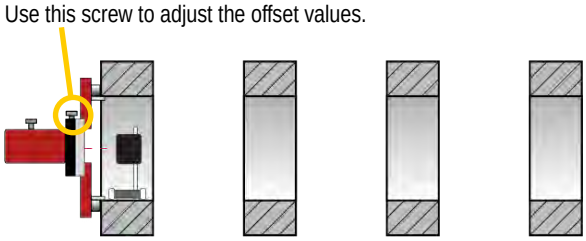
Zero set



Adjust offset

5. Turn the detector to 6 o'clock and select  to halve the value.
6. Adjust V and H offset values to within ± 0.5mm.

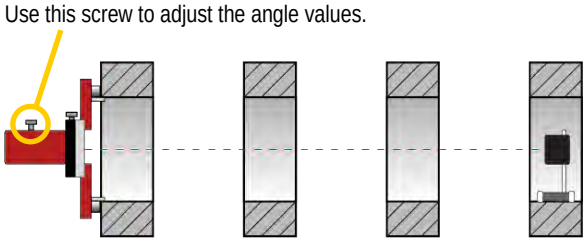
Use this screw to adjust the offset values.



Adjust angle

7. Move the detector to the position furthest away from the laser transmitter.
8. Adjust V and H angle values to within ± 0.5mm.

Use this screw to adjust the angle values.



See "Show target" on page 30.

Note!

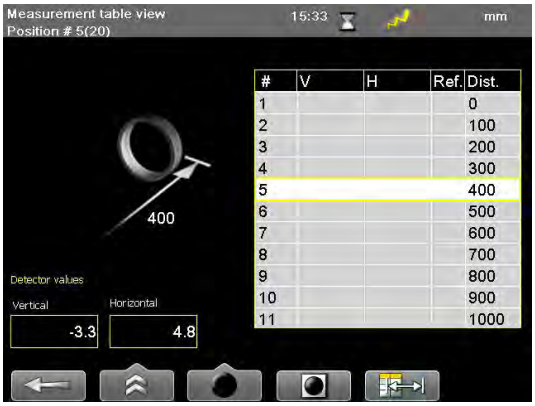
The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

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

Preparations

Mount units

Rough align


Show target


Show reference target

Measure

Press **OK** to register values.

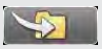
Measurement table view

Measurement position view

Adjust position view

Result

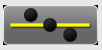

Set tolerance


Save


Print report


Set offset for reference point


Set reference point


Best fit around zero

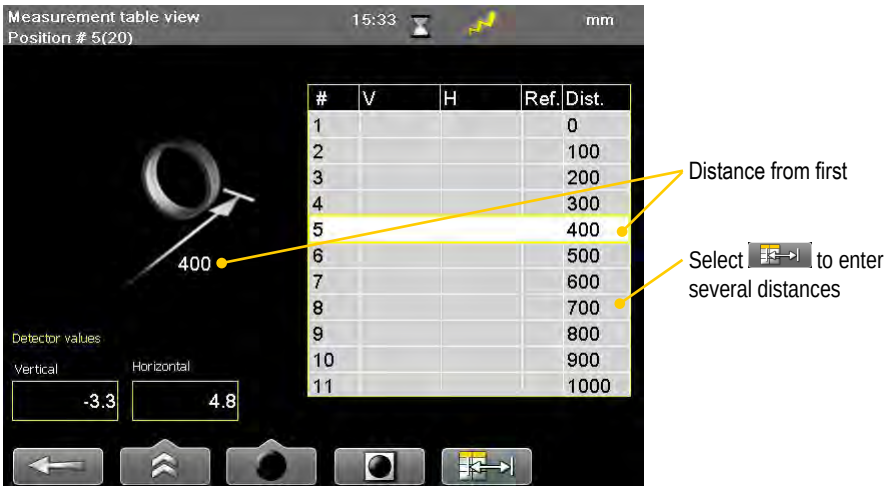

Best fit all positive


Best fit all negative


Waviness

Measurement table view

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

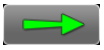


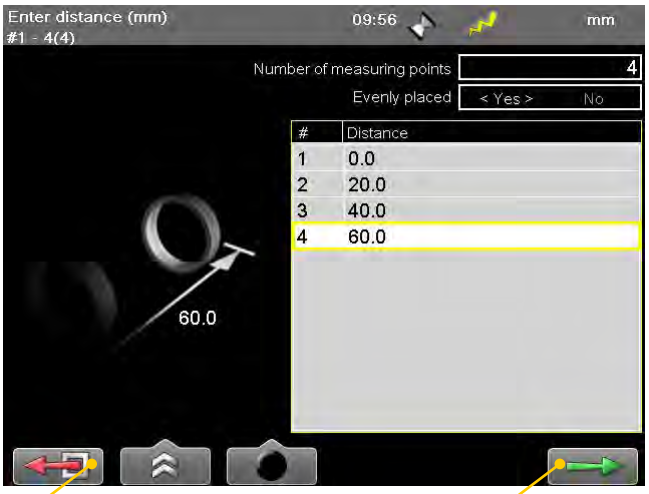
Function buttons

	Leave program.
	See *"Control panel" on page 15*. 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 measured two objects.

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  .
   - 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 object. Press to register a value.

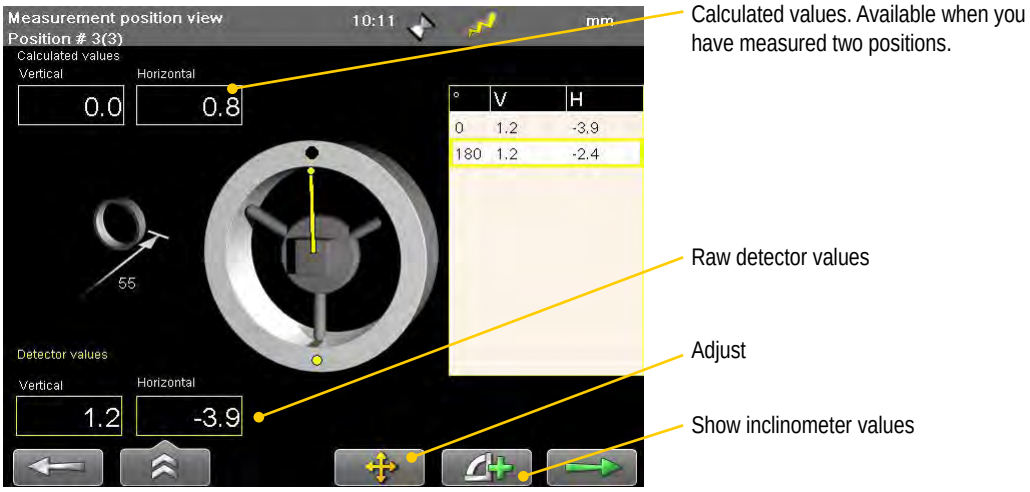
With inclinometer values

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

1. Turn to the yellow dot.
2. Press to register the position.
1. Turn 180º.
2. Press to register second position.
3. Select to adjust object, or to measure next object.

Without inclinometer values

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



Function buttons

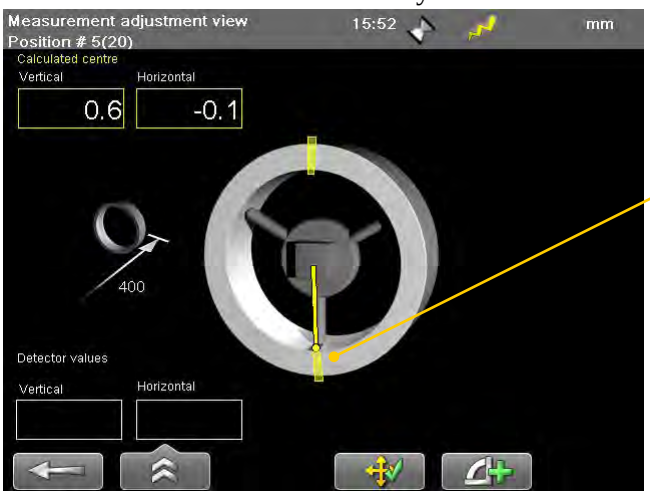
	Back to Measurement table view.
	Show target. See *"Show target" on page 30*. **Show reference target**.
	Only available before registering the first point. Zero set displayed value. Return to the absolute value. Halve displayed value. *See "Halve or Zero set value" on page 25*.
	Toggles between showing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

Adjustment view

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

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 object.

Calculated values are marked with yellow. Live values.



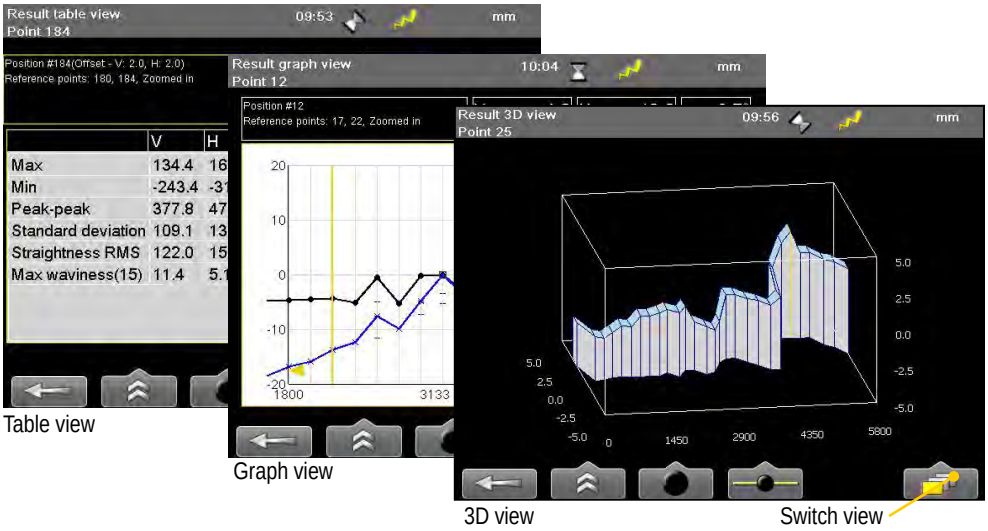
Horizontal or vertical values are live when marker is within the yellow adjustment areas.

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 remeasure the object.
	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

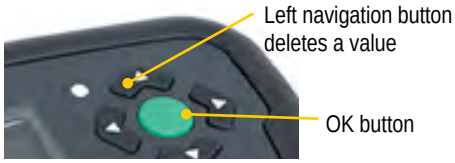
Roundness is used to measure for example single bearings. With the program Straightness Multipoint, you can measure several objects (for example bearing journals).

Measure

Select  and  to start the program Roundness.

1. Turn detector to any position.
2. Press ● to register points. For a more reliable measurement, spread the measuring points as much as possible.

- When you have registered three points with at least 20º between them, the **calculated centre** for the current object is displayed.
- To display an **ovality value**, you must have measured a sector large enough and at least five points.
- To **delete a value**, press the left navigation arrow.



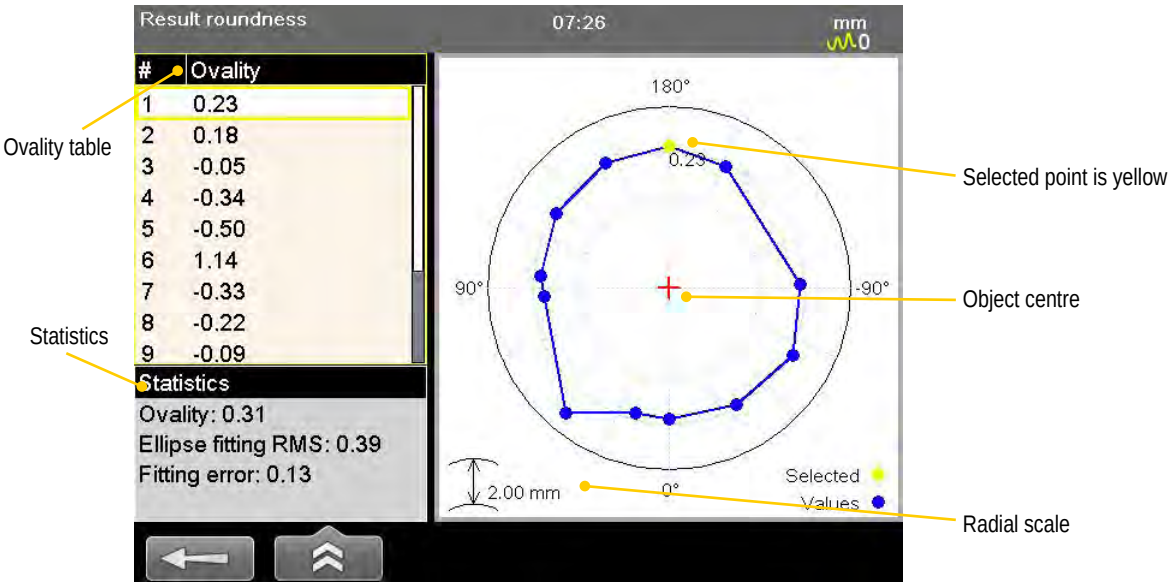
Function buttons

	Back, leave program.
	See "Control panel" on page 15. Show target.
	Display a polar diagram. Available when you have measured three positions with a spread of 20º between them.
0½	Only available before registering the first position. 0 Zero set displayed value. 1/1 Return to the absolute value. ½ Halve displayed value. *See "Halve or Zero set value" on page 25.*
	Toggles between showing and hiding inclinometer values.
	Continue to Result view. Available when there is an Ovality result.

Measure without inclinometer

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

Result



Ovality table

The number indicates how much the measured point differs from the ideal circle.

Use the navigation buttons up/down to move navigate in the table. The corresponding point is marked yellow in the graph.

Statistics

To display a value, you must have measured a sector large enough and at least five points.

Ovality: Ovality of the measured object. The difference between the largest and smallest radius.

Ellipse fitting RMS: Root Mean Square error of all points with respect to the fitted ellipse.

Fitting error: The error for the selected point compared to the fitted ellipse.

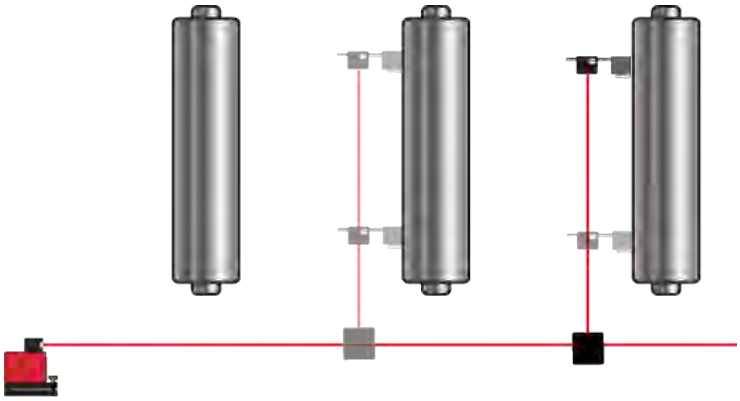
Function buttons

	Remeasure.
	Save file, *“Measurement file handling” on page 11.* *See “Control panel” on page 15.* *“Straightness settings” on page 42.*

Note!

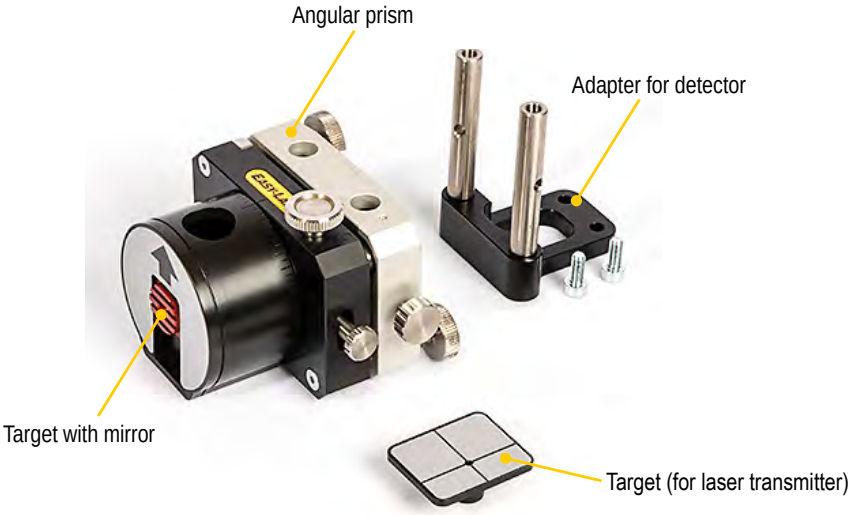
The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

Examples of parallelism measurement include parallelism between rolls and other surfaces in papermaking machines, printing presses, rolling mills, etc. Other examples include overhead tracks, rails, press machine tables.

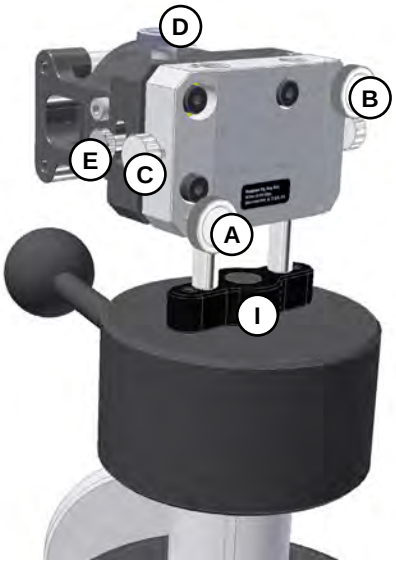


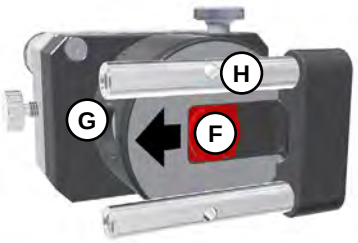
Angular prism kit

Part No. 12-1136



- (A) Vertical adjustment (pitch).
- (B) Horizontal adjustment (yaw).
- (C) Locking on the rods.
- (D) Fine tuning of rotation.
- (E) Lock for fine tuning of rotation. Unlock to disable fine tuning.
- (F) Target with mirror (beam inlet).
- (G) Beam outlet.
- (H) Adapter for detector.
- (I) Adapter for mounting on tripod *Part No. 01-2232*

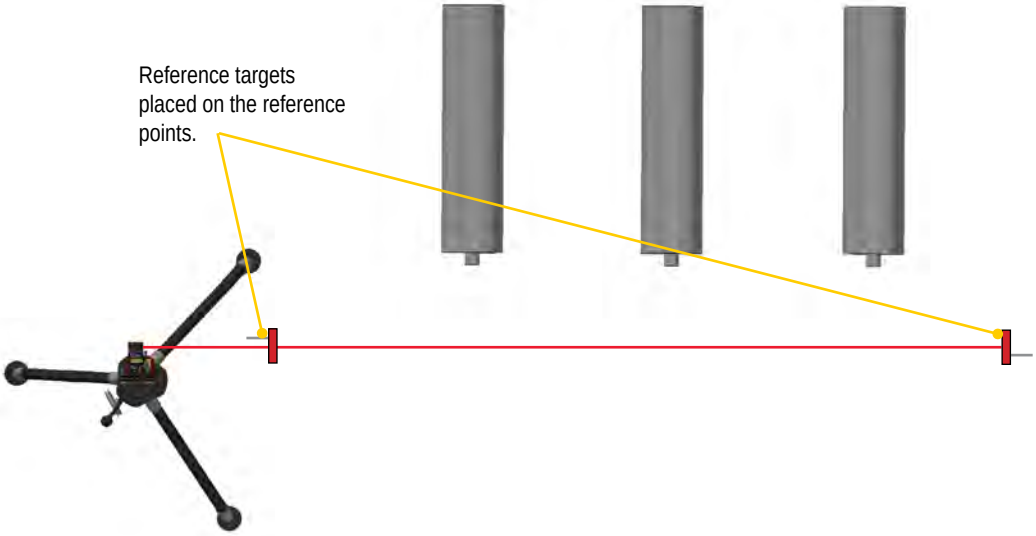




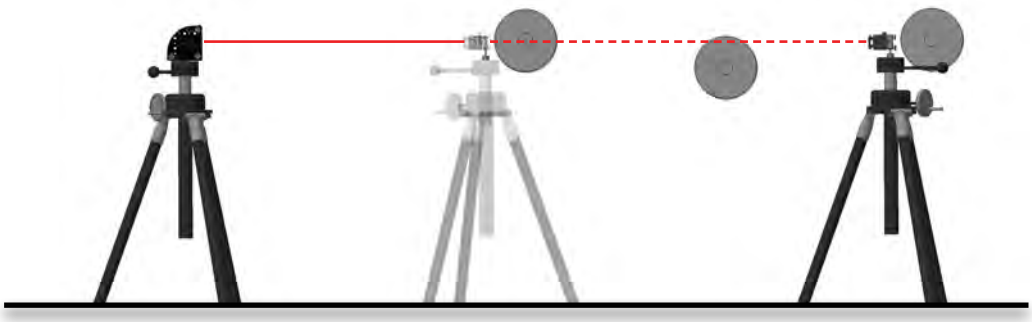
Laser and prism setup

1. Level the laser according to the spirit level.

2. Direct the laser beam along the machine and perpendicular to the measurement objects. Use targets or use detectors to set up the reference line (datum line).
   For more information on how to set up the laser, see the Easy-Laser “Roll Application Guide”

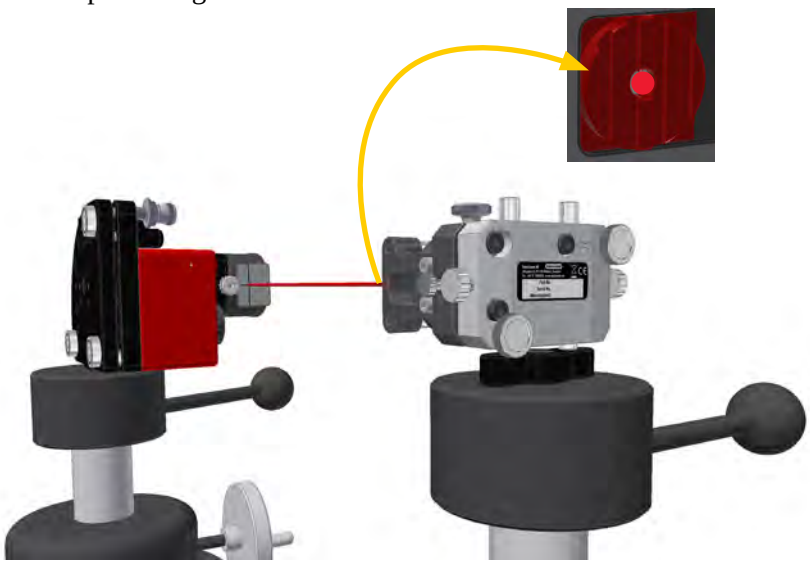


3. Mount the prism on the tripod and position it close to the laser.
4. Make sure the laser and the prism are at the same hight.
5. Move the tripod with the prism close to the roll you want to measure.
   (Note! Minimum 200 mm from the laser)

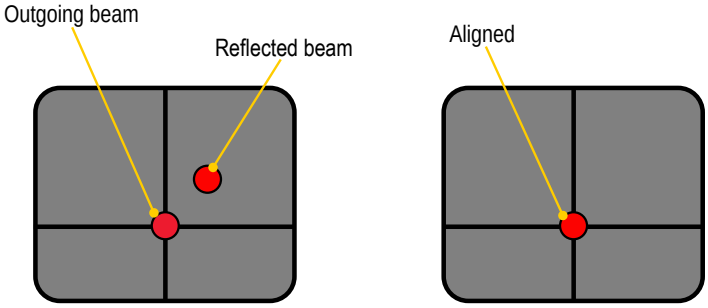


6. Move the laser beam to the prism target

7. Position the angular prism to the laser beam, let the beam hit the centre of the closed prism target.



8. Adjust the prism vertically (pitch) and horizontally (yaw) until the laser beam reflection hit the middle of the laser target.



9. Open up prism target and start the measurement.

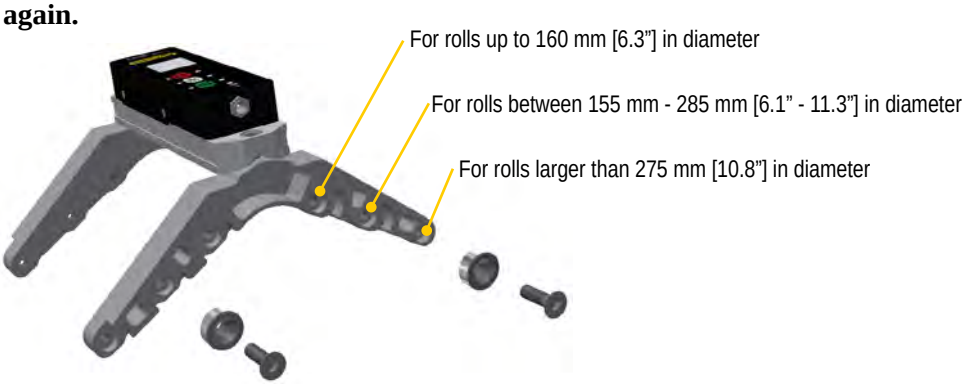
Precision level

The precision level is used to measure the vertical value. It is possible to skip the Precision level for all or single rolls. See also *Tech data > Precision level E290*.

Bracket for different roll sizes

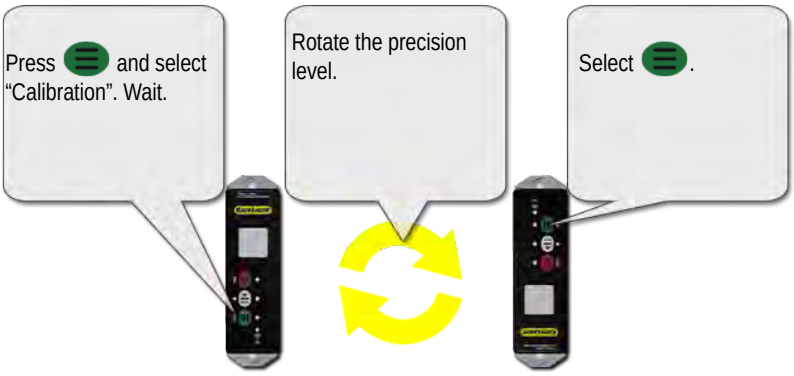
Use the bracket to ensure that the Precision level lands firmly on the roll. Mount the wheels in the appropriate position and then calibrate the Precision level.

If you change position of the magnets, you need to calibrate the Precision level again.



Calibrate the precision level

1. Place the Precision level on the reference roll. Make a mark on the roll to ensure that you place it in the same position.
2. Press and select “Calibration”.
3. Wait approx 15 seconds, until the value has stabilized. Press .
4. Rotate the Precision level 180º.
5. Wait approx 15 seconds, until the value has stabilized. Press . The Precision level has been calibrated. The calibration is saved even when the Precision level is switched off.



Note!

When you use the Precision level, it has to be switched on during the whole measurement.

Set up wireless connection

Make sure that the Precision level is connected to the Display unit via wireless connection.

1. Select and to open the Control panel.
2. Select .
3. Select to search for wireless units.

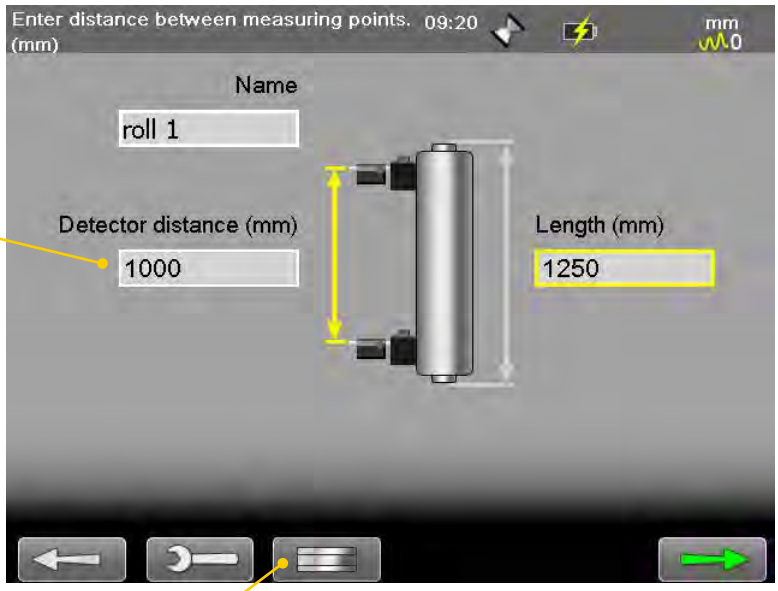
Measure

Enter distances

1. Enter a name or keep the default name. Press .
2. Enter the distance between the detectors. Measure between the rods.
3. Press to continue to Measure view, or use navigation button to enter the distance between the adjustment points.

The distance between adjustment points is not mandatory. If you leave the space empty, it will be filled in with the same length as the detector distance.

Make this distance as far as possible.
This will give an even more accurate measurement.



Toggle button. Show rail or roll.

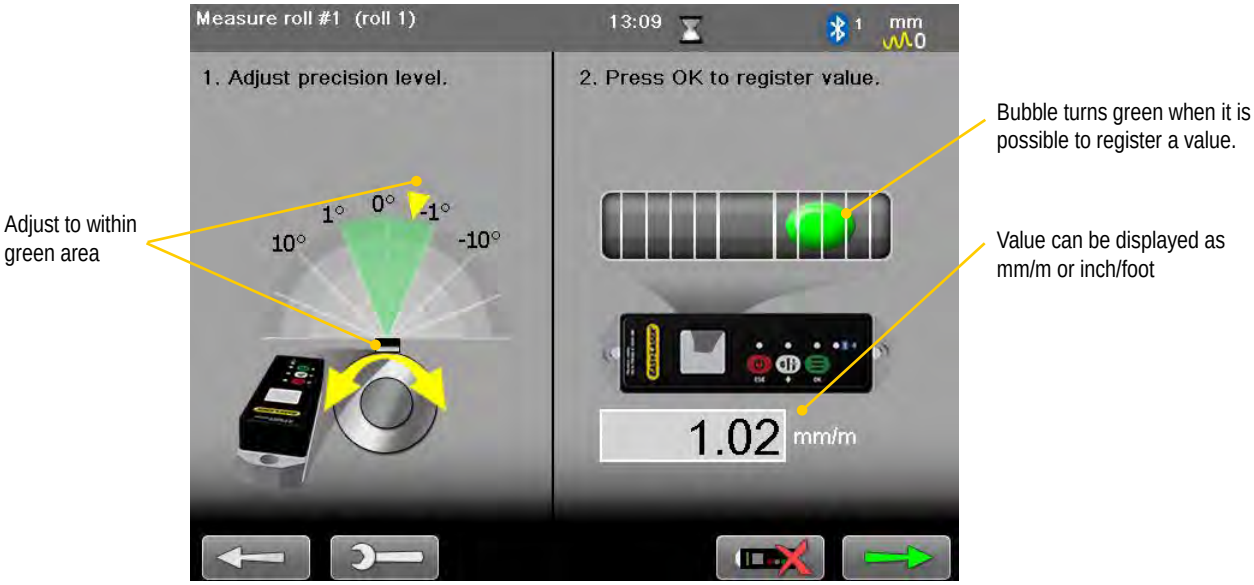
Measure vertical position

The vertical position of the object is measured with the Precision level. For a correct measurement result, it is very important that you place the Precision level in the same direction on all rolls.

1. Adjust the Precision level until the yellow arrow is within the green area.
2. Wait until the value has stabilized (approx. 15 sec.)
3. Press to register measurement value.

Place the Precision level in the same direction on all rolls!

The value is shown as mm/m or inch/foot. When it is not possible to register a value, the bubble turns red and the value is shown in degrees. To change unit, see *"Unit and resolution" on page 16.*



Function buttons

	Back to Distance view.
	Control panel.
	Skip measuring with the Precision level for **all rolls**. It is possible to turn it back on again from the result view.
	Continue. Skip measuring with the Precision level for **this roll**.

Skip Precision level

It is possible to skip measuring with the Precision level. When you do, you will not have a vertical value in the result view.

Note!

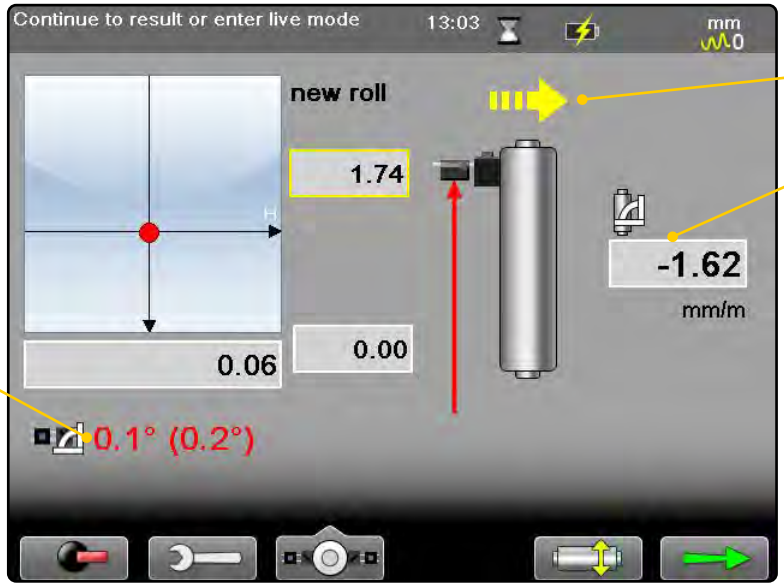
If you use cables to your detectors, remove the cable from the Display unit before measuring using the Precision level.

Measure horizontal position

The horizontal position of the object is measured with the detector.

1. Place the detector on the roll. The Display unit will recognize how the detector is placed. If you want to change it, use .
2. Use the navigation buttons to change the active measurement position.
3. Angle the laser beam along with the roll. See *“Laser and prism setup” on page 80.*
4. Adjust the laser beam via the prism until you hit the centre of the target.
5. Press to register the first position.
6. Move the detector to the second position.
7. Press to register the second position. The angle of the roll is displayed.
8. Press to go to Result view. Or select to adjust the roll.

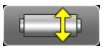
From the result view, select and to add a new roll.

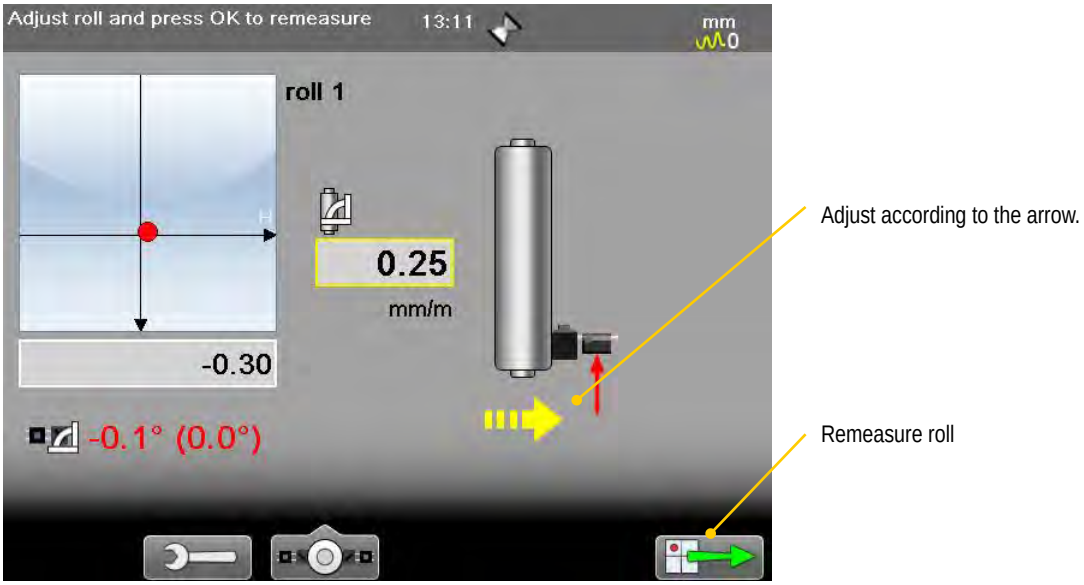


Function buttons

	Remove latest registered measurement point.
	Control panel.
	Automatic recognition, the Display unit recognizes how the detector is placed. The detector is placed on the right side. The detector is placed on the left side.
	Go to live adjustment view. See *“Adjust roll live” on page 86.*
	Forward to Result view.
	Forward from Adjust view. When you have adjusted a roll, you need to remeasure the roll.

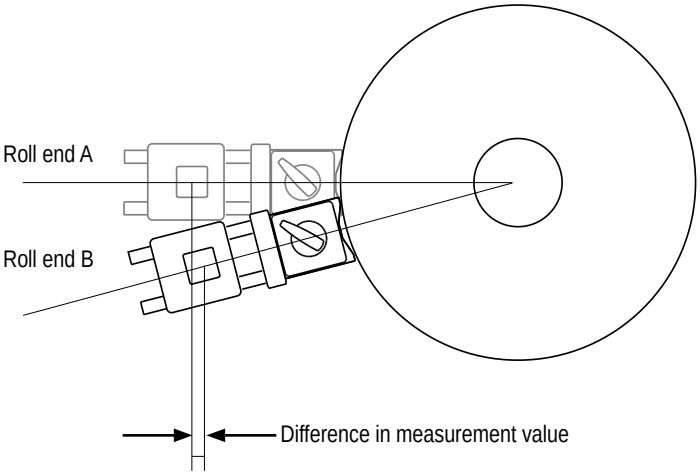
Adjust roll live

1. From the Measure view, select  to adjust the roll live.
2. Adjust the roll according to the arrow.
3. Press  to continue. The Measuring view is displayed and you are prompted to remeasure the adjusted roll before you can continue.



Detector angle

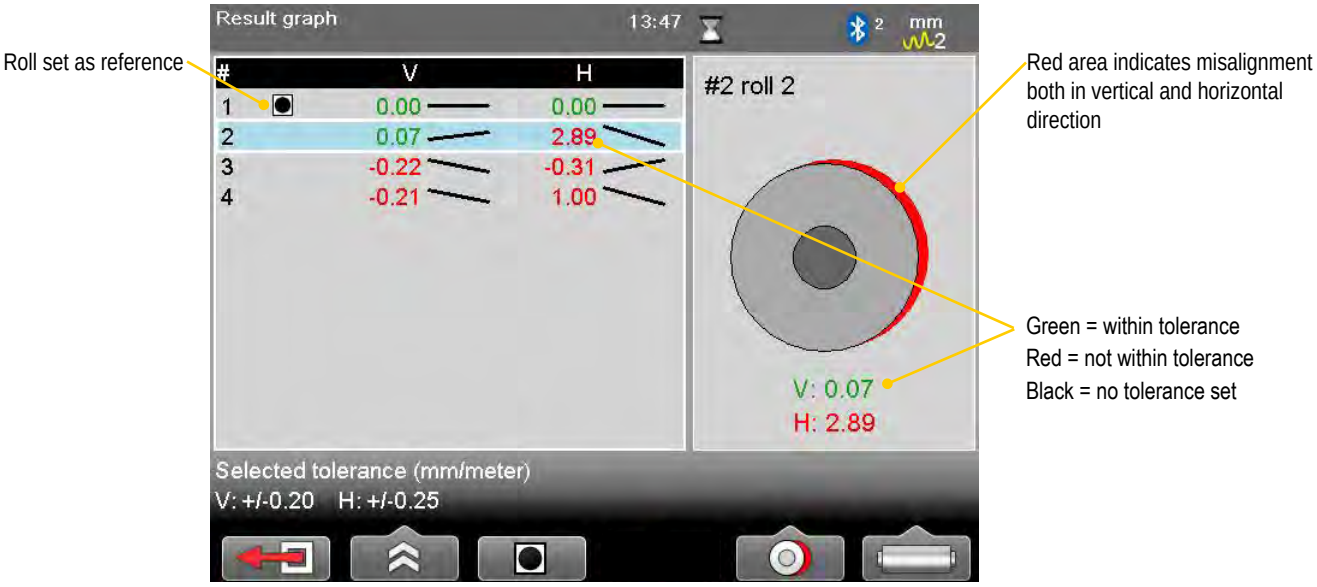
The position of the detector affects the measurement value when measuring parallelism. Therefore it is important to place the detector at the same angle at measurement position 1 and 2. At a 500 mm radius an angular deviation of 1° will cause a 0.1 mm difference in the measurement value.



Result

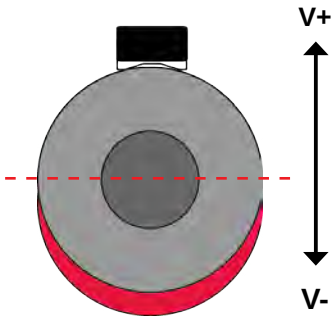
Table view

By default, the table view is displayed.



Vertical

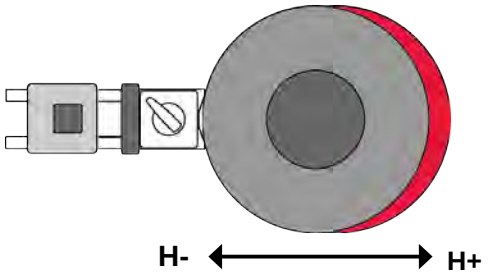
The vertical position is measured with the Precision level.



In this example, the roll has a negative vertical value.

Horizontal

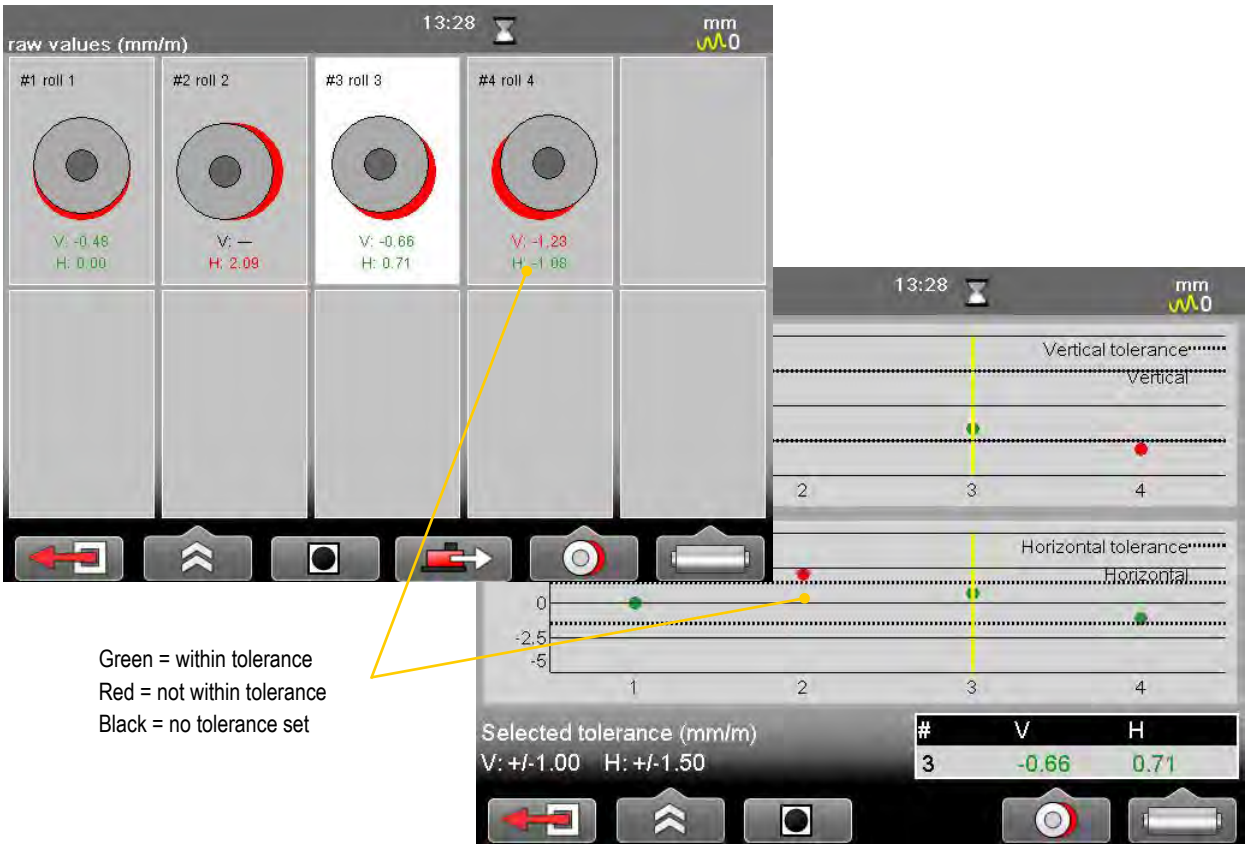
The horizontal position is measured with the Detector. When reading the horizontal value, face the laser transmitter from the roll. Then the value correspond to the measurement program.



In this example, the roll has a positive horizontal value.

Side and Graph view

The Side view and Graph view are great when you want to get an overview of all rolls.



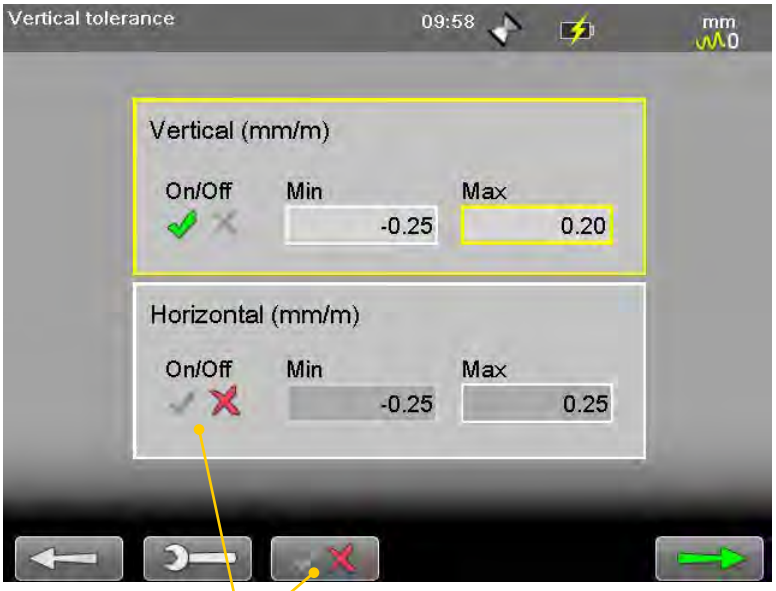
Function buttons

	Leave program.
	Control panel. Measurement file handling. Tolerance. Alter distance and/or name on roll. Turn the Precision level on/off.
	Toggle button. Set selected roll as reference. Or press .
	Show Result table view. Show Result side view. Show Result graph view.
	Add a new roll and measure it. Adjust and/or remeasure selected roll.

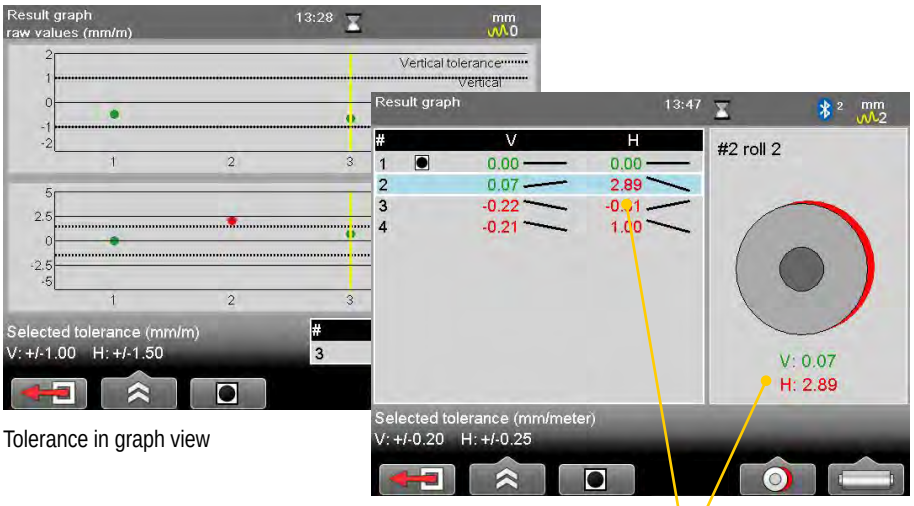
Tolerance

Select  and  to set tolerance.

- The maximum value has to be greater than the minimum value.
- When you use Metric (mm) two decimals is possible
- When you use Imperial (inch/foot), four decimals is possible



It is possible to set tolerance and then deactivate it.
A deactivated tolerance is not used in the measurement.



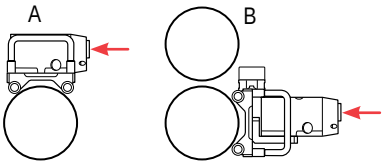
Tolerance in graph view

Tolerance in table view

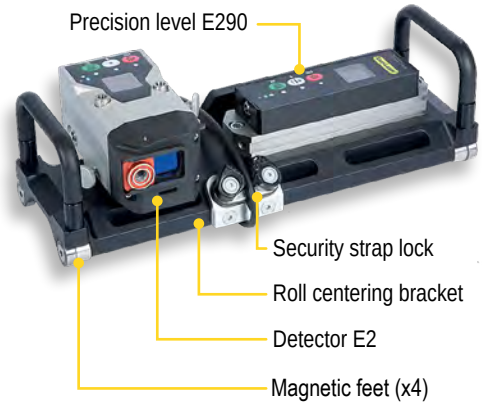
PARALLELISM B

Parallelism B is used for fast replacement and alignment of rolls in, for example, printing presses, paper machines and converting machines. Easy-Laser® E975 offers precision of ±0.02 mm/m (0.001 degree).

First you measure the vertical angle, then the horizontal. Maximum distance between transmitter and detector is 20 metres. The rolls can be mounted at different heights.



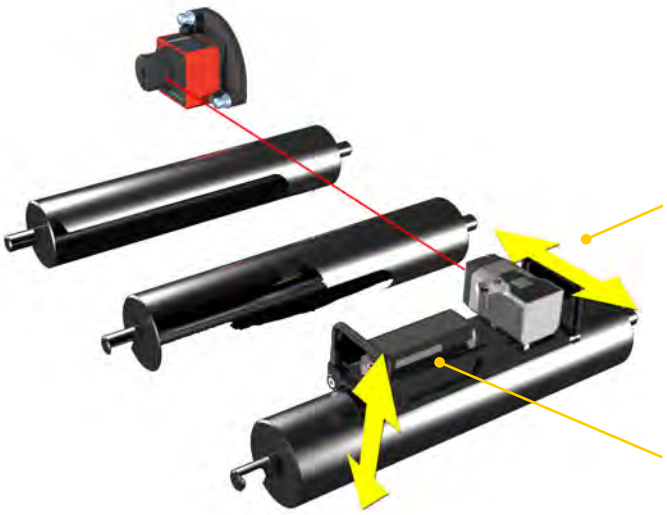
Alternative mounting of units:
A: Top attachment
B: Front attachment. If space on top is limited.



Mount the security strap

1. Unscrew the security strap lock.
2. Place the end of the security strap in the hole.
3. Screw the lock back in place. Make sure that the strap is securely in place.

Before each measurement, make sure that the security strap is undamaged.



Horizontal values

The horizontal value is measured with the Detector E2.

Vertical values

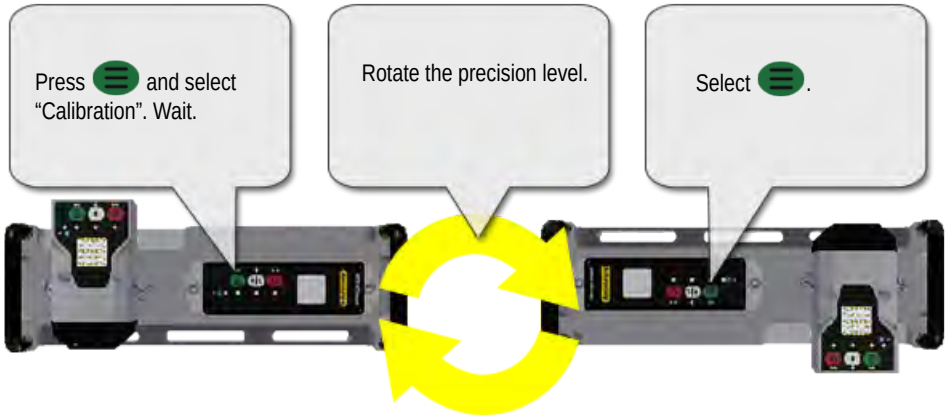
The vertical value is measured with the Precision level.

Preparations

The precision level is used to measure the vertical value. It is possible to skip the Precision level for all or single rolls. When you use it, the Precision level has to be switched on during the whole measurement.

Calibrate the precision level

1. Place the bracket with the Precision level on the reference roll. Make a mark on the roll to ensure that you place it in the same position.
2. Press and select “Calibration”.
3. Wait until the value has stabilized. Press .
4. Rotate the Precision level 180º.
5. Wait until the value has stabilized. Press . The Precision level has been calibrated. The calibration is saved even when the Precision level is switched off.



See also “Technical data > Precision level E290”.

Note!

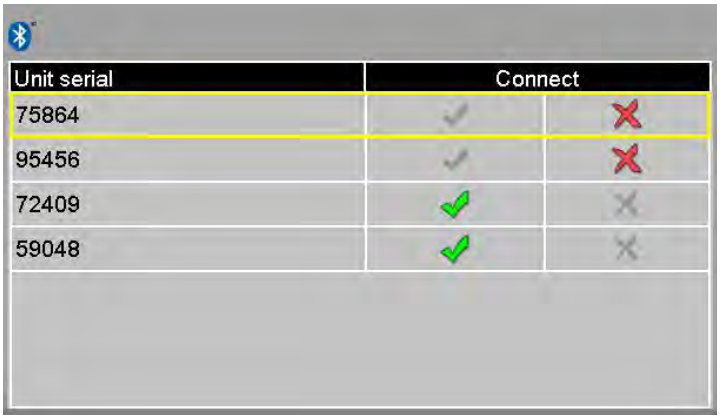
When you use the Precision level, it has to be switched on during the whole measurement.

Set up wireless connection

Make sure that the Precision level is connected to the Display unit.

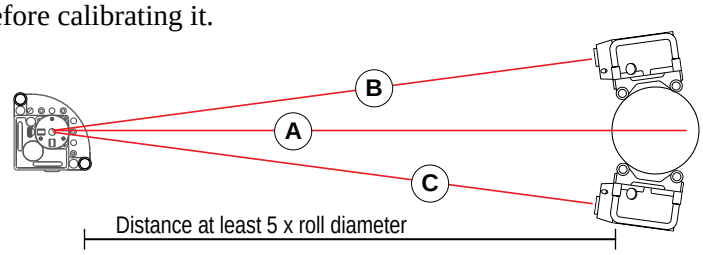
1. Select and to open the Control panel.
2. Select .
3. Select to search for wireless units.

See also *“Set up wireless connection” on page 21*.



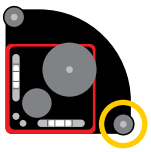
Calibrate E2 detector

The detector is mounted and calibrated on the factory. If you loosen the detector, you need to calibrate it on site. If you have zero set the E2 detector, you must restart it before calibrating it.



1. Place the laser transmitter parallel to the roll (**A**) and level it according to the spirit level. The distance between the roll and the laser transmitter should be at least five times the diameter of the roll.
2. Place the bracket with detector on the top of a roll (**B**). The green diode on the detector lights up when the laser beam hits the detector.
3. Level the laser to H value ±1mm/m using the tilting screw.
4. Press and select “Calibration”.
5. Select Horizontal and press to register a value.
6. Place the bracket with detector under the roll (**C**).
7. Press to register a value.
8. Press to accept the offset value.

The detector has been calibrated and the sign **Hc** is shown in the display. The calibration is saved even when the detector is switched off.

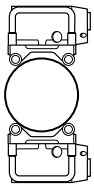


Level the laser transmitter

Press and select “Calibration”.

Check calibration

You can easily check the calibration. Place the detector on the top of a roll. Note the value. Place the detector under the roll and read the value. If the value is for example 0.22 on the top, a calibrated detector will then display -0.22 (± 0.05mm) on the bottom.



Value is: 0.22

The detector is calibrated when the value is within ±0.05mm.

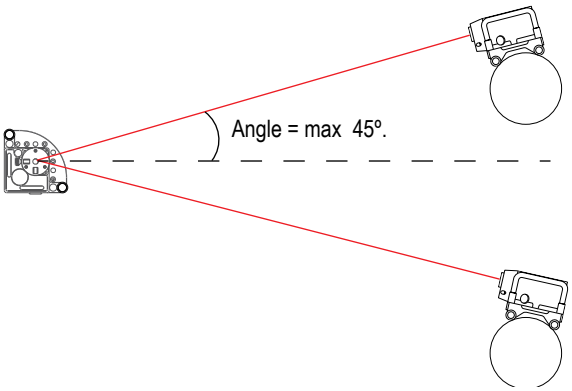
Value is: -0.22

Reset

Press and select “Reset” to return to factory settings.

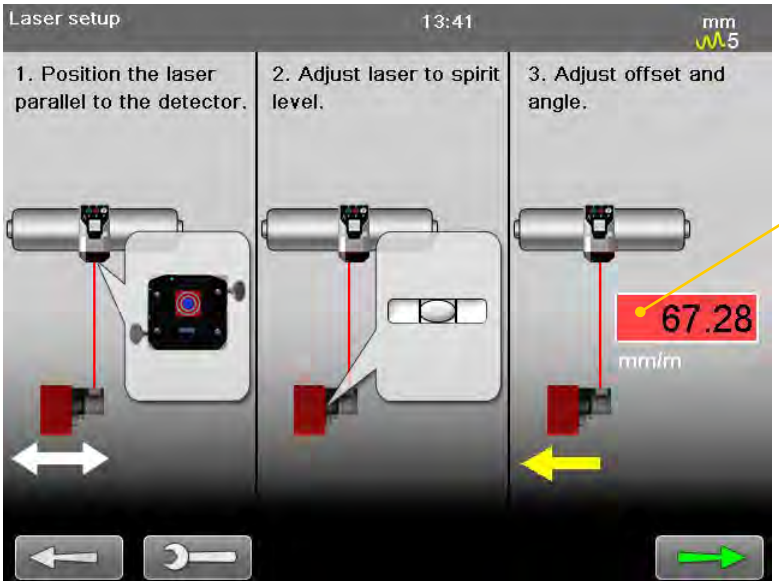
Laser setup

To establish a good reference line, it is important to set up the laser correctly. The green diode on the detector is lit up when the laser beam hits the detector.



The angle between the rolls should be no more than ± 45 degrees, see image.

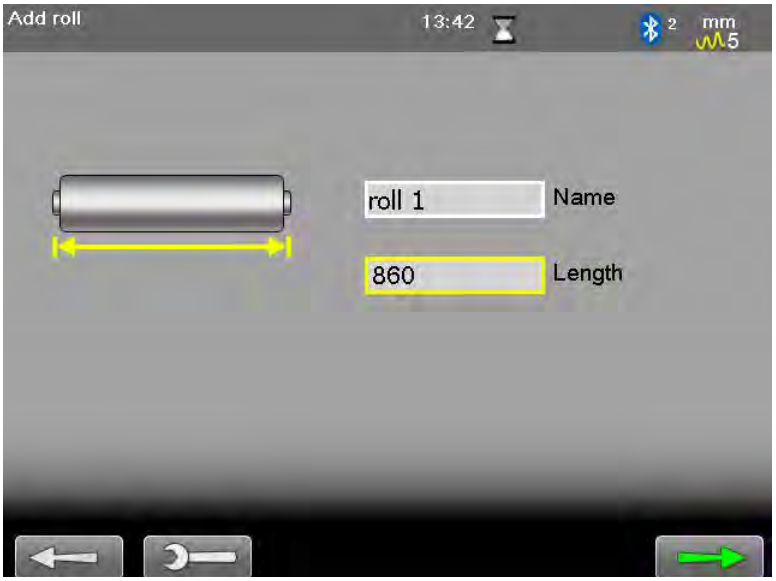
1. Adjust the offset by moving the laser transmitter.
2. Adjust the laser transmitter to spirit level.
3. Adjust the offset and angle. When the value box is green, it is OK to continue.
4. Select to continue.



When the box is green, it is possible to continue.

Enter distances

1. Enter a name or keep the default name.
2. Enter the distance between the adjustment points. It is not mandatory.
3. Press to continue.



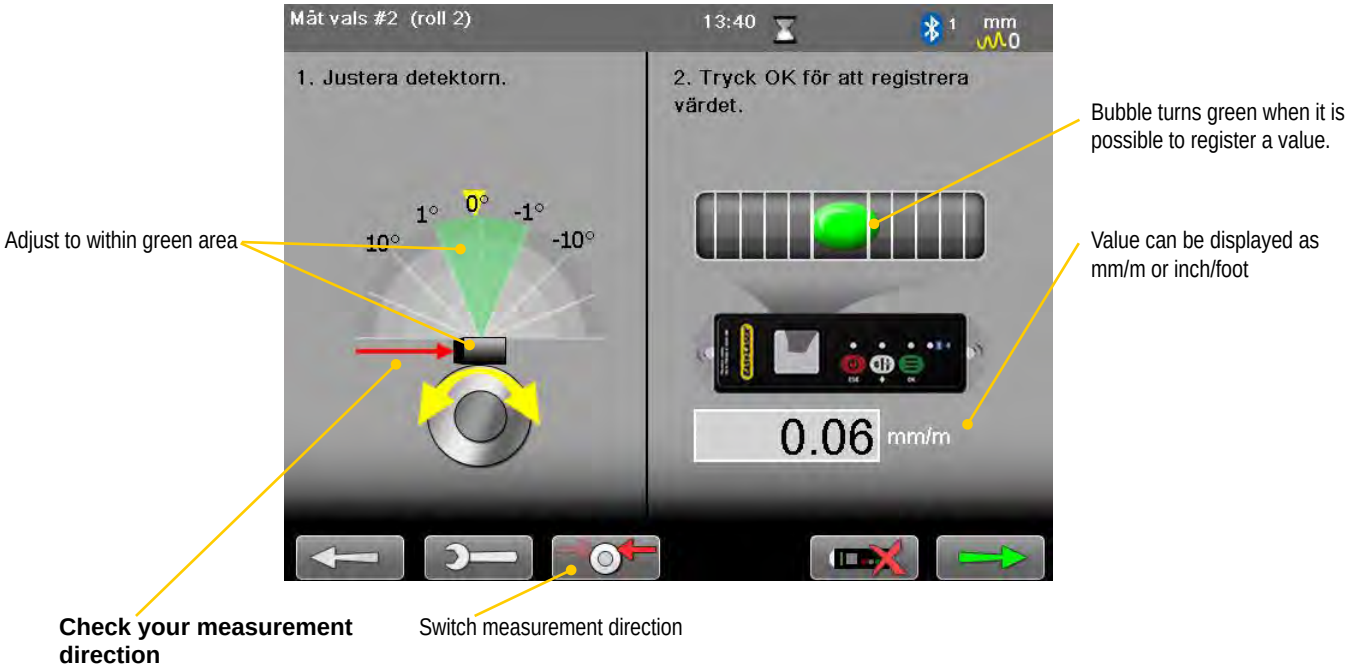
Measure

Measure vertical value

The vertical value is measured with the precision level.

1. Check your measurement direction. Use  to **switch direction** if needed.
2. Adjust the fixture until the yellow arrow is within the green area. See image.
3. Wait until the value has stabilized (approx. 15 sec.)
4. Press  to register measurement value.

The value is shown as mm/m or inch/foot. When it is not possible to register a value, the bubble turns red and the value is shown in degrees. To change unit, see *"Unit and resolution" on page 16.*



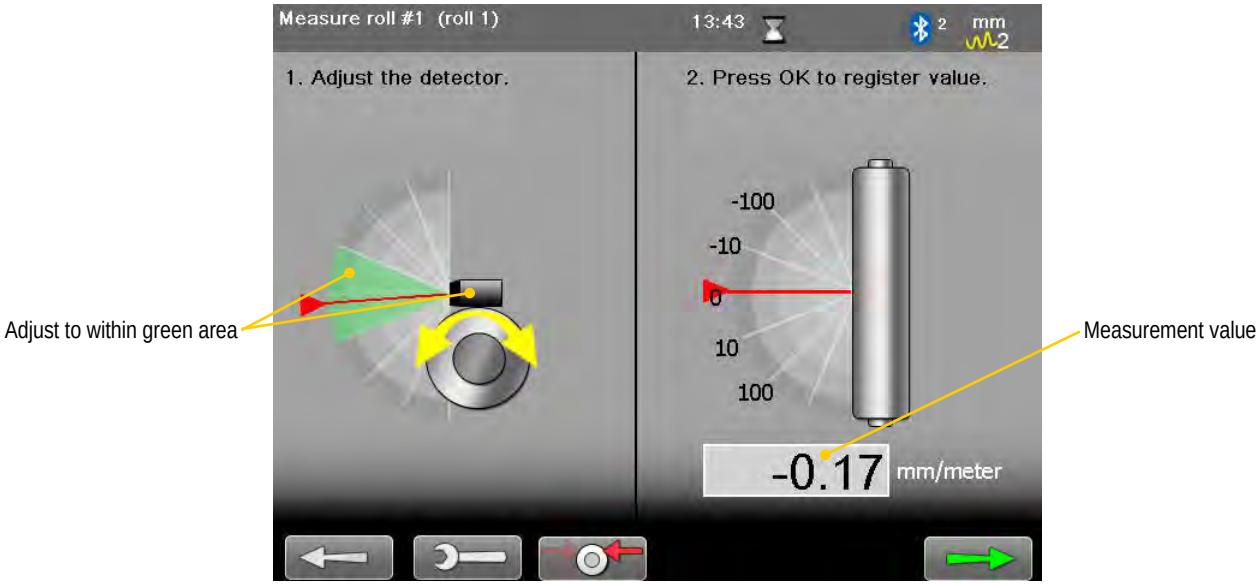
Function buttons

	Back to Distance view.
	Control panel.
	See *"Switch measurement direction" on page 96.*
	Skip measuring with the Precision level for **all rolls**. It is possible to turn it back on again from the result view. Use with care, the value from the level is used to calculate the horizontal value.
	Select to continue without measuring **this roll** using the Precision level.

Measure horizontal value

The horizontal value is measured with the E2 detector.

1. Adjust the bracket/roll until the laser beam hits the detector. You need to be within the green area to measure.
2. Press to register measurement value. The result view is displayed.



Switch measurement direction

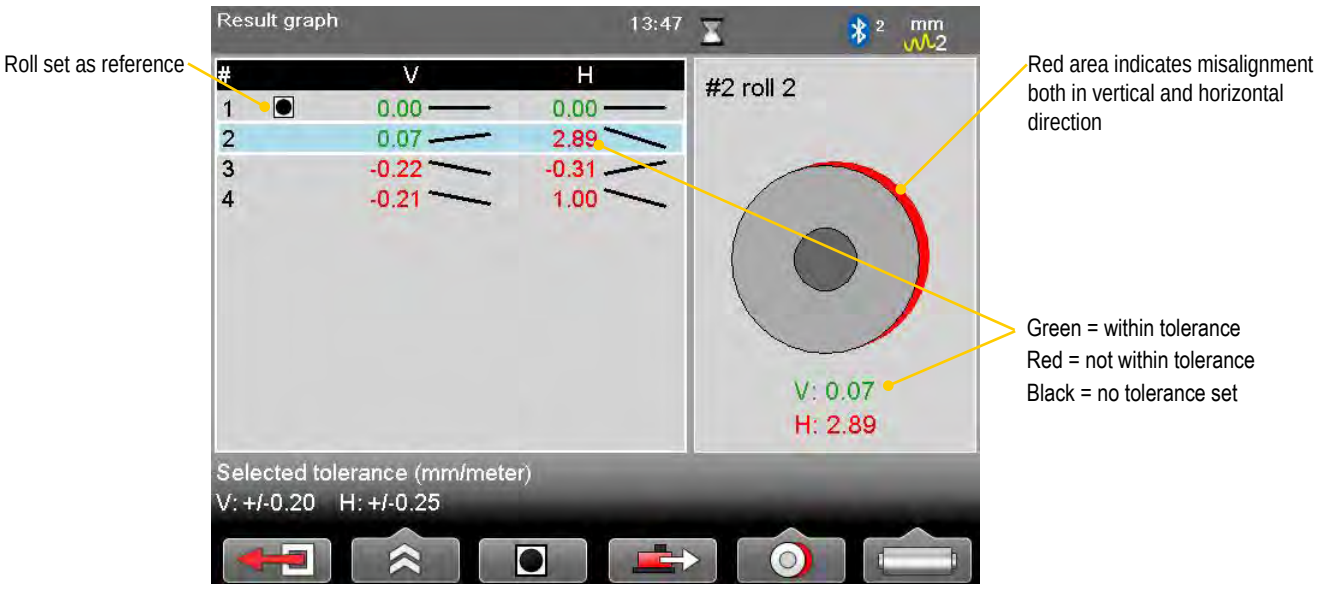
It is possible to switch measurement direction. To ensure an accurate measurement when you switch direction, it is important that the precision level has been indexed. See *"Calibrate the precision level" on page 92*.

Select  to switch direction.

Result

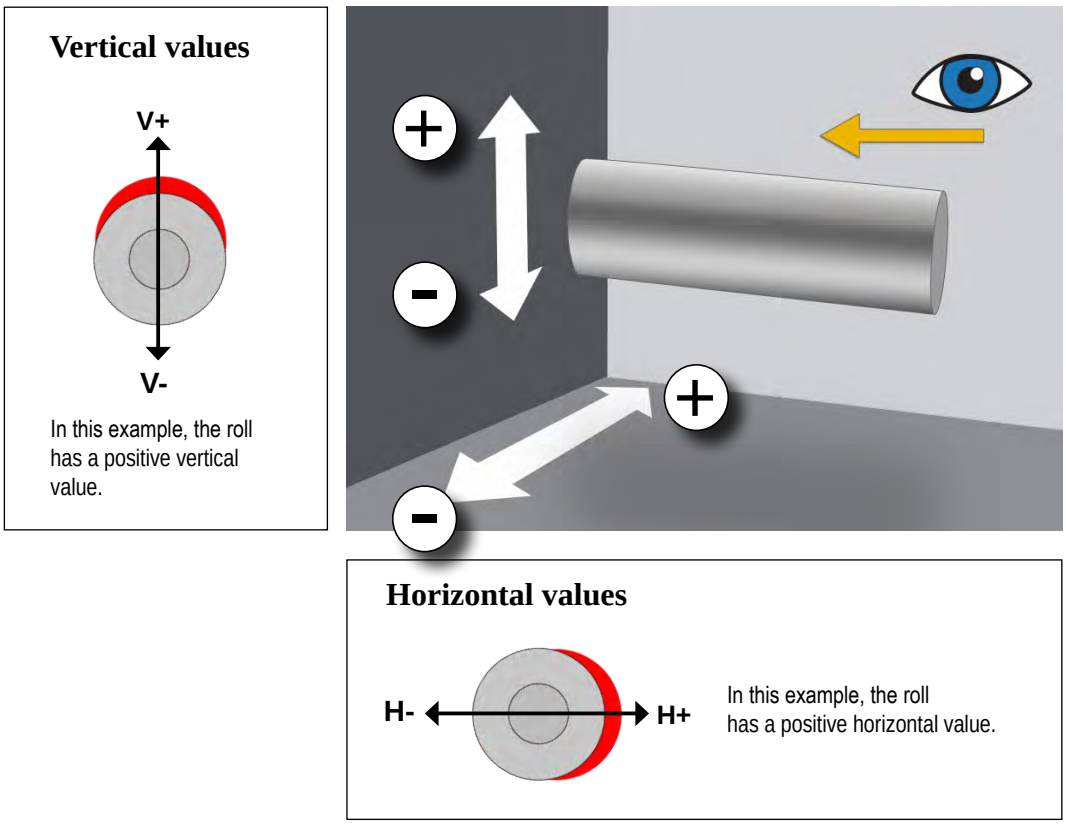
Table view

By default, the table view is displayed.



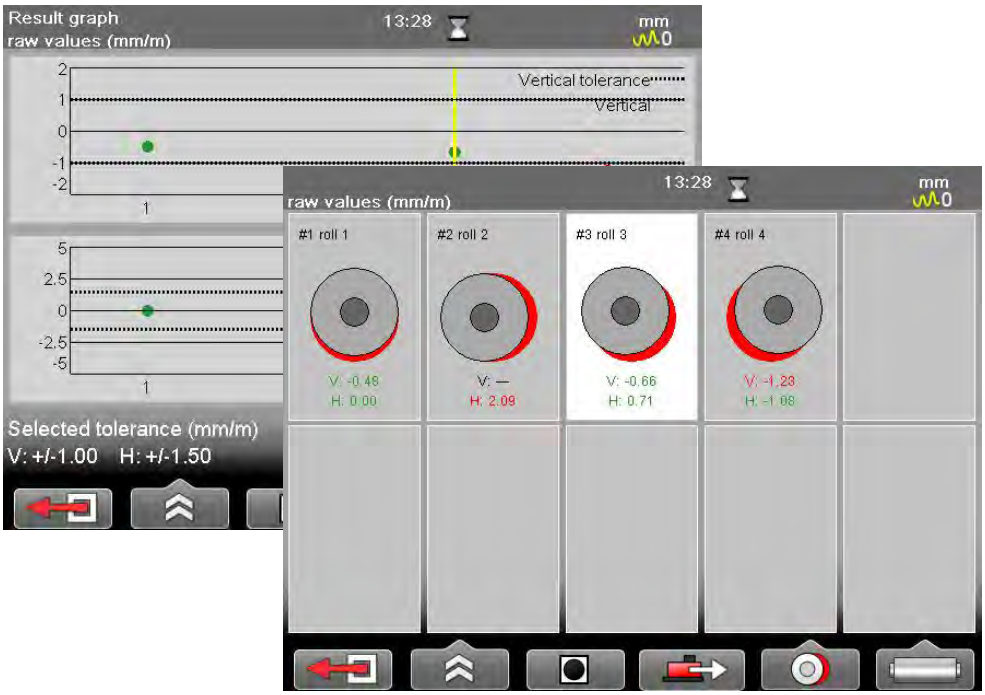
Reading the values

When reading the values, face the roll as shown below. Then the value corresponds to the measurement program.

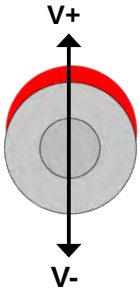


Side and Graph view

The Side view and Graph view are great when you want to get an overview of all rolls.

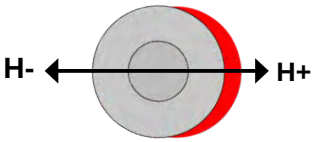


Vertical



In this example, the roll has a positive vertical value.

Horizontal



In this example, the roll has a positive horizontal value.

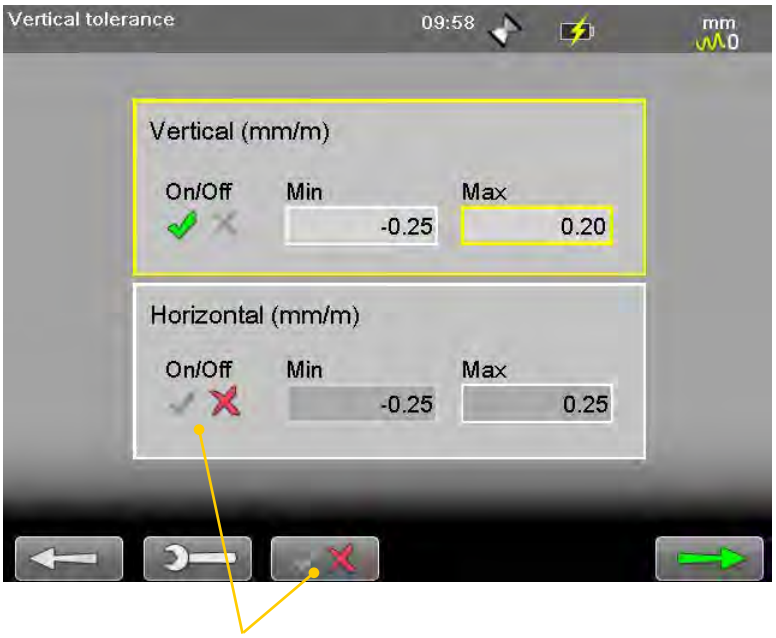
Function buttons

	Leave program. To remeasure roll, use and
	Control panel. Measurement file handling. Tolerance. Alter distance and/or name on roll. Turn the Precision level on/off.
	Set selected roll as reference. Or press
	See *“Move laser” on page 100.*
	Show Result table view. Show Result side view. Show Result graph view.
	Add a new roll and measure it. Adjust or remeasure selected roll.

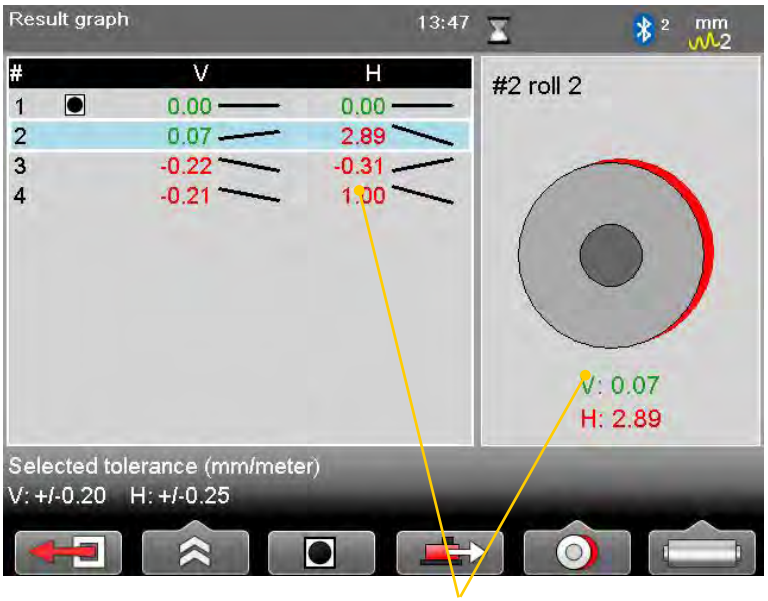
Tolerance

Select  and  to set tolerance.

- The maximum value has to be greater than the minimum value.
- When you use Metric (mm) two decimals are possible
- When you use Imperial (inch/foot), four decimals are possible



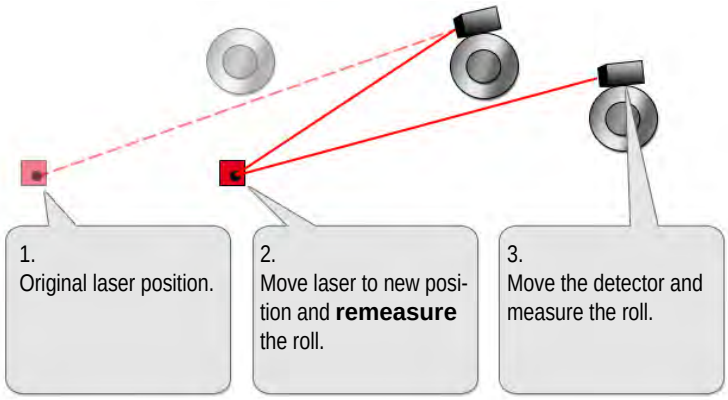
It is possible to set tolerance and then deactive it.
A deactivated tolerance is not used in the measurement.



Tolerance in table view

Move laser

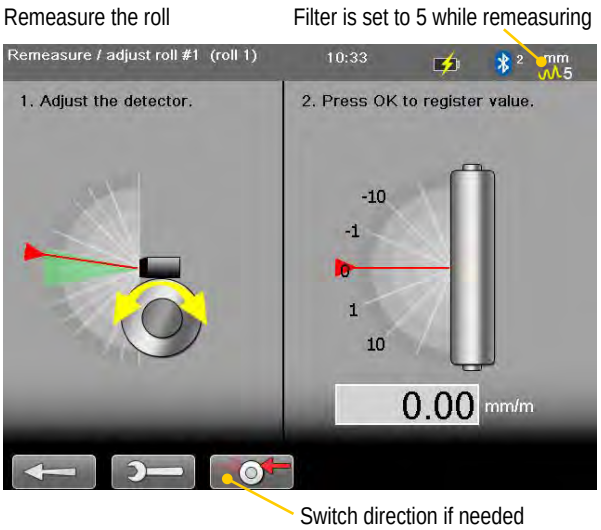
From the Result view, it is possible to select Move laser. You need to remeasure the roll after the move.



1. Select . An information view is displayed. If the roll was measured with a filter lower than 5, a warning is displayed.
2. Select to continue.
3. Move the laser to the new position. Do not move the detector yet!
4. Remeasure the roll. If needed, select to switch direction.
   See *"Switch measurement direction" on page 96.*
5. Select and to add a new roll.
6. Move the detector and measure the new roll.

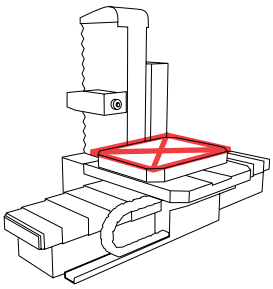
Filter

- If the roll was measured with a filter lower than 5, a warning is displayed when you select Move laser. You can choose to remeasure with a higher filter, or continue anyway.
- When you remeasure a roll after a move, the detector filter is set to 5 if a lower filter has been set. This is to ensure an accurate result.
- After the move, the filter is restored to the previous setting.



FLATNESS

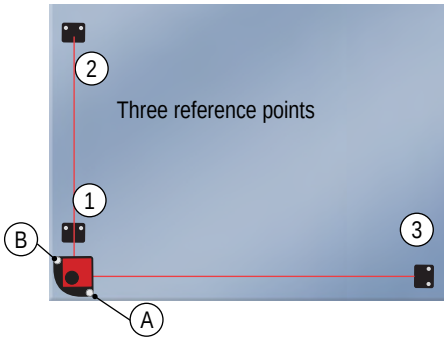
Program to measure flatness of machine bases, machine tables, etc.



Preparation

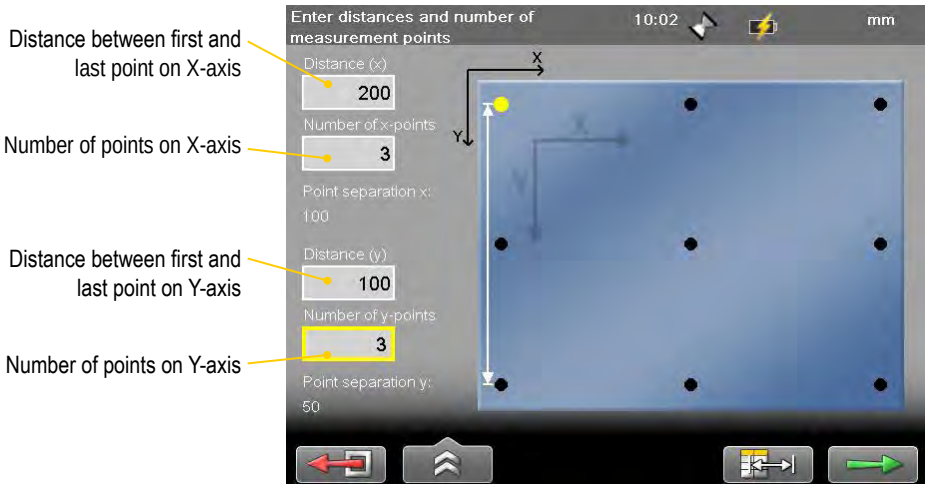
1. Mount the laser transmitter on the table.
2. Mount the detector close to the transmitter on the table (**1**).
3. Select  to open the program Flatness and enter distances.
4. Select  to open the target.
5. Select  to zero set the value. This is now reference point number one.
6. Move the detector 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

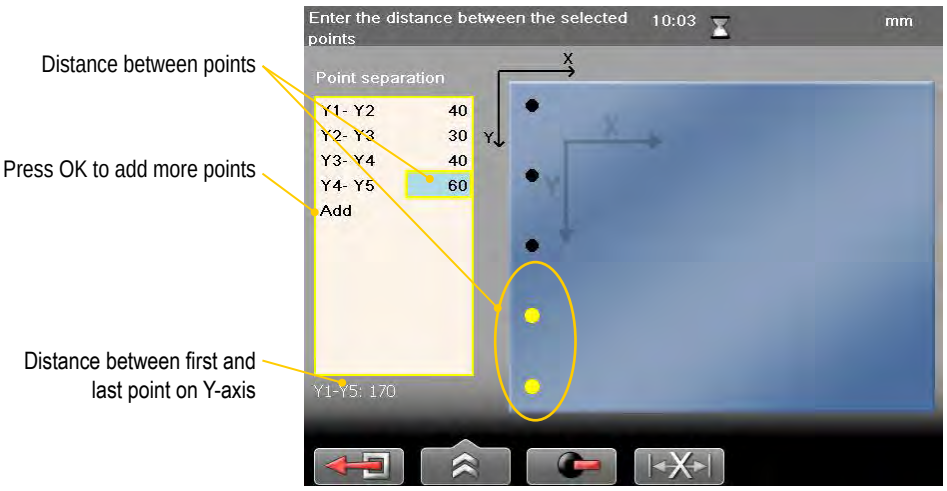
	**Back**. Leave program.
	 *See "Control panel" on page 15.*  *See "Tolerance" on page 103.*  **Show target**.
	Open distance table view. *"Distance table view" on page 102.*
	Continue to Measure view.

Note!

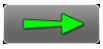
If one of your axis has more than six measurement points, make that the Y-axis. This will give you a better pdf-report.

Distance table view

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

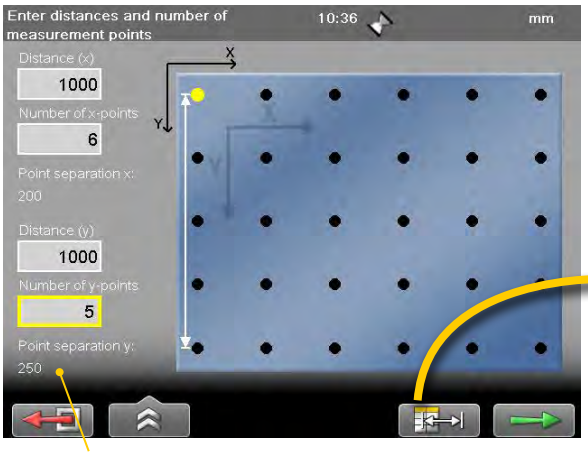


Function buttons

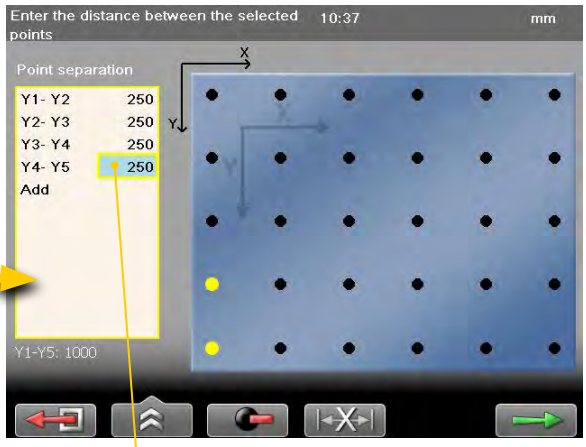
	Leave Distance table view and return to Distance view. No changes are saved.
	 *See "Control panel" on page 15.*  *See "Tolerance" on page 103.*
	Delete point. It is only possible to delete the last point in the list.
 	Toggle button. Enter distances for X or Y-axis.
	Continue to Measure view.

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



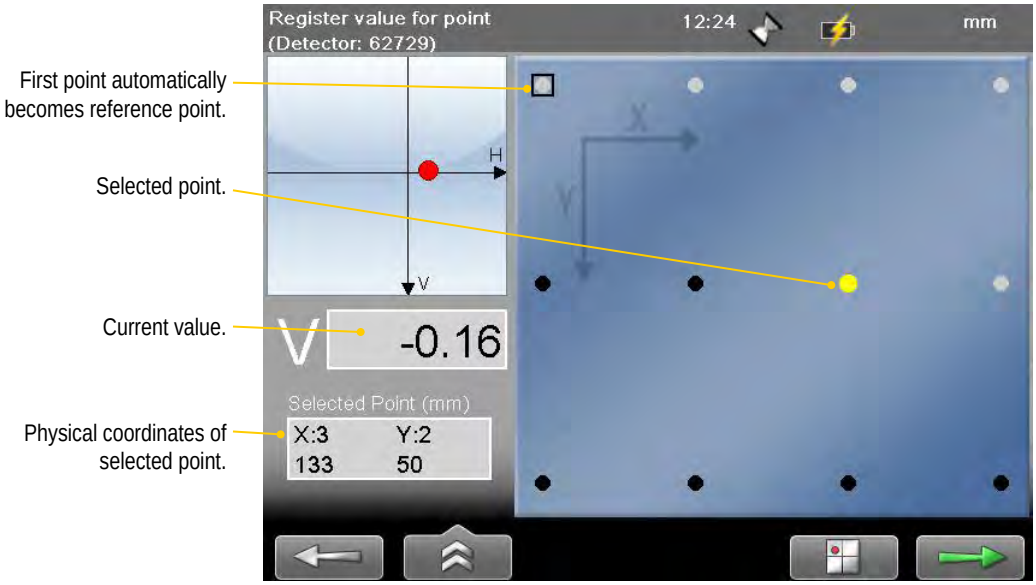
Distance table view
Change point separation if needed

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.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.



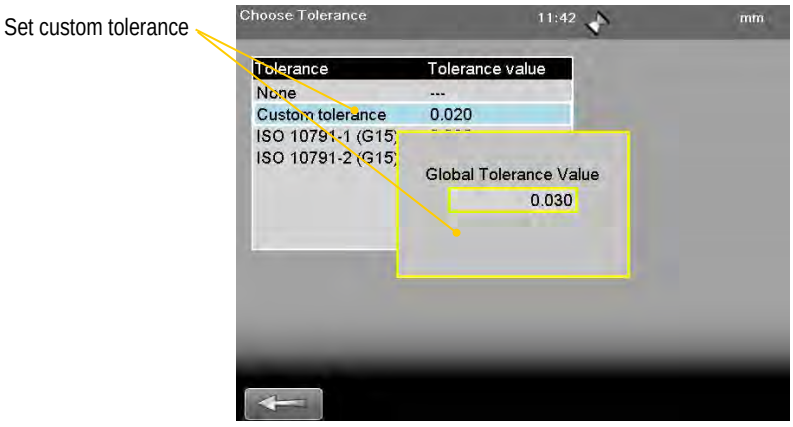
Function buttons

	Back. Return to enter distances.
	See "Control panel" on page 15. *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

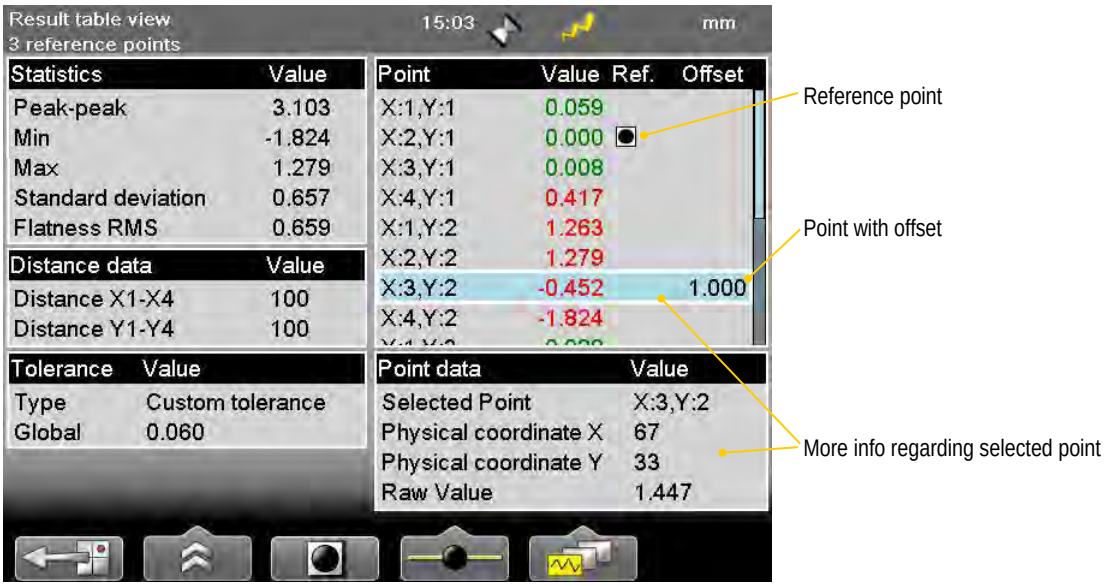
By default, the ISO standard is used. The ISO tolerance is calculated automatically depending on which distances you have entered. Only global tolerance is available.

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 15.*  Set offset for selected point.  *See "Tolerance" on page 103.*  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 106.*  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 105.*  See *"Result grid" on page 105.*  See *"Result table" on page 104.*

Note!

To remeasure: select a measurement point and select  .

Result grid

Select to open table view.

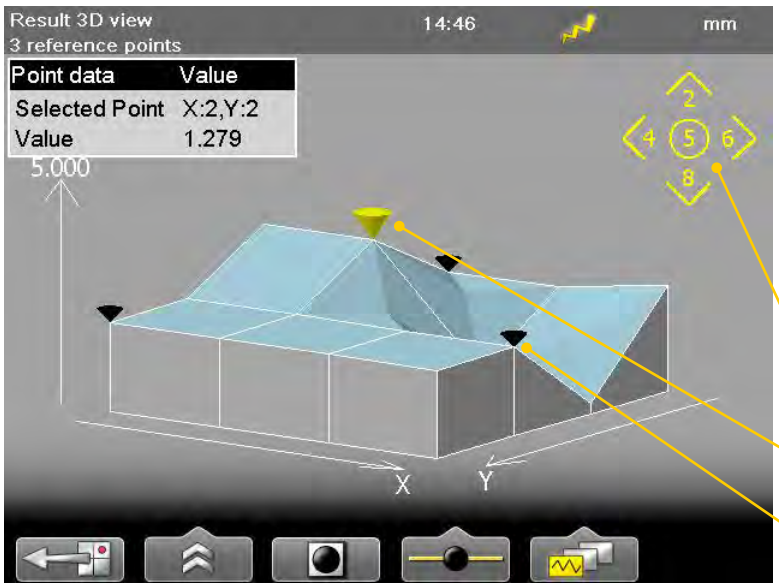
Red = values not within tolerance
Green = values within tolerance

Reference point

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.

Yellow = selected point

Black = reference point

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

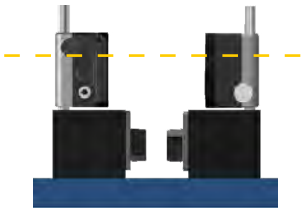
The measurement object is tilted as in a Best fit calculation, but the reference line is moved to the lowest measurement point. Select  and  to calculate the best fit with all measurement points above 0.

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

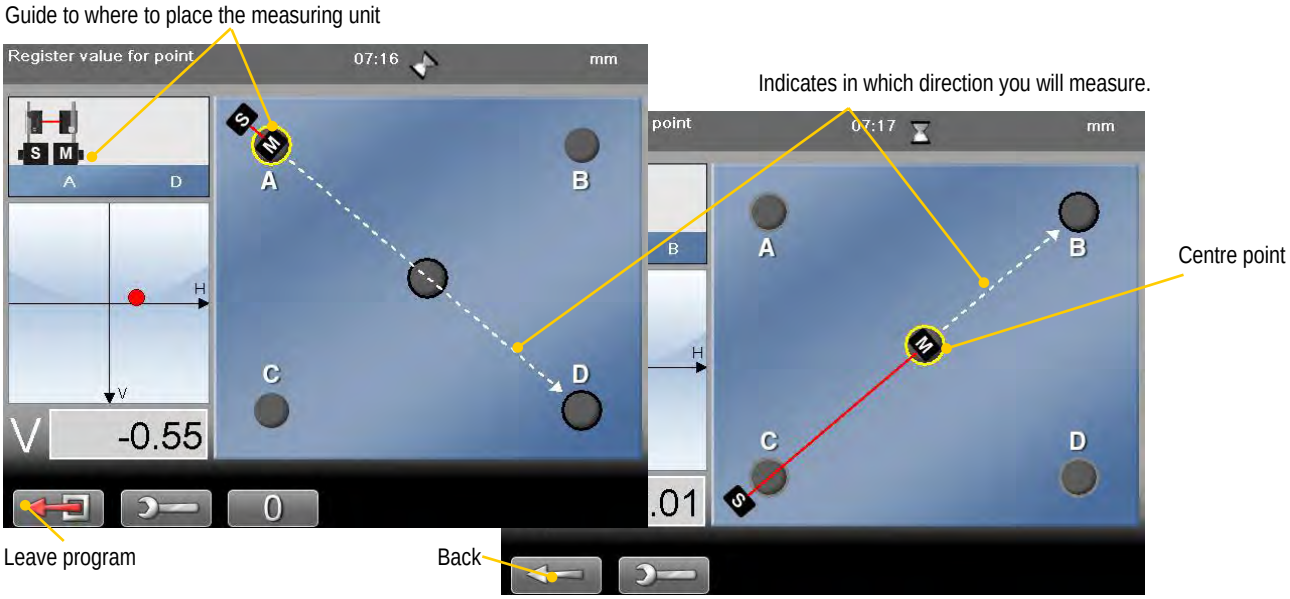
Select  and  to start the program Twist.

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.

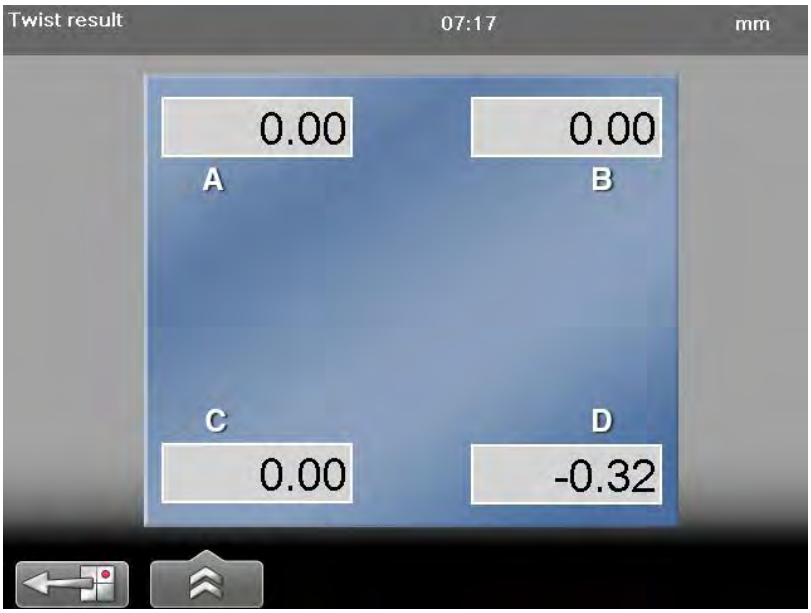


Function buttons

	**Back**. Leave program.
	*See "Control panel" on page 15.*
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.

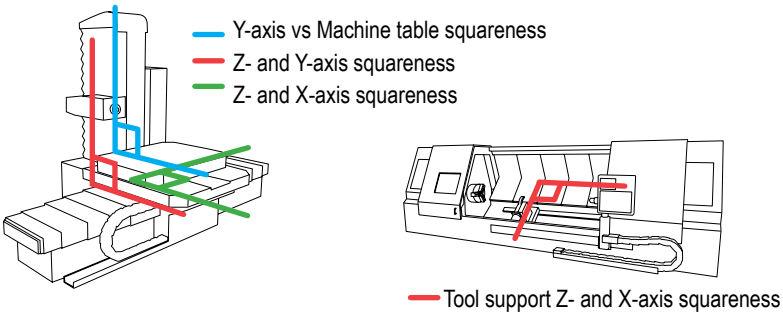


Function buttons

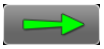
	Remeasure.
	Save file, *“Measurement file handling” on page 11.* *See “Control panel” on page 15.*

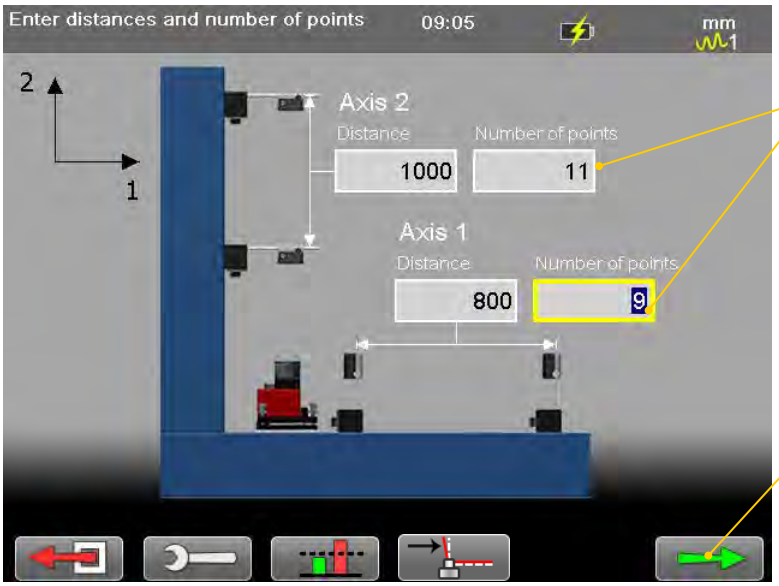
SQUARENESS

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



Enter distances

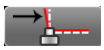
1. Enter the distance between the first and last measurement point.
2. Enter a number of measurement points, or leave the default number (2).
3. Select  to continue to Measure view.



The default number of measurement points is two.

Continue

Function buttons

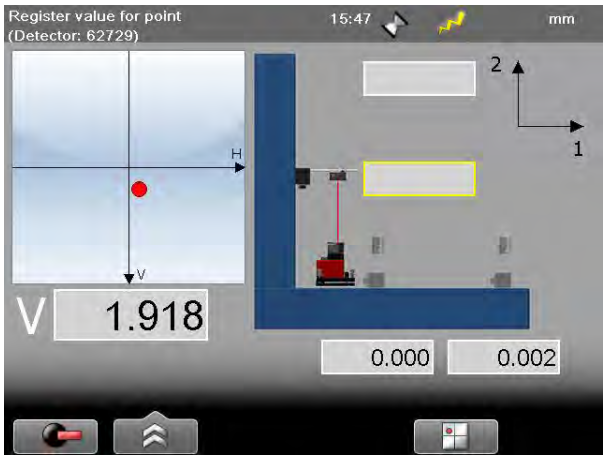
	**Back**. Leave program.
	*See “Control panel” on page 15.*
	*See “Tolerance” on page 112.*
	Squareness Compensation Value
	Continue to Measure view. Available when you have entered the distances.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

Measure two points/axis

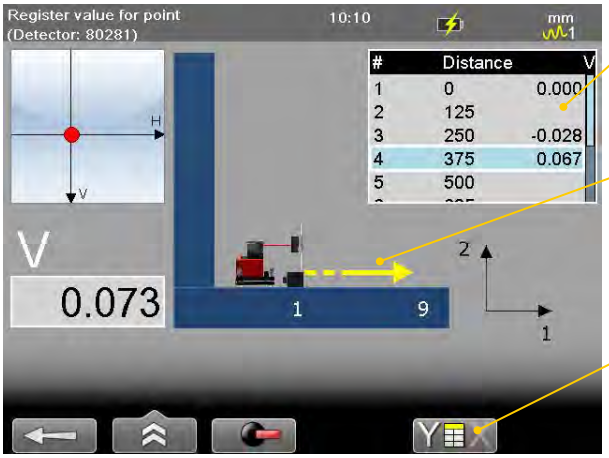
1. Place the detector on the X- or Y-axis. Use the navigation buttons to change the active measurement point.
2. Measure both points on the first axis. Press to register.
3. Move the detector to the second axis and deflect the laser beam.
4. Measure both points on the second axis. The result is automatically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



Measure using multipoint

If you enter more than two measurement points, a table is displayed on the Measure view.

1. Place the detector on the X- or Y-axis. Select to switch axis.
2. Select if you wish to start the measurement far away from the laser.
3. Press to register points. Use the navigation buttons to skip points.
4. Select to continue to Result view.



Point that has not been measured.
You can not skip the first point.

Measurement direction

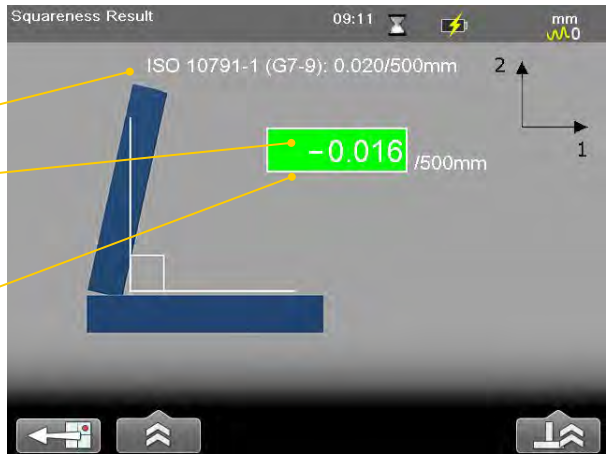
Measure X or Y axis.

Function buttons

	Back. Leave program.
	See "Control panel" on page 15. *See "Tolerance" on page 112.* Squareness Compensation Value. Show target. Useful if you want to rough align for example.
	Delete measurement point.
	Only for multipoint Toggle button. Start the measurement close to, or far from, the laser transmitter. Only available before you have registered the first position.
	Only for multipoint Toggle between measuring the X or Y axis.
	Continue to Result view.

Result

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



Selected tolerance

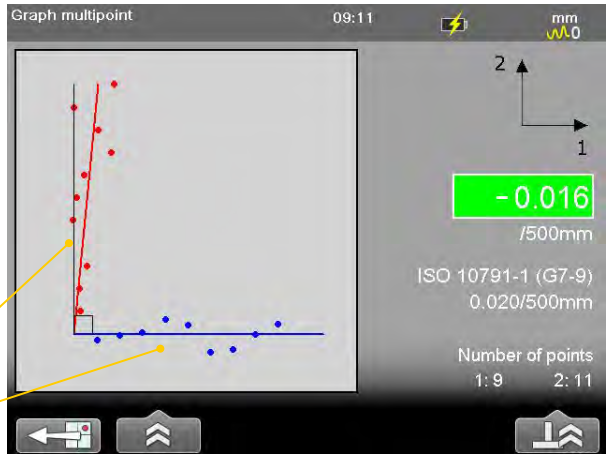
Angles smaller than 90° are shown as negative

Green = within tolerance
Red = not within tolerance

Result Multipoint graph

Select  and  .

- A reference line is fitted to the measured points on each axis, by means of a least squares optimization.
- Common length scale of both axis.
- Common point spread scale of both axis.



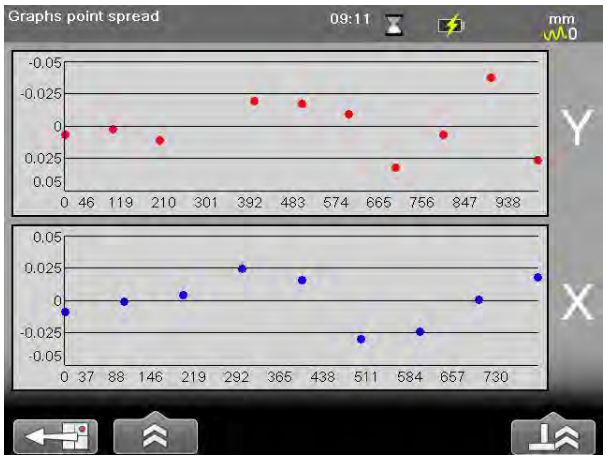
Red (Y-axis) = the inclination shows the direction of the angular error.

Blue (X-axis) = the reference axis.

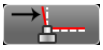
Result Multipoint spread

Select  and  .

- Shows the spread of the measurement points for each axis.
- The spread is shown around the calculated (least square) reference line.

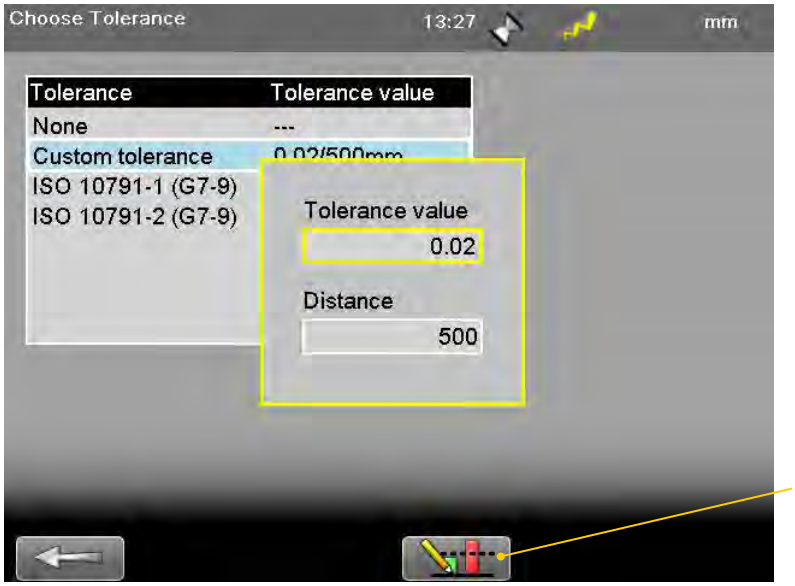


Function buttons

	Remeasure.
	 *See "Control panel" on page 15.*  Alter distance.  *See "Tolerance" on page 112.*  Squareness Compensation Value.  Save file, see *"Measurement file handling" on page 11.*

Tolerance

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

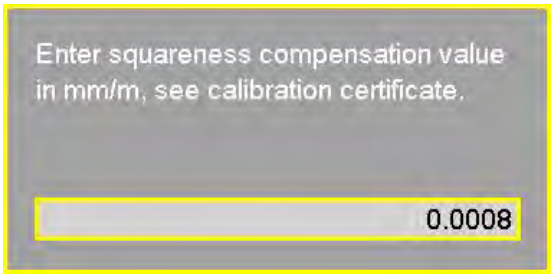


Select to set Custom tolerance

Squareness Compensation Value

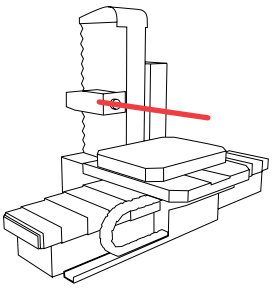
Squareness compensation value is used to compensate for the incorrectness of the laser. Note that the compensation value is only used on the D26 laser.

1. Select  to open Squareness compensation value view.
2. Type the Squareness compensation value and press  . This value is different for every laser transmitter and specified in the calibration certificate that is delivered with the laser transmitter. The unit is always in mm/m and will be automaticly recalculated when an other measuring unit is used.
3. If you do not have a Squareness compensation value you can leave this box empty and still get a good result on your measurement.

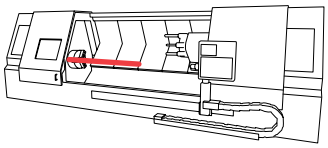


SPINDLE DIRECTION

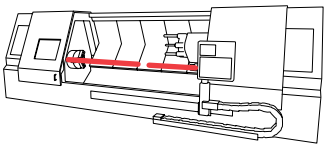
For measurement of the pointing direction of machine spindles in machine tools, drilling machines, etc.



Z-axis spindle direction



Z-axis spindle direction



Main spindle towards sub-spindle/tail stock

Note!

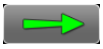
Do not start the machine when the S-unit is attached.

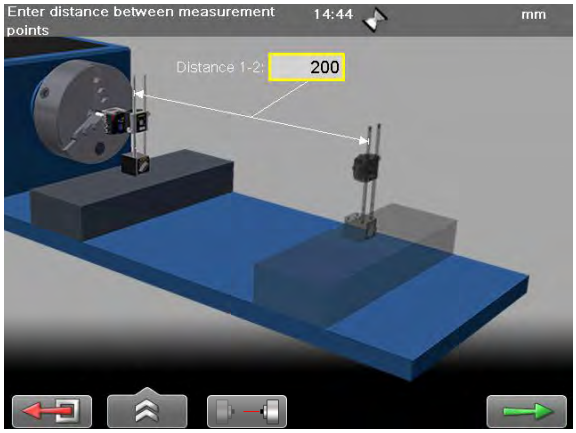
Mount the units

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.

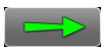
Enter distances

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 15.*  *See "Tolerance" on page 114.*
	Toggle button. Show spindle to the right or to the left.
	Continue to Measure view.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

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.

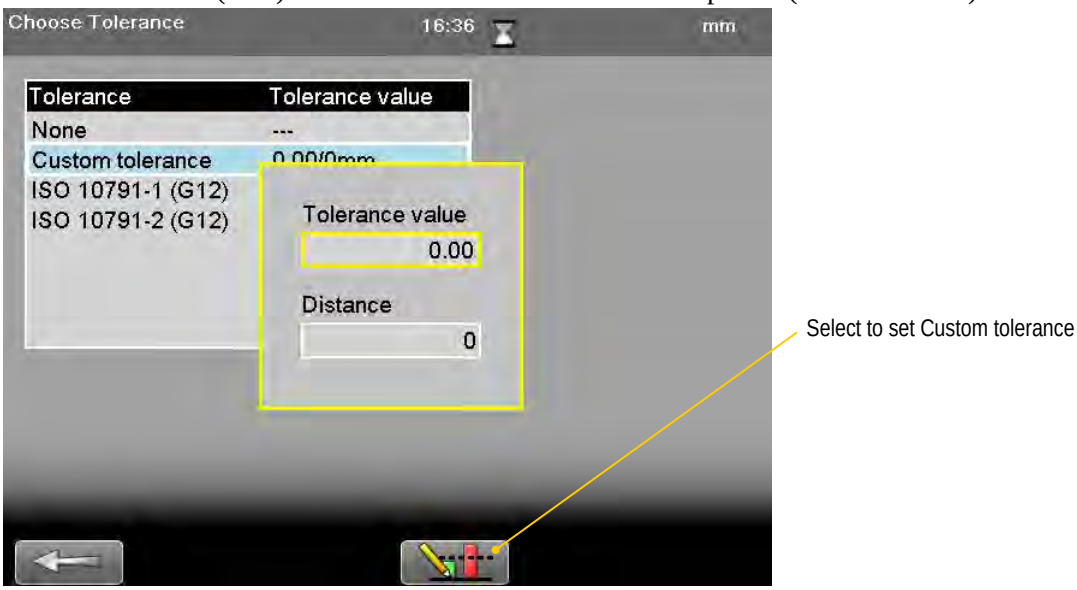
Cone laser beam

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.

Turn the spindle 180º.

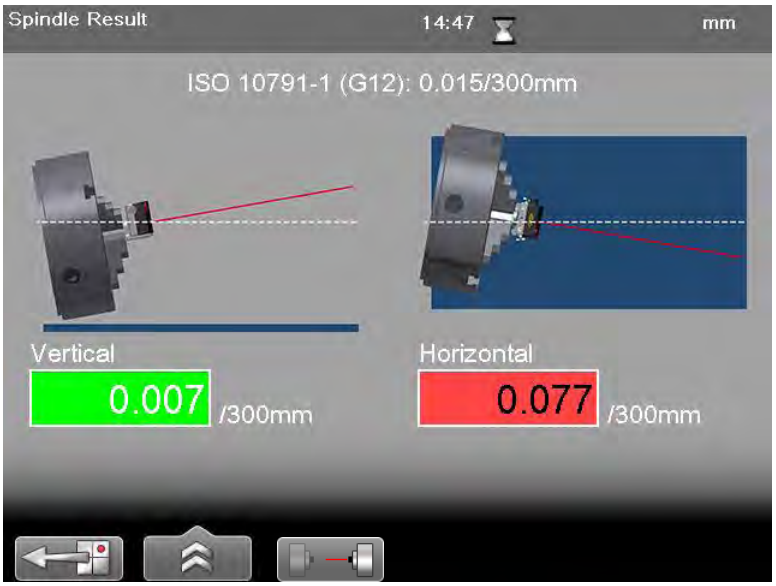
Angle value on the S-unit. Helpful when you turn the spindle 180º.

Function buttons

	Back to enter distance view.
	Delete measurement point.
	See "Control panel" on page 15. *See "Tolerance" on page 114.*
	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.

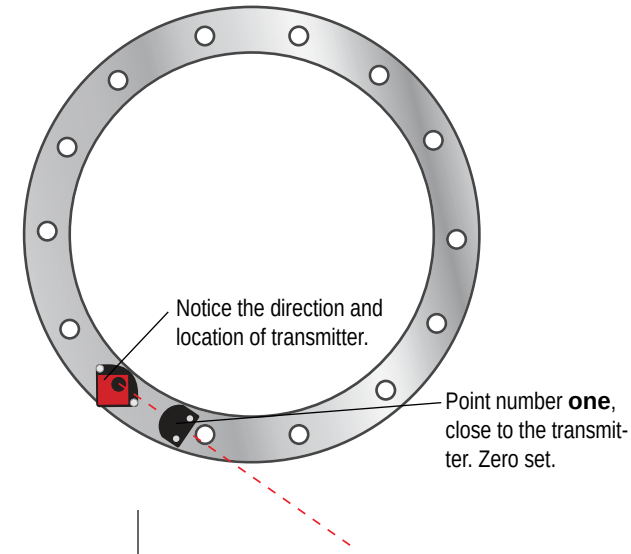


Function buttons

	Remeasure.
	See "Control panel" on page 15. Alter distance. *See "Tolerance" on page 114.* Save file, see *"Measurement file handling" on page 11.*
	Toggle button. Show spindle to the right or to the left.

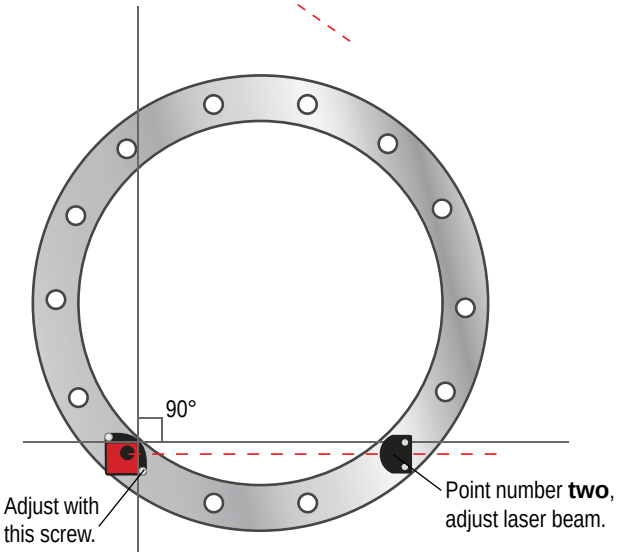
Preparations

- Ensure a good measurement environment. Strong sunlight, warning lights, vibrations and temperature gradients can affect the readings.
- Make sure the surface is clean.
- Use the program Values, Flange flatness or targets for the set up. The tighter the tolerances you require, the more important is an accurate set up and levelling.
- Fasten the laser transmitter using the safety strap. See *"Safety strap" on page 223.*



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 until the laser beam hits the centre.
5. If you use a measurement program, select 0 to zero set point number one.

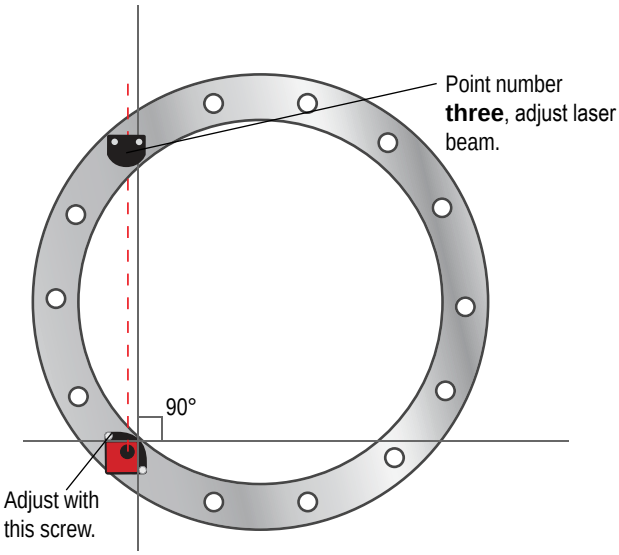


Point two

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

Point three

8. Move the detector to point number three, see image.
9. 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.

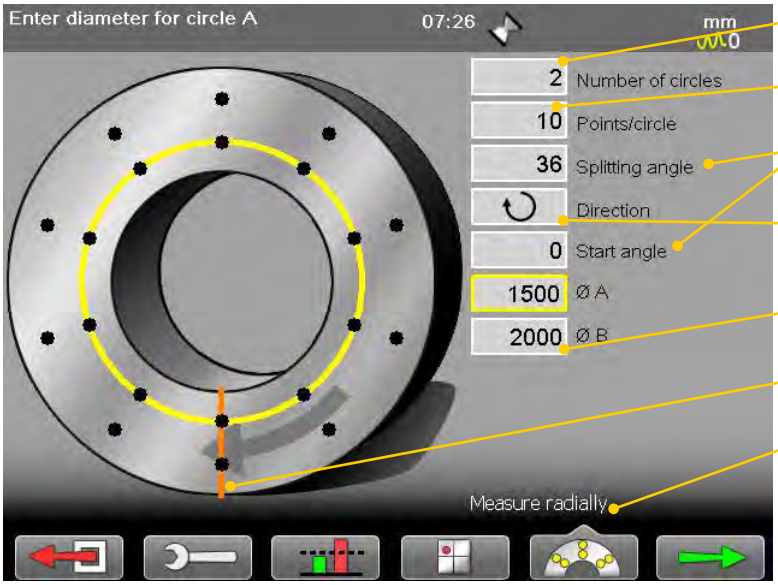
Note!

The tilting screws on the laser transmitter have to be operated carefully and according to instructions. See "Tilting screws" on page 59

Enter distances

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 6 – 180 measurement points. It is possible to measure the points in different orders, inner or outer circle first, or radially.

1. Select and to open the Flange flatness program.
2. Enter distances, confirm with .
3. Select to continue to measuring view.



Up to five circles is possible.

6-180 points/circle is possible.

See more information below

Use Navigation buttons to change measurement direction

Enter the diameter of each circle. The innermost circle is “A”.

First measurement point

Measurement direction

Splitting angle

The splitting angle is automatically calculated when you enter the number of measurement points. If you know the splitting angle, it is possible to enter this and get the number of measuring points.

Start angle

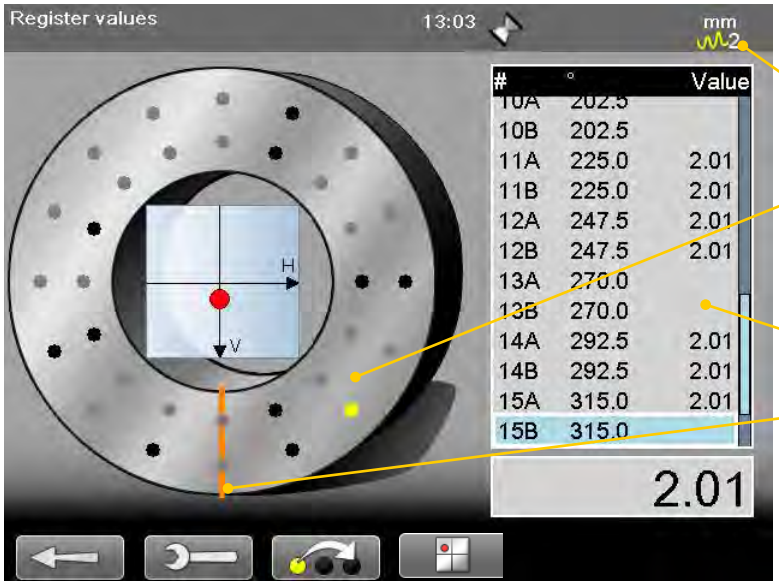
As default, the first measurement point is set to 0º. Select a start angle if you want to start somewhere else.

Function buttons

	Back. Leave program.
	Open Control panel.
	See “Tolerance” on page 126.
	Show target.
	The measuring order you select is saved and used if you open the file as template or favourite. Measure all points on the inner circle first. Measure all points on the outer circle first. Measure radially, inner point first. Measure radially, outer point first.
	Continue to measure.

Measure

1. If you are measuring a flange vertically, secure the laser transmitter with a safety strap. (Part no. 12-0554)
2. Press to register measurement values. Registered points are greyed out. Active point is yellow.



See "Filter" on page 15.

- Active point
- Measured point
- Unmeasured point

Point that has been skipped

First measurement point

Function buttons

	Back. Press and hold to leave program completely.
	Open Control panel.
	Skip point. Only available when it is possible to skip the selected point. Some measurement points are mandatory to ensure an accurate measurement result.
	Show target.
	Continue to result. Available when you have measured all mandatory points.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

Result

Flange table view

Select and to display Table view. Use navigation buttons to move in the table. Points marked with * have been skipped when measuring. Skipped points have a calculated value.

Reference point

Skipped point is marked with *

Green = within tolerance
Red = not within tolerance
Black = no tolerance set

Switch result view

Max	The highest value.
Min	The lowest value.
Peak-peak	Difference between Max and Min value
Standard deviation	Point spread around the mean (average) value.
Flatness RMS	Root Mean Square (Numerical Flatness)

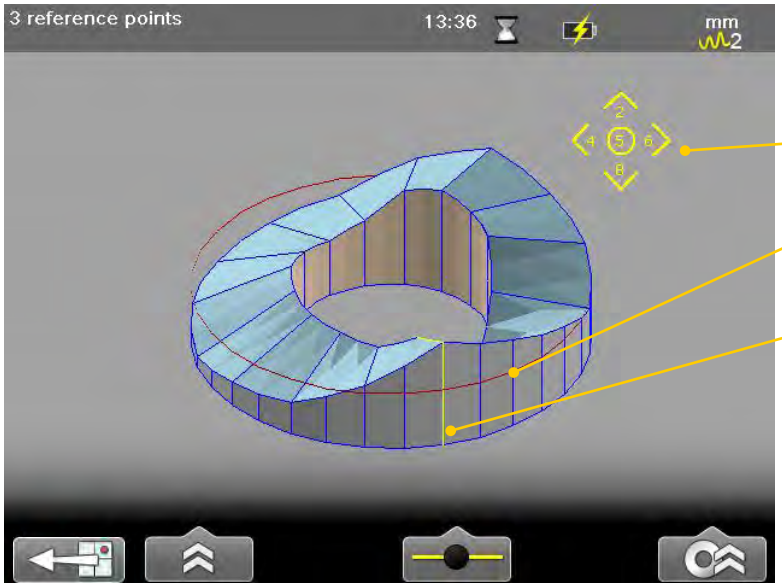
Function buttons

	Remeasure.
	Open Control panel. Save. *See "Measurement file handling" on page 11.* Alter flange diameter. *See "Tolerance" on page 126.* Print on thermal printer (Optional equipment).
	Add reference point. Or press to add reference points. Only available in the table view. *See "Custom reference points" on page 122.*
	See "Best fit" on page 123.
	Switch result view. Different flange and taper views.

Flange 3D view

Select and to display the 3D view.
Rotate the view using the numeric buttons.

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



Rotate the view using the numeric buttons

Reference plane

First point is indicated with a yellow line.

Same function buttons as in Flange table view.

Flange graph view

Select and to display the Graph view. In this view, you have a good overview of the result. Use the navigation buttons to move in the graph.

Tolerance line

Information regarding the selected point

Green = within tolerance
Red = not within tolerance
Black = no tolerance set

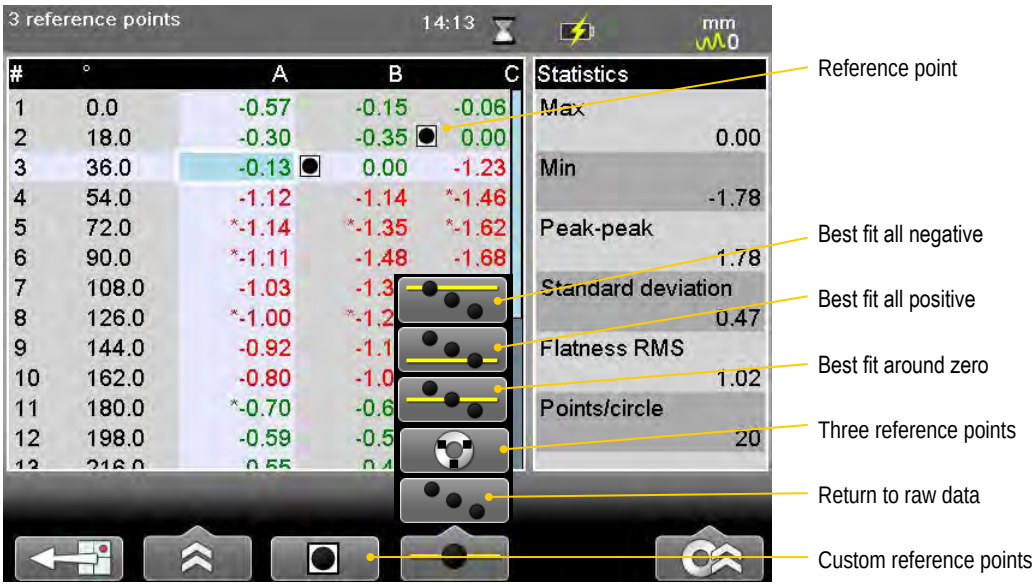
Same function buttons as in Flange table view.

Reference points

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

You can try different scenarios and analyze the measurement result directly in the Display unit. You can also save reports with different settings to analyze further later.

See also "Best fit" on page 123.

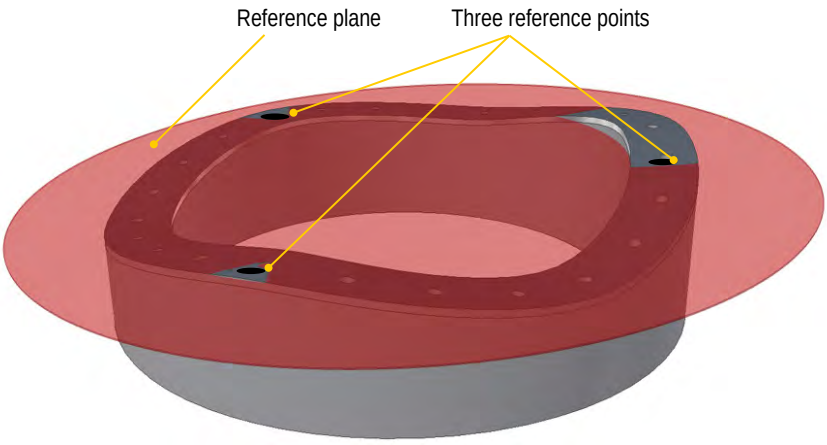


Custom reference points

1. Select a measurement point in the Table view.
2. Select to set currently selected point to zero. Or press .
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.

Three reference points

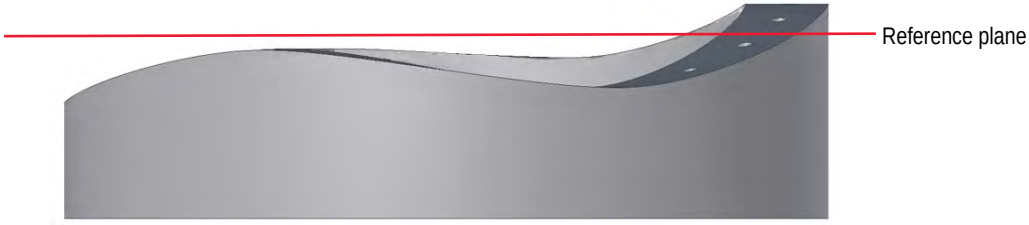
1. Select and to set three reference points. Three points with the lowest peak to peak value are set to zero.
2. Select if you want to return to raw data.



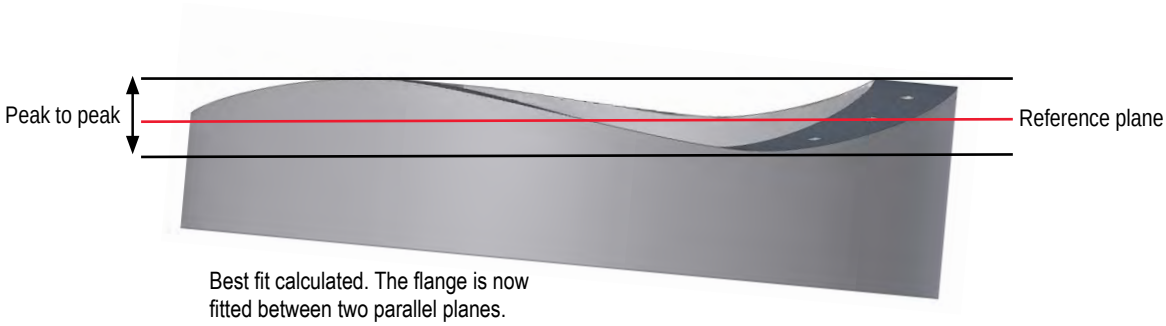
The reference plane is resting on three reference points.

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.
See example below:



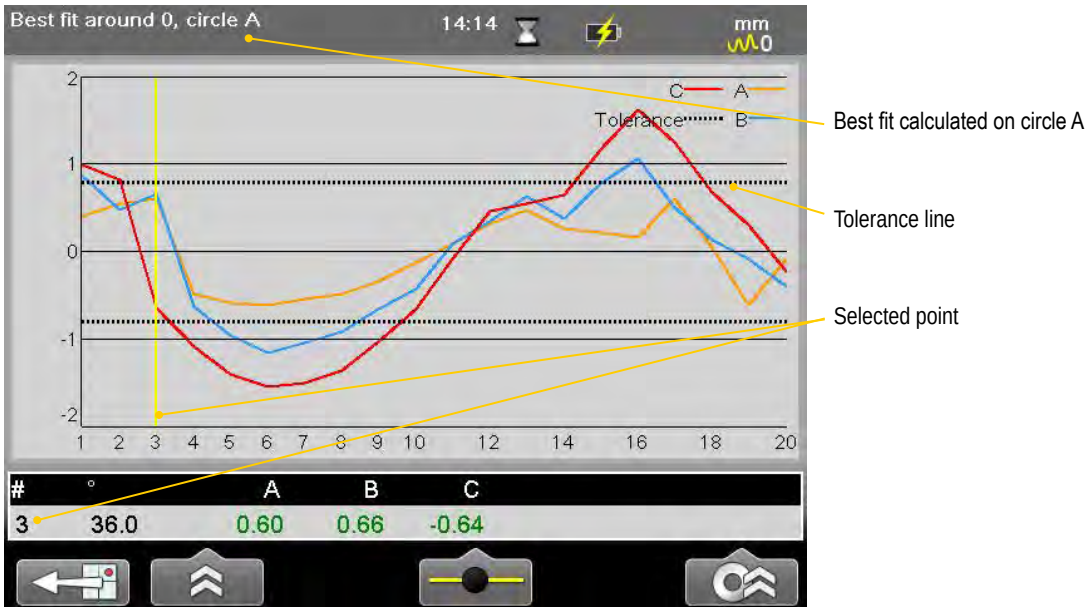
Raw data, in this case a flange with an irregular surface



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

Best fit around zero

Select and to calculate best fit around 0. Select one or all circles.

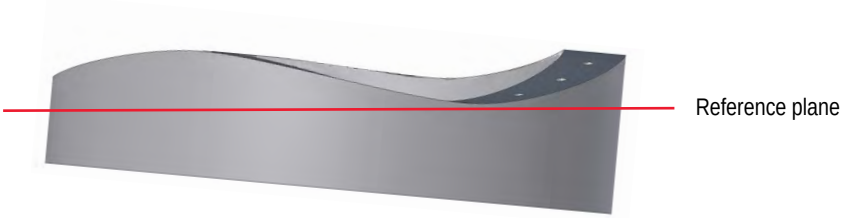


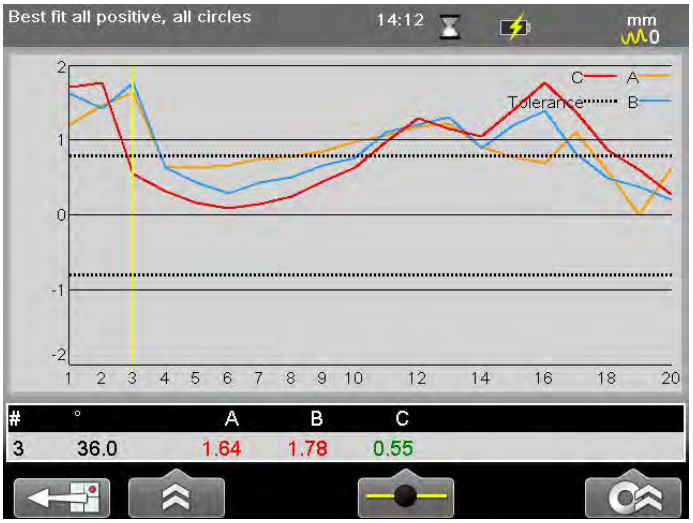
Note!

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

Best fit all positive

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

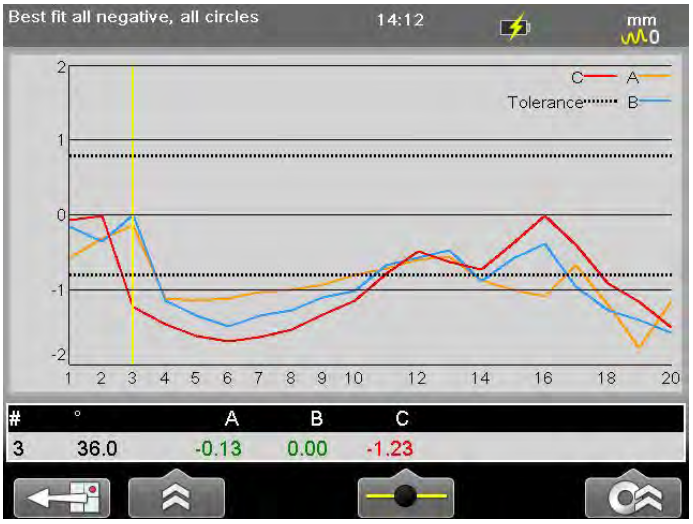




Select and to calculate the best fit with all measurement points above 0. Select one or all circles.

Best fit all negative

The flange 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. Select one or all circles.

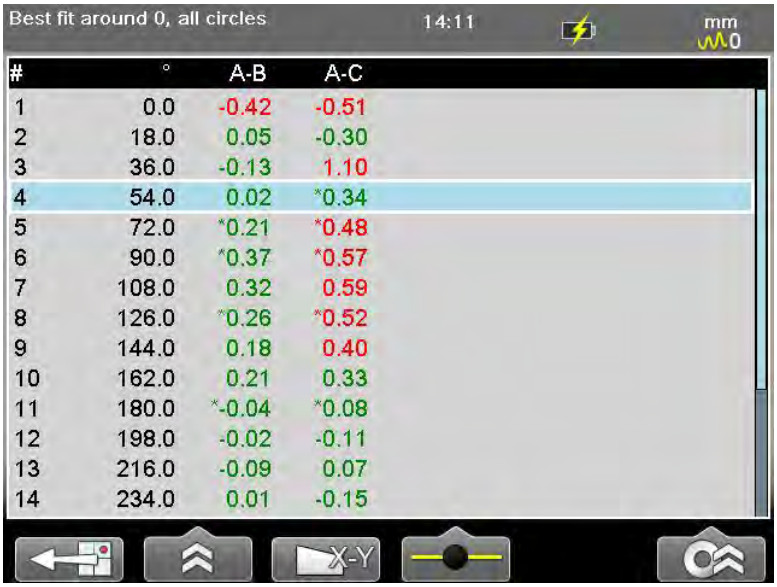
Taper result

If you have measured two or more circles, you can calculate taper. Taper values can be displayed as graph or table. The taper values are recalculated when you select a different Best fit.

From the Result view, select and or . As default, the taper value of outer circle minus inner circle is displayed. To calculate a different taper value, select .

Taper table

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



#	°	A-B	A-C
1	0.0	-0.42	-0.51
2	18.0	0.05	-0.30
3	36.0	-0.13	1.10
4	54.0	0.02	*0.34
5	72.0	*0.21	*0.48
6	90.0	*0.37	*0.57
7	108.0	0.32	0.59
8	126.0	*0.26	*0.52
9	144.0	0.18	0.40
10	162.0	0.21	0.33
11	180.0	*-0.04	*0.08
12	198.0	-0.02	-0.11
13	216.0	-0.09	0.07
14	234.0	0.01	-0.15

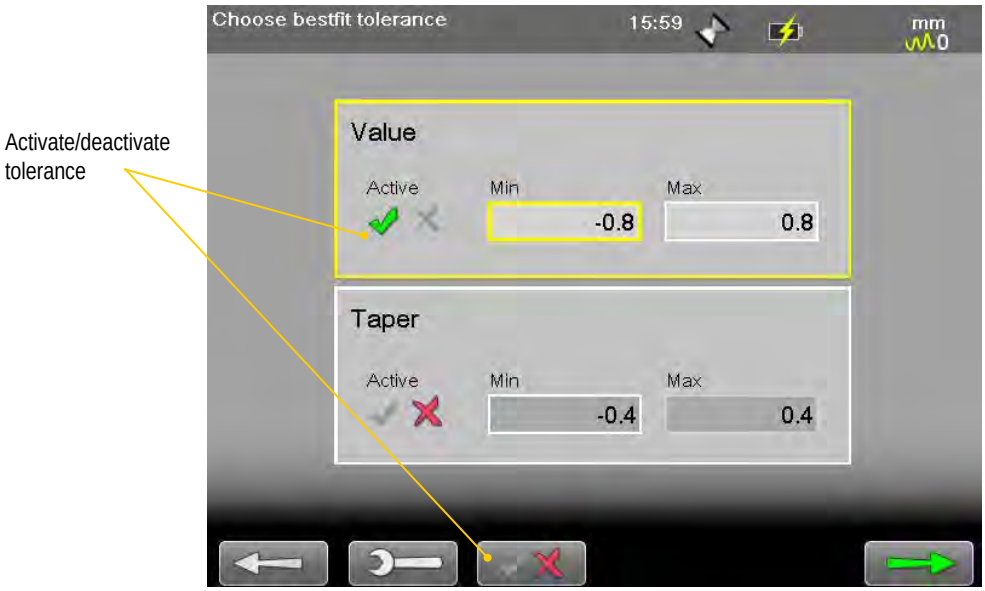
Taper graph

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

Tolerance

It is possible to set tolerance on Taper and/or Best fit.

1. Select and .
2. Enter tolerance values for Best fit and/or Taper.
3. Turn the tolerance on/off by .



Tolerance is displayed both in graph and table view.

PARTIAL FLANGE FLATNESS

The program Partial Flange Flatness is primarily used when you want to measure only a part of a large flange. For example when a large wind tower is split in half before transportation.

Preparations

- Ensure a good measurement environment. Strong sunlight, warning lights, vibrations and temperature gradients can affect the readings.
- Make sure the surface is clean.
- Use the program Values, Flange flatness or targets for the set up. The tighter the tolerances you require, the more important is an accurate set up and levelling.
- Fasten the laser transmitter using the safety strap.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

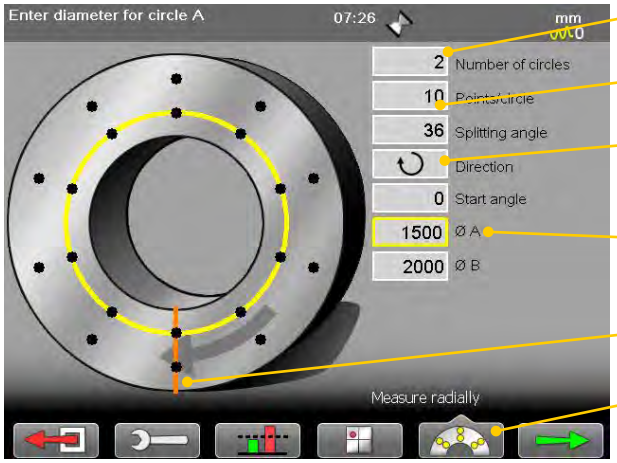
Enter distances

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 6 – 180 measurement points. It is possible to measure the points in different orders, inner or outer circle first, or radially.

1. Select and to open the Partial Flange Flatness.
2. Enter distances, confirm with . Enter number of points on the **whole** flange.
3. Select to continue to measuring view.

Note!

Enter number of points on the **whole** *flange, not only the ones you will measure.*



Up to five circles is possible

6-180 points/circle is possible

Use Navigation buttons to change measurement direction

Enter the diameter of each circle. The innermost circle is “A”.

First measurement point

Measurement direction

Splitting angle

The splitting angle is automatically calculated when you enter the number of measurement points. If you know the splitting angle, it is possible to enter this and get the number of measuring points.

Start angle

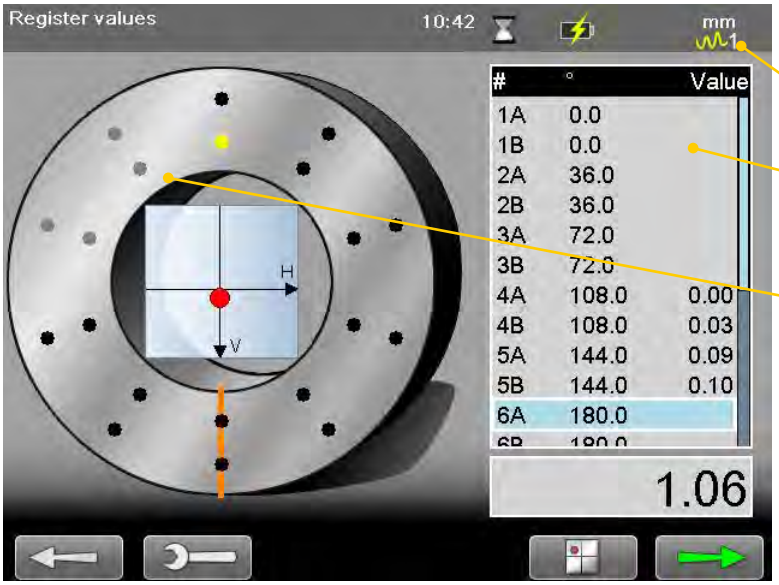
As default, the first measurement point is set to 0º. Select a start angle if you want to start somewhere else.

Function buttons

	Back. Leave program.
	Open Control panel.
	See *“Tolerance” on page 126.*
	Show target.
	The measuring order you select is saved and used if you open the file as template or favourite. Measure all points on the inner circle first. Measure all points on the outer circle first. Measure radially, inner point first. Measure radially, outer point first.
	Continue to measure.

Measure

1. If you are measuring a flange vertically, secure the laser transmitter with a safety strap. (Part no. 12-0554)
2. Press to register measurement values. Registered points are greyed out. Active point is yellow.
3. When you have measured the points you need, select to continue to Result view.



See "Filter" on page 15.

Points that has been skipped

Active point
Measured point
Unmeasured point

Function buttons

	Back. Press and hold to leave program completely.
	Open Control panel.
	Delete point.
	Show target.
	Continue to result. Available when you have measured enough points.

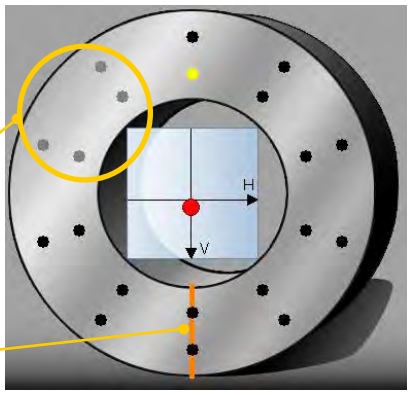
Start angle and first measurement

If you do not want to start to measure where the start angle is, simply use the navigation buttons to move to where you want to measure. You can skip points, but you can not leave "holes" in the area where you want to measure.

Minimum no. of measurements points

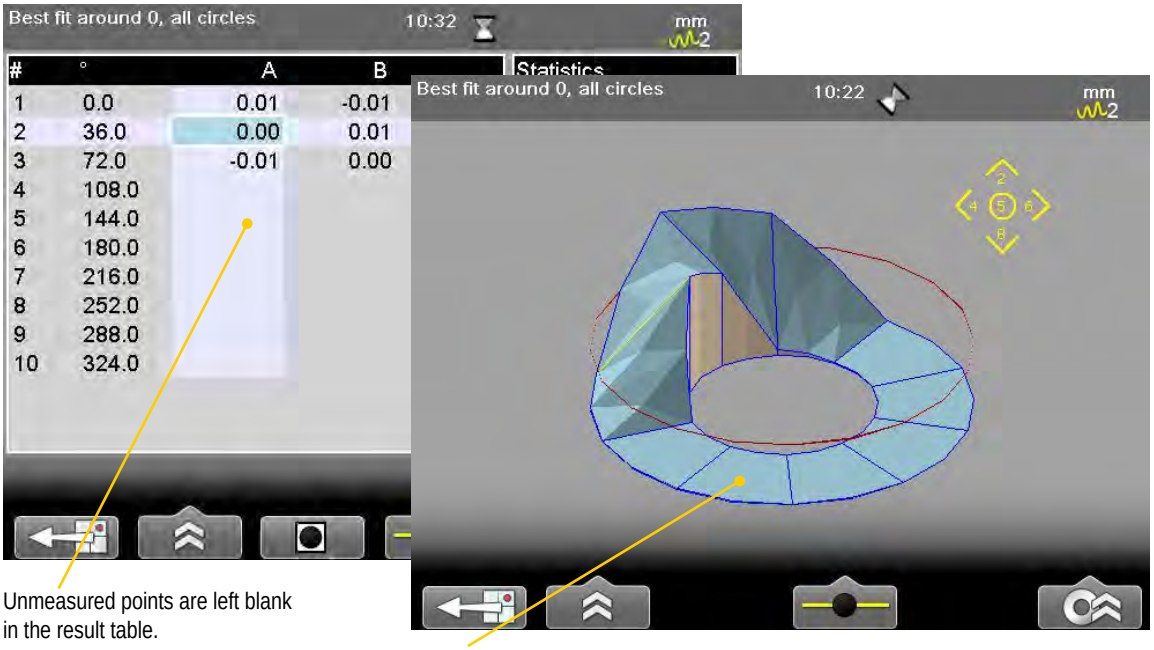
One circle:
as a minimum, you need to measure four points.

Two or more circles:
as a minimum, you need to measure two points on all circles, see image.



Result

The result can be shown as table, graph or 3D.
See *Flange Flatness "Result" on page 120.*
The only thing that differs from the Flange Flatness result, is that the unmeasured points are left blank.



Unmeasured points are left blank in the result table.

Flat area = Unmeasured points

Reference points

It is possible to set custom reference points or to select three reference points automatically.
See *"Reference points" on page 122.*

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.
See *"Best fit" on page 123.*

Taper

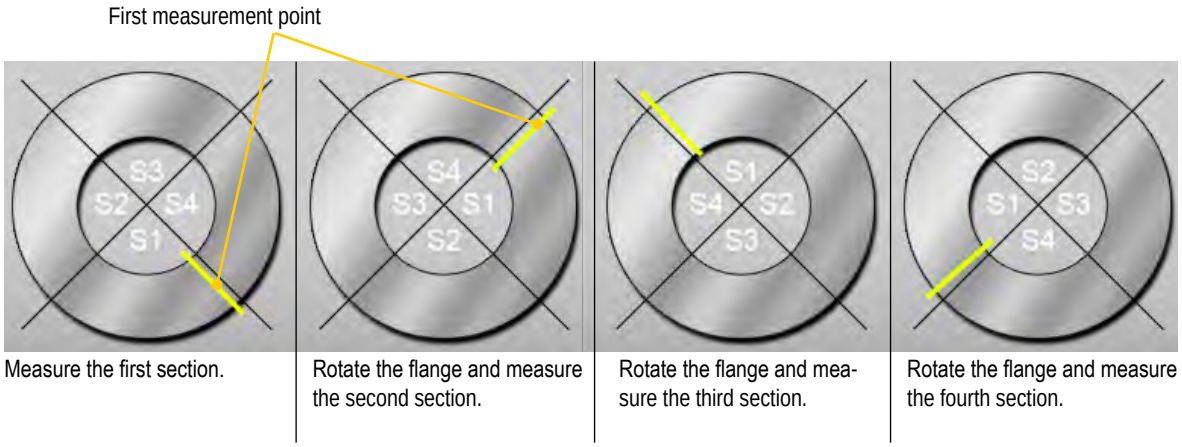
If you have measured two or more circles, you can calculate taper.
See *"Taper result" on page 125.*

Tolerance

It is possible to set tolerance on Taper and/or Best fit.
See *"Tolerance" on page 126.*

FLANGE FLATNESS SECTION

The program Flange Flatness Section is primarily used for large flanges. The flange is divided into four sections and rotated for easy measuring. Thanks to the fact that you only measure the lower part of the flange, there is no need to climb to fasten detectors or laser transmitters.



Measure the first section.

Rotate the flange and measure the second section.

Rotate the flange and measure the third section.

Rotate the flange and measure the fourth section.

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 16 – 180 measurement points. The program guides you graphically step-by-step through the entire measurement.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

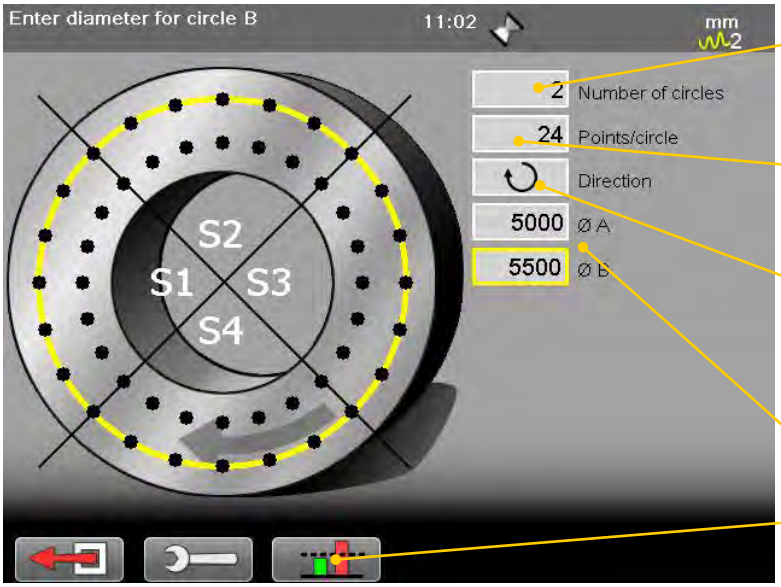
Note!

International patent (PCT/EP2014/052631)

Preparations

Enter distances

1. Select and to open the Flange flatness section program.
2. Enter distances, confirm with .



1–5 circles is possible.

16–180 points/circle is possible.

Use Navigation buttons to change measurement direction.

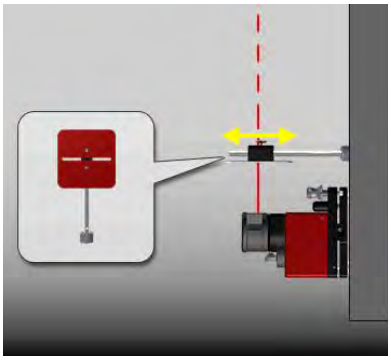
Enter the diameter of each circle.
The innermost circle is “A”

Set tolerance

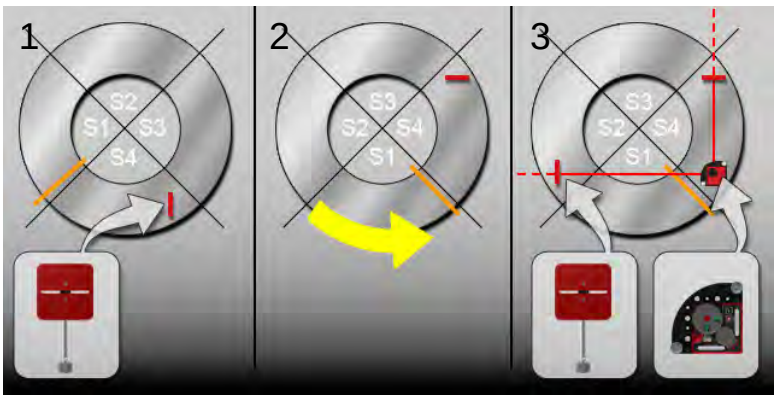
Visual targets

Adjust all three visual targets; place the target close to the laser transmitter and make sure that the laser beam goes through the slit.

1. Mount a target on the flange. Where you place it depends on which measurement direction you have chosen. Follow the instructions on screen.
2. Rotate flange. Note the direction on the screen.
3. Mount the laser transmitter and a laser target as shown on screen. Secure the laser transmitter with the safety wire. Adjust laser transmitter if needed.



Adjust all three targets



Follow instructions on the screen

Measure

1. The first measurement point is marked with a line. Active point is yellow.
2. Press to register measurement values. Registered points are greyed out.
3. Select to continue to next section.

Filter

Current section, S1 – S4.

Active point

Measured point

Unmeasured point

Point that has been skipped

First measurement point

Function buttons

	Back. Press and hold to leave program completely.
	Open Control panel.
	Skip point. Only available when it is possible to skip the selected point. Some measurement points are mandatory to ensure an accurate measurement result.
	Available when you have measured all mandatory points. **When you leave the current section, it is not possible to go back to remeasure**.

Filter

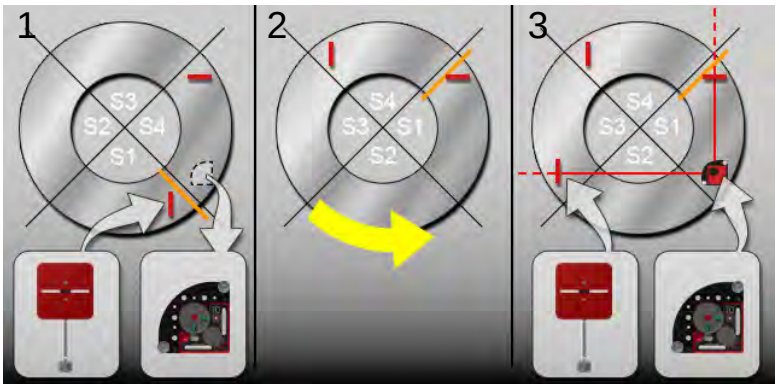
The filter is increased by two steps when measuring merge points. It is possible to override this. *See "Filter" on page 15.*

Note!

The merge points are analyzed and if uncertain points are found, a warning is displayed in the result. Uncertain merge points are also noted in the report.

Rotate flange

1. Remove laser transmitter and place a target as shown on the screen.
2. Rotate flange. Note the direction on the screen, it is contrary to the selected measurement direction.
3. Mount the laser transmitter and a laser target as shown on screen. Secure the laser transmitter with a safety wire. Adjust laser transmitter if needed.



Result

The result can be shown as table, graph or 3D. If you have measured two or more circles, you can see Taper result.

See *Flange Flatness "Result" on page 120.*

Reference points

It is possible to set custom reference points or to select three reference points automatically.

See *"Reference points" on page 122.*

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.

See *"Best fit" on page 123.*

Taper

If you have measured two or more circles, you can calculate taper.

See *"Taper result" on page 125.*

Tolerance

It is possible to set tolerance on Taper and/or Best fit.

See *"Tolerance" on page 126.*

Remeasure Flange Flatness Section

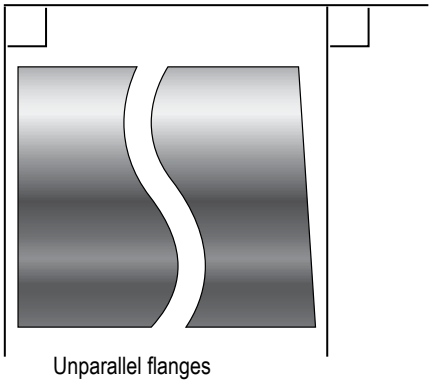
1. Select to remeasure one or more sections.
2. Select to continue to the section you want to remeasure.
3. Press to start a new measurement and proceed with the measurement as usual. If you choose to remeasure, the previous results in that section will be erased and replaced with the values from the new measurement.
4. After you finished remeasuring, select and proceed to the Result view. You will now see the results from the updated measurements.

Note! This function can also be used on saved measurements. Select (found on the start view and Control panel) to open saved measurements.

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.

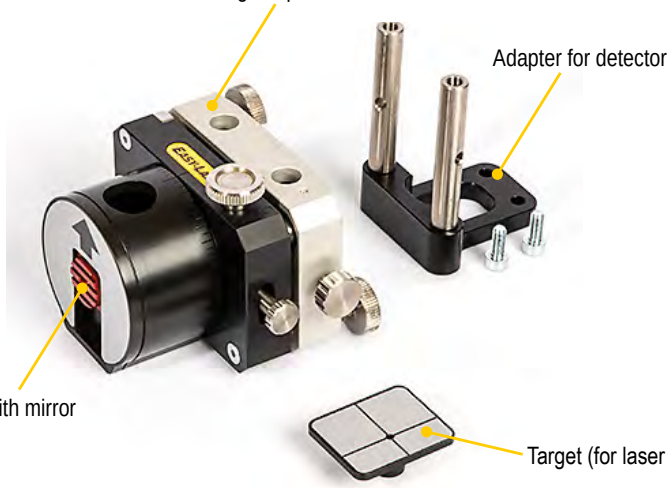
Tripod for use with angular prism and laser transmitter D22.



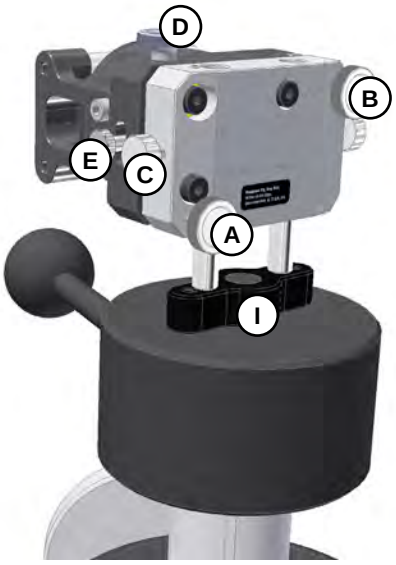
Unparallel flanges

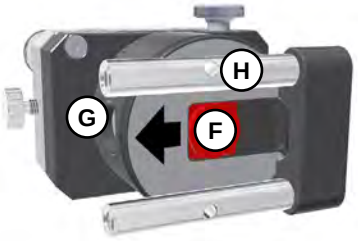
Angular prism kit

Part No. 12-1136



- (A) Vertical adjustment (pitch).
- (B) Horizontal adjustment (yaw).
- (C) Locking on the rods.
- (D) Fine tuning of rotation.
- (E) Lock for fine tuning of rotation. Unlock to disable fine tuning.
- (F) Target with mirror (beam inlet).
- (G) Beam outlet.
- (H) Adapter for detector.
- (I) Adapter for mounting on tripod *Part No. 01-2232*

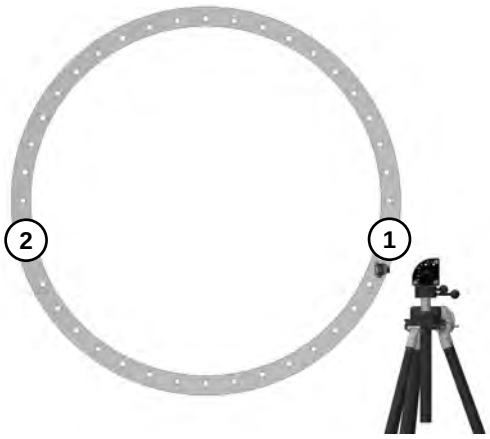




Laser and prism setup

1. Mount the laser on the tripod.
2. Put the laser roughly to the spirit level.

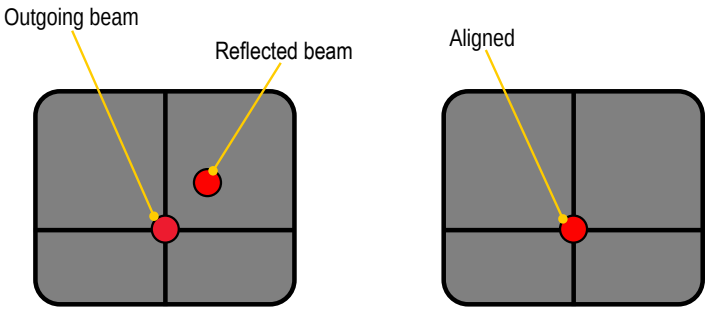
3. Place the detector close to the transmitter (1)
   Note! Always measure on the outside of the flange.
4. Adjust the detector on the rods so that the laser beam hit the centre of detector target (within ±0.5 mm).
5. Move the detector to the other side of the flange (2) Make sure that the laser beam is roughly in level. Adjust laser beam by using the tilt screw on the transmitter.
6. Turn the laser beam towards the detector and adjust by using the other tilt screw on the transmitter.



7. Repeat 1 to 6 until you reach within 0,1 mm in both positions.
8. Mount the prism on the other tripod in the same hight as the transmitter.
9. Turn the laser beam towards the prism.

10. Position the angular prism to the laser beam, let the beam hit the centre of the closed prism target.

11. Adjust the prism vertically (pitch) and horizontally (yaw) until the laser beam reflection hit the middle of the laser target.

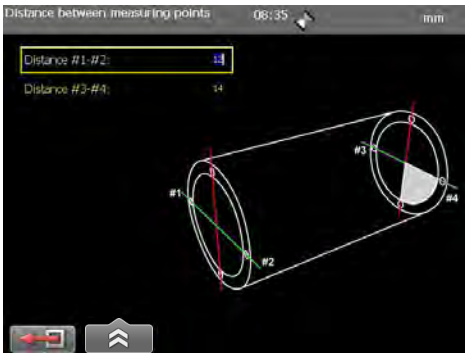


12. Open up prism target and start the measurement.

Measure

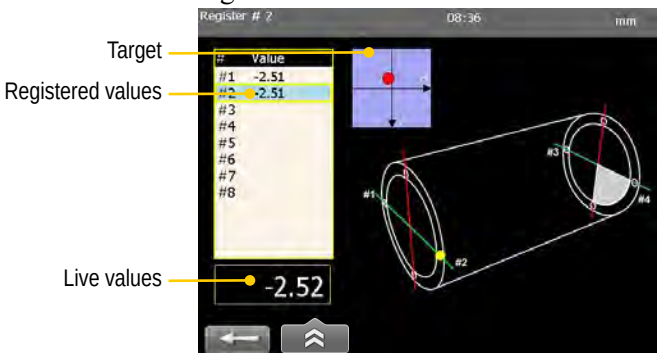
Enter distances

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



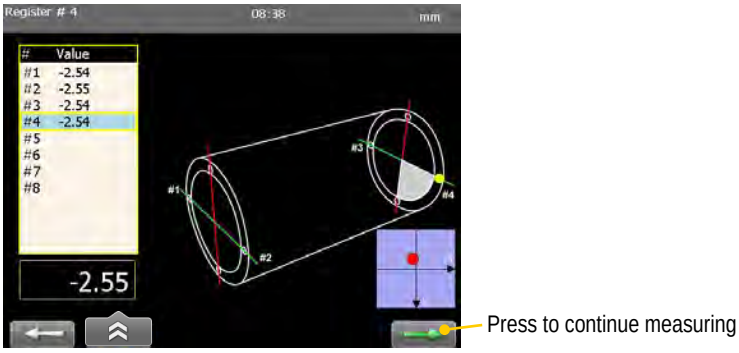
Measure point 1 to 4

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.



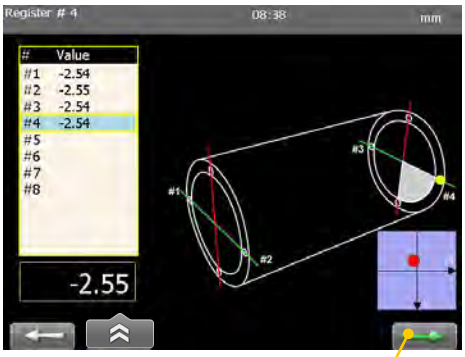
Result

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

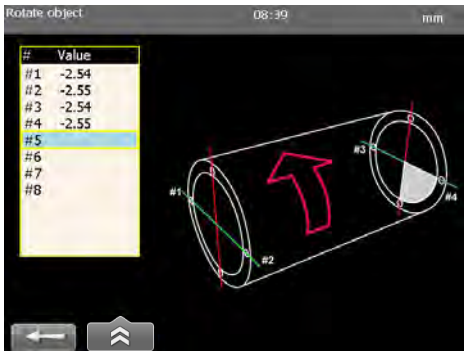


Measure point 5 to 8

1. Press to continue measuring.
2. Rotate the tower section 90º.
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.



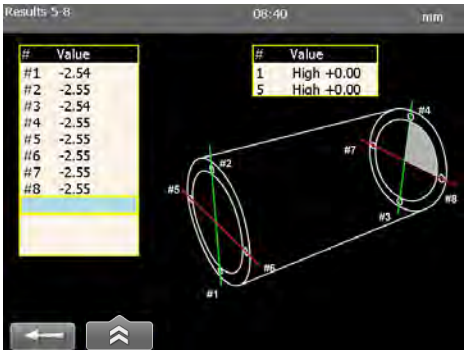
Press to continue measuring



Rotate tower section

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).
0	**Zero set**. Set current live value to zero. Only available before you have registered the first value.
1/1	**Absolute**. Return to absolute value.
	Continue. Continue measuring point 5 to 8.

HORIZONTAL

For horizontally mounted machines.

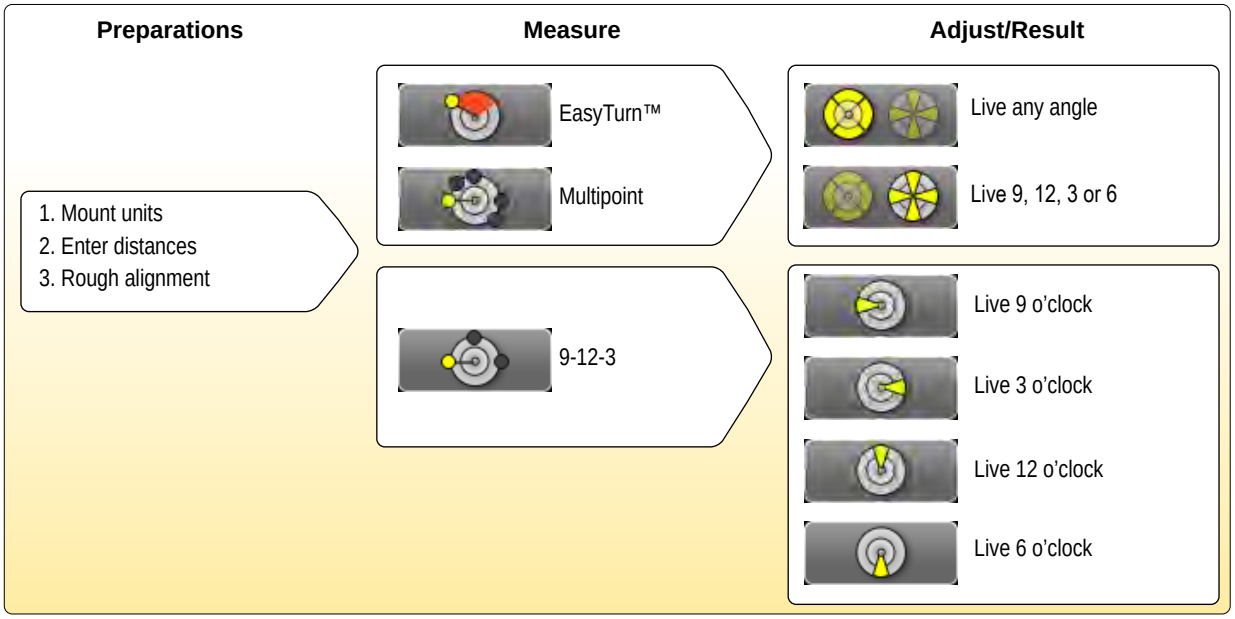
Select between three different measuring methods:

	**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 147.*
	**Horizontal Multipoint** Start anywhere on the turn. Register as many points as you wish. *See "Measure using Multipoint" on page 148*
	**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 150.*

Note!

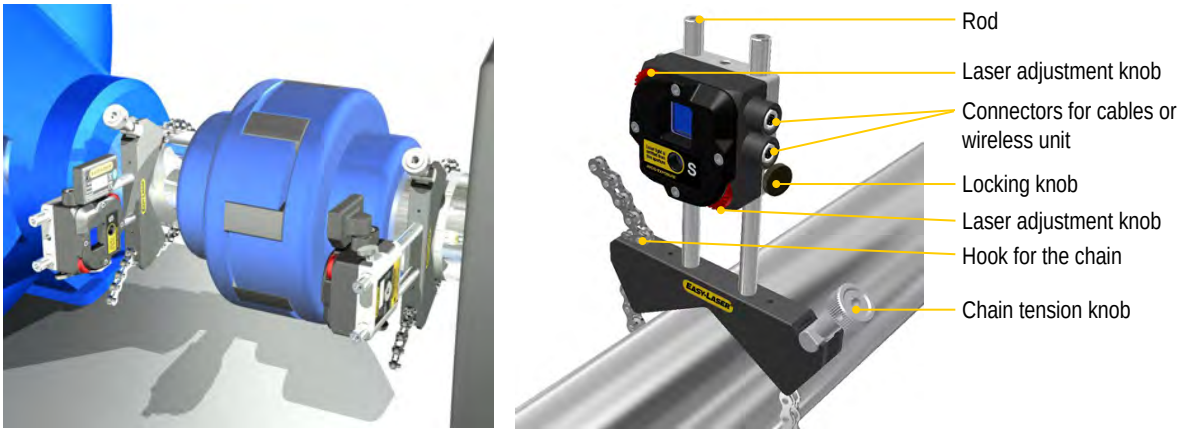
Measurements made with older versions of the Horizontal program are opened with the older version of the program. For information regarding the previous program version, please see corresponding manual.

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 wireless units

Cable

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

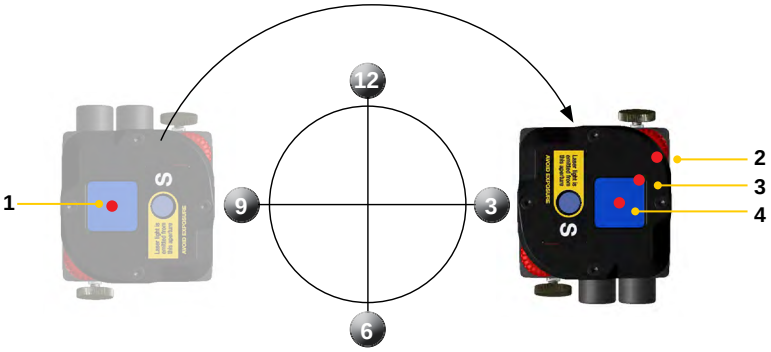
Wireless

The Display unit is equipped with wireless technology, which makes it possible for the Display unit to receive data without using cables. For more information, see *"Set up wireless connection" on page 21*.

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.

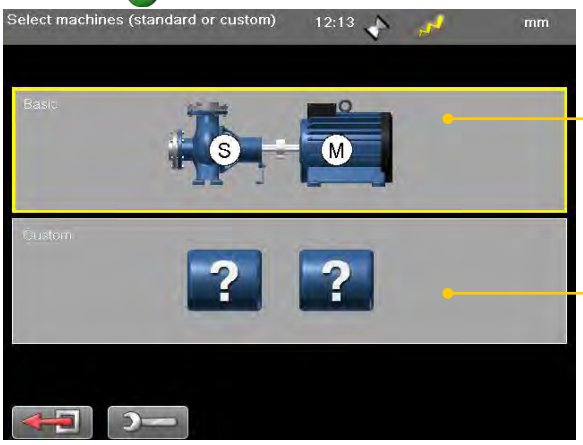


The example shows the S-unit, but the procedure is made on both units.

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 .

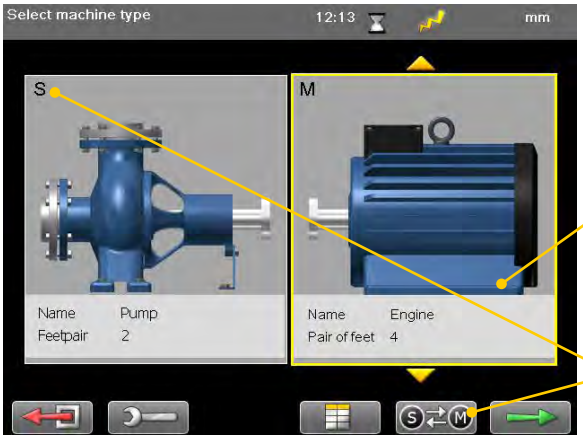


Basic: Contains a pump and a motor. These predefined machines have two feet pair each.

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

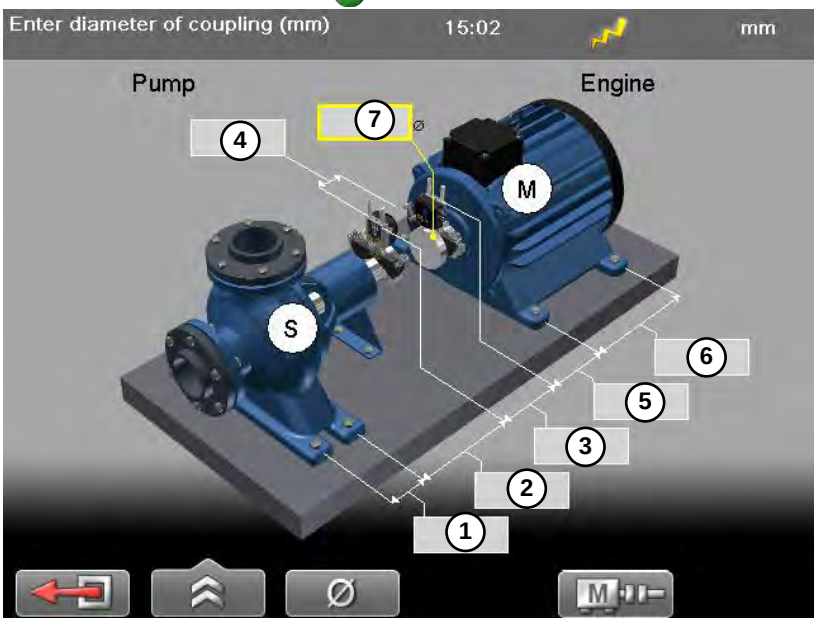
If you want to change the number of feet pair on the machine, simply enter the number you want on the numerical buttons.

Function buttons

	Leave program.
	See “Control panel” on page 15.
	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 15. *See "Tolerance" on page 157.* *See "Thermal compensation" on page 155.* Select to enter distances of the S-machine. 3D 2D Toggle between showing Distance view in 3D or 2D.
	Diameter. Select to enter coupling diameter. This is necessary if you want the result based on the gap of the coupling instead of angle.
	Toggle button. Show movable machine to the left or the right.
	Continue to Measure view. Available when you have entered the mandatory distances.

Note!

The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

Measure using Easy Turn™

Preparations

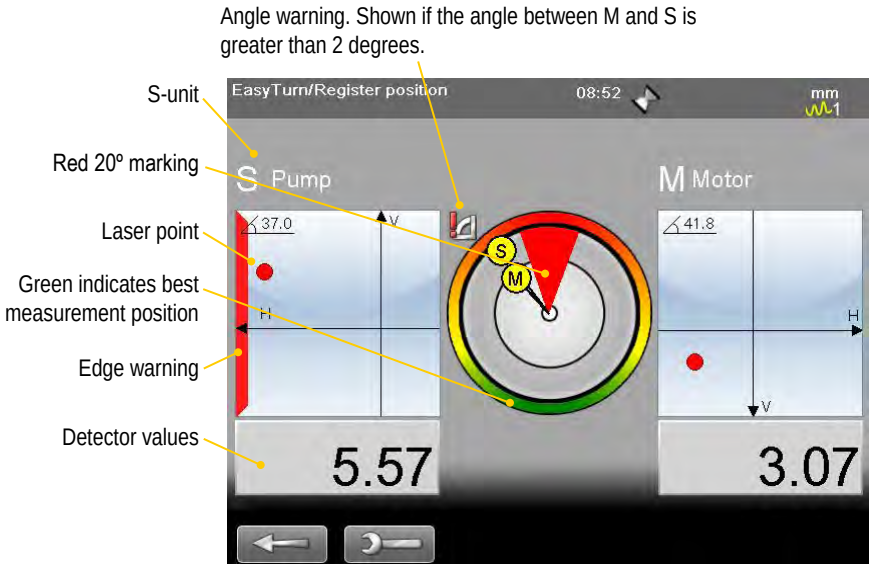
Follow the preparations as described in the previous pages.

1. Mount the measuring units.
2. Enter distances, confirm each distance with .
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 15.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See "SOFTFOOT" on page 159.

Measure using Multipoint

Preparations

Follow the preparations as described in the previous pages.

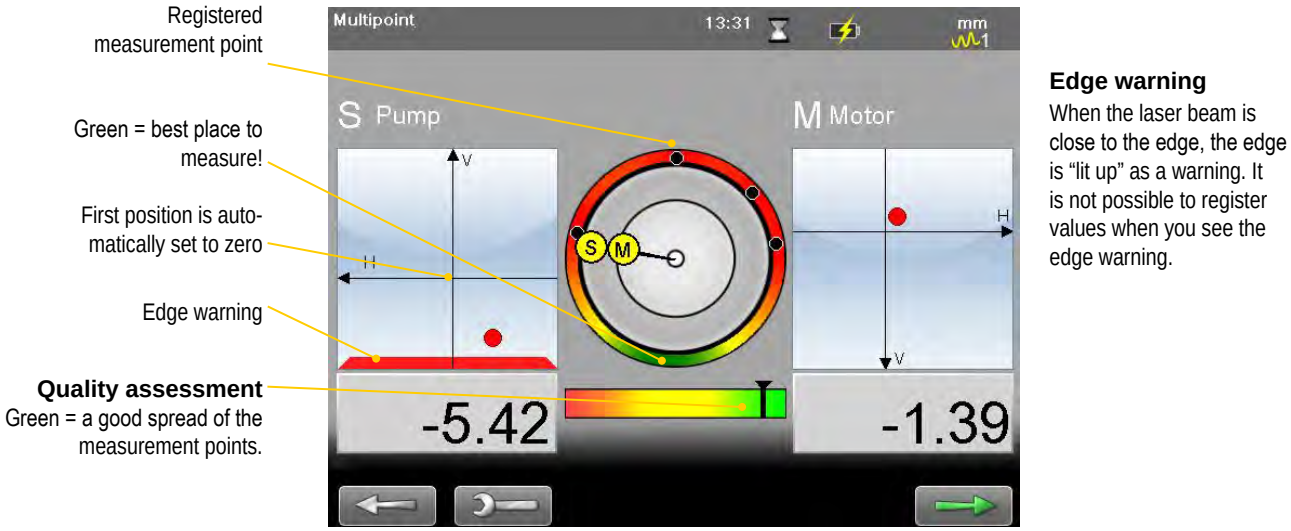
1. Mount the measuring units.
2. Enter distances, confirm each distance with .
3. If needed, perform a rough alignment.
4. If needed, perform a Softfoot check.

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 151*.

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.



Function buttons

	Back. Measure previous position or back to Distance view.
	See "Control panel" on page 15.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See "SOFTFOOT" on page 159.
	Continue to the Result and adjust view. Available after registering three positions with a minimum spread of 40º.

Quality assessment

Not available for the US market!

From the result view, select  and  to show the Quality assessment view

Attainable accuracy

Many measurement points that also have a good spread, will statistically ensure a high accuracy. This is the same indicator as on the measurement view. If the attainable accuracy is low, try to spread the points as much as possible.

Acquired accuracy

Actual measured values from the units. If the acquired accuracy is low, it may depend on for example air turbulence or bearing clearance.

Temperature stability

Measured temperature variation in the measuring units. If the stability is low, remeasure when the temperature has stabilized.

Measurement direction

Indicates if you have changed measurement direction. It is better to move the measurement units in the same direction.

Quality assessment

A sum of the four quality factors. Also available in the pdf report.

Measure using 9-12-3

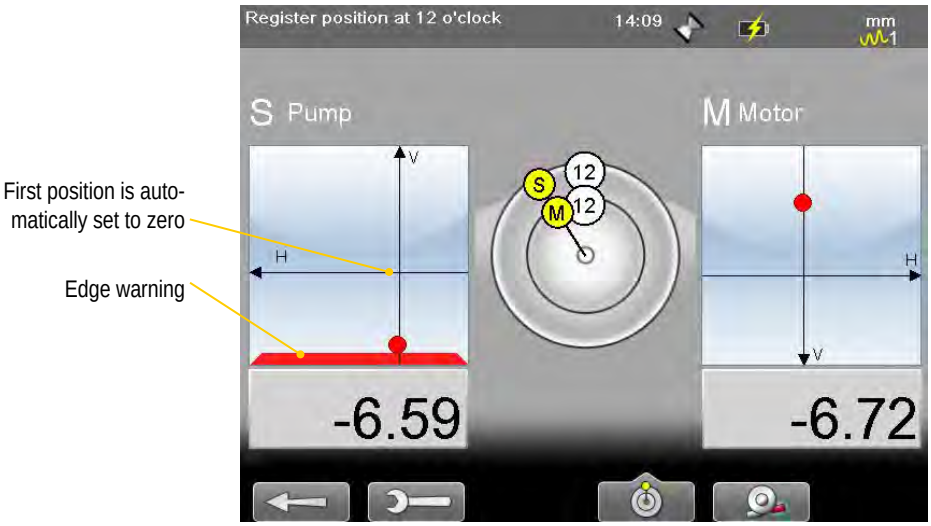
Preparations

Follow the preparations as described in the previous pages.

1. Mount the measuring units.
2. Enter distances, confirm each distance with .
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 151*.



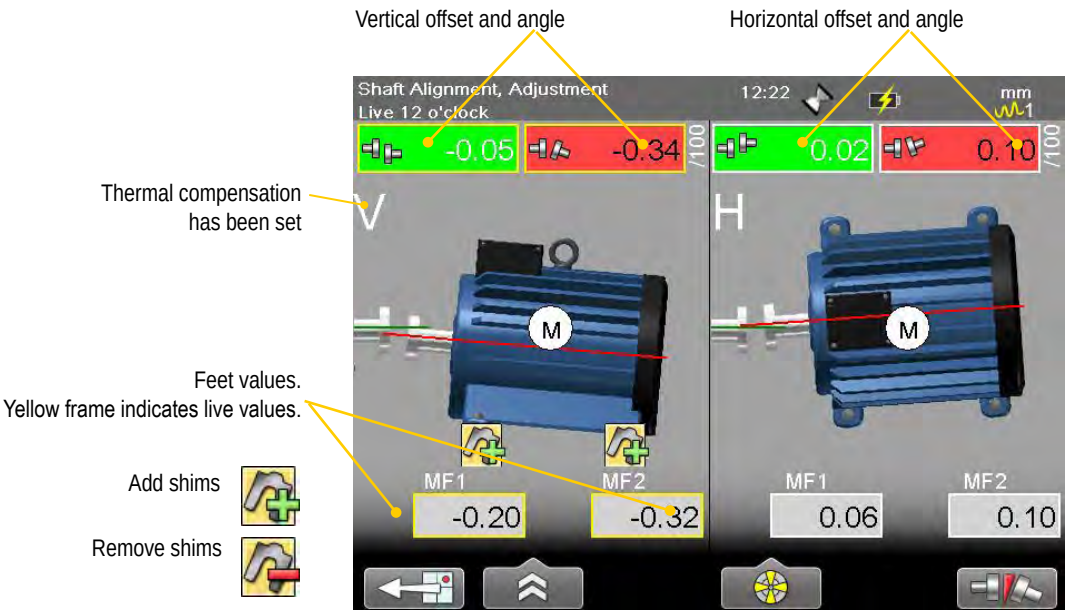
Edge warning
When the laser beam is close to the edge, the edge is "lit up" as a warning. It is not possible to register values when you see the edge warning.

Function buttons

	Back. Measure previous position or back to Distance view.
	See "Control panel" on page 15.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See "SOFTFOOT" on page 159.

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.

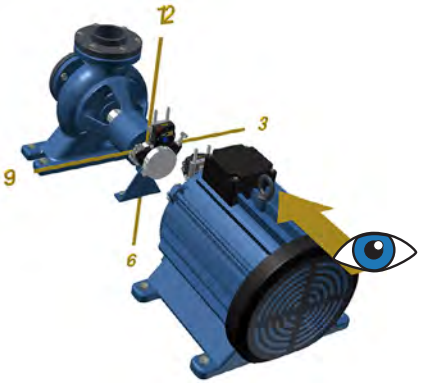


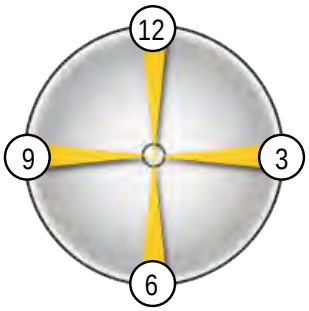
Function buttons

	Back to measure view.
	See "Control panel" on page 15. Save, *see "Measurement file handling" on page 11.* *See "Tolerance" on page 157.* *See "Thermal compensation" on page 155.* 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 to confirm changes. The result is recalculated. See *"Quality assessment" on page 149.* Result table.
	RefLock, lock feet. *Note! Not available for E420.*
	See *"Live values" on page 152.* Toggle button. Show/hide Position indicator. See *"Position indicator" on page 153.*
/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.

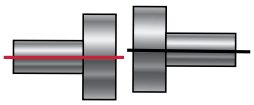




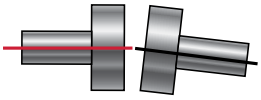
Face the stationary machine (S) from the movable machine (M). Then 9 o'clock is to the left, as in the measuring programs.

Offset and angle values

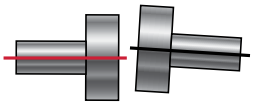
The offset and angle value indicate how well the machine is aligned at the coupling.
They appear in both horizontal and vertical direction.
These values are important to get within tolerance.



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.

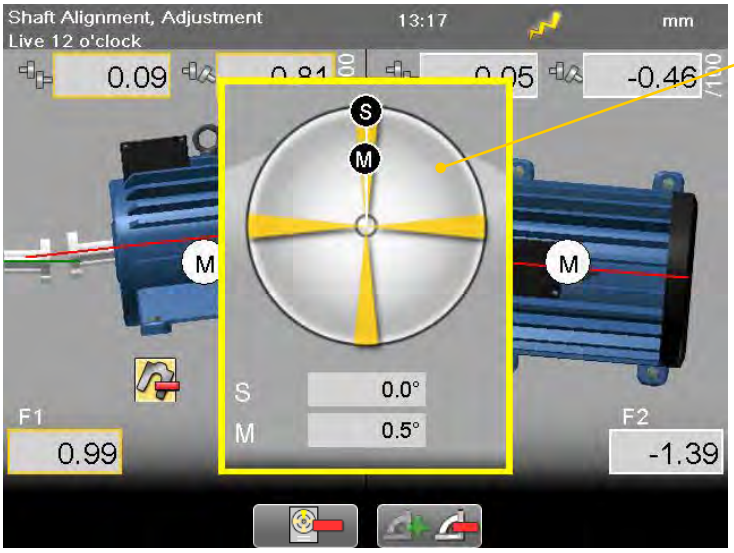
Adjust

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.



Position indicator

Function buttons

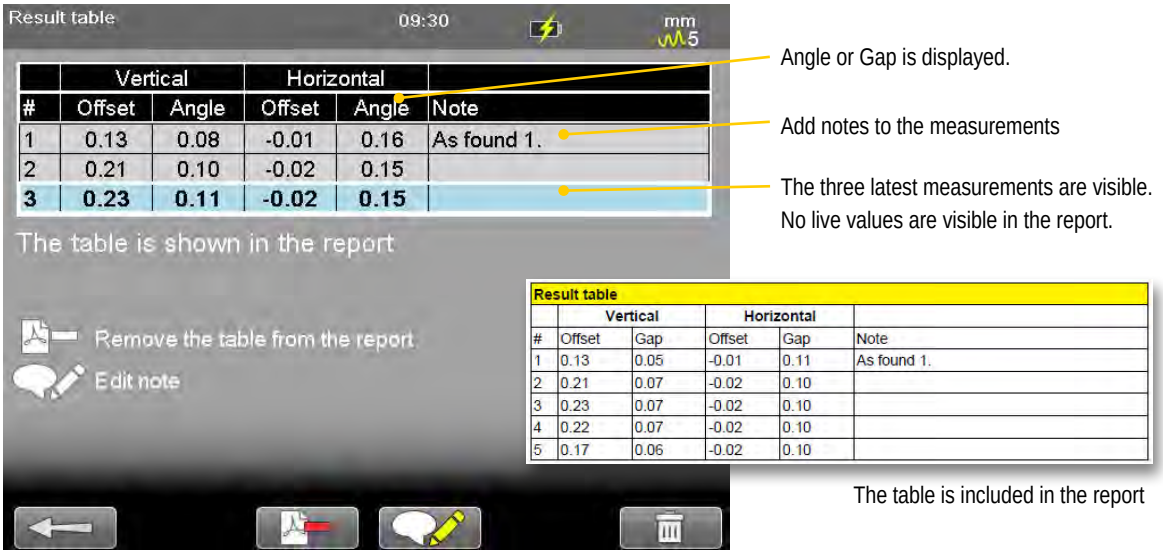
	Toggle button. Show/hide position indicator manually.
	Toggle button. Select to display the position indicator automatically when you move the measuring units. Only available when you have measured with EasyTurn.

Result table

With the result table, you can measure the same coupling several times and document the results.

1. Measure using Easy-Turn, 9-12-3 or Multipoint.
2. Go to the Result view.
3. Select to remeasure the coupling. Remeasure as many times as needed.
4. Go to Result view and select and to open the result table.

Once you have opened the result table, the information will also be included in the report. The three latest measurements are visible. If you have more, use the navigation buttons to scroll.



Add a note

1. Select a measurement.
2. Select or to write or edit a note.
3. Press to save the note.

Function buttons

	Toggle button. Show/hide the result table in the report.
	Add (or edit) a note for the selected measurement.
	Delete the selected measurement.

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.

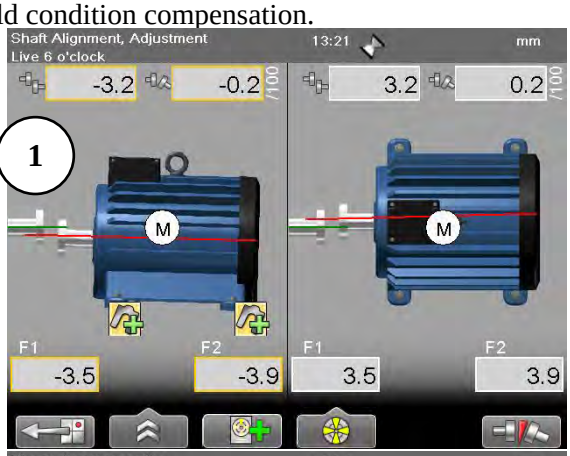
Thermal compensation

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.

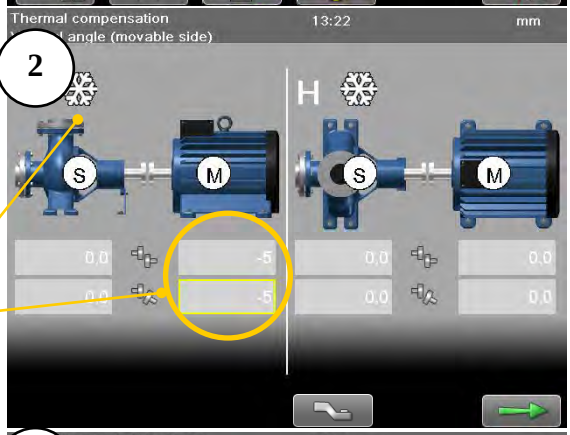
Select and from the result and distance view. The Thermal compensation view is displayed.

Example

It can be necessary to place the cold machine a bit lower to allow thermal growth. In this example we assume a thermal growth of +5mm in **HOT** condition. Therefore we compensate with -5mm in **COLD** condition.



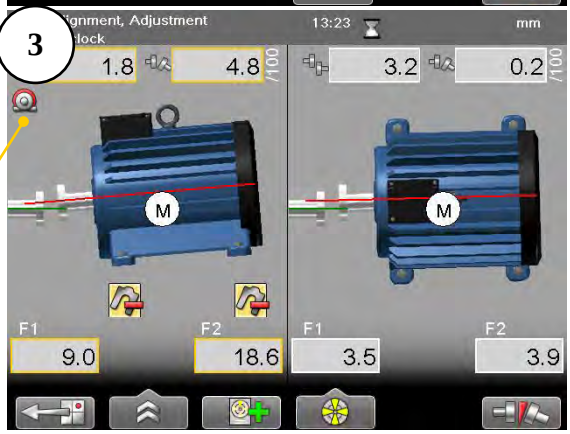
1 Before thermal compensation.



2 Set thermal compensation.

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

Vertical offset and angle for movable machine.

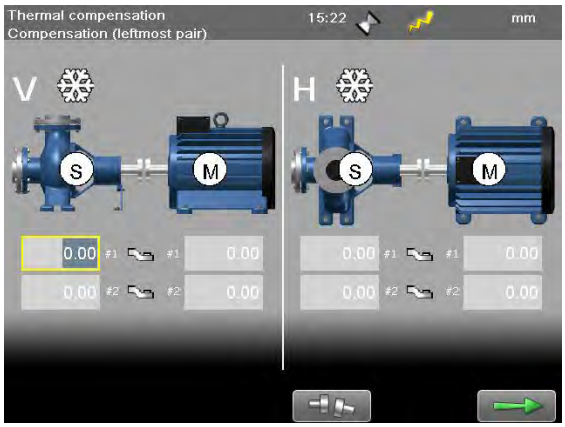


3 Thermal compensation set. When you have set thermal compensation and return to the result view, the values have changed. When the machine becomes warm, the thermal growth will make it perfectly aligned.

Indicates that 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.



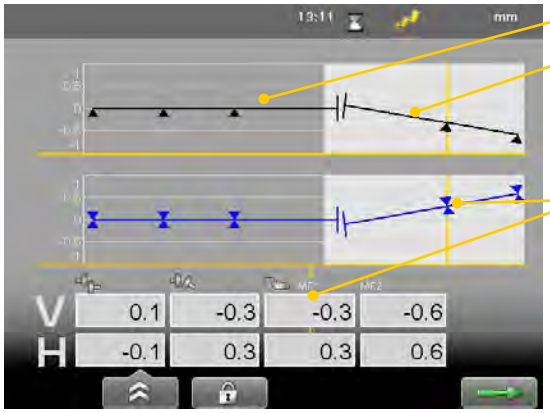
Note!

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.

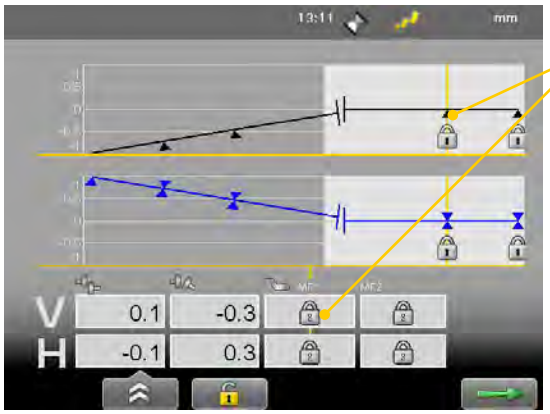
1. Select and .
2. The RefLock graph view is displayed. Navigate using the left and right navigation button.
3. Select to lock the selected feet pair or to unlock.
4. Select to continue to the result view.



Stationary machine

Movable machine

Selected feet pair



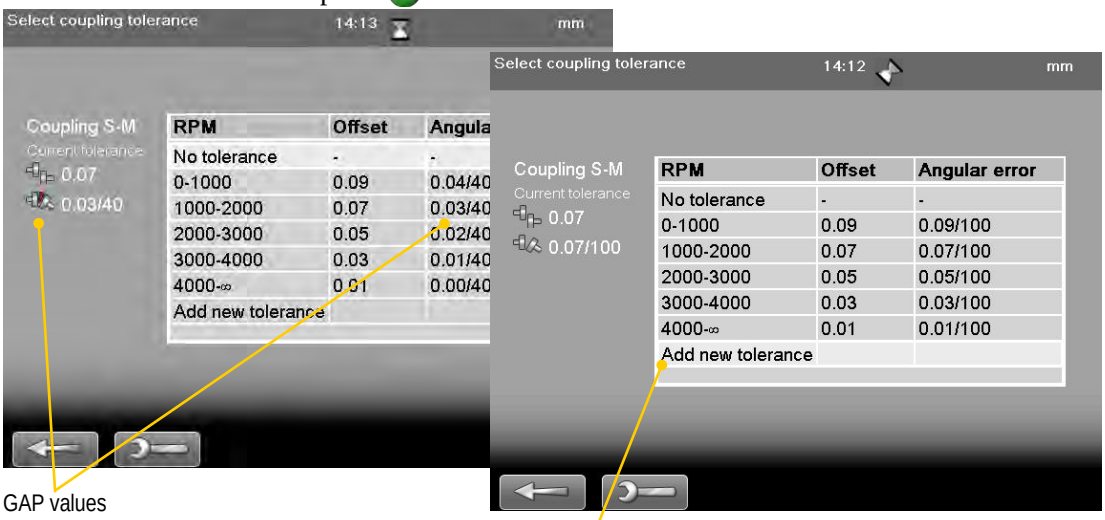
Locked feet pair

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 .



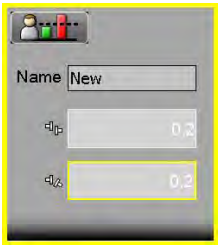
Function buttons

	Close Tolerance view.
	See "Control panel" on page 15.
	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!

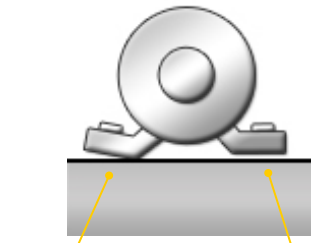
Consider these tables as guidelines. Many machines must be aligned very accurately even if they have a lower rpm. For example gearboxes.

SOFTFOOT

Perform a softfoot check to ensure that the machine is resting evenly on all its feet. A softfoot can be angular and/or parallel, see image.

Softfoot can be caused by:

- Twisted machinery foundations.
- Twisted or damaged machinery feet.
- Improper amount of shims under machine feet.
- Dirt or other unwanted materials under machine feet.

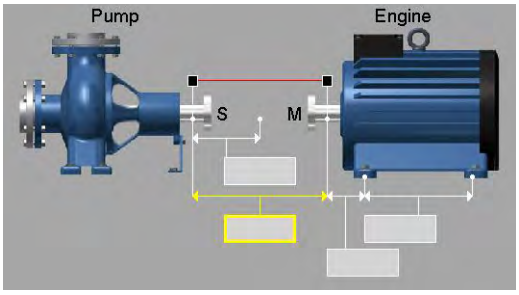


Start Softfoot from main shaft menu

1. Select and .
2. Enter distances. Select “Custom” if you want to select other machine images and/or more than three feet pair.
3. Select to continue.

Start Softfoot from Horizontal program

1. Select and to open Horizontal program.
2. Enter distances. Confirm each distance with . To perform a Softfoot check, you need to enter distances between the feet pairs. The measure view is displayed.
3. Select . Softfoot is only available before you have registered any measurement points.



Function buttons

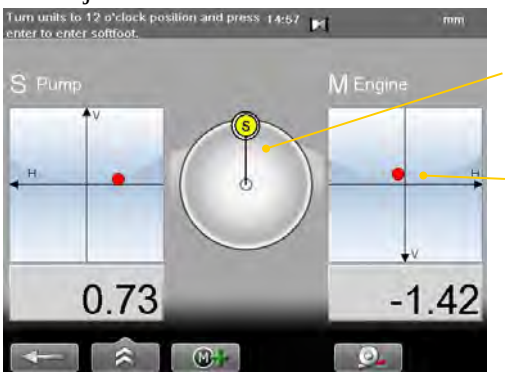
	Leave program.
	See”Control panel” on page 15. Enter distance for S-machine. Makes it possible to perform a soft-foot measurement on the S-machine. 3D 2D Toggle between 3D and 2D view.
	Add a feet pair. Only available for E540. In E710/E720 you select machines and optional number of feet when you select custom.
	Toggle button. Show movable machine to the left or the right.
	Continue to Measure view. Available when you have entered the distances.

Filter

When you measure Softfoot, the detector filter is increased by three steps (maximum to filter 7). If you measure with a higher filter than 7, that filter will remain. When the Softfoot measurement is done, the filter is restored.

Measure softfoot

1. Tighten all feet bolts.
2. Turn the measuring units to 12 o'clock.
3. Adjust laser to the centre of targets. If needed, adjust the units on the rods, then use laser adjustments knobs.



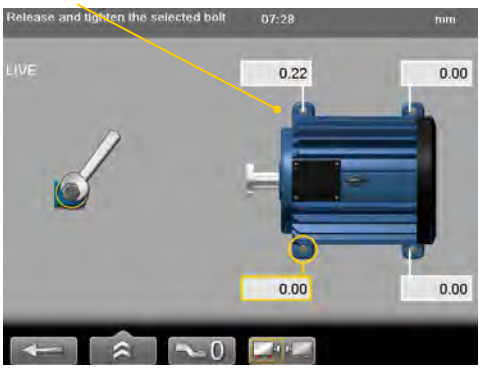
Turn the measuring units to 12 o'clock.

Adjust laser point to centre of target.

4. Press . The Softfoot measure view is displayed. The first bolt is marked with yellow.
5. Loosen and then retighten the first bolt.
6. Press to register value.
7. Register values on all four feet. The result is displayed.
8. Shim the foot with the largest movement.
9. Do a Softfoot check again.

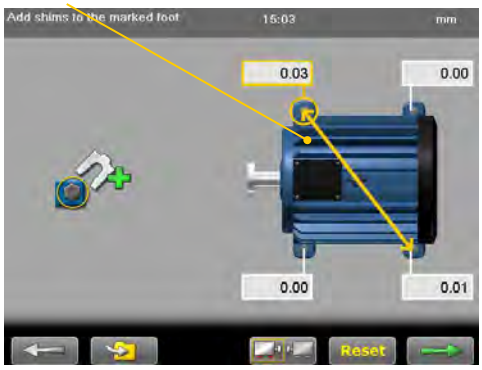
Measure:

Loosen and retighten bolt before register value.



Result:

Arrow indicating that the machine is tilting in this direction.



Note!

If the largest movement is opposite from the smallest it is not a conventional softfoot and you will be asked to check the foundation.

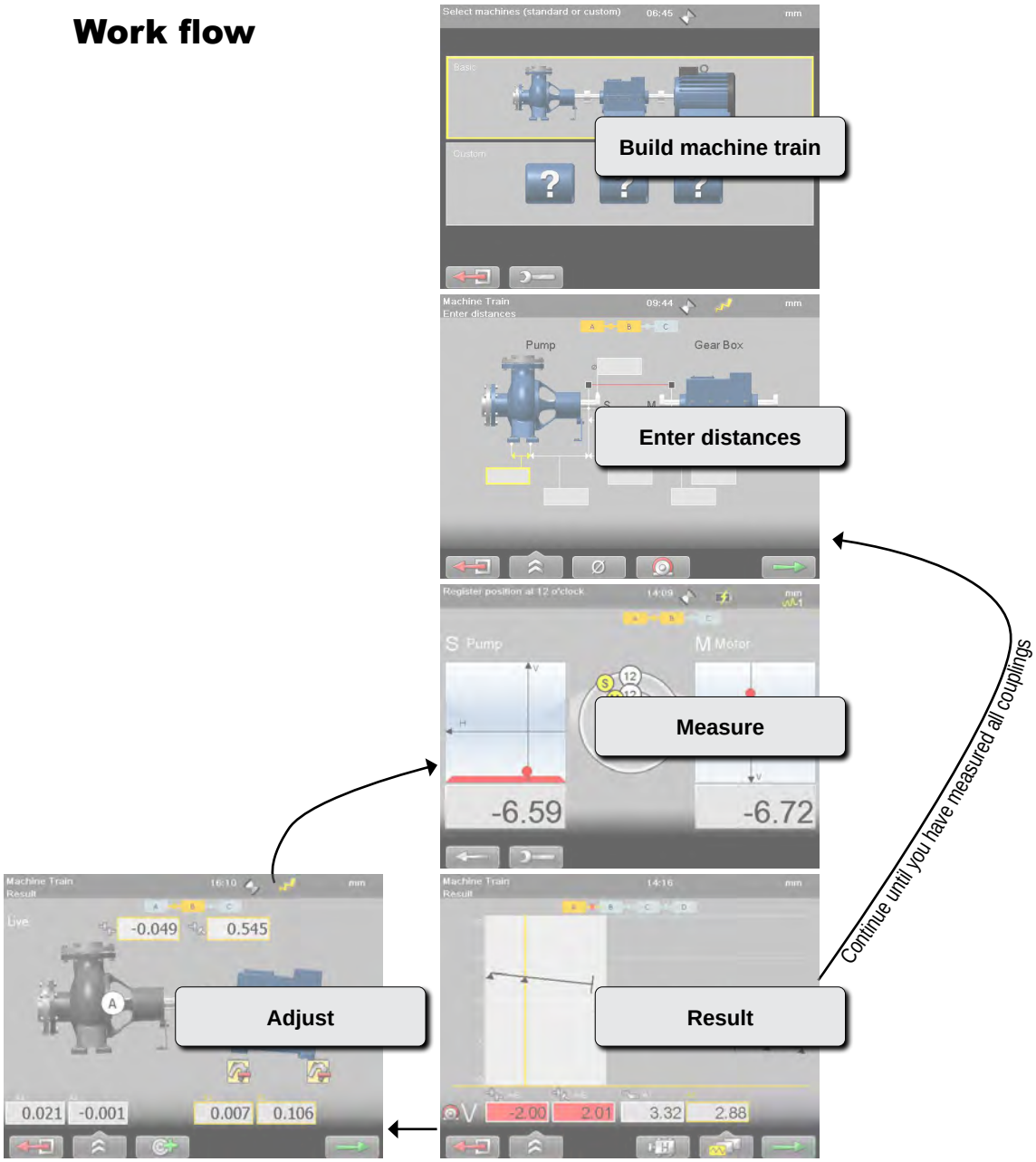
Function buttons

	Leave Softfoot.
	See "Control panel" on page 15. Save. Only available when you have started Softfoot from the main menu.
	Zero value of selected foot.
	Toggle button to switch machine. To check Softfoot, distances between feet pairs are necessary. If needed, the Enter distance view is displayed. *Not available for E420.*
	Remeasure Softfoot.
	Continue to Measure view, only available when you have started Softfoot from the program Horizontal.

MACHINE TRAIN

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

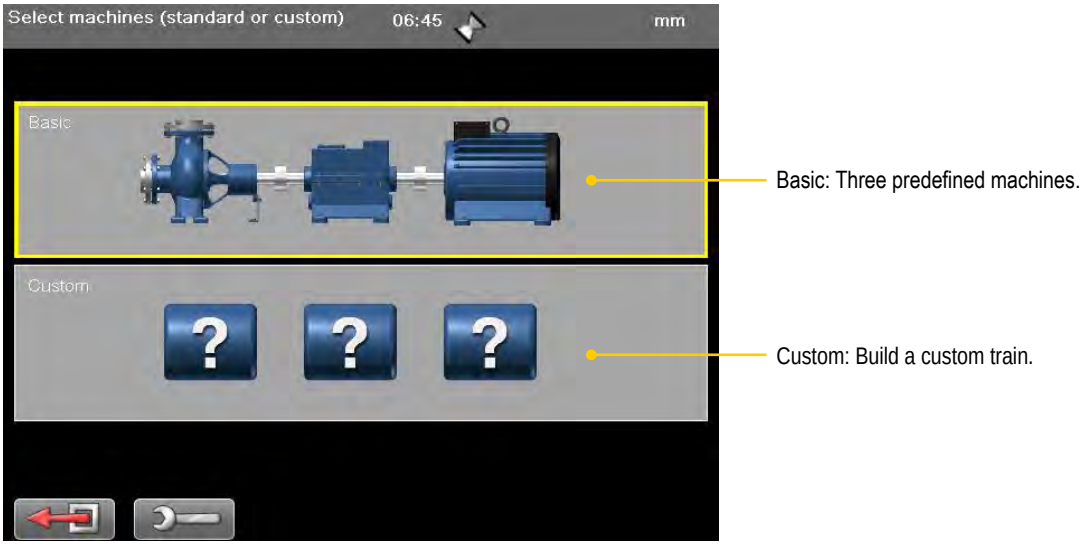
Work flow



Build machine train

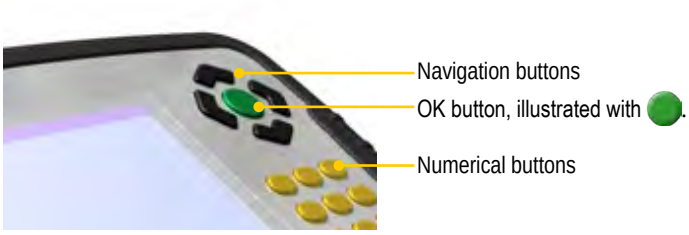
Before measuring your machines, you need to define what kind of machines you have.

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



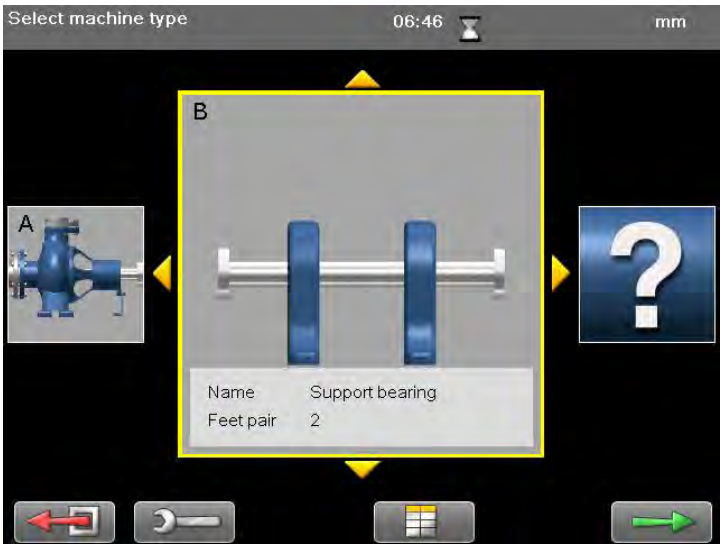
Basic

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.

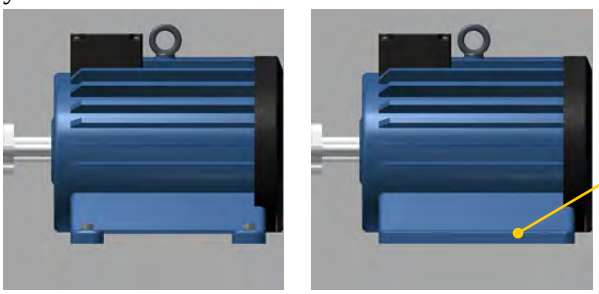


Select machine

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

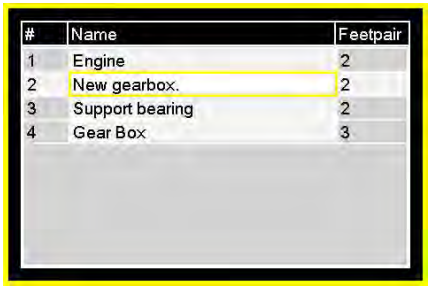
If you want to change the number of feet pair on the machine, simply enter the number you want on the numerical buttons.



Machine with two feet pairs

Build train table

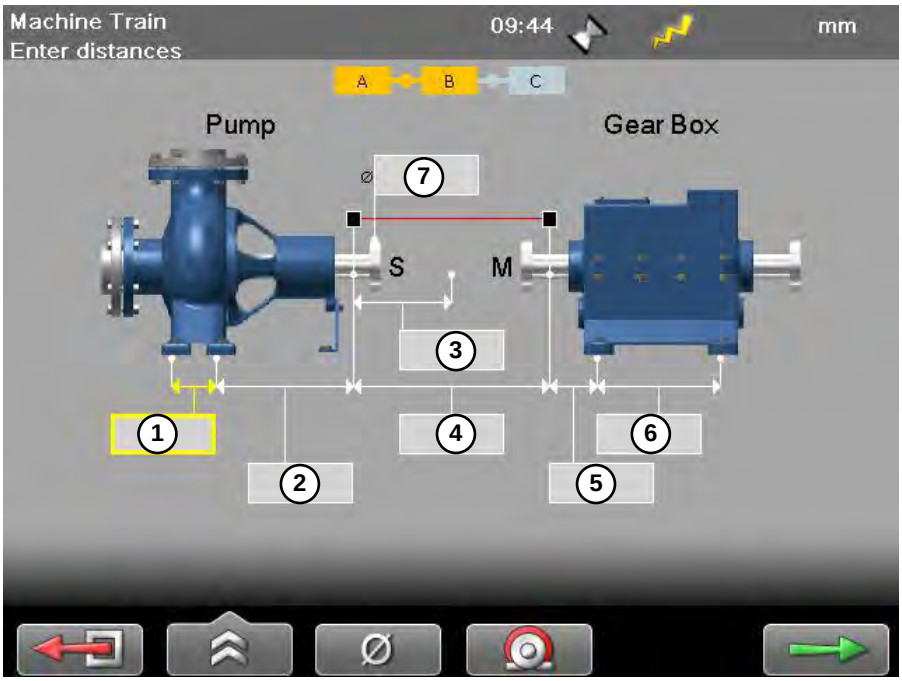
Select to open a table view. In this table you can rename the machines and change the number of feet pairs.



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

Enter distances

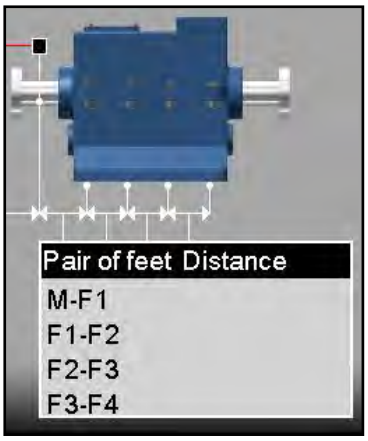
Confirm each distance with .



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 ⌀ to activate field.

Function buttons

	Leave program.
	See "Control panel" on page 15. *See "Tolerance" on page 174.* *See "Thermal compensation" on page 155.*
⌀	**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.

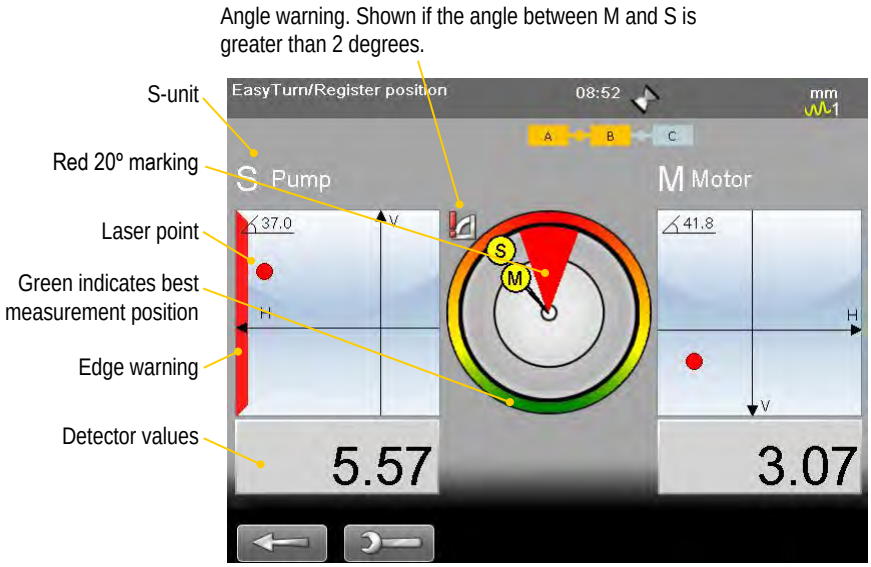


When there are more than three feet pairs, a table is displayed where you enter the distances.

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

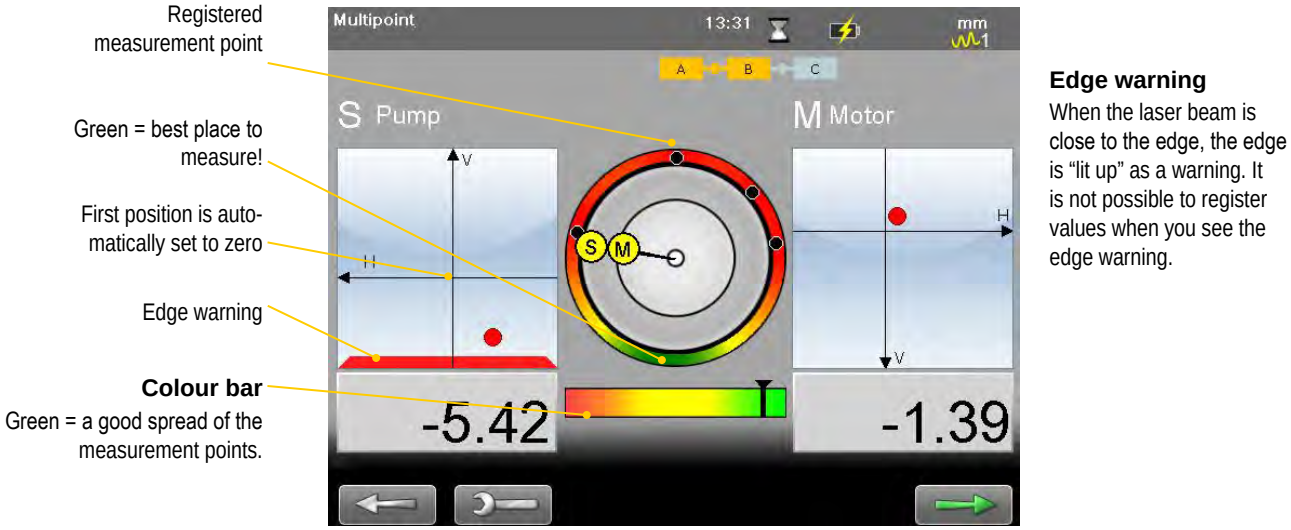
	Back. Measure previous position or back to Distance view.
	See "Control panel" on page 15.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See "SOFTFOOT" on page 159.

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 168*.
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 172*.

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.



Function buttons

	Back. Measure previous position or back to Distance view.
	See "Control panel" on page 15.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	See "SOFTFOOT" on page 159.
	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 168.*
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 172.*

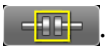
Function buttons

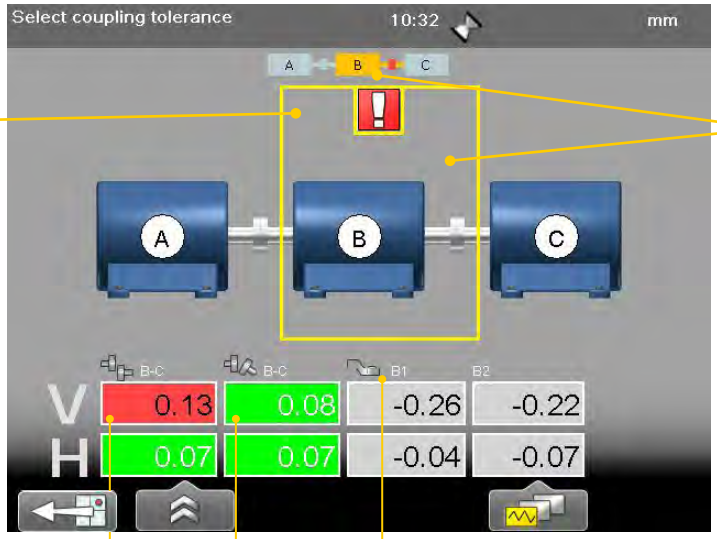
	Back. Measure previous position or back to Distance view.
	See "Control panel" on page 15.
	Switch to the EasyTurn™ method. Switch to the 9-12-3 method. Switch to the Horizontal Multipoint method.
	Softfoot.

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.



Coupling not within tolerance.

Selected machine and coupling

Horizontal and Vertical offset

Horizontal and Vertical angle

The selected machine's feet pair

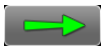
Feet pair

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

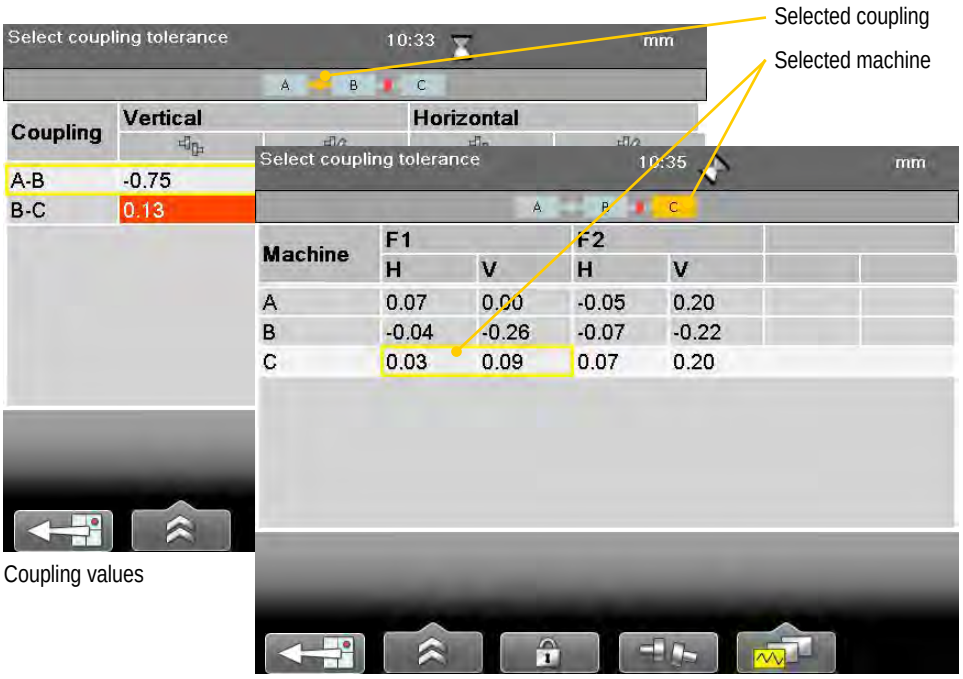
Select the machine you want to adjust and press  . *See "Adjust" on page 172.*

Function buttons

	Remeasure the coupling. Press and hold to leave program.
	 *See "Control panel" on page 15.*  **Save file**. *"Measurement file handling" on page 11.*  *See "Tolerance" on page 174.*  *See "Thermal compensation" on page 155.*  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 15.*  **Save file**. *"Measurement file handling" on page 11.*  *See "Tolerance" on page 174.*  *See "Thermal compensation" on page 155.*  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 171.*
	Toggle between showing feet or coupling values.
	**Switch result view**.

Save

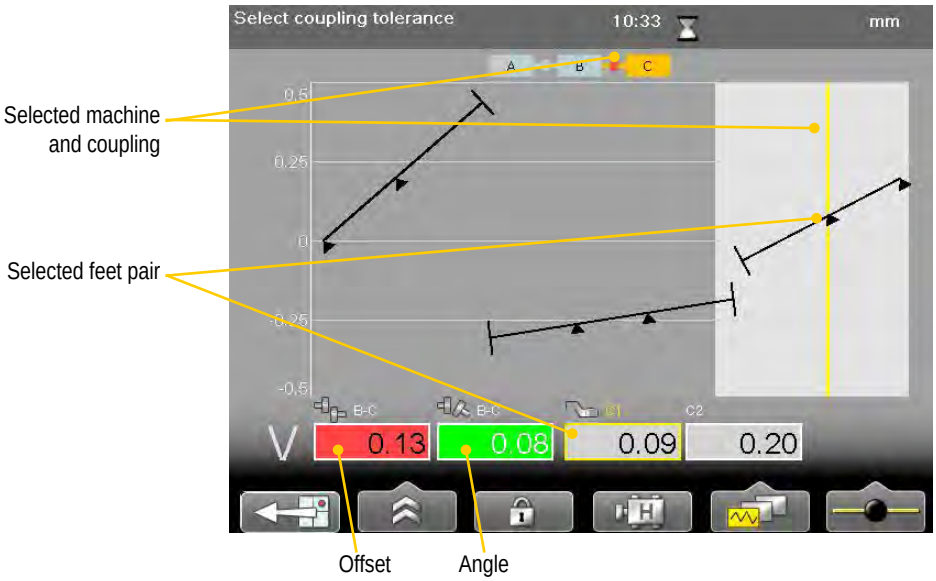
You can save a measurement and open it later to continue to measure. When you save the measurement again, it will **not** overwrite the earlier version.

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 168.*
	Lock / unlock feet pair. If you can not adjust a feet pair, use the lock function. *See "Lock feet pair" on page 171.*
	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

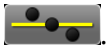
By default, an average best fit is calculated on the measured machine train. This means that the train is tilted to the flattest possible plane. If no feet pairs are locked, the system assumes that all machines are possible to move in all directions. For each coupling that you measure, the best fit is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

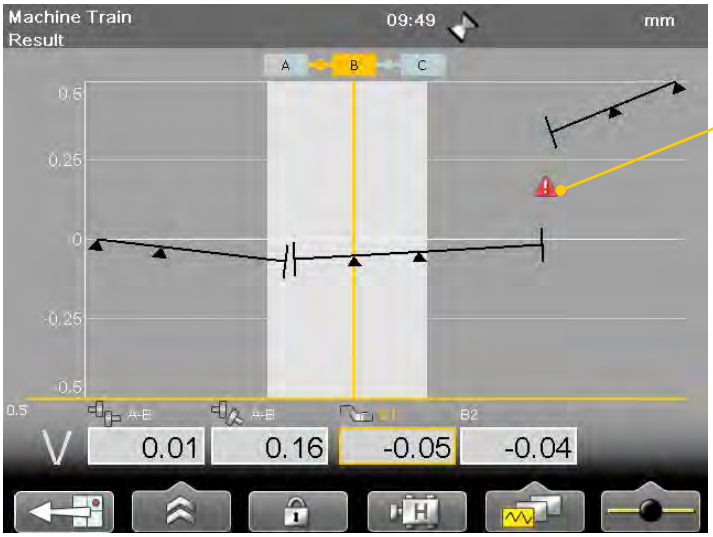
1. Select  and  to activate the Manual fit function. If there are locked feet pair, these are unlocked.
2. Use the numerical buttons to move the graph.

- 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  .

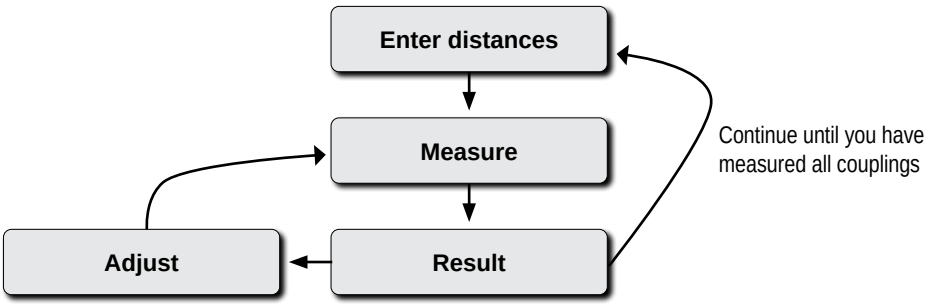
Uncertain coupling

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.

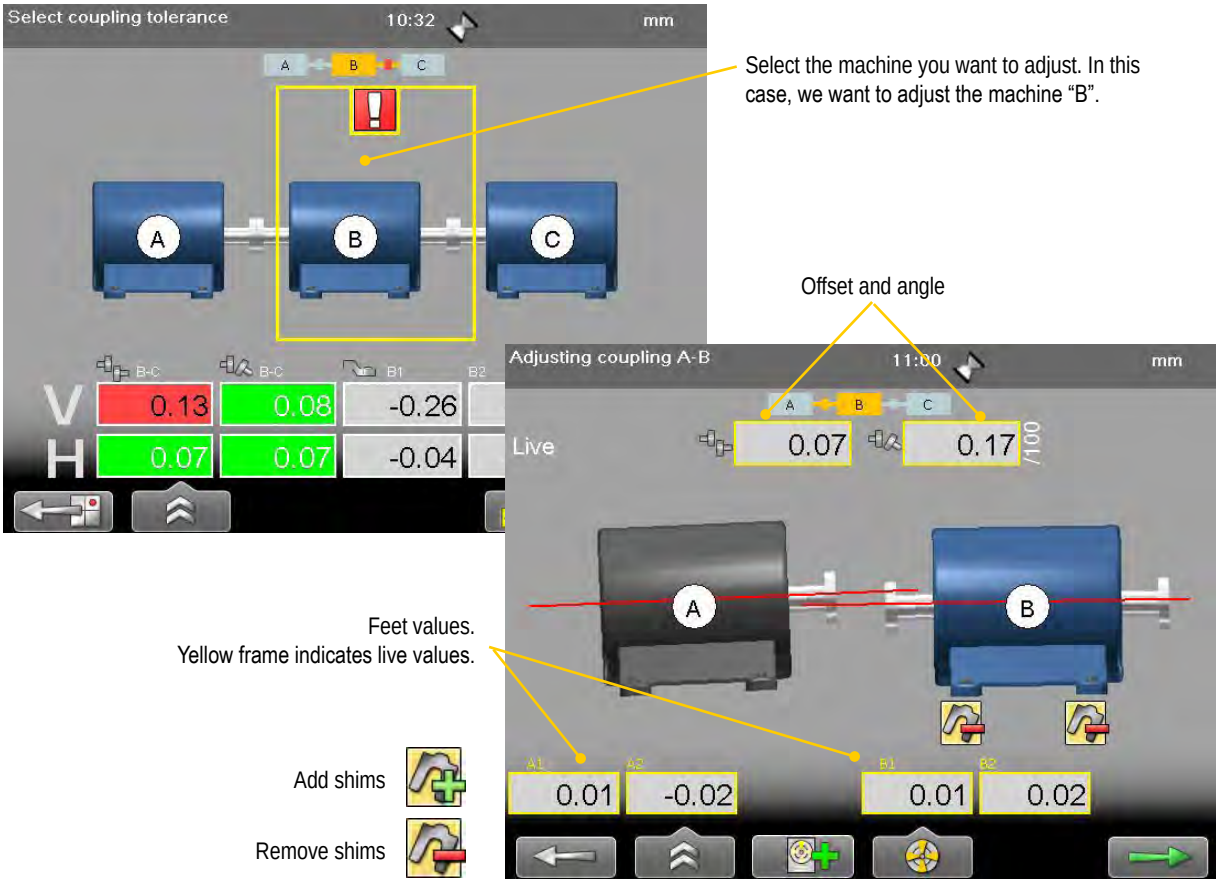


Adjust

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

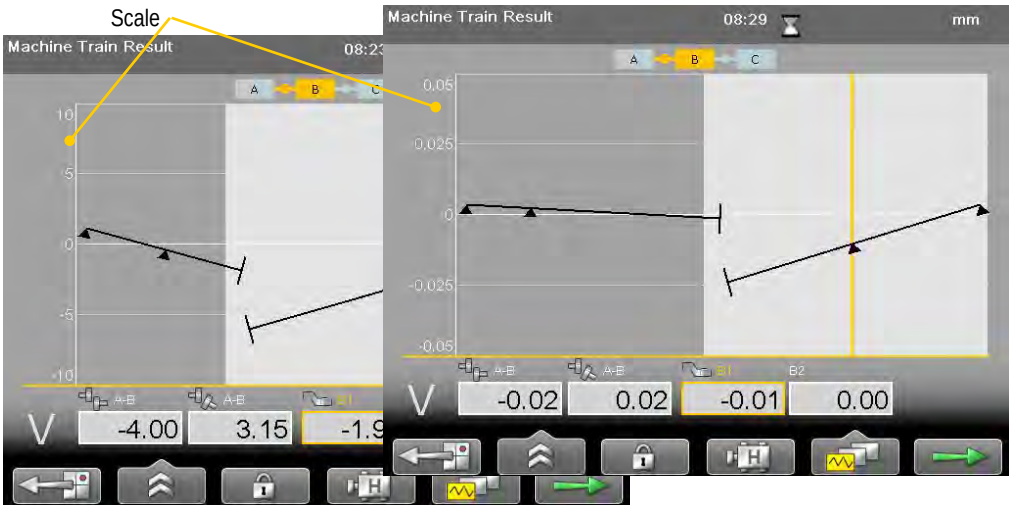
	Back to result view.
	See “Control panel” on page 15.
	Toggle button. Select to show/hide Position indicator. *See “Position indicator” on page 153.*
	See “Live values” on page 152.
	Continue. You need to remeasure the coupling to confirm the position of the measuring units.

Uncertain coupling

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

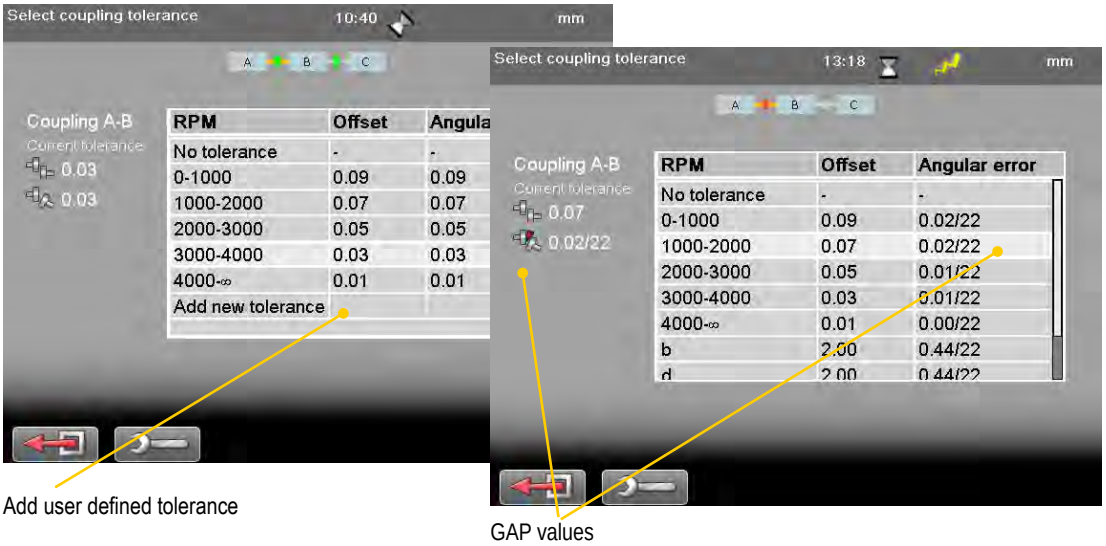
Scale

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



Tolerance

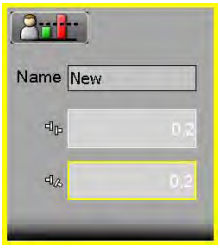
1. Select and . The tolerance window is displayed.
2. Select a tolerance and press . **The next coupling in the train is selected**.



Function buttons

	Close Tolerance view.
	See “Control panel” on page 15.
	Edit user defined tolerance.
	Delete user defined tolerance.

Add new tolerance

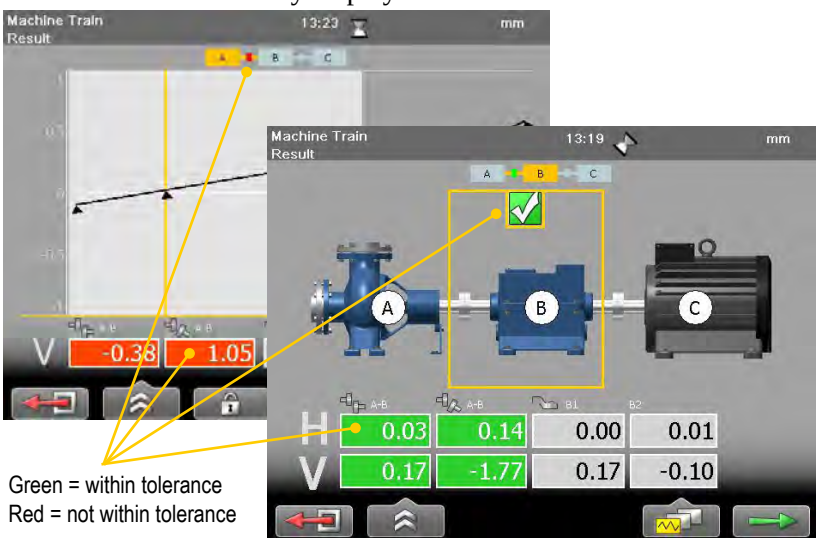


You can add your own user defined tolerance.

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.



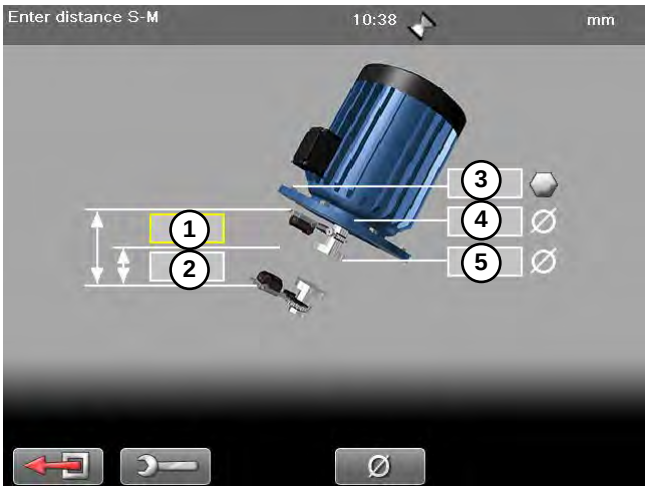
VERTICAL

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 15.
	Select to enter diameter of coupling.
	Forward to measure view.

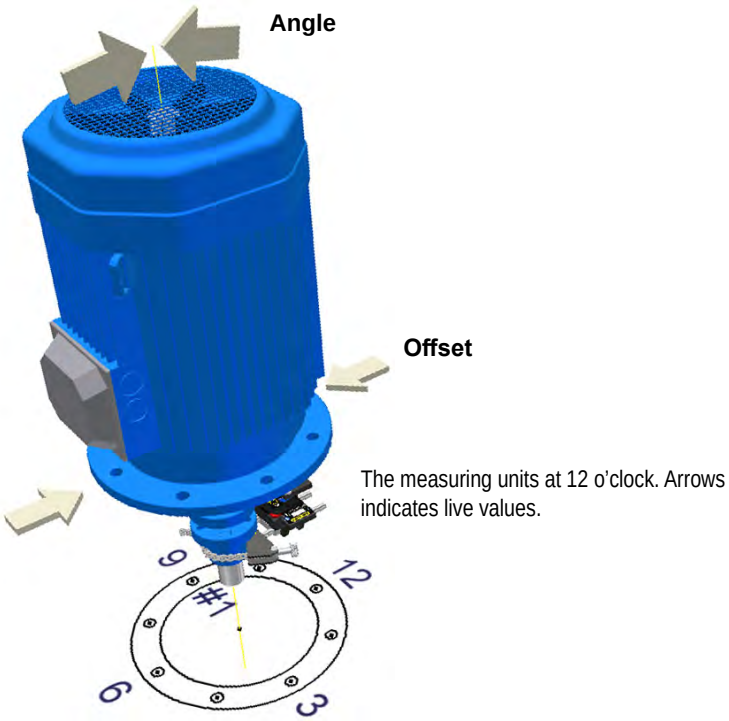
Measure

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.

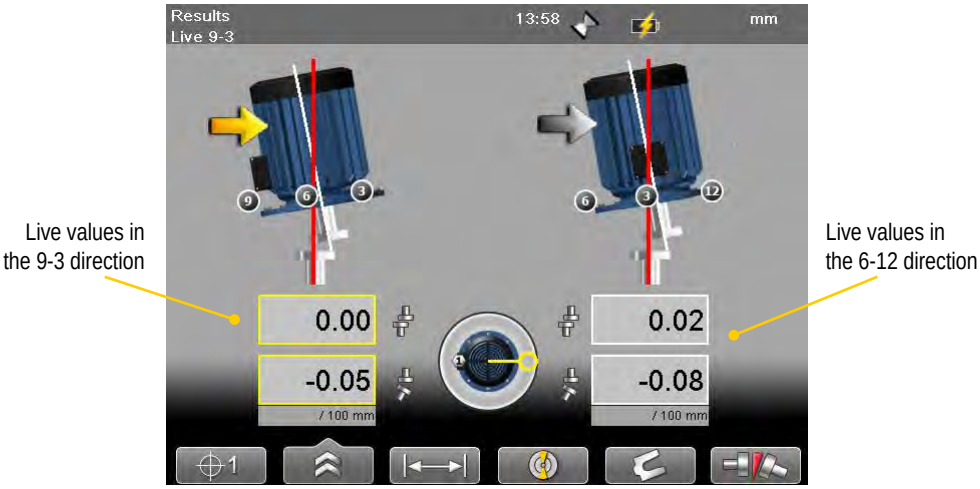
Edge warning

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 15.
	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 178.
/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.

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

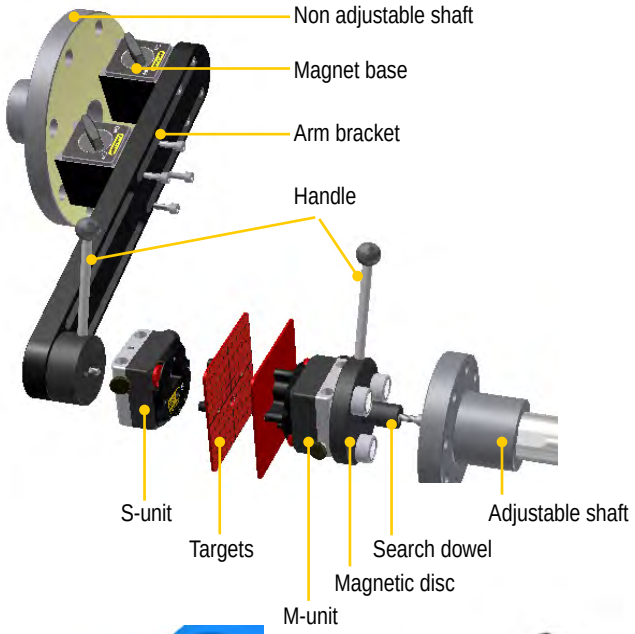
1. Compare the offset and angular error to the tolerance demands.
2. If the angular error need to be adjusted, please shim the machine first, then adjust the offset.
3. Tighten the bolts and remeasure.

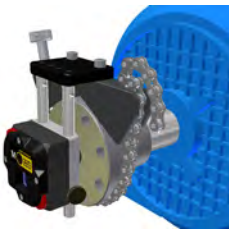
The Cardan program is used for alignment of cardan-shaft-coupled/centre-offset machines.

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.

The Cardan bracket has an offset range of 0 - 900mm.



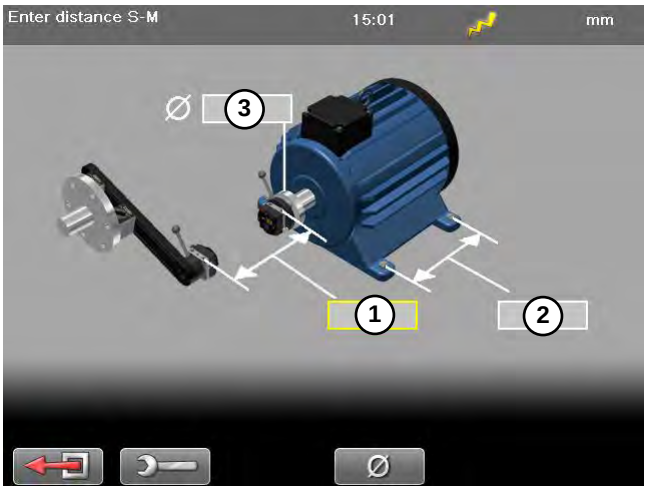


Alternative mounting with offset bracket and chain.

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.

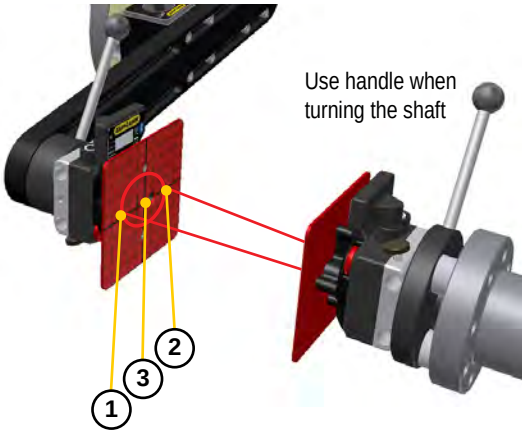
3 Coupling diameter. Optional, select Ø to activate field.

Function buttons

	Leave program.
	See "Control panel" on page 15.
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.

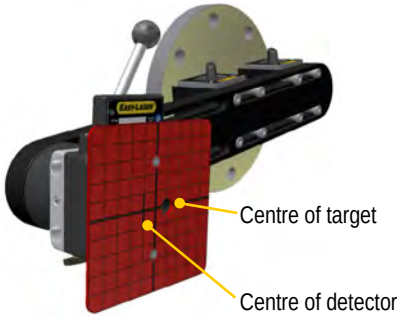
Cone laser beam

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*.



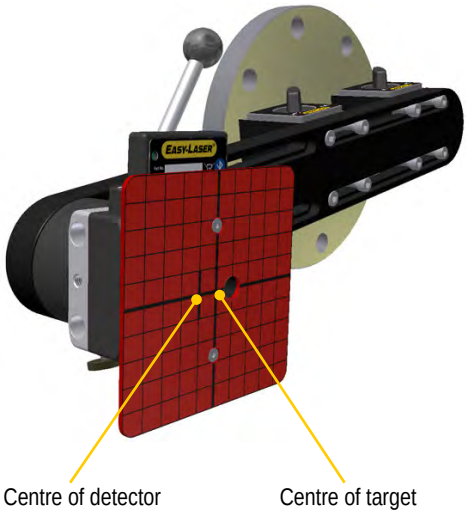
1. Note where the laser beam hit the target at position **1**.
2. Turn one of the shafts 180º. Note the position **2**.
3. Adjust the laser beam halfway towards position **1**, to position **3**.
4. Turn the shaft again. If the laser beam does not move when you turn, the laser beam is correctly coned.
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

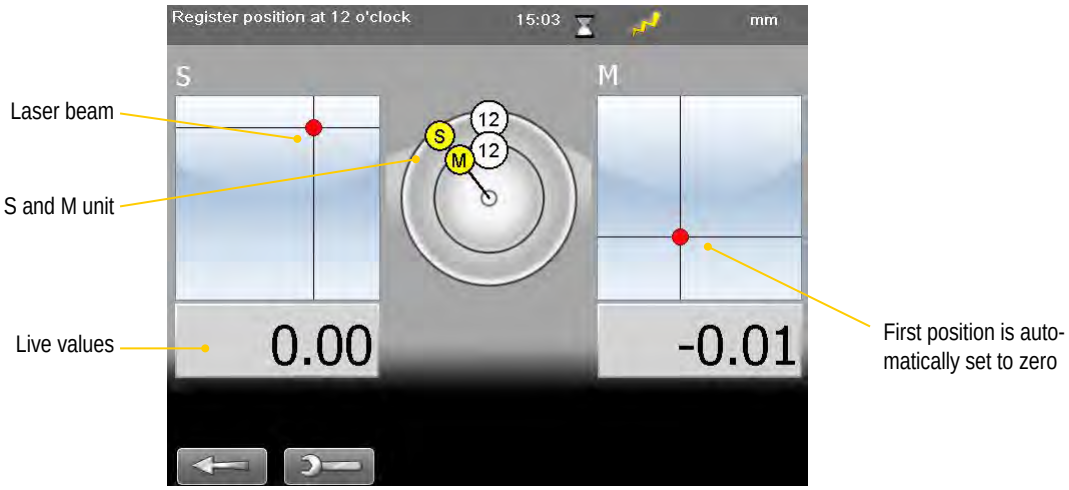
1. Adjust the arm bracket until the laser beam from the M-unit hits the centre of the target.
2. Adjust the movable machine until both laser beams hit **centre of the targets**.
3. Adjust the arm bracket if the adjustment of the machine is not enough.
4. Turn the shafts to 9 o'clock.
   Connectors pointing 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.



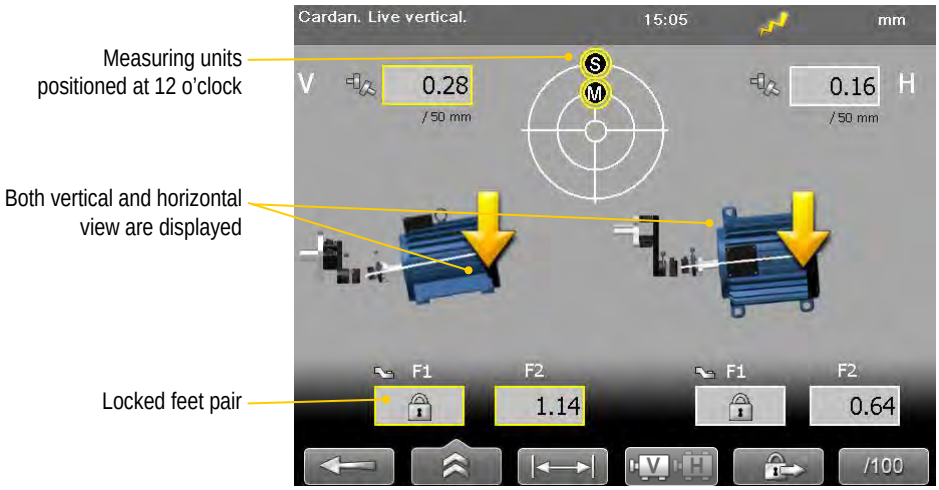
Measure

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 15. *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.
/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.

Adjustment

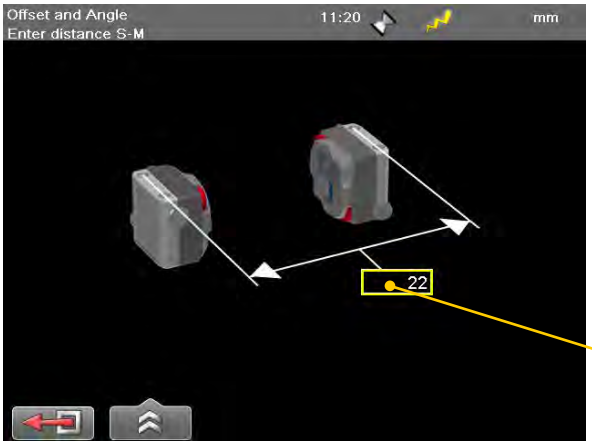
Check the machine according to the tolerance and adjust the machine if needed. No offset adjustment is made.

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 1 to remeasure.

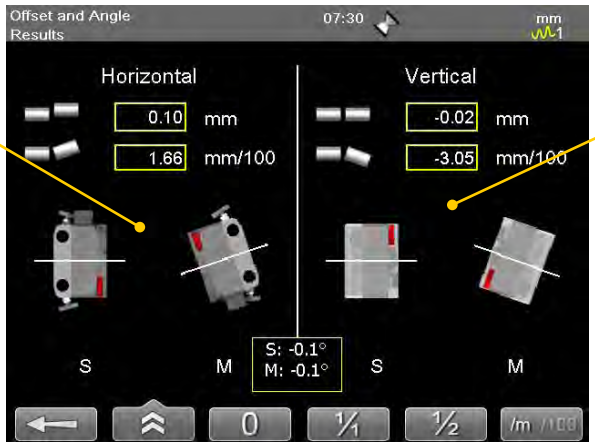
OFFSET AND ANGLE

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**.



Enter distance



Horizontal offset and angle displayed

Vertical offset and angle displayed

Function buttons

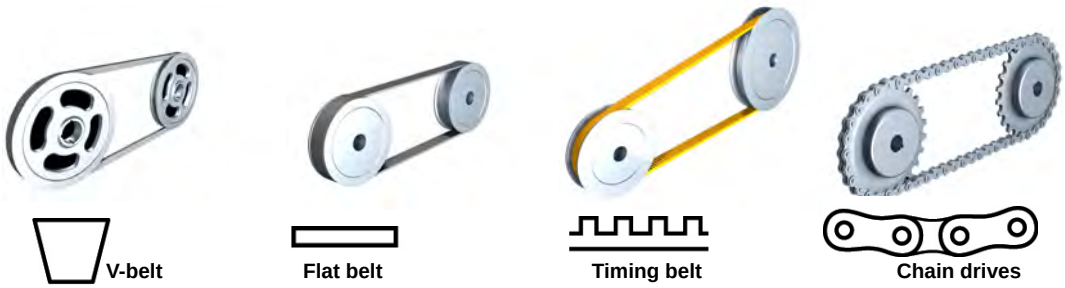
	Leave program.
	See "Control panel" on page 15. Show target. This is a quick way to see where the laser beam hits the target and how the measuring units are positioned. *See "Streaming values".*
0	**Zero set**. Set current value to zero.
1/1	**Absolute**. Return to absolute value.
1/2	**Halve**. Halve the displayed value.
/m /100	Toggle between showing the value as **mm/100** or **mm/m**.

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 the Shaft or Geo systems but bought as an option.

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.

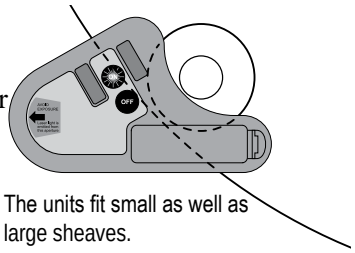
Offset misalignment | Angular misalignment | Offset and angular misalignment

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.

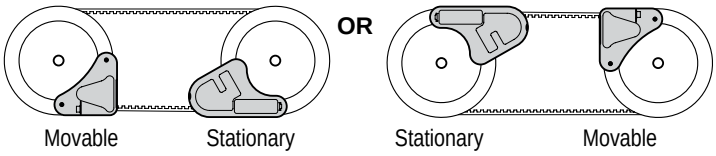
Mount the units

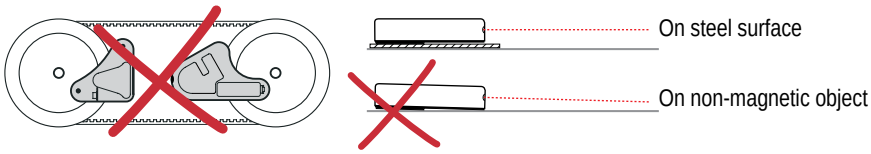
The units are mounted on a flat machined surface with magnets. The magnets are very strong, try to soften the touch by putting just one magnet to sheave first, then turning the other ones in. Non-magnetic sheave/pulleys can be aligned as the units are very light and can be mounted using double-sided tape.



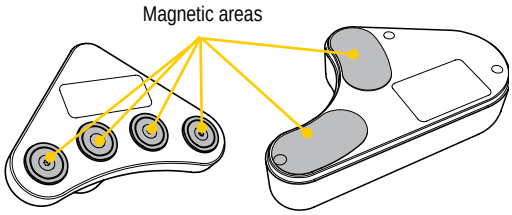
The units fit small as well as large sheaves.

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.

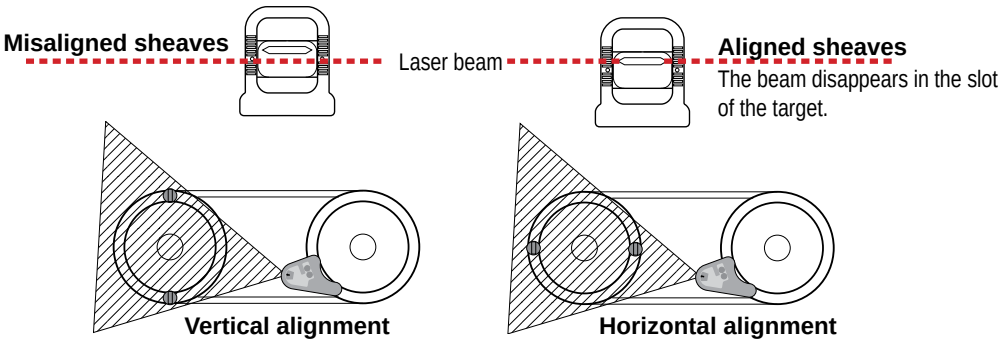




All of the magnetic surfaces must be in contact with the object.



Align with targets



Measure using Display unit

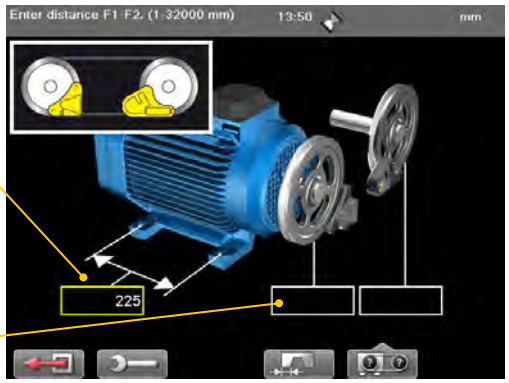
The XT190 can be used as a separate tool, see *"Measure without Display unit" on page 190*.

Enter distances

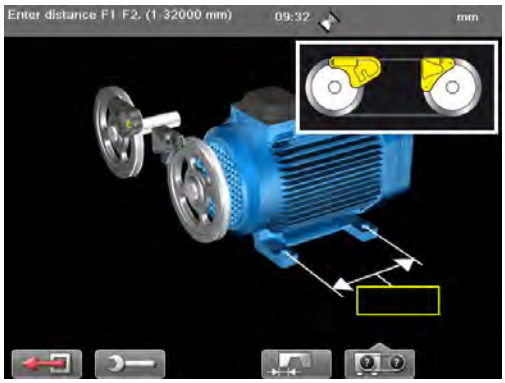
1. Connect to the Display unit.
2. Press the ON button on the laser transmitter.
3. Select to open the BTA program.
4. Select if you want to enter sheave face width. Press **OK**.
5. Enter distance between feet pairs. Press **OK**.

Distance between feet pairs **Mandatory**

Sheave face width **Optional**



Movable machine is to the left.



Movable machine is to the right.

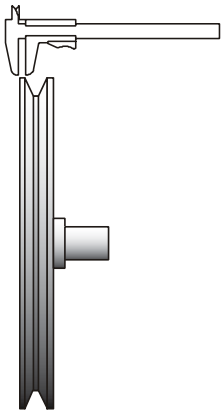
Function buttons

	Leave program.
	See "Control panel" on page 15.
	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

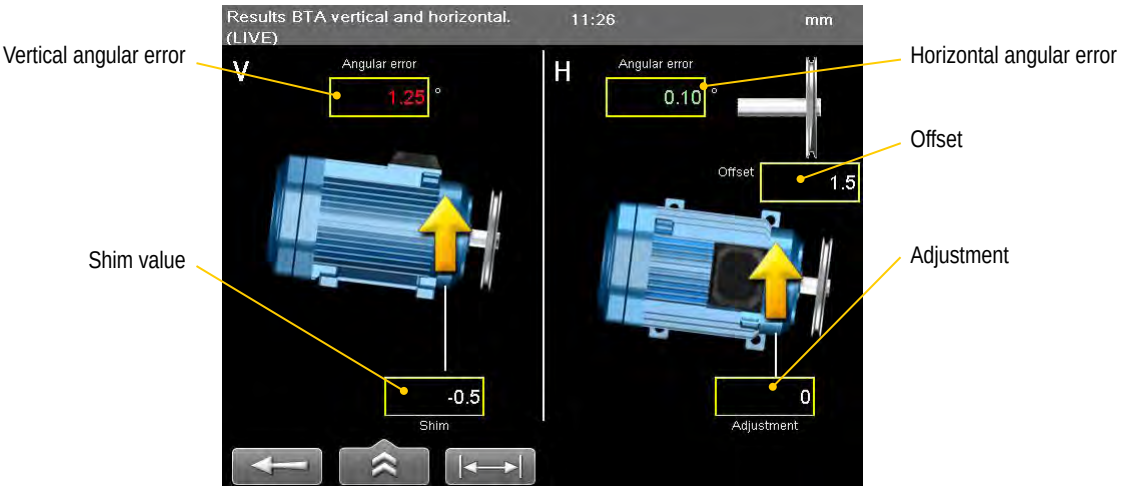
The distance from the belt to the axial face of the sheave can be different on the two sheaves. To calculate a possible offset the system requires both sheave face widths.

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 15. 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.

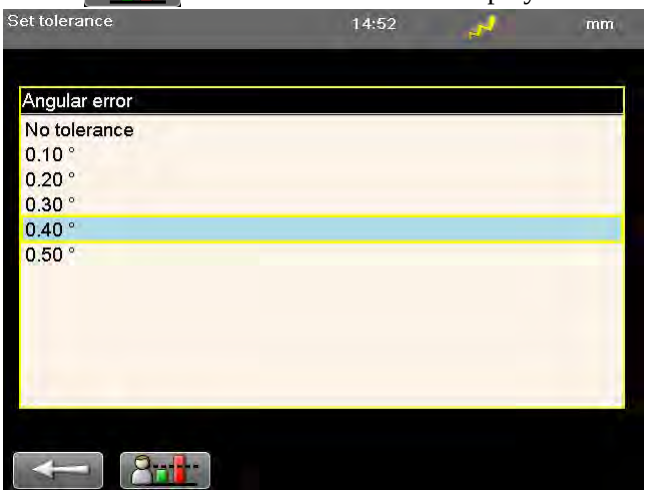
Note!

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.



<°	mm/m mils/inch	
0.1	1.75	
0.2	3.49	
0.3	5.24	
0.4	6.98	Recommended
0.5	8.73	
0.6	10.47	
0.7	12.22	
0.8	13.96	
0.9	15.71	
1.0	17.45	

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!

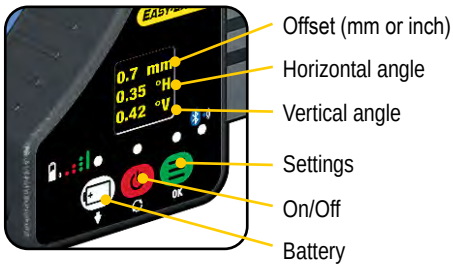
If not using the system for a long period of time, remove the batteries.

Measure without Display unit

The XT190 can be used as a separate tool.

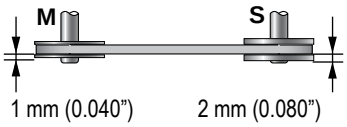
Measure

1. Press to start the detector and ON to start the laser transmitter.
2. Read the values. Offset, horizontal angle and vertical angle are displayed.
3. Adjust machine, see previous page.



Different sheave width

If the sheaves have different face widths, just add or subtract the difference from the zero value to get the value for perfect alignment.



Settings

Press to open the settings view. Use to move up and down in the menu.

- Press to switch position on the M and S-unit.
- Toggle between mm and inch with .
- Press to select XT or E-system.

Battery

Press to see the battery status of the detector. While the battery is charging, there is a green flashing light. The laser transmitter flashes when the battery is low. Change the batteries before you continue to measure.

Red, flashing once: Battery empty.	
Red, flashing twice: Battery needs charging.	
Green, flashing three times: Good.	
Green, fixed light: Battery full.	

Note!

If not using the system for a long period of time, remove the battery from the laser transmitter.

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.

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

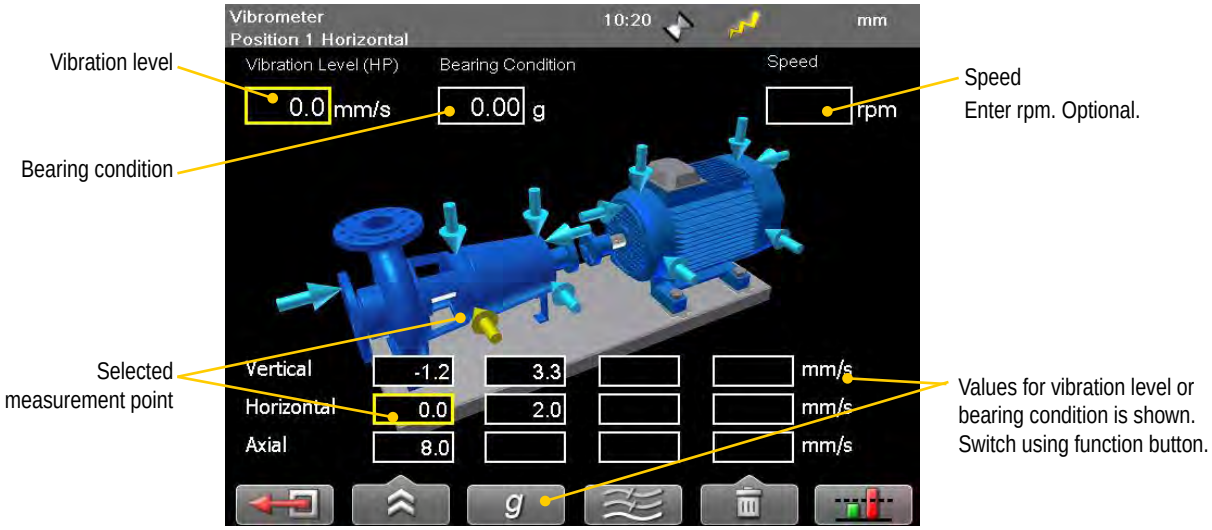
For measuring points that are hard to reach, use the measuring tip. Simply unscrew the magnetic tip and replace with the measuring tip. When measuring with the measuring tip, place it firmly against the measurement point and hold it as vertical, horizontal or axial as possible. When the measuring tip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

Note!

The Vibrometer (Part no. 12-0654) that is needed for this program has been discontinued.

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 ten seconds for the value to stabilize.
5. Press **OK** to register value.



Function buttons

	**Leave program**.
	 *See "Control panel" on page 15.*  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 deteriora-tion 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

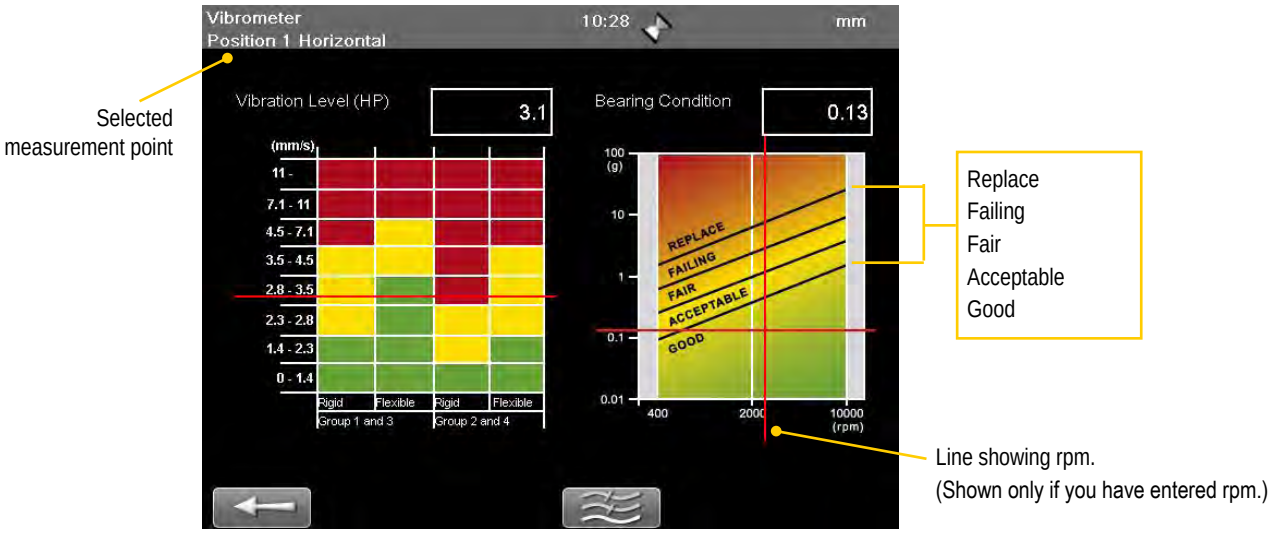
Bearing condition value is used for trend analysis. If the bearing condition value increases over time, it can be a sign that the bearing is poorly lubricated, overloaded due to misalignment or has a damaged surface. A high bearing condition value can however appear in gearboxes, converting machines 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 wireless connection.

Battery pack with wireless

(Part No. 12-0618)

This Battery pack has built-in wireless functionality. For more information on how to set up and search for units, *see "Set up wireless connection" on page 21*.

The Battery pack's serial number is placed on the backside. This serial number is shown 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 wireless 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.

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

*** Battery indicator**

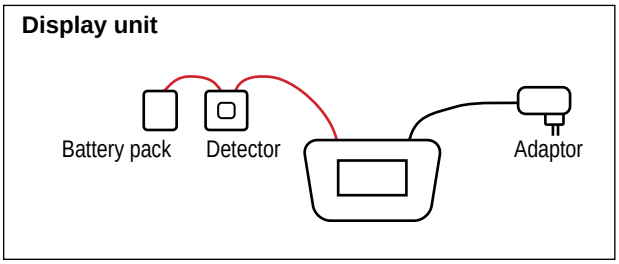
- Constant green light
  Battery pack full.
- Flashing green light
  Battery pack OK
- Flashing red light
  Battery pack low. Approx. 15 min. left to empty.
- Battery pack empty and will shut down.

Charge battery pack

Using Display unit

It is possible to charge battery packs **without** wireless funtionality 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.

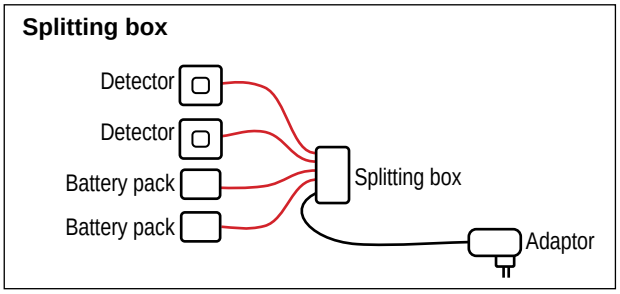
1. Connect the Display unit with the adaptor. The Display unit itself does not have enough power to charge the battery pack.
2. Use standard red cable to connect battery pack to the Display unit.



Using splitting box

When you have two battery packs or battery packs with wireless BT, 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.

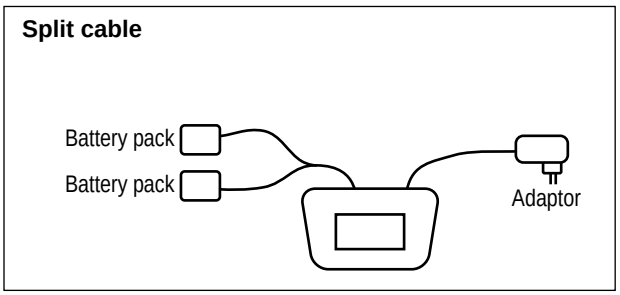


Using split cable

For two Battery packs or Battery packs with wireless BT, 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:

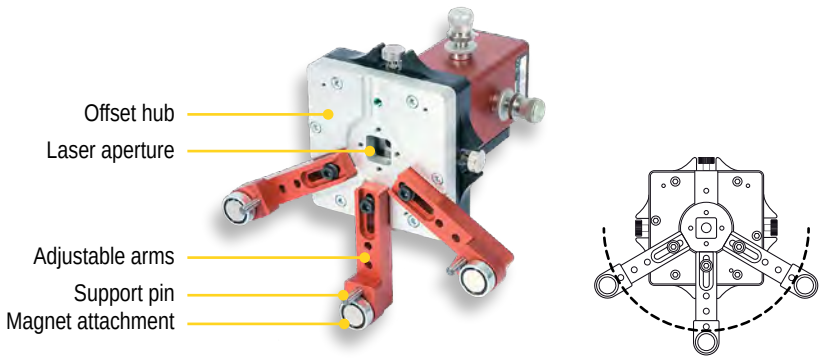
- Magnets are seated a machined surface, without tension.
- All magnets have full contact with the surface. If not, release and tighten screws.
- All screws on the bracket are properly tightened (but do not overtighten).
- Make sure that the laser transmitter battery is replaced to avoid interrupting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

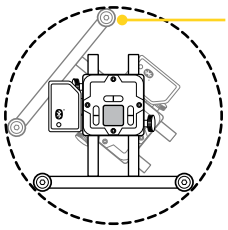
Using arms

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”]

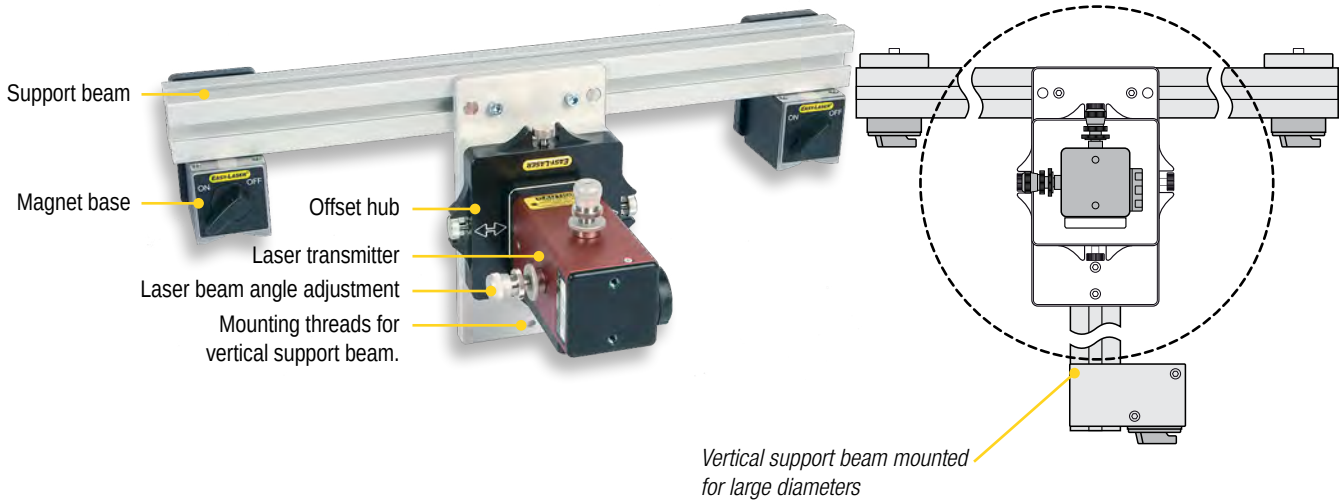
Part No: 12-0543

For bores Ø200–350 mm [7.87”–13.78”], width Min. 80 mm [3.15”].

Slide bracket min. Ø300 mm [11.81”]

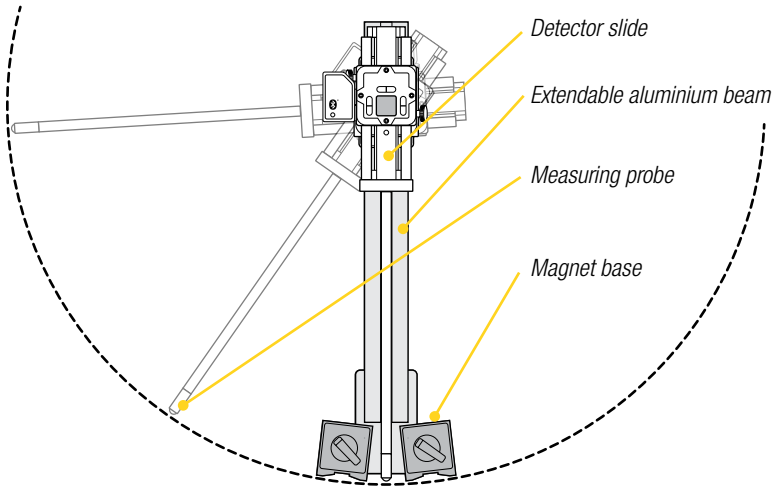
Part No: 12-0510

For bores Ø300–500 mm [11.81”–19.68”], width Min. 100 mm [3.94”].

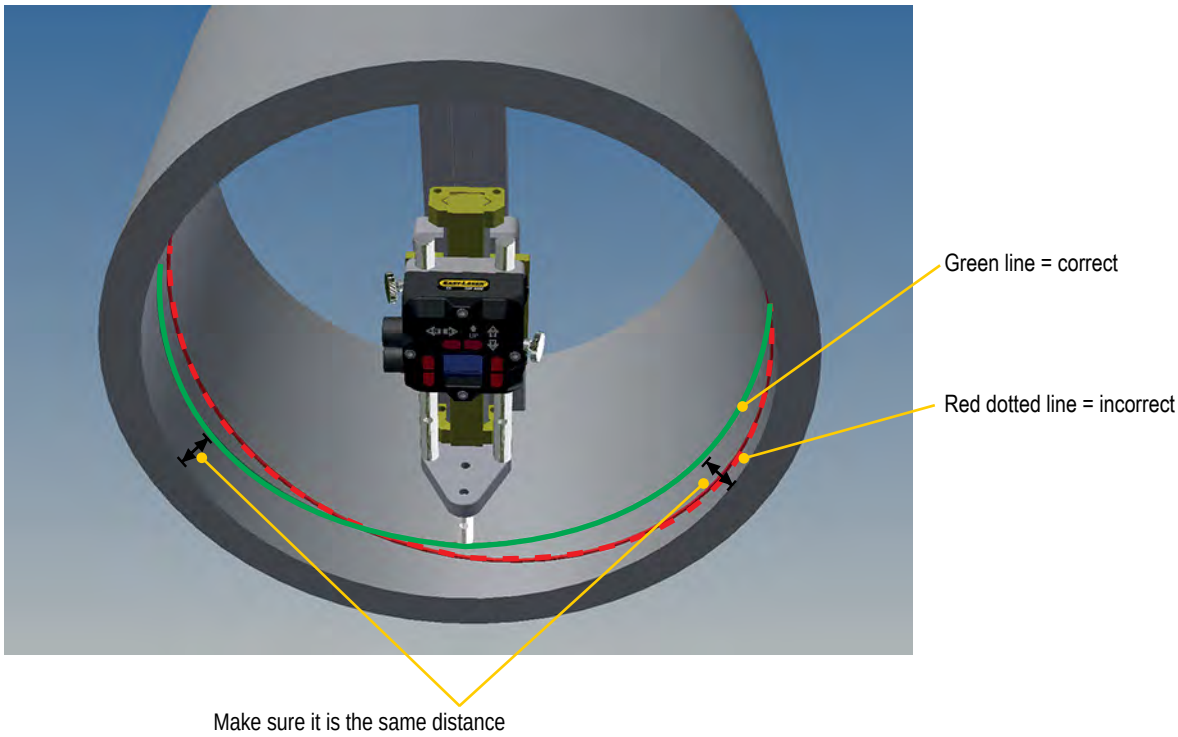


Self centering bracket

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

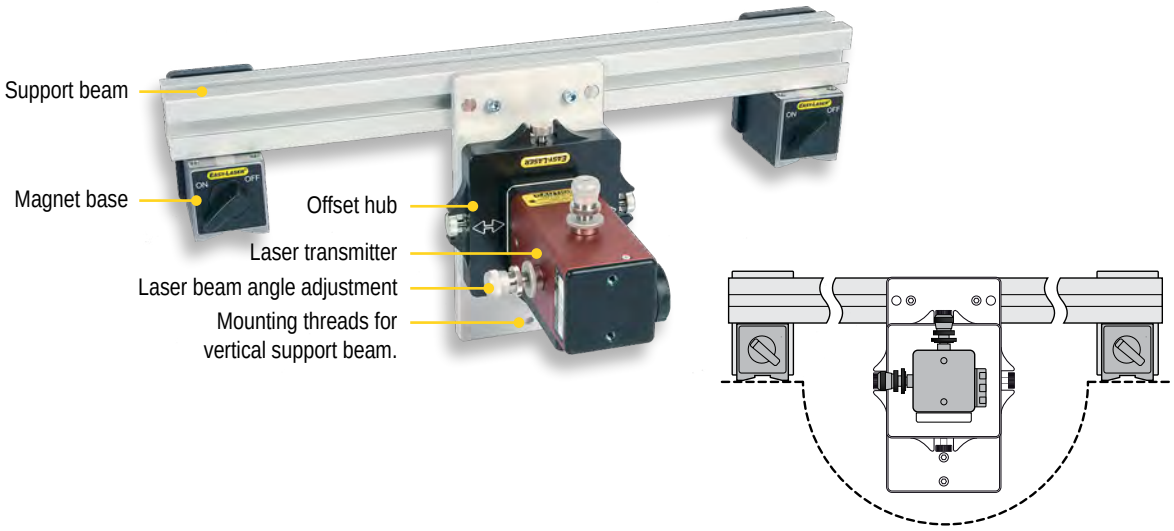
The laser should be placed on a stable and rigid place, free from air flow, vibrations and sunshine. A welded structure fixed to the ground or the turning gear bearing may be suitable locations.

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.

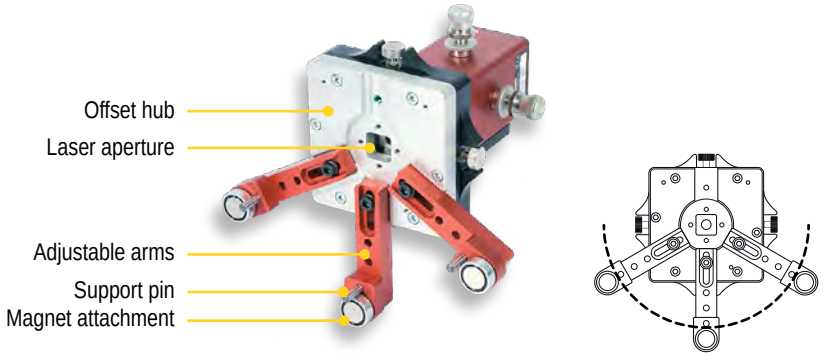
Using support beam

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.



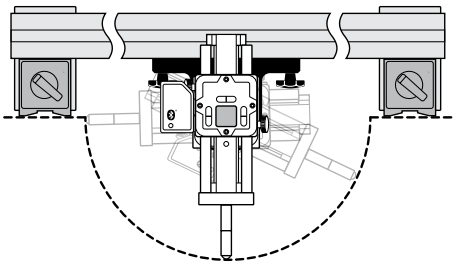
Using arms

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.

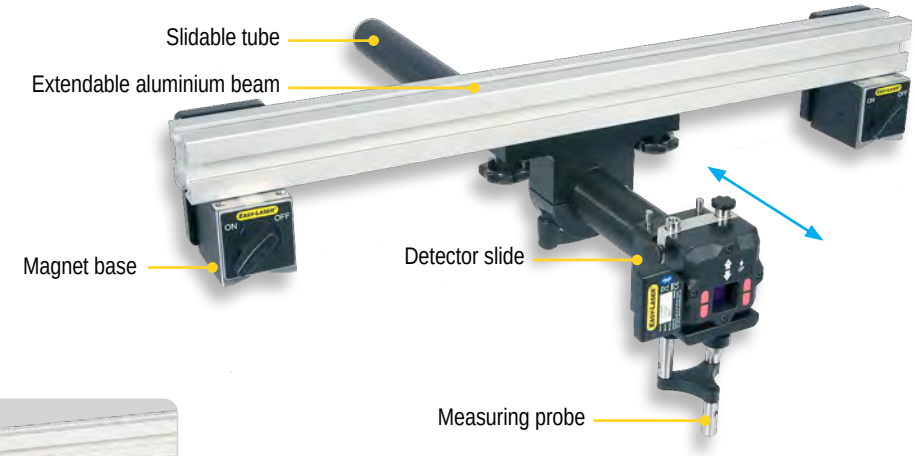


The measuring principle is the same for both long and short stroke bracket. The probe rod is very easily adapted to each diameter with extensions of different length.

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.

A B

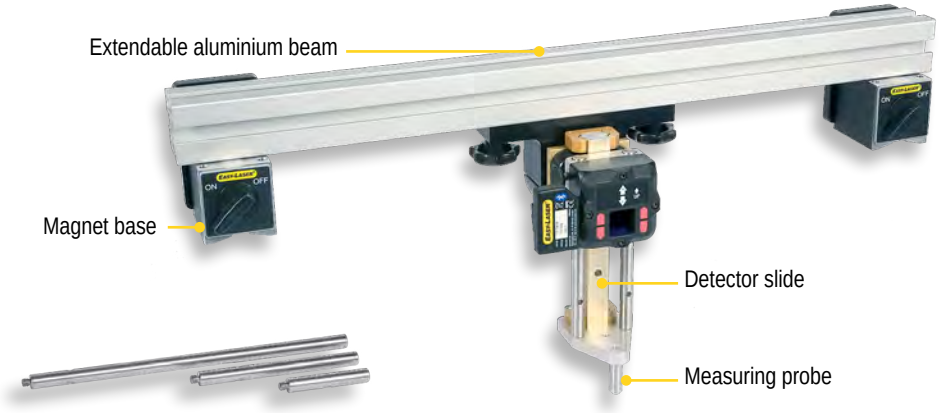
Included measuring probes:
A: Short ball top
B. Ball top

Gauge block (03-1291)

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® E720 Shaft

Part no. 12-0955

For the alignment of the machine, but also possibilities to perform the following:

- Measure the flatness of the foundation
- Check plane parallelism for several surfaces on large machines
- Measure flatness for a single machine foot support surface
- Align the foundation level and plumb
- Align pipes straight and square

A complete system contains	
1	Measuring unit M
1	Measuring unit S
1	Laser transmitter D22 incl. tilt table
1	Display unit E51
2	Wireless units. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
2	Cables 2 m
2	Shaft brackets with chains
2	Magnetic bracket
2	Extension chains
1	Magnet base
1	Magnet base with turnable head
2	Offset brackets
1	Set of rods 4x60 mm, 8x120 mm [4.72”, 2.36”]
1	Manual
1	Measuring tape 3 m
1	USB memory stick
1	USB cable
1	Charger (100–240 V AC)
1	Toolbox
1	Shoulder strap for display unit
1	Cleaning cloth for optics
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	14.8 kg [32.6 lbs]
Carrying case	WxHxD: 550x450x210 mm [21.6”x17.7”x8.3”] Drop tested. (3m/10 feet) Dust and water proof.

System Easy-Laser® E920 Geometric

Part no. 12-0771

This system is used for geometric measurements on machines. Straightness, flatness, squareness, plumb and level.

A complete E920 contains	
1	Display unit E51
1	Laser transmitter D22 incl. tilt table
1	Detector E7
1	Wireless unit (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
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	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

This system is designed to measure straightness and pointing direction, primarily on extruder pipes. Another application can be hydraulic pipes for example. The well-thought-out design of the system ensures that the measurement procedure is quick and accurate. Diameters down to 50 mm [1.97”] can be measured. Working range is up to 40 m [130’].

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	Carrying case

Note!

We recommend using cable when measuring extruder pipes, not wireless units.

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 D26 incl. tilt table
1	Measuring unit ESH (HyperPSD™)
1	Measuring unit EMH (HyperPSD™)
1	Display unit E51 (With HyperPSD™ support)
1	Wireless unit. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
1	Cable 2 m
1	Cable 5 m (extension)
1	Machine/magnet base pin for D26
2	Spindle brackets for measuring unit
1	Magnet base
1	Magnet base with turnable head
2	Offset brackets
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	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

Primarily for diesel engines (for example crank and camshaft bearings), gearboxes, compressors and similar applications. Positioning workpieces in machine tools is also an appropriate application.

Objects up to 40 m [132 feet] can be measured.

A complete E950-A contains	
1	Laser transmitter D75
1	Detector E7
1	Display unit E51
1	Wireless units (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
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	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

Primarily for propeller shaft installations on ships with stern tubes, support bearings, gearboxes and engines.

A complete E950-B contains	
1	Laser transmitter D75
1	Detector E7
1	Display unit E51
1	Wireless unit. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
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	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

Primarily for diesel engines (for example crank and camshaft bearings), gearboxes, compressors and similar applications. Positioning workpieces in machine tools is also an appropriate application.

A complete E950-C contains	
1	Laser transmitter D75
1	Detector E9
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	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

Has a 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.

A complete E960-A contains	
1	Laser transmitter D75
1	Detector E7
1	Display unit E51
1	Wireless unit (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
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
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	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

Has a measuring probe with a stroke of 60 mm. This system is suitable for larger turbines. Objects up to 40 m [132 feet] can be measured.

A complete E960-B contains	
1	Laser transmitter D75
1	Detector E7
1	Display unit E51
1	Wireless unit. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
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	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® E970

Part no. 12-0853

For parallelism measurement of rolls and other objects in numerous applications. The E970 is especially suitable when many objects are to be measured and aligned, and when the distances are long. Any chosen object or the baseline can be used as a reference.

For rolls with diameter 40 mm [1.6”] and larger. Maximum measurement distance with a standard system is 80 metres [260 feet].

A complete E970 contains	
1	Display unit E51
1	Laser transmitter D22 incl. tilt table
1	Detector E7
1	Wireless unit for E7. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
1	E290 Precision level.
1	Cable 2 m
1	Cable 5 m, extension
1	Angular prism D46
1	Parallelity kit
2	Tripods
1	Set of Rods 4x240 mm
1	Set of Rods 4x60 mm
1	Safety strap for laser transmitter
1	Manual
1	Measuring tape 5 m
1	USB memory stick
1	Battery charger (100–240 V AC)
1	Hexagon wrench set
1	Shoulder strap for display unit
1	Cleaning cloth for optics
1	Carrying case

System	
Relative humidity	10–95%
Weight (complete system)	18.9 kg [41.7 lbs] (complete system, tripods excluded)
Carrying case	Drop tested. Water and dust tight. WxHxD: 620x490x220 mm [24.4x19.3x8.7”]

System Easy-Laser® E975 Roll Alignment

Part no. 12-0854

System E975 is designed mainly for roll alignment. It is well suited when just one or two rolls are to be replaced or adjusted at the same time. For rolls with diameters 80–400 mm [3.1–15.8”], and a minimum length of 300 mm [11.8”] (accessory brackets for other dimensions available on request). Measurement distance between transmitter and detector up to 20 m (in each direction) [66 feet].

Note: The E2 detector that is included reads angles, not positions. This means that if you want to take full advantage of the measurement program package of system E975, you will also need a positional detector like e.g. the E7.

A complete E975 contains	
1	Display unit E51
1	Laser transmitter D22 incl. tilt table
1	Detector E2
1	Roll bracket
1	Digital Precision Level E290
1	Magnet base
1	Adapter plate for tilt table to magnet base
2	Rods 240 mm
2	Rods 120 mm
2	Rods 60 mm
1	Safety strap for laser transmitter
1	Manual
1	Measuring tape 5 m
1	USB memory stick with documentation
1	USB cable
1	Battery charger (100–240 V AC)
1	DC charging cable
1	DC to USB adapter
1	Hexagon wrench set
1	Shoulder strap for Display unit
1	Cleaning cloth for optics
1	Carrying case

System Easy-Laser® E980 Sawmill

Part no. 12-0727

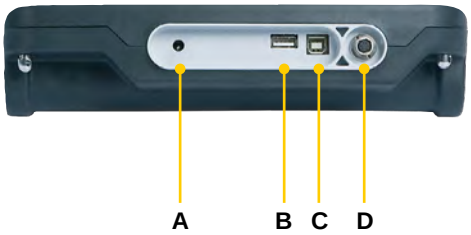
Easy-Laser® E980 helps sawmills to make optimal use of their machines. The system measures straightness, flatness and squareness.

A complete E980 contains	
1	Display unit E51
1	Laser transmitter D23
1	Detector E5
1	Wireless unit. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
2	Electronic targets
1	Cable 2 m
1	Cable 5 m, extension
1	Magnet base with turnable head
1	Shaft bracket
2	Brackets 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	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 USB A
C USB B
D Easy-Laser® measurement equipment

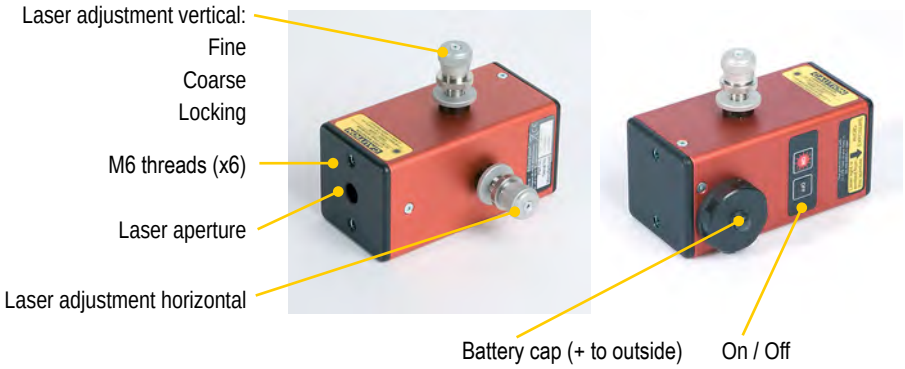
Display unit	
Type of display/size	VGA 5.7” colour
Displayed resolution	0.001 mm / 0.05 thou
Power management	Endurio™ system for unbroken power supply
Internal battery (stationary)	Li-Ion, Not restricted PI967, 3.7 volt, 43Wh, 11600 mAh
Battery compartment	For 4 pcs R 14 (C)
Operating time	Appro. 30 hours (Normal operating cycle)
Connections	USB A, USB B, Easy-Laser® units, charger
Storage memory	>100,000 measurements
Help functions	Calculator, Converter
Housing material	PC/ABS + TPE
Dimensions	WxHxD: 250x175x63 mm [9.8x6.9x2.5”]
Weight (without batteries)	1030 g [2.3 lbs]
Environmental protection	IP Class 65
Operating temperature	-10–50°C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	
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 and newer. 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.



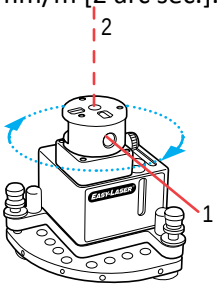
Laser transmitter D75 (with offset hub)	
Type of laser	Diode laser
Laser wavelength	630–680 nm, visible red light
Laser Safety Class	Class 2
Output	< 1 mW
Beam diameter	6 mm [1/4”] at aperture
Working distance	40-metre [130´]
Type of battery	1 x R14 (C) 1.5V, replaceable by user. Professional alkaline batteries recommended.
Operating time/battery	approx. 15 hours
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]
Operating temperature	0–50 °C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

Label with saftey precautions

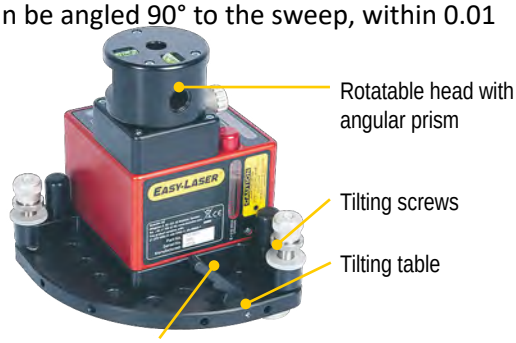
Laser transmitter D22

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 0.01 mm/m [2 arc sec.].



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

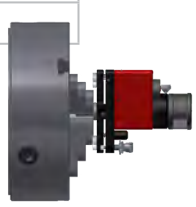


The release lever has to be removed before the D22 can be mounted on a tripod.

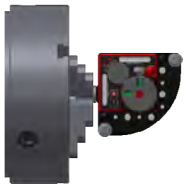
Note!

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	630–680 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) 1.5V, replaceable by user. Professional alkaline batteries recommended.
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]
Operating temperature	0–50° C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	



Mount D22 in a spindle

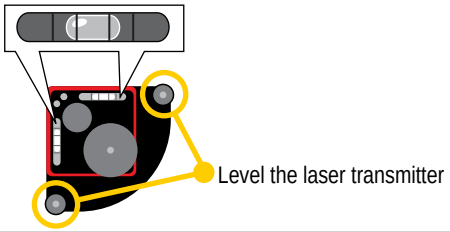


With the laser transmitter mounted in the spindle, you will have a stable laser beam position. You can mount the D22 in two different directions, see images.

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

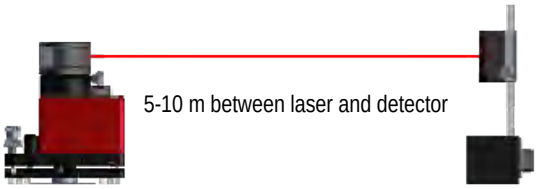
Calibrate spirit levels on D22

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.]. By calibrating the spirit levels and then use them to level the laser transmitter, you can achieve an absolute levelling of the laser plane of approximately 0.01 mm/m [2 arc sec.].



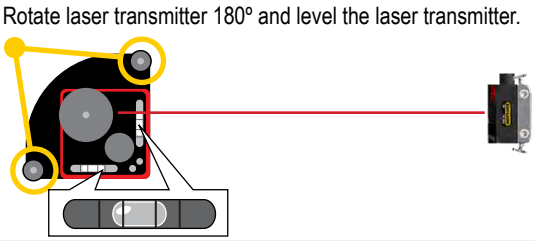
Level

1. Place the D22 laser transmitter on a flat and stable surface.
2. Level the laser transmitter according to the spirit levels. Use the tilting screws.



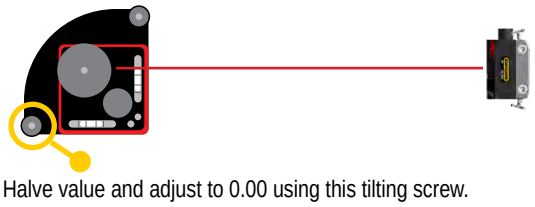
Zero set

3. Place the detector at a distance of 5-10 metres. Make sure that the laser beam hit the detector target.
4. Select V 0.00 H 0.00 to open the program Values.
5. Select 0 to zero set.



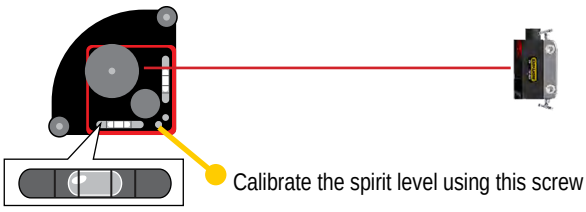
Index and level

6. Rotate the D22 180º and turn the laser beam to the detector.
7. Level the laser transmitter according to the spirit levels. Use the tilting screws.



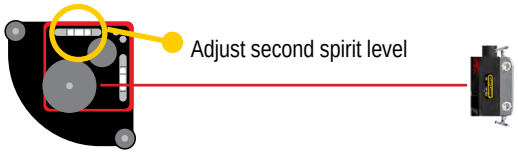
Adjust value

8. Select ½ to halve the value.
9. Adjust the V-value to 0.00 using the tilting screw.



Calibrate spirit level

10. Calibrate the spirit level using a hex key.
11. Repeat step 6–9 to control.

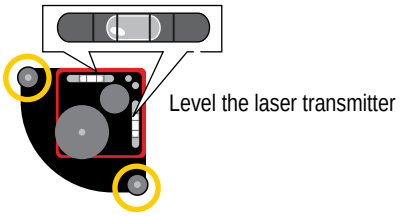


Calibrate second spirit level

12. Rotate the D22 90º and turn the laser beam to the detector.
13. Repeat step 4–12.

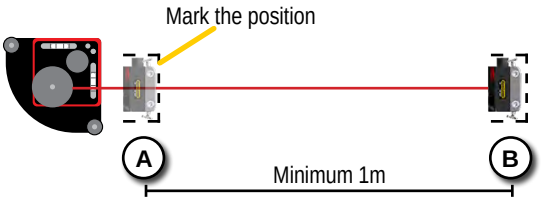
Calibrate the vertical spirit level on D22

Before you calibrate the vertical spirit level, you need to calibrate both horizontal spirit levels.



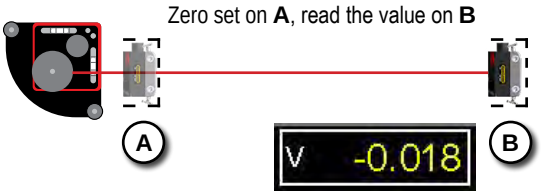
Level horizontally

1. Place the D22 laser transmitter on a flat, clean and stable surface.
2. Level the laser transmitter according to the spirit level. Use the tilting screws.



Rough align

3. Select V 0.00 H 0.00 to open the program Values.
4. Place the detector on position **A** and move the detector until the laser beam hits the centre.
5. Mark the position of the detector.
6. Move the detector to position **B** and move the detector until the laser beam hits the centre.
7. Mark the position of the detector.

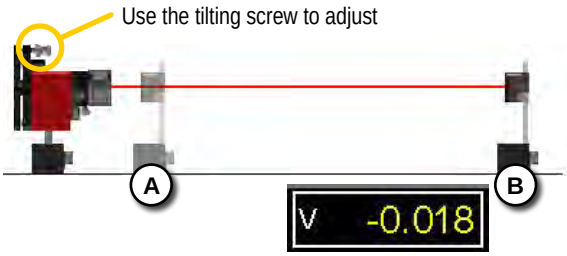


Zero set and read value

8. Move the detector back to position **A**.
9. Select 0 to zero set.
10. Move the detector to position **B**. Read and note the **vertical** value. In this example -0.018.

Mount the D22 vertically

11. Mount the D22 vertically using the pin (01-0139) or a plate (01-0874).
12. Rough align the detector on position **B** (± 0.1mm).



Zero set and adjust

13. Move the detector back to position **A**.
14. Select 0 to zero set.
15. Move the detector to position **B**.
16. Adjust until you have the same value as in step 10. Use the tilting screws.
17. Repeat steps 13–16 until you have 0 on position **A** and the right value on position **B**.

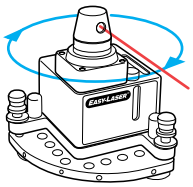
Calibrate spirit level

18. Calibrate the spirit level using a hex key.

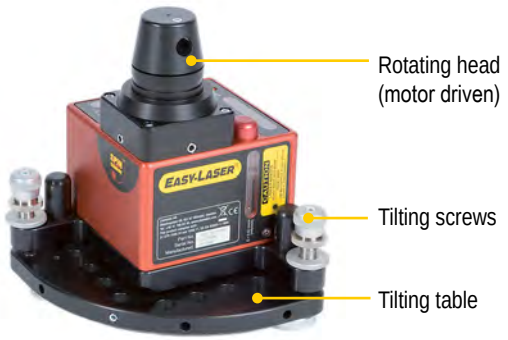
Laser transmitter D23 Spin

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) 1.5V, replaceable by user. Professional alkaline batteries recommended.
Operating time/battery	approx. 15 hours
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]
Operating temperature	0–50° C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

Labels with saftey precautions

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.

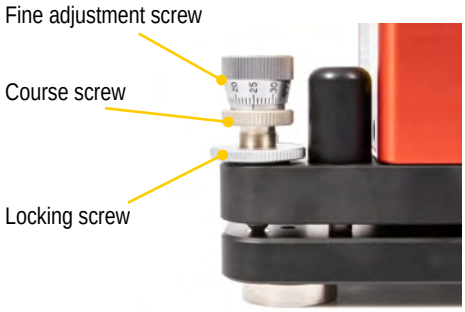
1. Loosen the locking screw.
2. Adjust with the course screw to wanted position.
3. Tighten the locking screw.

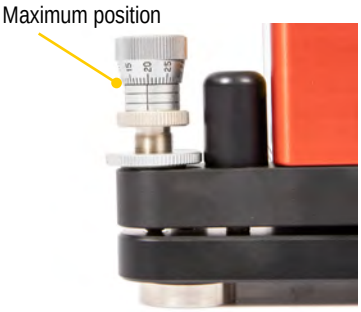
Digital fine adjustment to detector and read values

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.





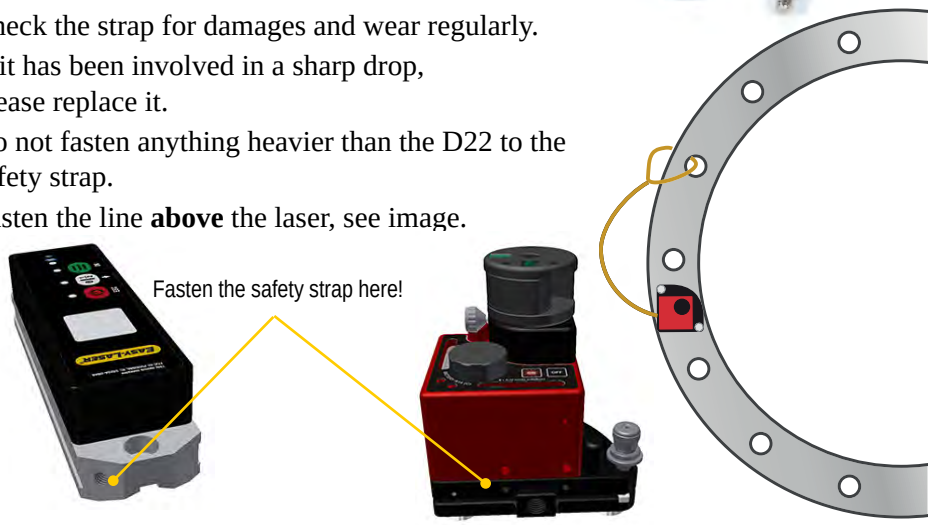
Safety strap

Part. no 12-0915

Use the safety strap to prevent equipment from falling and causing injuries. Used together with laser transmitter D22, D23 and the Digital Precision Level E290.

Note!

- Check the strap for damages and wear regularly.
- If it has been involved in a sharp drop, please replace it.
- Do not fasten anything heavier than the D22 to the safety strap.
- Fasten the line **above** the laser, see image.



Angle detector E2

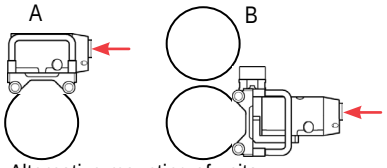
Part no. 12-0845

Detector for angle measurements, e.g. roll parallelism measurement. Built-in OLED display and rechargeable battery.

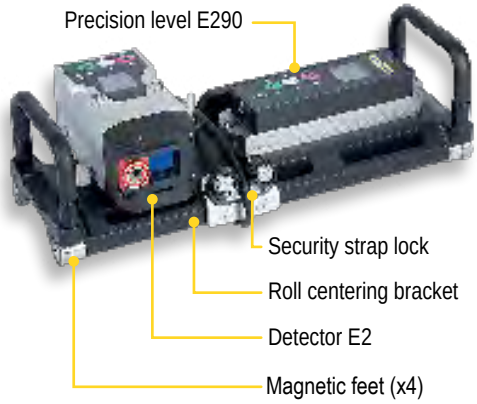
Note: The E2 detector reads angles, not positions. This means that if you want to take full advantage of the measurement program package of some geometric systems, you will also need a positional detector like e.g. the E7.

Detector E2	
Type of detector	2 axis PSD 20x20 mm [0.78” sq]
Type of display	OLED
Wireless communication	Class I wireless technology. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
Resolution	0.01 mm/m (0.001°)
Measurement error	Better than ± 0.02 mm/m
Inclinometers	0.1° resolution
Internal battery	Li-Ion
Housing material	Anodized aluminium
Dimensions	WxHxD: 116x60x57 mm [4.6x2.4x2.2”]
Weight	530 g [18.7oz]
Environmental protection	IP Class 67
Operating temperature	-10–50 °C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

The E2 detector is usually used together with Digital Precision Level E290.



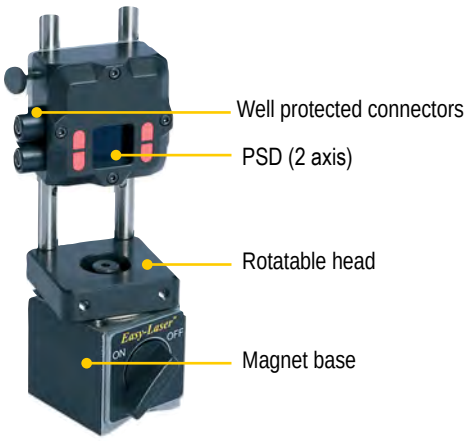
Alternative mounting of units:
A: Top attachment
B: Front attachment. If space on top is limited.



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 (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 accuracy	Spin ±10µm ±1% / Stationary beam ±10µm ±2%
Inclinometers	0.1° resolution
Thermal sensors	± 1° C accuracy
Internal battery	Li-Ion
Housing material	Anodized aluminium
Dimensions	WxHxD: 60x60x42 mm [2.36”x2.36”x1.65”]
Weight	186 g [6.6 oz]
Internal battery	Li-Ion, 3.7 volt, 2.5Wh, 680mAh
Environmental protection	IP Class 66 and 67
Operating temperature	- 10–50° C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	
Wireless connection unit (optional)	
Wireless communication	Class I BT 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 accuracy	±1µm ±1%
Inclinometers	0.1° resolution
Thermal sensors	± 1° C accuracy
Internal battery	Li-Ion
Protection	No influence from ambient light
Housing material	Anodized aluminium
Dimensions	WxHxD: 60x60x42 mm [2.36x2.36x1.65”]
Weight	186 g [6.6 oz]
Environmental protection	IP Class 66 and 67
Operating temperature	-10–50 °C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

Detector E9

Part no. 12-0759

Built-in 360° electronic inclinometer. Built-in 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 wireless unit and rechargeable battery
B. PSD
C. Mounting threads (four on each end)

Detector E9	
Wireless communication	Built-in Class I wireless technology. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
Type of detector	2 axis PSD 20x20 mm [0.78” sq]
Resolution	0.001 mm [0.05 mils]
Measurement accuracy	±1µm ±1%
Thermal sensors	± 1° C accuracy
Internal battery	Li-Ion
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]
Environmental protection	IP 67
Operating temperature	-10–50 °C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

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]
Measurement accuracy	±1µm ±0.5%
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
Internal battery	Li-Ion, 3.7 V, 2.5 Wh, 680 mAh
Housing material	Anodized aluminium
Dimensions	WxHxD: 60x60x42 mm [2.36”x2.36”x1.65”]
Weight	202 g [7.1 oz]
Environmental protection	IP class 66 and 67
Operating temperature	-10–50 °C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

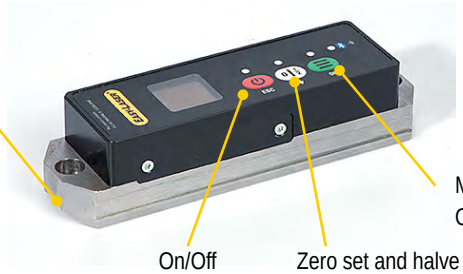
Label with saftey precautions

Precision level E290

Part no. 12-0846

Note!
Machined surface. Keep clean and dry. Grease surface when not in use.

Note!
To reach full accuracy, make sure that the temperature of E290 has stabilized in the measurement environment.



Change unit

Press and select “Unit”. Choose from the following units: mm/m, inch/foot, degrees or arc sec. Use to move in the menu.

Calibration

1. The Precision level is calibrated on the factory. To calibrated on site: Place the Precision level on a roll (or the object you are going to measure). Make a mark to ensure that you place the Precision level in the same position.
2. Press and select “Calibration”.
3. Wait until the value has stabilized. Press .
4. Rotate the Precision level 180º. Wait until the value has stabilized.
5. Press . The Precision level has been calibrated. The calibration is saved even when the Precision level is switched off.

Factory recall

Press and select “Fac. recall” to return to factory settings.

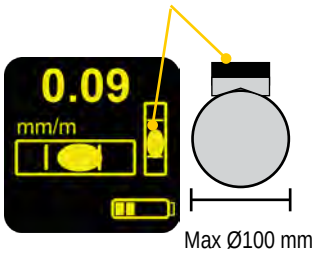
Visible

By default the precision level is set to visible. This means it will be shown when searching for wireless units. To save energy, the precision level is set to not visible once a wireless connection is established.

Connect to Display unit

Connect the Precision level to the Display unit.

Use the small indicator **only as a guide** to ensure that the Precision level is placed correctly on top of the measurement object.



When measuring a shaft using the Precision level, we recommend that the shaft is no larger than 100 mm in diameter.

Safety strap

Use the safety strap to prevent equipment from falling and causing injuries.

Precision level E290	
Displayed resolution	0.01 mm/m (0.001°) App: 0.001 mm/m (0.001°)
Range	± 2 mm/m
Measurement error	Range ±1mm/m: accuracy within ±0.02mm/m of displayed value. Range ±2mm/m: accuracy within ±0.04mm/m of displayed value.
Type of display	OLED
Wireless communication	Class I. (RF output power: max 11 dBm, frequency: 2.402 - 2.480 GHz)
Internal battery	Li-Ion, 3.7 V, 2.5 Wh, 680 mAh
Material	Hardened, polished and corrosion resistance steel, ABS plastics
Dimensions	WxHxD: 149x40x35 mm [5.9x1.6x1.4”]
Weight	530 g [18.7oz]
Environmental protection	IP Class 67
Operating temperature	-10–50 °C
Altitude	0-2000m
Designed for outdoor use (pollution degree 4)	

Charger

Part. no 03-1243

Wall socket connection cable also needed, choose part depending on country of use.

- Only the charger supplied by Easy-Laser may be used.
- Do not use a damaged charger or connection cable as it can be hazardous. A damaged charger should be replaced.

Input voltage	100-240V AC, 50/60Hz
Output voltage	12V DC, 2A
Power cords available	US, EU, UK and AUS.
Humidity	8% to 90% (storage 5% to 95%)
Operating temperature	0–40°C (storage temperature: –25°C to 70°C)
Altitude	0-2000m
Designed for indoor use only (pollution degree 2)	