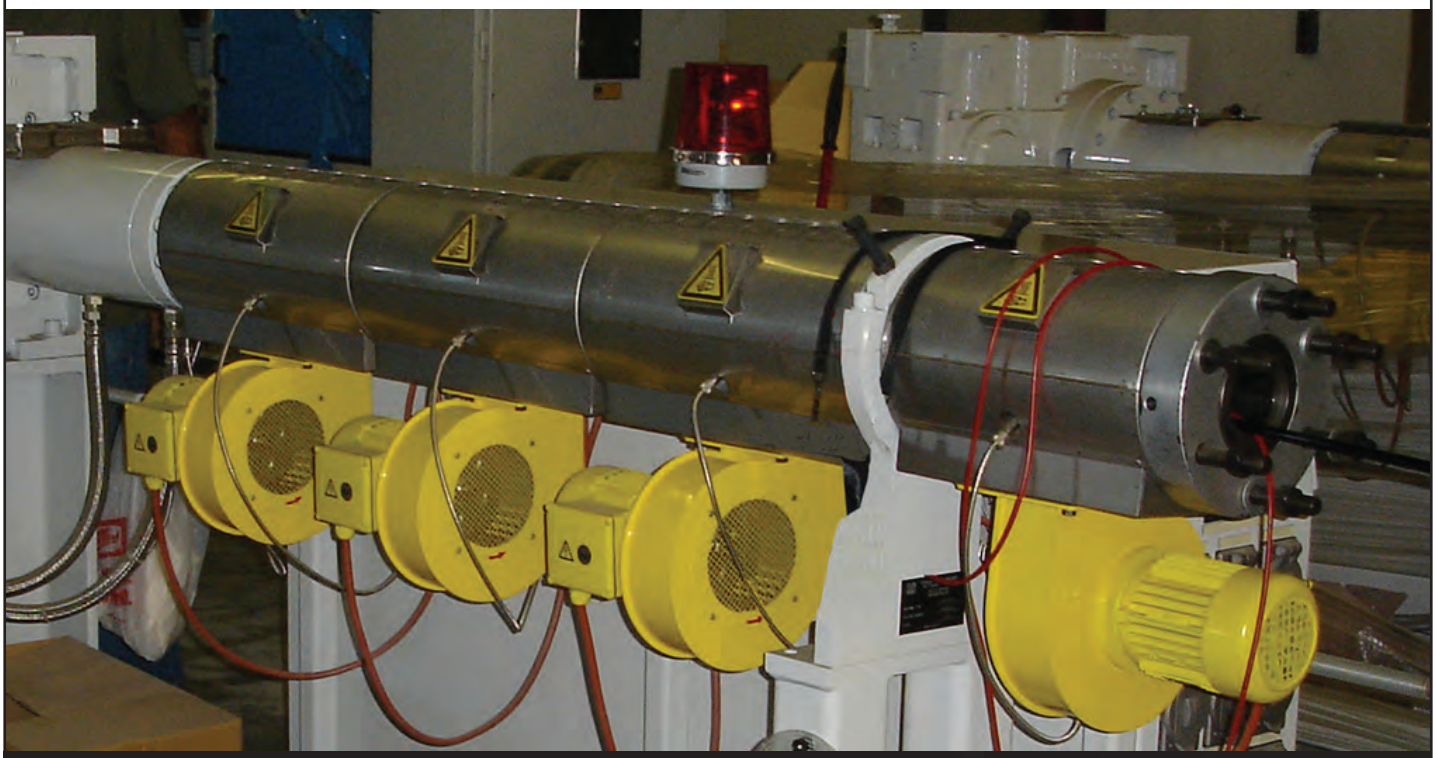


EXTRUDER GUIDE

English

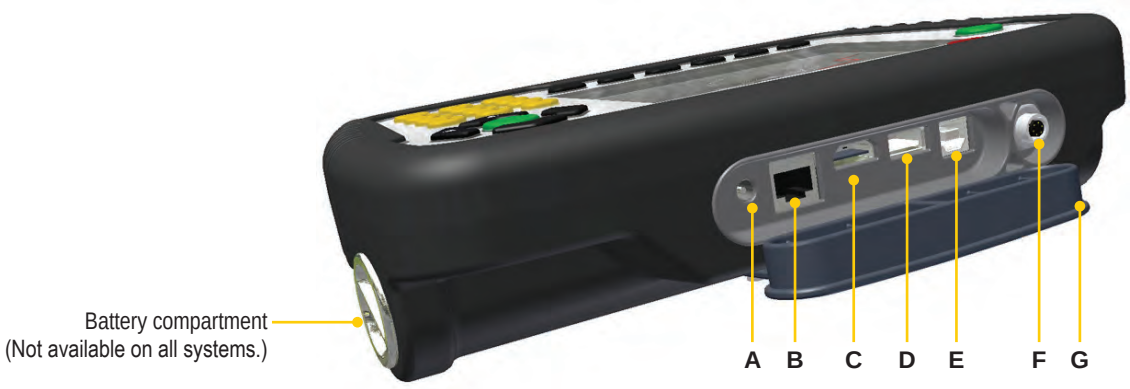
EASY-LASER®

05-0935 Revision 1
System version 12.4

CONTENT

DISPLAY UNIT

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

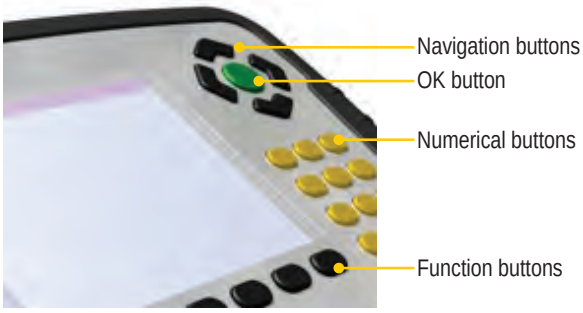


Reset the Display unit

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

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

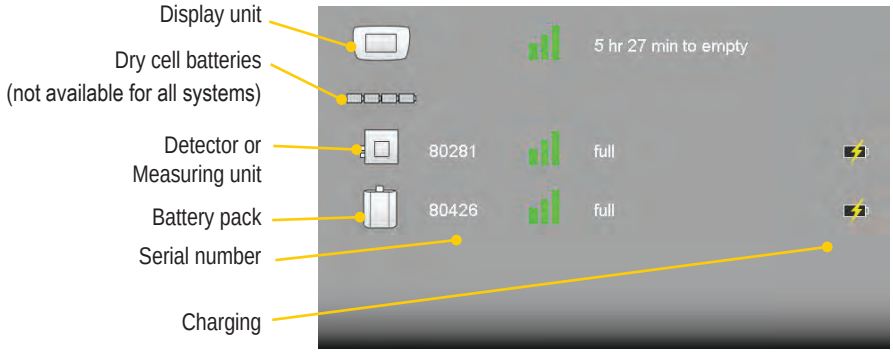
Left indicator has several functions and colours:

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

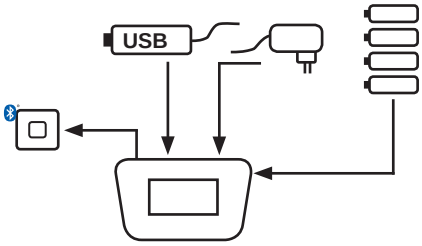
With the power adaptor plugged in, you can keep on working.

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

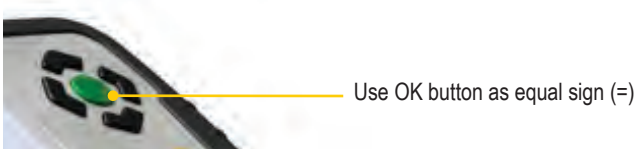
The wireless units are powered by the Detector/Measuring units. To save energy, the wireless units will only connect when you are using a measurement program. There is no power switch on the unit. To switch off, simply unplug the unit.

See "Charge the Display unit" on page 9.

Calculator

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

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

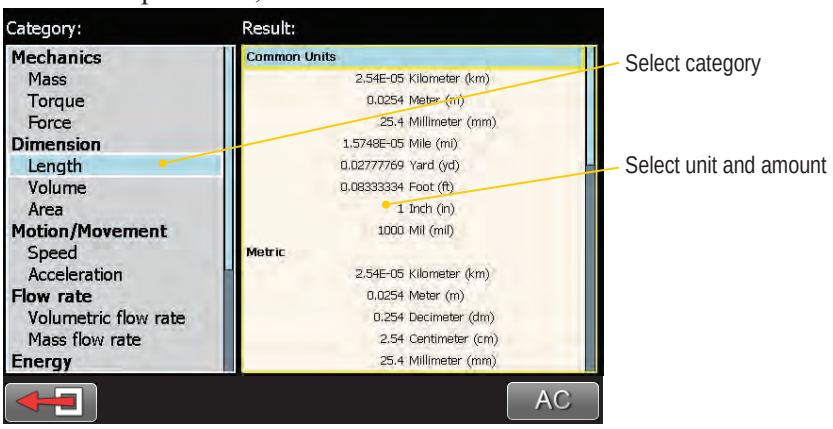


Unit converter

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

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

In the example below, one inch is selected.



Measurement **file handling**

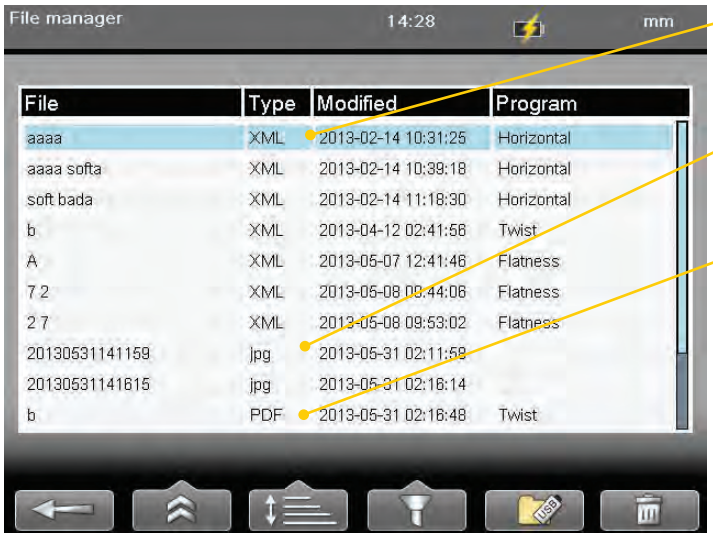
Save file

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

File manager

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

Press to open a measurement file.



xml
A measurement file.

jpg
"Screen dump" on page 8

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

Function buttons

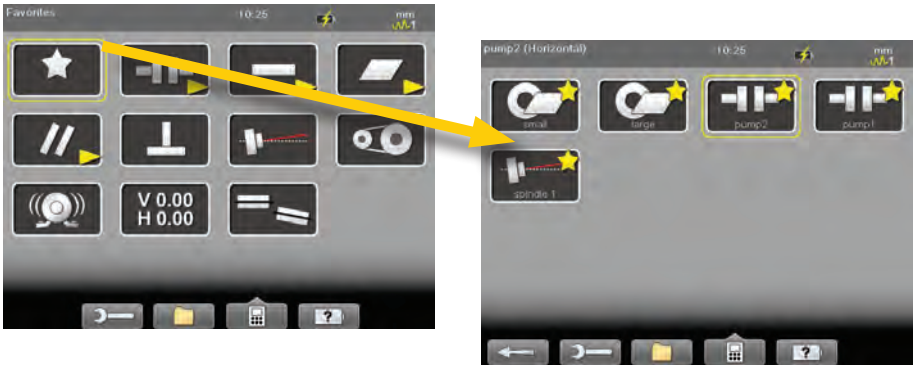
	Back to previous view.
	"Report" on page 14. *"Open file as template" on page 13.* *"Print file (Optional)" on page 14.*
	A...Z Sort files alphabetically. Sort files by measurement program. Sort by time.
	xml pdf jpg Show all files. xml Show only xml files. pdf Show only pdf files. jpg Show only jpg 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.



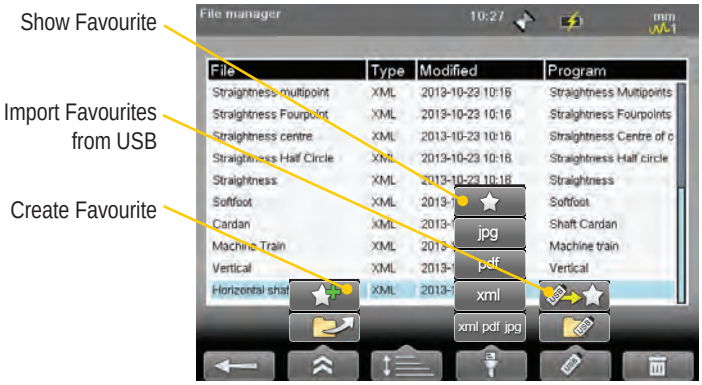
Import favourites

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\`.

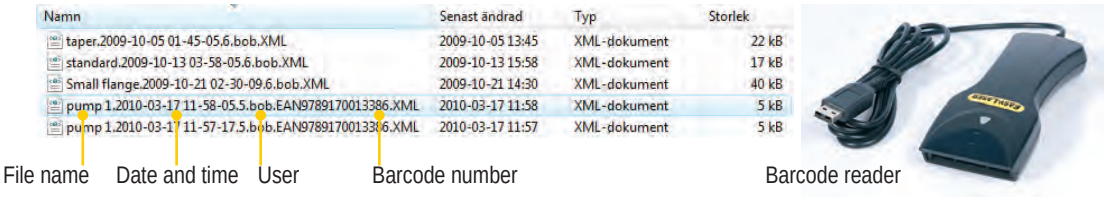
Barcode

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.

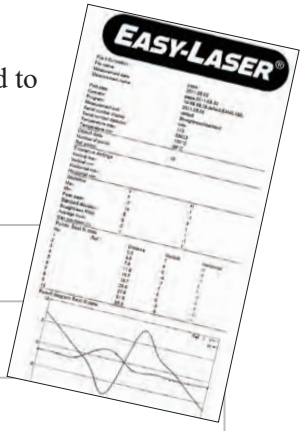
  OR

- 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

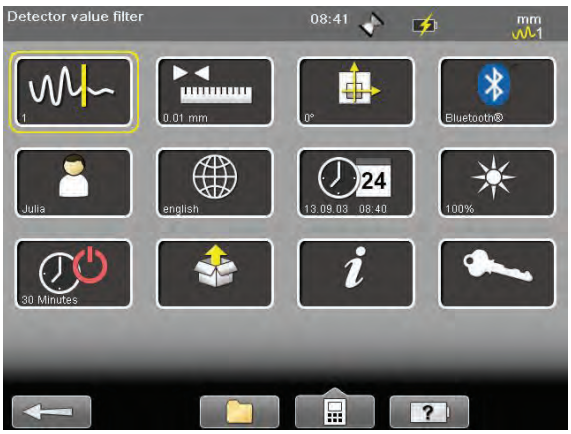
1. Start the Display unit. It is important to let it start fully before connecting the cable.
2. Connect the USB cable between the Display unit and PC.
3. While you have this connection, the Display unit is blocked.
4. View and/or copy the files to the PC.

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!

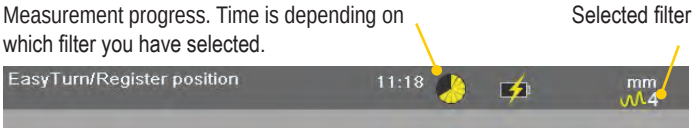
All settings are not available for all systems.

Filter

Select  to open the Filter view.

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

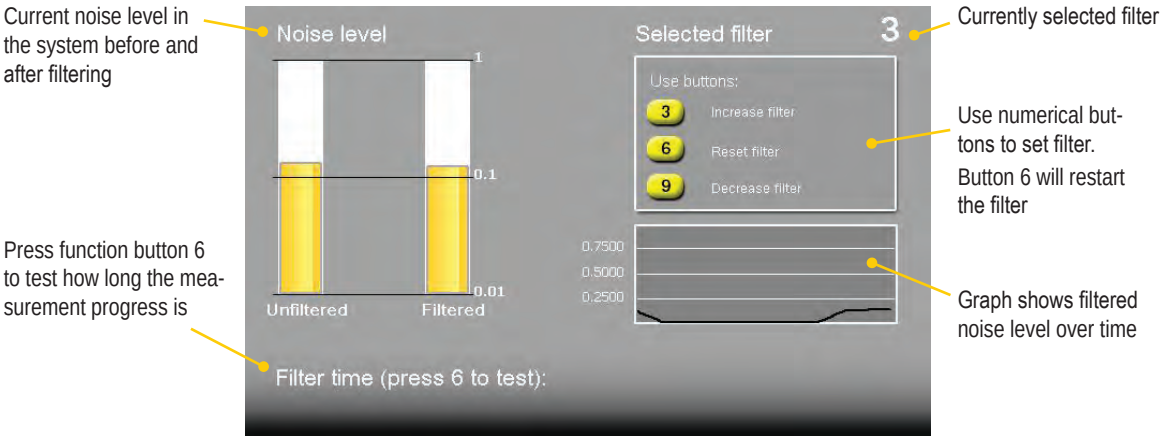
If the laser beam passes through air with varying temperature, this may influence the direction of the laser beam. If measurement values fluctuate, this could mean unstable readings. Try to reduce air movements between laser and detector by, for instance, moving heat sources, closing doors. If the readings 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.

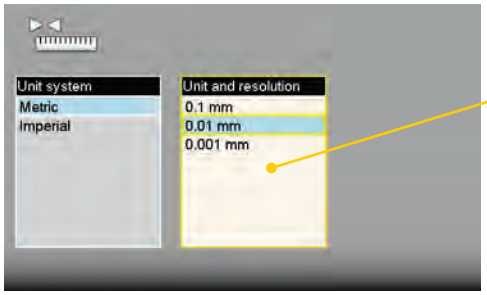
Use the numerical buttons 3, 6 and 9 to set the filter. In the Filter view but also when you are using a measuring program.



Unit and resolution

Personal setting

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



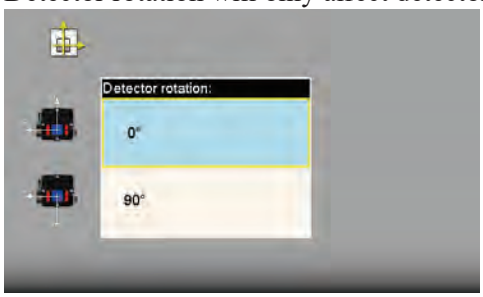
Note!

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

Detector rotation

Personal setting

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

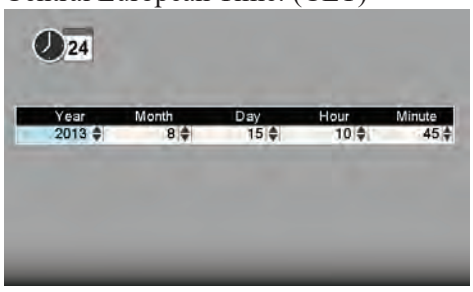


Detector rotation view

Warning displayed on Status bar

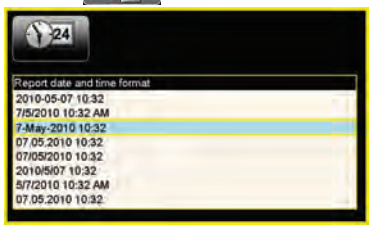
Date and time

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



Date and time view

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

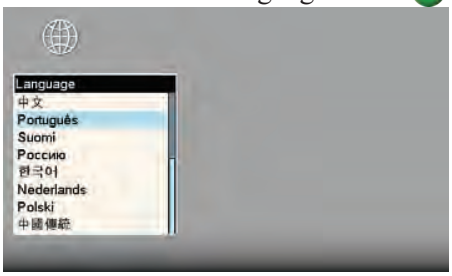


Date and time used in PDF reports

Language

Personal setting

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

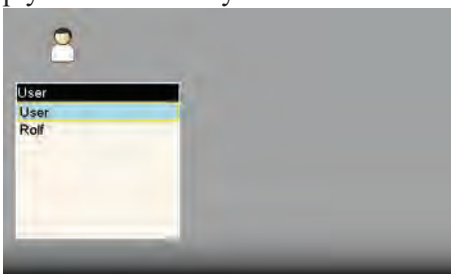


Language view

User

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

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



User view

Backlight

Personal setting

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

Backlight level

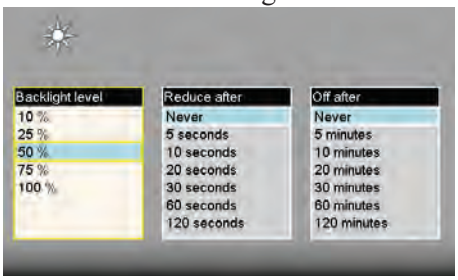
Adjust the backlight to make it easier to read in bright sunlight. Remember however that a high contrast consume more battery power. Default is set to 50%.

Reduce after

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

Off after

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

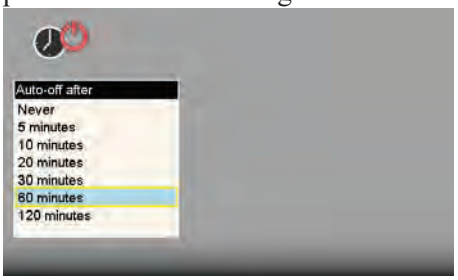


Backlight view

Automatic power off

Personal setting

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



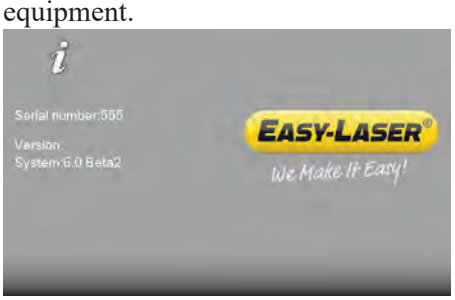
Automatic power off view

Note!

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

Information

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



Information view

VGA

(Not available on all systems.)

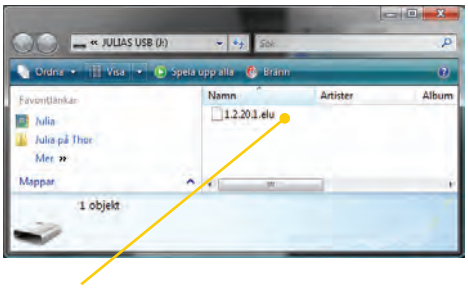
Makes it possible to show display unit screen image with a projector, for example in a training context. Must be factory installed on order.

Select  to open the VGA view.

System update

Download update file

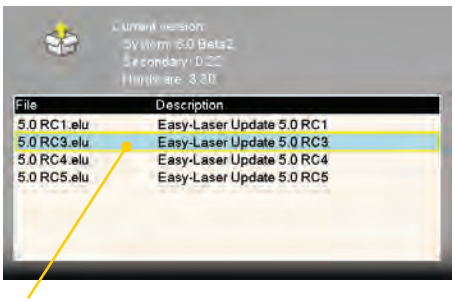
1. Go to easylaser.com>lifecycle support>software download.
2. Download the update file to your PC.
3. Unzip the file.
4. Copy the .elu file to the root of a USB memory.



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.

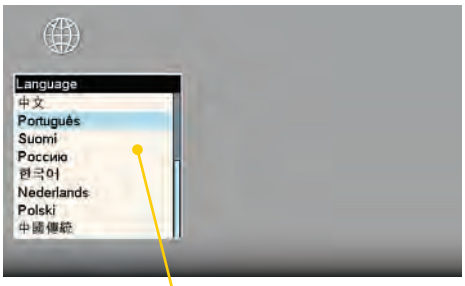
Main menu is automatically displayed after restart.

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.

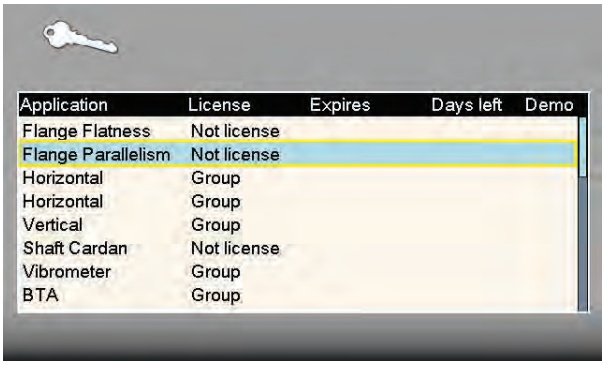
License

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

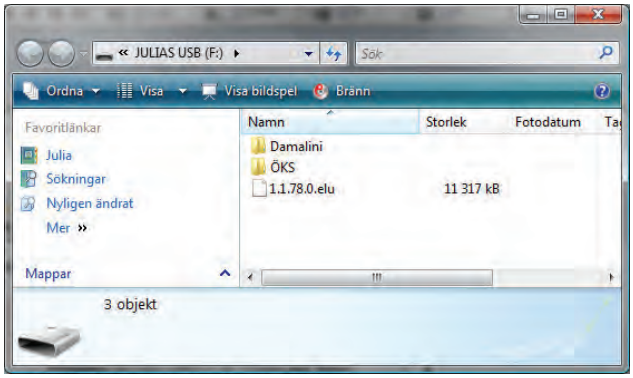
1. Save the downloaded license file to a USB memory stick.
2. Insert the USB memory stick in the Display unit.
3. Select  and  to display the License view.



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

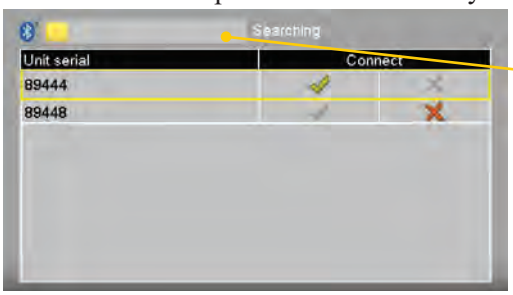
Wireless technology makes it possible for Display unit and Detector to exchange data without using cables.

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: PVH0925

IC: 5325A-0925

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions;

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

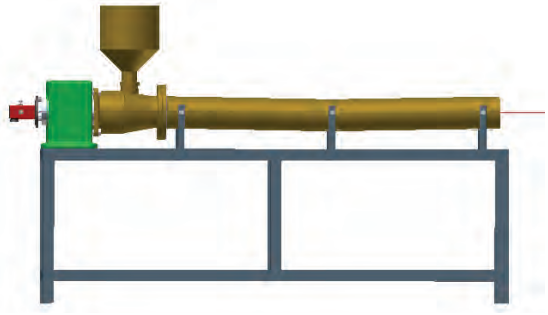
(2) this device must accept any interference received, including interference that may cause undesired operation.

EXTRUDER

The E930 Extruder 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 47 mm can be measured.

For information regarding what a complete system contains, please see *"TECHNICAL DATA" on page 67.*

Why align?



An aligned extruder machine leads to:

- Less tear on the extruder screw and tube.
- Even quality on the produced material.
- Lower energy consumption.
- Lower consumption of spare parts.
- Increased availability on machine time.

Four steps

The alignment of parts of an extruder plant can be divided up into four steps:

1. Alignment of the spindle centre – outlet

Alignment of the spindle centre of the gearbox compared to the centre line of the extruder tube at outlet.

2. Alignment of the spindle centre – inlet

Alignment of the spindle centre of the gearbox compared to the centre line of the extruder tube at inlet.

3. Straightness of the extruder tube

4. Alignment of motor – gearbox

The alignment of the transmission between motor and gearbox. This is made with other hardware and using horizontal shaft alignment.

Mount the equipment

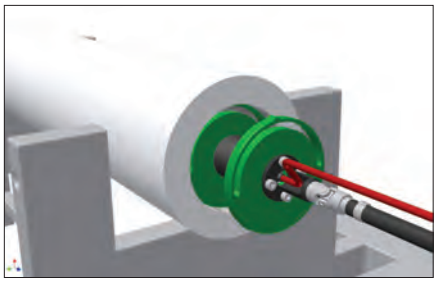
When the diameter is small (approx 200 mm), you might need to use a cable instead of the wireless unit.

1. Attach the laser transmitter to a magnetic bracket, pin for hub or a rotable busching (for when the gearbox is not possible to rotate).
2. Attach the laser to the gearbox spindle.

Laser D75 mounted on magnetic bracket

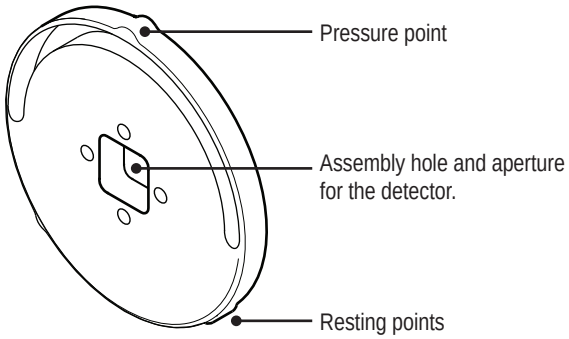
Laser D75 mounted on a chuck

3. Mount the detector on two adapters with 4+4 pcs. M5x16 screws, cable and cardan joint for the extension rods. The detector label facing the pressure points at the adapters.
4. Place the detector with adapters in the outlet of the extruder tube.



Adapter

Manufactured to fit in the tube and allows a deviation of ±1 mm [±0.04”].

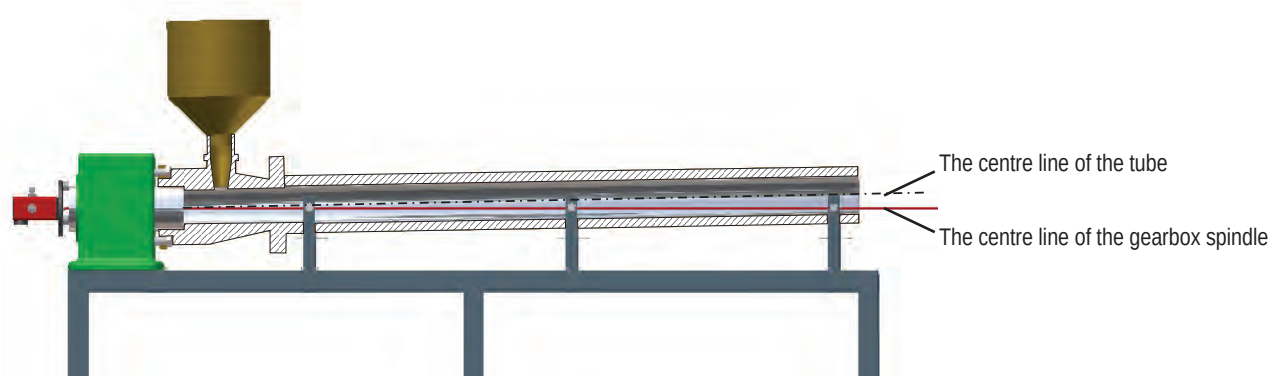


Spindle centre

It is important that the centre line of the spindle coincide with the centre line of the extruder tube. Otherwise the screw at the inlet's end will be pressed against the tube, which will lead to abnormal tear of both screw and tube along with an increased energy consumption. This tear can also result in metal fragments in the produced material.

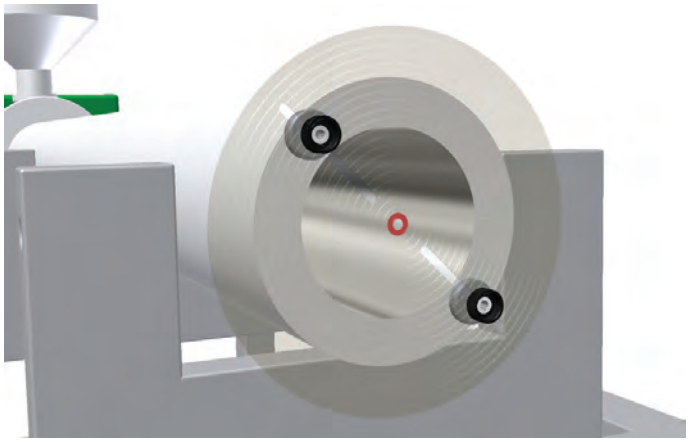
Often the gearbox and extruder tube are linked together, which makes it easy to believe that the spindle's centre line always coincide with the tube's centre line. However, the gearbox due to its weight can bend in its connection and a parallel offset occur.

During the alignment procedure we rotate both detector and spindle. This way we can read how the centre line of the spindle is compared to the tube's centre at the inlet end. Unacceptable misalignment at the connection are adjusted or shimmed.



Measuring gearbox – tube

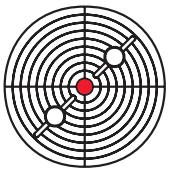
1. Mount the laser transmitter at the end of the gearbox spindle.
2. Mount the target at the end of the tube and adjust it to the centre with the help of its concentric circles.



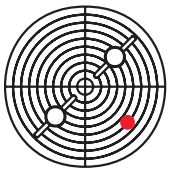
Rough align

Make sure that the laser beam hit the target directly. Reflections can appear to be the laser beam.

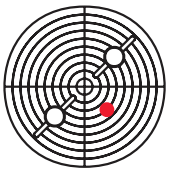
1. Rough align the laserbeam to the centre of the target. Adjust using the screws on the laser. See *"Tilting screws" on page 70.*
2. Rotate the laser transmitter 180º.
3. Adjust laser beam half way to the centre of target.
4. Remove the target.



Laser beam in centre of target.

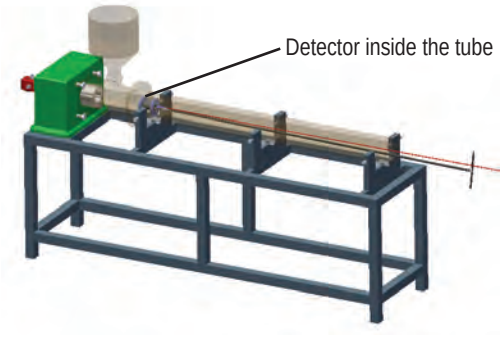


Turn laser 180°. Note laser spot.



Adjust to a point in between.

Measure

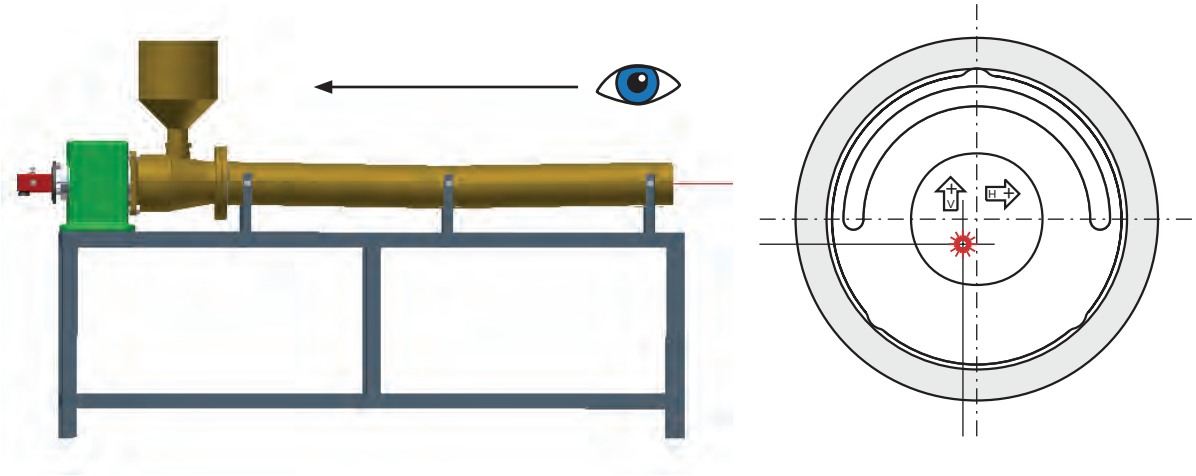


1. Place the detector at 180º inside the tube at the inlet.
2. Select V 0.00 H 0.00 to start the program Values.
3. Select 0 to zero set the value with.
4. Rotate the laser **transmitter** 180°.
5. Select ½ to halve the value.
6. Adjust laser beam to zero using tilting screws.
7. Rotate the **detector** 180° (±1°).
8. Press to register the value.
9. Move the detector to the outlet of the tube, then turn it 180° (±1°).

Repeat procedure from point 3 and read the pointing direction of the gearbox compared to the outlet of the tube

Result gearbox – tube

Always view the measurement results seen from the detector.



Positive V-values mean that the gearbox is pointing downwards, and positive H-values mean that it is pointing to the left.

The result shows the user if the position is high or low relative to the laser beam.

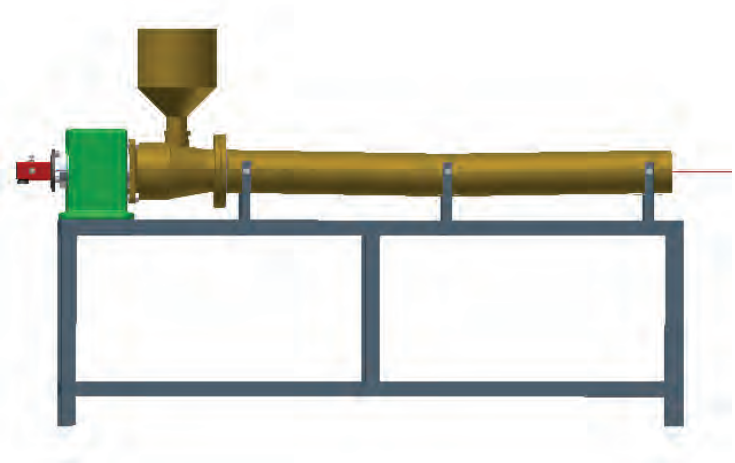
Straightness of the tube

It is important that the extruder tube is straight so that the screw does not rest against the tube in any part, which can result in abnormal tear and fragment of metal in produced material. If the tube is straight the screw can easier centre itself due to the forces in the produced material. We will get a more even temperature of produced material which in the end results in a better product.

Measurement procedure

Use the program Centre of circle or Multipoint

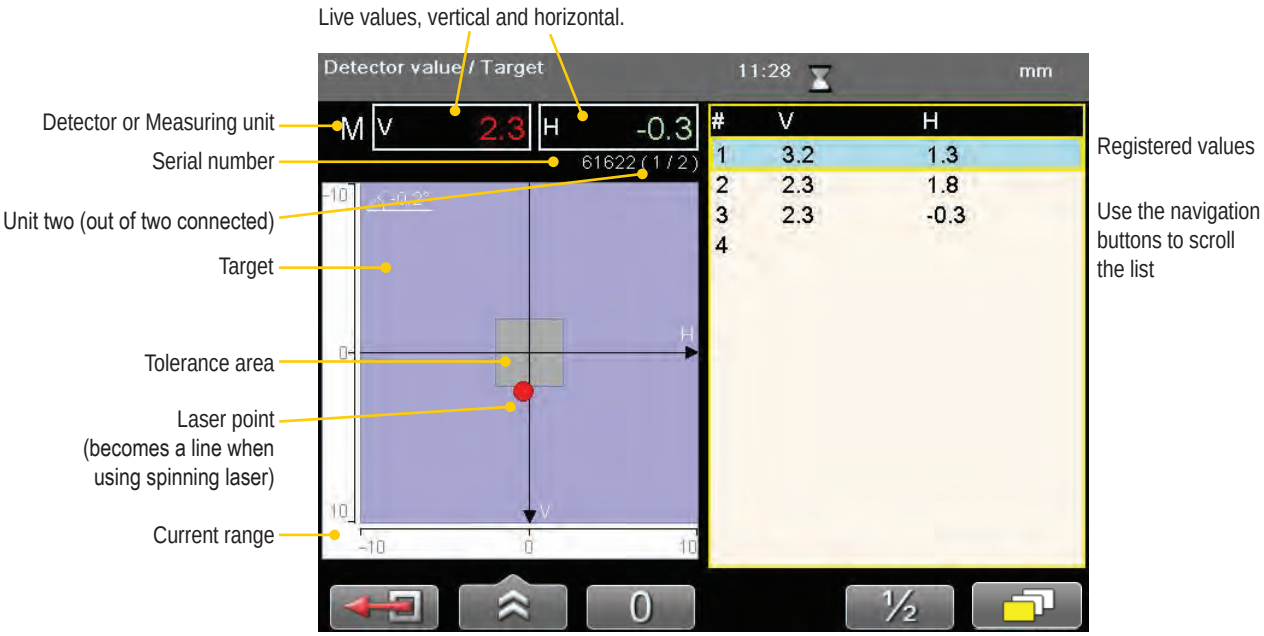
“CENTRE OF CIRCLE” on page 51
“MULTIPOINTS” on page 59



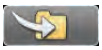
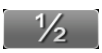
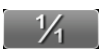
PROGRAM VALUES

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

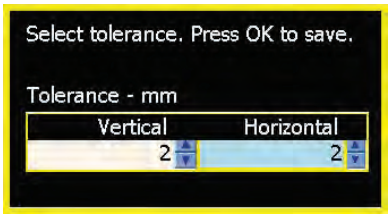
	Back, leave program.
	 *See "Control panel" on page 15.*  *See "Tolerance" on page 30.*  *See "Zoom" on page 30.*  Save file. *See "Measurement file handling" on page 11.*  *See "Automatic recording" on page 32.*  Delete registered values.  Print report on thermal printer (optional equipment).  *See "Streaming values" on page 33.*
	Set current value to zero.
	Halve displayed value.
	Return to absolute value. Only available after zeroing or halving.
	Choose how to display values. Use left and right navigation button to switch between two or more detectors when only one target is displayed.

Note!

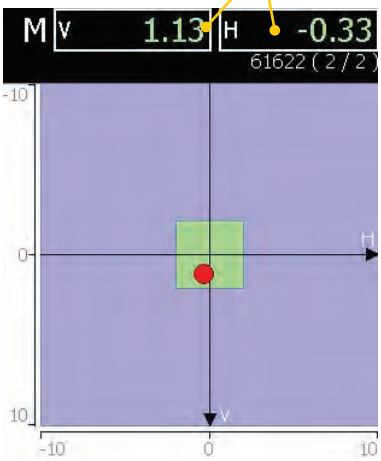
The M-unit can be used as a detector together with a laser transmitter. Do not use the S-unit for this.

Tolerance

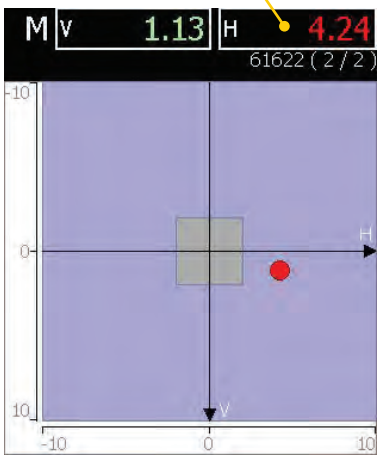
1. Select  and  to set tolerance.
   It is possible to set different tolerance in vertical and horizontal direction.
2. Use navigation buttons to move between the fields and to change the tolerance.
3. Press **OK**.



Live values and marking displayed in green when within tolerance.

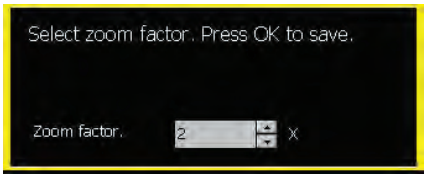


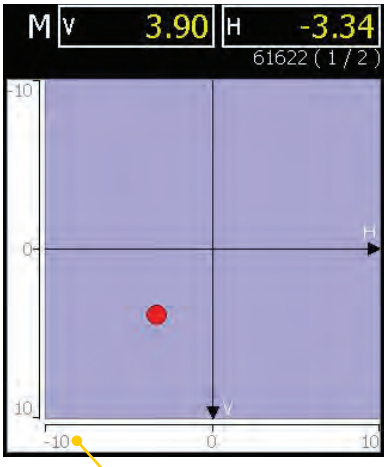
Live values displayed in red when outside tolerance.



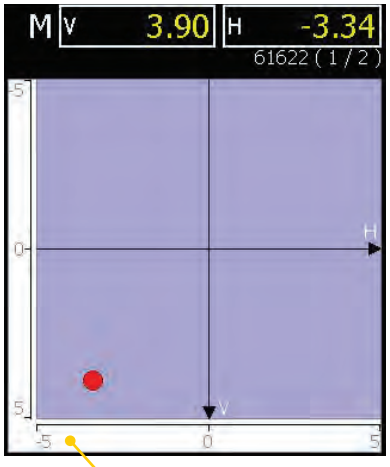
Zoom

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**.





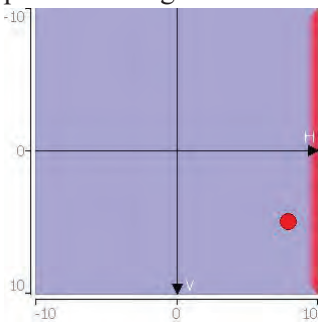
Default view



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

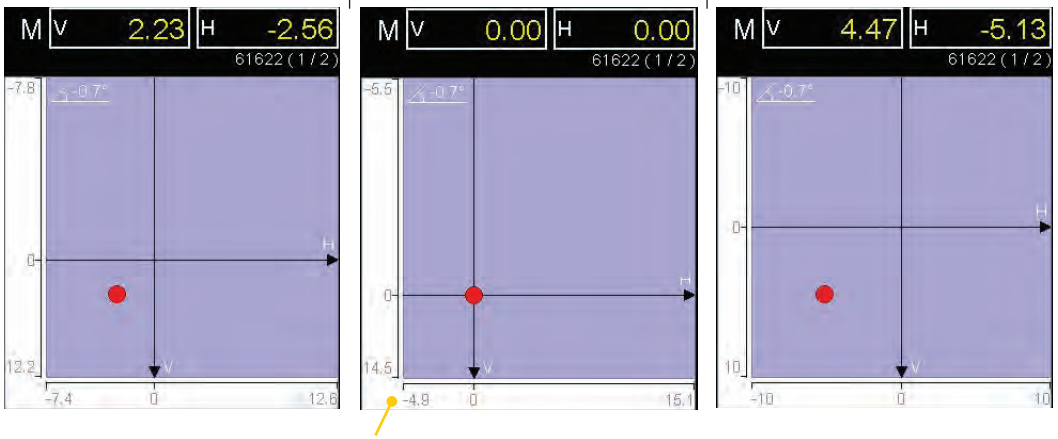
Select 0 to zero set displayed value.

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

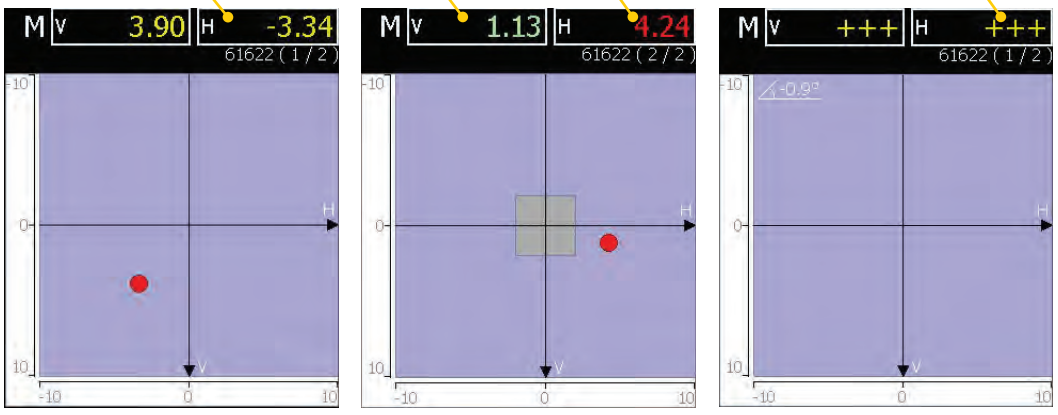
Live values – colours

Live values are normally yellow

Green when within tolerance

Red when outside tolerance

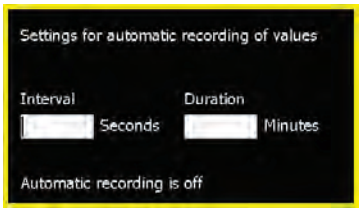
Loss of signal, laser beam interrupted for example



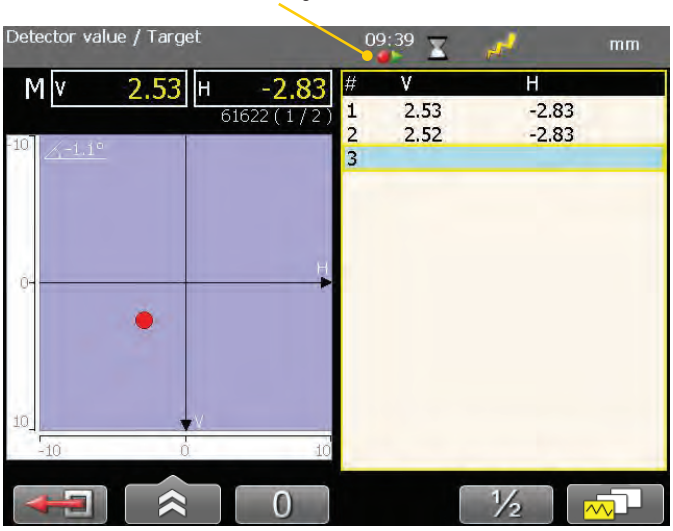
Automatic recording

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.

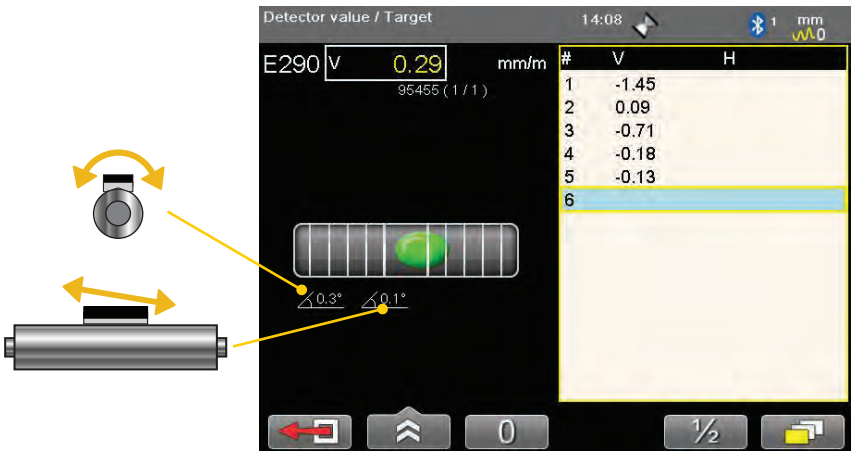
Select  to display the different layout options, see image below.

Note!

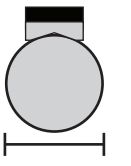
Use left and right navigation button to switch between two or more detectors when only one target is displayed.

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.

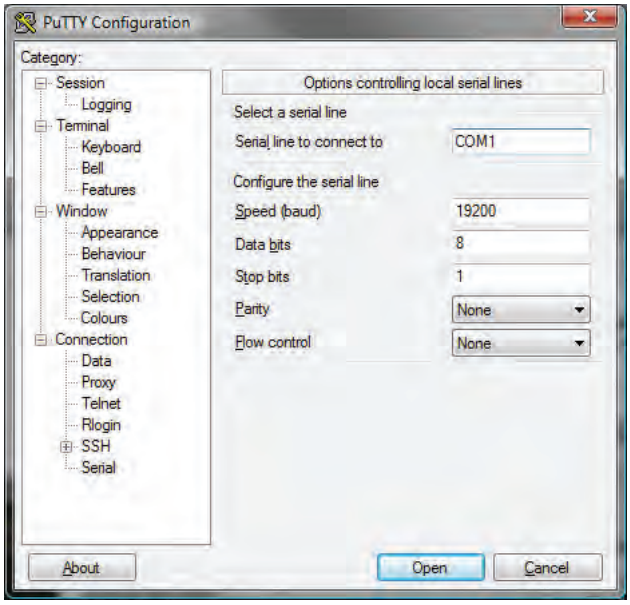


Max Ø100 mm

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.

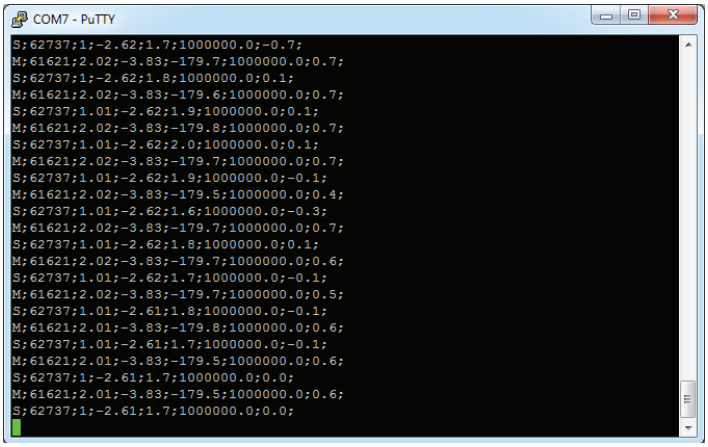
1. Connect the Display unit to the PC using a USB to USB Null Modem Cable.



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;

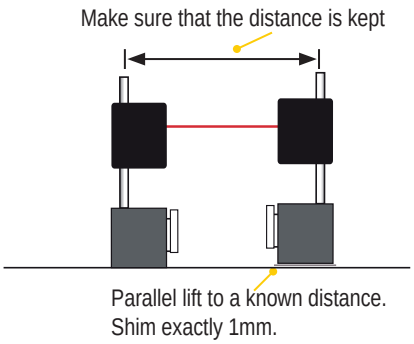
Data from M: M;serial;PSD X; PSD Y; X axis angle;Y axis angle;Z axis angle;

Calibration check

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

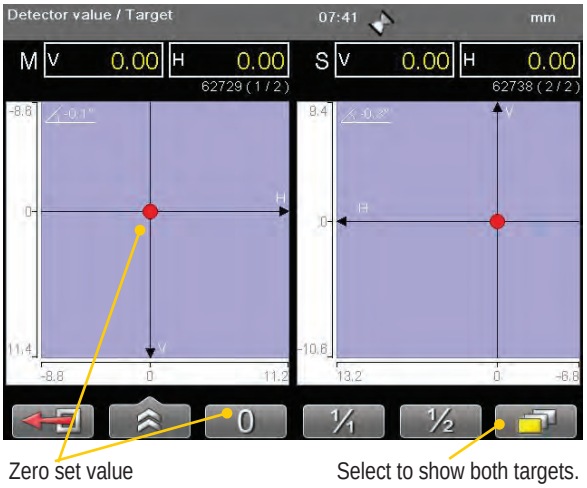
Quick check

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



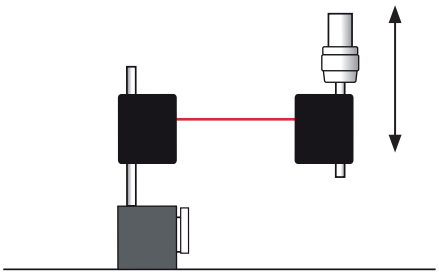
Note!

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



Precision check

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



Note!

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

STRAIGHTNESS

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

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

Work flow

Select and to start the Straightness program.

Preparations

Mount units

Rough align

Show target

Show reference target

Measure

Press 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!

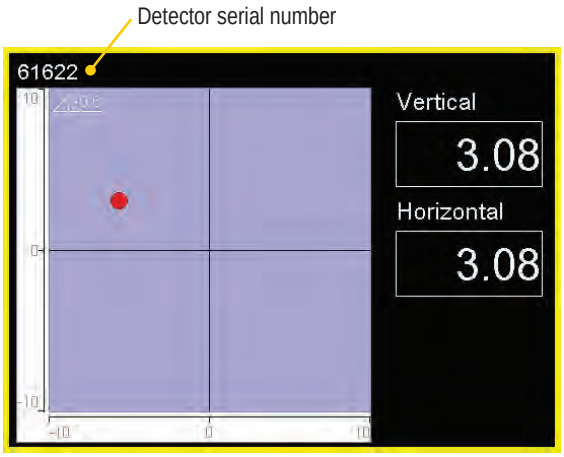
The M-unit can be used as a detector together with a laser transmitter. Do not use the S-unit for this.

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.

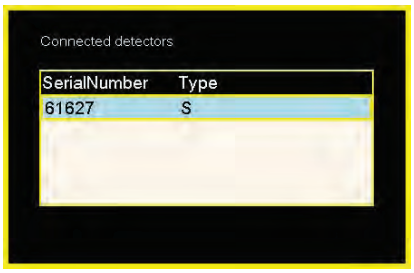


Function buttons

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 .



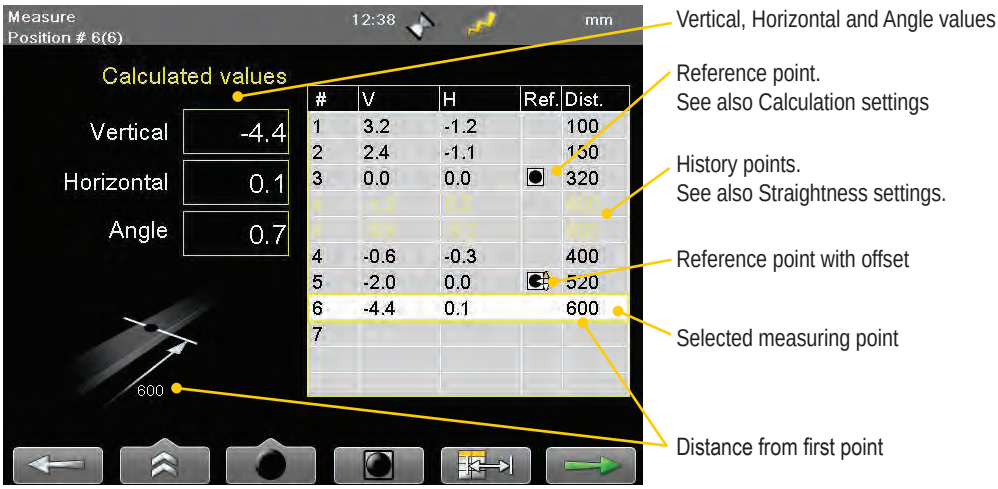
Function buttons

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 31.

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.

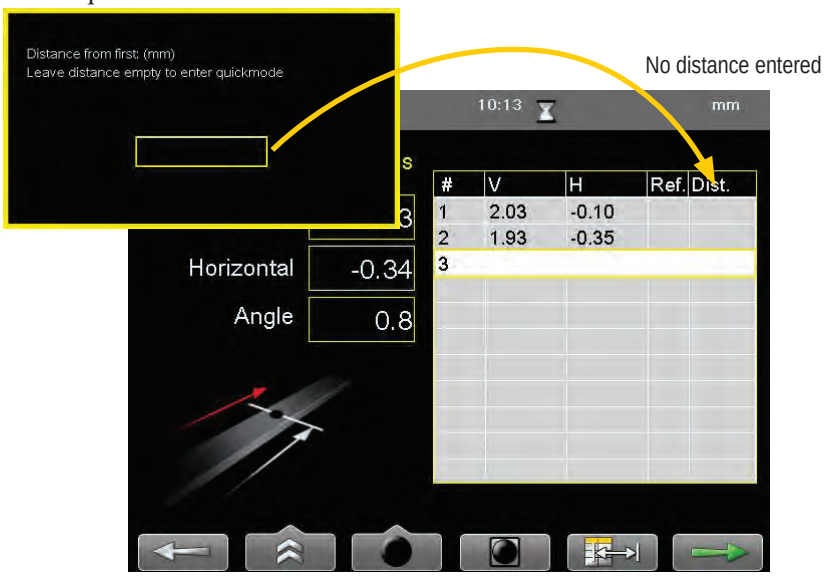


Function buttons

	Leave program.
	See “Control panel” on page 15. *See“Straightness settings” on page 48* **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 40.*
	Open Distance view, *see “Enter distances” on page 38.*
	Continue to Result view. Available when you have registered two points.

Quickmode

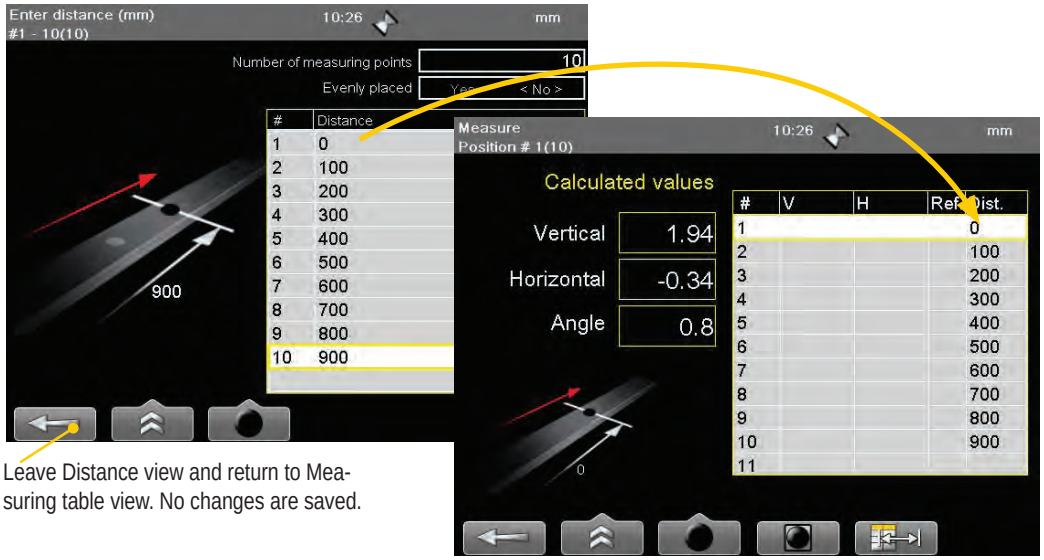
Quickmode means that you measure without entering any distances. Leave field empty to use quickmode.



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.



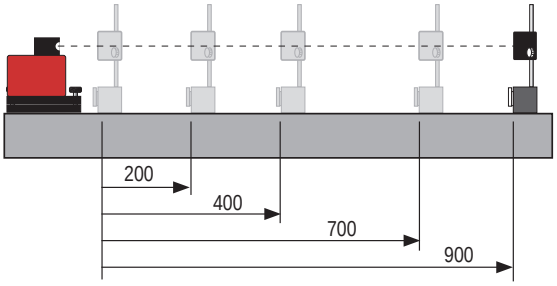
Leave Distance view and return to Measuring table view. No changes are saved.

Note!

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

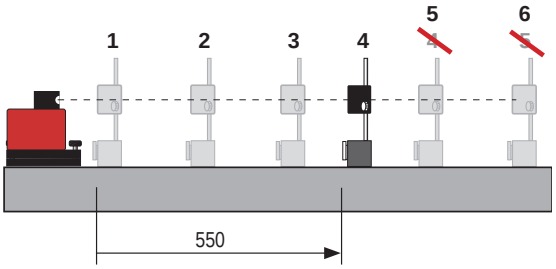
Add and delete points

Distances are always measured from the same point.



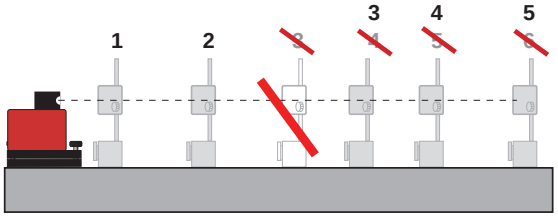
Add measuring point

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



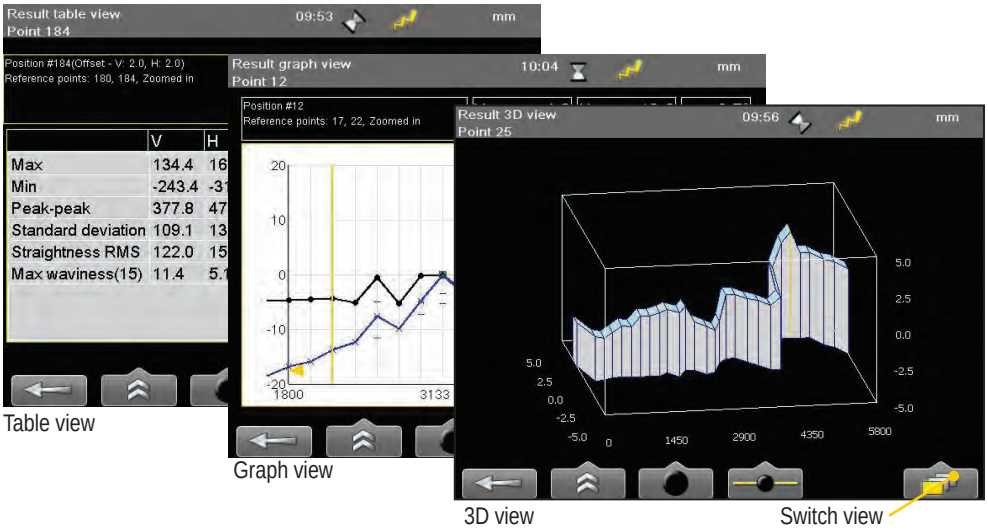
Delete measuring point

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

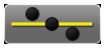
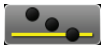


Result

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.

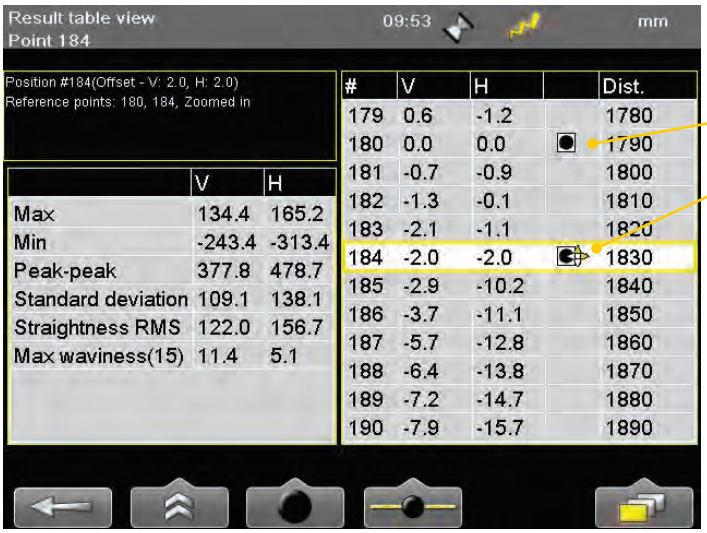


Function buttons

	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 48.*  **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 43.*  **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 44.*
	Contains a sub-menu. *See "Calculation settings" on page 44.*  **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  .

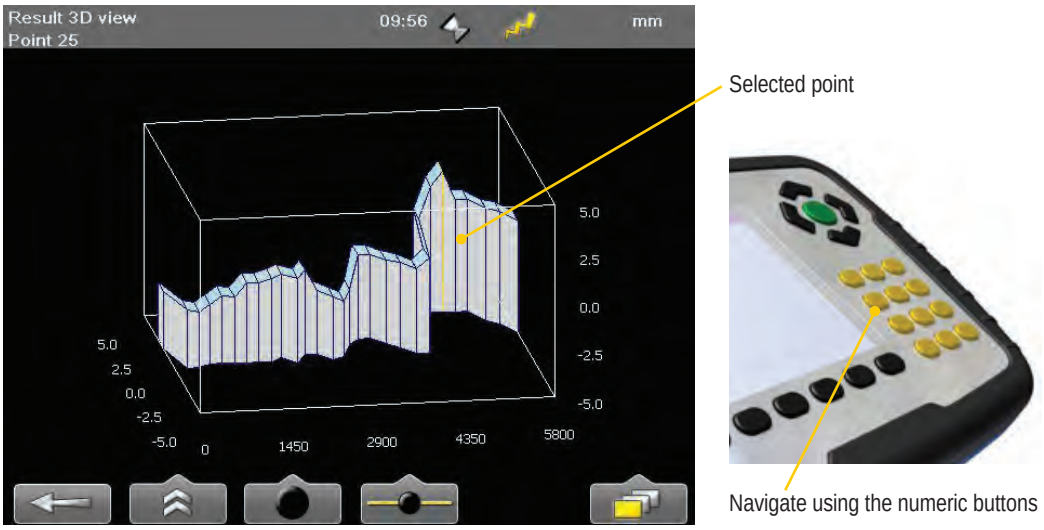


Max	The highest value.
Min	The lowest value.
Peak-peak	Difference between Max and Min value
Standard deviation	Average difference between Max and Min value.
Straightness RMS	Root Mean Square (Numerical Flatness)
Max waviness	Set waviness is shown in bracket. *See "Waviness" on page 47.*

Result 3D view

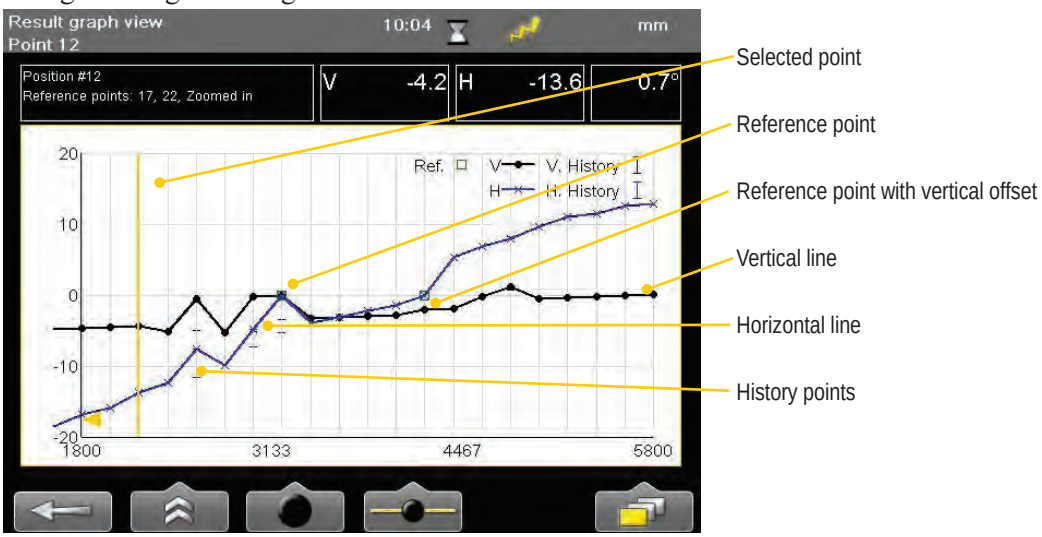
Navigate using the numeric buttons.

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



Result graph view

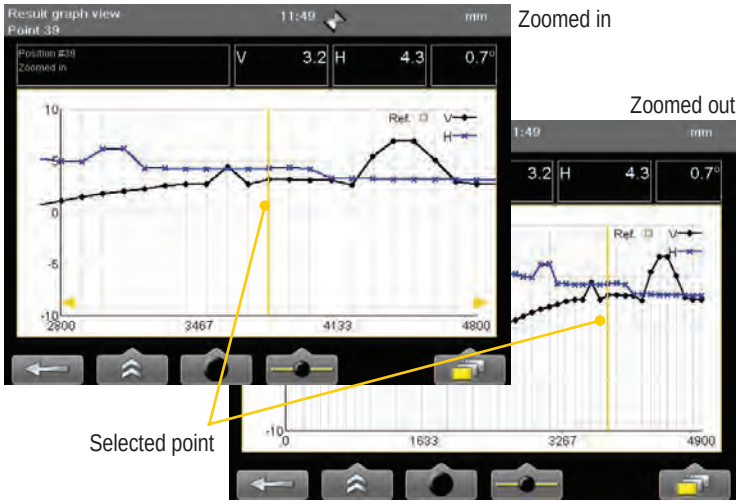
Navigate using the navigation buttons.



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

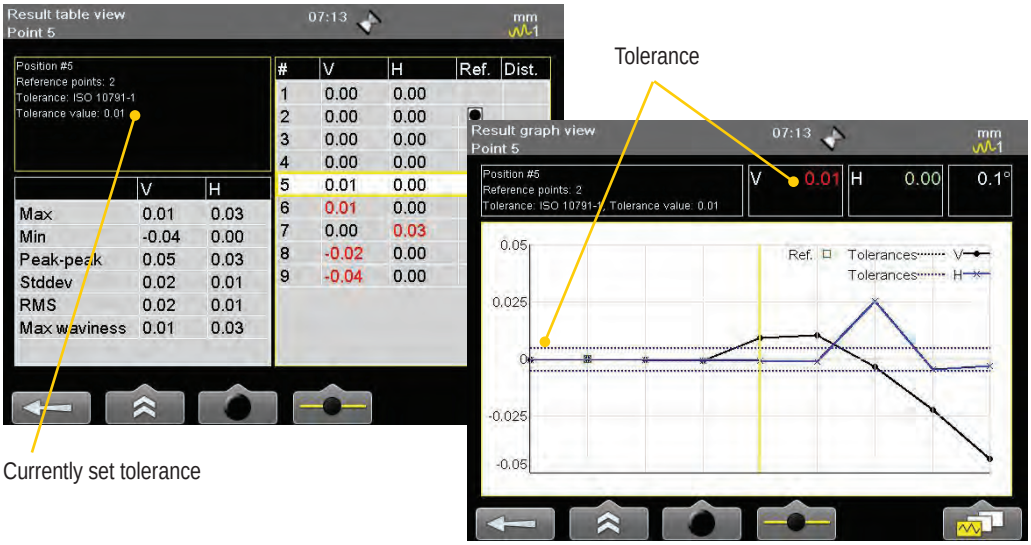
Press navigation button “Up” and “Down” to scale the result graph view.

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

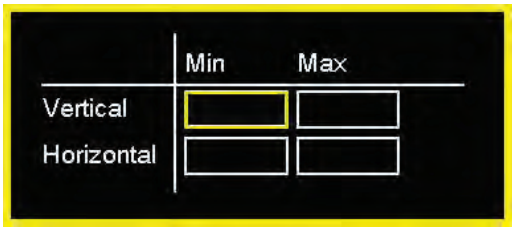
There are two ISO standard tolerances. The ISO tolerance is calculated automatically depending on which distances you have entered and interpreted in the same way as our custom tolerance.

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

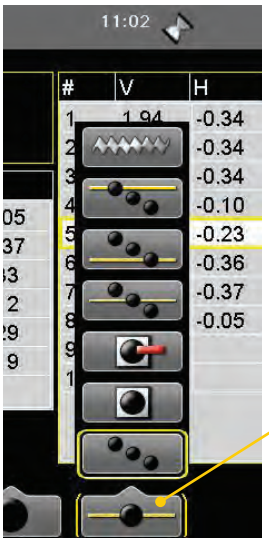
Custom tolerance

- 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

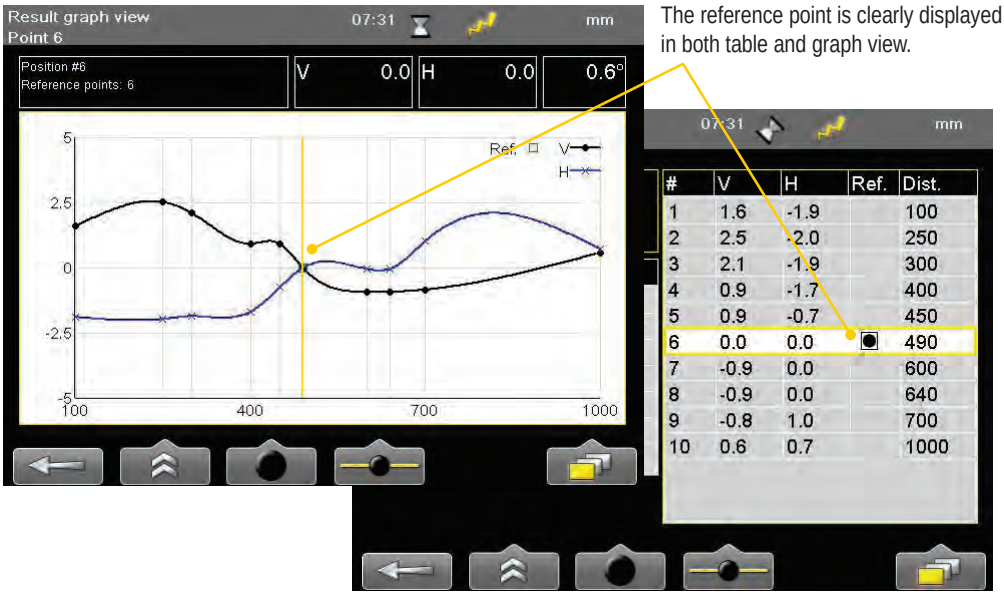
Select  and  to set selected point as reference point. You can set one or two reference points. To remove a reference point, select it in the table or graph and then select  . The point itself is **not** removed. The reference points are clearly displayed in both table and graph.

Note!

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

One reference point

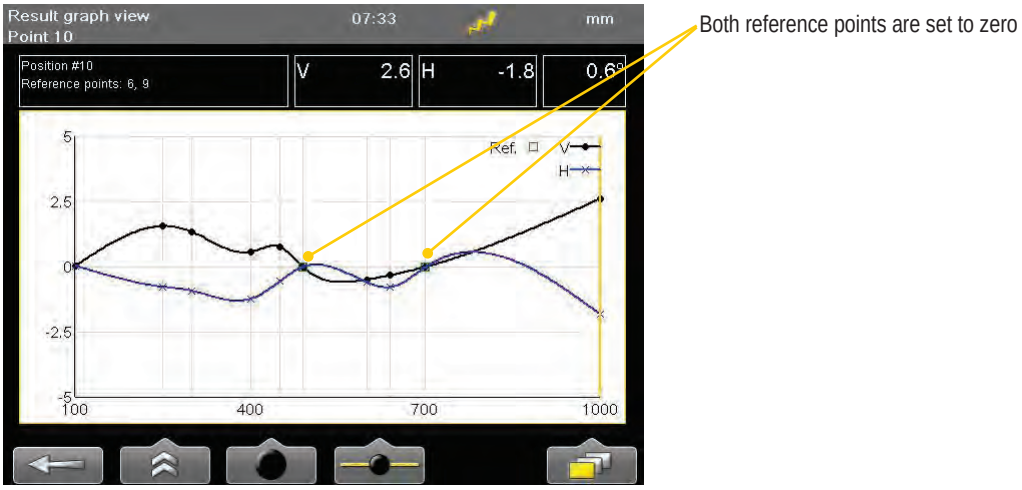
Setting a single reference point will offset all other measurement points based on the set reference point.



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

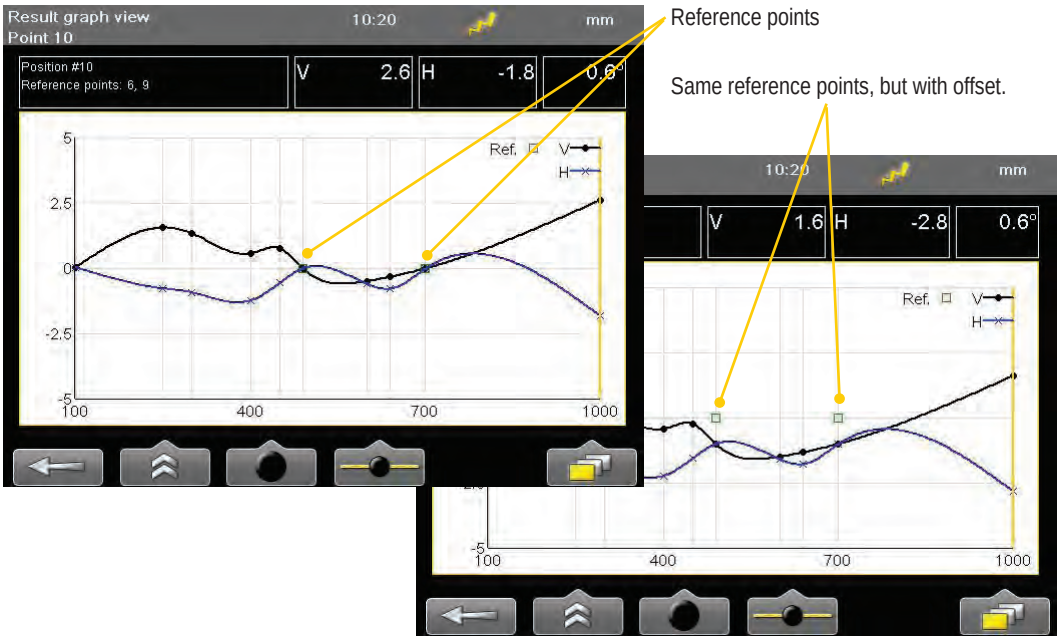
Two reference points

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.

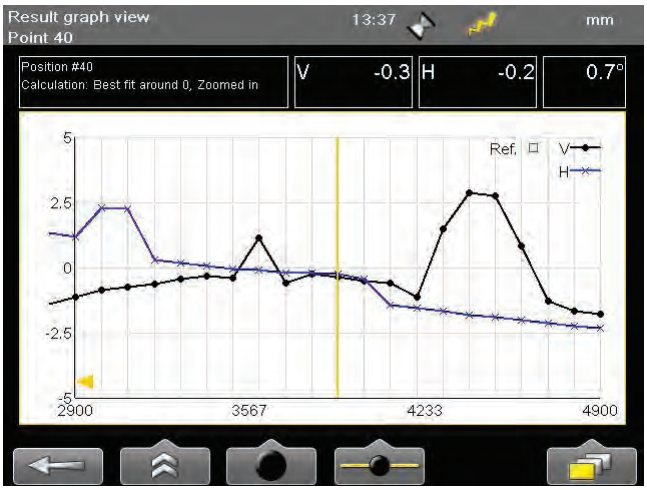


Best fit operations

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

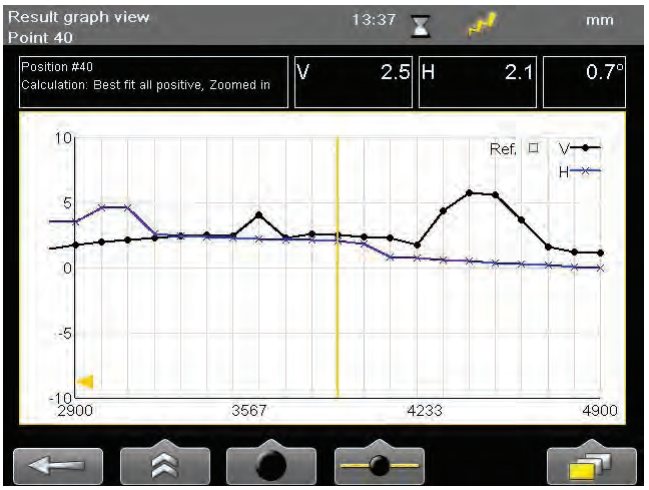
This operation removes all reference points. Centre the values so that the maximum and minimum values are equally large.



Best fit – all positive

Removes all reference points.

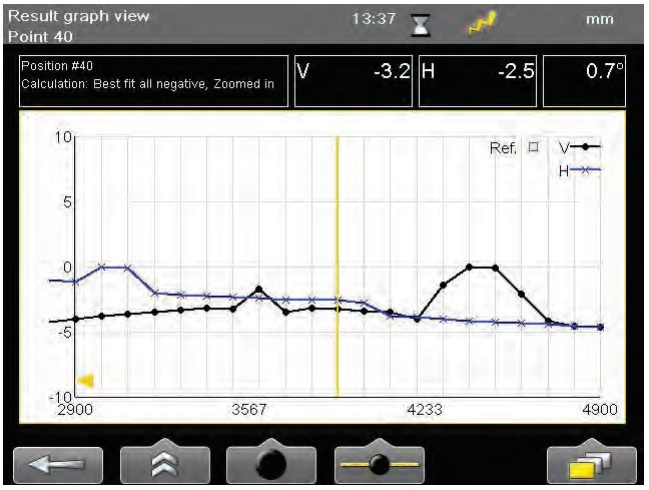
The best fit with all measurement points above zero.



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.

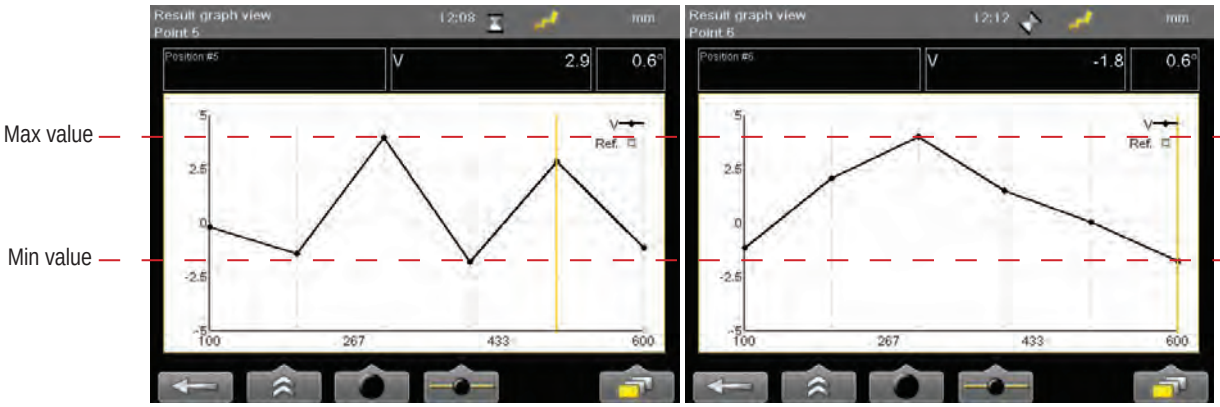
To set waviness, select  and  .

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.

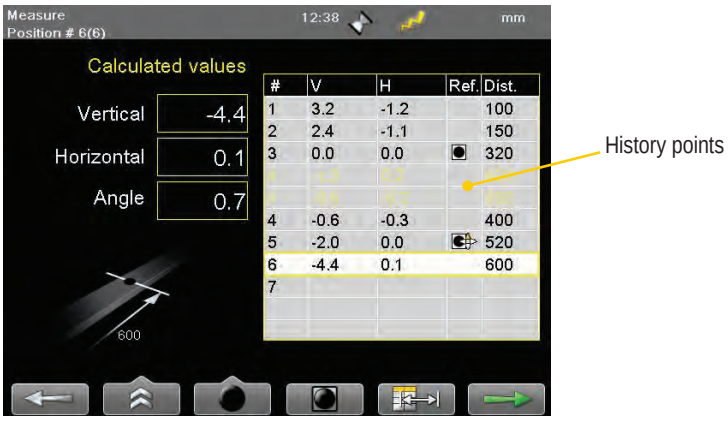
Note!

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.

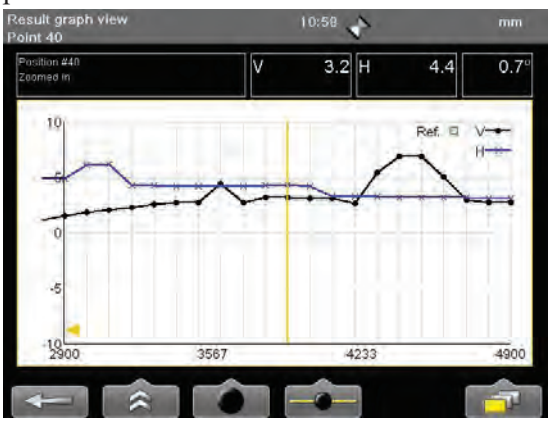
1. Select . A window is opened.
2. Select Yes or No. Navigate using the navigation buttons.
3. Press to confirm choice.



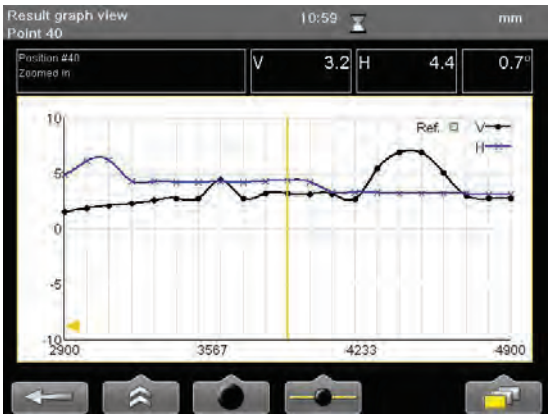
Smooth/sharp graph

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

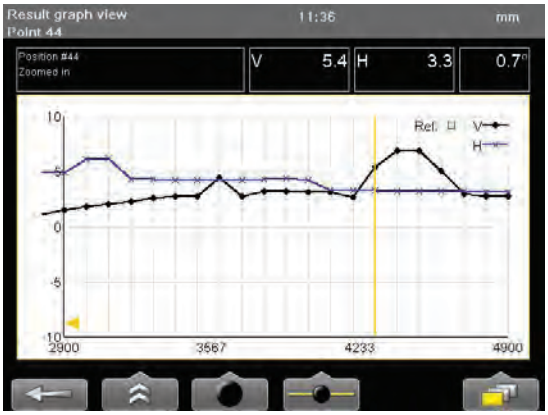


Smooth

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 47.

CENTRE OF CIRCLE

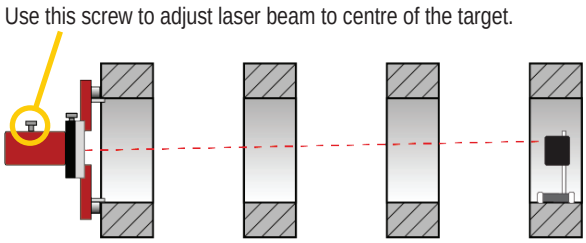
Values are registered at two points in a full bore.
Used for diesel engines, propeller shaft installations for example.

Rough align

Use the program Values or a target.

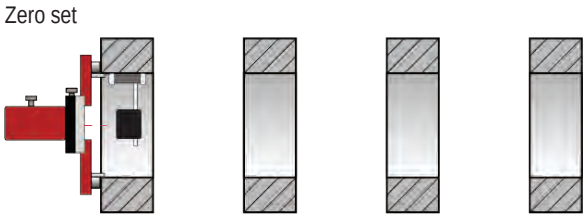
Adjust to target

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.



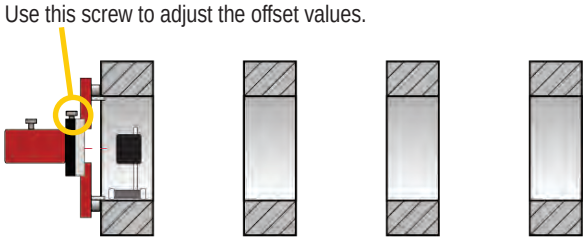
Zero set

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



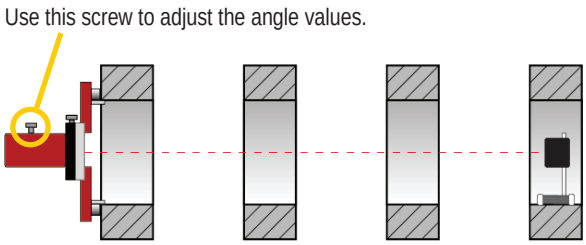
Adjust offset

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.



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.



See "Show target" on page 36.

Note!

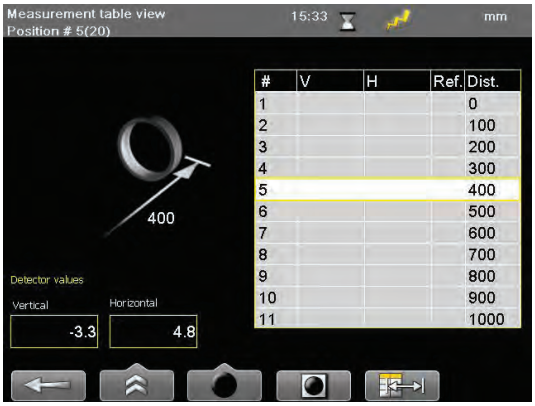
The M-unit can be used as a detector together with a laser transmitter.
Do not use the S-unit for this.

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.



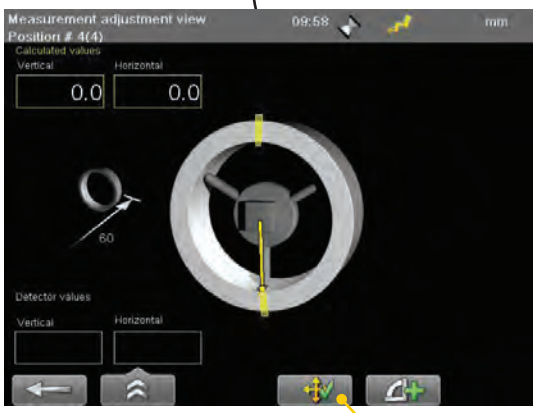
Measurement table view

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

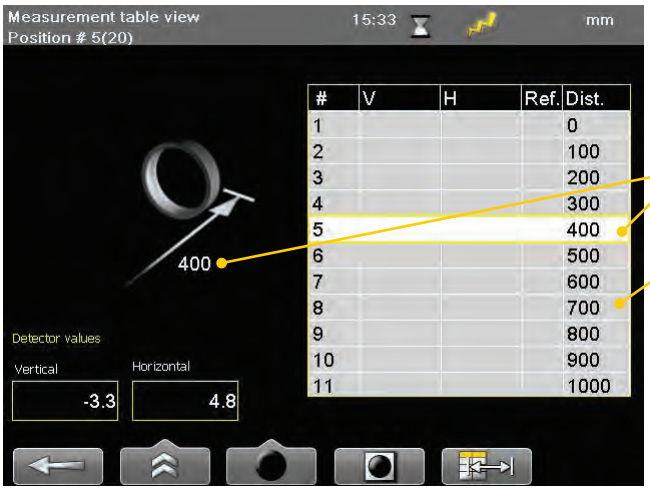
Best fit all positive

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.



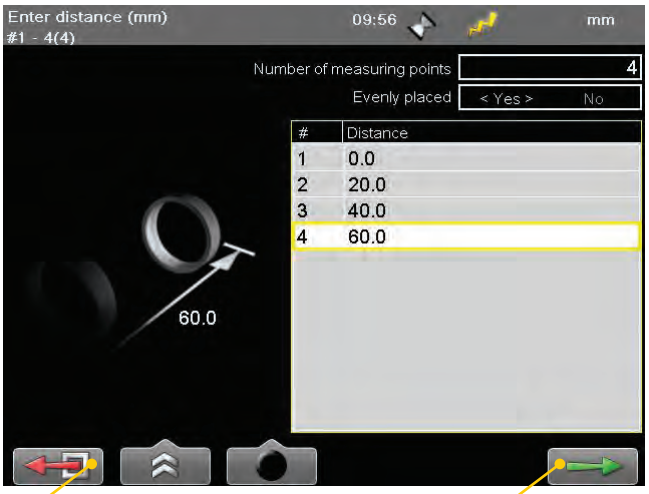
Function buttons

	Leave program.
	See *"Control panel" on page 15*. See *"Straightness settings" on page 48*. See *"Show target" on page 36*. **Show reference target**.
	Edit distance. Edit distance for selected point. **Add measuring point**. **Delete measuring point**. *See "Add and delete points" on page 39*. **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 40*.
	Open Distance view, *see "Enter distances" on page 38*.
	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.

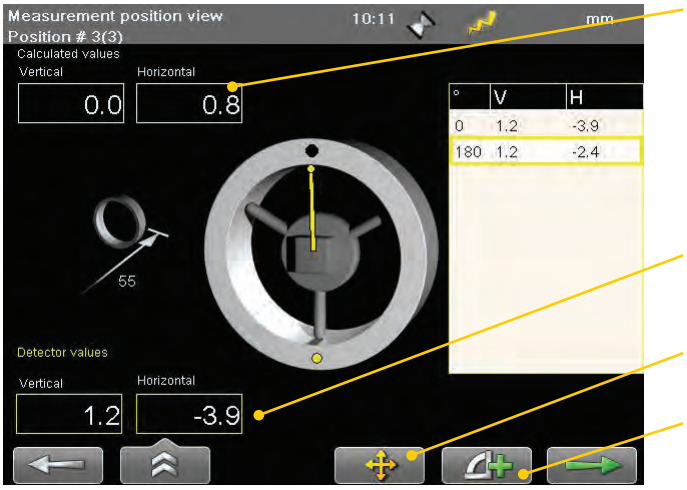
With inclinometer values

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

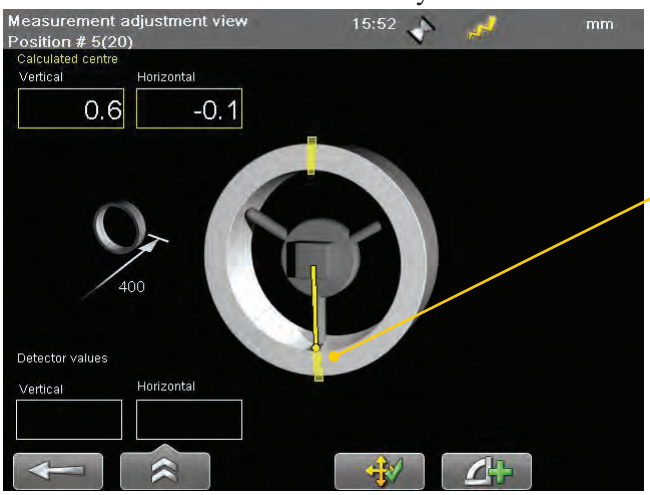
	Back to Measurement table view.
	Show target. See *"Show target" on page 36*. **Show reference target**.
0½	Only available before registering the first point. 0 Zero set displayed value. 1/1 Return to the absolute value. ½ Halve displayed value. *See "Halve or Zero set value" on page 31.*
	Toggles between 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.



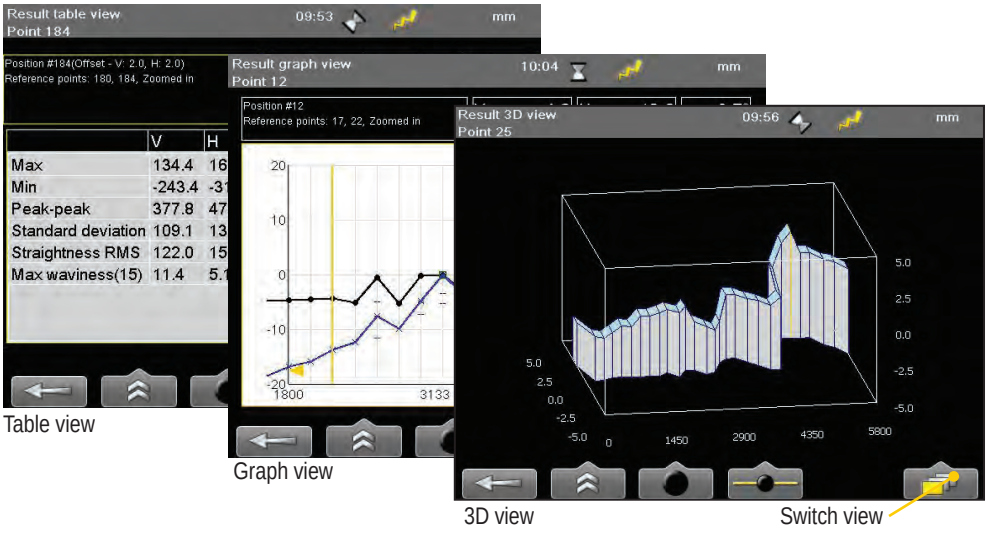
Horizontal or vertical values are live when marker is within the yellow adjustment areas.

Function buttons

	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 36*.  **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 40*.

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.

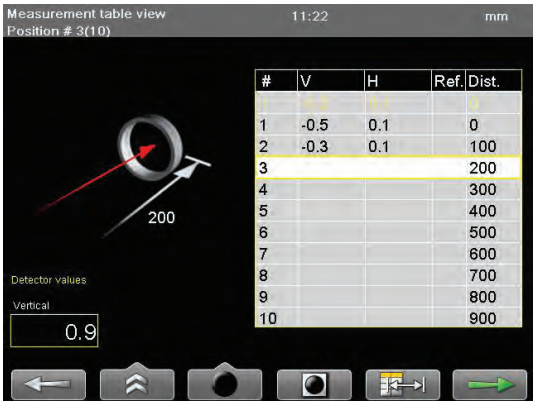
The values displayed here are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points. *See also "Show target" on page 36.*

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

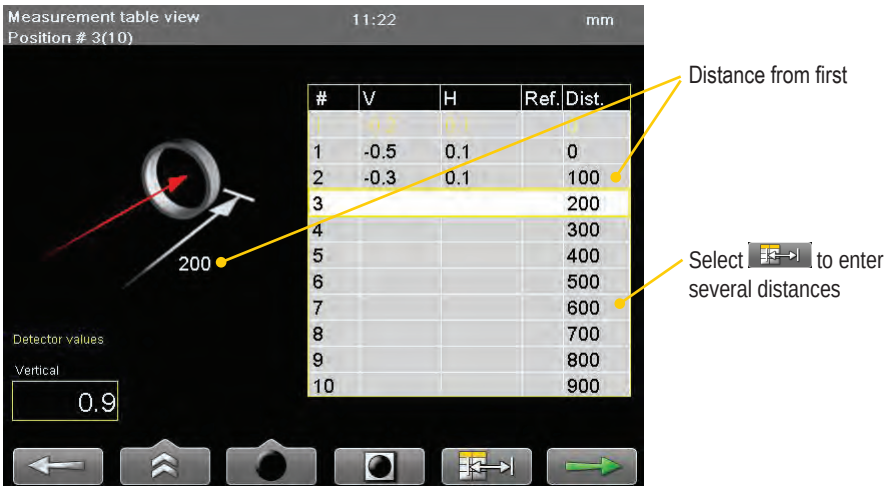
Adjustment view

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.



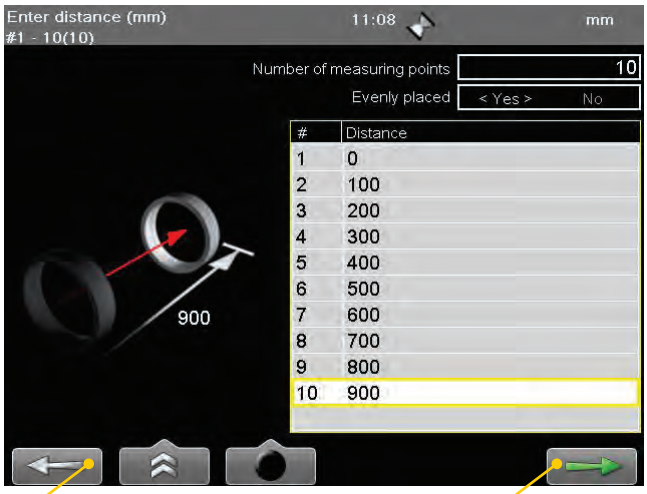
Function buttons

	Leave program.
	See *"Control panel" on page 15*. See *"Straightness settings" on page 48*. See *"Show target" on page 36*. Show reference target. Select to enter nominal mean diameter of measurement object #1. See *"Roundness view" on page 65*.
	Edit distance. Edit distance for selected point. **Add measuring point**. **Delete measuring point**. *See "Add and delete points" on page 39*. **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 40*.
	Open Distance view, *see "Enter distances" on page 38*.
	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!

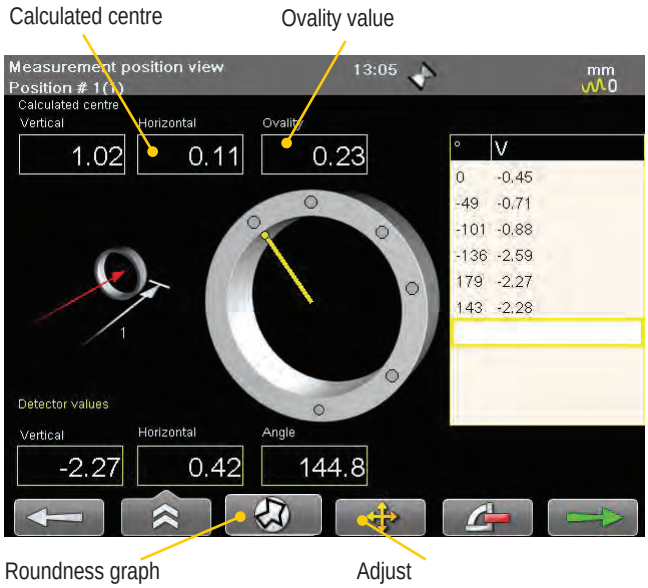
If you have registered values and open Enter distance view and make changes, your registered values will be deleted.

Measurement position view

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

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

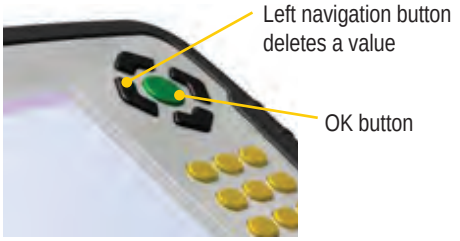
For a more reliable measurement, spread the measuring points as much as possible.



- 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 .



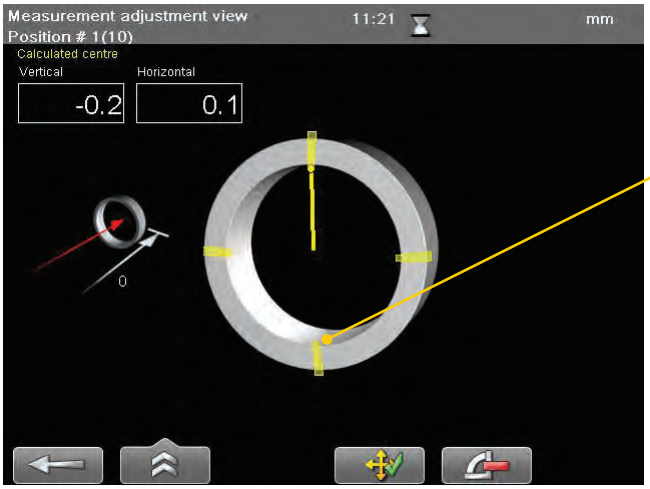
Function buttons

	Back to Measurement table view.
	Show target. See *"Show target" on page 36*. **Show reference target**. Select to enter nominal mean diameter of measurement object #1. See *"Roundness view" on page 65*.
	Show roundness graph. Available when you have registered three points.
0½	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 31.*
	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.



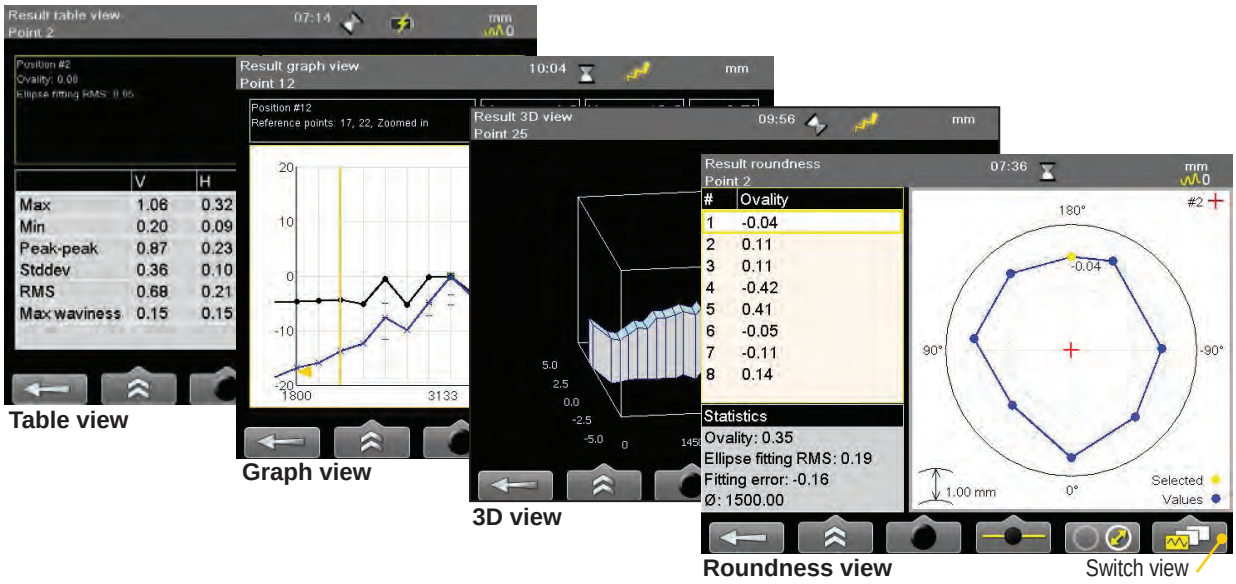
Horizontal or vertical values are live when marker is within the yellow adjustment areas.

Function buttons

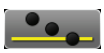
	Back to Measurement table view.
	 **Show target**. See *"Show target" on page 36*.  **Show reference target**.
	Adjustment ready. Returns to Measurement table view. You need to remeasure the object.
	Toggles between showing and hiding inclinometer values.

Result

The straightness result is displayed as a graph, table or 3D view, *see "Result" on page 40*. Roundness is displayed in a separate view, see *"Roundness view" on page 65*.



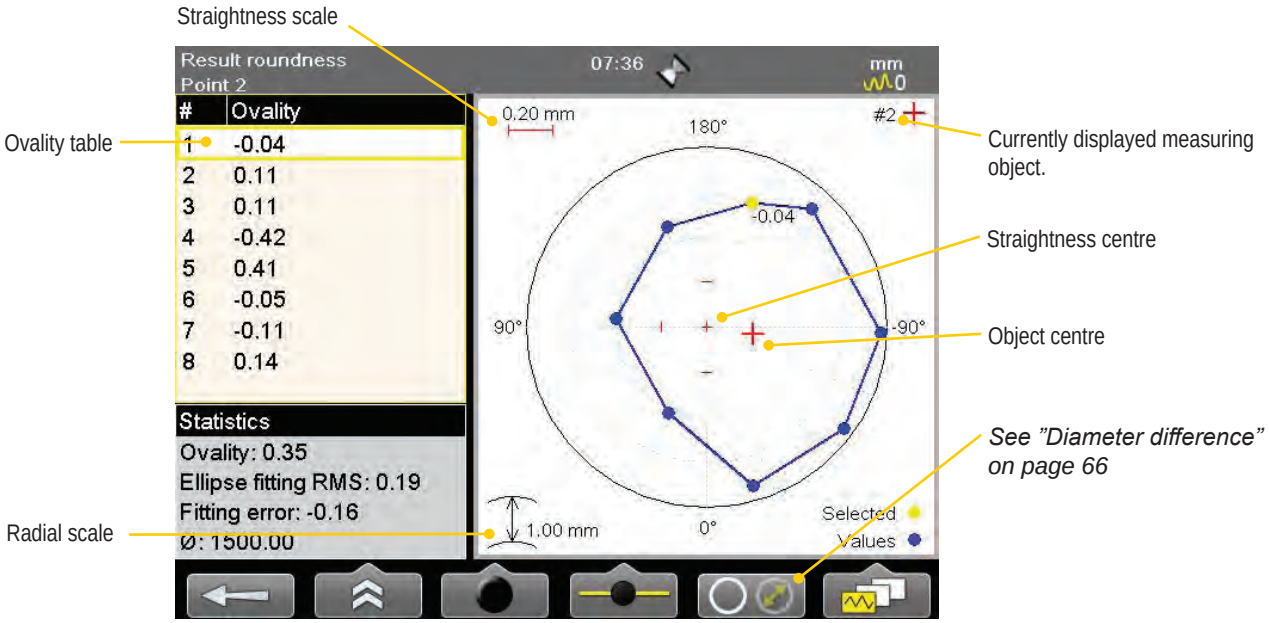
Function buttons

	Back to measure. To remeasure, select a point and then  .
	 *See "Control panel" on page 15.*  *See "Straightness settings" on page 48.*  **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 43.*  **Zoom**. Only available in Graph view.
	 **Go to measuring point**.  **Set offset for reference point**. *See "Calculation settings" on page 44.*
	Contains a sub-menu. *See "Calculation settings" on page 44.*  **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 40.*

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!

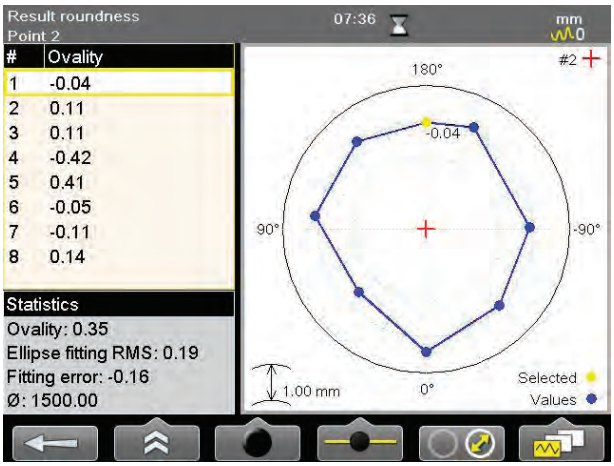
To measure roundness, you can also use the program Roundness. It is used to measure roundness on one measuring object.

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.

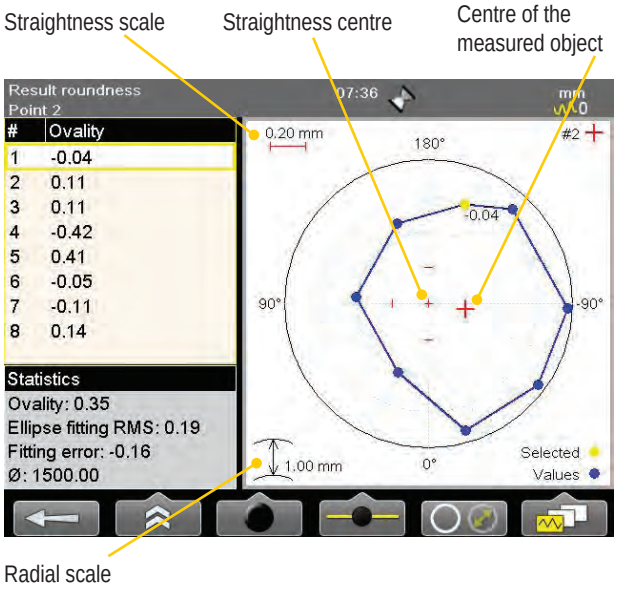
Hide diameter difference

- 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.

System Easy-Laser® E930 Extruder

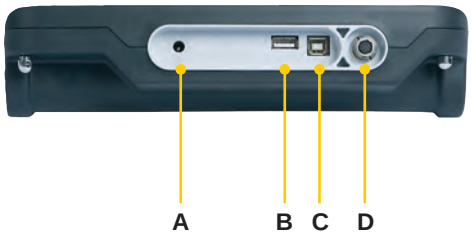
Part no 12-0788

A complete E930 contains	
1	Display unit E-series 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 (6.3 m)
1	Target for extruder
1	Shoulder strap for Display unit
1	Manual (Note: Refers to English manual)
1	Measuring tape 5 m
1	USB Memory stick with documentation
1	USB Cable
1	Battery charger (100–240 V AC)
1	Hexagon wrench set
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

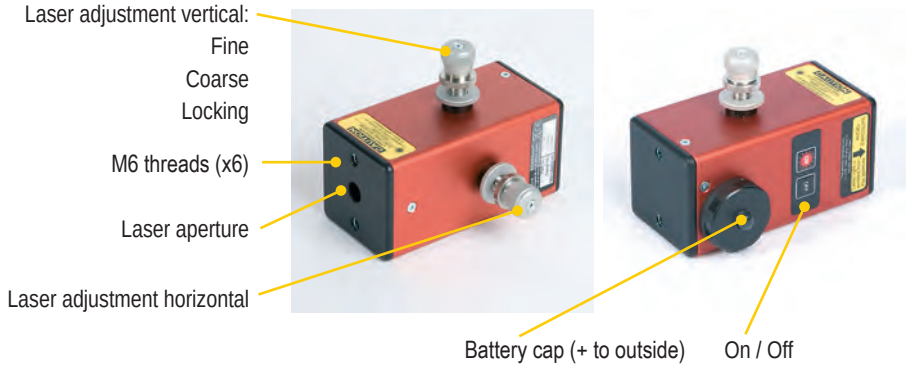
Display unit	
Type of display/size	VGA 5.7” colour
Displayed resolution	0.001 mm / 0.05 thou
Power management	Endurio™ system for unbroken power supply
Internal battery (stationary)	Li-Ion, Not restricted PI967, 3.7 volt, 43Wh, 11600 mAh
Battery compartment	For 4 pcs R 14 (C)
Operating time	Appro. 30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

Laser transmitter D75

Part no. 12-0075

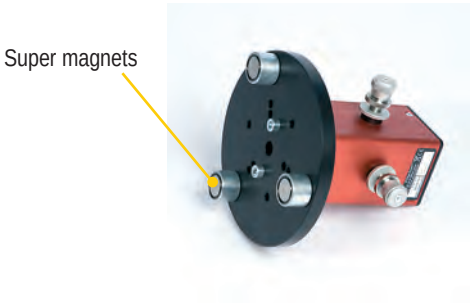
For measuring straightness and spindle direction. M6 threads on ends and sides offer alternative mounting options. Measurement distance 40 m [130’].

Use tilting screws for laser beam adjustment.



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

Bracket for D75 with magnets



Tilting screws

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

Visual rough alignment to (detector) target

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

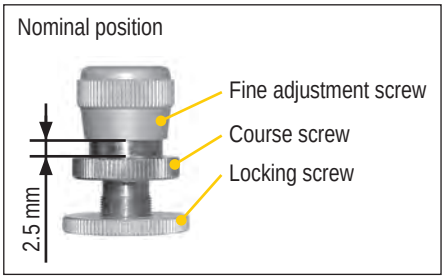
1. Loosen the locking screw.
2. Adjust with the course screw to wanted position.
3. Tighten the locking screw.

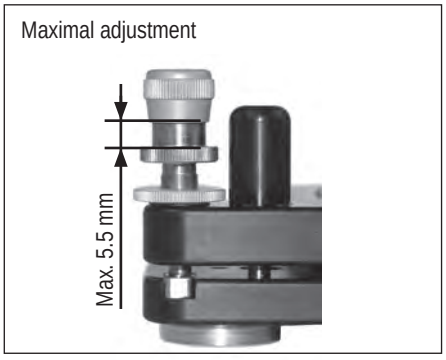
Digital fine adjustment to detector and read values

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

Note!

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





Detector 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 BT technology
Type of detector	2 axis PSD 20x20 mm [0.78” sq]
Resolution	0.001 mm [0.05 mils]
Measurement error	<1% +1 digit
Thermal sensors	± 1° C accuracy
Environmental protection	IP 67
Internal battery	Li-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]

Extruder brackets

Tube adaptors for detector. Manufactured to order to fit the actual diameter.