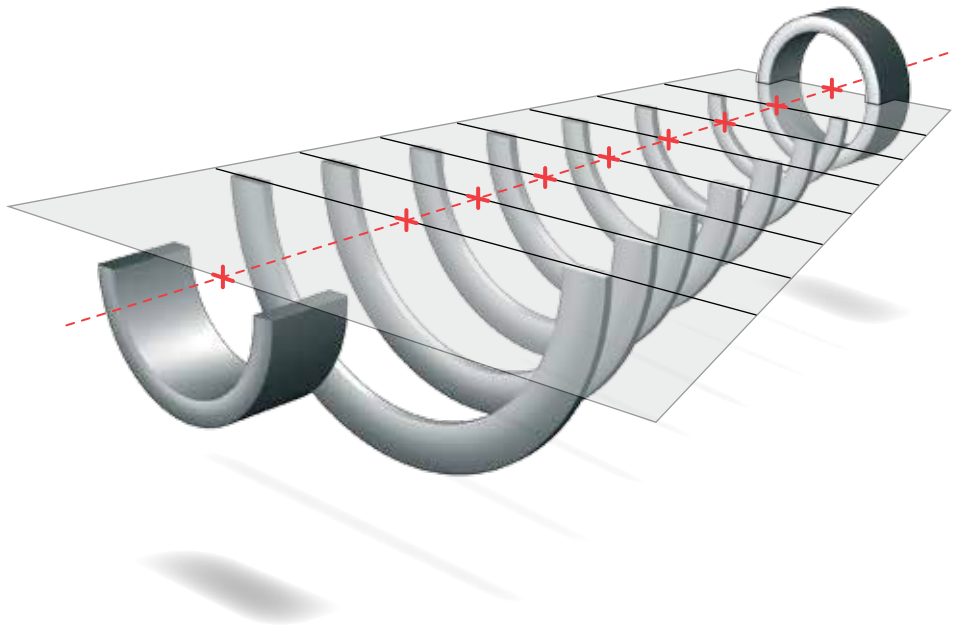
E960



TURBINE GUIDE

English

EASY-LASER®

05-0712 Revision 2.0

CONTENT

INTRODUCTION

Easy-Laser AB

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

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

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

Declaration of conformity

Equipment: Easy-Laser® product range

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

CE

EMC Directive	2014/30/EU
Low Voltage Directive	2014/35/EU
Laser Classification	Europe: SS_EN 60825-1 USA: CFR 1040.10/11
RoHs Directive	2011/65/EU
WEEE Directive	2012/19/EU
R&TTE Directive	1999/5/EC

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

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

(1) this device may not cause harmful interference

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

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

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

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

Quality certificate

Easy-Laser AB is ISO 9001:2008 certified. Certificate number 900958.

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

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

Limited warranty

This product is manufactured under 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

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

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

Before sending your measuring system to our main Service centre, please fill in the online Service and Repair report.

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	3.7 V	43 Wh	11600 mAh	12-0418, 12-0700
03-0765	Li-Ion	3.7 V	2.5 Wh	680 mAh	12-0433, 12-0434, 12-0509, 12-0688, 12-0702, 12-0738, 12-0752, 12-0759, 12-0758, 12-0846, 12-0790, 12-0789
03-0971	Li-Ion	3.7 V	8.5 Wh	2300 mAh	12-0617, 12-0618, 12-0823, 12-0845
03-1052	Li-Ion	3.7 V	1.5 Wh	380 mAh	12-0746, 12-0747, 12-0776, 12-0777, 12-0791
03-1055	Li-Ion	3.7 V	34 Wh	9200 mAh	12-0748
12-0953	Li-Ion	3.7 V	7.4 Wh	2000 mAh	12-0944, 12-0943
12-0952	Li-Ion	7.4 V	39.22 Wh	5300 mAh	12-0961 (2 pcs)

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.

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.

May 2017

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E960 TURBINE

System Easy-Laser® E960-A

Part no. 12-0710

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

System Easy-Laser® E960-B

Part no. 12-0711

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

Note!

For a complete technical data, please see Manual.

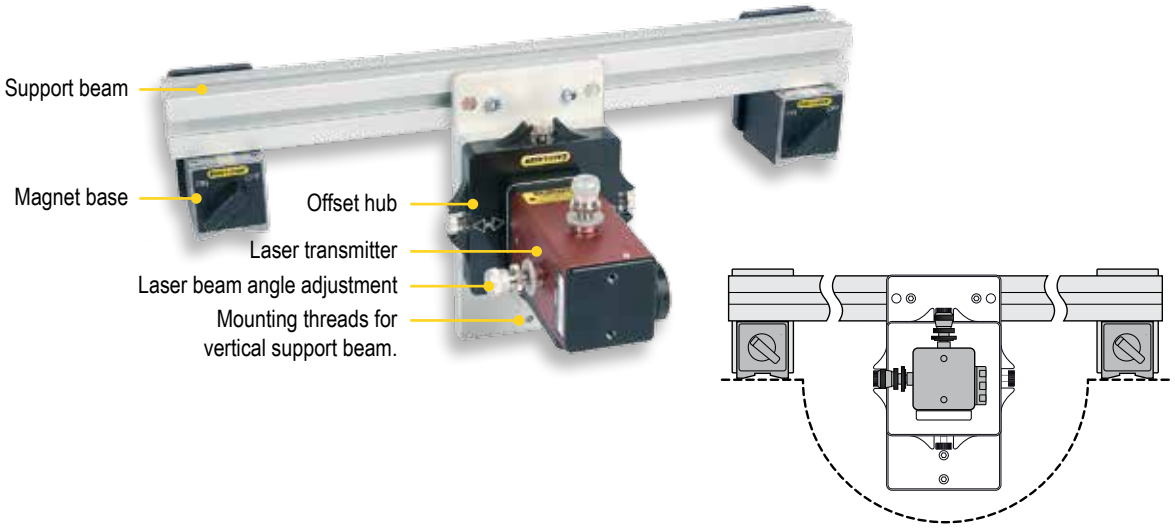
Prepare the work

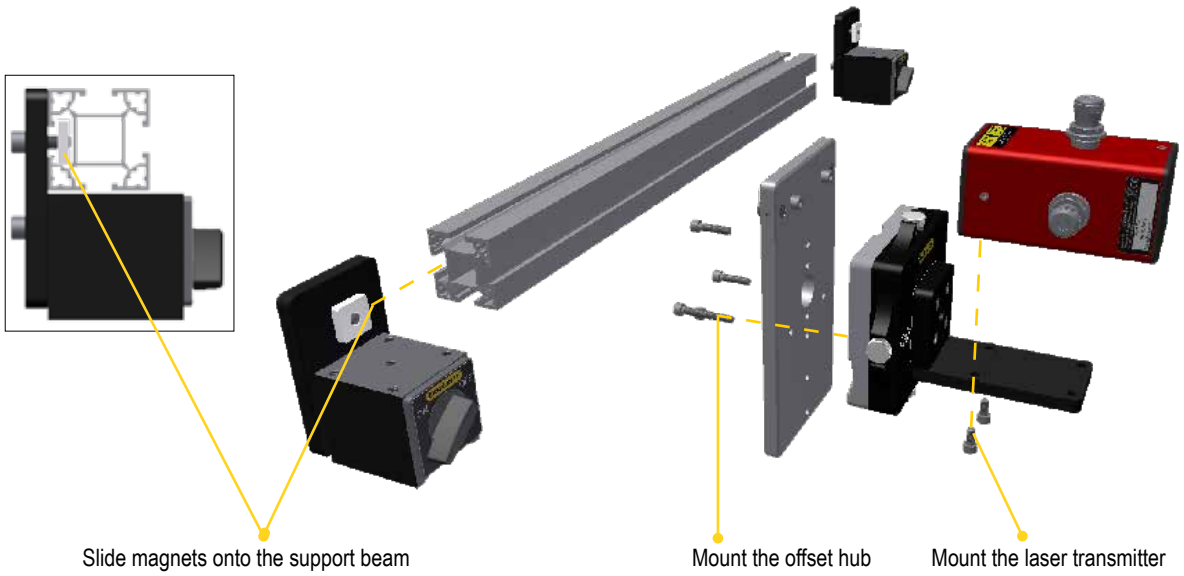
- Get hard copies of drawings with distances and diameters.
- Determine tolerances according to drawings, specification or standards.
- Assemble all brackets (as far as possible) in advance according to drawings.
- Check battery status of laser and display. Extra AA batteries for laser and display (Note! Alkaline type only)
- Chalk for marking

Assemble Laser transmitter

Using support beam

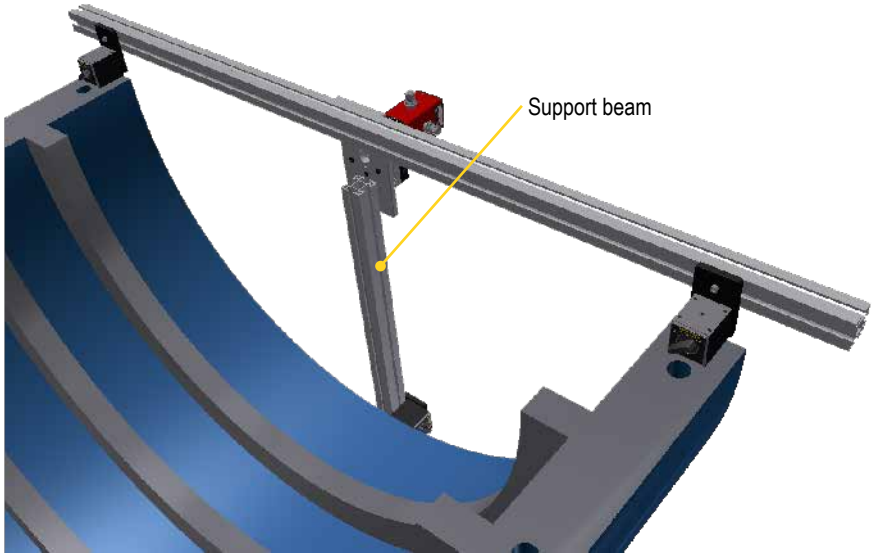
1. Select a horizontal support beam, long enough to rest on both sides with good margin.
2. Use as short bracket as possible to maintain stability.
3. Mount the laser transmitter approximately at the middle of the support beam using the square nuts.
4. Slide the magnets onto the support beam.





Using vertical support beam

Use the third vertical beam to increase stability if the horizontal beam is extended with one or more sections.

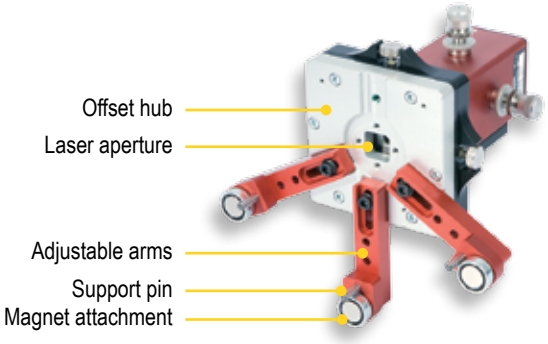


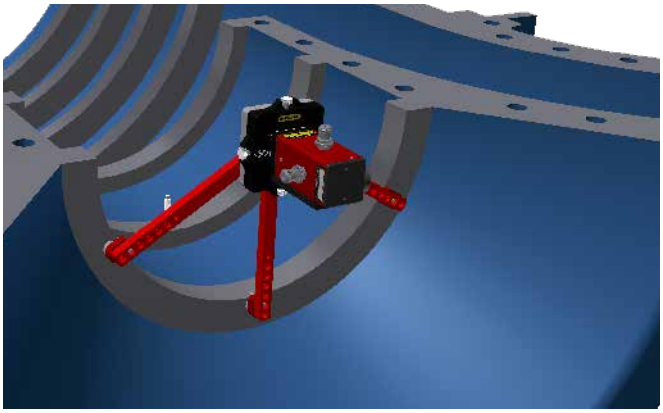
Using arms

If needed, you can use extension arms to mount the laser transmitter. The arms are 100–500 mm.

Note!

The arms are not included in the E960 system, but delivered as an option.





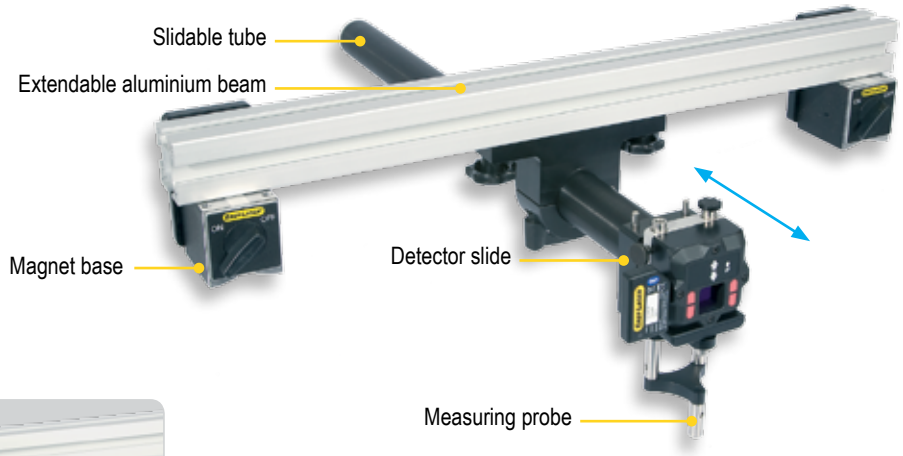
Assemble Detector

1. Select a horizontal support beam and extensions, long enough to rest on both sides with good margin.
2. Mount the detector with bracket in the middle of the support beam (± 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.

Using short stroke bracket

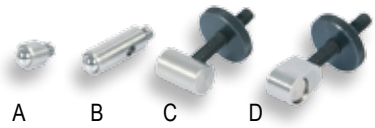
Part no. 12-0438

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

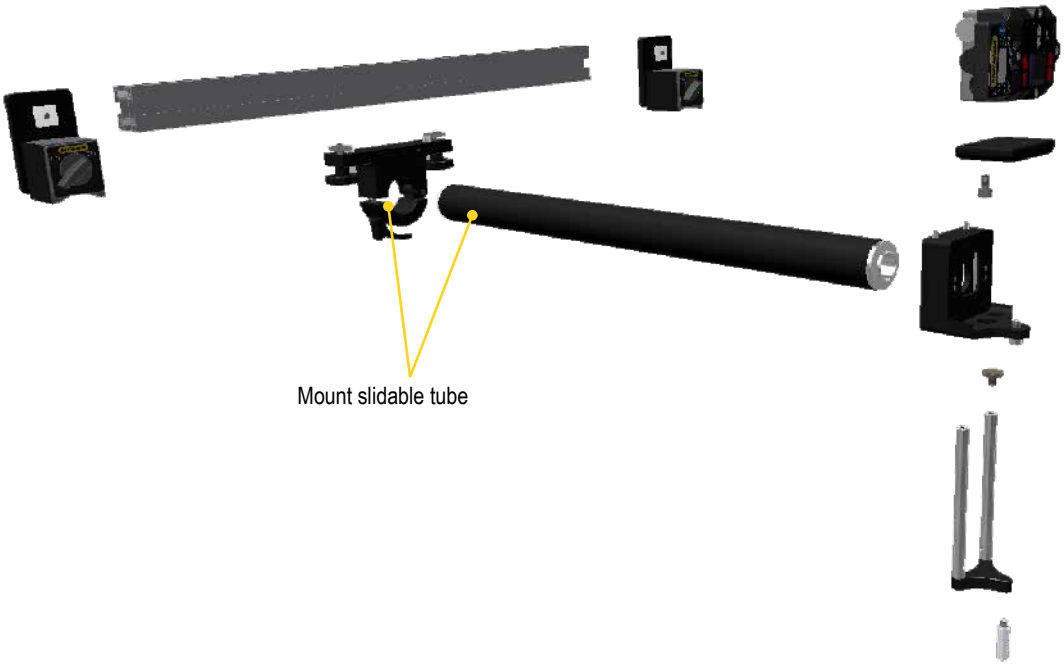


Detector slide mounted without tube (left).

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



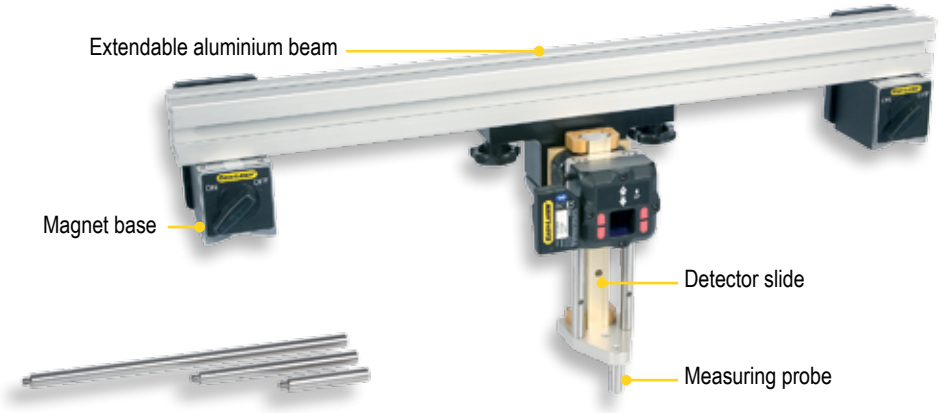
Included measuring probes:
A: Short ball top
B. Ball top
C. Cylinder top
D. Magnetic cylinder top

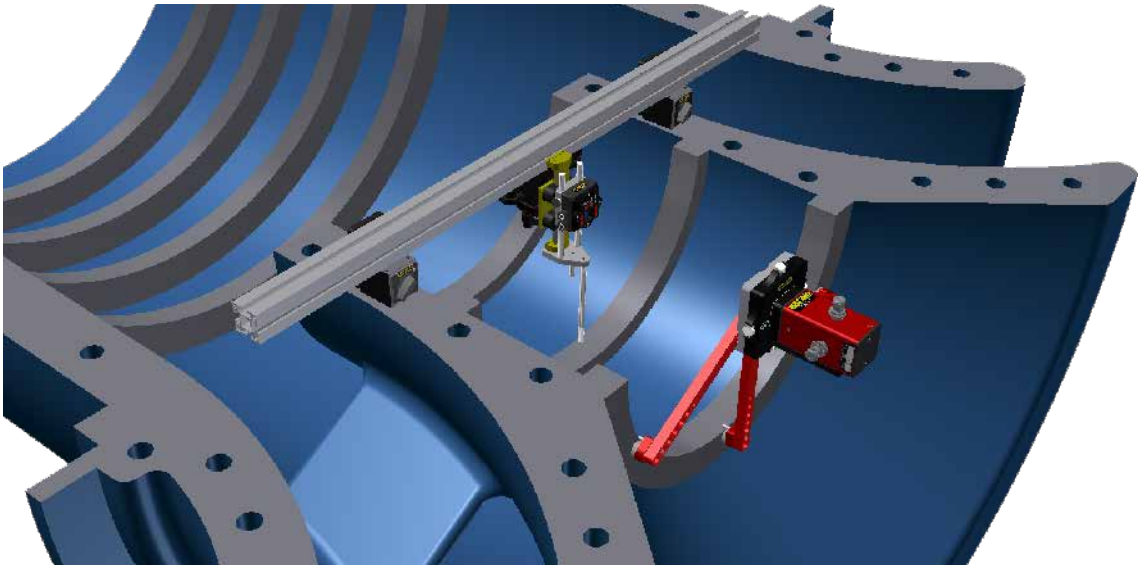


Using long stroke bracket

Part no. 12-0715

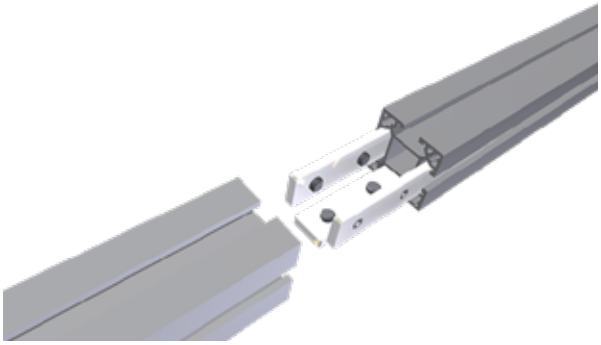
Measuring probe with a stroke of 60 mm. Suitable for larger turbines.





Beam extensions

It is possible to extend the support beams. Mount three extension plates on one of the aluminum beams. Slide the second beam onto the extension plates. See image below.



Using sliding bracket

It is not possible to slide in a turbine segment. Sliding brackets can only be used in support bearings.

When measuring in tops-on condition, the self-center bracket is replaced with light weight slide bracket. The slide bracket is useful in diameters up to 3m.

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”]

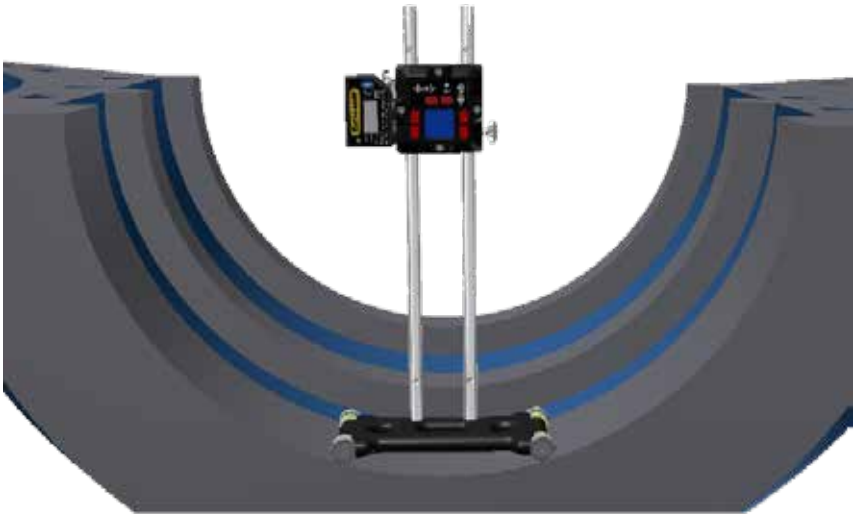
Part No: 12-0543

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”].



Preparations

Check the environment

- Check that the turbine has a uniform temperature. Mainly important if the turbine partly has been exposed to direct sunshine.
- Check that the laser, detector and brackets are covered from direct sunlight from roof windows or other sources. Direct light (sun, strong lights or welding) into the sensor may result in fluctuating measurements and has to be prevented.
- Check that the ambient temperature is within the operating range of the EasyLaser: 0 to 50 degrees.
- Check that airflow or wind does not enter the measurement area, especially not close to the laser source. To further reduce influence, use appropriate filter settings.
- Check for vibrations, low and mid frequencies, that may interfere with the measurement. If found, identify the source and take actions to reduce the vibrations. In case vibrations re-mains, use measurement filter (see the user manual).
- Check that rain can not enter into the measurement area
- Refrain from using mobile phone or communication radio while taking a reading.
- Clean all measurement points for oil, grease and other substances using grease cleaner
- Remove any burr, welding spatter etc. Ensure that no original material is removed during cleaning.

It is highly recommended that final measurement is done during the night time when there is less interfering work ongoing and the temperature has become stable (around midnight).

Mount the laser transmitter

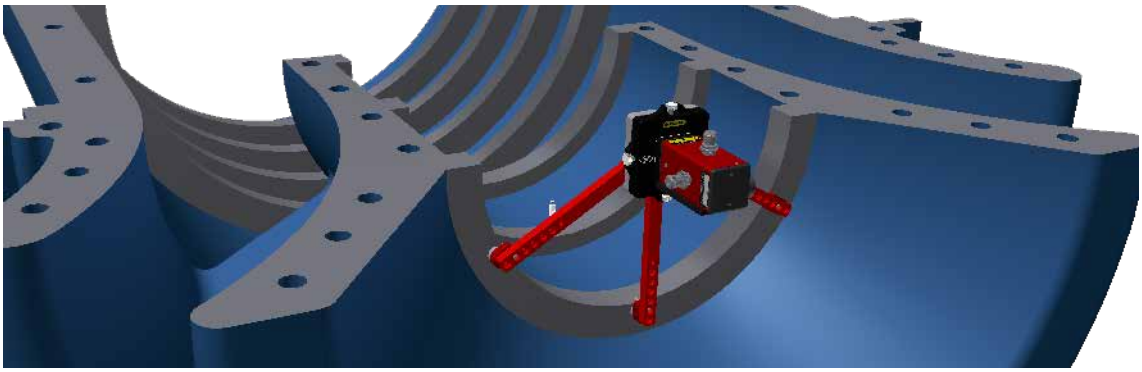
The laser should be placed on a stable and rigid place, free from air flow, vibrations and sunshine. A welded structure fixed to the ground or the turning gear bearing may be suitable locations.

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.

Note!

The fine adjustment screw on the tilting table must not exceed its maximum position. That might damage the threads of the screw. See also Techdata in Manual.

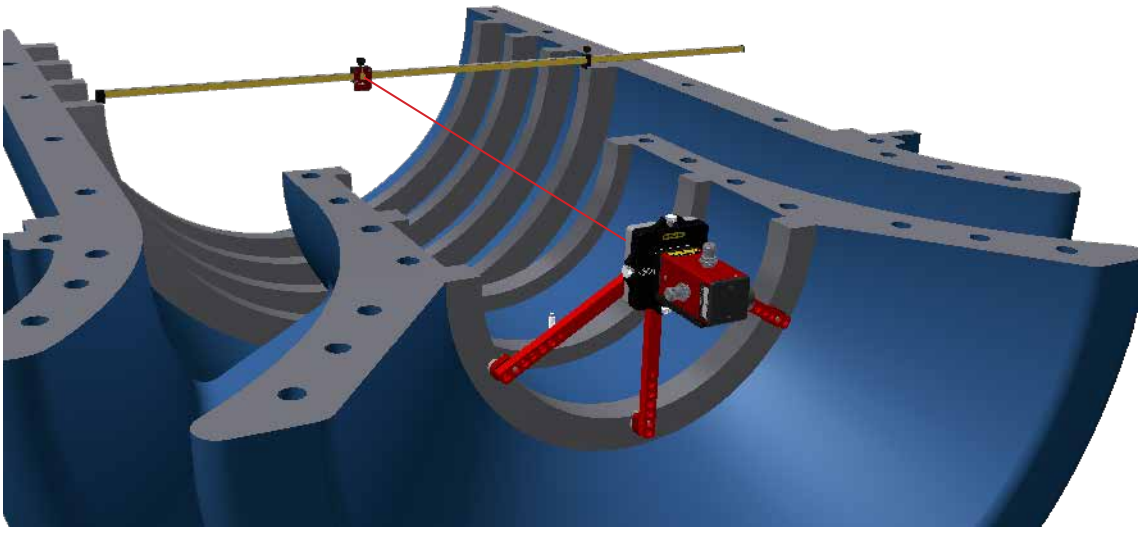


Rough align laser beam

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

Part no. 12-0443

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.

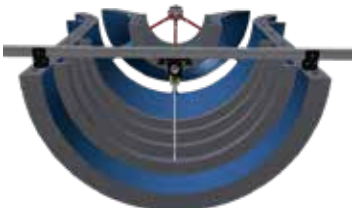


Align the laser beam

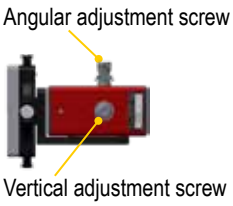
If extra high accuracy is required, for example during a final inspection, the beam may be precisely aligned to the reference surfaces. Note, this is not necessary during normal corrective adjustment work.

1. Place the detector at the reference point furthest away from the laser transmitter.
2. Turn the detector to position 9 o'clock position and select 0.

3. Turn detector to 3 o'clock and select 1/2.
4. Adjust horizontal error to zero with the angular adjustment screw.



5. Turn detector to 6 o'clock and adjust vertical error to zero.



6. Move the detector close to the laser transmitter and repeat step 2-5 to adjust the offset.

Repeat until both reference points are zero.

Reference target

The purpose of a reference target is to monitor that the laser beam remain in its original position during the measurement within the specified tolerance. Reasons for deviation may be temperature changes, sun light or someone touching the laser.

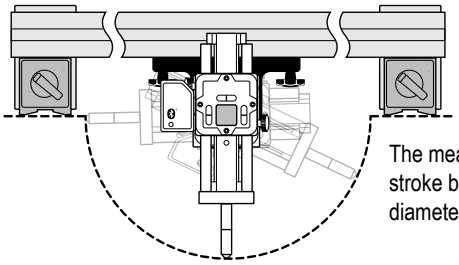
1. Place the reference target at the far end of the turbine.
2. Select  and  to display the reference target.
3. The first time you select the command, a window is displayed. Select which detector you want to use as reference detector and press **OK**.

Function buttons

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

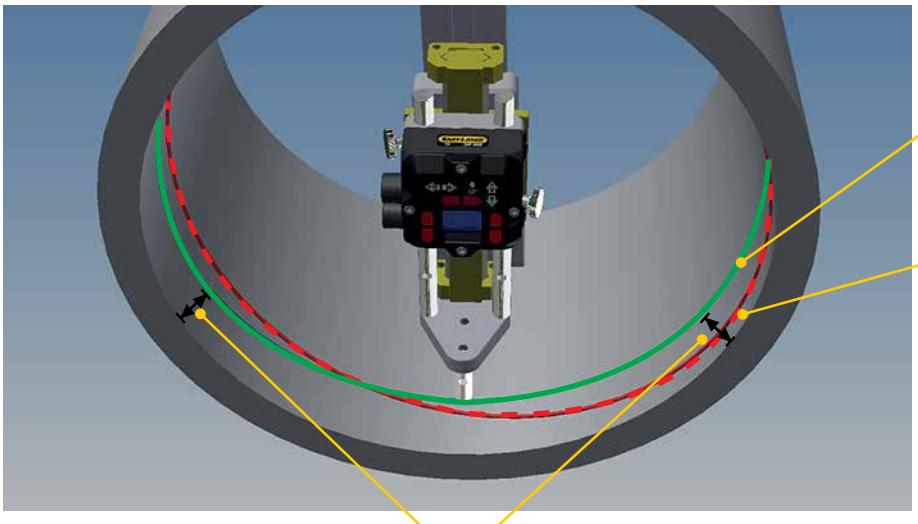
Adjust the measuring probe

1. Place the detector in the measurement position.
2. Adjust the probe length to the radius.
3. Turn the probe to position 6.
4. Adjust the detector vertically and horizontally to the centre of the laser beam.
5. Adjust the detector fixture so that the probe runs parallel to the surface to be measured.



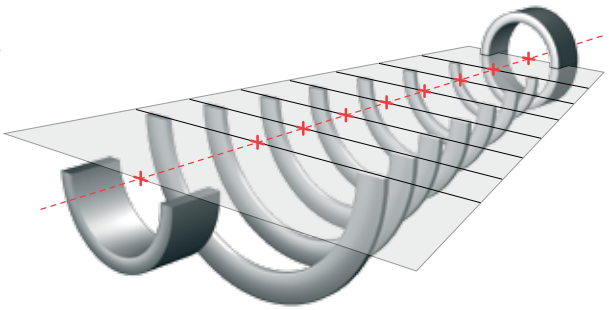
The measuring principle is the same for both long and short stroke bracket. The probe rod is very easily adapted to each diameter with extensions of different length.

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. Image below show a linebore measurement, but the same principle apply to turbines.

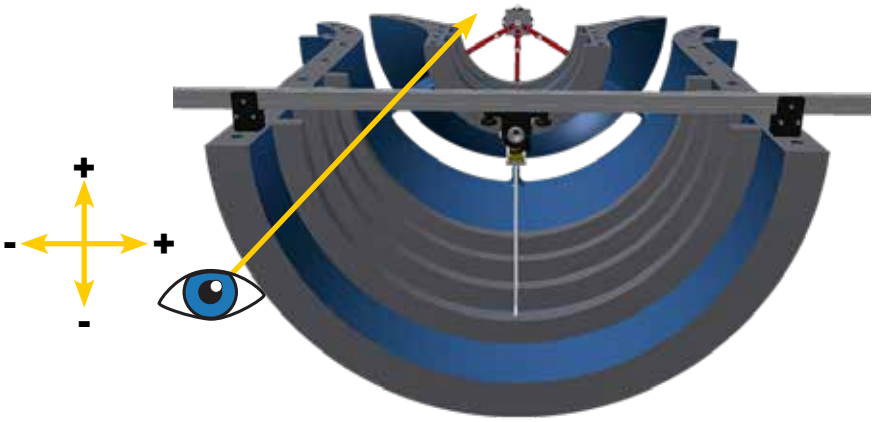


Measure

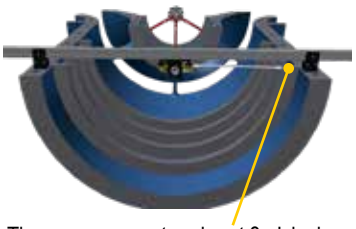
You can use the program Half circle or Multi-points. Here the program Half circle is used. Please note that the order of measurement or distances is not dependent on laser position. First measurement point may therefore be the most distant from the laser.

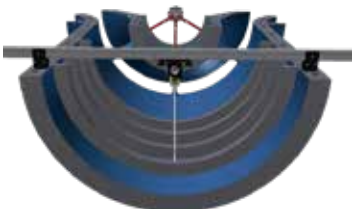


Note!
Face the laser transmitter from the detector. Then 9 o'clock is to the left, as in the measuring programs.




The measurement probe at 9 o'clock.

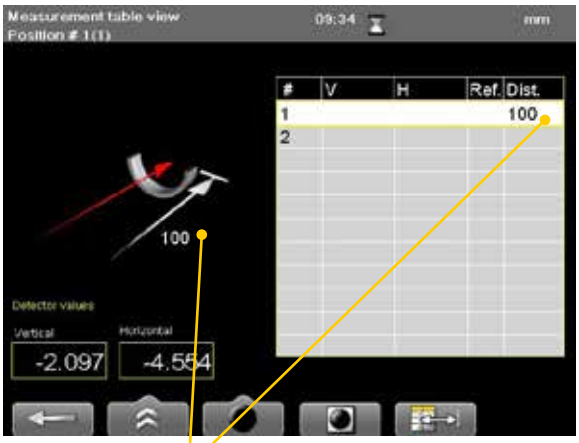

The measurement probe at 3 o'clock.


The measurement probe at 6 o'clock.

Enter distance

Press and enter the distance to the first measurement object.

Or Select to enter several distances.
For more information, see Manual.



Distance

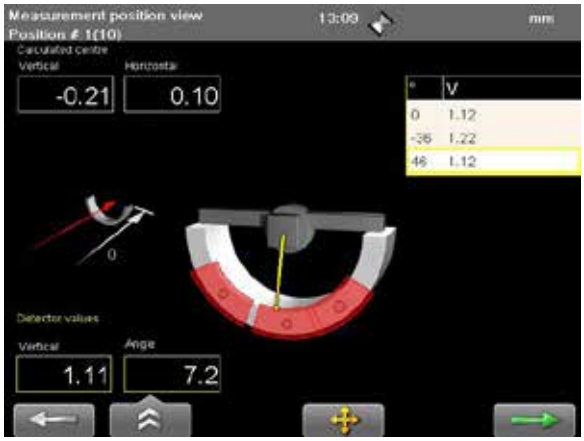
Register values

Press to register a value. The Measurement position view is displayed. Register values on three positions. You can register values with or without using inclinometer values.

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 measure next position.

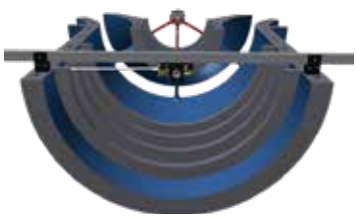


Inclinometer values on

Without inclinometer values

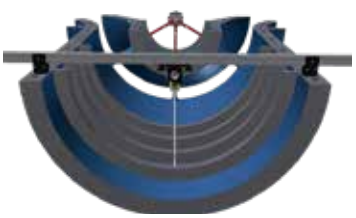
With the inclinometer values hidden, you are prompted to register points at three positions.
Press to register values.

Inclinometer values off



The measurement probe at 9 o'clock.

The measurement probe at 3 o'clock.



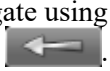
The measurement probe at 6 o'clock.

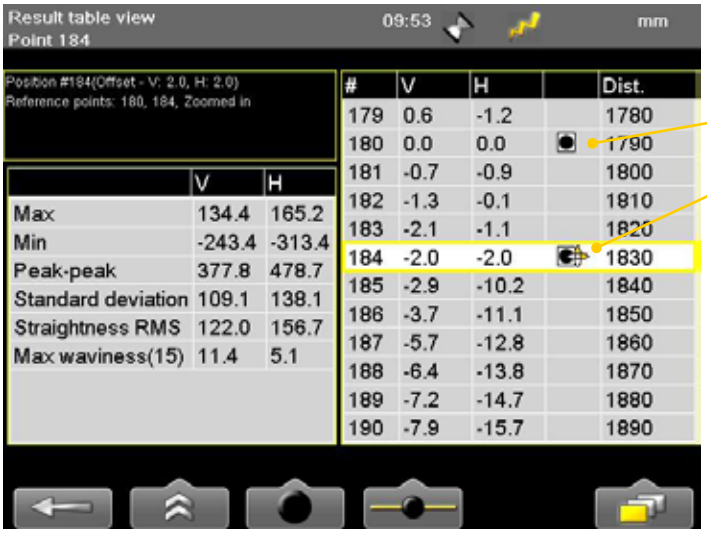
Result

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.

For more information regarding result views and different calculation settings, see Manual

Result table view

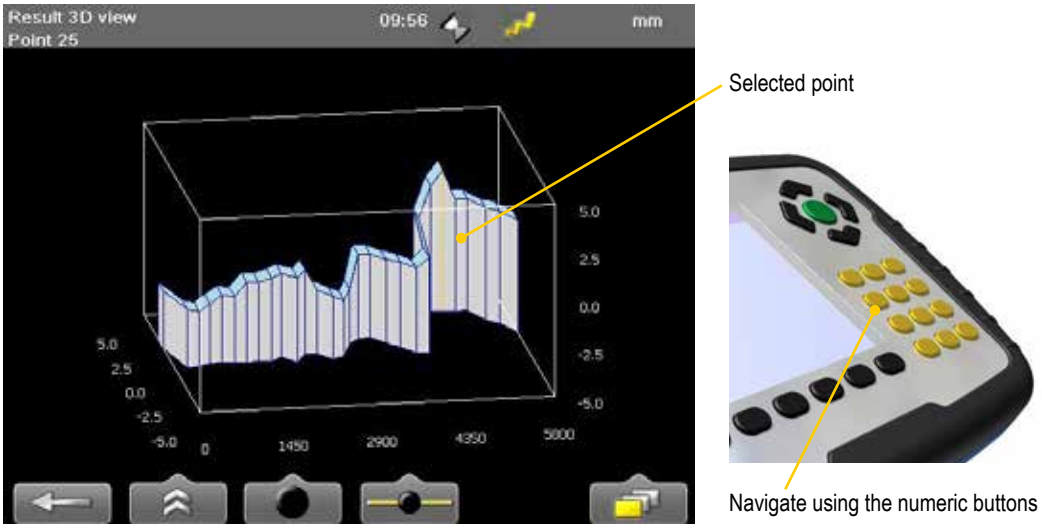
Navigate using the navigation buttons. To remeasure, select a point in the list and select  .



Result 3D view

Navigate using the numeric buttons.

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



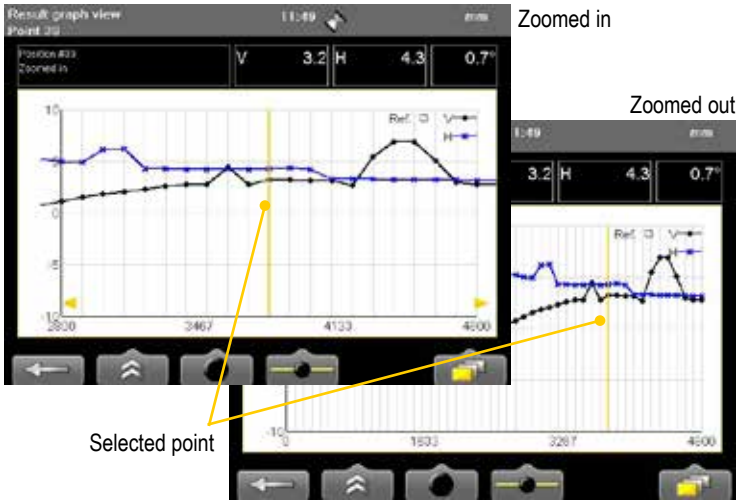
Result graph view

Navigate using the navigation buttons.

Zoom

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

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

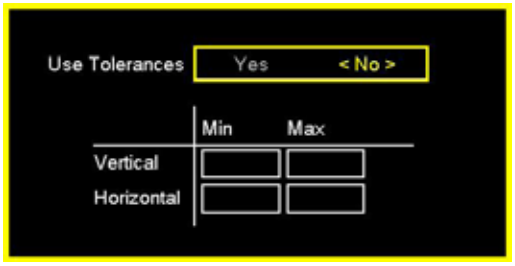


Scale using navigation buttons

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

Tolerance

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



Enter tolerance

Tolerance in graph and table view

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