EASY-LASER®


# Ship Application

05-0761 Revision 2.3

# CONTENT

# SHIP APPLICATIONS

There are many applications for laser measurement at a shipyard, such as when building new ships, repairing damaged ones and for regular maintenance.

- Alignment between propeller shaft and gearbox
- Alignment of bearing journals in relation to stern tube
- Stern tube measurement
- Measuring the flatness of a slewing ring bearing

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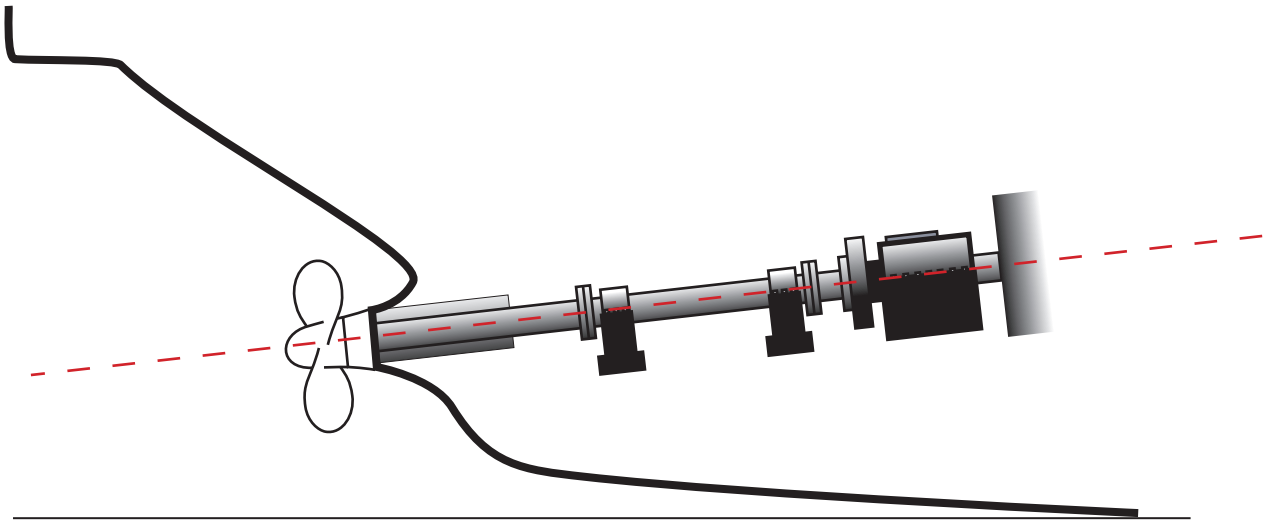


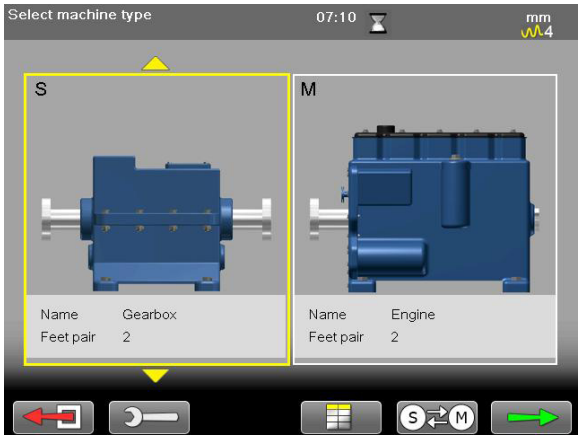
# ENGINE TO GEAR

## Preparations

If the gearbox is your best reference, mount the laser transmitter on the gear flange and point the laser beam backwards.

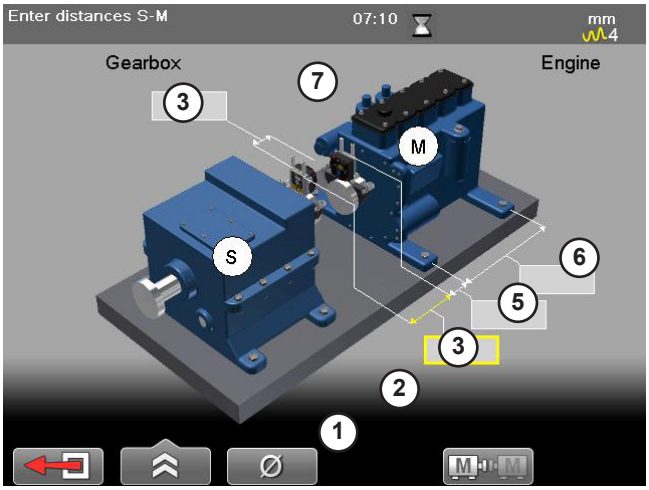
1. Select  and  to open the Horizontal program.
2. Select “Custom” if you want to select machine types.
3. Use navigation buttons up and down to find the machine you want. You can also define as many feet pairs as you need on the machines.
4. Press  . The next machine becomes active.

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




### Enter distances

Confirm each distance with  .



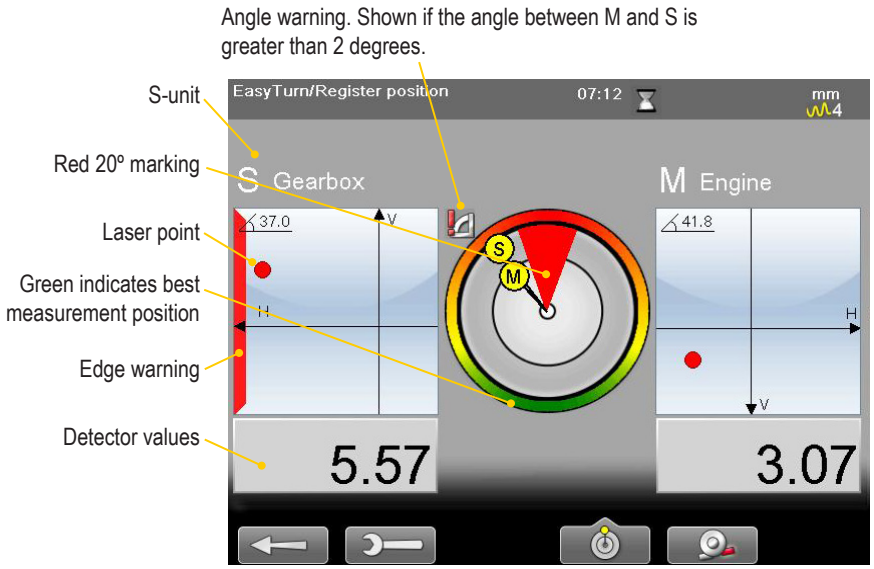

1. Distance between first and second feet pair. Optional, select  to activate field.
2. Distance between second feet pair and S-unit. Optional, select  to activate field.
3. Distance between S-unit and M-unit. Measure between the rods.
4. Distance between S-unit and centre of coupling.
5. Distance between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

Adjusting the diesel engine

## Measure

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

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

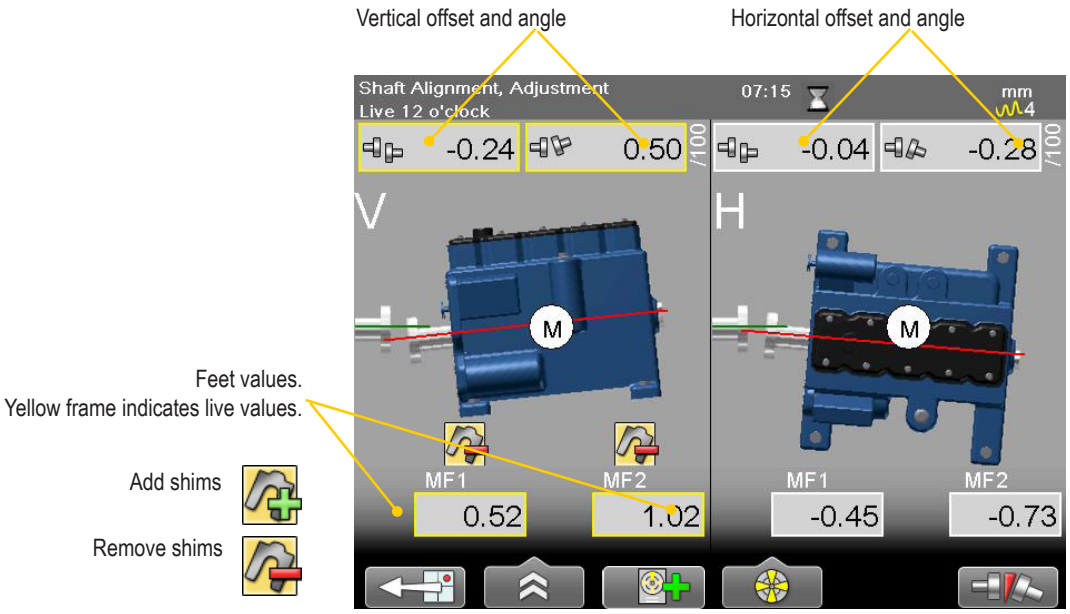



**Edge warning**

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

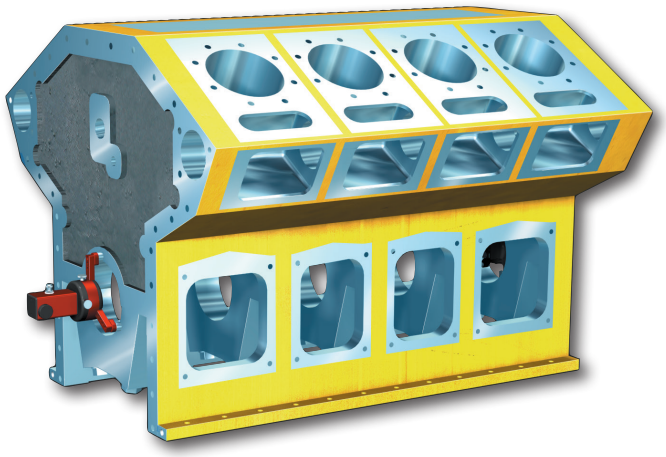
## Result

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



# DIESEL ENGINE

You can measure the crankshaft and camshaft bearings. We recommend to register two measuring points in each bearing pocket to show the angle of the bearings to the centre line.



## Preparations

When measuring bores, there are three programs you can choose from.

**Half circle**: Values are registered at three positions in a half bore. Used for turbines for example.

**Fourpoints**: Values are registered at four positions in a full bore.

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

For a full description of the measurement programs, please see the manual.

Detector E9 mounted on a cam shaft bracket

# Bores

For bigger bores

## Set up laser beam

1. Place the laser transmitter on the bearing pocket flange.
2. Mount the detector (E9 or E7) on the bracket.
3. Select  and  to start program Half circle.
4. Select  and  to open the target.
5. Adjust laser point to the centre of the target.
6. Place the detector on the first position, close to the laser transmitter.
7. Select  to zero set the displayed value.
8. Rotate the detector 180º.
9. Select  to half the displayed value.
10. Adjust both H and V value to 0.00 by using the adjustment screws on the hub.
11. Move the detector to the second position, far away from the laser transmitter.
12. Select  to zero set the displayed value.
13. Rotate the detector 180º.
14. Select  to half the displayed value.
15. Adjust both H and V value to 0.00 by using the adjustment screws on the laser.
16. Adjust both first and second position to within 0.1mm.

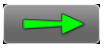
The values displayed in the target are **raw** values. When you measure, **calculated** values are used. Calculated values are based on the distance from first measurement point and selected reference points.

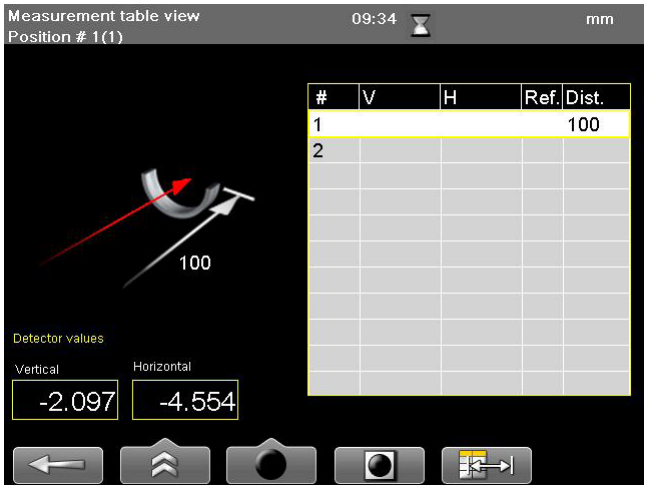
## Set tolerance

Select  to set tolerances. Typical tolerance for diesel engines is 0.04mm. Between two bearings, a typical tolerance is 0.02mm.

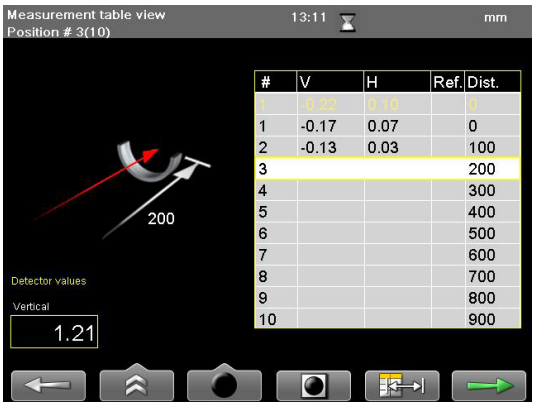
## Enter distances

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

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

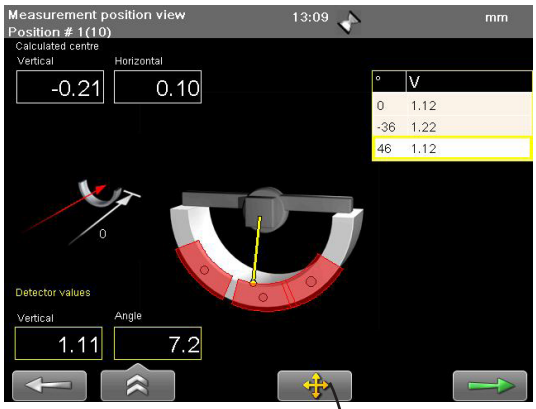


# Measure



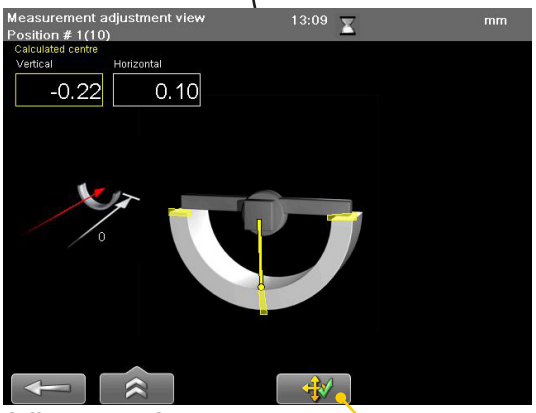

**Measurement table view**

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




**Measurement position view**

Measure points for selected position




**Adjustment view**

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

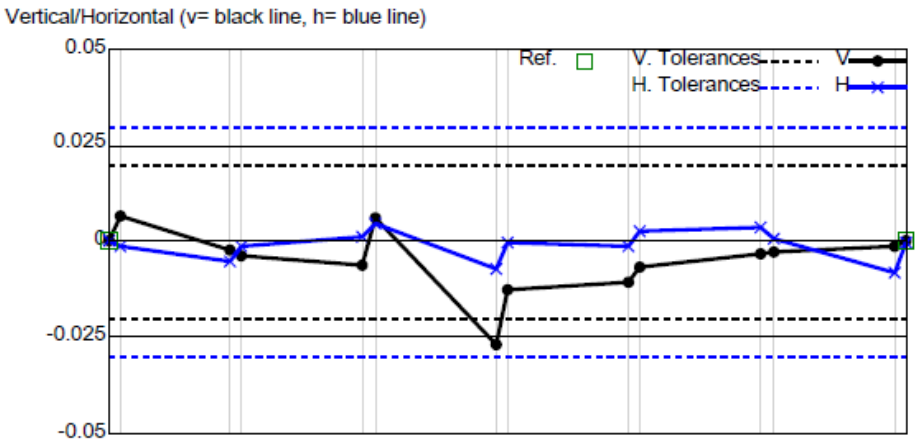
Adjustment ready

# 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. Below an example from a pdf-report.

| # | Ref. | Distance | V. Value | Tol. | V. Offset | H. Value | Tol. | H. Offset |
|---|---|---|---|---|---|---|---|---|
| 1 | ● | 0 | 0.00 | | 0.00 | 0.00 | | 0.00 |
| 2 | | 30 | 0.01 | | 0.00 | 0.00 | | 0.00 |
| 3 | | 310 | 0.00 | | | | | |
| 4 | | 340 | 0.00 | | | | | |
| 5 | | 650 | -0.01 | | | | | |
| 6 | | 680 | 0.01 | | | | | |
| 7 | | 990 | -0.03 | ! | | | | |
| 8 | | 1020 | -0.01 | | | | | |
| 9 | | 1330 | -0.01 | | | | | |
| 10 | | 1360 | -0.01 | | | | | |
| 11 | | 1670 | 0.00 | | | | | |
| 12 | | 1700 | 0.00 | | | | | |
| 13 | | 2010 | 0.00 | | | | | |
| 14 | ● | 2040 | 0.00 | | | | | |

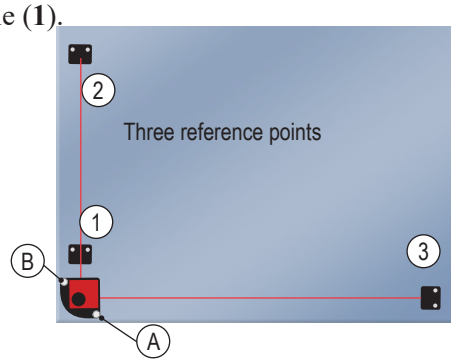
Two reference points set



# Flatness

## Preparations

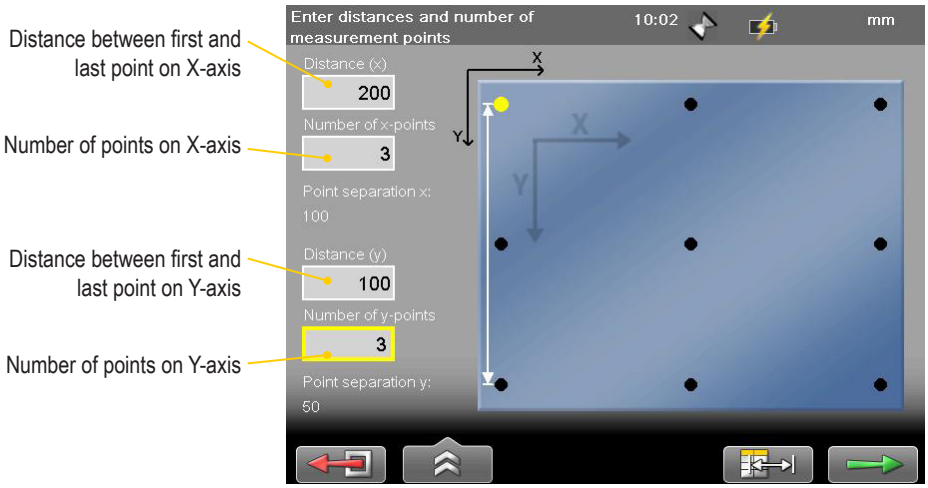
1. Mount the laser transmitter on the table.
2. Mount the detector close to the transmitter on the table (**1**).
3. Select  to open the program Flatness and enter distances.
4. Select  to open the target.
5. Select  to zero set the value. This is now reference point number one.
6. Move the detector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




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

### Enter distances

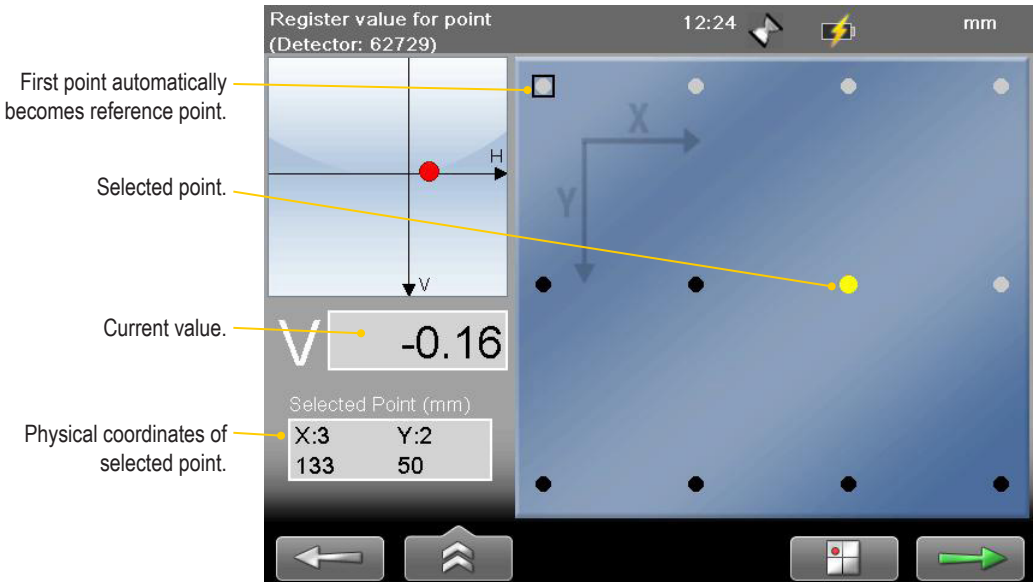
Up to 500 measurement points can be handled.




Straightness and flatness on the diesel engine block

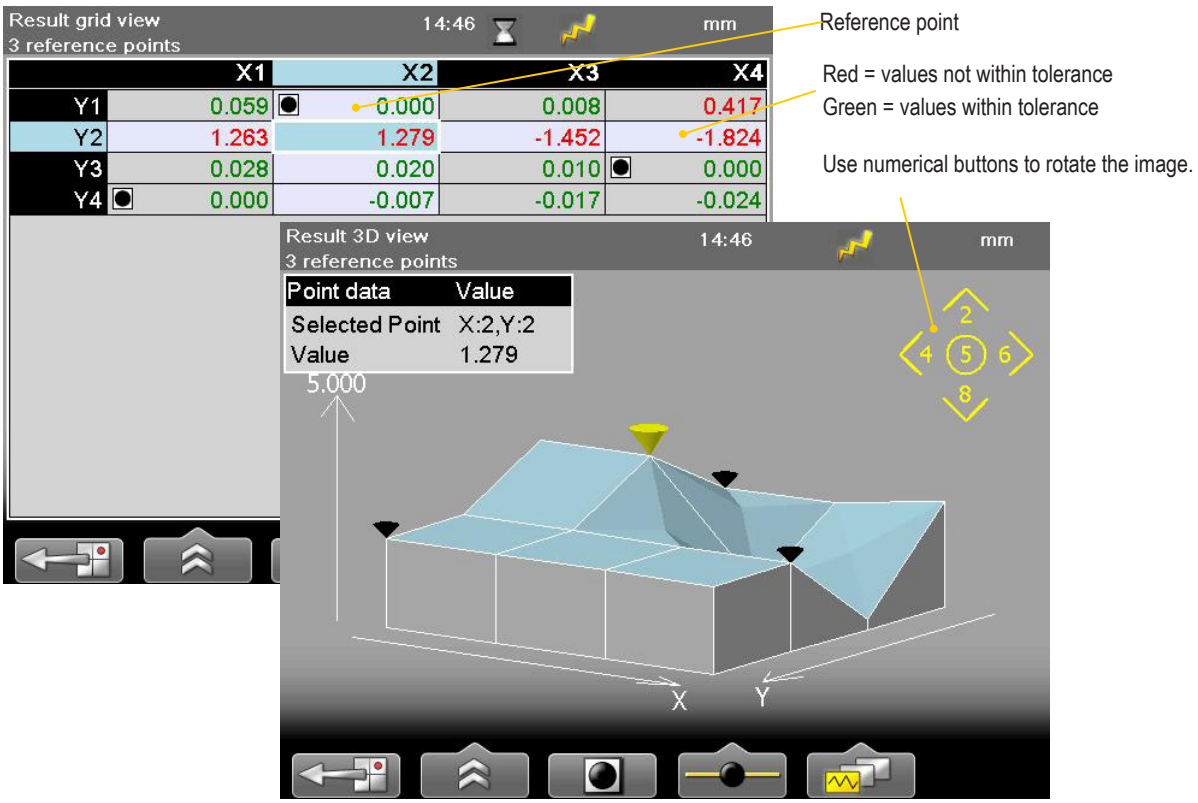
## Measure

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




## Result

The result can be displayed as a result grid, table or a 3D view.



# PROPELLER DRIVE LINE

## Preparations

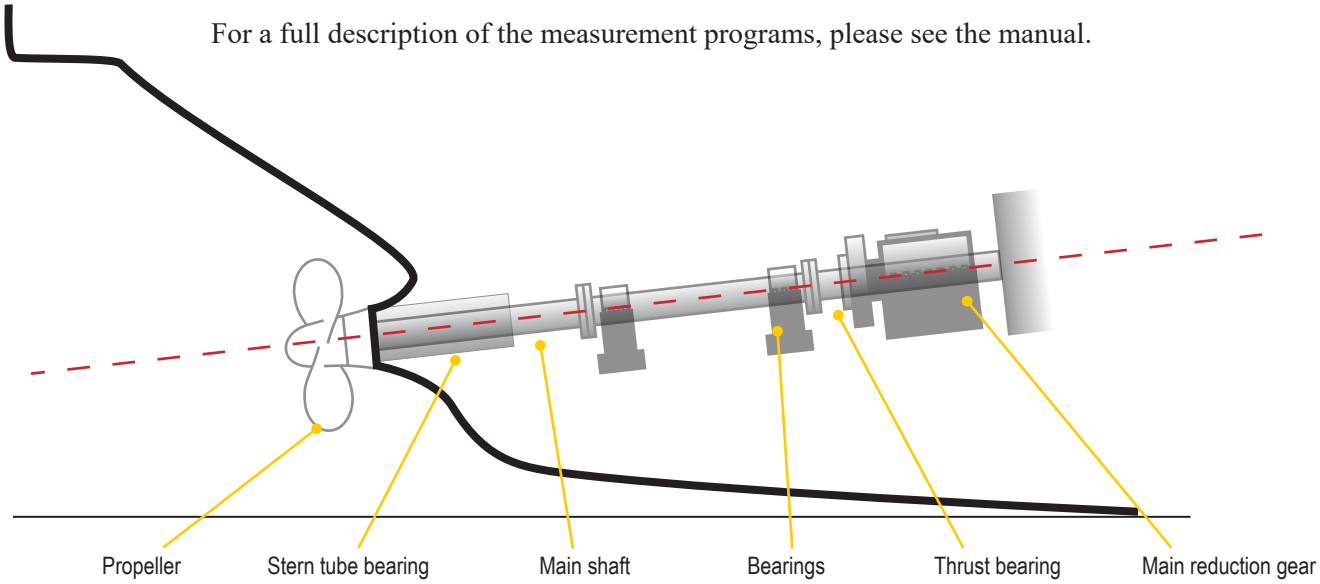
When measuring propeller drive line bearings, there are three programs you can choose from.

**Half circle**: Values are registered at three positions in a half bore. Used for turbines for example.

**Fourpoints**: Values are registered at four positions in a full bore.

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

For a full description of the measurement programs, please see the manual.




Setting up the laser beam from the sterntube

# Alignment of bearing journals

The alignment of bearing journals in relation to the stern tube (or gearbox) is carried out using Linebore equipment, where the laser transmitter is mounted on the axial surface at one end of the stern tube (or the gearbox flange) and the detector unit is placed in the bearing position. Measurement values are recorded in two positions for each bearing position (the detector unit is rotated through 180°), the measurement program calculates and then displays the position in the vertical and horizontal directions.

Detector E9 mounted on a cam shaft bracket

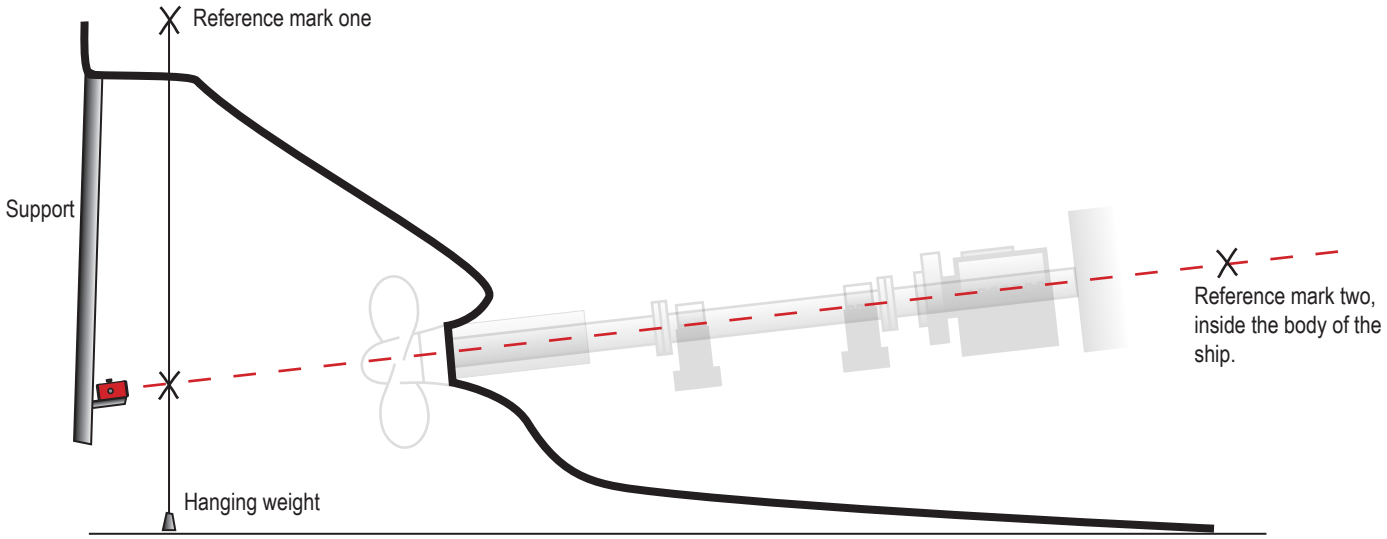
## New installation

When doing a new installation, you need to find the two reference marks on ship. These are shown on the mechanical drawing.

1. Find the reference mark number one.
2. Mount a hanging weight from the reference mark use the plumb line.
3. Weld a support behind reference mark one.
4. Mount the D75 laser on the support, approx. 220 mm from the ground.
5. Find reference point number two.
6. Mount a E9 detector on reference point number two.
7. Set the rear and the front references within 1-2 mm.

Now you can remove your equipment every day when you leave and set it up the next day, finding the two reference points again.

8. Install the stern tube according to the reference line.
9. Install the other bearings according to the reference line.



# Stern tube as reference

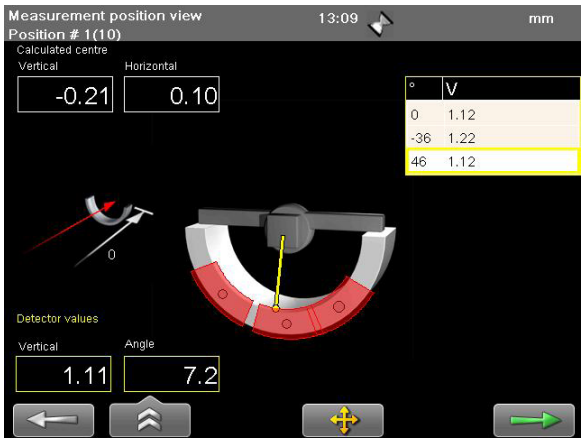
## Preparations

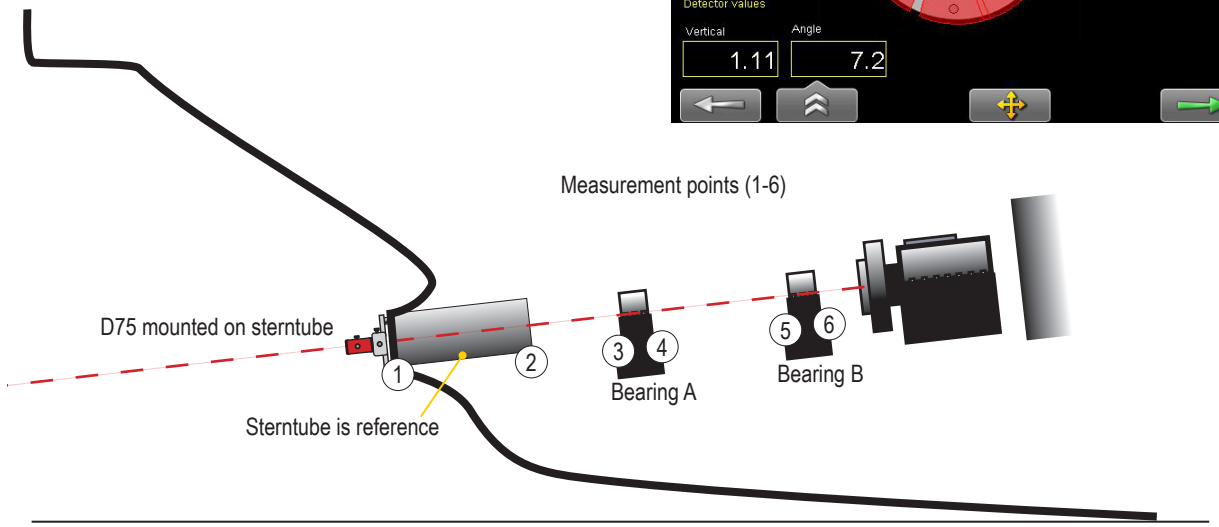
Set up the laser beam to the centre of the sterntube at both ends.

1. Place the laser transmitter on the stern tube flange.
2. Mount the detector (E9 or E7) on the bracket.
3. Select  and  to start program Straightness Half.
4. Select  and  to open the target.
5. Adjust laser point to the centre of the target.
6. Place the detector on position 1, see image.
7. Select  to zero set the displayed value.
8. Rotate the detector 180º.
9. Select  to half the displayed value.
10. Adjust both H and V offset value to 0.00 by using the adjustment screws **on the hub**.
11. Move the detector to position 2, see image.
12. Select  to zero set the displayed value.
13. Rotate the detector 180º.
14. Select  to half the displayed value.
15. Adjust both H and V value to 0.00 by using the adjustment screws **on the laser**.

## Measure

Measure all six positions.

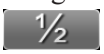
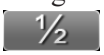


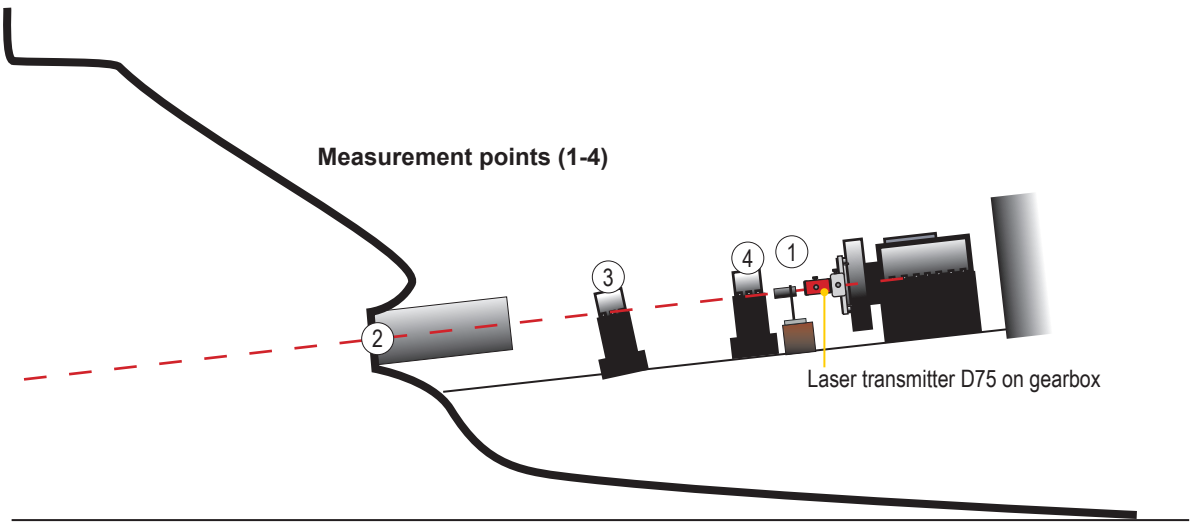
# Gear box as reference

## Preparations

### Set up the laser beam

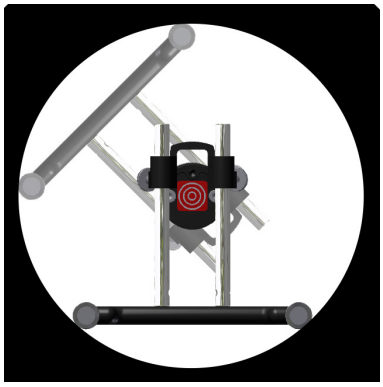
1. Place the laser transmitter on the gear flange.
2. Mount the detector (E9 or E7) on the bracket.
3. Select  and  to start program Straightness Half.
4. Select  and  to open the target.
5. Adjust laser point to the centre of the target.
6. Place the detector on position 1, place the detector with bracket close to the laser transmitter.
7. Select  to zero set the displayed value.
8. Rotate the gear 180º.
9. Select  to half the displayed value.
10. Adjust both H and V value to 0.00 by using the adjustment screws on the hub.
11. Make a mark on a piece of paper where the laser beam hit on position 2.
12. Rotate the gear 180º and make a new mark.
13. Make a mark in the middle of the two marks. Adjust the laser beam to the middle mark.
14. Move the detector to position 2.
15. Select  to zero set the displayed value.
16. Rotate the gear 180º.
17. Select  to half the displayed value.
18. Adjust both H and V value to 0.00 by using the adjustment screws on the laser.

Place the detector with bracket on a box of some kind.



## Measure

Take readings on positions 3 and 4 (the stern tube or other bearings) and adjust to your reference laser beam, or just show the results.



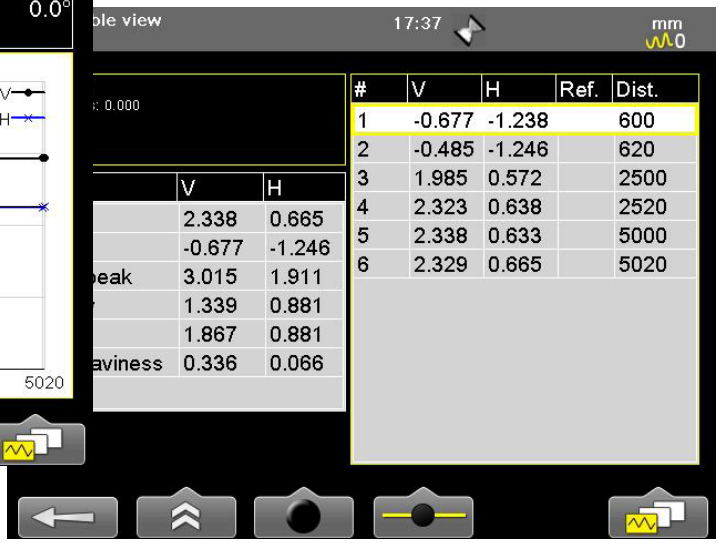
The magnetic feet holds the bracket perfectly in any position around the bore

Detector E9 mounted on a cam shaft bracket

## Result

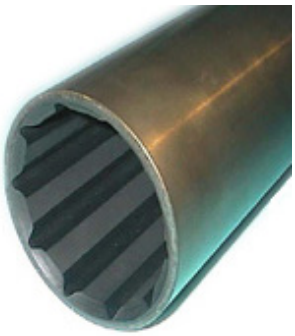
Your results without reference points will tell the position of your bearing centre compared to the gearbox pointing direction.


No reference points are set.

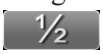


# Cutless bearings

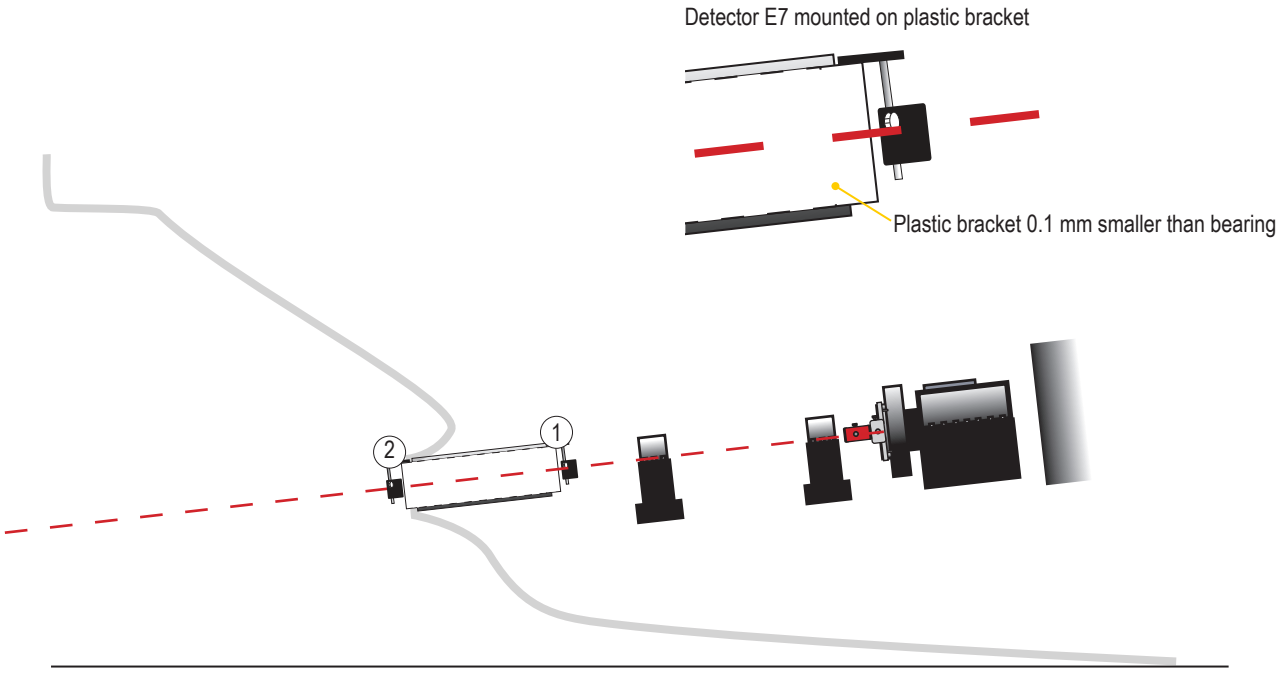
## Preparations



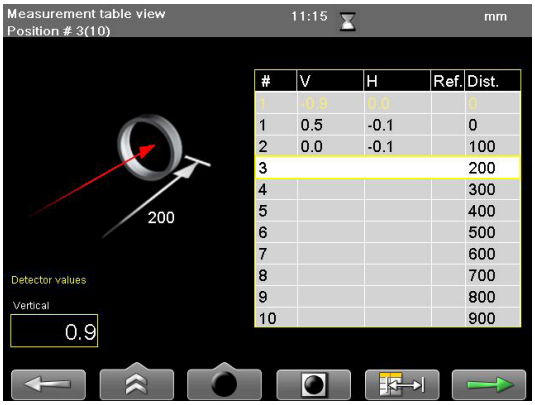
Make a bracket of a plastic tube 0.1mm smaller in diameter than the bearing. Place the bracket in the bearing. If necessary, use soap to lubricate the bracket.

1. Place the laser transmitter on the gear flange.
2. Mount the detector (E9 or E7) on the bracket.
3. Select  and  to start program Straightness Four-points.
4. Select  and  to open the target.
5. Adjust laser point to the centre of the target.
6. Place the detector close to the laser transmitter.
7. Select  to zero set the displayed value.
8. Rotate the gear 180º.
9. Select  to half the displayed value.
10. Adjust both H and V value to 0.00 by using the adjustment screws on the hub.
11. Make a mark on a piece of paper where the laser beam hit on position 2.
12. Rotate the gear 180º and make a new mark.
13. Make a mark in the middle of the two marks. Adjust the laser beam to the middle mark.
14. Move the detector close to the cutless bearing.
15. Select  to zero set the displayed value.
16. Rotate the gear 180º.
17. Select  to half the displayed value.
18. Adjust both H and V value to 0.00 by using the adjustment screws on the laser.

Now you have a good laser reference line from the rotation centre of the gear, giving your pointing direction of the same.

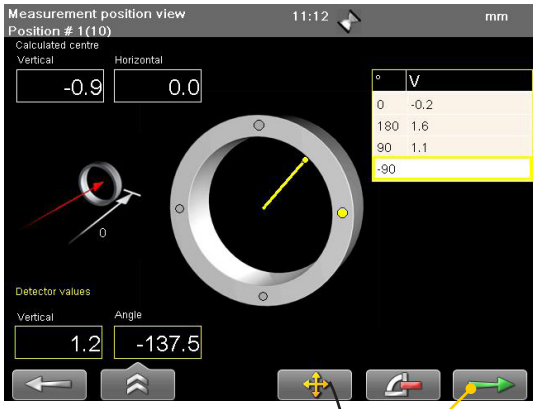


# Measure




**Measurement table view**

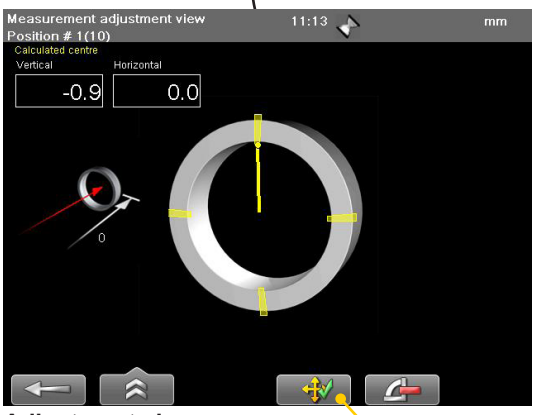
Select which position to measure. The table shows the calculated values for all measured positions.




**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

# CRANE FLANGES
# SLEWING BEARING

## Preparations

### Point one

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

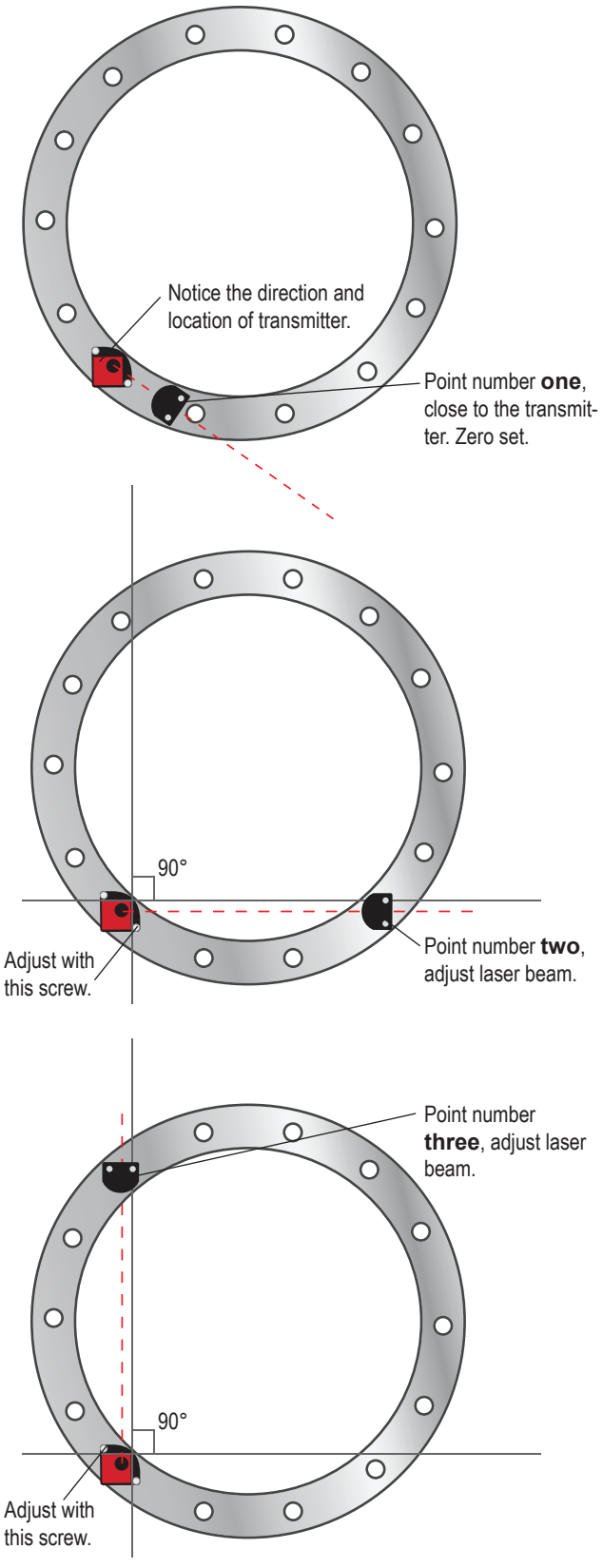
### Point two

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

### Point three

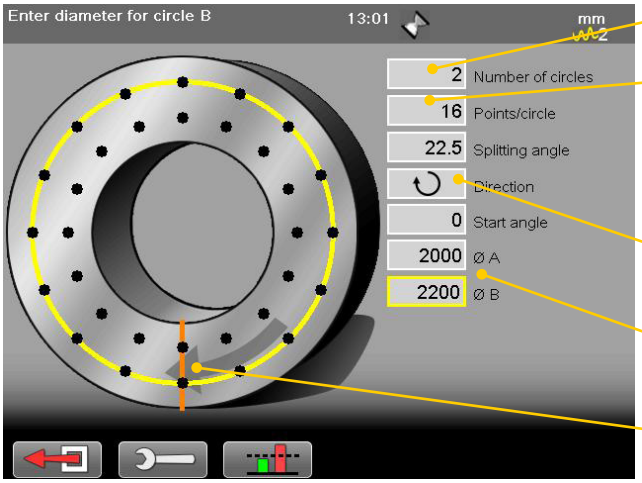
8. Move the detector to point number three, see image.
9. Adjust the laser beam by turning the screw on the transmitter's tilt table. Level to ± 0.05 mm or better.

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



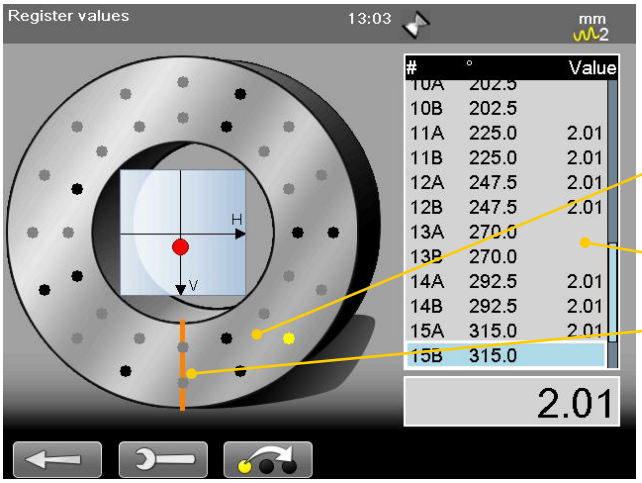
### Enter distances

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




## Measure

1. If you are measuring a flange vertically, secure the laser transmitter with an approved safety strap.
2. Press  to register measurement values. Registered points are greyed out. Active point is yellow.




## Result

Normally the lower bearing is damaged, so we set up a reference line in the centre of the two upper bearings (position one and two).

## Preparations

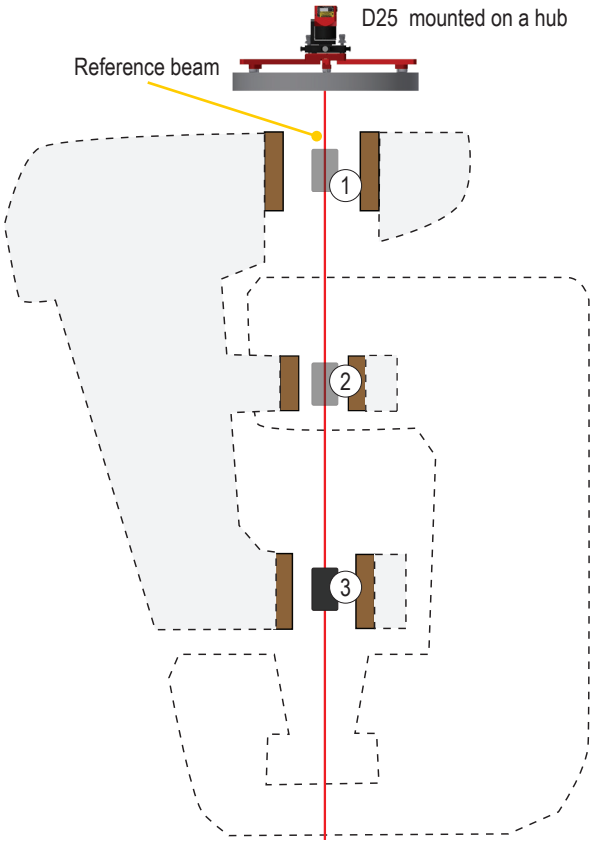
### Step one

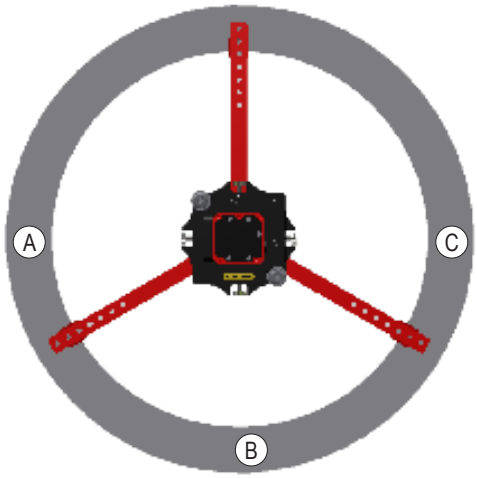
1. Mount the D25 laser transmitter on the top rudder stock flange.
2. Place the detector in position **1** in the bearing and select 0 to zero set.
3. Rotate the detector 180º and select ½ to half the displayed value.
4. Adjust both H and V value to 0.00 by using the adjustment screws on the hub.

### Step two

1. Place the detector on the flange, on position **A** and select 0 to zero set.
2. Move the detector to position **B** and adjust the tilt table angle to 0.00.
3. Move the detector to position **C** and adjust tilt table angle to 0.00.

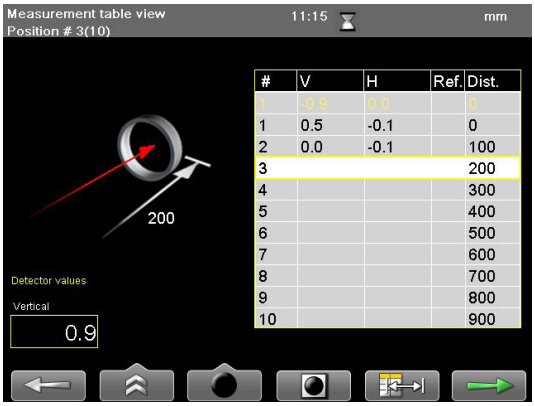
Repeat step one to make sure you are still in the centre of the bearing. When you are in the centre of the bearing **and** have the beam parallel to the top flange, your reference is set.



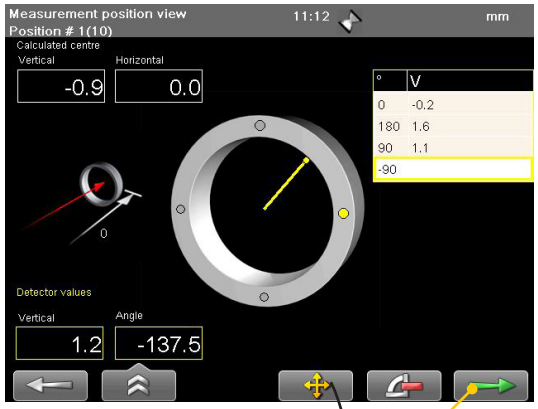
# Measurement and alignment

1. Flip the laser beam to one of your fresh bearing centres. While having the beam parallel to the flange and in the centre of one bore, you have an excellent set-up to adjust the next bore.
2. Select  and  to open the Straightness Fourpoints program. See next page.




**Measurement table view**

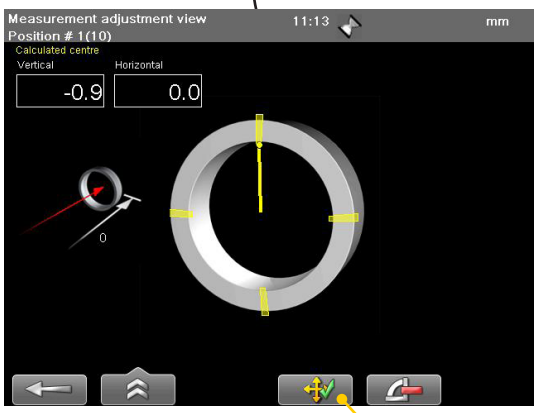
Select which position to measure. The table shows the calculated values for all measured positions.




**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

# BORING BAR SET UP

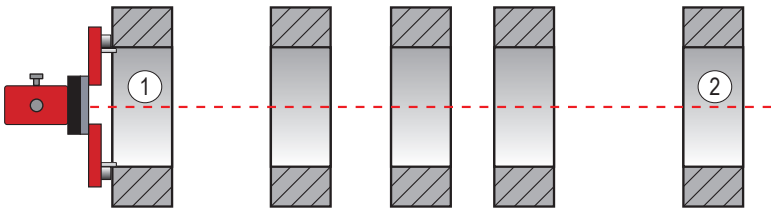
## Preparations

Mount the E9 detector with the special adapter in the support bearing.

1. Place the laser transmitter on the bearing pocket flange.
2. Mount the E9 detector on the cam shaft bracket.
3. Select  and  to start program Straightness Half.
4. Select  and  to open the target.
5. Adjust laser point to the centre of the target.
6. Place the detector close to the laser transmitter.
7. Select  to zero set the displayed value.
8. Rotate the detector 180º.
9. Select  to half the displayed value.
10. Adjust both H and V value to 0.00 by using the adjustment screws on the hub.
11. Move the detector to the second position, far away from the laser transmitter.
12. Select  to zero set the displayed value.
13. Rotate the detector 180º.
14. Select  to half the displayed value.
15. Adjust both H and V value to 0.00 by using the adjustment screws on the laser.
16. Adjust both first and second position to within 0.1mm.

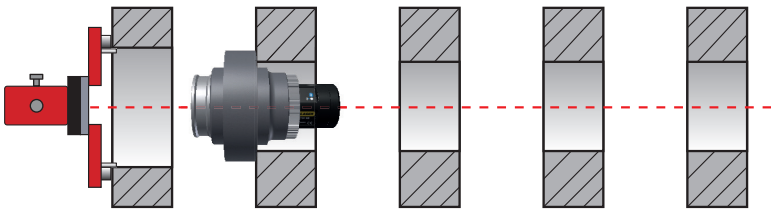
Detector E9 mounted on a cam shaft bracket

Laser transmitter D75 mounted on a hub




### Climax adaptor

We have developed a special adaptor for the Climax machine 2 ¼" support bearing.



Detector E9 mounted in a special adaptor.

## Measure

Now the beam is set and you can adjust your boring bar support bearings.

1. Mount the detector in your support bearing.
2. Select 0 to zero set the displayed value.
3. Rotate the detector 180º.
4. Select ½ to half the displayed value.
5. Adjust the bearing to 0.00, both H and V values.
6. Move the detector to the next support bearing
7. Select 0 to zero set the displayed value.
8. Rotate the detector 180º.
9. Select ½ to half the displayed value.
10. Adjust the bearing to 0.00, both H and V values.

Adjust the support to the centre of the bores and then put the boring bar in.

You can also use one of the programs:

**Half circle**: Values are registered at three positions anywhere in the bore.

**Fourpoints**: Values are registered at four positions in a full bore.

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

For a full description of the measurement programs, please see the manual.

## Result

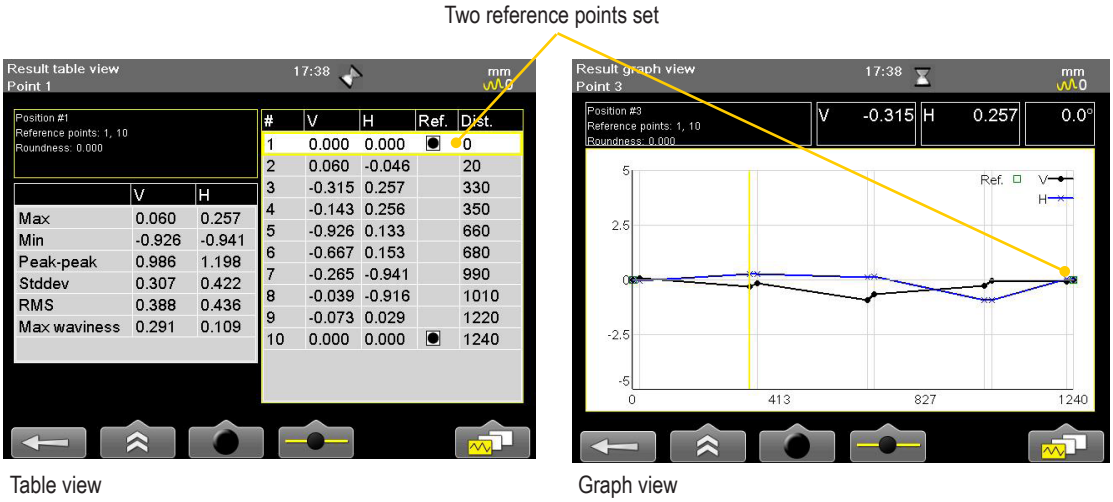
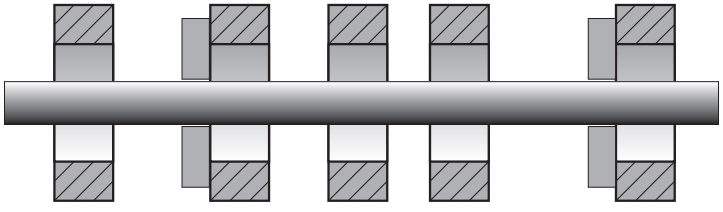



Table view

Graph view



Boring bar in position. Ready for machining.

# TECHNICAL DATA

## System Easy-Laser® E950-C

*Part no. 12-0772*

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

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

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