



FAG Top-Laser INLINE2

User manual

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**Attention:**

The machine to be moved must be checked for soft foot before each alignment is carried out!

1. Safety information

Application

FAG Top-Laser INLINE2 is used for shaft alignment on rotating machines with coupled shafts.

It can be used on shaft diameters from 12 to 500 mm.



Attention:

Ensure that FAG Top-Laser INLINE2 is used correctly and only by authorised personnel.

Never look directly into the laser beam!

CE conformity

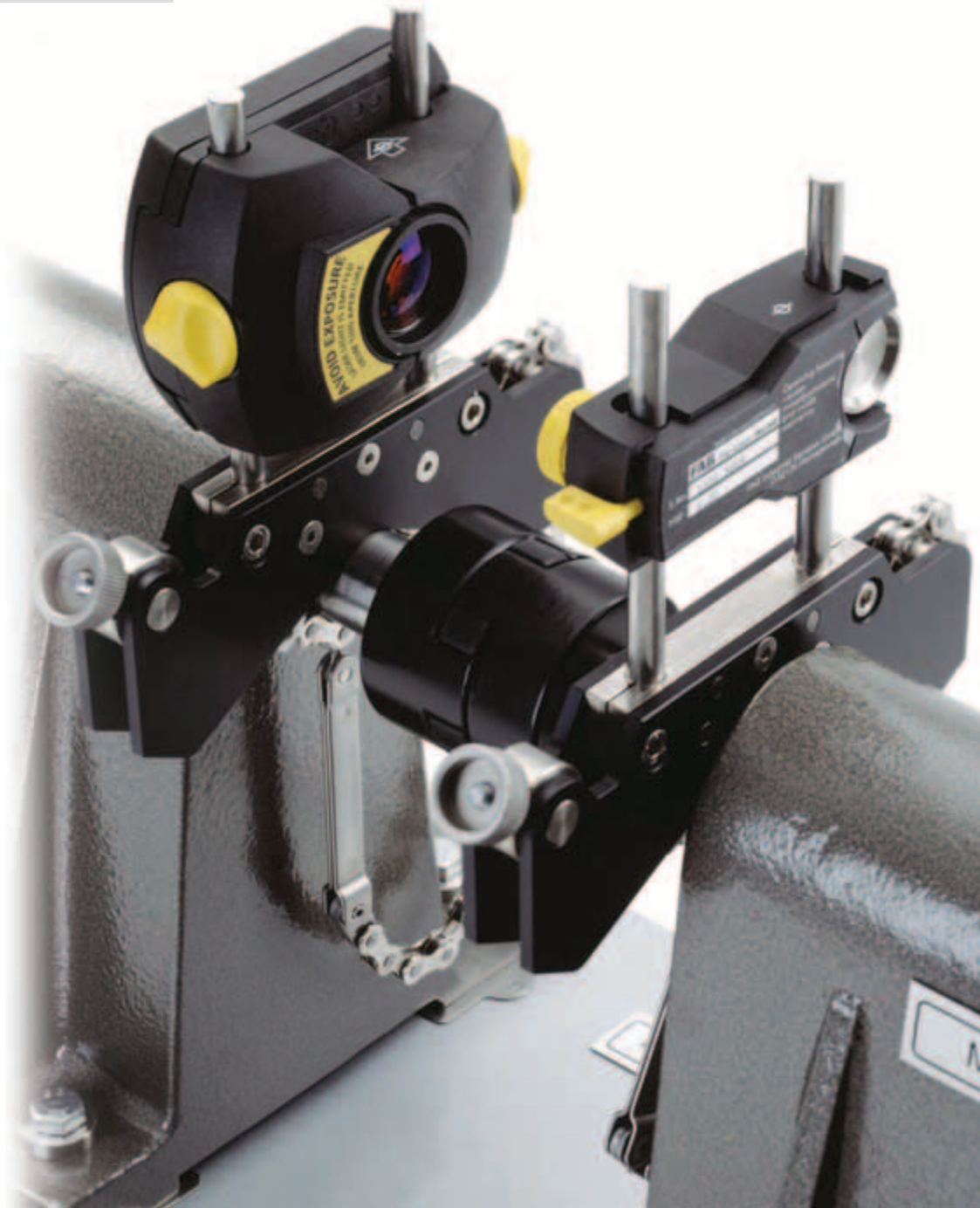
The FAG Top-Laser INLINE2 complies with all relevant CE standards.

It also fulfils the EEC standards for electromagnetic compatibility to EN 55011 Group 1, Class A and EN 50081-2.

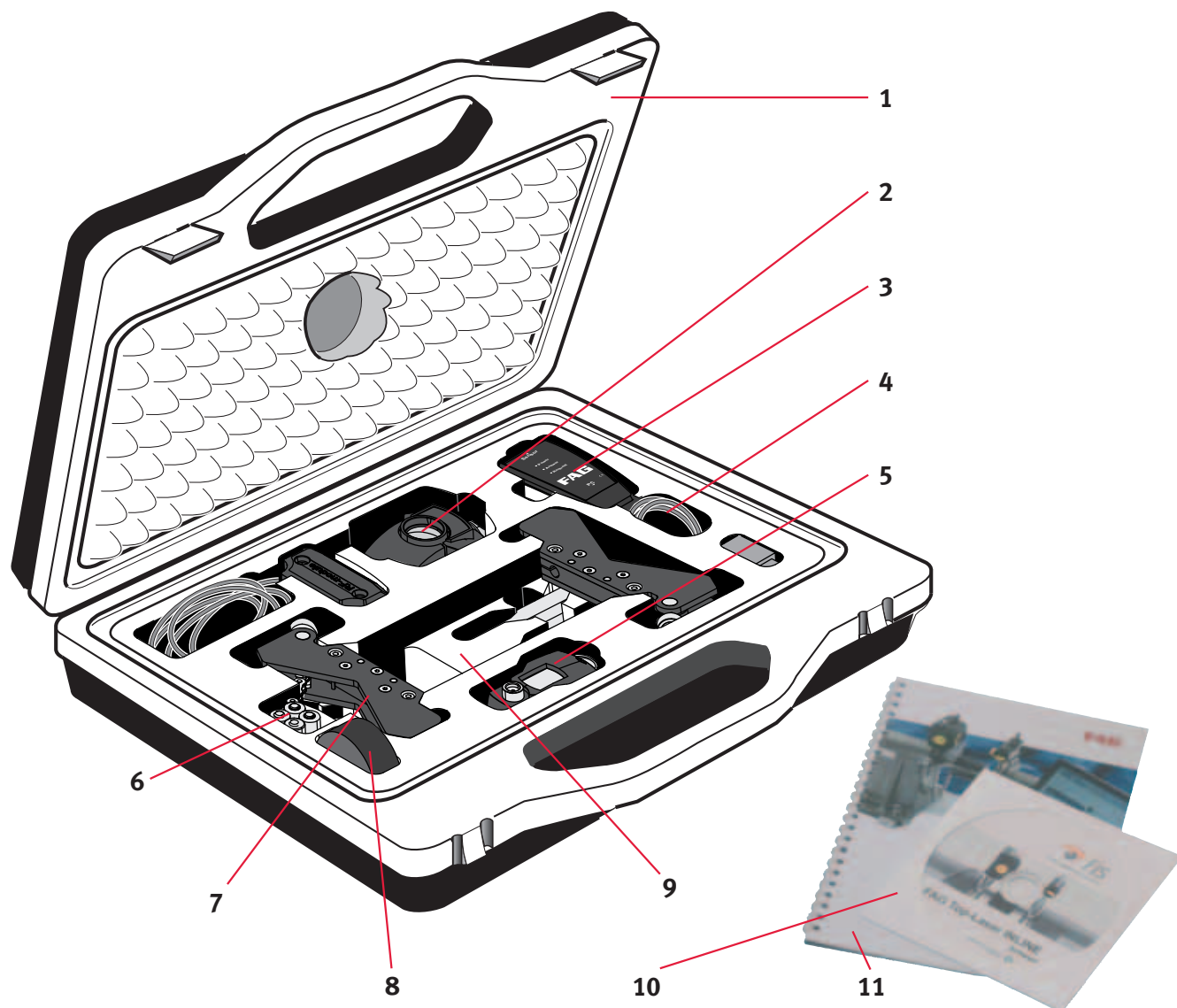
Laser classification

The FAG Top-Laser INLINE2 system has a Class II laser as its central element.

The laser operates on a wavelength of 670 nm.



2. Scope of delivery – FAG Top-Laser INLINE2



Ordering designation	Europe	Countries outside Europe
Complete set	LASER-INLINE2	LASER.INLINE2
1 Carry case	LASER-INLINE2.CASE	LASER.INLINE2.SUITCASE
2 Laser unit	LASER-INLINE.TRANS	LASER.INLINE.TRANS
3 USB Adapter	LASER-INLINE2.USB-ADAP	LASER.INLINE2.USB.ADAP
4 Cable for USB Adapter	LASER-INLINE2.USB-ADAP-CABLE	LASER.INLINE2.USB.ADAP.CABLE
5 Reflector	LASER-INLINE.REFLECT	LASER.INLINE.REFL
6 2 chains, 300 mm	LASER-INLINE.CHAIN ₃₀₀	LASER.INLINE.CHAIN300*2
7 2 chain type brackets	LASER-INLINE.BRACKET	LASER.INLINE.BRACKET
8 Measuring tape	LASER-INLINE2.TAPE	LASER.INLINE2.TAPE
9 4 posts, 115 mm	LASER-INLINE.POST115	LASER.INLINE.POST115*4
10 CD containing Software FAG Top-Laser INLINE2 and user manual in digital form	LASER-INLINE.SOFTW	LASER.INLINE.SOFTWARE
11 Printed user manual in German and English		

3. Installation of software before start

3.1 System requirements

Connect the laptop. This must fulfil the following requirements:

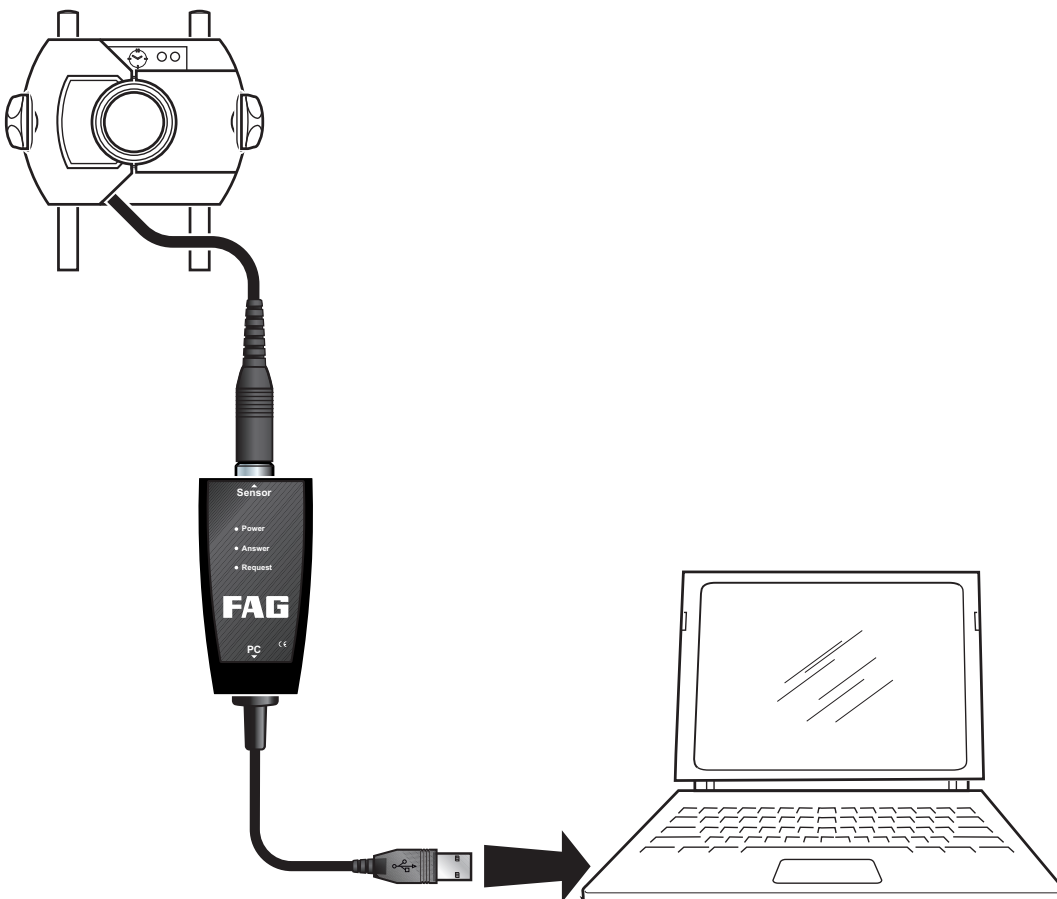
- Pentium processor or better,
- 32 MB RAM or more,
- Windows XP / Windows 7 (32 Bit or 64 Bit)
- 50 MB free hard disk space
- USB socket

3.2 Installation

1. Check that you have administrator rights for the laptop.
2. Place the FAG Top-Laser INLINE2 installation CD in the CD-ROM drive.

Start the installation with “setup.exe“ in the main folder on the CD.

3. Double click to start the software installation and follow the instructions.
4. Once the software installation is complete, connect the USB adapter to the laptop. The hardware will be detected automatically.



4. Software setup

Please select the communication mode:

4.1 Toolbar

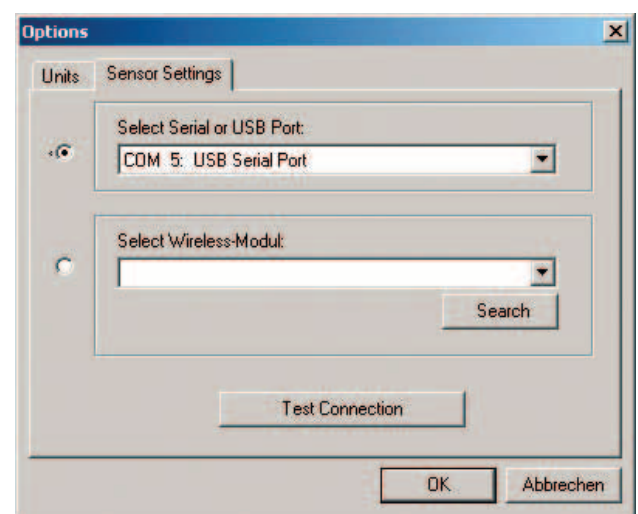
The FAG Top-Laser INLINE2 toolbar offers rapid access to the most frequently required functions:



- a . . . Create a new measurement file
- b . . . Open an existing measurement file
- c . . . Save measurement file
- d . . . Print preview
- e . . . Print
- f . . . If necessary, adjust measurement file
- g . . . Soft foot
- h . . . Enter machine dimensions
- i . . . Enter measurement distance
- k . . . View alignment results

4.2 Setup USB Communication

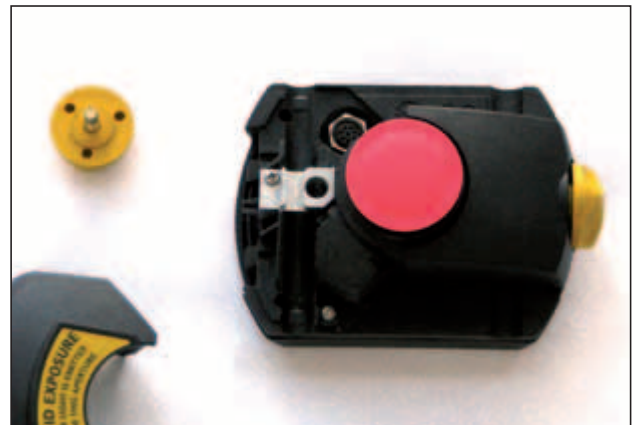
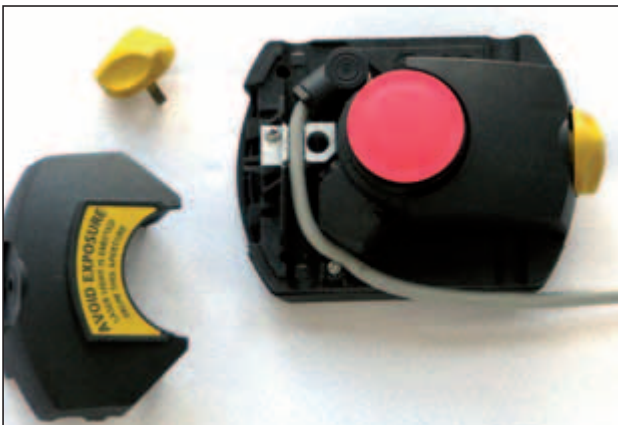
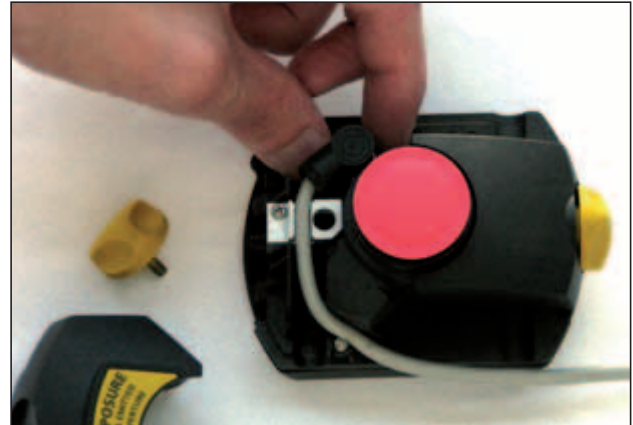
- Start the FAG Top-Laser INLINE2 software
- Click on the tab "Options", then "General" and finally on "Sensor Settings".
- Select the COM port for the USB adapter. This is shown by the designation: "USB Serial Port".
- Click OK.



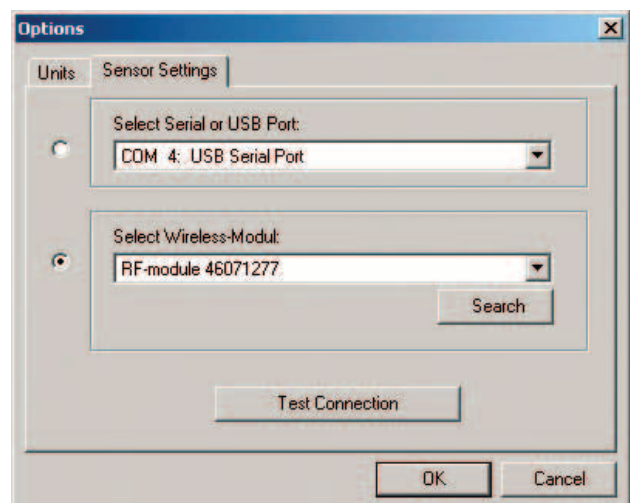
4.3 Setup wireless communication

- Connect the wireless module to the transmitter. Loosen the left hand fixing screw and remove the cover. Detach the round plug

and replace it with the cable of the wireless module. Mount the transmitter again.



- Switch the wireless module on. All 3 LEDs will flash green. Once the LEDs are lit solid, the wireless module is ready for operation.
- Start the FAG Top-Laser INLINE2 software.
- Click on the tab "Options", then "General" and finally on "Sensor Settings".
- Click on "Search". Wait until your wireless module is displayed and select it.
- Click OK.



5. Preparing the machinery



Before using the FAG Top-Laser INLINE2 please ensure the following requirements are met:

**Switch off the machine before starting the alignment job.
Ensure that it cannot be switched on again by mistake.**

- ▶ The machine pedestal must be flat and intact.
- ▶ The contact surfaces of the machine feet with the pedestal must be clean and free from paint and rust.
- ▶ The machine can be freely moved.
- ▶ Any rigid couplings must be loosened before measurement.

Generally the alignment job should be done in the following steps:

- ▶ Visual check of the machine
- ▶ Mounting of the sensor elements
- ▶ Enter the dimensions of the machine
- ▶ Test measurement

**Is the alignment of the machine within the tolerances at the test measurement there is not additional alignment necessary.
The alignment job is now finished.**

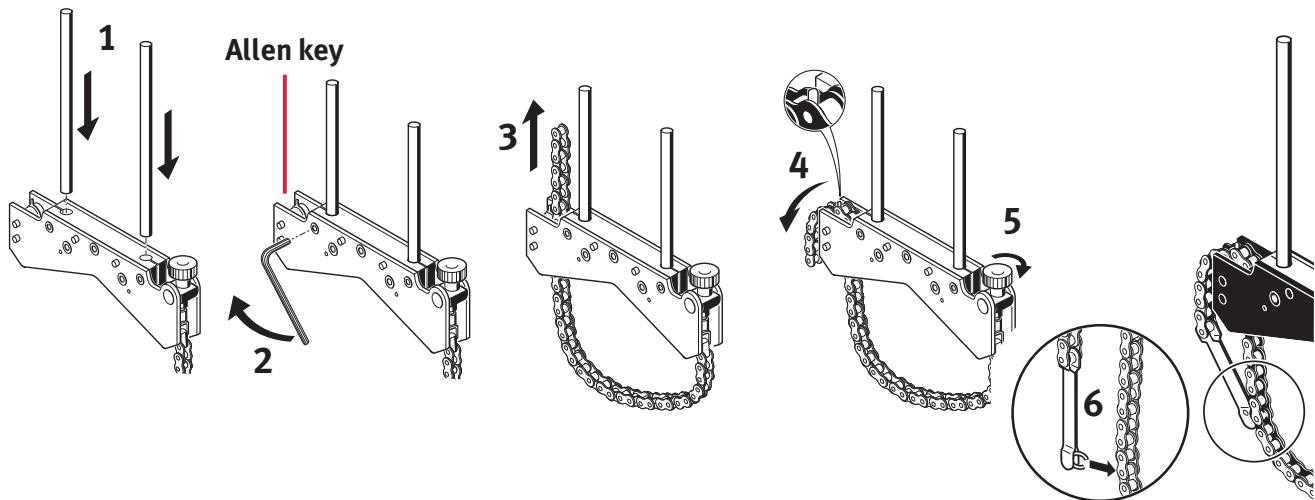
Is the alignment of the machine not in tolerance at the test measurement the following steps has to be done:

- ▶ Check of softfoot
- ▶ Vertical alignment
- ▶ Horizontal alignment
- ▶ Check measurement

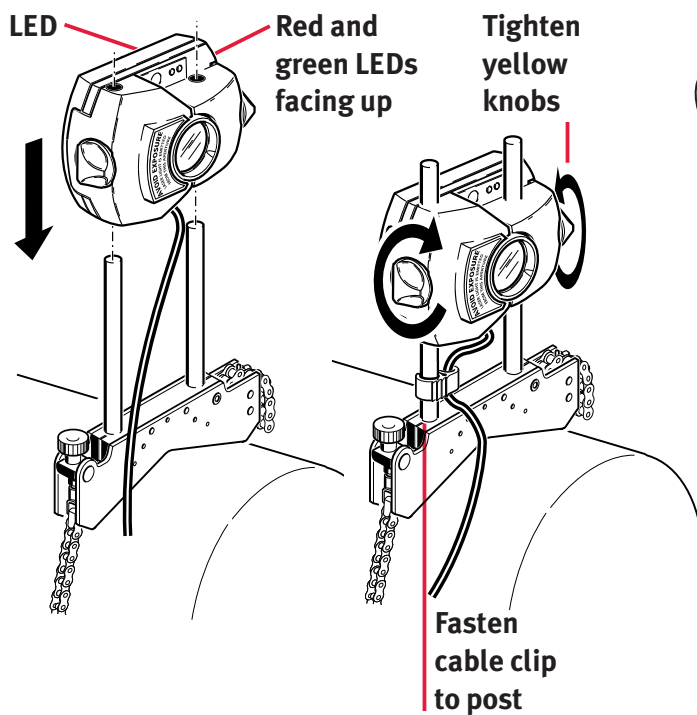
The following the next steps will be explained in detail:

6. Mounting the laser unit and the reflector

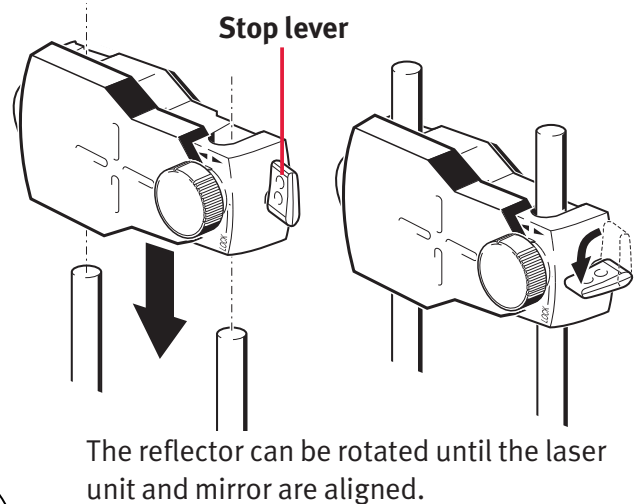
- a) Mount the chain-type brackets at the same angle on the machine shafts or coupling halves:



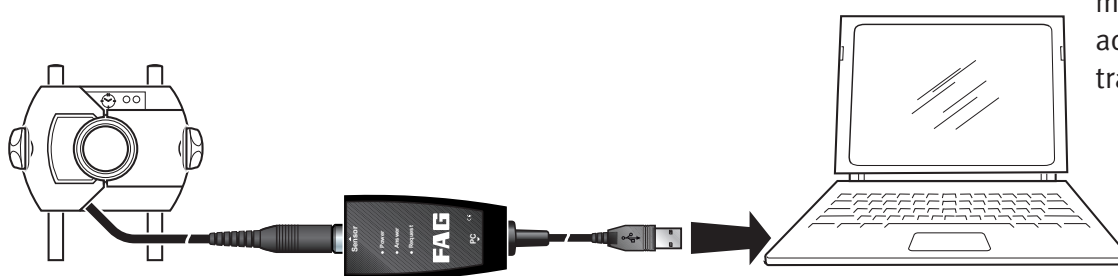
- b) Mount the laser unit on the left hand chain-type bracket of the non-movable (static) side of the assembly:



- c) Mount the reflector on the right hand chain-type bracket of the movable side of the assembly.



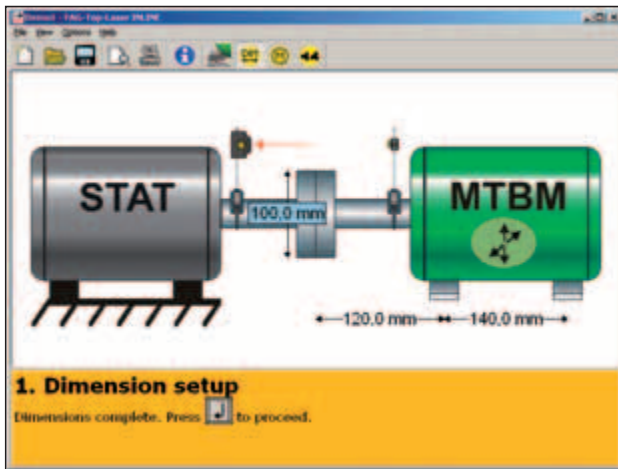
- d) Connect the transceiver to the USB adapter:



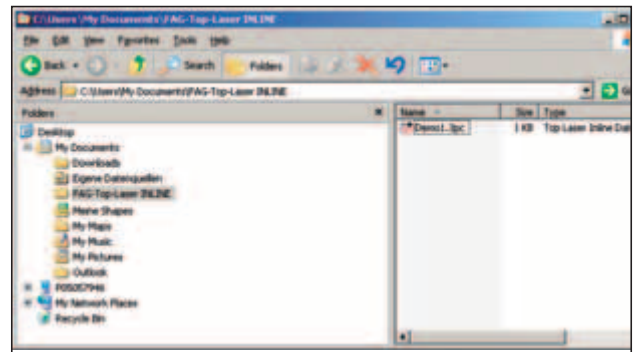
Alternatively, mount the wireless adapter below the transmitter.

7. Starting the software

- a) In the Start menu, select “Programs / FAG / FAG Top-Laser INLINE”.
The window ”Dimension input“ will appear:




- b) Alternatively, you can start by double clicking on “My Documents/FAG-Top-Laser INLINE” an existing alignment job.

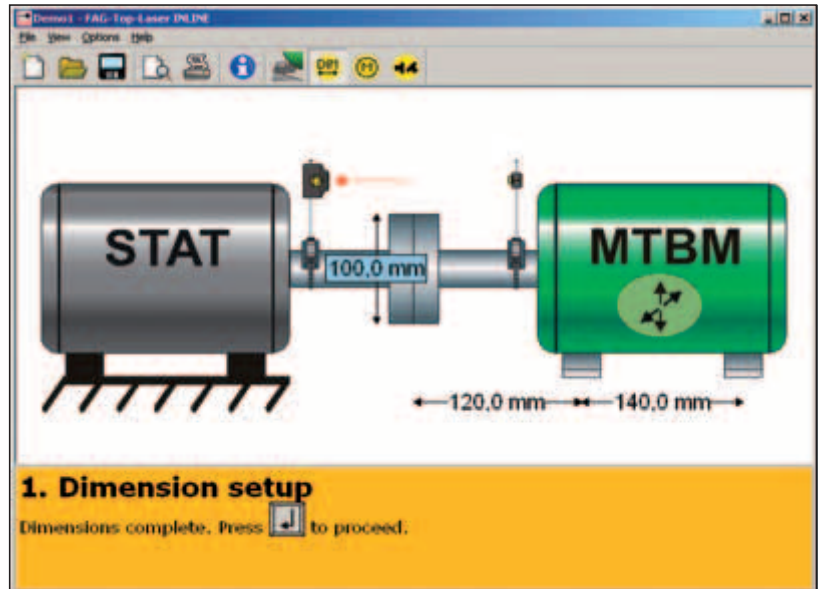


The measurement files contain all the saved machine data. When you open a measurement file, all the machine values are preassigned.

7.1 Inputting the dimensions

Machine dimensions


- a) Enter the following dimensions on the  screen:
coupling diameter, coupling centre to front pair of feet and front pair of feet to rear pair of feet.
- b) Tolerances
To activate, please open the dialogue "Options" then "Tolerances"
- c) Confirm these three values using "Return" or click on "Return".

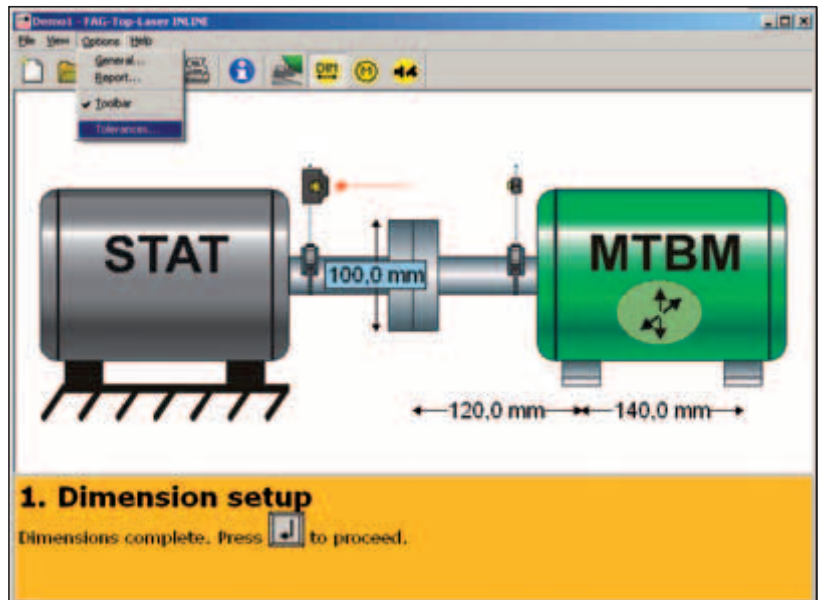


The tolerances are speed dependent. Please choose the speed of the machine to be aligned.

The given tolerances are based by experience and should only be used if the manufacturer of the machine or the manufacturer of the coupling don't provide this information.

FAG Industrial Services GmbH does not cover any liability for machine damages.

- d) Enter the following dimensions on the  screen:
laser unit to reflector and to coupling centre.
- e) Confirm these two values using "Return" or click on "Return".



7.2 Adjusting the laser

Centre the laser beam according to the instructions on the screen.

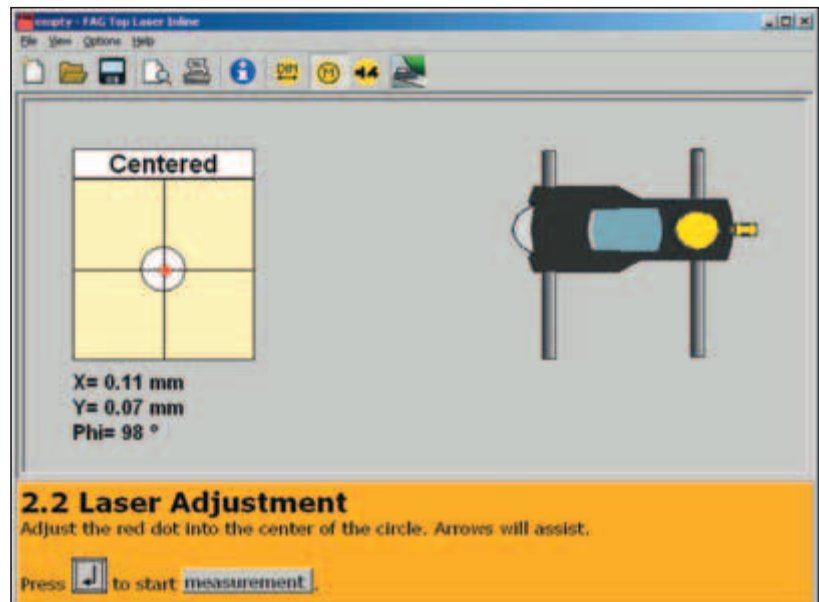
Communication between the receiver and the PC only functions if the correct COM interface was selected.

Set the correct COM interface in "Options/General/Sensor Settings".

- If "Laser off" appears on the screen, ensure that the protective covers have been removed from the transceiver and the reflector.
- "Laser end" means that the laser beam has reached the edge of the receiver.

If the laser beam does not reach the receiver, determine its position using a sheet of paper or similar item. Once you have found the position you can readjust the beam.

Press "Return" or click on the "Return" icon or the "Measurement" button to start the measurement.



Laser unit / LED Codes

Green	Red	Laser
Off	Off	Laser off
On	On	Laser centred
On/off	On/off	Flashing: laser at edge
Off	On	Laser beam not on receiver

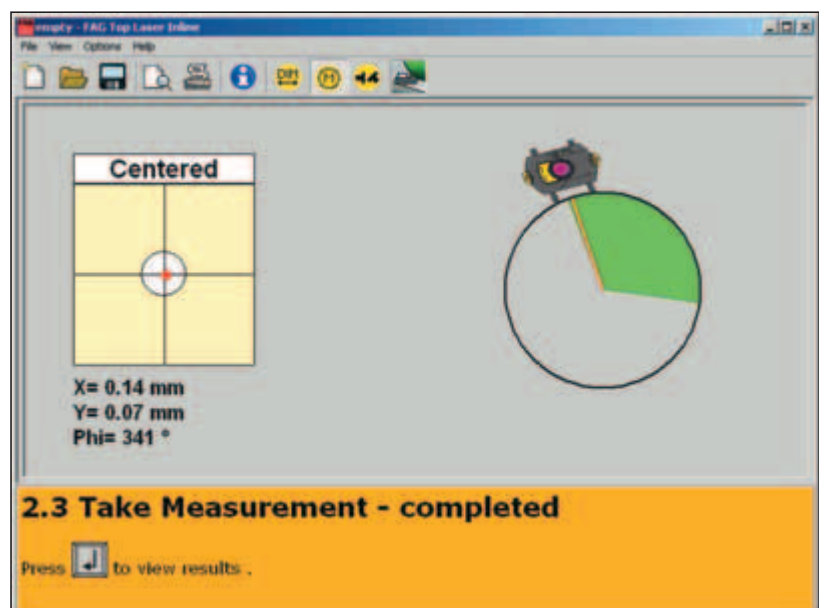
Alignment measurement

Rotate the shaft until the displayed circular segment on the screen turns green. The larger the range of rotation, the more accurate the measurement result will be.

Rotate the shaft as far as possible!

Confirm using "Return" or click on the "Return" icon to stop the measurement and transfer the measurement values to the laptop.

The software will jump automatically to the results display.



8. Measurement results

Mathematical sign convention:

The GAP is positive if it is open at the top and opens away from the observer.

The OFFSET is positive if the right hand machine is higher and further away from the observer than the left hand machine.

Vertical alignment

First correct the vertical alignment using shims.



Horizontal alignment

This function shows you the current lateral machine movement in real time ("live MOVE").



Attention:

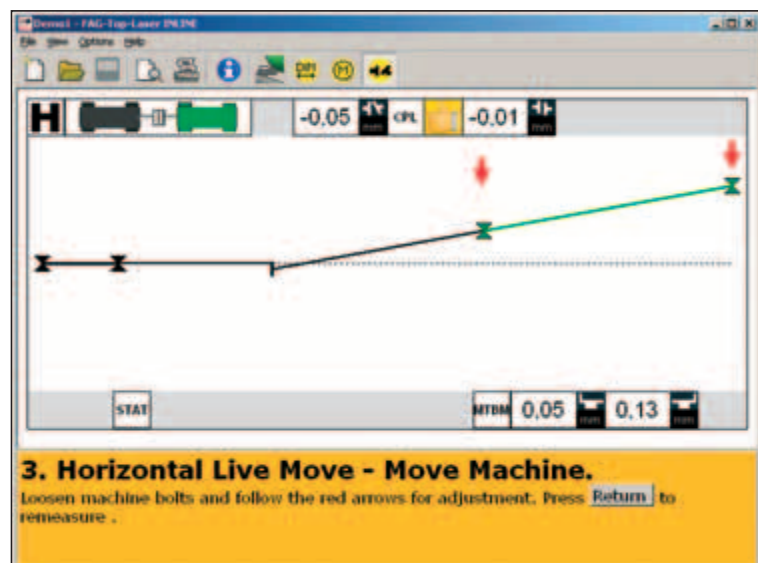
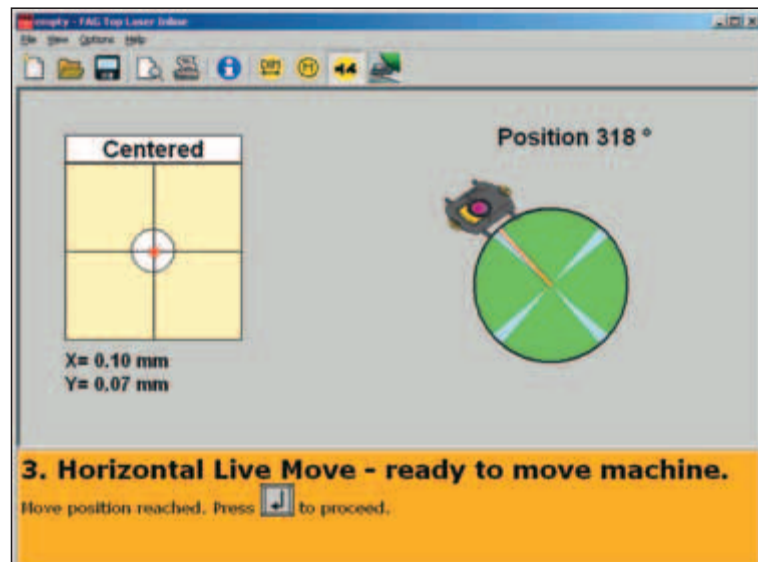
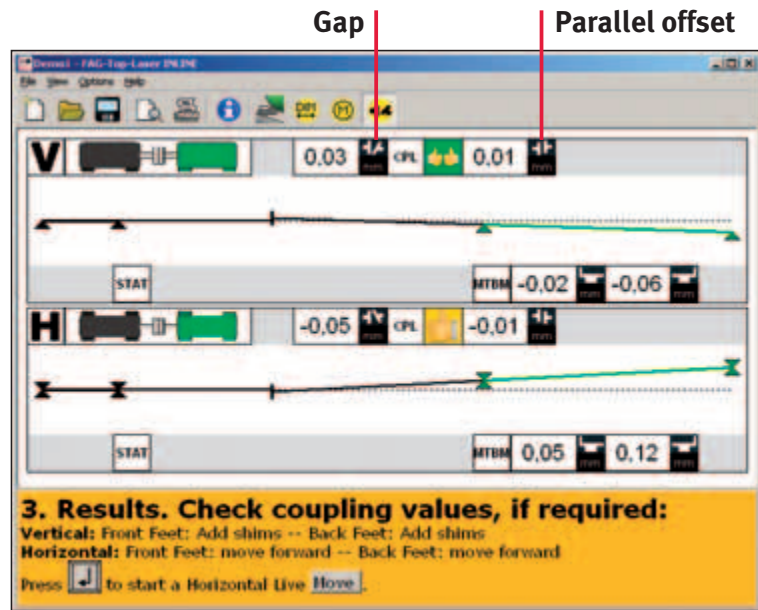
Do not move the machines using a hammer → this can lead to bearing damage!

Activate the  function by pressing the "Return" key or clicking on the  icon.

Centre the laser beam and rotate the shaft to one of the four 45° positions.

Press "Return" or click on the "Return" icon to continue with the "live MOVE" function.

Rotate the coupled shafts as shown and press "Return" to carry out measurement again and check the alignment.



9. Soft foot variants

The term "soft foot" describes a machine foot that lifts off the pedestal when it is unscrewed.

Possible reasons:

- The locating surfaces of the machine foot and pedestal are not parallel
- Deformed machine feet, deformed housing
- External forces (pipe connections etc.)
- Supporting with bent materials
- The contact surfaces of the machine feet are contaminated/rusty/painted etc.

The machine to be moved must be checked for soft feet before each alignment is carried out!

The FAG Top-Laser INLINE2 reduces the time required to just a few minutes since it is only necessary to loosen each individual foot screw mechanism.

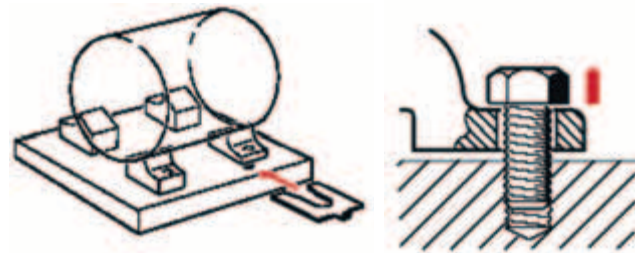
If the foot then moves and the machine moves upwards with it, a soft foot is present.

This movement is measured by the sensor.

A soft foot can be eliminated using shims.

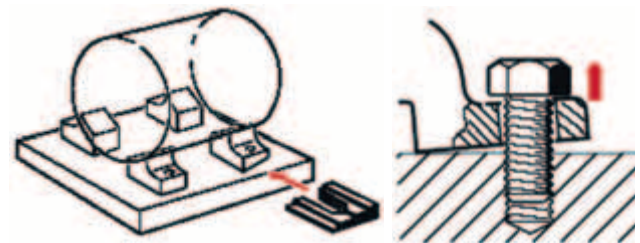
There are two different types of soft foot: parallel soft foot and angular soft foot. A distinction is drawn between the two since different measures are used for their elimination.

Parallel soft foot



The underside of the machine foot is parallel to the pedestal but is not in contact when the fastening bolt is loosened. If this type of soft foot is present on only one of the four feet, the result generally obtained is two diagonally opposing values of approximately the same magnitude since the machine is tilted on the diagonal.


Angular soft foot

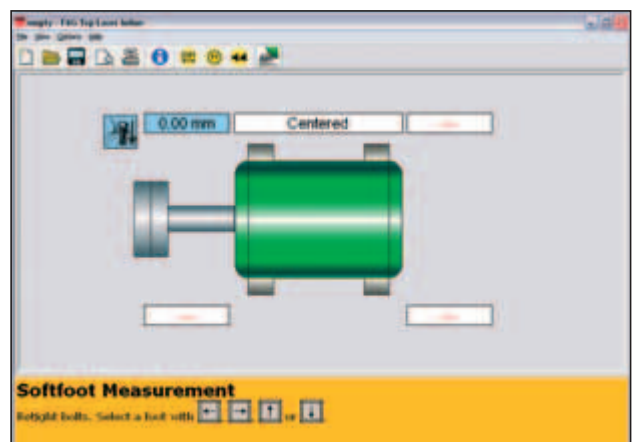
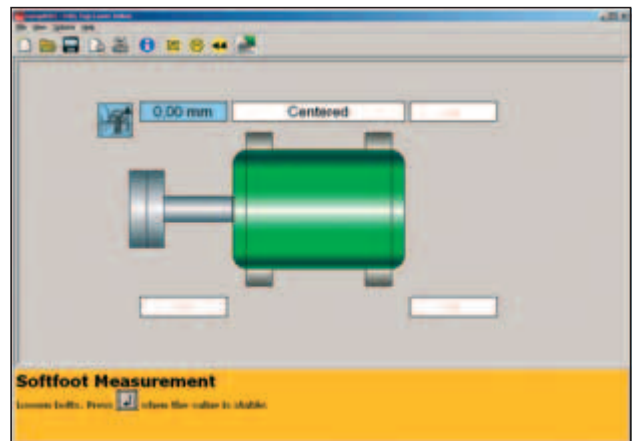
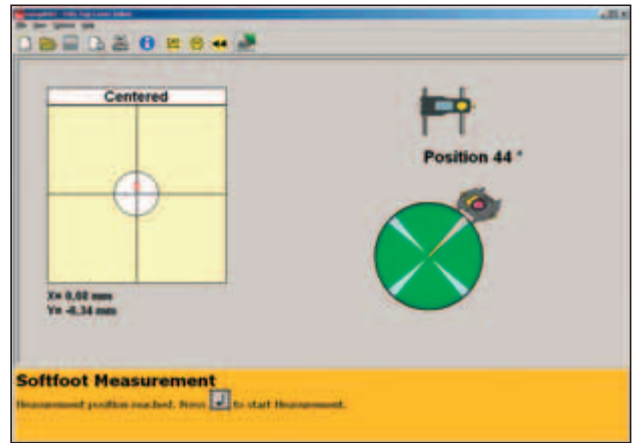


Where the locating surface is inclined, there is an angle between the foot and pedestal. This can affect all the machine feet simultaneously and in different ways. An angular soft foot is indicated by one high value and three low values. In order to correct this, the direction of incline must be determined using gauges.

9.1 Checking and correcting soft foot

Checking the soft foot before aligning the shaft:

- a) Once you have entered the machine dimensions, select "Options/Soft Foot" from the menu bar or click on the icon  and confirm this with "Return".
- b) Start the soft foot measurement with "Return".
- c) Rotate the shaft to a 45° position and centre the laser beam as necessary. Use "Enter" to call up the machine view where you can select a foot.
- d) Select the foot to be measured using the cursor keys and start the measurement process with "Return".
- e) Loosen the foot screw of the selected foot on the machine and confirm a stable measurement value with "Return".
- f) Retighten the foot screw.
- g) Select the next foot using the cursor keys and continue as described in e) to f).
- h) Correct the soft foot, if it exceeds 0.05 mm.



9.2 Example of soft foot correction

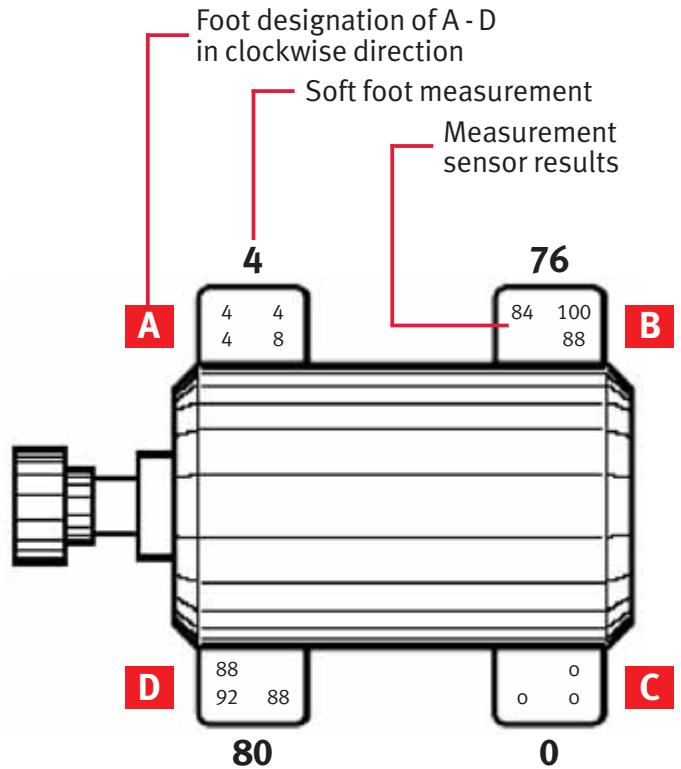
Explanation of the screen graphics:

- The feet are shown oversized outside the outlines of the machine.
- The FAG Top-Laser INLINE2 measurement values are outside the schematic feet.
- The measurement sensor results are inside the feet.
- An empty space means: measurement values are not available.
- The feet are designated from A to D in a clockwise direction.

The soft foot measurements show almost "perfect" tilting on the diagonal which could deceptively lead to the supporting of feet B and D. This would be incorrect.

The 0.04 mm difference on the diagonal – while the values are nearly zero on the other diagonal – require investigation of feet B and D using feeler gauges.

This shows that the mean gap on feet B and D is almost identical, where one foot is significantly arched while the other is almost flat in contact.


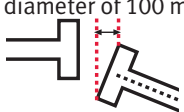


Consequence:

Support foot D only with shims to 0.88 mm and check all the feet again.

If you do not have any manufacturer's specifications for assessing your coupling results, you can use the table below:

Recommended tolerances for shaft alignment

	1/min	Tolerance [mm]	
Soft foot	All	0.06 mm	
		Acceptable	Excellent
Short "flexible" couplings Parallel offset 	0 – 750	0.19	0.09
	> 750 – 1,500	0.09	0.06
	> 1,500 – 3,000	0.06	0.03
	> 3,000 – 6,000	0.03	0.02
Angular offset ("Gap") Gap width relative to coupling diameter of 100 mm 	0 – 750	0.13	0.09
	> 750 – 1,500	0.07	0.05
	> 1,500 – 3,000	0.04	0.03
	> 3,000 – 6,000	0.03	0.02

Please note: the given tolerances are based by experience and should only be used if the manufacturer of the machine or the manufacturer of the coupling don't provide this information.

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10. Specifications

Transducer

Measurement method	Coaxial reflected laser beam
Protection	IP 67 (dust and splash water proof)
Protection against ambient light	Yes
Storage temperature	-20 to +80 °C / -4 to 176 °F
Operating temperature	0 to 55 °C / 32 to 131 °F
Dimensions	approx. 107 x 70 x 49 mm (W x H x D)
Weight	approx. 177 g / 6.5 oz.

Suitable for shaft diameters from 12 to 500 mm

Laser

Type	Ga-Al-As semiconductor laser, Class 2 (FDA 21CFR)
Wavelength	Typically 670 nm (red, visible)
Beam power	< 1 mW
Interface	USB adapter

Never look directly into the laser beam!

Detector

Measurement range	+/- 4 mm
Resolution	1 µm
Accuracy	Mean measurement error < 2%

Inclinometer

Measurement range	0 to 360°
Resolution	Less than 1°

Reflector

Type	90° roof prism
Protection	IP 67 (dust and splash water proof)
Accuracy	Better than 1%
Storage temperature	-20 to +80 °C / -4 to 176 °F
Operating temperature	0 to 55 °C / 32 to 131 °F
Dimensions	approx. 100 x 41 x 35 mm (W x H x D)
Mass	approx. 65 g / 2.5 oz.

USB adapter

Connection	USB 2.0
------------------	---------

Wireless module (optional)

Range	10 m
Power supply	2 x AA-Batteries (rechargeable batteries possible)

Carry case

Material	ABS, grey
Dimensions	approx. 440 x 398 x 130 mm (W x H x D)
Mass including components	approx. 4.0 kg

CE declaration of conformity

Declaration of conformity in accordance with ISO/IEC Guide 22

This is to certify that the following product:

EQUIPMENT: Top-Laser INLINE


corresponds to the fundamental safety requirements as laid down in the guidelines of the advice for the approximation of laws of the member states on electro-magnetic compatibility (89/336/EEG) and electrical resources for application within specific voltage limits (73/23/EEG).

For the appraisal of this certification with respect to the fulfillment of the safety requirements, the following standards were consulted:

- DIN EN 61326, Edition 03/2002
- DIN EN 61000-4-2, Edition 12/2001
- DIN EN 61000-4-3, Edition 11/2003
- EN 60825-1, Edition 3/1997
- DIN EN 61000-4-4 Edition 07/2002
- DIN EN 61000-4-6, Edition 12/2001
- EN 55011, Edition, 08/2003

The party responsible for this declaration is

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ppa Armin Kempkes
General Manager FIS


i.A. Matthias Gilzen
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