FAG

FAG Top-Laser EQUILIGN

Operating handbook

SCHAEFFLER

LuK INA FAG

Imprint

Imprint

FAG Industrial Services GmbH
Kaiserstraße 100
52134 Herzogenrath
Germany
Telephone: +49 (0) 2407 9149 66
Fax: +49 (0) 2407 9149 59
Email: industrial-services@schaeffler.com
Website: www.schaeffler.com/services

Original user manual

CE

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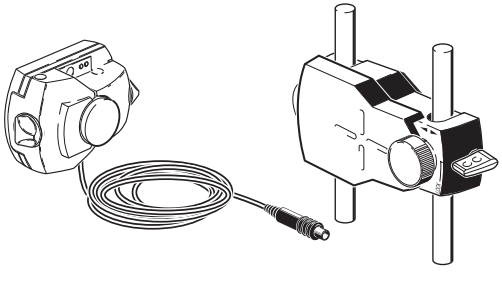
FAG Top-Laser EQUILIGN package

FAG Top-Laser EQUILIGN scope of delivery

LASER-EQUILIGN.CASE	**FAG Top-Laser EQUILIGN case**
LASER-EQUILIGN-DEVICE	**FAG Top-Laser EQUILIGN computer incl. batteries and computer stand**
LASER-EQUILIGN.TRANS	**FAG Top-Laser EQUILIGN transducer incl. dust cap and transducer cable**

LASER-EQUILIGN.CASE

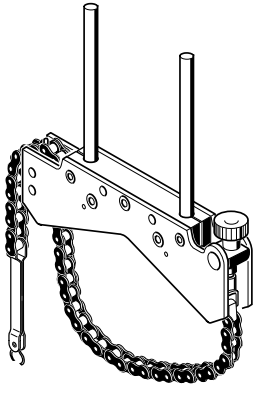
LASER-EQUILIGN-DEVICE



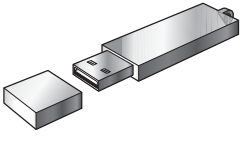
LASER-EQUILIGN.TRANS

LASER-EQUILIGN.REFLECT

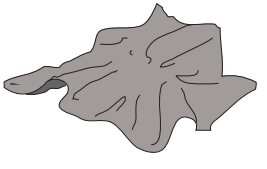
LASER-EQUILIGN.REFLECT	Reflector incl. dust cap
	Chain-type bracket Please note that there are two pieces in the package
LASER-EQUILIGN.PC-CABLE	PC cable for FAG Top-Laser EQUILIGN
LASER-EQUILIGN.USB-CABLE	FAG Top-Laser EQUILIGN USB cable
	FAG USB memory stick for firmware upgrade
	Lens cleaning cloth
LASER.TAPE	Tape measure mm/inch
	FAG Top-Laser EQUILIGN pocket guide



LASER-EQUILIGN.PC-CABLE



LASER-EQUILIGN.USB-CABLE



LASER.TAPE

Safety information

The FAG Top-Laser EQUILIGN system must only be used for the alignment and calibration of machines in an industrial environment. Care must be taken to ensure that the device is not subjected to mechanical knocks. FAG Top-Laser EQUILIGN must only be operated by trained personnel. FAG Industrial Services GmbH accepts no liability for damages caused by incorrect usage.

Symbols

The following symbols are used in this handbook to draw the reader's attention to important parts of the text.

This symbol denotes general information and tips regarding the operation of FAG Top-Laser EQUILIGN.

Note

This symbol denotes information that must be followed in order to avoid damage to equipment.

Caution

This symbol denotes information that must be followed in order to avoid personal injury.

Warning

Numbers in red circles indicate the corresponding operating steps described in this handbook and must be closely observed.

1

CE conformity and EMC

FAG Top-Laser EQUILIGN fulfils the EU Directives on electrical equipment (73/23/EEC) and electromagnetic compatibility (EMC) (2004/108/EC).

FAG Top-Laser EQUILIGN has been tested in line with the following guidelines: EN 50011 (VDE 0875-11), EN 61000 (VDE 0838) and EN 61326 (VDE 0843-20).

IP classification

FAG Top-Laser EQUILIGN is dust-tight and protected against water jets (IP 65). The transducer and the reflector are protected against dust and temporary immersion in water (IP 67).

Laser safety

The FAG Top-Laser EQUILIGN is classified under laser protection class 2. Lasers in protection class 2 comply with the requirements outlined in FDA specification 21 CFR, Ch. 1, parts 1040.10 and 1040.11 as well as the ANSI standard. They also comply with the British standard BS 4803 (Part 1 to Part 3) and the European industrial standard IEC 825. Lasers in protection class 2 operate at a typical wavelength of 675 nm with a maximum pulse duration of 128 µs, maximum radiant power of 0.8 mW and maximum radiant energy per pulse of 0.1 µJ. No maintenance is required to keep this device in line with the specifications mentioned above.

- Never look directly into the laser beam!
- Do not place any lenses or optical glass in the beam path.
- The red LED on the transducer illuminates whenever the laser beam is being emitted.

Warning

Operating information

Temperature range

The permissible temperature range for EQUILIGN and its components is between 0°C and 50°C. Higher or lower temperatures can distort the measurement results or damage the components.

Store the FAG Top-Laser EQUILIGN system at temperatures between -20°C and 60°C.

External influences

Nearby sources of intense heat or water vapour could deflect the laser beam and affect the accuracy of measurements. In practice, however, this effect rarely occurs at distances up to 1 m. If in doubt, the laser beam can be shielded from environmental influences during adjustment and measurement.

As with all optical precision measurement equipment, sudden fluctuations in temperature (e.g. direct sunlight) could cause FAG Top-Laser EQUILIGN to produce false measurements.

Allow adequate time for the FAG Top-EQUILIGN components to reach the ambient temperature before taking any measurements.

Note

Incident light

Protect the lens from strong incident light, e.g. direct sunlight.

Resistance to water spray and dust

The FAG Top-Laser EQUILIGN computer (IP 65), the transducer (IP 67) and the reflector (IP 67) are protected against environmental influences. The components are protected against water spray on all sides but should not remain fully submerged in water over long periods. As with all waterproof electrical devices, the resistance of the FAG Top-Laser EQUILIGN computer and its components should be checked regularly. This can be carried out during calibration of the system, which we recommend be completed every two years.

Interfaces

FAG Top-Laser EQUILIGN is fitted with two interfaces: one for data transfer to a PC/printer and one for data transfer to the transducer.

Information on data storage

As with all electronic memory chips, data may be lost or modified under certain circumstances. It is therefore advisable to keep a back-up copy and printed records of particularly important data.

FAG Industrial Services GmbH accepts no liability for data lost as a result of improper use, incorrect repairs, incorrect battery replacement or any other operating errors.

FAG Industrial Services GmbH accepts no direct or indirect liability for financial losses or claims from third parties resulting from lost or modified data.

Note

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FAG Top-Laser EQUILIGN overview

FAG Top-Laser EQUILIGN keyboard at a glance

The FAG Top-Laser EQUILIGN computer has five function keys:

- The 'Dimensions' key opens the dimensions screen.
- The 'Measurement' key opens the measurement screen.
- The 'Results' key opens the alignment results.
- The 'Soft foot' key activates the soft foot measurements.
- The 'Live MOVE' key activates Live MOVE mode (Monitoring of corrective movements in real-time).
- The 'Up' key has several functions. On the Dimensions screen, it is used to switch between the auto-flow and advanced modes. On the Measurement and Results screen, it can open the measurement and results options or return to the previous screen.
- The 'CLR' (Clear) key deletes data that has been entered incorrectly.
- The 'Menu' key opens the main menu and its many useful alignment options.
- The navigation keys are used to navigate through the individual program steps.
- The 'On/Off/Enter' key is used to turn on the computer, confirm entered values and open the highlighted menu items. On the 'Results' screen, it can be used to open the results options. Press the 'On/Off/Enter' key to turn on the computer.
- The data entry keys are used to enter machine data and file names.

The auto flow function guides the operator step-by-step to the alignment results. The Enter key is used to navigate through the auto flow. In advanced mode, individual steps must be specifically selected.

1. USB PC/printer-connection (grey)
2. Transducer connection (blue)
3. Clear key
4. LED (alignment status)
5. Up key
6. On/Off/Enter key and navigation keys
7. Menu key
8. Live MOVE key
9. Soft foot key
10. Results key
11. Measurement key
12. Dimensions key
13. Data entry keys
14. LED (battery charge level)
15. Sensor for automatic regulation of display brightness

Power supply

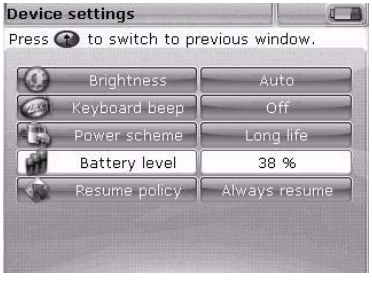
FAG Top-Laser EQUILIGN is powered by five standard 'AA' batteries. These batteries also serve as the power supply for the transducer and allow operation of up to nine hours (33% active measurement, 33% stand-by, 33% 'sleep' mode).

Replacing disposable batteries

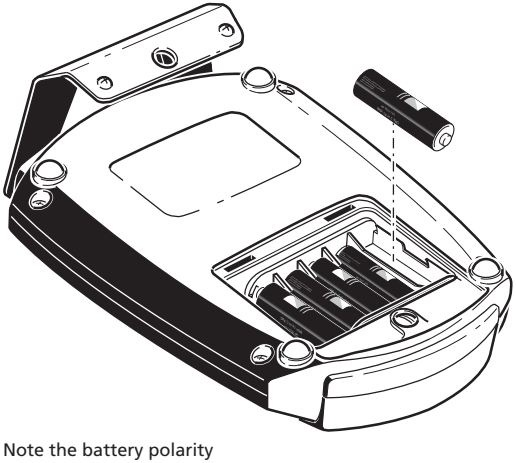
Batteries should be removed as soon as they become depleted or if the system has not been used for an extended period. Any type of high-quality 'AA' size batteries can be used in the FAG Top-Laser EQUILIGN standard computer, including alkaline-manganese batteries or high-capacity batteries, e.g. Duracell PLUS MN 1500. It is recommended to replace all five batteries together. Note the battery polarity when inserting the batteries in the battery compartment.
To replace the batteries, turn over the computer while taking care not to damage the display or the keys. The locking screw for the battery housing can be loosened with a quarter-turn of a 7-mm screwdriver. When the screw comes loose, lift off the cover of the battery housing and remove the batteries.

Dispose of used batteries in accordance with applicable regulations!

The charge level of the battery is displayed under the 'Device settings' menu item. Turn the computer on and press the Menu key. Then use the navigation keys to highlight the 'Configuration' menu item. Press Enter to confirm the selection and then highlight the 'Device settings' option in the configuration menu by using the navigation keys. Press Enter to confirm the selection. The device settings are displayed.



We recommended using five alkaline-manganese'AA' size batteries (IEC LR6) for the standard computer.



Note the battery polarity when inserting the batteries (alternating +/-).

Transducer

The transducer contains a laser diode that emits a beam of red light (wavelength 675 nm). The beam becomes visible when it hits a surface. It is emitted with a diameter of approx. 5 mm. The same housing also contains a position detector that measures the exact position of the laser beam as the shafts are rotated. This component is a biaxial, analogue, photoelectric semiconductor position detector with a resolution of 1 µm. The transducer also contains an electronic inclinometer with a resolution better than 1° for measuring the shaft rotation angle.

There are two indicator LEDs on the front of the transducer: a green LED for indicating beam adjustment and a red LED to indicate when the laser is switched on. The transducer is powered by the FAG Top-Laser EQUILIGN computer via a cable that is also used to transfer measurement data.

The transducer is protected against environmental influences (IP 67). The internal optics and electronics are sealed to prevent any possible contamination. However, the transducer lens must be kept clean. Use the lens cleaning cloth provided or a fine dusting brush such as those normally used to clean other optical devices. Keep the dust cap on when the transducer is not in use.

Caution

- Avoid polishing the lens too vigorously to prevent irreparable damage to the anti-reflective coating.
- Do not remove the six smaller housing screws sealing the housing under any circumstances. This can lead to misalignment of the laser. Warranty claims are void if the housing is opened!
- The calibration of the transducer should be checked every two years — as indicated by the coloured label on the transducer. Please contact our support centre for calibration checking.
- Never look directly into the laser beam!

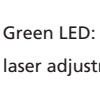
Note

Warning

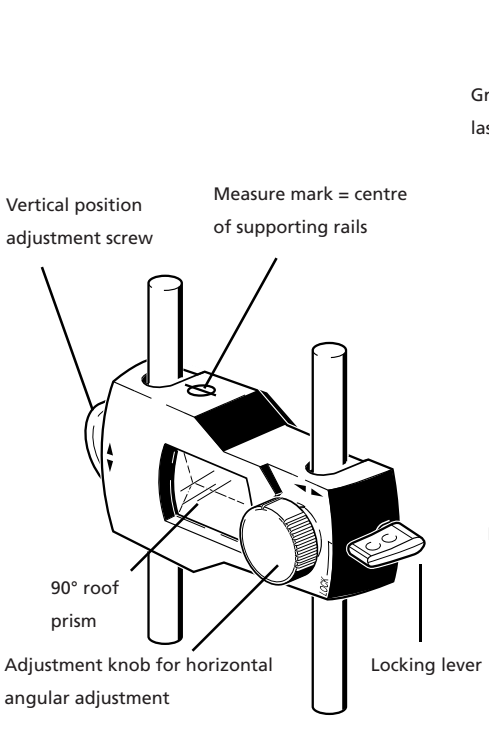
Reflector

The reflector is mounted on the shaft or the coupling half of the machine that is to be moved. It reflects the laser beam back into the position detector as the shafts are rotated. The locking lever is moved to the horizontal position to hold the reflector in place on the supporting rails. The reflector is adjusted by changing its vertical position and horizontal angle (adjustment screw, adjustment knob) so that the beam is reflected directly back into the transducer.
The reflector must be kept clean. Use the lens cleaning cloth provided or a fine dusting brush such as those normally used to clean other optical devices.

Avoid rubbing the reflective surface too vigorously as this can lead to irreparable damage to the anti-reflective coating. Keep the dust cap on when the reflector is not in use.



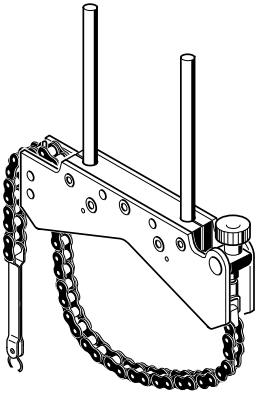
Caution



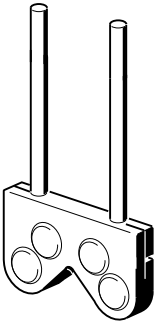
Compact chain-type bracket

Compact and lightweight, the chain-type bracket provides sturdy support for the measurement components. This easy-to-mount holding device is suitable for shaft diameters ranging between 15 mm and 500 mm. The bracket covers the full range of diameters — limitations are due to the chain length (chains of varying lengths are available). Mounting instructions can be found in the 'Horizontal machine alignment' chapter on Page 37. Other chain and rail types are available. Contact your local representative for details on additional accessories.

Compact chain-type bracket



Optional compact magnetic bracket

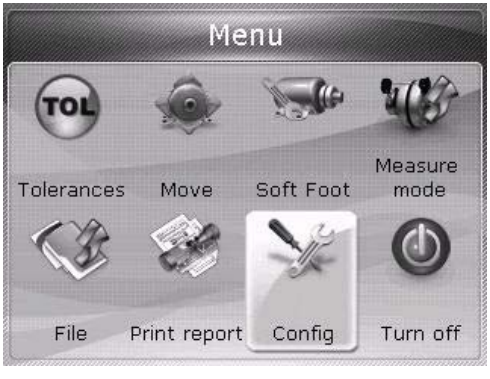


Configuration and data management

Configuration

The 'Configuration' menu item is used to configure FAG Top-Laser EQUILIGN settings, regional settings, default settings and printer settings. It can also be used to open detailed information about the device.

The Configuration menu can be opened at any time and from any screen. With the FAG Top-Laser EQUILIGN computer switched on, press the Menu key to open the Configuration menu. The following screen appears. Use the navigation keys to highlight the 'Config' icon.

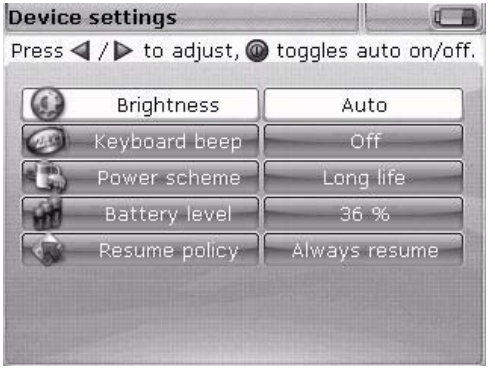


When 'Config' is highlighted, press Enter to open the Configuration menu.

Use the navigation keys to highlight the required configuration menu items.

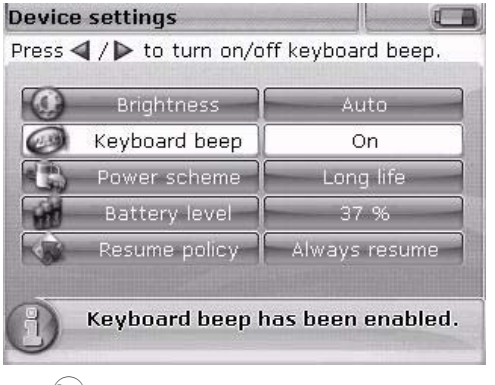
Device settings

To open the 'Device settings' screen, highlight the 'Device settings' menu item using the navigation keys and then press Enter to confirm the selection. The possible settings are displayed. These are brightness, keyboard beep, power scheme, battery level and resume policy. Highlight the desired menu item using the △/▽ keys.

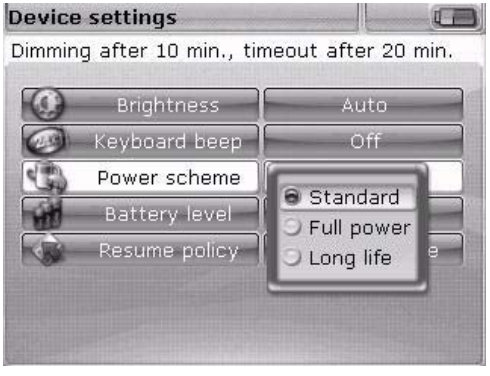


FAG Top-Laser EQUILIGN offers two display brightness modes: automatic mode and manual mode. Automatic mode automatically adjusts the brightness to the ambient lighting conditions.

There are two modes to regulate display brightness in the FAG Top-Laser EQUILIGN computer. The auto mode uses a light sensor to automatically adjust the display brightness to the ambient lighting conditions. To adjust the display brightness manually, switch to manual mode using the Enter/◁/▷ keys. Increase the display brightness using the ▷ key or decrease it using the ◁ key.



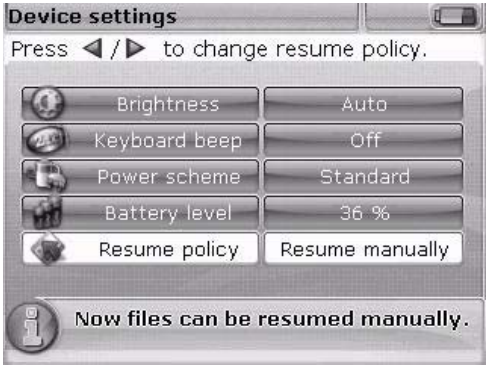
Press Enter to turn the keyboard beep on or off. If the keyboard beep is activated, each key will make a beeping sound when pressed.



The 'Power scheme' option is used to select a setting that manages the power usage of the FAG Top-Laser EQUILIGN. The three options are: 'Standard' (the display dims after ten minutes and turns off after 60 minutes), 'Full power' (does not dim or turn off automatically) and 'Long life' (dims after three minutes, turns off after eight minutes). Select the desired setting using the △/▽ keys and press Enter to confirm the selection.

The charge level of the battery is displayed in the top right-hand corner of every screen.

The current battery capacity is displayed next to the 'battery level' bar. This value corresponds with the charge level of the battery icon in the top right-hand corner of the screen.

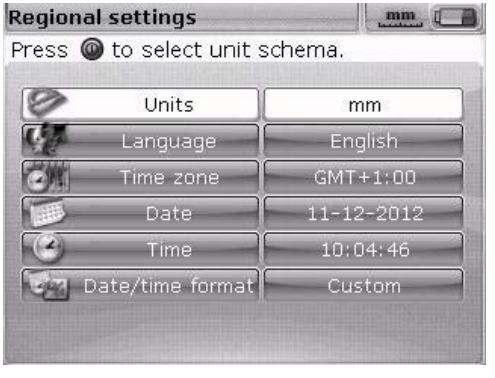


The ◁ / ▷ keys can also be used to switch between the two 'Resume policy' options.

'Resume policy' allows the user to specify the measurement file that opens when the FAG Top-Laser EQUILIGN computer is switched on. It may be set to automatically open the last used measurement file ('automatic') or open a new measurement file ('manual'). Press Enter to switch between these two options.

Regional settings

This option is used to set the units of measurement, preferred language and the date and time. Open the configuration menu screen. Use the navigation keys to highlight the 'Regional settings' menu item and then press Enter to confirm the selection.



Highlight the 'Units' menu item using the △ / ▽ keys and press Enter to confirm the selection. The measurement units available for selection are American, English and metric units (SI units). Select the desired system of units using the △ / ▽ keys. Press Enter to confirm the selection.

Highlight the 'Language' menu item using the ▵/▿ keys and press Enter to confirm the selection. Select the required language from the list using the ▵/▿ keys. Press Enter to confirm the selection.

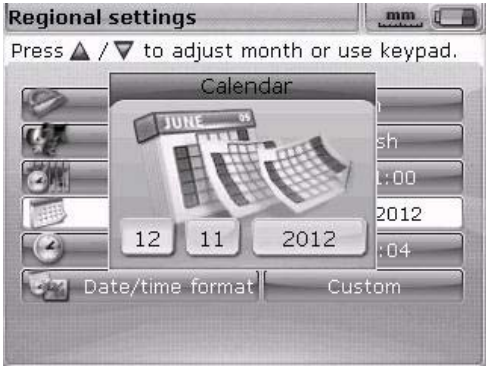
> Before the chosen language is set, a query appears asking whether the system of units and the date and time format should also be changed to match the new language selection. Select the action required using the ▵/▿ keys and then press Enter.

Note

Highlight the 'Time zone' menu item using the ▵/▿ keys and press Enter to confirm the selection. Select the required time zone using the ▵/▿ keys and confirm your selection by pressing Enter.

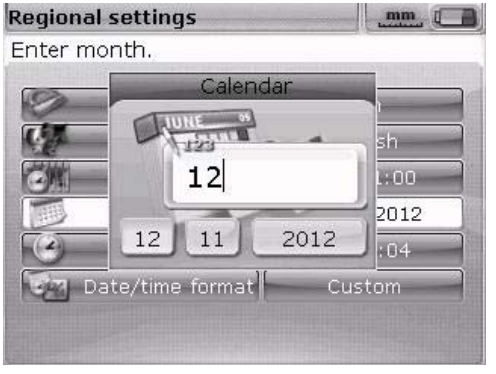
When a time zone is opened, a box appears displaying the major world cities in that time zone. Note: Changing the time zone automatically adjusts the time.

Set the current date and time by highlighting the relevant option using the ▵/▿ keys. Press Enter to confirm the selection.



Note: The date format displayed here can be set via the 'Date/time format' option.

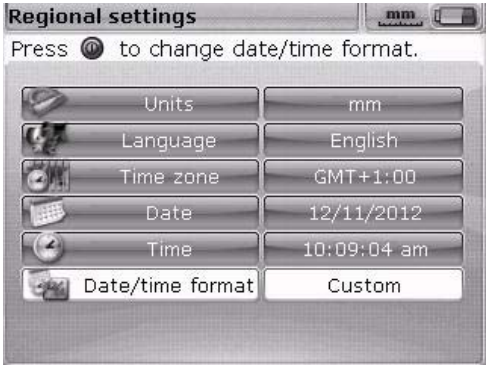
Highlight the date (day, month or year, depending on the display format) using the ◁/▷ keys. Set the highlighted date component using the △/▽ keys. Use the △ key to increase the values and the ▽ key to decrease the values.
Alternatively, the date can also be set using the data entry keys. Highlight the required data component and directly enter the new value using the data entry keys. The editing box appears as soon as the first key is pressed.



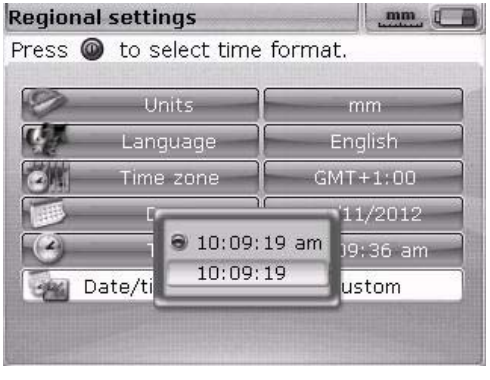
Enter a value and press Enter or t to confirm the entry.

Note: The time format displayed here can be set via the 'Date/time format' option.

Switch between the hours and minutes using the ◁/▷ keys. Set the highlighted time component using the △/▽ keys. Use the △ key to increase the values and the ▽ key to decrease the values. Alternatively, the time can also be set using the data entry keys. Highlight the required time component and directly enter the new value using the data entry keys. The editing box appears as soon as the first key is pressed. Enter a value and press Enter or t to confirm the entry.



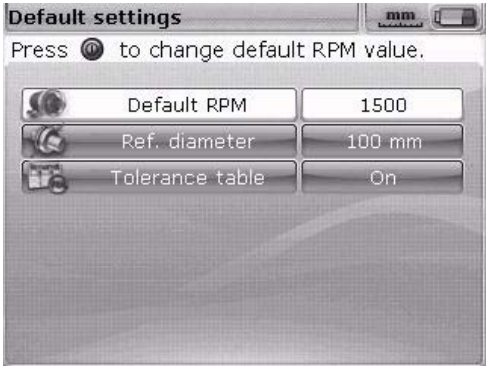
Highlight the 'Date/time format' menu item and press Enter. This opens a selection menu with the 'Date format' and 'Time format' menu items. Select a menu item from the pull-down menu using the △/▽ keys.



Under 'Time format', you can select whether the time is displayed in the 12-hour or 24-hour format. Confirm your selection by pressing Enter. Under 'Date format' you can select whether the date is displayed as dd-mm-yyyy or mm/dd/yyyy.

Default settings

To open the 'Default settings' screen, use the navigation keys to highlight the 'Default settings' option in the configuration menu and then press Enter to confirm the selection. This screen is used to set specific default settings. Any changes made to the default settings come into effect when the computer is restarted or if a new file is created.

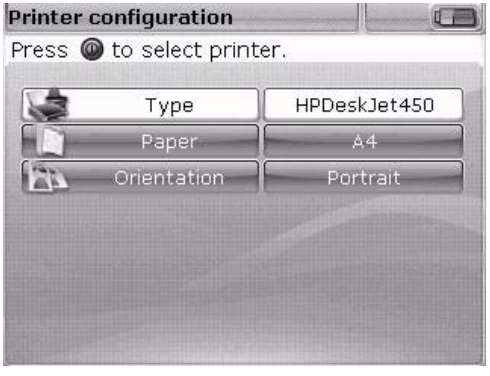


Navigate through the parameters using △ or ▽.

- Default RPM — used to set the required default RPM. Highlight the 'Default RPM' menu item and enter the required value using the data entry keys. Press Enter or ↵ to confirm the entry.
- Ref. diameter — used to set the required reference diameter. Highlight the 'Ref. diameter' menu item and enter the required diameter using the data entry keys. Press Enter or ↵ to confirm the entry. When opened, every new alignment file will contain the predetermined RPM value and reference diameter.
- Tolerance table — the available options are 'On' or 'Off'. The RPM determines the correct tolerance value. Tolerance values based on these RPMs can be obtained from the FAG Industrial Services GmbH tolerance table.

Printer configuration

This option is used to select printers and printer settings in FAG Top-Laser EQUILIGN.



Three printing options can be selected via 'Printer Configuration':

'Type' — highlight 'type' and press Enter. A list of all the supported printers is displayed.

'Paper' — select the required paper format

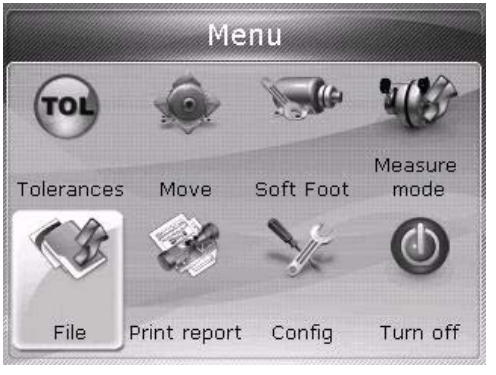
'Orientation' — select the paper orientation. Select 'Portrait' for vertical orientation and 'Landscape' for horizontal orientation.

Details

The information contained in this section can be displayed in the configuration menu. Highlight the 'Details' icon and press Enter to confirm the selection. The details include information, for example, about the current version of the device and the application.

Data management

FAG Top-Laser EQUILIGN features an effective system for managing data and files. Press the Menu key to open the data management options and highlight the 'File' icon using the navigation keys.



Press Enter to confirm the selection. The file management menu appears.

Navigate through the four items in the file menu using ◁ or ▷.
Note: Highlighted menu items are identified by an orange rectangle.

Highlight one of the four data management options using the ◁/▷ keys. The available options are 'Files list', 'Save file', 'Resume' (or 'New file') and 'Print report'.

Note: The 'New file' and 'Resume' menu items are dependent on the selected resume policy, which can be selected in the configuration menu under 'Device settings'. 'Resume' only appears when the resume policy is set to 'Manual'.

Note

'Files list' — this option is used to load any stored file. Highlight 'Files list' using the ◁/▷ keys and press Enter to confirm the selection. A list of all the saved files is displayed.

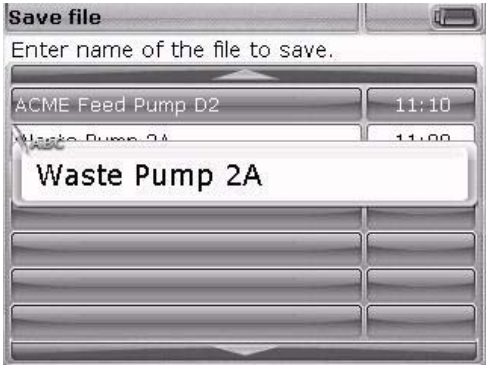
The files are arranged according to date and time of creation. This order cannot be changed.

Highlight the file you want to open using the △/▽ keys and then press Enter.

To delete an existing file, highlight the file using the △/▽ keys and press the CLR key. On the next screen, highlight 'Yes' using the △/▽ keys. Press Enter to confirm deletion. To rename an existing file, highlight the file using the △/▽ keys, enter the new file name using the data entry keys and press Enter to confirm the change.

Note

'Save file' — this option is used to save the current file. If the file is new and currently unnamed, use the data entry keys to enter the new data name in the editing box.



If the file name already exists, the editing box appears with the existing file name highlighted. Press Enter to confirm the selection.

Press Enter to confirm the file name.

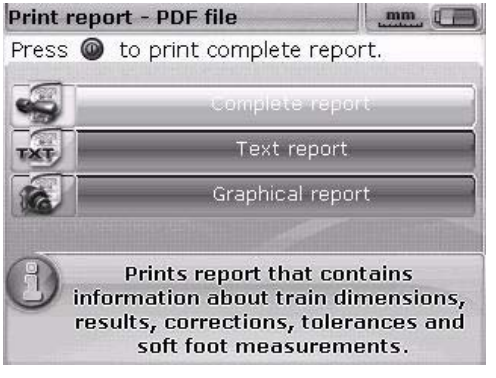
You can store up to 100 measurement files.

Note

'New file' — this menu item appears in the file menu if the resume policy in device settings is set to 'Automatic'.

'Resume' — this menu item appears in the data menu instead of 'New file' if the resume policy in device settings is set to 'Manual'. This menu item is used to automatically open the last file that was used before the computer was turned off.

'Print report' — this menu item is used to print the measurement report or the soft foot measurement report.



The following report types are available:

- Complete report — this menu item is used to print a complete report that includes machine graphics and measurement results in both numerical and graphical format.
- Text report — this menu item is used to print a report in text format.
- Graphical report — this menu item is used to print the results in a graphical format.

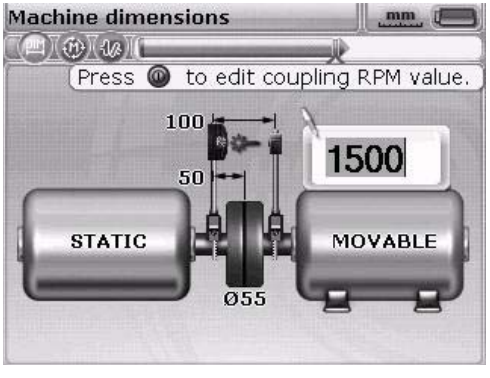
Getting started

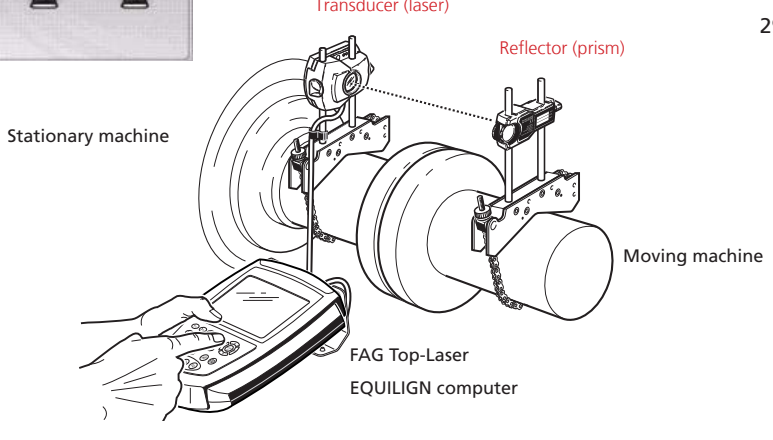
Installing FAG Top-Laser EQUILIGN components

1. Prepare the machines (disconnect and take all necessary safety precautions).
2. Mount the brackets, the transducer and the reflector. The transducer should be mounted on the left coupling half (stationary machine).
3. Connect the transducer cable to the blue port on the FAG Top-Laser EQUILIGN computer and switch on the FAG Top-Laser EQUILIGN computer by pressing and holding the Enter key. The LEDs light up and a there is a short beep. Shortly afterwards, the dimensions screen is displayed.

Entering dimensions

Enter all the required machine data and dimensions using the data entry keys.





An editing box appears with information about the machine data that must be entered or edited. Enter the machine data using the data entry keys and confirm the entry by pressing the Enter key. The highlighted box moves automatically to the next empty field and a corresponding message appears. Repeat this process until all the required dimensions have been entered. The following dimensions must be entered:

1. Distance from transducer (sensor/laser) to reflector (prism)
2. Distance from transducer (sensor/laser) to centre of coupling
3. Coupling diameter (default is 100 mm. This default value can be changed; see the 'Default settings' section on Page 24.)
4. RPM (see the 'Default settings' section on Page 24)
5. Distance from centre of coupling to front feet (machine on the right)
6. Distance from front feet to back feet (machine on the right)

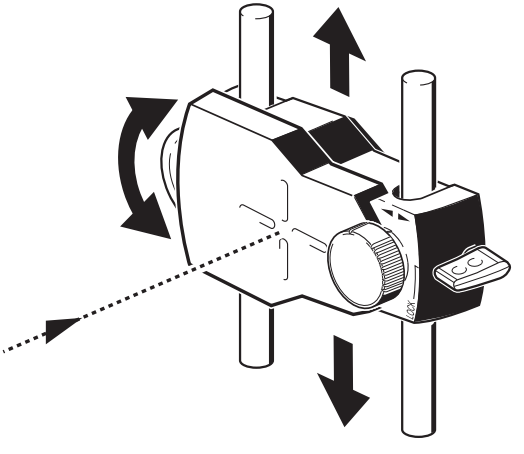
When all of the required dimensions have been entered, the measurement screen appears automatically.
The dimensions screen can be reopened at any time using the DIM key.

Measuring

The measurement mode described here is active clock mode. In this mode, measurements are taken at any three or four points in the eight available sectors. Both 'active clock' and 'static' are default measurement modes.

Note

Remove the dust cap from the transducer and centre the laser beam on the dust

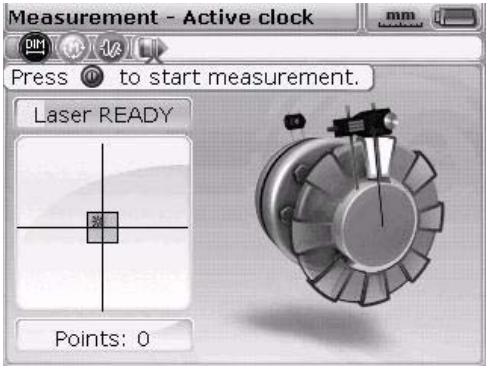


cap of the reflector. If the dust cap is on, the message 'Laser off' will appear on the screen and the indicator LED for the alignment status on the FAG Top-Laser EQUILIGN computer will light up in red.

- Do not look into the laser beam! Risk of injury!

Warning

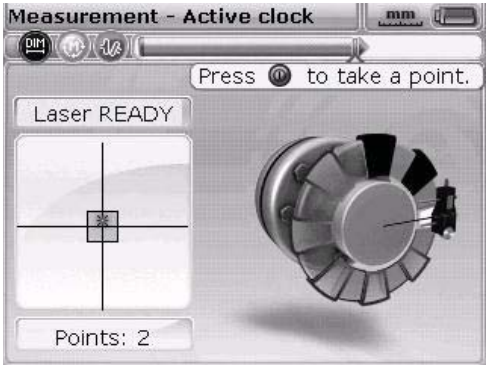
If necessary, adjust the chain-type bracket so that the laser beam is centred horizontally on the reflector, then secure the chain-type bracket. Slide the reflector on the supporting rails to centre the laser beam vertically on the reflector dust cap. When the laser beam is centred, remove the dust cap from the reflector.
In order to position the laser beam in the centre or as close to the centre as possible, use the adjustment screw on the side of the reflector to make vertical adjustments and the yellow adjustment knob to make horizontal adjustments.



When making the adjustments mentioned above, take note of the LEDs on the FAG Top-Laser EQUILIGN computer and the laser dot on the display screen. The LED lights up in green when the laser position is suitable and measuring can commence. The LED lights up in blue when the laser beam is centred exactly in the target box.

Note

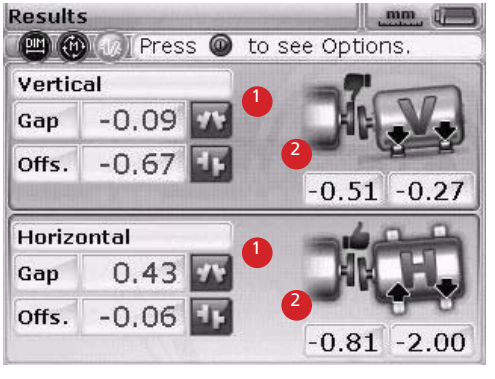
Further information about adjusting the laser beam can be found from Page 45. Once the laser beam has been centred exactly, rotate the shafts to the first measurement position. Measurements can only be taken if the sector in which the shaft rotates is highlighted. Press Enter to take the first measurement. The sector is now marked in black, indicating that a measurement has already been taken in that sector.



Rotate the shafts to the next measurement position and take a measurement point. Three or four measurement values (depending on the default settings; see Page 24) from the eight possible positions are required for an analysis of the results. Measurements can be carried out in any order. The results screen opens automatically after all the required measurements points have been taken.

Results

The alignment results, with both coupling and foot values, are displayed automatically.



The coupling values (**1**) and foot values (**2**) are displayed in both horizontal and vertical directions.

The foot results indicate the foot positions relative to the centre axis of the stationary machine.

Coupling results are given in the form of gap and offset values. If the stationary machine is to the left of the viewer, the gap is positive when it opens at the top or away from the viewer. The offset is positive if the moving machine (on the right) is higher or further away from the viewer.

Positive values in the foot results mean that the machine on the right is higher or further away from the viewer. Negative values mean that the machine on the right is lower or closer to the viewer. The alignment status is displayed using the tolerance icon.

'Thumbs up' icon (the alignment status LED lights up blue) — measured values within good tolerances

'Thumbs down' icon (the alignment status LED lights up red) — measured values outside tolerances

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Horizontal machine alignment

1. Preparing the alignment process

Before you use the FAG Top-Laser EQUILIGN system, prepare the machine as follows:

Warning

Before starting any work, disconnect the machine so that it cannot be activated accidentally.

a. Stable and flat base

A solid and stable base is required to obtain correct, lasting alignment of the machine.

b. Machine mobility

If the machine to be moved is standing directly on the base, it cannot be lowered for alignment correction. It is therefore advisable to insert 2 mm shims under the feet of the machine before commencing alignment. Adjustable screws or hydraulic aids are recommended for any movement.

c. Rigid couplings

Rigid couplings must be loosened before alignment so that the alignment conditions are not negatively affected.

d. Torsion play/axial play

Torsion play on the coupling should be avoided. Axial shaft play up to 3 mm has no significant effect on measurement results (though it may affect machine operation).

e. Soft foot

When the fixing screws on a machine are loosened, the tension causes the machine foot to lift up and change the position of the shaft. Precise machine movement during alignment is therefore not possible.

f. Coupling requirements/tolerances

The machine default values can be obtained from the machine specifications.

g. Measurement distance

As the FAG Top-Laser EQUILIGN system does not require mechanical connections across the coupling (e.g. dial indicator brackets) during measurement, measurements can be carried out easily over large distances between transducer and reflector.
Shafts and couplings may sag over large distances and it may be necessary to take this into account when aligning the machine. In this case, refer to the manufacturer's specifications.

2. Checking for soft foot

See the 'Soft foot' chapter on page 71.

3. Mounting the chain-type brackets

Mount a bracket on either side of the coupling and ensure that both are at the same angle.

When mounting the brackets please note the following information in order to obtain the highest possible measurement accuracy and to avoid damage to the equipment:

- The brackets for the transducer and the reflector must be mounted securely.
- Do not use self-constructed brackets. Never modify the original brackets supplied by FAG Industrial Services GmbH. Do not use support rails longer than those recommended for the respective brackets. FAG Industrial Services GmbH supplies support rails and chains in varying lengths.

Caution

Warning

Mounting procedure

To mount the brackets, refer to the diagrams provided and follow the instructions:

1. Choose the shortest possible support rails that allow the laser beam to shine over the coupling and onto the reflector. Insert the support rails into the brackets.

For particularly large couplings, a coupling bolt can be removed and the laser beam can be directed through the bolt hole. In this case, the compact chain-type brackets or a special magnetic bracket can be used.

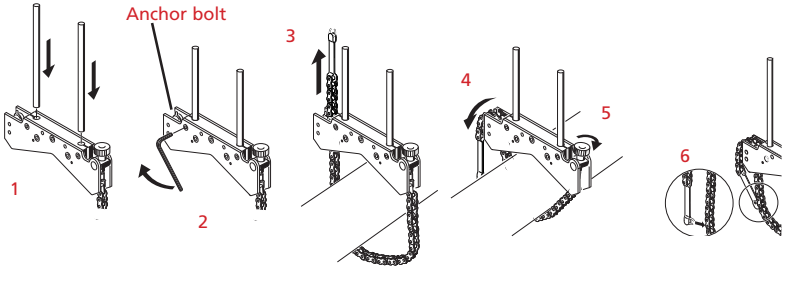
Note

2. Secure the brackets in place by tightening the hex socket head screws on the back of the mounting.
3. Place the chain-type bracket on the shaft and wrap the chain around the shaft. If the shaft is smaller than the brackets, place the chain around the brackets from the inside (see diagram). If the shaft is larger than the brackets, insert the chain into the brackets from the outside.
4. Place the chain on the anchor bolt.
5. Tighten the knurled thumb screw to secure the brackets onto the shaft.
6. Secure the loose end of the chain with the fastener.

Check that the chain-type brackets are tightly secured but do not apply too much force.
To release the brackets, loosen the knurled thumb screw and remove the chain from the anchor bolt.

The compact chain-type brackets cover most alignment situations but in cramped conditions or special cases, special optional brackets may be required. Please ask your local FAG Industrial Services GmbH representative for details.

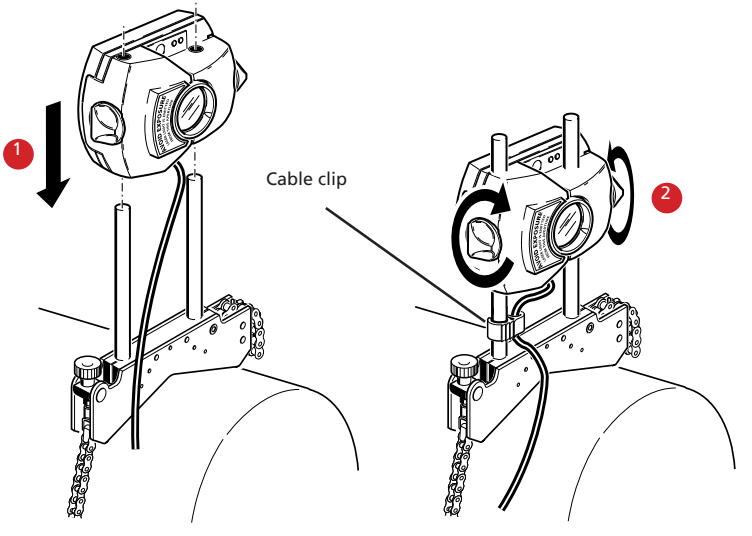
Note



4. Mounting the transducer and reflector

Mounting the transducer

1. Position the transducer on the bracket support rails on the stationary machine (left) as pictured below, as viewed from a normal working position. Loosen the yellow locking screws enough to allow the transducer to slide onto the support rails, with the transducer cable pointing down towards the shaft.
2. Secure the transducer onto the support rails by tightening the yellow locking screws. Make sure that the laser can shine over the coupling and is not obstructed in any way. Affix the cable to one of the support rails using the cable clip.



1. Loosen the yellow locking screws and slide the transducer onto the support rails.

2. Tightly fasten the locking screws and attach the cable clip to the support rails.

Do not tighten the locking screws too much.

Mounting the reflector

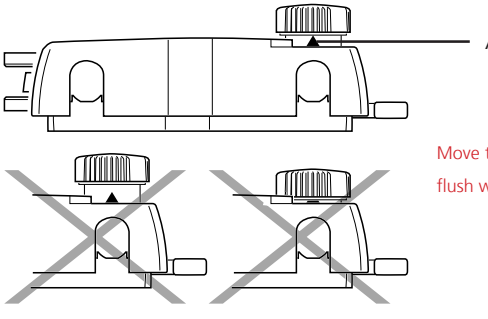
a. Position the reflector on the bracket support rails on the machine on the right (moveable).

The yellow adjustment knob on the front of the reflector is used to set the horizontal angle of the reflected laser beam. A rough estimation of this angle must be set before mounting the reflector to allow for rapid and precise adjustment on the detector surface. Check the position of the yellow adjustment knob. The back of the yellow adjustment knob must be flush with the arrow marker on the housing.

b. Put the mounted locking lever on the side of the reflector in the vertical, open position. Slide the reflector onto the bracket support rails that are mounted on the moveable machine, as shown on the right. Secure the reflector to the support rails by returning the lever to the horizontal position.

The transducer and reflector should be at the same height and as low as possible, but must still allow the laser beam to shine over the coupling. Make sure that the transducer and reflector are in line with each other.

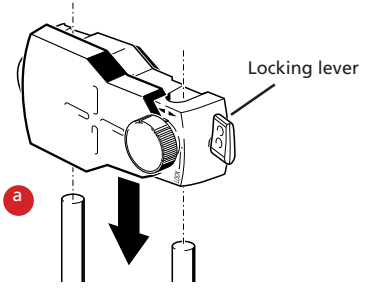
If necessary, loosen the brackets and rotate into the correct position. Retighten the brackets before continuing.



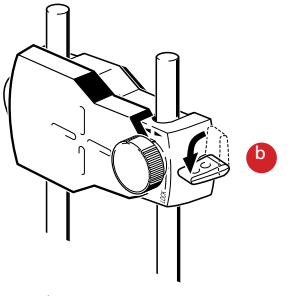
Move the adjustment knob to sit flush with the arrow marker.

Too high!

Too low!



Locking lever open (vertical position).



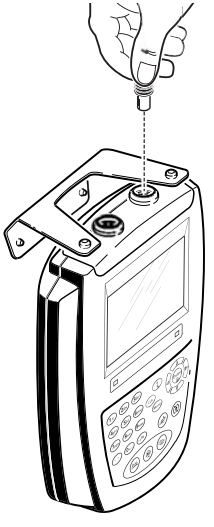
Attach the reflector (locking lever in horizontal position). The adjustment knob allows fine adjustments to be made.

5. Connecting the transducer

Insert the plug of the transducer cable into the blue port on the top of the computer housing.

Turn the plug so that the arrow matches up with the white arrow on the blue port to ensure the plug is orientated correctly; otherwise, the contact pins inside the plug may become damaged.

Caution



Note the white arrow on the blue port

Disconnecting the transducer

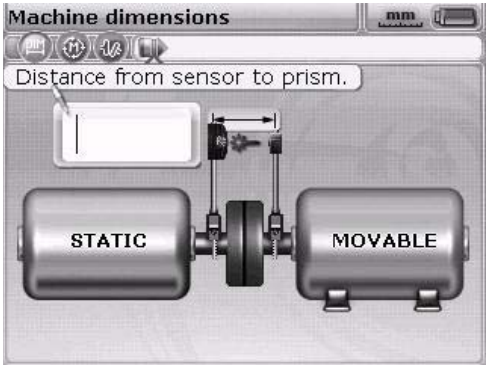
Carefully remove the plug from the computer by grasping the ribbed collar as far forward as possible.

6. Switching on FAG Top-Laser EQUILIGN and starting applications

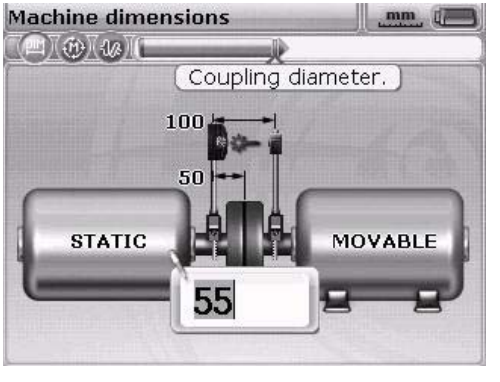
Press Enter and hold down the key for a few seconds. The display LED for the alignment status illuminates and a beep sounds. The start screen appears shortly afterwards, followed by the dimensions screen for shaft alignment.

7.1 Entering dimensions

Machine data and measurements are entered using the grey data entry keys.



An editing box appears with information about the measurement that must be entered or edited. Any missing measurements that are required can be entered directly using the data entry keys.



Alternatively, auto flow mode can be overridden using the t key. This allows activation of advanced entry mode, which can be used to access editing boxes and machine elements using the navigation keys.

Confirm the entered value by pressing Enter. The highlighted box moves automatically to the next missing measurement.

In advanced entry mode, the dimensions can also be accessed using the navigation keys. Entered values can then be confirmed by pressing Enter or t.

Note

The dimensions to be entered vary according to the machine and the coupling type. For standard horizontal alignment, enter the following dimensions:

7.1.1 Distance from transducer to reflector

1

This is the distance between the markings on top of the transducer and the reflector (refer to the diagrams below).

7.1.2 Distance from transducer to centre of coupling

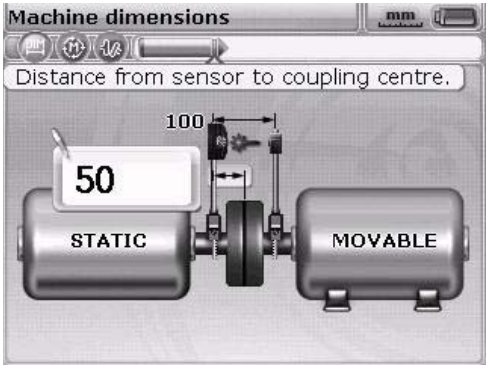
2

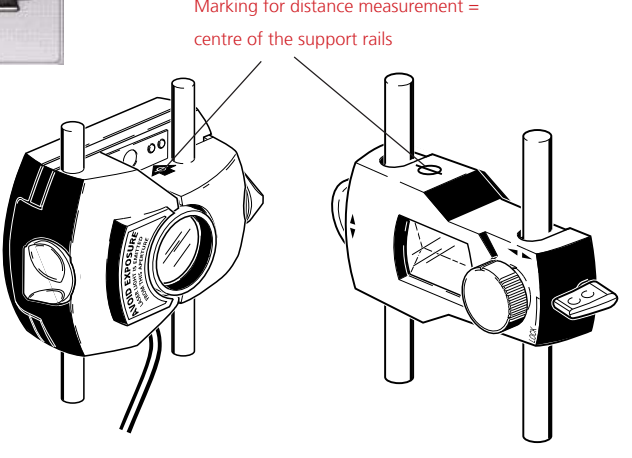
This is the distance between the marking on top of the transducer and the centre of the coupling.

This distance is calculated automatically from the entered distance from the transducer to the reflector. The value can be entered directly in the editing box and confirmed by pressing Enter.

In advanced mode, the distance is calculated and highlighted automatically. If this value needs to be edited, enter the new value directly using the data entry keys. The editing box appears as soon as the first key is pressed. Press either Enter or t to confirm the entry.

Note





In advanced mode, the navigation keys can be used to move the marking through the editing boxes and machines.

Note

7.1.3 Coupling diameter

3

Measure the circumference of the coupling and divide this value by 3.142 (pi).
The default value is 100 mm. If this value needs to be edited, highlight the value using the navigation keys. Press Enter to open the editing box. Change the value using the data entry keys.
Confirm the entered value by pressing Enter or t. The highlighted box moves automatically to the next missing measurement.

7.1.4 RPM

The default value is 1500. If this value needs to be edited, highlight the value using the navigation keys. Press Enter to open the editing box. Change the value using the data entry keys.

7.1.5 Distance from centre of coupling to front feet, machine on the right

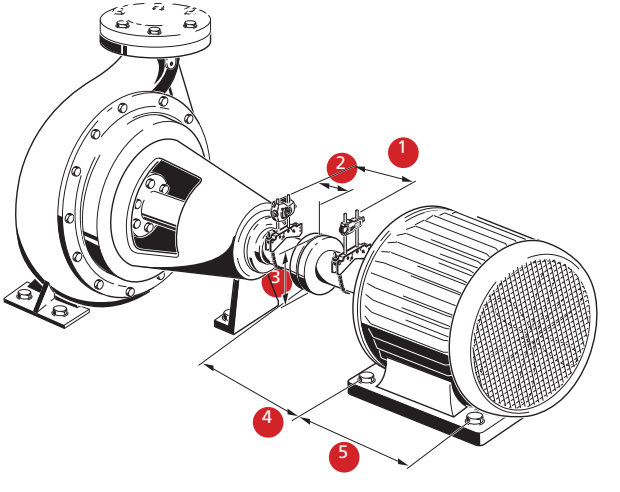
4

This is the distance from the centre of the coupling to the feet of the machine on the right that are nearest to the coupling.

7.1.6 Distance from front feet to rear feet, machine on the right

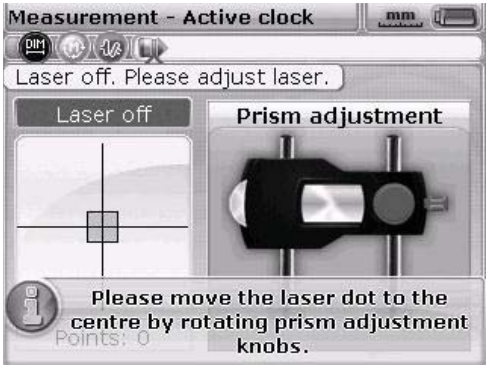
5

This is the distance between the front feet and the rear feet of the machine on the right.



7.2 Laser beam adjustment

When all of the required values have been entered, the measurement screen appears automatically.



The transducer and the reflector must be arranged so that the laser beam strikes the reflector and is reflected back into the transducer.

Never look directly into the transducer when the laser is switched on!
Danger of laser radiation!

7.2.1 Remove the transducer dust cap

The laser beam is now on! Leave the other dust cap on the reflector so that the laser beam is visible on it. If the laser does not strike the reflector, hold a white sheet of paper in front of the reflector to locate the laser beam.

7.2.2 Centre the laser beam on the reflector dust cap

Leave the dust cap on the reflector and adjust the laser beam so that it strikes the crosshairs on the dust cap:

Note

- › To set the laser vertically, slide the reflector and/or transducer up and down the support posts. Use the adjustment screw on the side of the reflector housing. Loosen the locking screws to move the transducer.
- › To adjust the laser horizontally, loosen one of the chain-type brackets and rotate it slightly. Retighten the chain-type bracket after adjustment.

7.2.3 Adjust the reflector until both of the LEDs on the transducer flash in unison and the LED on the FAG Top-Laser EQUILIGN computer lights up blue

Red and green LEDs on the transducer indicate the laser beam alignment status. An indicator LED on the FAG Top-Laser EQUILIGN computer can also be used simultaneously to read this alignment status.

Note

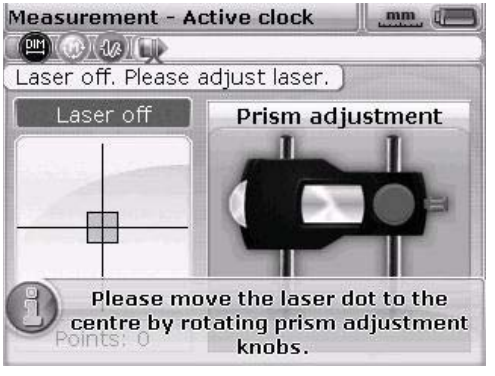
The reflector prism and transducer lens must be clean — use a lint-free cloth. A lens cleaning cloth is supplied.

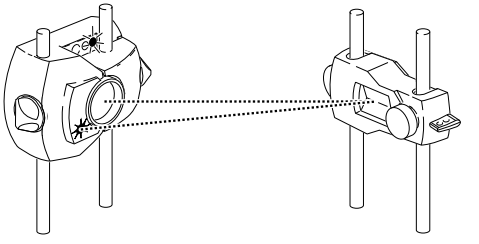
If the red LED on the transducer flashes quickly (every 0.3 seconds) and the FAG Top-Laser EQUILIGN indicator LED on the computer lights up red, the laser beam is failing to strike the position detector. The message 'Laser off' then appears on the computer screen. Use the metal thumbwheel and yellow adjustment knob to adjust the reflected laser beam, as described on the following page. If the laser beam strikes the edge of the position detector, the computer LED lights up yellow and the red transducer LED continues to flash red. The message 'Laser end' then appears on the computer screen.

7.2.5 Centre the laser beam so that the indicator LED on the FAG Top-Laser EQUILIGN computer light up blue.

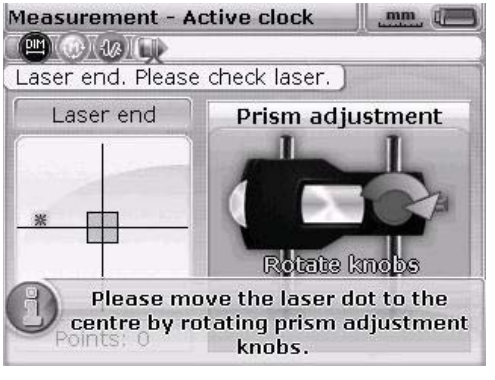
Adjust the laser beam so that the laser dot strikes the display screen inside the green box in the centre of the detector display.

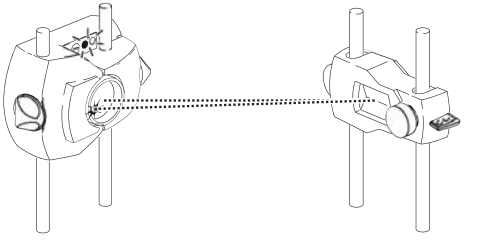
x = set horizontally with the yellow adjustment knob
y = set vertically with the thumbwheel on the side
The LED on the FAG Top-Laser EQUILIGN computer lights up blue.



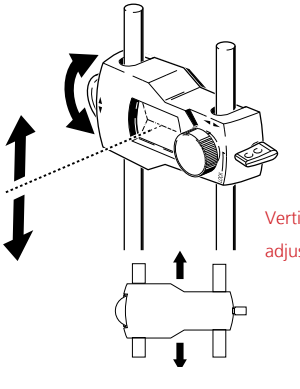


The RED LED on the transducer flashes quickly, the GREEN LED is off and the indicator LED on the FAG Top-Laser EQUILIGN computer lights up RED.

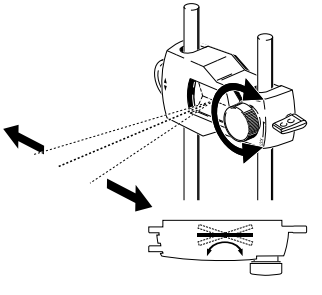




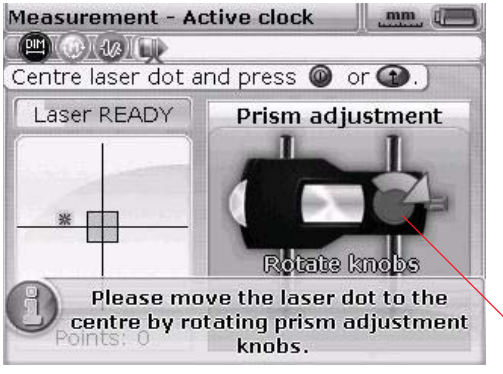
Both transducer LEDs flash alternately and the indicator LED on the FAG Top-Laser EQUILIGN computer lights up YELLOW.

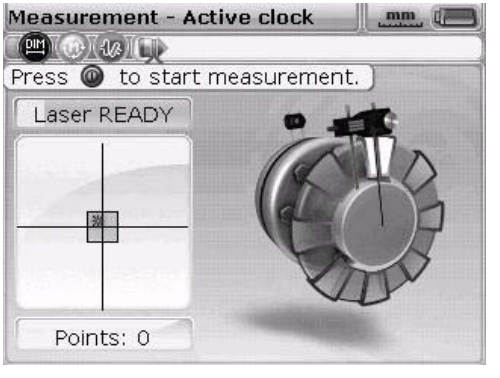


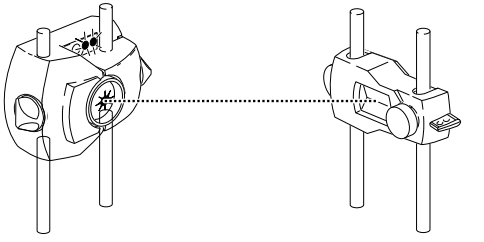
Vertical adjustment



Horizontal adjustment



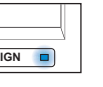




Both transducer LEDs flash slowly in unison and the indicator LED on the FAG Top-Laser EQUILIGN computer lights up GREEN.

The arrow shows which way the adjustment knob should be rotated. The more centred the laser beam, the smaller the arrow becomes.

The alignment status indicator LED lights up BLUE.



The co-ordinates do not have to be set exactly to (0.0) to obtain precise measurements, but the maximum measurement range is available in all directions if the laser beam is centred.

Do not touch components!
The adjusted components must not be touched during the measurement process, as this could adjust them further, which would deliver incorrect results.

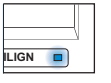
Note

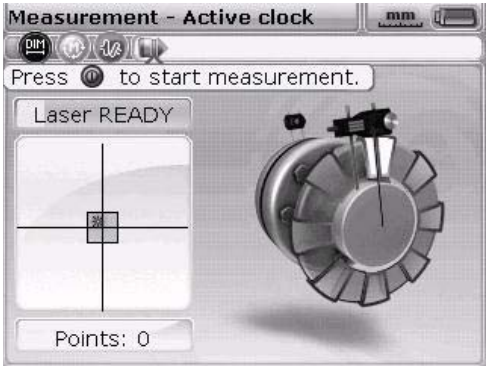
8. Taking measurements

Take note of which measurement mode is best suited to your particular application. The table below shows which measurement mode is used for each measurement:

Measurement mode	Application
Active clock measurement mode	Standard machines
Continuous measurement mode	Standard machines
Static measurement mode	Uncoupled shafts that cannot be rotated

If the laser beam is centred in such a way that the laser dot strikes the display screen in the centre of the crosshairs (inner square), then the indicator LED lights up blue.





Active clock is the default measurement mode. In this mode, measurement points are taken at any three or four points in the eight possible sectors. Three measurement points are sufficient to determine the alignment status.
You can find information about static measurement mode (default) in the 'Alignment options' chapter on Page 79.

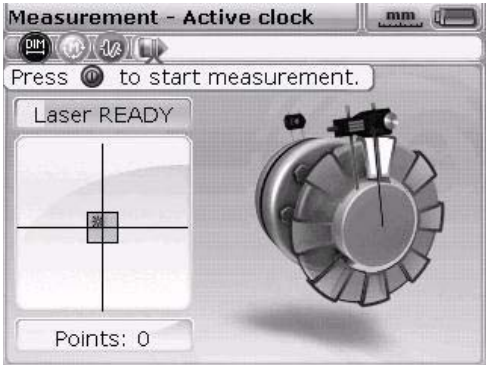
Note

If coupling play (torsion play) is suspected, rotate the shafts once in the direction of operation before measurement. Rotate the shaft or coupling end on which the reflector is mounted. Ensure force is acting permanently on the coupling. Covering the coupling with adhesive tape can prevent torsion play when the shaft is rotating.

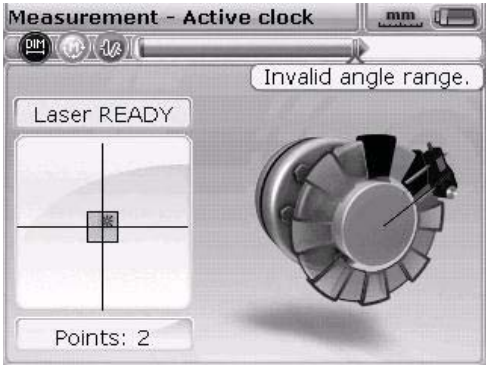
Note

8.1 Rotate shaft!

To measure, rotate the shaft to the first measurement position. Measurements can only be taken if the sector in which the shaft was rotated is highlighted. Press Enter to take the first measurement point. The sector is then marked in black to show that a measurement has already been taken in this sector.



After taking the measurement, rotate the shaft into the next sector and repeat the process.



In this example, the transducer is in a sector marked in black. No measurement can be taken at this angle.

In active clock measurement mode, the electronic inclinometer in the transducer is active and automatically sets the shaft rotation angle.

Note

Make sure that you do NOT touch the measurement components (transducer, reflector and chain-type bracket)!
Use the shaft to start its own rotation — do not use the chain-type bracket to help gain momentum!
The shafts should be rotated in the normal direction of operation.
In continuous measurement mode, rotating the shafts or pressing the enter key begins measurement, even if the laser beam is not adjusted to strike the centre of the crosshairs exactly.

8.2 Laser end or Laser off? Extend the measurement range

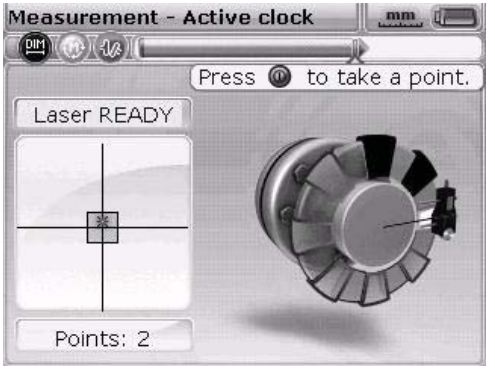
The 'Laser end' or 'Laser off' messages indicate that the laser has drifted out of the measurement range of the detector and no measurement values are being taken. You can also use the optional 'Extend measurement range' function, which is described in detail on page page 81.

The 'Extend measurement range' option is only available in active clock and static measurement modes.

Note

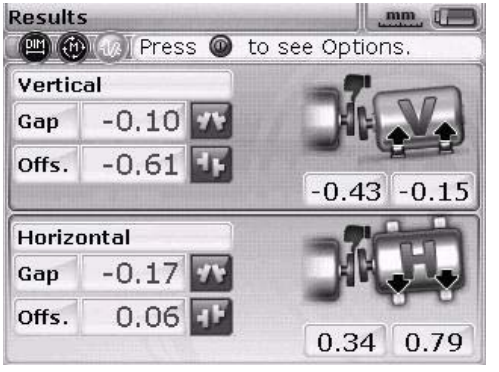
9. Results

The alignment results are opened automatically once the set number of measurement points has been taken.



If, in active clock mode, the number of measurement points has been set to four, the results can be accessed after three measurement points have been taken by pressing .

9.1 Alignment results in vertical and horizontal directions



The vertical foot results show that the back feet on the right-hand machine must be raised with a 0.45 mm shim.

Coupling results are given in the form of gap and offset values in horizontal and vertical directions.

Sign convention
POSITIVE GAP: Opens at the top and away from the viewer.
POSITIVE OFFSET: If the machine on the right is higher or further away from the viewer than the machine on the left.

Note

If all four coupling values are within the tolerance, the machines do not need to be aligned. If no in-house standards or specifications from the coupling or machine manufacturer are available, the FAG Top-Laser EQUILIGN system provides a tolerance check, shown by an indicator LED and the 'thumb' icon:

- LED lights up blue: measured alignment within tolerance
- LED lights up red: measured alignment outside tolerance

In the last two cases, the machines must be aligned.

If the coupling results indicate that the misalignment is too great, then the machine must be shimmed vertically and/or moved horizontally to align it.

9.3 Tolerances

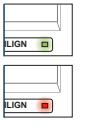
The 'thumb' icon on the display screen shows the degree to which the measured alignment status lies within the tolerance. These foot tolerances are calculated from the coupling tolerances. The 'thumb' icon indicates whether the alignment is within or outside the tolerance.

Within the tolerance

Outside the tolerance

The FAG Top-Laser EQUILIGN indicator LED provides further information on the tolerance status.

Tolerance	Thumb icon	LED colour
within	up	green
outside	down	red



9.3 Tolerance table

It is possible to display the FAG Industrial Services GmbH tolerance table, which is only valid for standard equipment running between 600 and 6000 RPM.

Suggested alignment tolerances are based upon experience and should not be exceeded. They are to be used only if no in-house standards or specifications from the coupling or machine manufacturer are available.

Note

Information about opening the tolerance table can be found on page 93.

10. Aligning the machine

The machines can now be aligned using the foot results. Remember that if all feet lie within the tolerance range (indicator: thumbs up and the LED lights up blue or green), then the machine does NOT need to be aligned.

Note

To align your machine, move it vertically by shimming the feet and horizontally by moving it to the side. These adjustments can be made in succession or simultaneously, but following the procedure described below is recommended:

10.1 Shim first

We recommend shimming first, unless the horizontal corrective movement required is significantly greater than that resolved by shims.
Shimming means lifting the machine and inserting or removing shims with a specified thickness under its feet. FAG LASER-SHIMS are durable and labelled with their thickness.

First move the machine horizontally if the horizontal correction required is very large, as horizontal corrections move the feet to a different position on the base. It is therefore possible that the machine may need to be checked for soft foot again before continuing the alignment process.

Note

10.1.1 Preparation

To shim the machine correctly, ensure the following:

1. Feet are clean, intact and mobile
2. Soft foot has been eliminated
3. There are enough shims under the machine to enable it to be lowered if necessary
4. High-quality shims such as FAG LASER-SHIMS are available.

10.1.2 Loosen bolts

Avoid moving the machine horizontally. If one of the feet comes off the ground when loosening the bolt, there is a soft foot problem.

10.1.3 Shim feet

Use the vertical foot results to shim BOTH the front and back feet. Negative foot values mean that shims must be added, while positive foot values mean shims must be removed.

Vertical Live MOVE (real time movement) can also be used to move the machine vertically.

Note

10.1.4 Retighten bolts

The machines should now have good vertical alignment.

10.1.5 Measure again

Measure again to verify the shims and to determine the exact alignment status.

10.2 Horizontal Live MOVE

Horizontal MOVE is used to position the machine laterally. The conventional method is to use dial gauges on the machine feet, but with the MOVE function, the horizontal movement of the machine can now be followed in real time on the display screen.

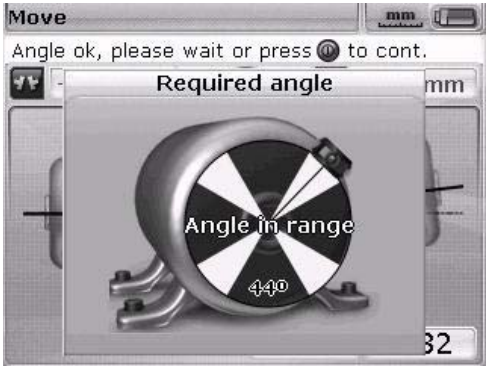
10.2.1 Start horizontal Live MOVE

On the results screen, press Enter. The 'Results Options' screen opens.

Use the navigation keys to highlight the 'Move' icon, then press Enter to confirm the selection. A screen opens to angle the shaft at any 45° position to the transducer.

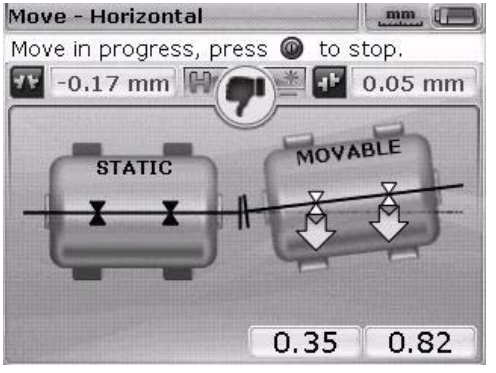
10.2.2 Rotate shaft into a 45° position

Rotate the shaft into any 45° position (10:30, 1:30, 4:30 or 7:30 position as viewed from the coupling towards the transducer).



If the laser is centred and the shaft is rotated into one of the green sectors, then the screen to select the direction of movement will open automatically.

Use the ◁ / ▷ keys to highlight 'Horizontal' for horizontal machine movement. Press Enter to confirm the selection. Live MOVE starts immediately.

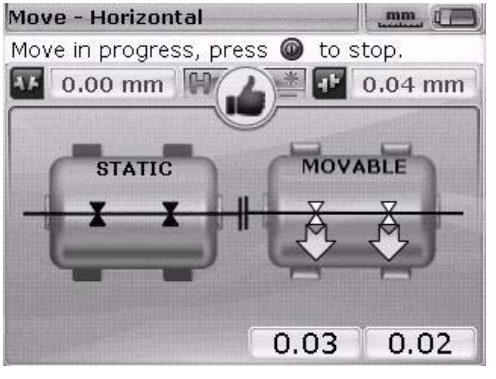


10.2.3 Loosen bolts and move the machine as shown

Loosen the foot anchor bolts and move the machine feet in the direction of the yellow arrows, taking note of the thumb icon on the display screen. The movement changes the arrow size automatically. Watch the display screen carefully to ensure that the sides of the machine and direction of movement match. The thumb icon on the display screen and the FAG Top-Laser EQUILIGN LED show the alignment status while the machine is being moved.

Never attempt to move the machine with heavy blows from a sledgehammer, as this will not only damage the measurement components but also lead to bearing damage on the machine. Adjustable screws on the machine or other mechanical/ hydraulic aids are not only more convenient to use but also protect the materials.

Caution



If a laughing smiley appears or if the smiley converts into an 'OK' icon, the alignment

status is within the tolerance. Press Enter to confirm the alignment status after alignment correction.

10.2.4 Tighten foot anchor bolts

Tighten the foot anchor bolts and check the results on the screen one more time. If tightening the foot anchor bolts changes the results, check the machine for soft foot or funnel-shaped washers. If necessary, carry out the measurement again.
If the values are correct, press the Enter key to save the measurement results.

10.2.5 Measure again after MOVE — machine within tolerance?

As the machine has been moved, previous measurement results are no longer valid. Once the MOVE process is complete, highlight 'OK' and press Enter to confirm the selection. The measurement mode is initialised on confirmation. If necessary, centre the laser beam and take another set of measurements. The machines are aligned if the results are within the required tolerance.

10.2.6 Save and print data

See the 'Saving and printing data' chapter.

10.2.7 Disassembly

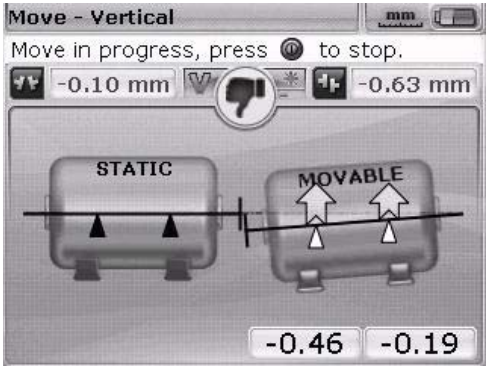
Switch off the FAG Top-Laser EQUILIGN computer. Remove the measurement components from the shaft and store them in the case.

Place the protective housing back on the machines before switching them back on.

Caution

10.3 Vertical Live MOVE

For vertical Live MOVE, repeat steps 10.2.1 to 10.2.3 on the previous pages while taking note of the vertical foot corrections.

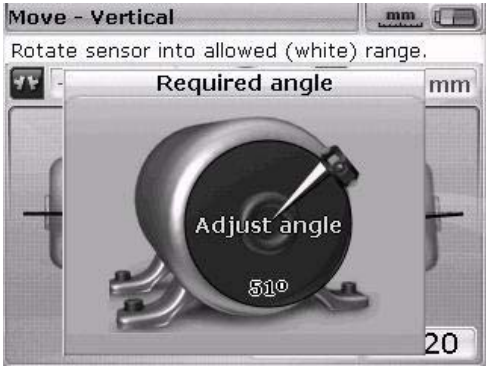


10.4 Important points during the MOVE process

Follow points 10.4.1 to 10.4.5 closely during the MOVE process.

10.4.1 Has the shaft been moved by accident?

The shaft, transducer and reflector must NOT be moved for the duration of the MOVE procedure! If the shaft moves from its set 45° position during the MOVE process, the angle selection screen opens showing the current angle position for the shaft.



Live MOVE resumes automatically once the shaft is rotated back to its previous 45° position.

Note

10.4.2 Laser end or Laser off? Extend the measurement range

The 'Laser end' or 'Laser off' messages indicate that the laser has drifted out of the measurement range of the detector and no measurement values are being taken. In this case, you can extend the measurement range during measurement. See the 'Alignment options' chapter, 'Extend measurement range' section on page 50.

10.4.3 Approaching zero value: Note the thumb icon and computer LEDs

Move the machine so that the values displayed for both machine ends approach zero value. The colour of the computer LED changes from red (poor alignment) to green (good alignment).

10.4.4 Soft foot

The effect of the MOVE function is affected by soft foot on the machine, resulting in the machine changing its position every time the bolts are loosened and tightened. For this reason, make sure to eliminate any soft feet before starting the alignment process.

10.4.5 Do the measurement values deteriorate after alignment?

Possible causes:

- Brackets mounted incorrectly
- Brackets used to help rotate the shaft
- Significant play between couplings
- Soft foot can lead to positioning errors, meaning measurements need to be taken again
- Loosened foot anchor bolts
- Yellow locking screws on the transducer loosened or reflector not secured
- Fluctuation in temperature: Has the machine only recently been shut down?
- Mounting: Have the laser and transducer been switched?
- Mounting: Has the transducer been rotated 180° when mounted (cable pointing upwards)?
- Any vibrations?

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11. Saving and printing data

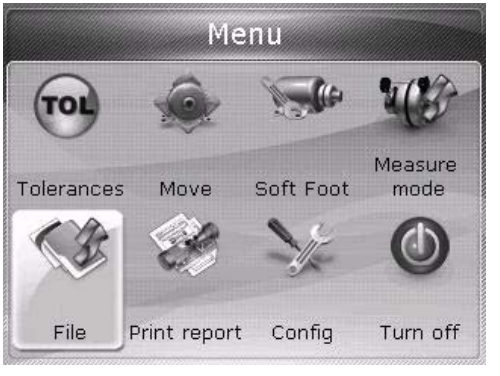
Before switching the device off, please save all dimensions, measurements, results and all settings in the device's non-volatile memory for use in analysis, future applications or as measurement documentation.

The length of possible file names depends on the use of upper or lower case letters.

Note

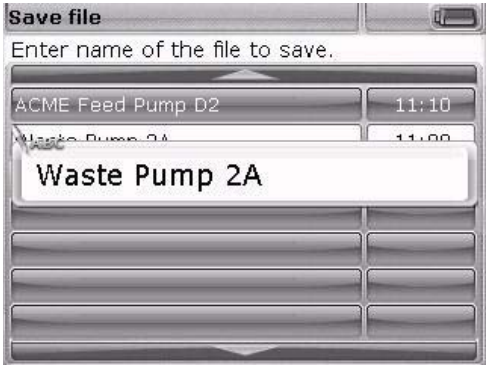
11.1 Save the file

The measurement file currently in use can be saved at any time. Press Menu and highlight the 'File' icon using the navigation keys.



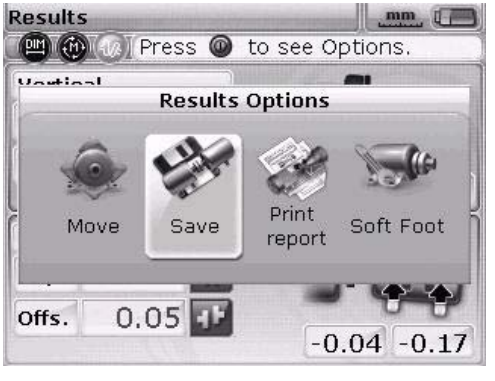
Press Enter to confirm the selection. The file menu screen opens.

Highlight the 'Save file' icon and press Enter to confirm the selection. An empty editing box appears on the 'Save file' screen.

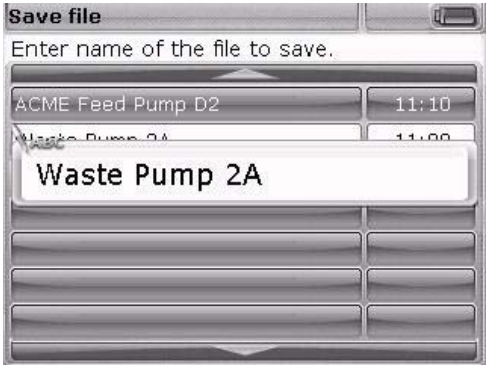


If the name contains both upper and lower case letters and numbers, use ·/* to cycle through these three options. Press and hold down ·/* while observing the indicator in the top left corner of the editing box. The indicator switches between the types of character that can currently be entered (upper case, lower case or numbers). Spaces are entered by pressing 0␣.

Use the data entry keys to enter the file name and press Enter to confirm the entry. Measurement files can also be saved on the results screen after measurements have been taken by pressing Enter on the results screen and using the navigation keys to highlight the 'Save' icon.

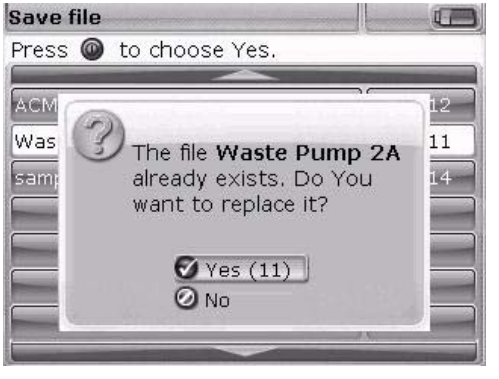


Press Enter to confirm the selection. An empty editing box appears on the 'Save file' screen. If a measurement file is being saved for the first time, then an empty editing box appears. The file name can be entered using the data entry keys and confirmed by pressing Enter. However, if the file has been saved once already, the editing box appears containing the existing file name highlighted.



In this example, the file 'Waste Pump 2A' had already been saved once, so the file name appears in the editing box.

Press Enter to save the measurement results under the name displayed. A query appears asking for confirmation to overwrite the existing file.



Overwriting the last version ensures that the measurement file is saved together with the latest alignment results.

It is good practice to have the latest alignment data available at all times.

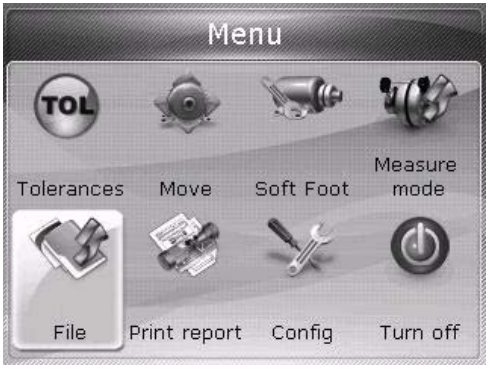
Note

Use △/▽ to highlight 'Yes' and press Enter to overwrite the existing file.

11.2 Print measurement reports

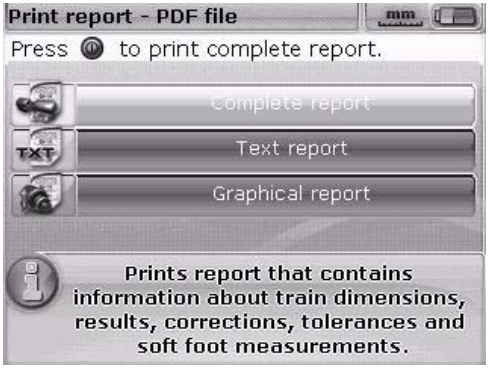
Measurement reports can be printed directly from the FAG Top-Laser EQUILIGN computer on a printer using the 'LASER-EQUILIGN.USB-CABLE'.

There are various ways of printing measurement reports.
To print the current measurement report, press the Menu key and use the navigation keys to highlight the 'File' icon.



Press Enter to confirm the selection. The file menu appears. Use the navigation keys to highlight the 'Print report' icon.

Press Enter to confirm the selection. The 'Print report' screen opens.



In this example, the print option to print a complete report has been selected, containing both graphics and text. The selected printer is visible in the header; in this case 'HPDeskJet450'.

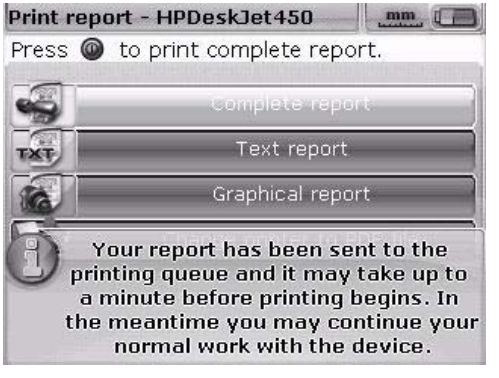
Note that in FAG Top-Laser EQUILIGN, the default printed copy is a PDF file. With this option selected, the printed copy of the measurement report is saved automatically as a PDF file. This file can then be printed out on any printer compatible with Windows. See the 'Available print options' section on Page 68.

FAG Top-Laser EQUILIGN offers three different printing options. Use the △/▽ keys to highlight the required format.

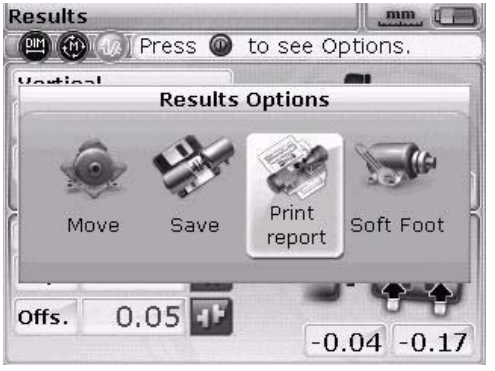
Make sure that the FAG Top-Laser EQUILIGN computer is connected to the printer via a USB cable and that the printer is fully configured. Follow section '11.3 Printer configuration' if it is not configured.

Note

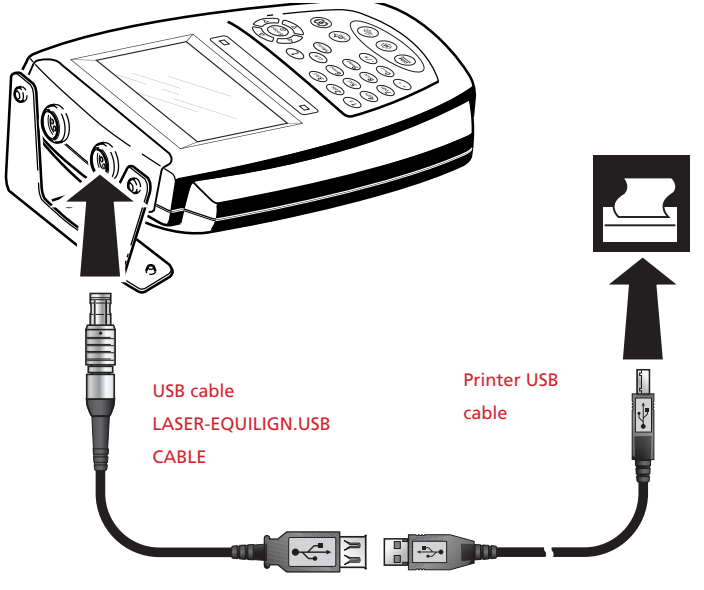
Press Enter to print the measurement report for the selected measurement file.



Alternatively, the measurement report can be printed directly via the results screen by pressing Enter on the results screen. The 'Results Options' screen opens. Use the navigation keys to highlight the 'Print report' icon.



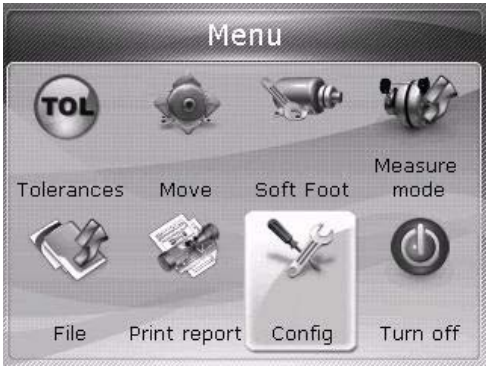
Press Enter, to open the 'Print report' screen. Choose the format of the report, connect the printer and print the report as described in the section above.



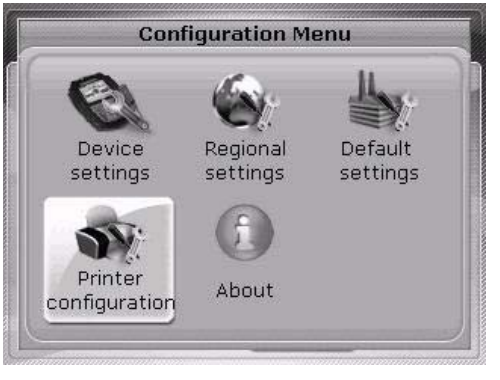
The FAG Top-Laser EQUILIGN computer is connected to the printer via the short USB cable and the printer USB cable. The printer USB cable is a printer accessory and is available from most electronics retailers.

11.3 Configure the printer

If the measurement report cannot be printed, check the printer settings. The settings can be configured in the menu. Press Menu and use the navigation keys to highlight the 'Configuration' icon.



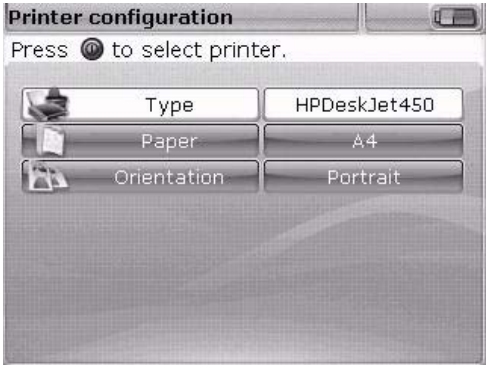
Press Enter to confirm the selection. The 'Printer configuration' screen opens. Use the navigation keys to highlight the 'Printer configuration' icon.



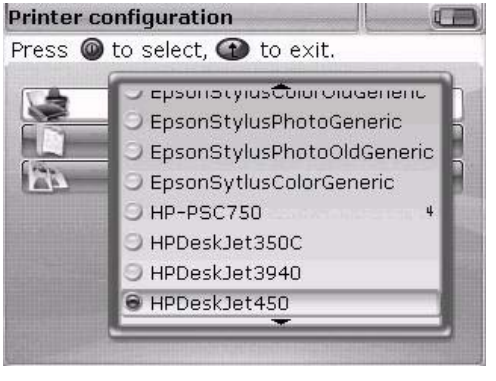
Once highlighted, press Enter to open the Printer configuration options.

11.4 Available printing options

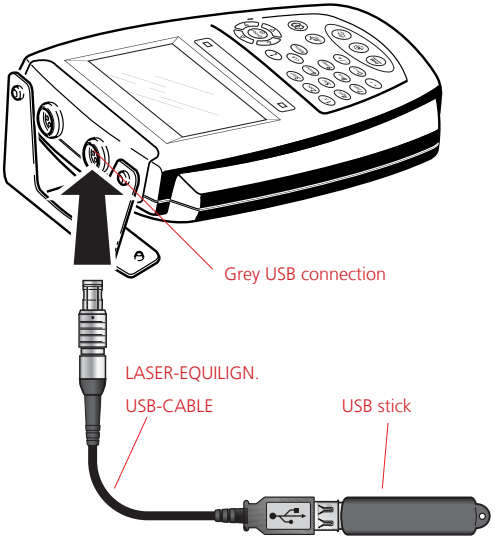
The 'Printer configuration' screen shows the options available.



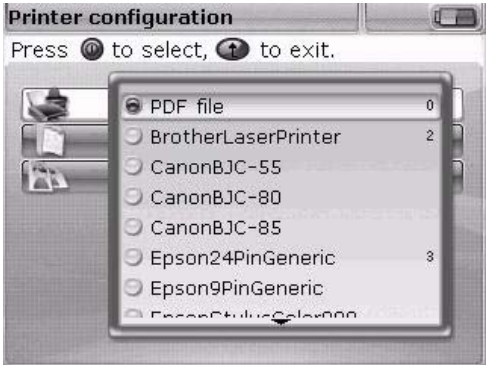
Use the △/▽ keys to highlight the option that you want to change. Press Enter.
A selection window opens with the available settings.



Use △/▽ to select a printer. Highlight a printer and press Enter to confirm the selection.

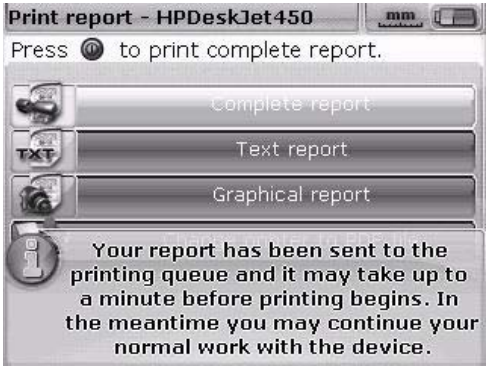


Measurement files can also be saved directly as PDF files by selecting the 'PDF file' option, which enables files to be shared immediately and printed by any printer compatible with Windows.
Use the △/▽/0 keys to highlight 'PDF file' on the top line of the printer selection.



If 'PDF file' is selected, press Enter to confirm the selection. Selecting this printer configuration saves the measurement report as a PDF file when printing.

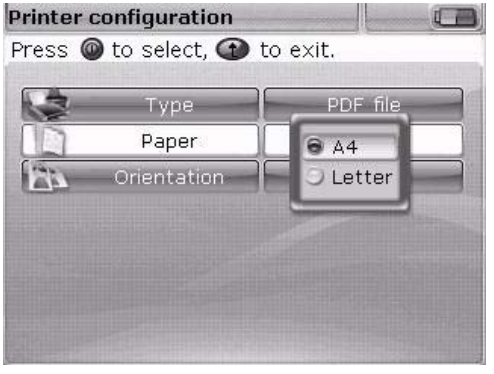
If the selected printer configuration is 'PDF file', measurement reports from FAG Top-Laser EQUILIGN can be saved directly as PDF files. Select one of the printing options that was described in section 11.2. On the 'Print report' screen, use the △/▽ keys to highlight the required report format.



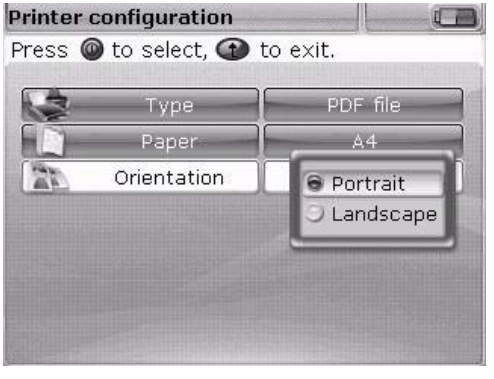
Before confirming the saving process, ensure that the short FAG Top-Laser EQUILIGN USB cable is inserted in the grey FAG Top-Laser EQUILIGN USB connection and a FAG memory stick is connected to the short cable.
The FAG Top-Laser EQUILIGN directory on the memory stick should be empty to prevent updates from being launched accidentally.

Note

Press Enter to save the selected measurement file as a PDF file.



Highlight the required paper size using the ▵/▿ keys. Press Enter.



Change the paper orientation to 'Portrait' for a vertical layout or 'Landscape' for a horizontal layout using the ▵/▿ keys. Press Enter.

Switch between the options for two of the settings ('Paper' and 'Orientation') using the ◃/▹ keys. For example, when 'Paper' is highlighted, use the ◃/▹ keys to switch between the options for 'A4' and 'Letter'.

Note

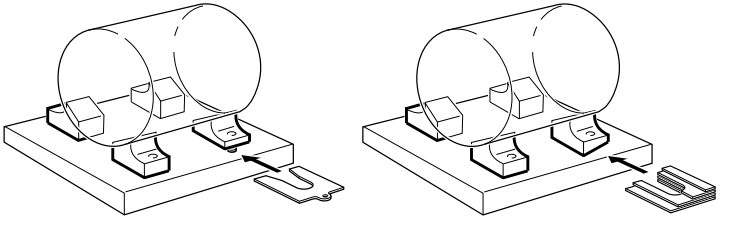
Soft foot

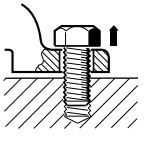
The term 'soft foot' refers to a machine foot lifting up from the base when its bolt is loosened. Possible causes include:

- The contact surfaces on the machine foot and base are not parallel
- Deformed machine feet, deformed housing
- External forces (pipe connections etc.)
- Inaccurate shimming, soiled/rusty machine feet
- If too many shims are placed under one machine foot, they may act as a spring assembly (a maximum of four to five shims should be used)

Possible consequences include increased vibrations, bearing damage from strain in the housing or premature machine failure.

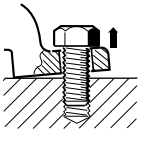
Soft foot should be eliminated before making any alignment. The FAG Top-Laser EQUILIGN soft foot function reduces the time required to eliminate soft foot to only a few minutes, as the only task is to loosen each individual foot screw. If, as a result, the foot and the entire machine move upwards, there is a case of soft foot. This movement is recorded by the computer. Soft foot can be eliminated using shims.





Parallel soft foot

One or two machine feet are too short or too long. The machine tilts diagonally. Parallel soft foot is corrected by shimming ONE of the feet that is too short.



Angular soft foot

The contact surface of the foot is at an angle to the base (there is only partial contact). Feeler gauges must be used to ascertain the direction of inclination. Angular soft foot is corrected with a 'wedge' or by machining the surface of the foot.

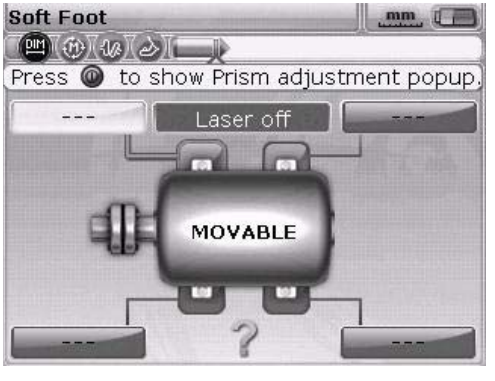
Measuring and correcting soft foot conditions

There are three different types of soft foot: parallel, angular and induced soft foot. In some instances, soft foot is a combination of two or more types. Checking for soft foot is part of the preparatory work for alignment measurements.

Any machine to be measured typically has four feet in an approximately square formation. If a machine has six feet, the measurement should be conducted in two parts: first the four feet to the front, and then the four feet to the rear. Soft foot is only measured on machines that are defined as movable and have been provided with dimensions.

Note

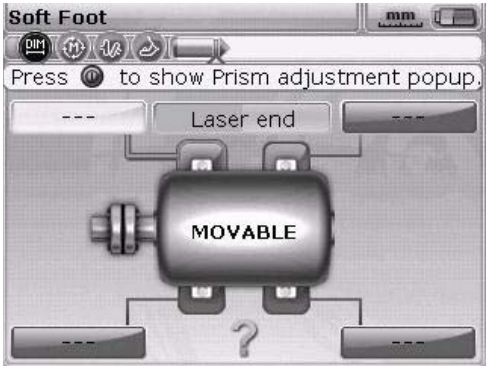
Start up the FAG Top-Laser EQUILIGN computer in the usual way, as described in the 'Getting started' chapter. Centre the laser beam as described in chapter '7.2.5 Laser beam adjustment' on Page 45.
Rotate the shaft so that the transducer and reflector are either positioned at 3 o'clock or 9 o'clock.
Enter the machine dimensions and then press . If the laser beam is not correctly centred, the following screen appears:



Centre the laser beam as described in chapter '7.2.5 Laser beam adjustment' on Page 45 or follow the instructions on-screen.

The 'Soft foot' screen can also be accessed via the menu. Press the Menu key and then use the navigation keys to highlight the 'Soft foot' icon. Press Enter to confirm the selection.

Follow the instructions on-screen to centre the laser beam.



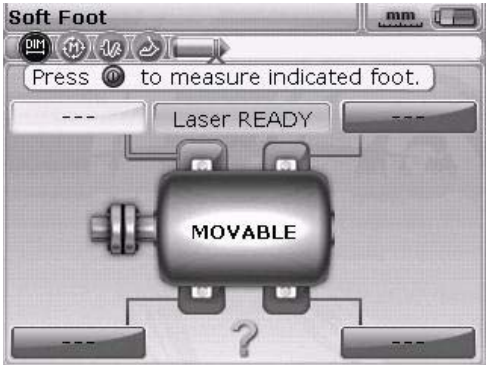
In this example, the instructions on-screen show that Enter must be pressed in order to open the laser beam adjustment help screen.

After pressing Enter, the laser beam adjustment help screen opens.

If soft foot has been measured in the order specified, then the laser beam adjustment help screen appears automatically and does not need to be opened.

Note

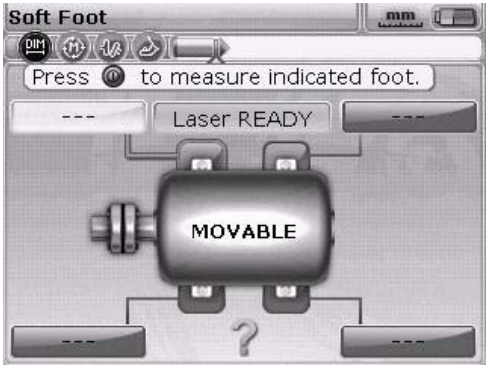
Follow the instructions on-screen and adjust the laser beam by rotating the adjustment screw or the yellow adjustment knob.



Centre the laser beam and press the Enter or t key.

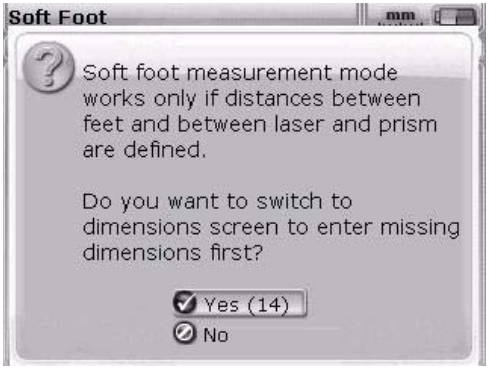
If the laser beam has already been centred during set up, the following screen appears:

Note



If not all dimensions have been entered into the dimensions screen, the following screen appears:

Note



Use the △/▽ keys to highlight 'Yes' and press Enter to confirm the selection.
The dimensions screen reappears so that the missing values can be entered.

If the shaft has not been positioned correctly at 3 o'clock or 9 o'clock, the following screen appears:

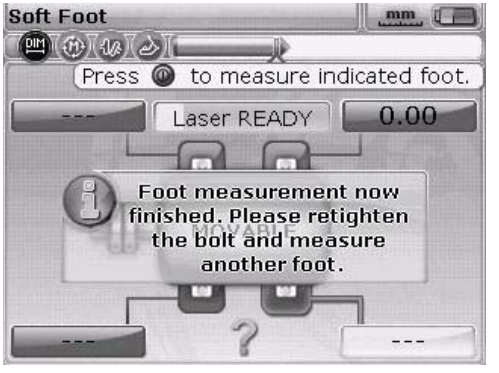
Rotate the shaft to the correct 3 o'clock or 9 o'clock position (green segments in the circle) and continue the measurement process.

If the message 'Angle ok' appears, press either Enter or L to continue the measurement process or wait until the process continues automatically.

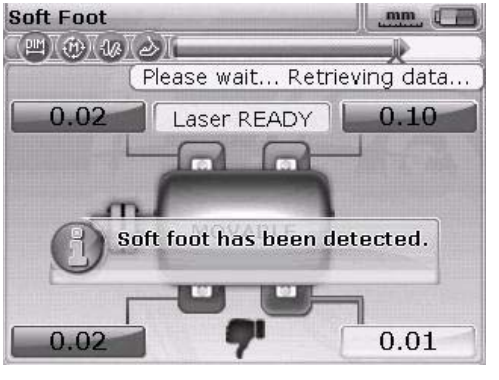
Use the navigation keys to highlight the foot that will be measured. Press Enter to confirm which foot has been selected.

After selecting a foot, the spanner icon appears to indicate that the foot anchor bolt should be loosened:

Loosen the corresponding foot anchor bolt then press the Enter key.



Loosen the corresponding foot anchor bolt. The measured distance by which the foot has lifted is shown on the screen.
Press Enter to save the value and display it on the screen permanently. Retighten the foot anchor bolt. The next foot is highlighted automatically. Any other foot can be highlighted as required using the navigation keys.
Repeat the process for each foot. Use the navigation keys to highlight the next foot.



The default foot tolerance is 0.06 mm. If any single foot exceeds this tolerance, a 'thumbs down' icon appears immediately.

Corrections for the feet are calculated with the four foot values. Please note that these values are saved together with the dimensions, measurements and results in the measurement file and also appear in the measurement report.

Parallel soft foot — correction

Parallel soft foot is present if two large values and two small values are diagonally opposite to each other. The machine rests on both of the higher feet and tilts towards the lower feet.

Angular soft foot — correction

If one individual foot value is considerably higher than the others, it is called angular soft foot.

To correct angular soft foot, the direction in which the soft foot is angled must first be determined by loosening the foot bolt and using feeler gauges.

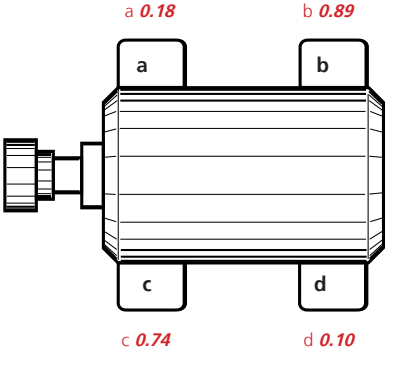
If the soft foot is 'purely' angular, the shim value will range from zero to twice the thickness displayed. A graduated shim will eliminate angular soft foot.

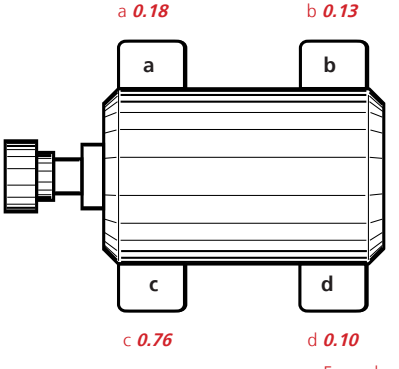
Parallel soft foot

In the example shown here, 89-100 mm shims are inserted under foot 'b' (the foot with the highest value) — just like putting a beer mat under the shortest leg of a wobbly table!

Angular soft foot

If one individual foot value is considerably higher than the others, it is called angular soft foot.





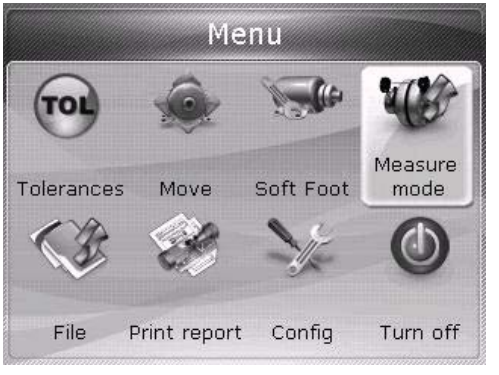
Example values in mm

Alignment options

Measurement modes

FAG Top-Laser EQUILIGN provides both **active clock** and **static (0369) as default measurement modes**.

All measurement modes can be accessed via the menu screen. Press the Menu key to open the menu screen. Use the navigation keys to highlight the 'Measure mode' icon on the menu screen.



Press Enter to confirm the selection.

The 'Measurement Options' screen can only be accessed if all necessary machine data has been entered in the measurement file that is currently open.

Use the navigation keys to highlight the required measurement mode and press Enter to confirm the selection.

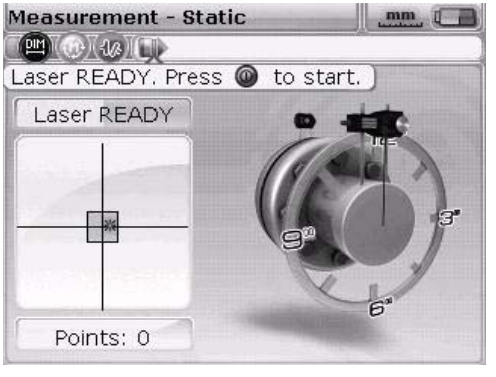
Static measurement mode

This measurement mode is ideally suited for:

- Uncoupled shafts
- Non-rotatable shafts

Centre the laser beam as described in chapter '7.2.5 Laser beam adjustment' on page 45. Rotate the shaft into any of the eight possible 45° positions (i.e. 12:00, 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 or 10:30, as viewed from the coupling towards the transducer). Position the shaft as precisely as possible.
Use an external inclinometer, a spirit level or protractor for accuracy. In this mode, the internal inclinometer in the FAG Top-Laser EQUILIGN transducer is deactivated.

Position the clock hour hand on the screen in the corresponding shaft position.



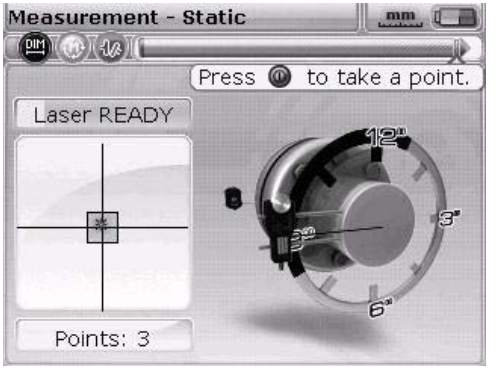
Move the clock hour hand to the next 45° position by pressing the navigation keys.

Press Enter to take the first measurement point. Rotate the shaft in the normal direction of operation to the next measurement position. Make sure that the shaft is placed exactly in a 45° position. Use the navigation keys to move the clock hour hand into the corresponding shaft position on the display screen. Press Enter to take the next measurement point.

If machine conditions at a certain shaft position mean that no measurement can be taken, use the navigation keys to bypass the corresponding measurement position on the display screen.

Note

At least three measurement points must be taken at a 90° rotation angle. It is advisable to take more measurement points over a larger rotation angle.



Once measurement is complete, press the key to display the results.

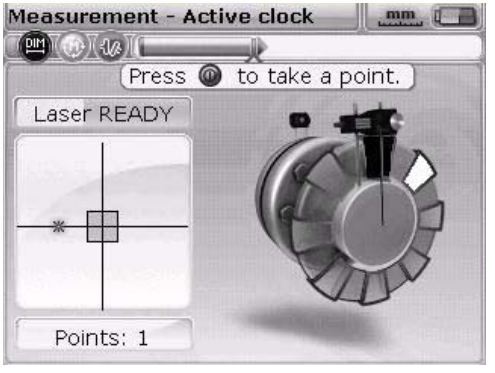
Extending the measurement range — InfiniRange

Gross misalignment of shafts or a small angular misalignment over a large distance can lead to the laser drifting out of the detector measurement range during measurement. The message 'Laser end' or 'Laser off' appears on the screen. In this case, the 'Extend measurement range function can be helpful.

The 'Extend measurement range' function is not available in continuous measurement mode.

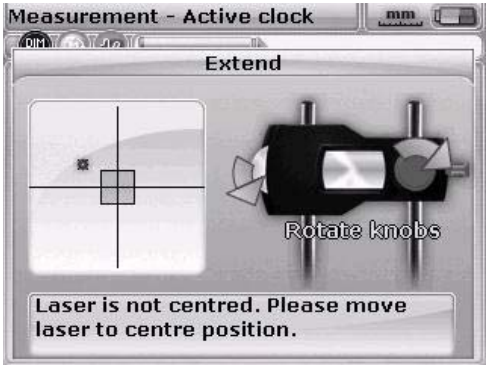
Note

1. If the message 'Laser end' appears during measurement, rotate the shafts back until the laser beam is within the measurement range again. The message 'Laser OK' or 'Laser READY' appears on the screen again.

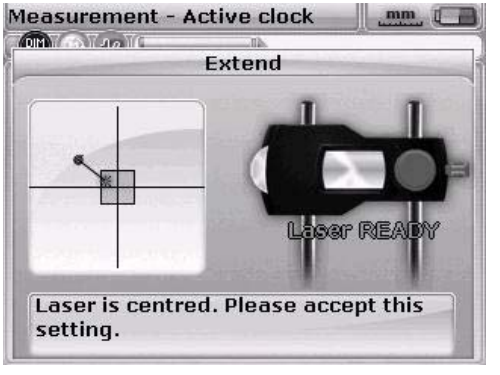


2. Press Menu, to open the menu. Use the navigation keys to highlight the 'Measurement mode' icon on the menu screen and press Enter to confirm the selection. The 'Measurement Options' screen opens.

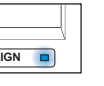
3. Use the navigation keys to highlight the 'Extend' icon on the 'Measurement Options' screen and press Enter to confirm the selection. The computer interrupts the measurement and switches to the laser beam adjustment screen. The current beam position is recorded automatically and is used as the starting point for extending the measurement range.



4. Re-adjust the laser beam to strike the target box using the yellow adjustment knob and the thumbwheel on the side of the reflector.



5. Once you have centred the laser point, the LED on the computer lights up blue. The set laser beam position is recorded and automatically becomes the end point for laser beam deviation.



6. Continue the measurement as previously described. Rotate the shafts and press Enter to take measurement values at each of the required measurement positions.

The computer considers the laser beam readjustment in all further alignment calculations.

The message 'Laser end' is displayed if the reflected laser beam does not strike the detector. This situation arises when machines are extremely misaligned or if the measurement paths are too long. No measurements can be taken while this message is displayed.

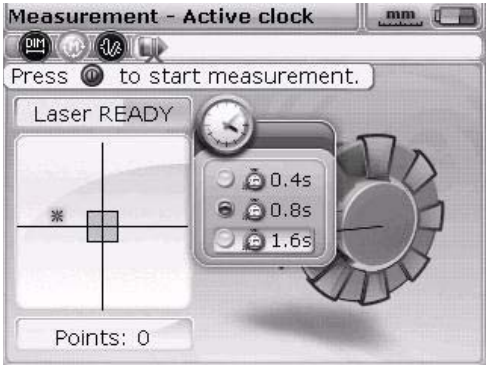
Note

Averaging

In certain alignment situations, the average must be taken from a high number of measurement values to reach the level of accuracy required. Particular cases include industrial facilities that are exposed to increased machinery vibrations. An increased average also improves accuracy when measuring plain bearings, white metal bearings and journal bearings.

The number of individual measurements needed for the averaged measurement is set on the 'Measurement Options' screen. Press Menu to open the menu. Use the navigation keys to highlight the 'Measurement mode' icon on the menu screen and press Enter to confirm the selection. The 'Measurement Options' screen opens.

Use the navigation keys to highlight the 'Averaging' icon, then press Enter to confirm the selection.



The setting options for calculating the average range from 0.4 seconds (smallest value) to 1.6 seconds (largest value).

Calculating an average is possible in the 'static measurement mode'. The selected setting for the average is also valid for measuring soft foot and for Live MOVE. If a higher average is selected (e.g. 1.6 seconds), more time and patience must be exercised when taking the measurements to allow the FAG Top-Laser EQUILIGN computer to 'catch up' with machine movement (MOVE). In this instance, it takes 1.6 seconds to take each measurement needed to update the graphical format!

Note

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Upgrading FAG Top-Laser EQUILIGN firmware

Upgrading the FAG Top-Laser EQUILIGN computer

- Use the enclosed FAG USB memory stick to update FAG Top-Laser EQUILIGN firmware.
- Check our website to see if you own the latest version (www.schaeffler.com/services). If you have any questions, please contact our support team.

Note

Old FAG memory sticks must be disposed of in accordance with the WEEE Directive (Waste Electrical and Electronic Equipment). Do not dispose of memory sticks in household waste!

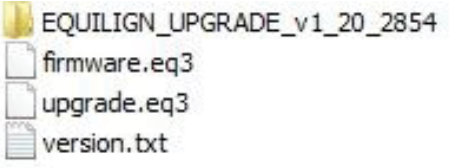
1. Download the latest upgrade from the Schaeffler website

The file available for download is a .zip file. Download the file to any directory desired. e.g.: C:\temp\

Extract the file and copy the resulting files to the FAG memory stick.

2. Upgrade the firmware

Use the memory stick and the 'short' FAG Top-Laser EQUILIGN USB cable to upgrade firmware. No PC is required during the upgrade. Before starting the upgrade, make sure that the memory stick contains the following files:



Open the directory on the memory stick to see the files and further directories it contains.

a) Press Enter to switch on the FAG Top-Laser EQUILIGN computer. Wait for the dimensions screen to open.

Before continuing with the upgrade, make sure that the battery is at least 50% charged. If not, first recharge the battery to full power (for rechargeable batteries) or replace all five 'AA' batteries simultaneously (for non-rechargeable batteries).

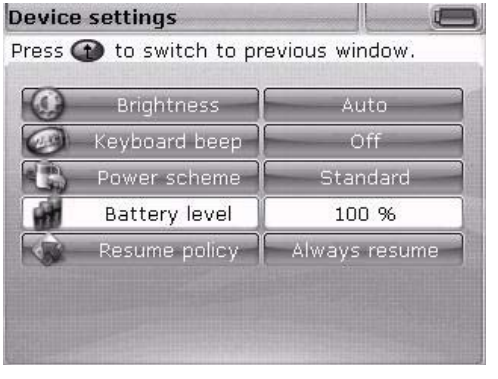
Note

To check the battery charge level:

› Press Menu

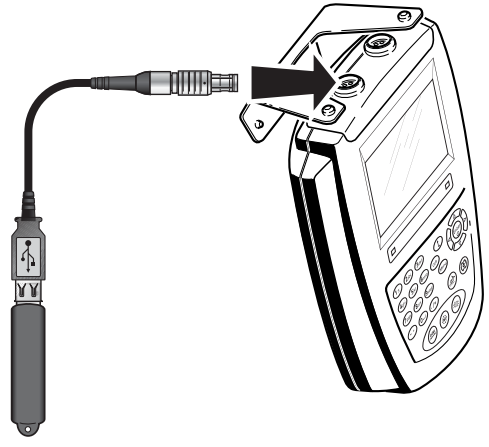
› Use the navigation keys to highlight the 'Configuration' icon. Press Enter to confirm the selection

› Use the navigation keys to highlight the 'Device settings' icon in the configuration menu. Press Enter to confirm the selection. The current battery charge level is shown on this screen.



b) Insert the 'short' FAG Top-Laser EQUILIGN USB cable into the grey USB port on the FAG Top-Laser EQUILIGN computer.

c) Once it has been checked, connect the FAG memory stick to the 'short' USB cable.



d) A message appears saying new firmware is available and that the FAG Top-Laser EQUILIGN computer must be re-started.

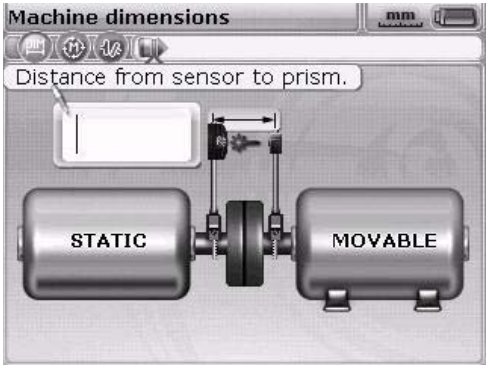
e) When the message shown above appears, press and hold Enter to restart the computer. The display will also switch off.

f) After a short time (approx. 10 seconds), the upgrade process starts automatically. The computer beeps and the alignment status indicator LED flashes when the process starts.

Do NOT remove the memory stick from the computer and do NOT switch the computer off during the upgrade (duration approx. 4 minutes).

Note

g) Shortly before the upgrade process ends, the screen below appears. The dimensions screen is displayed shortly afterwards.



h) Once the dimensions screen has appeared, press Menu. Use the navigation keys to highlight the 'Configuration' icon. When the icon is highlighted, press Enter to open the configuration menu.

i) Use the navigation keys to highlight the 'Details' icon. When the icon is highlighted, press Enter to confirm the selection. The 'Details' screen opens.

The new firmware version on the FAG Top-Laser EQUILIGN computer is now ready to use and can be found on the 'Application details' screen. The current application build, the number of functions installed and further information is also displayed.

The USB cable can now be removed from the FAG Top-Laser EQUILIGN computer.

Note

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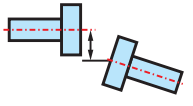
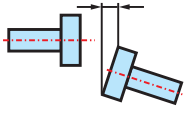
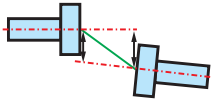
Appendix

Recommended alignment tolerances

	[RPM]	Metric [mm]	Imperial [mils]
Soft foot	All	0.06 mm	2.0 mils
Short 'flexible' couplings Offset 		Good 	Good 
	600		9.0
	750	0.19	
	900		6.0
	1200		4.0
	1500	0.09	
	1800		3.0
	3000	0.06	
	3600		1.5
	6000	0.03	
	7200		1.0
Angular offset (gap) Width of gap per 100 mm coupling diameter 	600		15.0
	750	0.13	
	1500	0.07	
	1800		5.0
	3000	0.04	
	3600		3.0
	6000	0.03	
	7200		2.0

[continued]

	[RPM]	Metric [mm]	Imperial [mils]
		Good	Good
Spacer shafts and membrane (disc) couplings Offset (per 100 mm spacer shaft length) 	600		3.0
	750	0.25	
	1500	0.12	
	1800		1.0
	3000	0.07	
	3600		0.5
	6000	0.03	
	7200		0.3

FAG Top-Laser EQUILIGN technical data

Computer

CPU	Intel XScale PXA270 312 MHz
Memory	64 MB RAM, 32 MB flash
Display	Type: TFT, transmissive (suitable for sunlight), black/white, backlit LED display Integrated light sensor for automatic adjustment of display brightness according to lighting conditions (longer operation time) Resolution: 320 x 240 pixels Dimensions: 3.5 inches (8.9 cm) diagonal Keyboard: navigation keys, back key, delete key, menu key, alpha-numeric keyboard with additional function keys (dimensions, measurements, results, soft foot and Live MOVE)
LED indicators	Multi-colour indicator LED for laser beam adjustment and alignment status Multi-colour indicator LED for battery/rechargeable battery charge level
Power supply	Batteries: 5 x 1.5 V IEC LR6 ('AA') Operating time: typically nine hours (based on an operating cycle consisting of 33% measurement, 33% data processing and 33% standby)
External interface	USB host, USB slave, power/charge cable, RS232 (serial) for transducer
Safety class	Shock proof, dust and water spray resistant (IP 65) Relative humidity 10% to 90%
Temperature range	Operating: -10°C to 50°C, storage: -20°C to 60°C
Dimensions	Approx. 220 x 165 x 45 mm
Weight	742 g
CE conformity	CE requirements for electrical equipment (73/23/EEC) and electromagnetic compatibility (2004/108/EC) are fulfilled.

[continued]

Transducer

Details	Measurement principle: coaxial, reflected laser beam
	Safety class: IP 67 (resistant to dust and immersion in water)
	Protection from ambient light: yes
	Storage temperature: -20°C to 80°C
	Operating temperature: 0°C to 55°C
	Dimensions: approx. 107 x 70 x 49 mm
	Weight: approx. 177 g
Laser	Type: Ga-Al-As diode laser
	Typical wavelength 675 nm (red, visible)
	Safety class: Class 2, FDA 21 CFR 1000 and 1040
	Beam power: < 1 mW
	Safety instruction: Do not look into the laser beam!
Detector	Measurement range: any, dynamically extendable
	(U.S. Patent 6,040,903)
	Resolution: 1 micrometre
	Accuracy (average): > 98%
Inclinometer	Measurement range: 0°-360°
	Resolution: <1°

Reflector

Details	Type: 90° roof prism
	Accuracy (average): > 99%
	Safety class: IP 67 (resistant to dust and immersion in water)
	Storage temperature: -20°C to 80°C
	Operating temperature: -20°C to 60°C
	Dimensions: approx. 100 x 41 x 35 mm
	Weight: approx. 65 g

Transport case

Details	Standard: ABS
	Case dimensions: approx. 500 x 410 x 140 mm
	Weight, including all standard parts: approx. 4.1 kg

EC Declaration of Conformity

en

EC Declaration of Conformity

in accordance with EC – Machinery Directive 2006/42/CE and EMC Directive 2004/108/CE

We hereby declare that the product described below is in conformity with the applicable health and safety requirements of the EC Directive in terms of its design and type and in the execution we have brought into circulation. This declaration shall cease to be valid if any modification is made to the product without our agreement.

Product description:	Shaft Alignment System
Product name:	FAG Top-Laser EQUILIGN

Applicable harmonised standards:

Directive 2004/108/EG	OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility
Directive 2006/95/EG	OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits
DIN EN 61326-1; VDE 0843-20-1	Electrical equipment for measurement, control and laboratory use – EMC requirements - Part 1: General requirements (IEC 61326-1:2005); German version EN 61326-1
DIN EN 61326-2-2; VDE 0843-20-2-2	Electrical equipment for measurement, control and laboratory use – EMC requirements - Part 2-2: Particular requirements - Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems (IEC 61326-2-2); German version EN 61326-2-2

Signatures:

Dipl. Ing. Armin Kempkes
Vice President Services Industrial Aftermarket
Schaeffler Group Industrial

i.V.
Dipl. Ing. Oliver Massa
Department Manager
Product Management

Date:
Herzogenrath, 28.11.2013

This declaration certifies conformity with the stated directives but does not represent a guarantee of characteristics.
The safety guidelines in the user manual must be observed.

FAG Industrial Services GmbH • Kaiserstrasse 100 • D-52134 Herzogenrath • Tel.: +49 2407 9149-99

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FAG Industrial Services GmbH
Kaiserstrasse 100
52134 Herzogenrath
Germany
Tel: +49 (0) 2407 9149 66
Fax: +49 (0) 2407 9149 59
industrial-services@schaeffler.com
www.schaeffler.com/services

Support:
Tel: +49 (0) 2407 9149 99
support.is@schaeffler.com

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