PRÜFTECHNIK
Alignment Systems

OPTALIGN® smart

Operating handbook – Shaft alignment

Number 1 in laser precision alignment

www.pruftechnik.com

A user's handbook

Dear Customer,

If you have any suggestions for improvement or corrections (not just to this manual, but also for hardware), please drop us a line. We would be glad to make improvements wherever possible.
We look forward to hearing from you.

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CE

Foreword

OPTALIGN smart is an addition to the current range of laser alignment systems from PRÜFTECHNIK. OPTALIGN smart is user-friendly, thanks to its intuitive operation, ergonomic design and its many beneficial features. The result of continued development, OPTALIGN smart features an alphanumeric keyboard with strategically placed navigation keys that handles all data entry functions. OPTALIGN smart has a high resolution backlit TFT screen, a long lasting rechargeable battery, handy on-screen context menu, computer LEDs that give the instant status of the alignment condition and a remarkable file storage capacity.

OPTALIGN smart possesses powerful optional features that include among others, the alignment of 3-machine trains and wireless data transmission between computer and transducer.

The instrument has been designed so that its functionality can be expanded.

The system is delivered together with ALIGNMENT REPORTER, a PRÜFTECHNIK Alignment Systems freeware used for generating and printing measurement reports. An intrinsically safe version is also available.

This handbook sets out to help the instrument user work through the instrument with the required ease. It is meant to be a quick learning tool that hopefully should make compelling reading.

PRÜFTECHNIK Alignment Systems
December 2008
Ismaning, Germany

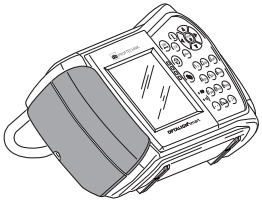
Contents

OPTALIGN smart packages

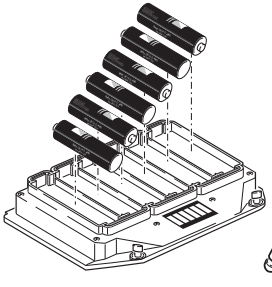
OPTALIGN smart package ALI 12.000

ALI 12.800	**OPTALIGN smart case**
ALI 12.200	**OPTALIGN smart computer including batteries**
ALI 12.600	**OPTALIGN smart battery housing**
ALI 12.201	**Computer stand**

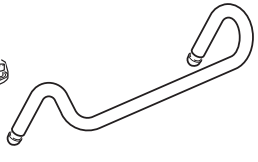
ALI 12.800



ALI 12.200

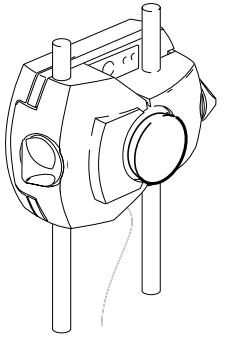


ALI 12.600



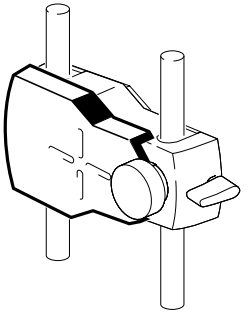
ALI 12.201

ALI 12.100	**OPTALIGN smart transducer including dust cap ALI 5.105**
ALI 12.501–2	**OPTALIGN smart transducer cable**
ALI 5.110	**Reflector including dust cap ALI 5.115**
ALI 2.118	**Chain-type bracket** **Note that the OPTALIGN smart package contains 2 no. ALI 2.118**

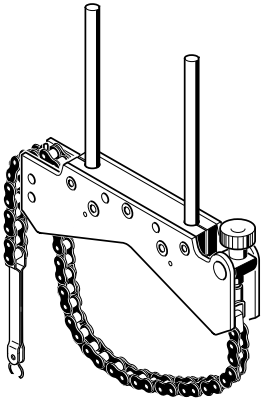


ALI 12.100

ALI 12.501-2



ALI 5.110



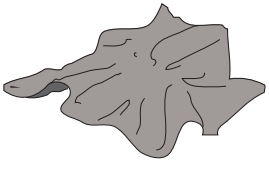
ALI 2.118

ALI 12.502-2	**PC cable for OPTALIGN smart**
ALI 12.503	**USB cable**
ALI 12.700 SET	**USB memory stick for firmware update**
ALI 12.701	**OPTALIGN smart shaft firmware certificate**
ALI 2.905	**Lens cleaning cloth**
ALI 3.588	**Tape measure mm/inch**

ALI 12.502-2

ALI 12.503

ALI 12.700 SET



ALI 2.905

ALI 3.588

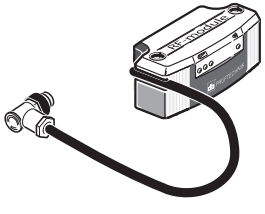
ALI 9.122.G	**OPTALIGN smart pocket guide**
ALI 9.123.G	**OPTALIGN smart operating instructions**
ALI 9.638.G	**Shims mailing insert**
ALI 13.700 CD SET	**ALIGNMENT CENTER CD/Resources CD**
ALI 13.701	**ALIGNMENT REPORTER CD**

ALI 13.701

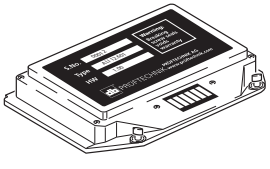
ALI 9.123.G ALI 9.122.G ALI 9.638.G ALI 13.700 CD SET

Optional OPTALIGN smart components

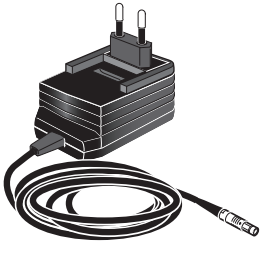
ALI 4.620 SET	**Wireless communication RF module package**
ALI 12.610	**OPTALIGN smart rechargeable battery set**
ALI 12.601	**OPTALIGN smart rechargeable battery**
ALI 12.651.X	**OPTALIGN smart charger (region-dependent)**



ALI 4.620 SET



ALI 12.601

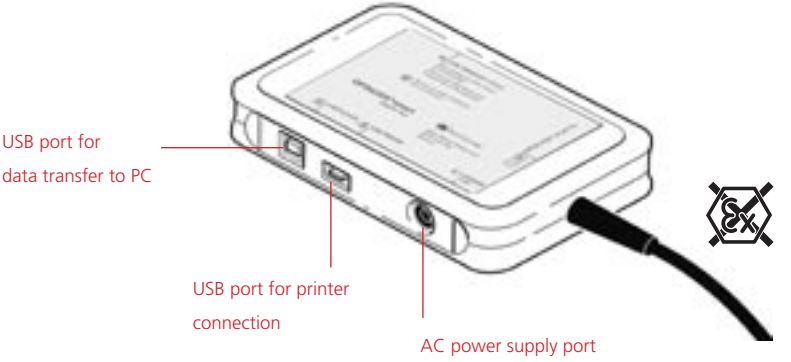


ALI 12.651.X

OPTALIGN smart intrinsically safe package ALI 12.000 EX

ALI 12.801*	**Case for intrinsically safe OPTALIGN smart computer (*part number may differ)**
ALI 12.200 EX	**OPTALIGN smart intrinsically safe version computer including approved batteries**
ALI 12.201	**Computer stand**
ALI 12.100 EX	**OPTALIGN smart intrinsically safe transducer including dust cap ALI 5.115**
ALI 12.500	**Adapter box for intrinsically safe OPTALIGN smart version**
ALI 12.511-2	**Transducer cable connected to instrinsically safe OPTALIGN smart version**

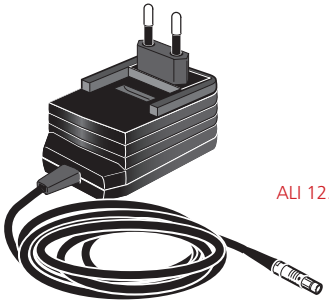
ALI 12.500



The adapter box ALI 12.500 is not intrinsically safe and is not to be used within an explosive environment.

ALI 12.651	**AC power supply/charger**
ALI 12.701	**OPTALIGN smart shaft firmware certificate**
ALI 12.700 SET	**USB memory stick for firmware update**
ALI 12.504-2	**USB A/B cable for connecting to printer or PC**
ALI 5.110	**Reflector including dust cap ALI 5.115**
ALI 2.118	**Chain-type bracket Note that the OPTALIGN smart intrinsically safe package contains 2 no. ALI 2.118**
ALI 2.905	**Lens cleaning cloth**
ALI 3.588	**Tape measure mm/inch**

ALI 12.504-2



ALI 12.651

ALI 9.122.G	**OPTALIGN smart pocket guide**
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ALI 13.701	**ALIGNMENT REPORTER CD**

Safety notes

OPTALIGN smart is to be used in industrial environments only for shaft alignment. Care must be taken to ensure that the instrument is not subjected to mechanical knocks. OPTALIGN smart must be operated only by properly trained personnel. No liability will be assumed when components or operating procedures as described in this manual are altered without permission of the manufacturer.

Safety symbols

The following symbols are used in this manual in order to draw the reader's attention to especially important text, such as that regarding possible sources of danger or useful operating tips.

This symbol denotes general information and tips regarding operation of OPTALIGN smart.

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

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

CE compliance and EMC

OPTALIGN smart fulfills the EC Guidelines for electric devices and those relating to electromagnetic compatibility (2004/108/EC).

OPTALIGN smart has been tested to the scope of EN 50011 Edition 2003, EN 61000-3-2 Edition 2006, EN 61000-3-3 Edition 2006, EN 61000-4-2 Edition 2001, EN 61000-4-3 Edition 2003, EN 61000-4-4 Edition 2005, EN 61000-4-5 Edition 2001, EN 61000-4-6 Edition 2001, EN 61000-4-11 Edition 2005, EN 61326-1 Edition 2006 and EN 61326-2-2 Edition 2006.

IP classification

OPTALIGN smart is dust-tight and protected against water jets (IP65). The transducer and reflector comply with code IP67 (dust-tight and protected against immersion).

Notes for intrinsically safe models

In addition to the general notes described previously, the following notes must strictly be observed when working in explosive atmospheres.

- When equipment to be aligned is located in an explosive environment, the intrinsically safe OPTALIGN smart EX computer ALI 12.200 EX and the intrinsically safe OPTALIGN smart transducer ALI 12.100 EX must be used.

WARNING

- Batteries must be changed only outside the explosive area! Note that only alkali-manganese batteries can be used in explosive atmospheres. With the OPTALIGN smart EX version, use only 1.5V AA MN 1500 batteries from Duracell or the reachargeable batteries AccuCell AC 1800 (ALI 2.811).
- The OPTALIGN smart case (ALI 12.800) must not be taken into the hazardous area. Should the case be taken into an explosive atmosphere, appropriate measures must be taken to prevent static electrification.
- The circuit parameters meet the intrinsic safety requirements Ex ib IIC.
- The maximum cable length between the OPTALIGN smart computer socket and the transducer must not exceed 10 m.
- The interfaces for USB host and device, and the 12 V supply are not certified for use in explosive environments and therefore its use must take place outside the hazardous zone, and must be connected via the adapter box ALI 12.500.
- The adapter box ALI 12.500 is not intrinsically safe and must therefore be used outside explosive atmospheres.
- The optional wireless data transmission RF module ALI 4.620 SET must never be connected to the intrinsically safe OPTALIGN smart transducer ALI 12.100 EX.
- Devices that rely on the power supply to the USB host for initiation (for example the USB memory sticks) must only be connected to the adapter box ALI 12.500 outside the explosive area.

- The intrinsically safe OPTALIGN smart computer may be powered using the AC power supply/charger ALI 12.561 as long as the power supply /charger is only used outside the hazardous area, and is connected via the adapter box ALI 12.500.

WARNING

- The installation and operation of the intrinsically safe OPTALIGN smart must be in accordance with the European regulations (EN 60079-10:2003 ff) and equipment safety law as well as the general recognised rules of the technology and this operating manual.
- The most current regulations regarding servicing, maintenance and testing, as they appear in EN 60079-14 and EN 60079-17 must be observed. The rules of the manufacturer as they appear in this manual must also be observed.
- The EC type examination certificates (ATEX) and the IECEx certificates of conformity are attached in the appendix.

Laser safety

The OPTALIGN smart system uses a class II laser beam. Class II lasers comply with the requirements outlined in the USA's FDA specification 21 CFR Ch. 1, Parts 1040.10 and 1040.11 as well as the ANSI standard. It also fulfills British standard BS 4803 (Part 1 to Part 3) and European Industrial Standard IEC 825. The class II laser operates at a 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 necessary to keep this product in compliance with the specifications referred to.

WARNING

- Do not look directly into the laser beam at any time. (Since FDA specifications allow maximum exposure of 0.25 seconds, the natural blink reaction of the human eye is normally sufficient to avert any danger, provided that no optical instruments other than ordinary eye glasses/contact lenses are used.)
- Do not insert any optical devices into the beam path.
- The red LED on the front of the transducer illuminates whenever the laser beam is emitted.

Operating information

Temperature range

OPTALIGN smart and its related system components must be used at temperatures between 0° and 50° C (32° to 122° F). Outside of this range, the specified accuracy may not be maintained.

Store OPTALIGN smart and its related components at temperatures between -20° C and 60° C (-4° F to 140° F).

Temperature effects and fluctuations

Powerful heat sources or steam located near the laser beam could influence the accuracy of measurements as a result of beam deflection. In practice, however, this effect occurs seldom at distances up to 1 m. If in doubt, the effect can be eliminated by shielding the system from the heat/steam source during measurement and adjustment.

As with all precision optical measurement devices, sudden fluctuations in temperatures (e.g. resulting from sunlight), could result in erroneous measurements.

Note

Allow adequate time for OPTALIGN smart and its related components to reach the ambient temperature.

Incident light

Avoid exposing OPTALIGN smart to strong, hot light such as direct sunlight.

Dust and water seals

OPTALIGN smart is water and contamination resistant to specification IP65; the transducer and reflector are resistant to specification IP67. This specification requires that each component be able to withstand a water jet spray from any direction (the components are NOT guaranteed to withstand a full submersion). Note, as with most water-resistant products, the resistance must be periodically checked and re-sealed if necessary. This can be carried out during service and recalibration of the system which should be carried out every two years.

Interface connection

OPTALIGN smart is fitted with a single interface for data exchange with a PC/printer, the transducer as well as mains supply.

Note regarding data storage

With any data processing software, data may be lost or altered under certain circumstances. PRÜFTECHNIK strongly recommends that you keep a backup or printed records of all important data.

PRÜFTECHNIK assumes no responsibility for data lost or altered as a result of improper use, repairs, defects, battery replacement/failures or any other cause.

PRÜFTECHNIK assumes no responsibility, directly or indirectly, for financial losses or claims from third parties resulting from the use of this product and any of its functions, such as loss or alteration of stored data.

Note

Component labelling

The labels shown below are to be found on the rear of OPTALIGN smart and its related components.

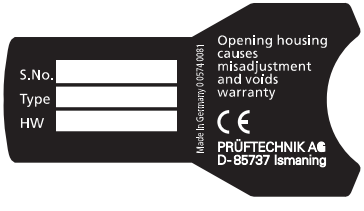
Note that non-Ex instruments are supplied without Ex labels.

The above labels are on the back of the OPTALIGN smart computer, fixed to the type of battery in current use

On the bottom of the OPTALIGN smart computer

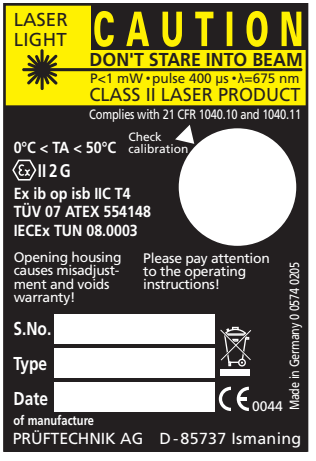
On the back of the transducer

On the front of the transducer

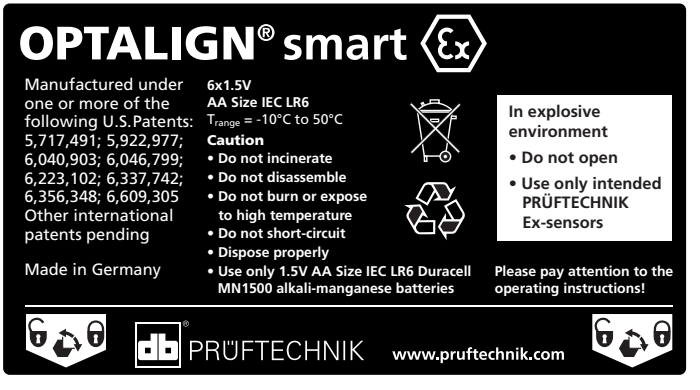


On the back of the reflector unit

Component labelling for intrinsically safe versions



Attached to the back of the intrinsically safe transducer



These two labels are affixed to the back of the intrinsically safe OPTALIGN smart computer.

OPTALIGN smart – an overview

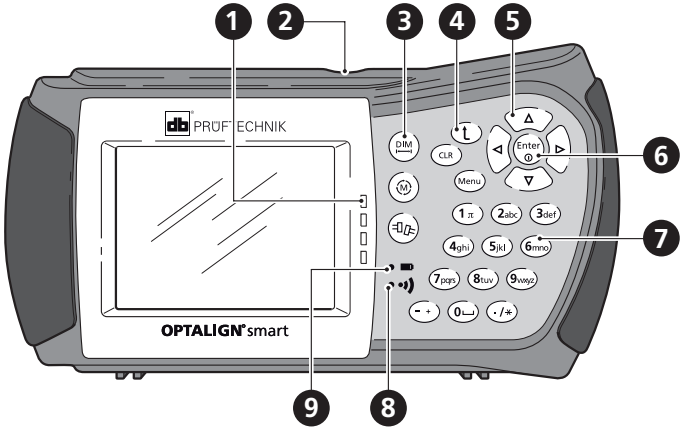
Description

The OPTALIGN smart keyboard at a glance

OPTALIGN smart possesses 3 function keys.

- The 'Dimensions' key is used to initiate entry of machine dimensions.
- The 'Measurement' key is used to start the measurement process.
- The 'Result' key is used to call alignment results into the display.

- The 'Up' key is used to confirm entered values, and as a back/return key, taking user to previously selected screen.
- The 'Clr' (Clear) key is used to delete information entered inadvertently.
- The 'Menu' key offers a choice of procedures for setting up the computer and proceeding with different alignment situations.
- The navigation keys are used to navigate through the program steps.
- The 'On/Off/Enter' key is used to perform the dual function of switching on OPTALIGN smart, confirming entered values and accessing any selected item. To switch OPTALIGN smart on, press the 'On/Off/Enter'
- The data entry keys are used to enter relevant machine data.



1. Alignment condition LEDs
2. USB port / Transducer socket / Charger socket
3. Function keys
4. Up / Clear / Menu keys
5. Navigation keys
6. On/Off/Enter keys
7. Data entry keys
8. Bluetooth indicator LEDs
9. Battery status LEDs

Power supply

OPTALIGN smart is powered using a 7.2 V 2.4 Ah Lithium-ion rechargeable battery ALI 12.601 (optional), which is to be charged only using the OPTALIGN smart battery charger ALI 12.651. The battery can be charged only inside the computer.

OPTIONAL

Alternatively, use 6 standard 'AA' size alkaline batteries contained in the battery compartment ALI 12.600.

AccuCell AC 1800 rechargeable batteries (order number ALI 2.811) may also be used.

The batteries allow operation of up to 18 hours (25% active measurement, 25% standby, 50% 'sleep' mode).

Batteries for intrinsically safe version

The intrinsically safe version of OPTALIGN smart ALI 12.000 EX (with all electrical components also suffixed by "EX"), requires special attention with regard to batteries.

Only alkali-manganese batteries of the type listed below is to be used with the intrinsically safe version:

- 1.5 V "AA" MN 1500 from Duracell
- AccuCell AC 1800 rechargeable battery

Otherwise, intrinsic safety may be compromised.

Be sure to remove the OPTALIGN smart computer from the explosive environment before changing batteries.

DO NOT USE lithium batteries or nickel-cadmium rechargeable batteries in explosive environments.

WARNING

Replacing batteries

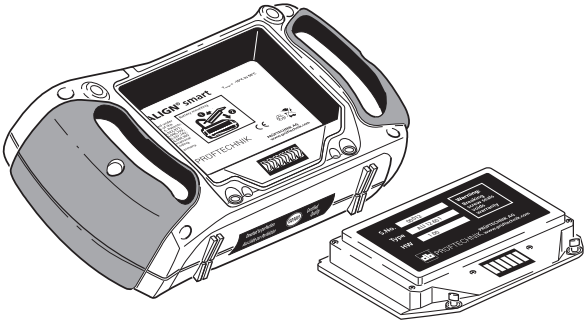
The rechargeable battery ALI 12.601 and the battery compartment ALI 12.600 have identical shapes and are therefore interchangeable. If batteries require removal, turn over the computer taking care not to damage the display and the hard keys. Undo the two half-turn screws by rotating them at least 180° (1/2 turn). With the screws loosened, lift and pull out the rechargeable battery or the battery compartment (depending on power supply source). The reverse procedure is used to reinstall the rechargeable battery or the battery compartment.

If you are using the standard 'AA' size batteries, it is recommended to replace all of them together. Note the battery polarity when inserting them in the compartment ALI 12.600.

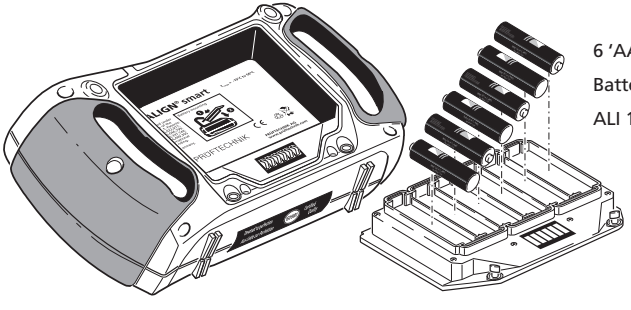
The battery compartment of the intrinsically safe OPTALIGN smart computer is to be opened with use of a 3 mm allen key.

Used batteries should be disposed of in an environmentally responsible manner in accordance with applicable regulations!

Due to similarity, the battery compartment is removed and replaced in the same manner as the rechargeable battery ALI 12.601.



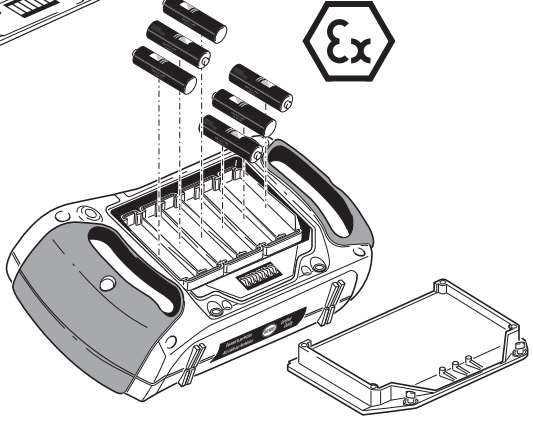
Lift compartment or rechargeable battery after undoing the screws
Replace compartment or rechargeable battery by sliding it into the groove appropriately



6 'AA' size batteries
Battery compartment
ALI 12.600

For battery usage with the instrinisicaly safe OPTALIGN smart computer please refer to the safety notes for intrinsically safe models

With the intrinsically safe OPTALIGN smart computer, the battery compartment is within the computer and therefore batteries are placed directly into the computer.



Charging the battery

Connect the OPTALIGN smart battery charger ALI 12.561 to the interface connection and to the mains supply.

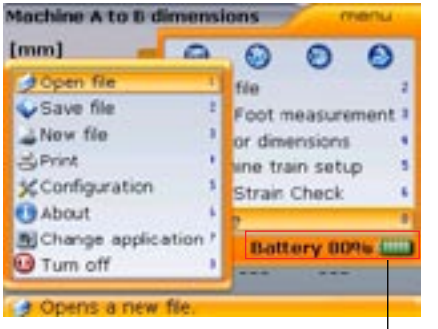
Before charging, the rechargeable battery should be discharged as much as possible. To charge the battery from 0% to 100% capacity takes approximately 4 hours.

Note

The battery LED indicates the charging status of the battery. A flashing red LED indicates that the battery is either defective or fully discharged. The LED flashes green at initialization and during the charging process. A constantly lit green LED denotes that the battery is fully charged.

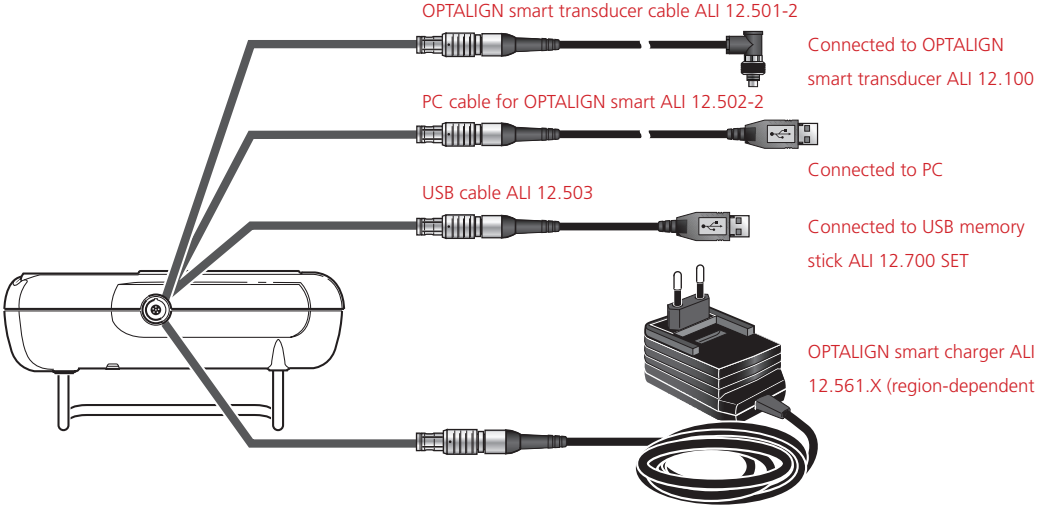
The charge level of the battery is displayed by pressing Menu.

The context menu appears showing the current battery capacity.



battery charge level

Interface for data exchange with a PC/ printer, transducer and power supply.



Transducer ALI 12.100 / ALI 12.100 EX

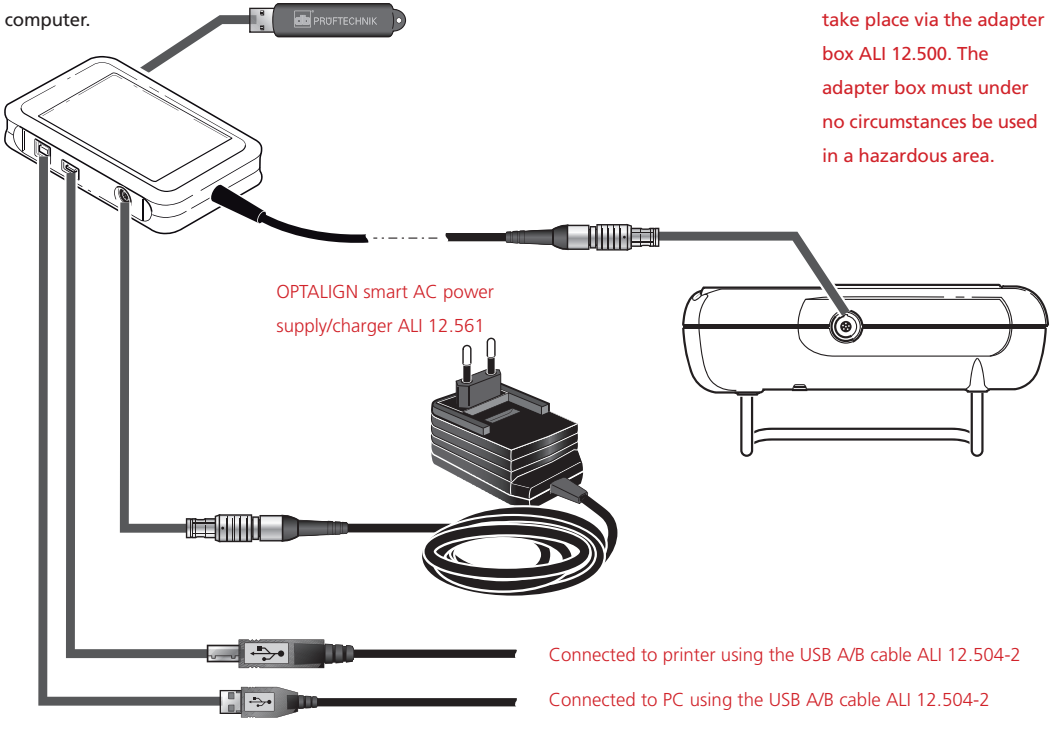
The transducer contains a laser diode which emits a beam of red light (wavelength 675 nm). The beam is visible at the point it strikes a surface. It is emitted with a diameter of approx 5 mm (3/16”). Also located in the same housing is a beam detector which measures the exact position of the laser beam as the shafts are rotated. This component is a biaxial, analog, photoelectric semiconductor position detector with a resolution of 1 µm. The transducer also contains an electronic inclinometer with resolution better than 1° for measurement of the shaft rotation angle.

Interface for data exchange with a PC/ printer and power supply to an intrinsically safe OPTALIGN smart computer.

The USB memory stick is connected to the adapter box using the USB cable ALI 12.503.
Note: No other device is to be connected to this specific port.

Note: The USB memory stick and printer interfaces cannot be used simultaneously.

Connection of peripheral devices (PC, printer , USB stick, and power supply) to an intrinsically safe OPTALIGN smart can only take place via the adapter box ALI 12.500. The adapter box must under no circumstances be used in a hazardous area.



OPTALIGN smart AC power supply/charger ALI 12.561

Connected to printer using the USB A/B cable ALI 12.504-2

Connected to PC using the USB A/B cable ALI 12.504-2

The transducer has two indicator LEDs on its front side, one green for indicating beam adjustment, and the other red when the laser is on. The transducer is powered by the OPTALIGN smart computer via a cable through which measurement data also passes.

Alternatively, the transducer may be powered via the optional wireless communication RF module ALI 4.620 SET. The RF module must never be connected to the intrinsically safe OPTALIGN smart transducer ALI 12.100 EX.

Note

The transducer is IP67 protected to resist water spray and dust. The internal optics and electronics are sealed to prevent any possible contamination. The transducer lens, however, must be kept clean. Use the lens cleaning cloth ALI 2.905 or a fine dusting brush such as that normally used to clean other optical devices. Keep the dust cap on when not in use.

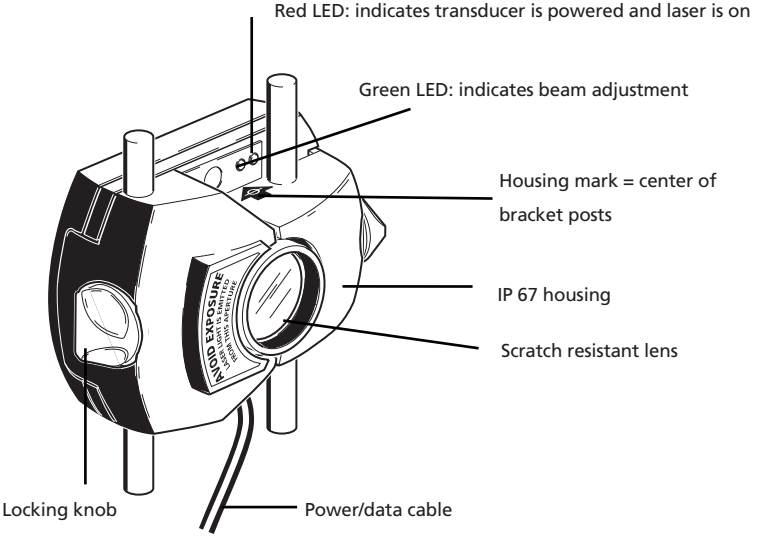
Avoid polishing the lens too vigorously to prevent irreparable damage to its anti-reflective coating.

CAUTION

Under no circumstances may the six smaller housing screws be removed, as that would result in loss of calibration and would void all warranty coverage.

Do not stare into the beam!

WARNING



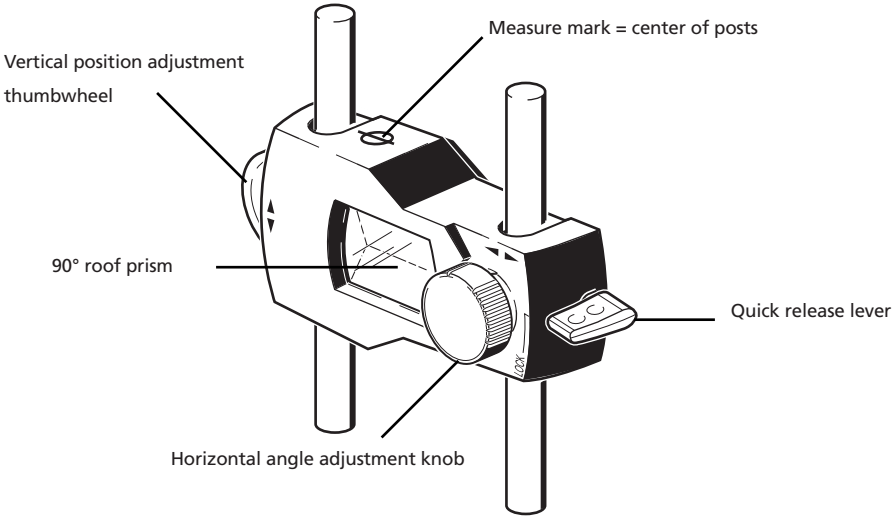
Reflector ALI 5.110

The reflector is always mounted on the shaft or solid coupling of the machine to be moved. It reflects the laser beam back into the position detector as the shafts are rotated. The locking lever flips into the horizontal position, facing forward, to hold the reflector in place on the bracket posts. The reflector is adjusted by changing its vertical position and its horizontal angle (using the thumbscrews) so that the beam is reflected directly back into the transducer.

The reflector must be kept clean. Use the lens cleaning cloth ALI 2.905 or a fine dusting brush such as that normally used to clean other optical devices.

Avoid vigorous polishing to preserve the anti-reflective coating. Keep the dust cap on the reflector when it is not in use.

CAUTION



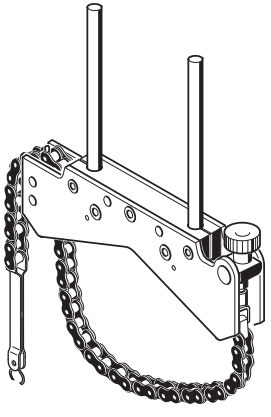
Mini compact chain-type bracket ALI 2.118

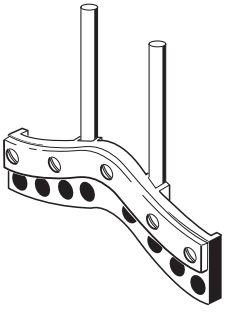
Compact and lightweight, this bracket is designed to provide extremely rigid support for the measurement components with a minimum of mounting time and effort. The chain-type bracket fits onto shafts and couplings ranging from 15 to 200 mm (1/2" to 8") in diameter. Chains of varying lengths are also available. Mounting instructions are given in 'Horizontal machine alignment'. Other bracket types are also available. Contact PRÜFTECHNIK Alignment Systems or your local representative for details on additional accessories.

The OPTALIGN smart default entry level packages ALI 12.000 and ALI 12.000 EX are shown in the "OPTALIGN smart packages" section.

Note

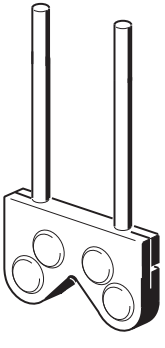
Compact chain-type bracket



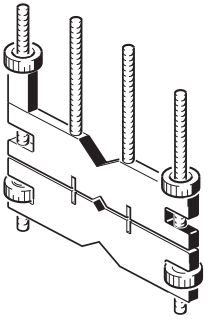


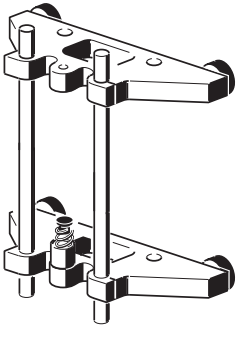
Optional magnetic sliding bracket ALI 2.230

Optional compact magnetic bracket ALI 2.112



Optional extra-thin bracket ALI 2.109 SET





Optional coupling bolt hole bracket ALI 2.106 SET

Configuration and data management

Shortcut numbers

OPTALIGN smart menu items are accessed using the navigation keys. The navigation direction is either upwards/downwards or sideways. Alternatively, use may be made of the data entry keys which provide navigation shortcuts.

All context menu items are labelled with digits for quick access. The required menu item is accessed directly by pressing the corresponding data entry key.

Note

Configuration

The menu item "Configuration" is used to configure the OPTALIGN smart settings, the regional settings, default settings, printer, licence available applications, and display specific system details.

With OPTALIGN smart switched on, access "Configuration" by pressing Menu twice. The expanded menu as shown below appears.

Alternatively, when the expanded menu appears, use △/▽ to highlight "Configuration", then press Enter to confirm selection.

The "Configuration" screen is opened directly by pressing 5 jkl. The screen with items that can be configured appears.

Each item in the configuration screen can be opened by pressing the corresponding data entry key.

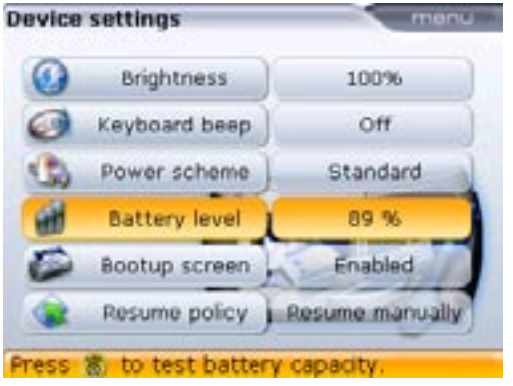
Device settings

The "Device settings" screen is opened by pressing 1. Alternatively, use the navigation keys to highlight the "Device settings" icon then confirm selection by pressing Enter to access the available settings. These include brightness, keyboard beep, power scheme, battery level and boot up screen. Use ▲/▼ to select item to be set.

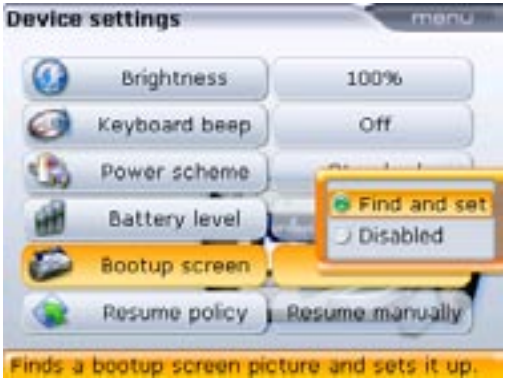
The display brightness is adjusted using ◁/▷.

To turn the keyboard beep on/off, press Enter. The on/off box appears. Use △/▽ to select either "on" (to enable the beep) or "off" (to disenable the beep). Press Enter to confirm selection.

The power scheme option is used to select setting that manages the power usage in OPTALIGN smart. The four available options are: "Standard" (the display dims after 10 minutes and shuts down after 1 hour), "Full power" (no dimming and no shutdown), "Use standby" (no dimming and shutdown is after 1 hour) and "Long life" (the display dims after 3 minutes and shutdown takes place after 10 minutes). The required setting is selected using △/▽ and confirmed by pressing Enter.

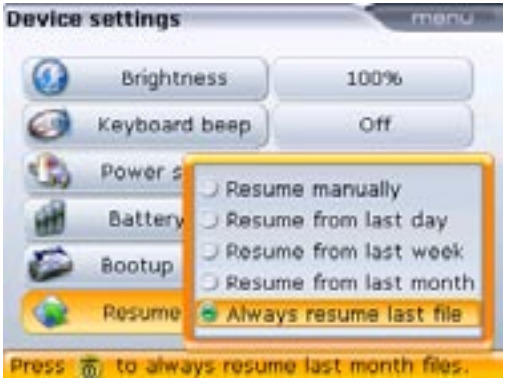


The capacity of the battery appears next to the battery level bar. The item is also used to carry out a Li-ion battery test for service and trouble shooting purposes. This utility is accessed by pressing Enter with "Battery level" highlighted.



The item "Boot up screen" is used to upload an image, such as the company logo, to OPTALIGN smart, that appears when the system is started or booted.

The image to be uploaded is saved in the approved memory stick ALI 12.700 SET in .png format under the name "companylogo" together with a folder named OPTALIGN. Connect the memory stick to the OPTALIGN smart computer via the USB cable ALI 12.503. With "Boot up screen" highlighted, press Enter and use △/▽ to highlight the item 'Find and set'. Confirm by pressing Enter.



"Resume policy" allows the user to specify the measurement file that opens when OPTALIGN smart is turned on. The system may be set to open the last used measurement file ('Always resume last file') or open a new measurement file ('Resume manually'). The option may also be used to open measurement files based on date last used. With "Resume policy" highlighted, press Enter to display the available resume options. Use △/▽ to highlight preferred resume option. Confirm selection by pressing Enter.

Regional settings

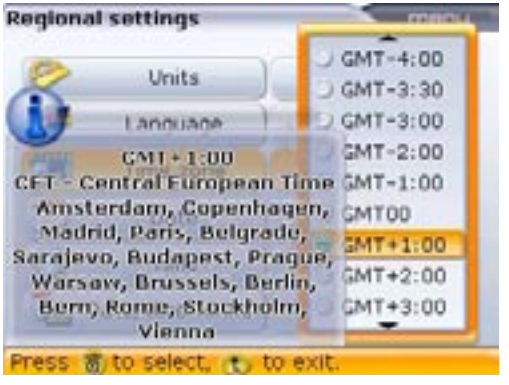
This option is used to set the units of measurement, the preferred country language, current date and time. The screen is opened by pressing 2abc while in "Configuration" screen.

Highlighting "Units" using △/▽ and confirming selection by pressing Enter reveals the available units of measurement. These are the US units, the English units and the SI (metric) units.

Select the required system of units using △/▽. Press Enter to confirm selection.

Highlighting "Language" using △/▽ and confirming selection by pressing Enter displays a list of the available country languages. Select the preferred country language using △/▽. Press Enter to confirm selection.

Highlighting "Time zone" using △/▽ and confirming selection by pressing Enter displays the different time zones. The required zone is selected using △/▽ and confirmed by pressing Enter.



When a time zone is initially highlighted, a appears displaying major world cities within the selected time zone. Note that changing the time zone automatically alters the time set.

Current date and time are set by highlighting the respective option using △/▽ and confirming selection by pressing Enter.

Use ◁/▷ to highlight either date, month or year.

Set the date using the data entry keys and confirm entry using either t or Enter. Alternatively, both date and time can be set using △/▽.

The format in which the date or time is displayed is set via the item "Date/time format". Open regional settings by pressing 2abc. Use △/▽ to highlight the menu item 'Date/time format'.

Pressing Enter with 'Date/time format' highlighted reveals a menu box with the items 'Date format' and 'Time format'. Use △/▽ to select either item, confirming selection by pressing Enter.

The time format is used to set either the 12h or 24h notation. The selected notation is confirmed by pressing Enter.
The date format is used to set dd-mm-yyyy or mm/dd/yyyy format.

Default settings

The "Default settings"screen is opened by pressing 3def while in the configuration screen. The screen is used to set specific default parameters. The default changes are effective upon restart or if a new file is created.

- 'Results resolution' is used to set the results resolution at either 'Normal' or 'High'.

Alignment results and units used	Result resolution normal	Result resolution high
Coupling results (mm / mrad)	2 decimal places x.xx mm	3 decimal places (1 µm res.) x. xxx mm
Foot results (mm)	2 decimal places x.xx mm	2 decimal places x.xx mm
Coupling results (mils / mils per inch)	1 decimal place	1 decimal place
Foot results (mils)	1 decimal place rounded off to 1/2 mil (0.5 mil, 1 mil, 1.5 mils)	1 decimal place rounded off to 1/2 mil (0.5 mil, 1 mil, 1.5 mils)

- Workflow assistant has three options – 'On', 'Important', 'Off'. The options determine the guidance steps required to carry out an alignment job.
- Default rpm – used to set the required default rpm
- Reference diameter – used to set the required reference diameter
- Cardan units – used to set the required measurement unit
- Tolerance table – the available options are 50 Hz and 60 Hz. The mains supply frequency determines the standard rpm values that appear in the tolerance table. Tolerance values based on these frequencies may be read off the suggested PRÜFTECHNIK Alignment tolerance table.

Licence manager

This option is used to licence OPTALIGN smart applications and all additional features. To licence any application, use the navigation keys to highlight “Licence manager”. Press Enter to confirm selection. Select the application that requires licencing using △/▽. Press Enter to confirm selection.

Use the data entry keys to enter the application licence code. Press Enter to activate the application.

Under normal conditions, OPTALIGN smart is delivered with Shaft Alignment application licenced for the default mode.

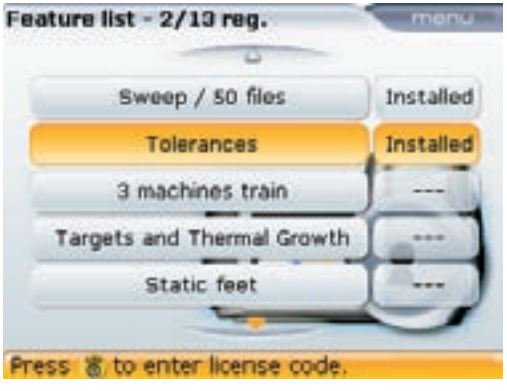
The following features are available in the default mode:

- Continuous sweep measurement mode
- Static measurement mode
- Dynamic tolerance table
- Saving up to 50 measurement files
- Ability to print reports directly from instrument
- Soft foot measurement
- Multi feet machine correction (six feet machines)
- Averaging
- Deviation band

To find out which additional features are available on your particular instrument, press Menu while in the "Licence manager" screen.

The menu item "About" (described later within this section) provides a quick overview of important information related to the instrument and the installed features.

Use either △ or ▽ to highlight 'Feature list'. Press Enter to confirm selection.



Use △/▽ to scroll through the features list. Licenced features are referenced by the text 'Installed'. Unmarked features are unlicenced and therefore not available to the user until the feature is purchased and licenced.

Note

Missing features may be ordered from PRÜFTECHNIK Alignment Systems using the OPTALIGN smart Additional Features Assistant which is available from the Resources CD ALI 13.700 CD SET which is delivered together with the OPTALIGN smart package.
The Assistant guides the user through the entire ordering process.

Note

To register any feature, press (Menu) while in the "Licence manager" screen.

Use either (△) or (▽) to highlight 'Register feature'. Press (Enter) to confirm selection.

Use the navigation keys to highlight the 'Feature key' and 'Licence code' boxes. Enter the received key and code values using the data entry keys. The feature is now activated and ready for use.

Printer configuration

This option is used to set up printers and the printing configuration in OPTALIGN smart.

Four printing options can be set using "Printer configuration".

"Type" – Selecting "Type" and then pressing Enter displays a list with all supported printers.
"Paper" – Used to select the required paper size
"Orientation" – Used to set the paper orientation. Select "Portrait" for a vertical layout and "Landscape" for a horizontal layout.
"Color mode" – Used to set the color mode in which the measurement report is to be printed. This can either be in full color or in grayscale.

About application

The information contained under this section is accessed by pressing 6mno while in the configuration screen. The displayed information is depicts the current status of the device and application.

If using the intrinsically safe version, the displayed firmware version (application version) is suffixed EX.

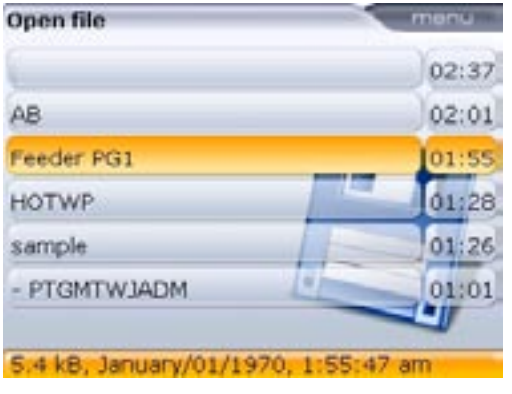
Data management

OPTALIGN smart possesses an effective file and data management facility. The file and data management options are accessed by pressing Menu twice.

Use ◁ / ▷ to cycle the cursor between the two panes.
Note: By "cursor", we are referring to the orange highlight bar.

Use ◁ to access the box with the file and data management options. These are "Open file", "Save file", "New file", "Print" and "About".

"Open file" – This option is used to load any stored file. Pressing 1π with the cursor on the left pane reveals a list consisting all stored files.



Alternatively, the "Open file" option may be accessed in the set-up screen above using the navigation keys to highlight "Open file" then pressing Enter.

Use △ / ▽ to highlight file to be opened and press Enter to open the file.

"Save file" – This option is used to save the current file. If the file is new and does not yet have a name, use the data entry keys to enter the new file name in the editing box that appears.

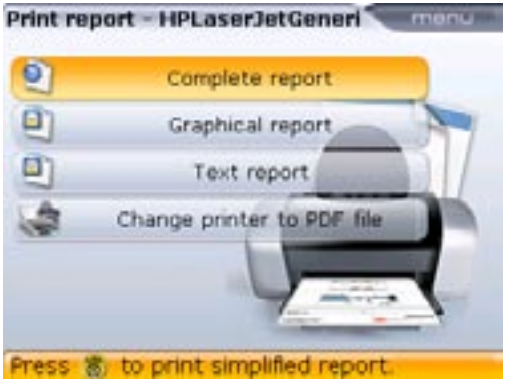
Press either ↵ or Enter to confirm file name.
If the file name already exists, the editing box appears with the existing file name highlighted. This may be overwritten or replaced with a new file name.

Depending on the functionality options purchased for your system, you may be able to store up to 500 measurement files. The default entry level allows you to store 50 files.

Note

"New file" – This option is used to create a new measurement file.

"Print" – This option is used to print the measurement report or the soft foot measurement report.



The following report options are available:

› Complete report – this option prints a complete report that includes machine graphics and measurement results in both numerical and graphical format.

- Graphical report – reports printed using this option display only graphical representation
- Text report – this option generates reports in only in text format
- Change printer to PDF file – this option is used to save a complete or graphical measurement report as a PDF file. Details of how this option works are found within the section ‘Saving data and printing’.

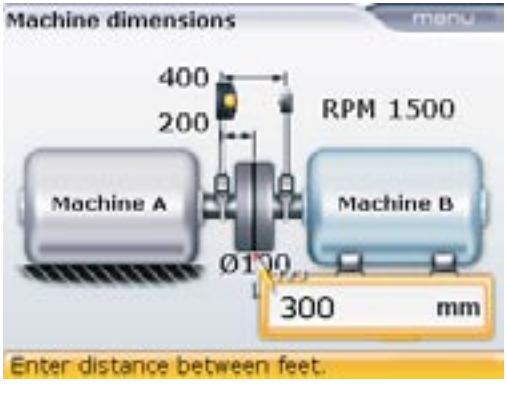
Getting started

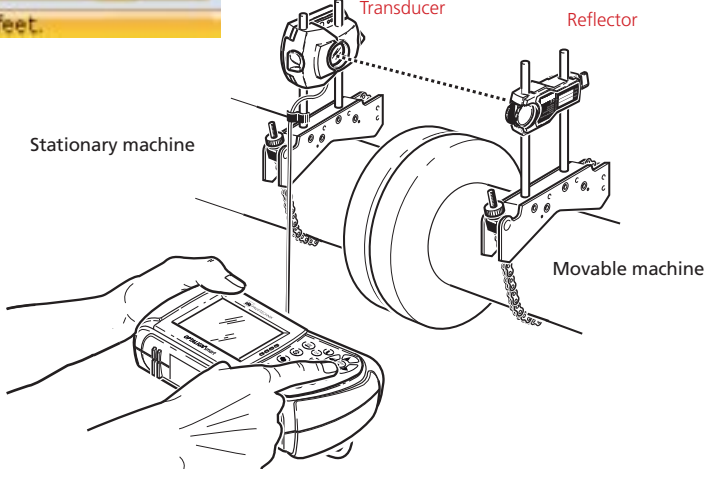
Set up OPTALIGN smart

1. Prepare the machines by making certain that they are locked out, tagged out and all necessary safety precautions have been taken.
2. Mount brackets, transducer and reflector. The transducer should be mounted on the stationary machine.
3. Connect cable and switch on OPTALIGN smart by pressing Enter and holding down briefly. All four LEDs light up and the start screen pops up. Shortly afterwards, the machine dimensions screen is displayed.

Enter dimensions

Use the data entry keys to directly enter all required dimensions.





The editing box appears as soon as a data entry key is pressed. Confirm entry by pressing either Enter or ↵. The rectangular highlight box moves to the next dimension. The navigation keys can also be used to cycle through all dimensions.
Dimensions to be entered include:

1. Transducer-to-reflector
2. Transducer-to-coupling center
3. Coupling diameter (default is 100 mm / 10" {for US units})
4. RPM (default is 1500 / 1800 {for US units})
5. Coupling center-to-front foot (right machine)
6. Front foot-to-back foot (right machine)

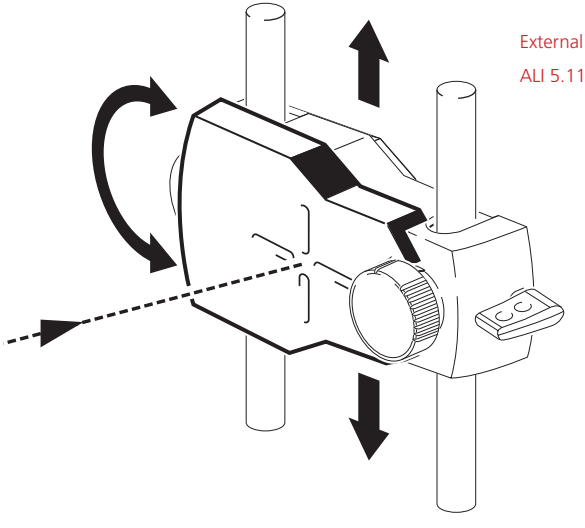
Measure

Press M to proceed with measurement. Initially center the beam on the reflector dust cap. With the dust cap on, 'laser off' appears on the screen with the RED OPTALIGN smart computer LED lit.

- Avoid looking directly at the laser beam.

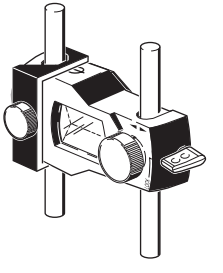
WARNING

Adjust bracket if necessary to center beam horizontally onto the reflector. Tighten bracket. Slide the reflector on the support posts to center beam vertically onto the reflector dust cap. When centered, remove the reflector dust cap.

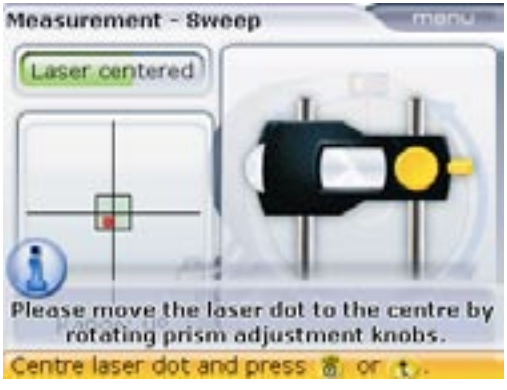


External reflector clamp
ALI 5.116

Note: For high vibration environments, the use of the optional accessory, external reflector clamp ALI 5.116 is recommended.



Use the yellow knob to make horizontal adjustments of the reflected laser beam, and the thumbwheel to make vertical adjustments to position the dot at the center of the target square or as near the center as possible.

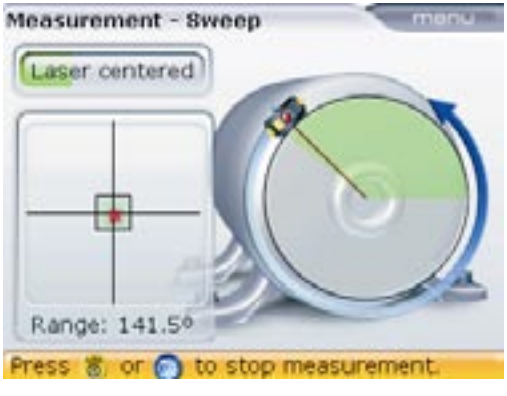


When making the above adjustments, observe the OPTALIGN smart computer LEDs and the dot on the display screen. The green LED lights up to indicate that the reflected beam position is OK and measurement can be made. The blue LED lights up when the dot is centered in the target square.

Note

After centering the laser beam, rotate shafts to automatically initiate continuous sweep measurement mode which is the default mode.

Rotate the shafts as through a complete turn or as far as possible. A minimum rotation of at least 60° is required.



Press Enter to finish measurement.

Results

Press  to view alignment results.

Vertical gap

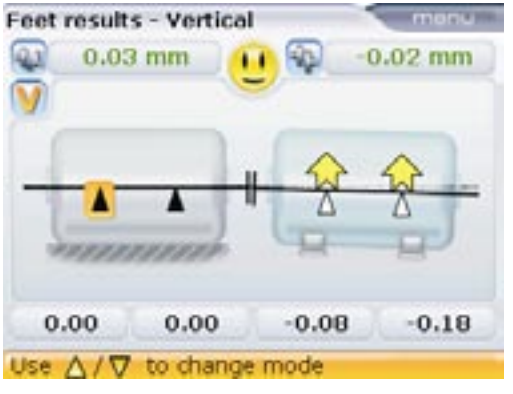
Vertical offset

Horizontal gap

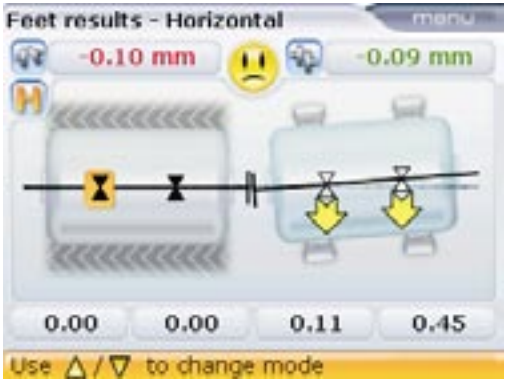
Horizontal offset

Coupling results are given in the form of gap and offset. With stationary machine on the viewer's left, gap is positive when open at the top or side away from viewer. Offset is positive when the movable machine is higher or further away from viewer.

Horizontal and vertical foot position results are accessed by pressing either  or  or  .



Vertical position results (a happy "smiley" indicates alignment within tolerance)



Horizontal position results (a sad "smiley" indicates alignment out of tolerance)

Both vertical and horizontal results show the foot position relative to the stationary machine centerline.
Positive values indicate that right machine is upwards or away from viewer. Negative values indicate that right machine is downwards or towards the viewer. The alignment condition is indicated by the tolerance symbol.

With blue LED lit – values within excellent tolerances

With green LED lit – values in acceptable tolerances

With red LED lit – values out of tolerance

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Horizontal machine alignment

1. Preparing for the alignment procedure

Before using OPTALIGN smart, prepare the machine for alignment as described below.

Make sure machines are locked out and tagged out and cannot be started accidentally or deliberately while you are working on them!

WARNING

a. Solid, flat foundation

A solid, rigid foundation is required to obtain correct, lasting shaft alignment that allows long-term uninterrupted machine service.

b. Machine mobility

If the machine to be moved stands directly on the foundations, it cannot be lowered for alignment correction. It is therefore advisable to start with about 2 mm (50 mils) of shims beneath the feet of both machines. Hydraulic or screw-type positioning aids are recommended for horizontal movement.

c. Rigid couplings

Rigid couplings must be loosened before measurement so that they do not distort the alignment condition.

d. Shaft play and coupling backlash

Axial shaft play of up to 3 mm (1/8") has no adverse effect on alignment results (but not necessarily for machine operation!).

Because of the measuring principle, turning the shaft or coupling end where the reflector is mounted eliminates the effects of coupling backlash, as readings are taken only when the transducer moves.

e. Soft foot

Soft foot causes the machine frame distortion every time the anchor bolts are tightened, making proper alignment difficult or impossible.

f. Thermal growth, alignment targets, tolerances

These values can be obtained from the individual machine specifications, and then entered into the program.

g. Measurement separation

Since OPTALIGN smart requires no mechanical connections (such as cantilevered dial indicator brackets) to span over the coupling during measurement, alignment may easily be performed over large transducer–reflector separations.

Note: A maximum transducer-reflector separation of 10 m (33 feet) is recommended.

Note that over very large distances the shafts and coupling may sag, and the machines may need to be deliberately misaligned to take this into account, if such sag does not disappear when machines are put into operation. Refer to the machine manufacturer's specifications.

2. Check for soft foot

Refer to section on soft foot on page 99.

3. Mount the brackets

Mount the brackets on either side of the machine coupling, and both at the same rotational position.

Please note the following in order to obtain the highest possible measurement accuracy and to avoid damage to equipment:

CAUTION

WARNING

- Ensure that the brackets fit solidly onto their mounting surfaces!
- Do not use self-constructed mounting brackets, or modify the original bracket configuration supplied by PRÜFTECHNIK Alignment (for example, do not use support posts longer than those supplied with the bracket).

Bracket mounting procedure

To fit the compact bracket chains, refer to the diagram shown below and follow the instructions carefully.

1. Choose the shortest support posts which will still allow the laser beam to pass over the coupling flange. Insert the support posts into the bracket.

Note

In some cases, if the coupling is large enough, a coupling bolt can be removed and the laser beam shot through the bolt hole, in order to avoid protruding radially beyond the coupling's outer diameter (OD).

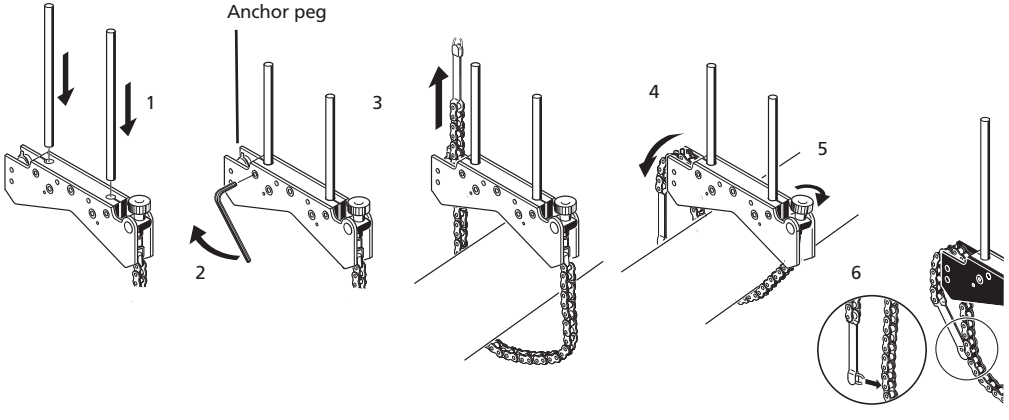
2. Fasten them in place by tightening the hex screws on the sides of the bracket frame.

3. Place the bracket on the shaft or coupling. Wrap the chain around the shaft and feed it through the other side of the bracket: if the shaft is smaller than the width of the bracket frame, insert the chain from the inside of the bracket as shown below; if the shaft is larger than the bracket width, insert the chain into the frame from the outside.
4. Catch the chain loosely on the anchor peg.
5. Turn the bracket thumbnut to tighten the assembly onto the shaft.
6. Clip the loose end of the chain back onto itself.

The bracket should now be tight upon the shaft. Do not push or pull on the bracket to check, since this could loosen its mounting.
To remove the brackets, loosen the thumbnut, then remove the chain from its anchor peg.

The compact chain-type brackets cover most situations, but in cramped or special cases, other types of brackets may be required. Please contact your PRÜFTECHNIK representative for details.

Note

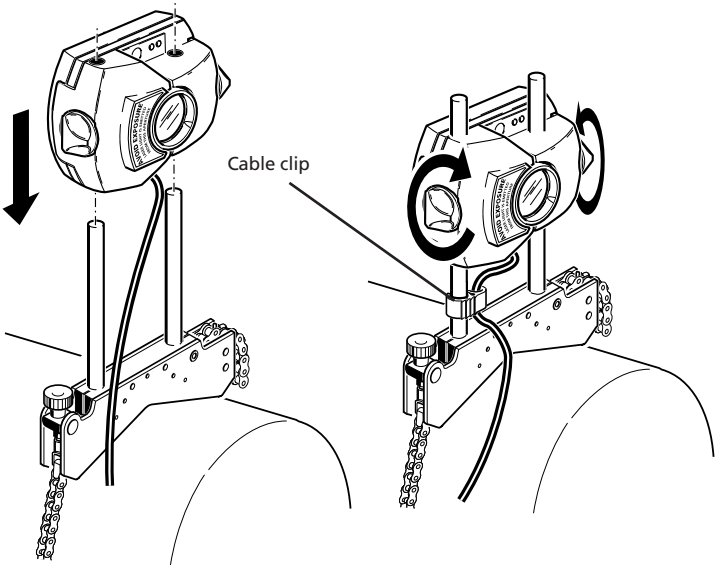


4. Mount the transducer and reflector

Mount transducer

Mount the transducer on the support posts of the bracket fixed on the shaft of the left machine (usually stationary machine) – as viewed from normal working position. Ensure that its yellow knobs are loosened enough to let you slide the housing onto the support posts with the cable side downward.

Clamp the transducer onto the support posts by tightening the yellow knobs. Ensure that the laser can pass over or through the coupling and is not blocked. Fasten the cable to one of the support posts using a cable clip.



1. Loosen the yellow knobs and push the transducer down onto the posts.

2. Tighten the yellow knobs; attach cable clip to post.

Mount reflector

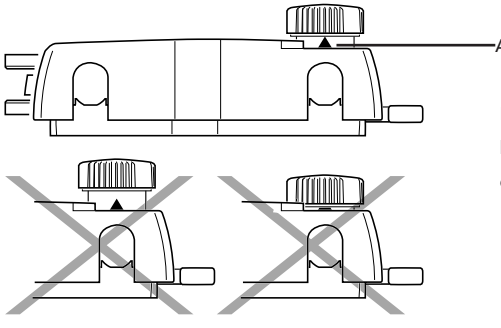
a. Mount the reflector on the support posts of the bracket fixed on the shaft of the right machine (usually moveable machine) – as viewed from normal working position.

The yellow knob on the front of the reflector allows you to adjust the horizontal angle of the reflected laser beam. Before you mount the reflector make sure that this knob is centered to allow for maximum adjustment range later on. The bottom of the knob should be flush with the arrow marking on the reflector housing.

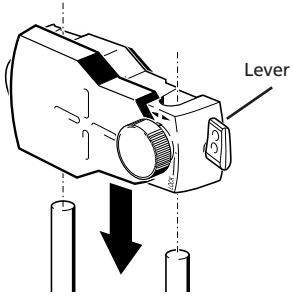
b. Flip up the quick-release lever on the side of the reflector housing, then slide the reflector onto the right-hand bracket posts. Return the lever to its horizontal position to secure the reflector on the posts.

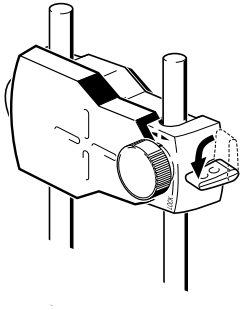
Both transducer and reflector should be at the same height, as low as possible, yet just high enough for the beam to clear the coupling flange. They should also visually appear to be parallel to each other.

Make the final adjustments, loosening the brackets slightly if necessary, then rotating them and retightening.



Match the height of the yellow knob approximately to the tip of the arrow

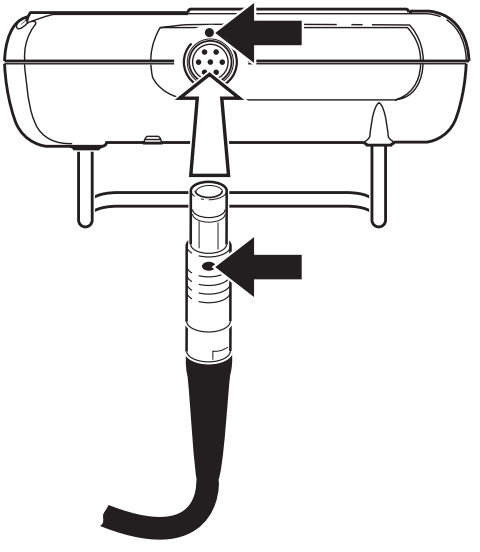




In some cases, if the coupling is large enough, a coupling bolt can be removed and the laser beam shot through the bolt hole, in order to avoid protruding radially beyond the coupling's outer diameter (O.D.).

5. Connect the transducer

Insert the straight-ended plug of the transducer cable ALI 12.501-2 into the transducer/ USB/charger socket on the top of the computer housing, with the red dot at the top.



Matching red dot

Match the red dot on the plug to the red marking on the socket to ensure proper plug orientation; otherwise the pins inside the plug may be damaged.

Note

Disconnecting the transducer

To disconnect, grasp the ribbed collar of the transducer plug and carefully pull it out of the control unit socket.

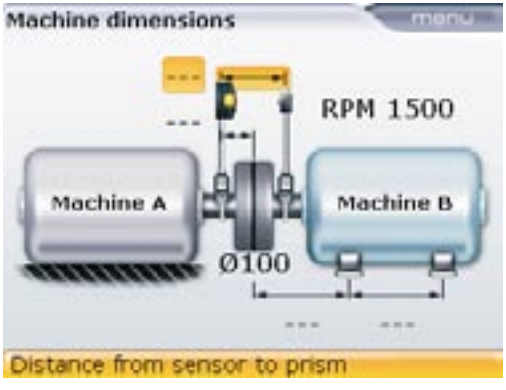
6. Switch OPTALIGN smart on and start application

Press Enter and hold down for a few seconds. The 4 alignment condition LEDs and the Bluetooth indicator LED light up. Shortly afterwards, the splash screen appears, followed by the shaft alignment machine dimensions screen.

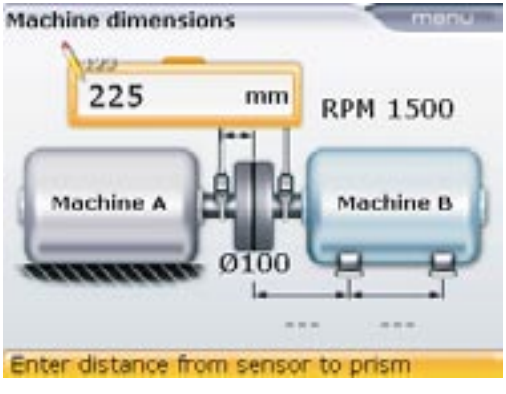
The splash screen may be set by the user to display a company logo or image. This can be useful for identification purposes. Refer to page 30 for information on how to do this.

7.1 Enter machine dimensions

Machine information and dimensions are entered using the grey data entry keys.



The required missing dimensions are entered directly using the data entry keys. With the missing dimension highlighted, enter dimension by pressing the appropriate data entry keys. The editing box appears as soon as the first key is pressed.



Confirm the entered value by pressing either Enter or ↵. The highlight advances automatically to the next missing dimension. Alternatively, any dimension can be accessed by using the navigation keys.

The dimensions to be entered vary according to machine and type of coupling. In a standard horizontal alignment application enter dimensions as follows:

7.1.1 Transducer to reflector

This is the distance between the markings on top of the transducer and the reflector.

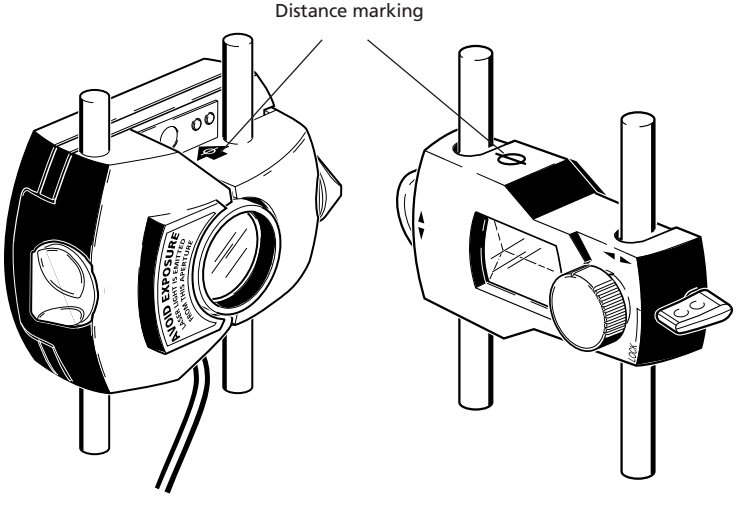
7.1.2 Transducer to coupling center

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

This dimension is calculated automatically from the entered transducer to reflector distance. Should there be need to edit the value, proceed by highlighting it using the navigation keys. Press Enter to activate the editing box, and then use the data entry keys to edit the value.

7.1.3 Coupling diameter

The coupling diameter can be obtained by measuring the circumference of the coupling and dividing the value by 3.142 (pi).
The default value is 100 mm (10" if set to US units). Should there be need to edit the value, use the navigation keys to highlight the value. Press Enter to activate the editing box, and then use the data entry keys to edit the value. Confirm the value by pressing either Enter or t. The highlighting box advances to the next required missing distance automatically.



7.1.4 RPM (revolutions per minute)

The default value is 1500 (1800 if set to US units). Should there be need to edit the value, press Enter with the dimension highlighted to activate the editing box, and proceed to edit using the data entry keys.

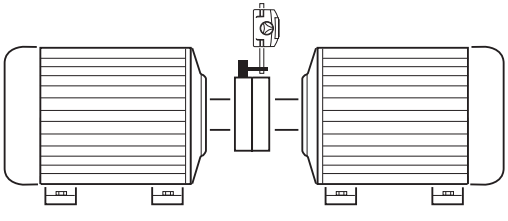
7.1.5 Coupling center to front foot, right machine

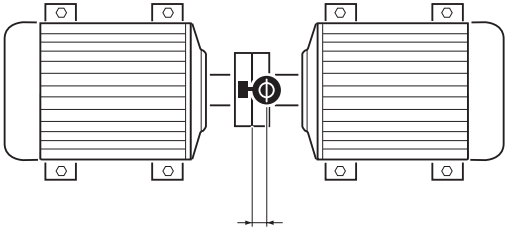
This is the distance from the centre of the coupling to the pair of feet on the right machine nearest to the coupling.

7.1.6 Front foot to back foot, right machine

7.1.7 Entering negative dimensions

In certain circumstances or unusual machine configurations, negative dimensions may also be entered where needed, such as coupling center-to-front foot (right machine) when this foot is behind the coupling center, or transducer to coupling center if the transducer is mounted on the coupling such that the transducer distance marking is infront of the coupling as shown in the following diagrams.





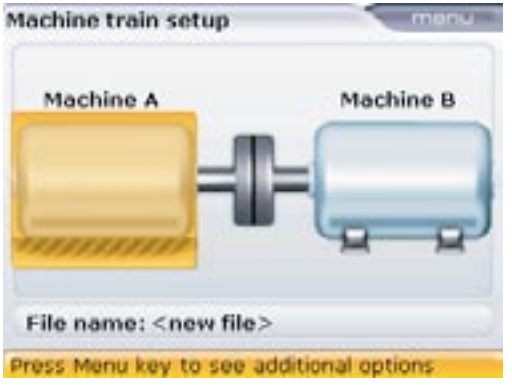
In the configuration shown, the dimension transducer-to-coupling center has a negative value.

Spacer shaft

If the spool piece of a spacer coupling is removed, and offset support posts used to clear any radial obstructions, the situation illustrated below could occur.

7.2 Machine set-up

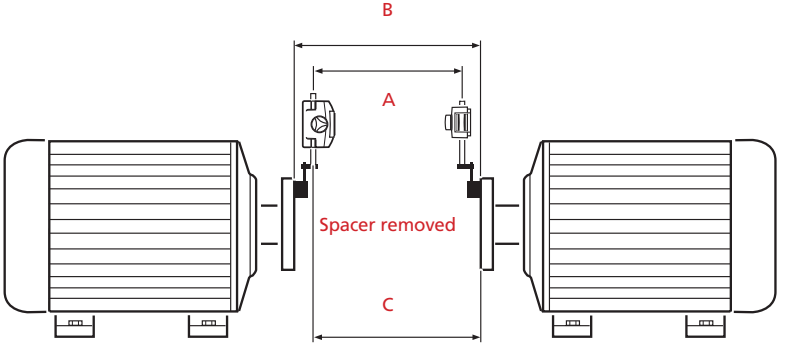
Machine set-up allows selection of machine train orientation, type of coupling, machine fixation, editing machine and coupling properties and reference name.
Machine set-up is accessed via the dimensions screen. To access "Machine train set-up" press (t) while in dimensions. The "Machine train set-up" screen opens.



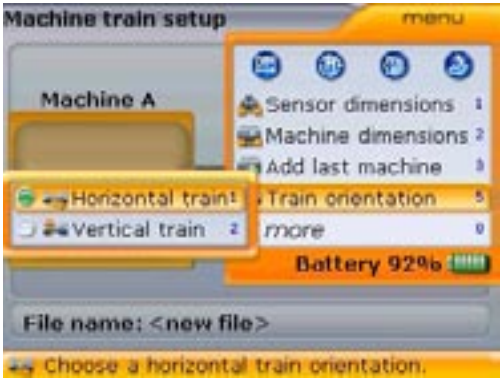
The individual machine train elements are highlighted using ◁ or ▷.

Pressing (Menu) while in "Machine train set-up reveals the menu items shown in the next screen.

This screen may also be accessed from the dimensions screen by pressing (DIM). Note that this screen is accessible only if any one of the following optional features has been purchased and licenced: fixed feet, vertical machine alignment, spacer shaft coupling, targets and thermal growth, and the bonus OPTALIGN smart feature for editing machine name and printing measurement report to pdf.



In the case shown, B>A and C>A. This spacer shaft situation is effectively handled by OPTALIGN smart.



The menu items are accessed by pressing the respective shortcut key. Alternatively, highlight the respective item using △ or ▽ then pressing Enter to confirm selection.

'Sensor dimensions' is used to edit the transducer-to-reflector dimension

'Machine dimensions' returns the user to the "Machine dimensions" screen where all machine dimensions can be edited.

'Add last machine' is used to add a machine to the current train. (This option only appears if the three-machine train option has been purchased and activated.)

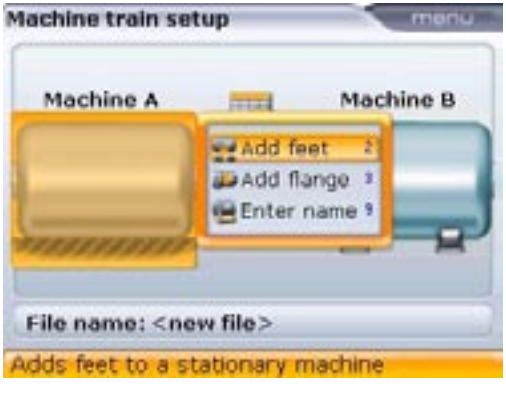
'Train orientation' is used to select either a vertical or horizontal machine train orientation. For instance, you may wish to select 'Vertical train' for some flange-mounted machines.

The expanded sub-menu with the items 'Horizontal train' and 'Vertical train' appears by pressing 5jkl. The required orientation is selected by pressing the appropriate shortcut key. Alternatively use △/▽ to highlight the required menu item, shifting between the two panes using ◁/▷. Confirm selection by pressing Enter.

OPTIONAL

7.2.1 Machine properties

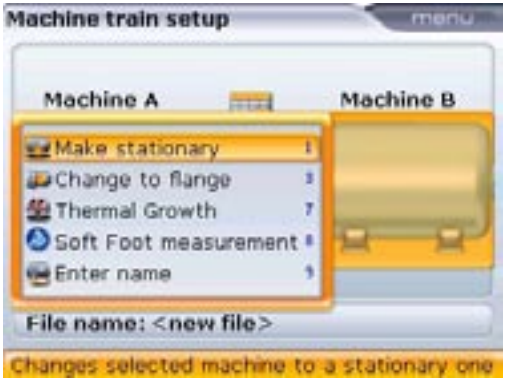
With the machine highlighted, pressing Enter reveals the machine parameters that can be edited.



Parameters that can be edited for stationary machines include: fixation, flange position and machine name.

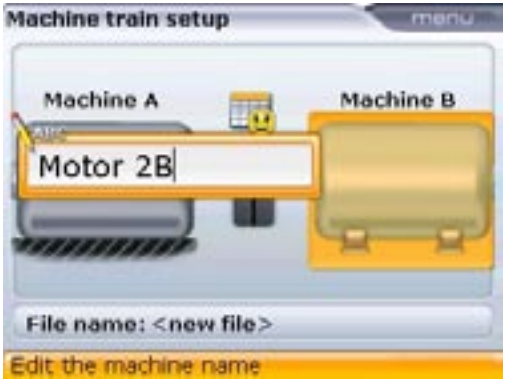
The editing of specific machine parameters is possible only if the respective options have been purchased and licenced. Please consult your local PRÜFTECHNIK Alignments Systems representative for details.

Note



If a machine is defined as moveable, the parameters that can be edited include: fixation, flange position, thermal growth values and machine name. Soft foot measurement can also be carried out from the set-up screen.

To edit the machine name, press 9wxyz while in the 'Machine train set-up' screen. The screen below with the editing box appears.

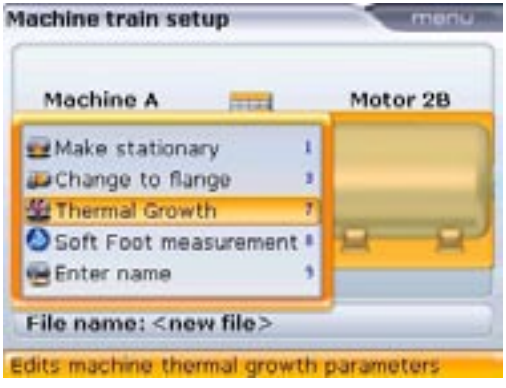


Alternatively use ▵/▿ to highlight 'Enter name' from the previous screen. Confirm selection by pressing Enter. The editing box appears and the machine name may be edited.

Use the data entry keys to edit the machine name.

OPTIONAL

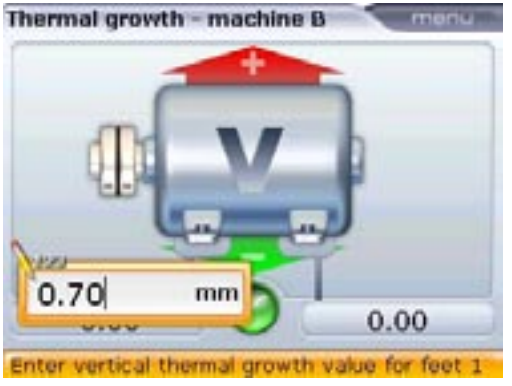
Thermal growth values can be entered only when the machine is defined as moveable. To enter thermal growth values, highlight "Thermal Growth" using either △ or ▽.



Alternatively, access the 'Thermal growth' screen directly by pressing the shortcut key 7pqrs with the 'Machine train set-up' menu displayed.

Press Enter. The "Thermal growth" screen appears.

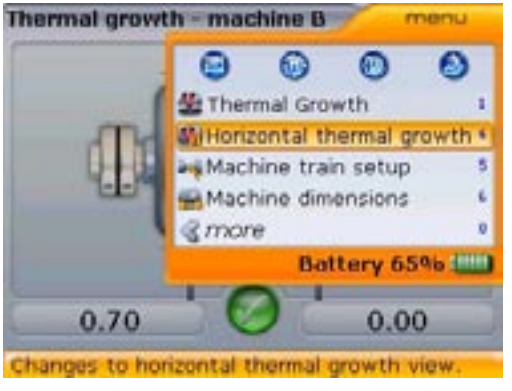
Use the navigation keys to highlight the 'feet pair' where thermal growth is to be entered. The editing box appears when any data entry key is pressed. Use the data entry keys to enter the thermal growth value in the vertical orientation, cycling through the feet pairs using the navigation keys.



The editing box may also be opened by highlighting a foot value using the navigation keys then pressing Enter.

Carefully observe sign convention (+ and -) when entering thermal growth values. Thermal growth values are NOT a target; instead they represent the amount and direction of the anticipated movement of the machine will undergo when put in operation.

To enter values in the horizontal orientation, press Menu while in the ‚Thermal growth' screen. The context menu as shown below appears.



Press 4ghi to open the horizontal thermal growth view, and proceed to enter values as described for vertical orientation previously.

Press t after entering all values.

To disenable thermal growth values, use the navigation keys to highlight the green tick. With the green check mark highlighted, press Enter. This disenables thermal growth.
Alternatively, press Menu while in the 'Thermal growth' screen. The context menu appears.

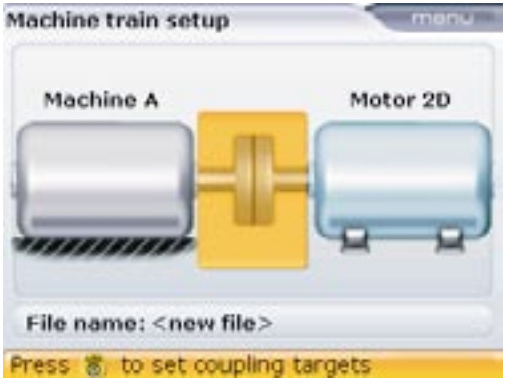
Alternatively use △/▽ to highlight 'Thermal growth' then use ◁ to switch to the next pane. Highlight 'Disable' using △/▽ then confirm disenabling values by pressing Enter.

Press 1π followed by 2abc to disenable thermal growth values.

Thermal growth values may be enabled once again by pressing Enter.

7.2.2 Coupling properties

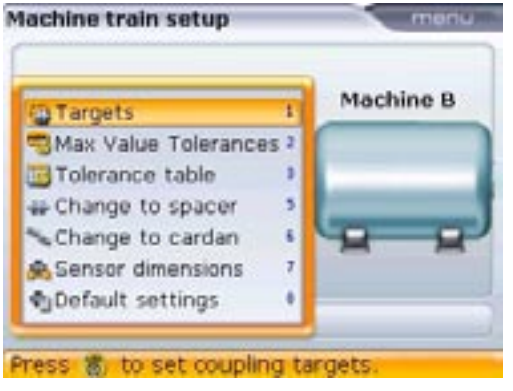
Coupling properties are entered and edited in the same manner as machine properties.
From the dimension screen, press t or DIM to access "Machine train set-up screen". Use ◁ or ▷ to highlight the coupling.



The availability of several of these options (such as spacer shafts and user defined tolerances) depend on whether these optional firmware modules were purchased and activated for your unit. If not, they will not appear in the menu.

OPTIONAL

With the coupling highlighted, pressing Enter reveals the coupling parameters that can be edited.



The menu may also be used to reset the coupling settings to default, i.e rpm is 1500, coupling diameter is 100 mm and the tolerance table is based on 50 Hz.

Coupling parameters that can be edited include: coupling targets, maximum coupling values [user defined tolerances], type of coupling [types available are short flex, cardan and spacer shaft] and required coupling dimensions.

To enter coupling target values, press 1 π with the menu displayed. Alternatively, highlight "Targets" using either △ or ▽ then press Enter. The "Coupling targets" screen appears.

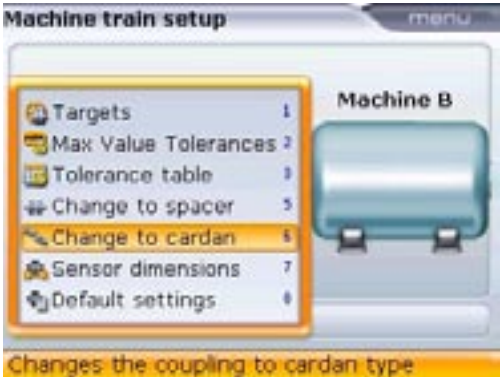
OPTIONAL

The editing box may also be opened by highlighting a value position using the navigation keys then pressing Enter.

Carefully observe sign convention (+ and -) when entering target values. Target values are NOT the anticipated thermal growth values; instead they represent the amount and direction of the desired misalignment to be set at the coupling to compensate for the anticipated movement the machine will undergo when put in operation.

Use the navigation keys to highlight respective gap/offset to be entered. Enter coupling target value directly using the data entry keys. The editing box appears when any data entry key is pressed. Confirm entry by pressing either Enter or t.

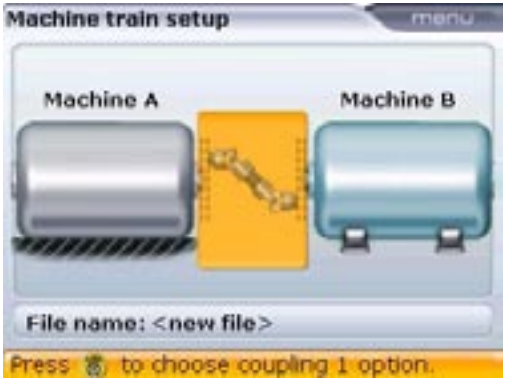
To select type of coupling, simply press the corresponding shortcut key with the menu displayed. Alternatively, highlight type of coupling required from the menu using △ / ▽.



Press Enter to confirm selection.

Pressing 5jkl sets the coupling as a spacer shaft. The option "short flex" does not appear under the menu items as it is the current setting. If the current setting was either "spacer" or "cardan", the item "short flex"would appear in the menu.

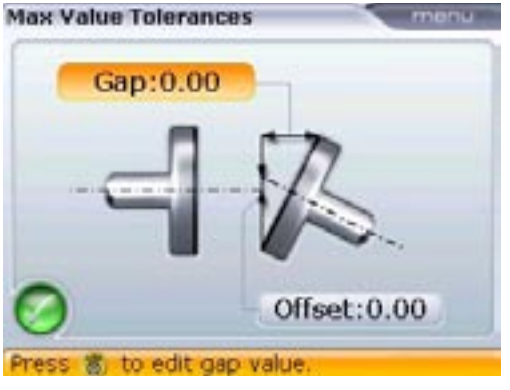
The format of target values that can be entered depends upon the coupling type selected. For short flex couplings, enter Gap and Offset; for spacer shafts enter projected Offset and Offset; for cardan shafts enter the maximum angle at each cardan coupling.



Type of coupling selected is cardan

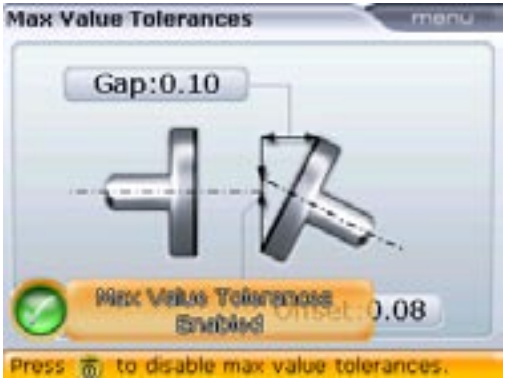
It may be necessary to specify individual tolerances. This is carried out using the menu item 'Max Value Tolerance'.

To enter maximum coupling tolerance values, press 2abc with the coupling properties context menu displayed. Alternatively, highlight 'Max Value Tolerances ' using either △ or ▽. Press Enter. The "Max Value Tolerances" screen appears.



Use the navigation keys to highlight gap or offset. Enter maximum coupling tolerance value directly using the data entry keys. The editing box appears when any data entry key is pressed. Confirm entry by pressing either Enter or t.

The format of tolerance values that can be entered depend upon the coupling type selected. For short flex couplings, enter Gap and Offset; for spacer shafts enter projected Offset and Offset; for cardan shafts enter the maximum angle at each cardan coupling.



The green check mark indicates that the user defined tolerances have been activated and may be deactivated by pressing Enter with the check mark highlighted.

The values entered above are independent of rpm. When these values are enabled, they override the system tolerance table.
Alternatively, the user defined tolerances may be deactivated by pressing Menu while in the "Max Value Tolerances" screen. Use △/▽ to highlight 'Max Value Tolerances'. The 'Enable'/'Disable' options appear. Use ◁ to access the field with the two options. Use △/▽ to highlight the required option.

Alternatively, pressing 1 π followed by 2 abc deactivates the user defined tolerances.

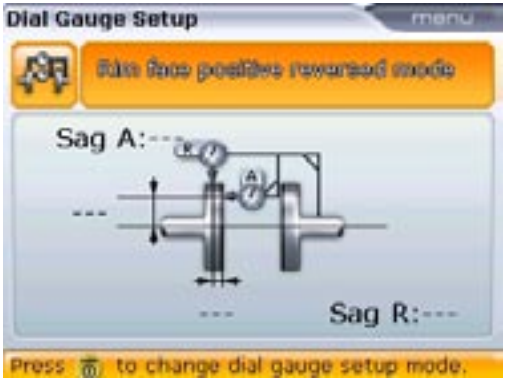
Confirm selection by pressing Enter.

Entering coupling target values as dial indicator readings

Coupling target values given in terms of dial indicator readings can be entered into OPTALIGN smart for conversion to gap and offset. If the function coupling targets is enabled, the converted values are automatically taken into account when determining the alignment condition. To enter dial indicator measurements proceed by pressing Menu while in the "Coupling targets" screen.

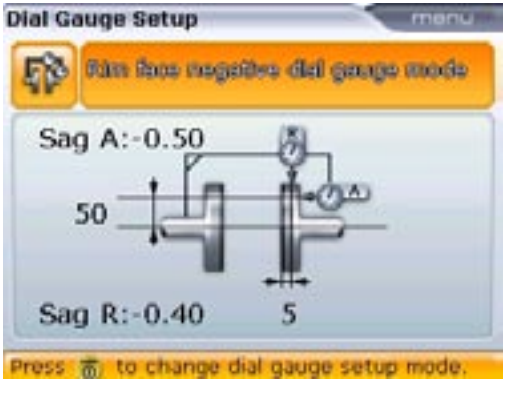
The "Coupling targets" screen is accessed as described on page 63.

When the context menu appears, press 2abc to display the "Dial gauge set-up" screen.



The dial gauge configuration is set at the header. Use the navigation keys to highlight the header then cycle through the various configurations by pressing Enter with header highlighted.

Enter the required dimensions, and if known, the amount of bracket sag.



Press ⓣ to access the "Targets as dial gauge values" display. Enter the dial indicator values in the respective value boxes.

Press ⓣ to display the target values, including any bracket sag amounts entered in terms of gap and offset.

7.3 Laser beam adjustment

After entering all required dimensions, press (M) to start the measurement process. The transducer and reflector need to be adjusted so that the laser beam strikes the reflector and is reflected back into the transducer.

Do not look into the laser transducer aperture!

WARNING

7.3.1 Remove transducer cap

The laser beam is now on! Leave the reflector cap on. When the beam strikes the cap it should be readily visible. Should the beam be so far off target that it misses the reflector completely, hold a sheet of paper in front of the reflector to try and locate the beam.

If using the wireless communications RF module ALI 4.620 SET, connect it to the transducer and turn it on at this point. (For details please refer to the chapter "Using the optional RF module".) If the module has not been scanned and recognized by the OPTALIGN smart computer yet, refer to the instructions in section 7.3.3 within this chapter.

Note

7.3.2 Adjust beam onto reflector cap

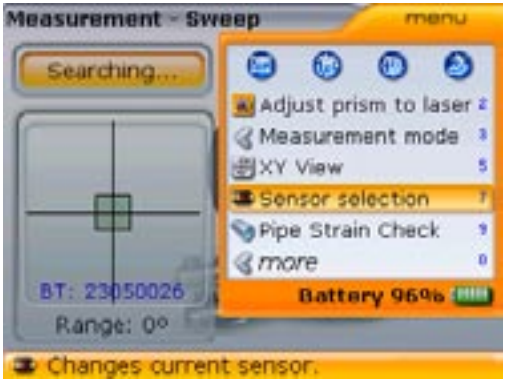
With the reflector dust cap still in place, adjust the beam onto the center of the target:

- To adjust vertically slide the reflector and/or transducer up and down along their support posts. Use the thumbwheel on the side of the reflector housing. To move the transducer, loosen the yellow knobs.
- To adjust horizontally you will have to loosen one of the brackets on the shaft and rotate it slightly. Retighten.

Note

7.3.3 Remove reflector cap and establish communication between the transducer and OPTALIGN smart computer

OPTALIGN smart collects measurement data using either the wireless data transmission module (ALI 4.620 SET) or via the RS232 interface. After removing the dust cap to allow the beam strike the reflector and be reflected back to the transducer, press Menu. Use either △ or ▽ to highlight 'Sensor selection'.



Alternatively, the sensor selection window is opened directly by pressing 7pqrs with the context menu displayed.

Press Enter to confirm selection.

If using the RS232 interface, use either △ or ▽ to highlight "Sensor @ Port 1 (RS232)". Press Enter to confirm selection, and proceed with laser beam adjustment.

If using the wireless data transmission module (also referred to as the RF module), and it is not already registered, proceed to scan for it by highlighting "Scan" and then press Enter to scan the neighborhood for any RF modules.

After the scanning process is completed, any detected module is listed as shown below.

The RF module complies with the conducted and radiated emission limits of FCC rules part 15.247.

Note

Use either △ or ▽ to highlight the connected RF module. Press Enter to confirm selection, and proceed with laser beam adjustment.

If only one RF module is detected during scanning, it is connected automatically. The serial number of the RF module in use is diplayed on the screen during measurement.
All RF modules found will be remembered. It may be necessary to delete some of these entries as they could no longer be in use. To delete unwanted entries, access the 'Sensor selection' menu. Use the navigation keys to highlight the RF module to be deleted and press CLR.

Modules deleted are remembered if detected during scanning.

7.3.4 Adjust reflector until both transducer LEDs blink together slowly and the green OPTALIGN smart computer LED lights

The transducer has a red and a green LED to indicate the beam adjustment condition. This condition is simultaneously monitored on the OPTALIGN smart LEDs.

Make sure that the reflector and transducer lens are clean. Use a soft lint-free cloth. A lens cleaning cloth ALI 2.905 is supplied.

Note

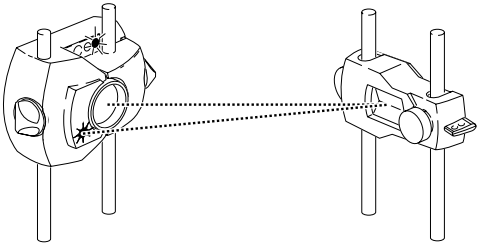
When the reflected beam fails to strike the detector surface, the red OPTALIGN smart computer LED lights up and the red transducer LED blinks quickly (0.3 s). The message 'Laser OFF' appears on the display screen. Adjust the reflected beam using the reflector metal thumbwheel and the yellow adjustment knob on the reflector as shown on the next page. As the reflected beam strikes the edge of the detector, the amber OPTALIGN smart computer lights up with the red transducer LED still blinking quickly. The message 'Laser End' appears on the display screen. (Here it may be helpful to use a piece of paper to trace the path of the reflected beam toward the transducer.)

7.3.5 Center beam such that blue OPTALIGN smart LED lights

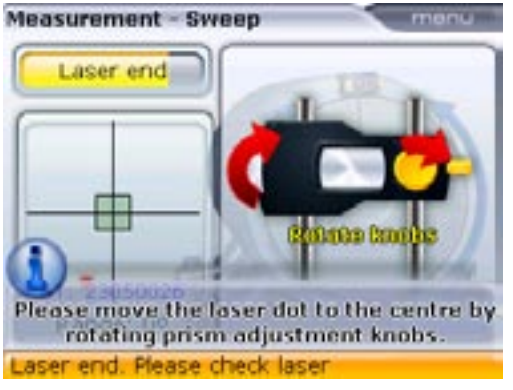
Adjust the laser beam such that the laser dot on the display screen is positioned in the green square in the center of the detector display.

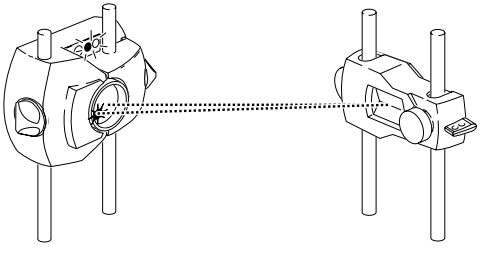
- x = horizontal adjustment with yellow reflector knob
- y = vertical adjustment with the side metal thumbwheel.

The blue OPTALIGN smart computer LED lights up.



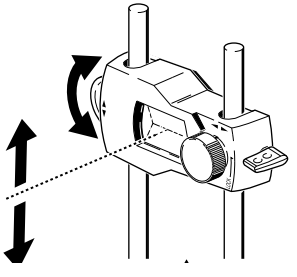
RED transducer LED blinks quickly while GREEN is OFF



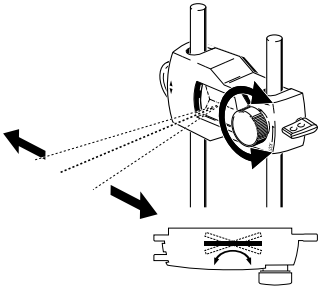


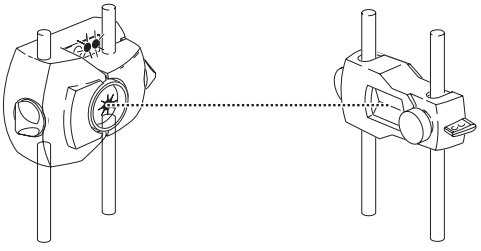
Both transducer LEDs blink quickly and alternately

Vertical adjustment

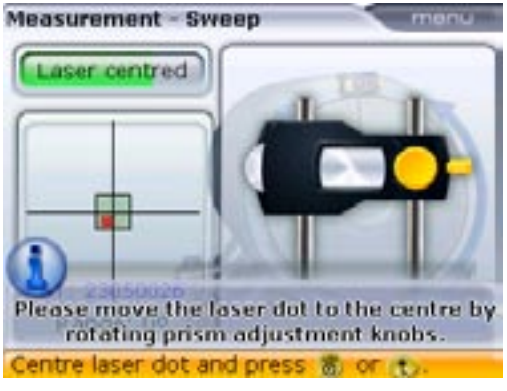


Horizontal adjustment





Both transducer LEDs blink together slowly



BLUE OPTALIGN smart computer LED lights up

The beam does not have to be exactly at the center of the crosshair, as this will not affect measurement accuracy. However, maximum range for measurement is available when the beam is well centered.

Once centered, the transducer and reflector must not be touched, as any movement during measurement will be interpreted as misalignment. These components may however be moved when extending the measurement range (see 'Alignment options' on page 112).

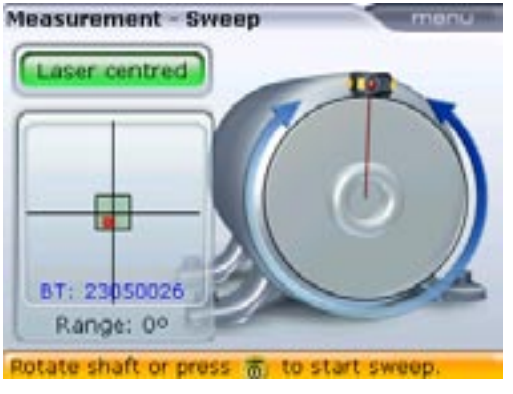
Note

8. Take measurements

It is important to note which measurement mode is best suited for a particular application. The table below gives a guide as to which measurement mode is ideal for which measurement.

Measurement mode	Application	
Continuous sweep	standard machines	
Multipoint measurement	uncoupled shafts, nonrotatable shafts, shafts that cannot be rotated smoothly or evenly	OPTIONAL
Static measurement	uncoupled shafts, nonrotatable shafts, vertical machines (four feet or flange mounted)	OPTIONAL

When the laser beam is centered such that the dot on the display screen is at the center of the crosshair, the blue OPTALIGN smart LED lights up. Start measurement by turning the shafts or press Enter to initiate the continuous sweep measure mode.



Continuous measurement starts automatically when the shafts begin to rotate.

Note

The Continuous sweep measurement mode is the default. (Refer to 'Alignment options' for static and multipoint measurement modes.)

If coupling torsion play (backlash) is suspected, turn the shaft or coupling end where the reflector is mounted. Ensure shaft is turned in the normal rotation direction of the machine.

Note

8.1 Turning shafts

To measure, rotate the shafts a full turn, or as far as possible.

Remember not to touch mounted components!
It is advised to turn shafts in the same direction as the machine normally rotates, in case the shafts shift from their normal seating in the bearings.
You may begin measurement by turning the shafts even if the beam is not centered exactly at the center of the crosshair.

Note

8.2 END or OFF? Extend

OPTIONAL

If laser END or Laser OFF appears on the screen during the turning of the shafts, the laser has drifted out of the detector due to great misalignment or long beam travel. If this happens, then use the 'Extend' function (see page 112) to extend the measurement range.

The 'extend' option is available only in 'multipoint' and 'static' measurement modes.

Note

9. Results

Results are obtained after rotating the shaft through as wide an angle as possible. As the shaft is rotated, the covered arc changes color from red to yellow and finally to green. A red sector signifies that the covered angle is insufficient for accurate results. Results can be obtained when the sector is yellow, but it is recommended that the shafts be rotated until the arc is green.

Once measurement is completed, press to view alignment results.

9.1 Coupling results

How well is the machine aligned? How much misalignment does the coupling have?

Coupling results are given in the form of gap and offset values in both vertical and horizontal directions. The true gap being the difference in gap between the coupling faces top to bottom (vertical) or side to side (horizontal) at the diameter that was entered. Offset on the other hand is the distance between two lines at the transmission plane of the coupling.

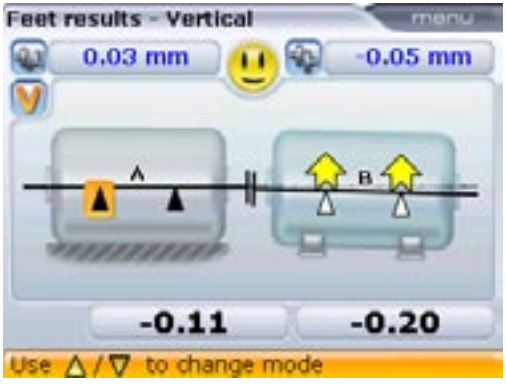
Sign convention
Gap is positive when open at top or side away from viewer. Offset is positive when moveable machine is higher or further from viewer.

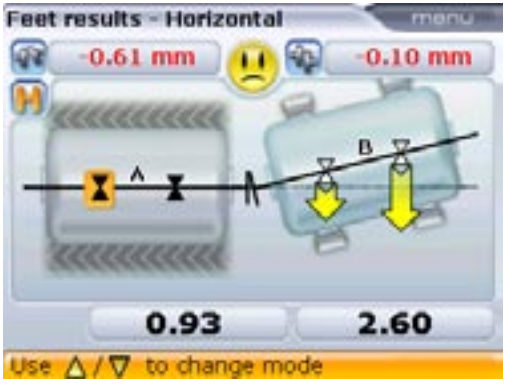
Note

If all four coupling values are within tolerance, you do not need to align the machines. If no in-house standards or specifications from the coupling or machine manufacturer are available, the OPTALIGN smart computer LED system and the smiley provides a tolerance check based on standard industry norms. If the measured alignment falls within acceptable tolerance, the green LED lights up. The blue LED lights up when the measured alignment falls within excellent tolerance. The red LED lights up when alignment is out of tolerance. In this case, the machines must be aligned.

9.2 Shaft and foot positions

If the coupling results show that misalignment exeeds the tolerance, then the machine must be realigned by shimming vertically and repositioning the machine horizontally. Foot results are accessed by pressing / / .





OPTIONAL

The orange cursor at the foot position is cycled through all foot postions using ◁ / ▷. Any foot position can be designated static/unfixed by pressing Enter with the position highlighted. Note that only two feet pairs can be designated static at any one given time.
This feature is only available if the optional firmware module for it ALI 12.714 has been purchased and activated.

The horizontal results show that the machine front feet are to be moved 0.93 mm towards the viewer and the rear feet moved 2.60 mm also towards viewer.

Sign convention
Positive values are upwards or away from the viewer.
Negative values are downwards or towards the viewer
Fixed feet can be changed while in results – This is possible only if the optional firmware module ALI 12.714 has been activated.

Note

9.3 Foot Tolerances

The 'smiley' symbol on the foot results display indicates the degree to which the measured alignment condition meets tolerances. These are calculated from the coupling tolerances. The smiley face depicts either alignment within tolerance or out of tolerance.


Within tolerance

Within tolerance


Out of tolerance

The OPTALIGN smart LED system provides additional information on the tolerance status.

Tolerance	Smiley	Lit LED
Within tolerance	Happy face	Blue or green
Within tolerance	**OK**	Green
Out of tolerance	Sad face	Amber or red


Note

- The 'smiley' TAKES INTO ACCOUNT any targets and thermal growth values which you may have entered – see pages 61 – 62.


Note

9.4 Tolerance table

It is possible to display the suggested active PRÜFTECHNIK Alignment Systems tolerance table.

These suggested alignment tolerances are general values based upon experience and should not be exceeded. They are to be used only if existing in-house standards or the manufacturer of the machine or coupling prescribe no other values.


CAUTION

The tolerance table is accessed from the "Results" screen. Press Menu to display the context menu.

With the context menu open, press 5jkl to open the tolerance table.

The type of coupling appearing on the table is the same as that applied in machine set-up. The checked rpm value is the currently applied value.

Note

The rpm can be changed from the tolerance table. Use the navigation key to highlight the new rpm. Confirm selection by pressing Enter. The hint requesting confirmation of the change is displayed.

Use △/▽ to highlight 'Yes', and press Enter to confirm change. The new rpm is now applied in the machine set-up.
Other menu items related to the tolerance table may be accessed via the context menu which opened by pressing Menu from the "Tolerance table" screen.

- The context menu item 'Max. value tolerances' is used to set the maximum coupling gap and offset tolerance values. Entering these maximum values activates this option and consequently disenables the tolerance table. The menu item 'Disable tolerance'/'Enable tolerance' is the used to toggle between maximum tolerance values and the tolerance table values.
- The tolerance table can be printed directly to the configured printer or saved to a memory stick (aka jumpdrive) as a pdf if the printer configuration is set to pdf file. In this case, use is made of the 'short' OPTALIGN smart USB cable ALI 12.503.

10. Align machine

Machines can be aligned using the given foot results by proceeding as described below. Remember, if alignment is in tolerance (indicated by a happy smiley symbol and the blue or green OPTALIGN smart computer LED), there is NO need to align the machines.

Note

To align your machine you need to move it vertically by shimming the feet, and horizontally by shifting it sideways. You could do these operations in either order or simultaneously, but the recommended procedure is as follows:

10.1 Shim first

It is recommended to perform vertical corrections first, since the horizontal condition is easily affected by the process of loosening anchor bolts and inserting/removing shims, whereas the vertical condition is less prone to being affected when performing horizontal moves. You may need to recheck soft foot before proceeding.

Note

10.1.1 Preparation

To shim the machine successfully, ensure the following:

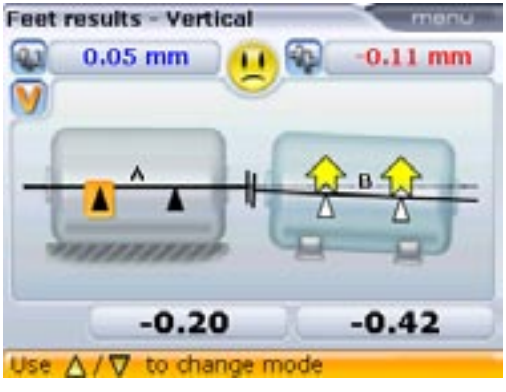
i. The foot bolts are clean, intact and removable.
ii. Soft foot has been eliminated.
iii. The feet have enough shims under them should lowering the machine be necessary.
iv. Good quality shims such as PERMABLOC, MYLAR or LAMIBLOC are available.

10.1.2 Loosen bolts

Avoid moving the machine horizontally. If any foot comes off the ground when loosened, suspect soft foot.

10.1.3 Shim feet accordingly

Use the vertical results to shim BOTH front and back feet as required. Negative feet values indicate that the machine feet are low and therefore shims should be added, while positive feet values suggest removal of shims.



Note that vertical shimming can also be carried out with the live vertical MOVE.

Note

10.1.4 Retighten bolts

The machine should now have good vertical alignment.

10.1.5 Remeasure

Remeasure to verify vertical alignment results and determine the exact alignment condition.

10.2 Horizontal live MOVE

Shimming usually involves the jacking up of the machine and inserting or removing shims of known thicknesses. (PRÜFTECHNIK shims have the thicknesses indelibly etched on them.)

The horizontal move is used for the lateral positioning of the machine. This used to be done with a dial gauge at the machine feet, but with the 'MOVE' function, you can view the horizontal movement live on the display screen.

10.2.1 Start live horizontal MOVE

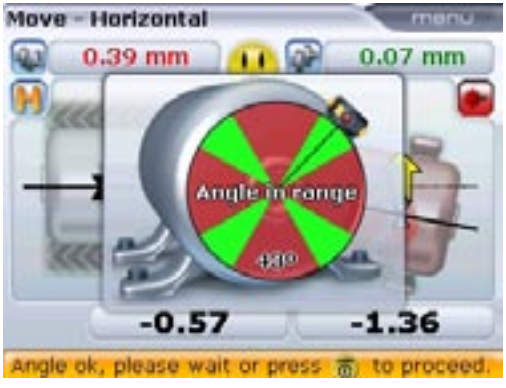
While in results mode, press Menu. Use either △ or ▽ to highlight "Move".

Alternatively, press 1 π to access Move directly.

Press Enter to confirm selection. The screen used to position the transducer in the appropriate 45° position appears.

10.2.2 Turn shafts to any 45° position

Rotate the shaft to any 45° position (this could be either the 10:30, 1:30, 4:30 or 7:30 o'clock position as viewed from coupling towards transducer).



Rotate the shaft into any of the green sectors and pause there. The move orientation selection screen will follow automatically.

If the laser beam has been centered, rotating the shaft to an angular position corresponding to any of the four green sectors prompts the Move direction dialog window.

If the laser beam has not been centered, laser adjustment hint screens appear.

Use either △ or ▽ to highlight "Horizontal" for horizontal machine movement. Confirm selection by pressing either t or Enter. Live Move starts as soon as the direction of movement has been confirmed.

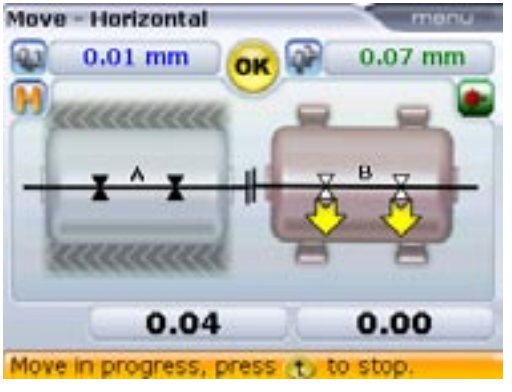
Positive values indicate the machine is positioned away from the viewer and must be brought towards the viewer, towards 9 o'clock; negative values indicate the machine should be pushed away from the viewer, towards 3 o'clock.

10.2.3 Loosen bolts and move machine as required

After loosening the anchor bolts, move the machine feet in the direction of the yellow arrows, keeping an eye on the smiley on the display screen. The arrows change with the movements automatically. Watch the display screen carefully to ensure that machine end and direction moved are correct. The smiley on the display screen and the OPTALIGN smart computer LEDs also give an indication of the alignment condition as the machine is moved. (Refer to the tolerances table on page 155 – 156.)

Do NOT attempt to move the machine using heavy sledgehammer blows. This can cause bearing damage, and also produce inaccurate MOVE results. Jack bolts on the feet or other mechanical or hydraulic devices are recommended for moving machines.

CAUTION



If the smiley returns a happy face or an OK symbol, the alignment condition is within tolerance. Press either Enter or to proceed to verify alignment condition after Move.

10.2.4 Tighten the anchor bolts

Tighten anchor bolts and recheck alignment. If machine moves while tightening correct soft foot first and also check for a cocked anchor bolt and dished washer, then realign.

10.2.5 Remeasure after MOVE - machine in tolerance?

Since the machine has been moved, earlier results are no longer valid. With 'Ok' highlighted after MOVE is completed, press Enter to confirm selection. On confirmation, the measurement mode is initialized. If necessary, center laser beam and take another set of measurements and view results. If the results are within required tolerance, then the machines are aligned.

10.2.6 Saving data and printing

(See section 11 on page 91.)

10.2.7 Finally

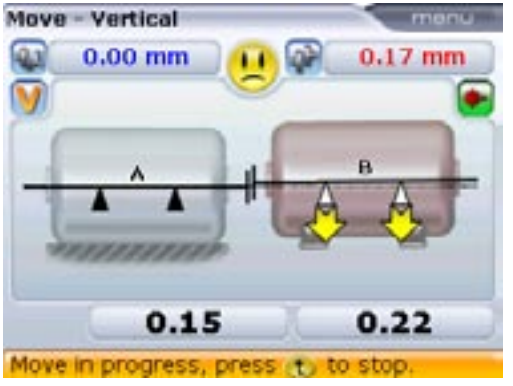
Switch off the computer, remove the components from the shafts and store them in the case.

Replace guards before you switch the machine back on.

WARNING

10.3 Vertical live MOVE

For vertical live MOVE repeat steps 10.2.1 through to 10.2.3 (pages 84 – 86) with reference to the vertical foot corrections. In this case, shimming as required.

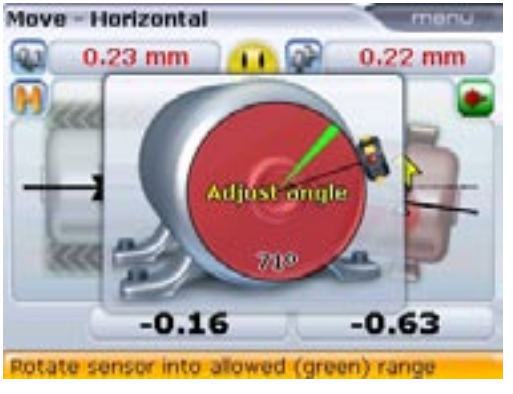


10.4 Points to observe during the MOVE

10.4.1 Have shafts accidentally moved (rotated)?

The shafts, transducer and reflector MUST remain steady during the entire MOVE procedure!

Should the shaft move from the set 45° green sector while in MOVE, the angle selection screen comes up indicating the angle to which the shaft has rotated. The shafts must be rotated back into the narrow green sector.



Live move resumes automatically when the shafts are rotated back into this sector.

Note

10.4.2 END or OFF? The 'Extend' function

If END or OFF appears on the screen during machine MOVE, then the laser beam has drifted out of detection range due to great misalignment or long beam travel. In this case, the measurement range can be extended as described on page 112, if the optional InfiniRange® module ALI 12.716 has been purchased and activated

10.4.3 Nearing zero : watch the smiley and computer LEDs

Proceed towards zero at both machine ends until the smiley returns a happy face. As the machine position moves towards zero, the computer LEDs change from red (bad) to green (OK) to blue (excellent).

10.4.4 Soft foot

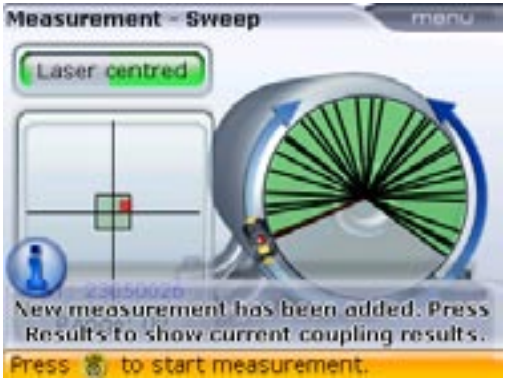
If the machine suffers from excessive soft foot, the MOVE function may be hampered by the fact that the machine changes its position on its own every time the bolts are loosened and tightened. Correct this before aligning. (See page 99 for details.)

10.4.5 If poor repeatability is experienced

Possible causes include:

Note

- Incorrect or loose bracket mounting
- Significant shaft play or coupling backlash
- Soft foot can cause positioning errors that make repeat measurement necessary
- Loose anchor bolts
- Yellow knobs on transducer loose, or reflector not locked
- Is transducer mounted in the correct way and not upside down?
- Temperature changing: machines recently shut down?
- Uneven shaft rotation – You may work around this problem as follows: Press Enter to stop measurement. The measurement screen appears.



The black lines in the rotational arc indicate the positions where readings have been taken. If any erratic readings are observed, switch to multipoint measure mode.

11. Saving data and printing

Before switching off the instrument, dimensions, measurements, results and all settings can be saved for analysis, future use or record purposes in the instrument's non-volatile memory. Full file names with up to 32 alphanumeric characters are possible.

The length of the file name is limited depending on the typeface used.

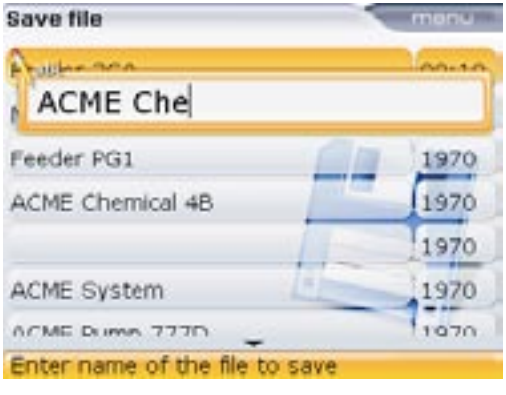
Note

11.1 To save a file

The current measurement file can be saved at any time. To save the file, press Menu twice. Highlight "Save file" using △/▽.

Alternatively, press Menu twice followed by 2abc to open the "Save file" dialog window directly.

Press Enter to confirm selection. The editing box appears.



When entering names that contain both upper and lower case characters as well as numerals, use ·/* to cycle through the three options. Press and hold down ·/* while observing the status indicator at the top left corner of the editing box. This displays the type of character to be entered. Empty spaces are entered by pressing 0␣.

Use the data entry keys to enter the file name and confirm entry by pressing either t or Enter.

11.2 Printing reports

Using the PRÜFTECHNIK Alignment freeware ALIGNMENT REPORTER, reports may be saved on a PC then printed off any Windows printer or networked printer without disconnecting or reconfiguring the printer. ALIGNMENT REPORTER is available on the ALIGNMENT REPORTER CD ALI 13.701 CD or may be downloaded from the ALIGNMENT REPORTER website – www.alignment-reporter.com.

For details on using ALIGNMENT REPORTER please refer to the software's online help which is also available in hardcopy.

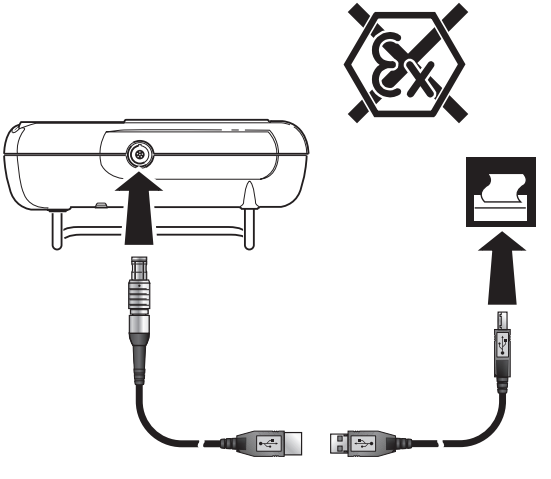
Note

Reports can also be printed directly from OPTALIGN smart to a printer. For the standard OPTALIGN smart computer ALI 12.200, this is done using the USB cable ALI 12.503.

To print the current measurement report, press Menu twice, then use △/▽ to highlight "Print".

Alternatively, press Menu twice followed by 4ghi to open the "Print report " dialog window directly.

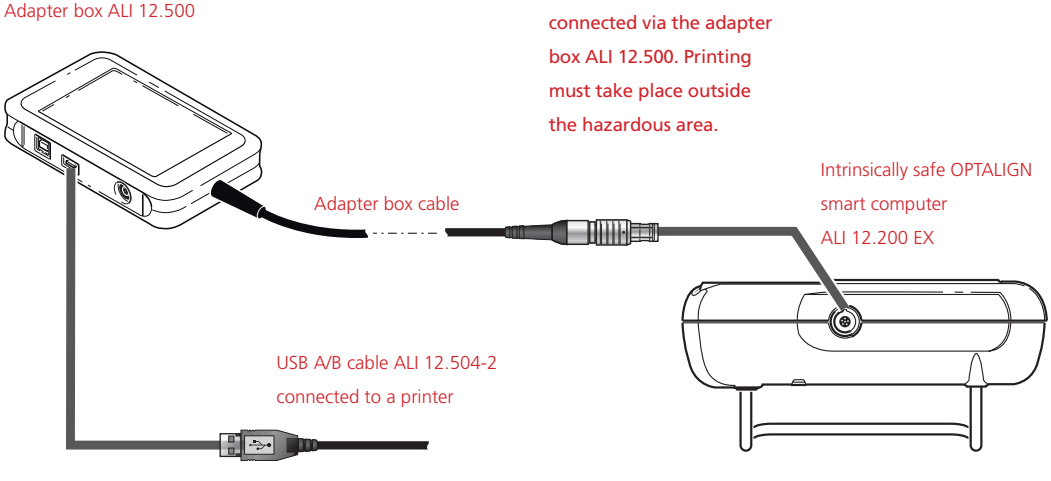
The standard OPTALIGN smart computer is connected to the printer via the USB cable ALI 12.503 and the printer USB cable (supplied with the printer or readily available in most electronics stores).



Press Enter to confirm selection. The “Print report” screen appears.

OPTALIGN smart provides the option of printing reports in four different formats. Use △/▽ to highlight the desired format and then press Enter to print the selected report.

For the intrinsically safe OPTALIGN smart computer version ALI 12.200 EX printing is carried using the USB A/B cable ALI 12.504-2 connected via the adapter box ALI 12.500. Printing must take place outside the hazardous area.



11.3 Configuring printer

If unable to print the measurement report, the printer settings must be verified. This can be carried out from the "Print report" screen. Press Menu and use either △/▽ to highlight "Printer configuration".

Alternatively, with context menu displayed, press 3def to access printer cconfiguration directly.

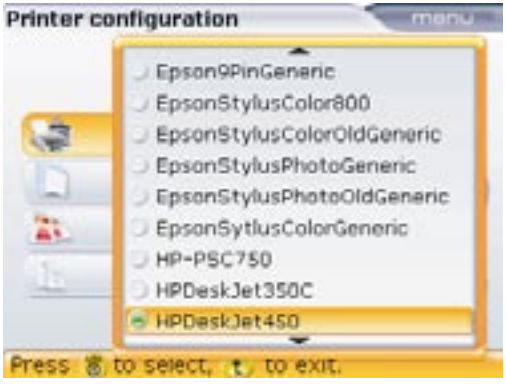
Press Enter to confirm selection. The "Printer configuration" screen appears and the printing settings are made.

Alternatively, the "Printer configuration" screen can be accessed at any time as described in Configuration and data management.

11.4 Available printing options

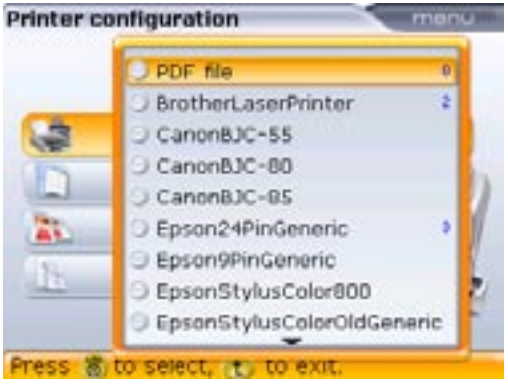
The "Printer configuration" screen shows the options that can be selected.

Use either △/▽ to highlight the printer setting to be changed. The options that are available are displayed by pressing Enter.

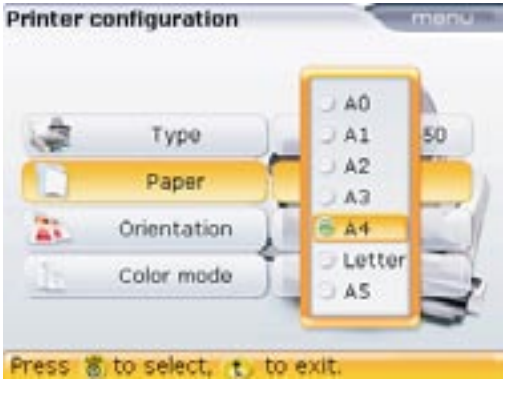


Use ▵/▿ to scroll through the available printers. Highlight a printer and press Enter to confirm selection.

This option can also be used to save measurement files directly as a pdf. Use ▵/▿/0 to select the topmost printer type "Pdf file".



After highlighting "Pdf file" press Enter to save the selected measurement file as a pdf file.



Use ▵/▿ to scroll through the available paper sizes. Highlight the required paper size and press Enter to confirm selection.

Use ▵/▿ to change the page orientation between "Portrait" for a vertical layout and "Landscape" for a horizontal layout. Confirm selection by pressing Enter.

Use ▵/▿ to select the colour in which the report will be printed. Selecting "Color" results in full colour reports, while "GrayScale" results in black and white reports.

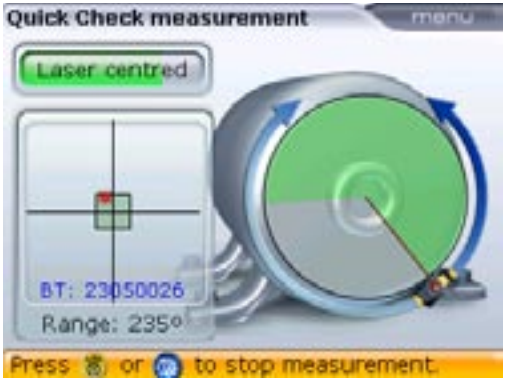
Hot alignment check

At some point, it may be necessary to check the alignment of a machine set that has been running long enough to reach its 'steady state' ('hot') operating condition. In that case, OPTALIGN smart can be used to take 'hot' alignment readings in a matter of a few minutes after the machines are shut off. The following procedure saves time by allowing you to begin measurement immediately after switching on OPTALIGN smart, i.e. without entering machine dimensions first. Measurement is possible only in the continuous sweep measurement mode.

1. As soon as the shafts have stopped rotating, lock out machines and observe all safety precautions, then mount the components, and connect the transducer to OPTALIGN smart as described in "Getting started" (page 43). If using the wireless data transmission module ALI 4.620 SET, please refer to "Laser beam adjustment" on page 70.

2. Switch OPTALIGN smart on and press (M). A hint indicating that certain dimensions are missing appears on the display.

3. Use (△)/(▽) to highlight 'Yes' and confirm selection to proceed by pressing (Enter). Center the laser beam on the detector, then turn the shafts in their normal direction of operation by at least 60°.



4. Press to display coupling results. Missing machine dimensions are prompted.

5. Use / to highlight 'Yes' and confirm selection to proceed by pressing Enter. Once all required dimensions have been entered, the alignment results are automatically displayed.

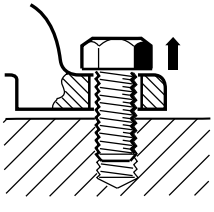
Soft foot

SOFT FOOT is the condition of machine frame distortion. Any cause that results in machine frame distortion when the machine is anchored to its foundation is a soft foot. Some of the principal causes are:

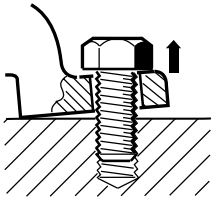
- Non-coplanar machine mounting surfaces,
- Deformed machine frame or feet,
- External forces e.g. from connecting pipe or bracket,
- Improper shimming or soiled machine feet.
- Too many shims under a machine foot (a maximum of 3 should be used)

The consequences of forcibly tightening down the feet are deformed machine frames, bent shafts and distorted bearings. This leads to high vibration and premature failure.

Soft foot should be checked before aligning the shafts. This can be done quickly and conveniently with the aid of the instrument's soft foot function. With the transducer and reflector mounted on the shaft in the usual way, the system is able to sense any machine movement when the machine bolts are loosened individually. By entering the machine dimensions, OPTALIGN smart is able to calculate, from shaft movement, by how much each foot has moved as it is loosened.



Parallel soft foot
One or more feet are too short or too long. This usually results in the machine rocking on the longer feet. This is corrected by shimming the shorter feet.



Angular soft foot
The base of the foot is at an angle to its foundation and they are only partly in contact. In this case, suspect foot is checked with a feeler gauge and corrected by building a custom 'shim wedge' or machining the underside of the foot.

Once foot movements have been established, the results are interpreted and translated into shim thicknesses to be placed under the feet. How straightforward this is, depends on the type of soft foot present.

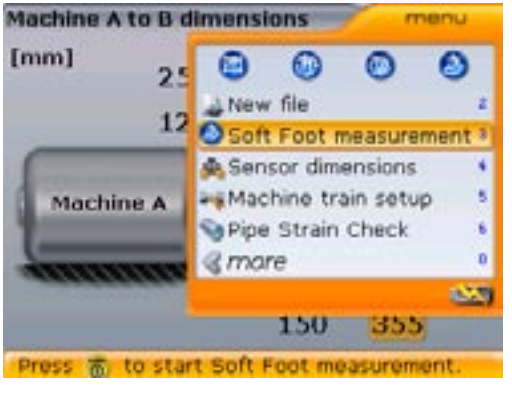
Checking and correcting soft foot conditions

The three main types are parallel soft foot, angular soft foot, and induced soft foot. There are instances where the soft foot is a combination of two or more types. Checking for soft foot is part of machine and job preparation.

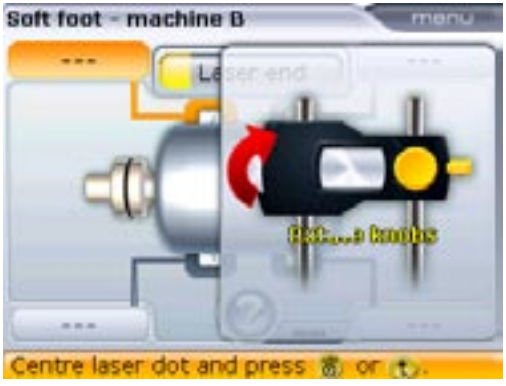
Note

The machine(s) to be checked is/are assumed to have four feet in an approximately square formation. If the machine has six feet, it is advisable to leave the middle feet loose and treat the machine as a four-footed machine. Soft foot is measured only on machine designated as movable.

Set up OPTALIGN smart in the normal way as described in "Getting started" (page 43).
Rotate shafts to position the transducer and reflector at either the 3:00 or 9:00 o'clock position.
Enter machine dimensions and then press Menu. With the context menu displayed, press 3 def to access "Soft foot" screen. Alternatively, access the screen by using the navigation keys to highlight , then pressing Enter to confirm selection.



If initially the laser beam has not been centered, the following screen appears.



Use the on-screen instructions to adjust the laser beam, or refer to 'Laser beam adjustment' on page 70.

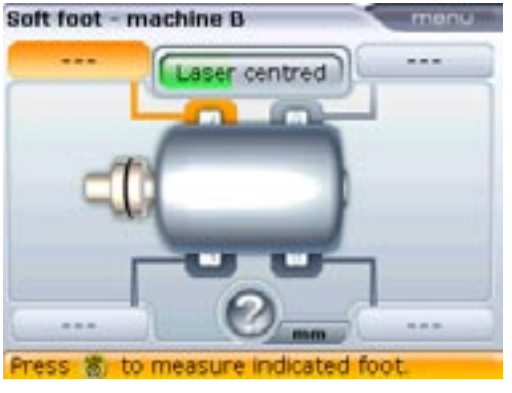
The on-screen instructions may also be prompted from the 'Soft foot' screen by pressing Menu followed by 1π. Alternatively, use either △/▽ to highlight "Adjust prism to laser", then press Enter to confirm selection.

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

After centering the laser beam, press either t or Enter and proceed with soft foot measurement.

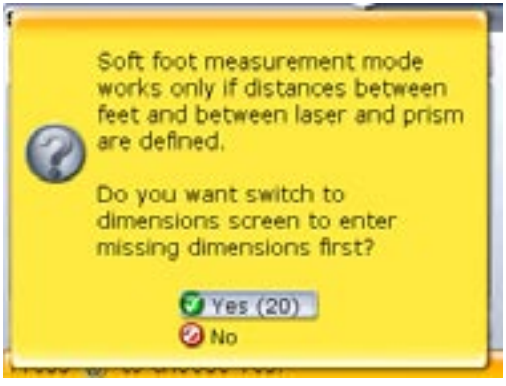
If however, the laser beam had already been centered during set-up, the screen below appears.

Note



If however, either of the two significant machine dimensions, "front foot-to-back foot" and "transducer-to-reflector", are missing, the following hint appears.

Note



Use △/▽ to highlight 'Yes', confirming selection by pressing Enter. The dimensions screen opens, and missing values may be entered.

If the shafts slip away from the 3:00 or 9:00 o'clock position, an angle correction hint appears as shown below.

Rotate the shafts back into the green sector and resume measurement.

When the message "angle in range" appears, you may either press Enter to continue with soft foot measurement or wait for the process to resume automatically.

Use the navigation keys to select the foot to be measured. Press Enter to confirm foot selection. Loosen the corresponding anchor bolt.

The calculated distance that the foot has risen is shown on the screen. Press Enter to store the value and retain it in the display. Retighten the bolt. The next foot is highlighted automatically, or any desired foot can be selected using the navigation keys.

Repeat this procedure for each foot. Cycle through using the navigation keys.

The set soft foot tolerance is 0.06 mm (0.002”). The happy Smiley indicates that the measured soft foot is within tolerance and shimming corrections are not necessary.

With the four foot values, the shimming corrections can be determined. Note that these values are saved in the file along with the dimensions, measurement and results, and appear in the printed report.

Parallel soft foot correction

If two diagonal values are roughly equal and significantly higher than the other two, parallel soft foot can be assumed as a first solution.

Angular soft foot correction

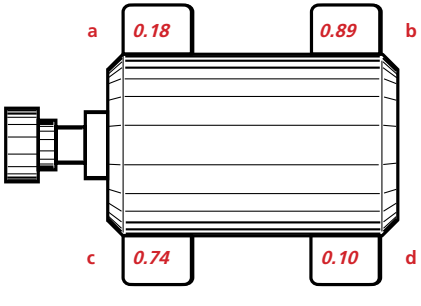
If one value is significantly higher than the others, then angular soft foot can be suspected.

The 'problem foot' or machine frame is probably bent or distorted in some way. In this case loosen the bolt and examine the foot more closely. Use a feeler gauge to establish the variation of the gap and use these measurements to sketch the shape and dimensions for a 'stair stepped shim wedge'.

If the soft foot is purely 'angular' then the stepped shim will vary in thickness from about zero to twice the value displayed by OPTALIGN smart.

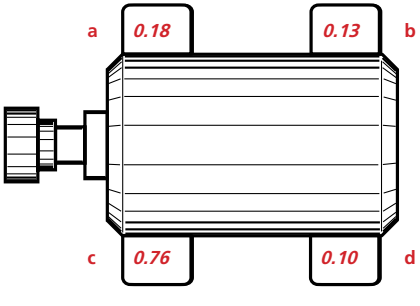
Parallel soft foot

The machine is rocking on two diagonal feet which are longer than the other two. In this example, the correction would be to place a 0.89mm shim under foot ‚b' (the foot with the largest gap)



Angular soft foot

The base of one or more feet is at an angle to the foundation and is only partly in contact.



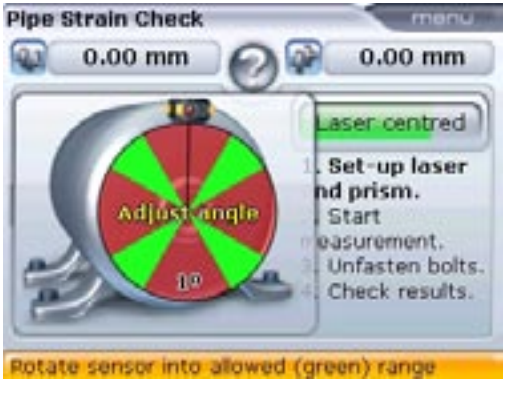
Checking pipe strain

The effects of pipe strain on shaft alignment can be measured using OPTALIGN smart. This feature is used to check for strain from external sources acting on machines. The measured values are quantified in terms of offset and angularity. The values are combined for both the vertical and horizontal directions. This check can prove the existence of pipe strain on a pump or conduit strain on a motor.
An external stress on a machine frame usually results in machine frame distortion. It is important to ascertain its existence and eliminate it. This check complements but does not replace the soft foot function.

How the function works

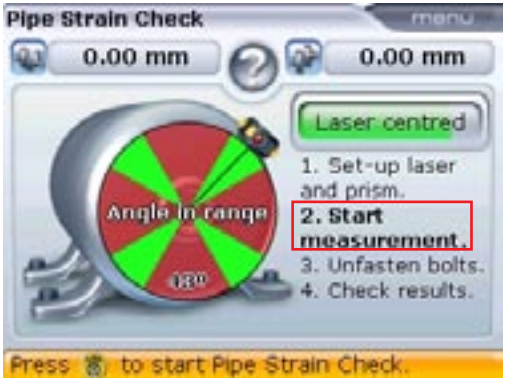
After mounting the transducer and prism as usual, turn OPTALIGN smart on. Enter all necessary machine dimensions as usual. Press Menu while in the dimensions screen. The context menu with the function 'Pipe strain check' (6) appears.

Access the "Pipe strain check" screen by pressing 6mno.



If the laser beam is not centered, press M and proceed to center the laser beam as usual. After centering beam, press DIM to return to the dimensions screen. Use Menu to access "Pipe strain check" once again.

Rotate the shafts to place the transducer at any one of the four 45° positions (denoted by the four green sectors). With the shaft steady in position, the hint to start measurement is highlighted on the display



The hint to start measurement appears on the display in bold.

Press Enter to start measurement. The hint to undo the piping bolts appears on the display.

Loosen the bolts observing how the values change. After the values have stabilized, press Enter to stop measurement. Hint to check results appears on the display

The display shows the effect of the strain in terms gap and offset.

These results are a combined value for both the horizontal and vertical directions, in other words, the vector values of offset and gap are given.

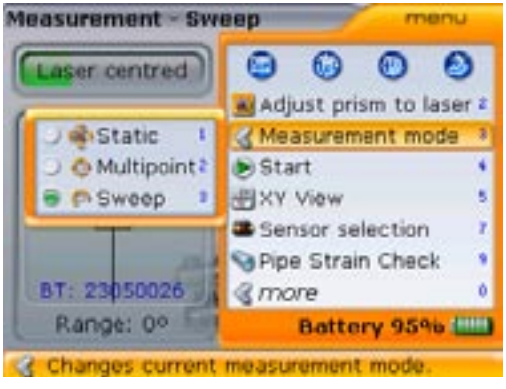
Alignment options

Measurement modes

OPTIONAL

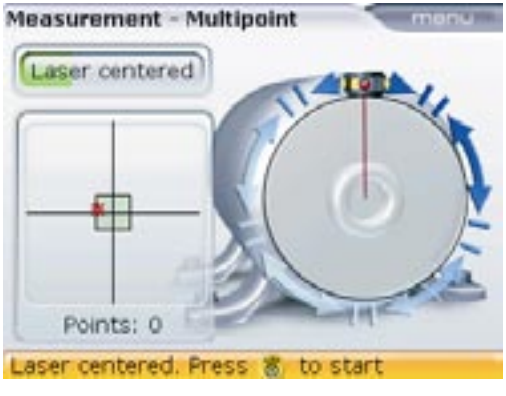
In addition to the standard 'continuous sweep mode', OPTALIGN smart also offers **Multipoint** and **Static** (**0369**) measurement modes.

The measurement modes are accessed via the measurement screen. Press (M) to access the measurement screen. While in the measurement screen, press (Menu). Use the navigation keys to select "Measurement mode"/"Static" (or "Multipoint" or "Sweep"). The choice depends on the measurement mode required.



Alternatively, the required measurement mode may be selected directly by pressing (3def) followed by the shortcut key to the required mode, e.g (2abc) for Multipoint measurement mode.

Press (Enter) to confirm selection.



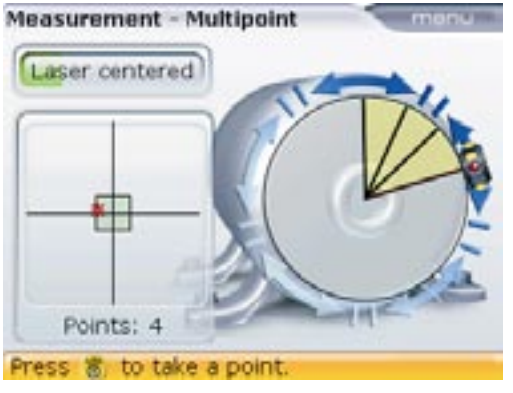
In this case, the selected measurement mode, Multipoint is now active.

Multipoint measurement

OPTIONAL

This mode is used to measure shafts which are either difficult to turn continuously or allow measurement only in certain rotational positions. The method can also be used to measure uncoupled shafts, nonrotatable shafts, sleeve bearings, white metal bearings and journal (radial) bearings.

After centering the laser beam as described in "Laser beam adjustment" on page 70, press Enter to take the first measurement point. Rotate shafts in their normal direction of operation from one measurement position to the next, pressing Enter to take measurement. Measurements must be taken in at least three positions over at least 60° of rotation, but more measurements over a wider angle is recommended.



The measurement arc turns from red to yellow to green depending on the number points taken and the angle covered. A yellow arc signifies that taken measurements are sufficient to obtain results; however, it is recommended to obtain a green arc for even greater accuracy and quality of readings.

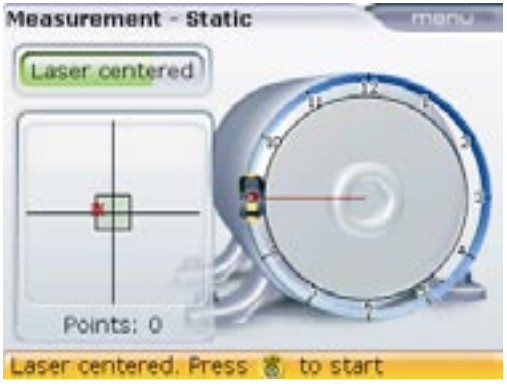
After finishing measurement, press to display results.

Static measurement

This measurement mode is used for uncoupled shafts, nonrotatable shafts and vertical foot-mounted or flange-mounted machines.

After centering the laser beam as described in "Laser beam adjustment" on page 70, turn the shafts to any of the eight 45° positions (i.e. 12.00, 1.30, 3.00, 4.30, 6.00, 7.30, 9.00 or 10.30 o'clock position viewed from coupling towards transducer). Position shaft as accurately as possible using either an external inclinometer, spirit level or protractor.

Use the navigation keys to position the clock hour hand to the corresponding shaft position.



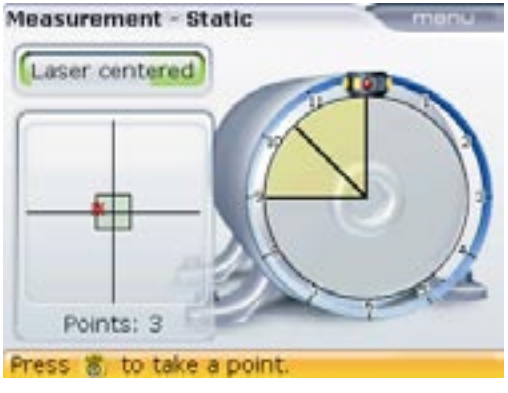
Pressing the navigation keys positions the clock hour hand at the next 45° position.

Press Enter to take the first measurement point. After point is taken, rotate shafts to the next measurement position. Ensure shafts are accurately placed at the 45° position. Use the navigation keys to move the clock hour hand on the display screen to the corresponding shaft position. Take next measurement point by pressing Enter.

If shaft rotation restrictions hinder the taking of measurement at particular shaft positions, bypass these using the navigation keys.

Note

Measurements must be taken in at least three positions over 90°, but it is recommended to take more measurements over a wider angle.



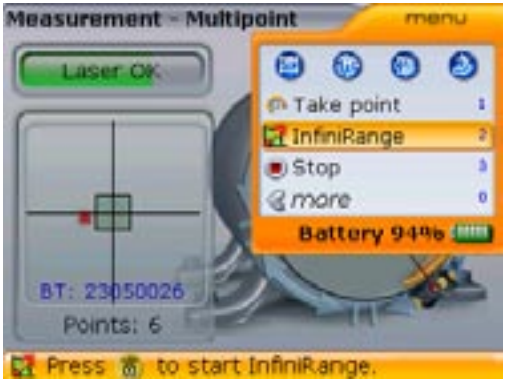
After finishing measurement, press to display results.

Extending the measurement range

OPTIONAL

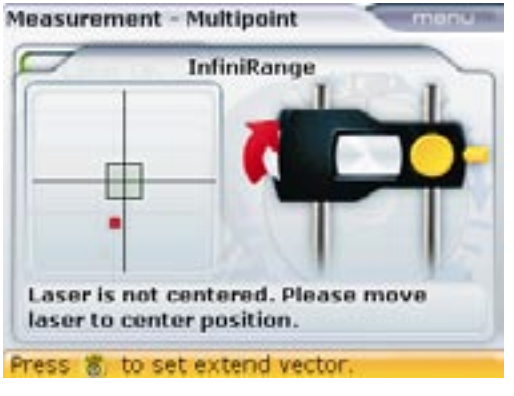
Gross misalignment of shafts or small angular misalignment over large distances can cause the laser beam to miss the detector surface during measurement. When this happens, 'Laser End' appears on the display screen and the instrument's 'extend' function can be used.

1. When measuring and 'Laser End' message appears, rotate the shafts backwards until the laser beam re-enters the measurement range. The message 'Laser OK' reappears on the display. Press (Menu) to access the 'extend' option. Use (▽)/(△) to highlight "InfiniRange".



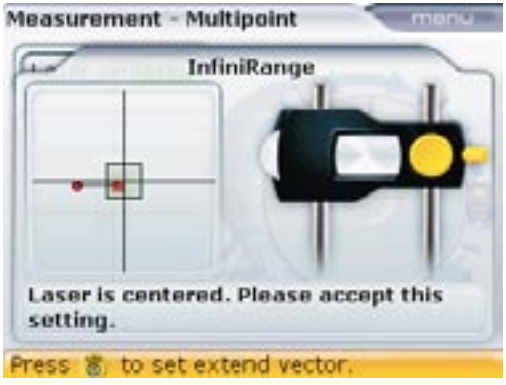
Alternatively, access the Infinirange screen directly by pressing (2abc) with the context menu displayed.

2. Press (Enter) to confirm selection. The program interrupts measurement and switches to the beam adjustment screen. The current beam position is automatically recorded and taken as the starting point for range extension.

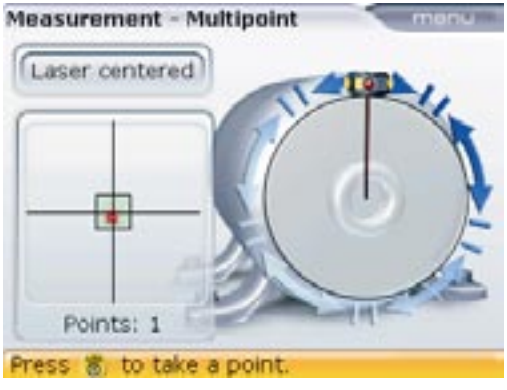


CAUTION! Do not allow shafts to turn during this process.

3. Readjust the beam into the target square using the yellow reflector knob and the metal thumbwheel.



4. On centering the laser dot, the blue OPTALIGN smart LED lights up. Press Enter. The adjusted beam position is automatically recorded and taken as the end point of the readjustment.



5. Continue measurement as before, rotating the shafts and pressing Enter to take measurements at the desired positions.

The program includes the displacement of beam readjustment in its alignment calculations.

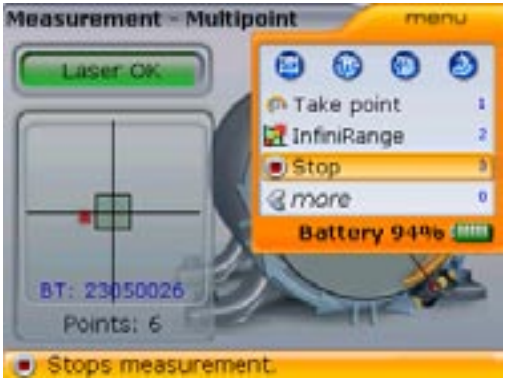
The 'extend' option is available only in 'multipoint' and 'static' measurement modes.

'Laser END' is displayed when the reflected beam misses the detector. This situation occurs when machines are severely misaligned, or when the beam travel is long. Measurement is not taken when this message appears.

Note

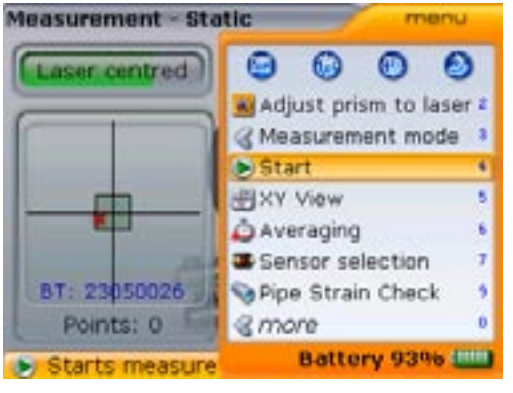
Remeasuring

The possibility to remeasure is provided in all measurement modes. To remeasure, the current measurement needs to be stopped. To stop a measurement, press Menu while carrying out measurement. Use ▽/△ to highlight "Stop".



Alternatively, stop measurement by pressing 3def with the context menu displayed.

Confirm selection by pressing Enter.
To start a new measurement, press Menu and use ▽/△ to highlight "Start".



Start measurement directly by pressing 4ghi.

A different measurement mode can also be selected under "Measurement mode" before starting to remeasure.

Confirm selection by pressing Enter.

Resume

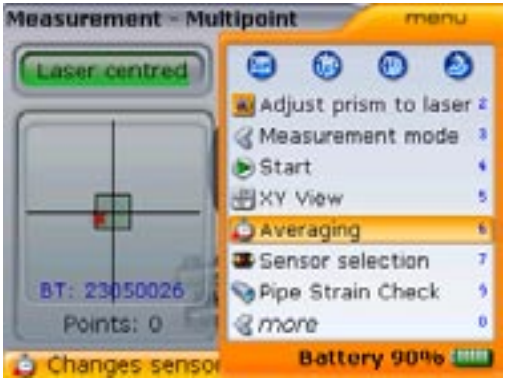
OPTALIGN smart provides the possibility to turn off the instrument during measurement and resume with the last file opened. On switching the instrument on, the measurement file loaded is the one that was last opened, provided it had already been saved. If you prefer to open a completely new file, press Menu followed by 2abc.

This auto-resume function ensures that the measurement file last selected, when the instrument switches itself off due to the power management function "power scheme" (see configuration on page 28), remains the active file when the instrument is switched on again.

Averaging

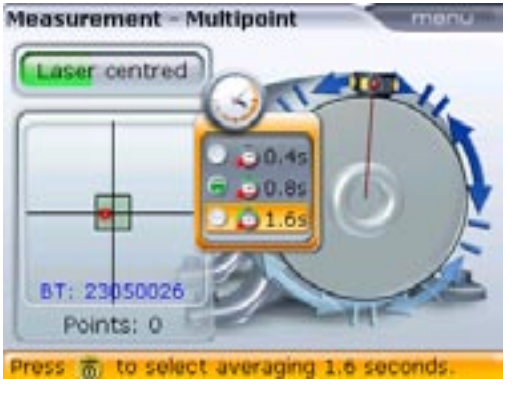
In certain industrial conditions, it may be necessary to increase the number of measurements to be averaged when taking readings to attain the desired accuracy. Particular cases include applications with increased machinery vibration. An increased averaging also improves the accuracy when measuring sleeve bearings, white metal bearings and journal bearings.

The number of individual readings which are averaged together to form one measurement are set via the measurement screen. Press Menu while in the measurement screen. Use ▽/△ to highlight "Averaging".



Alternatively, access the averaging screen directly by pressing 6mno while the context menu is displayed.

Confirm selection by pressing Enter.



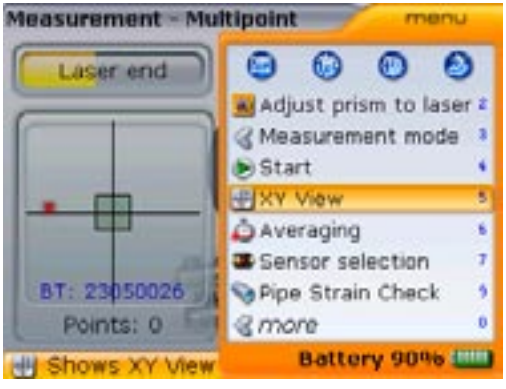
The average setting can be changed from a minimum averaging of 0.4 seconds to a maximum averaging of 1.6 seconds.

Averaging is possible only in Multipoint and Static measurement modes. The averaging setting that is selected will also be active in soft foot and Move. Should high averaging be selected, patience must be exercised during Move to allow OPTALIGN smart enough time to "catch-up"as the machine is moved. In this case, each reading that must be calculated to update the graphic display will take a longer time. Averaging cannot be changed once a measurement has been started.

Note

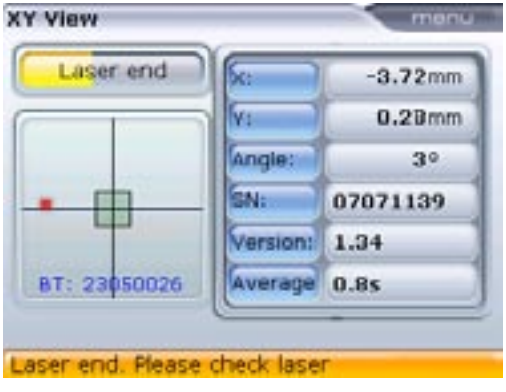
XY View

Before measurement begins, the reflected laser beam must be adjusted such that it strikes the detector surface. The beam should strike the detector as close to the center as possible. To facilitate adjustment, the height of the transducer and the reflector should be aligned and the brackets rotationally aligned.
The option "XY View" can be activated to help meet the requirement mentioned above.
To access the "XY View", press Menu while in the measurement screen. Use ▽/△ to highlight "XY View".



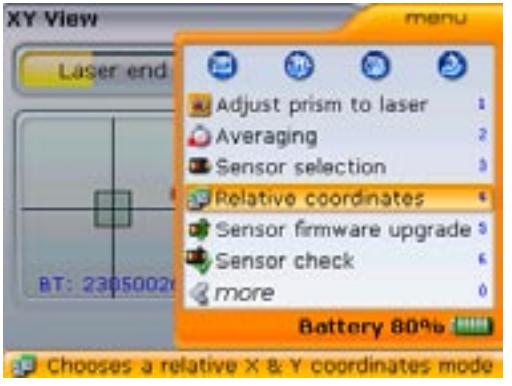
Alternatively, access the XY view directly by pressing 5jkl while the context menu is displayed.

Confirm selection by pressing Enter. The "XY View" table screen appears.



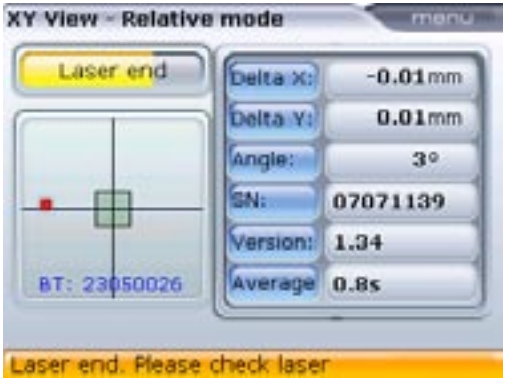
Displayed are the absolute X,Y coordinates of the laser beam on the detector surface, the angle at which the transducer is currently positioned on the shaft, the transducer serial number and firmware version.

Additional "XY View" capabilities include the setting of the XY coordinates as a reference value. To access this option, press Menu while in the "XY View" table screen above. Use ▽/△ to highlight "Relative coordinates".



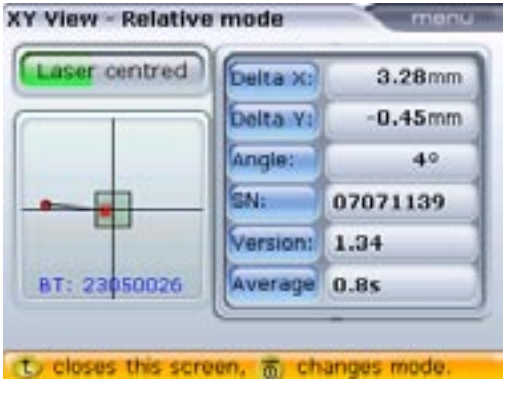
Relative coordinates may be accessed directly pressing 4ghi while the context menu is displayed.

Press Enter to set the current laser dot position as 0,0.



The adjusted beam position is set to '0,0' to serve as a reference.
Press Enter to toggle between the reference and the absolute values. This can also be done via the "XY View" context menu.

If the laser beam dot is adjusted while in the "Relative mode" screen, it traces a path showing the laser dot movement.



The coordinates to the new laser dot position are '3.3, -0.5'.

Updating the OPTALIGN smart firmware

Updating OPTALIGN® smart to a newer version

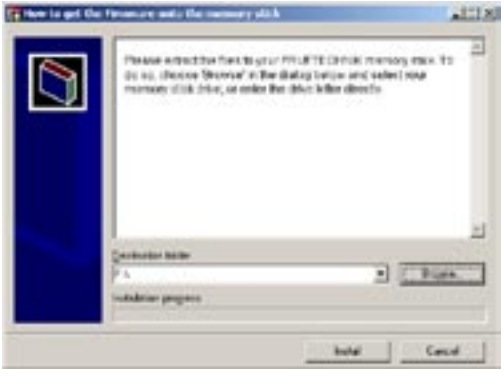
- OPTALIGN smart firmware updates are carried out with the use of the especially approved PRÜFTECHNIK 128/256 MB or 1G USB memory stick (aka jumpdrive). The memory stick is preloaded with the current firmware, and is an integral part of ALI 12.700 SET.
- Check our website to ensure you have the latest version. If in doubt, please contact your local representative or PRÜFTECHNIK Alignment Systems.
- If the update is downloaded from the PRÜFTECHNIK website, you will be first required to download the compressed upgrade package to your PC, then extract it to an approved memory stick.

Note

1. Downloading the firmware from the PRÜFTECHNIK website

The file available for download is an .exe file. Download the file to a desired directory.

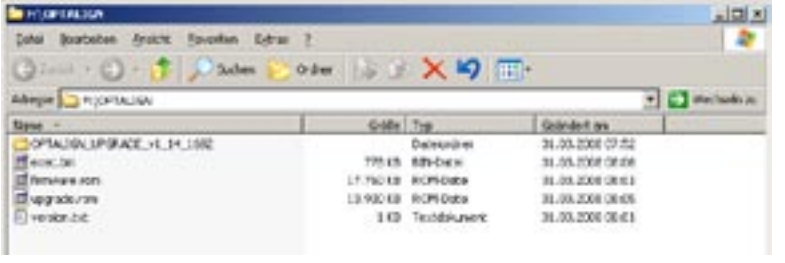
Double-click the file to extract it to the approved memory stick. The following screen with instructions on how to extract the firmware files into the memory stick appears.



After selecting the location of the approved PRÜFTECHNIK memory stick by clicking 'Browse', start file extraction by clicking 'Install'.

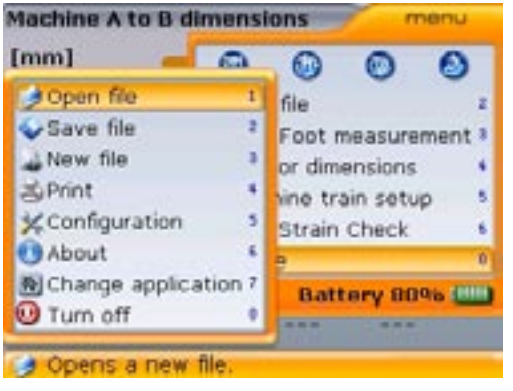
2. Carrying out the firmware update

The firmware update is carried out using the memory stick and the 'short' OPTALIGN smart USB cable ALI 12.503. The actual update does not require a PC.
Before starting the update verify that your memory stick has the following files on it.



The displayed files and folder are viewed by expanding the folder 'OPTALIGN'.

a) Press Enter to switch OPTALIGN smart on. Wait for the dimensions screen to appear. Press Menu to view the battery capacity.



Before proceeding with the update ensure that the indicated nominal capacity of the battery is greater than 50%. If this is not the case, recharge the battery to full capacity first (if using a rechargeable battery), or replace all six AA batteries at the same time.

- For the intrinsically safe version, the computer may be mains powered via the adapter box ALI 12.500 should the battery capacity fall below 50%.

Note

Please note that the following update procedure hold for both the intrinsically safe and non-intrinsically safe versions of OPTALIGN smart computer. The ***significant difference*** when carrying out firmware update to the intrinsically safe OPTALIGN smart EX computer ALI 12.200 EX, is that the adapter box ALI 12.500, must be connected to the intrinsically safe OPTALIGN smart computer. Note that instructions relating to the intrinsically safe version ONLY are marked with a ***red arrow***.

CAUTION

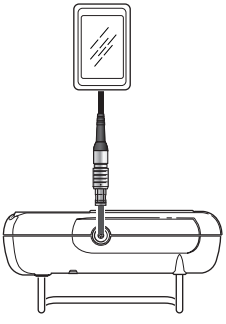
b) Attach the 'short' OPTALIGN smart USB cable ALI 12.503 to your OPTALIGN smart (ALI 12.200) via the socket.

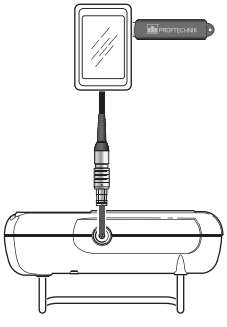
- For the intrinsically safe version ALI 12.200 EX, connect the adapter box to the computer which MUST remain switched off.

c) Insert the approved PRÜFTECHNIK memory stick ALI 12.700 SET into the 'short' USB cable.

- For the intrinsically safe version ALI 12.200 EX, connect the approved PRÜFTECHNIK memory stick ALI 12.700 SET to the adapter box directly via the USB memory stick interface, then switch the computer on.

The update process will start automatically after a little while (as long as 10 seconds). You will hear a few beeps and see flashing diodes as the process begins.





Connections to OPTALIGN smart intrinsically safe version ALI 12.200 EX via the adapter box ALI 12.500 are shown above

Do NOT turn off the device or remove the memory stick during the entire update process, which takes up to 10 minutes.

Note

3. Completing the update – Step 1

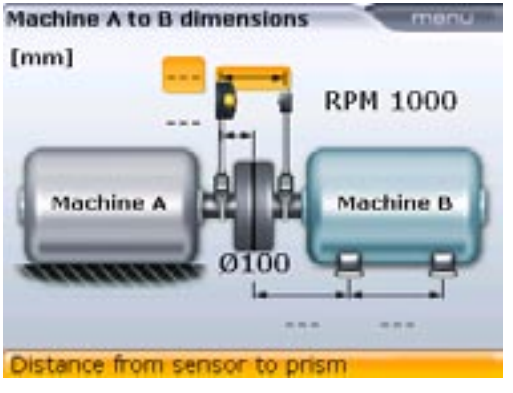
a) Follow the screen prompts during the upgrading process. When the first step of automatic update is completed, the shown below appears.

b) Press Enter and hold down until OPTALIGN smart computer reboots. The display goes dark and the second update step starts automatically.

4. Completing the update – Step 2

a) Follow the screen prompts during this process, which takes up to 10 minutes.

b When the process is completed, the dimensions screen appears.



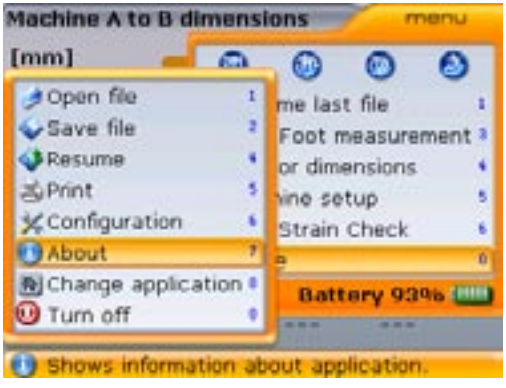
Your OPTALIGN smart is now ready for use with the uploaded version.

The USB cable and the adapter box may now be detached from the respective OPTALIGN smart computers.

Note

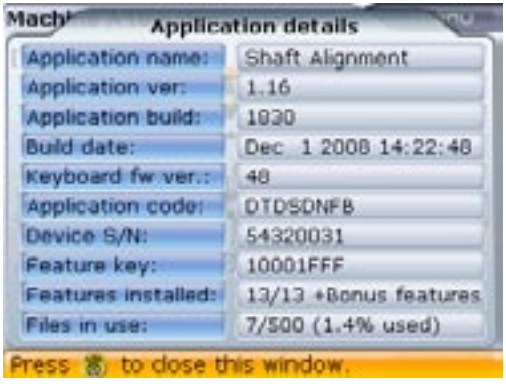
5. Checking uploaded version

a) After the opening dimensions screen appears, press Menu and use the navigation keys to select "More"/"About"



Alternatively, after pressing Menu access the 'Application info' screen directly using the shortcut numbers on the data entry keys. Pressing 0 followed by 7pqrs opens the 'Application info' screen shown below.

b) Press Enter to confirm selection. The application information screen shown below appears, with the new firmware version listed under "Application version".



The application details include the uploaded firmware version, the application build, currently loaded features among others.

Transducer firmware update

It is now possible to carry out a transducer firmware update directly via the OPTALIGN smart computer. If a transducer with an older firmware version is connected to the OPTALIGN smart computer, a hint indicating that the transducer firmware requires updating appears on the display.

Use △/▽ to select 'Yes'/'No' respectively. Confirm selection by pressing Enter.

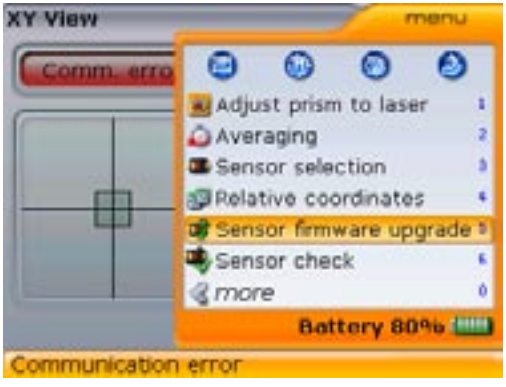
Use △/▽ to select whether or not to update the transducer. If you select to update the transducer, press Enter. The sensor firware update wizard appears.

The transducer must be connected to the OPTALIGN smart computer to perform this update

Note

The wizard guides the user through the transducer firmware update in self-explanatory steps.

Alternatively, the transducer firmware update can be carried out later by accessing "sensor firmware upgrade" through the "XY View" screen.



The wizard is accessed by pressing (M) followed by Menu then by 4ghi. This opens the "XY View". From the "XY View" screen press Menu and open the wizard by pressing 5jkl.

It is strongly recommended that the transducer firmware update be carried out. The transducer firmware update takes about 10 – 15 minutes and should be carried out using the OPTALIGN smart transducer cable ALI 12.501-2. And therefore if your currently set connection is via wireless RF module, you must first access the "sensor selection" option through the Measure screen's context menu and select and confirm the "Sensor @ Port 1 (RS-232)" option instead.
All OPTALIGN smart transducers manufactured before August 2007 have firmware version 1.31. Transducers manufactured after August 2007 are version 1.33. The current transducer firmware version is 1.34.

Note

Checking transducer firmware version

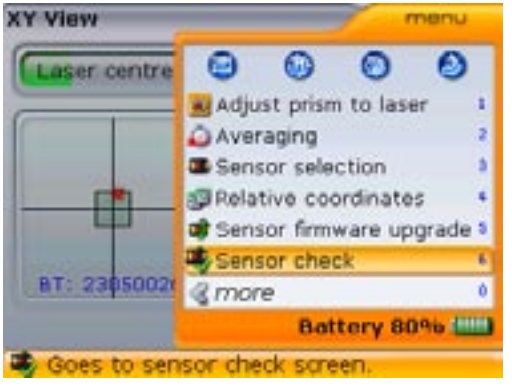
The firmware version of the transducer may be checked at any time. To do this, proceed as follows.

a) Connect the transducer to the OPTALIGN smart computer. For non-intrinsic safety versions, the connection may take place via the RF module ALI 4.620 SET.
b) Press (M) to access the measurement screen. While in the measurement screen, press Menu to display the context menu.
c) With the context menu displayed, use △/▽ to highlight "XY View".

Alternatively, the XY View screen may be accessed directly by pressing 4ghi while the context menu is displayed.

d) Press Enter to confirm selection. The XY View screen appears.

f) With the XY View screen displayed, press Menu to display the context menu. Use ▵/▿ to highlight the menu item "Sensor check".



Direct sensor check may also be achieved by pressing 6mno while the context menu is displayed.

g) Press Enter to confirm selection.

h) If the transducer firmware version is up-to-date, the screen below appears.

i) If however, the transducer firmware version is old, the following screen appears.

Using the optional RF module

The RF module powers the transducer and passes alignment readings from the transducer to the OPTALIGN smart internal antenna. The module covers direct line of sight distances of up to 10 m / 33' depending on the prevailing environmental conditions. Its electronic compartment complies with code IP65 (dust tight and protected against water jets). The RF module is powered by 2 'AA' size batteries. The operating time for the alkaline batteries is 14 hours – based on an operating cycle of 50% measurement, 50% standby. Lithium-ion AA batteries (such as for cameras) may also be used, in place of alkaline batteries. For lithium-ion batteries, the operating time is significantly longer; however, the drop-off rate when they become depleted is much faster than with alkaline batteries, providing less advance warning.

Mounting the RF module

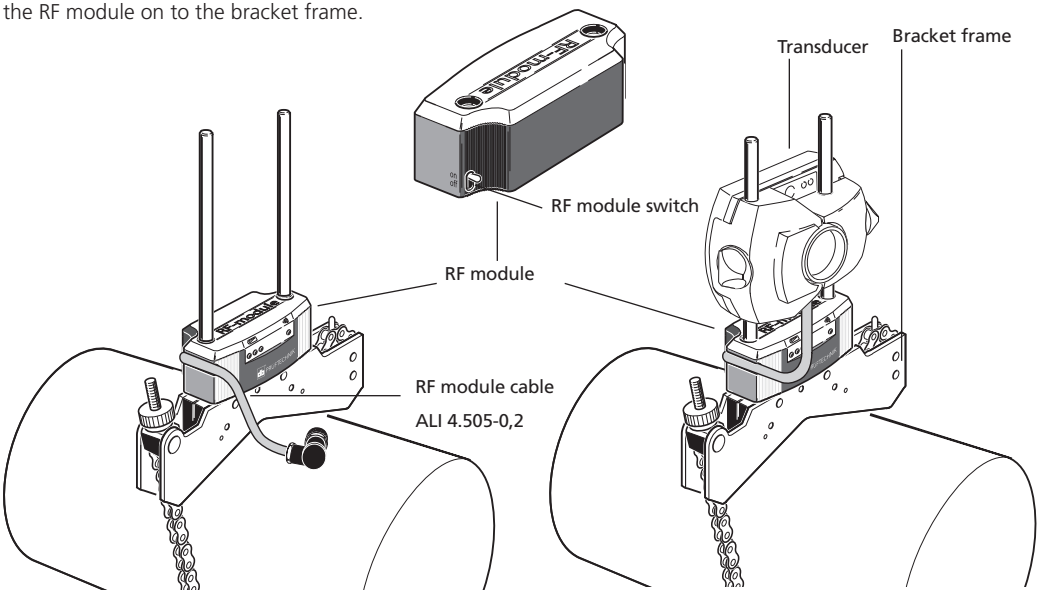
Connect the cable ALI 4.505-0,2 to the RF module ALI 4.621 by inserting the longer 90-degree connector of the cable into the four-pin socket on the side of the module with a groove.

Longer connection cables for the RF module are optionally available for special situations.

Match the red dot on the plug to the groove on the socket to ensure proper plug orientation.

Note

Mount the RF module on the support posts of the bracket fixed on the shaft of the left machine (usually stationary machine) as shown in the figure below. The module slides onto the support posts and is held in place by friction fit. It is recommeded to mount the RF module on to the bracket frame.



Do not connect the wireless RF module to the intrinsically safe OPTALIGN smart transducer.
The RF module is not intrinsically safe and therefore must not be used within explosive environments.

Switch the RF module on

After mounting the transducer on the support posts, connect the module to the transducer by inserting the shorter 90-degree connector of the cable into the 8-pin transducer socket, noting the keyway orientation, and screwing in the knurled sleeve of the connector until it is snug. Switch the RF module on.
The battery status LEDs blink for 3 seconds. The module is now ready for operation. When the RF module is switched on, it supplies power to the receiver. If no measurement action is activated in OPTALIGN smart, the power supply to the transducer stops.

Operating time of battery status LED indicators

State of LEDs	Indicates
3 LEDs lit continuously	Operating time is between 75%–100%
2 LEDs lit continuously	Operating time is between 50%–75%
1 LED lit continuously	Operating time is between 25%–50%
Only 1 LED blinking (slowly)	Operating time is under 25%
Only 1 LED blinking (very fast)	Operating time in critical phase. Measurement should not be taken

The operating time may vary significantly depending on the type of batteries used. Normally, alkaline AA-size batteries are used; With lithium-ion batteries, the operating time is significantly longer; however, the drop-off rate when they become depleted is much faster than with alkaline batteries, providing less advance warning.

Note

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Special alignment applications

This chapter deals with alignment of machines that require use of special procedures rather than those for the standard horizontal alignment. These special applications include:

- Machine trains (groups of 3 machines coupled together)
- Cardan drive machines
- Flanged machines (mounted vertically or horizontally)

OPTIONAL

Machine train alignment

How to align machinery trains

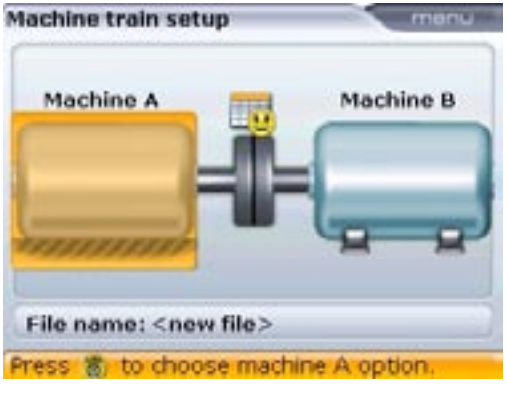
The following step-by-step approach is recommended for 3-machine trains.

› a. Measure alignment at each coupling
› b. Display results and optimize corrections (by defining 'stationary' machine feet)
› c. Align two machines (remount transducer and reflector if necessary)
› d. Recheck alignment results
› e. Align the next machine in the train and repeat alignment check

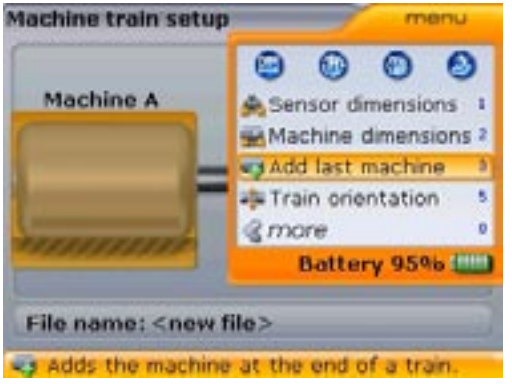
Machine train set-up

Machine train set-up resembles the set-up described on page 58 and will therefore be outlined here only briefly.

› Press (t) while in dimensions to access "Machine train set-up" screen.



› Highlight either machine and then press (Menu). The context menu with the menu item 'Add last machine' appears.

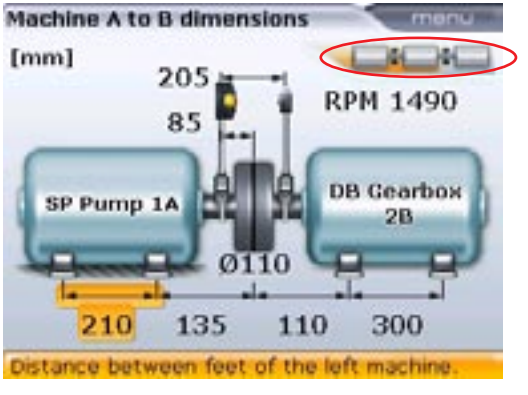


Alternatively, use ▵/▿ to highlight "Add last machine" and confirm selection by pressing Enter.

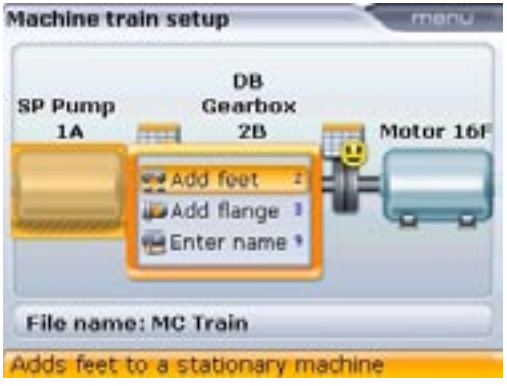
› Press 3def to add a third machine to the right end of the train.
› A hint appears requesting confirmation whether the machine should be added. Highlight 'Yes' using ▵/▿ then pressing Enter.

The added machine always appears on the right end of the train, and the only machine that can be deleted from the train is the one positioned at the right end.

› Configure the machine train as appropriate



The train elements appearing on the screen are shown highlighted on the train icon on the top right of the display. Pressing ◃ or ▹ long enough moves the view of the train to the right or left respectively.



Quick editing of specific machine properties and parameters is achieved when the machine train is zoomed out to the 3-machine view. To zoom out the train, press (t) while in dimensions. Use (◁ / ▷) to highlight machine to be edited. Pressing (Enter) reveals the corresponding submenu.

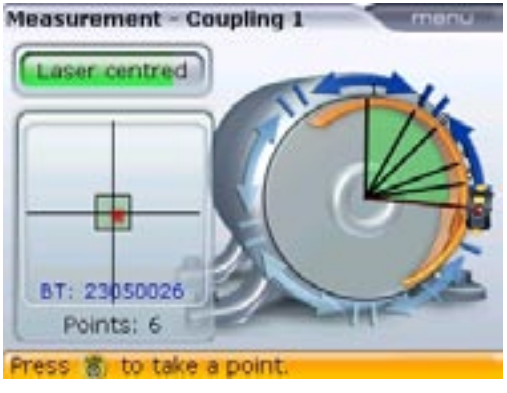
Measurement

› Use (◁ / ▷) to select the coupling to be measured. The transducer is to be mounted on the machine shown on the left side in the screen diagram.

› Remove the dust cap from the transducer and switch it on. Leave the reflector dust cap on.

› Press (M) and adjust the beam onto the dust cap (refer to section 7.3 'Laser beam adjustment' on page 70).

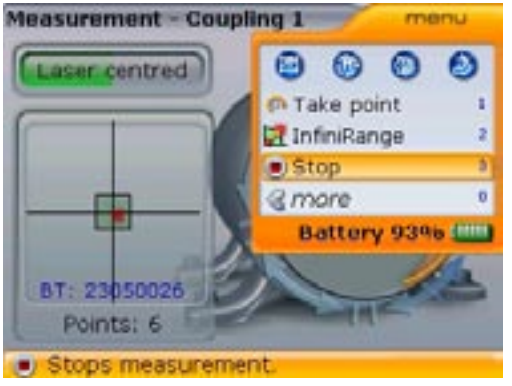
› Proceed to carry out measurement as described in section 8 'Take measurements' in the chapter "Horizontal shaft alignment", observing the requirements for valid measurement – shafts must be turned by at least 60°, a minimum of 3 measurement points to be taken.



In this example, coupling 1 is measured using the multipoint measurement mode. Measurement is stopped by pressing (Menu) followed by (3def) when the context menu appears

› Press (Enter) to stop measurement.

If the measurement mode used is not continuous sweep, measurement is stopped by pressing (Menu) followed by (3def), as shown in the following screen.



Pressing 3def when the context menu appears stops measurement.

› Mount the transducer and reflector across the next coupling.
› Press ◁ / ▷ long enough to select the next coupling.

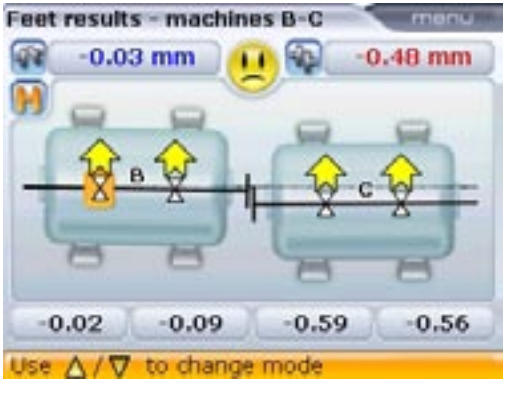
In this example, coupling 2 is measured using the continuous sweep measurement mode. In this case, measurement is stopped by pressing Enter. Alternatively, press Menu followed by 3def when the context menu appears

› Repeat the measurement procedure as described previously.

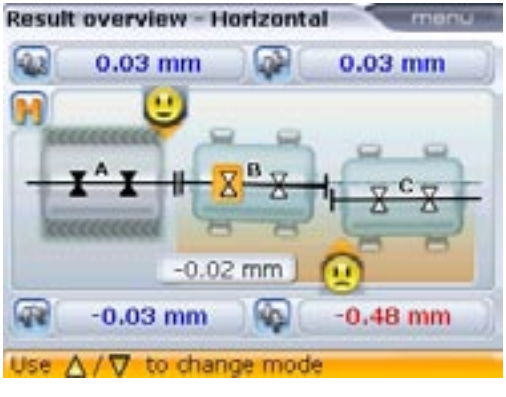
Evauating results

Press to view the alignment results at the individual couplings. Cycle through all available results screens using /.

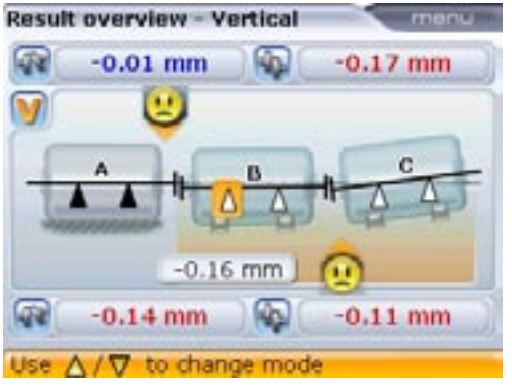
Coupling values at the second coupling position accessed using /



Horizontal feet results at the middle and farthest right machines accessed using /

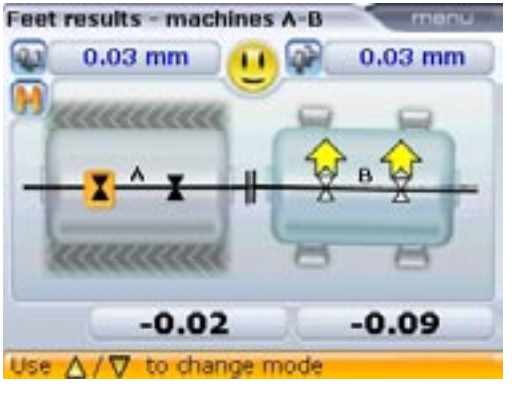


Horizontal coupling results for entire machine train accessed using /

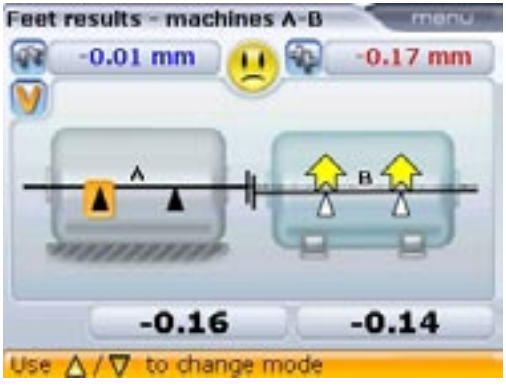


Vertical coupling results for entire machine train accessed using △/▽

Coupling values at the first coupling position accessed using △/▽



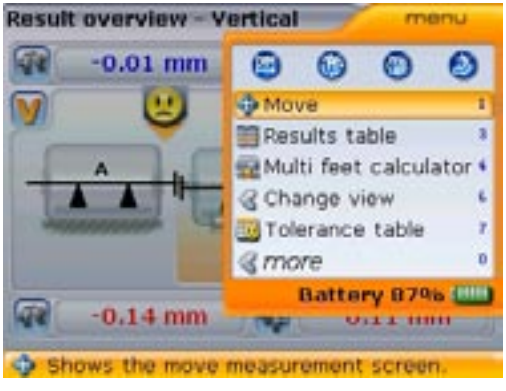
Horizontal feet results at the farthest left and middle machines accessed using △/▽



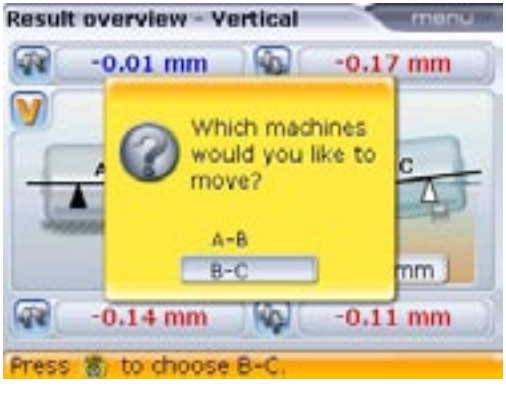
Vertical feet results at the farthest left and middle machines accessed using △/▽

Move corrections

Correction of misalignment may be carried out using the live move function. Press Menu while in 'Results'. The context menu appears.

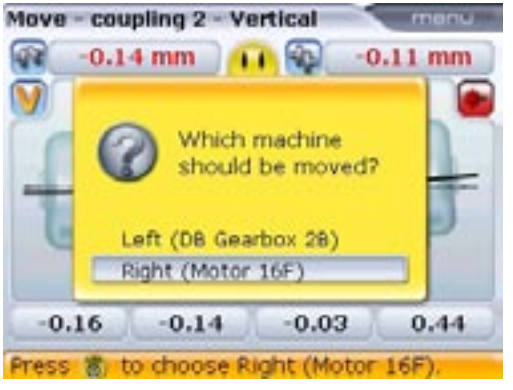


Press 1 to access 'Move'. A hint appears on the display requesting the coupling location with the pair of machines to be moved.

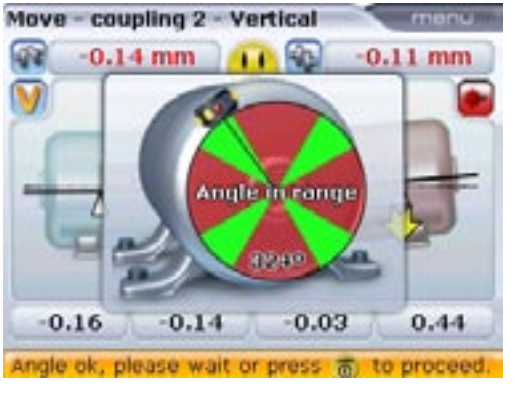


Use △/▽ to highlight the pair of machines to be moved, and confirm selection by pressing Enter.

Use △/▽ to highlight the pair and confirm selection by pressing Enter. A further hint appears requesting selection of machine to be moved



Use △/▽ to highlight machine to be moved and confirm selection by pressing Enter.



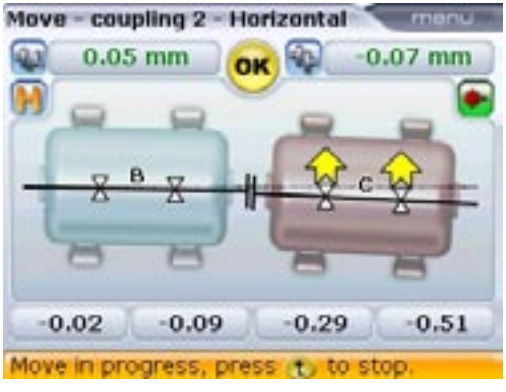
Rotate the shaft to position the transducer and reflector in any one of the four 45° positions indicated by the green sectors. If the laser beam has been centered, a hint appears on the display requesting selection of direction of the move.

If the laser beam has not been centered, the laser adjustment guide appears on the screen. Use it to center the laser beam

Use △/▽ to highlight the direction to move the machine and confirm selection by pressing Enter. Live move starts automatically. Loosen the machine anchor bolts and move the machine with the aid of the yellow arrows.

Do NOT attempt to move the machine using heavy sledgehammer blows. This can cause bearing damage, and also produce inaccurate MOVE results. Jack bolts on the feet or other mechanical or hydraulic devices are recommended for moving machines.

CAUTION



Move the machines until the alignment condition is within the specified tolerance which is indicated by the smiley and the OPTALIGN smart alignment condition LEDs. Tighten the anchor bolts and then press t to conclude the move procedure. A hint appears on the display requesting whether to repeat move or exit and remeasure.

Use ▲/▼ to highlight action to be taken. Press Enter to confirm selection.

As the true position of shaft rotation axes can only be determined by rotating shaft during measurement, it is not possible to exit live move without carrying out another measurement.

Note

Remeasure to confirm the alignment condition. If the smiley returns a happy face, the alignment condition is within tolerance and you may press Enter to save measurement results.

Cardan drive machines

This section describes the aligning of cardan shafts using the cardan shaft bracket lite ALI 2.874 SET used in conjunction with OPTALIGN smart. Cardan drives are installed and operate with a large offset between the driver and the driven shaft. The spacer shaft is set at a considerable angle (usually 4° to 6°) in order to ensure sufficient lubricant circulation, which in turn prevents the universal joints from seizing. Excessive misalignment of such a configuration leads to rapid fluctuation of the driven shaft RPM during operation, which holds grave consequences for electronically-controlled synchronous and asynchronous AC drive motors.

Precise alignment reduces the rotational irregularities of the cardan shaft to a minimum, so that the uneven bearing loading during cardan shaft rotation is also minimized, the service life of the components is extended and the chance of unexpected machine failure is reduced.

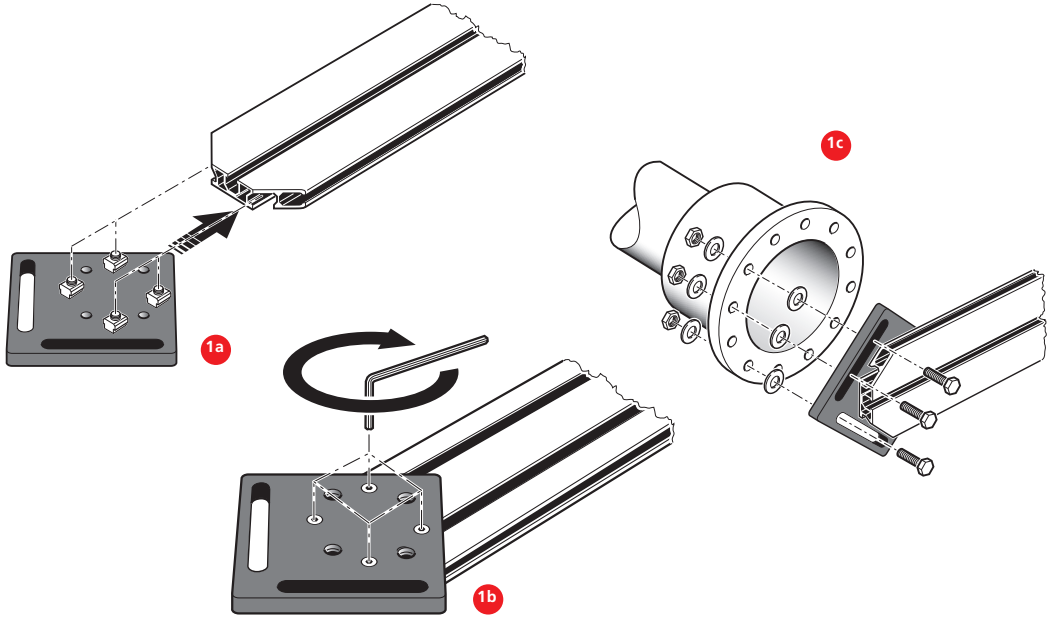
The measurement procedure described here allows precise measurement of machines joined by cardan shafts over distances of up to 3 m (10 ft) and shaft offsets of up to 400 mm (15 3/4 in.) using OPTALIGN smart.

1. Mounting the faceplate to the rail

a. Slide the the faceplate down the rail as shown in figure (1a) below. The four T-nuts should sit in the grooves.
b. After positioning the faceplate on the rail, tighten the four socket head screws using the provided M5 allen key.
c. Mount the bracket assembly to the coupling face of the non-rotatable shaft. If the coupling face has a raised rim, the precision machined spacers are used as shown in order to separate the bracket faceplate from the coupling face.

(Without the spacers, there would be no direct contact between the faceplate and the coupling surface surrounding the bolt holes – exactly the location where the faceplate and coupling are being joined.) The washers prevent the nuts from marking the coupling surface when tightened.

Depending on the relative positions of the machines joined by the cardan shaft, an inclinometer or spirit level should be used to position the bracket assembly at the same angle as the cardan shaft when installed, before tightening down the bolts. A design drawing from the machine manufacturer can be helpful in determining the intended horizontal and/or vertical offset between the machine coupling halves. The inclination can be calculated from these horizontal and vertical distances as follows:
Inclination = arctan (vertical offset / horizontal offset)

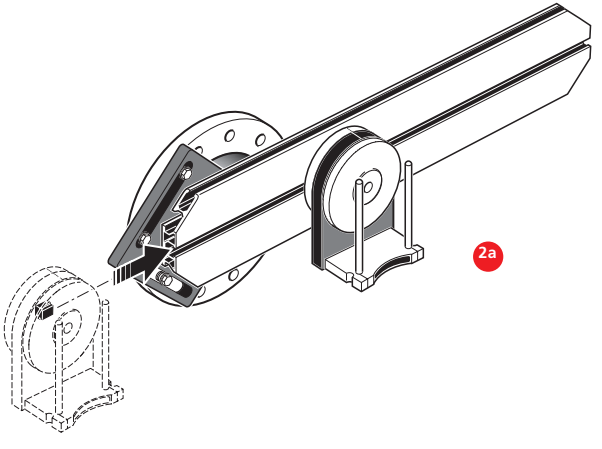


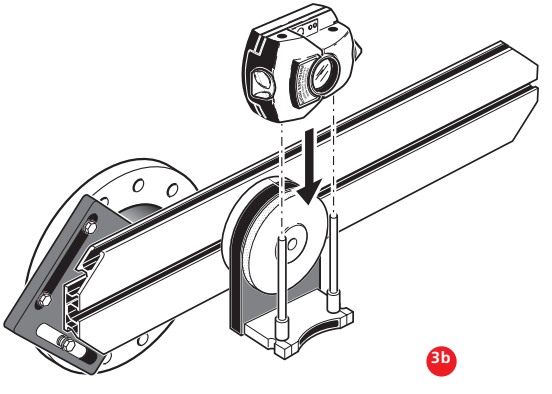
2. Mounting the laser holder assembly on to the rail

a. Loosen the handwheel slightly, then slide the laser holder assembly down the center groove of the rail, with the T-nut acting as a guide.
b. Fasten the laser holder assembly onto the rail at the appropriate position by tightening the handwheel.

3. Mounting and adjusting the transducer

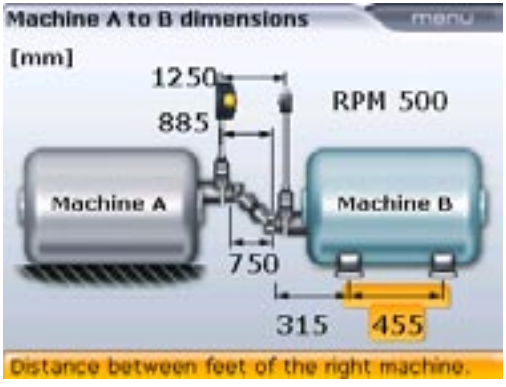
a. Slide the two distance sleeves (the slightly larger diameter bushing-like pieces seen resting at the bottom of the support posts) down the support posts.
b. Slide the transducer onto the posts until it rests on the distance sleeves. When sitting on the sleeves, the beam aperture is approximately in line with the rotation axis of the holder
c. Mark a set of target crosshairs on the shaft rotation centerline of the other machine coupling (if the flange has a center hole, a dust cap can be inserted to provide a temporary target surface).



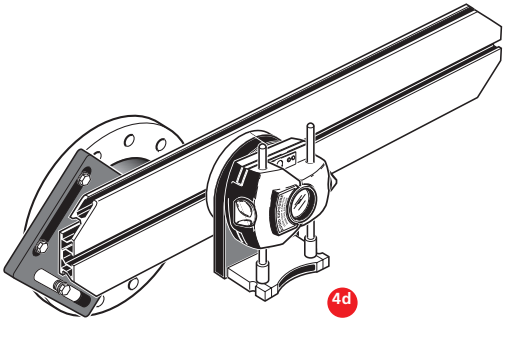


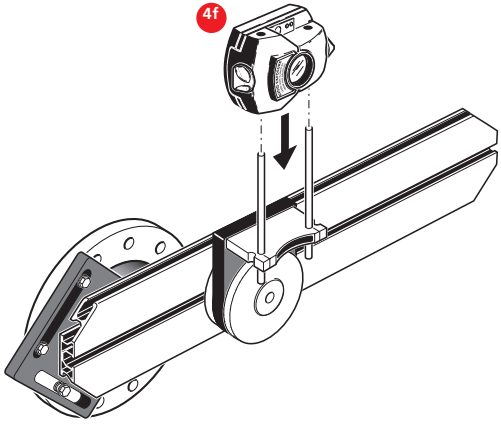
4. Set-up

a. Connect the transducer to the computer, then switch on OPTALIGN smart.
b. Set up the machines (refer to section 7.2 ‘Machine set-up’ on page 58) and select “Change to cardan” in coupling properties
c. Enter all required machine dimensions.



d. Press ⓜ to initialize the sensor. The laser beam is now on. Adjust the beam to strike the center of the target on the opposite coupling:
   › For rough adjustment, loosen the handwheel and slide the holder along the rail.
e. Remove the transducer from the laser holder.
f. Using the provided M5 allen key, loosen the support posts and slide them through the bracket frame so that they protrude from the other side.
g. Remount the laser onto the support posts.

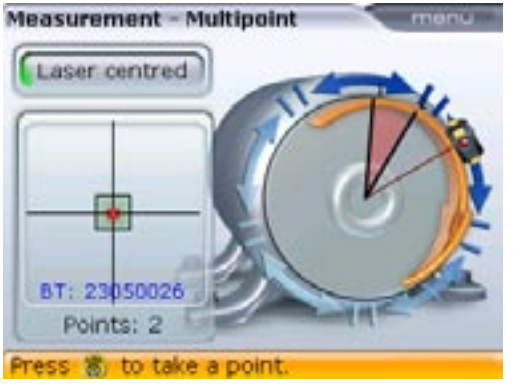




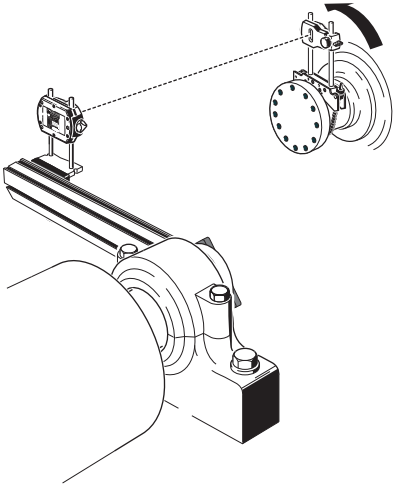
h. Use the chain-type or magnetic brackets to mount the prism on the opposite machine shaft.
i. Adjust the beam onto the reflector (refer to section 7.3 ‘Laser beam adjustment’ on page 70).

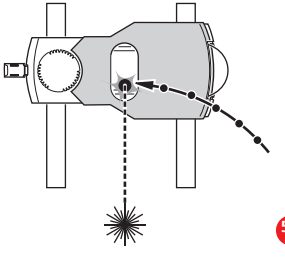
5. Measurement

a. Take alignment readings using the Multipoint mode.
b. Place the specially designed beam adjustment cap on the reflector to help with monitoring the position of the beam during rotation, and then rotate the reflector to the next measurement position.
c. Rotate the cardan bracket holder with the transducer until the laser beam strikes the prism through the opening on the specially designed beam adjustment cap. The position of the beam as it strikes the prism can also be observed in the measurement screen.



4h 4i





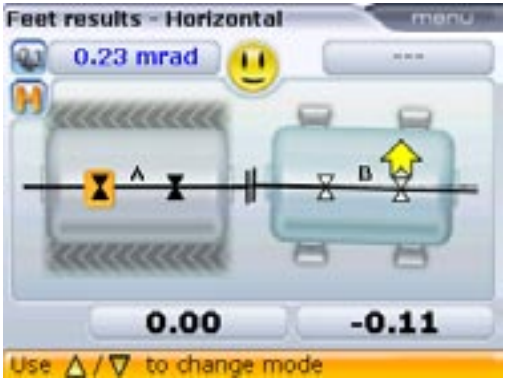
5b 5c

d. Press Enter to take measurement point.
e. Repeat steps c and d to take measurements in at least three positions over at least 60° of rotation. (Taking more position measurements over a wider range improves the reliability of results).

6. Evaluation and alignment

Since offset does not affect the performance of cardan shafts, only angularity must be corrected here.

a. Press to view alignment results.



b. If the machines are out of tolerance, reposition them with the help of the MOVE function (refer to pages 84 – 88).
c. Remeasure to determine the new alignment condition.

Flanged machines

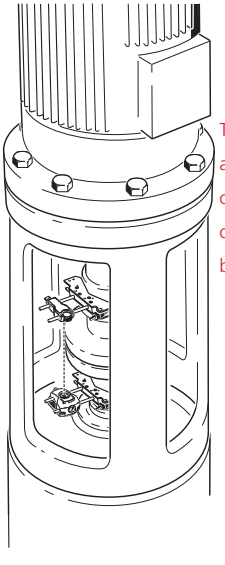
The diagram at the bottom of the page shows a typical vertical machine arrangement with one machine mounted on top of the other using a bolted flange.
Flange-mounted machines can be situated vertically or horizontally. In either case, alignment corrections are made directly at the flange.
Angularity is corrected by inserting or removing shims between the flanges. OPTALIGN smart calculates the shimming thickness for each flange bolt. Offset is corrected by positioning the flange laterally.

Set-up

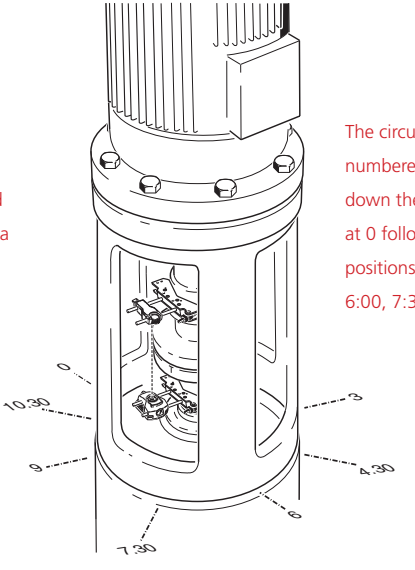
Before commencing with this section, please acquaint yourself with the chapter 'Horizontal machine alignment' starting page 43.

Note

The transducer and reflector are mounted on either side of the coupling as for horizontal machines, with the transducer below (the stationary machine) and the reflector above (MTBM). In this set-up, the electronic inclinometer cannot detect the rotation angle of vertical shafts. Measurement of vertical machines is carried out using static measurement mode. The eight 45° measurement positions used with this procedure must be marked accordingly on the machine.



Typical vertical machine arrangement comprised of one machine mounted on top of the other with a bolted flange.

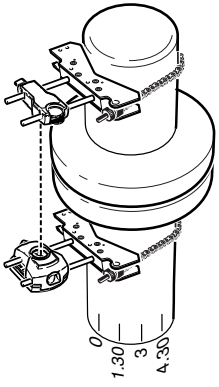


The circular housing is numbered clockwise looking down the shaft, starting at 0 followed by the clock positions 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 and 10:30.

1. Marking measurement positions

a. Mark a reference position on the coupling housing close to the shaft and in line with one of the pillars or bolts. Likewise, mark a starting point on the shaft. This ensures that lateral corrections can be performed with the minimum of effort.
b. Measure the circumference of the shaft and divide by eight.
c. Use this distance to make seven more evenly-spaced marks on the shaft beginning at your chosen start point. Number the points counterclockwise as seen from reflector to transducer, beginning with 0 first, followed by 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 and 10:30.

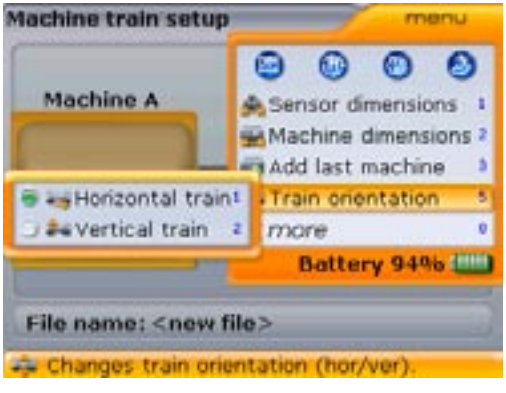
For circular housings, measure the circumference of the coupling housing and divide by eight. Use this distance to make eight evenly-spaced marks on the housing beginning at your chosen start point. Number the points clockwise looking down onto the shaft with 0 as the first, followed by 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 and 10:30. (Refer to the diagram on the previous page.)



The shaft is numbered counterclockwise looking down the shaft, starting at 0 followed by the clock positions 1:30, 3:00, 4:30, 6:00, 7:30, 9:00 and 10:30.

2. Mounting components and selecting machine orientation

a. Mount the transducer and reflector on either side of the coupling, ensuring that they are aligned exactly with the 0 or reference mark.
b. If using the RS232 interface to collect measurement data, connect the transducer to OPTALIGN smart and switch on the instrument. If using the wireless data transmision RF module ALI 4.620 SET, simply switch on the instrument.
c. From the dimension screen that appears, press (t). The "Machine train setup" screen appears. Press (Menu) then (5jkl) to select 'Train orientation' then (▽) to select 'Vertical train'.



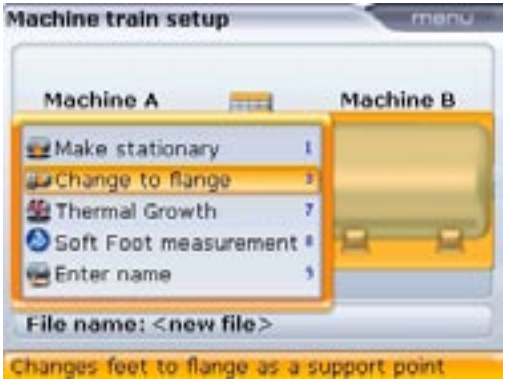
Alternatively, select train orientation directly by pressing (Menu) while in 'Machine train set-up' screen. With the context menu displayed, press (5jkl) then (2abc). A hint requiring confirmation to the selected train orientation appears.

d. Confirm selected train orientation by pressing (Enter). A hint appears requiring the acknowledgement of the change. Press (Enter) to acknowledge.

3. Editing flange configuration

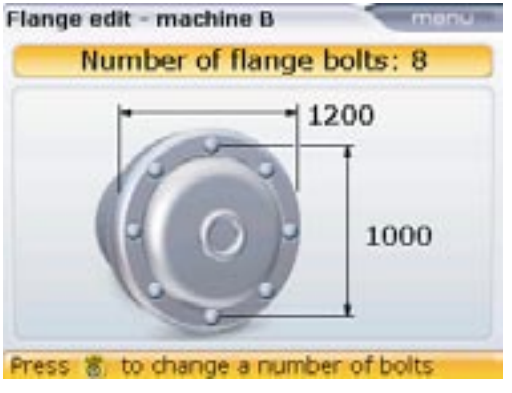
A typical vertical machine train arrangement consists of machines mounted together using a bolted flange. To configure the flange proceed as follows:

a. Proceeding from 2 above, and with MTBM highlighted press Enter and use ▽ to highlight "Change to flange".



Alternatively, press 3def with the menu items displayed.

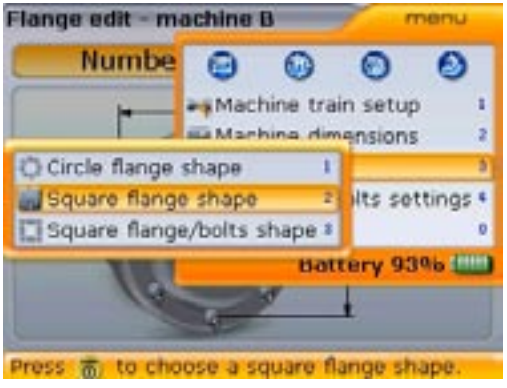
b. Confirm selection by pressing Enter. The "Edit flange" screen appears.



The parameters that can be edited are number of bolts, outer flange and bolt circle diameters. These parameters are highlighted using the navigation keys, and edited directly using the data entry keys.

c. To edit the flange pattern, press Menu while in the 'Flange edit' screen.
   The following flange patterns are available:
   - › Circular flange
   - › Square flange
   - › Square flange - circular bolt pattern

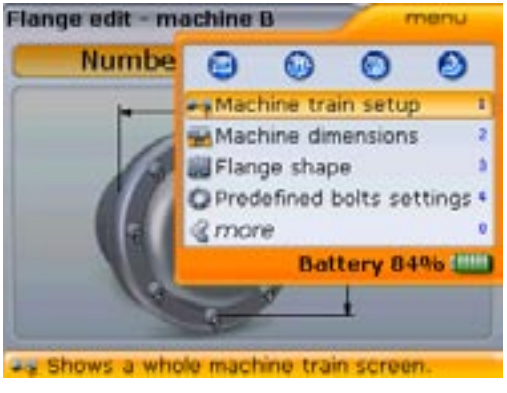
d. Press 3def to access the flange configuration submenu items.



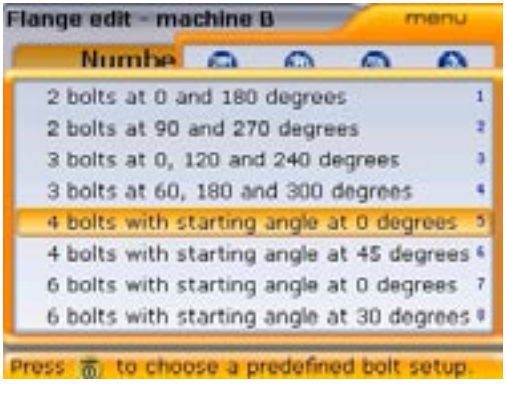
1 = circular flange
2 = square flange
3 = square flange - circular bolt pattern

e. It is possible to select predefined bolt patterns. This option defines the number of bolts and their respective positions.

› i) Press Menu while in the "Edit flange" screen.



› ii) When the context menu appears, press 4.



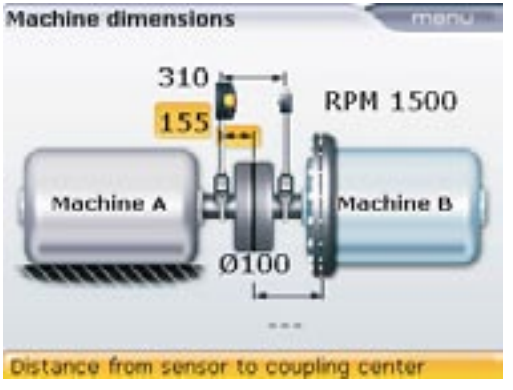
The option of selecting predefined bolt positions is currently possible with circular bolt patterns only.

› iii) Confirm bolt pattern selection by pressing Enter.

4. Enter dimensions

Press t or DIM to return to the dimensions screen.

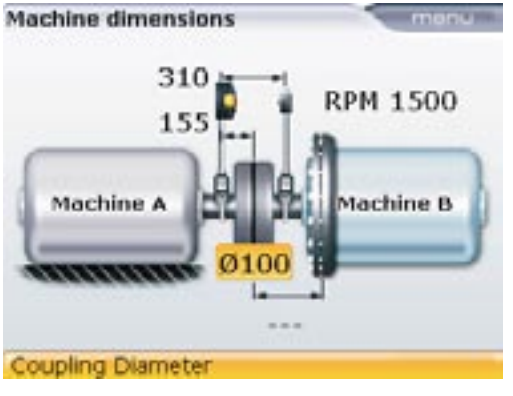
a. Enter the transducer-to-reflector distance.



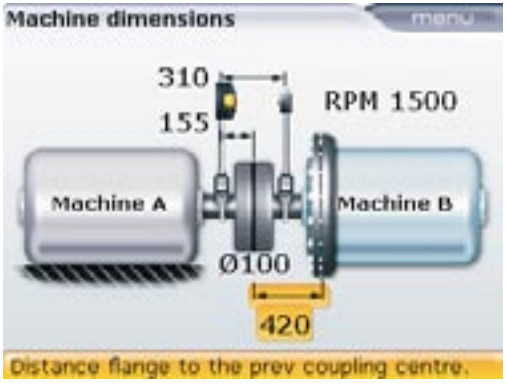
The transducer-to-coupling center distance is calculated as half the transducer-to-reflector distance automatically. Should need be, this value can be edited directly using the data entry keys.

Note

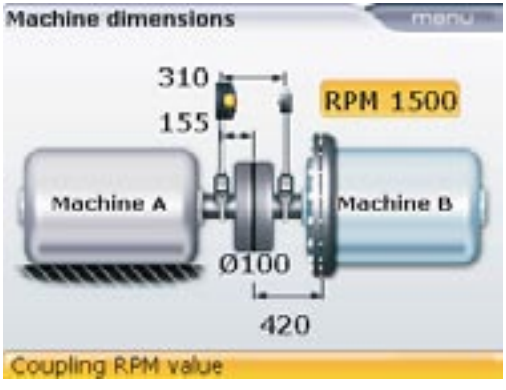
b. Enter the coupling diameter. The default is 100 mm.



c. Enter the coupling center-to-flange distance.

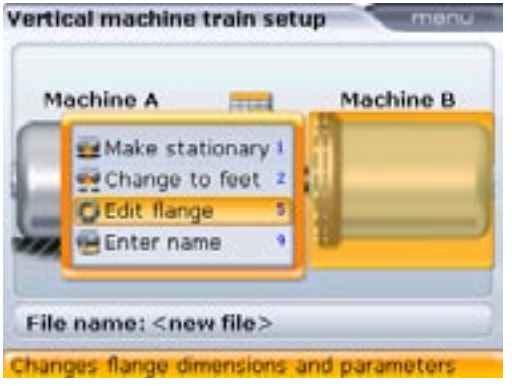


d. Enter the RPM. The default is 1500. (1800 if units option is set to US units.)



The flange configuration can also be edited from the above screen by highlighting the flanged machine. This is accomplished by pressing (L) and then pressing (Menu)

Note



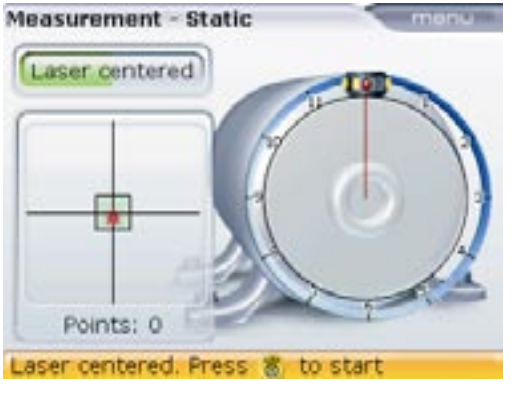
To edit the flange configuration, press 5jkl. The "Edit flange" screen described in 3 previously appears. Alternatively access the "Edit flange" screen using ▽ to highlight "Edit flange" and confirm selection by pressing Enter.

Measurements can now be made. If using the wireless data transmission RF module, ensure it is switched on.

5. Measure

a. Press M and then center the laser beam.

b. Rotate the shafts to the first measurement position. The reference mark and the measurement position 0 must be aligned with each other. Use the navigation keys to place the screen hour hand to correspond with the position of the reflector and transducer on the shafts.

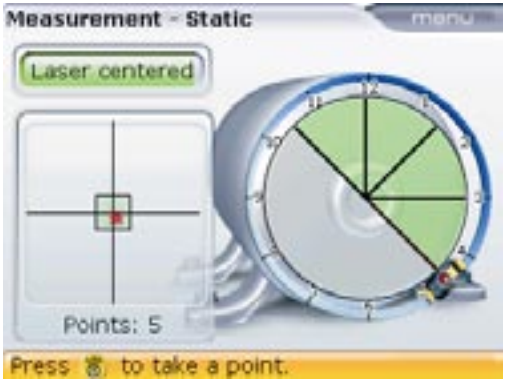


c. Press Enter to take the first measurement point.

d. Rotate the shafts to the second measurement position (e.g. 1:30). Move the screen hour hand using the navigation keys to correspond with the new position of the reflector and transducer on the shafts. Press Enter to take measurement point.

A minimum of three measurement positions are required to obtain results, but it is recommended that a maximum number of measurement points be taken to improve the quality of results.

Note



6. Results

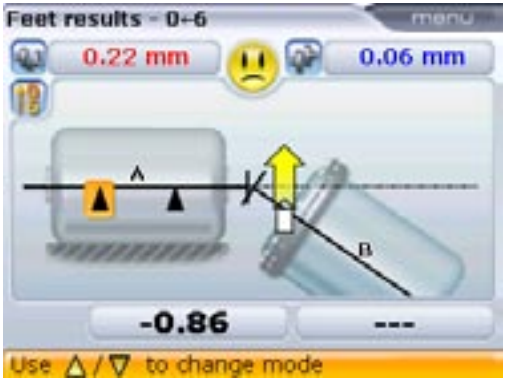
When measurement is complete, press to view results.

Coupling results show the gap and offset values in the 0-6 and 3-9 directions for short flex coupling.

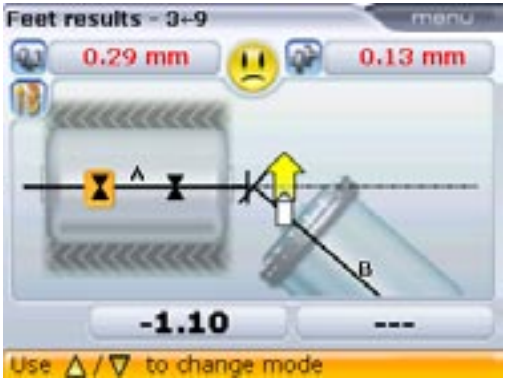
Sign convention (for vertical machines)
POSITIVE GAP opens towards 0:00 or 3:00
POSITIVE OFFSET if the top coupling half is offset towards 0:00 or 3:00

Note

Cycle through the coupling results and the flange correction positions using either , or .



In this example, the sad face smiley indicates that the flange needs to be adjusted in the 0-6 direction.



Shimming corrections are accessed by pressing (Menu) while in the "Feet results" screen. Use (▽) to highlight the context menu item 'Flange/Bolt results'.

Shimming corrections screen may be accessed directly by pressing (5jkl) with the context menu displayed. If the context menu is accessed from "Coupling results", shim corrections for each flange bolt are displayed by pressing (6mno).

Confirm selection by pressing (Enter). The shim corrections screen appears.

The shimming correction value (-0.44 mm) and the corresponding bolt are highlighted automatically as shown.

The shim corrections are numbered to correspond with the bolt positions. The bolt position corresponding to the currently highlighted calculated shim correction value appears numbered and highlighted with a yellow dot.

Use △/▽ to cycle through the shim values.

Use ◁/▷ to set the type of shimming required. The following options are available:

- Bolt correction (+) – means all shimming corrections are positive (add shims)
- Bolt correction (-) – means all shimming corrections are negative (remove shims)
- Bolt correction (+) – means all shimming corrections are minimized (optimized). Therefore half of the corrections will be negative and half of them positive. This option results in zero axial movement of the shaft.

7. Machine alignment

Alignment is carried out by correcting angularity and offset.

Correcting angularity

a. Loosen the flange bolts and lift the upper machine.

The machine bolts must be undamaged and removable.

CAUTION

b. Angularity corrections are made by shimming. The shim correction screen shows the shimming values at the respective bolt locations. Insert (or remove) shims with the correct thickness under the selected bolt.

Use good quality shims such as MYLAR, PERMABLOC or LAMIBLOC.

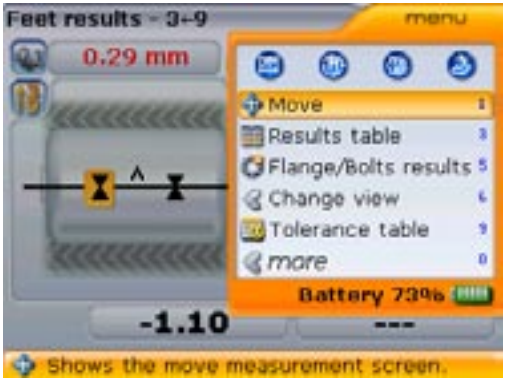
Note

c. Retighten the bolts and then remeasure to verify shimming results and determine the exact alignment condition.

Correcting offset

The correction of offset misalignment is carried out using the live MOVE function.

a. Access live MOVE by pressing (Menu) while in "Results" screen. Use (▽) to highlight the context menu item 'Move'.



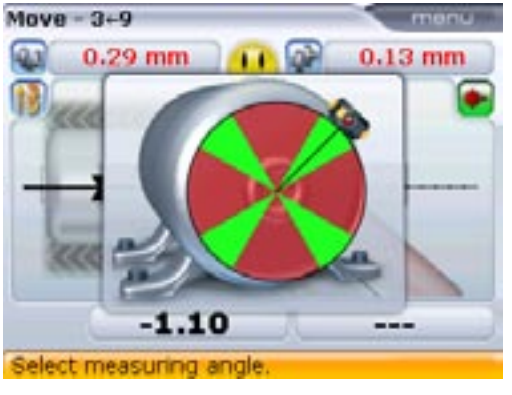
Alternatively, access Move by pressing (1 π) with the context menu displayed.

b. Confirm selection by pressing (Enter).

If move is selected from the coupling results screen a hint requesting the direction to carry out the move appears.

Note

c. On confirmation the screen used to position the transducer and reflector for optimal moves appears.



d. Rotate shaft to any of the four positions highlighted in green. These are 1:30, 4:30, 7:30 and 10:30.

e. Use (▷) to position the transducer on the screen to correspond to the position of the transducer and reflector on the shafts.

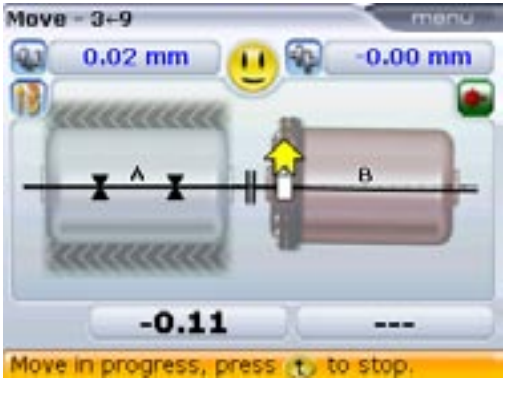
f. Press Enter to start live MOVE. The Move direction dialog window appears.

g. Use either ▵ or ▿ to highlight "Horizontal" for horizontal machine movement. Confirm selection by pressing either Enter or t.

If the laser beam is centered, Live MOVE starts automatically. If beam is not centered , a hint to center the laser beam appears on the display.

Note

h. Loosen the flange bolts. Move the machine laterally in the direction of the bold yellow arrow as indicated in the live MOVE display.



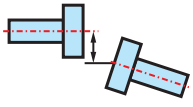
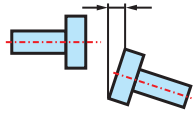
i. Corrections should be brought as close as possible to zero. The smiley changes from a sad face to OK to a happy face. At the same time the OPTALIGN smart LEDs change from red to amber to green and to blue.

Note

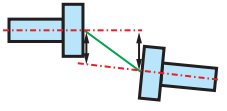
Use appropriate tools (e.g. levers) to position the machine.
Take care not to let the shims slip out of place during lateral positioning.
When machine is correctly positioned, tighten the bolts back down. Remeasure to check if the new alignment condition is within tolerance.

Appendix

Suggested shaft alignment tolerances

	[RPM]	metric [mm]		inch [mils]	
Soft foot	any	0.06 mm		2.0 mils	
Short "flexible" couplings Offset 		Acceptable 	Excellent 	Acceptable 	Excellent 
	600			9.0	5.0
	750	0.19	0.09		
	900			6.0	3.0
	1200			4.0	2.5
	1500	0.09	0.06		
	1800			3.0	2.0
	3000	0.06	0.03		
	3600			1.5	1.0
	6000	0.03	0.02		
	7200			1.0	0.5
Angularity (coupling gap difference per 100 mm or 10" diameter 	600			15.0	10.0
	750	0.13	0.09		
	900			10.0	7.0
	1200			8.0	5.0
	1500	0.07	0.05		
	1800			5.0	3.0
	3000	0.04	0.03		
	3600			3.0	2.0
	6000	0.03	0.02		
	7200			2.0	1.0

[continued]

	[RPM]	metric [mm]		inch [mils]	
		Acceptable	Excellent	Acceptable	Excellent
Spacer shafts and membrane (disk) couplings Offset (per 100 mm spacer length or per inch of spacer length) 	600			3.0	1.8
	750	0.25	0.15		
	900			2.0	1.2
	1200			1.5	0.9
	1500	0.12	0.07		
	1800			1.0	0.6
	3000	0.07	0.04		
	3600			0.5	0.3
	6000	0.03	0.02		
	7200			0.3	0.2

OPTALIGN smart technical data

Computer	
CPU	Intel XScale PXA270 running at 520 MHz [312 MHz for the intrinsically safe version]
Memory	64 MB RAM, 32 MB Flash
Display	Type: TFT, transflective (sunlight-readable), 65 535 colours, backlit LED Resolution: 320 x 240 Pixel Dimensions: 3.5 inch diagonal Keyboard elements: Navigation cursor cross with up, clear and menu keys; Alphanumeric keyboard with dimensions, measure and results hard keys
LED indicators	4 LEDs for laser status and alignment condition 2 LEDs for wireless communication and battery status
Power supply	Operating time: 18 hours typical use (based upon an operating cycle of 25% measurement, 25% computation and 50% 'sleep' mode) Disposable batteries: 6 x 1.5 V IEC LR6 ("AA") Lithium-Ion rechargeable battery: 7.2 V / 2.4 Ah (optional) For intrinsically safe versions only use 1.5 V "AA" MN 1500 from Duracell or AccuCell AC 1800 rechargeable batteries
External interface	USB host USB slave RS232 (serial) for transducer Integrated wireless communication, class 1, transmitting power 100 mW AC adapter/charger socket
Environmental protection	IP 65 (dustproof and water spray resistant), shockproof Relative humidity 10% to 90%
Intrinsic safety (optional)	II 2 G Ex ib [ib] IIC T4, Zone 1 Certificate numbers: TÜV 08 ATEX 554162, IECEx TUN 08.0006
Temperature range	Operation: -10°C to 50°C [14°F to 122°F] Storage: -20°C to 60°C [-4°F to 140°F]
Dimensions	Approx. 214 x 116 x 64 mm [8 7/16" x 2 1/2"]
Weight	865 g [1.9 lb]
CE conformity	EC guidelines for electric devices (2004/108 EWG) are fulfilled
Transducer	
Particulars	Measurement principle: Coaxial, reflected laser beam Environmental protection: IP 67 (submersible, dustproof) Ambient light protection: yes Storage temperature: -20°C to 80°C [-4°F to 176°F] Operating temperature: 0°C to 55°C [32°F to 131°F] Dimensions: approx. 107 x 70 x 49 mm [4 1/4" x 2 3/4" x 2"] Weight: approx. 177 g [6 1/2 oz.]
Intrinsic safety (optional)	II 2 G Ex ib op isb IIC T4, Zone 1 Certificate numbers: TÜV 07 ATEX 554148, IECEx TUN 08.0003
Laser	Type: Ga-Al-As semiconductor laser Wavelength (typical) 675 nm (red, visible) Safety class: Class 2, FDA 21 CFR 1000 and 1040 Beam power: < 1 mW Safety precautions: Do not look into laser beam

Detector	Measurement area: unlimited, dynamically extendible (U.S. Patent 6,040,903)
	Resolution: 1 µm
	Accuracy (avg): > 98%
Inclinometer	Measurement range: 0° to 360°
	Resolution: <1°
Reflector	
Particulars	Type: 90° roof prism
	Accuracy (avg): > 99%
	Environmental protection: IP 67 (submersible, dustproof)
	Storage temperature: -20°C to 80°C [-4°F to 176°F]
	Operating temperature: -20°C to 60°C [-4°F to 140°F]
	Dimensions: approx. 100 x 41 x 35 mm [4" x 1 5/8" x 1 3/8"]
	Weight: approx. 65 g [2 1/2 oz.]
Carrying case	
Particulars	Standard: ABS, drop tested 2 m [6 1/2 ft]
	Case dimensions: approx. 470 x 400 x 195 mm [18 1/2" x 15 3/4" x 7 3/4"]
	Weight, including all standard parts: approx. 5.8 kg [12.8 lb]
RF module for wireless communication with transducer (optional)	
Particulars	Class 1, wireless transmitter, transmitting power 100 mW
	Transmission distance: 10 m [33 ft.]
	LED indicators: 1 LED for wireless communication, 3 LEDs for battery status
	Power supply: Batteries 2 x 1.5 V IEC LR6 ("AA")
	Operating time: 14 hours typical use (based upon an operating cycle of 50% measurement, 50% standby)
	Operating temperature: -10°C to 50°C [14°F to 122°F]
Environmental protection	IP 65 (dustproof and water spray resistant), shockproof
Dimensions	Approx. 81 x 41 x 34 mm [3 1/8" x 1 11/16" x 1 5/16"]
Weight	Approx. 130 g [4.7 oz.] including batteries

Attachments

Translation

(1) EC-Type Examination Certificate

TÜV NORD

(2) Equipment and protective systems intended for use in potentially explosive atmospheres, **Directive 94/9/EC**

(3)	**Certificate Number**	**TÜV 08 ATEX 554162**
(4)	for the equipment:	Control and display unit OPTALIGN smart type ALI 12.200 EX
(5)	of the manufacturer:	PRÜFTECHNIK Dieter Busch AG
(6)	Address:	Oskar-Messter-Str. 19-21 D–85737 Ismaning
	Order number:	8000554162
	Date of issue:	2008-08-11

(7) This equipment or protective system and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV NORD CERT GmbH, notified body No. 0044 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive. The examination and test results are recorded in the confidential report No. 08203554162.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0:2006 **EN 60079-11:2007**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment or protective system must include the following:

Ex II 2 G Ex ib [ib] IIC T4

TÜV NORD CERT GmbH, Langemarckstraße 20, 45141 Essen, accredited by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The head of the certification body

Schwedt

Hanover office, Am TÜV 1, 30519 Hanover, Fon +49 (0)511 986 1455, Fax +49 (0)511 986 1590

P11 F 211 06.08

TÜV NORD

(13) SCHEDULE

(14) EC-Type Examination Certificate No. TÜV 08 ATEX 554162

(15) Description of equipment

The device is a control and display unit to be connected to an alignment sensor. It also offers an interface for data output via USB or Bluetooth. The control and display unit is a battery-powered handheld device.

Technical data:

Maximum permissible ambient temperature range: -10 °C to 50 °C

Supply	Duracell MN1500 (6 pieces in serial connection) with a cell voltage of 1.5 V
External power supply, only to be connected in the absence of a hazardous atmosphere (pin 3)	U_m = 12.5 V
Pin 2, 4, 5,12	Ground
Interface adaptor ALI 12.500 for the connection to external devices in the absence of a hazardous atmosphere via interface connector (pin 6, 7, 8, 9 and 13).	U_m = 253 V

Output circuits in type of protection Ex ib IIC for the connection to certified intrinsically safe circuits.

Maximum values:

Sensor interface (pin 1)	U_o = 6 V I_o = 200 mA P_o = 1.2 W (characteristic line: rectangular)
USB interface (Pin 6)	U_o = 6 V I_o = 22.9 mA P_o = 34.4 mW (characteristic line: linear)
USB interface, per channel (Pin 7, 8, 9, 13)	U_o = 3.6 V I_o = 65 mA P_o = 58.5 mW (characteristic line: linear)

TÜV NORD

Schedule EC-Type Examination Certificate No. TUV 08 ATEX 554162

USB interface (Pin 10)	U_o = 3.6 V I_o = 13.2 µA P_o = 11.9 µW (characteristic line: linear)
RS232 interface (output) (Pin 14)	U_o = +/- 6 V I_o = 13.8 mA P_o = 20.7 mW (characteristic line: linear)
Max. permissible external capacitance	C_o = 27.9 µF
Max. permissible external inductance	L_o = 1.25 µH

Input circuits in type of protection Ex ib IIC for the connection to certified intrinsically safe circuits

Maximum values:

RS232 interface (input) (Pin 11)	U_i = +/- 6 V
USB interface (Pin 7, 8, 9, 10, 12)	U_i = 6 V
Internal capacitance	C_i = 3.1 µF
Internal inductance	L_i = 0.75 µH

The following devices are also allowed to be connected via the following cables	The sensors ALI 11.100..EX.. and ALI 12.100..EX.. (CoC TUN08.0003) via the cable ALI 12.511-X with a maximum length of 10 m.

(16) Test documents are listed in the test report No. 08203554162.

(17) Special conditions for safe use

None

(18) Essential Health and Safety Requirements

No additional ones

Translation

(1) EC-Type Examination Certificate

(2) Equipment and protective systems intended for use in potentially explosive atmospheres, **Directive 94/9/EC**

(3)	**Certificate Number**	**TÜV 07 ATEX 554148**
(4)	for the equipment:	OPTALIGN sensors ALI 11.100..EX.. and ALI 12.100..EX..
(5)	of the manufacturer:	PRÜFTECHNIK Dieter Busch AG
(6)	Address:	Oskar-Messter-Str. 19-21 D–85737 Ismaning
	Order number:	8000554148
	Date of issue:	2008-02-16

(7) This equipment or protective system and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV NORD CERT GmbH, notified body No. 0044 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive. The examination and test results are recorded in the confidential report No. 07203554148.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-0:2006 **EN 60079-11:2007** **EN 60 079-28:2007**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment or protective system must include the following:

Ex II 2G Ex ib op isb IIC T4

TÜV NORD CERT GmbH, Langemarckstraße 20, 45141 Essen, accredited by the central office of the countries for safety engineering (ZLS), Ident. Nr. 0044, legal successor of the TÜV NORD CERT GmbH & Co. KG Ident. Nr. 0032

The head of the certification body

Schwedt

Hanover office, Am TÜV 1, 30519 Hanover, Fon +49 (0)511 986 1455, Fax +49 (0)511 986 1590

TÜV NORD

(13) **SCHEDULE**

(14) **EC-Type Examination Certificate No. TÜV 07 ATEX 554148**

(15) Description of equipment

The device is an alignment sensor. The hitting point of a laser beam, generated by the device itself, is detected. The detected values are transmitted to an evaluation unit via one of two interfaces. The interfaces must only be used in the absence of explosive gas atmospheres. The voltage supply results from the connected evaluation unit.

Technical data:

The following input circuits in type of protection Ex ib IIC for the connection to intrinsically safe circuits only.

Maximum values:

Supply and I-Data interface (Contacts X1 5, X1 6)	U_i = 6V
RS232 interface (input) (Contact X1 4)	U_i = +/- 6V
Maximum overall current and maximum overall power.	I_i = 200mA P_i = 1.2W
(Contacts X1 1, X1 2, X1 8)	Ground
Maximum internal capacitance and inductance	C_i = 24.65µF L_i = 0.44µH
RS232 interface (output) (Contact X1 7)	U_o = +/- 6V
I-Data interface and clock output (Contacts X1 3, X1 6)	U_o = 6V
Total overall output current and overall output power	I_o = 200mA P_o = 1.2W

Maximum permissible ambient temperature range: 0 °C to 50 °C

TÜV NORD

Schedule EC-Type Examination Certificate No. TÜV 07 ATEX 554148

(16) Test documents are listed in the test report No. 07203554148.

(17) Special conditions for safe use

None

(18) Essential Health and Safety Requirements

No additional ones

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx TUN 08.0006 Issue No.:0

Certificate history:

Status: Current

Date of Issue: 2008-08-20 Page 1 of 3

Applicant: **PRÜFTECHNIK Dieter Busch AG**
Oskar-Messter-Str. 19-21
85737 Ismaning
Germany

Electrical Apparatus: **OPTALIGN Smart EX, ALI 12.200..EX..**
Optional accessory:

Type of Protection: **Intrinsic Safety**

Marking: **Ex ib [ib] IIC T4**

Approved for issue on behalf of the IECEx Certification Body:

Position:

Signature:
(for printed version)

Date:

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

TÜV NORD CERT GmbH
Hanover Office
Am TÜV 1
30519 Hannover
Germany

IECEx Certificate of Conformity

Certificate No.: IECEx TUN 08.0006

Date of Issue: 2008-08-20 Issue No.: 0

Manufacturer: **PRÜFTECHNIK Dieter Busch AG**
Oskar-Messter-Str. 19-21
85737 Ismaning
Germany

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex produ covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identi documents, was found to comply with the following standards:

IEC 60079-0 : 2004 Edition: 4.0	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
IEC 60079-11 : 2006 Edition: 5	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than thos expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

DE/TUN/ExTR08.0013/00

Quality Assessment Report:
DE/TUN/QAR07.0002/01

IECEx Certificate of Conformity

Certificate No.: IECEx TUN 08.0006

Date of Issue: 2008-08-20 Issue No.: 0

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The device is a control and display unit to be connected to an alignment sensor. It also offers an interface for data output via USB or Bluetooth. The control and display unit is a battery-powered handheld device.

Technical data:

Maximum permissible ambient temperature range: -10 °C to 50 °C

Supply.....	Duracell MN1500 (6 pieces in serial connection) with a cell voltage of 1.5 V
External power supply..... only to be connected in the absence of a hazardous atmosphere (pin 3)	Um = 12.5 V
Pin 2, 4, 5, 12.....	Ground
Interface adaptor ALI 12.500..... for the connection to external devices in the absence of a hazardous atmosphrer via interface connector (pin 6, 7, 8, 9 and 13)	Um = 253 V

Output circuits in type of protection Ex ib IIC for the connection to certified intrinsically safe circuits.

Maximum values:

Sensor interface (pin 1)	Uo = 6 V Io = 200 mA Po = 1.2 W (rectangular characteristic line)
USB interface (pin 6)	Uo = 6 V Io = 22.9 mA Po = 34.4 mW (linear characteristic line)
USB interface, per channel (pin 7, 8, 9, 13)	Uo = 3.6 V Io = 65 mA Po = 58.5 mW (linear characteristic line)
USB interface (pin 10)	Uo = 3.6 V Io = 13.2 µA Po = 11.9 µW (linear characteristic line)
RS232 interface (output pin 14)	Uo = +/- 6 V Io = 13.6 mA Po = 20.7 mW (linear characteristic line)
Max. permissible external capacitance	Co = 27.9 µF
max. permissible external inductance	Lo = 1.25 µH

Output circuits in type of protection Ex ib IIC for the connection to certified intrinsically safe circuits.

Maximum values:

RS232 interface (input pin 11)	Ui = +/- 6 V
USB interface (pin 7, 8, 9, 10, 13)	Ui = 6 V
Internal capacitance	Ci = 3.1 µF
Internal inductance	Li = 0.75 µH
The following devices are also allowed to be connected via the following cables	Sensors ALI 11.100..EX.. and ALI 12.100..EX.. (CoC TUN 08.0003) via cable ALI 12.511-X with a maximum lenght of 10 m.

CONDITIONS OF CERTIFICATION: NO

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx TUN 08.0003 issue No.:0

Certificate history:

Status: Current

Date of Issue: 2008-06-30 Page 1 of 4

Applicant: PRÜFTECHNIK Dieter Busch AG
Oskar-Messter-Str. 19-21
85737 Ismaning
Germany

Electrical Apparatus: OPTALIGN Sensor ALI 11.100..EX.. and ALI 12.100..EX..
Optional accessory:

Type of Protection: Intrinsic Safety

Marking: Ex ib op isb IIC T4

Approved for issue on behalf of the IECEx Certification Body: Karl-Heinz Schwedt

Position: Head of IECExCB

Signature:
(for printed version) _____

Date: _____

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

TÜV NORD CERT GmbH
Hanover Office
Am TÜV 1
30519 Hannover
Germany

IECEx Certificate of Conformity

Certificate No.: IECEx TUN 09.0003

Date of Issue: 2008-06-30 Issue No.: 0

Page 2 of 4

Manufacturer: PRÜFTECHNIK Dieter Busch AG
Oskar-Messter-Str. 19-21
85737 Ismaning
Germany

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2004 Edition: 4.0	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
IEC 60079-11 : 2006 Edition: 5	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
IEC 60079-28 : 2006-08 Edition: 1	Explosive atmospheres - Part 28: Protection of equipment and transmission systems using optical radiation

This Certificate does not indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

DE/TUN/ExTR09.0005/00

Quality Assessment Report:
DE/TUN/QAR07.0002/01

IECEx Certificate of Conformity

Certificate No.: IECEx TUN 09.0003

Date of Issue: 2009-06-30 Issue No.: 0

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The device is an alignment sensor. The hitting point of a laser beam, generated by the device itself, is detected. The detected values are transmitted to an evaluation unit via one of two interfaces. The interfaces must only be in the absence of explosive gas atmospheres. The voltage supply results from the connected evaluation unit.

CONDITIONS OF CERTIFICATION: NO

IECEx Certificate of Conformity

Certificate No.: IECEx TUN 09.0003

Date of Issue: 2009-06-30 Issue No.: 0

Page 4 of 4

EQUIPMENT(continued):

Technical data:

Supply and I-Data interface (Contacts X1 5, X 1 6)	Ui = 6V
RS232 Interface (input) (Contacts X1 4)	Ui = +/- 6V
Maximum overall current and maximum overall power	Ii = 200mA Pi = 1.2W
Contacts X1 1, X1 2, X1 8	Ground
Maximum internal capacitance and inductance	Ci = 24.65µF Li = 0.44µH
RS232 interface (output) (Contact X1 7)	Uo = +/- 6V
I-Data interface and clock output (Contacts X1 3, X1_6)	Uo = 6V
Total overall output current and overall output power	Io = 200mA Po = 1.2W

Index

A

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

X