USER MANUAL

EXO

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WELCOME TO OUR WORLD

Since the very beginning in 1984, ACOEM AB (formerly known as ELOS Fixturlaser AB) has helped industries throughout the world to achieve more profitable and sustainable production. We have reached where we are today by having the courage to think beyond the norm and follow slightly unconventional paths. We have had the courage to make mistakes and find new directions. Through our resolve, ambition, and knowledge we have become a global player and a leader in innovative, user-friendly shaft alignment.

WARNING!

Read the safety instructions for EXO before using the equipment.

SUSTAINABLE INNOVATIONS

During our 40 years in this industry, we have explored, tweaked, and tested more than anyone. Some might say we are incurable innovators whereas others might say that we are highly focused. They both probably have a point. If we had not been devoted and ambitious, we would not have been the first in the industry to have a touch screen. Nor would we have been pioneers in the use of visible lasers and dual measurement heads.

Over the years, we have learnt to never compromise on quality, and we are constantly in search of new, unexplored opportunities by combining advanced technology with design and function. By doing so, we have become the leading innovator in our industry. Not only do we minimize wear, production stoppages and costs, but we also help save the environment. Natural resources are in short supply and if we can contribute to a more sustainable world by making it a little bit straighter, we couldn't be happier.

TRUE COMMITMENT

One reason for our success is our solid commitment. We have ensured that we remain attentive to constantly pick up on the needs of the market. Our expert employees and dedicated dealers in over 70 countries are undoubtedly our most important asset. Satisfaction and team spirit are of particular importance to us and are consistently at the top of our priority list. With experience from a wide range of industries and manufacturing processes, we are fully aware of the problems and needs of our end-customers. We are passionate about what we do, and we are driven by the desire to eliminate anything in the industry worldwide that may be even slightly out of line.

PURE USABILITY

Our design and user-friendliness are carefully interwoven. As we develop new products, they also become cleaner, smarter, more functional, and more robust. An industrial environment is demanding, infinitely more difficult to work in and inevitably subject to time pressure. There is no place for equipment with unnecessary functions, complicated interfaces and that is difficult to assemble.

Usability and user friendliness mean everything, not only to us but also to our customers. We have designed products that are easy to learn and can be incorporated quickly. By removing non-essential functions, we make life less difficult for our users – and probably a little more difficult for our competitors.

END USER LICENSE AGREEMENT

The rights to use the software in this product are offered only on the conditions that you agree to all the terms stated below, i.e., the end user agreement. By using this product, you agree to be bound by this agreement. If you do not accept this agreement your sole remedy is to return the entire unused product, hardware, and software, promptly to your place of purchase for a refund.

The user is granted a single license to use the software contained in this product. Use is only permitted on the hardware it has been installed on at the time of purchase. The software may not be removed from the hardware.

The software contained in the system is the property of ACOEM AB, any copying or redistribution is strictly prohibited.

Modifying, disassembling, reverse engineering or decompiling the system or any part thereof is strictly prohibited.

Disclaimer of warranties: To the maximum extent permitted by applicable law, ACOEM AB and its suppliers provide the software contained in this product ‘as is’ and with all faults, and hereby disclaim all other warranties either expressed, implied or statutory.

Limited liability: No liability shall exceed the price of the product, and the sole remedy, if any, to any claim shall be a right of return and refund.

ACOEM AB or its suppliers shall, to the maximum extent permitted by applicable law, not be liable to any indirect, special, incidental, punitive, and consequential damages arising from the use of the system or any part thereof, authorized, or unauthorized.

ACOEM AB (formerly known as Elos Fixturlaser AB) is since mid-2014 a fully owned subsidiary of ACOEM Group, headquartered in Lyon, France. For more information, please visit www.acoem.com

DECLARATION OF CONFORMITY

In accordance with
2014/35/EU Low Voltage Directive
2014/53/EU Radio Equipment Directive
2012/19/EC Waste electrical and electronic equipment (WEEE)
2011/65/EU Restriction of the use of certain hazardous substances (RoHS)
2006/66/EU Battery Directive
2001/95/EC CE marking directive
2014/34/EU ATEX Directive

Type of equipment

Alignment System

Brand name or trademark

ACOEM

Type designation(s)/Model no(s)

1-1041 EXO (system)
1-1043 M4 Ex
1-1044 S4 Ex

Manufacturer's name, address, telephone & fax no

ACOEM AB
Box 7
SE-431 21 Mölndal
Sweden

Tel: +46 31 7062800

The following standards and/or technical specifications, which comply with good engineering practice in safety matters in force within the EEA, have been applied:

Standard/Test report/Technical construction file/Normative document

EN 61000-6-3:2021.

EN 61000-6-2:2019, EN 61000-4-2, -3, -4, -5, -6, -11.

EN 61010-1:2010

EN 60079-0:2018, EN 60079-0/A11:2013, EN-60079-11:2012, EN-60079-28:2015.

ISO9001:2015 Ref. No/ Issued by: DNV Certification AB Certification No. 2009-SKM-AQ-2704/2009-SKM-AE-1419.

The laser is classified in accordance with the International Standard IEC-60825-1:2014, USA FDA Standard 21 CFR, Ch 1, Part 1040.10 and 1040.11 except for deviations pursuant to laser notice No. 50, dated June 24, 2007.

The wireless device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions;
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Additional information

The product was CE-marked in 2019.

As manufacturer, we declare under our sole responsibility that the equipment follows the provisions of the Directives stated above.

Date and place of issue

Mölndal 2023-04-17

Signature of authorized person

Hans Svensson, Managing Director

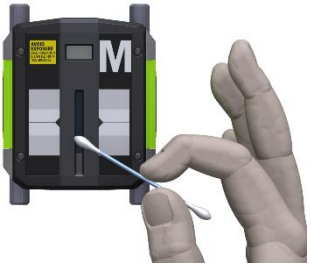
CARE

PACKING THE CASE

CLEANING

The system should be cleaned with a cotton cloth, or a cotton bud moistened with a mild soap solution, except for the detector and laser window surfaces, which should be cleaned with alcohol.

For the best possible function, the laser diode apertures, detector surfaces and connector terminals should be kept free from grease or dirt.



Do not use paper tissue, which can scratch the detector surface.

Do not use acetone.

The chains on the V-brackets are delivered dry. If the system is used in highly corrosive environments, the chains should be oiled.

DATE OF CALIBRATION DISCREPANCY

Our instruments store the electronic date of the latest calibration of the instrument. Due to production processes and storage time, this date will differ from the date of the calibration certificate. Hence, it is the date of the calibration certificate which is important and that indicates when the next calibration is due.

APPS

The following apps are available in the EXO system.

Horizontal Shaft Alignment

Vertical Shaft Alignment

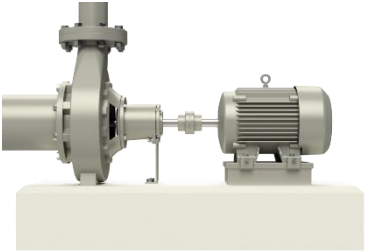
Download the apps from Google Play.

The apps work with the sensors S4 Ex and M4 Ex.

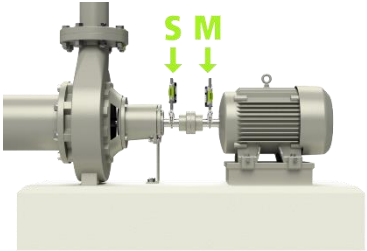
SHAFT ALIGNMENT HORIZONTAL MACHINES

INTRODUCTION

Shaft alignment: Determine and adjust the relative position of two machines that are connected, such as a motor and a pump, so that the rotational centers of the shafts are collinear, when the machines are working in a normal operating condition. Correction of horizontal shaft alignment is done by moving the front and the rear pair of one machine's feet, vertically and horizontally, until the shafts are aligned within the given tolerances. A tolerance table is available in the system.



The system has two sensors that are placed on each shaft by using the fixtures supplied with the system.



After rotating the shafts into different measuring positions, the system calculates the relative distance between the two shafts in two planes. The distances between the two measuring planes, distance to the coupling and distances to the machine feet are entered into the system. The display box then shows the actual alignment condition together with the position of the feet. Adjustment of the machine can be made directly, according to the displayed values.

The alignment results can be saved for further documentation purposes.

PRE-ALIGNMENT FUNCTIONS

To obtain the best possible conditions for shaft alignment, it is necessary to perform some pre-alignment checks. In many cases it is necessary to make these checks to obtain precise alignment. It is often impossible to reach the desired alignment results if you do not make any pre-alignment checks.

Before going on site, check the following:

- What are the required tolerances?
- Any offsets for dynamic movements?
- Are there any restrictions for mounting the measuring system?
- Is it possible to rotate the shafts?
- What shim size is needed?

Before setting up the alignment system on the machine, check the machine foundation, bolt, and shim condition. Also check if there are any restrictions in adjusting the machine (if e.g., there is enough space to move the machine).

After the visual checks have been performed, there are some conditions that must be considered:

- Check that the machine has the right temperature for alignment.
- Take away old rusty shims (check that you can remove shims).
- Check coupling assembly and loosen the coupling bolts.
- Check soft foot conditions.
- Mechanical looseness.
- Check coupling and shaft run-out.
- Pipe work strain.

- Coarse alignment.
- Check coupling gap (axial alignment).

STARTING

Turn on the sensors.

Turn on the tablet.

Start the Horizontal Shaft Alignment app.

Go to settings for connecting the sensors if they are not already connected.

Settings.

Settings are described in the end of the chapter.

MOUNTING

The sensor marked “M” should be mounted on the movable machine and the sensor marked “S” on the stationary machine. The sensors shall be assembled on their V-bracket and placed on each side of the coupling.

Hold the V-bracket upright and mount it on the shafts of the measurement object.

Lift the open end of the chain, tension it so that the slack is removed and attach it to the hook.

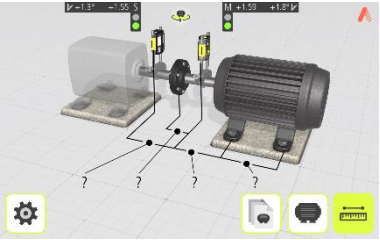
Firmly tighten the chain with the tensioning screw. Use the supplied tensioning tool. Do not over-tighten. If the shaft diameter is too large the chains can be extended with extension chains.

Adjust the height of the sensor by sliding it on the posts until a line of sight is obtained for both lasers. Secure its position by locking both clamping devices on the back of both units.

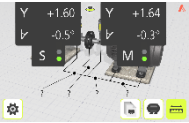
MACHINE CONFIGURATION

The screen displays the movable machine.

The traffic lights show green when the laser hits the detector.



The sensor values can be enlarged by touching them.



Select to enter distances and tolerances or select a pre-defined machine or work order from the machine list.

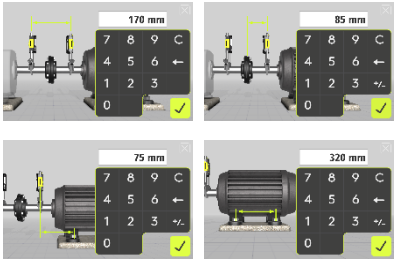
Touch the distance icon, to enter distances and tolerance.

Touch the machine list icon, to select a pre-defined machine or work order.

It is also possible to go to the configuration screen, to configure the machine.

Go to the configuration screen.

Measure and enter distances



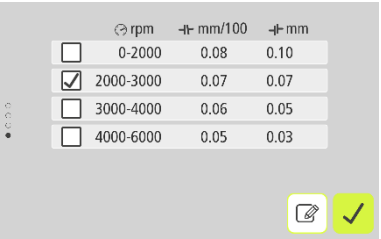
You must enter all the distances. The distance between the sensors, the distance between the center of the coupling and the M-sensor, the distance between the M-sensor and the first pair of feet and the distance between the first and the second pairs of feet.

Enter tolerances

Alignment tolerances depend to a large extent on the rotation speed of the shafts. Machine alignment should be carried out within the manufacturer's tolerances.

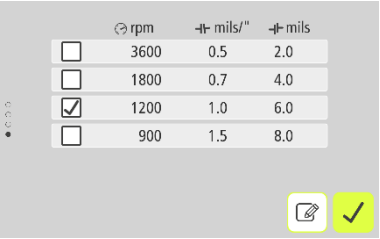
The provided table can be helpful if no tolerances are specified. It is also possible to enter customized tolerances.

The tolerances are the maximum allowed deviation from desired values.

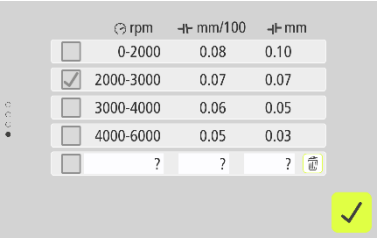


	rpm	mm/100	mm
☐	0-2000	0.08	0.10
☑	2000-3000	0.07	0.07
☐	3000-4000	0.06	0.05
☐	4000-6000	0.05	0.03

Tolerance Table mm-mode



Tolerance Table inch-mode



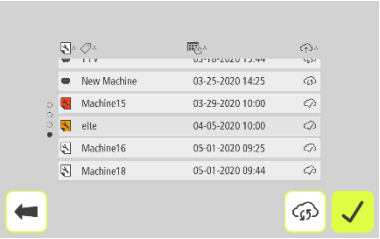
Editing mode for customized tolerances

Select the tolerance to use in the alignment by touching its check box to the left.

Confirm.

Touch the edit icon to enter and edit customized tolerances.

MACHINE LIST



The machine list shows pre-defined machines and work orders.

Work orders require connection to the ACOEM Augmented Mechanics Platform. (See Settings and Cloud Synchronization at the end of this chapter.)

It is possible to order the machine list depending on each column's status by touching the column header.

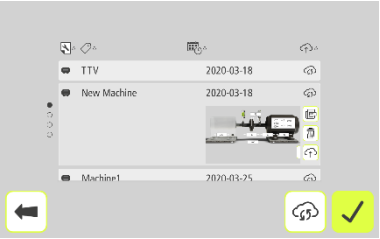
For example: To bring all overdue work orders that must be managed urgently to the top of the list, click on the work order column header.

Pre-defined machines

Pre-defined machines can be created in the configuration screen.

A pre-defined machine is shown with a machine symbol, machine name and creation date.

Touch a machine to expand the view and show more details.



Confirm to measure the selected machine.

Other options in the expanded view.

PDF report.

Delete the machine.

Upload to cloud.

Work orders

A work order is shown with a work order status symbol, machine name and due date.

Touch a work order to expand the view and show more details.

Confirm to measure the selected work order.

Other options in the expanded view.

PDF report.

Delete the work order.

Close the work order.

Upload to cloud.

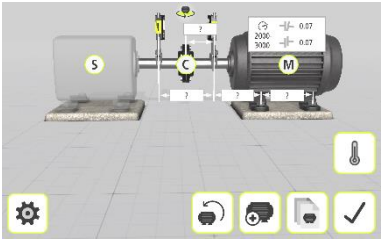
Work order status

	Work order to realize, not started.
	Work order soon overdue (<1 week).
	Work order closed.
	Work order overdue.

Cloud sync status

	Waiting to be synced.
	Synced.
	Not connected to cloud.

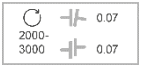
CONFIGURATION SCREEN



Distances

Opens window for entering distance.

Tolerance table



Opens the tolerance table.

Target Values

Opens Target Values.

Add New Machine

Adds the pre-defined machine to the machine list.

Machine List

Opens the machine list.

Restart

Deletes all entered data and restarts the app.

Coupling

Select coupling type.

Standard coupling, spacer shaft or cardan shaft and coupling gap on/off.

Motor

Select motor color.

Grey, blue, green, yellow, or red.

Stationary machine

Select stationary machine type.

Alternator, blower, centrifugal compressor, fan, gear box, lobe compressor, pump or undefined machine.

Hot Check

Opens Hot Check.

Confirm

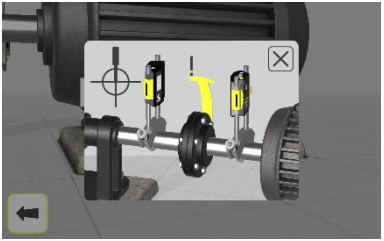
Confirms the machine configuration.

SOFTCHECK™

Go to Softcheck for checking soft foot conditions.

A soft foot condition needs to be corrected before any alignment takes place. If not, the measurement result will be of no value. It is more or less impossible to establish if there is a soft foot condition without using some kind of measurement tool. The Softcheck application checks each foot and displays the result in mm or mils.

Place the sensors at the 12 o'clock position.



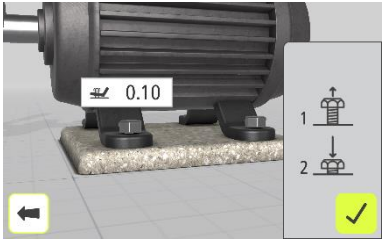
All the distances must be entered, before checking for soft foot.

Check that all foot bolts are firmly tightened.

Measurement value registration

The program will guide you to the feet.

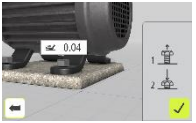
The first foot.

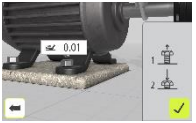


1. Loosen the bolt fully and wait a few seconds.
2. Tighten the bolt firmly, preferably with a dynamometric wrench.
3. Register the measurement value.

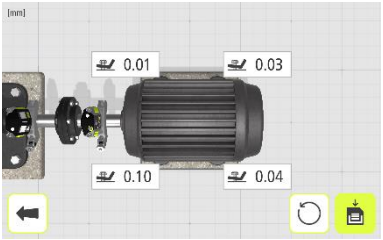
Register the measurement value by touching the confirmation icon.

Repeat the procedure at the rest of the feet.





Measurement result and Corrections



Make the necessary corrections and then check each foot again (the values show approximately how many shims that are needed to eliminate the soft foot).

Re-measurements can be done by touching the re-measure icon to re-measure all feet, or by touching a single foot to re-measure just that foot.

Re-measure all feet.

Re-measure a single foot.

The Softcheck result can be saved separately.

Touch the save icon to save the result.

(The measurement is saved in the app and can be handled further by generating a PDF report.)

TARGET VALUES

Go to Target Values to enter target values.

(Target Values are reached from the configuration screen.)

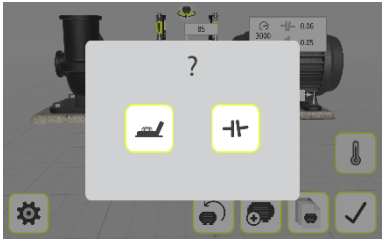
Introduction

Most machines develop a certain amount of heat while running. In the best case both the driving and the driven machine are affected equally requiring no input of compensation values. But in some applications the driven machine is either hotter, i.e., a pump for hot liquid, or cooler than the driving machine.

Machine manufacturers define the thermal expansion of machines differently, but in most cases, you will find it as a factor of deliberate misalignment expressed in parallel offset and angular error.

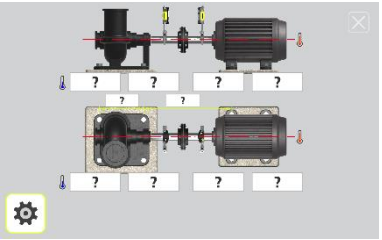
You can pre-set target values before starting your alignment work. Accepted values are feet values and angle and offset values.

The entered values are target values. Target values mean that these are the values at which the machine should be positioned when not running (cold condition) to obtain correct alignment while the machine is running (hot condition).

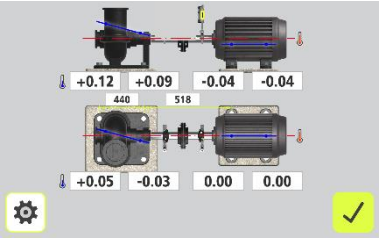


Select one of two ways to express the offset values: Feet values or angle and offset values.

Feet values

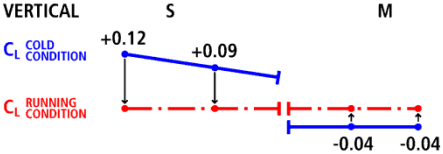


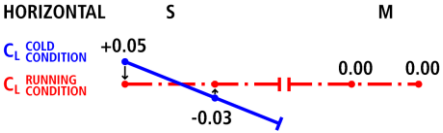
Touch the feet value boxes. Enter target values for the feet in mm or mils according to the pre-set measurement unit together with the required distances.



In the example above, the stationary machine will shrink vertically by 0.12 mm at the rear feet and 0.09 mm at front feet while the movable machine will expand 0.04 mm while running.

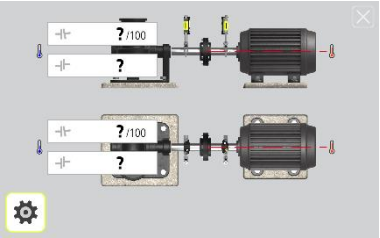
Horizontally, the rear feet will move 0.05 mm towards you and the front feet will move 0.03 mm away from you while the movable machine does not change its position while running.



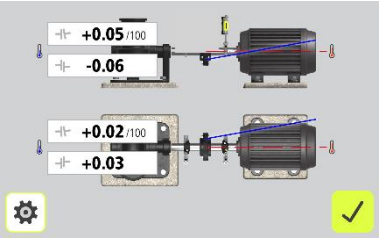


After having entered these feet values, the system calculates how the movable machine should be positioned (target position) in cold condition to obtain perfect alignment during running condition.

Angle and offset values

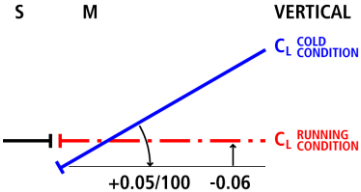


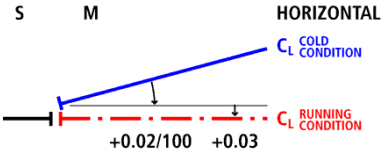
Touch the value boxes and enter target values for the angles in mm/100 mm and target values for the offsets in mm, or mils/inch and mils, according to the pre-set measurement unit.



In the example above, the movable machine should be vertically adjusted to a position with an angular misalignment of +0.05 mm/100 mm and an offset of
-0.06 mm.

Horizontally, the movable machine should be positioned with a
+0.02 mm/100 mm angular misalignment and a +0.03 mm offset, in cold condition to obtain perfect alignment while running.


S
M
VERTICAL
C_L COLD CONDITION
C_L RUNNING CONDITION
+0.05/100
-0.06


S
M
HORIZONTAL
C_L COLD CONDITION
C_L RUNNING CONDITION
+0.02/100
+0.03

MEASUREMENT METHOD

Tripoint™ method

In the Tripoint method, the alignment condition can be calculated by taking three points while rotating the shaft at least 60°.

NOTE: The shafts should be coupled during measurement to achieve as reliable and accurate results as possible, when using the Tripoint method.

TIP: The larger the angle over which the three points are measured, the fewer moves and repeat measurements will have to be made. The minimum angle between readings is 30°.

Express Mode™ method

The Express Mode method works as the Tripoint method with the following additions.

The first position can be registered automatically, if the shafts first are rotated counterclockwise more than 3° between 6 o'clock and 12 o'clock and then clockwise more than 3°. The reading is then taken automatically when the sensors have been stationary for 2 seconds.

After recording the 1st point, the other points are taken automatically when the shafts are rotated to a new position and are kept in position for more than 2 seconds.

Multipoint method

10 9

In the Multipoint method, the alignment condition can be calculated by recording 6 to 9 points while rotating the shafts at least 50°.

NOTE: The shafts should be coupled during measurement to achieve as reliable and accurate results as possible, when using the Multipoint method.

TIP: The larger the angle over which the three points are measured, the fewer moves, and repeat measurements will have to be made. The minimum angle between readings is 10°.

Multipoint express method

10 9

The Multipoint express method works as the Multipoint method with the following additions.

The first position can be registered automatically, if the shafts first are rotated counterclockwise more than 3° between 6 o’clock and 12 o’clock and then clockwise more than 3°. The reading is then taken automatically when the sensors have been stationary for 2 seconds.

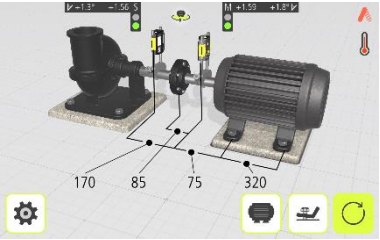
After recording the 1st point, the other points are taken automatically when the shafts are rotated to a new position and are kept in position for more than 2 seconds.

Clock method

In the Clock method, machinery positions are calculated by taking three points with 180° of rotation.

The Clock method is useful when comparing the measurement results with traditional alignment methods using dial gauges and reversed rim method. The method can also be used when the machines are standing on non-horizontal foundations or when the shafts are not coupled.

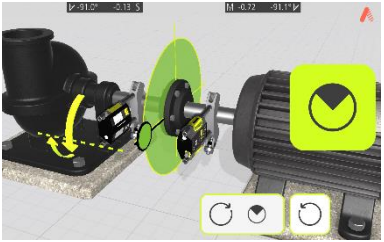
MEASUREMENT POINT REGISTRATION



Go to measurement.

Select measurement method.

Tripoint™ method

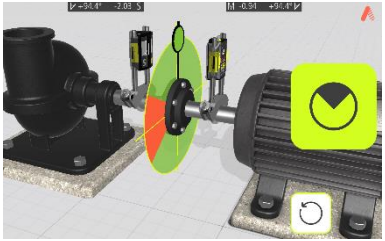


Set the sensors at approximately the same rotational angle at the first measurement position.

Touch the measurement icon, to register the first position.

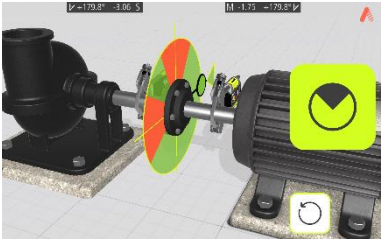
Rotate the shafts to the next position. The shafts must be rotated over a minimum of 30°.

Red sector shows already measured zone. The Register icon is not shown if the rotation is less than 30°.



Touch the measurement icon, to register the second position.

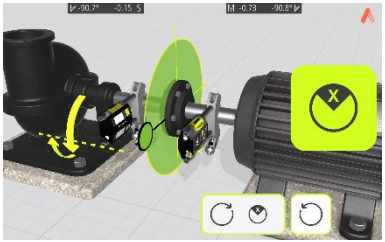
Rotate the shafts to the third position.



Touch the measurement icon, to register the third position.

TIP: When registering the third reading at the 3 o’clock position, the sensors will already be in the right position for horizontal alignment.

Express Mode™ method



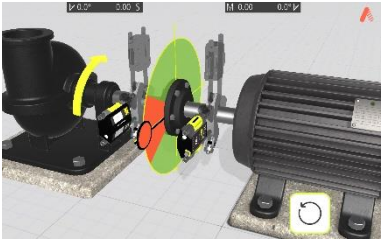
Set the sensors at approximately the same rotational angle at the first measurement position.

Touch the measurement icon.

This starts the measurement point registration and registers the first reading.

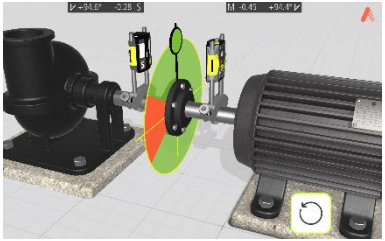
The first position can be registered automatically, if the shafts first are rotated counterclockwise more than 3° between 6 o'clock and 12 o'clock and then clockwise more than 3°.

The reading is then taken automatically when the sensors have been stationary for 2 seconds.



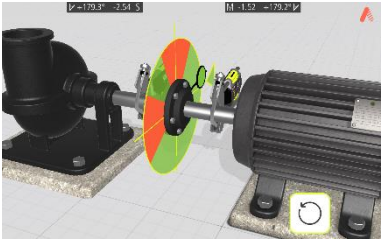
Rotate the shafts to the next position. The shafts must be rotated over a minimum of 30°.

Red sector shows already measured zone.



The reading is taken automatically when the sensors have been stationary for 2 seconds.

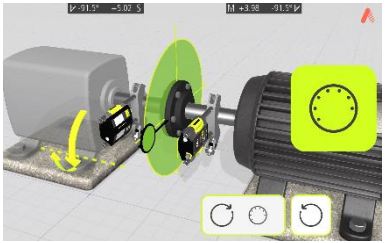
Rotate the shafts to the third position.



The reading is taken automatically when the sensors have been stationary for 2 seconds.

TIP: When registering the third position at the 3 o’clock position, the sensors will already be in the right position for horizontal alignment.

Multipoint method

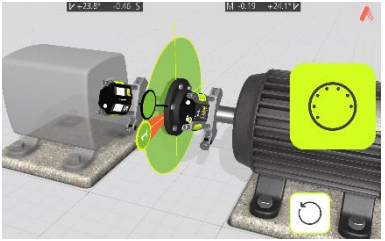


Set the sensors at approximately the same rotational angle at the first measurement position.

Touch the measurement icon, to register the first position.

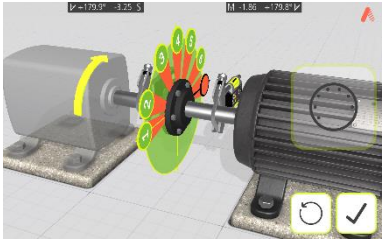
Rotate the shafts to the next position. The shafts must be rotated over a minimum of 10°.

Red sector shows already measured zone. The Register icon is not shown if the rotation is less than 10°.



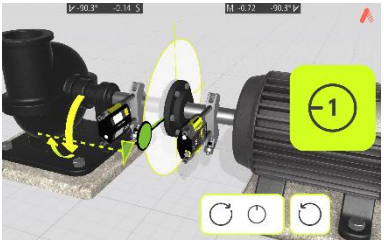
Touch the measurement icon, to register the second position.

Continue to measure. Between 6 and 9 positions can be measured.



Finish measurement.

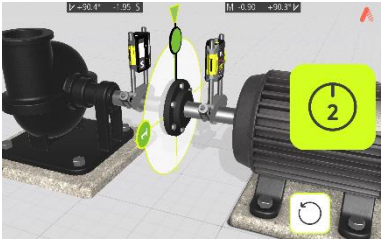
Clock method



Set the sensors at approximately the same rotational angle at the first measurement position, 9 o’clock.

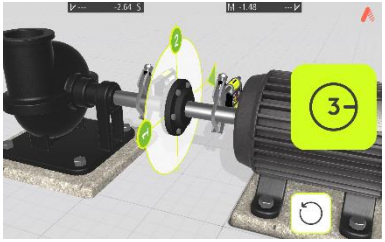
Touch the measurement icon, to register the first position.

Rotate the shafts to the next position, 12 o’clock.



Touch the measurement icon, to register the second position.

Rotate the shafts to the third position, 3 o’clock.

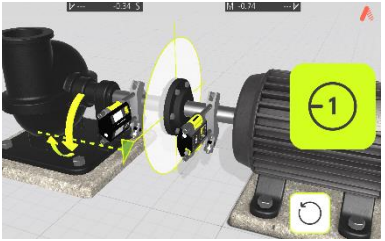


Touch the measurement icon, to register the third position.

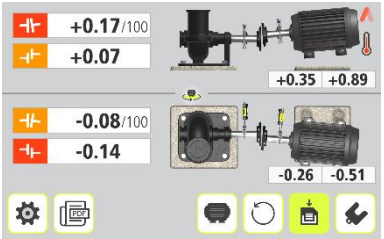
Clock method with disabled inclinometers

If the inclinometers are not functioning properly, e.g., in high vibrations, they can be disabled.

Go to settings to disable inclinometers.



MEASUREMENT RESULTS



The Measurement Result screen shows coupling values and foot values in both the vertical and horizontal direction.

The symbol to the left of the coupling values indicates the angular direction and offset, and if the values are within tolerance.

Within tolerance (green).

Within double tolerance (yellow and inverted).

Out of double tolerance (red and inverted).

When a coupling is in tolerance in one direction, this is indicated with a check symbol at the motor.

EVALUATING AND SAVING THE RESULT

The angle and offset values are used to determine the alignment quality. These values are compared with the alignment tolerances to determine whether correction is necessary. If suitable tolerances are selected in the tolerance table, the symbols described above indicate if the angle and offset values are within tolerance or not.

The foot values indicate the movable machine's foot positions where corrections can be made.

Depending on the result, the program will also guide the user.

First, the program will always guide the user to save the measurement.

Touch the save icon to save the result.

(The measurement is saved in the app and can be handled further by generating a PDF report.)

Then, if the measurement result shows that the machine is misaligned, the user will be guided to go to shimming.

If the measurement result is within tolerance and has been saved, the user will be guided to do a PDF report.

NOTE: It is necessary to make a PDF report for documenting and exporting the measurement from the app.

VERTIZONTAL™

Align faster with the VertiZontal Moves feature.

First correct the vertical misalignment in the shimming screen. The system shows how much you need to remove or add shims to correct the machine vertically.

Next correct the horizontal misalignment in the alignment screen. The system goes live and will deliver real time values during the adjustment phase.

SHIMMING

The Shimming screen shows foot values in the vertical direction as suitable shim values (0.05 mm / 1 mil).

The arrows show if shims must be added or removed to adjust the machine in the vertical direction.

The check signs show that shimming is not needed.

When shimming is completed, continue to alignment for adjustments in the horizontal direction.

Go to alignment.

ALIGNMENT

If the machine has been adjusted vertically in the shimming screen, go directly to alignment in the horizontal direction.

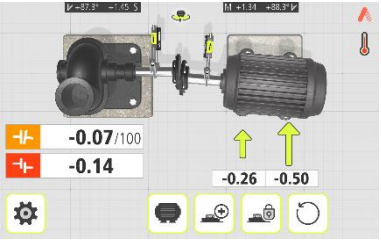
If the machine has not been adjusted in the shimming screen, alignment in the vertical direction must be done first.

Vertical direction

Rotate the shafts to the 12 or 6 o'clock position to make adjustments in the vertical direction. The angle guide helps you to reach the right position.

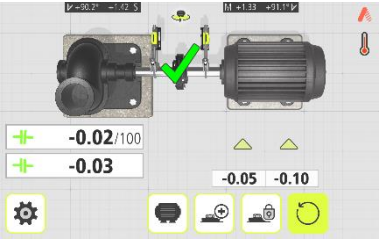
Adjust the machine vertically until the values for both angular and parallel alignment are within tolerance. The arrows by the feet show in which direction the machine should be moved.

Horizontal direction

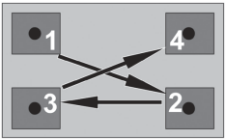


Rotate the shafts to the 3 or 9 o’clock position to make adjustments in the horizontal direction. The angle guide helps you to reach the right position.

Adjust the machine horizontally until the values for both angular and parallel alignment are within tolerance. The arrows by the feet show in which direction the machine should be moved.



Tighten the bolts using the tightening sequence, as below.



Check and re-measure

Rotate the shafts back to the 12 or 6 o'clock position and check that the machine is still within tolerance.

Alignment is now completed. To confirm the result, re-do the measurement.

Re-measure.

Clock method with disabled inclinometers

If the inclinometers are not functioning properly, e.g., in high vibrations, they can be disabled.

Go to settings to disable inclinometers.

When the inclinometers are disabled, use the change view icon to change from horizontal to vertical view of the machine and vice versa.

Change view.

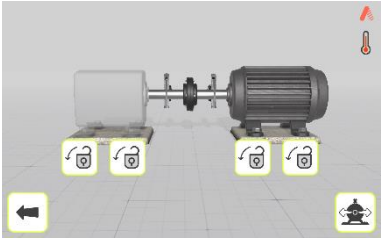
FEET LOCK FUNCTION

In some cases, the machine that is displayed as the movable machine is not movable, or maybe some of the feet are not adjustable. To perform proper alignment in these cases, the Feet Lock function can be used. This function allows you to select which feet are locked and which feet are adjustable.

Feet Lock is available both in shimming and alignment.

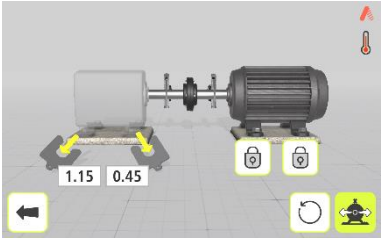
Touch the Feet Lock icon to enter the Feet Lock function.

Enter dimensions. The required distances are those between the first and second pairs of feet on the stationary machine and between the first pair of feet on the stationary machine and the first pair of feet on the movable machine.



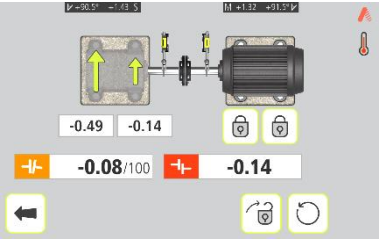
Select the two pairs of feet you want to lock.

Feet Lock Shimming



Shim values are shown for the two pairs of feet that are not locked.

Feet Lock Alignment



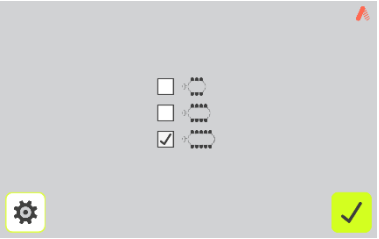
Live values are shown for the two pairs of feet that are not locked.

MULTIPLE FEET

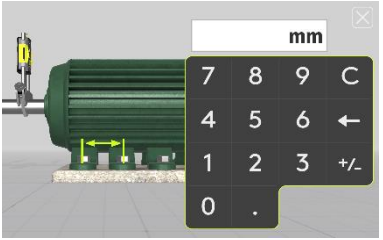
Some machines have more than two pairs of feet. To perform proper alignment in these cases, the Multiple Feet function can be used. This function allows you to select 3, 4 or 5 pairs of feet.

Multiple Feet is available both in shimming and alignment.

Touch the Multiple Feet icon to enter the Multiple Feet function.

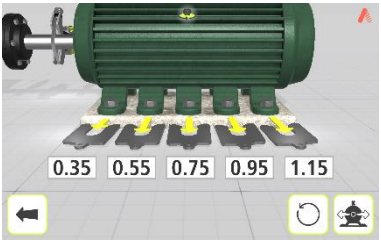


Select numbers of pairs of feet, 3, 4 or 5.



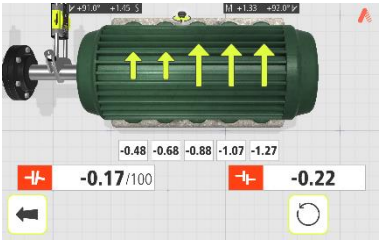
Enter distances between the pairs of feet, 1-2, 2-3…

Multiple Feet Shimming



Shim values are shown for the selected pairs of feet.

Multiple Feet Alignment

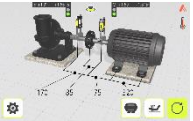


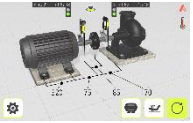
Live values are shown for the selected pairs of feet.

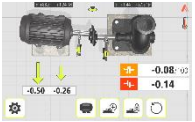
SCREEN FLIP

Screen Flip enables the user to see the machine set-up from the actual view.

Touch the Screen Flip icon to change view.







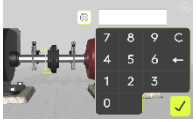
COUPLING GAP

Configuration

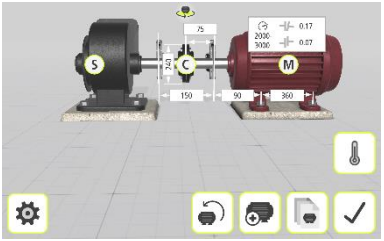
Go to the configuration screen.

Select coupling type.

Activate coupling gap.



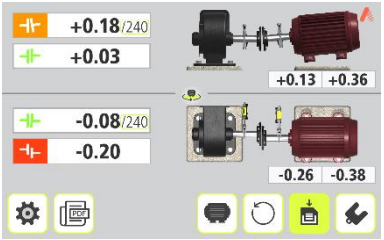
Enter coupling diameter.



The coupling diameter can also be entered as circumference.

Enter circumference.

Measurement results



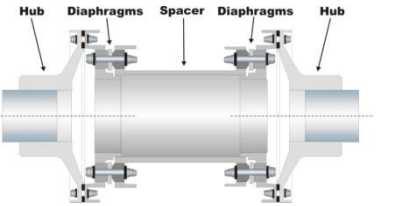
The angular error is shown per coupling diameter.

When coupling gap is activated, the coupling diameter is editable in the result screen.

SPACER SHAFT

The spacer shaft function is used when the alignment is performed on machinery using a membrane coupling. The membrane coupling is a typical high-performance coupling, with no backlash, used for maintenance free operation. It is also suitable for high speeds or high temperature applications.

Membrane couplings are normally designed with a spacer shaft between two flexible elements making it possible to compensate for both axial, radial (offset) and angular misalignment. Each flexible element normally consists of a steel disc pack (diaphragms) which has a high torsional stiffness. A single flexible element can only compensate for angular misalignment and cannot take any radial misalignment. To compensate for all types of misalignment, the membrane couplings use two flexible elements with a spacer in between.



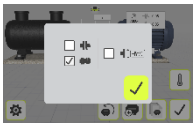
When using the spacer shaft function, the misalignment is presented as an angle for each flexible element. The angles can be compared directly to the figures on allowed misalignment normally delivered from the coupling manufacturer.

Depending upon the alignment condition, there can be differences in angle between the two flexible elements. The pictures below show different examples of how the angles in the flexible elements can be.

Configuration

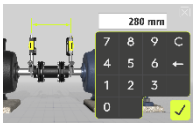
Go to the configuration screen.

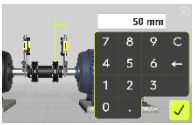
Select coupling type.



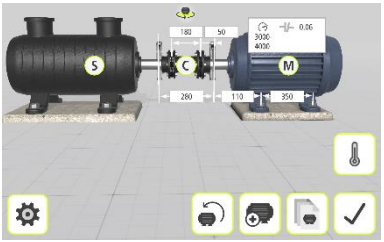
Activate spacer shaft.

Measure and enter distances.





You must enter all the distances. The distance between the sensors, the “spacer shaft length”, the distance between the “end of the spacer shaft” and the M-sensor, the distance between the M-sensor and the first pair of feet and the distance between the first and the second pair of feet.

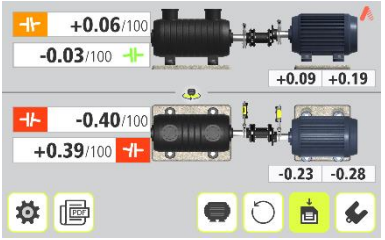


Measurement point registration

See selected measurement method, the Tripoint method, the Express Mode method or the Clock method.

Generally, the measurement procedure for spacer shaft works in the same way as for standard coupling, except for the two angular values.

Measurement results



The Measurement Result screen shows coupling values and foot values in both the vertical and horizontal direction.

The symbol to the left or right of the coupling values indicates the angular direction, and if the values are within tolerance.

Evaluating and saving the result

The angle values are used to determine the alignment quality. These values are compared with the alignment tolerance to determine whether correction is necessary. If suitable tolerance is selected in the tolerance table, the symbols described above indicate if the angle values are within tolerance or not.

The foot values indicate the movable machine's foot positions where corrections can be made.

Touch the save icon to save the result.

(The measurement is saved in the app and can be handled further by generating a PDF report.)

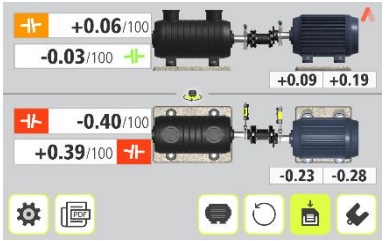
Shimming

See shimming for standard coupling.

Alignment

If the machine has been adjusted vertically in the shimming screen, only the horizontal direction remains to align.

If the machine has not been adjusted in the shimming screen, alignment in the vertical direction must be done first.



Adjust the machine horizontally until both the angular values are within tolerance. The arrows by the feet show in which direction the machine should be moved.

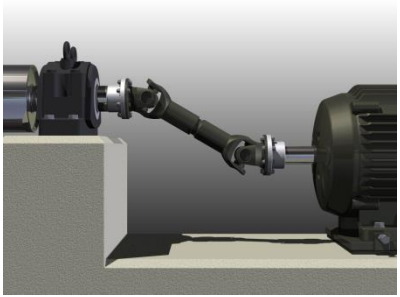
Alignment is now completed. To confirm the result, re-do the measurement.

Re-measure.

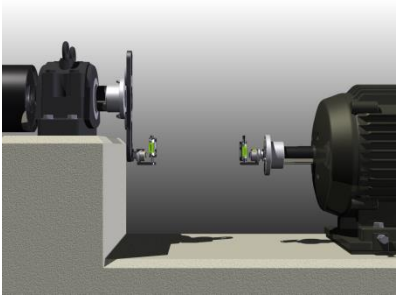
CARDAN SHAFT

Introduction

The most common set-up for offset machines is the Z-configuration, where the drive shaft and the driven unit should have rotational centers that are parallel to each other. This configuration can appear in both horizontally and vertically mounted machines.



The Offset laser fixture is adjustable in a plane parallel to the stationary machine's flange face and can be set at any position to eliminate the offset from the driven unit. The dummy rotational center on the fixture is set in front of the driven unit and any angular misalignment is measured by using the sensors.



Alignment of offset machines with the AT system involves the following:

- Pre-alignment.
- Mounting the fixtures to eliminate the offset between the rotational centers.
- Coarse alignment using the built-in lasers.
- Precision alignment using the AT system.

Pre-Alignment

The machined parts of the Offset fixture allow the dummy axis to be set parallel with a tolerance of better than 0.2 mm per meter. However, if the flange face is deformed, not truly flat, or has a run-out, the accuracy of the system can be compromised. It is important that the flange is clean and that all high spots are removed before mounting the fixtures on the flange. It is also important to use the spacers and washers that are included in the fixture system according to the instructions mentioned in the mounting section of this manual.

Perform the following actions before mounting the fixture on the flange:

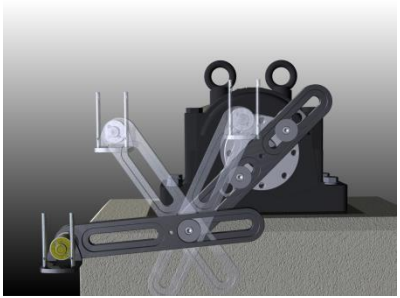
- Dismount the covers and remove the cardan shaft.
- Remove all high spots, such as burs from the bolt holes, and clean the flange faces.

- Check the run-out on the flange faces, using a dial indicator.
- Lock the shaft of the stationary machine before mounting the fixture on the flange.

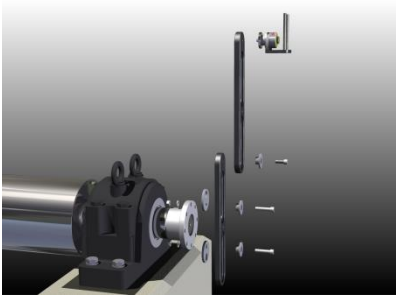
Mounting (Stationary)

The Offset fixture comes with several methods of attachment. The system is designed so that you can utilize the coupling bolts themselves in most cases when mounting the arm on the flange. Remember to place the steel spacers between it and the face before bolting up. This helps to eliminate any problems with high spots on the surface. The arm can be fixed at any point across the face, but placing it at the outer diameter, rather than across the center, secures the fixture arm over a longer distance and increases stability. The offset and the space available determine the set-up of the fixture arrangement. The figures below show different ways of mounting the fixture on the stationary machine.

Mounting the fixture with 2 arms is the most flexible set-up, which also covers the entire range in terms of offset.



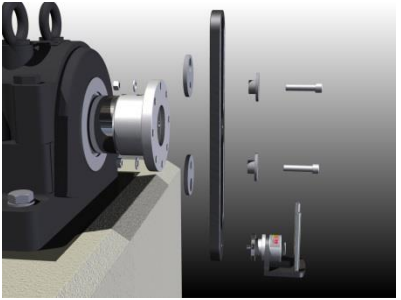
1. Clean the flange and mount the inner arm on the flange. Make sure to use the hardened washers as spacer between the arm and flange. Try to have as much distance between the two bolts as possible. Use the bolts from the cardan shaft (maximum M12 Allen screw) together with the guide washers to fix the arm on the flange. Make sure that the arm has maximum contact surface, equally distributed across the width, with the hardened washers, and that the arm is properly fastened on the flange.
2. Mount the 2nd arm with the turret onto the 1st arm, using the M10 bolt and guide washer. By slightly tightening the arm, it is possible to adjust its position roughly in front of the movable unit.
3. Make sure to tighten the bolt that connects the two arms before the fixture is left unsupported.

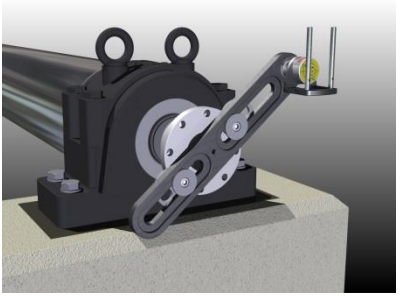


Mounting alternatives (Stationary)

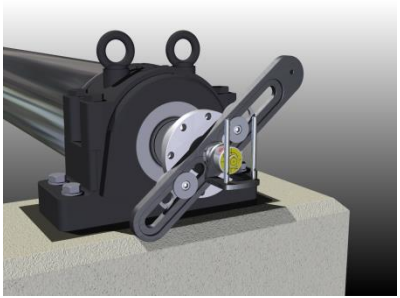
In applications where the flange can be rotated, where access is limited, or where you cannot use the “2-arm set-up”, it is possible to mount just one arm on the flange.

- Mount the arm on the flange and rotate the flange to a position where the "dummy axis" of the turret can hit the center of the movable machine.
- Make sure to lock the stationary unit in this position to prevent any movement of the flange.
- Make the final adjustment of the arm until the "dummy axis" of the turret hits the center of the movable machine.
- Tighten the arm’s fastening bolts.



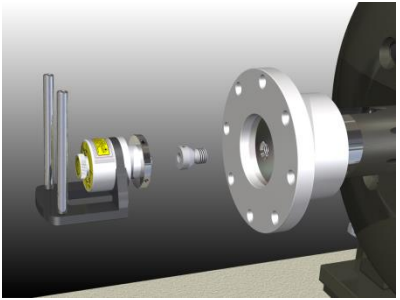


For applications with a small offset, you sometimes must mount the turret close to the center and in between the fastening bolts on one arm. In this case, it is necessary to dismount the turret at the end and place it in the center thread on the arm.



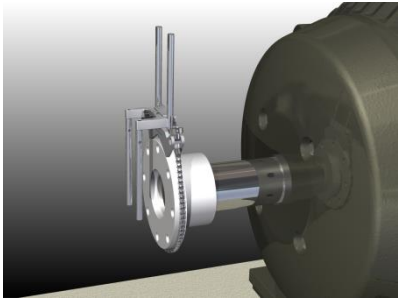
Mounting (Movable)

To attach the turret on the movable machine, the kit is provided with a selection of threaded nuts which will fit common coupling faces that have a threaded hole in the shaft center. These can be used to secure the turret to the flange face. The adaptors are only used to mount the turret onto shafts that can be rotated. When performing the measurement, it is important to rotate the machine shaft and not the turret itself.

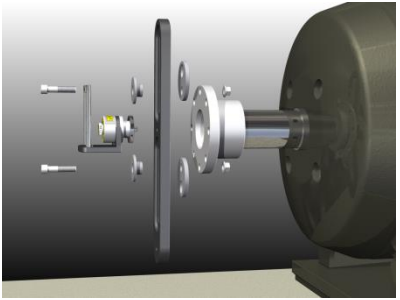


Mounting alternatives (Movable)

If no thread is present in the shaft center of the movable machine, the M-sensor can be mounted by using the chain fixture, extension bracket (optional) and the longer rods from the NXA system. The chain fixture is attached to the flange. The extension bracket is mounted on the chain fixture so that the rods are positioned in front of the flange.



If the shaft cannot be rotated, an extra arm can be mounted in front of the flange. The threaded hole in the center of the arm should be positioned near the center of the shaft. Try to have as much distance as possible between the fastening points.



Coarse alignment

The purpose of coarse alignment is to align the machines roughly by using the built-in lasers.

The built-in lasers in each turret are pre-adjusted so that the laser beam represents the axis of rotation for the unit it is mounted on.

1. Turn on the built-in laser in the turret on the stationary side, by rotating the laser unit clockwise until it bottoms.

   The lasers may cause interference with each other, so it is recommended that the laser pointers are turned on one at a time.

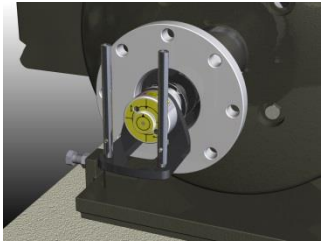
2. Rotate the turret on the stationary side and make sure that the laser beam hits the same spot (within 2 mm). If not, adjust the built-in laser according to steps 5-12.

3. Loosen fastening screw and adjust the position of the arm until the laser beam hits the target center on the movable machine. Tighten and verify that the laser beam is still hitting the center of the target.

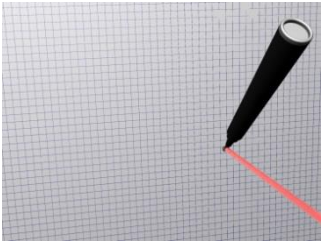
4. Turn off the laser in the turret on the stationary side.

5. Turn on the laser in the turret on the movable machine.

6. Turn the turret until it is standing in a vertical position.

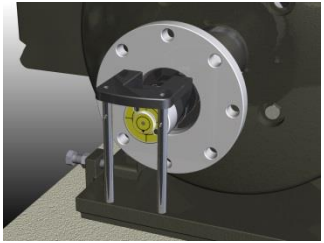


7. Aim the laser onto a target (a piece of paper or cardboard). Make a mark where the laser beam hits.



8. Rotate the **shaft** 180˚.

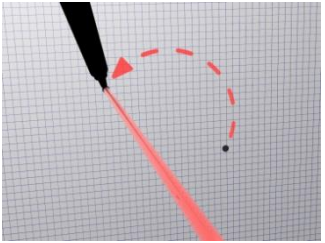
   Note: On the movable side, the shaft should be rotated, not just the turret.



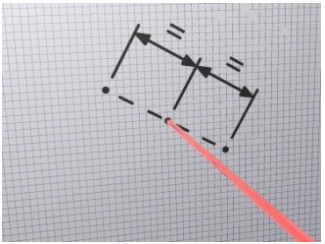
When using this procedure on the stationary side, only the turret shall be rotated 180˚.

9. The laser spot should now have moved on the surface, in a pattern of a half circle.

   Make a 2nd mark where the laser beam hits the target.



10. Make a 3rd mark on the target at half the distance between the 1st and 2nd mark.

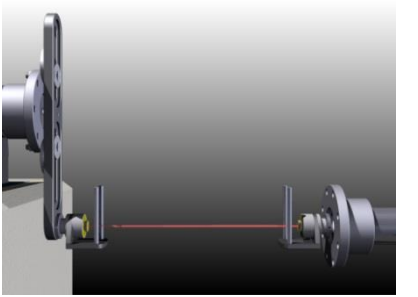


11. Adjust the position of the laser beam until it is hitting the 3rd marking on the target, using the two adjustment screws on the front on the turret. Make sure not to rotate the turret during the adjustment of the laser.

12. Repeat the coning process until the circle is a single spot on the surface during rotation of the shaft.

13. Make a coarse adjustment of the movable machine. Loosen the bolts and adjust the movable machine until both lasers are in the center of each opposing target.

14. If necessary, re-adjust the arm position to get both lasers in the center of the targets.



Configuration

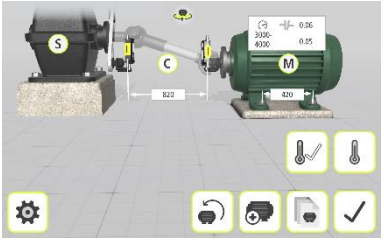
Go to the configuration screen.

Select coupling type.

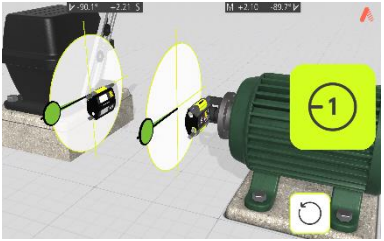
Activate cardan shaft.

Measure and enter distances.

The distance between the sensors, and the distance between the first and the second pair of feet are the only distances that need to be entered.



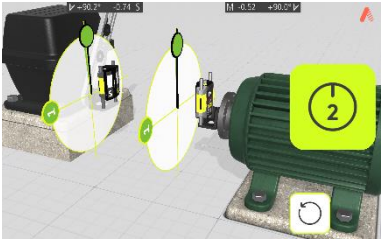
Measurement point registration



Set the sensors at approximately the same rotational angle at the first measurement position, 9 o'clock.

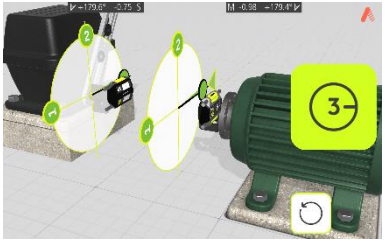
Touch the measurement icon, to register the first position.

Rotate the shafts to the next position, 12 o'clock.



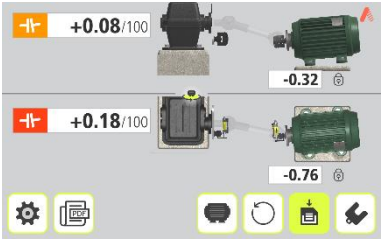
Touch the measurement icon, to register the second position.

Rotate the shafts to the third position, 3 o’clock.



Touch the measurement icon, to register the third position.

Measurement results



The Measurement Result screen shows coupling values and foot values in both the vertical and horizontal direction.

The symbol to the left or right of the coupling values indicates the angular direction, and if the values are within tolerance.

Evaluating and saving the result

The angle values are used to determine the alignment quality. These values are compared with the alignment tolerance to determine whether correction is necessary. If suitable tolerance is selected in the tolerance table, the symbols described above indicate if the angle values are within tolerance or not.

The foot values indicate the movable machine's foot positions where corrections can be made.

Touch the save icon to save the result.

(The measurement is saved in the app and can be handled further by generating a PDF report.)

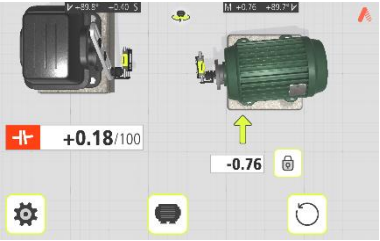
Shimming

See shimming for standard coupling.

Alignment

If the machine has been adjusted vertically in the shimming screen, only the horizontal direction remains to align.

If the machine has not been adjusted in the shimming screen, alignment in the vertical direction must be done first.



Adjust the machine horizontally the angular value is within tolerance. The arrow by the feet shows in which direction the machine should be moved.

Alignment is now completed. To confirm the result, re-do the measurement.

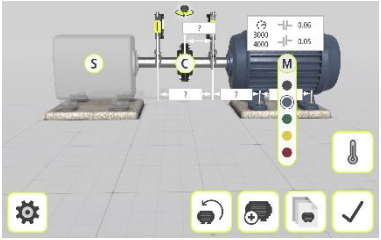
Re-measure.

MOTOR & STATIONARY MACHINE

Motor color and stationary machine type can be selected in the configuration screen.

Motor

Select motor color.



Select grey, blue, green, yellow, or red.

Stationary machine

Select stationary machine type.

Select undefined machine, centrifugal compressor, alternator, lobe compressor, blower, fan, gear box or pump.

HOT CHECK 10 9

Hot Check is a simplified way to get Target Values.

The Hot Check is performed by doing a measurement just after the machine has been shut off (hot condition), and another one when the machine has been shut off and cooled down (cold condition). These two measurements are then compared to get Target Values. The measurement result in hot condition is subtracted from the measurement result in cold condition.

WARNING!

The machine must be shut off before starting the measurement.

Measure Hot condition

Shut off the machine.

Do a Horizontal Shaft Alignment measurement, just after the machine has been shut off.

Save this measurement as “…Hot…”.

Measure Cold condition

Wait until the machine has cooled down.

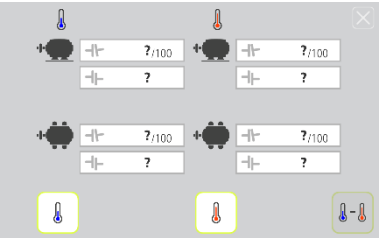
Do another Horizontal Shaft Alignment measurement.

Save this measurement as “…Cold…”.

Perform a Hot Check

Go to Hot Check.

(Hot Check is reached from the configuration screen.)

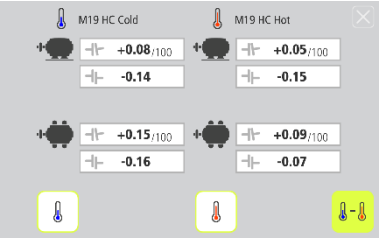


Pick up a saved measurement in cold condition.

Select the cold measurement to use in the list and confirm.

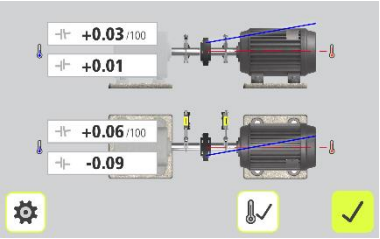
Pick up a saved measurement in hot condition.

Select the hot measurement to use in the list and confirm.



The screen shows coupling values from the picked-up measurements in cold and hot conditions.

Calculate Target Values.



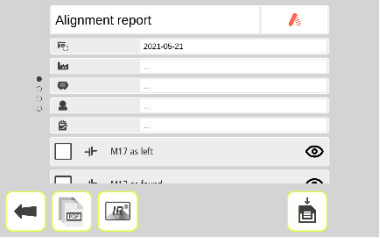
The screen shows the target values.

PDF REPORT

A PDF report with several measurements can be generated.

Touch the PDF icon to create a PDF report.

(The PDF icon is found in the result screen and in the setting screen.)



Enter data

Touch the white field at the top to enter a header for the PDF report.

Touch the white fields to enter date, site, machine, user and note.

Select files

Touch the check box to the left to select files.

Generate and save the PDF report

Touch the save icon to generate and save the PDF report.

Enter a file name and confirm.

The PDF report will then be shown, for further handling. It can be downloaded or shared using standard features of the tablet.

View a file

Touch the eye to view a file.

PDF-report list

Touch the PDF list icon to view existing PDF-reports.

IR Pictures

Touch the IR Picture icon to import IR pictures.

Customized logo

Touch the logo up to the right to change it.

Add your logo as a PNG or JPG file.
The maximum recommended file size is 500 kB.

The maximum space for logo on the PDF report is 51 x 17 mm.

OTHER FEATURES

Looseness indicator

The system has a function for detecting coupling backlash and looseness to achieve optimum accuracy. The system will display the looseness indicator if one of the following conditions is met:

- The M and S units are more than 3° apart.
- The mutual angular position changes more than 0.7° from that when the first measurement point was taken.

When the coupling backlash or looseness is eliminated to avoid any of the above conditions, the looseness indicator will automatically disappear.

Target Value symbol

When Target Values are used in the measurement, this is indicated with the Target Value symbol in the upper right corner of the screen.

SETTINGS

User Log in

Touch the User icon to log in to the ACOEM Augmented Mechanics Platform.

Info

Touch the Info icon to go to website for downloading user manual.

Photo

Touch the Photo icon to take a photo.

Flir One

Touch the IR Photo icon to go to the Flir One app.

PDF report

Touch the PDF icon to create a PDF report.

Privacy policy

Touch the Privacy Policy icon to go to website for information about privacy policy.

Intelligent screen filter and sampling time

Activate or deactivate intelligent screen filter with increased sampling time.

Note: The intelligent screen filter should be deactivated for normal operation, and only activated in environments with severe vibrations.

Inclinometer Off

Deactivate inclinometer.

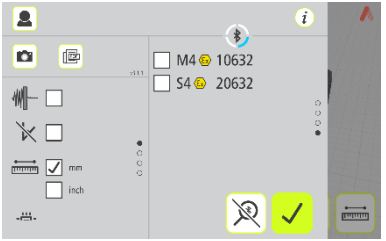
Measurement unit

Select mm or inch.

Bluetooth settings

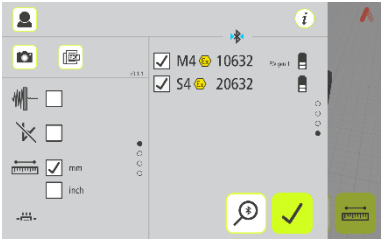
When entering settings, the system starts searching for pair able sensors.

Only ACOEM sensors, that are switched on, will be discovered.



Pair able sensors will appear in the list.

Select the sensors to pair. (Maximum two units.)



Paired units are marked with a check mark.

If there are units paired to the app, they must be unpaired before it is possible to pair new units.

To unpair units, touch the check mark icon beside the units.

Search

Starts searching for pairable sensors.

Cancel search

Stops searching for pairable sensors.

Confirm

Exits the Settings and returns to the application.

CLOUD SYNCHRONIZATION

Accessing the ACOEM Augmented Mechanics Platform allows for easy collaborative work, sharing machines, results, and providing a centralized multi-technical view (alignment, vibration) for a more effective decision making on maintenance action and plant performance.

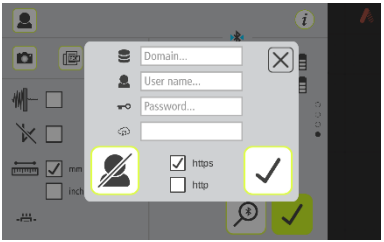
User authentication

To exchange data between the ACOEM Horizontal Shaft Alignment app and the cloud, the user must be logged in with a valid login and password. To do so, it is possible to authenticate from the app settings.

Click on the User icon and fill in your login and password that were provided at the creation of your account on the ACOEM Augmented Mechanics Platform (ai.acoem.com).

NOTE!

The validity of your information will be checked every time a synchronize action is trigged from the app.



Confirm.

Log out.

Upload a machine

Machines that are created in the configuration screen can be uploaded to the cloud.

To do so, from the machine list, display the machine details and touch the upload icon.

Upload to cloud.

Upload all completed work orders

From the machine list, touching the cloud synchronization icon will upload all completed and closed work orders.

Cloud synchronization.

Download available work orders

From the machine list, touching the cloud synchronization icon will automatically download all work orders assigned to the user logged in to the app.

Machines to be measured with due date will then appear in the machine list.

Cloud synchronization.

Completing a work order

Once a job is performed, the work order must be closed by the user prior to the upload to the cloud.

Once the work order is closed, its status is automatically updated in the machine list.

It means that the machine results and report are ready to be uploaded to the cloud and shared with other users.

A work order can either be closed from the result screen or from the machine list, by touching the work order closing icon.

Close the work order.

SHAFT ALIGNMENT VERTICAL MACHINES

INTRODUCTION

Shaft alignment: Determine and adjust the relative position of two machines that are connected, such as a motor and a pump, so that the rotational centers of the shafts are collinear, when the machines are working at a normal operating temperature. Correction of vertical shaft alignment is done by moving the flange of the machine until the shafts are aligned within given tolerances. A tolerance table is available in the system.

The system has two sensors that are placed on each shaft by using the fixtures supplied with the system.

After rotating the shafts to different measuring positions, the system calculates the relative distance between the two shafts in two planes. The distances between the two measuring planes, distance to the coupling, number of bolts and pitch circle diameter are entered into the system. The display box then shows the actual alignment condition together with the position of the feet. Adjustment of the machine can be made according to the values displayed. The angular misalignment is corrected by placing shims under the bolts and offset is corrected by moving them laterally.

The alignment results can be saved for further documentation purposes.

PRE-ALIGNMENT FUNCTIONS

To obtain the best possible conditions for shaft alignment, it is necessary to perform some pre-alignment checks. In many cases it is necessary to make these checks to obtain precise alignment. It is often impossible to reach the desired alignment results if you do not make any pre-alignment checks.

Before going on site, check the following:

What are the required tolerances?

Any offsets for dynamic movements?

Are there any restrictions for mounting the measuring system?

Is it possible to rotate the shafts?

What shim size is needed?

Before setting up the alignment system on the machine, check the machine foundation, bolt, and shim conditions. Also check if there are any restrictions in adjusting the machine (if e.g., there is enough space to move the machine).

After the visual checks have been performed, there are some conditions that must be considered:

- Check that the machine has the right temperature for alignment?
- Take away old rusty shims (check that you can remove shims).
- Check coupling assembly and loosen the coupling bolts.
- Check soft foot conditions.
- Mechanical looseness.
- Check coupling and shaft run-out.
- Pipe work strain.

- Coarse alignment.
- Check coupling gap (axial alignment).

STARTING

Turn on the sensors.

Turn on the tablet.

Start the Vertical Shaft Alignment app.

Go to settings for connecting the sensors if they are not already connected.

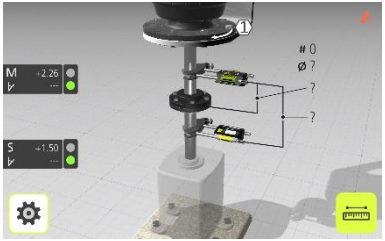
Settings.

Settings are described at the end of the chapter.

MOUNTING

The sensors are mounted as described in chapter “Shaft Alignment Horizontal Machines”.

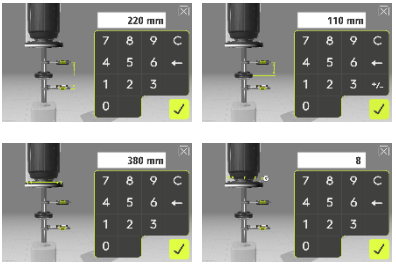
MACHINE CONFIGURATION



The screen displays the movable machine. The traffic lights show green when the laser hits the detector.

Touch the distance icon.

Measure and enter distances

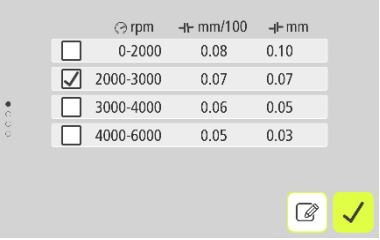


You must enter all the distances. The distance between the sensors, the distance between the center of the coupling and the M-sensor, the pitch circle diameter, and the number of bolts.

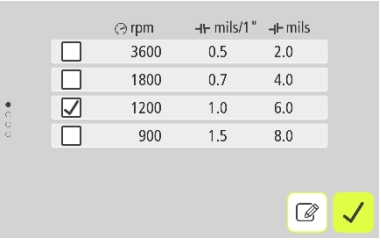
Enter tolerances

Alignment tolerances depend to a large extent on the rotation speed of the shafts. Machine alignment should be carried out within the manufacturer's tolerances.

The tolerances are the maximum allowed deviation from desired values.



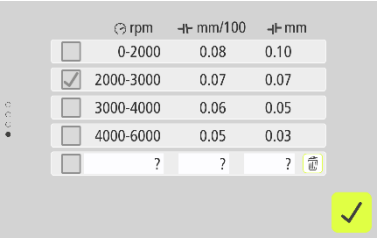
Tolerance Table mm-mode



Tolerance Table inch-mode

Select the tolerance to use in the alignment by touching its check box to the left.

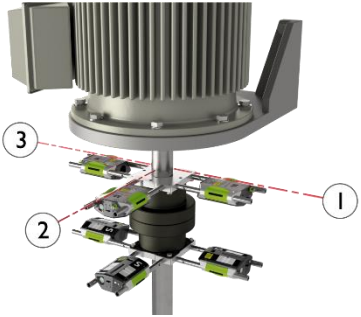
Confirm.



Editing mode for customized tolerances

MEASUREMENT METHOD

In the Vertical Shaft Alignment program, machinery positions are calculated by taking three points with 180° of rotation.

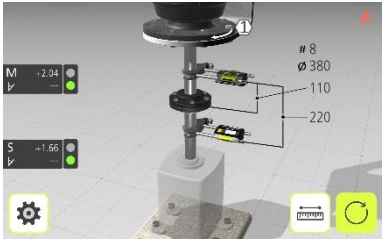


Place yourself at the position corresponding to the second measurement position, where it is easiest to turn the shafts through 180°.

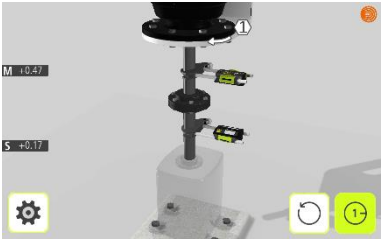
The first measurement position must be at bolt number 1.

Tip: Mark the positions 1, 2 and 3 before you start measuring.

MEASUREMENT POINT REGISTRATION



Go to measurement.

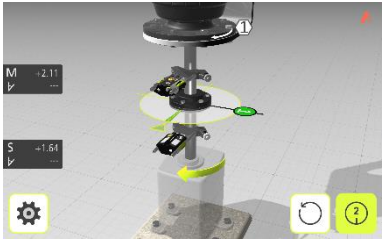


Set the sensors at approximately the same rotational angle at the first measurement position, with bolt number 1 to the right.

Touch the register icon.

This registers the first reading.

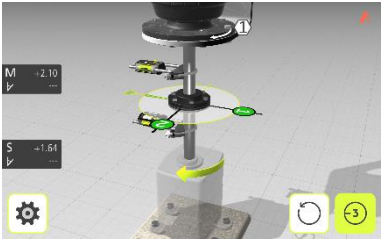
Rotate the shafts 90° to the second position (where you are standing).



Touch the register icon.

This registers the second reading.

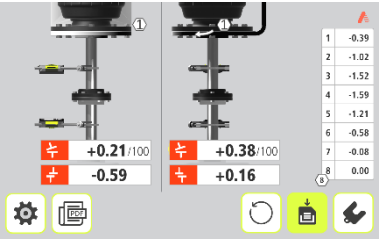
Rotate the shafts 90° to the third position, to the left.



Touch the register icon.

This registers the third reading.

MEASUREMENT RESULTS



The Measurement Result screen shows coupling values in both directions, and bolt values.

The symbol to the left of the coupling values indicates the angular direction and offset, and if the values are within tolerance.

Within tolerance (green).

Within double tolerance (yellow and inverted).

Out of double tolerance (red and inverted).

When a coupling is in tolerance in one direction, this is indicated with a check symbol at the motor.

EVALUATING AND SAVING THE RESULT

The angle and offset values are used to determine the alignment quality. These values are compared with the alignment tolerances to determine whether correction is necessary. If suitable tolerances are selected in the tolerance table, the symbols described above indicate if the angle and offset values are within tolerance or not.

The bolt values indicate the movable machine's bolt positions where corrections can be made.

Depending on the result, the program will also guide the user.

First, the program will always guide the user to save the measurement.

Touch the save icon to save the result.

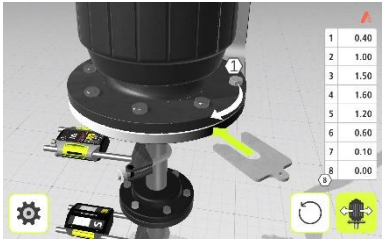
(The measurement is saved in the app and can be handled further by generating a PDF report.)

Then, if the measurement result shows that the machine is misaligned, the user will be guided to go to shimming.

Go to shimming

If the measurement result is within tolerance and has been saved, the user is recommended to exit the measurement.

SHIMMING



The Shimming screen shows bolt values as suitable shim values (0.05 mm / 1 mil).

Adjust the angular error by placing shims under the bolts as required.

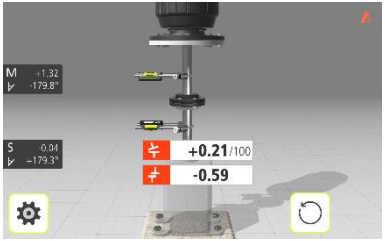
The arrow show if shims must be added to adjust the machine.

The check sign shows that shimming is not needed.

When shimming is completed, continue to alignment for adjustments of parallel offset.

Go to alignment.

ALIGNMENT



If the angular error has been correctly adjusted in the shimming screen the angular value should now be in tolerance.

Now adjust the parallel offset in both directions. The parallel offset is displayed live in the first direction when the sensors are placed in position number 1, and in the second direction when they are placed in position number 2.

Check that both the angular value and the parallel offset are within the required tolerances once the adjustments are completed.

Alignment is now complete. To confirm the result, re-do the measurement.

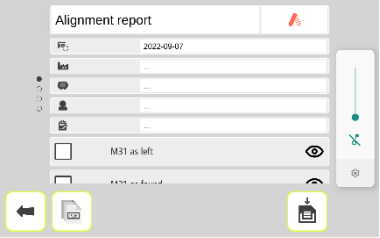
Re-measure.

PDF REPORT

A PDF report with several measurements can be generated.

Touch the PDF icon to create a PDF report.

(The PDF icon is found in the result screen and in the setting screen.)



Enter data

Touch the white field at the top to enter a header for the PDF report.

Touch the white fields to enter data.

Select files

Touch the check box to the left to select files.

Customized Logo

Touch the logo up to the right to change it.

Generate and save the PDF report

Touch the save icon to generate and save the PDF report.

Enter a file name and confirm.

The PDF report will then be shown, for further handling. It can be downloaded or shared using standard features of the tablet.

View a file

Touch the eye to view a file.

PDF-report list

Touch the PDF list icon to view existing PDF-reports.

SETTINGS

Info

Touch the Info icon to go to website for downloading user manual.

Photo

Touch the Photo icon to take a photo.

PDF report

Touch the PDF icon to create a PDF report.

Measurement unit

Select mm or inch.

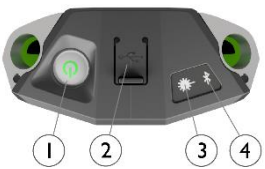
Privacy policy

Touch the Privacy Policy icon to go to website for information about privacy policy.

Bluetooth settings

See Shaft Alignment Horizontal Machines.

SENSORS M4 EX AND S4 EX



1. ON/OFF button with status indication LED
    a. Continuously green – On
2. Mini USB for charging
3. Laser transmission indication LED
    a. Green – laser transmission
4. Bluetooth indication LED
    a. Continuously blue – paired and ready.
    b. Flashing blue – searching/ready to pair
    c. No light – Bluetooth disabled.

5. Battery status button – press to instantly show the battery status (also works when the unit is switched off).

6. Battery status LED
   a. One LED continuously red – less 10% charge left.
   b. One LED flashing red – less than 5% charge left.
   c. One LED continuously orange – charging
   d. One LED continuously green – fully charged.

7. Battery status LED when battery button is pressed
   a. Continuously green – battery status

OPERATING MODES

M4 Ex and S4 Ex units has two operating modes: On and Off.

Turn the units on and off by pressing the ON/OFF button firmly.

In case the units fail to respond, it is possible to turn it off by pressing down the ON button for more than 10 seconds.

CONNECTIONS

Bluetooth connection

The M4 Ex and S4 Ex units are connected by the built in Bluetooth connection. The units will automatically connect to the app when turned on if they are paired. See chapters about apps for instructions on how to pair measurement units.

To avoid accidental Bluetooth transmission in a restricted area the Bluetooth function can be completely disabled – contact your local sales representative for more information.

If the Bluetooth has been disabled (as indicated by the fact that the Bluetooth LED is not flashing or continuously blue when the unit is turned on) it can be enabled by pressing the battery status button quickly 5 times in a row.

POWER SUPPLY

The M4 Ex and S4 Ex units are powered by a high-capacity rechargeable Li-Ion cell.

The operating time of the batteries is approximately 12 hours when the system is used for a typical alignment work (continuously on).

By pressing the battery status button, the battery level can be monitored.

The M4 Ex and S4 Ex units are charged with the supplied power adapter.

When the external power adapter is connected, the unit will automatically start charging the batteries. This will be indicated by the first battery status LED turning orange, when the unit is fully charged the LED will turn green.

The charging time is approximately 5 hours for fully drained batteries.

WARNING!

The sensors must be turned off when charging.

WARNING!

Do not turn on the sensors or press the battery status button while the power adapter is connected.

When used in typical conditions the batteries will sustain good capacity for approximately 2-3 years before needing replacement. Contact your sales representative for battery replacement.

The batteries contain safety circuitry to operate safely with the unit. The unit can therefore only be used with the Li-Ion batteries supplied by ACOEM. Improper replacement of batteries can cause damage

and risk for personal injury. Please refer to the chapter on safety for further instructions.

TECHNICAL SPECIFICATION – M4 EX AND S4 EX

Art. No. M4 Ex 1-1043, S4 Ex 1-1044

Housing Material	Anodized Aluminum frame and high impact PP plastic over molded with TPE rubber
Operating Temp	0 to 50°C (32 to 122°F)
Storage Temp	-20 to 70°C (-4 to 158°F)
Long term storage temp	Room temp. 18 to 28°C (64 to 82°F)
Battery Charging Temp	5 to 40°C (41 to 104°F)
Relative humidity	10 – 90%
Weight	M4 Ex: 220 g (7,8 oz) S4 Ex: 190 g (6,7 oz)
Dimensions	92 mm x 77 mm x 33 mm (3,6 in x 3,0 in x 1,3 in)
Environmental protection	IP65 (Dust tight and protected against water jets)
Laser	650 nm class II diode laser
Laser line fan angle	6°
Laser line width ($1/e^2$)	1.6 mm
Laser line divergence (full angle)	0.25 mrad
Laser power	< 1 mW
Measurement distance	Up to 10m
Detector	2nd gen. digital sensor
Detector length	30 mm (1,2 in)

Detector angular subtense	30 mrad/m (3mm/100mm per meter)
Detector resolution	1 µm
Measurement accuracy	0,3% ± 7 µm
Signal processing:	Digital signal processing with Sidespot rejection, edge detection, ambient light elimination and anti-vibration mode
Ambient light protection	Optical filtering and digital ambient light signal elimination
Inclinometer:	Dual High Performance MEMS inclinometers
Inclinometer resolution	0,01°
Inclinometer accuracy	±0,2°
Wireless communication	Class I Bluetooth transmitter
Communication range	10 m (33 ft)
Connectors	1 USB Mini port (IP67); Charging: 5V, 0,5A
Power supply	High performance Li Ion battery or external power.
Operating time:	12 hours continuous use (measuring)
Battery Charging time (system off, room temperature)	5 h
Battery Capacity	9.0 Wh
LED indicators	Unit state, laser transmission and 5 battery status indicators with instant battery check

Specifications are subject to change without notice.

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