



USER MANUAL RT-300

acoem



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## **WELCOME TO OUR WORLD**

*For more than 30 years, ACOEM 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 reliability solutions.*

## **SUSTAINABLE INNOVATIONS**

During our 30+ 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 field of laser alignment to have a touch screen. Nor would we have been pioneers in the use of visible lasers and dual measurement heads. Nor would we have been the first to bring a wireless vibration sensor for machine diagnostics. We are now the first to provide a combined alignment and diagnostic solution on standard mobile devices.

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, 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 could not 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 group, 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 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 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 group is headquartered in Lyon, France. For more information please visit [acoem.com](http://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

### **Type of equipment**

Alignment Tool

### **Brand name or trade mark**

ACOEM

### **Type designation(s)/Model no(s)**

1-1216 M7  
1-1217 S7  
1-1063 P1

### **Manufacturer's name, address, telephone & fax no**

ACOEM AB  
Box 7  
SE-431 21 Mölndal  
Sweden

Tel: +46 31 7062800  
Fax: +46 31 7062850

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 61000-6-3:2007.

EN 61000-6-2:2005, EN 61000-4-2, -3, -4, -5, -6, -11.

EN 61010-1:2010

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 2020.

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

**Date and place of issue**

Mölnadal 2020-04-16

**Signature of authorized person**A handwritten signature in black ink, appearing to be 'Hans Svensson', written in a cursive style.

Hans Svensson, Managing Director



## **SAFETY**

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions.

Failure to observe the safety pre-cautions and operating instructions can cause bodily injury, fire, and damage to the equipment.

Do not disassemble, modify or use the equipment in other ways than explained in the operating instructions. ACOEM AB will not accept any liability for such use.



## **WARNING!**

Do not mount equipment on running machines and take all appropriate measures to prevent unintentional start-up of machines. Make sure to fully comply with all appropriate shut down procedures, safety measures and regulations at worksite and local regulations regarding safety in a machine environment.

## LASER PRECAUTIONS

The system uses laser diodes with a power output of  $< 1.0$  mW. The laser classification is Class 2.

Class 2 is considered safe for its intended use with only minor precautions required. These are:

- Never stare directly into the laser transmitter.
- Never shine the laser directly into anyone else's eyes.



COMPLIES WITH 21 CFR 1040.10 AND 1040.11  
EXCEPT FOR DEVIATIONS PURSUANT TO  
LASER NOTICE No. 50, DATED JUNE 24, 2007



### CAUTION!

USE OF CONTROLS OR  
ADJUSTMENTS OR  
PERFORMANCE OF  
PROCEDURES OTHER THAN  
THOSE SPECIFIED HEREIN  
MAY RESULT IN HAZARDOUS  
RADIATION EXPOSURE.

Your system complies with the requirements in:

- IEC-60825-1:2007
- British Standard BS EN 60825-1
- DIN EN 60825-1
- USA FDA Standard 21 CFR, Ch 1, Part 1040.10 and 1040.11

## POWER SUPPLY

The sensors are powered by high-capacity rechargeable Li-Ion batteries mounted in the sensors or by the external power unit.



The sensors (M7 and S7) can be connected to their charger and charged while lying in the case. It is important that the lid of the case is open during the charging and that the charger is placed outside the case or else the system will not be charged properly and might be damaged.

Do not expose the power adapter to rain or wet conditions.

Always unplug the charger from the electrical outlet after charging.

Leaving a display unit or a measurement unit with an empty battery for a prolonged time can reduce the capacity of the battery or even damage the battery.

If the system is not used for a long time, charge the batteries to approximately 50-75% before storing the system, if kept in storage repeat this every 3-4 month (if needed).

When used in typical conditions the battery 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 display 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.





## **WARNING!**

BATTERY REPLACEMENT SHALL ONLY BE PERFORMED BY AUTHORIZED ACOEM REPRESENTATIVES.

USE OF ANY OTHER BATTERIES THAN THOSE SUPPLIED BY ACOEM WILL CAUSE SEVERE DAMAGE TO THE SENSOR AND CAN CAUSE RISK FOR PERSONAL INJURY!

Handle any batteries with care. Batteries pose a burn hazard if handled improperly. Do not disassemble and keep away from heat sources. Handle damaged or leaking batteries with extreme care. Please keep in mind that batteries can harm the environment. Dispose of batteries in accordance with local regulatory guidelines, if in doubt contact your local sales representative.

Only use the external power adapters supplied by ACOEM for use with the sensors. Using other power adapters can cause damage to the unit and personal injury.

## WIRELESS TRANSCEIVER

The sensors are fitted with Bluetooth wireless transceivers.

Make sure that there are no restrictions on the use of radio transceivers at the site of operation before using the wireless transceivers.



### **WARNING!**

Before using the wireless transceivers make sure that there are no restrictions on the use of radio transceivers at the site. Do not use on aircraft.

## CARE

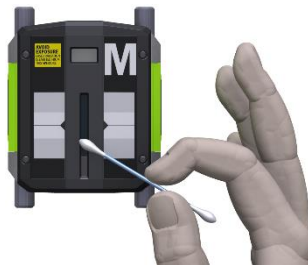
### PACKING THE CASE



## 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 AT system.



Horizontal Shaft Alignment



Vertical Shaft Alignment



Pre-Alignment



Download the apps from Google Play or App Store.

The Horizontal Shaft Alignment app and the Vertical Shaft Alignment app work with the sensors M7 and S7.

The Pre-Alignment app works with the Run-Out probe P1.

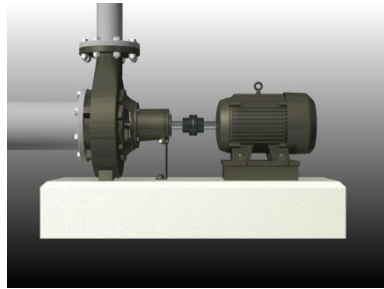




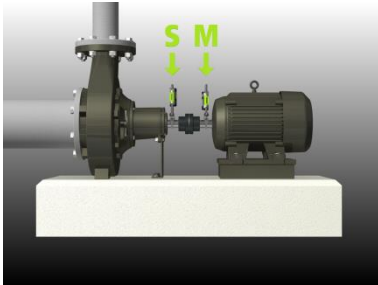
## **SHAFT ALIGNMENT HORIZONTAL MACHINES**

### **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 measuring units 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 in order 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).

The Pre-Alignment app can be used for several Pre-Alignment checks.

There is also a Softcheck function in the Horizontal Shaft Alignment app.

## 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 front to front on each side of the coupling.

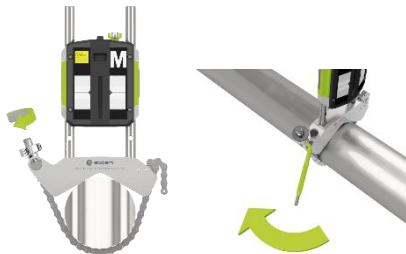
Hold the V-bracket upright and mount it on the shafts of the measurement object.



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.



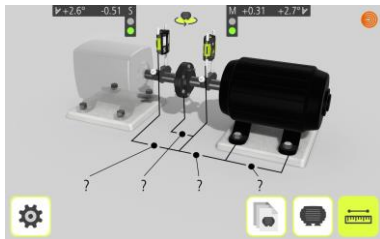
Adjust the height of the sensor by sliding it on the posts until a line of sight is obtained for both lasers. Secure its position by locking both clamping devices on the back of both units.



## MACHINE CONFIGURATION

The screen displays the movable machine.

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



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.



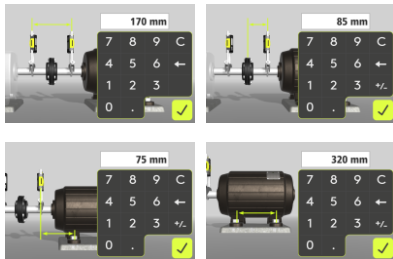
Touch the machine list icon, to select a pre-defined machine or work order.

It is also possible to go to the configuration screen, for configuring 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 tolerances are the maximum allowed deviation from desired values.

	rpm	$\pm$ mm/100	$\pm$ mm
<input type="checkbox"/>	0-2000	0.08	0.10
<input checked="" type="checkbox"/>	2000-3000	0.07	0.07
<input type="checkbox"/>	3000-4000	0.06	0.05
<input type="checkbox"/>	4000-6000	0.05	0.03

Tolerance Table mm-mode

	rpm	± mils/"	± mils
<input type="checkbox"/>	3600	0.5	2.0
<input type="checkbox"/>	1800	0.7	4.0
<input checked="" type="checkbox"/>	1200	1.0	6.0
<input type="checkbox"/>	900	1.5	8.0



Tolerance Table inch-mode



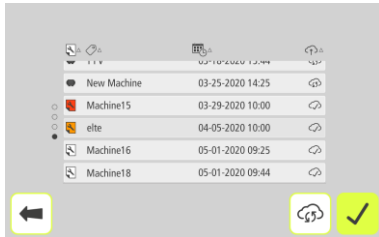
Select the tolerance to use in the alignment by touching its check box to the left.



Confirm.



## MACHINE LIST



	111	03-10-2020 13:44	
	New Machine	03-25-2020 14:25	
○	Machine15	03-29-2020 10:00	
○	elite	04-05-2020 10:00	
●	Machine16	05-01-2020 09:25	
	Machine18	05-01-2020 09:44	

to the top of the list, click on the work order column header.

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

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

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

For example: In order to bring all overdue work orders that have to be managed urgently

## 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.

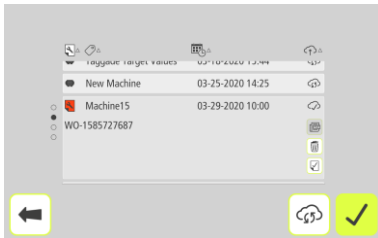


Upload to cloud.

## 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.

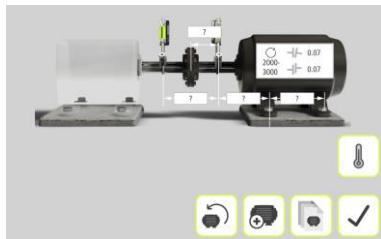


Synced.



Not connected to cloud.

## CONFIGURATION SCREEN

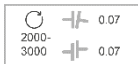


### Distances



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.

## Confirm



Confirms the machine configuration.

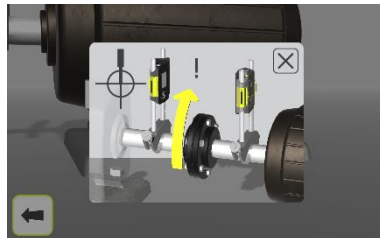
## SOFTCHECK™



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 application will guide you to the different feet.

The first foot.



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



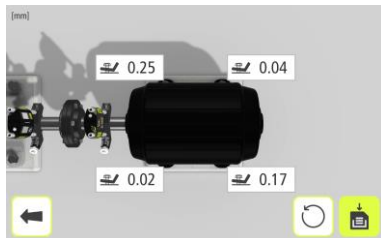
Touch the confirmation icon.

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 for entering target values.

(Target Values are reached from the configuration screen.)

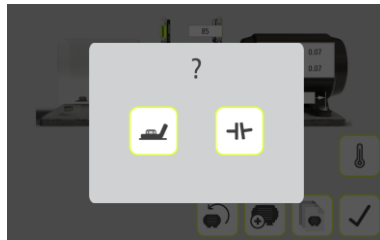
### Introduction

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.

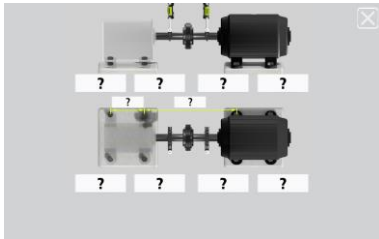
You can pre-set target values before starting your alignment work. Accepted values are feet values and angle and offset values.

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) in order to obtain correct alignment while the machine is running (hot condition).

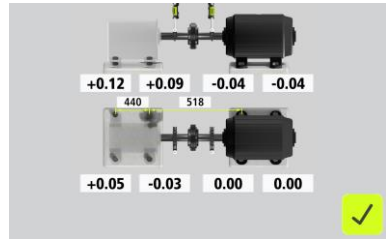


Select one of two ways to express the offset values: Feet values or angle and offset values.

## Feet values

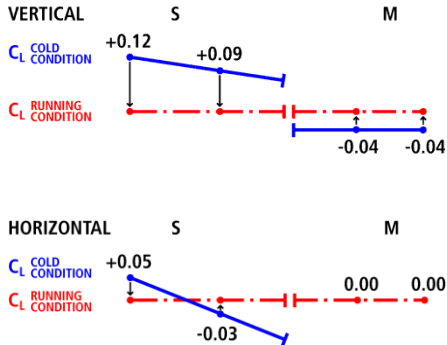


Touch the feet value boxes. Enter target values for the feet in mm or mils according to the pre-set measurement unit together with the required distances.



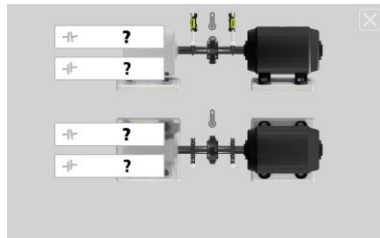
In the example above, the stationary machine will shrink vertically by 0.12 mm at the rear feet and 0.09 mm at front feet while the movable machine will expand 0.04 mm while running.

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.

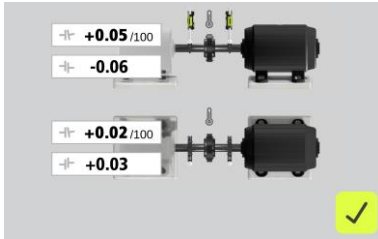


After having entered these feet values, the system calculates how the movable machine should be positioned (target position) in cold condition to obtain perfect alignment during running condition.

## Angle and offset values

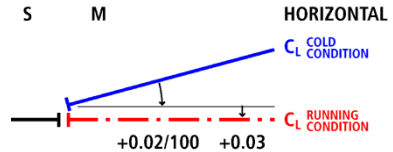
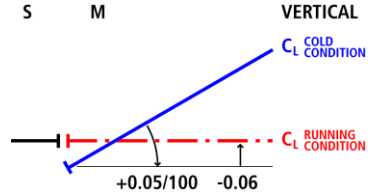


Touch the value boxes and enter target values for the angles in mm/100 mm and target values for the offsets in mm, or mils/inch and mils, according to the pre-set measurement unit.



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.



## MEASUREMENT METHOD



### Tripoint™ method

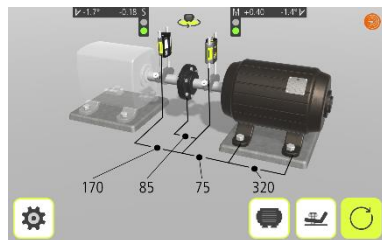
In the Tripoint method, the alignment condition can be calculated by taking three points while rotating the shaft at least 90°.

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

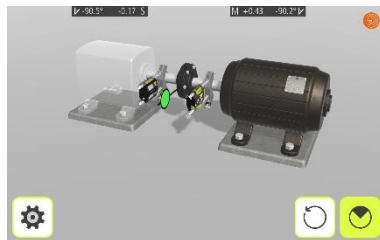
**TIP:** The larger the angle over which the three points are measured, the fewer moves, and repeat measurements will have to be made. Minimum angle between readings is 45°.

Shadowed sensors suggest suitable measurement positions.

## MEASUREMENT POINT REGISTRATION



Go to measurement.



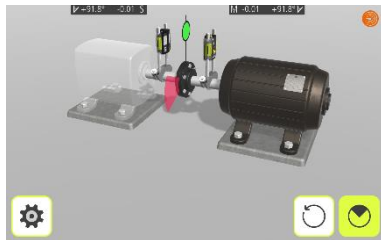
Set the sensors at approximately the same rotational angle at the first measurement position.



Touch the measurement icon, to register the first position.

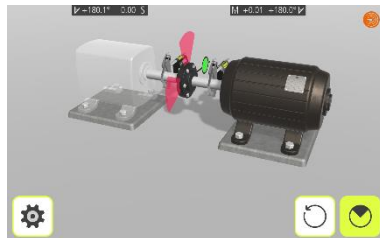
Rotate the shafts to the next position. The shafts must be rotated over a minimum of 45°.

Red sector shows already measured zone. The Register icon is not shown if the rotation is less than 45°.



Touch the measurement icon, to register the second position.

Rotate the shafts to the third position.

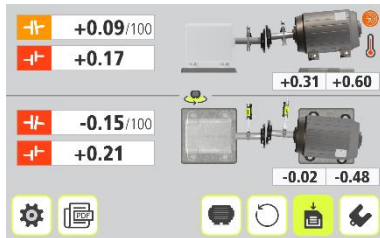


Touch the measurement icon, to register the third position.

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



## 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 also 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 in order 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



Go to alignment.

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.

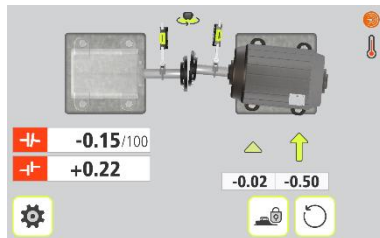
6.30

## ALIGNMENT

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

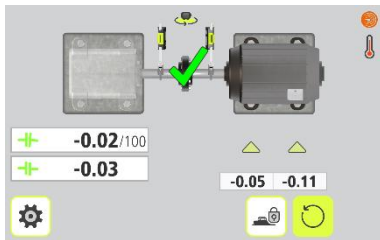
If the machine has not been adjusted in the shimming screen, alignment in the vertical direction must be done first.

### Horizontal direction



Rotate the shafts to the 3 or 9 o'clock position, if they are not already positioned there. 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.

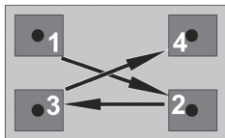


Alignment is now completed. To confirm the result, re-do the measurement.



Re-measure.

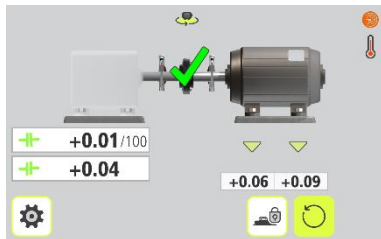
Tighten the bolts using the tightening sequence, as below.



## Vertical direction

To check or align in the vertical direction, rotate the shafts to the 12 or 6 o'clock position. 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.



## FEET LOCK FUNCTION

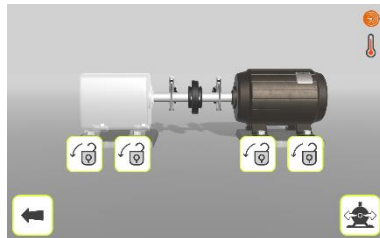
In some cases, the machine that is displayed as the movable machine is not movable, or maybe some of the feet are not adjustable. In order to perform proper alignment in these cases, the Feet Lock function can be used. This function allows you to select which feet are locked and which feet are adjustable.

Feet Lock is available both in shimming and alignment.



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

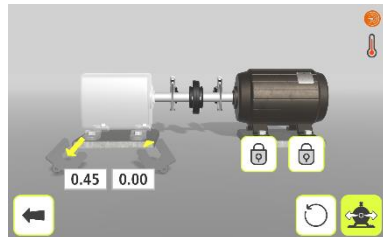
Enter dimensions. The required distances are those between the first and second pairs of feet on the stationary machine and between the first pair of feet on the stationary machine and the first pair of feet on the movable machine.



Select the two pairs of feet you want to lock.

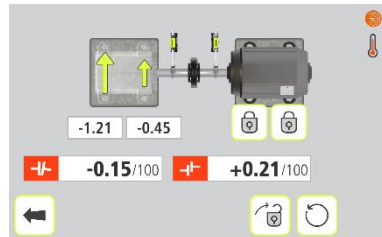


## Feet Lock Shimming



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

## Feet Lock Alignment



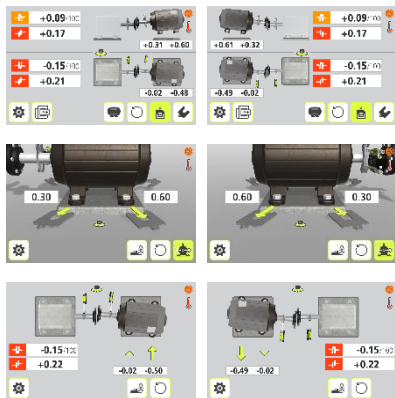
Live values are shown for the two pairs of feet that are not locked.

## 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.



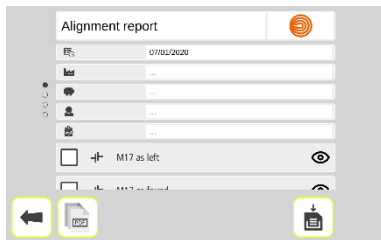
## PDF REPORT

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.

## 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.

## OTHER FEATURES

### Looseness indicator



The system has a function for detecting coupling backlash and looseness in order 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  $3^\circ$  apart.

- The mutual angular position changes more than  $0.7^\circ$  from that when the first measurement point was taken.

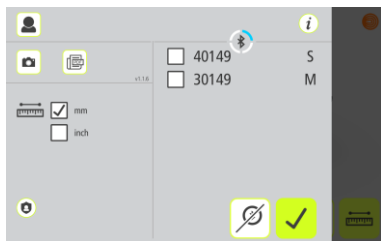
When the coupling backlash or looseness is eliminated to avoid any of the above conditions, the looseness indicator will automatically disappear.

### 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.

### PDF report



Touch the PDF icon to create a PDF report.

### Measurement unit



Select mm or inch.

### Privacy policy

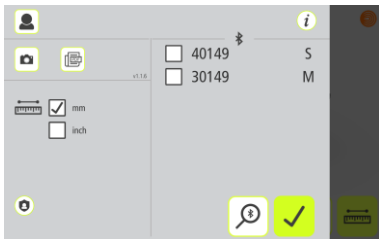


Touch the Privacy Policy icon to go to website for information about privacy policy.

## Bluetooth settings

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

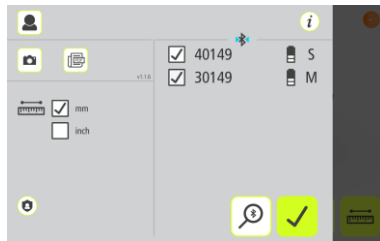
Only ACOEM sensors, that are switched on, will be discovered.



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 triggered 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 measuring units 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 in order 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).

The Pre-Alignment app can be used for several Pre-Alignment checks.



## 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.



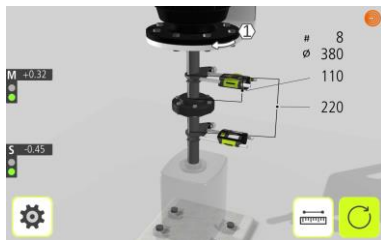
Settings.

Settings are described in the end of the chapter.

## MOUNTING

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

## MACHINE CONFIGURATION

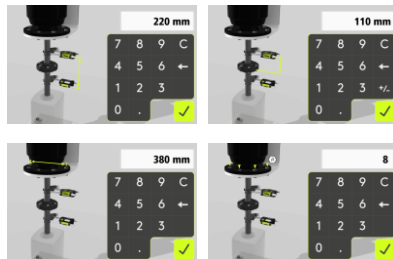


The screen displays the movable machine. The traffic lights show green when the laser hits the detector.



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.

	rpm	± mm/100	± mm
<input type="checkbox"/>	0-2000	0.08	0.10
<input checked="" type="checkbox"/>	2000-3000	0.07	0.07
<input type="checkbox"/>	3000-4000	0.06	0.05
<input type="checkbox"/>	4000-6000	0.05	0.03



Tolerance Table mm-mode

	rpm	± mils/"	± mils
<input type="checkbox"/>	3600	0.5	2.0
<input type="checkbox"/>	1800	0.7	4.0
<input checked="" type="checkbox"/>	1200	1.0	6.0
<input type="checkbox"/>	900	1.5	8.0



Tolerance Table inch-mode



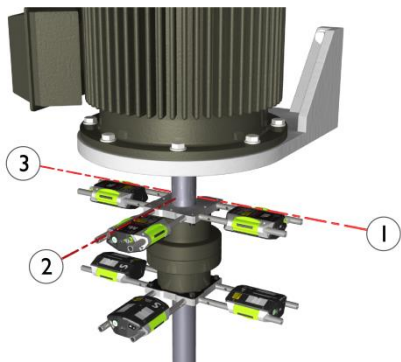
Select the tolerance to use in the alignment by touching its check box to the left.



Confirm.

## MEASUREMENT METHOD

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

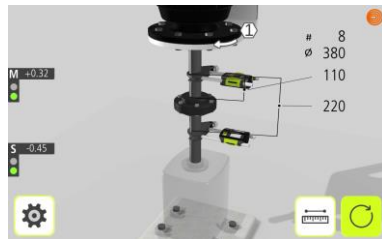


Place yourself at the position corresponding to the second measurement position, where it is easiest to turn the shafts through 180°.

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.

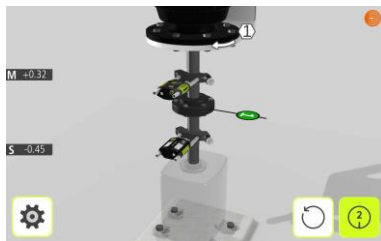


Set the sensors at approximately the same rotational angle at the first measurement position, with bolt number 1 to the right.



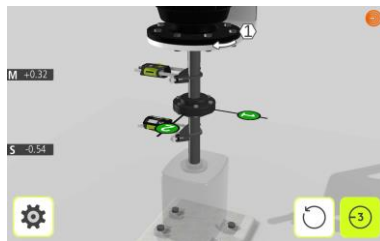
Touch the register icon to register the first position.

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



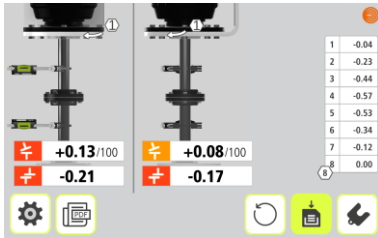
Touch the register icon to register the second position.

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



Touch the register icon to register the third position.

## 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 also 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 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.



## 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 shows if shims must be added to adjust the machine.

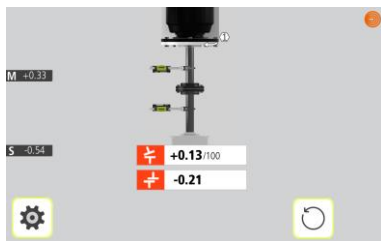
The check sign shows that shimming is not needed.

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.

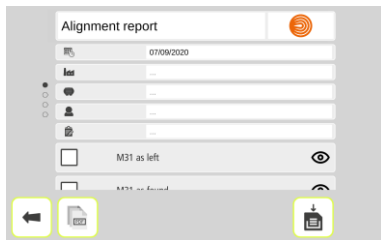
## PDF REPORT

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 date, site, machine, user and note.

## 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



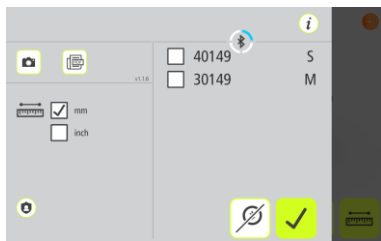
Touch the eye to view a file.

## 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

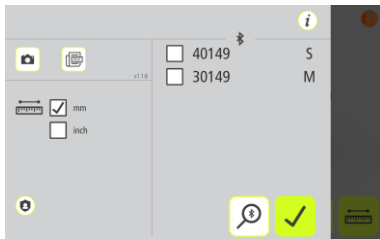


Touch the Privacy Policy icon to go to website for information about privacy policy.

## Bluetooth settings

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

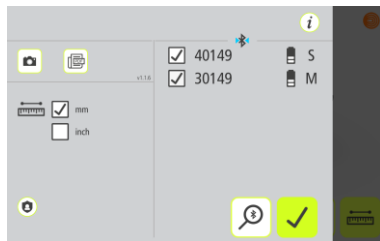
Only ACOEM sensors, that are switched on, will be discovered.



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.







## PRE-ALIGNMENT



## STARTING

Turn on the sensors.

Turn on the tablet.



Start the Pre-Alignment app.

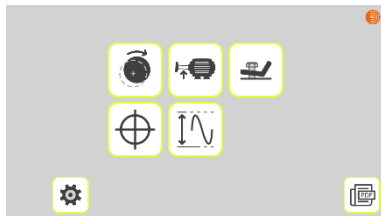
Go to settings for connecting the sensors, if they are not already connected.



Settings.

Settings are described in the end of the chapter.

## HOME MENU



Run-Out



Bearing Clearance



Softcheck ROP



Sensor Display ROP



Max Min ROP



Settings

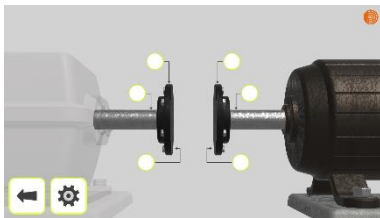


PDF report

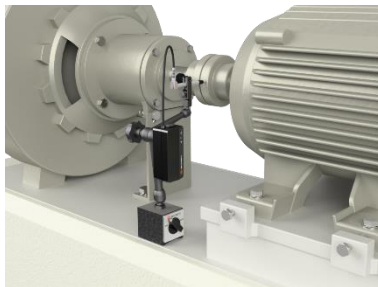
## RUN-OUT



Start Run-Out.

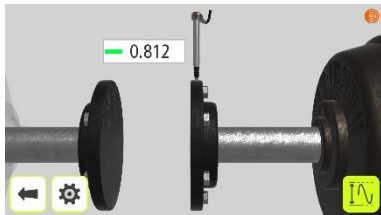


Select a position to measure.



Place the Run-Out Probe on the measurement object.

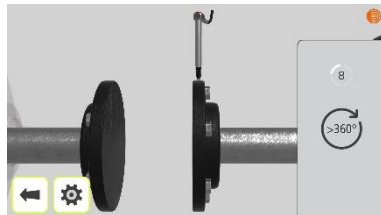
## Rim



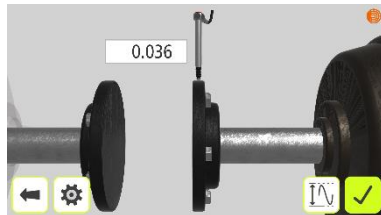
Make sure that the Run-Out Probe is at a suitable part of the measuring range before starting the measurement.



Start measuring run-out.



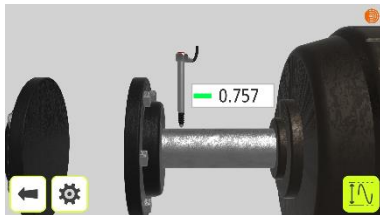
Rotate the shaft  $>360^\circ$ .



Confirm the measurement.



## Shaft



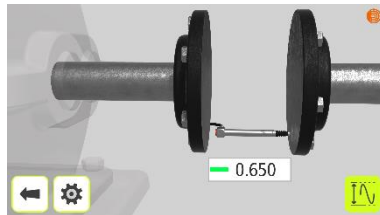
Start measuring run-out.

Rotate the shaft  $>360^\circ$ .



Confirm the measurement.

## Face



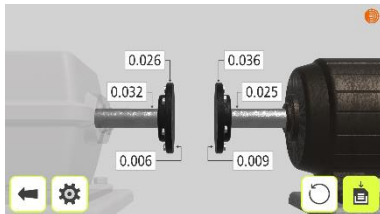
Start measuring run-out.

Rotate the shaft  $>360^\circ$ .



Confirm the measurement.

## Result



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.)

## BEARING CLEARANCE



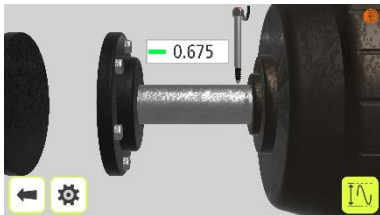
Start Bearing Clearance.



Select a position to measure.



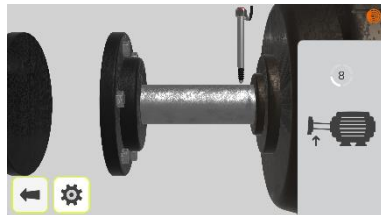
Place the Run-Out Probe on the measurement object.



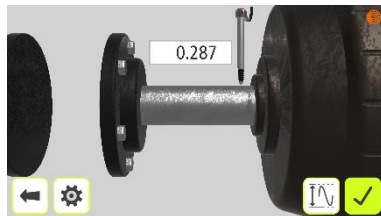
Make sure that the Run-Out Probe is at a suitable part of the measuring range before starting the measurement.



Start measuring bearing clearance.



Lift the shaft.



Confirm the measurement.



## Result



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.)

## SOFTCHECK ROP



Start Softcheck ROP.



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 ROP application checks each foot and displays the result in mm or mils.

Check that all foot bolts are firmly tightened.

## Measurement value registration

The program will guide you to the different feet.

The first foot.



1. Place the Run-Out Probe at the first foot.
2. Start measuring.



Touch the measurement icon.



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



Touch the confirmation icon.

Repeat the procedure at the rest of the feet.

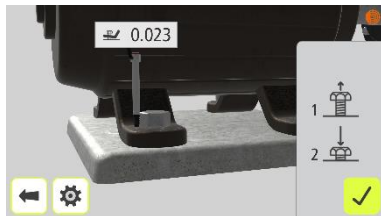
The second foot.



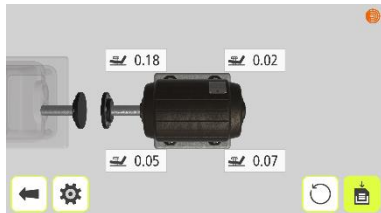
The fourth foot.



The third foot.



## Measurement result



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.)

## 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.

## SENSOR DISPLAY ROP



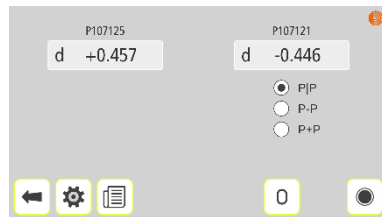
Start Sensor Display ROP.

The Sensor Display for the Run-Out Probe can be used for different applications where you want to use the readings from the linear sensor in various ways. The program is used with up to two sensors, P, connected to the display unit.

The Sensor Display application shows the values from both sensors. Each sensor is measuring the distance (d). The displayed values are shown live. They can also be zeroed to increase the usage in several applications. It is also possible to register measuring values.

When the Run-Out Probe is used to measure the position of an object to a rotational center, the values can be zeroed and then halved.

Make sure that the Run-Out Probe is at a suitable part of the measuring range before zeroing.

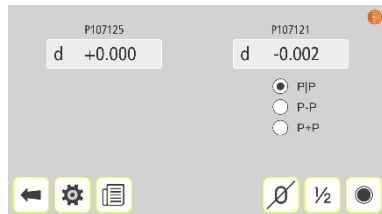


When entering Sensor Display ROP, raw data from the connected Run-Out Probes are displayed.

## Zero values



Zero values.



After zeroing values, they can also be halved. It is also possible to return to raw values.



Halve values.

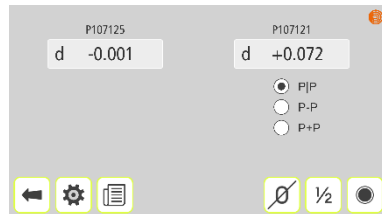


Return to raw values.

## Register values



Register values.



Registered values will be added to the list.



Go to list.

## P|P, P-P and P+P

The values from the second pen (to the right) can either be displayed separately or relative to the first pen (to the left), either P-P or P+P.

## List

	🕒	Type	d P107125	d P107121	P P	🔴
1	13:12	REL	-0.001	+0.074	+0.074	
2	13:12	REL	-0.001	+0.073	+0.073	
3	13:12	REL	-0.001	+0.073	+0.073	
4	13:12	REL	-0.001	+0.037	+0.037	
5	13:14	REL	+0.001	+0.139	+0.139	
6	13:14	REL	+0.000	+0.070	+0.070	
7	13:15	REL	+0.000	-0.014	-0.014	

🏠 ⚙️ 🎯 📄



Save the list.



Return to Sensor Display.



Return to Home Menu.



## MAX MIN ROP



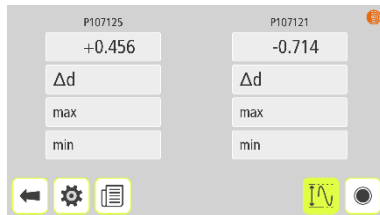
Start Max Min ROP.

Max Min ROP for the Run-Out Probe can be used for several applications where the user wants to measure the displacement of an object to a rotational center.

Measuring values from the Run-Out Probe are continuously registered under a dedicated sampling time.

Result from the measurement are shown directly on the screen. The maximum value (Max) and the minimum value (Min) are shown together with the difference (Max-Min).

The measuring result can be added to a list, that can be saved for further documentation.

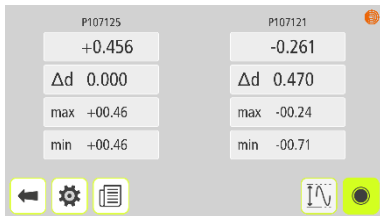


When entering Max Min ROP, raw data from the connected Run-Out Probes are displayed.

Adjust the position of the probes to be within the measuring range, using the raw data on the screen.



Measure max min.



When max min is measured the difference during the measurement is displayed. The max and min values are also displayed.

The displayed measurement result can be registered and added to the list.



Register the measurement.

When the measurement is registered it will be added to the list.



Go to the list.

		P107125			P107121		
		$\Delta d$	max	min	$\Delta d$	max	min
1	13:19	0.000	-0.456	+0.456	0.170	0.243	0.713
2	13:20	0.000	+0.456	+0.456	0.149	-0.201	-0.350
3	13:20	0.000	-0.456	+0.456	0.165	-0.161	-0.326
4	13:21	0.000	-0.456	+0.456	0.264	+0.023	-0.222
5	13:21	0.000	-0.456	+0.456	0.216	+0.061	0.155



Touch the save icon to save the list.

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

## 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 home menu 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.

## 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.

### View a file



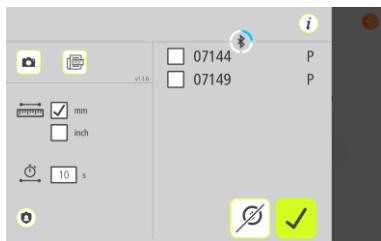
Touch the eye to view a file.

### 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.

### Sampling time

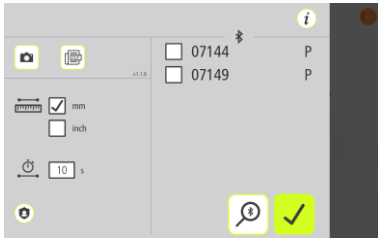


Touch the white box to enter sampling time.

## Bluetooth settings

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

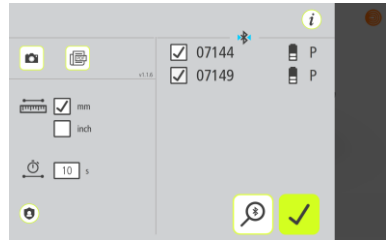
Only ACOEM sensors, that are switched on, will be discovered.



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.

## SENSORS M7 AND S7



1. ON/OFF button with status indication LED
  - a. Continuously green – On
  - b. Switching green/red – Gyro activated.
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 than 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
  - b. Rolling green – battery charging



## **OPERATING MODES**

M7 and S7 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 M7 and S7 units are connected by the built in Bluetooth connection. The units will automatically connect to the app when turned on as long as 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 M7 and S7 units are powered by a high-capacity rechargeable Li-Ion cell, or by the external power unit.

The operating time of the batteries is approximately 11 hours when the system is used for a typical alignment work (continuously on).

The M7 and S7 units can be charged with the supplied charger.

When the external power supply 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. By pressing the battery status button, the exact charging status can be monitored.

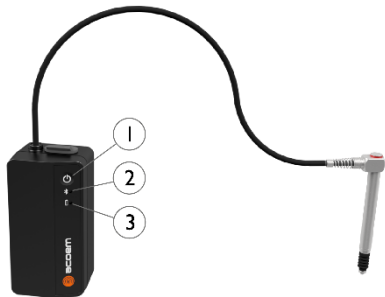
The charging time is approximately 8 hours for fully drained batteries. The charging time will be longer if the unit is turned on while being charged.

9.4

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.

## RUN-OUT PROBE P1



The Run-Out Probe is a battery operated, wireless linear gauge used for measuring run-out on shafts, coupling hubs, flanges and other components used on rotating machinery. It can also be used for distance measurements during adjustments of machinery, soft foot or checks of bearing clearances. The probe is wirelessly connected to the app for registration, display and

documentation of the measuring results.

1. ON/OFF button
2. Bluetooth indication LED
  - a. Continuously blue – paired and ready.
  - b. Flashing blue – searching/ready to pair
3. Battery status LED
  - a. Continuously red – less than 10% charge left.
  - b. Flashing red – less than 5% charge left.
  - c. Continuously orange – charging
  - d. Continuously green – fully charged.

## **OPERATING MODES**

P1 has two operating modes: On and Off.

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

## **CONNECTIONS**

### **Bluetooth connection**

The P1 unit is connected by the built in Bluetooth connection. The unit will automatically connect to the app when turned on as long as it is paired. See chapters about apps for instructions on how to pair the Run-Out Probe.

## **POWER SUPPLY**

The P1 unit are powered by a high-capacity rechargeable Li-Ion cell, or by the external power unit.

The operating time of the batteries is approximately 11 hours (continuously on).

The P1 unit is charged with the supplied charger.

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

The charging time is approximately 8 hours for fully drained batteries. The charging time will be longer if the unit is turned on while being charged.

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 – M7 AND S7

Art. No. M7 1-1216, S7 1-1217

Housing Material	Anodized Aluminum frame and high impact ABS plastic over molded with TPE rubber
Operating Temp	-10 to 50°C (14 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	0 to 40°C (32 to 104°F)
Relative humidity	10 – 90%
Weight	M7: 212 g (7,5 oz), S7: 186 g (6,6 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 <sup>2</sup> )	1.6 mm
Laser line divergence (full angle)	0.25 mrad
Laser power	< 1 mW
Measurement distance	Up to 10 m
Detector	2nd gen. scientific grade CCD
Detector length	30 mm (1,2 in)

Detector angular subtense	30 mrad/m (3mm/100mm per meter)
Detector resolution	1 $\mu\text{m}$
Measurement accuracy	0,3% $\pm$ 7 $\mu\text{m}$
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	$\pm$ 0,2°
Gyroscope	6-Axis MEMS Inertial Motion Sensor with drift compensation and automatic field calibration
Gyroscope accuracy	$\pm$ 1°
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	11 hours continuous use (measuring)
Battery Charging time (system off, room temperature)	8 h
Battery Capacity	10.4 Wh



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LED indicators

Unit state, laser transmission and 5 battery status indicators with instant battery check

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Specifications are subject to change without notice.



## TECHNICAL SPECIFICATION – P1

### Art. No. 1-1063

Housing Material	ABS plastic
Operating Temp	0 to 40°C (32 to 104°F)
Storage Temp	-20 to 60°C (-4 to 140°F)
Long term storage temp	Room temp. 18 to 28°C (64 to 82°F)
Battery Charging Temp	0 to 40°C (32 to 104°F)
Relative humidity	10 – 90%
Weight	142 g (5.0 oz)
Dimensions battery unit	44 x 91 x 33 mm (1.7 x 3,6 x 1,3 in)
Dimensions pen body	Length: 85 mm (3.34 in) Diameter: Ø 8 mm (Ø 0.31 in)
Length cable	400 mm (15.7 in)
Environmental protection	IP65
Measuring range	5 mm (0.20 in)
Mechanical travel	6.6 mm (0.26 in)
Measuring force	0.70 N ±25%
Repeatability	0.15 µm
Thermal drift	0.25 µm/°C
Accuracy error (K=Reading in mm)	±MAX(5+ 2*K ; 7*K ) µm
Contact type	Ø 3 mm (Ø 0.12 in) carbide

Contact thread	M2.5
Interface	Membrane Switch Keyboard
Wireless communication	Class I Bluetooth transceiver with multi-drop capability. BLE Bluetooth Low Energy (BT 4.0)
Communication range	10 m (33 ft)
Connectors	1 USB Mini micro port Charging: 5V, 0.5A
Power supply	Rechargeable Li Ion battery or external power supply.
Operating time	11 hours continuous use
Battery Charging time (system off, room temperature)	8 h
Battery Capacity	10.4 Wh
LED indicators	Wireless communication and battery status indicators.

Specifications are subject to change without notice.

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## **WELCOME TO OUR WORLD**

*For more than 30 years, ACOEM 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 reliability solutions.*

## **SUSTAINABLE INNOVATIONS**

During our 30+ 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 field of laser alignment to have a touch screen. Nor would we have been pioneers in the use of visible lasers and dual measurement heads. Nor would we have been the first to bring a wireless vibration sensor for machine diagnostics. We are the now the first to provide our customers with combined alignment and diagnostic solution on standard mobile devices.

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, 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.

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ACOEM group is headquartered in Lyon, France. For more information please visit [acoem.com](http://acoem.com)



## **EC DECLARATION OF CONFORMITY**

In accordance with:

2014/35/EU Low voltage Directive

2014/30/EU Electromagnetic compatibility Directive

2014/53/EU RED (Radio equipment Directive)

2011/65/UE RoHS Directive

### **Type of equipment**

Vibration Tool

### **Brand name or trade mark**

ACOEM

### **Type designation(s)/Model no(s)**

CAC1008000

### **Manufacturer's name, address, telephone & fax no**

ACOEM France SAS

200 chemin des Ormeaux

69578 Limonest Cedex

France

Tel: +33 4 72524800

Fax: +33 4 42901766

### **Company certification**

ISO 14001:2015 – 0027566

ISO 9001:2015 – 0027567

Issued by LRQA France SAS, for and on behalf of: Lloyd's Register Quality Assurance Limited

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

**Safety requirements for electrical equipment:**

IEC60950-1.

**Electromagnetic compatibility:**

ETSI EN 301 489-1 v2.1.1, ETSI EN 301 489-17 v3.1.1, EN55032 (2015), EN61326-1 (2013), EN55011(2009) + A1 (2010), EN 61000-3-2 (2014), EN 61000-3-3 (2013), EN 61000-4-2 (2009), EN 61000-4-3 (2006+A1/2008+A2/2010), EN 61000-4-4 (2012), EN 61000-4-5 (2014), EN 61000-4-6 (2014), EN 61000-4-11 (2004), EN 61000-4-8 (2010).

**Radio :**

ETSI EN 300 328-1 v2.1.1, EN 62311 (2008)

**Additional information**

The product was CE-marked in 2020.

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

**Date and place of issue**

Limonest, 2020-01-10

**Signature of authorized person**

Fabien CONDEMINÉ, ACOEM France CEO

## **SAFETY**

Retain and follow all product safety and operating instructions. Observe all warnings on the product and in the operating instructions. Failure to observe the safety precautions and operating instructions can cause bodily injury, fire, and damage to the equipment.

Do not disassemble, modify or use the equipment in other ways than explained in the operating instructions. ACOEM will not accept any liability for such use.

## **POWER SUPPLY**

The CAC1008000 sensor is powered by high-capacity rechargeable Li-Ion batteries mounted in the sensor or by the external power unit. Do not expose the power adapter to rain or wet conditions.

Always unplug the charger from the electrical outlet after charging.

Leaving a sensor with an empty battery for a prolonged time can reduce the capacity of the battery or even damage the battery. If the system is not used for a long time, charge the batteries to approximately 50-75% before storing the system, if kept in storage repeat this every 3-4 month (if needed).

Only use the external power adapters supplied by ACOEM for use with the sensors. Using other power adapters can cause damage to the unit and personal injury.

## **WIRELESS TRANSCEIVER**

The CAC1008000 sensor is fitted with a standard Wi-Fi 2.4GHz communication module

Make sure that there are no restrictions on the use of radio transceivers at the site of operation before using the wireless transceivers. Do not use on aircraft.

## UNBOXING

The following packages are delivered with the CAC1008000 wireless sensor: RT-300; VT-300-BD; VT-300-MD

The content of the package related to the CAC1008000 are the following

1. Wireless sensor CAC1008000 with M6 threaded hole
2. M6 Bipolar magnet for mounting the sensor on the machines
3. Tri-axial orientation key for bipolar magnet
4. USB cable for power supply
5. Power supply module and international adapters (VT-300 packages only)
6. Transport bag
7. Probe tip, for use only with the Bearing Defender app in forced single axis mode for narrow locations







## **CARE**

### **SEALING**

The wireless sensor CAC1008000 is rated IP65 with its top rubber in closed position. It is mandatory to keep it closed in operation to avoid any damage of the sensor board resulting from external liquid drops, condensation, and others.

Damages resulting from a bad operation of the sensor without the top rubber in closed position are not covered by the warranty. The top rubber shall only be opened in the office to recharge the sensor battery through its USB connector.

## **CLEANING**

The sensor is delivered with a magnet. It is recommended after operation to dry the magnet with clean cloth to avoid any risk of corrosion of this accessory over time.

## **CALIBRATION**

Our instruments are delivered with a calibration certificate. To provide best diagnostic accuracy, it is recommended to perform inspection and calibration of the vibration wireless sensor CAC1008000 every 24-month.

Calibration must be achieved by ACOEM approved service center.

To benefit of the lifetime warranty accessible with the VT-300-MD package, sensor inspection and calibration is mandatory every 24-month.

## INTRODUCTION TO THE APPS

The CAC1008000 tri-axial vibration sensor can be used with different ACOEM apps for specific purposes described hereafter in this manual.



### ACOEM Bearing Defender

Art. VT-300-BD



### ACOEM Machine Defender

Art. VT-300-MD

Freely download the apps from Google Play or the App Store.



The apps are compatible with the following sensors:

## CAC1008000

*Make sure you are using a compatible sensor from the type number engraved on the sensor body*



*Note that the sensor can only be used with one app at a time. Switching from one app to the other may require disconnecting the sensor for good operation.*

## **VIBRATION DIAGNOSTIC AS A RELIABILITY TOOL**

Determining the overall health status of a rotating asset can be achieved easily through automatic interpretation of vibration data using the ACOEM apps and their built-in artificial intelligence.

The ACOEM Bearing Defender and ACOEM Machine Defender apps, in combination with the CAC1008000 sensor, aim to provide a first level of autonomy to non-expert vibration users and maintenance teams.

Assessing automatically the health of your assets will help to improve the plant reliability and performance meanwhile reducing maintenance costs, by:

- Detecting suspicious faulty machines and prevent from unexpected shutdown.
- Implementing preventive checks on large amount of assets and get warned on the need to carry out maintenance actions.
- Pro-actively performing acceptance tests before/after repair and after commissioning.
- In combination with the ACOEM Augmented Mechanics Platform, the VT-300-MD also allows for trending and such provide better scheduling capabilities.



## ACOEM BEARING DEFENDER

### TARGET APPLICATION

The ACOEM Bearing Defender provides spot diagnostic capability on a single bearing. It relies on the ISO10816-3 standard as well as the ACOEM Defect Factor™ algorithm to provide a first level of indication of the global health status of the bearing, and give an indication of what can be the cause of the detected problems.

It is particularly relevant for common rotating assets such as electric motors, pumps and fans, without gearboxes, and in a speed range of 600 to 6000 RPM.

When needed, results can be shared via email or social network using the screenshot feature.

### FAULTS MANAGED



Bearing or lubrication



Misalignment or Unbalance



Miscellaneous defect

### TUTORIAL VIDEO

To access to a commented step by step tutorial, please check our video online at <https://www.youtube.com/watch?v=cpCul1q44TU>



## WHAT IS NEEDED

To use the Machine Defender application, you will need:

- The free ACOEM Bearing Defender app must be installed on your mobile device on iOS (9.3 or sup.) or Android (4.4.2 or sup.)
- a CAC1008000 wireless sensor

## STARTING UP

On your tablet or smartphone:



Start the ACOEM Bearing Defender app.



Turn on the sensor by pressing on the ON/OFF Switch of the unit. The sensor start up time takes approximately 30 seconds.

The sensor is ready to be paired to a tablet/smartphone when only the blue light stays put, and actively connected once the blue light is flashing.



## APP MENU

The app menu helps browsing through the different features of the app



Access to the main measurement screen



Access to bearing reference database



Access to wireless sensor information  
(only available if a sensor is connected)



Save a screenshot from any screen



Find more from ACOEM



Access to the settings of the app and of  
the measurements



Access to the information about the app



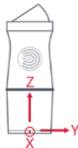
## SENSOR MOUNTING

### Sensor placement

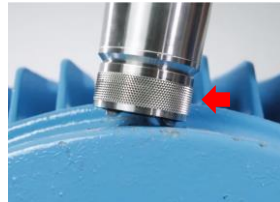
The tri-axial vibration sensor must be placed on the bearing as close as possible to the load zone to best sense the components vibration.



Note that the X, Y, and Z directions indicated on the app result screen will correspond to the X, Y and Z directions of the sensor.



*Using a magnetic base can cause the sensor to hit strongly the machine when approaching it. It can affect the sensor measurement reliability. Always slightly mount the sensor as if you were rolling the magnet on the bearing.*



### Tutorial video

For more information on sensor mounting best practices, please check our tutorial video online:

<https://www.youtube.com/watch?v=a0K3K3T45eM>













## Mounting accessory

It is important to note that the mounting accessory (part between the sensor and the machine) will affect the quality of the vibration measurement. The closer is the sensor to the machine and the better it will sense the vibration.

Several options are available but deliver different results:

- Cementing studs offers the best performances for all types of defects but studs needs to be glued prior to the measurement.
- Magnetic provides ease of use and a compromise on how early faults can be detected.
- A probe tip can help accessing narrow locations with the sensor but it does not permit relevant tri-axial measurement

(sensor has to be forced into single axis mode, see app settings section) and is not suitable for reliable detection of bearing problems and miscellaneous problems.

				
	★★★★	★★★★	★★★★	XYZ
	★★★☆☆	★★★★	★☆☆☆☆	XYZ
	×	★★★☆☆	×	Z

Available options for sensor mounting with the ACOEM Bearing Defender



## MEASUREMENT ACCESS



Press on the green “Signal” button to start the streaming of the measurement.

About 2 seconds will be needed to stabilize the signal acquisition before values are displayed and refreshed at the startup.



Press on the red Record button to trig the acquisition. It takes about 10 seconds.

This time may vary depending on the distance from the sensor and environment.



If needed, press the graph button to access to the ACOEM ZYXtrum™ display that will be helpful to communicate with reliability teams and vibration experts.

## AUDIO LISTENING



To access to the audio listening, feature, first press on the green Signal button to start the streaming.



Once live streaming is started, press on the deactivated “Listening” icon on the top right corner of the app to activate the audio listening



To stop the audio listening, click again on the active listening icon



## RESULTS

The results available from the main screen are:

1. The presence of a fault with medium (yellow) or strong (red) severity: Bearing or lubrication; Unbalance or Misalignment; Miscellaneous defect
2. A vibration table displaying the values measured in the three directions of the sensor.



## Machine picture

It is possible to replace the picture shown on the main screen. To do so, click on the camera icon and take a picture.

Note that to reset the picture to the standard picture, you must delete the app data from the native features of your mobile device on the app management.

## Screenshot



To communicate results of interests, it is possible to take a screenshot on any screen. To do so you can use native features of your smartphone, as well as the screenshot button available from the menu.

The screenshot can then be shared standard features of your mobile device: email, MMS, social media...



## ACOEM ZYXTRUM™ DISPLAY

The ACOEM ZYXtrum™ provides a simplified representation of the vibration observed in the three directions according to the frequency domain.

As the ACOEM Bearing Defender helps detecting automatically faulty machines in a simplified format, this feature is aimed to provide a representation that can be shared with reliability teams or vibration experts so that they can better decide if their action is needed.

It is possible to zoom on the graph and plot a cursor to get some information about it.



Note that you must point exactly onto the curve to change the cursor selection

The buttons available on the ACOEM ZYXtrum™ are the following:



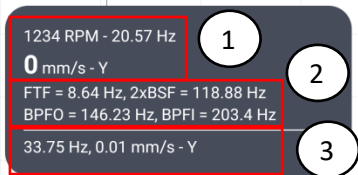
Cursors information display. Note that if a bearing reference has been selected in the bearing database, bearing fault frequencies will be automatically display to help confirming a potential bearing fault.



Save active cursor as machine rotation speed: this action will recalculate automatically the bearing fault frequencies



The cursors information are presented in the following position:

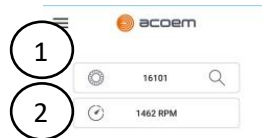


1. RPM info if RPM was recorded
2. Bearing fault frequencies (if bearing reference was set)
3. Current cursor information with frequency (RPM/Hz), and max amplitude with direction in which it was measured

## BEARING DATABASE

The built-in bearing database allows automatic calculation of bearing fault frequencies from the bearing reference input. To obtain the correct frequencies

1. Select your bearing reference from the database
2. Enter the RPM of the machine. Note that this RPM value can be collected from the ACOEM ZYXtrum™ interface





## APP SETTINGS



Units' selection



Machine RPM range



Machine Power range



Machine foundation (rigid or flexible)



Scale selection for ZYXtrum™ display



Number of axes used

**DEF**

ACOEM Defect Factor™ algorithm display activation

**ACC HF**

High Frequency Acceleration Display activation



Wi-Fi channel selection



Note that a change in the Wi-Fi channels reboots the sensor.

It is recommended to only change that setting if transfer time is abnormally slow.

## Sensor information

The following information is dynamically updated according to the sensor connected:

- Battery level
- Serial number
- Firmware version of the sensor

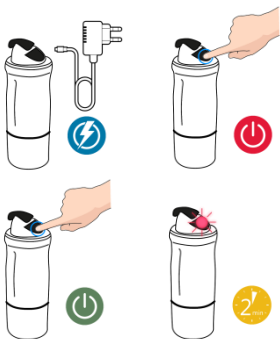


## FIRMWARE UPDATE

To update your sensor firmware with the latest version available indicated, click on the



button and follow the onscreen guided procedure.





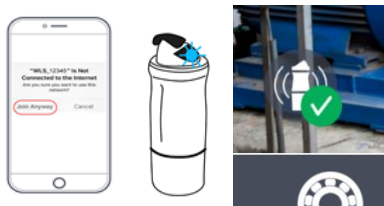
## WI-FI CONNECTION

The Wi-Fi Connection on the sensor can be done directly from the standard from the Wi-Fi settings of the smartphone/tablet. The Wi-Fi settings can also be opened from the app clicking on the Wireless sensor icon on the main screen. The wireless sensor appears in the list as “WLS\_*serialnumber*”.

The Wi-Fi password requested corresponds to the serial number engraved on the sensor body. Example: “20148”



Once the password is entered, confirm selection by clicking on “Join anyway”.



The communication is successfully established once the blue light is flashing on the sensor. You can then go back to the app, the sensor icon shall switch automatically to green in few seconds.

*Important note: once connected on the sensor, other Wi-Fi network access as well as internet will no longer be accessible. You must disconnect from the sensor to retrieve your network connection.*





## **ACOEM MACHINE DEFENDER**

### **TARGET APPLICATION**

The ACOEM Machine Defender provides spot diagnostic on a full rotating asset. It relies on the ISO10816-3 standard and the patented ACOEM Accurex™ automatic diagnostic to provide a good understanding of what is the health status of the machines, which faults have been detected and how confident is the system in the presented result, as well as a first level of maintenance recommendations.

It is particularly relevant for most of the rotating assets available in the industries such as electric motors, pumps, fans, centrifugal compressors, alternators, shafts and rollers, that can be direct driven, belt/pulley driven, or gearbox driven, in a speed range of 120 to 12000 RPM.

Full illustrated reports can be edited in pdf on the spot to be shared via email and social media, as well as connected to the Augmented Mechanics Platform at [ai.acoem.com](http://ai.acoem.com) to benefit of more services in the cloud.

### **WHAT IS NEEDED**

To use the ACOEM Machine Defender application, you will need:

- The free ACOEM Machine Defender app must be installed on your mobile device on iOS (9.3 or sup.) or Android (4.4.2 or sup.)
- a CAC1008000 wireless sensor with firmware in version 1.40 or more
- a Machine Defender License

Note: an external laser pyrometer could be used when rotation speed is unknown and cannot be detected.



## FAULTS MANAGED



Bearing or lubrication problem



Unbalance



Misalignment



Structural Resonance



Other ISO defect (*Soft foot, Belt wear, Nearby disturbance, Vane pass ...*)



Shocks/Modulation (*Looseness, Electrical defect, gear geometric defect, gear localized defect...*)



Pump Cavitation



Gear wear



Suspicious machine  
*Vibration behavior not healthy but no fault could be automatically identified*

## DIAGNOSTIC RESULTS



Machine Global advice



Fault detected per bearing



Fault confidence level

*Translated instructions*

First level of maintenance recommendation



## STARTING UP

On your tablet or smartphone:



Start the ACOEM Machine Defender app.



Switch on the sensor by pressing on the ON/OFF Switch of the unit. The sensor start up time takes approximately 30 seconds.

The sensor is ready to be paired to a tablet/smartphone when only the blue light stays put.

It is actively connected once the blue light is flashing.

## HOME SCREEN BUTTONS



Access the list of existing machines



Create a new machine



Enter the app settings



## SENSOR CONNECTION

Using the native Wi-Fi settings of your smartphone / tablet, select the wireless sensor in the list of Wi-Fi available. The wireless sensor appears in the list as “WLS\_ *serialnumber*”.

The Wi-Fi password requested corresponds to the serial number engraved on the sensor body. Example: “20148”



Once the password is entered, confirm selection by clicking on “Join anyway”.



The communication is successfully established once the blue light is flashing on the sensor. You can then go back to the app, the sensor icon shall switch automatically to green in few seconds.



### Important note

*Once connected on the sensor, other Wi-Fi network access as well as internet will no longer be accessible. You must disconnect from the sensor to retrieve your network connection.*



## SENSOR INFORMATION

The sensor status is displayed in different screens of the app as follows:



**No sensor connected**



**Sensor License invalid**



**Sensor connected with valid license**



Once connected, the following sensor information is available in the settings menu:



Sensor Connection status



Battery level



Serial number with app association



License input field



License validity date



Firmware version

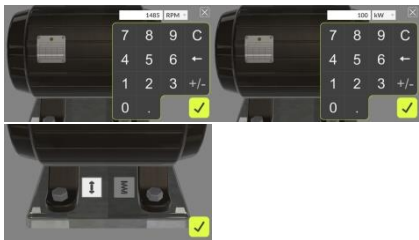


## CREATE A NEW MACHINE



To create a new machine, touch the **New Machine icon**.

**Enter the motor's information** (RPM, power, type of foundation)



You must enter all information requested, which will impact on the set of parameters and rules applied to perform the ACOEM Accurex™ automatic diagnostic.



## IMPORTANT WARNING

**RPM information is crucial to any vibration diagnostic and will drastically affect the diagnostic quality.**

Inputting the value written on the nameplate is usually a good starting point unless your machine is driven by a VFD.

ACOEM Machine Defender can automatically recognize the RPM in a +/-30RPM range from the user input.

If you are not sure of the RPM value you are entering, or the ACOEM Machine Defender app warns of wrong speed input, it is recommended to collect this information using an external laser tachometer for best accuracy, or getting it from the plant operations.



## Select the transmission type

You must tell the system if your rotating asset is direct driven (no transmission), belt/pulley driven, or gearbox driven. The default settings is set to direct driven (no transmission component)



In case a transmission is selected, you must input the speed ratio or the exact output RPM.

## Enter the transmission properties

The speed ratio OR the output RPM must be entered. If the speed ratio is known, the output speed is calculated automatically. If only the output speed is known, the ratio is calculated automatically



This information must be accurate as it will have a direct impact on the diagnostic results of the components on the output shaft. If you input wrong information, the diagnostic result may be incorrect.



### Note about gearbox setup

*If the speed ratio information is not available and the output speed is also unknown, it can be calculated from the gears teeth number*

*Ratio = Driven Gear Teeth / Drive Gear Teeth  
e.g. 30 teeth (output) / 20 teeth (input) = 1.5*

*For multiple-stage gearboxes, the global speed ratio is equal to the multiplication of intermediate speed ratios.*

*For example with the following setup*

- Drive Gear (input): 7 teeth
- Intermediate gear: 20 teeth
- Driven Gear (output): 30 teeth

*Ratio = (20/7) × (30/20) = 4.3*

### Select the driven component

The ACOEM Machine Defender can manage Pumps (overhung and between bearings), Fans (overhung and between bearings), Roller, Shaft, Alternator, Centrifugal compressor.

Select the right component accordingly in the list. It is recommended that even if you only measure the electric motor, you create the full asset including the driven component.







## Edit Machine Name and Picture



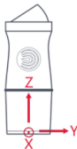
The machine picture will be placed in the report and also saved to the machine properties.



## SENSOR MOUNTING

### Sensor placement

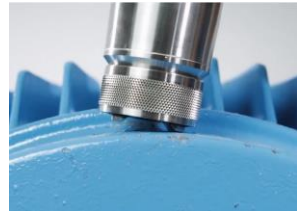
The tri-axial vibration sensor must be placed on the bearing as close as possible to the load zone to best sense the component vibration.



**Attention must be paid on position and tri axial orientation of the sensor** as it must be input into the app. This information is important as it can affect the diagnostic output.



*Using a magnetic base can cause the sensor to hit strongly the machine when approaching it and affect the sensor measurement reliability. Always slightly mount the sensor as if you were rolling the magnet on the bearing*



### Tutorial video

For more information on sensor mounting best practices, please check our tutorial video online:



<https://www.youtube.com/watch?v=a0K3K3T45eM>



## Mounting accessory








It is important to note that the mounting accessory (part between the sensor and the machine) will affect the quality of the vibration measurement. The closer is the sensor to the machine and the better it will sense the vibration.

Several options are available but deliver different results:

- Cementing studs offers the best performances for all types of defects but studs needs to be glued prior to the measurement.
- Magnetic provides ease of use and a compromise on how early faults can be detected.

Note that ACOEM Accurex™ requires tri-axial data and good quality measurement to provide accurate results. A probe tip is not

compatible with the need of the ACOEM Machine Defender.

				
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	★★★☆☆	★★★★	★☆☆☆☆	XYZ

*Available options for sensor mounting with the ACOEM Machine Defender*



## MEASUREMENT

### Overall Machine view

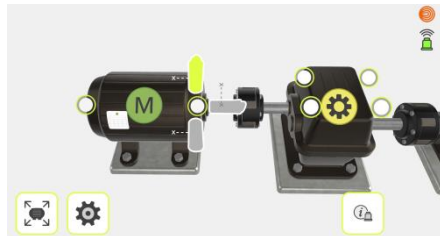


From the machine view select the bearing you want to measure to access to the zoomed view. As the RPM detection is based on the motor RPM input, it is strongly recommended to start measurements from the Motor Side.

To enter a measurement screen, select a point on the machine, the view will be zoomed on this point with access to different features.

### Sensor position assignment

Define how the sensor is mounted on the machine: Horizontally, vertically or axially.



Attention must be paid on the tri-axial orientation of the sensor; it will affect the diagnostic results!

**Always refer to the X axis dot marked at the base of the sensor.**

The X axis must be parallel to the shaft for Horizontal and Vertical direction.



The X axis must correspond to the vertical axis of the machine when the sensor is mounted in axial direction.



Click on the unzoom button to go back to the overall machine view

### Measurement point information



Click on the sensor information icon to access to the measurement point detailed information.

It is possible to take a picture of the sensor mounted on the machine, and access to the values of the vibration velocity with alarm status according to the ISO10816-3 standard.

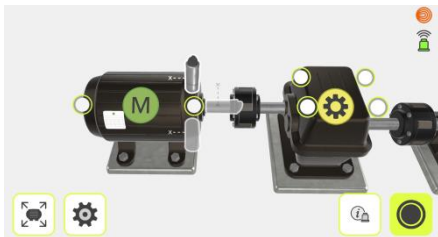







## Start a measurement



Once the sensor orientation is defined, the record button to trig the measurement is accessible



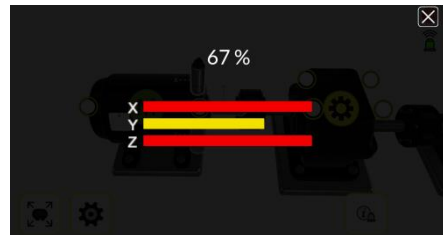
Note that the sensor must be connected with a valid license  to access the record button!


If no sensor is available  or if the license is not valid , the record button is not displayed.

## Measurement Progress

During the measurement, the following information is displayed:

- Measurement progress in %
- Live alarm status according to the ISO10816-3 standard.

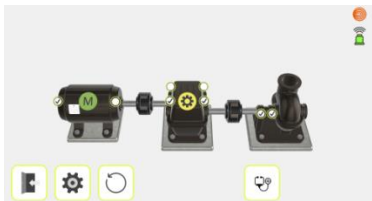


Once a measurement is completed, the point is displayed with a checkmark 



The detailed values of the vibration velocity can be accessed afterwards clicking on the sensor information icon

To go on, simply point to the next measurement point or swipe on the machine and repeat the measurement process until you have collected all accessible points.



### RPM auto check

Immediately after the measurement, the RPM is checked vs. the RPM input during the

setup. If it cannot be found, a warning is presented to the user.

Note that the RPM of the machine must be in a range of +/-30RPM of the real rotation speed.

### Motor setup modification



If the RPM is not valid on the motor, click on the **M** button to open its properties and change it.




*Note that it will reset all measurements done on the machine.*



## Transmission properties modification



If the RPM is not valid on the gearbox or on the driven component, click on the button on the transmission  to edit its properties.



*Note that this will reset all measurements done on the output shaft (gearbox and driven component). This modification will not affect the measurements done on the motor.*

## RPM incorrect or not found

If the RPM is cannot be found, the ACOEM Machine Defender app is able to deliver a limited diagnostic. All defects with direct relations to the machine true RPM, such as Unbalance, Misalignment and Structural Resonance, will not be diagnosed correctly. Bearing and shocks problems may still be identified correctly.

In this situation, it is highly recommended to collect the true machine RPM using an external laser tachometer for best accuracy, or getting the information from the plant operations if the machine is connected.





## AUTOMATIC DIAGNOSTIC RESULTS



Once a measurement has been recorded, a diagnostic button is accessible from the measurement screen, or from the overall machine view.

### Measurement completion warning



The more measurement can be taken, the more accurate can be the system. It is proposed to go back to the machine overall view to continue measurements or confirm the diagnostic with limited number of points. The

warning is shown only if <80% of the points have been measured.

### RPM warning



The incorrect RPM warning is given immediately after the measurement. It is also reminded at the moment of the diagnostic as it can have a big impact on the diagnostic accuracy and types of faults managed.

It is proposed to go back to the machine overall view to make new measurement or confirm the diagnostic with erroneous RPM.



## ACOEM Accurex™ Global Advice

A global advice is given on the machine health to indicate to the user if an action is required or not. The results are presented as follows:



No action required



Machine to be monitored or action conceivable during next scheduled shutdown



Maintenance action needed as soon as possible

## ACOEM Accurex™ Detailed Diagnostic



An interactive display of the machine is provided to the user. Each fault is presented with:

1. **Severity**
2. **Confidence level** (stars rating)
3. **Location on the machine** (interactive picture with colored bullets)
4. **Maintenance recommendation** (expand fault details)



## REPORT

From the diagnostic view, a PDF report can be generated.



Touch the PDF icon to create a PDF report.

### Add information to the report

Machine Health Report	
Report Date:	2019-12-12
Site:	Building B2
Machine:	MP-1001
Operator:	Anders
Comment:	abnormal noise

Information can be added or edited prior to the report edition, such as:

- Site
- Machine name
- Operator
- User comment

Touch the white fields to edit the information.

### Generate and save the PDF report



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

The PDF report will then be shown using native pdf reader of the smartphone/tablet, for further handling. It can be shared using standard features of the smartphone (email, social media...)

It can also easily be accessed afterwards from the machine list (see next chapter)



## MACHINE LIST



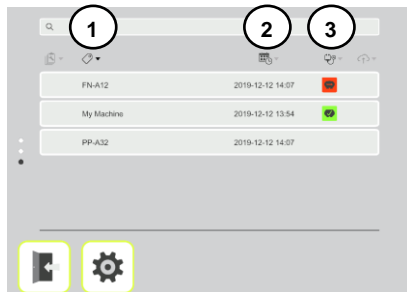
From the home screen of the ACOEM Machine Defender app, click on the machine list icon to access existing machines.

For machines which have not been connected to the ACOEM Augmented Mechanics Platform, the information available for each machine is the following:

1. **Machine name**
2. **Creation date**
3. **ACOEM Accurex™ global advice**

Touch a line for more details:





4. **Machine Picture**
5. **Setup info** (motor RPM, power and foundation type)
6. **Quick access to the report** previously edited
7. **Delete** the machine







For machines which have been connected to the ACOEM Augmented Mechanics Platform, an extra set of information is available for each machine:

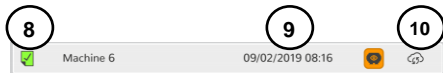
#### 8. Work order status:

-  Work order to realize not started
-  Work order soon overdue (<1 week)
-  Work order closed
-  Work order overdue and not uploaded

#### 9. Due date (replaces creation date)

#### 10. Cloud Sync. status:

-  New data to be uploaded
-  Transfer in progress



It is possible to order the machine list depending on each column status by touching the column header. For example:

- In order to bring on the top of the list all overdue work orders which have to be managed urgently, click on the work order column header.
- In order to bring on the top of the list all machines with critical diagnostic, click on the diagnostic column header



## 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.

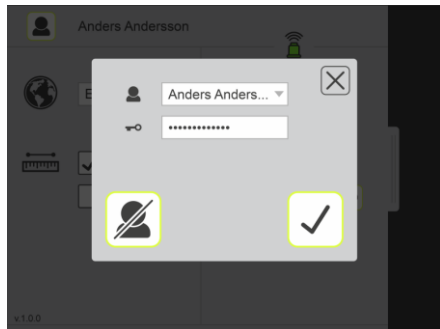
### User authentication

To exchange data between the ACOEM Machine Defender 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](http://ai.acoem.com))




*Note that the validity of your information will be checked every time a synchronize action is triggered from the app.*





## Upload a machine for the first time

All machines are originally created on the app. After its first creation, the machine can be uploaded to the cloud.

To do so, from the machine list, display the machine details and click on the button upload 

At the next time, this machine will be downloaded to the app as a work order. It will be possible to manage the upload from the global synchronization button

## Upload all completed work orders



From the machine list, pressing on the cloud synchronization button will upload all validated work orders.



*Once the machines of the validated work orders have been uploaded successfully, they are deleted automatically from the app.*

The results remain accessible through the cloud interface, and the machine setups can be resent to the app through new work orders.

## Download available work orders



From the machine list, pressing on the cloud synchronization button will automatically download all work orders assigned to the user


logged on the app.

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





## Completing a work order

Once a job is performed, the work order has to 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 be closed:

- from the machine details in the machine list by clicking on the work order validation button 
- from the diagnostic result screen 





## APP SETTINGS

### User Manual



Download the latest user manual online.

*Note: as an internet access is required, you must not be connected to the sensor to download the user manual*

### Measurement unit



Select mm mode or inch mode.

This user settings impacts on:

The vibration velocity unit displayed (mm/s or inch/s), the power unit displayed (kW or hp), and the date format.

### Language



Select the language in which will be displayed the ACOEM Accurex™ maintenance recommendations



## SENSOR CAC1008000

### USER INTERACTIONS

1. ON/OFF button (press few seconds)
2. Mini USB for charging protected by top rubber
3. Communication indication LED (blue)
  - Continuously ON when not paired to any device
  - Flashing when successfully paired with device
4. Battery status LED (red)
  - Continuously ON during charging and power up phase
  - Flashing when low battery
  - Flashing with different intensity during firmware upgrade



## **POWER SUPPLY**

The CAC1008000 sensor is powered by a high-capacity rechargeable Li-Ion cell, or by the external power unit.

The operating time of the batteries is approximately 8 hours when the system is used for a typical vibration measurement activity

The CAC1008000 unit can be charged with the supplied USB charger

When the external power supply is connected, the unit will automatically start charging the batteries. This will be indicated by the first battery status LED turning red, when the unit is fully charged the LED will switch off.

The charging time is approximately 8 hours for fully drained batteries. The charging time will be longer if the unit is turned on while being charged.

## TECHNICAL SPECIFICATION – CAC1008000

### Part. No. VT-300-BD and VT-300-MD Packages

Housing Material	Stainless steel
Operating Temp	-20°C to 60°C (-4 to 140°F)
Storage Temp	-20°C to 60°C (-4 to 140°F)
Long term storage temp	Room temp. 18 to 28°C (64 to 82°F)
Battery Charging Temp	0 to 35°C (32 to 95°F)
Relative humidity	0-95%
Resistance to shocks	5,000 g peak
Resistance to continuous vibration	500 g peak
Protection	IP65
Weight	373g (13,16 oz)
Dimensions	Ø42 x H116 mm
Mounting	M6 threaded hole
Battery Type	Li-Ion, USB rechargeable
Operating time	8 hours
Battery charging time	8 hours with the 500 mA charge current
Automatic stand-by	10 min if no connection has been established
Environmental protection	IP65
Number of axes for vibration measurement	3
Acquisition type	Synchronous acquisition in all axes (X, Y, Z)
Sampling frequency	51.2 kHz on all axes (Fmax 20kHz)

Sensing element	Piezoelectric / Annular shear mode
Sensing element internal sensitivity, 24°C	100mV/g (numerically converted)
Sensitivity adjustment	Factory-calibrated and adjusted
Full scale	80 g
Signal-to-Noise ratio	> 80dB
Amplitude non-linearity	1% max
Frequency response $\pm 3$ dB (Z)	0.4 Hz – 15 kHz
Frequency response $\pm 3$ dB (XY)	0.4 Hz – 6 kHz
Full bandwidth	20 kHz on all axes
Accuracy	+/- 5% @ 120 Hz, 1g
Transverse response sensitivity (120Hz, 1g)	< 5% (< -26dB)
Electrical noise 0 Hz–5 kHz	< 5 mg
Electrical noise > 1 Hz	< 20 $\mu$ g/ $\sqrt$ Hz
Electrical noise Peak velocity (after 1 integration)	< 0.13 mm/s
Interface	ON/OFF Switch Keyboard
Wireless communication	Wi-Fi Point to point 2.4 GHz, WLAN b/g/n
Communication range	Up to 25 m (82 ft) line of sight
Wi-Fi communication channel	User setting: 1, 6, 11
Radio certifications	EC, FCC, IC, MIC
Patented Technology	Patent US 9,921,136

Specifications are subject to change without notice.





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