



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 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 故障类型



Bearing or lubrication problem
轴承或者润滑问题



Unbalance 不平衡



Misalignment 不对中



Structural Resonance 结构共振



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



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



Pump Cavitation 泵汽穴



Gear wear 齿轮箱



Suspicious machine 其他可能的机械问题
Vibration behavior not healthy but no fault could be automatically identified

DIAGNOSTIC RESULTS 诊断结果



Machine Global advice
设备总体建议



Fault detected per bearing
故障问题



Fault confidence level
严重程度

Translated instructions

First level of maintenance recommendation
维护建议 ..



STARTING UP 开始测量

On your tablet or smartphone:



Start the ACOEM Machine Defender app. 进入设备诊断程序



Switch on the sensor by pressing on the ON/OFF Switch of the unit. The sensor start up time takes approximately 30 seconds.
按下开关键，启动传感器需要30秒时间

The sensor is ready to be paired to a tablet/smartphone when only the blue light stays put. 蓝灯亮时，传感器需被主机搜索连接

It is actively connected once the blue light is flashing. 蓝灯闪烁则传感器以连接主机

HOME SCREEN BUTTONS



Access the list of existing machines
进入机械列表



Create a new machine
创建新的设备诊断



Enter the app settings
参数设置



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".

使主机搜索传感器WiFi信号，wifi名称为WLS+序列号

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

wifi密码是传感器序列号，如20148



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

wifi密码输入后，确认选择项为“任何方式”



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.
传感器闪烁蓝灯时即成功连接主机，此时可直接退回操作程序操作设备



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.

主机连接传感器后，其他wifi信号便不能与主机连接，需要断开传感器与主机的连接后才可以



SENSOR INFORMATION 传感器信息

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

屏幕上传感器的连接情况



No sensor connected
传感器未连接



Sensor License invalid
传感器密钥激活



Sensor connected with valid license
传感器已连接



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

连接传感器后，传感器的信息可在设置界面找到



Sensor Connection status



Battery level 电池电量情况



Serial number with app association 软件序列号



License input field 密钥输入



License validity date 密钥有效期



Firmware version 固件版本



CREATE A NEW MACHINE 新建设备诊断



To create a new machine, touch the **New Machine** icon.
点击图标创建设备诊断

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

输入电机参数（转速·功率·基础类型）



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

必须正确输入诊断系统所要求的参数，以保证设备诊断结果



IMPORTANT WARNING 警告

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

转速是任何振动诊断中极其关键的因素，其将严重影响诊断质量

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

在命名栏正确输入设备的名称有助于对设备诊断识别

ACOEM Machine Defender can automatically recognize the RPM in a ± 30 RPM range from the user input. AOEM的MD功能可以自动识别输入转速的 ± 30 RPM偏差范围

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.

如果不确定设备转速或者MD功能提醒输入转速错误建议用其他高精度的测速仪器采集数据



Select the transmission type 选择传动类型

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)

必须让系统知道旋转设备的传动类型，如皮带传动，齿轮箱传动 或者直联传动（无传动部件）



In case a transmission is selected, you must input the speed ratio or the exact output RPM. 选择传动类型之后，必须输入传动比或者输出转速

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

确定传动比或者输出转速两者其中一个之后，另一个参数会自动导入



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.

因为此参数直接影响输出轴部件的诊断结果，所以数据必须精确输入



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
如果传动比和输出转速不知道，可以通过齿轮齿数计算出来

$\text{Ratio} = \text{Driven Gear Teeth} / \text{Drive Gear Teeth}$
e.g. 30 teeth (output) / 20 teeth (input) = 1.5

传动比=从动齿轮齿数/主动齿轮

例如30（从动齿数）/20（主动齿数）=1.5

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

多级齿轮箱的传动比是中间齿轮传动比的乘积

For example with the following setup 例如

- Drive Gear (input): 7 teeth 主动齿数：7
- Intermediate gear: 20 teeth 中间齿数：20
- Driven Gear (output): 30 teeth 从动齿数：30

$\text{Ratio} = (20/7) \times (30/20) = 4.3$

传动比= (20/7) x (30/20)=4.3

Select the driven component 选择从动设备

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

ACOEM 的诊断系统可以提供包括泵，风机，滚筒，转轴，交流发电机和离心压缩机模型

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.

在列表中选择合适的从动设备，如果只是测量电机也建议创建好完整的传动模型（无从动设备）





Edit Machine Name and Picture

编辑设备名称和拍照



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

设备图片会放置于诊断报告中，并以设备特性保存



SENSOR MOUNTING 振动测量

Sensor placement 传感器放置

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. 三轴传感器应尽可能的放置于接近轴承位置区域以便更好的检测部件振动



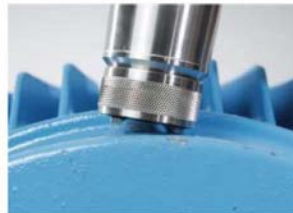
Attention must be paid on position and tri axial orientation of the sensor as it must be input into the app. This information is important as it can affect the diagnostic output.

传感器的轴位方向必须与软件中的轴位方向一致，此操作严重关系到振动数据的诊断输出



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

使用磁座能使传感器牢固的吸附于设备被测位置，以使测量更加的真实准确



Tutorial video 操作指导视频

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.

必须注意的是，安装附件（传感器和机器之间的零件）将影响振动测量的质量。传感器离机器越近，振动测量值越可靠。

Several options are available but deliver different results:

传感器的几种安装方式呈现的不同效果

- Cementing studs offers the best performances for all types of defects but studs needs to be glued prior to the measurement.

对于所有类型的故障，黏合螺栓都能提供最佳性能，但在测量之前，需要对螺栓进行黏合紧固。

- Magnetic provides ease of use and a compromise on how early faults can be detected.

磁吸安装为检测提供了便利性，并应用于早期的故障检测

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.

需要注意的是诊断系统要求三轴的测量数据真实可靠以便提供准确的诊断结果

				
	★★★★	★★★★	★★★★	XYZ
	★★★☆☆	★★★★	★★☆☆☆	XYZ

Available options for sensor mounting with the ACOEM Machine Defender



MEASUREMENT 测量

Overall Machine view 模型界面



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.

根据设备模型的测量点，选择要测量的位置。因转速检测基于电机输出，强烈建议测量从电机端开始

To enter a measurement screen, select a point on the machine, the view will be zoomed on this point with access to different features. 选择测量点之后界面会出现不同轴方的选择

Sensor position assignment

Define how the sensor is mounted on the machine: Horizontally, vertically or axially.
确定传感器安装的轴向位置：水平，垂直，轴向



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.

X轴方向参考传感器中部的标记

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

对于水平和垂直方向安装，X轴必须与轴向方向平行



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

当传感器安装在轴向时，X轴必须与机器的垂直轴相对应



Click on the unzoom button to go back to the overall machine view
点击界面底部图标返回设备主界面



Measurement point information



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

点击该传感器图标浏览测量点详细信息

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.

可以拍摄安装在机器上的传感器的照片，并根据ISO10816-3标准查看具备报警状态的振动速度值






Start a measurement 开始测量



Once the sensor orientation is defined, the record button to trig the measurement is accessible
传感器的放置方向确定后，即可点击按钮开始测量



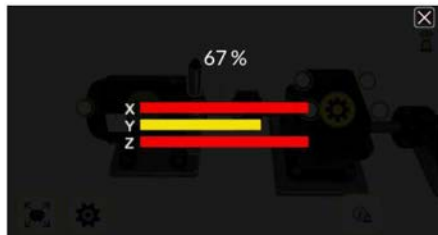
Note that the sensor must be connected with a valid license  to access the record button!
If no sensor is available  or if the license is not valid , the record button is not displayed.


Measurement Progress

During the measurement, the following information is displayed:

测量过程中，以下会显示以下信息

- Measurement progress in % 完成进度
- Live alarm status according to the ISO10816-3 standard.
根据ISO10816-3标准显示报警状态



Once a measurement is completed, the point is displayed with a checkmark 
测量完成后，或显示√图标



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

单击传感器信息图标后，可以访问振动速度的详细值

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.

点击下一个测量点继续测量，并重复测量操作直到收集到所有测量点的数据



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.


测量后设备转速会被自动识别，如果转速没有被识别，则会出现警告提示

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

设备的转速必须与真实转速偏差 ± 30 转范围内

Motor setup modification



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

如果转速无效，电机M图标更改电机参数



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.

如果转速无效，点击齿轮箱图标更改齿轮箱传动参数



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 转速无法识别

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.

如果识别不到转速，则诊断系能够提供的诊断是有限的。所有与机器实际转速直接相关的缺陷，如不平衡、不对中和结构共振，将无法正确诊断。轴承和冲击问题仍然可以正确识别。

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.

在这种情况下，强烈建议使用额外的激光转速计收集真实的机器转速，以获得最佳精度，或从设备操作中（如果机器已连接）获取信息。



AUTOMATIC DIAGNOSTIC RESULTS

智能诊断结果



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

测量完成后，点击诊断按钮即可智能诊断结果

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.

测量得越多，系统就越精确。建议回到机器整体视图，继续测量或用有限的点数确认诊断。只有在测量到<80%的点时才会显示警告。

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.

测量后会发出不正确的转速警告。在诊断时也会提醒您，因为它会对诊断准确性和所管理的故障类型产生很大影响。

It is proposed to go back to the machine overall view to make new measurement or confirm the diagnostic with erroneous RPM. 17
建议回到机器整体视图进行新的测量或确认错误的转速诊断。



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:

系统会对机器的运行状况给出全局建议，以指示用户是否需要操作。结果如下：



No action required

设备故障问题



Machine to be monitored or action conceivable during next scheduled shutdown

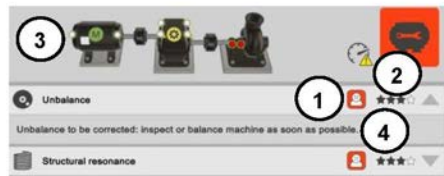
设备需要检测或者在下一次计划停机中检修



Maintenance action needed as soon as possible

设备需要尽快采取检修措施

ACOEM Accurex™ Detailed Diagnostic



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

诊断结果会向用户提供机器的多种形式显示。每个故障都有：

1. **Severity** 严重程度
2. **Confidence level** (stars rating)
可行度水平
3. **Location on the machine** (interactive picture with colored bullets)
机器的故障点位置（在图片中以颜色凸显）
4. **Maintenance recommendation** (expand fault details)
维护建议（展开查看详细故障信息）



REPORT 诊断报告

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



Touch the PDF icon to create a PDF report.
点击PDF图标创建报告

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:

可在报告生成之前添加或编辑信息，例如：

- Site 地点
- Machine name 设备名称
- Operator 操作人
- User comment 用户评论

Touch the white fields to edit the information.
点击白色栏目编辑信息

Generate and save the PDF report



Touch the save icon to generate and save the PDF report.
点击保存图标创建并保存PDF报告

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...)

使用显示主机自带的PDF阅读器显示PDF报告，以便进一步处理。它可以使用主机的分享功能（电子邮件、社交媒体...）共享

It can also easily be accessed afterwards from the machine list (see next chapter)
之后可以在机器列表中轻松访问



MACHINE LIST 机器列表



From the home screen of the ACOEM Machine Defender app, click on the machine list icon to access existing machines.
在系统的主界面上点击机器列表可以访问已保存的诊断设备

For machines which have not been connected to the ACOEM Augmented Mechanics Platform, the information available for each machine is the following:
对于尚未连接到系统平台的机器，每台机器的可用信息如下：

1. **Machine name** 设备名称
2. **Creation date** 创建日期
3. **ACOEM Accurex™ global advice**
ACOEM Accurex系统整体意见

Touch a line for more details: 点击列表查看细节

4. **Machine Picture** 设备图片
5. **Setup info** (motor RPM, power and foundation type)
参数设置（电机转速，支撑类型等）

6. **Quick access to the report** previously edited
访问之前的设备报告
7. **Delete** the machine 删除设备文件





APP SETTINGS 软件设置

User Manual



Download the latest user manual online. 在线下载最新的操作手册

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

注意：由于需要访问网络，您需要断开传感器以下载用户手册

Measurement unit 测量单位



Select mm mode or inch mode.

选择mm或者英寸模式

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.

该功能设置体现在：

显示振动速度单位（mm/s或inch/s）、功率单位（kW或hp）和日期格式。

Language 语言形式



Select the language in which will be displayed the ACOEM Accurex™ maintenance recommendations
选择诊断系统的界面语言形式