



# ECO系列操作说明书

## **1 INTRODUCTION** 简介

Congratulations on your choice of the Fixturlaser ECO!

We are convinced that you have made the right decision and we hope the system will meet, and even exceed, your expectations.

感谢您选择 Fixturlaser ECO。

希望本系统能满足或超出您的期望。

It is important that you read the sections about safety and care before you proceed with your first measurement.

请您在测量前仔细阅读安全与保养章节。

The purpose of this manual is to guide you through the different procedures and operations of the hardware and software. Since machine installations and setups are often different from each other, we have focused this manual on measurement principles and how to handle the system.

本手册的目的是指导您了解系统硬件软件的操作过程。因为每台设备安装不尽相同，我们重点介绍测量原理与操作。

We wish you many successful measurements!

祝您测量成功！

## 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 Elos Fixturlaser AB, any copying or redistribution is strictly prohibited.

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

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

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

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

## **2 DECLARATION OF CONFORMITY** 合格声明

In accordance with the EMC Directive 2004/108/EC, the Low Voltage Directive 73/23/EEC, including amendments by the CE-marking Directive 93/68/EEC & EC directives RoHS, 2002/95.

### **Type of equipment**

Alignment System

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

Fixturlaser ECO

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

1-0875 Fixturlaser ECO

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

Elos Fixturlaser AB  
Box 7  
SE-431 21 Mölndal  
Sweden

Tel: +15015607091

Fax: +020 85262155

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**

Emission: EN 61000-6-3:2007.

Immunity: EN 61000-6-2:2005, EN 61000-4-2, -3.

ISO9001:2008 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-60825-1:2007, 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.

#### **Additional information**

The product was CE-marked in 2010.

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

#### **Date and place of issue**

Möln dal 2010-09-30

#### **Signature of authorized person**

A handwritten signature in black ink, appearing to read 'Hans Svensson', written in a cursive style.

Hans Svensson, Managing Director

### 3 SAFETY 安全

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

遵守产品安全操作规则，注意所有安全提示。

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

忽略安全提示可能会造成人身伤害，火灾与设备损坏。

Do not disassemble, modify or use the equipment in other ways than explained in the operating instructions. Fixturlaser will not accept any liability for such use. 请勿拆开，维修或用不当的方式使用设备。否则 Fixturlaser 不承担相关责任。

#### LASER PRECAUTIONS 激光防护

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

Fixturlaser ECO 使用功率小于 1.0mW 的激光二极管，激光等级为 2 级



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

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

- Never stare directly into the laser transmitter. 请勿直视激光发射器
- Never shine the laser directly into anyone else's eyes. 勿将激光射向人眼

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### **WARNING!**



USE OF ANY OTHER BATTERIES THAN THOSE SPECIFIED BY FIXTURLASER WILL CAUSE SEVERE DAMAGE TO THE DISPLAY UNIT AND CAN CAUSE RISK FOR PERSONAL INJURY!

Your system complies with the requirements in:

- SS-EN-60825-1-1994
- British Standard BS 4803 Parts 1 to 3
- Deutsche Industrie Norm DIN JEC 76 (CO) 6
- USA FDA Standard 21 CFR, Ch 1, Part 1040.10 and 1040.11

使用其它电池有可能导致设备损坏  
或人身伤害

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.

操作电池时请小心，否则会产生灼伤。使用时请勿拆卸，请远离热源。电池损坏或漏液时请小心污染环境。请循守当地法规处理废旧电池。

## WIRELESS TRANSCEIVER

The ECO system is fitted with Bluetooth wireless transceivers.

ECO系统采用蓝牙技术的无线收发装置。

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

请确保测量现场没有使用无线收发器的任何限制。



### 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.

请确保测量现场没有使用无线收发器的任何限制。请勿在飞行器上使用。



## 4 CARE 保养

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

请使用湿棉布或棉签擦拭系统。激光接收器请使用酒精擦拭。

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

Do not use acetone.

请勿使用抽纸，会导致接收器刮伤。

请勿使用丙酮

For the best possible function, the laser diode apertures, detector surfaces and connector terminals should be kept free from grease or dirt. The display unit should be kept clean and the screen surface protected from scratches.

请保持激光二极管缝隙，接收器表面，连接线清洁，无油污。显示单元应预防刮伤。





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

新出厂的 V 型夹具的链条是干燥的。如果在高腐蚀性环境中使用，应给链条上油。

## 5 MAIN MENU 主菜单

The Fixturlaser ECO is provided with different programs for specific purposes. Fixturlaser ECO 根据您的需要提供不同的程序。



Press the red On/Off button to start the system and the Main Menu appears. Here you can select the program that you want to use.

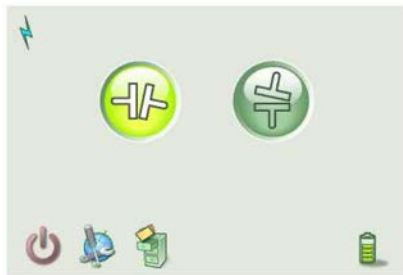
按下红色启动按钮启动系统，主菜单会显示。

In the Main Menu you will also find the Memory Manager and Global Settings. 在主菜单中您可以找到内存管理与环境设定。



Select icon with the arrow buttons and confirm with the OK button.

用方向键选择所需程序，并使用 OK 按钮确认



## APPLICATION PROGRAMS



Shaft Alignment  
Horizontal Machines

水平转轴对中



Shaft Alignment  
Vertical Machines

垂直转轴对中

## MEMORY MANAGER 内存管理



Memory Manager

## SYSTEM FUNCTIONS 系统功能



Global Settings  
环境设定



Off  
关机



Wireless indicator  
蓝牙图标



Battery indicator  
电量显示

## **6 SHAFT ALIGNMENT HORIZONTAL MACHINES**

### **水平转轴对中**

#### **INTRODUCTION 介绍**

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 centres 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.

轴对中：测定和调整两台连接设备，使其旋转中心共线。水平对中的调整是通过调整设备前后脚的高低和水平位移，使其达到公差允许值。

The Fixturlaser ECO 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 position between the two shafts in two planes. The distance 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.

ECO系统有两个测量单元，分别固定在两个轴上，旋转轴到不同位置，系统会技术两轴的相对位移，并显示对中结果和调整建议。

The alignment results can be saved in the memory manager. The measurements in the memory manager

can easily be transferred to a PC for further documentation purposes.

测量结果可保存。

## **PRE-ALIGNMENT FUNCTIONS**

### **预对中功能**

In an effort 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.

为获得最佳的对中效果，需在测量之前做一些检查工作以保证获得精确测量数据。

Before going on site, check the following:  
去现场之前，请检查下列要求：

- Safety regulations? 安全规则?
- What are the required tolerances?  
测量公差?
- Any offsets for dynamic movements?  
是否有动态位移补偿?

- Are there any restrictions for mounting the measuring system?  
安装条件是否受限?
- Is it possible to rotate the shafts?  
测量轴是否可旋转?
- What shim size is needed?  
所需垫片尺寸

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).

安装对中系统之前请检查设备底座，螺丝与垫片情况以及是否有空间限制

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

目测检查完成后，考虑以下情况：

- Make sure the machine is off line and safety tagged. 设备已关机，安全标识已放置。
- Check that the machine has the right temperature for alignment. 设备温度是否正常
- Take away old rusty shims (check that you can remove shims). 移除旧的生锈垫片
- Check coupling assembly and loosen the coupling bolts. 检查连轴器连接情况，松开连轴器螺丝
- Check soft foot conditions. 检查软脚情况
- Mechanical looseness. 设备有无负载
- Check coupling and shaft run-out. 检查连轴器与转轴离合情况
- Pipe work strain.

管道张力

- Coarse alignment.  
粗对中
- Check coupling gap (axial alignment).  
检查耦合间隙



## MOUNTING 安装

The sensor marked "M" should be mounted on the moveable machine and the sensor marked "S" on the stationary machine. The sensors shall be assembled on their V-block fixture, and placed on each side of the coupling.

Hold the V-block fixture upright and mount it on the shafts of the measurement object. 有 M 的单元装在可动设备端，有 S 的装在固定端。用 V 型夹具固定



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

将 V 型夹具向上安装在轴上，用锁紧链条固定。



Firmly tighten the chain with the tensioning screw. If necessary, use the supplied tensioning tool. Do not over-tighten. If the shaft diameter is too large the chains can be extended with extension chains (optional).

用提供的扳手锁紧螺丝，不要过紧。如轴径过大，需使用延长链条。（可选）



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.

调整激光器高度直到两侧的激光都可以接收，锁紧两侧的夹子使其固定。





## STARTING THE PROGRAM

开始程序



Start the program by selecting the Horizontal Shaft Alignment icon in the Main Menu and press OK.

在主菜单选择水平对中程序，点击 OK

When the program is started, a tolerance table will be displayed first.

Select tolerance and press OK.

当程序显示时，首先会出现公差表格。

选择其中一个，然后按确认。







Go to settings for selecting settings.


设置选项及其它

## TOLERANCE TABLE 公差表

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 table provided in Fixturlaser ECO can be helpful if no tolerances are specified. The suggested tolerances can be used as a starting point for developing in-house tolerances when the machinery manufacturer's recommended tolerances are not available. The tolerances are the maximum allowed deviation from desired values.

对中的公差很大程度上取决于轴的转速，通常须达到制造商提供的公差以内。当没有现成的公差要求时，ECO 提供的公差表可根据转速指导公差设定。

 rpm	 mm/100	 mm
-2000	0.08	0.10
 2000-3000	0.07	0.07
3000-4000	0.06	0.05
4000-6000	0.05	0.03
MY TOL	0.06	0.08



### Select tolerance 选择公差

The arrow to the left indicates selected tolerance. 左边箭头指示所选公差。

Select tolerance by scrolling up/down and press OK. 通过上下箭头调整选择公差，然后按确认。



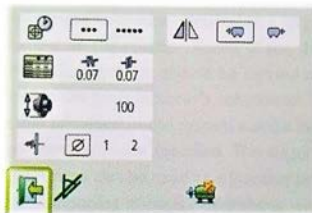
Select the OK icon and press OK to continue to shaft alignment. 选择图标，然后按 OK 继续进行轴对中

## Enter a customized tolerance

### 输入一个自定义公差

1. Scroll down to the last row.  
向下滚动到最后一行。
2. Enter tolerance name/rotation speed and press OK or scroll to the right.  
输入公差名称/旋转速度，然后按 OK 或向右滚动。
3. Enter tolerance for the angle values and press OK or scroll to the right.  
输入角度值公差，然后按 OK 或滚动到右侧。
4. Enter tolerance for the offset values and press OK or scroll to the right.  
输入位移值公差按 OK 或向右滚动。

## SETTINGS 设置



Settings unique for this application.  
设定只对本次测量有效

### Sampling time 采样时间



Select normal or long sampling time.  
可选一般采样时间或延长采样时间

To change sampling time, select the sampling time icon and press OK. Select

normal or long sampling time with the left/right buttons and press OK.

Long sampling time is suitable for high vibration environments.

进入采样时间区域，通过方向箭头按钮与 OK 键改变采样时间。延长采样时间通常在高振动环境中使用。

### Tolerance table 公差表



Open the tolerance table by selecting the tolerance table icon and press OK.  
通过选择打开公差表图标，然后按确定。

### Unit of angularity 角度表示单位



To change unit of angularity, select the unit of angularity icon and press OK. Enter another unit of angularity and press OK.要改变角度单位，选择该图标，然后按确定。输入其他轴径，然后按确定。

## Turn off inclinometers 关闭倾角仪

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

如倾角仪不能正常显示，如高振动环境，倾角显示功能可以关闭



Turns off the inclinometers.

关闭倾角仪

Measurement with disabled inclinometers is described at the end of this chapter.

无倾角仪的测量在本章结尾处说明

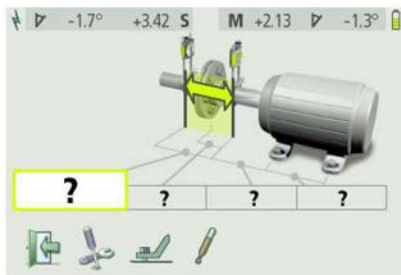
## Exit 退出



Exits the Settings and returns to the application.

退出设置，返回应用界面

## ENTER DIMENSIONS 输入尺寸



The screen displays the movable machine.

图示可动端设备



Select the dimension boxes to enter dimensions.

选择尺寸框输入尺寸

Measure and enter dimensions.

测量与尺寸输入

You must enter all the distances. The distance between the sensors, the distance between the centre 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.

必须输入两激光器间距，M 激光器到联轴器中心距，M 激光器到设备前脚距离与设备前后脚距离。



## SOFTCHECK 软脚检查



Go to Softcheck for checking soft foot conditions.

See chapter "Softcheck".

点击进入软脚检查界面。

## MEASUREMENT METHOD 测量方法



### Tripoint™ method 三点法

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

三点法需要测量三个位置，每个位置点距离至少 90 度。

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

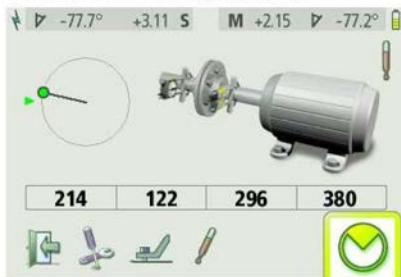
**注意：**当使用三点法测量时，为了达到尽可能可信和精确的测量结果，转轴联轴器需要连接

**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°.

提示：所测三点距离角度越大，重复性越好。  
两次测量之间的最小角度为 45 度

- ▶ A green flashing arrow suggests suitable measurement positions.  
闪烁的绿色箭头显示合适的测量位置。

## MEASUREMENT POINT REGISTRATION 测量点记录

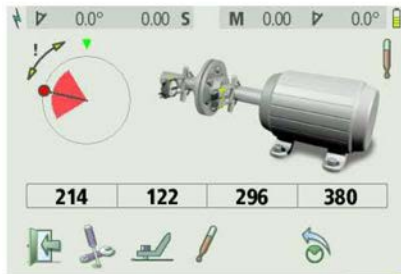


Set the sensors so that they are approximately at the same rotational angle at the first measurement position. 第一个测量位置，将激光器调整至大约相同位置。



Select the register icon and press OK. 选择测量图标点 OK。

This registers the first reading. 记录第一个测量点。

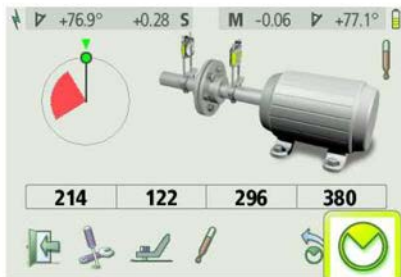


Rotate the shafts to the next position. The shafts must be rotated over a minimum of 45°.

旋转主轴至第二点位置，最小转动 45 度。

Green sector show permitted positions. Red sector show forbidden positions. The Register icon is not shown if the rotation is less than 45°.

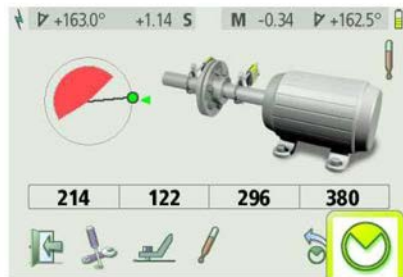
白色区域标识可测区域，红色为非可测区域。如选择角度小于 45 度，测量图标不显示。



Select the register icon and press OK. 选择测量图标点 OK。

This registers the second reading. 记录第二个测量点。

Rotate the shafts to the third position.  
选择轴到第三个位置



Select the register icon and press OK. 选择测量图标点 OK

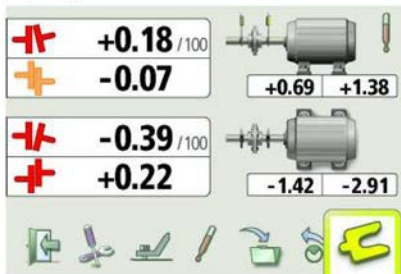
This registers the third reading. 记录第三个测量点

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

在 3 点钟方向记录第三个测量点。可方便下一步进行水平方向调整。

## MEASUREMENT RESULTS

### 测量结果



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.

测量结果同时显示水平垂直方向的对中值与调整值。左侧的符号表示位移偏差与角度偏差，以及是否在公差范围内。



Within tolerance (green).  
绿色表示在公差内。



Within double tolerance (yellow and inverted).  
黄色表示在两倍公差内。



Out of double tolerance (red and inverted).  
红色表示超出两倍公差。

A symbol at the coupling indicates the status of the coupling.

联轴器上的符号表示对中结果是否在公差之内。



Within tolerance.  
公差范围内

## EVALUATING THE RESULT

### 测量结果评估

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.

角度偏差与位移偏差可以衡量对中情况，并计算是否需要进行调整。如果已经选择合适的公差，测量结果会通过不同颜色表示是否在公差范围之内。

地脚调整值给出设备对中需要进行的地脚调整数据。

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

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

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

If the measurement result is within tolerance, the system will recommend the user to exit the measurement.

根据结果，软件会指导下一步操作。首先，始终建议用户保存测量结果。

然后，如果测量结果表明需要调整，用户将被推荐去调整界面。

如果测量结果公差范围内时，系统会建议用户退出测量。



Save the measurement result.

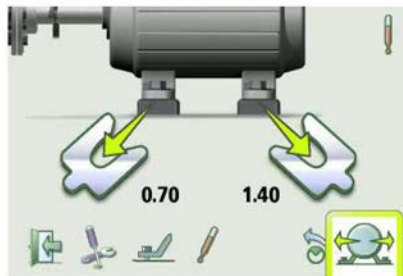
保存测量结果



Go to shimming.

做调整

## SHIMMING 调整垫片



The Shimming screen shows foot values in the vertical direction as suitable shim values.

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.

在垫片调整界面会显示合适的垫片厚度，作为垂直方向的调整值。

箭头显示垫片需要添加或删减，以调整垂直方向的设备。

检查符合表示无需调整垫片。

当垫片调整完后，继续在水平方向调整。



Go to alignment.

进入实时调整

## ALIGNMENT 对中

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

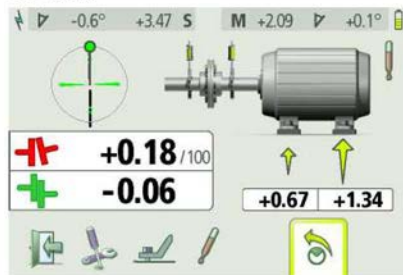
If the machine has not been adjusted in the shimming screen, alignment in the vertical direction has to be done first.

如垫片调整已在上一步完成，可直接进入水平方向对中。

如果机器没有进行垫片调整，则需要先调整垂直方向。

## Vertical direction

垂直方向



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

旋转主轴至 12 点或 6 点钟方向调整竖直方向对中，倾角仪帮您达到正确的位置。

Adjust the machine vertically until the values for both angular and parallel alignment are within tolerance. The

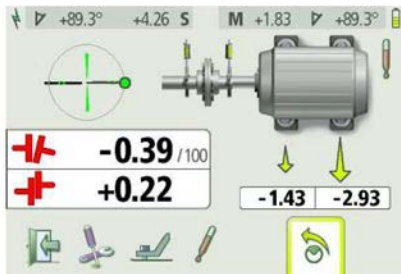


arrows at the feet show in which direction the machine shall be moved.

在竖直方向调整设备直到角度与位移同时达到公差范围内。箭头表示需要调整的方向

## Horizontal direction

水平方向



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

旋转主轴到 3 点或 9 点钟方向调整水平对中

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

在水平方向调整设备直到角度与位移都达到公差范围内。箭头表示需要调整的方向

## Check and re-measure

检查并从新测量

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

主轴转回 12 点或 6 点钟方向，检查测量结果是否发生变化。

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

对中调整完成，为确保对中结果，可以重新测量



Re-measure.

重新测量

## OTHER FEATURES 其他特性

### M and S unit LED function

#### M 与 S 单元 LED 功能

The front of the M and S units has two LEDs.

激光器面板上有两个 LED 显示

Laser operation LED (close to laser):

激光操作 LED (接近激光束)

Continuously  
green:

持续绿色

Laser is firing.

激光发射

Status LED (close to detector):

状态 LED (接近接收器)

Continuously  
green:

持续绿色

Unit OK and  
ready.

设备正常

Continuously red:

Unit start up or  
malfunction during

持续红色

Flashing green:  
绿灯闪烁

Flashing red  
红灯闪烁:

start up.

正在启动或故障

Unit placed at 9,  
12 or 3 o'clock  
positions (within  
+/-3°).

激光器置于 9,12,3  
点位置

Measurement in  
progress.

正在测量

### Looseness indicator 齿轮隙检查



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

为达到最佳精度，系统带有齿轮隙检测功能，  
当下列情况出现时，系统显示齿轮隙报警

- The M and S units are more than  $3^\circ$  apart.

M 与 S 激光器分离超过 3 度以上

- The mutual angular position of the M and S units changes more than  $0.7^\circ$  at the following measurement points, compared to the first measurement point.

当第一点测量之后，共有角度位置变化  
超过 0.7 度

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

当联轴器齿轮隙消除之后，报警将自动消失

## Measurement with disabled inclinometers

### 关闭倾角仪测量

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

当倾角仪在某些情况下不能正常显示时，如高振动情况下，可以被关闭

- Turn off the inclinometers in Settings. 在设定中关闭倾角仪

When the inclinometers are disabled the system will work as normal with the following exceptions:

除了以下情况，关闭倾角仪的系统可以正常工作：

- The readings have to be registered according to the "clock method". Register the first

reading at 9 o'clock, rotate the shafts 180° and register the second reading at 3 o'clock, rotate 90° back to 12 o'clock to register the third and final reading.

- 根据 9,3,12 点钟法进行测量时

During alignment, use the up and down buttons to change from horizontal to vertical view of the machine and vice versa.

对中过程中，转动探头位置可改变水平与垂视角

## **7 SHAFT ALIGNMENT VERTICAL MACHINES**

### *垂直转轴对中*

#### **INTRODUCTION** 介绍

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 centres 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.

轴对中：测定和调整两台连接设备，使其旋转中心共线。水平对中的调整是通过调整设备前后脚的高低和水平位移，使其达到公差允许值

The Fixturlaser 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 position between the two shafts in two planes. The distance 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 the machine laterally.

ECO系统有两个测量单元，分别固定在两个轴上，旋转轴到不同位置，系统会计算两轴的相对位移，并显示对中结果和调整建议。角度偏差调整需增减垫片，位移偏差需侧向移动

The alignment results can be saved in the memory manager. The measurements in the memory manager can easily be transferred to a PC for further documentation purposes.

测量结果可保存

## PRE-ALIGNMENT FUNCTIONS

### 预对中功能

In an effort 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.

为获得最佳的对中效果，需在测量之前做一些检查工作以保证获得精确测量数据

Before going on site, check the following

在去现场之前，检查以下项目：

- Safety regulations? 安全规范
- What are the required tolerances? 公差要求
- Any offsets for dynamic movements? 是否有动态补偿
- Are there any restrictions for mounting the measuring system? 安装条件是否受限
- Is it possible to rotate the shafts? 被测轴是否可旋转
- What shim size is needed? 所需垫片尺寸

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).

安装对中系统之前请检查设备底座，螺丝与垫片情况以及是否有空间限制

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

目测检查完成后，考虑以下情况

- Make sure the machine is off line and safety tagged.  
确保设备处于关闭的安全状态
- Check that the machine has the right temperature for alignment?  
检查设备温度是否适合测量
- Take away old rusty shims (check that you can remove shims).  
移除旧的生锈垫片
- Check coupling assembly and loosen the coupling bolts.  
检查连轴器情况，松开连轴器螺丝
- Check soft foot conditions.

检查软脚情况

- Mechanical looseness.  
设备负载情况
- Check coupling and shaft run-out.  
检查轴与连轴器
- Pipe work strain.  
考察管线张力
- Coarse alignment.  
粗对中
- Check coupling gap (axial alignment).  
检查耦合间隙

## MOUNTING 安装

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

激光器安装可参考水平转轴对中章节

## STARTING THE PROGRAM

开始程序



Start the program by selecting the Vertical Shaft Alignment icon in the Main Menu and press OK.

选择垂直轴对中图标点击OK.



Go to Settings for selecting settings.

进入设置

## SETTINGS 设置



Settings unique for this application.

设置只对本次测量有效

### Sampling time 采样时间



Select normal or long sampling time.

可选一般采样时间或延长采样时间

To change sampling time, select the sampling time icon and press OK. Select



normal or long sampling time with the left/right buttons and press OK.

Long sampling time is suitable for high vibration environments.  
进入采样时间区域，通过方向箭头按钮与 OK 键改变采样时间。延长采样时间通常再高振动环境中使用。

### Tolerance table 公差表



Open the tolerance table by selecting the tolerance table icon and press OK.  
The tolerance table is described in the chapter "Shaft Alignment Horizontal Machines".  
通过选择公差表，然后按确定。

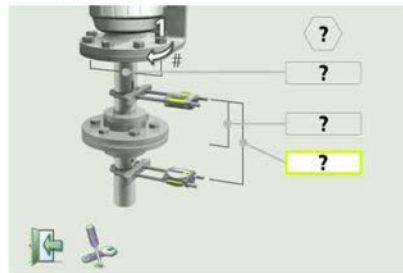
### Exit 退出



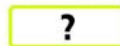
Exits the Settings and returns to the application. 退出设置，返回测量界面。

### ENTER DIMENSIONS

输入距离



The screen displays the movable machine.  
图示可动端设备。



Select the dimension boxes to enter dimensions.  
选择尺寸对话框输入尺寸

Measure and enter dimensions.

测量与尺寸输入。

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

必须输入所有测量距离，包括两激光器间距，M 激光器到联轴器中心距，输入节距圆直径与总螺栓数

Up to 8 bolts can be entered.

最多可测输入 8 个螺栓

### MEASUREMENT METHOD 测量方法

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

在竖直轴对中程序要求轴旋转 180 度，取三点读数

### MEASUREMENT POINT REGISTRATION 测量点记录



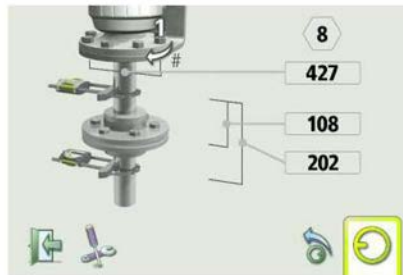
Place yourself at the position corresponding to the second measurement position, where it is easiest to turn the shafts through 180°.

站在第二测量点位置，此位置需方便将轴旋转 180 度

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

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

旋转 90 度到第三点位置



Select the register icon and press OK.

This registers the third reading.

选择测量图标点击 OK，记录第三个测量点

## MEASUREMENT RESULTS

测量结果



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

测量结果同时显示两个方向的对中值与调整值

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

左侧的符号表示位移偏差与角度偏差，以及是否在公差范围内



Within tolerance (green).  
绿色表示在公差内



Within double tolerance  
(yellow and inverted).  
黄色表示在两倍公差内



Out of double tolerance (red  
and inverted).  
红色表示超两倍公差

A symbol at the coupling indicates the status of the coupling.

符号表示是否对中结果之内。



Within tolerance.  
公差范围内。



Save the measurement result.  
保存测量结果



Go to alignment.  
进入实时调整

## EVALUATING THE RESULT

### 测量结果评估

The angle and offset values are used to determine the alignment quality. These values are compared with alignment tolerances to determine if any 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.

角度偏差与位移偏差可以衡量对中情况，并计算是否需要进行调整。如果已经选择合适的公差，测量结果会通过不同颜色表示是否在公差范围之内

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

地脚调整值给出设备对中需要进行的地脚调整数据

## ALIGNMENT 对中调整



Adjust the angular error by placing shims under the bolts as required (negative bolt value means that shims should be added.) The angular error 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.

通过在螺栓下加垫片调整角度偏差（负值表示需增加垫片），当激光器在位置一时显示位置

一方向的实时偏差值，在位置二时显示位置二方向的实时偏差值

Now adjust the parallel offset in both directions by moving the machine. 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.

同时调整两个方向的位移偏差，实时显示值随着激光器在位置一、二的变化而改变

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

调整过程完成后，再次检查角度与位移偏差是否在所要求的公差范围内

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

对中调整完成，可重新测量确认



Re-measure.

从新测量

## 8 SOFTCHECK™软胶测试

### INTRODUCTION 介绍

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 Fixturlaser Alignment System's built-in Softcheck program checks each foot and displays the result in mm or mils.

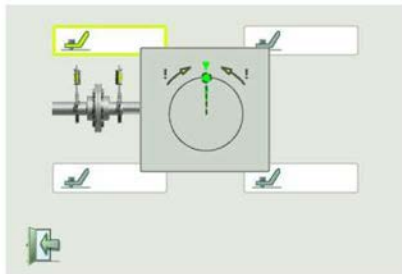
在对中调整开始前，应先进行软脚测试，否则对中结果是没有意义的。如果没有使用专业工具，软脚情况通常很难发现。Fixturlaser 对中测量系统内置软脚测试程序可以帮您精确检测软脚情况。

The Softcheck program is entered from the Horizontal Shaft Alignment program. 可以从水平轴对中程序里进入软脚测试程序

### STARTING THE PROGRAM 开始程序



Start the Softcheck by selecting its icon in the Shaft Alignment program and press OK. 在轴对中程序里选择此按钮并点击 OK



Place the sensors at the 12 o'clock position.

将激光器置于 12 点位置

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

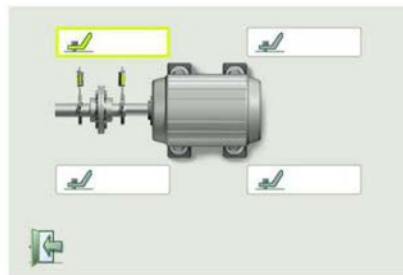


Check that all foot bolts are firmly tightened.

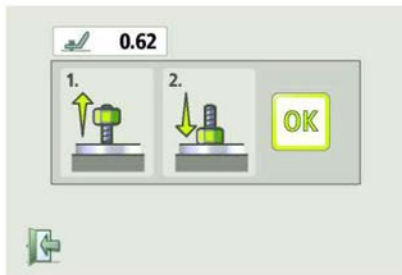
开始软地脚测量之前，必须输入激光器间距，M端激光器与前地脚间距，以及设备前后地脚的间距。检查每个地脚螺栓是否拧紧。

## MEASUREMENT VALUE REGISTRATION

测量



Select a bolt of your choice and press OK.  
选择你所需要测量的软脚



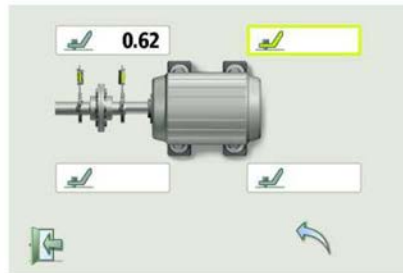
Loosen the bolt fully and then tighten it firmly, preferably with a dynamometric wrench.

完全放松螺栓，然后拧紧



Press OK to register the measurement value.

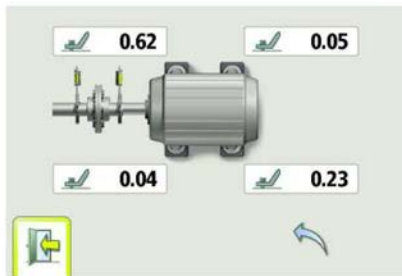
点击 OK 记录测量结果



Continue with the rest of the bolts.  
继续其它地脚测量

Re-measurements can be done at any time by selecting the requested bolt again and press OK.

任何时间都可重新测量



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).

根据测量结果做调整，然后重新测量。（测量结果指导您需要什么垫片以消除软脚）

## SHAFT ALIGNMENT 轴对中



Return to shaft alignment by selecting the Exit icon and press OK.

选择此按钮并点击 OK 返回轴对中测量界面

## 9 MEMORY MANAGER

### 存储器管理

#### FILE MANAGER 文件管理

<b>M218 ALIGNED</b>	2010-10-20 11:12
<b>M218</b>	2010-10-20 10:55
<b>M217 ALIGNED</b>	2010-10-20 10:35
<b>M217</b>	2010-10-20 10:20



#### Select file 选择文件

Files can be selected by scrolling.

可通过上下滚动按钮选择



Scroll upwards.

上滚动



Scroll downwards.

下滚动

#### Open file 打开文件



Opens selected file.

#### Delete 删除文件



Deletes selected file.

#### Exit 退出



Exits the Memory Manager.

NOTE: When there are a lot of files in the memory, processing can be slow.

注：如存储器文件过多，速度会较慢

## SAVE MEASUREMENT

保存测量结果



When saving a measurement, both a text file and a picture file (bmp) are created.

当存储一个测量结果，系统会生成一个文本文件与图片文件（bmp 模式）

**Enter file name** 输入文件名

Enter file name with the keyboard, when the file name field is selected.  
点击命名区域，通过键盘输入文件名

**Confirm** 确认



Confirm.

## Transfer files to a pc 文件导出至电脑

1. Turn on the display unit and stay in the Main Menu.  
打开显示单元，保持在主菜单
2. Attach the display unit to the PC with the USB cable. The display unit will be automatically detected and will appear as a mass storage device on the PC.

将显示单元通过 USB 电缆与电脑连接，电脑会将显示单元当成一个大存储器而自动识别

NOTE: The display unit must be turned on and in the Main Menu before it is connected to the PC in order for the display unit to appear on the PC.。

注：在连接到电脑之前，显示单元必须打开并置于主菜单界面

3. The files in the display unit can be transferred to the PC using the ordinary functions in Windows Explorer (i.e. cut, copy or drag and drop).

显示单元中的文件可以通过 Windows 操作系统的一般操作实现转移，如剪切，复制，拖拽等。

In the PC there will be two files for each measurement; a picture file (.bmp) and a text file (.txt). The picture file shows the same picture as in the memory. The text file shows just the measurement data.

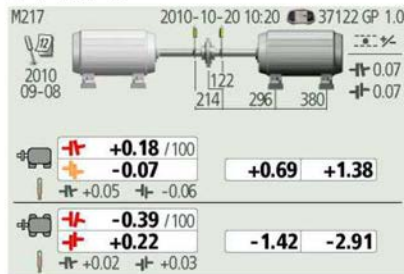
导出到电脑的每一个测量结果包含两个文件，一个图片文件(.bmp)，一个文本文件(.txt)。图片与显示单元的显示结果一致，文本文件包含测量数据。

It is recommended that you delete the files from the display unit after they have been safely transferred in order to avoid full memory.

在测量结果安全得转移到电脑之后，建议您删除显示单元内的记录，以免显示单元内存过多。

## SHAFT ALIGNMENT FOR HORIZONTAL MACHINES

### 水平转轴对中



The screen displays measurement results, dimensions, target values if any, file name, date and time, serial number of the display unit, program, program version, calibration date and tolerances.

屏幕会显示测量结果，尺寸，注释，目标值，文件名，时间，激光序列号，程序版本与公差。



Exits the measurement file.  
退出测量结果



Scrolls to measurement saved after the one displayed.  
向上滚动



Scrolls to measurement saved prior to the one displayed.  
向下滚动



Deletes the measurement file.  
删除测量结果



## 10 GLOBAL SETTINGS

### 全局设定



The global settings menu includes settings that are universal for all applications.

全局设定菜单包含其它应用的设定。

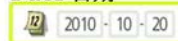
For most of the settings, the current selection is shown in the icon.

对大部分设定来说，当前设定值均直接显示。

The program version number is also shown on this screen.

程序版本号同时显示。

#### Date 日期

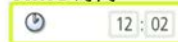


Date settings.日期设定。

To change date, select the date icon and press OK. Enter year and press OK. Enter month and press OK. Enter day and press OK.

选择日期图标点击 OK，输入年，点击 OK，输入月份，点击 OK，再输入日期，点击 OK

#### Time 时间



Time settings.时间设定

To change time, select the time icon and press OK. Enter hour and press OK. Enter minute and press OK.

选择时间图标点击 OK，输入小时，点击 OK，再输入分钟，点击 OK

### Measurement unit 测量单位



Changes between mm mode and inch mode.

更改英制与公制单位

To change measurement unit, select the measurement unit icon and press OK. Select mm or inch with the left/right buttons and press OK.

更改单位，选择测量单位图标，点击 OK。然后通过左右方向键选择毫米或英寸，点 OK 确认

To change battery type, select the battery type icon and press OK. Select standard batteries or rechargeable batteries with the left/right buttons and press OK.

改变电池类型，选择电池类型图标点击 OK，用左右方向键选择标准电池或可充电电池，点 OK 确认。

### Wireless settings 无线蓝牙设置



Wireless settings. See chapter “Wireless Transceivers”.

无线蓝牙设置。参见“无线接收器”章节。

Open the wireless settings by selecting the wireless settings icon and press OK. 选择图标，打开无线蓝牙设置，然后按确定。

### Exit 退出



Exits the global settings.  
退出全局设定。

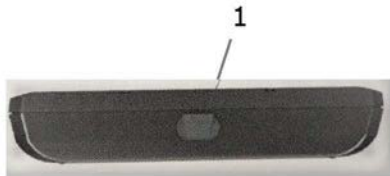
## 11 DISPLAY UNIT

### ECO D

#### 显示单元



1. Alfa-numeric keyboard  
字母, 数字键盘
2. LED indicator  
LED 指示灯
3. On/Off button  
开/关 按钮
4. Navigation buttons  
导航键



1. USB slave  
USB 接口

## OPERATING MODES 操作模式

The display unit has two operating modes: On and Off.

显示单元有两种操作模式，开与关。

The display unit is turned on by a short press on the On/Off button.

短按开关按钮可开启显示单元。



To turn off the unit, select the Off icon in the main menu and press OK or while in the main menu press the On/Off button on the front.

在主菜单选择此按钮点击 OK 或在主菜单直接点开关按钮均可关闭显示单元。

In case the system fails to respond, remove the batteries and reinstall them.

如果系统没有响应，请移除电池并重新启动。

## CONNECTIONS

### 连接

- USB slave; for attaching the DU to a PC.

通过副 USB 接口连接 DU 与电脑。



### **WARNING!** 警告

To fulfill the IP 54 classification, the lids protecting the USB port must be properly sealed. Do not use the USB connection in wet conditions.

为满足 IP54 的安全级别，USB 接口的盖子必须密封，请勿在潮湿环境进行连接。

## Battery time

The operating time of the batteries is approximately 30 hours when the system is used for a typical alignment job. The power indicator in the main menu displays the capacity of the batteries. When the capacity is low, a battery low warning appears on the screen.

进行一般的对中测量，电池可使用大约 30 个小时。主菜单的电源图标会显示当前的电池电量，当电量不足时，屏幕会报警提示。

Remove batteries when the system is stored for prolonged periods of time.

长时间不使用请取出电池。

### **BACKLIGHT** 背光

If no button is pressed within 15 minutes the backlight will turn off automatically.

如 15 分钟内没有按键，背光会自动关闭

Press one of the navigation buttons to turn the backlight on again.

按任一导航键可重新开启背光

### **AUTO-OFF** 自动关闭

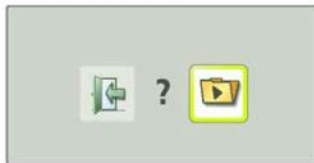
If no button is pressed within 60 minutes the system will turn off automatically.

如 60 分钟内无按键，系统将自动关闭。

### **RESUME FUNCTION** 恢复功能

If the system is turned off due to low power or auto-off, the resume function will save the data.

如系统因低电量或自动关闭时间到而关闭，恢复功能可以保持数据



When the system is turned on again after battery exchange or auto-off, you will be prompted to choose whether to return to the stage when the system was turned off (i.e. resuming operation without loss of data) or start the main menu.

当更换电池或自动关闭后重新开启系统，系统会提示您选择返回关机时的状态或重新开始主菜单。

## UPGRADING THE SOFTWARE 软件升级

Any upgrades of the software will be distributed or made available for download on our website.

新的升级软件会发布或置于网页上方方便下载

1. Turn on the display unit and stay in the Main Menu.  
打开显示单元，保持在主菜单
2. Attach the display unit to the PC with the USB cable. The display unit will be automatically detected and will appear as a mass storage device on the PC.

将显示单元通过 USB 电缆连接到电脑，系统会自动识别显示单元。

NOTE: The display unit must be turned on and in the Main Menu before it is connected to the PC in order for the display unit to appear on the PC.

注：显示单元必须开启并保持在主菜单界面。

3. Copy the file containing the new software to the display unit.  
将新软件复制到显示单元
4. Disconnect the display unit from the PC and wait until the display unit turns itself off (this can take several minutes).  
等待显示单元自动关闭（需要花费几分钟），然后断开连接。
5. Turn on the display unit. The upgrade file will be automatically detected and installed. This can take approximately one minute. Wait until the Main Menu is displayed, and the DU is then ready to be used again.

打开显示单元，系统会自动识别升级文件并安装，等待大约一分钟后，主菜单显示，系统可以重新使用。

**Settings and stored measurements will not be affected by an upgrade.**

升级不会影响测量的设定与结果保存。

**The upgrade file will be automatically deleted from the display unit when the upgrade is completed.**

升级完成后，升级文件会被自动删除。



## SENSORS M6 AND S6

### M6和S6激光探测器



1. ON/OFF button with status indication  
LED 电源键及LED指示灯
  - a. Continuously green – On持续绿灯-开启
2. Mini USB for charging USB充电接口
3. Laser transmission indication LED 激光指示灯
  - a. Green – laser transmission 绿色-激光发射
4. Bluetooth indication LED 蓝牙指示灯
  - a. Continuously blue – paired and ready. 持续蓝光-蓝牙已连接
  - b. Flashing blue – searching/ready to pair 闪烁蓝光-蓝牙搜索中或未连接
  - c. No light – Bluetooth disabled. 无蓝光-蓝牙未开启



5. Battery status button – press to instantly show the battery status (also works when the unit is switched off).  
电池状态按钮—显示当前电量（即使激光单元处于关闭状态）

6. Battery status LED. 电池状态指示灯
- a. One LED continuously red – less 10% charge left.  
一个红灯持续亮—电量小于10%
  - b. One LED flashing red – less than 5% charge left.  
一个红灯闪烁—少于5%电量
  - c. One LED continuously orange – charging  
一个橙灯长亮—充电中
  - d. One LED continuously green – fully charged.  
一个绿灯持续亮—充满
7. Battery status LED when battery button is pressed  
按下电池状态按钮
- a. Continuously green – battery status  
绿灯长亮—电池电量显示
  - b. Rolling green – battery charging  
滚动绿色—充电中

## OPERATION 操作

In order for the display unit to communicate with the wireless units they need to be paired. This is normally done at the factory when a system is ordered. If this is not the case please refer to the section "Pairing wireless units".

为了显示单元能进行正常通信，他们需要无线装置进行配对。这通常是在工厂完成的。如果不是这种情况，请参阅节“配对无线单元”。

The communication mode also needs to be set to wireless on. (See the wireless settings part below.)  
通讯方式也需要设置为无线。（请参阅下面的无线设置的一部分。）



### **WARNING!** 警告

Before using the wireless option make sure that there are no restrictions on radio transceivers on the site. Do

not use on aircraft.

在使用无线选项，确保现场没有任何无线限制。不要在飞机上使用。

For the fastest connection turn on the wireless units/battery packs before turning on the display unit. It can take up to one minute for the wireless units to connect. When connected the status LED will become continuously green.  
最快的配对方式，是在未开启显示单元之前打开无线蓝牙开关。无线单元通过一分钟左右时间进行连接。当连接信号灯稳定绿色时，表示连接完成。

Long distances and rough environments can affect the data transmission speed adversely. This will make the display unit appear slower.  
长距离和恶劣环境会影响数据传输速度造成影响。这将使显示单元数据显示变缓。

If the connection for some reason should be lost, the system will try to resend messages for 5 seconds after

which it will automatically try to reconnect.

如果由于某种原因，连接丢失，系统会尝试 5 秒钟后重新发送，自动尝试重新连接。

When connected to Fixturlaser M6 or S6 the operating time will be over 8 hours continuously measuring.

当连接到 Fixturlaser M6 或 S6 的连续测量运行时间将超过 8 小时。

The battery warning LED will flash when the batteries need to be charged.

电池警告灯闪烁，代表电池需要充电。

## WIRELESS SETTINGS 无线设置



The Wireless Settings are accessed from the Global Settings.

通过全局设定进入无线设置界面。



Information on which units are paired to the display unit is displayed. The display unit will only communicate with units that are paired.

系统会显示现有配对的激光器信息，只有匹配过的激光器才可以通信。

There is also a battery indicator for each wireless unit (requires that the unit is turned on and that the wireless link is on).

系统还会显示每个接收器的电池电量（需要激光器打开，连接正常）。

## Communication mode 连接模式



Changes between wireless on and off.

无线之间的切换与关闭。

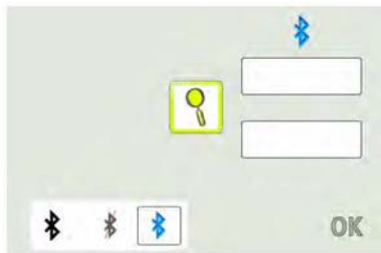
To change communication mode, select the communication mode icon and press OK. Select wireless on or off with the left/right buttons and press OK.

要改变连接方式，选择通信模式图标，然后按确定。选择无线用左/右按钮或者关闭，然后按确定

You have to exit the settings menu in order for the changes to take place.

设置之后需要退出，更改的设置才能生效。

### Pairing wireless units 配对无线单位



If no units are displayed in window touch the search icon to search for units that are available. If there already are

units paired to the display unit press the delete icon to release them.

如果显示窗口未显示匹配单元，需要点击“搜索”图标寻找可用的无线单元。如果已有配对单元，可删除图标，重新释放并寻找无线单元。



Search for wireless battery packs.

搜索无线装置。



Release paired wireless battery packs.

删除配对的无线装置。

When the search is finished a list of pairable units will be displayed. Notice – the wireless units/battery packs must be switched on for the display unit to discover them. The display unit will only discover units approved by Fixturlaser.

当搜索完成后，搜索到的无线单元会被显示出来。需要注意：请务必打开无线单元开关。显示单元只能发现了 Fixturlaser 认可的无线单元。



- ▶ Choose the unit to pair with the display unit from the list. That unit will be automatically paired and stored by the display unit.  
选择列表中所搜索到得单位。该装置会自动匹配。



Select the OK icon and press OK to confirm wireless settings.

选择 OK 图标，然后按 OK 确认无线设置。

## **TROUBLESHOOTING 故障排除**

There are three major factors that can affect the system's ability to connect and communicate; distance between transceivers, obstructions between transceivers and electromagnetic interference.

主要有三个因素会影响到系统的连接和通信：接收发射器的距离、电磁干扰和障碍物。

### **The wireless units will not connect**

#### **无线单元无法连接**

Try these steps until the units connect:

尝试以下步骤：

- Make sure that communication mode Wireless is on.  
确保连接模式设置为蓝牙。
- Go into the setting and check that the wireless units that are used are paired with this display unit.  
进入设置，检查现有匹配的无线单元。

- If possible bring the wireless units and the display unit close together without any obstructing objects between them – wait one minute.

尽可能将无线单元与显示单元放在一起，等待一分钟。

- Restart the wireless units – wait one minute.

重新启动无线单元-等待一分钟

- Turn off both the wireless units and the display unit. Restart the wireless units. Restart the display unit. Wait one minute.

关闭无线装置和显示单元。重新启动无线单元，重新启动显示单元。等待一分钟

- Go into the settings and release the paired unit. Search for pairable units. If none are available they are either out of range, or unable to communicate due to



interference or damage. If the units are available, choose them and they will be paired and automatically connected when the settings menu is exited.

进入设置，删除无线单元。搜索可匹配单元。如无可用无线单元，可能是超出范围，或因为故障与干扰无法通信。如搜索到可用单元，选择并匹配。

- If still not connected, try at another location or contact your nearest Fixturlaser representative.

如果还是没有连接，请尝试在另一地点测试或联系 Fixturlaser 办事处。



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