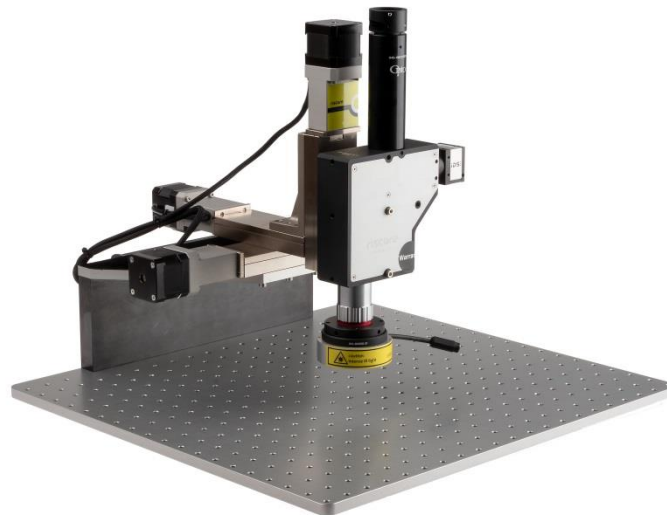


# Compact Laser Microscope

## Quick Start Guide



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## **Disclaimer**

Every effort has been made to make this document as complete and as accurate as possible, but no warranty of fitness is implied. The information is provided on an as-is basis. Riscure shall have neither liability nor responsibility to any person or entity with respect to any loss or damage arising from the information contained in this documentation.

The information contained in this document is subject to change without notice.

The Compact Laser Microscope must be used according to the Compact Laser Microscope user guide. Any operation related to maintenance, repair or calibration must be carried out by qualified personnel. Consequently, in case of failure, contact Riscure to find out about the procedure to follow.

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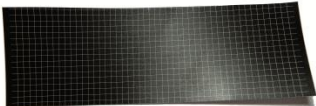
## What is in the box

The box contains the Compact Laser Microscope, and all accessories to connect it to a computer. Some of the components in the package list are optional. They are purchased separately



## Package list

Quantity	Description with image	
1	Compact Laser Microscope body  <i>Built-in beam splitter wavelength:</i> <ul style="list-style-type: none"> <li>• 700nm – 1100nm</li> <li>• Or 370nm – 532nm</li> </ul>	
1	Compact Laser Microscope bracket for Probe Station  <ul style="list-style-type: none"> <li>• Black metal bracket</li> <li>• 4 mounting screws to Probe Station</li> </ul>	
1	Microscope objective  <ul style="list-style-type: none"> <li>• magnification 5x (red line)</li> </ul>	
1	Spot-size reducer:  <ul style="list-style-type: none"> <li>• Spot size reducer</li> </ul>	

Quantity	Description with image	
1	Infrared Upgrade for Microscope with: <ul style="list-style-type: none"> <li>• IR ring light</li> <li>• 1 magnetic objective rings</li> <li>• power supply</li> <li>• power cable (region specific)</li> <li>• NIR camera</li> <li>• Camera cable</li> </ul>	
1	Set of 3 hex wrenches: M1.5 + M2 + M3	
1	Double open-ended wrench 6 x 7 mm	
1	Set of 2 mounting screws	
1	Laser test paper	
1	This "Compact Laser Microscope - Quick Start Guide"	

**Note: optional components, like objectives and laser sources, can be purchased additionally.**

# Safety instructions

## Laser safety

The Compact Laser Microscope needs to be equipped with laser sources which are power compatible with a Class 4 laser product as defined in international Standard IEC 60825-1.



The operator of the Compact Laser Microscope should observe the general precautions:



**DO NOT** attempt to use the laser sources outside a safety box with interlock switch, e.g. Riscure Safety Box.



**DO NOT** disassemble the laser source or safety box, while the interlock system is powered



**DO NOT** attempt to disable the door interlocks of the safety box.



**ONLY** operate the laser when the laser source is mounted on the microscope together with the camera, light guide and objectives



**Caution:** Use of controls or adjustments or performance of procedures other than those specified may result in hazardous laser radiation exposure.

## Recommendations for safe use of lasers

The standard reference for laser safety is the American Standard for the Safe Use of Lasers, Z136.1-2000, developed by the American National Standards Institute (ANSI). This reference is the basis for many of the federal regulations for laser and laser system manufacturers, and for the Occupational Safety and Health

Administration (OSHA) laser safety guidelines. It contains detailed information concerning proper installation and use of laser systems.

While the ANSI standard itself does not have the force of law, its recommendations, including warning signage, training, and the designation of a laser safety officer, may be compulsory under local workplace regulations when operating laser systems above Class I. It is the operator's responsibility to ensure that the installation and operation of the laser source with safety box is performed in accordance with all applicable laws.

Copies of ANSI Standard Z136.1-2000 are available from:

Laser Institute of America  
12424 Research Parkway, Suite 125  
Orlando, FL 32826  
(407) 380-1553

The safety features of the Riscure Safety Box are described in section Safety Features and Regulatory Compliance.

## Electrical safety

The IR ring light is powered by a 12V power supply unit. The AC input to the 12V power supply unit is potentially lethal and is fully contained with the power supply unit.



**DO NOT** open the 12 V power supply unit while the unit is plugged in. Opening the power supply unit may expose the operator to the unit's AC input power.

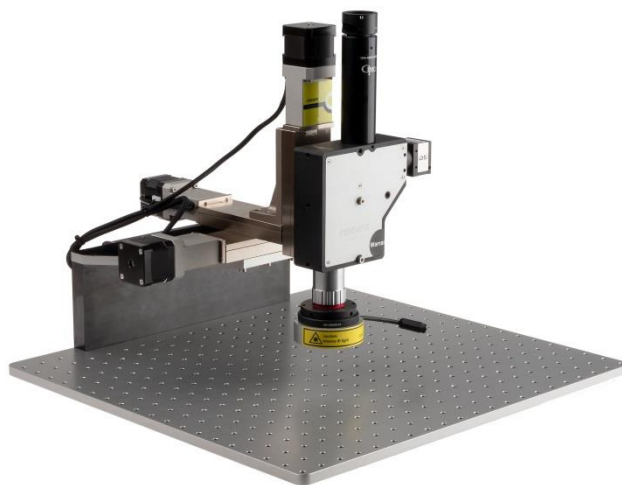
## What does it do

The Compact Laser Microscope is a workbench for optical Fault Injection (FI) attacks on semiconductors using a laser. The workbench consists of a microscope which can be mounted on a XYZ stage like Riscure EM Probe Station.

A laser unit should be mounted on top of the microscope and laser light is inserted into the optical path of the microscope. Laser light is aimed and guided through an optional spot size reducer, a beam splitter and an objective to a spot area on the target. A 5x objective is delivered as part of the package. Objectives for 20x, and 50x magnification can be purchased separately.

The microscope has a side Near-InfraRed (NIR) camera for visual confirmation of the laser spot on the target. An IR ring light provides additional illumination for the top camera view.

The position of the Compact Laser Microscope should be controlled via an additional XYZ-stage like the Riscure EM Probe Station. The XYZ stage controls position of the laser spot on the target via XY stages and focus of image and laser spot via Z stage. The laser spot and camera image are both in focus simultaneously when adjusting the height.



*Figure 1 Compact Laser Microscope mounted to a probe.*

## How to build the setup

Follow the next steps to assemble the Compact Laser Microscope.



**DO NOT** allow dust and dirt to enter the microscope and damage the objectives.

Create a clean environment before assembling the Compact Laser Microscope.



The Compact Laser Microscope with XYZ stage (like Risucre EM Probe Station) is **HEAVY** and cannot be moved inside the safety box by a single person. Please consider to build up the stand and mount the laser body inside the safety box directly. The photos in this guide are taken outside the safety box to improve photo quality.

Tools required:

- Double open-ended wrench 6 x 7 mm



- Hex wrenches M1.5, M2 and M3





## Dismount the probe clamp assembly from the Probe Station



**DO NOT MOUNT BACK** the probe clamp to the probe station without reading the corresponding section in this QSG.

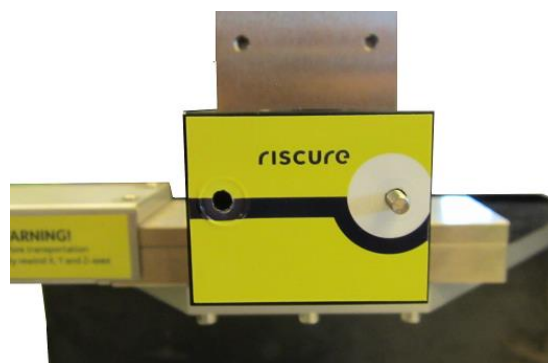
If **NOT** mounted properly, the plate behind the Z-axis arm will be damaged by the “R” screw when the arm moves.

1. Turn “L” screw counter-clockwise until it can be pulled out completely.
2. Collect and store the flat washer padded in between the screw cap and the probe clamp.



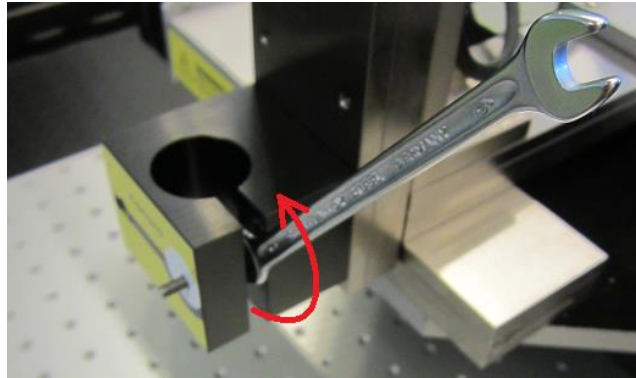
*Figure 2 loosen and remove the “L” screw and “R” screw cap*

3. Turn the “R” screw cap counter-clockwise, until the cap becomes detached from the screw.
4. Collect again and store the flat washer padded in between the screw cap and the probe clamp.



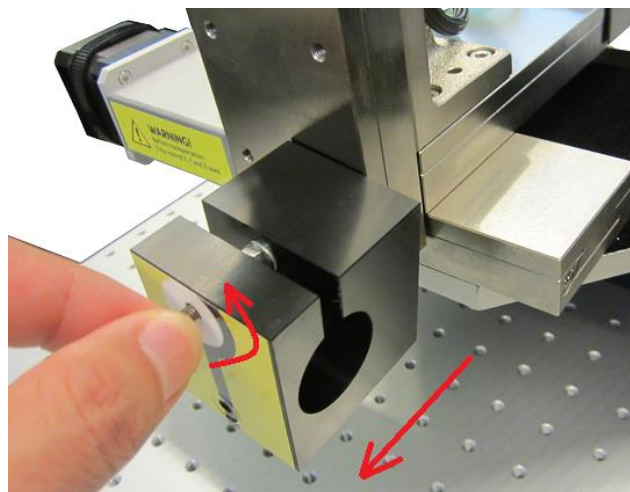
*Figure 3 exposed screw head after removing the “R” screw cap and the flat washer*

5. With the 7mm end of the hand spanner, turn the nut located in between the opening of the clamp counter-clockwise to release the clamp module from the arm. Once released, the clamp will start to rotate downwards from its horizontal position.



*Figure 4 loosen the nut in between the clamp opening*

6. Pinch the screw with fingers and turn it counter-clockwise until the probe clamp becomes detached from the probe station Z-axis arm.



7.

*8. Figure 5 turning the screw so that the clamp will detach from the arm*

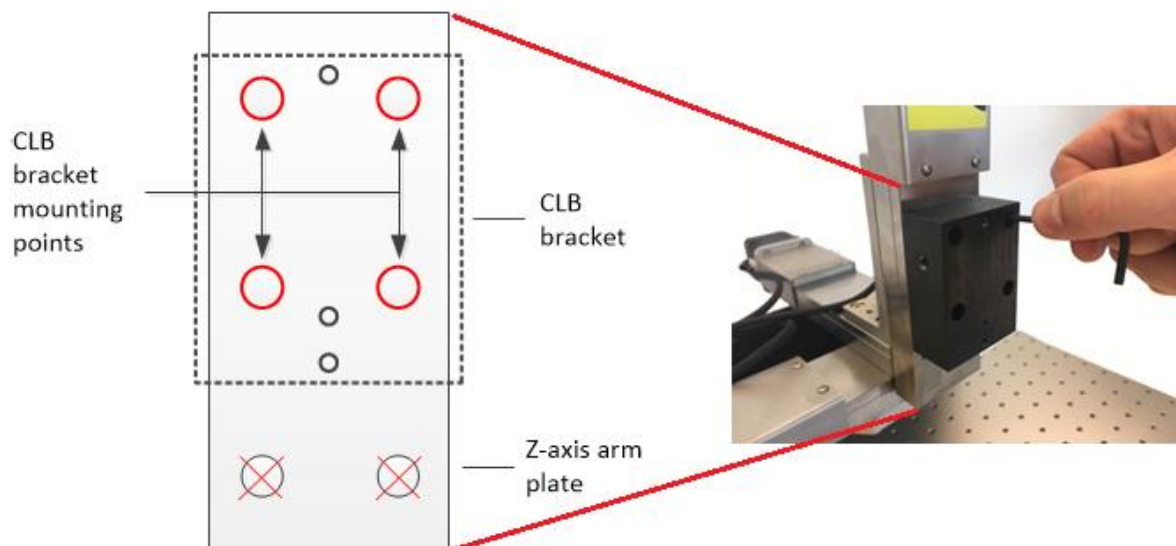
9. Keep the removed parts for later use.



*Figure 6 probe clamp and accessories removed from the station*

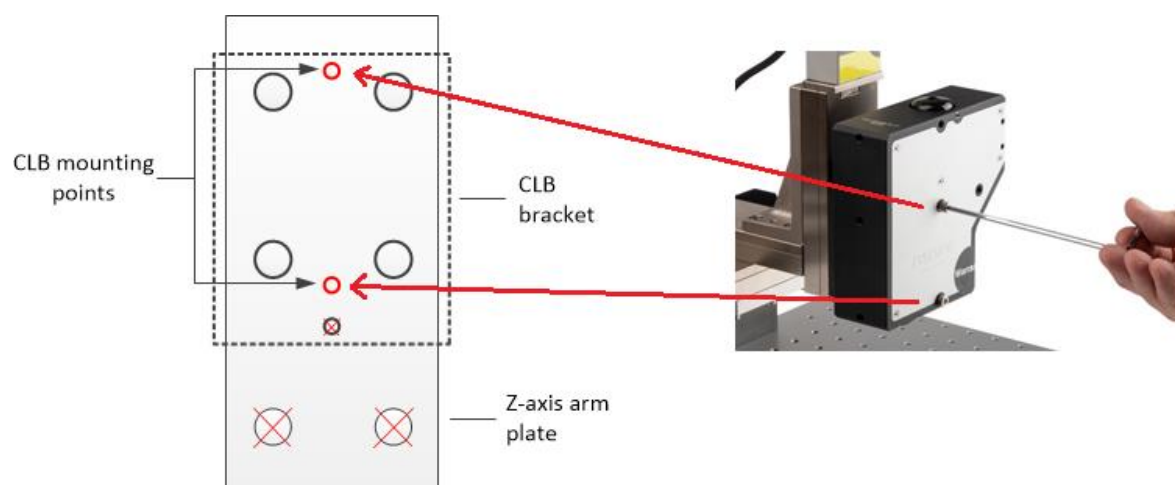
## Build Compact Laser Microscope stand

1. Place XYZ stage on a solid foundation.
2. Mount bracket as interface between XYZ stage and Compact Laser Microscope. For the Riscure EM Probe Station a Compact Laser Microscope bracket is provided in the package. Mounting the bracket is illustrated in Figure 7. Hold Compact Laser Microscope bracket in front of EM Probe Station with four holes aligned.
3. Insert and tighten 4 hex screws to fix Compact Laser Microscope bracket to EM Probe Station.



*Figure 7 Mounting Compact Laser Microscope bracket on EM Probe Station.*

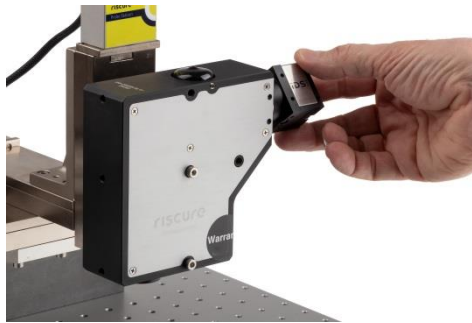
4. Hold Compact Laser Microscope body in front of Compact Laser Microscope bracket with two holes aligned.
5. Insert and tighten 2 hex screws to fix Compact Laser Microscope body to Compact Laser Microscope bracket.



*Figure 8 Mounting Compact Laser Microscope body on Compact Laser Microscope bracket.*

## Mount the camera

1. Mount camera to the body via a C-mount flange.
2. Loosen the hex screws which fix the C-mount flange. Rotate camera to show camera type sticker on top. Tighten hex screws to fix the C-mount flange.

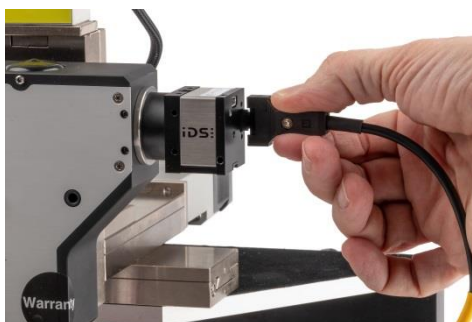


*Figure 9 Mounting NIR camera on C-mount flange.*



*Figure 10 Loosen hex screws of C-mount flange and rotate NIR camera.*

3. Connect camera to PC via USB cable.



*Figure 11 Connect USB cable to NIR camera.*



**OVER VOLTAGE** will damage the color and NIR cameras. Camera receives 5 V power supply over USB. USB hubs which deliver more

than 5 V may damage the camera. This may happen if (by accident) the USB hub is powered by a voltage supply which exceeds 5 V.

## Camera driver installation

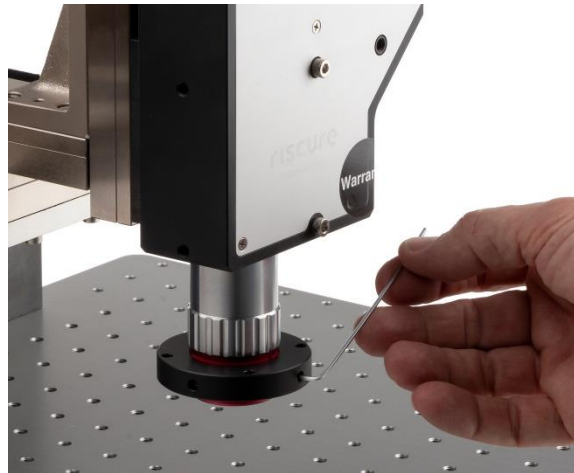
1. Camera driver installation files can be found in the Inspector folder > hardware > Camera > driver
2. Run uEye32\_44001\_WHQL.exe or uEye64\_44001\_WHQL.exe for 32– or 64– bits.
3. Run uEye-DirectShow\_44100.exe and check "Register cameras on connect" and "Use camera names" during installation



The **IDS uEye Cockpit** camera interface software allows detailed setting of NIR camera parameters. After launching uEye Cockpit, select Monochrome > uEye > Properties. Set Pixel Clock and frame refresh rate to the lowest values to improve image clarity.



## Mount objectives and the IR ring light



*Figure 12 Mount 5x objective at bottom of Compact Laser Microscope body.*

1. Mount 5x objective at the bottom of the Compact Laser Microscope body
2. Connect the magnetic ring of the IR ring light to the 5x objective using a hex-key
3. Apply a distance of 4.5 mm between magnetic ring and thicker ring around objectives
4. Click the IR ring light to magnetic ring



*Figure 13 Mount magnetic ring and IR ring light to objective.*

## Mount the spot size reducer and laser

1. Insert spot size reducer in laser port on top Compact Laser Microscope body. The spot size reducer will reduce the spot size diameter by a factor 10. The total power over the spot area will be reduced by approximately a factor 10 as well. The use of the spot size reduction is optional. The spot size reducer can be taken out to obtain a larger spot size



*Figure 14 Mount Spot Size Reducer on top of Compact Laser Microscope body.*

2. Fix spot size reducer by tightening screws
3. Mount laser on spot size reducer and tighten screws. In photo Riscure Multi-Mode Diode Laser has been taken as example.



*Figure 15 Mount laser on top of Spot Size Reducer.*


## Bring the laser spot to focus

1. Loosen the head lock screw with hex wrench M1.5. You are now able to rotate the spot size reducer head relative to the spot size reducer body.
2. By rotating the head you will focus the laser spot
3. The table below gives approximate values for the gap with for various laser wave lengths
4. Fasten the head lock to secure the reducer head



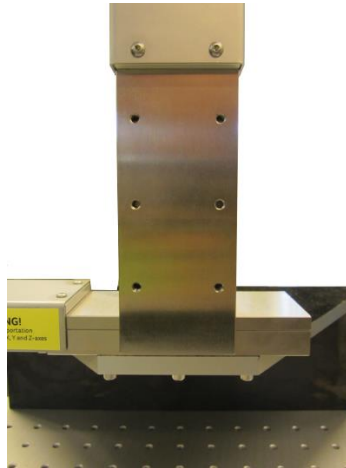
### **Note:**

The wavelength of the laser source must match that of the beam splitter.

	Laser wavelength	Gap width
	445 nm (blue)	0 mm
	532 nm (green)	0 mm
	808 nm (red)	0 mm
	1064 nm (near infrared)	2 mm

## Mount the probe clamp assembly back to the Probe Station

1. Remove any other add-on modules from the Z-axis arm, exposing 6 drill holes on it.



*Figure 16 the z-axis arm ready to mount the probe clamp*

2. Align the screw, which goes through the clamp opening, to the bottom right hole of the Z-axis arm.
3. Turn the screw clockwise so that the clamp assembly is merely attached to the Z-axis arm. Do NOT turn the screw all the way to the end.



*Figure 17 probe clamp loosely attached to the z-axis arm*

4. Put a flat washer over the “L” screw and plug the screw into the clamp assembly via the hole on the left side.



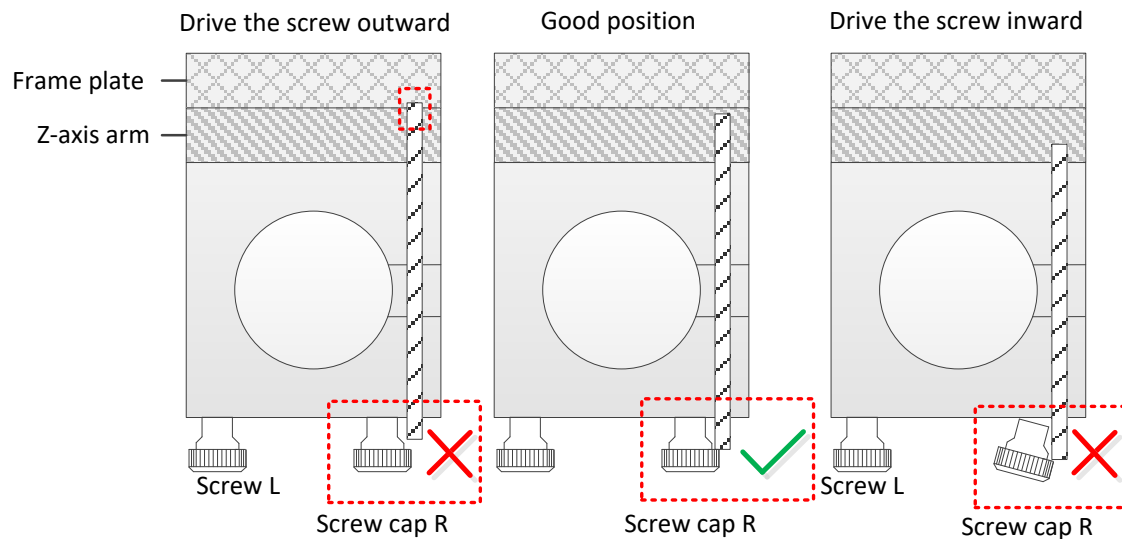
*Figure 18 screw “L” with flat washer*

5. Align the end of the “L” screw to the bottom left drill of the Z-axis arm, turn it clockwise and tighten it.



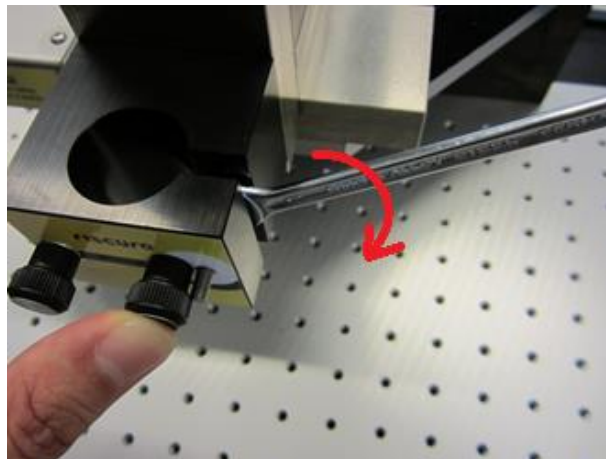
*Figure 19 align the “L” screw to the drill hole on the arm and tighten it*

6. Place the “R” screw cap next to the uncapped screw. Use the edge of the screw cap as a measure to determine if the screw should be driven further into the drill hole or not. See Figure 20 for an illustration.
7. Turn the screw clockwise, if it has to be driven further into the drill. Or counter-clockwise, if it has to be driven out of the drill. Repeat until the screw reaches the Good position shown in Figure 20.



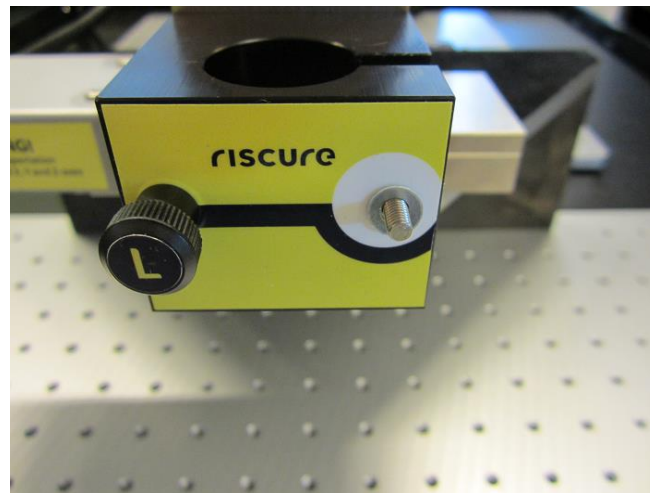
*Figure 20 top slice view of the probe clamp illustrating good and bad screw positions*

8. Use the 7mm end of the hand spanner to turn the nut clockwise and fasten the probe clamp to the arm. The nut should be tightened in such a way that it presses the clamp holder firmly against the z-axis arm.



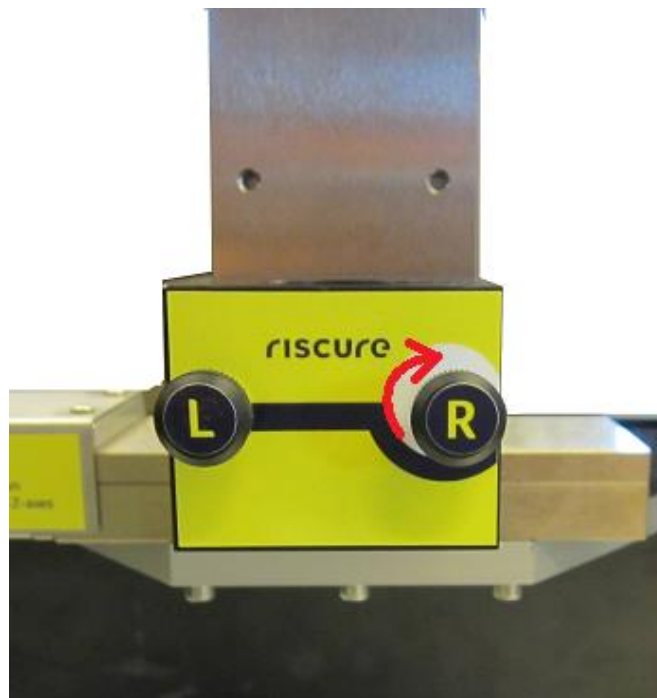
*Figure 21 tighten the nut and measure the position of the screw after it*

9. Measure the position of the screw once more using the screw cap. If the screw has drifted away from the Good position shown in Figure 20, loosen the nut slightly and drive the screw toward the good position. Tighten the nut once again after tuning is complete.
10. Place the flat washer over the screw.



*Figure 22 the flat washer and the screw*

11. Align the “R” screw cap to the screw and turn it clockwise until resistance can be felt from the probe clamp. Turning the screw cap clockwise further will increase the grip of the probe clamp.



*Figure 23 turn and fasten the “R” screw cap to the probe clamp*

## Verification of the setup

Follow the next checks to verify you have built a working setup.

1. Is the Compact Laser Microscope powered?
2. Is the Compact Laser Microscope connected?

Please ensure that a check is successful, before proceeding to the next check.

If a check is not successful, refer to section “Common problems”.

### Check 1 - Is the Compact Laser Microscope powered?

If the IR ring light is powered a small red power on LED is illuminated. The NIR illumination by the ring of IR LEDs is not visible for the human eye.



Do **NOT STARE** into the IR LEDs of the IR ring light. The NIR illumination is not visible for the human eye.

If the LES is powered the target under the objective is illuminated.

### Check 2 - Is the Compact Laser Microscope connected?

The Compact Laser Microscope is connected to the computer by:

- The USB camera.

The USB camera is recognized by Windows as a generic video capturing device. Video can be recorded and viewed by any suitable application, and does not depend on Inspector.



## Help and troubleshooting

### Common problems

1. The uEye camera (indicated by 'UI-serial number') is not shown in the camera device pull down menu of Tools > Open Camera View or of Perturbation > Camera tab. Possible causes:
  - Camera not connected. After connection of the camera to the USB port, at first the led on the camera is illumined red.
  - Driver not installed. After a couple of seconds, the color should change from red to green. If not, try to reinstall the hardware driver following the description in section 8.4.4 uEye Microscope Camera.
  - Driver not installed correctly. Perhaps you forgot to check "Register cameras on connect" and "Use camera names" during the installation of the DirectShow driver since this deviates from the default installation. Please uninstall the driver and re-install while checking "Register cameras on connect" and "Use camera names".

### Have questions?

Visit the Riscure Support portal: <http://support.riscure.com>.

## Technical specifications

### Operational conditions

- Room temperature 15 – 35 °C (59 – 95 °F), non-condensing
- AC mains 100 – 240 V, 50 – 60 Hz.



Maintain stable environmental conditions (temperature, humidity, airflow etc.) in order to reliably repeat tests and compare test results.



Unplugging the PSU from the product is not required, but recommended when not used for an extended time.

### Power supply input



Use of a PSU other than supplied by Riscure is not supported. Power spikes may cause internal damage and loss of accuracy.

### Cameras

#### NIR

- 1/1.8" Sony CMOS
- monochrome
- 3.1 MP
- USB 2.0

### Optical system

- 1 objective; magnification 5x
- Spot size: 60 x 14 µm @ 5x objective for 808 nm and 1064 nm diode lasers including 10x spot size reducer tube
- Beam splitter is version dependent:

- Standard version for NIR lasers: 700 nm – 1100 nm with 80% transmission for lasers within this wavelength range. Remaining reflected light from target goes to camera.
- Standard version for green and blue lasers: 370 nm – 532 nm with 80% transmission for lasers within this wavelength range. Remaining reflected light from target light goes to camera.

## **Remote connections**

- USB 2.0 camera connection to PC.

# Declaration of conformity

## EC-DECLARATION OF CONFORMITY

### Suppliers Details

Name

Riscure B.V.

Address

Frontier Building, Delftechpark 49, 2628 XJ Delft, The Netherlands

### Product Details

Product Name

Inspector

Model Name(s)

Compact Laser Microscope

Trade Name

Riscure

### Applicable Standards Details

Directives:

- MD (2006/42/EC) - LVD (2006/95/EC) - EMC directive (2004/108/EC)

Standards:

- IEC 60825-1; IEC 320 C8; IEC 60950-1; 21 CFR 1040; ANSI/ESD S20.20:2007; BS EN 61340-5-1:2007; EN55022-B; EN61000-4-2, 4-5; EN-ISO 12100:2010; CISPR 11; CISPR22-B; UL 1950

### Supplementary Information

The appliance fulfils the relevant requirements of the above mentioned directives according to our technical documentation TCD - Compact Laser Microscope. Risk assessment according to the EN-ISO 12100:2010.

### Declaration

I hereby declare under our sole responsibility that the product(s) mentioned above to which this declaration relates complies with the above mentioned standards and Directives

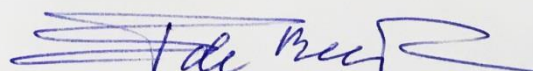
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Dr.ir. F.G. de Beer /  
Technical Director

Issued Date

12 / 12 / 2018



Signature of representative

