User Guide

High Resolution Portable Microscope Model 1 – 1mm & 2mm field of view

Thank you for purchasing the ioLight microscope, we very much appreciate your custom.

Please contact us on info@iolight.co.uk if you have any problems or questions.

Bold text indicates a button or icon on the screen of your computer.

Contents

1. Before you start

The ioLight microscope displays images on Apple or Android phones and tablets and on any other devices that have WiFi and a web browser, for example laptop computers. The microscope creates its own WiFi network, to which you connect your device as described in 'Connecting to the microscope' below.

It is a good idea to charge the microscope before you start. Connect the charger and lead supplied in the box, to the micro USB socket on the back of the microscope. You can use other micro USB leads and chargers, but they may not charge the microscope as quickly as those we supplied.

2. Connecting to the microscope

Switch on the microscope by pressing and releasing the power button. The blue light will flash when the microscope is ready to use, then follow one of the procedures below:

Apple iPhone or iPad

The iPhone or iPad app works with iOS 8.1 or higher. For iOS less than 12.4 some features are not available.

1. Download the ioLight App from the App Store. If this is the first time you have used the App, you will see instructions that take you through the following connection process:
2. On your device, tap on Apple's **Settings** App, which is normally on the device's home screen (press the Home button to get to the home screen).
3. Scroll to the top of the settings menu and tap on **WiFi**.
4. Wait for the device to find a list of WiFi networks, then tap on the **iolightxxxxxx** network (xxxxxx is the serial number, which is printed on the bottom of the microscope).
5. When connection to the microscope WiFi network is complete a tick will appear against the iolightxxxxxx WiFi network.
6. Tap the Home button, to return to the home screen and open the ioLight App to use the microscope.

Android phone or tablet

The Android app works with Android version 4.4 or higher running on newer high performance devices from Samsung, Sony, Google, Asus, Huawei and other leading manufacturers.

1. Download the ioLight App from the Google Play store. If this is the first time you have used the App, you will see instructions that take you through the following connection process:
2. On your device, start the ioLight App by tapping it.
3. Follow the prompts to connect your device to the iolightxxxxxx network (xxxxxx is the serial number of your microscope, which is on the bottom of the microscope).
4. After a few seconds you should see a live image from the microscope on the device screen
5. Your device may tell you that there is no internet available on the iolightxxxxxx network. If it does, choose to stay connected to this network.

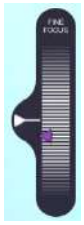
Web Browser Interface (laptop, computer, smart TV, or other device with WiFi and a web browser)

1. Most computers with WiFi and a web browser will work with the microscope. We recommend using the Chrome web browser.
2. Connect the computer to the WiFi network created by the microscope. The WiFi network will be called iolightxxxxxx (xxxxxx is the serial number of your microscope, which is on the bottom of the microscope).
3. Open Google Chrome or another web browser. In the URL bar type the address 192.168.1.1 and press enter. Do not type http:// or www, just 192.168.1.1.
4. After a few seconds you should see a live image from the microscope.

3. Your first image

1. Place your sample on the stage aligned over the bottom illuminator.
    - You might find it helpful to place your sample on a blank microscope slide, since that makes it easier to move around.
    - It is easiest to look at samples that are flat. When looking at thin samples, placing a cover slip on top helps to keep the sample flat.
2. Connect your device (phone, tablet or computer) to the microscope and get a live image from the microscope as described above in 'Connecting to the microscope'
3. Switch on the top and/or bottom illuminators using the on-screen controls.
4. You can test that the image is live by waving your hand between the camera head and the stage, and watching the image change.
5. The image will be blurred at first. To focus the microscope, slide the camera head down the mast, until the image is clear.
    - The image will be in focus when the lens is about 1mm above the sample for the 1mm microscope and about 2.5mm above the sample for the 2mm microscope.

- The purple buttons release brakes on the slide. You can press these to change the amount of force needed to slide the camera head and give a feel that makes it easy for you to focus the microscope.
- Fig 2 shows the hand position we find easiest for focusing.

6. There is a fine focus adjustment bar on the side of the screen which can be used when the image is nearly in focus. Set the focus in the middle of its range before you start. You can find approximate focus by sliding the camera head, then get a more precise focus using the fine focus **Thumbwheel**  on screen.
7. When the screen image is focused you can capture a high resolution copy using the **Camera Icon** .

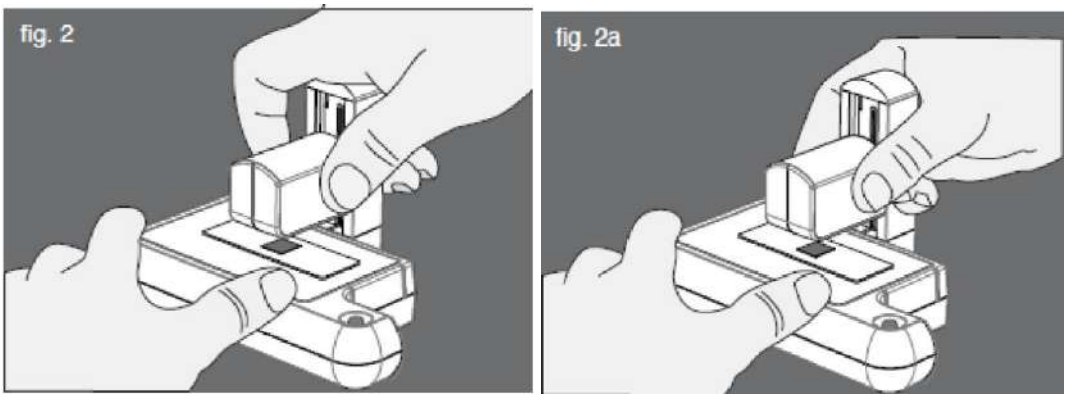


Fig 2a The hand positions for easiest focusing

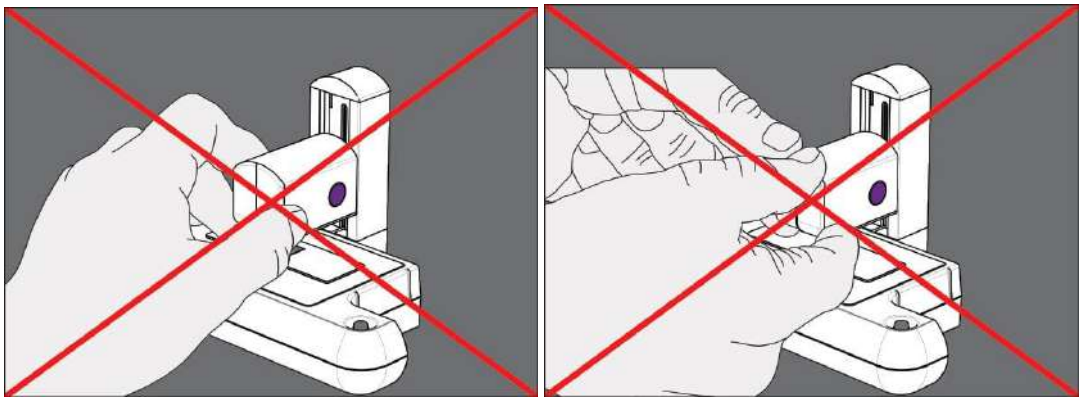


Fig 2b Hand positions that make focusing difficult

4. When you have finished

- Turn off the microscope by pressing and releasing in the on/off switch or using the on screen controls. The microscope then takes about 10 seconds to shutdown (the blue light goes out).
- Remove any dirt or liquids from the microscope body using a damp or dry cloth.
- Only clean the lens if it is obviously dirty, since cleaning risks scratching the lens. If you do need to clean the lens use a clean cotton bud dipped in alcohol. Clean gently to avoid scratching.
- Charge the battery as described below

5. Charge the microscope's battery

- The microscope is powered by a lithium ion battery which needs to be charged.
- Connect the charger and lead supplied to the micro USB socket on the back of the microscope.
- The green light indicates that the microscope is charging. It goes out when the microscope is charged.
- Other micro USB chargers (such as those used with mobile phones) may be used with the microscope. However, you may find that the microscope charges more quickly with the ioLight charger and lead.
- USB ports on computers are not usually designed to charge devices and may not charge the microscope properly, even if the green light illuminates. Some computers have special USB charging ports with a battery label. These are more likely to charge the microscope successfully.

6. The on-screen controls

6.1. iPad or iPhone app

Illumination from above sample

Illumination from below sample

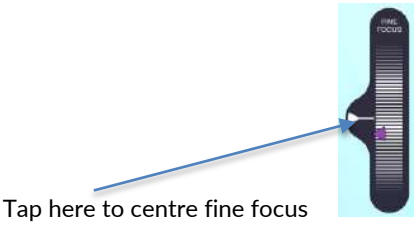
Save image

Record video

Settings menu

100% Microscope battery charge level
(not available on iOS less than 12.4)

Fine focus.



Tap here to centre fine focus

The Settings menu:

The Settings menu allows you to:

- Go directly to the Photos App to view saved images
- Switch on the Scale Grid
- Switch off the microscope

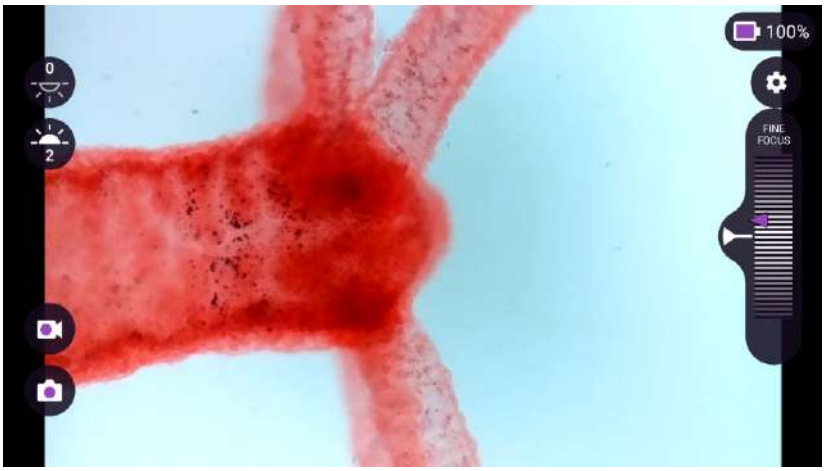
You can zoom in on the live image by pinching two fingers together on the screen then moving them apart. Use HD mode to give fine detail when you are zooming in, see below *(not available on iOS less than 12.4)*.

Resolution:

- Saved images are always full resolution (5MP = 2592 x 1944 pixels).
- The live video resolution is lower. To see the best quality image and to zoom in, save an image, then look at the saved image in the Apple Photos App.
- The resolution of both the live video and the saved video is the same. For high resolution, press the Home button on your iPad or iPhone to leave the ioLight App, then open Apple's **Settings App** (normally located on your home screen). Scroll down to the bottom of the settings menu and tap on the **ioLight App** settings to switch on High Resolution Mode.
- When should I use High Resolution Mode?

- High Resolution Mode is good when you want to record high quality videos, or to see fine detail in the live image. Remember, you can always see more detail on the saved image.
- For general use, it is best to turn High Resolution Mode off because the live video is smoother (higher frame rate). High Resolution Mode transmits a lot of data and so the video is more susceptible to WiFi interference when High Resolution Mode mode is on.

6.2. Android app



 Illumination from above sample

 Illumination from below sample

 Save image

 Record video

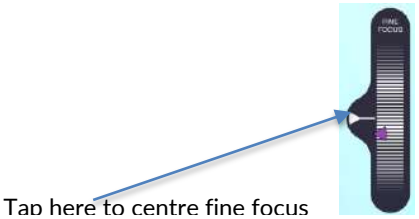
 Settings menu

 Fine focus.

The Settings menu:

The Settings menu to allows you to:

- See microscope battery charge level.
- Go directly to your Photos App to view saved images.
- Switch on the Scale Grid.
- Switch on HD mode (High Resolution Mode).
- Switch off the microscope.



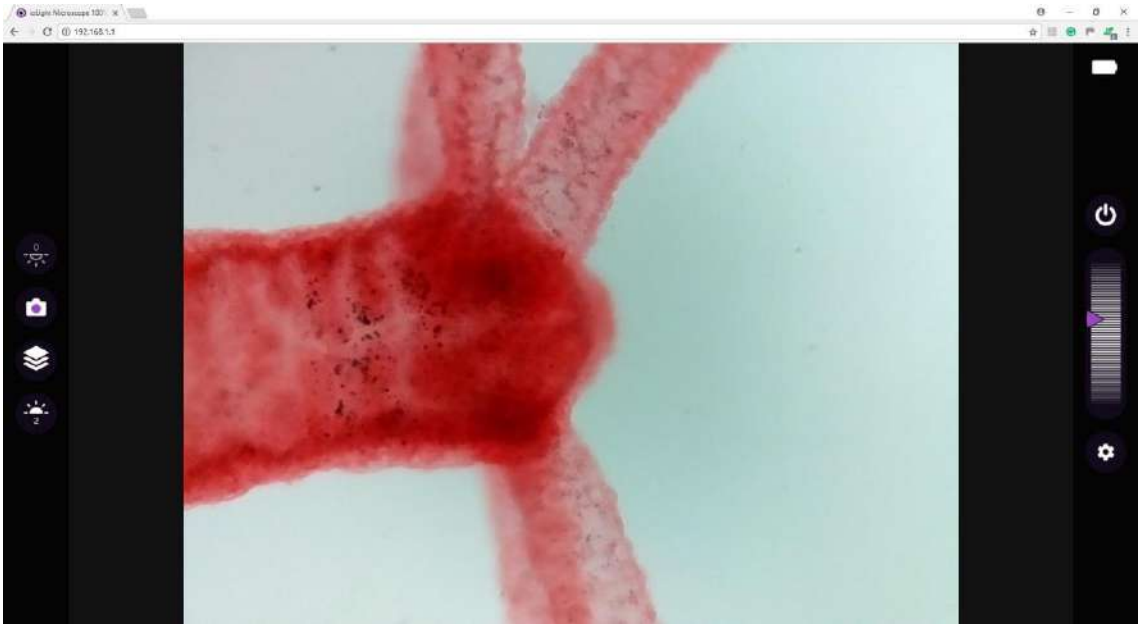
You can zoom in on the live image by pinching two fingers together on the screen then moving them apart. Use HD mode to give fine detail when you are zooming in, see below.

Resolution:

- Saved images are always full resolution (5MP = 2592 x 1944 pixels).
- The live video resolution is lower. To see the best quality image and to zoom in, save an image, then look at the saved image in the Photos App.
- The resolution of both the live video and the saved video is the same. For high resolution, tap the **Gear icon**  on screen to open the settings menu and switch on HD mode.
- When should I use HD mode?
  - HD mode is good when you want to record high quality videos, or to see fine detail in the live video. Remember, you can always see more detail on the saved still image.
  - For general use, it is best to turn HD mode off because the live video is smoother (higher frame rate). HD mode transmits a lot of data and so the video is more susceptible to WiFi interference when HD mode is on.

6.3. Web Browser

Live image:



Illumination from above sample

Illumination from below sample

Save image

Record 12 images for Z-Stacking

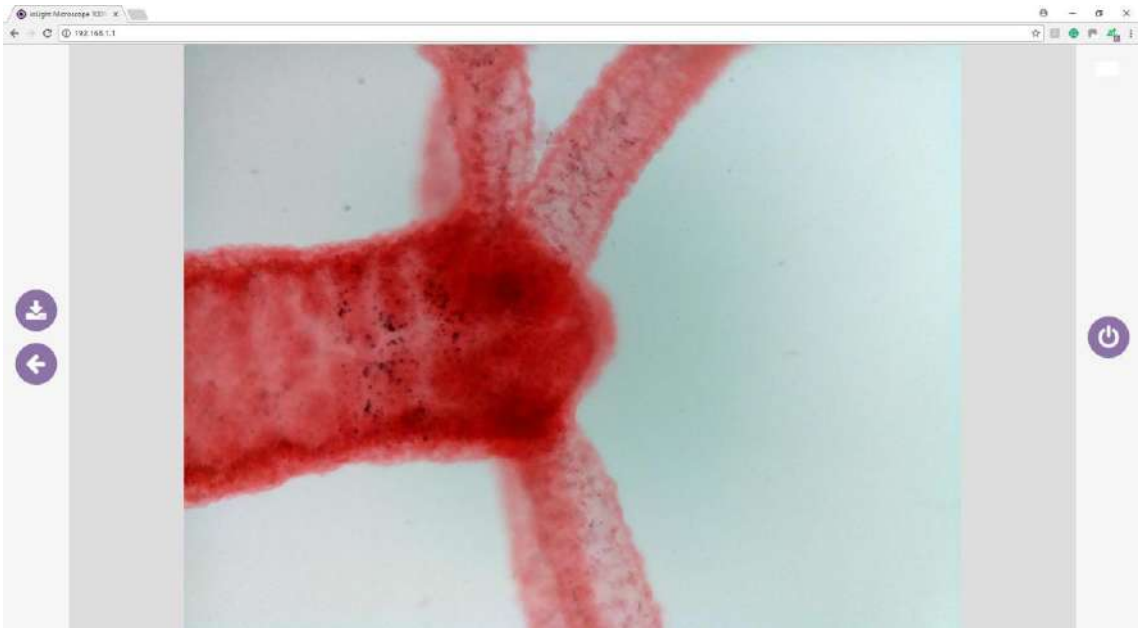
Settings menu

Fine focus

Microscope battery charge level

Switch off microscope

- You can switch off the microscope by clicking the **Power Icon** . The microscope takes about 10 seconds to shut down and for the blue light to go out.
- Many of the controls can be used via keyboard shortcuts instead of clicking the icon:
  - g – turn the scale grid on and off
  - u – show or hide the controls
  - ↑ and ↓- adjust the fine focus in large steps
  - ← and → - adjust the fine focus in small steps
  - p – switch off microscope
- For details on Z-Stack images see 'Expert Techniques' below.
- When you click the **Save Image Icon** the microscope takes a full resolution still image (5MP = 2592 x 1944 pixels) and you see the image in the screen below:



Download image to downloads folder

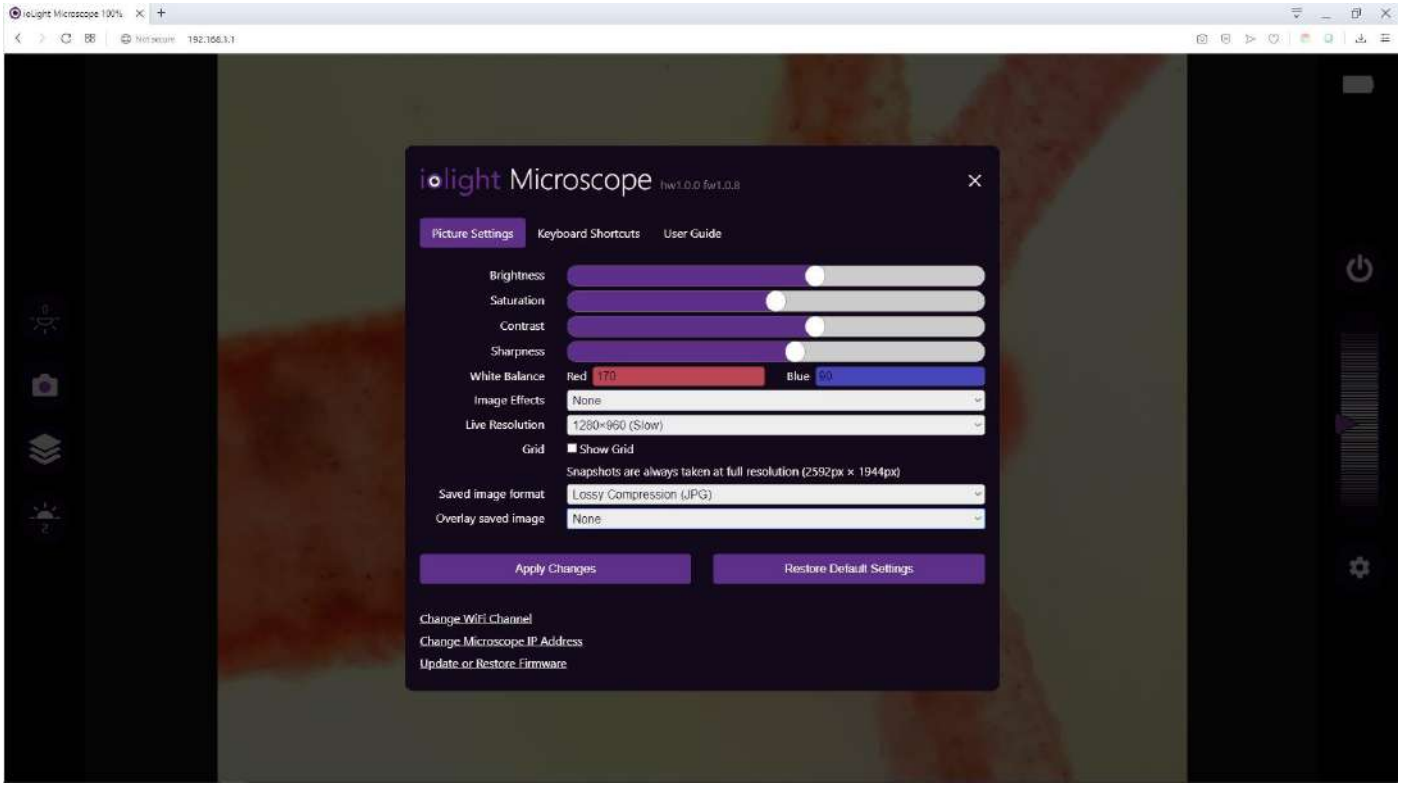
Back to live image

Switch off microscope

- To save the still image to your computer, click the **Download Image Icon**

- The image will be saved to the downloads directory that your web browser uses, and will be called 'iolight_image.jpg'

Settings menu:



Tap the **Gear Icon** to display the settings menu to:

- Change camera settings (white balance, brightness, contrast, saturation, sharpness).
- Use image effects.
- Change the live image resolution. Higher resolution enables you to see more detail when zooming in.
- Switch the Scale Grid on and off.
- Set the image file (or snapshot) format.
- Overlay saved images - save scale grid or scale bar on saved images
- Change the WiFi channel.
- Change the microscope IP address
- Enter recovery mode to fix problems or update the microscope's firmware (see Troubleshooting).
- See list of keyboard shortcuts.
- See this user guide.

Saved image file format

You can set the saved image format to jpg, png or bmp.

- jpg is a compressed file format, which gives the smallest file size and fastest performance. jpg is best for general use.
- png files are also compressed, but in a way that doesn't lose any image data. This file type will result in slightly better quality images but the file sizes are larger and performance slower.
- bmp files are uncompressed, although the image quality should be the same as the lossless compression used in png files. bmp files are very large and microscope performance will be very much slower if you use bmp files.

Image resolution

- Saved images are always full resolution (5MP = 2592 x 1944 pixels).
- The live image resolution is set in the Settings Menu.
- Which live image resolution should I use?
    - The lower resolution settings result in faster, smoother, live images (higher frame rate). This makes it easier to see what is going on when moving the sample under the microscope.
    - Higher resolution settings allow you to see more detail in the image. You will need to zoom in to see the full detail on the highest 2 resolution settings
    - It is possible to have the live images at full resolution (2592 x 1944 pixels). However this will make the frame rate very slow (approx. 1 frame per second) which will make it difficult to use the microscope if you move the sample
    - A good way to use the microscope is to set a lower resolution, say 640 x 480, and focus the microscope on the region of the sample that you want to look at. Then increase the resolution and zoom in to see the full detail
    - If there is interference on the WiFi signal then the live images may deteriorate. In this situation it may be better to use a lower resolution, since this needs less information to be transmitted over the WiFi link to the microscope.

Change WiFi channel

If you are experiencing difficulties connecting to the microscope's WiFi, or there is interference on the live video, then using a different WiFi channel may help. To change the WiFi channel click on **Change WiFi channel** then select the WiFi channel you want to change to. The microscope will then reset the WiFi signal to the new channel.

Your computer and web browser may not follow the change of WiFi channel. If you don't see a live image after changing the WiFi channel, first make sure that your computer is connected to the microscope's WiFi, then close the browser, open it again and go to web address (IP address) 192.168.1.1.

Recovery Mode

You should not normally need to use Recovery Mode, except when ioLight issue an update to the firmware on the microscope. When this happens, ioLight will provide instructions.

7. Expert Techniques

Illumination

The microscope includes top and bottom illumination for your subject. These are controlled by two buttons on the left hand side of the screen,  and  . Tap these buttons to adjust each illuminator from 0 (off) to 4 (full). In general the bottom illuminator gives the best images for transparent samples (for example, biological slides) and the top illuminator gives the best images for opaque samples (for example, coins or printed circuit boards). If needed, both illuminators can be used at the same time. Note that the microscope automatically sets image exposure.

Scale Grid

The Scale Grid helps you to estimate the size of objects in the image. On the 1mm microscope the grid lines are separated by 0.1mm and on the 2mm microscope 0.2mm.

Saving images or videos

You can capture an image by tapping the **Camera Icon**  on the screen . The images will be saved to the Photo App on your phone or tablet. On Android devices a separate 'ioLight' folder will be created for the images. If you are using a web browser then the images will be saved in the web browser's downloads folder.

The iPhone, iPad and Android Apps can also record video by pressing the **Video Icon** on the screen. The web browser cannot record video. The video will be recorded at high resolution when High resolution mode or HD mode is switched on.

Sharing images over the internet

If your phone or tablet normally connects to the internet using WiFi, you will need to disconnect it from the microscope and reconnect it to your normal WiFi internet Access Point to share images and videos. The microscope has no direct connection to the internet.

If you are using a computer, you may be able to use a second wired or WiFi connection to connect to the internet and the microscope at the same time. You can add a second WiFi connection to your computer simply and inexpensively by adding a USB WiFi dongle.

Z Stack images

A Z Stack is a sequence of images taken different fine focus positions. When the object is not flat, different parts of the image will be in focus at different focus positions. Widely available software packages (such as Photoshop) can be used to combine the in-focus sections of each image. The ioLight microscope can record images for Z-Stacking using external software. This feature is only available when you connect to the microscope using a web browser.

To record a Z Stack, slide the microscope head so that the chosen parts of the object can be brought into focus by adjusting the fine focus on the screen. Click the **Z-Stack Icon** and the microscope will automatically save 12 images at different focus positions covering the entire fine focus range. There are a number of different software packages that can be used to combine the 12 images into a single image. These software packages include Photoshop, Helicon Focus and ImageJ.

Some web browsers cannot save the Z-stack images. For instance Google Chrome running on Windows works, but Safari running on an iPad does not.

8. Troubleshooting

Problem	Try This
I can't find my sample!	Move the head to the top of the mast and position the sample so that it is centred on the bottom illuminator. Then move the head down to get the best focus. You can use the grid printed on the sample stage to help you to locate the centre of a slide: line up the edges on the slide with the grey outline of a slide printed on the sample stage, and then the centre of the slide will be in the field of view. Like laboratory microscopes, the depth of field (focus) is narrow, so you can miss your sample if it is not properly focused. Check that you are not focusing on the top of the cover slip or the bottom surface of the slide. Check that the head is not touching the slide.
Image freezes, is jumpy or pixilated and difficult to focus	This can happen in high resolution mode where several other Wi-Fi networks are present. Try moving away from Wi-Fi networks (perhaps to a pond or jungle for some interesting samples….!) Switch to standard resolution mode in the iPhone, iPad or Android apps, or reduce the image resolution in the Web Browser. This transmits less data and is less susceptible to interference - see Expert Techniques. Also see 'Can't connect to WiFi, or poor WiFi connection' below.
Blue connection light is flashing	This means that the microscope is on, but not sending video to

slowly (see below if blue light is flashing quickly)	your device. Start the ioLight app or connect a web browser window to 192.168.1.1 to view the live image from the microscope. If this happens unexpectedly, close the ioLight app or web browser window and then open it to start again. If this doesn't work, follow the reset procedure in 'The microscope is not working as expected' below
Blue light is flashing quickly and my phone or tablet will not connect to the microscope The microscope is in recovery mode.	If there is a problem starting or shutting down the microscope, the next time it is switched on it will enter recovery mode. If the microscope has previously been working, simply switch off the microscope, wait 1min and switch it on again and it should start normally. If are having problems or want to update the microscope firmware and you have entered recovery mode deliberately, then connect to the microscope with a web browser and follow the on screen instructions.
Reset procedure The microscope is not working as expected.	Use this procedure to reset the microscope. Begin by closing the ioLight app or web browser window. • To close the app on iPhone or iPad, double tap the home button to show the open apps. Scroll to the ioLight app, then close it by swiping the app upwards off the screen. • To close the app on Android, launch the recent applications menu by tapping one of the 3 navigation buttons at the bottom of the screen. On some devices this is the square button, on others it looks like two 90 degree angles. Find the ioLight app by scrolling through the list and close it by swiping it to the right. • Once you have closed the app or browser, hold the power button on the microscope down hard for 4-5 seconds until the microscope switches off. The blue light switches off. • Wait 1min and switch the microscope back on again. • Reconnect your device to the microscope WiFi • Start the app or if using a web browser go to 192.168.1.1. If the above doesn't work, connect the microscope to power using the USB charger and lead supplied with the microscope, check the green charging light lights, then try the above procedure again
Image completely black (black cat in a coal cellar!)	Check that one or both of the illuminators are switched on. The bottom illuminator will not help with opaque samples. The 2mm microscope gives much better images of opaque shiny surfaces, like polished rocks or metals than the 1mm microscope. If the surfaces are rough or textured, you should see a really good image with the top illuminator on either microscope.
The microscope switches off when you try to connect to it. Problems charging.	Use the supplied charger and lead to charge the microscope battery. Some other leads and chargers may work but some will charge slowly or even not charge at all. Most USB ports on computers will not charge the microscope properly since they only supply a very small amount of power. The exception to this is if the USB port has a battery symbol next to it. This indicates that the port is designed for battery charging.
Can't connect to WiFi, or poor WiFi connection	If there is a lot of interference on the WiFi signal then your device may not be able to connect to the microscope. If this happens, you may find that changing WiFi channel helps.

	You can change the WiFi channel using the web browser interface as follows: 1. Connect to the microscope using a web browser (see 'Connecting to the microscope' above) 2. Go to settings by clicking on the [gear] icon 3. Click on [change WiFi channel] 4. Select the [WiFi channel] to want to use 5. Wait for the microscope to change to the new WiFi channel. 6. Your device may disconnect from the microscope WiFi network. Check that it is still connected to the iolightxxxxxx WiFi network using the WiFi settings on your device. You can use a WiFi network analyser app on a laptop or Android device to scan the WiFi environment for a WiFi channel with less interference. After changing the WiFi channel with a web browser, the new WiFi channel will work with the web browser, iPhone, iPad and Android apps.
Can I use the web browser interface on an iPad, iPhone or Android device?	Yes, but for normal use the app will be much better. Z Stack images will not work on many phones or tablets. Using the web browser interface on a phone or tablet does allow you to use features that are not available on the apps. For example changing the WiFi channel.
I can't see the high resolution setting in the Settings app on iPhone or iPad	Close the Apple Settings app by double tapping the home button to show the open apps, then scroll to the Settings app and close it by swiping the app upwards off the screen. Open the Apple Settings app again from the home screen of the device.

9. Contact

If you have any questions, please contact ioLight at info@iolight.co.uk