

# Lumen 300-LED

Fluorescence Excitation Illumination System  
Manual Version 2.2



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Thank you for choosing to purchase a Lumen 300-LED Illumination System from Prior Scientific. We are confident it will prove to be a reliable and useful addition to your microscopy system. Please do take the time to thoroughly read this manual before using this product; as it contains not only important operating instructions but also health and safety information which should be understood before use. Do not attempt to use this product in a manner not specified in this manual without contacting Prior Scientific first. Contact Prior Scientific if you have any comments or questions.

## SAFETY INFORMATION

### SECTION I

**Please read and understand these safety instructions before use. Only use this product as specified in the manual.**

**NEVER** look directly into the LED light output, as doing so could damage the cornea and retina. Avoid contact with the skin. If, for any reason the unit is to be operated when not attached to a microscope, everyone present should wear eye shielding and clothing to protect exposed skin.

**DO NOT** expose the product to extreme heat, cold, or to open flames.

**DO NOT** use in areas of high humidity, or expose the unit to moisture or water.

**DO NOT** allow objects to fall, or liquids to spill, on the product.

**DANGER – Never alter the AC cord or plug. The power cord set must be an appropriately rated and approved cord set in accordance in the regulations of the country it is used in. If the supplied plug adapter is not the correct fitting for your geographic area or if you are unsure about the relevant regulations, please contact your supplier for advice**

Only use the supplied AC/DC adapter with this product. **Never substitute another adapter.** Should the adapter be in any way faulty or damaged **contact your supplier.**

All electrical equipment to be used with this product must comply with EN/IEC 60950.

Disconnecting the mains power supply is achieved by unplugging the power cord from the power supply block. Only plug in the power cable once the unit is attached to the microscope. Make sure the unit is securely attached before using.

To clean the exterior of the unit use a slightly dampened cloth with a simple water/detergent solution only. Avoid optical surfaces and lenses, which should only be cleaned by specialist optical wipes and fluids.

# INTRODUCTION

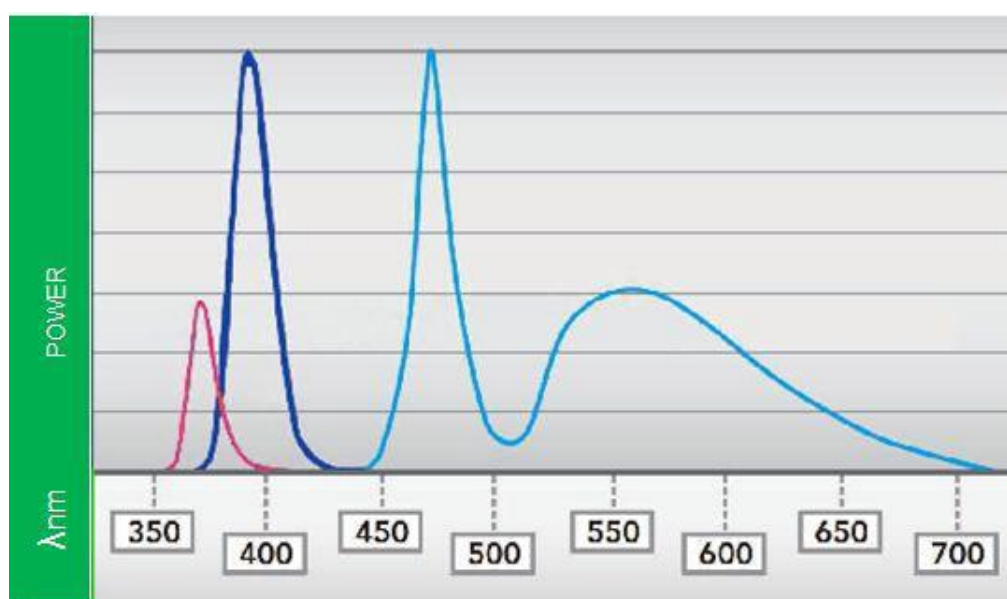
## SECTION 2

Prior's Lumen 300-LED light source is designed to offer broad spectrum LED illumination for general use in fluorescence microscopy applications. Spectral coverage is from the UV (DAPI) to the red (Cy5) excitation. It will excite the vast majority of common fluorophores used in healthcare facilities and research environments. It can be fitted to most current and older microscopes. The Lumen 300 is a safe, convenient light source, suitable for a wide range of applications, which will last for many years without additional operating costs (such as news bulbs). This manual should give you all the information required to install and operate your new light source, but please contact Prior if you are still unsure.

Conventional 'white light' sources used for fluorescence microscopy (e.g. mercury lamps) have a single element which emits light in a series of peaks across the spectrum, giving the effect of white light. LEDs are different; a single element will emit a single peak of light. Therefore LEDs peaking at different wavelengths must be combined together to create white light. Using a pumped phosphor LED a broad peak covering green, yellow and red emissions can also be created. In the Lumen 300 LEDs emitting in the UV and blue regions are combined with a pumped phosphor to create a white light that excites all commonly used fluorescence stains.

The Lumen 300-Led has independent circuits giving the user control of the three main peaks of emissions. On the standard configuration these are referred to as UV, BLU and GYR – respectively UV, Blue and Green/Yellow/Red Light.

There is a special variant of the Lumen for use with multi-band filter sets where the first peak has been shifted from the UV to the VIO (violet) region. See Appendix I for more information.



# SYSTEM COMPONENTS

## SECTION 3

The Lumen 300-LED is supplied with

- a) The LED Head (aka 'the unit').
- b) Manual control pod
- c) Microscope adapter for the specific microscope mode (supplied already attached to a) ).
- d) DC Power supply (type **GS90A160**)
- e) IEC Power cable
- f) User guide

If any components are missing or appear damaged please contact Prior or your distributor immediately.

# INSTALLATION

## SECTION 4

### 4.1 Basic Installation

Carefully unpack the components from the shipping cartons and check for damage.

Remove the protective cap from the end of the pod cable connector.

Insert the pod cable into the LED head using the red dots as a guide for the orientation of the plug.



Connect the power connector from the DC power supply. At this stage do not connect the mains power lead to the DC power supply.



Attach the LED head to the epi-fluorescence port on your microscope. Your Lumen 300-LED will have been supplied with a compatible fitting for the microscope you specified at order – if this is not correct, or does not fit your microscope, please contact Prior immediately. Attach the head ensuring that it is secure and true/flush with the microscope.





Ensure that there is free airflow around the LED head so that the cooling system is not impaired. A gap of 200mm on either side is sufficient. Ideally the unit should be upright, but it may be set with the cables at the top or at either side.

With the LED unit now attached to the microscope it is safe to connect the mains power. Connect the mains lead supplied to a convenient socket, plug in the IEC connector the DC power supply and switch the power on at the socket.

## 4.2 Optical Set up

The Lumen 300-LED has been designed to work on the majority of fluorescence microscopes, both old and new. As would be expected there is variation between models in terms of optical paths and elements. The Lumen 300-LED can be slightly adjusted which allows the user to optimise the performance of the light source when it is first fitted to accommodate this variation and optimise the light source for the particular microscope. This only needs to be done once in the lifetime of the product unless changes are made to the microscope or the unit is fitted to another microscope.



To make the adjustment, set up a typical sample on the microscope that gives an image over the whole field of view. Loosen the thumbscrew and move the post back and forth until you get the brightest and most even illumination possible. Tighten the screw again when finished.



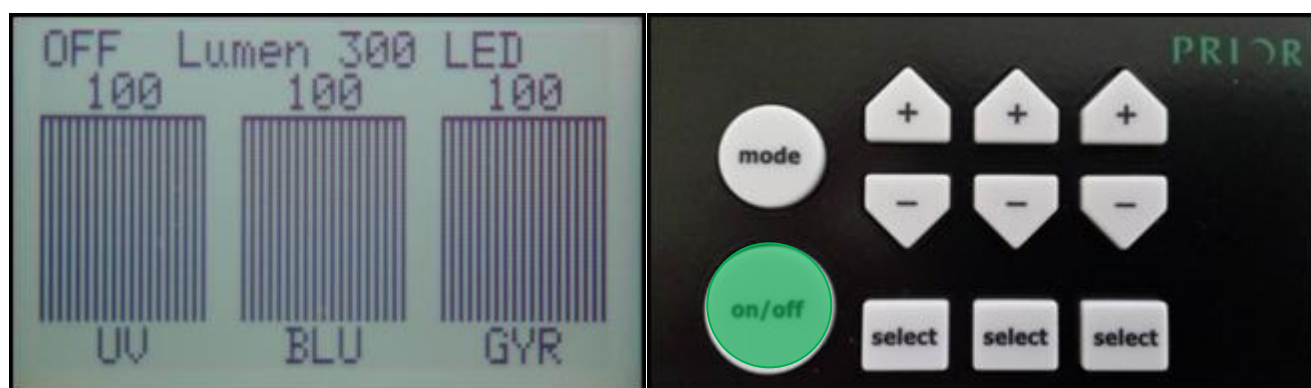
## OPERATION

### SECTION 5

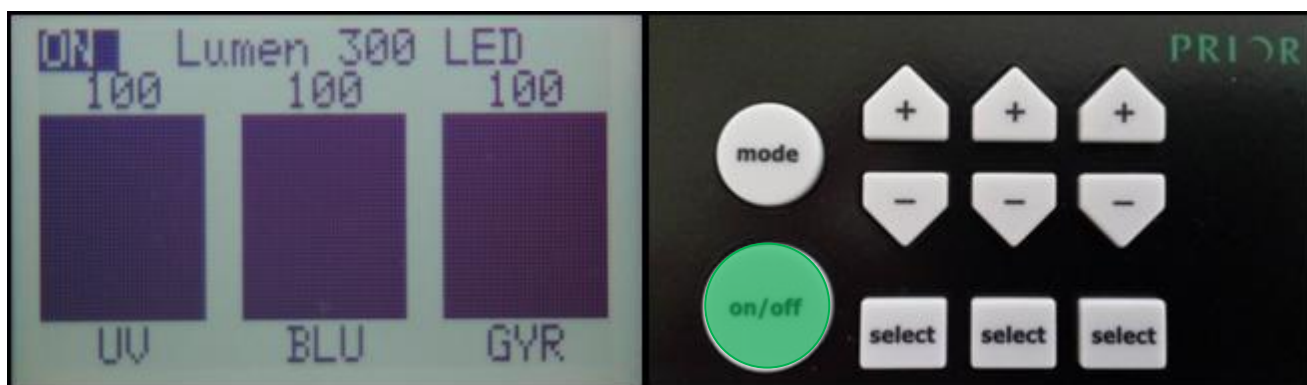
#### 5.1 Manual Control

The Lumen 300-LED is easy to control from the manual control pod. LEDs are switched both on and off by pressing the 'On/off' button.

At start up the unit will revert to the same settings that were set when the unit was last powered down. New units have the default setting selected – all LEDs at 100%.

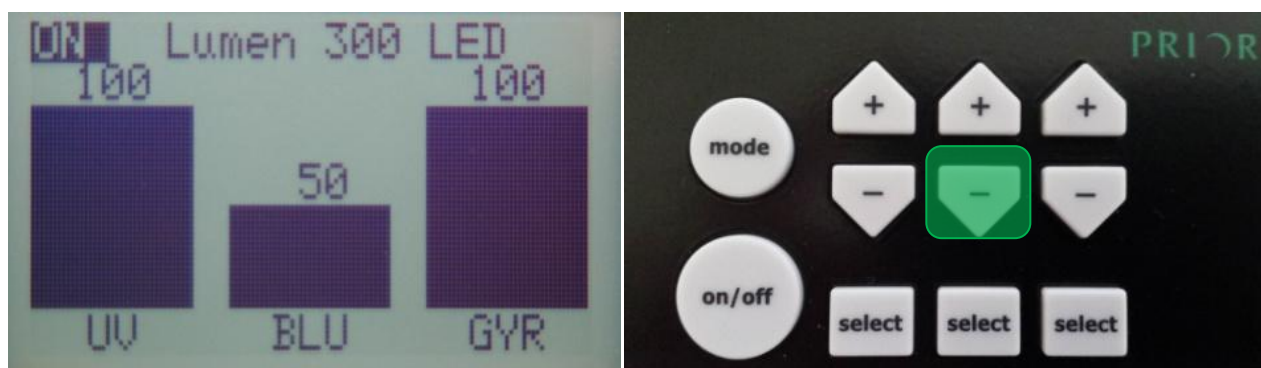


To switch on the LEDs press 'on/off' once. To switch them off again press 'on/off' again.

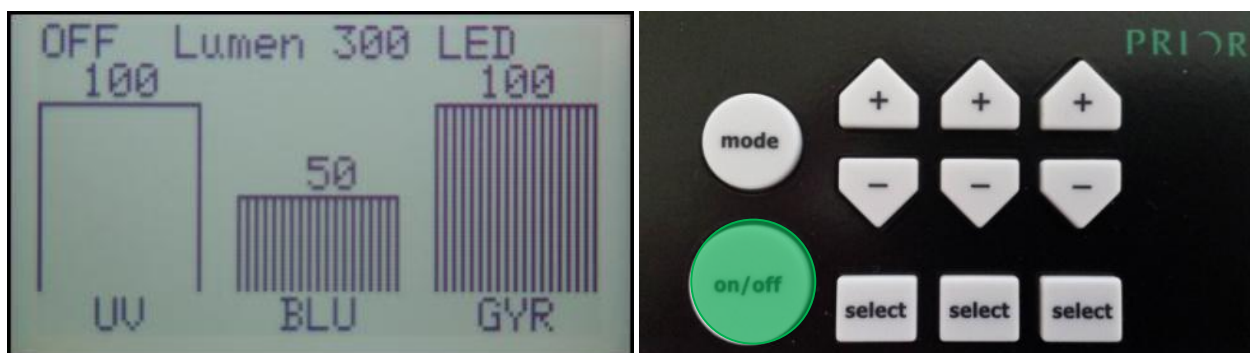
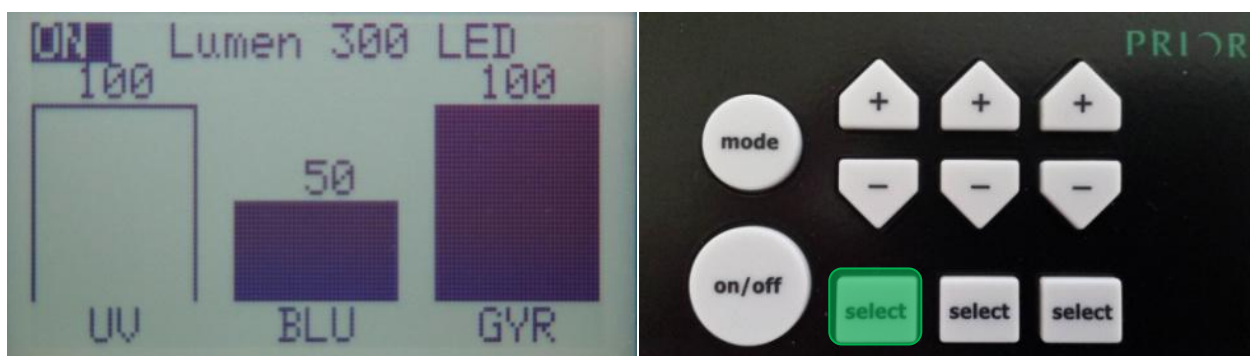


The control pod enables the user to control the intensity of the LEDs that are exciting different stains. This helps to balance the emissions so that one stain does not dominate another. This feature is very useful in multi-band work (see Appendix).

Reduce the intensity of one stain by pressing the 'down' button for that particular band.



Individual bands can be switched off entirely. This can improve contrast and cell viability and well as save energy. Switching off UV, in particular, will reduce photo-bleaching and damage of samples. Bands can be switched off by pressing the 'on/off' button and switched on again by pressing the 'on/off' button again.

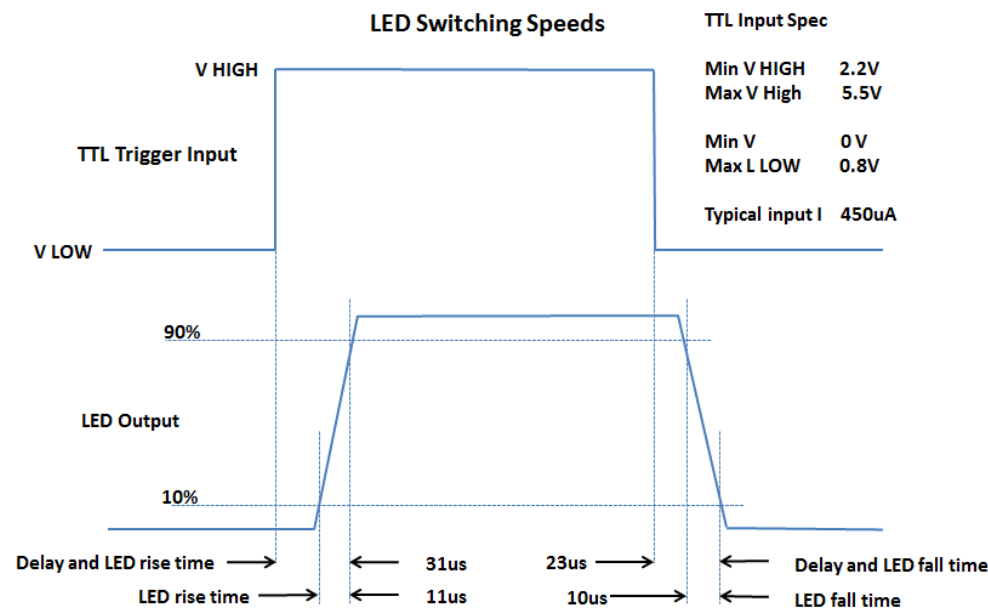


5.2 TTL Control

The Lumen 300-LED can be controlled remotely via a TTL signal. The input uses the single BNC socket on the reverse of the head.



The TTL signal controls the on/off function of the unit. A TTL ‘high’ will cause the LEDs to be on, independent of the state of the on/off button, however only those bands which have been manually selected on the pod will be switched by the TTL signal. The intensities of the selected bands are manually set on the pod.



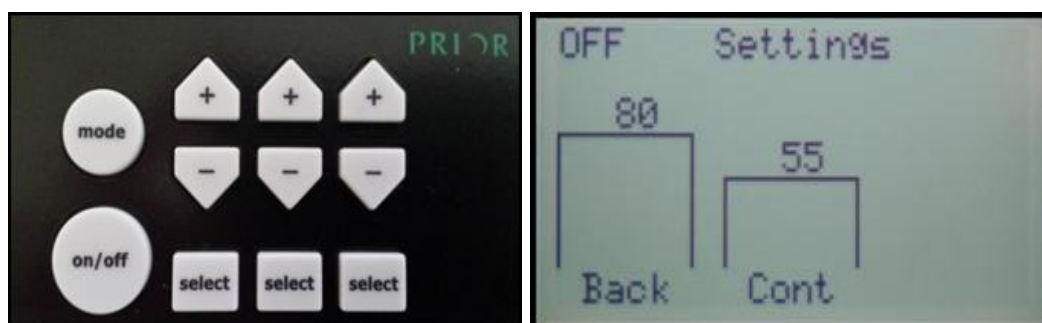
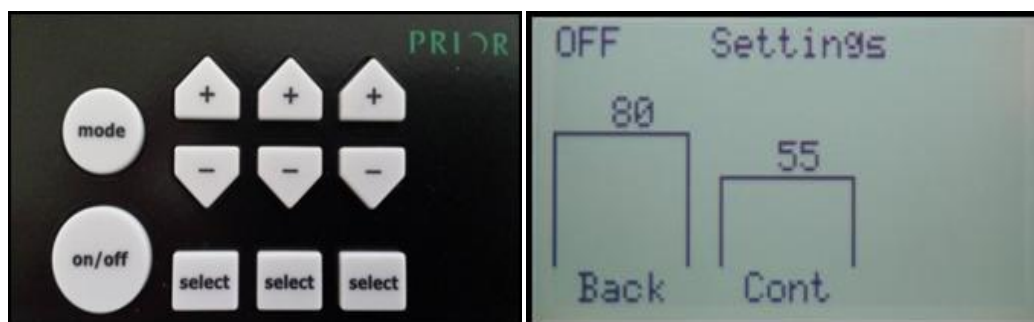
The TTL input circuit has been designed to maximise the switching speed of the LEDs to give the user precise control of the excitation light reaching the sample.

With fast repetitive switching, the pod display will not be able to respond at the same speed and so can get out of synch. If after a train of pulsing, the display on the pod indicates that the LEDs are on whilst they are actually off, simply press the 'on/off' button to reset the display correctly.

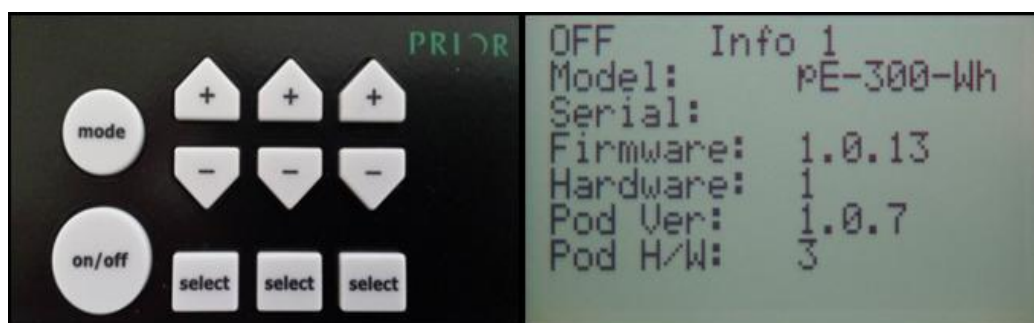
## SETTINGS AND ADDITIONAL INFORMATION

### SECTION 6

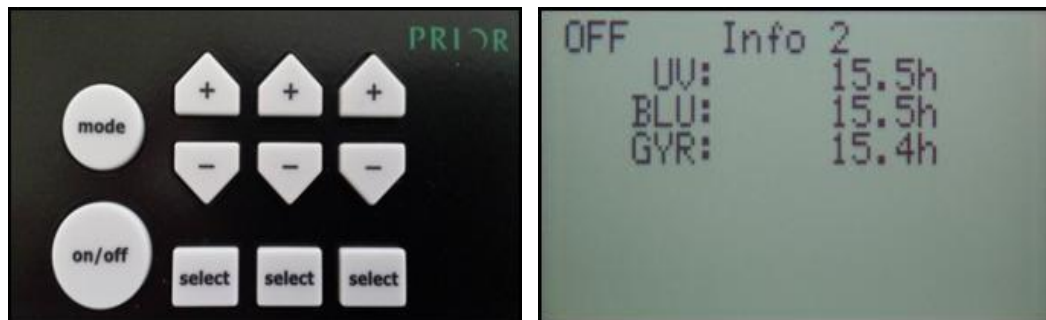
The pod display settings can be adjusted to suit the lighting environment that the instrument is been operated in. To make adjustments, press and hold the 'mode' buttons for 3 seconds. Use the first column of up/down buttons to adjust the backlight to the desired level, and the second to adjust the contrast as required. Wait 10 seconds to return to the main screen or alternatively press and hold the 'mode' button for 3 seconds.



To interrogate the product on its firmware and hardware, press and hold the 'mode' button for 3 seconds. Once the display settings screen appears, release the 'mode' button and then give it a second short duration press. The screen will display the relevant information. To return to the main screen, either press and hold the 'mode' button for three seconds or wait for 10 seconds for the screen to automatically return.



To find out how long the LEDs have been lit, press and hold the 'mode' button for 3 seconds. Once the display settings screen appears, release the 'mode' button and then give two short duration presses to retrieve this information. Wait 10 seconds to return to the main screen or alternatively press and hold the 'mode' button for 3 seconds.



# TROUBLESHOOTING

## SECTION 7

The Lumen 300-LED is a relatively simple system and is easy to operate. The following is a checklist should the product does not operate as expected. Do not attempt to disassemble or repair the unit yourself; it contains no user serviceable parts. Disassembly may damage the unit and voids the warranty.

*Problem: Unit does not power up – nothing appears on the pod screen.*

Check: Is the power jack fully inserted in the Lumen 300-LED head?  
Is the mains lead fully inserted in the DC power supply?  
Is the mains supply switched on?

*Problem: Display does not respond to any button presses.*

Check: Is the pod connector full inserted in the Lumen 300-LED head?  
Was the pod connector inserted after power up? If so, power down and power up again once pod connector is fully inserted to reboot the system.

*Problem: LEDs fail to switch on with message on screen 'Hot Lams'.*

Check: LEDs are over heating so check that there is sufficient clearance for airflow around the Lumen 300-LED head.  
Check that the ambient temperature is below the maximum operating.  
Check that there are no local heat sources close to the head.  
Check: Listen for the fan switching on. It should not run continuously -only when deemed necessary by the system's thermal management controls. If the fan does not operate with all the LEDs on and set at maximum intensity, then there is an internal fault and the unit must be returned to Prior for repair.

*Problem: Illumination appears to be weak*

Check: Are the intensity settings on the pod turned up? Has the single optical setup procedure for the Lumen 300-LED been followed (see 4.2)? Is the microscope set up correctly? Check for shutters and apertures being open and for appropriate filters and cubes. If microscope previously used a mercury or metal halide lamp, check for damage or frosting of optics in light path.



*Symptom: Illumination on sample is not flat and even.*

Check: Has the single setup procedure been followed (see 4.2) ?

*Problem: The Illumination is not centralized over the field of view.*

Check: Carefully slacken off the fixing retaining the Lumen 300-LED on to the epi-port and rotate the head while viewing the field of view. If the illumination offset follows the rotation, then the optics within the Lumen 300-LED have lost their alignment, possibly through mishandling and the product will need to be returned to Prior for re aligning. If the illumination offset remains unchanged when rotating the light source then the problem is within the microscope and a person competent with microscope servicing will need to investigate the cause of the problem.

## **ROUTINE CARE AND MAINTENANCE**

### **SECTION 8**

The Lumen 300-LED requires little or no maintenance throughout its life. There are no field serviceable parts so there is no need to remove the covers.

Cleaning of the external surfaces can be carried out with a mild soap and water used to lightly dampen a lint-free cloth. Ensure that no liquid is allowed to enter the product through vents and panel edges. Avoid optical surfaces.

Cleaning of optical surfaces maybe necessary if debris or finger prints accidentally come into contact with the lens during installation. In the first instance remove any loose debris with an air duster (aerosol or rubber blower).

Finger prints or other liquid type contaminants should be removed using standard lens cleaning procedures. Do not flood the lens surfaces with fluid as liquid could enter the product and cause damage.

## **SPECIFICATIONS SECTION 9**

### Power requirements

110-240Va.c 50/60Hz 2A

### Power consumption

Standby mode max 2W

White (all 3 bands at 100% intensity) max 80W

Two bands at 100% max 63W

Single band at 100% max 38W

### Dimensions

Main Head Unit 77mm (w) x 186mm (d) x 162mm (h)

-weight 1.40kg

Control Pod 88mm (w) x 125mm (d) x 37mm (h) - weight 0.32kg

Power Supply 140mm (w) x 56mm (d) x 32mm (h) - weight 0.43kg

### Environmental Operating Conditions

Operating 5 – 35 deg C

## **PRODUCT OPTIONS AND REPLACEMENTS**

### **SECTION 10**

Please visit [www.prior.com](http://www.prior.com) or contact Prior Scientific to obtain details of replacement parts and product option.

# WARRANTY, RETURNS AND REPAIRS

## SECTION 11

Please contact Prior Scientific prior to returning any product. An RMA number must be obtained in order to facilitate the return and repair or replacement of any product.

This product is supplied with a 12 month warranty which is calculated from the date of invoicing, covering defects in materials and workmanship. It does not cover or form the basis for any claims for damages or consequential losses. In addition the warranty covering the LEDs is extended from 12 months to 36 months or 25,000 hours, whichever is first. Any repair that is carried out by Prior Ltd, or its approved agent is warranted for 100 days.

The warranty does not cover excessive wear and tear, poor handling or any fault caused by operating the product outside the advice of this User Guide.

In the event of the product developing a fault, make contact with Prior and provide a brief description of the problem. It is useful to have the product serial number available. If a repair is required, a support team member will provide a RMA number to log the incident.

All returned units, including warranty claims should be packed up carefully and adequately (preferably in the original packaging), and sent postage and carriage paid to the service centre as specified by the support team member.

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## APPENDIX I

New ways of working with multiband filter sets can now be achieved using the Lumen 300-LED.

These are not possible with other broad spectrum light sources.

While the Lumen 300-LED delivers a wide spectral output covering most filter sets, its intuitive manual control pod allows the user to select and adjust the intensity in three key bands of the excitation spectrum.

Working with these three bands, selected and set at 100% intensity, the system can be operated as a broad spectrum 'white' light source, replacing an existing mercury or metal halide bulb. In this mode, working procedures and filter set selections remain unchanged.

The three band control feature of the Lumen 300-LED increases the practical uses of multiband filter sets, from only providing multi-coloured images to also allowing single fluorophore viewing.

By simply selecting or switching off regions of the excitation spectrum, single fluorophores can be viewed in isolation or in conjunction with one or two other fluorophores on the same sample. This is possible due to LED emissions being limited in bandwidth and so adding practically no energy outside the excitation region of interest. The result is reduced background with the great signal-to-noise.

In addition the three band controls of the Lumen 300-LED allow the user to vary the brightness of the individual fluorescence stains on a multi-stained sample so that a balance can be achieved between them. This can prevent brighter stains from over-powering or masking weaker ones as viewed through the eyepieces.

By using a Lumen 300-LED in conjunction with a multiband filter set, swapping between filter cubes is no longer required. The user can select which single or combination of stain emissions is being viewed solely through the pod controls.

Apart from not having to remember which filter cube is in each position there are additional benefits in having a single multiband filter set.

Capturing multi-colour images with multiband filters and conventional broadband white light sources is practical with the use of a colour camera although the ability to balance the colours is not possible. However monochrome cameras tend to be more common in microscopy labs as they are generally cheaper and provide better sensitivity and resolution than a similar pixel numbered colour camera. For this reason a multi coloured image will

generally be constructed by taking a series of sequential single colour images through a series of single band filter cubes. This sequential single band filter approach does provide images with great signal to noise. However the movement between filter cubes can introduce problems in the form of time delays and vibration. Misalignment of overlaid images (pixel shift) can also occur when using different single band sets due to the individual dichroics in each cube not being set at exactly the same angle. There are solutions to these issues involving the use of excitation and emission filter wheels.

By contrast the Lumen 300-LED with a straight forward multiband set can achieve both full simultaneous multicolour imaging as well as sequential imaging without the need for any moving parts.

The three controllable spectral regions of the Lumen 300-LED are:

1. UV/Violet - For UV and Violet excited fluorophores such as DAPI, Hoechst and Calcofluor White etc.
2. Blue - For Blue excited fluorophores such as GFP, FITC, Auramine etc.
3. Green/Red - For green and red excited fluorophores such as Cy3, TRITC, TxRed and mCherry as well as Cy5.

Users of triple multiband filter sets should be aware that DAPI is excited at a longer Violet wavelength (400nm) than the normal UV band (365nm). This is caused by complications for the filter manufacturers in producing a single filter with three pass bands with the lowest one at 365nm.

To match these triple multiband filters sets, the Lumen 300-LED-M should be used which has the DAPI excitation band positioned in the violet region, rather than the UV. The following is a list of available triple multiband-pass sets that can be used with the Lumen 300-LED Violet, Blue and GYR.

Chroma:

<http://www.chroma.com/product/complete-filter-sets/widefield-microscopy/triple--69000--ET-DAPI-FITC-TRITC>

<http://www.chroma.com/product/complete-filter-sets/widefield-microscopy/triple--69002--ET-DAPI-FITC-Texas-Red>

<http://www.chroma.com/product/complete-filter-sets/widefield-microscopy/triple--69010--ET-DAPI-FITC-Cy3>

Semrock

<http://www.semrock.com/SetDetails.aspx?id=2738>

<http://www.semrock.com/SetDetails.aspx?id=2757>

<http://www.semrock.com/SetDetails.aspx?id=2710>