

# UHP-T

## LED Illuminator with

# UHPTLCC-02-STBL

## Controller

(with Power Stabilization)

# User Manual



Ver 3.1

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## 1 Introduction

The UHP-T LED is an Ultra High Power LED light source for various laboratory applications including fluorescence microscopy, Optogenetics, high power illumination and other applications. It is an effective replacement for spectral lamps and lasers.

The UHPTLCC-02-STBL current controller supports CW operation, TTL triggering control from computer via USB interface and active power stabilization by a reference photo-receiver.

### 1.1 Features

- Compatible with Prizmatix modular UHP-T-LED, UHP-Mic-LED and Mic-LED Light-Source products families – for creation of multi-wavelength setups for Fluorescence microscopy, Optogenetics, fiberoptic applications and more.
- Single chip Ultra High Brightness LED (Except UHP-T-LA product line).
- Optically isolated TTL input for external triggering (no shutter needed)
- LED spectrum can be narrowed by band pass filters or a filter wheel.
- Computer control via USB and LabView software
- Excellent for fluorescence excitation
- Stable precisely adjustable power
- Long life (no lamp or laser tube replacement required)
- Rapid warm up time

### 1.2 Intended use


The UHP-T is an Ultra-High-Power LED light source designed to be used in various scientific applications in laboratory. Few examples of use are fluorescence microscopy, whole body imaging of small animals, bio-analysis, photo-activation and numerous others.


## 2 Safety

### 2.1 General safety

Please make yourself familiar with the contents of these operating instructions before using the UHP-T system. Use the illuminator only as specified in this manual. Otherwise, the protection provided by the illuminator may be impaired.

The following symbols are used for the warnings:

 **CAUTION!** Failure to comply with the safety instructions can be hazardous to the user.

 **CAUTION!** Failure to comply with the safety instructions can result in damage to the instrument.

Do not use the illuminator if it is damaged. Before you use the illuminator, inspect the case. Look for cracks or missing parts.

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Do not use the device around explosive gas.

Never operate the illuminator with the cover removed or the case open.

Any maintenance should ONLY be performed by a Prizmatix authorized technician.

**Prizmatix products are NOT authorized for use as components in life support devices or systems.**

## 2.2 Eye safety

The UHP-T illuminator system is in **excess of the Exempt Group**. The viewer-related risk is highly dependent upon the use and installation of the product. For example if the product is attached to epifluorescence port of microscope the beam is restricted and in most case such system will be assigned to a Low Risk or Exempt Group, on the contrary if the illuminator is used for table top illumination of a Petri dish – such assembly may be of potentially High Risk Group. Each specific setup shall be evaluated and assigned to an appropriate risk group by the user and appropriate safety means should be taken. Herein below a free space unrestricted setup is analyzed and various models of UHP-T illuminators are assigned to appropriate Risk Groups. This assignment is a worst case analysis.

### 2.2.1 UHP-T illuminator assignment according to IEC 62471

The UHP-T illuminator is assigned to following risk groups according to IEC 62471: 2006. The assignment done based on the standard system configuration for table top illumination. The assignment results are summarized in Table 1.

**Table 1:** UHP-T illuminator assignment to risk groups according to IEC 62471: 2006.

Product Type	Assignment to Risk Group			
	Exempt RG0	Low Risk RG1	Mod Risk RG2	High Risk RG3
UHP-T-405-EP				√
UHP-T-455-EP				√
UHP-T-520-EP			√	
UHP-T-625-EP		√		
UHP-T-White			√	

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The UHP-T illuminators are marked on the product with following labels:

Product	Safety Label
UHP-T-405-EP	<div style="border: 2px solid black; background-color: yellow; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 3</b></p> <p>WARNING UV emitted from this product.</p> <p>WARNING Possibly hazardous optical radiation emitted from this product</p> </div>
UHP-T-455-EP	<div style="border: 2px solid black; background-color: yellow; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 3</b></p> <p>WARNING Possibly hazardous optical radiation emitted from this product</p> <p>CAUTION Possibly hazardous optical radiation emitted from this product</p> <p>NOTICE UV emitted from this product</p> </div>
UHP-T-520-EP	<div style="border: 2px solid black; background-color: yellow; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 2</b></p> <p>CAUTION Possibly hazardous optical radiation emitted from this product</p> </div>
UHP-T-625-EP	Not required
UHP-T-White	<div style="border: 2px solid black; background-color: yellow; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 2</b></p> <p>CAUTION. Possibly hazardous optical radiation emitted from this product.</p> </div>

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## 2.2.2 Special safety notes

Table 2 summarize the safety notes specific to various product types (IEC/TR 62471-2, 2009 Tables 1 and 2).

**Table 2:** Safety labels specific to various product types

Product	Safety Label
UHP-T-405-EP	<div style="border: 2px solid black; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 3</b></p> <p>WARNING. UV emitted from this product. Avoid eye and skin exposure to unshielded product</p> <p>CAUTION. UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding.</p> <p>CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.</p> <p>WARNING. Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.</p> </div>
UHP-T-455-EP	<div style="border: 2px solid black; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 3</b></p> <p>WARNING. Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.</p> <p>CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.</p> <p>NOTICE UV emitted from this product. Minimize exposure to eyes and skin. Use appropriate shielding.</p> </div>
UHP-T-520-EP	<div style="border: 2px solid black; padding: 5px;"> <p style="text-align: center;"><b>RISK GROUP 2</b></p> <p>CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.</p> </div>
UHP-T-625-EP	Not required
UHP-T-White	<div style="border: 2px solid black; padding: 5px;"> <p style="text-align: center;">Risk Group 2</p> <p>CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.</p> </div>

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## 2.2.3 Hazard Distances (HD)

Following Table 3 provides the distance from distal end of the fiber at which the threshold illuminance EL returns the product to RG 1.

**Table 3:** Distances from distal end of the fiber at which the photochemical hazard reduces to Risk group 1, for relevant products.

Product	Distance at which Blue-Light hazard reduced to Risk Group 1
	[m]
UHP-T-405	8.0
UHP-T-455	11.5
UHP-T-520	2.4
UHP-T-625	Already within RG1 at 0.2m
UHP-T-White	4.4

## 2.2.4 Permissible exposure duration ( $t_{max}$ )

The Permissible Exposure Durations for UHP-T product are calculated and reported in Table 4 below

Table 4: Permissible Exposure Durations for UHP-T product.










Product	Radiance	$t_{max}$
	[W·m <sup>-2</sup> ·sr <sup>-1</sup> ]	[sec]
UHP-T-405-EP	1.597E+05	6
UHP-T-455-EP	3.242E+05	3
UHP-T-520-EP	1.336E+04	75
UHP-T-625-EP	1.450E+02	6895
UHP-T-White	4.701E+04	21

## 3 Setup of the device

Remove the device from the packaging and inspect the device for loose components or any signs of damage. Notify Prizmatix if the device appears damaged in any way: do not install or operate a damaged device.

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## 3.1 Package contents list

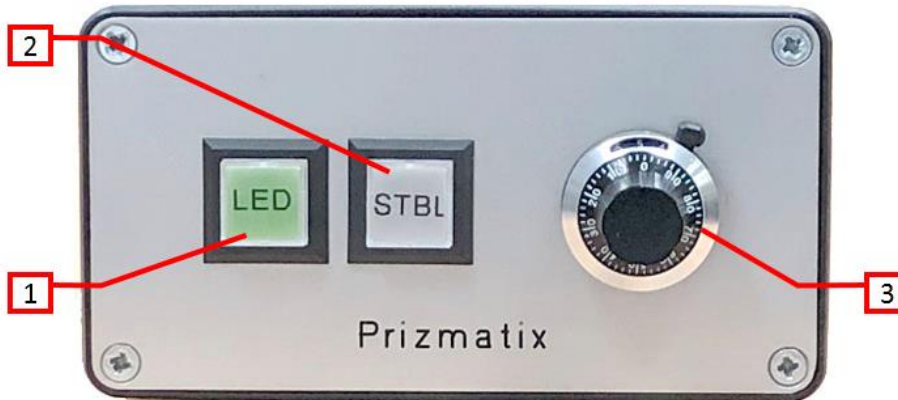
(1)		(2)	
(3)		(4)	
(5)		(6)	
(7)		(8)	
(9)			

#	Item	Description	QTY
1	UHP-T-LED Head	UHP-T-LED head, with Olympus / Zeiss / Nikon / Leica microscope adaptor assembled on it (optional).	1
2	UHPTLCC-02-STBL	UHP-T-LED Benchtop Current Controller with USB connection	1
3	LED Control Cable	Cable to connect the UHP-T-LED to Controller (4 pin connectors)	1
4	LED Current Cable	Cable to connect the UHP-T-LED to Controller (3 pin connectors)	1
5	Mains Power Cord	Cord to connect the power adaptor to mains voltage	1
6	Power Adaptor	Universal power adaptor	1
7	USB Cable	USB-A to USB-B Cable	1
8	PD-LT Photosensor	Photosensor for power monitoring at computer. Typically, this item will be assembled on UHP-T-LED head.	1
9	Photosensor cable	Cable to connect the photosensor to the UHPTLCC-02-USB controller.	1



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## 3.2 System overview:



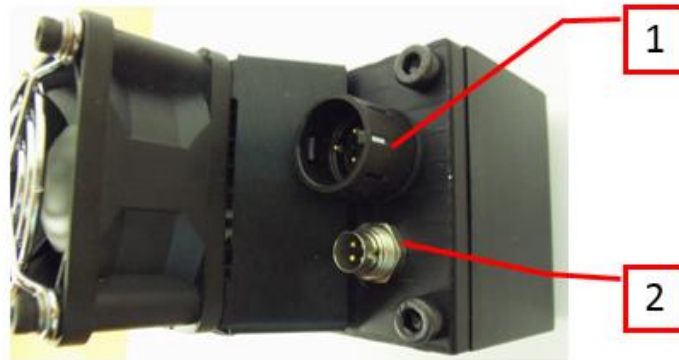
**Figure 1:** Front panel of UHPTLCC-02-STBL Current Controller: (1) LED On/Off switch with internal LED indicator, (2) STBL – LED power stabilization enable switch with internal LED indicator, (3) Power adjustment dial (10-turn potentiometer).



**Figure 2:** UHPTLCC-02-STBL LED Current Controller - back panel: (1) DC power jack, (2) Power switch, (3) LED current cable connector, (4) LED control cable connector, (5) Photosensor connector, (6) USB connector, (7) Indicator LED, (8) TTL input connector, (9) TTL-enable toggle switch.

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**Figure 3:** UHP-T LED illuminator head: (1) Connector for LED current cable, (2) Connector for LED control cable



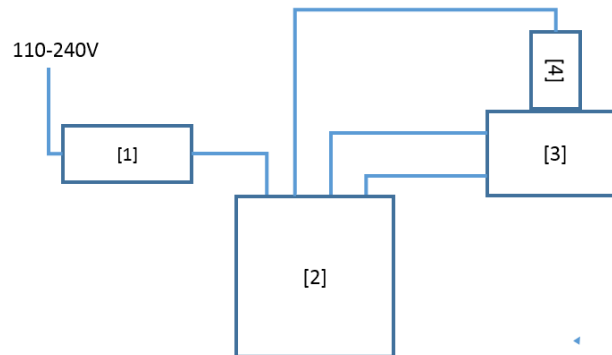
**Figure 3a:** PD-LT photosensor installed on the UHP-T-LED head: (1) D-Type 9-pin Connector for PD-LT cable

### 3.3 UHP-T illuminator system connection

1. Check that power On/Off switch on back panel is in OFF position.
2. Check that both LED and STBL buttons on front panel of UHPLCC-USB-STBL current controller is in OFF position (pulled out position).
3. Turn the LED power adjustment dial on the front panel of the current controller counterclockwise to the lowest setting
4. Connect the LED Control Cable and the LED Current Cable to the UHPTLCC-02-STBL LED current controller and to the UHP-T-LED head (See Figure 4 and 5 below).
5. Connect the PD-LT Photosensor Cable to the UHPTLCC-02-STBL current controller.

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**! CAUTION!** Both metal and plastic connectors have a key to prevent mating in incorrect orientation. Pay attention to connect the connectors correctly. Do not use excessive force!



**Figure 4:** UHP-T LED Illuminator cable connection: (1) Power Adaptor, (2) UHPTLCC-02-STBL controller, (3) UHP-T-LED head, (4) PD-LT Photosensor

5. Connect the Power Adaptor cord to the 12VDC jack on the back panel of the Current Controller.
6. Connect the Mains Power Cord to the Power Adaptor.
7. Plug the Power Adaptor into the wall outlet with the Mains Power Cord.
8. Switch the Int / Ext toggle switches at the back panel of current controller to Int position.
9. Switch the Power Switch on back panel to ON position.
10. Push the LED button on the front panel (LED emission switch). The button will light up..
11. Adjust the dial control to the desired output power level.

**! CAUTION!** Never disconnect the power cord form the product before switching the ON/OFF switch on back panel to OFF position

**Note:** The LED button's indicator on the front panel will turn ON, ONLY if all the cables from LED head to controller are connected.

**Note:** The LED head contains a thermistor to regulate the temperature of the LED. The fan is activated only once the LED begins to warm up. When the LED is switched on from a cold

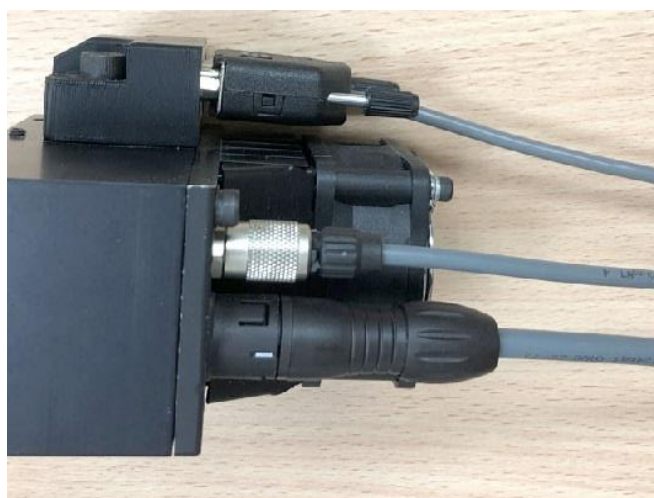
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state at the *maximum power* setting the fan will start to work after 5 - 30 seconds, depending on the LED wavelength and operation conditions.



**Figure 5a:** Cable connections on the back panel of the UHPTLCC-02-STBL current controller. Remark: PD-LT Photosensor Cable has 5 pin metal connector; LED Control Cable has 4 pin metal connector.



**Figure 5b:** Cable connections on the UHP-T-LED head

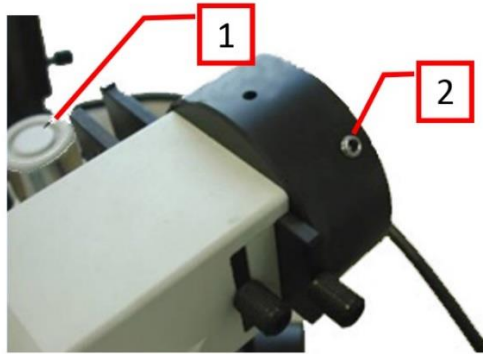
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## 3.4 Use of UHP-T LED illuminator on a microscope

### 3.4.1 Setting of the illuminator LED head on the microscope

1. The UHP-T-LED is designed to fit into the fluorescence lamp port of a microscope by using appropriate microscope adaptors.
2. Dismantle any existing fluorescence lamp (Hg, Xenon, etc.) from the microscope: most microscope manufacturers (Zeiss, Olympus, Leica) use set screws to tighten the lamp onto the port. Release the screws and carefully pull out the lamp. In the case of Nikon microscopes with an F-mount, turn the grooved collar counterclockwise and release the lamp.
3. Carefully insert the UHP-T-LED into the lamp port. Ensure the Z-adjustment screw is accessible and tighten the set screws (or collar in Nikon microscopes).
4. Observe the illumination. If needed adjust the UHP-T-LED axial focus by a Hex Key (2mm or 5/64")



**Figure 6:** Olympus microscope epi-fluorescence lamp port: (1) Olympus hex screw driver, (2) Light source fixation set screws.

### 3.4.2 Illuminator alignment on the microscope

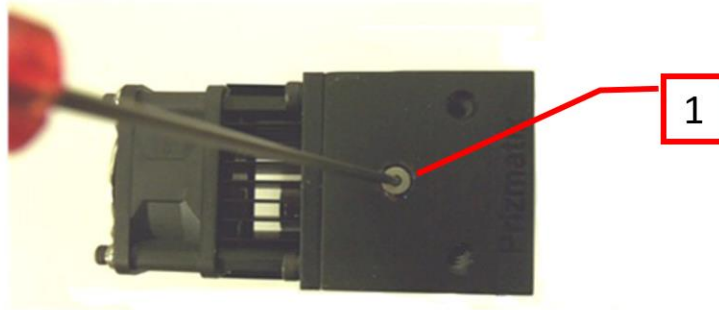
Z -alignment of the collimator lens is required to optimize the illumination provided by the UHP-T LED illuminator.

Adjustment of the Z placement of the collimating lens relative to the LED chip is done by slightly turning the Z-Adjust screw on the top of the UHP-T LED head (see Figure 7 below).

Note that the span of the screw motion is less than one full turn – this covers the full Z adjustment move.

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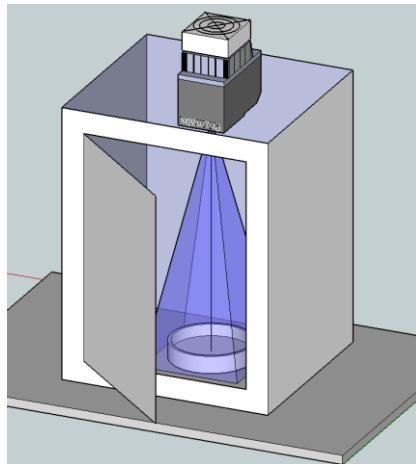
**Figure 6:** Z-Axis Focus Adjust: (1) Focus adjust screw

### 3.4.3 Disconnection of illuminator LED head from a microscope

1. Turn the power OFF and disconnect the cables from the LED head.
2. Loosen the two fixing set screws (or the F-mount collar on Nikon).
3. Pull out the UHP-T-LED head to disengage it from the microscope.

### 3.5 Use of UHP-T LED illuminator for table-top illumination

In case the UHP-T illuminator is used for table top application as illumination of Petri dish, the eye safety issues shall be considered. In order to minimize user and by stander exposure protection enclosure shall be considered, see example at Figure 7.



**Figure 7:** Protection enclosure for UHP-T LED illuminator used for Petri dish illumination experiment.

### 3.6 LED Control by TTL Input

The TTL input (TTL) BNC connector is placed at rear panel of the UHPTLCC-02-STBL controller, featuring the TTL connector and Int/Ext toggle switch as shown above.

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To control the LED by TTL input:

- Connect the BNC cable to the TTL input and to TTL trigger source.
- Switch the "TTL Enable" toggle to **Ext** position to enable the triggering

**! CAUTION!**

- The absolute maximum voltage to be applied to TTL is +5.5V.
- The internal pin of BNC connector is Positive (+).
- The external part of the connector is Negative (-).
- The TTL input is opto-isolated.

**! CAUTION!**

Using more than the maximum voltage or inverse polarity may cause permanent damage to LED and Current Controller!

### 3.7 Power Stabilization Mode

The regular operation mode of UHP-T-LED is constant Current Mode. In general, the output power of a LED is a linear function of LED current. Still some factors as increase in LED die temperature and aging may change the output power over the time. The aim of power stabilization system is to compensate these changes and operate the system in Stabilization Mode (STBL Mode) or constant power mode. The system comprises photosensor measuring the output power and transmitting the reference power data to a microcontroller. The microcontroller implements PID algorithm (for more details see [https://en.wikipedia.org/wiki/PID\\_controller](https://en.wikipedia.org/wiki/PID_controller) ). The microcontroller calculates the desired corrected control value and sends it to the Digital to Analog Converter (DAC). The DAC is the device that sets the control voltage of the LED driver that generates the LED high current.

The UHP-T-LED system can be switched from Current Mode to STBL Mode by pressing of STBL button at the front panel of UHPTLCC-02-STBL controller.

The following steps are correct usage of the stabilization system:

- (a) Turn ON the system by Power switch on back panel ( See Figure 2 item 2)
- (b) Ensure the TTL-enable toggle switch is in INT position (See Figure 2 item 9). The STBL Mode does not intend for operation in strobe mode
- (c) Press LED button on front panel to switch the UHP-T-LED ON and set the desired power by the dial (See Figure 1 items 1 and 3)

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- (d) After you reach the desired power press the STBL button (see Figure 1 item 2). The system will do a short calibration procedure, during this calibration procedure the STBL button will blink several times. When the STBL button will be illuminated constantly the STBL Mode is enabled.
- (e) When system power is changed by turning of the Dial or by switching the LED button to OFF the system quits the STBL Mode back to Current Mode. The STBL button light will change to OFF. In order to enable the STBL Mode again the STBL switch shall be depressed and pressed again.

## 3.8 Computer Control and Power Monitoring

To control the UHP-T-LED light (ON/OFF and output power) from computer the UHPTLCC-02-STBL shall be connected to the computer by USB cable and LED Control software shall be installed on the PC. The LED Control software can be downloaded from Prizmatix website:

<https://www.prizmatix.com/software.htm>

The User-Manual of the software is available at same place.

In order to monitor LED power on computer the UHP-T-LED head shall be equipped with PD-LT photosensor. The PD-LT shall be connected to the UHPTLCC-02-STBL controller by the photosensor cable.

When user will run the LED control software the UHPTLCC-02-STBL controller will acknowledge the software that PD-LT is connected and the LED Control software will show a Graph that will enable monitoring of LED set power and actual power as function of time. Please refer to the User-Manual of the LED Control software.

**Remark:** The UHPTLCC-02-STBL can be controlled from miro-Manager and MetaMorth. Additionally, any software capable of sending and receiving simple ASCII commands over a USB interface can be used. Few examples are MATLAB, LabVIEW, LabVIEW/CVI, VISUAL Basic and Python. Prizmatix can provide code examples and API for custom software programming.

**Remark:** The UHPTLCC-02-USB can be used with Raspberry-Pi running Python, ask for example code.



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## 4 Cleaning

Keep the UHP-T LED illuminator head clear from dirt and do not leave it open. Make sure to close the output aperture of the illuminator with a cap when it is not in use.

The UHPTLCC-02-STBL current controller box can be wiped with mild wet-wipes.

**! CAUTION!:**


Do not attempt to use chemicals, e.g. Alcohol or Acetone – you may damage plastic components!

## 5 Specifications

### 5.1 Electrical specifications

TTL Input		Optically isolated BNC connectors
TTL Input level	V	5
Current controller input supply voltage	V	12
Power Adaptor Input		85-264 VAC, 47-63 Hz, 1.5 A

### 5.2 General specifications

Operation temperature range	°C	10 - 35
Storage temperature range	°C	-10 - 55
Operating relative humidity (Non-condensing)	%	<90
Head dimensions		See drawing below
Head weight	g	450
Controller dimensions (L x W x H)	mm	166 x 106 x 56
Controller weight	g	450
Power adaptor dimensions (L x W x H)	mm	165 x 65 x 35
Power adaptor weight	g	570
Power Adaptor Safety		
LED Head fan noise	dBA	38