X-Cite® 200DC User Guide

X-Cite® 200DC User Guide
035-00446R Rev. 4
Made in Canada

Excelitas Canada Inc.
2260 Argentia Road
Mississauga ON   L5N 6H7 CANADA

Trademarks

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1   X-Cite® 200DC Message Reference

Display Message	Definition	Description
XXXX.	Lamp Hours	Displays the "hours of use" accumulated by the lamp
Flashing: "**XXXX**"	Warming Up	The lamp is warming up. Warm up time is approximately 4 minutes ref section 6.1
bulb	Lamp Error	Lamp installed incorrectly /Lamp did not strike. See section 8.3
cool	Lamp is too hot to strike	The lamp will automatically strike when it has cooled to the optimum striking temperature. See section 8.3
Alternating: **old / bulb**	Old Lamp	The lamp has accumulated over 2500 hours. Lamp may be near end of life.
Alternating: **end / bulb**	New Lamp Required	The lamp has reached end of life. The lamp will not strike.
SFI	Shutter Failure	The shutter has failed to return to home position. Unit should be restarted. If the error repeats, contact Tech Support.
E1	Lamp temperature is too high	Check ventilation filters and outlets to ensure that no blockage exists. Restart unit and if problem persists replace lamp. If problem continues contact Tech Support
E4	Internal hardware failure	Restart unit, if problem persists contact Tech Support
E5	Failure to communicate with Intelli-Lamp	Check Intelli-Lamp connection and restart unit. If problem persists try another lamp, if problem still persist contact Tech Support.
E6	Lamp self extinguished	Let system cool and restart lamp. If it goes out again, replace lamp. If new lamp continues to self-extinguish, contact Tech Support
E7	Internal system error	Restart unit, if problem persists contact Tech Support

See Section 8 for troubleshooting.

2   Introduction

The X-Cite$^®$ 200DC illuminator is the ultimate combination of ease of use and performance. Like the previous X-Cite$^®$ illuminators, the X-Cite$^®$ 200DC has the convenience of pre-aligned, long-life Intelli-Lamps, easy installation and compatibility with all major microscope brands. With smooth 0-100% intensity control, a high speed shutter and ultra-stable lamp output, the X-Cite$^®$ 200DC is an ideal choice for both routine assays and advanced imaging applications.

Excelitas Technologies Corp. is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of customers. X-Cite$^®$, formerly of Lumen Dynamics (which was acquired by Excelitas Technologies Corp. in November 2013) offers the Life Science and Analytical Instrumentation market a broad range of innovative lamp and LED fluorescence illumination and measurement solutions.

The X-Cite$^®$ 200DC is a high quality product manufactured in accordance with ISO 9001, CE marked and certified to UL, China RoHS and CSA standards.

We suggest that you read this manual to discover all its features, and how to use them.

Thank you for choosing X-Cite$^®$!

3 Safety

3.1 Glossary of Symbols

CAUTION - Risk of danger: consult accompanying documents

WARNING -Eye damage may result from directly viewing ultraviolet light – protective eye shielding and clothing must be used at all times.
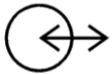
Input/Output Signals
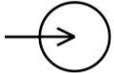
Input Signal

CAUTION – Hot Surface

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3.2 Safety Precautions

Please observe the following precautions during use. This series of cautions, warnings and dangers relate to the operation and maintenance of the X-Cite® 200DC. They are also presented throughout this User's Guide where necessary.

Warning
Eye damage may result from directly viewing the light produced by the lamp used in this product. Always use protective eyewear and turn the lamp off before removing cover.

Caution
Never look into the light emitting end of the light guide. The light could severely damage the cornea and retina of the eye if the light is observed directly. Eye shielding must be used at all times as well as clothing to protect exposed skin.

Warning
Always make sure the light guide is properly inserted into the X-Cite® 200DC and the microscope prior to turning on power to the unit. This will minimize the risk of exposure to the UV light.

Caution
UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding.

Warning
IR emitted from this product. Do not stare at operating lamp.

Caution
Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.

Caution!
To prevent damage/ degradation of the light guide, always allow adequate clearance at the front of the X-Cite® 200DC unit to prevent kinking or excessive bending.

Warning
To reduce the risk of fire or shock, always replace the fuses with the same type and rating.

Warning
Disconnecting of main supply source is only possible by unplugging the power cord.

Danger
This unit contains HIGH VOLTAGE components. It is recommended that ONLY QUALIFIED TECHNICAL PERSONNEL perform any testing or repairs described in this manual. Disconnect the AC power cord from the unit before opening the cover of this unit. All cover screws must be replaced prior to applying power to the unit, or safety of the unit will be impaired.

Monitoring the unit during manual operation
The level of UV and visible energy supplied by the X-Cite® 200DC is sufficient to ignite flammable substances. During manual operation, the unit must be attended at all times by a qualified operator. The unit must not be left unattended while turned on. If an operator leaves the work area of the unit, the lamp power switch must be turned off.

Monitoring the unit during Automated operation
The level of UV and visible energy supplied by the X-Cite® 200DC is sufficient to ignite flammable substances. Therefore, when the unit is operated unattended in an automated environment, an alarm function must be provided by the user to indicate a malfunction in the associated equipment used.

Warning
Hg – LAMP CONTAINS MERCURY, Manage in Accord with Disposal Laws, see: www.lamprecycle.org or 1-800-668-8752

Danger: Exposure to Mercury represents a health hazard to humans.
When unpacking or installing the lamp, always wear protective clothing and a face mask. Operate the lamp inside the X-Cite® 200DC housing only. This prevents direct viewing of the arc and in the case of lamp bursting, contains the lamp particles. In the rare instance in which a lamp bursting occurs, and the mercury content is released, the following safety precautions are recommended; all personnel should be immediately evacuated from the area to prevent inhalation of the mercury vapour. The area should be well ventilated for a minimum of 30 minutes. Prior to clean up ensure an 'approved-for-mercury' respirator mask and non-porous gloves such as latex or rubber are used. After the lamp housing elements have cooled, the mercury residue should be collected with the use of a special absorbing agent available from laboratory equipment suppliers.

Listed below are examples of internet web sites for obtaining Mercury Spill Kits;

- *http://www.rosshealthcare.org/Mercon.spill.kits.htm*
- *http://www.coleparmer.ca/catalog/product_index.asp?cls=43577*
- *http://www.environmental-expert.com/technology.aspx?idCategory=2054&word=mercury%20spill%20kits*
- *http://www.alibaba.com/products/spill_kit/4.html*

Warning
Should this X-Cite® 200DC unit be used in a manner not specified by Excelitas Technologies, the protection provided by the equipment may be impaired.

Warning
The method in which lamps are disposed of must comply with local rules and regulations for disposal of hazardous materials. Lamps may be returned to Excelitas Technologies providing they are returned in their original packaging. Excelitas Technologies will dispose of them in the appropriate manner.

Warning
This unit is designed for bench top use only! Always ensure that the unit is operated on a hard, stable surface. This will prevent obstruction of the bottom chassis ventilation openings. Any obstruction of these openings could result in a possible over-heating condition. Do not attempt to remove or tamper with the rubber feet located on the bottom of the unit.

Caution
The lamp module's operational life can be significantly shortened if it is handled incorrectly. Do not touch the bulb's glass envelope or the inside surface of the reflector. Skin oils can cause the lamp module to fail prematurely.

Caution
Prior to opening the unit and handling the lamp module, allow a minimum of 5 minutes for the lamp module to cool down completely.

Caution
Any electronic equipment connected to the X-Cite® 200DC must be comply with the requirements of EN/IEC 60950.

Cleaning:
Clean the exterior of the unit with a slightly dampened cloth and simple water/ detergent solution only.

4   Getting Started

4.1 System Components

Carefully unpack the unit and accessories. Ensure that all components are present. Store the packing material for future use.

Box Contents:
1. X-Cite® 200DC Illumination Unit…………………………………………………………….. ☐
2. Lamp Module, X-Cite® 200DC (012-66000R)……………………………………………….. ☐
3. Microscope Adapter (if ordered)…………………………………………………………….. ☐
4. Liquid Light Guide (3mm x 1.5m or 3mm x 3.0m)…………………………………………… ☐
5. Power Cord, IEC (shielded and grounded)………………………………………………… ☐
6. Quick Start Guide, X-Cite® 200DC
(User Guide download: http://www.excelitas.com/Pages/Product/X-Cite-200DC.aspx)…….. ☐
7. Foot Pedal Switch Assembly………………………………………………………………… ☐
8. Hex Key, 3mm (Lamp access cover)……………………………………………………….. ☐
9. Safety Precautions Booklet………………………………………………………………….. ☐

If your packaged unit is missing any of the above components,
call Excelitas Canada Inc, at (905) 821-2600
or TOLL FREE 1-800-668-8752.
Any additional optional items purchased to customize the unit will also be present.

4.2 Front Panel
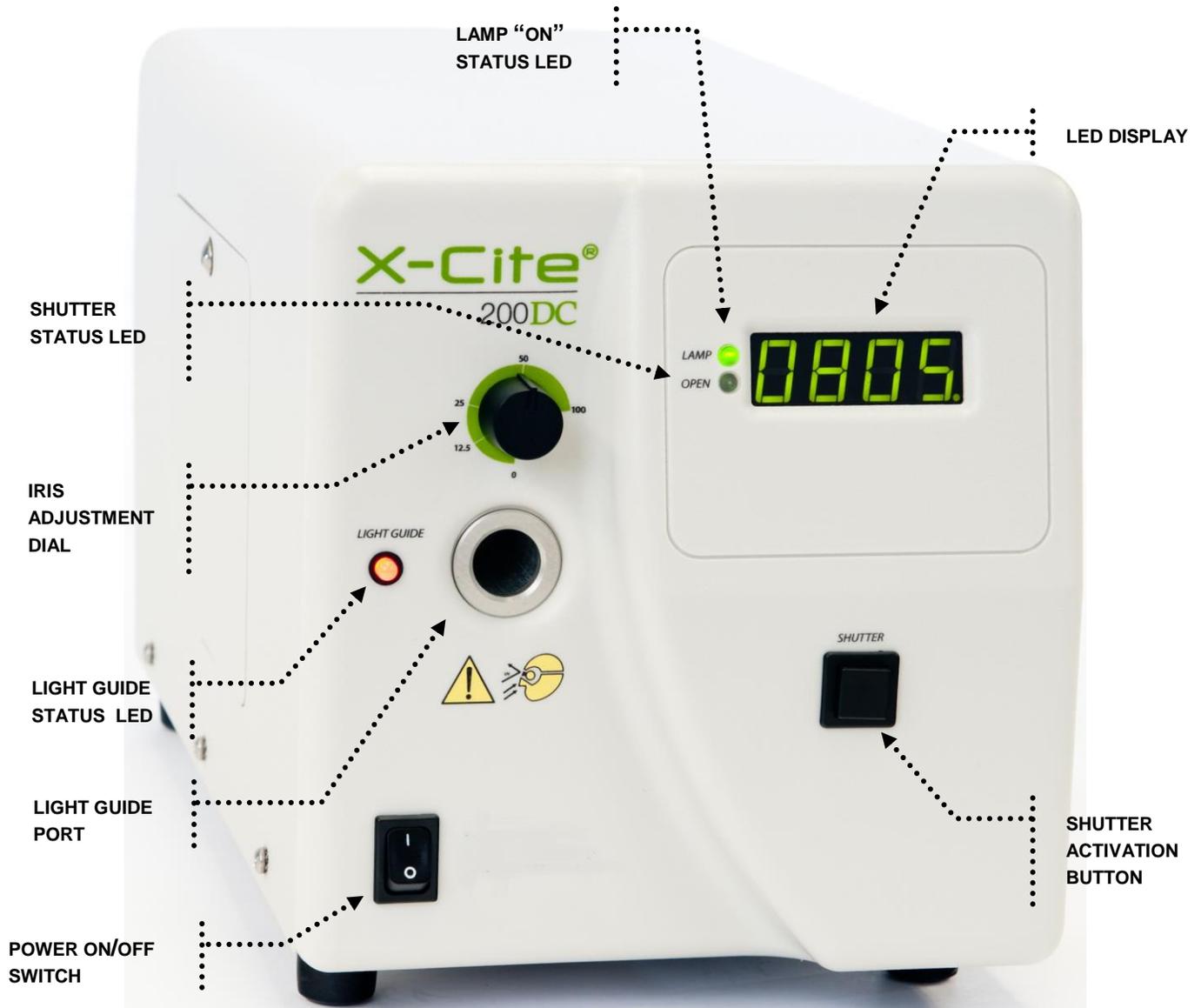
Figure 1 Front Panel

4.3 Rear panel

TTL INPUT FOR SHUTTER

TTL OUTPUT FOR SHUTTER SYNC

TTL IN

SYNC OUT

AC RECEPTACLE AND FUSE DRAWER

F5.0A 250V~

FP IN

FOOT PEDAL INPUT

Tel: (905) 821-2600
Fax: (905) 821-2055
e-mail. X-Citte@excelitas.com

Model No.:   XCT200
Input: 100-240V
          50/60Hz, 3.5/2.0A
Fuse: F5.0A 250V~
Lamp: 200 Watt Mercury Arc

XCT200-0001

US Patent # 6,333,602, 6,847,170
911-00037R Rev.0

MADE IN CANADA

RECOGNIZED
COMPONENT
CONFORMS TO
UL STD NO. 61010-1:2004
Intertek
3089355
CERTIFIED TO
CAN/CSA STD C22.2 NO. 61010-1-04

Figure 2 Rear Panel

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5 Installation/Set-up

5.1 Installing Lamp Module

5.1.1   Be sure the AC POWER cord is disconnected from the unit.

5.1.2   Remove the screw from the lamp housing side panel using the 3mm hex tool provided and remove the panel from the unit cover.
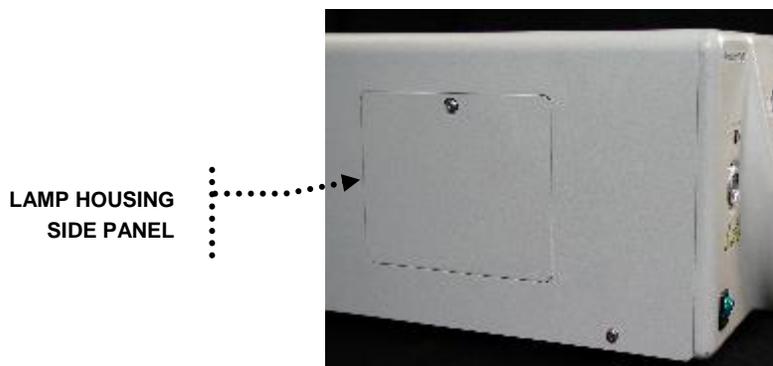
Figure 3 Side Panel

5.1.3   Carefully remove the lamp module from its container, holding only the ceramic component and lamp rim.

Caution! The lamp module's operational life can be significantly shortened if handled incorrectly. Be sure only to handle the ceramic surfaces and the lamp rim. Do not touch the bulb's glass envelope or the inside surface of the reflector. Skin oils can cause the lamp module to fail prematurely.

5.1.4   As illustrated below, position the lamp facing towards the front of the unit with the POWER leads facing towards you. The lamp should be aligned so that the leading edge of the reflector (lamp rim) fits into the mounting groove on the lamp holder assembly.
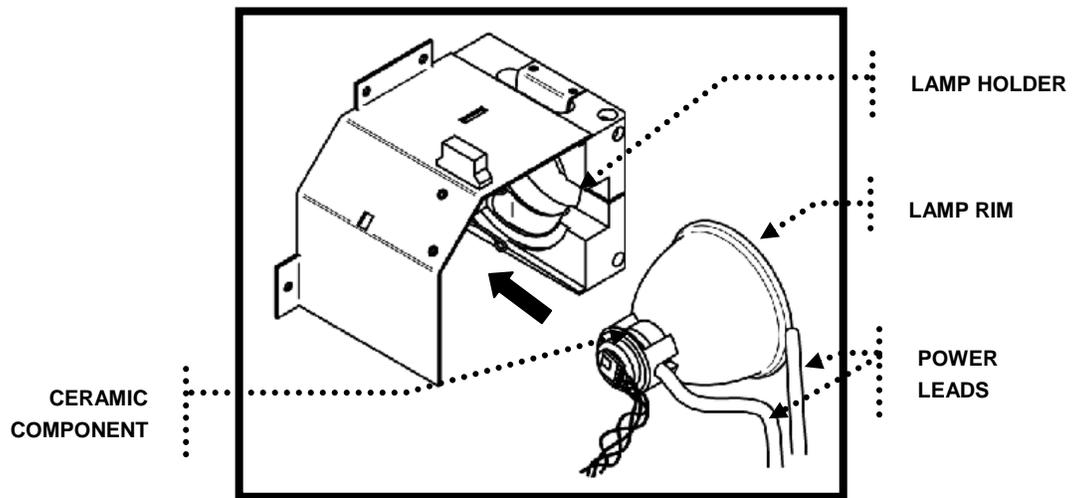
Figure 4 Lamp Housing

5.1.5   Make sure the middle of the lamp is in position to fit into the spring clamp. Slide the lamp until it snaps into the spring clamp. The leading edge of the reflector (lamp rim) should fit snugly into the lamp holder recess.

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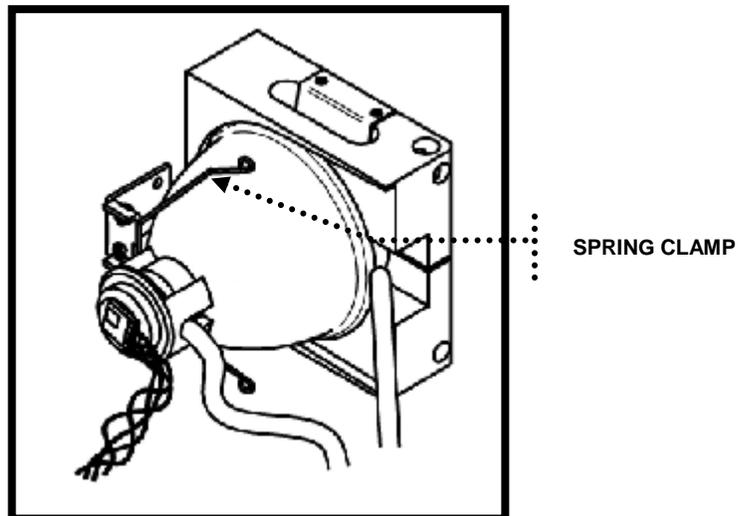
5.1.6   Locate the 4-pin Intelli-Lamp sensor connector at the rear of the lamp module and connect it to its mate located on the top of the lamp-housing wall.

Tip: The Intelli-Lamp connector will only attach in the correct orientation. If you are having difficulty attaching the connector, try rotating it by 180º.

Note: If the Intelli- Lamp connector is not installed correctly, the lamp will not strike and the "bulb" message will display when POWER is turned on to the unit.
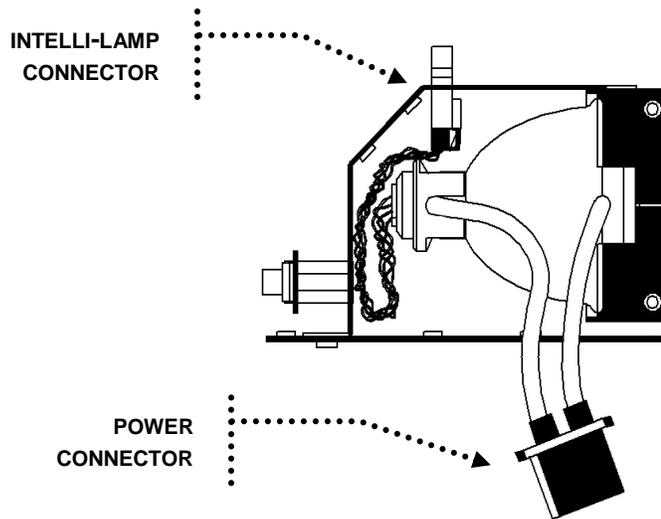
Figure 5 Lamp connections

5.1.7   Locate power connector with two leads and connect it to its mate located on the side of the lamp-housing wall.

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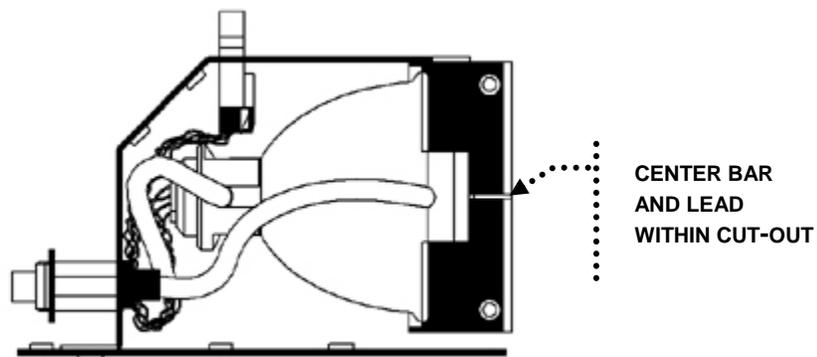
5.1.8   Ensure the lamp anode cooling fin (bar) and lamp power lead, at the front of the lamp, are centered within the lamp holder cut-out. Rotate the lamp as required.

5.1.9   Replace the lamp housing side panel and tighten the fastening screw.

> *Note: If the lamp housing panel is not secured completely the lamp will not strike and the "**bulb**" message will display when power is turned on to the unit.*

5.1.10 Replace the hex tool in the clips underneath the system for future use.

> **Warning** This unit is designed for bench top use only! Always ensure that the unit is operated on a hard, stable surface. This will prevent obstruction of the bottom chassis ventilation openings. Any obstruction of these openings could result in a possible over-heating condition. Do not attempt to remove or tamper with the rubber feet located on the bottom of the unit.

5.2 Inserting/Removing Light Guide

5.2.1   Ensure the power is not connected to the X-Cite® 200DC unit.

5.2.2   Ensure that the protective end caps are removed from both the input and output ends of the light guide prior to installation.

5.2.3   Remove plastic plug (if present) from the light guide port on the front panel of the X-Cite® 200DC.

5.2.4   Holding the light guide by the grey sleeve and strain relief portion only, insert the light guide into the light guide port. Push the light guide in until it seats with a second positive "click" (up to the "A" line printed on the grey ferrule).

> *Note: Never grip the light guide during installation or removal in a place other than the reinforced strain relief portion of the light guide.*
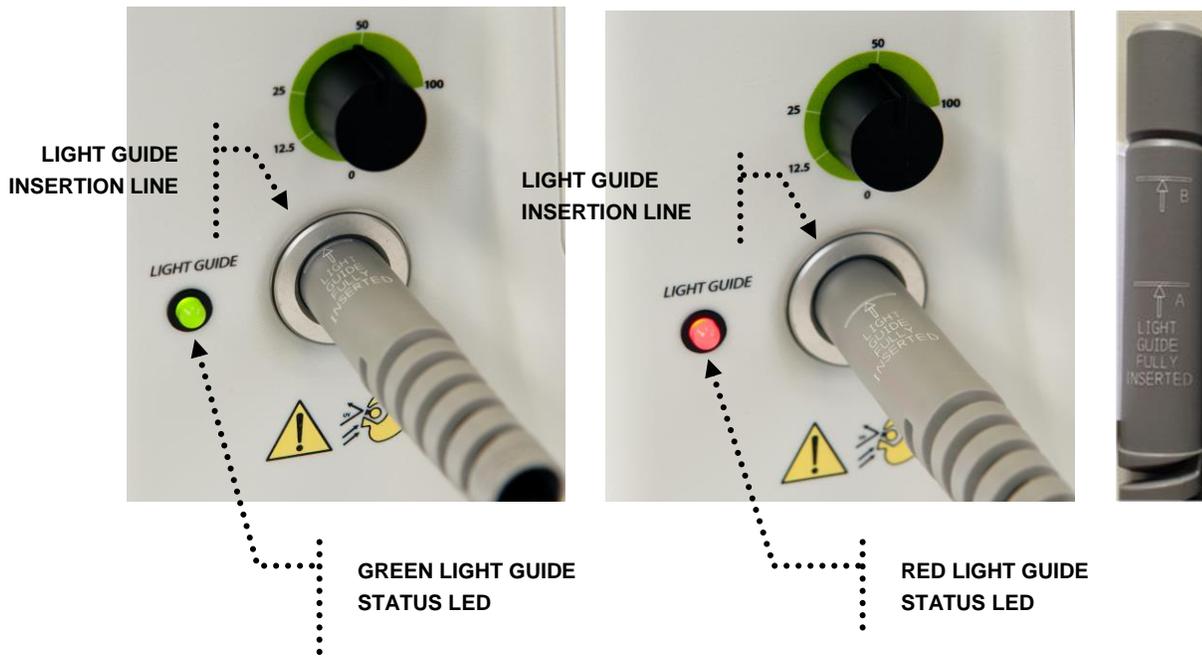
Figure 6 Light Guide Position

Tip: *When the light guide is fully inserted, the line on the light guide insertion label will be right up against the light guide port. Also, the LED above the light guide port will illuminate green when POWER is on to the unit. If the light guide is not fully inserted the LED will illuminate red.*

Note: *The shutter will not open if the light guide is not fully inserted.*

5.2.5   To remove the light guide, firmly grip the strain relief near the light guide retainer and pull out firmly.

Note: The X-Cite® 200DC is designed for use with a 3mm liquid light guide. Excelitas Technologies can not guarantee the performance of the X-Cite® 200DC if using light guides other than those supplied by Excelitas Technologies.

Note: The light guide has a minimum bend radius of 1.6 inches (40.mm). Bending or coiling the light guide tighter than this radius will result in permanent damage to the light guide.

5.3 Installing the Collimating Adapter

5.3.1   Ensure that the power is off on the X-Cite® 200DC unit.

5.3.2   The existing lamp housing must be removed from the microscope before the collimating adapter can be mounted. Do not discard the existing mounting hardware, since it will be used to secure the collimating adapter to the microscope.

5.3.3   Remove the collimating adapter from its packaging.

Note: The collimating adapter has been factory set. No adjustments by the customer are required; however some adapter models are outfitted with centering set screws, for longer light path applications. Separate instructions are included with these models.

5.3.4   Insert the flange portion of the collimating adapter into the lamp port of the microscope. Using the existing hardware, tighten the screw(s) until the flange is fully secured.

Note: The installation of the collimating adapter will vary with microscope models.

5.3.5   Remove the protective cap from the output end of the light guide. Insert the light guide into the input portion of the collimating adapter until it is flush with the adjustable insert. Secure the light guide to the collimating adapter by tightening the thumbscrew. Do not over tighten.

Note: The light guide has a minimum bend radius of 1.6 inches (40.0mm). Bending or coiling the light guide tighter than this radius will result in permanent damage to the light guide.
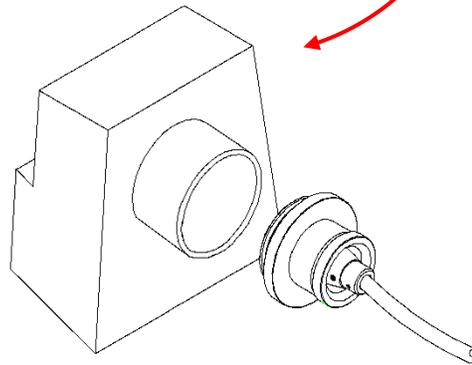
Figure 7 Collimating Adapter

⚠️ **Warning!**
Turning power to the on position without the light guide properly installed in the unit and in the microscope can increase your risk of exposure to UV light.

6   Operation

6.1 Powering Up/Powering Down

> ***Lamp Warm-Up:***
>
> *The ARC lamp has 3 distinct phases of operation;*
>   ***1. Ignition***.
>   ***2. Warm-up.*** *Excelitas Technologies recommends 20 minutes of*
>   *proper warm-up to ensure a stable optical output.*
>   ***3. Stable*** *Operation.*
> *It is recommended that phase 1 and 2 are not interrupted. This can result in*
> *shortened lamp life. The lamp must be allowed to warm-up uninterrupted**.***

6.1.1   Ensure that the lamp and light guide have been properly installed and that the lamp housing panel is securely fastened.

6.1.2   Plug the X-Cite® 200DC unit into a properly grounded AC outlet.

> **Warning!** Turning power on to the on position without the light guide properly installed in the unit and in the microscope can increase your risk of exposure to UV light.

6.1.3   Turn on the main POWER switch "I", located on the front panel and check the fan for airflow.

6.1.4   As soon as the LED display turns on, it will display the version of software currently programmed in the unit *(i.e. R – X)*. Once the software version level has been indicated, the display will reset after several seconds to the next display mode.

6.1.5   The lamp will automatically turn on within 45 seconds and the LAMP indicator will illuminate (green). The display will flash during the warm up period for approximately 4 minutes. The display will stop flashing when the warm up period has completed. Wait until the warm up period has completed before using the unit to illuminate a specimen. **Excelitas Technologies recommends 20 minutes to ensure a stable output**

   Note: Unit should not be turned off unless the lamp has been on for a minimum of 20 minutes.

6.1.6 To power down the unit after use, set the main power switch located on the front panel to "0".

> ***Note:*** *If the lamp is turned off, and an attempt is made to turn it back on before it has fully cooled, the "**Cool**" message will appear on the display and the lamp indicator will be un-lit. The lamp will automatically re-strike when the lamp has cooled, the lamp indicator will illuminate (green).*

6.2 Illuminating a Specimen

6.2.1 When the X-Cite® 200DC is first powered on, the internal shutter will be in the closed position as a safety precaution. If the shutter is not closed error code **SFI** will appear on the LED display.

6.2.2 To illuminate a specimen, press and release the **SHUTTER** button to open the shutter (**OPEN** LED will turn on).

6.2.3 Use **"Iris Adjustment Dial"** for intensity adjustment to desired level.

6.2.4 Press the **SHUTTER** button to close the shutter. The **OPEN** LED will turn off.

6.3 Front Panel Button Functions

Button	Condition	Description
I/O	Press on press off	Turns unit on "I" Turns unit off "0"
SHUTTER	Press and release	Opens/closes internal shutter

6.4 LED Indicators

LED Indicator	Status	Description
LIGHT GUIDE	On – green	The light guide is fully inserted
	On – red	The light guide is not fully inserted
LAMP	On - green	The lamp is on
	Off – no illumination	The lamp is off
OPEN	On - green	The shutter is open
	Off – no illumination	The shutter is closed

6.5 Display Format Reference

6.5.1 The formatting used on the display board is used to identify the unit of measurement or phase of operation.

Display Format	Definition	Description
XXXX.	Lamp Hours	Displays the "hours of use" accumulated by the lamp
Flashing: "**XXXX**"	Warming Up	The lamp is warming up. Warm up time is approximately 4 minutes

6.6 Adjusting Light Output
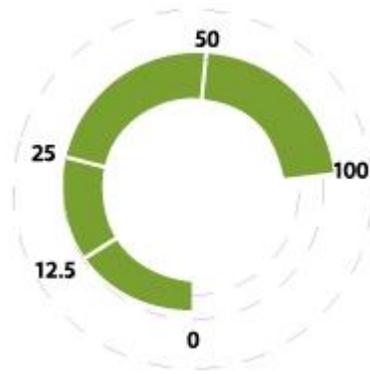
Figure 8 Iris Adjustment Dial Layout

6.6.1 To adjust light intensity, use the Iris Adjustment Dial and set to desired level by turning. Clockwise to increase light intensity and counter-clockwise to decrease light intensity.

6.6.2 There are no detent stops, motion is smooth starting from 0% and ending at 100%. 0, 12.5, 25, 50, 100% are marked on the fascia around the dial for reference (ref. Figure 8)

6.6.3 Note that as the lamp ages, absolute power at a given setting will decrease. Adjust the intensity as necessary. If monitoring absolute value of lamp output is desired, refer to section 6.8 or contact Excelitas Technologies about purchasing an X-Cite® Optical Power Measurement System (OPMS).

6.7 Viewing Accumulated Lamp Hours

6.7.1 The X-Cite® 200DC system automatically accumulates the number of hours for which the lamp has been on by saving it to the Intelli-Chip on the lamp, and shows this information on the LED display. The lamp hours are shown when the unit is powered on and after lamp has warmed up.

6.8 Power Measurement (Optional)

6.8.1 If your X-Cite® 200DC was purchased with the X-Cite® Optical Power Measurement System accessory, power output can be measured at the end of the light guide using the XR2100 or at the specimen plane using the XP750.

Note: To learn more about the OPMS or to purchase the OPMS accessory contact Excelitas Technologies.

XR2100 Optical Power Meter with Light Guide Input;

1. Install the supplied light guide adaptor corresponding to the size of your light guide into the Optical Input Port of the XR2100

2. Ensure the X-Cite® 200DC shutter is closed and set Iris to the desired intensity level.

3. Remove light guide from microscope adapter and insert the light guide end into the light guide adaptor and fasten in place using the supplied thumb screw.

4. Open shutter and turn the XR2100 to ON.

5. Use **Relative/Absolute** button on the XR2100 to adjust display mode of measurement.

XP750 Objective Plane Power Meter Sensor (with upright microscopes);

1. Plug the XP750 multi-pin connector into the XR2100, turn the XR2100 to ON.

2. Place the XP750 onto the stage with the detection window facing up, and approximately centered beneath the microscope objective lens.

3. Secure the XP750 in place using the microscope's stage clip and the supplied suction-cup ensuring the XP750 is seated firmly and sits flush on the stage.

4. Turn on the epi-fluorescence light source and open the microscope shutter, ensure that the filter cube in the beam path is directing visible light to the microscope stage

5. To align the detection window with the visible light from the microscope objective, use the microscope stage x-y controls, ensuring the light is centered within the window.

6. Engage the appropriate objective, filter cube, intensity and other microscope settings and press the '**λ(nm)'** button on the XR2100 to see the current wavelength setting.

XP750 Objective Plane Power Meter Sensor (with inverted microscopes);

1. Plug the XP750 multi-pin connector into the XR2100 turn the XR2100 to ON.

2. Place the XP750 onto the stage with the detection window facing down, and approximately centered beneath the microscope objective lens. The + icon (etched inside a circle) should be facing up which marks the center of the detection window.

3. Secure the XP750 in place using the microscope's stage clip and the supplied suction-cup ensuring the XP750 is seated firmly and turn on the transmission light source and using the microscope stage x-y controls, center the light on the + icon.

4. Engage the appropriate objective, filter cube, intensity and other microscope settings and press the '**λ(nm)'** button on the XR2100 to see the current wavelength setting.

Note: To learn more about the OPMS or to purchase the OPMS accessory contact Excelitas Technologies.

6.9 Warnings and Alarms

6.9.1   The X-Cite® 200DC is designed to detect certain conditions that may affect safe
or proper functioning. These conditions are categorized as one of two "alarm
types" according to the danger they pose to the operator, system or experiment:

1. Critical Safety – continuing may cause harm to the operator or equipment,
   alarm is an audible 3 beep "Alarm Condition".
2. Function – operation may continue, but depending on specific alarm
   condition, functionality of unit may be limited or impossible (e.g. lamp too hot
   to strike)

Alarm Condition	Alarm	Type	Other Actions/ Corrections
Light guide is not inserted properly and/or removed while shutter is open or an attempt is made to open the shutter	LIGHT GUIDE LED turns red, "3 beep" audible alarm	Critical Safety	Shutter shall automatically close and be disabled from opening until light guide is inserted
Lamp failure to strike	Display "BULB"	Function	
Lamp too hot to strike	Display "CooL"	Function	Automatically attempts to re-strike lamp when cool
Shutter failure	"3 beep" audible alarm display "SF1"	Critical Safety	If failure to close—lamp turns off
Lamp overheated	"3 beep" audible alarm. Display "E1"	Critical Safety	Lamp turns off
Lamp self-extinguish or non-passive failure	"3 beep" audible alarm. Display "E6"	Critical Safety	Fan/blower shall shut off

6.10 Clearing Alarms

6.10.1 The X-Cite® 200DC provides an audible alarm (3 beeps only) to alert the operator
of various error conditions. After the 3 beeps have counted off, the alarm will
automatically shut off.

7 Shutter Control

7.1 Shutter Control via Foot pedal

7.1.1 For hands-free operation, the X-Cite[®] 200DC is equipped with a foot pedal. The foot pedal is an alternative to the SHUTTER button and can only be used to open and close the internal shutter. To use the foot pedal:

1. Plug the foot pedal into the 3.5mm audio style port labelled FP on the back on the X-Cite[®] 200DC.
2. Place the foot pedal on the floor or another conveniently located flat surface.
3. Power-up the X-Cite[®] 200DC as normal, and wait for the lamp to warm up.
4. Press down on the foot pedal until it clicks to open or close the shutter.

7.2 Shutter control via TTL

7.2.1 For high-speed shutter activation, TTL control can also be used. The plot below shows typical timing values for the X-Cite[®] 200DC internal shutter when controlled by TTL. Note that these values should be used as a guide only, and that actual values will vary slightly from unit to unit.
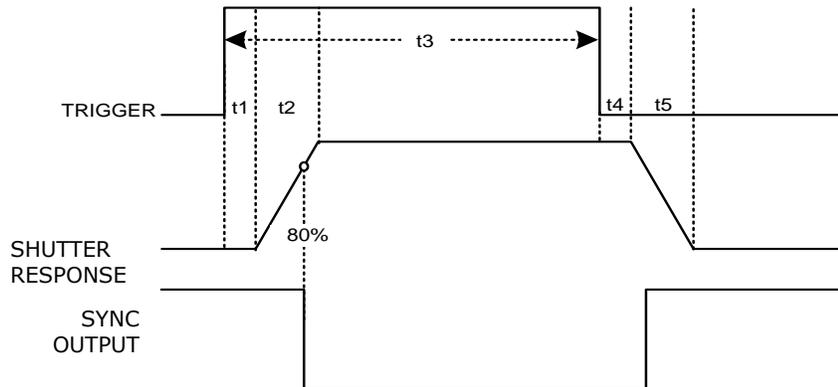
Interval	Description	Time (milliseconds)
t1	Delay time, trigger to start of opening	4
t2	Start of opening to 100% open	2
t3	Minimum recommended exposure time (trigger open to trigger close)	40
t4	Delay time, trigger to start of close	4
t5	Start of close to 0% open	2

Note: Using values of t3<40ms may result in shutter bounce-back and a brief unintentional exposure period.

TTL Signal and Shutter Status

TTL	Shutter	Sync
high	open	low
low	closed	high

TTL INPUT (BNC)
Maximum low-level +0.8VDC
Minimum high-level +2.0VDC
Maximum high-level +5.5VDC
Typical input current: 800uA

SYNC OUT (BNC)
Maximum low-level +0.8VDC
Minimum high-level +4.5VDC
Maximum output current: 500uA

8   Troubleshooting

Service to be completed by qualified repair personnel only!

8.1 Error Codes

If the X-Cite® 200DC internal monitoring systems identify a problem, an error code will be generated. Definitions and recommended actions are in the following table.

Code	Error Description	Recommended Action
E1	Lamp temperature is too high	Check ventilation filters and outlets to ensure that no blockage exists. Restart unit and if problem persists replace lamp. If problem continues contact Tech Support. See also section 8.7
E4	Internal hardware failure	Restart unit, if problem persists contact Tech Support
E5	Failure to communicate with Intelli-Lamp	Check Intelli-Lamp connection and restart unit. If problem persists try another lamp, if problem still persist contact Tech Support.
E6	Lamp self-extinguished	Let system cool and restart lamp. If it goes out again, replace lamp. If new lamp continues to self-extinguish, contact Tech Support
E7	Internal system error	Restart unit, if problem persists contact Tech Support
bulb	Lamp Error	Lamp installed incorrectly /Lamp did not strike.
cool	Lamp is too hot to strike	The lamp will automatically strike when it has cooled to the optimum striking temperature
Alternating: **old / bulb**	Old Lamp	The lamp has accumulated over 2500 hours. Lamp may be near end of life.
Alternating: **end / bulb**	New Lamp Required	The lamp has reached end of life. The lamp will not strike.
SFI	Shutter Failure	The shutter has failed to return to home position. Unit should be restarted. If the error repeats, contact Tech Support.

8.2 Power Up Failure

If the unit fails to POWER up or function properly, use the following checklist to eliminate the most common causes of problems. Check that:

1. The AC POWER cord is securely plugged into a functional AC wall plug.
2. The AC POWER cord is securely plugged into the AC inlet on the rear of the unit.
3. The main AC POWER switch is in the ON position.
4. Check that the ventilation openings on both the bottom and rear of the unit are not blocked.

If the unit still does not power-up:

5. Check both main power fuses by first disconnecting the power cord. Then carefully remove the fuse drawer assembly below the AC inlet on the rear of the unit. If the fuse(s) is/ are open, replace with the same type (5A, 250 V, Fast acting).

8.3 Lamp Strike Failure

If the LED display lights and the fan starts, but the lamp will not turn on, check for the following:

1. The LED display indicates the "**bulb**" message and the system begins to beep. This indicates that no lamp is detected. Check if the lamp has been installed correctly. Refer to section 5.1– Installing the Lamp Module.
2. The LED display indicates the "**bulb**" message after approximately 45 seconds and the system will beep 3 times as an audible warning. This indicates that the lamp has failed to strike. It may be a result of the lamp reaching end of life, or that the lamp housing panel is not secured properly in place. Press the MODE button to clear the audible alarm. Turn power off to the unit. Check that the lamp housing panel is secured properly. Wait a few minutes and turn the power on to the unit. If it still does not strike, replace the lamp.
3. The LED display indicates the "**Cool**" message. This indicates the lamp is too hot to strike. The lamp will automatically strike when it has cooled.

8.4 Low Light Intensity

If the light intensity is too low, check that:
1. The percent iris opening is set high enough, if not turn Iris Adjustment Dial to a higher setting.
2. There are no foreign substances on the emitting end of the light guide.
3. There are no bends, kinks, or other physical damage to the guide. Replace the light guide if there is any physical damage.
4. The lamp has been installed correctly. See section 5.1– Installing the Lamp Module.
5. Check the microscope settings, filter cubes, ND filters, manual stops, polarisers, and position of camera port beam splitters for anything that may be blocking the light path between the X-Cite® and eyepieces/camera.

It may be necessary to replace the lamp or to replace the light guide. Contact your Excelitas Technologies sales representative for information on purchasing a new lamp or light guide.

8.5 Shutter Failure

If the shutter does not open, check that:

1. The light guide is fully inserted; the LED above the light guide port will be illuminated green. The lamp is warmed-up; the display is not flashing. The iris setting is not at 0%.

2. If the LED displays **"SF1"**, indicating a shutter failure. POWER down the unit, wait a few minutes and turn POWER on to the unit. If the unit displays a shutter failure again, contact your local Excelitas Technologies Service Center to have your unit serviced.

8.6 LED Display Failure

If the LED display does not light:
1. If the fan is functional, POWER down the unit, wait approximately 20 seconds then POWER it up again.
2. If the problem persists, contact your local Excelitas Technologies Service Center.

8.7 Cooling Fan Failure

If one or more fans do not work:
1. If the LED display is functional, POWER down the unit, wait approximately 20 seconds then POWER it up again.
2. If the problem persists, contact your local Excelitas Technologies Service Center.

9   Care and Maintenance

9.1   General

This section contains installation, maintenance and troubleshooting tips to help optimize the lifetime and performance of X-Cite® 200DC units and components. This information is intended to supplement the detailed installation and operating instructions found in the X-Cite® User Manuals. Topics covered include liquid light guides, lamps, and air vents – the components most likely to affect performance over time and require maintenance or replacement. Note that the lifetime information on components is for typical or average conditions. Depending on the imaging application, more frequent replacement may be required—for example, if a fluorophore's signal is low to begin with, or is excited by a low power portion of the X-Cite® 200DC lamp's output spectrum.

9.1.1   Operate the unit in a well ventilated area with at least six inches clearance at the rear of the unit for proper air flow. Do not place any objects below the unit, between the feet as this will restrict airflow through the bottom of the front face plate.

9.1.2   For safe operation, use only a grounded outlet.

9.1.3   Avoid physical shocks or jarring to the unit especially while the unit is operating. Such sudden movements reduce the lamp module life.

9.1.4   The lamp module must be operated for a minimum of 20 minutes each time it is turned on to prevent damaging the lamp. Increasing the time between turning the lamp module on and off will maximize lamp life.

9.1.5   Replace the air filter, found under the front face plate, frequently to ensure unrestricted air flow. It is recommended as a minimum that the air filter be replaced every time the lamp module is replaced.

   Note: restricted airflow can cause the lamp temperature to increase above optimum temperature, significantly reducing lamp life.

9.1.6   When necessary, clean the light emitting end of the light guide using an optical cleaning solution.

9.1.7   Cleaning of unit is not required, however if cleaning is desired, disconnect the AC power cord from the unit and use only a water and simple detergent solution. Ensure that cleaning solution does not come in contact with any optical, moving mechanical or electrical parts.

9.2 Liquid Light Guides

Tips to Prevent Premature Degradation of Light Guides

9.2.1   Liquid light guides have a typical useful life of 2-3 years/4000 operational hours in the X-Cite® 200DC when installed and handled properly. The formation of bubbles is one of the most common reasons for a light guide to degrade prematurely and result in a sudden reduction in illumination intensity. Bubbles form without warning, usually due to overheating and/or mechanical stress to the light guide. Below are some simple tips to avoid overheating and stressing the light guide.

9.2.2   The light guide has a minimum bend radius of 1.6 inches (40.0mm) however, a bend radius of at least 75mm is recommended for a light guide while "in use". Sharper bends can cause heat to build up and cause problems longer term. Bending or coiling the light guide tighter than this radius will result in permanent damage to the light guide. Minimum bend radius to prevent immediate damage to the LLG is 40mm,.

9.2.3   Make sure the light guide is cooled properly during use, and prevent overheating:
   a. Always fully insert the light guide in to the X-Cite® 200DC; this ensures contact with a heat sink to conduct heat away from the light guide.

   b. Never obstruct the air vents on the X-Cite® 200DC. Vents are located at the rear and underside of the unit.

   c. Do not remove the rubber feet on the X-Cite® 200DC or otherwise reduce/block the space between the bottom of the unit and bench top. This may compromise airflow through the unit.

   d. Ensure that the air being used to ventilate the X-Cite® 200DC is approximately "room temperature" (e.g. do not place the X-Cite® unit on top of another heat-producing instrument).

   e. If a heated environmental chamber is being used for live cell imaging, make sure that the X-Cite® 200DC and the light guide are located outside of the chamber.

9.2.4   Do not expose the light guide to extreme temperatures (above 35°C, below -5°C) for extended periods of time during use, transport or storage; this may cause degradation of the seals and allow air bubbles to form in the liquid.

9.2.5   Never kink, bend, crush, or stretch the light guide; this type of mechanical stress may cause bubbles to form in the liquid and/or damage to the outer sheath
   a. Always allow adequate clearance between the light guide port of the X-Cite® 200DC and other objects to prevent excessive bending.

   b. Place the X-Cite® 200DC close enough to the microscope so that there is some slack in the light guide and no sharp bends.

9.2.6   Never leave an endcap on the output end of the light guide when the other end is connected to the X-Cite® 200DC; if the unit is turned on in this condition, the cap will overheat, melt and/or permanently discolour the quartz end of the light guide.

9.2.7   While the X-Cite® 200DC is on but not in actual use (i.e. during sample preparation, or between time lapse time points) close the iris/shutter on the X-Cite®; this reduces unnecessary UV photon load on the liquid light guide. (Using only the shutter/stop in the microscope itself protects the specimen, but energy is still passing through the light guide.)

Proper handling and installation of liquid light guides

9.2.8   Liquid light guides have a typical useful life of 4000 hours of operation when handled properly and installed in a well maintained X-Cite® 200DC. The formation of bubbles is one of the most common reasons for a light guide to degrade prematurely and result in a sudden reduction in illumination intensity. Bubbles can form without warning, and if they occur within the first 1500 to 2000 hours of use, is it typically due to overheating and/or mechanical stress to the light guide. Below are some simple tips to avoid overheating and stressing the light guide;

9.2.9   Always fully insert the light guide in to the X-Cite® 200DC (refer to section 5.2); this ensures contact with a heat sink to conduct heat away from the light guide.

9.2.10 Always place the X-Cite® 200DC close enough to the microscope so that there is some slack in the light guide and no sharp bends.

9.2.11 Never leave an endcap on the output end of the light guide when the other end is connected to the X-Cite® 200DC; if the unit is turned on in this condition, the cap will overheat, melt and/or permanently discolour the quartz end of the light guide.

9.2.12 Do not expose the light guide to extreme temperatures (above 35°C, below -5°C) for extended periods of time during use, transport or storage; this may cause degradation of the seals and allow air bubbles to form in the liquid.

What does a bubble look like?

9.2.13 Depending on the size and location in the light guide, a bubble may or may not be obvious. To check for bubbles:

9.2.14 Disconnect the LLG from the X-Cite® 200DC and microscope adapter.

9.2.15 Hold one end towards a bright window or overhead room light - DO NOT use an X-Cite® 200DC or any other focused light source for this test!

9.2.16 Look at the quartz at the other end of the LLG
   a. Bubble-free: quartz end will appear as a bright, solid circle; you may also be able to see a thin circular outline at the quartz/liquid interface.
   b. Bubbles at/near the quartz end: appear as dark spots, as small as 0.5mm in diameter or even as larger more defined spheres.
   c. Bubbles in the middle of the light guide: may not be well-defined spots, but will appear as dark shadows.
   d. In extreme cases, where the bubble is blocking the entire diameter of the light guide, no light will come through, even when pointing the distal end at a light source.
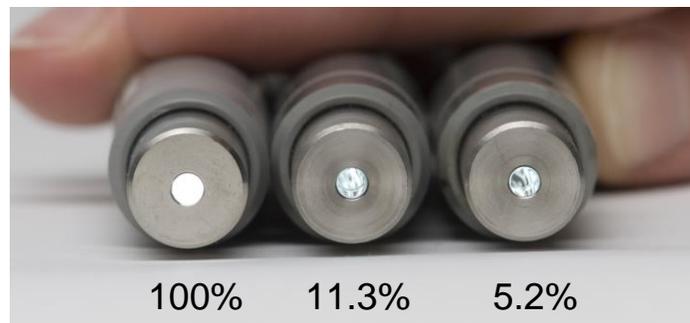
**Appearance and % output of light guides
with bubbles relative to an LLG without bubbles (100%).**

Can a bubbled light guide recover?

9.2.17 Yes, light guides with small bubbles can sometimes recover. Disconnect the light guide from the X-Cite® 200DC, and leave the light guide undisturbed on a shelf for 1-2 weeks. For this to be effective, it is important to catch the bubble when it is small.

When should light guides be replaced?

9.2.18 It is usually time to replace a light guide when:

1. Illumination is low and replacing the lamp does not improve brightness
2. Dark or uneven areas become visible in the field of view (a bubble is blocking part of the light)
3. A section of the light guide becomes noticeably warmer than the rest of the guide (a bubble is blocking transmission of light, forcing the light guide to absorb the energy)
4. It is 2-3 years old OR has been in use for 4000-6000 hours (2-3 lamp changes)

9.3 Lamps

Spectrum and lifetime

9.3.1 The lamp output and typical output levels over lifetime are shown below.

Lamp Output Spectrum X-Cite® 200DC
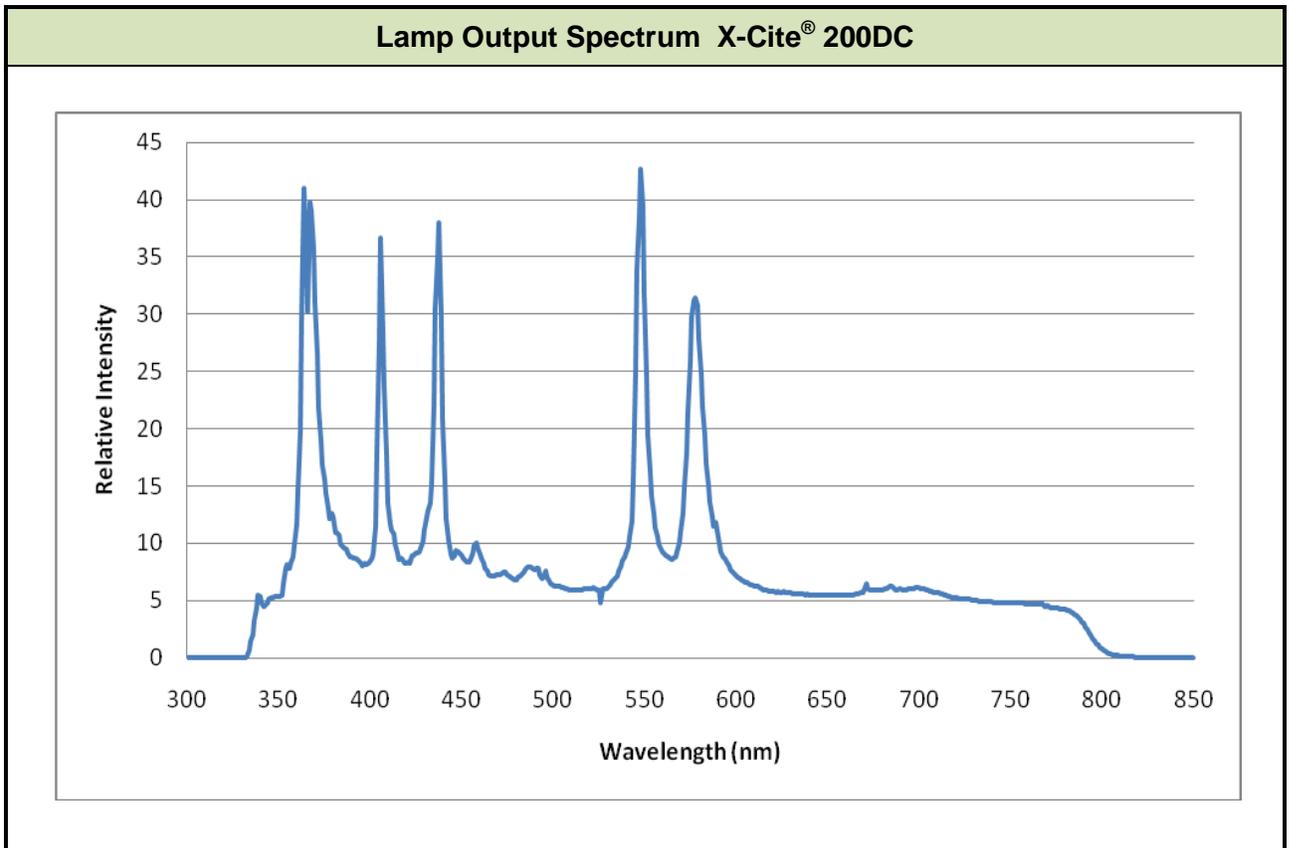
9.3.2   It is normal for the output to decline over the first several hundred hours of use and then stabilize at a level ~70% of the initial output for the remainder of the lamp life. If the lower power regions of the output spectra are being used, it may be desirable to replace lamps more frequently to maximize signal levels.

X-Cite® 200DC Lamp: Typical Degradation

X-Cite exacte Lamp: Typical Degradation

X-Cite® 200DC User Guide
035-00446R rev. 4
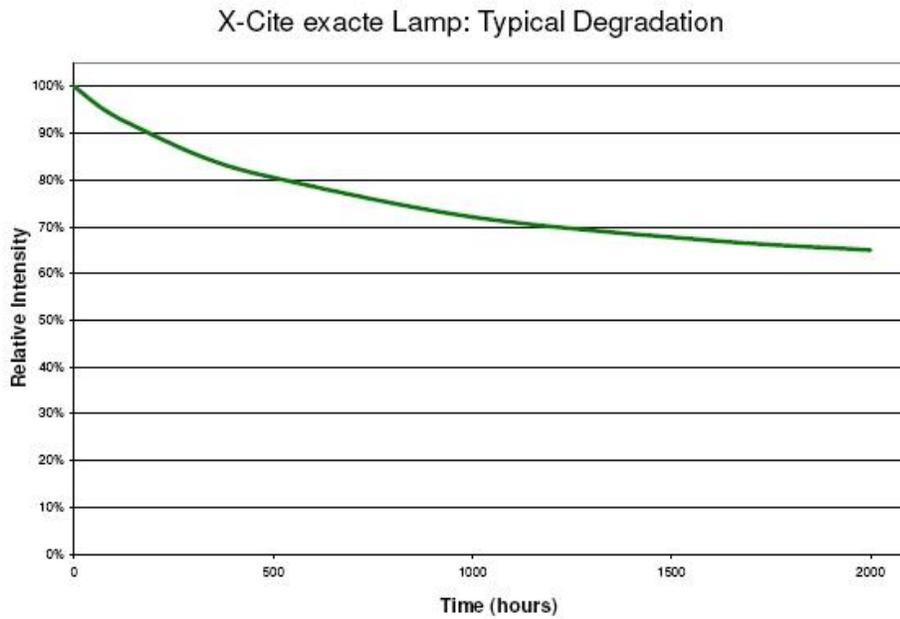
General tips to help maximize lamp lifetime:

1. Each time the lamp is ignited, the stress on the lamp effectively decreases lamp life by 5 hours, therefore it is recommended to avoid shutting down the unit during lunch or short breaks or between users, if being used in a multi-user lab

2. After lamp ignition, avoid turning the lamp off until it has run for a minimum of 20 minutes

3. Avoid attempting to strike a hot lamp (note: the X-Cite® 200DC Intelli-Lamp will prevent this)

4. Avoid unnecessary movement and jarring of the lamp, especially when it is in operation or hot.

5. When changing a lamp:

    a. Handle the lamp only by the ceramic areas

    b. Never touch the glass envelope of the bulb (inner stem), the inner surface, or the outer surface of the reflector. If touched, carefully clean the envelope with alcohol. Skin oils can etch the glass and cause premature bulb failure

    c. Wear cotton gloves or powder free latex/nitrile gloves when handling any lamp

6. Ensure that air filters are kept clear of dust and debris – even a partially blocked filter can reduce lamp lifetime to approximately 25% of what is normally expected.

9.4 Replacing the Lamp Module

9.4.1 The X-Cite® 200DC is designed to operate only with the X-Cite® 200DC lamp module supplied by an <u>authorized Excelitas Technologies distributor</u>. When the lamp requires replacing, use only:

Excelitas Technologies Part #	Description
012-66000R	X-Cite® 200DC/exacte replacement lamp module

Refer to section 5.1 for lamp module replacement instructions
Refer to section 8 for messages regarding troubleshooting and lamp module replacement.
⚠ Refer to section 3.1 Glossary of Symbols, for lamp warning information.
Refer to section 6.1 Powering Up/Powering Down, powering up/down instructions.

9.5 Air Vents & Filters

9.5.1   X-Cite® 200DC has several air vents that are an integral part of the cooling
system and overall lamp performance.   Proper cooling ensures that lamps
operate at optimal temperature and pressure for output power, spectrum, lamp
life, light guide life and safety.

Ensuring adequate cooling

9.5.2   Never obstruct the air vents on the X-Cite® 200DC. Vents are located at the rear
and underside of the unit.

9.5.3   Always leave clearance for air flow between the X-Cite® 200DC and walls or
other equipment. Do not remove the rubber feet on the X-Cite® 200DC unit or
otherwise reduce/block the space between the bottom of the unit and bench top.
This may compromise airflow through the unit.

9.5.4 Ensure that the air being used to ventilate the X-Cite$^®$ 200DC is approximately "room temperature" (e.g. do not place the X-Cite$^®$ 200DC on top of another heat-producing instrument).

9.5.5 If a heated environmental chamber is being used for live cell imaging, make sure that the X-Cite$^®$ 200DC and the light guide are located outside of the chamber.

9.5.6 Periodically check the air filter at the air intake vent for debris. Replace or clean as necessary

How to Check/Clean Metal Vents

9.5.7   When unit is OFF and lamp is COOL, unplug power from X-Cite® 200DC and turn unit upside down. Visually inspect the metal gratings for lint, dust and other debris.

9.5.8   Debris can be removed from the gratings using a small vacuum cleaner with a crevice tool, or blown out with a can of compressed air. If using compressed air, direct the air flow ACROSS the vents, not perpendicularly (i.e. into the X-Cite® 200DC).
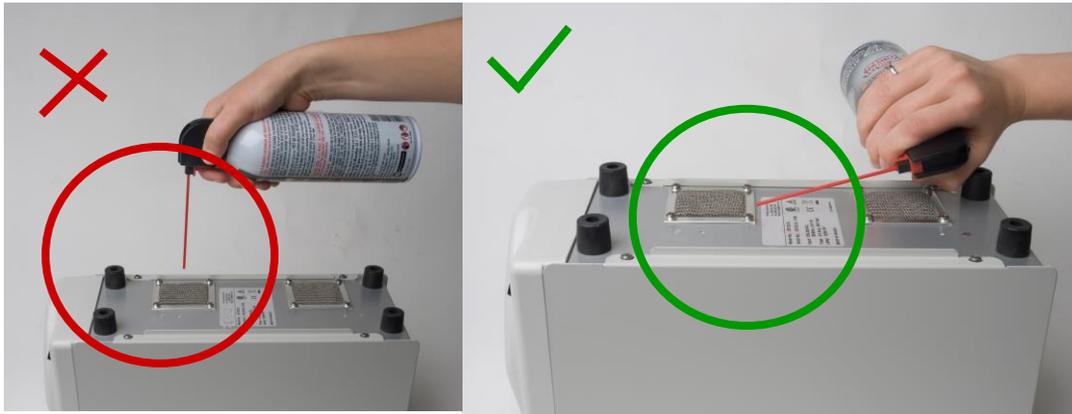
9.6 Replacing the Air Filter

9.6.1   The external air filter is located under the front face plate of the X-Cite® 200DC.

9.6.2   Turn off the main POWER switch and remove the AC POWER cord from the unit.

9.6.3   Gently slide and pull out the filter.

9.6.4   Push in the replacement filter so that it sits flat in place

What happens if filters and vents are not clean?

9.6.5   A complete filter blockage or airflow obstruction generally results in an automatic lamp shutoff within 10-15 minutes of the unit being powered on due to lack of adequate cooling.

9.6.6   A partially clogged filter may allow enough airflow for continued operation, but not for optimal cooling. In this case, the result is usually dramatically reduced lamp life, e.g. 400 hours instead of 2500+ hours.

9.7 Replacing the External Fuses

9.7.1   The external (main) fuses are located in the fuse drawer which is located in the AC inlet module on the rear panel.

9.7.2   Turn off the main POWER switch and remove the AC POWER cord from the unit.

9.7.3   Gently pull out the drawer with the aid of a flat-head screwdriver.

9.7.4   Carefully lever one end of each fuse up from its retaining clip with a small flat-head screwdriver and lift it out.

9.7.5   Replace the blown fuse(s) only with the same type and rating (F5A, 250V). The rear compartment must contain two active fuses.

9.7.6   Close the fuse drawer.

9.7.7   Reconnect the AC POWER cord.

10   Technical Specifications

10.1 Electrical

Power Supply: Power Factor Corrected, Universal Input

Input Voltage: 100 - 240VAC, 50/60Hz

Current: 3.5A max at 120VAC
                             2.0A max at 240VAC

Input Surge: 50A max. (cold start)

Protection: Power supply:
                             Short circuit protection
                             Overvoltage protection: 30-50% above nominal output
                             Overload protection: 110-160% of normal rating

Fuse Rating: Dual fuse system: each fuse rated at F5.0A 250V,
   5x20mm type located in the AC receptacle

10.2 Environmental

Operating Conditions

Ambient Temperature: 15ºC to 40ºC

Altitude: 2000m max.

Atmospheric Pressure: 700 to 1060 hPa

Relative Humidity: 15% to 95% (non-condensing)

Installation Category: II

Pollution Degree: 2

Enclosure Rating: IPXO

Transport and Storage Conditions

Temperature: -40 to +70ºC

Relative Humidity: 10% to 100%

Atmospheric Pressure: 500 to 1060 hPa

10.3 Lamp
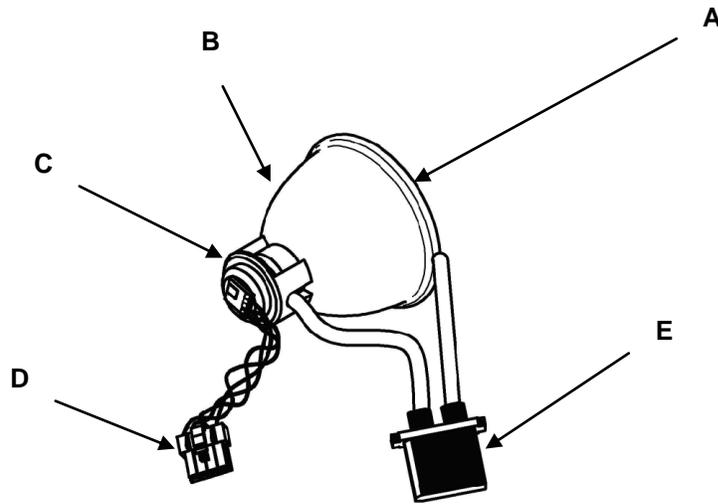
A - Rim of Lamp Reflector . **B -** Reflector. **C -** Back Ceramic Mount
D - Intelli-Lamp Connector. **E -** Power Connector

|	
Lamp Module	Excelitas Technologies 200W Arc Lamp
Lamp Module Life	2000 hours
⚠ **Warm Up**	20 minutes (min), reference sections 3.1 Glossary of Symbols and 6.1 Powering Up/Powering Down.

⚠ **CAUTION:**
**Use only Excelitas Technologies lamp part number 012-66000R in the X-Cite®
200DC unit.**

10.4 Light Guide

Light Delivery
Flexible liquid filled light guide 1.5m or 3m in length with a core diameter of 3mm. Custom light guides are also available.

Liquid Light Guide End Fitting
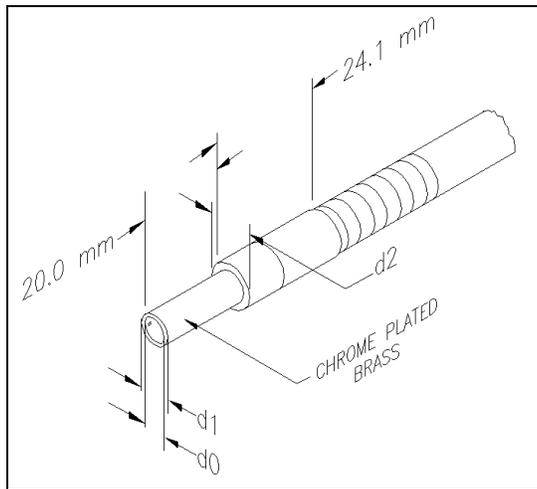
Liquid Light Guide Dimensions in mm

Core	End Fitting	End Fitting Radius	Minimum Bend (mm)
d0	d1	d2	
3	5	9	40

Transport and Storage Conditions

Temperature: -5°C to 35°C

Note: Refer to section 9.2 for tips on maintaining liquid light guides in good working condition.

10.5 General

Height :	8.2" / 20.6cm
Depth:	13.3" / 33.8cm
Width:	7.1" / 18.0cm
Weight:	10.8lbs / 4.9kg

Note: X-Cite® 200DC <u>unit</u> dimensions only, does not include clearance at front of unit for liquid light guide.

11   Regulatory

11.1 Product Safety and Electromagnetic Compatibility:

The X-Cite 200DC has been tested and found to comply with product safety and electromagnetic compatibility requirements. For a complete list of tests and for certification details, please contact your X-Cite representative or visit http://www.excelitas.com/Pages/Product/X-Cite-200DC.aspx.

CE Marking:

Council Directive 2014/35/EU	Low Voltage Directive	
Council Directive 2014/30/EU	EMC Directive	$C \in$
Council Directive 2012/19/EU	WEEE Directive	
Council Directive 2011/65/EU	RoHS	

FCC Class A Digital Device or Peripheral - Information to User

NOTE
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING
Changes or modifications not expressly approved by Excelitas Technologies could void the user's authority to operate the equipment.

WEEE Directive (2012/19/EU)

The symbol above indicates that this product should not be disposed of along with municipal waste, that the product should be collected separately, and that a separate collection system exists for all products that contain this symbol within member states of the European Union.
- The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

- In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.
- The crossed-out wheeled bin symbol indicated above invites you to use those systems.
- If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

11.2 China RoHS

The symbol above indicates that this product is in compliance with China RoHS requirements.

12   Warranty

Excelitas Technologies warrants the original purchaser for a period of one (1) full year, calculated from the date of purchase, that the equipment sold is free from defects in material and workmanship.

In the event of a claim under this guarantee, the equipment is to be sent postage and carriage paid, including a description of the fault, to the Excelitas Technologies Service Center. Returned equipment will not be received without a Return Authorization (RA) Number, issued by the appropriate Service Center.

In the case of damage caused by wear and tear, careless handling, neglect, by the use of force or in the case of interventions and repairs not carried out by an Excelitas Technologies Service Center, the guarantee ceases to be valid. This guarantee may not form the basis for any claims for damages, in particular not for compensation of consequential damages.

The warranty is not transferable. No warranty is extended to perishable items, such as fuses, air filters and light guides.

Any claims for units received with defects in material or workmanship must be reported to an authorized Excelitas Technologies Service Center within 30 days from the original date of receipt.

Replacement Bulb Warranty

If the X-Cite® 200DC bulb fails to strike during the warranty period of 2000 hours, the bulb will be replaced under warranty, or a credit will be applied to the purchaser's account. In the event of a claim under this guarantee, the lamp is to be sent postage and carriage paid, including a description of the fault, to the Excelitas Technologies Service Center. Returned equipment will not be received without a Return Authorization (RA) Number, issued by the appropriate Service Center. Lamps must be purchased from an authorized Excelitas Technologies Representative or Distributor to be eligible for the warranty replacement. This warranty is non-transferable.

In the case of damage caused by careless handling, neglect, by the use of force or in the case of interventions and repairs not carried out by an Excelitas Technologies Service Center to the X-Cite® 200DC system, the guarantee ceases to be valid.

Returning equipment to Excelitas Technologies

1. Please make a note of the problem encountered, the steps followed to isolate the problem and the result of any trouble shooting steps taken.
2. Contact the nearest Excelitas Technologies Service Center to obtain a Return Authorization Number. For your convenience, RA numbers can also be requested on-line at: http://www.excelitas.com/Pages/Support/Service-Request-Form.aspx

3. Follow shipping instructions provided by the service technician. The unit should be returned in its original packaging if possible. Please do not ship the unit with the lamp installed.

13   Contact Information

Excelitas Canada Inc,
Tel: (905) 821-2600
Fax: (905) 821-2055
1-800-668-8752 (*USA and Canada)*
x-cite@excelitas.com
www.excelitas.com/Pages/Product/X-Cite.aspx

13.1 Replacement Parts and Accessories

Replacement parts and accessories can be purchased directly from Excelitas Technologies. For ordering and pricing information contact the inside sales department at:

x-cite@excelitas.com
http://www.excelitas.com/Pages/Contact/Contact-Us.aspx
1-800-668-8752

Part Number	Description
010-00283R	X-Cite® 200DC Illumination System
012-66000R	X-Cite® 200DC/Exacte Lamp Module
805-00038	X-Cite® Liquid Light Guide 3mm x 1.5m
805-00040	X-Cite® Liquid Light Guide 3mm x 3.0m
622-00012R	Replacement Air Filter
850-00023R	Hex Key, 3mm (lamp access cover)
035-00447R	X-Cite® 200DC Quick Start English
010-00245R	Optical Power Measurement System includes; - X-Cite® XR2100 Optical Power Meter (010-00242R) - X-Cite® XP750 Objective Plane Power Sensor (010-00241R)