

X-Cite® 120LED User Guide

X-Cite® 120LED User Guide

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Made in Canada

Lumen Dynamics Group Inc. 2013

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Table of Contents

1	Introduction	5
2	Safety.....	6
2.1	Glossary of Symbols	6
2.2	Safety Precautions	6
3	Getting Started.....	8
3.1	System Components	8
3.2	Installation/Set-up	9
4	Operation – Manual Control	12
4.1	The Basics.....	12
4.2	SpeedDIAL Home Screen.....	12
4.3	SpeedDIAL Menu and Settings.....	13
4.3.1	SpeedDIAL Menu Structure.....	13
4.3.2	LCD – Display Screen Brightness and Color Settings.....	14
4.3.3	Favo – Favorite Intensity Setting.....	14
4.3.4	TTL –TTL Mode Control	15
4.3.5	Hand – Display Screen Orientation	15
4.3.6	Srvc – Service Data	15
5	Operation - External Control	16
5.1	USB/RS-232	16
5.1.1	Driver Installation (via internet).....	16
5.1.2	Driver Installation (via CD or ZIP file)	17
5.1.3	Verify Installation & Get COM Port Number.....	17
5.1.4	X-Cite Control Panel / GUI installation (via CD or ZIP file)	18
5.1.5	X-Cite Control Panel – Tips for Use	18
5.1.6	Commercial Software Support.....	19
5.1.7	Software Developer’s Kit (SDK).....	20
5.2	TTL.....	20
5.2.1	TTL Mode	20
5.2.2	TTL Mode Timeout	20
5.2.3	TTL Timing Diagram.....	21
5.2.4	TTL Signal and LED Status.....	21
5.2.5	TTL Input Specifications	21
5.3	Foot Pedal Control (Optional)	21
6	Troubleshooting	22
6.1	Error Messages.....	22
6.2	Failure to Power Up	22
6.3	Low Illumination Intensity	23
6.4	Other Potential Symptoms & Questions.....	24
7	Routine Care and Maintenance	24
7.1	General.....	24
7.2	Cleaning - Exterior Surfaces	25

7.3	Cleaning - Optical Surfaces	25
7.4	Thermal Management System	26
8	Technical Specifications	26
8.1	General.....	26
8.2	Electrical.....	26
8.3	Environmental – Operating Conditions	27
8.4	Environmental – Transport and Storage Conditions.....	27
8.5	Input/Output (I/O) Connections	27
8.6	Output Stability.....	27
9	Regulatory.....	28
9.1	Product Safety.....	28
9.2	Electromagnetic Compatibility.....	28
9.3	CE Marking	28
9.4	FCC	29
9.5	WEEE Directive.....	29
9.6	China RoHS.....	30
10	Warranty & Repairs	30
10.1	Warranty Terms	30
10.2	Returning equipment to Lumen Dynamics	31
11	Contact Information.....	32
11.1	General.....	32
11.2	Accessories and Replacement Parts	32

Table of Figures

Figure 1	PowerCUBE Front and Rear Panels	8
Figure 2	LED Head	9
Figure 3	SpeedDIAL	9
Figure 4	Installing Microscope Flange on LED Head	10
Figure 5	LED Head and Arrow in Correct Position	11
Figure 6	SpeedDIAL Home Screen Icons	12
Figure 7	Device Manager, COM Port Listing	17
Figure 8	X-Cite Control Panel	18
Figure 9	Sequence of Events for TTL Mode Timeout (set to 4 hours)	20
Figure 10	Location and Removal of Fuse Tray in AC Receptacle	23

1 Introduction

The new X-Cite® 120LED is LED illumination, with no compromise required. X-Cite® 120LED provides superior optical power and exceptional field uniformity at the specimen level with the broadest spectrum of fluorescence excitation through manual, PC and TTL control. With LEDs rated to 25,000 hours and no lamps or modules to replace, X-Cite® 120LED offers sheer simplicity and convenience to researchers allowing them to focus on their experiments instead of equipment maintenance.




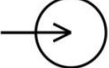

This product is intended for use in fluorescence microscopy illumination. It allows researchers the ability to excite fluorescence in samples being studied and characterize their location or behaviour.

Since 1984, Lumen Dynamics has combined next generation optical engineering, state-of-the-art electronics and fibre-optics to produce sophisticated technologies that employ light. Today, Lumen Dynamics is a leading developer of light-based systems for industries ranging from manufacturing to bio-imaging and we are unmatched in our commitment to quality and service. Lumen Dynamics recommends reading this manual to discover all the features available in X-Cite® 120LED.

Thank you for choosing X-Cite®!

2 Safety

2.1 Glossary of Symbols

Symbol	Meaning
	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

2.2 Safety Precautions

Please observe the following safety precautions at all times during operation and maintenance of this product. Failure to do so may result in personal injury or property damage.

1. UV emitted from this product. Avoid eye and skin exposure to unshielded product. Do not look at operating lamp/LED. Eye injury may result.
2. Never look into the light emitting end of the LED head. 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.
3. Always make sure the LED head is securely attached to the microscope prior to turning on power to the unit. This will minimize the risk of exposure to the UV light.
4. To reduce the risk of fire or shock, always replace the fuses with the same type and rating.
5. Disconnecting of main supply source is done by putting the on/off button in the off “O” position and unplugging the power cord.
6. 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.

7. **Monitoring the unit during manual operation**
The level of UV and visible energy supplied by this product 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 power switch must be turned off.
8. **Monitoring the unit during automated operation**
The level of UV and visible energy supplied by this product 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.
9. Should this X-Cite unit be used in a manner not specified by Lumen Dynamics, the protection provided by the equipment may be impaired.
10. This unit is designed for bench top use only! Always ensure that the unit is placed on a hard, stable surface, ensuring that ventilation openings are not obstructed. Any obstruction of these openings could result in a possible over-heating condition.
11. Any electronic equipment connected to this product must comply with the requirements of EN/IEC 60950.
12. To clean the exterior of the unit, use a slightly dampened cloth and a simple water/ detergent solution only. Avoid the optical surfaces and lenses. Cleaning of optics should only be attempted by qualified personnel using appropriate fluids and lens paper.

3 Getting Started

3.1 System Components

The X-Cite 120LED system contains the following components:

1. LED Head and powerCUBE (connected via 1.5m cable)
2. SpeedDIAL Manual Controller
3. Microscope Flange
4. Accessories Box, containing:
 - a. Quick Start Instruction Sheet
 - b. User Guide & Software CD
 - c. Hex Tool, 3mm
 - d. USB Cable
 - e. Power Cord

If any components are missing or appear damaged, please contact Lumen Dynamics immediately.

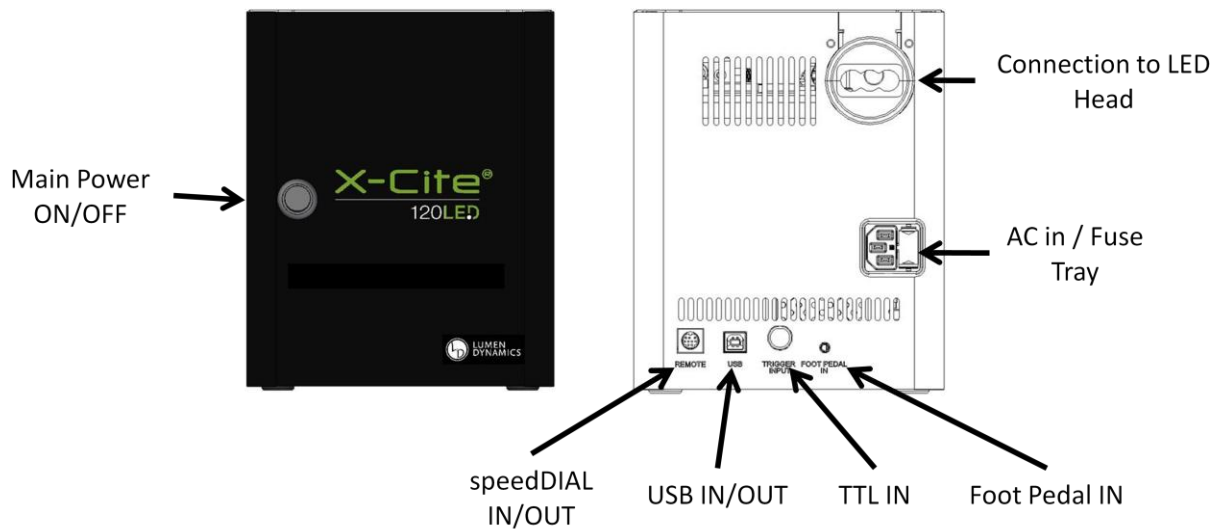


Figure 1 PowerCUBE Front and Rear Panels

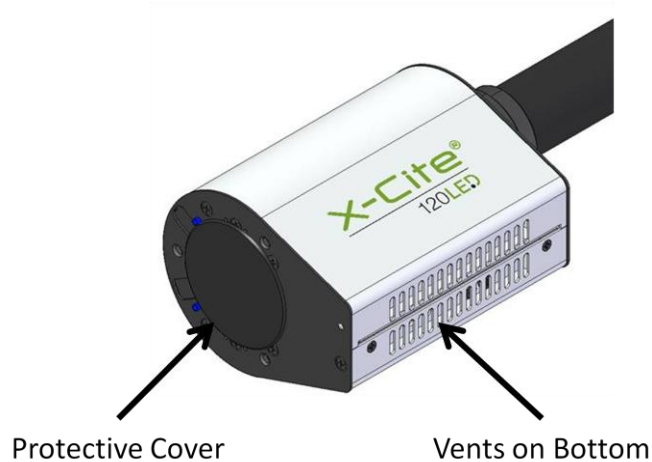


Figure 2 LED Head

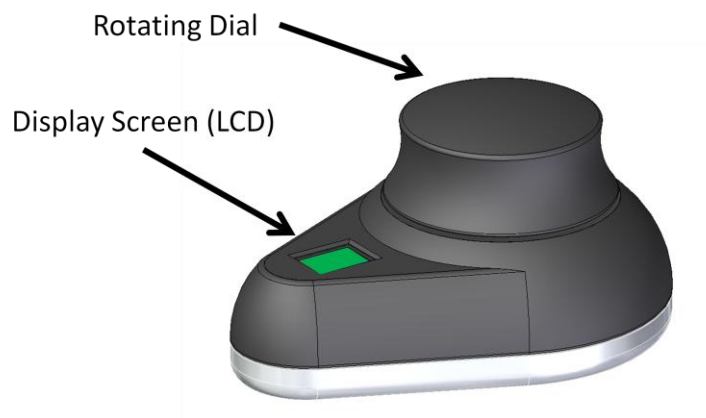


Figure 3 SpeedDIAL

3.2 Installation/Set-up

1. Unpack
 - a. Carefully unpack the unit and accessories from the shipping carton.
 - b. When removing the LED Head and powerCUBE from the carton, ensure that both components are supported and there is always some slack in the cable. Excessive strain on the cable may damage or weaken the connection.
 - c. **Do not use the cable as a “handle”.** PowerCUBE is packed with a cardboard insert with handles to assist in removing it from the protective foam. Set aside the insert and support powerCUBE from the bottom as soon as it is possible to do so. The insert will not support the full weight of the unit for an extended period of time, and the handles may tear.

2. Install the Microscope Flange

- a. Remove protective wrap from the Microscope Flange, being careful not to touch the lens surfaces.
- b. Remove protective cap from LED Head. **Never power up the unit with this cap installed – it can melt very quickly at high power settings and damage the unit.**
- c. Align the mounting holes on the Microscope Flange and the LED Head. Attach the Microscope Flange using the Hex Tool and three (3) fasteners provided. The two (2) dowel pins on the LED Head will allow you to install the Flange quickly and in the proper position as required by your microscope.

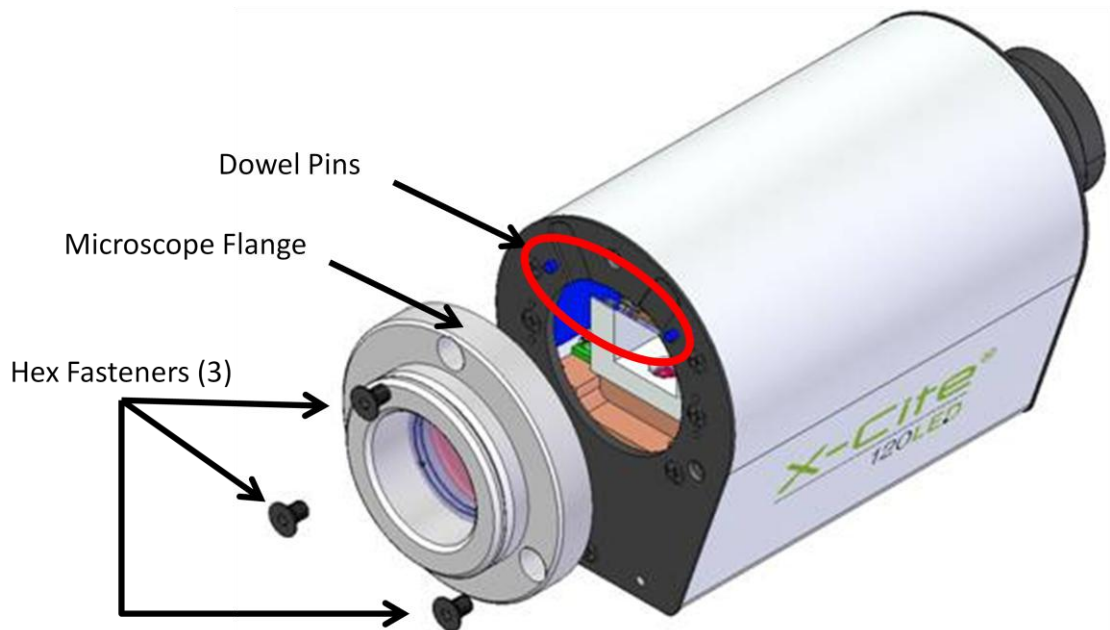


Figure 4 Installing Microscope Flange on LED Head

3. Position the equipment

- a. TIP: The cable connecting the LED Head and powerCUBE has limited flexibility, so take a moment to position the equipment before connecting it.
- b. PowerCUBE should be positioned to avoid sharp bends and strain on the cable, preferably on the same level as the microscope or slightly above it on a low shelf.
- c. The front panel of powerCUBE should be within reach to access the main power switch. (During operation, all other functions are controlled via speedDIAL or USB interface.)
- d. Air vents on both sides of powerCUBE should be clear of obstruction. Recommended clearance is 20cm (8 inches) on all sides.

4. Connect LED Head to Microscope

- a. Insert Microscope Flange portion of the LED Head into the light port on the microscope, and secure it using the hardware provided on the microscope. (Refer to relevant microscope user manual for complete instructions on mounting a standard epi-fluorescence lamphouse.) General guidelines:
 - i. Carl Zeiss – Tighten the hex fastener on the side of the light port with the 3mm Hex Tool .
 - ii. Leica - Tighten the hex fastener on the side of the light port with the 3mm Hex Tool .
 - iii. Nikon – Line up the Microscope Flange “notch” with the pin on the microscope fitting, hold the LED head firmly against the light port, and twist the collar to lock the components together.
 - iv. Olympus - Tighten the hex fastener(s) with the 3mm Hex Tool. Depending on the model, there may be one (1) fastener on the side, or two (2) fasteners located at the 10:00 and 2:00 positions. **Note for IX3-RFAL use: the epi-light train aperture MUST be properly aligned before turning on X-Cite 120LED, or heat damage may result** - see procedure in Olympus manual for assistance.
- b. Verify that LED Head is oriented with air vents facing downwards and the arrow label is pointing up (see figure 5). Adjust position if necessary – operating X-Cite 120LED with the LED Head at an angle will affect performance and may cause damage long term.
- c. Verify that the LED Head is securely fastened by attempting to gently rock it from side to side.

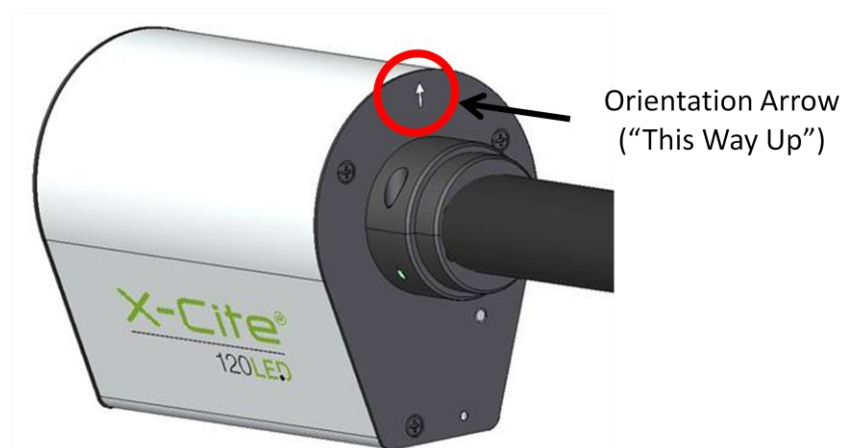


Figure 5 LED Head and Arrow in Correct Position

5. Connect speedDIAL to powerCUBE

- a. Insert the mini DIN plug into the “Remote” port on the rear of the powerCUBE. Ensure the arrow mark on the connector is on top and centered. Note: Never force the connector – this can damage the pins. If connector does not insert smoothly, stop and check for bent pins.
- b. Place speedDIAL next to the microscope, or another easily accessible location.

6. Connect USB (if using)
 - a. Insert “B” (square) end into the “USB” port on rear of the powerCUBE.
 - b. Insert “A” (flat) end into an available port on the computer.
 - c. Note: For best performance, use the supplied USB cable or one of equivalent quality and length. Using a longer USB cable than the one supplied may result in intermittent communication errors.
7. Connect AC Power
 - a. Connect female end to AC port on rear of the powerCUBE.
 - b. Connect male end to a properly grounded electrical outlet.
 - c. For safe operation, use only the power cord supplied or one with an equivalent rating.

4 Operation – Manual Control

4.1 The Basics

1. Start the unit
 - a. Flip the rocker switch on the front of powerCUBE to turn X-Cite 120LED on.
 - b. The system will have a brief initialization period (approximately 10 seconds). The speedDIAL display will show “X-Cite” during this time.
 - c. When the display shows “x%”, it is ready to use.
 - d. Note: If speedDIAL will be used for manual control, it must be connected before turning system on. SpeedDIAL can be damaged if it is plugged into, or unplugged from, the system while it is powered on.
2. Illuminate a specimen
 - a. Click the dial (shutter button) on speedDIAL to turn on/off the excitation light.
3. Adjust intensity
 - a. Turn the dial to adjust intensity - clockwise to increase, counter-clockwise to decrease.
 - b. The dial is speed sensitive – turning slowly will allow adjustments in smaller increments, turning quickly will increase the step sizes.

4.2 SpeedDIAL Home Screen

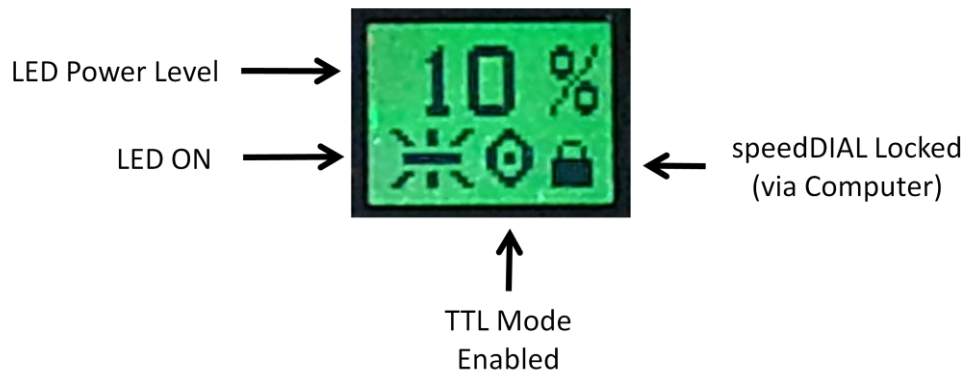


Figure 6 SpeedDIAL Home Screen Icons

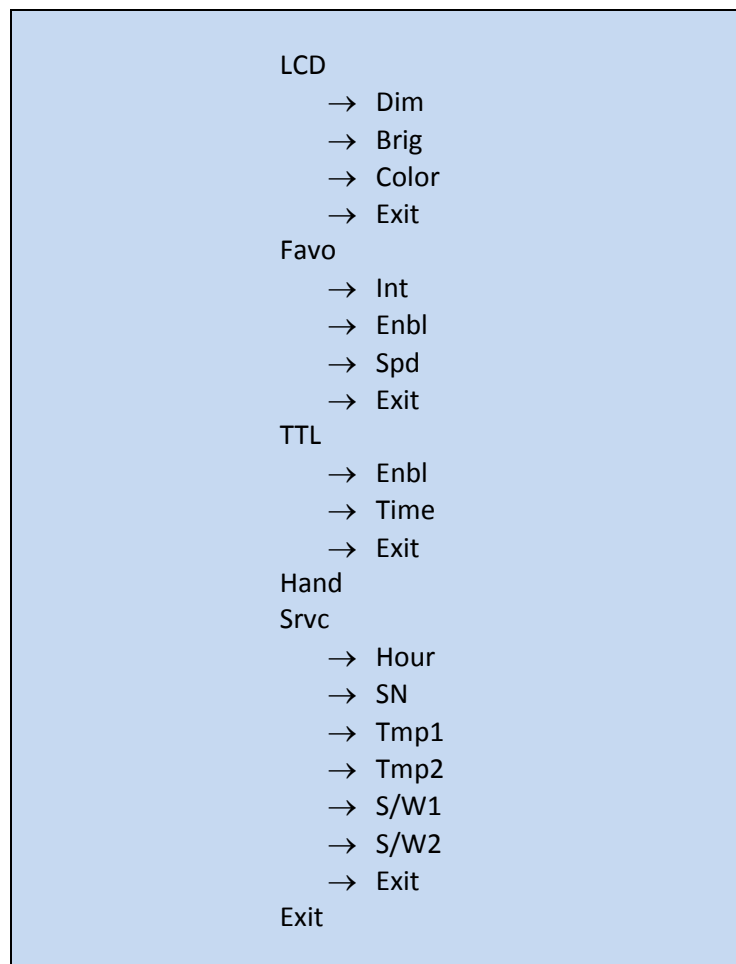
4.3 SpeedDIAL Menu and Settings

In addition to the intuitive intensity adjustment and illumination ON/OFF control, speedDIAL has several advanced settings and control options.

- To access the main menu, press and hold the dial for one (1) second.
- To navigate the menus, turn the dial to scroll through the options. An arrowhead will indicate the currently selected menu option; click the dial to make a selection.
- To adjust settings, turn the dial. To exit the setting adjustment, click the dial.
- To exit menu system at any time, press and hold the dial for one (1) second.

Note: Setting changes will take effect immediately after selection. However, for the first five (5) minutes, the new settings are stored in a temporary memory location. If X-Cite 120LED is powered down during this time, settings will revert back to their previous values. To ensure that new settings will be remembered, wait at least five (5) minutes before powering down the unit.

4.3.1 SpeedDIAL Menu Structure



4.3.2 LCD – Display Screen Brightness and Color Settings

In the LCD sub menu, the backlight on the display screen can be turned on/off, set to a different brightness level, or set to a different color.

- a. Select the “LCD” option from main menu.
- b. To adjust LCD display backlight time out:
 - i. Select “Dim” and scroll through the time out options, which are: Off and 1 thru 999 seconds in 1 second increments. “Off” will turn off the backlight timer (i.e. backlight will always be on).
 - ii. Click dial to save selection and return to “LCD” menu.
- c. To adjust LCD brightness:
 - i. Select “Brig” and scroll through % brightness settings until the desired level is reached. To turn backlight off, set level to 0%.
 - ii. Click dial to save selection and return to “LCD” menu.
- d. To change LCD color:
 - i. Select “Color” and scroll up /down through the options until desired color is on LCD.
 - ii. Click dial to save selection and return to “LCD” menu.
- e. Select “Exit” to go back to the main menu, or press and hold dial to return to the home screen.

4.3.3 Favo – Favorite Intensity Setting

In the FAVO sub menu, a favorite, commonly used intensity setting can be saved. When this mode is enabled, the intensity level will instantly jump to this setting with a double-click of the dial.

- a. Select “Favo” option from main menu.
- b. To set/change the favorite intensity:
 - i. Select “Int” and scroll through % intensity settings until the desired level is reached.
 - ii. Click dial to save selection and return to “Favo” menu.
 - iii. TIP: Scrolling through % settings in this menu will not actually change the output in real time, even if LED is on. The favorite intensity should be determined before entering this menu.
- c. To enable/disable favorite intensity mode:
 - i. Select “Enbl” and scroll up/down to the desired setting.
 - “On” will enable (i.e. double-click speedDIAL = Favorite setting)
 - “Off” will disable (i.e. double-click speedDIAL = do nothing)
 - ii. Click dial to save selection and return to “Favo” menu.
- d. To adjust the delay between clicks in the “double-click”:
 - i. Select “Spd” and scroll up/down to the desired delay setting. “1” will provide the shortest delay, “10” will be the longest.
 - ii. Click dial to save selection and return to “Favo” menu.

- iii. TIP: If double-clicking results in the light being turned OFF instead of going to favorite intensity, increase the delay setting.
- iv. Note: Setting long delay times will result in a longer response time for regular ON/OFF control with speedDIAL (the system must wait to see if the single-click turns into a double-click). Response times for TTL, USB or foot pedal on/off control will not be affected.

4.3.4 TTL –TTL Mode Control

In the TTL menu, TTL mode can be enabled for experiments that require rapid LED ON/OFF control. For further information on TTL mode, refer to the External Control, TTL section 5.2.

NOTE: TTL mode MUST be enabled for the system to respond to a TTL signal.

- a. Select “TTL” option from main menu.
- b. To enable/disable TTL mode:
 - i. Select the “Enbl” menu item.
 - ii. Scroll to the desired setting, “On” to enable TTL or “Off” to disable TTL.
 - iii. Click dial to save selection and return to “TTL” menu.
- c. To define the TTL timeout setting:
 - i. Select the “Time” menu item.
 - ii. Scroll through the time out options, which are: Never and 4 to 24 hours in half hour increments. “Never” will turn off the timeout feature (i.e. the cooling system and driver will always be active when TTL mode is enabled).
 - iii. Click dial to save selection and return to “TTL” menu.

4.3.5 Hand – Display Screen Orientation

In this menu, the LCD orientation can be rotated 180°. This allows operators to use speedDIAL on the left or right side of the microscope without blocking the view of the display with their hand.

- a. Select “Hand” option from main menu.
- b. Turn dial to toggle between “Right Hand” and “Left Hand” operation. Note that the screen will flip while adjusting this setting.
- c. Click dial to save selection and return to the main menu.

4.3.6 Srvc – Service Data

In the Service menu, information specific to each X-Cite 120LED unit can be found. This includes total hours accumulated on the LED, unit serial number, temperatures measured at specific locations in the unit, and embedded software versions for powerCUBE and speedDIAL. LDGI Tech Support personnel may request some or all of this information during a support call.

- a. Select “Srvc” option from main menu.
- b. To obtain the LED “in use” hours:
 - i. Select the “Hour” menu option.
 - ii. LED “hours of use” will be shown in one (1) hour increments from 0 to 999 hours. Due to space limitations on the LCD, when 1000 hours are logged, the

format will change to “1.0k hours”, and increments will increase to 100 hours (e.g. 1142 hours will display as “1.1k hours”). The precise hour-by-hour data will continue to be available via USB communication.

- iii. Click dial to return to “Srvc” menu.
- c. To obtain the unit serial number:
 - i. Select the “SN” menu option.
 - ii. Serial number of the unit will be shown.
 - iii. Click dial to return to “Srvc” menu.
- d. To obtain current system temperatures:
 - i. Select “Tmp1” or “Tmp2” as required.
 - ii. Temperature will be shown in degrees Celsius.
 - iii. Click dial to return to “Srvc” menu.
- e. To obtain the embedded software version numbers:
 - i. Select the “S/W1” or “S/W2” menu items.
 - ii. The software version numbers will be shown in the format X.X.X.
 - iii. Click dial to return to “Srvc” menu.

5 Operation - External Control

5.1 USB/RS-232

A virtual COM port driver must be installed to enable Windows communication via the USB port. For computers running Windows which are connected to the internet, the driver will install automatically. For manual installation, the driver is available on the CD included with the X-Cite 120LED, and as a software download from the LDGI website. Note that administrator privileges may be required to install drivers on your computer, in which case you may need to contact your IT department for assistance.

5.1.1 Driver Installation (via internet)

For these instructions: internet is required, Windows 7 prompts are listed

- a. Ensure X-Cite 120LED is powered off.
- b. Ensure X-Cite 120LED is connected to the computer with the USB cable.
- c. Ensure computer is connected to internet.
- d. Power on X-Cite 120LED.
- e. Driver installation will begin automatically. A dialogue box will confirm installation has started.
 - i. If the dialogue box reports that **Driver installation was not successful**, click on **Get Details**.
 - ii. Click on option to **Change Settings to Automatically search Windows for drivers**. Confirm **Yes, do this automatically**, and save changes.
- f. A second dialogue box will confirm successful installation and provide a COM port number. Note the COM port number for use in other software applications.

5.1.2 Driver Installation (via CD or ZIP file)

For these instructions: internet is not required, Windows XP prompts are listed

- a. Ensure X-Cite 120LED is powered off.
- b. Ensure X-Cite 120LED is connected to the computer with the USB cable.
- c. Prepare the driver files:
 - i. Via CD: Insert the CD into the CD-ROM drive.
 - ii. Via ZIP file: Extract and save the files into a folder on desktop (or another easily accessible location).
- d. Power on X-Cite 120LED.
- e. The “new hardware found” wizard will appear. Select **No** to search Windows update for the software. Click **Next** to continue.
- f. Select **Install from a list or specific location (Advanced)** to locate the driver and click **Next**.
 - i. From CD: Select **Search removable media (floppy, CD ROM...)**. Click **Next**.
 - ii. From ZIP: Select **Include this location in the search:** and browse to the location on your hard drive where unzipped files were saved in step c. Click **Next**.
- g. Wait for installation to complete. Click **Finish**.

5.1.3 Verify Installation & Get COM Port Number

- a. Open the “Device Manager” utility on the computer.
- b. “X-Cite 120LED USB Communications” will be listed under “Ports (COM & LPT)”.
- c. Note the COM port number for use in other software applications.

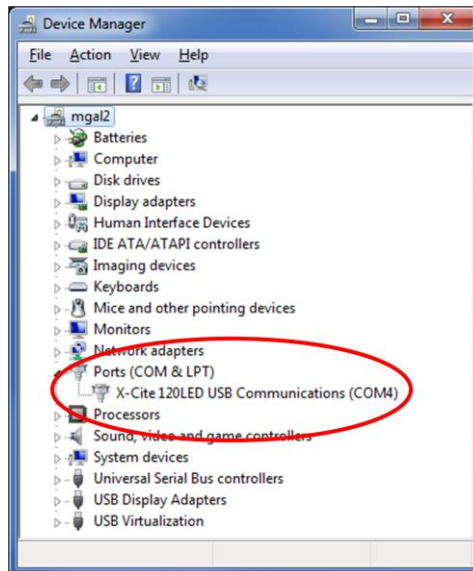


Figure 7 Device Manager, COM Port Listing

5.1.4 X-Cite Control Panel / GUI installation (via CD or ZIP file)

For these instructions: internet is not required

- a. Uninstall any previous versions of X-Cite Control Panel/GUI. (Previous versions released under the EXFO name will not be automatically replaced by versions 1.1.0 or later, and may cause confusion.)
- b. Prepare the driver files (if not already done in previous section):
 - i. Via CD: Insert the CD into the CD-ROM drive.
 - ii. Via ZIP file: Extract and save the files into a folder on desktop (or another easily accessible location).
- c. To begin installation:
 - i. From CD: Go to **My Computer**, double-click on CD ROM **X-Cite 120LED**
 - ii. From ZIP: Go to unzipped files from step b, double-click on **setup.exe** or **setup**
- d. Setup Wizard will open. Follow prompts and click **Close** when Wizard is finished.
- e. To find GUI, go to: **Start, All Programs, Lumen Dynamics, X-Cite Control Panel**. Click to start/open GUI, or click-and-drag to copy a shortcut to desktop or Quick Launch toolbar.

5.1.5 X-Cite Control Panel – Tips for Use

- a. X-Cite Control Panel is available on the CD accompanying the X-Cite 120LED and as a download from the LDGI website. This tool provides an interface for controlling the X-Cite 120LED via PC and general testing of the communication port.
- b. Note that X-Cite Control Panel is designed to function with multiple X-Cite devices, and not all icons and features can be used with all devices. See the icon table below to determine which icons are relevant to control of X-Cite 120LED.
- c. Icon color code:
 - i. Green icons mean status is OK and/or the function is engaged
 - ii. Yellow icons mean a warning or “getting ready”
 - iii. Red icons mean there is an alarm condition
 - iv. Grey icons mean a feature is not engaged, and/or not available
 - v. If icons are ALL grey, X-Cite 120LED is not connected and/or turned off

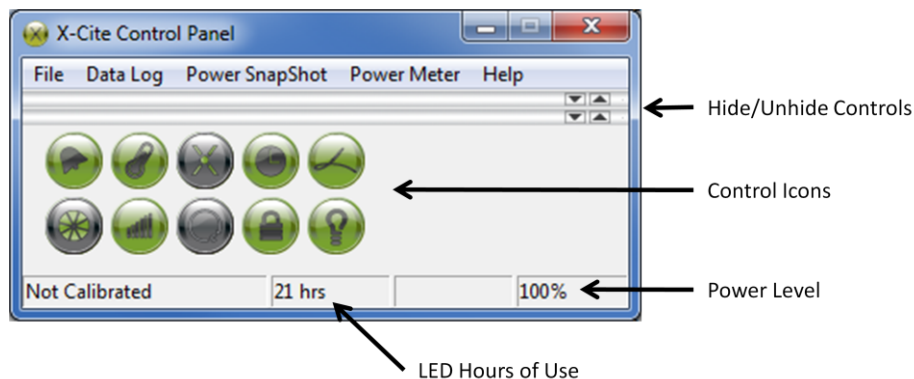












Figure 8 X-Cite Control Panel

ICON	NAME	DESCRIPTION
	Alarm	Green = All OK Red = Alarm on Click will clear alarm, unless unsafe to ignore
	Temperature	Indicates system temperature status Yellow = warning, LED temp above normal Red = LED off, temp is too high
	Calibration	Not applicable for X-Cite 120LED
	LED Hours	Indicates hours logged on LED Green = <20K hours, yellow = >20K hours, red = >40K hours
	Light Guide	Not applicable for X-Cite 120LED
	Shutter	Click to turn LED on/off
	Intensity	Left mouse click = increase by 1% increment. Right mouse click = decrease by 1% increment. Left double click = opens dialog box type in value
	Closed-Loop Feedback	Not applicable for X-Cite 120LED
	Lock/unlock	Lock/unlock speedDIAL control Green = speedDIAL is locked Grey = speedDIAL is unlocked
	Lamp	Not applicable for X-Cite 120LED

5.1.6 Commercial Software Support

- a. X-Cite 120LED can be controlled through many commercially available packages. Where X-Cite 120LED specific control may not be available, basic functionality can be achieved using X-Cite 120PC or X-Cite *exacte* hardware drivers. For an updated list of software packages that support X-Cite products, see www.ldgi.com/downloads/LDGI-XCite-softwareSupport.pdf
- b. For commercial software packages, if requested specify the serial port parameters as: 19,200 baud, no parity, 8 data bits and 1 stop bit.
- c. When controlling X-Cite 120LED, some commercial software packages may block manual input from speedDIAL. The lock icon will appear on the speedDIAL display in these cases.

5.1.7 Software Developer's Kit (SDK)

The command list for X-Cite 120LED is available by request. To obtain the latest update, please contact LDGI.

5.2 TTL

For high speed LED on/off control, TTL triggering can be used. The key thing to note about TTL control in the X-Cite 120LED is: **TTL mode MUST be enabled for the system to respond to a TTL signal.**

5.2.1 TTL Mode

TTL mode ensures that X-Cite 120LED's cooling system and LED driver are active between exposures, ensuring the fastest possible response to a TTL signal.

- Enabling/disabling TTL mode can be accomplished manually via speedDIAL (refer to section 4.3.4) or via computer commands (refer to SDK).
- ON/OFF status of the system will be updated on speedDIAL when it is controlled via TTL.

5.2.2 TTL Mode Timeout

There is a potential disadvantage of TTL mode - in this "always active" state, the system continues to consume energy and mechanical components accumulate wear. To help minimize unnecessary consumption at the end of an imaging session (or if equipment is accidentally left on), X-Cite 120LED is equipped with a TTL timeout setting. The factory default for the TTL timeout setting is "Never", but defining a timeout is recommended for any imaging session that will end without an operator present to shut down equipment (e.g. middle of the night).

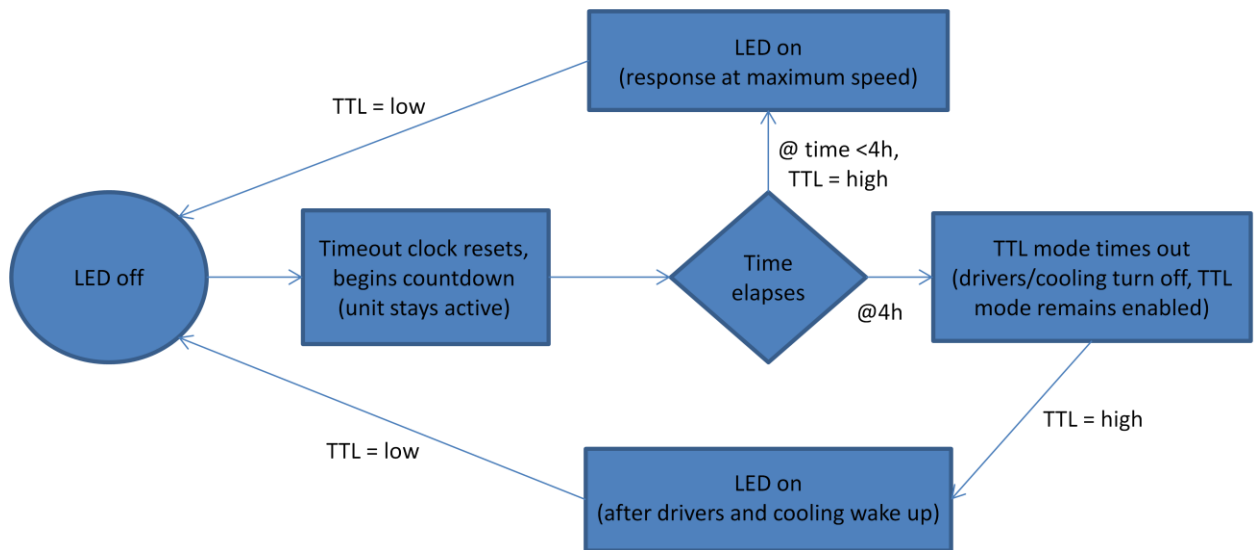
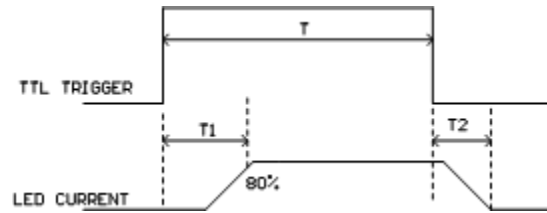


Figure 9 Sequence of Events for TTL Mode Timeout (set to 4 hours)

5.2.3 TTL Timing Diagram

This plot shows typical TTL timing values. These values should be used as a guide only. Actual values will be dependent on the specific configuration/control hardware being used.



Interval	Description	Time (μs)
T1	Delay time, TTL trigger on to LED on	100 @ 100% power
T2	Delay time, TTL trigger off to LED off	30

5.2.4 TTL Signal and LED Status

TTL	LED Status
High	ON
Low	OFF

5.2.5 TTL Input Specifications

- a. Connector type: BNC (female port)
- b. Maximum low level : +0.8V
- c. Minimum high level : +2.2V
- d. Maximum high level: + 5.5V
- e. Typical input current: 800μA

5.3 Foot Pedal Control (Optional)

For hands-free operation, a foot pedal can be used to manually turn the LED on and off. The foot pedal is an optional accessory and can be purchased separately from Lumen Dynamics.

1. Installing the foot pedal
 - a. Locate the “FOOT PEDAL IN” / “FP IN” input port on the rear panel of X-Cite 120LED.
 - b. Insert foot pedal plug.
 - c. Place foot pedal on floor.
2. Operating the foot pedal
 - a. Press and release pedal with your foot to toggle LED on and off.
 - b. On/off status of LED will be shown on speedDIAL display.

- c. If desired, the foot pedal can be used in combination with speedDIAL (e.g. turn on with speedDIAL, turn off with foot pedal.) The ON/OFF status of the system will be reflected on speedDIAL’s home screen whether it is changed via the foot pedal or by any other means.

6 Troubleshooting

Organized by symptom, this section provides basic troubleshooting information for installation and set-up parameters. X-Cite 120LED may be serviced by authorized technical personnel only.

6.1 Error Messages

If X-Cite 120LED detects a problem, an error message with one of the following codes will appear on the speedDIAL display.

Error Code	Description	Action
1	LED has exceeded maximum operating temperature	Turn off the system and wait for the LED to cool down. Verify that the system has been installed with adequate clearance for ventilation, especially around vents on powerCUBE and LED Head. If fan is not running or the problem persists contact technical support for assistance.
3 or 5	Internal Error	Power cycle the X-Cite 120LED unit. If the error message reappears contact technical support for assistance.
6	LED is below minimum operating temperature	Ensure the room temperature is within the recommended operating limits. If unit has been stored / transported in a cold environment, allow it to warm up to room temperature and restart. If the problem persists contact technical support for assistance.

6.2 Failure to Power Up

If X-Cite 120LED fails to POWER up or function properly, use the following checklist to eliminate the most common causes of problems. Check for the following:

1. Power Connection Check:
 - a. The power supply cord is securely connected to a grounded (earthed mains socket) functional outlet.
 - b. The power supply cord is securely connected into the 3-pin outlet on the rear of the controller unit.
 - c. The main AC power switch is in the ON position.

2. Fuse Check:

- a. Check both main power fuses. First disconnect the power cord, then carefully remove the fuse tray assembly next to the AC receptacle on the rear of the unit. Note: depending on the orientation of the AC receptacle, the fuse tray may be below or beside it. The red arrow in figure 10 (A) shows where a flat screwdriver can be inserted to gently lever out the fuse tray.

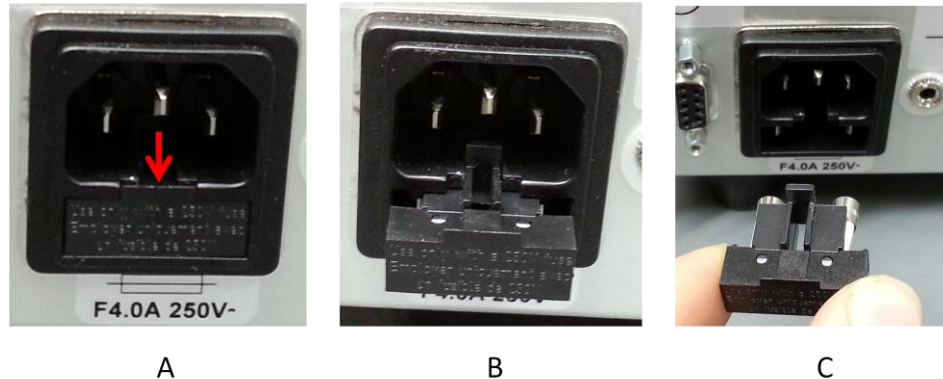


Figure 10 Location and Removal of Fuse Tray in AC Receptacle

- b. If either or both of the fuses are open, replace with the same type (4A, 250V).
 - c. Note: To determine if a fuse is intact (i.e. OK) or open (i.e. blown), remove the fuse from the tray and check with a multi-meter set to resistance (Ω). An intact fuse will read "0 Ω " (or another very low value), an open fuse will have an extremely high Ω reading.
 - d. Note: Fuses that chronically need replacing are usually a signal that something is wrong and Technical Support should be contacted.
- ## 3. SpeedDIAL Check:
- a. Verify that the pins on speedDIAL connector are straight.
 - b. Verify that speedDIAL is plugged securely into powerCUBE.

6.3 Low Illumination Intensity

1. SpeedDIAL Setting Check:

- a. Verify that the LED intensity is set to a sufficient level.
- b. Verify that the LED Head is turning on.

2. Microscope Check:

- a. Verify that the Microscope Flange is appropriate for the microscope configuration.
Note: Some flanges have the same mechanical fitting but different optics.
- b. Verify that everything in the microscope beam path is properly aligned and open, e.g. shutters, apertures, diaphragms, filters, filter cubes, etc.
- c. Verify that microscope filter sets are for the appropriate wavelengths.
- d. Verify that air objectives are clean / immersion objectives have enough of the appropriate fluid.

6.4 Other Potential Symptoms & Questions

Category	Symptom	Action
speedDIAL	Favorite intensity setting: double-click turns off LED instead of going to the stored setting	Increase delay in the speed (Spd) setting.
	New settings are forgotten when unit is shut down and powered up	After changing settings, wait at least five (5) minutes before shutting unit down.
	Turning dial does not scroll through the menu options	Turn dial in the opposite direction.
	“Lock” icon is on display, speedDIAL not responding to manual control	Send “unlock” command via computer OR power down unit and restart.
TTL Triggering	TTL signal does not trigger unit	Enable TTL mode.
	TTL response time is longer than usual	Verify that timeout settings are appropriately set.
Audible Noise	PowerCUBE fan never turns off, even when LED is not on	Fan continues to run for five (5) minutes after LED is turned off. If it runs longer, disable TTL mode (it is likely enabled).
	Bubbling noise is coming from LED Head.	Disconnect LED Head from microscope and move to a position lower than powerCUBE. Set LED to 1%, turn on, and run for several minutes until noise stops. When remounting LED Head to microscope, ensure arrow label is pointing straight up.
Output Linearity	Plotting output power vs. intensity setting is not a straight line	No action. “x%” shown on speedDIAL refers to LED input current, which is not necessarily linear with optical output.

7 Routine Care and Maintenance

7.1 General

X-Cite 120LED is a very low maintenance system with no consumable components. By maintaining the following conditions, performance will be maximized and risk of future problems will be reduced.

1. Maintain a clean work area, keeping the X-Cite 120LED air vents unobstructed.
2. Ensure that the cable connecting the powerCUBE and LED Head has some slack in it and is never cut, stretched, kinked, or forced into a sharp bend.
3. If X-Cite 120LED must be moved, ensure that both the powerCUBE and the LED Head are supported. Never use the cable as a handle.
4. Never leave the internal optics of the LED Head exposed. When not connected to a microscope, ensure the output port is always covered by a Microscope Flange or the supplied protective plastic cover.

5. Never touch optical surfaces with fingers, tools or any other abrasive/sticky/sharp materials or fluids.
6. If cleaning is required, follow the directions in the next section.

7.2 Cleaning - Exterior Surfaces

If necessary, exterior surfaces of X-Cite 120LED's LED Head, powerCUBE and speedDIAL can be cleaned with a mild soap and water solution and lint-free cloth.

1. Turn unit off and disconnect AC power prior to cleaning.
2. Use a damp cloth only - do not allow cleaning solution to get into I/O ports, air vents or seams.
3. Avoid optical surfaces.
4. Allow the unit to dry before turning it on.

7.3 Cleaning - Optical Surfaces

Cleaning of optical surfaces is not generally required. However, if any visible contamination or fingerprints appear on the lens surface, cleaning may be necessary.

1. Recommended Cleaning Materials
 - a. Rubber bulb dust blower
 - b. Lint-free lens tissue, lint-free cotton swabs
 - c. Powder-free gloves or finger cots
 - d. Lens cleaning solution, reagent-grade isopropyl alcohol, or another appropriate solvent
2. Cleaning Procedure
 - a. Use rubber dust blower to blow off any loose lint, dust or other contaminant.
 - b. If the contaminant is a fluid (e.g. water, immersion oil), first use a dry lens tissue (or cotton swab) to wick away as much as possible – do not wipe.
 - c. Saturate a corner of the lens tissue (or the cotton swab) with cleaning solvent, and gently wipe the optical surface in one pass. Note: Take care not to “flood” the area with solvent, particularly near unsealed joints (e.g. lens-retaining ring interface).
 - d. Repeat the previous step with a fresh portion of lens tissue (or new cotton swab) – this will help avoid recontamination of the optical surface and minimize the amount of cleaning required.
 - e. Let solvent evaporate and verify that the optical surface is clean. Repeat cleaning steps as necessary.
 - f. Before reinstalling and/or using the optics, allow them to dry completely.

CAUTION: Before using any solvent, consult the manufacturer's Material Safety Data Sheet (MSDS) and your internal Health and Safety Advisor for proper handling, storage, and disposal instructions.

7.4 Thermal Management System

X-Cite 120LED's unique thermal management system incorporates both air and liquid cooling technologies. If the general care and maintenance guidelines described above are followed, no further maintenance is required to ensure continued superior performance.

This robust design is similar to those used in high-powered computers, and through normal use the liquid will remain contained. If, through accident or negligence, the cable between powerCUBE and the LED Head is punctured or otherwise damaged, some liquid may escape. Should this occur:

1. Don't panic.
2. Power off and discontinue using the system.
3. Elevate the damaged portion of the cable.
4. Clean spill with absorbent material. The liquid is a non-toxic mix of propylene glycol and distilled water. Refer to Material Safety Data Sheet (MSDS), located in the Appendix.
5. Contact Technical Support.

8 Technical Specifications

8.1 General

	powerCUBE	LED Head	speedDIAL
Height	213mm (8.4")	116mm (4.6")	59mm (2.3")
Width	173mm (6.8")	90mm (3.5")	80mm (3.1")
Depth	260mm (10.2") ^a	166mm (6.5") ^{a,b}	112mm (4.4")
Weight	3.9kg (8.6lbs)	0.9kg (2lbs)	0.3kg (0.7lbs)

Notes:

- a. Does not include clearance required for cable, minimum 200mm (8").
- b. Does not include microscope flange, varies by type, approximately 10-15mm (0.4-0.6").

8.2 Electrical

Power Supply	Power Factor Corrected, Universal Input
Input Voltage	100-240VAC, 50/60Hz
Current	3.0A max /100V, 1.5A max/240V
Input Surge	With cold start 40A/115V, 80A/240V
Protection	Over load and over temperature
Fuse Rating	Dual fuse system: each fuse rated at F 4.0A 250V 5x20mm type located in AC receptacle

8.3 Environmental – Operating Conditions

Ambient Temperature	10° to 35° C
Altitude	2000m max
Atmospheric Pressure	700 to 1060 hPa
Relative Humidity	15 to 90% RH (non-condensing)
Installation Category	II
Pollution Degree	2
Enclosure Rating	1

8.4 Environmental – Transport and Storage Conditions

Temperature	-35° to 60° C
Relative Humidity	10 to 95% RH (non-condensing)
Atmospheric Pressure	500 to 1060 hPa

8.5 Input/Output (I/O) Connections

Connection	Connection Style	Purpose
speedDIAL - IN/OUT	Mini DIN plug, 9pos	Communication between speedDIAL and powerCUBE to control LED and report status (on/off, intensity adjustment, system error, etc.)
USB - IN/OUT	B	Communication between computer and powerCUBE to control LED and report status.
TTL - IN	BNC	External trigger to turn LED on/off
Foot Pedal - IN	3mm stereo plug	External trigger to turn LED on/off

8.6 Output Stability

For maximum output stability, X-Cite 120LED should be set to a power level of 5% or greater. At lower power levels (<3%), some intensity fluctuation may be observed.

If an application requires lower power levels, strategies to avoid fluctuations include:

- Increase power level, and reduce exposure time to compensate for brighter signal.
- Increase power level, and use a neutral density filter or iris in the microscope light train to reduce intensity to an appropriate level for the specimen.

9 Regulatory


9.1 Product Safety

CAN/CSA C22.2# 61010-1: 2012 3rd edition	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1: General Requirements
UL 61010-1: 2012 3rd Edition	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use Part 1: General Requirements
IEC 61010-1: 2010 3rd Edition	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements
IEC 62471: 2006 1st Edition I.S. EN 62471:2008	Photobiological Safety of Lamps and Lamp Systems / Guidance on manufacturing requirements relating to non-laser optical radiation safety Risk Group 3
IEC Equipment Class	I
Installation Category	II
Pollution Degree	2

9.2 Electromagnetic Compatibility

EN 61326-1: 2013	Immunity Testing - Electrical equipment for measurement, control and laboratory use-EMC requirements Part 1: General Requirements
CISPR 11: 2009 + A1:2010/ EN 55011:2009 + A1:2010	Emissions Testing – Class A Group 1 Limits and Methods of Measurements of Radio Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment
FCC PART 15, Subpart B, Class A	Unintentional Radiators

9.3 CE Marking

Council Directive 2006/95/EC	Low Voltage Directive	
Council Directive 2004/108/EC	EMC Directive	
Council Directive 2012/19/EU	WEEE Directive	
Council Directive 2011/65/EU	RoHS	

9.4 FCC

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 Lumen Dynamics could void the user's authority to operate the equipment.

9.5 WEEE Directive



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.

9.6 China RoHS

		Pb	Hg	Cd	Cr6+	PBB	PBDE
016-00244R	PCB ASSY, LED WITH THERMISTOR	o	o	o	o	o	o
016-00245R	PCB ASSY, CONTROLLER WITH 30A DRIVER	o	o	o	o	o	o
016-00246R	PCB ASSY, LCD CONTROLLER	o	o	o	o	o	o
610-00318R	LED, WHITE, 30A, ROUND	o	o	o	o	o	o
290-00035R	Power Supply, 12V, 300W	o	o	o	o	o	o
<p>o : Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006</p> <p>x: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 (Enterprises may further provide in this box technical explanation for marking "X" based on their actual conditions.)</p>							

10 Warranty & Repairs

10.1 Warranty Terms

Lumen Dynamics 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. All repairs are warranted for 90 days. The LED assembly within the LED Head has a warranty period of 25,000 hours of use or 3 years, whichever comes first.

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 Lumen Dynamics Service Center. Returned equipment will not be received without a Return Material Authorization (RMA) 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 a Lumen Dynamics 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 and air filters.

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

SYSTEM COMPONENT	WARRANTY	WARRANTY VOID IF...
X-Cite® 120LED powerCUBE X-Cite® 120LED Head	1 year	<ul style="list-style-type: none"> • Unit has been subjected to misuse or mishandling. • Unit has been opened or tampered with.
X-Cite® 120LED speedDIAL	1 year	<ul style="list-style-type: none"> • Unit or cabling has been subjected to misuse or mishandling. • Unit has been opened or tampered with. • LCD display damage (physical).
LED assembly (in X-Cite® 120LED Head)	<ul style="list-style-type: none"> • 25,000 hrs • 3 years whichever Comes first	<ul style="list-style-type: none"> • Cable damage due to misuse or mishandling. • LED Head has been opened or tampered with. • For all other LED Head components, 1 year warranty applies.

10.2 Returning equipment to Lumen Dynamics

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 Lumen Dynamics Service Center to obtain a Return Material Authorization (RMA) number. For your convenience, RMA numbers can also be requested on-line at: www.ldgi.com/contact/
3. Follow shipping instructions provided by the service technician. The unit should be returned in its original packaging if possible.

11 Contact Information

11.1 General

Lumen Dynamics Group, Inc.

Tel: (905) 821-2600 1-800-668-8752 (*USA and Canada*)

Fax: (905) 821-2055

1-800-668-8752 (*USA and Canada*)

x-cite@ldgi.com

www.ldgi.com

For a list of Authorized Service Centers, visit:

www.ldgi.com/support/authorized-service-centers/

11.2 Accessories and Replacement Parts

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

(905) 821-2600

1-800-668-8752 (*USA and Canada*)

x-cite@ldgi.com

www.ldgi.com

Appendix

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

PART I

What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED): DYNALENE PG™
CHEMICAL NAME/CLASS: Heat Transfer Fluids
SYNONYMS: Inhibited Propylene Glycol
DISTRIBUTOR'S NAME: Dynalene Heat Transfer Fluids
ADDRESS: 5250 West Coplay Road
 Whitehall, PA 18052
EMERGENCY PHONE: 1 -800-424-9300 (CHEMTREC)
BUSINESS PHONE: 1-610-262-9686
DATE OF PREPARATION: August 29, 2004
DATE OF REVISION: March 9, 2011

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	WT %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV	STEL	PEL	STEL	IDLH	OTHER
			mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³	mg/m ³
Propylene Glycol	57-55-6	>95	NE	NE	NE	NE	NE	NE
Inhibitor Solution		Balance	None of the ingredients in the Inhibitor Solution contribute any significant, additional hazard to these products. All pertinent hazard information has been provided in this Material Safety Data Sheet, per the requirements of the Federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Level See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a clear, odorless, syrupy liquid. Vapors and mists from this product may be irritating if inhaled. The solution can be irritating to contaminated skin or eyes. This product must be substantially preheated before ignition can occur. If involved in a fire, this liquid will release toxic gases (i.e. carbon monoxide and carbon dioxide). This product is not reactive. Emergency responders must wear proper personal protective equipment and have adequate fire protection for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:

The most significant routes of exposure to this product are by inhalation of the vapors and contact with the skin and eyes.

INHALATION: Inhalation of the mists or vapors of this product may be irritating to the nose, throat, mucous membranes, and other tissues of the respiratory system. Propylene Glycol is the main component of this product. Vapor concentrations of Propylene Glycol are normally too low at room temperature (due to the low vapor pressure) to cause significant toxic effects from vapor alone.

CONTACT WITH SKIN or EYES: This product may cause local redness or irritation of the skin. Repeated or prolonged exposure may lead to dermatitis. Contact with the eyes will cause redness, irritation, tearing, and possibly burning.

SKIN ABSORPTION: Based on clinical tests, skin absorption is a potential route of over-exposure for Propylene Glycol (the main component of this product). Symptoms of such exposure can include symptoms described for "Contact with Skin and Eyes".

INGESTION: Ingestion of this product, while not likely to occur in an industrial setting, may cause irritation of the mouth and throat, gastric upset, nausea and vomiting.

INJECTION: Though not an expected route of occupational exposure for this product, injection (via punctures or lacerations in the skin) may cause local reddening, tissue swelling and discomfort.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms.** Symptoms associated with over-exposure to this product are as follows:

ACUTE: Inhalation of the mists or vapors of this product may be irritating to the nose, throat, mucous membranes, and other tissues of the respiratory system. This product may also be irritating to contaminated skin or eyes.

CHRONIC: Prolonged or repeated skin exposures may cause irritation, which could lead to dermatitis (dry, chapped skin).

TARGET ORGANS: Skin, eyes.




HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	0
---------------	--------	---

FLAMMABILITY	(RED)	1
---------------------	-------	---

REACTIVITY	yellow	0
-------------------	--------	---

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		

For routine industrial applications

PART II

What should I do if a hazardous situation occurs?

4. FIRST-AID MEASURES

SKIN EXPOSURE: If this product contaminates the skin, immediately begin decontamination with running water. Remove exposed or contaminated clothing, taking care not to contaminate eyes. The minimum recommended flushing time is 15 minutes. Contaminated individual must seek immediate medical attention, especially if irritation or redness develops.

EYE EXPOSURE: If this product enters the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Contaminated individual must seek immediate medical attention, especially if symptoms persist.

INHALATION: If vapors or mists of this product are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers.

INGESTION: Hazards from swallowing this product is not expected to be serious. If symptoms develop, seek medical attention.

5. FIRE-FIGHTING MEASURES

The following information is available for Propylene Glycol, the main component of this product.

FLASH POINT, °C (method): 99°C (210°F), Closed Cup

AUTOIGNITION TEMPERATURE, °C: 371°C (700°F)

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): 2.6%
Upper (UEL): 12.5%

The following information is available for this product.

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (cooling only)

Carbon Dioxide: YES

Foam: YES

Dry Chemical: YES

Other: Any "ABC" Class

Halon: YES

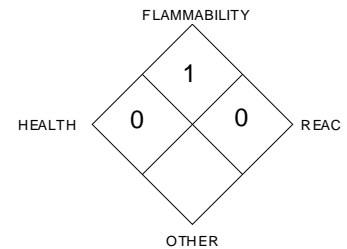
UNUSUAL FIRE AND EXPLOSION HAZARDS: This product must be substantially pre-heated before ignition can occur. When involved in a fire, this material may decompose and produce irritating vapors and toxic gases (e.g., carbon oxides).

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move fire-exposed containers if it can be done without risk to firefighters. If possible, prevent run-off water from entering storm drains, bodies of water, or other environmentally areas. Decontaminate fire-response equipment with soap and water solution if necessary.

NFPA RATING



6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of an uncontrolled release, clear the affected area, protect people, and respond with trained personnel.

SMALL SPILL: Cover with absorbent material (floor absorbent, vermiculite, etc.) Soak up spill and place material into a drum.

LARGE SPILL: Personnel involved with large releases should wear protective equipment. Stop spill at source, dike the area surrounding the spill to prevent further exposure. Prevent material from entering sewer system. If pump is available, pump spilled material into 55-gallon drums for proper disposal. If necessary, absorbents such as vermiculite, clay floor absorbent may be used on spill and shoveled into drums.

Personal Protective Equipment should be **Level D: chemical resistant gloves (rubber gloves and Nitrile gloves), and coveralls, safety glasses, safety shield.** If heated, this product may displace oxygen in an enclosed area. **Monitoring of oxygen level is recommended.** Decontaminate the area thoroughly. If necessary, decontaminate spill response equipment with soap and water solution. Dispose of in accordance with Federal, State and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

PART III

How can I prevent hazardous situations from occurring?

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat or drink while handling these materials. Use in a well-ventilated location. Use ventilation and other engineering controls to minimize potential exposure to the aerosol, sprays and vapors of this product. Remove contaminated clothing immediately.

7. HANDLING and STORAGE

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Use in a well-ventilated location. Open drums and other containers of this product slowly, on a stable surface. Drums and other containers of this product should be properly labeled. Empty drums and containers may contain residual amounts of this product, therefore, empty containers should be handled with care. Move drums of this product carefully, with the appropriate drum-handling equipment.

Store drums and other containers in a cool, dry location, away from direct sunlight, or sources of intense heat. Storage areas should be made of fire-resistant materials. Keep containers away from incompatible chemicals (See Section 10, Stability and Reactivity).

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. General methods include mechanical (local exhaust) ventilation, process or personnel enclosure and control of process conditions. Local exhaust ventilation may be necessary when this material is heated or a mist created. Supply sufficient replacement air to make up for air removed by exhaust system. Prudent practice is to ensure eyewash/safety shower stations are available near areas where This product is used.

RESPIRATORY PROTECTION: None needed for normal circumstances of use. If respiratory protection is needed, use only protection authorized in 29 CFR 1910.134, or applicable State regulations. Use supplied air respiration protection if oxygen levels are below 19.5% or are unknown.

EYE PROTECTION: Splash goggles or safety glasses.

HAND PROTECTION: Wear butyl rubber, natural rubber, neoprene, Nitrile rubber, or other suitable gloves for routine industrial use.

BODY PROTECTION: Use body protection appropriate for task.

PERSONAL PROTECTIVE EQUIPMENT LEVEL: D

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is available for Propylene Glycol, the main component of this product.

RELATIVE VAPOR DENSITY (air = 1): 2.62

FREEZING/MELTING POINT or RANGE: At 95% Concentration: -51°C (-60°F) (Product)

EVAPORATION RATE (n-BuAc=1): Not available.

SPECIFIC GRAVITY (water = 1): 1.038

SOLUBILITY IN WATER: Soluble.

VAPOR PRESSURE, mm Hg @ 20 °C: 0.07

ODOR THRESHOLD: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = -1.41, -0.30

BOILING POINT: 188°C (371°F)

pH: Approximately 8.9

APPEARANCE AND COLOR: This product is a colorless, odorless, syrupy liquid with a faint, chemical odor. Alternate colors are available, pending customer preferences.

HOW TO DETECT THIS SUBSTANCE (warning properties): The appearance is a distinguishing characteristic of this product.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Mainly carbon dioxide and carbon monoxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers, strong acids, acid chlorides, acid anhydrides, chloroformates, or strong reducing agents.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible chemicals.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: Additional toxicology information for components greater listed in Section 2 (Composition and Information on Ingredients) in concentration is provided below.

PROPYLENE GLYCOL:

Skin-Human: 500 mg/7 Days; Mild irritation effects
Skin-Human: 104 mg/3 days - Intermittent, Moderate irritation effects
Skin-Man 10%/2 days
Eye effects-Rabbit, adult : 100 mg, Mild irritation effects
Eye effects-Rabbit, adult: 500 mg/24 hours, Mild irritation effects
DNA Inhibition-Mouse-Subcutaneous: 8000 mg/kg
Cytogenetic Analysis-Mouse-Subcutaneous: 8000 mg/kg
Cytogenetic Analysis-Hamster: fibroblast: 32 g/L
Intraperitoneal-Mouse TDLo: 100 mg/kg (15 days preg): Teratogenic effects
Intraperitoneal-Mouse TDLo: 100 mg/kg (11 days preg): Reproductive effects
Oral-Child TDLo: 79 g/kg/56 weeks, Intermittent: Central nervous system and brain effects

PROPYLENE GLYCOL (Continued):

Parenteral-Infant TDLo: 10 g/kg/3 days - Continuous: systemic effects
Oral-Rat LD50: 20 g/kg
Intraperitoneal-Rat LD50: 6660 mg/kg
Subcutaneous-Rat LD50: 22,500 mg/kg
Intravenous-Rat LD50: 6423 mg/kg
Intramuscular-Rat LD50: 14 g/kg
Oral-Mouse LD50: 22 g/kg
Intraperitoneal-Mouse LD50: 9718 mg/kg;
Subcutaneous-Mouse LD50: 17,370 mg/kg;
Intravenous-Mouse LD50: 6630 mg/kg

SUSPECTED CANCER AGENT: The ingredients of this product are not listed on the following lists: FEDERAL OSHA Z LIST, NTP, IARC or CAL/OSHA, and therefore are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: This product may cause irritation to contaminated tissues.

SENSITIZATION TO THE PRODUCT: The components of this product are not known to cause sensitization after prolonged or repeated exposures.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and their components on the human reproductive system.

Mutagenicity: The components of this product are not reported to cause mutagenic effects in humans.

Embryotoxicity: This product is not reported to produce embryotoxic effects in humans.

Teratogenicity: This product is not reported to cause teratogenic effects in humans.

Reproductive Toxicity: This product is not reported to cause reproductive effects in humans.

A *mutagen* is a chemical, which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An *embryotoxin* is a chemical, which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A *teratogen* is a chemical, which causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance, which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: It is anticipated that mainly skin and eye disorders may be aggravated after over-exposure.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure.

BIOLOGICAL EXPOSURE INDICES: Currently, there are no Biological Indices (BEIs) associated with the components of this product.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: The components of this product will be degraded over time into other inorganic and organic compounds. The following information is available for the components of this product:

PROPYLENE GLYCOL: Soluble in water. Stable under ordinary conditions. Should be subject to biodegradation.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: This product may be harmful to contaminated plant and animal life especially if large quantities are released.

EFFECT OF CHEMICAL ON AQUATIC LIFE: This product may be harmful to aquatic life if large quantities are released into bodies of water.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

EPA WASTE NUMBER: Not applicable to wastes consisting only to wastes of this product.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Not applicable.

HAZARD CLASS NUMBER and DESCRIPTION: Not applicable.

UN IDENTIFICATION NUMBER: Not applicable.

PACKING GROUP: Not applicable.

DOT LABEL (S) REQUIRED: Not applicable.

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): Not applicable.

MARINE POLLUTANT: No component of this product is classified as a Marine Pollutant, as per Appendix B to 49 CFR 172.101.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS NOT CONSIDERED AS DANGEROUS GOODS.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: The components of this product are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows.

COMPOUND	SECTION 302	SECTION 304	SECTION 313
Propylene Glycol	NO	NO	NO

SARA THRESHOLD PLANNING QUANTITY: Not applicable.

TSCA INVENTORY STATUS: The components of this product are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER FEDERAL REGULATIONS: Not applicable.

15. REGULATORY INFORMATION (continued)

STATE REGULATORY INFORMATION: Components of this product are covered under specific State regulations, as denoted below:

Alaska – Designated Toxic and Hazardous Substances: NO
California – Permissible Exposure Limits for Chemical Contaminants: NO
Florida – Substance List: NO
Illinois – Toxic Substance List: NO
Kansas – Section 302/313 List: NO

Michigan - Critical Materials Register: NO
Minnesota – List of Hazardous Substances: NO
Missouri – Employer Information/ Toxic Substance List: NO
New Jersey – Right to know Hazardous Substance List: NO
North Dakota – List of Hazardous Chemicals, Reportable Quantities: NO

Pennsylvania – Hazardous Substance List
Propylene Glycol
Rhode Island – Hazardous Substance List:
Propylene Glycol
Texas – Hazardous Substance List: NO
W. Virginia–Hazardous Substance List: NO
Wisconsin – Toxic and Hazardous Substance: NO.

CALIFORNIA PROPOSITION 65: No component of this product is on the California Proposition 65 lists.

LABELING (Precautionary Statements): **CAUTION! MAY CAUSE SKIN AND EYE IRRITATION.** Avoid contact with eyes, skin, and clothing. Wear appropriate eye and skin protection. Avoid breathing air or mist. Use or store with adequate ventilation. Keep workplace airborne concentrations below legal and recommended limits. Circumstances could require use of respiratory protection. Refer to applicable OSHA Regulations. Wash thoroughly after handling. Do not transfer to unmarked container. Keep container closed when not in use. Open container slowly. Do not empty with pressure. Empty containers may contain hazardous product residues. Do not use welding or cutting torch on or near this container, even when empty. **IN CASE OF SPILL**: Absorb with inert material and place in suitable container. Flush area with soapy water. Refer to MSDS for additional information.

WHMIS SYMBOLS: Not applicable.

16. OTHER INFORMATION

PREPARED BY:

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<p>The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Dynalene Heat Transfer Fluids assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Dynalene Heat Transfer Fluids assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.</p>

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these that are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number who uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association that establishes exposure limits.

TLV - Threshold Limit Value - an airborne concentration of a substance, which represents conditions under which it is generally believed that nearly all workers, may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour **Time Weighted Average (TWA)**, the 15-minute **Short Term Exposure Limit**, and the instantaneous **Ceiling Level**. Skin adsorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - this exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL", is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL.

NIOSH is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issue exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

FLAMMABILITY LIMITS IN AIR

Much of the information related to fire and explosion is derived from the **National Fire Protection Association (NFPA)**. **LEL** - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. **UEL** -the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds is presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LCLO**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause death. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

REGULATORY INFORMATION

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and Transport Canada, respectively. The following laws are pertinent to the information presented in the MSDS: **Superfund Amendments and Reauthorization Act (SARA)**; the **Toxic Substance Control Act (TSCA)**; Marine Pollutant status according to the **DOT**; California's Safe Drinking Water Act (**Proposition 65**); the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)**. This section also includes information on the precautionary warnings, which appear, on the material's package label.