

X-Cite® TURBO User Guide

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Made in Canada

Excelitas Canada Inc. 2022

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1 Introduction

Meet X-Cite TURBO - a powerful, color switching LED source, with six channels and excitation filtering capabilities, for fluorescence applications. Delivering light through a liquid light guide, X-Cite TURBO delivers superior optical power and exceptional field uniformity to the specimen with the broadest spectrum of fluorescence excitation through manual, PC and TTL control. With LEDs rated to 15,000 hours and no lamps or modules to replace, X-Cite TURBO offers simplicity and convenience to researchers and instrument developers, allowing them to focus on their experiments instead of equipment maintenance.

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

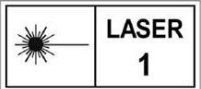
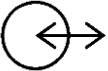
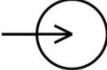
Excelitas Technologies Corp. is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of customers. X-Cite, formerly of Lumen Dynamics (which was acquired by Excelitas Technologies Corp. in November 2013) offers the Life Science and Analytical Instrumentation market a broad range of innovative lamp and LED fluorescence illumination and measurement solutions. Recognized as the industry standard in research microscopy, X-Cite also provides solid state LED technologies to instrument manufacturers, and combines maximum optical performance with flexible design, as well as best-in-class manufacturing quality and lead time.

Excelitas recommends reading this manual to discover all the features available in X-Cite TURBO.

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.
	WARNING – UV light hazard.
 IEC 60825-1: Safety of laser products – Part 1: Equipment classification and requirements: 2014-05	WARNING – Class 1 laser product.
	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 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.
3. Always make sure the light guide and microscope adapter (if applicable) are 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. Always use this product with the external power supply and power cord set provided. Ensure the external power supply cord is connected to a grounded 3-pin outlet only. Any substitution of these components will invalidate regulatory certification of this product and may impair operating safety.
5. Disconnecting of main supply source is done by putting the on/off button in the off position and unplugging the power cord.
6. It is recommended that ONLY QUALIFIED TECHNICAL PERSONNEL perform any testing or repairs of this unit. If servicing the unit, disconnect the external power supply 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. Note that opening the cover and/or altering the unit in any way may void the warranty (see section 10 for more details).
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 Excelitas, 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. 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

This X-Cite system contains the following components:

1. X-Cite TURBO unit (Model no: XT600-T), LEDs and dichroics are installed
2. SpeedDIAL Manual Controller
3. External Power Supply and Power Cord
4. Microscope Adaptor (if ordered)
5. Accessories Box, containing:
 - a. Quick Start Instruction Sheet (User Guide and Software download are available on Excelitas website: <https://www.excelitas.com/>)
 - b. Hex Tools (Allen Keys), 3mm and 0.05 inch
 - c. Set screws (6) for filter brackets
 - d. USB Cable
 - e. Light Guide
 - f. TTL/Analog Trigger Cable, DB25 to 12 x BNC
 - g. Safety Precautions Booklet

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

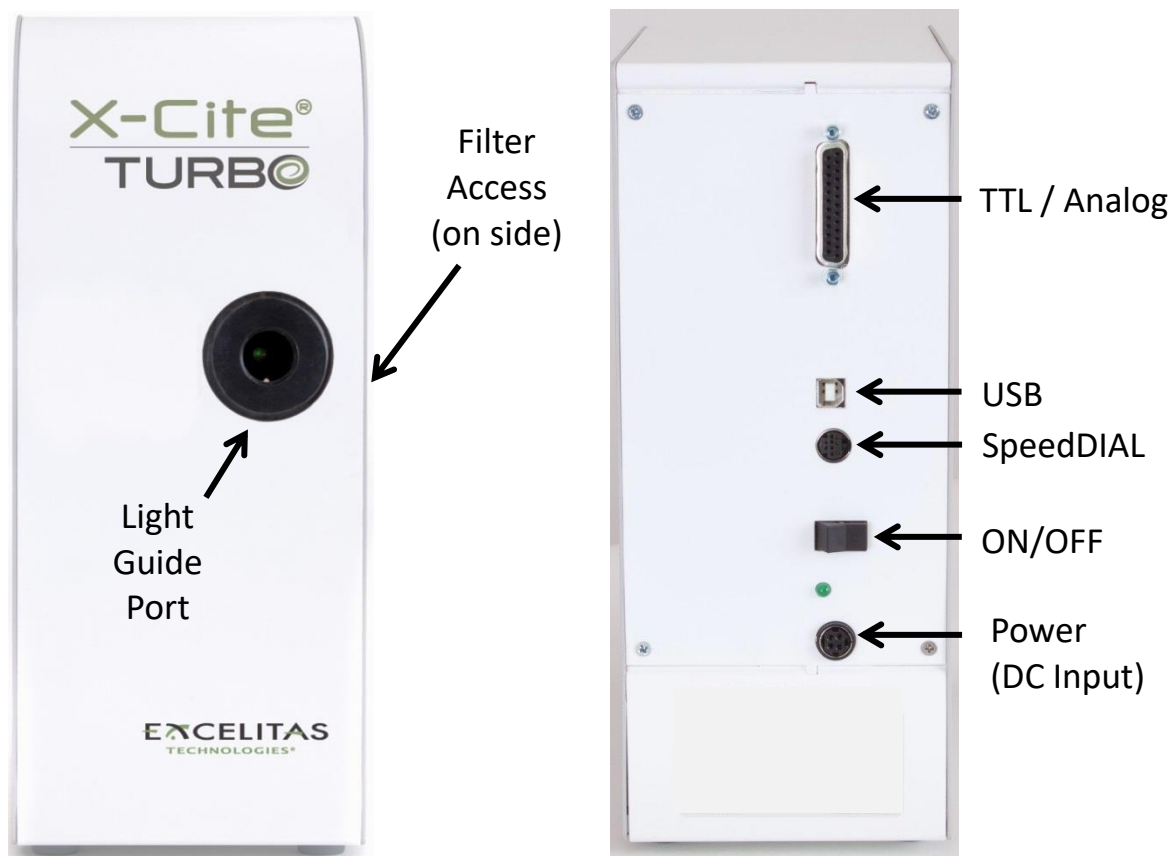


Figure 1 Front and Rear Panel Connections

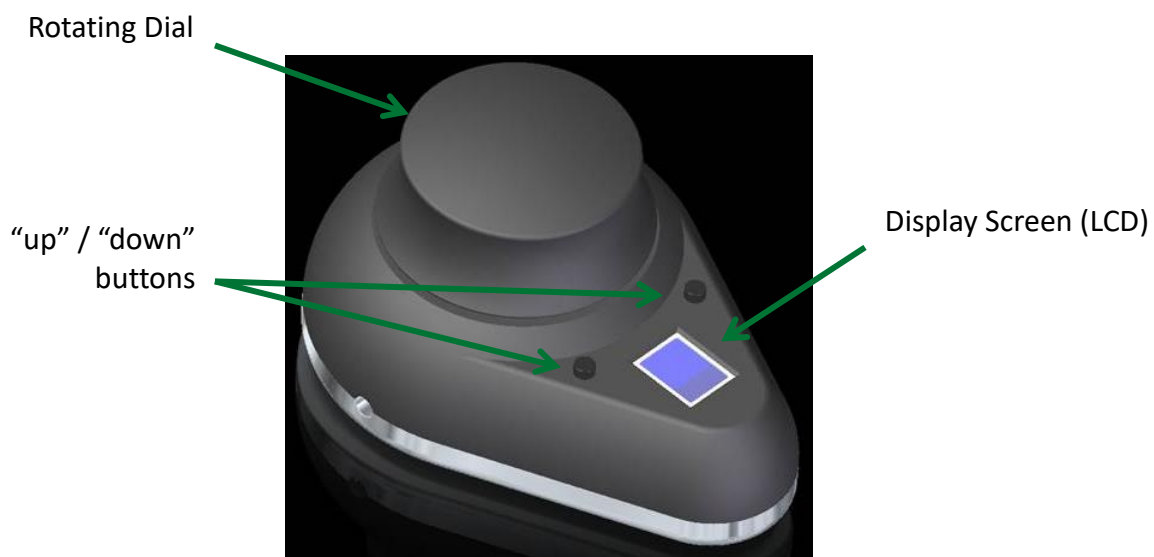


Figure 2 SpeedDIAL

3.2 System Layout

X-Cite TURBO unit contains the following LED wavelengths:

LED Position	LED Center Wavelength	Useable Wavelength Range
1	385nm	375nm – 400nm
2	430nm	410nm – 450nm
3	475nm	460nm – 495nm
4	525nm	500nm – 520nm
5	575nm	525nm – 610nm
6	630nm	615nm – 660nm

The LEDs (black numbers) and the dichroics (white numbers) that combine them are positioned as shown in Figure 3.

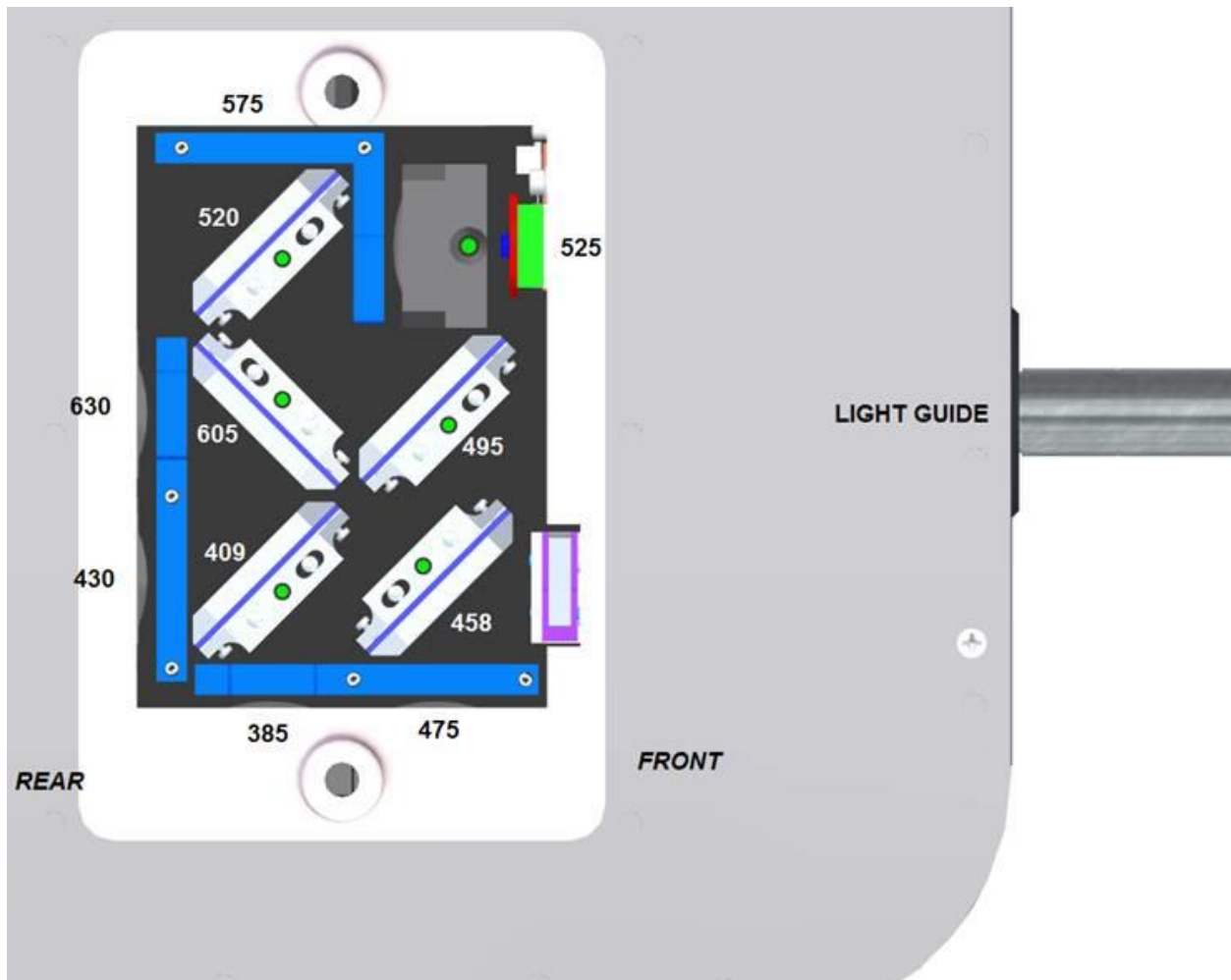


Figure 3 LED and Dichroic Internal Layout

3.3 Installation/Set-up

1. Unpack

- a. Carefully unpack the unit and accessories from the shipping carton.
- b. When unpacking the light guide (liquid or quartz fiber), take care not to bend sharply or kink.

2. Installing Excitation Filters (if using)

Note: 25mm mounted Excitation filters are not supplied with the system.

Important: Ensure that main unit is powered OFF before attempting to install filters

- a. Remove the filter access panel with the 3mm hex tool. Note that the access panel is holding the filter brackets in place – if work surface is not level, the brackets may begin to slide out on their pins once the panel is removed. You may prefer to lay the system on its side for filter installation/exchange.
- b. Refer to Figure 3 to determine location of specific LEDs.
- c. Slide out the relevant filter brackets by grasping the black “tabs”.
- d. Place 25mm mounted filter in the bracket in the correct orientation advised by the filter manufacturer.
- e. Tighten a set screw at the bottom of the bracket.
- f. Over a clean surface, turn filter bracket over to ensure the filter is firmly installed.
- g. Repeat for any additional filters being installed.
- h. Reinstall the filter bracket(s) by aligning the holes with the locator pins, and gently sliding the bracket all the way in.
- i. Reattach the filter access panel.

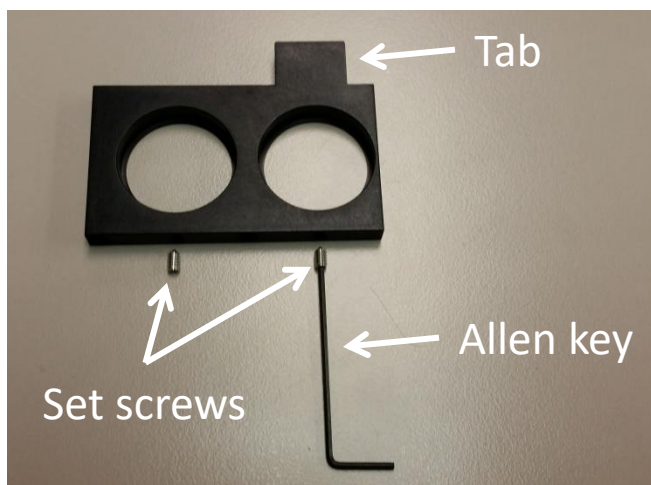


Figure 4 Filter bracket

3. Install the Microscope Adaptor (if applicable)

- a. Remove the protective wrap from the Microscope Adaptor, being careful not to touch the lens surfaces.

- a. Insert the flange portion of the Microscope Adaptor 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 “notch” with the pin on the microscope fitting, hold the adaptor 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.
4. Install the Light Guide
 - a. Remove the red plug from the light guide port located on front fascia.
 - b. Remove the red caps from the ends of the light guide.
 - c. Insert the larger end of the light guide into the light guide port. For X-Cite TURBO, the light guide must be inserted up to the “B” line printed on the grey ferrule, see Figure 5. [Note: If using an X-Cite 3mm or 5mm light guide with only one “insertion line” on the grey ferrule, this line will be 20mm away from the light guide port.]
 - d. Insert smaller end of the light guide into the Microscope Adaptor (or light guide port on the microscope/imaging instrument). Ensure that light guide is fully inserted and lock in place with thumbscrew (or appropriate fastener).



Figure 5 Correct position for fully inserted X-Cite LLG and LLG with A and B insertion lines

5. Check Position of the Equipment

- a. The X-Cite unit should be positioned to avoid sharp bends and strain on the light guide. This applies to both liquid and quartz fiber light guides. Ideally, the unit should be positioned so that:
 - i. The light guide has as few bends as possible.
 - ii. Bends have the largest bend radius possible.
 - iii. There is some slack in the light guide.
- b. To avoid overheating the LEDs and other electronics, ensure all air vents on the side panel of the unit are clear of obstruction and have ready access to room temperature air. Recommended clearance is 20cm (8 inches).
- c. If installing the unit within another imaging instrument, the air vent side should be placed against an outside panel with venting to allow fresh air to be drawn into the system.
- d. Note that the main power switch is located on the rear panel of the unit. The unit should be placed so that the switch is convenient for the operator to access.

6. Connect speedDIAL to main unit

- a. Important: Ensure that main unit is powered OFF before attempting to connect speedDIAL, or damage to the device may result.
- b. Insert the mini DIN plug into the “speedDIAL” port on the rear of the unit. Ensure the arrow mark on the connector is on the right (i.e. at the 3:00 position). Note: Never

force the connector – this can damage the pins. If connector does not insert smoothly, stop and check for bent pins.

- c. Place speedDIAL next to the microscope, or another easily accessible location.
7. Connect USB (if using)
 - a. Insert “B” (square) end into the “USB” port on rear of the unit.
 - 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), and plug directly into the computer. Using a USB hub or longer USB cable than the one supplied may result in intermittent communication errors.
 8. Connect TTL/Analog Trigger Cable (if using)
 - a. Insert DB25 end into the port on rear of the unit. Tighten fasteners with flat head screwdriver.
 - b. Connect BNC cables to appropriate signal generating device. BNC connectors are labeled with TTL and Analog channel numbers.
 9. Connect AC Power
 - a. Connect Power Supply: Insert the 4-pin connector on the cable into the power port on rear of the main unit. Ensure that the orientation is correct, or else damage to the pins may result. The arrows on the plug should be on the right (i.e. at the 3:00 position).
 - b. Connect Power Cord: Connect female end of the power cord to AC port on the power supply. 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 rear of the main unit to turn X-Cite system on.
 - b. The system will have a brief initialization period (approximately 5 seconds). The speedDIAL display will show “X-Cite” during this time.
 - c. When the display shows LED positions 1 and 2 with their intensity setting (a number from 5 to 100 for LEDs 1, 2, 3, 4 and 6; a number from 10 to 100 for LED 5), 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. Press the “up” and “down” buttons until the arrow is pointing to the desired LED channel (1 to 6).
- b. Click the dial (shutter button) on speedDIAL to turn on/off the excitation light. A dot will appear beside the LED channel numbers that are ON. (See Figure 6 – LED 1 is off, LED 2 is on at 100% intensity.)
- c. To turn all LEDs ON/OFF at once, move arrow to “All” at the bottom of the list. Click the dial. Note: All function is controlled from speedDIAL, if using the command line all on/off control, the speedDIAL all on/off status will not correlate.



Figure 6 speedDIAL Display – Turning LED ON/OFF

3. Adjust intensity

- a. Press the “up” and “down” buttons to the LED to be adjusted.
- b. Turn the dial to adjust intensity - clockwise to increase, counter-clockwise to decrease. (intensity is updated in real time) (See Figure 7 – LEDs 1 and 2 are both OFF, LED 1 is set to 100%, LED 2 is being set to 42%)
- c. Repeat steps b and c for any other LEDs requiring adjustment.
- d. The dial is speed sensitive – turning slowly will allow adjustments in smaller increments, turning quickly will increase the step sizes.
- e. Intensity can be adjusted in 1% increments from 5% to 100%. (Note: 5% is the minimum for LED 1, 2, 3, 4 and 6; 10% is the minimum for LED 5)



Figure 7 SpeedDIAL Display – Adjusting Intensity

NOTE: If the LEDs are Locked via PC, the “Lock” symbol will show to the right of “All”. Unit can only be unlocked via PC control, or by power cycling the unit.

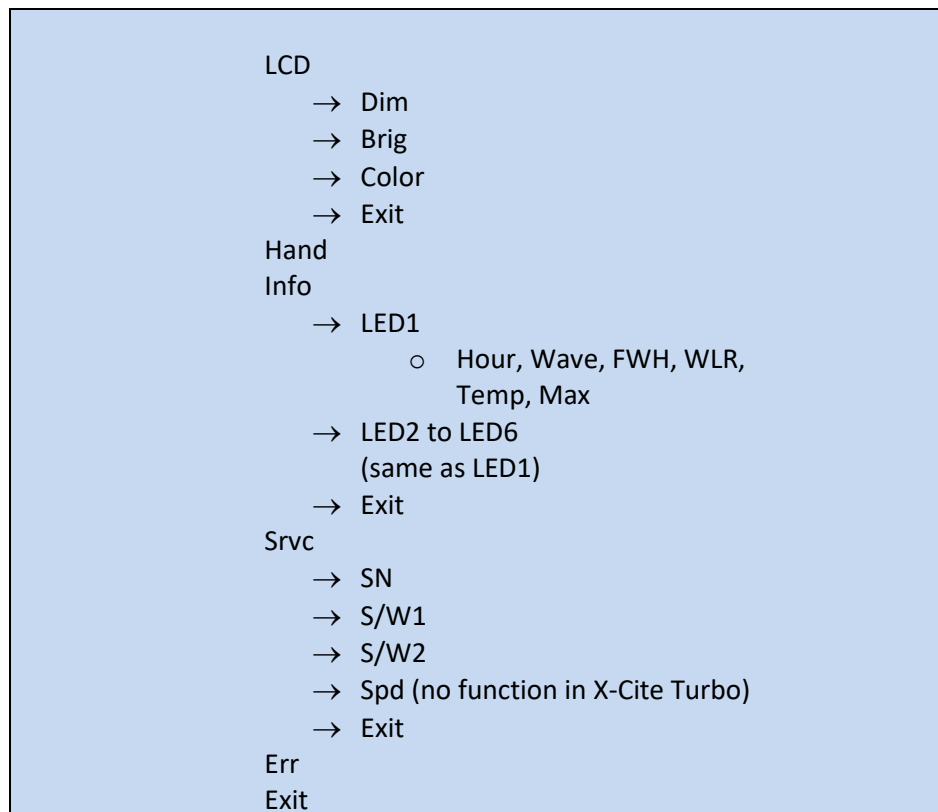
4.2 SpeedDIAL Menu and Settings

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 the menu system at any time, press and hold the dial for one (1) second, or select Exit at the bottom of the menu list.

Note: Setting changes will take effect immediately during selection. However, for the first five (5) minutes, the new settings are not saved for restoration after power cycle. If the X-Cite unit 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 after the last settings adjustment before powering down the unit. “Up” and “down” buttons are disabled in the speedDIAL menu and settings.

4.2.1 SpeedDIAL Menu Structure



4.2.2 LCD – Display Screen Brightness and Color Settings

In the LCD sub menu, the time before the backlight is turned off (the backlight will turn back on with a movement of the speedDIAL), 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 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 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 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.

4.2.3 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 return to the main menu.

4.2.4 Info

In this menu, information specific to each LED may be found. This includes total hours accumulated on the LED, center wavelength, full width half maximum of each LED, useable wavelength range and temperature.

- a. Select “Info” option from the main menu.
- b. Scroll through the LED list and click on the “LED#” of interest.
- c. 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 previous sub menu.
- d. To obtain center wavelength information:
 - i. Select the “Wave” menu option.
 - ii. Center wavelength will be shown as “###”, units are nanometres.
 - iii. Click dial to return to previous sub menu
- e. To obtain full width half maximum information:
 - i. Select the “FWH” menu option.
 - ii. Width will be shown as “##”, units are nanometres.
 - iii. Click dial to return to previous sub menu.
- f. To obtain wavelength range information:
 - i. Select the “WLR” menu option.
 - ii. Due to space limitations on the LCD, wavelength range will be shown as two alternating values “##-” and “##”. The delay between screen views is approximately one second. Units are nanometres.
 - iii. Click dial to return to previous sub menu.
- g. To obtain current LED temperature:
 - i. Select the “Temp” menu option.
 - ii. Current temperature will be shown in degrees Celsius.
 - iii. Click dial to return to previous sub menu.
- h. To obtain maximum allowable LED temperature:
 - i. Select the “Max” menu option.
 - ii. Maximum allow allowable temperature will be shown in degrees Celsius. (Note: should the “Temp” value ever equal or exceed the “Max” value during operation, the LED will be turned off and an Error condition will result.)
 - iii. Click dial to return to previous sub menu.
- i. Select “Exit” to go back to the main menu, or press and hold dial to return to the home screen.

4.2.5 Srvc – Service Data

In the Service menu, information specific to each X-Cite unit can be found. This includes unit serial number, embedded software versions for main unit and speedDIAL. 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 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.
- c. To obtain the embedded software version numbers:

- i. Select the “S/W1” or “S/W2” menu items. The software version numbers will be shown in the format X.X.X.
 - ii. Click dial to return to “Srvc” menu.
- d. “Spd” – no function in X-Cite Turbo

4.2.6 Err

In the Error menu, error conditions specific to each LED or the system in general can be checked. Tech Support personnel may request some or all of this information during a support call.

- a. Select “Err” option from main menu.
- b. Scroll to find the “LED#” of interest or “Sys” for the system/unit in general. Click to select.
- c. A numerical error code will be displayed. If no error condition is present, “0” will be displayed. Refer to section 6.1 for definition of the error code numbers.
- d. Click dial to return to previous sub menu.
- e. Select “Exit” to go back to the main menu, or press and hold dial to return to the home screen.

5 Operation - External Control

5.1 USB/RS-232

This X-Cite unit is a USB device which operates at USB 2.0 speeds of 12Mb/s and does not use a USB to RS-232 adapter. However, the X-Cite will appear as a COM port in Device Manager, and is functional as a COM port for programming purposes. This is done for legacy program support and ease of integration.

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 (and running an OS that Microsoft supports windows updates for), the driver will install automatically. For manual installation, the driver is available as a software download from the Excelitas 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 (automatically via internet)

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

- a. Ensure X-Cite unit is powered off.
- b. Ensure X-Cite unit is connected to the computer with the USB cable.
- c. Ensure computer is connected to internet.
- d. Power on X-Cite unit.
- 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 ZIP file)

For these instructions: download the driver ZIP file from the Excelitas website

<https://www.excelitas.com/>.

- a. Ensure X-Cite unit is powered off.
- b. Ensure X-Cite unit is connected to the computer with the USB cable.
- c. Prepare the driver files by extracting and saving the files into a folder on desktop (or another easily accessible location).
- d. Power on X-Cite unit.
- 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**. 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 LED (XT600 Series)” will be listed under “Ports (COM & LPT)”.
- c. Note the COM port number for use in other software applications.

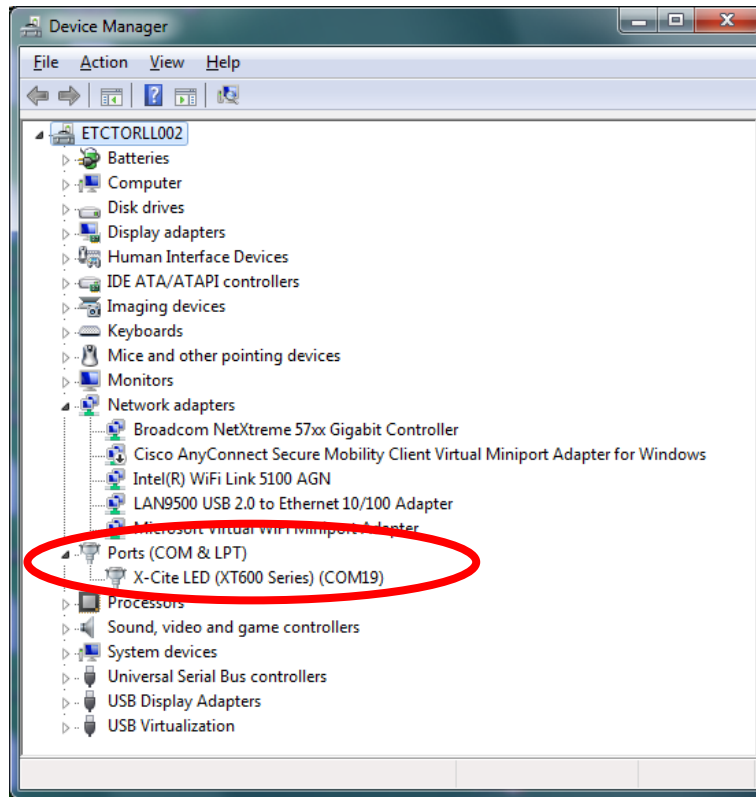


Figure 8 Device Manager, COM Port Listing

5.1.4 Software Developer's Kit (SDK)

The command list is available by request. To obtain the latest update, please contact Technical Support. Tips for specific use cases can be found in section 5.3.

5.1.5 Commercial Software Support

- a. This X-Cite unit can be controlled through several commercially available packages. Where model-specific control may not yet be available, basic functionality can be achieved using X-Cite XLED1 hardware drivers and "Grouping" – see next section. For an updated list of software packages that support X-Cite products, see <https://www.excelitas.com/>
- 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 this X-Cite unit, some commercial software packages may block manual input from speedDIAL. The lock icon will appear on the speedDIAL display in these cases.

5.1.6 Grouping Controls / Compatibility Mode

To enable compatibility with existing device drivers for X-Cite XLED1, it is possible to run X-Cite TURBO in 4-channel mode by creating "Groups". Groups can be configured and enabled using

the LED Grouping and Trigger Sequencing commands in the SDK. Up to four groups can be defined, and each group may contain 1-6 LEDs. See table below for an example.

Group Number	LEDs in Group
1	1 – 385nm
2	2 – 430nm
3	3 – 475nm & 4 – 525nm
4	5 – 575nm & 6 – 630nm

5.2 TTL & Analog

5.2.1 TTL Input Specifications

- Connector type: BD25 (female)
- Maximum low level : +0.8V
- Minimum high level : +2.2V
- Maximum high level: + 5.5V
- Typical input current: 800μA

5.2.2 TTL Signal and LED Status

TTL	LED Status
High	ON
Low	OFF

5.2.3 Analog Input Specifications

- Connector type: DB25 (female port)
- Maximum input current: 500μA

5.2.4 Analog Signal and LED Power Setting

Analog Signal	LED Power Setting
0-1V	Signal ignored*
1-1.2V / 1-1.4V	5% for LED 1-4 & 6 / 10% for LED 5
1.2- 5V for LED 1-4 & 6 / 1.4-5V for LED 5	Conversion factor: 0.04/1%
5-5.25V	100%

*Note: If input voltage is below 1V, analog input will be ignored. When LED is triggered it will turn on with previous power setting or with USB defined power setting. If an analog input is provided along with input from speedDIAL or USB, the analog input will take precedence. Analog intensity settings are not saved to the unit and will not be restored after a power cycle.

5.2.5 DB25 Pin-Out

Pin Number	Channel	Description
1	1	TTL Input
2	1	IsoDGND
3	2	TTL Input
4	2	IsoDGND
5	3	TTL Input
6	3	IsoDGND
7	4	TTL Input
8	4	IsoDGND
9	5	TTL Input
10	5	IsoDGND
11	6	TTL Input
12	6	IsoDGND
13		Reserved – Do not connect
14	1	Intensity Input
15	1	IsoAGND
16	2	Intensity Input
17	2	IsoAGND
18	3	Intensity Input
19	3	IsoAGND
20	4	Intensity Input
21	4	IsoAGND
22	5	Intensity Input
23	5	IsoAGND
24	6	Intensity Input
25	6	IsoAGND

5.3 Tips for Specific Use Cases

Refer to the SDK for full programming and command details.

5.3.1 Simultaneous Control to produce White Light Mode – USB

To simultaneously control all six LED channels with single commands:

- ON/OFF - Use the “turn all LEDs ON/OFF” command.
- Intensity Setting – use the standard intensity setting command, and set all six LED intensities in a single string (#, #, #, #, #, #). All six must be given a % value * 10 (a # of 500 sets the intensity to 50.0%) - so you can use the same setting for all channels, or different settings to remove the UV component or otherwise adjust the color balance.
- Note - Refer to SDK for complete syntax details.

5.3.2 Simultaneous Control to produce White Light Mode – TTL & Analog

To simultaneously control all six LED channels with a single TTL input:

- a. ON/OFF - Configure a TTL Trigger Sequence where all LEDs are set to “1” via a USB command. Connect triggering device to input TTL1. (Please see SDK)
- b. Intensity Setting
 - a. USB - If intensity does not need to change constantly, use the standard intensity setting command, and set all six LED intensities in a single string (#, #, #, #, #, #). All six must be given a % value * 10 (a # of 500 sets the intensity to 50.0%) - so you can use the same setting for all channels, or different settings to remove the UV component or otherwise adjust the color balance.
 - b. Analog – If intensity needs to be adjusted during imaging session (without a USB connection), set analog input to “Analog1” For this to be applicable, a USB command to use one analog input also needs to be given. (Please see SDK)

5.3.3 Ring Buffer / TTL Sequencing Mode

To control all six LED channels with a single TTL input, there is a one-time set-up with USB commands. After five minutes, the settings will be stored in NVM and do not need to be adjusted until new settings are desired. Use TTL input channel TTL1 to trigger.

To configure TTL ON/OFF settings:

- a. Via USB commands - enable TTL sequencing and triggering order with the “ts” command. See SDK for syntax details.

5.3.4 Controlling with X-Cite XLED GUI

For demonstration, communication testing purposes and existing software compatibility purposes, X-Cite TURBO can emulate the XLED command set and be controlled with an X-Cite XLED GUI.

- a. Configure LED Groups and enable Compatibility Mode on X-Cite TURBO via USB. This can be done via HyperTerminal using SDK commands. Refer to section 5.1.6 for complete details.
- b. Install the XLED GUI (Control Panel Software: **032-00136.zip** file) from Excelitas website: <https://www.excelitas.com/>
(Note: XLED GUI versions prior to 1.1.0.2, including the one available for download on the X-Cite website will not be compatible with X-Cite TURBO.)
- c. Open XLED GUI and use as normal.

6 Troubleshooting

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

6.1 Error Messages

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

LED Errors

Error Code	Description	Action
1	An 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 the side panel of the unit. If fan is not running or the problem persists contact technical support for assistance.
2 or 4	Laser Protection Error	Power cycle the X-Cite TURBO unit. If the error message reappears contact technical support for assistance.
3 or 5	Internal Error	Power cycle the X-Cite TURBO unit. If the error message reappears contact technical support for assistance.
6	An 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.

System (Sys) Errors

Error Code	Description	Action
1	Sensor Input Error	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 the side panel of the unit. If fan is not running or the problem persists contact technical support for assistance.
3	Internal Error	Power cycle the X-Cite TURBO unit. If the error message reappears contact technical support for assistance.
5	Inadequate System Performance	Reduce the rate at which commands are given to the unit as it is unable to keep up with the commands.
6	Low Power Error	The system experienced a brown out and had to shut down the LED's as a safety precaution. Ensure the unit is given constant power or contact service if problem persists.

6.2 Failure to Power Up

If X-Cite TURBO 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 power supply brick
 - c. The DC cord from the power supply is securely connected to the “Power” port on the rear of the X-Cite unit.
 - d. The main power switch is in the ON position.
2. SpeedDIAL Check:
 - Verify that the pins on speedDIAL connector are straight.
 - Verify that speedDIAL is plugged securely into main unit.
3. Unit door check:
 - Verify the door screws of main unit are tightened

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 LEDs are turning on.
2. Light Guide Check:
 - a. Verify that the ends of the light guide are free of debris.
 - b. Verify that there are no bubbles in the light guide. (For detailed steps contact Tech Support.)
 - c. Verify that the light guide is fully inserted in the main unit and the microscope.
3. Microscope Check:
 - a. Verify that the Microscope Adaptor is appropriate for the microscope configuration.
Note: Some adaptors 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	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.
	“NO LG” icon is on display	Ensure the light guide is fully inserted in the main unit
	“Lock” icon is on display, speedDIAL not responding to manual control	Send “unlock” command via computer OR power down unit and restart.
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 TURBO is a very low maintenance system with only one consumable component – the liquid light guide. 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 TURBO air vents unobstructed.
2. Ensure that the light guide has some slack in it and is never cut, stretched, kinked, or forced into a sharp bend.
3. Never touch optical surfaces with fingers, tools or any other abrasive/sticky/sharp materials or fluids.
4. If cleaning is required, follow the directions in the next section.

7.2 Cleaning - Exterior Surfaces

If necessary, exterior surfaces of X-Cite TURBO 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.

8 Technical Specifications

8.1 General

	Main Unit	speedDIAL
Height	264mm (10.4")	59mm (2.3")
Width	110mm (4.3") ^a	80mm (3.1")
Depth	230mm (9") ^b	112mm (4.4")
Weight	4.3kg (9.4lbs)	0.3kg (0.7lbs)

Notes:

- a. Does not include clearance required for ventilation.
- b. Does not include clearance required for cables or light guide.

8.2 Electrical

AC input information for external power supply:

Power Supply	Power Factor Corrected, Universal Input
Input Voltage	100-240VAC, 50/60Hz
Current	1.85A max /115V, 1.0A max/230V
Input Surge	With cold start, 120A max/230V
Protection	Over load and over temperature

DC input information for X-Cite TURBO:

Model #	Input Voltage	Input Current
XT600-T	24VDC	6.5A

8.3 Environmental – Operating Conditions

Ambient Temperature	10° to 30° C
Altitude	2000m max
Atmospheric Pressure	700 to 1060 hPa
Relative Humidity	15 to 90% RH (non-condensing)
Installation Category	II
Pollution Degree	2

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
Remote - IN/OUT	Mini DIN plug, 9pos	Communication between speedDIAL and X-Cite unit to control LED and report status (on/off, intensity adjustment, system error, etc.)
USB - IN/OUT	B	Communication between computer and X-Cite unit to control LED and report status.
Trigger Input	DB25	External trigger to turn LEDs on/off and adjust LED intensities

8.6 Output Stability

High power LEDs tend to lose their output stability when operated at low drive currents (i.e. set to low intensity levels). To prevent power fluctuations, X-Cite TURBO has a built-in 5% lower limit on the intensity setting for LEDs 1, 2, 3, 4, 6 and 10% lower limit for LED 5. To further maximize output stability 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 Compliance

9.1 Product Safety and Electromagnetic Compatibility

The X-Cite TURBO 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 <https://www.excelitas.com/>.

9.1.1 Laser Safety

The X-Cite TURBO is classified as Class 1 laser product according to IEC 60825-1: Safety of laser products – Part 1: Equipment classification and requirements: 2014-05 and complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

This class is eye-safe under all operating conditions. This class includes all lasers or laser systems which cannot emit levels of optical radiation above the exposure limits for the eye under any exposure

conditions inherent in the design of the laser product. There may be a more hazardous laser embedded in the enclosure of a Class 1 product, but no harmful radiation can escape the enclosure.

9.1.2 Optical Safety

The X-Cite TURBO is classified as Risk Group 2 according to IEC 62471: Photobiological Safety of Lamps and Lamp Systems.

Resulting Classification and Labelling:

Hazard	Model XT600-T
Actinic UV	Risk Group 1
Near UV	Risk Group 2
Blue Light	Risk Group 1
Retinal Thermal Weak Visual	Exempt Group



9.2 CE Marking

Council Directive 2014/35/EU
Council Directive 2014/30/EU
Council Directive 2012/19/EU
Council Directive 2011/65/EU
as amended by (EU) 2015/863

Low Voltage Directive
EMC Directive
WEEE Directive
RoHS



This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

9.3 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/her own expense.

WARNING

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

9.4 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.

9.5 China RoHS



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

Part Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr (VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Printed circuit board assemblies	X	O	O	O	O	O

This table is compiled according to SJ/T 11364.

O : Indicates that the content of the hazardous substance in all homogeneous materials of the part is below the limit requirement of GB/T 26572.

X : Indicates that the content of the hazardous substance in at least one of the homogeneous materials of the part exceeds the limit requirement specified by GB/T 26572.

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷电路板组件	X	O	O	O	O	O

本表格依据 SJ / T 11364 的规定编制。

O : 表示该有害物质在该部件所有均质材料中的含量均在 GB / T 26572 规定的限量要求以下。

X : 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB / T 26572 规定的限量要求。

9.6 Korean KC Certification

사용자안내문

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

※ 사용자 안내문은 “업무용 방송통신기자재”에만 적용한다.



Warning statement

EMC Registration is done on this equipment for business use only. If the product is used in the home, it may cause interference.

- This warning statement applies to products for business use.

9.7 Australia - RCM



The symbol above indicates that this product is in compliance with the Electromagnetic Compatibility and Labelling requirements of the Australian Communications and Media Authority (ACMA).

10 Warranty & Repairs

10.1 Warranty Terms

Excelitas 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 assemblies within the unit have a warranty period of 15,000 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 an appropriate Excelitas Authorized Service Center. Returned equipment will not be received without a Return Material Authorization (RMA) Number, issued by the 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 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 light guides, fuses and air filters.

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

SYSTEM COMPONENT	WARRANTY	WARRANTY VOID IF...
X-Cite TURBO main unit	1 year	• Unit has been subjected to misuse or mishandling. • Unit has been opened or tampered with.
X-Cite speedDIAL	1 year	• Unit or cabling has been subjected to misuse or mishandling. • Unit has been opened or tampered with. • LCD display damage (physical).
LED assembly (each LED)	• 15,000 hrs • 3 years whichever Comes first	• LED assembly has been opened or tampered with.

10.2 Returning equipment to Excelitas

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 Service Center to obtain a Return Material Authorization (RMA) number. For your convenience, RMA numbers can also be requested on-line at:
https://www.excelitas.com/ox_service_request_form
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

Excelitas Canada Inc.

Tel: (905) 821-2600

Fax: (905) 821-2055

Toll Free: 1-800-668-8752 (*USA and Canada*)

x-cite@excelitas.com

<http://www.excelitas.com/x-cite>

11.2 Technical Support and Service

For Technical Support and Service specific to Excelitas UV & Microscopy products:

(905) 821-2600, option 3

1-800-668-8752, option 3 (*USA and Canada*)

https://www.excelitas.com/ox_service_request_form

11.3 Accessories and Replacement Parts

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

(905) 821-2600

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

x-cite@excelitas.com

<https://www.excelitas.com/omnicure-x-cite-inquiries>