X-Cite TETREM™ User Guide

Applies to XT600 Series Models:

- XT640S
- XT640L

X-Cite TETREM™ User Guide

035-00759R rev. 0
Made in Canada

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Trademarks

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1 Introduction

Meet X-Cite TETREM™ - a compact 4-channel LED illuminator for routine fluorescence applications. With coverage of the four key spectral bands (DAPI, FITC, TRITC, Cy5) and liquid light guide coupling, X-Cite TETREM delivers superior optical power and exceptional field uniformity. X-Cite TETREM's four independent LEDs can be controlled via USB, TTL and our sleek new X-Cite smartDIAL™. Controlling an X-Cite system has never been this easy and intuitive! Once again, X-Cite innovation offers 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.

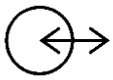
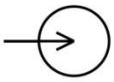
Excelitas Technologies Corp. is a global technology leader focused on delivering innovative, customized solutions to meet the lighting, detection and other high-performance technology needs of customers. X-Cite offers the Life Science and Analytical Instrumentation market a broad range of innovative 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 TETREM.

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.
	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. 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

This X-Cite system contains the following components:

1. X-Cite TETREM unit
2. smartDIAL Manual Controller (if ordered)
3. 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. USB Cable
    c. Hex tool, 3mm
    d. Safety Precautions Booklet
    e. Liquid Light Guide (if ordered)
    f. DB25 x 8 BNC TTL/Analog Input Cable (if ordered)

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

Figure 1 System Components

Figure 2 Front and Rear Panel Connections

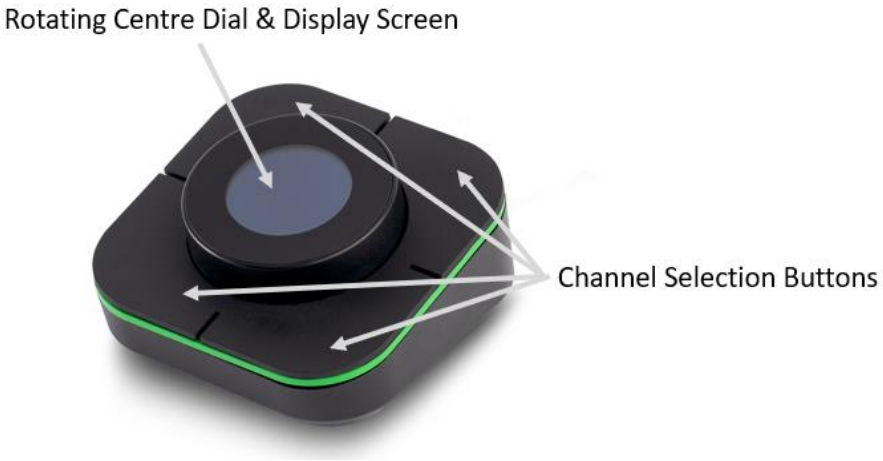


Figure 3 SmartDIAL

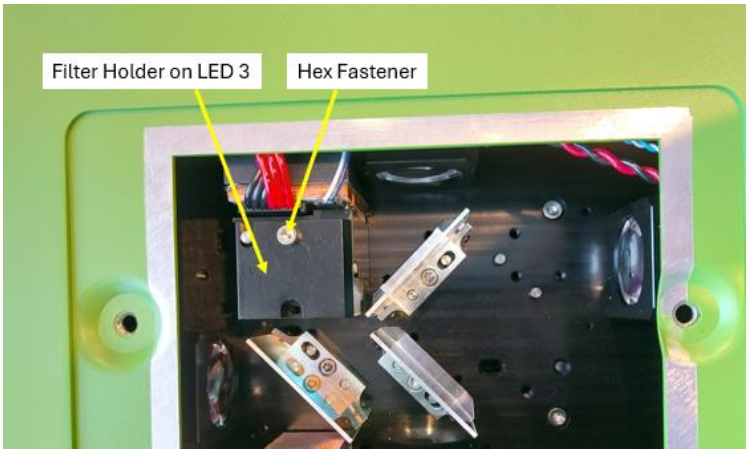
3.2 Installation/Set-up

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

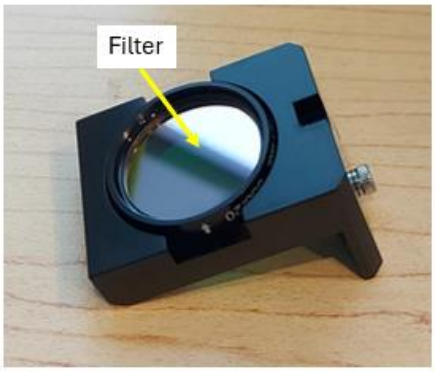
2. Install or change clean up filter on LED 3 (if applicable)

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

    a. Lay the X-Cite unit on its side, access panel side up. Remove the filter access panel with the 3mm hex tool.
    b. Locate LED 3. Remove the hex fastener (2mm hex tool) on the filter holder.



    c. Gently remove the filter holder out of the unit – take care not to bump, touch, or put any pressure on the dichroics. (Tip: There is a curved lens in front of the LED, so rotate the holder before pulling it out.)
    d. Place the filter holder on a clean surface and loosen the set screw (0.05” hex tool)
    e. Place the filter in the frame. Secure the set screw.



    f. Gently maneuver the filter holder back into its original position. Secure the hex fastener.
    g. Replace the access panel.

3. Install the Microscope Adaptor (if applicable)

a. Remove the protective wrap from the Microscope Adaptor, being careful not to touch the lens surface.
b. 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 the front panel.
    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 TETREM, the light guide must be inserted up to the “B” line printed on the grey ferrule, see Figure 4. [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 the smaller end of the light guide into the Microscope Adaptor (or light guide port on the microscope/imaging instrument). Ensure that the light guide is fully inserted and lock it in place with the thumbscrew (or appropriate fastener).

Figure 4 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. 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. All air vents on the side panel of the unit should be clear of obstruction. Recommended clearance is 20cm (8 inches).
    c. 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 smartDIAL to main unit
    a. Important: Ensure that main unit is powered OFF before attempting to connect smartDIAL, or damage to the device may result.
    b. Insert the mini DIN plug into the “Remote” 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 smartDIAL 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 main 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. Using a longer USB cable than the one supplied may result in intermittent communication errors.

8. Connect AC Power
    a. Connect Power Supply: Insert the power supply’s 4-pin connector 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 SmartDIAL Home Screen

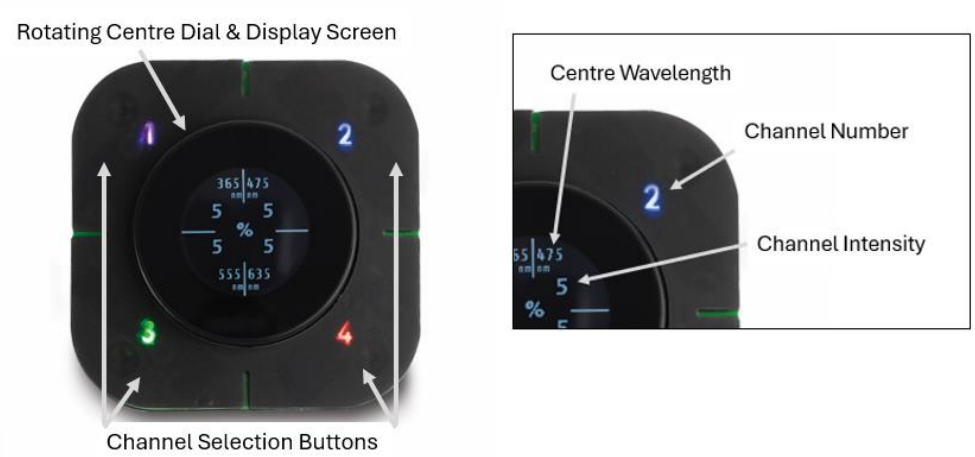


Figure 5 SmartDIAL Home Screen

4.2 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 smartDIAL display will show “X-Cite” during this time.
    c. When the display shows “%” in the centre and information for the four channels as shown in Figure 5, it is ready to use.
    d. Note: If smartDIAL will be used for manual control, it must be connected before turning system on. SmartDIAL can be damaged if it is plugged into, or unplugged from, the system while it is powered on.

2. Illuminate a specimen
    a. Single-click the channel button corresponding to the desired wavelength. The button's number will change from white to the corresponding LED colour to confirm that the command was received and the X-Cite unit is producing light.

Channel Button	Wavelength (nm)	LED Colour	Default Number Colour when LED is "ON"	Provides excitation for:
1	365 or 385	UV	Violet	DAPI
2	475	Blue	Blue	FITC
3	555	Green	Green	TRITC/mCherry
4	635	Red	Red	Cy5

    b. Single-click the channel button again to turn off the LED. Button number will turn back to white to indicate that the X-Cite unit is not producing light.
    c. To turn ON/OFF all LEDs simultaneously, single-click the centre dial.

3. Adjust intensity
    a. Turn the dial to adjust intensity - clockwise to increase, counter-clockwise to decrease. The LED intensities being adjusted will depend on the state of the LEDs:

LED State	Turning the centre dial will adjust intensity setting for:
All LEDs OFF	All LEDs
1 or more LEDs ON	Only the LEDs in the ON state
Selected*	Only the selected LED

*Select/Deselect an LED by "long pressing" the corresponding Channel Button. If an LED is "selected", an arc will be displayed on the centre dial. (NOTE: If there is a combination of ON and "selected" LEDs, only the "selected" LED will be adjusted. Only one LED can be "selected" at a time.)

    b. The dial is speed sensitive – turning slowly will allow adjustments in smaller increments, turning quickly will increase the step sizes.
    c. Intensity can be adjusted in 1% increments from 1 to 100%.
    d. Double click the centre dial to jump to 100% on all channels

4. Status Indicator
    a. The tri-color light on the front of the unit indicates power, light guide, LED and ALARM status:

Color	Power to Unit	LLG Status	LED status
Light off	OFF	n/a	n/a
RED	ON	No LLG installed	OFF
GREEN	ON	LLG installed	OFF
ORANGE	ON	LLG installed	ON
RED - Blinking	ON	LLG installed	Alarm/Error

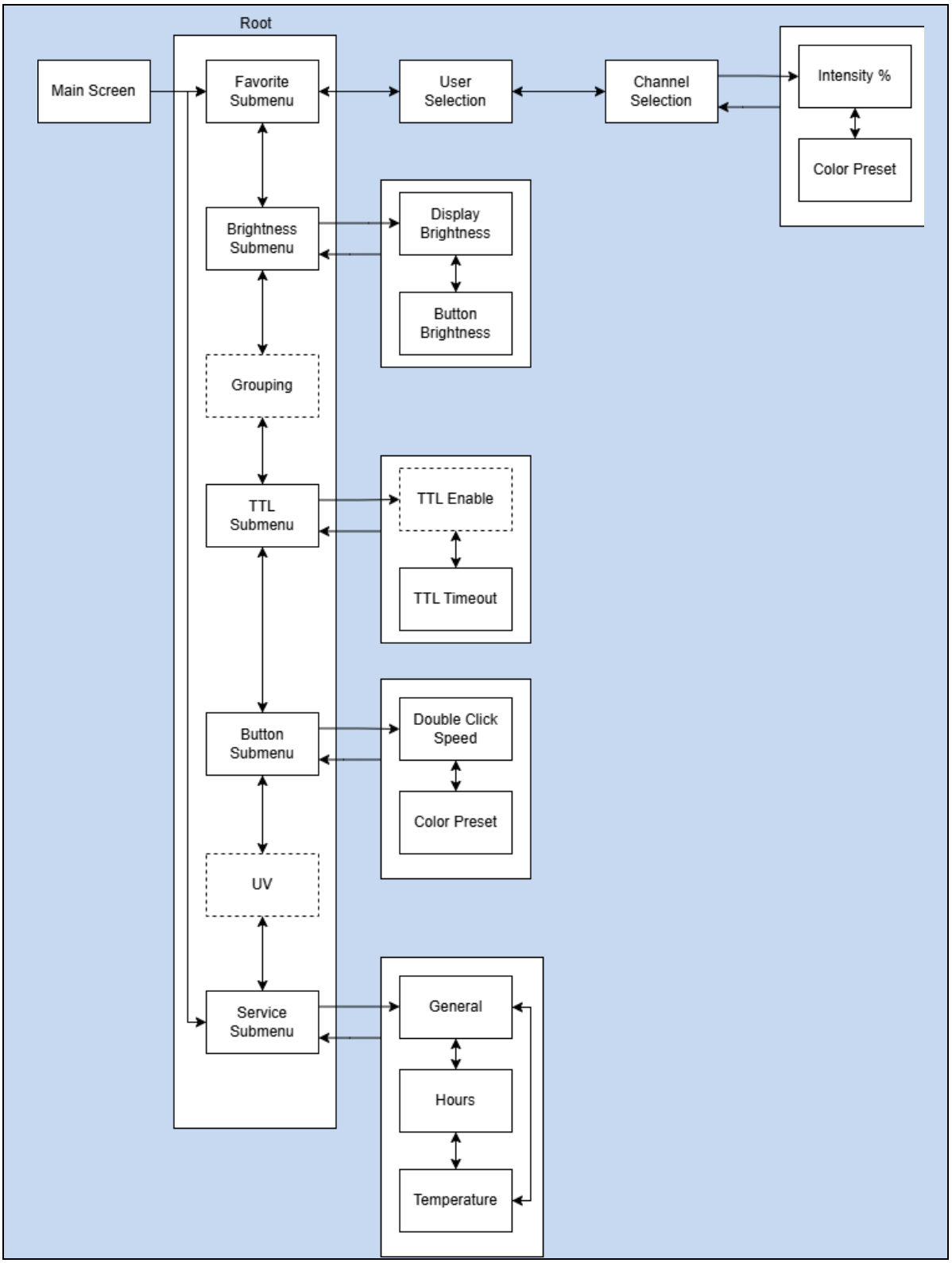
4.3 SmartDIAL Menu and Settings

In addition to the intuitive intensity adjustment and illumination ON/OFF control, smartDIAL 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, click the dial to make a selection.
- To adjust settings, turn the dial. To save and exit the setting adjustment, click “Done” (Button 4).
- To go back a level in the menu, click “Back” (Button 3).
- 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 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 before powering down the unit.

4.3.1 SmartDIAL Menu Structure



4.3.2 FAV – Favourite Intensity/Colour Settings

In the FAV sub menu, up to four (4) combinations of intensity and button colour settings can be saved under a user profile. Profiles can be to specific users or experiment protocols.

To define profile settings:

a. Select “FAV” option from main menu.
b. Turn the dial until the appropriate profile (USER#) is displayed, e.g. USER1. Click the dial to select USER1.
c. Turn the dial until the appropriate channel number (CH#), e.g. CH1. Click the dial to select CH1.
d. When the display shows INT%, turn the dial to scroll through % intensity settings until the desired level is reached. Click the dial to confirm the setting and move to the next option.

    NOTE: Scrolling through % settings in this menu will not actually change the output in real time, even if the LED is on. The intensity should be determined before entering this menu.

e. When the display shows COLOR, turn the dial to scroll through colour options for the CH# indicator light (0=pink, 1=violet, 2=blue, 3=cyan, 4=green, 5=green/yellow, 6=yellow, 7=orange, 8=red).
f. Click “Back” (Button 3) to save the setting, and go to the previous menu level.
g. Repeat steps c to f for channels 2-4.
h. Click “Back” (Button 3) twice to define settings for the next user profile, or click “Done” (Button 4) to exit and return to the home screen.

To use a profile:

i. Exit the menus and return to the home screen.
j. Double-click the numbered channel button that matches the user number, i.e. button #2 for USER2 settings.
k. Note: Settings will update, but LEDs will remain OFF.
l. To go back to the default settings, double-click the centre dial.

4.3.3 BRIGHT – Display Screen and Button Brightness Settings

In the BRIGHT sub menu, the display screen and channel number button brightness can be adjusted.

a. Select the “BRIGHT” option from main menu.
b. To adjust display screen brightness:
    i. Select “DISPLAY” and scroll through settings 0 to 10 until desired brightness level is reached.
    ii. Click “Done” (Button 4) to exit and return to the home screen or Click “Back” (Button 3) to move back a level in the submenu.

c. To adjust channel number brightness:
    i. Select “BTN” and scroll through settings 0 to 10 until desired brightness level is reached.
    ii. Click “Done” (Button 4) to exit and return to the home screen or click “Back” (Button 3) to move back a level in the submenu.

4.3.4 TTL –TTL Mode Control

In the TTL sub menu, define a timeout setting that keeps the LED drivers active/charged between exposures, allowing for the fastest response time.

a. Select “TTL” option from main menu.
b. To define the TTL timeout setting:
    i. Select the “T/O” menu item.
    ii. Scroll through the time out options, which are: 5 to 240 minutes, in 1 minute increments.
    iii. Click “Done” (Button 4) to exit and return to the home screen or click “Back” (Button 3) to move back a level in the submenu.

4.3.5 BTN – Channel Button Settings

In the BTN sub menu, double-click speed and channel indicator light colours can be defined.

a. Select “BTN” option from main menu.
b. To set double-click speed:
    a. Select the “DBLCLK” menu item.
    b. Scroll through the options (SLOW, MID, FAST) until the desired setting is reached.
    c. Click “Done” (Button 4) to exit and return to the home screen or click “Back” (Button 3) to move back a level in the submenu.
c. To set channel indicator light colour:
    a. Select the “COLOR” menu item.
    b. Use “CH-“ (Button 1) and “CH+” (Button 2) to select a channel.
    c. Turn the dial to scroll through colour options for the CH# indicator light (0=pink, 1=violet, 2=blue, 3=cyan, 4=green, 5=green/yellow, 6=yellow, 7=orange, 8=red).
    d. Repeat steps b and c for the other channels.
    e. Click “Done” (Button 4) to exit and return to the home screen or click “Back” (Button 3) to move back a level in the submenu.

NOTE: Changing a channel’s indicator light colour from this menu changes the default setting, i.e. what the colour settings go back to when the centre dial is double-clicked. Factory default settings are:

Channel Button	Default Indicator Colour when LED is "ON"
1	Violet (setting 1)
2	Blue (setting 2)
3	Green (setting 4)
4	Red (setting 8)

4.3.6 SRVC – Service Data

In the Service menu, information specific to each X-Cite 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 the main unit and smartDIAL. Excelitas 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 embedded software version numbers:
    i. Select the "GEN" menu item.
    ii. Scroll through the options "S/W1" (for main unit) or "S/W2" (for smartDIAL).
    iii. The software version numbers will be shown in the format vX.X.X.
    iv. Click "Done" (Button 4) to exit and return to the home screen or click "Back" (Button 3) to move back a level in the submenu.
c. To obtain the X-Cite unit serial number:
    i. Select the "GEN" menu item.
    ii. Scroll through the options until SN is reached. The numeric portion of the unit's serial number will be shown.
    iii. Click "Done" (Button 4) to exit and return to the home screen or click "Back" (Button 3) to move back a level in the submenu.
d. To obtain the accumulated LED "hours of use":
    i. Select the "HOURS" menu option.
    ii. LED "hours of use" will be shown in one (1) hour increments.
    iii. Turn the dial to scroll through the data for each channel.
    iv. Click "Done" (Button 4) to exit and return to the home screen or click "Back" (Button 3) to move back a level in the submenu.
e. To obtain current system temperatures:
    i. Select the "TEMP" menu option.
    ii. Temperature will be shown in degrees Celsius.
    iii. Turn the dial to scroll through the data for each channel.
    iv. Click "Done" (Button 4) to exit and return to the home screen or click "Back" (Button 3) to move back a level in the submenu.

5 Operation - External Control

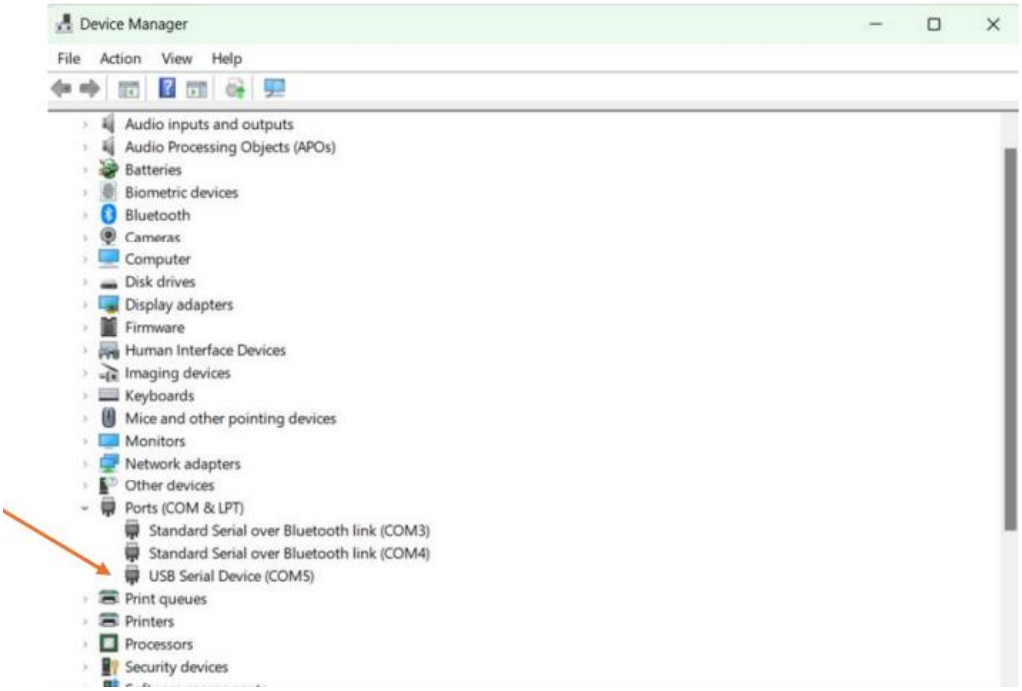
5.1 USB/RS-232

The 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, 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 Windows 11 Compatibility

This X-Cite unit uses the generic USB driver which is included in your Windows 11 system. Simply connect X-Cite and the PC via USB cable. No additional file download or internet connection is required. The X-Cite unit will be listed as “USB Serial Device” in the COM port list:

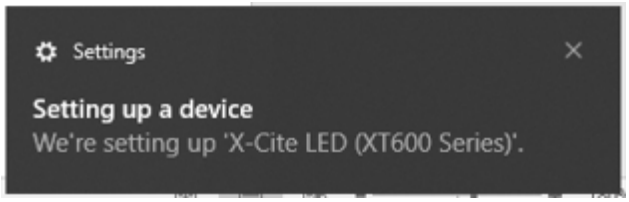


5.1.2 Windows 10 Driver Installation (via internet)

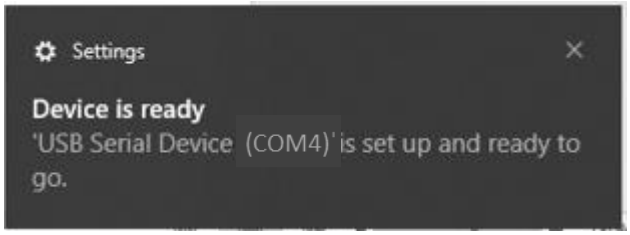
For these instructions: internet is required, Windows 10 prompts are listed.

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.



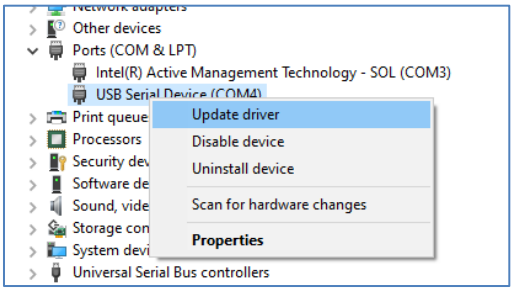
f. A second dialogue box will confirm successful installation and provide a COM port number. Note the COM port number for use in other software applications.



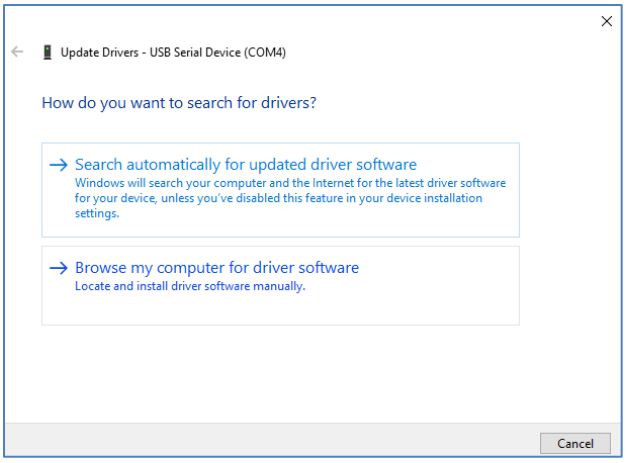
5.1.3 Windows 10 Driver Installation (via ZIP file)

For these instructions: download the driver ZIP file from the Excelitas website https://www.excelitas.com/. (see X-Cite TETREM page, under software tab)

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. Open the "Device Manager" utility on the computer.
f. Find the X-Cite device under "Ports (COM & LPT)".
g. Right click and select **Update driver.**

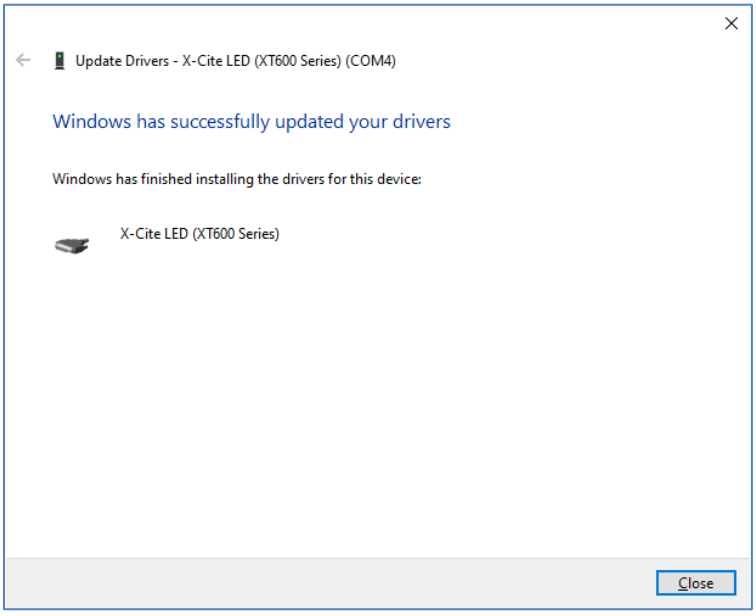


h. Select **Browse my computer…**



i. Navigate to the folder of extracted files from step c and select it.

j. Wait for installation to complete. Windows will confirm when driver has been updated.



k. Click **Close**.

5.1.4 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)”. Note that it may be listed as simply “USB Serial Device”. If desired, doing a driver update from ZIP file (5.1.2) will relabel it as “X-Cite” to distinguish it from other devices on the COM ports.

c. Note the COM port number for use in other software applications.

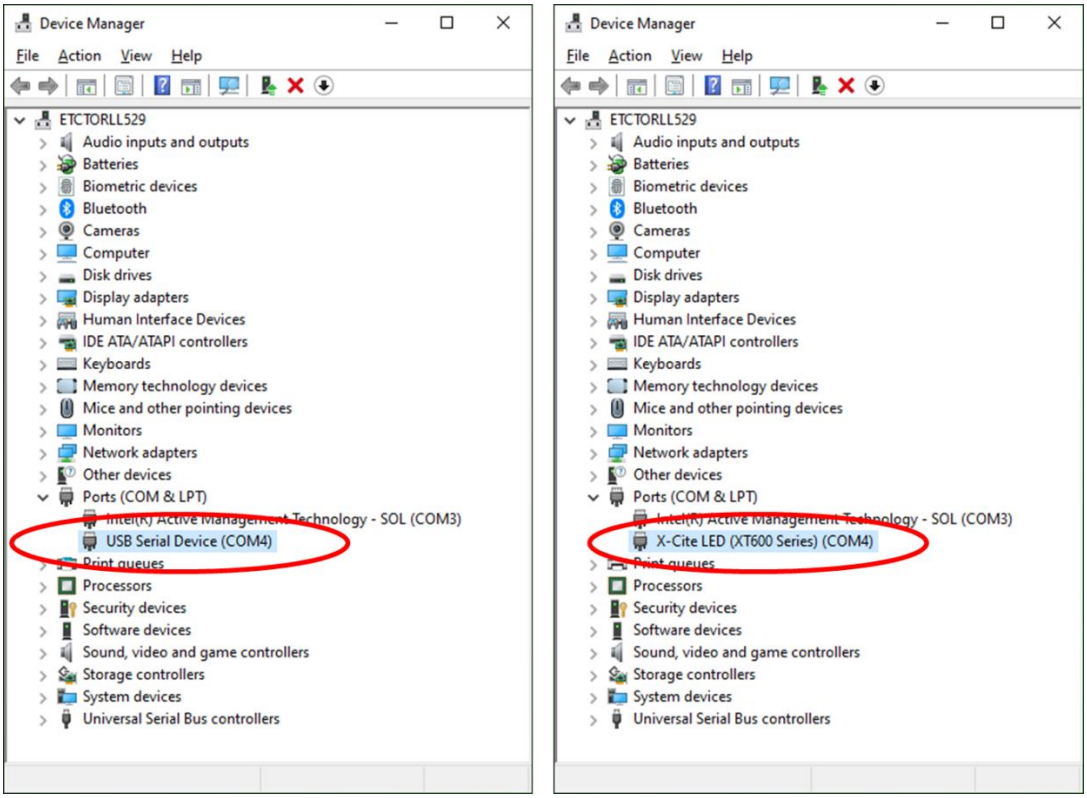


Figure 6 Device Manager, COM Port Listing

5.1.5 X-Cite Control Panel / GUI installation (via ZIP file)

X-Cite TETREM is compatible with X-Cite TURBO/XT600 Control Panel, which is available as a download from the X-Cite TETREM webpage.

a. Uninstall any previous versions of X-Cite TURBO/XT600 Control Panel/GUI.
b. Download current version from www.excelitas.com
c. Prepare the installation files by extracting and saving the files into a folder on desktop (or another easily accessible location).
d. To begin installation, go to unzipped files from step c, double-click on **setup.exe** or **setup**
e. Setup Wizard will open. Follow prompts and click **Close** when Wizard is finished.
f. To find GUI, search for **XT600 Control Panel** in the programs menu. It will be located in a folder named "Excelitas Technologies Corp". Click to start/open GUI, or click-and-drag to copy a shortcut to desktop or Quick Launch toolbar.

5.1.6 X-Cite Control Panel – Tips for Use

This tool provides an interface for controlling the X-Cite unit via PC and general testing of the communication port. For an updated list of software packages that support X-Cite products, see https://www.excelitas.com/

MAIN SCREEN

a. Note that X-Cite TURBO/XT600 Control Panel is designed to be compatible with several devices from the XT600 series which share some common electronic and optical layout elements. As such, when X-Cite TETREM is connected, users may notice:
    i. There are spots for six channels. (TETREM will use only the first four.)
    ii. The default channel display labels in the GUI are 1,3,5,6. (These reference numbers are used internally by the system for consistency with other XT600 devices. The labels can be changed to something more relevant to the user, if desired.)

b. To change the labels, click on the label. A dialogue box will appear. Enter the new label text and click OK. Repeat for each channel.

b. Ways to adjust the intensity of an LED:
    i. Use the slider bar (click, hold and move with mouse)
    ii. Use up/down arrows (click with mouse)
    iii. Click on the xx% display, type in a new value.
c. To turn an LED on/off, click the on/off graphic.

GROUPING SCREEN

d. Grouping LEDs together enables simultaneous on/off control of several (or all) LEDs via USB.

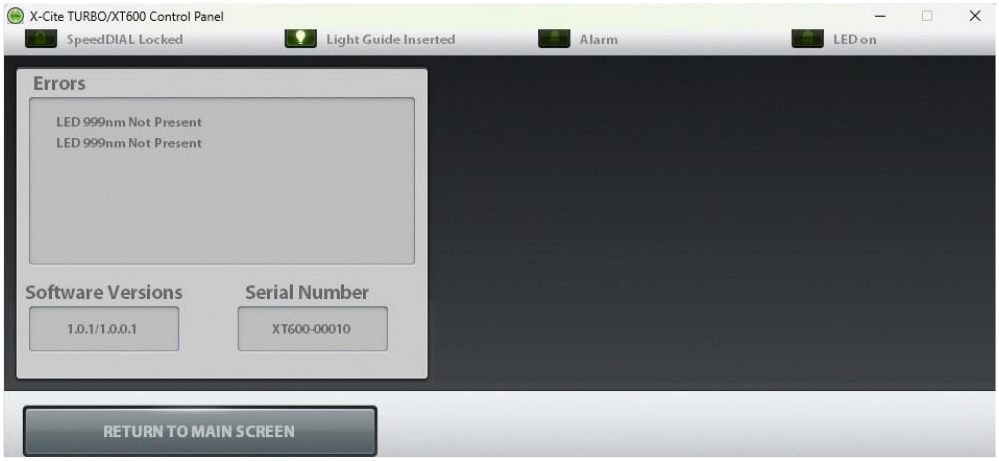
TTL/TRIGGER SCREEN

e. Setting a trigger sequence enables control of the LEDs via a single TTL input.
    i. Global Trigger – Set all LED sequence values to "1". Send a high signal to the TTL1 input, and all LEDs will turn on.
    ii. Ring Buffer – Assign a number to each of the LEDs, indicating the order in which they should be triggered. (0=omitted, 1=turn on with first "high" TTL signal, 2=turn on with seconds "high" TTL signal, etc.) Trigger the LEDs using the TTL1 input connection.

f. TTL Timeout – Reduces wear on system components by shutting off drivers and fans after the set period of inactivity.

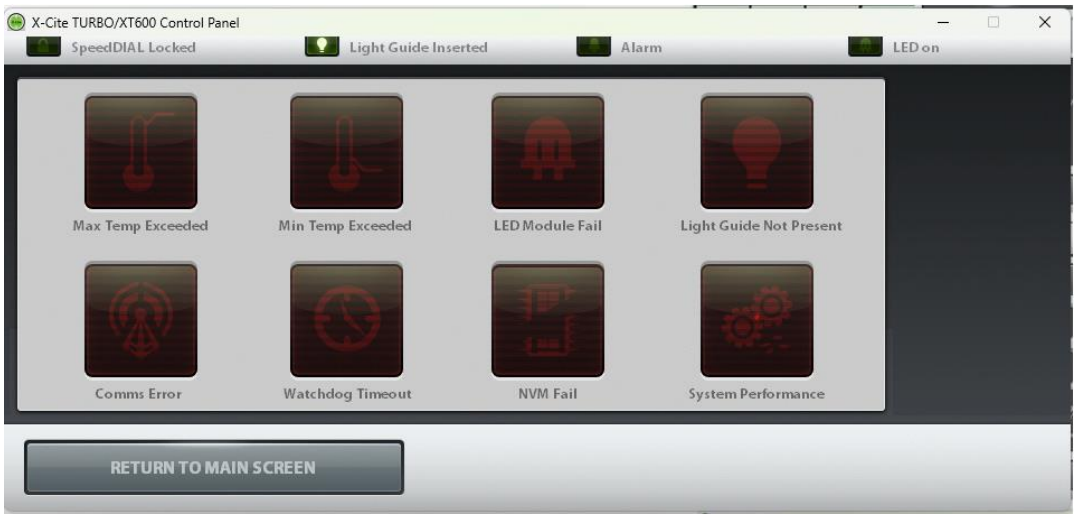
MAINTENANCE SCREEN

g. The maintenance screen has:
   i. Error Dashboard – get additional information on system errors
   ii. System information, including software versions for the X-Cite unit and controller, and X-Cite unit serial number.



ALARMS

h. The alarms screen identifies the reason for critical system alarms.



5.1.7 Commercial Software Support

a. This X-Cite unit can be controlled through many commercially available packages. Where model-specific control may not be available, basic functionality can be achieved using X-Cite TURBO hardware drivers. For an updated list of software packages that support X-Cite products, see http://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 smartDIAL. The lock icon will appear on the smartDIAL display in these cases.
d. Note: Even in cases where input from smartDIAL is not specifically blocked, commercial software may not poll the X-Cite unit to be aware of changes originating outside of its own interface. Unless the control software is designed to manage GUI and smartDIAL input simultaneously (e.g. X-Cite Control Panel), it is recommended to use a single input method (e.g. PC control OR smartDIAL).

5.1.8 Software Developer's Kit (SDK)

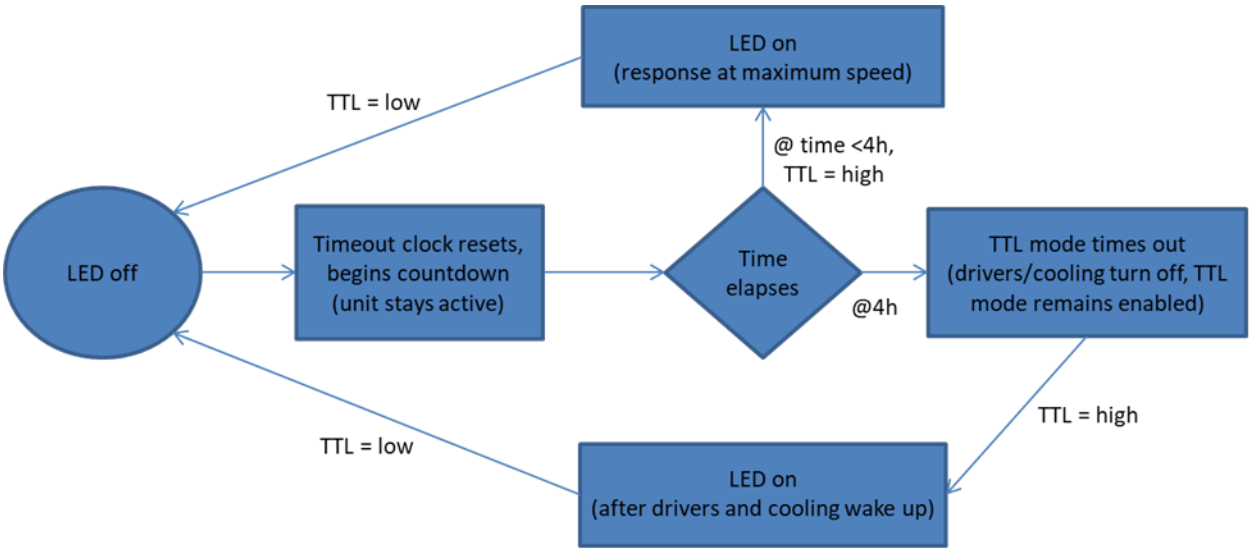
The command list for this X-Cite unit is the same as for X-Cite XT600 series, and is available by request. To obtain the latest update, please contact Technical Support.

5.2 TTL

For high speed LED on/off control, TTL triggering can be used.

5.2.1 TTL Mode

To minimize response time, a TTL Mode "timeout" setting can be used to keep the LED drivers active and prevent discharging between exposures. This value can be set via SDK commands or via smartDIAL (section 4.3.4).



5.2.2 TTL Signal and LED Status

TTL	LED Status
High	ON
Low	OFF

5.2.3 TTL Input Specifications

a. Connector type: DB25 (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

5.2.4 Analog Input Specifications

a. Connector type: DB25 (female port)
b. Maximum input current: 500µA

5.2.5 Analog Signal and LED Power Setting

Analog Signal	LED Power Setting
0-1V	Signal ignored*
1-1.2V	1%
1.2-5V	Conversion factor: 0.038/1%
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 smartDIAL 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.

5.2.6 DB15 Pin-Out and Cable Labels – TTL Input

DB25 Connector Pin	DB25 Cable Label	Corresponding Wavelength Channel	
		XT640S	XT640L
1	TTL1	365nm	385nm
2			
3			
4			
5	TTL2	475nm	475nm
6			
7			
8			
9	TTL3	575nm	575nm
10			
11	TTL4	635nm	635nm
12			
13			
14	Analog 1	365nm	385nm
15			
16			
17			
18	Analog 2	475nm	475nm
19			
20			
21			
22	Analog 3	575nm	575nm
23			
24	Analog 4	635nm	635nm
25			

6 Troubleshooting

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

6.1 Error Messages

If X-Cite TETREM detects a problem, an error message with one of the following codes will appear on the smartDIAL 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 the side panel of the unit. If fan is not running or the problem persists contact technical support for assistance.
3 or 5	Internal Error	Power cycle the X-Cite 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 TETREM 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 external 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. SmartDIAL Check:
    a. Verify that the pins on smartDIAL connector are straight.
    b. Verify that smartDIAL is plugged securely into main unit.

6.3 Low Illumination Intensity

1. SmartDIAL 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
smartDIAL	Favorite intensity setting: double-click turns off LED instead of going to the stored setting	Increase delay in the speed (Spd) setting. Ensure Favorite mode is enabled.
	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, smartDIAL not responding to manual control	Send "unlock" command via computer OR power down unit and restart.
	LED on/off/intensity changes via smartDIAL are not reflected in commercial software GUI	Commercial software is not looking for changes made externally. Control X-Cite with GUI only.
TTL Triggering	TTL response time is longer than usual	Verify that timeout settings are appropriately set.
Audible Noise	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, adjust the TTL timeout setting.
Output Linearity	Plotting output power vs. intensity setting is not a straight line	No action. "x%" shown on smartDIAL refers to LED input current, which is not necessarily linear with optical output.

7 Routine Care and Maintenance

7.1 General

X-Cite TETREM 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 unit's 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 the X-Cite unit and smartDIAL 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	smartDIAL
Height	230mm (9.1")	50mm (2.0")
Width	95mm (3.7") [a]	85mm (3.3")
Depth	212mm (8.4")[b]	87mm (3.4")
Weight	3kg (6.6lbs)	0.35kg (0.77lbs)

Notes:

a. Does not include clearance required for adequate 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 unit:

Model #	Input Voltage	Input Current
XT640S (X-Cite TETREM, 365nm)	24VDC	4.0A
XT640L (X-Cite TETREM, 385nm)	24VDC	4.0A
Other variations:		
XT600	24VDC	5.5A
XT601	24VDC	8A
XT640-W (X-Cite 110LED)	24VDC	3.0A
XT641-W	24VDC	5.5A
XT651-V	24VDC	4.5A

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

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 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.
TTL/Analog - IN	DB25	External trigger to turn LED on/off

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). In X-Cite TETREM, the intensity levels can be set as low as 1%. However, to prevent power fluctuations, an intensity setting of greater than 5% is recommended. 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 TETREM 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/product-category/x-cite-illuminators.

9.1.1 Optical Safety

The X-Cite TETREM / XT600 series is classified as Risk Group 2 according to IEC 62471: Photobiological Safety of Lamps and Lamp Systems.

Resulting Classification and Labelling:

Hazard	
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 **Low Voltage Directive**
Council Directive 2014/30/EU **EMC Directive**
Council Directive 2012/19/EU **WEEE Directive**
Council Directive 2011/65/EU **RoHS**
as amended by (EU) 2015/863

CE

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 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)	Hexa-valent Chromium (Cr (VI))	Polybromi-nated biphenyls (PBB)	Polybromi-nated diphenyl ethers (PBDE)	Dibutyl phthalate (DBP)	Diisobutyl phthalate (DIBP)	Butyl benzyl phthalate (BBP)	Bis(2-Ethylhexyl) phthalate (DEHP)
Printed circuit board assemblies	X	O	O	O	O	O	O	O	O	O

This table is prepared in accordance with the provisions of SJ/T 11364-2024.
Note 1: O: Indicates that the content of the hazardous substance in all homogeneous materials of the component does not exceed the national standard requirements for the restricted use of hazardous substances in electrical and electronic products.
X: Indicates that the content of the hazardous substance in at least one homogeneous material of the component exceeds the national standard requirements for the restricted use of hazardous substances in electrical and electronic products.
Note 2: For components not listed above, it means that the content of their hazardous substances does not exceed the national standard requirements for the restricted use of hazardous substances in electrical and electronic products.
(Enterprises can further explain the technical reasons for marking "X" in the above table here according to actual conditions.)

部件名称	有害物质									
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBBs)	多溴二苯醚 (PBDEs)	邻苯二甲酸二正丁酯 (DBP)	邻苯二甲酸二异丁酯 (DIBP)	邻苯二甲酸丁苄酯 (BBP)	邻苯二甲酸二(2-乙基)己酯 (DEHP)
印刷电路板组件	X	O	O	O	O	O	O	O	O	O

本表格依据 SJ/T 11364-2024 的规定编制。

注 1：O: 表示该有害物质在该部件所有均质材料中的含量均不超出电器电子产品有害物质限制使用国家标准要求。

X: 表示该有害物质至少在该部件的某一均质材料中含量超出电器电子产品有害物质限制使用国家标准要求。

注 2：以上未列出的部件，表明其有害物质含量均不超出电器电子产品有害物质限制使用国家标准要求。

（企业可在此处，根据实际情况对上表中打“X”的技术原因进行进一步说明。）

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 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 an appropriate Excelitas Authorized Service Centre. Returned equipment will not be received without a Return Material Authorization (RMA) Number, issued by the Service Centre.

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 Centre, 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 Centre within 30 days from the original date of receipt.

SYSTEM COMPONENT	WARRANTY	WARRANTY VOID IF…
X-Cite TETREM main unit	1 year, parts and labour	• Unit has been subjected to misuse or mishandling. • Unit has been opened or tampered with.
X-Cite smartDIAL	1 year, parts and labour	• Unit or cabling has been subjected to misuse or mishandling. • Unit has been opened or tampered with. • LCD display damage (physical).
LED assembly	• 25,000 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 Centre 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
https://www.excelitas.com/product-category/x-cite-illuminators

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)*
techsupport@excelitas.com
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