



LCC25

Liquid Crystal Controller

Operating Manual



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Part 1. Important Safety Notice

Do Not Open Housing!

The LCC25 has no user-serviceable parts. Service should only be performed by trained service personnel.

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly.



SHOCK WARNING



High voltage inside. To avoid electrical shock, before powering unit, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock resulting in severe injury or even death. Do not operate without cover installed.



WARNING



This unit must not be operated in explosive environments

Unit is supplied with a 115 V parallel blade line cord for North American use only. For all other applications use an IEC 320 compatible line cord fitted with a plug appropriate for your particular AC wall socket.

Make sure that the line voltage rating marked on the rear panel agrees with your local supply and that the appropriate fuses are installed. Changing of the mains fuse can be done by the user (see Setting the AC Line Voltage and Installing Fuses). With the exception of the mains fuses, there are no user serviceable parts in this product.



WARNING



Do Not Operate in Wet/Damp conditions. Do not obstruct the air-ventilation slots in the housing!

Mobile telephones, cellular phones or other radio transmitters should not to be used within the range of three meters of this unit since the electromagnetic field intensity may exceed the maximum allowed disturbance values according to EN50082-1.

Part 2. Product Overview

The LCC25 is a liquid crystal controller compatible with all Thorlabs LC Variable Retarders. The LCC25 will drive most nematic liquid crystal devices. The liquid crystal device is connected to the BNC voltage output port. The amplitude of the output voltage, adjusted by the front panel knob, and external signal, and a computer via a USB interface, controls the retardance of the LC device.

The LCC25 produces a 2 kHz AC square wave with an amplitude that is adjustable from 0 to 25 V_{RMS} .

The unit features two selectable set points, Voltage 1 and Voltage 2. Both set points are controlled by the user, and they produce a square wave that is plus/minus the set point. For example, if the user sets Voltage 1 to 15.000, the output would be a $\pm 15.000V$, 2 kHz square wave (see figure 1).

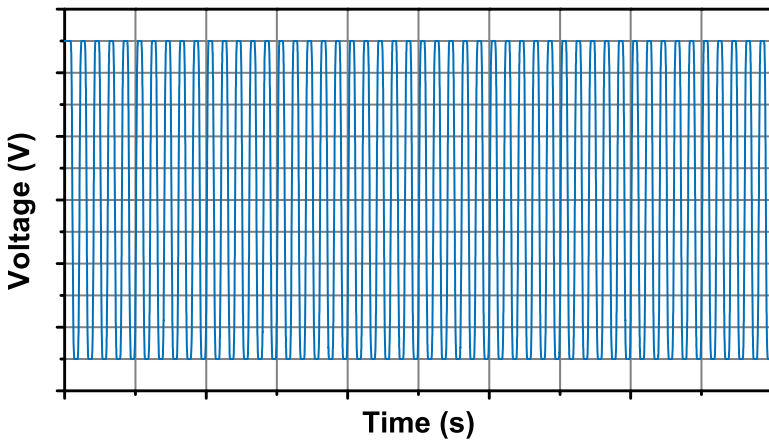


Figure 1: A 2 kHz Square Wave Output with no Additional Modulation

The user can also select a modulated output with a frequency range of 0.5 to 150 Hz. The first cycle will be equal to Voltage 1 and the second cycle will be equal to Voltage 2 (see figure 2)

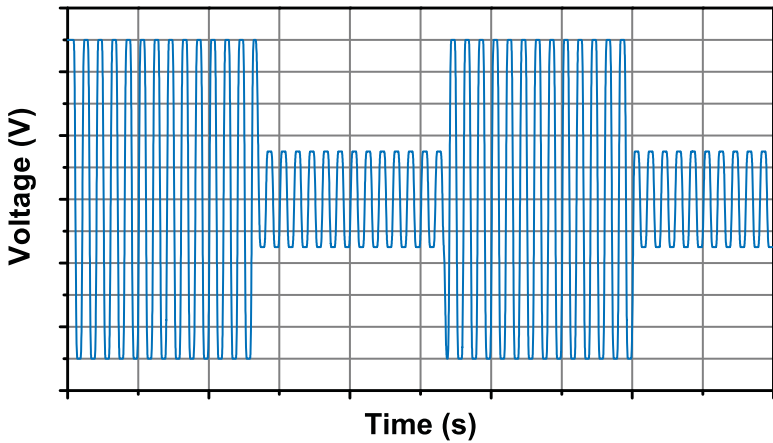


Figure 2: A 2 kHz Square Wave Output with 150 Hz Modulation

The LCC25 will automatically detect and correct any DC offset in real time to within ± 10 mV. This feature increases the life of the liquid crystal device.

The device can be controlled using tactile buttons on the front panel to select the voltage and frequency and then using the knob to adjust the levels. The system's display is a 16 x 2 LCD which displays the voltages and frequency (see figure 3). There are two BNC connectors. The top BNC is the external input and allows the user to input an external modulation frequency square wave up to 5 volts. The bottom BNC is the system output.



Figure 3: Front Display

The LCC25 may also be controlled by a command line language through the USB port. This is offered to enable operation through a terminal interface or for those who may want to write their own program to control the unit.

Part 3. Setup and Operation

To setup the unit, refer to Figures 4 and 5, and the legend table on the preceding page and perform the following steps:

NOTE: For optimal performance a warm up time of at least 30 minutes is recommended.

AC Line Voltage

The LCC25 is designed to operate at 100 to 240 VAC operation. There is no line switch adjustment to be made. However it may be necessary to replace an open fuse. To do this you must perform the following procedure on page 14, Fuse Replacement.

Powering ON the LCC25

- Connect the appropriate power cord into the AC receptacle and plug the unit in.
- Set power switch to the ON position. Thorlabs will scroll across the display. Voltage 1, Voltage 2, and the Frequency then will be displayed.
- BNC Output and External input LED indicators will be OFF. This is the default state when the unit is power on.

Setting the Voltage and Modulation Frequency

There is a set of 6 buttons beneath the LCD display and a knob for adjustment to the left of the display.

- To change Voltage 1 press the VOLTAGE 1 key, the LCD top left will flash. Adjust the knob to the desired Voltage.
- To change Voltage 2 press the VOLTAGE 2 key, the LCD bottom left will flash. Adjust the knob to the desired Voltage.
- To change Frequency Modulation, press the FREQ key, the LCD top right will flash. Adjust the knob to the desired Frequency.

After pressing the key, the selected voltage or frequency can be saved by pressing the key while the cursor is flashing or by letting the cursor time out in about 5 seconds. These settings will be saved during power down and retrieved on power up.

Setting the Output

Output Mode has three selections. Pressing the OUTPUT MODE key will toggle through each mode. The selected mode will be indicated in the bottom right of the LCD display. The sequence is as follows: Voltage 1, Voltage 2, and Modulation. To activate the output, press the OUTPUT ENABLE button. When active, the LED indicator next to the OUTPUT BNC connector will be lit.

The supported modes are:

- **Voltage 1:** The output signal will be a 2 kHz square wave with an RMS voltage level equal to the value set by Voltage 1
- **Voltage 2:** The output signal will be a 2 kHz square wave with an RMS voltage level equal to the value set by Voltage 2.
- **Modulation:** The output signal will be a 2 kHz square wave at an RMS voltage level switching between the value currently set for Voltage 1 and the value set for Voltage 2 at the currently selected frequency.



Internal Modulation Frequency

The LCC25 has internal modulation frequency adjustable from 0.5 to 150 Hz. To use the internal modulation, the LED next to the EXT INPUT BNC connect should be off. If it is lit, press the INT/EXT key disabling the LED indicator. To adjust the modulation frequency, push the FREQ key and adjust the knob to the desired output.

External Modulation Frequency

The LCC25 can be modulated by an external input. The modulation frequency device is connected to the EXT INPUT BNC. The input signal can be any waveform with a frequency from 0.5 to 500 Hz, and any duty cycle, but must be 0 and 5 Volts to trigger the flip. The output from the LCC25 will be modulated based on the input frequency with Voltage 1 being the high and Voltage 2 being the low.

To select the external modulation, the LED next to the EXT INPUT BNC connector should be on. If it is not lit, press the INT/EXT key enabling the LED indicator. When the external input is enabled, the top right of LCD will display EXT and bottom right will switch to the modulation square -wave symbol (same as modulation is shown above).

Computer Controlled Operation

The LCC25 may also be controlled by a command line language through the USB port. This is offered to enable operation through a terminal interface or for those who may want to write their own program to control the unit. The command language is described below. Prior to running the command line interface, the included drivers should be installed, the unit should be powered, and a USB cable should be connected between the LCC25 and the host.

The terminal emulator should be set as follows:

- Baud Rate: 115.2k b/s (bits per second)
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

If the connection is correct and after pressing the Enter key, you will see the following: *Command error CMD_NOT_DEFINED* followed by the command prompt, “>”

The basic structure of the interface is a keyword followed by either an equals sign (=) or a question mark (?). The (=) or (?) will determine if the string is a command or a query. All strings, commands and queries, must be terminated by a carriage return (CR) or pressing the ENTER key on the computer.

The command structure is as follows:

Keyword = argument (CR)

Where “keyword” defines the function and “argument” is a numerical value followed by a carriage return (CR).

The query structure is as follows:

Keyword? (CR)

The “keyword” defines the function and the question mark (?) indicates a query. The string is terminated with a carriage return (CR).

There are a few exceptions to this which are noted below, also noted are unique shortcut keys. The following table lists the commands and queries available with this device. The prompt symbol (>) will appear on power up and after a command is accepted by the LCC25 indicating it is ready to receive another command line.

If the keyword, format, or argument are incorrect or out of range the unit will return an error string.

Command	Syntax*	Description
Get ID	*idn?	Returns the model number and firmware version
Set Voltage 1	volt1=(n)	Where (n) equals a voltage between 0 and 25V
Get Voltage 1	volt1?	Returns the current voltage set for Voltage 1
Set Voltage 2	volt2=(n)	Where (n) equals a voltage between 0 and 25V
Get Voltage 2	volt2?	Returns the current voltage set for Voltage 2
Set Modulation Frequency	freq=(n)	Where (n) equals a frequency between 5 and 150 Hz
Get Modulation Frequency	freq?	Returns the current modulation frequency
Set Output Mode	mode=0	Sets output mode to Modulation
	mode=1	Sets output mode to Voltage 1
	mode=2	Sets output mode to Voltage 2
Get Output Mode	mode?	Returns the current output mode
Set Output Enable	enable=0	Output is disabled
	enable=1	Output is enabled
Get Output Enable	enable?	Returns current output enable state
Set External Modulation	extern=(n)	Where (n) is 0 for internal modulation and 1 for external
Get External Modulation	extern?	Returns current modulation mode – internal or external
Set Preset	set=(n)	Stores the current settings in the preset (n)
Get Preset	get=(n)	Restores the settings saved in the preset (n)
Save Parameters	save	Stores parameters in static memory
Restore Default Parameters	default	Restores the initial factory settings
Set Test Mode Dwell Time (mS)	dwel=(n)	Sets the dwell time for LC Test Mode
Get Test Mode Dwell Time (mS)	dwel?	Returns the current dwell time for LC Test Mode
Set Test Mode Increment (V)	increment=(n)	Sets the voltage step increment for LC Test Mode
Get Test Mode Increment (V)	increment?	Returns the current voltage step increment for LC Test Mode
Set Test Min Voltage (V)	min=(n)	Sets the starting voltage level for LC Test Mode
Get Test Min Voltage (V)	min?	Returns the current starting voltage level for LC Test Mode
Set Test Max Voltage (V)	max=(n)	Sets the ending voltage level for LC Test Mode
Get Test Max Voltage (V)	max?	Returns the current ending voltage level for LC Test Mode
Run Test Mode	test	Starts the LC Test Mode that will step the output voltage from the min voltage to the max voltage by steps equal to increment. At each voltage level it will delay for the time specified by dwell.
Remote not shown on Display Normal use of button on display	remote=0	Disables remote from being shown on display. Normal operation
Remote shown on Display and current Set voltage Locks out use of buttons	remote=1	Enables remote shown on display and displays current Set voltage. Locks out buttons on from panel.
Command Query	?	Returns a list of these commands

**) All commands and queries are in lower case letters.*

3.1. LCC25 Controls and Features

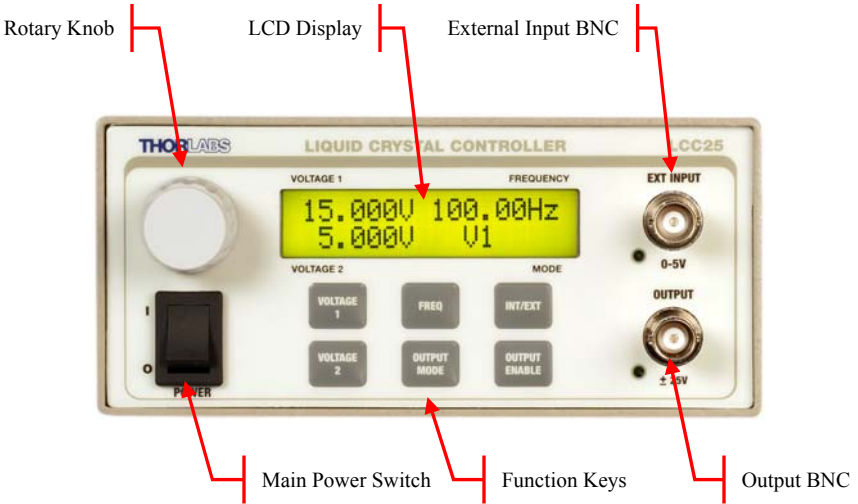


Figure 4: LCC25 Front Panel

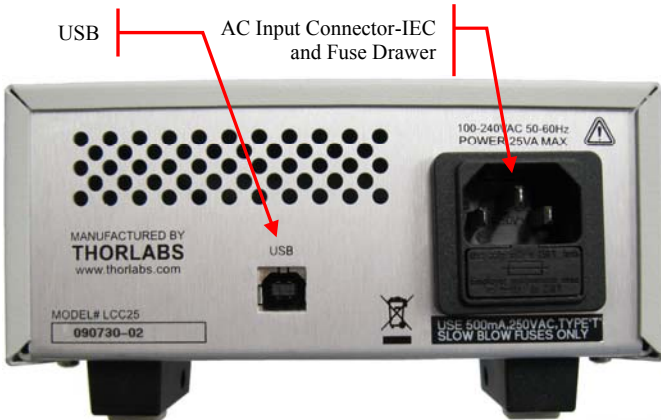


Figure 5: LCC25 Rear Panel Features

Part 4. LCC25 Specifications

Specification	Description
Max Ratings	
Max Output Current	15 mA
Max External Input Voltage	5 VDC
Fuse Rating *See replacement spec. page 14	500 mA, 5 x 20 mm SLO-BLO
Operating Temperature Range	10 to 40 °C
Maximum Relative Humidity	85%
Electrical Characteristics	
External Input Voltage	0 to 5 VDC Square Wave
Adjustable Output Voltage	± 25 V
Voltage resolution	1.0 mV
Adjustable Internal Modulation Frequency	0.5 to 150 Hz @ 50% Duty Cycle
Switching Frequency	2,000 ± 5 Hz, 50% Duty Cycle
Slew Rate	10 V/μs
DC offset	±10 mV
AC Power	85 – 264 VAC, 47 – 63 Hz, 25 VA
Warm Up Time	30 Minutes
Physical Features	
External Input Connector	BNC
External Input Enable	Front Panel: INT/EXT enable Key
External Input Indicator	Green LED
Output Connector	BNC
Output Enable	Front Panel: OUTPUT ENABLE Key
Output Indicator	Green LED
Rotary Knob	Digital Encoder
Display	LCD 16 x 2
Power Switch	Rocker Switch
USB interface	USB Standard B Plug
Dimensions	5.75" x 3" x 12.2" 146 mm x 78 mm x 309 mm
Weight	3.6 lbs
Other	Tilting Rubber-Padded Feet

4.1. Mechanical Drawing

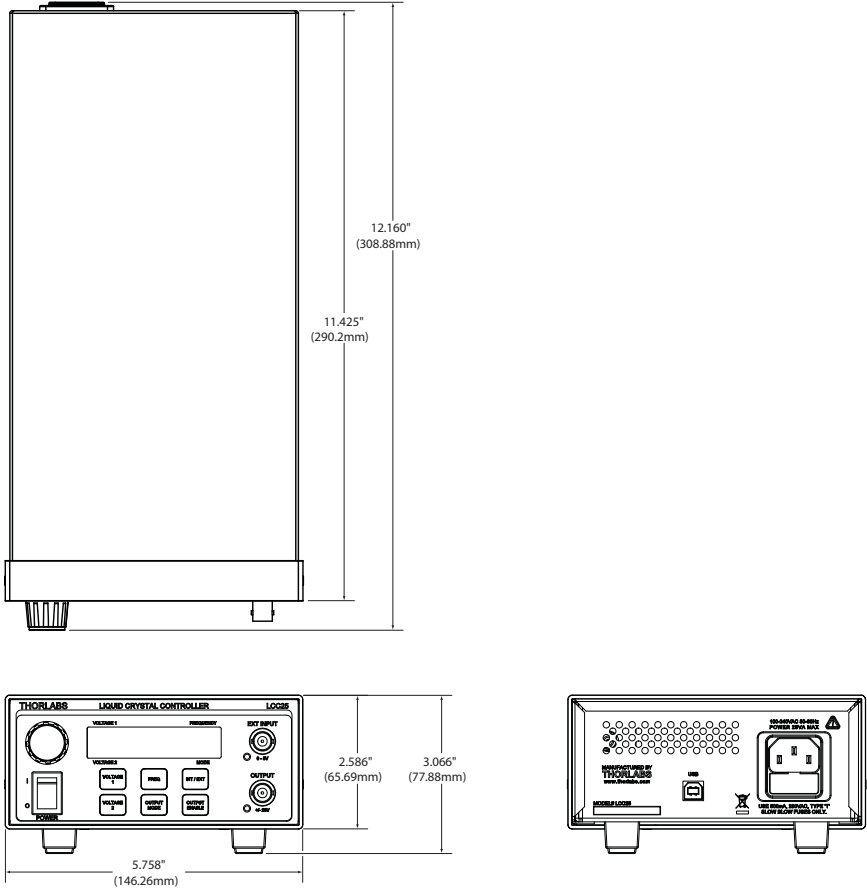


Figure 6: LCC25 Mechanical Drawing

Part 5. Maintenance

The LCC25 amplifier needs very little maintenance under normal operating conditions. The enclosure may be cleaned by wiping with a soft damp cloth.

There are no serviceable parts in the LCC25 and no reason to open the unit. If you suspect a problem with your LCC25 please call Thorlabs and technical support will be happy to assist you.

5.1. Fuse Replacement

The AC input is protected by a fuse located in a pull out compartment drawer on the rear panel AC connector. If replacement is required:

- Remove the AC power cord if it is connected to the unit.
- Locate the Fuse tray directly below the AC power cord connection on the rear panel of the unit.
- Carefully use a flat blade screwdriver to open the fuse tray.
- Remove the existing fuse and install the appropriate 500mA fuse. The replacement fuse must be a 5 mm x 20 mm 250 VAC Type T Fuses (IEC 60127-2/III, low breaking capacity, slow blow), see fuse specification below.
- Push the fuse tray back into place making sure that it snaps and seats correctly.
- Connect the appropriate power cord into the AC receptacle and plug the unit in.

* Replace the fuse with the correct rating and type. It is not recommended to use a fuse other than what is specified. Do not use a fuse with a current rating higher than the unit is rated for.

Fuse specification:

- Manufacturer: Littlefuse
- Manufacturer part#: 0218.500HXP
- Description: Fuse, 0.500A 250V IEC SLO 5x20mm 218 series
- Thorlabs part#: 4300-GMC-250-500MA

5.2. Ventilation

For proper operation and protection, it is important that the ventilation passages located on the sides and rear of the unit not be obstructed from free airflow.

5.3. Troubleshooting

Problem	Solutions
Unit will not power up. LCD display not illuminating, unit is not functioning	Check the power switch is in the ON position, the mains connection is correct, and the fuse has not been damaged.
DC Offset Error	If Error appears on LCD. Disconnect LC device from the output of the LCC25. Cycle power switch to reset parameters. If ERROR reappears, please contact Thorlabs technical support for assistance.

Note: The LCC25 circuitry has been designed to monitor and correct the DC offset in real time. This will increase the life of the Liquid Crystals. For any unforeseen reason DC offset is detected above the ± 10 mV limit enabling the DC OFFSET ERROR to appear. To eliminate damage to the LC device disconnect from LCC25 output BNC.

Part 6. Warranty Information

General Product Warranty

Thorlabs warrants that all products sold will be free from defects in material and workmanship, and will conform to the published specifications under normal use and service when correctly installed and maintained.

Opto-Mechanics

Lifetime Warranty: Thorlabs offers a lifetime warranty on all opto-mechanical components. Thorlabs will repair or replace any opto-mechanical product which after evaluation has failed to perform in the above conditions.

Optical Tables and Breadboards

Lifetime Warranty: We provide a lifetime guarantee that all of our passively damped optical tables and breadboards will meet all originally stated performance specifications under normal use and proper handling. We additionally guarantee that all our table tops and breadboards, both active and passive, will be free from defects in workmanship, including de-lamination of the skins under normal use and handling.

Lasers and Imaging Systems

Thorlabs offers a one year warranty on all lasers and imaging systems, with the exceptions of laser diodes. Some products are warranted for the number of hours specified in the operating manual of each laser.

Opto-Electronics, Control Electronics, Optics, and Nano-Positioning Product Lines

Thorlabs offers a two year warranty on the above mentioned product lines, provided normal use and maintenance of the products and when properly handled and correctly installed.

Thorlabs shall repair or replace any defective or nonconforming product as detailed above. We ask that buyer contact Thorlabs for a Return Material Authorization number (RMA #) from our Customer Service>Returns department in order to most efficiently process the return and/or repair.

Products returned for repair that are not covered under warranty, a Thorlabs standard repair charge shall be applicable in addition to all shipping expenses. This repair charge will be quoted to the customer before the work is performed.

Warranty Exclusions

The stated warranty does not apply to Products which are (a) specials, modifications, or customized items (including custom patch cables) meeting the specifications you provide; (b) ESD sensitive items whose static protection packaging has been opened; (c) items repaired, modified or altered by any party other than Thorlabs; (d) items used in conjunction with equipment not provided by, or acknowledged as compatible by, Thorlabs; (e) subjected to unusual physical, thermal, or electrical stress; (f) damaged due to improper installation, misuse, abuse, or storage; (g) damaged due to accident or negligence in use, storage, transportation or handling.

Part 7. Declaration of Conformity**Konformitätserklärung
Declaration of Conformity
Déclaration de Conformité****Thorlabs Inc
435 Rt 206
Newton, NJ
USA**

erklärt in alleiniger Verantwortung, dass das Produkt:
declares under it's own responsibility, that the product:
déclare sous notre seule responsabilité, que le produit:

LCC25

mit den Anforderungen der Normen
fulfills the requirements of the standard
satisfait aux exigences des normes

72/73/EEC	Low Voltage Directive 19.02.1973
EN 61010-1:2001	Safety of Test and Measurement Equipment
EMC 89/336/EEC	Electromagnetic Compatibility Directive
92/31/EEC	Amended, EMC Directive
93/68/EEC	Amended, CE Marking Directive
EN 61326:97+A1:98+A2:2001 +A3:2003	EMC of Test and Measurement Equipment
EN 55011:2007 +A2:2007	Conducted Emissions – Voltage – Class A
EN 55011:2007 +A2:2007	Radiated Emissions – Class A
EN 61000-4-2:1995 +A1:1998 +A2: 2001	Electrostatic Discharge Immunity (Crit. B)
EN 61000-4-3: 2006	Radiated Electromagnetic Field Immunity (Crit. A)
EN 61000-4-4: 2004	Electrical Fast Transient/Burst Immunity (Crit. B)
EN 61000-4-5: 2006	Power Line Surge Immunity (Crit. B)
EN 61000-4-6: 2007	Conducted RF Immunity (Crit. A)
EN 61000-4-11: 2004	Voltage Dips, Interruptions and Variations (Crit.B/C)

übereinstimmt und damit den Bedingungen entspricht.
and therefore corresponds to the regulations of the directive.
et répond ainsi aux dispositions de la directive.

Dachau, 23. November 2009

Ort und Datum der Ausstellung
Place and date of issue
Lieu et date d'établissement



.....

Name und Unterschrift des Befugten
Name and signature of authorized person
Nom et signature de la personne autorisée

Part 8. Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

8.1. Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

8.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of live products will thereby avoid negative impacts on the environment.

Part 9. Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



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