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THORLABS

LCC1320-A - January 18, 2018

Item # LCC1320-A was discontinued on January 18, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

EMPTY LIQUID CRYSTAL CELLS

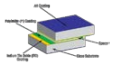
- **Eight Different Cell Gaps**
- **Two Liquid Crystal Inject Holes**
- **AR Coating (350 - 700 nm) on Both Sides**

LCC1312-A

LCC1318-A
Filled Cell with Wires Attached

OVERVIEW

Features



Click to Enlarge

- Models with Eight Different Cell Gaps Available
- Anti-Reflective Coating (350 - 700 nm) on Both Sides
- High Resistance Indium Tin Oxide (ITO) Conductive Layer (300 - 350 Ω/sq Resistance)
- All Models Except 20 µm Cell Feature an Anti-Parallel PI Alignment Layer
- Custom Cells Available Upon Request to Technical Support

Thorlabs' empty liquid crystal cells are designed for testing liquid crystal compounds and materials. These cells are coated with an Indium Tin Oxide (ITO) conductive layer and a Polyimide (PI) alignment layer (20 µm version has no PI layer). Eight cells are available with various sized spacers to provide cell gaps from 3 µm to 20 µm, and all are designed for simple filling in the lab (See the *Filling Instructions* tab).

Our empty cells are optimized for high transmission in the visible range, using UV Fused Silica glass, a broadband anti-reflective coating, and thin film, high resistance ITO. If your application requires liquid crystal cells for other wavelength ranges, please contact us for such a custom cell.

Empty cells with cell gaps from 3 to 10 µm are rubbed and assembled for anti-parallel alignment of the liquid crystal. The LCC1324-A has a 20 µm gap and no polyimide alignment layer. This cell is designed for use with materials that do not require an alignment layer, such as Polymer Dispersed Liquid Crystal (PDLC) materials. Thorlabs can also provide cells with different alignment methods such as 90° twist, parallel alignment, or with custom PI material.

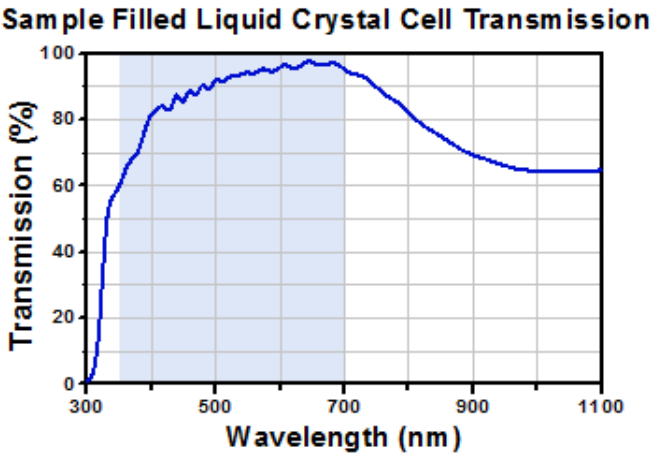
SPECS

Item #	LCC1310-A	LCC1312-A	LCC1314-A	LCC1316-A	LCC1318-A	LCC1320-A	LCC1322-A	LCC1324-A
Cell Gap	3 ± 0.3 µm	4 ± 0.4 µm	5 ± 0.5 µm	6 ± 0.6 µm	8 ± 0.8 µm	9 ± 0.9 µm	10 ± 1 µm	20 ± 2 µm
Cell Gap Uniformity	5% over the Entire Clear Aperture							
ITO Resistance (See Below)	350 - 450 Ω/sq							
AR Coating	R_{avg} <0.5%, 350 nm – 700 nm							
External Dimensions	17 ± 0.1 mm x 12 ± 0.1 mm x 6 ± 0.2 mm							
Clear Aperture	10 mm x 10 mm							
Surface Quality	40 -20 Scratch Dig							
Surface Flatness	λ/10 @ 633 nm							
PI Alignment	Anti-Parallel							N/A
Glass Material	UV Grade Fused Silica							

Sheet Resistance

The resistance of a thin film is usually described using the sheet resistance (R_s) instead of the resistivity (ρ). Sheet resistance is defined as the ratio between the resistivity (ρ) and the film thickness (t), with units of ohms per square (Ω/sq). It is a more convenient parameter for users because the film thickness has been taken into account and only two dimensions (the length L and the width W) are needed to calculate the resistance of the thin film, which is $R = R_s*L/W$.

Since a square has L = W, the resistance of a square of the thin film is constant and equal to the sheet resistance, regardless of the size of the square. Our liquid crystal cells are 12 mm x 15 mm, so the actual resistance is 15/12 times the sheet resistance.



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Transmission of Unpolarized Light in a Liquid Crystal Cell Filled with a Typical Nematic LC Material

FILLING AND ITO

Recommended Filling Procedures

Filling Using the Capillary Effect

- In a clean environment, remove the cell from the packaging. Place a drop of liquid crystal material on one of the filling ports and wait for the LC material to completely fill the cell. Note: Depending on the LC material and cell gap, this can take anywhere from 10 minutes to several hours.
- After the cell is completely full, seal the two holes with UV glue (such as the NOA68) and cure the glue. Note: If you are using nematic LC material you will need to bake the filled cell for two hours at a temperature above the clearing temperature (i.e., the temperature at which the liquid crystal becomes isotropic) to get a homogenous alignment of the LC material.

Filling Using a Vacuum Chamber

- In a clean environment, remove the cell from the package. Using UV glue (such as the NOA68), seal one hole and cure the UV glue.
- Insert the cell into a vacuum chamber, place the liquid crystal material in a container under the cell (but not touching the cell), and hold the cell with a device that can later be lowered.
- Evacuate the vacuum chamber to a level of 10 Pa, and heat the chamber to a temperature above the LC clearing point.
- After the chamber has reached the required vacuum level and temperature, lower the cell so that the filling hole touches the LC.

- Release the pressure in the chamber and the LC will fill the cell.
- Slowly reduce the temperature back to room temperature.
- Remove the cell from the chamber, seal the second hole with UV glue, and cure the glue.

Electrical Connections

After completing the filling using either method, use conductive epoxy such as EG58 to connect wires to the two ITO strips.

C CONTROLLER

The LCC25 liquid crystal variable retarder and polarization rotator controller produces a 2000 Hz square wave output with an amplitude that can be varied from 0 to 25 V_{rms}. The output amplitude can be set via the front panel controls, the USB interface, and the external input. Both the front panel and USB interface allow the user to select two voltage levels, Voltage 1 and Voltage 2. When the LCC25 is operated in the constant voltage mode, the output of the controller will be a 2000 Hz square wave with an amplitude equal to either of the two set voltage levels (Figure A). If the LCC25 controller is operating in the modulation mode, the output 2000 Hz square wave will be modulated in amplitude between the two voltage settings with a modulation frequency that can be set by the user to be between 0.5 and 150 Hz (Figure B).

The modulated mode can be used to measure the response time of the LC retarder.

External or remote control of the LCC25 is possible using the external input or the USB interface. The external input accepts a 0 to 5 VDC TTL signal that modulates the 0 to 25 V_{rms} output of the LCC25 between the two set voltages. The USB interface can be used to send line commands to the controller so that the LCC25 can be used in automated lab sequences.

In order to prevent the separation and build up of charges in the liquid crystal layer, the LCC25 will automatically detect and correct any DC offset in real time to within ±10 mV.

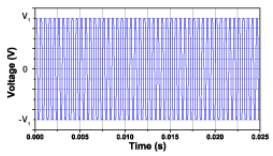


Figure A. A plot of the output voltage of the LCC25 Liquid Crystal Controller when it is being operated in the constant voltage mode.

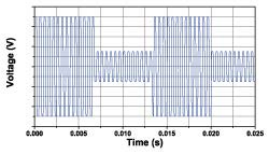


Figure B. A plot of the output voltage of the LCC25 Liquid Crystal Controller when the ouptput voltage is being modulated between the two set voltages.

LCC25 Specifications	
Electrical Specs	
Adjustable Output Voltage	± 25 V
External Input Voltage	0 to 5 VDC Square Wave
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
Max Output Current	15 mA
AC Power	85 – 264 VAC, 47 – 63 Hz, 25 VA
Fuse Rating	125 mA, 5 x 20 mm SLO-BLO
Warm Up Time	30 Minutes
Physical Specs	Less [-]
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
Operating Temperature Range	10 to 40 °C
Maximum Relative Humidity	85%
Other	Tilting Rubber-Padded Feet

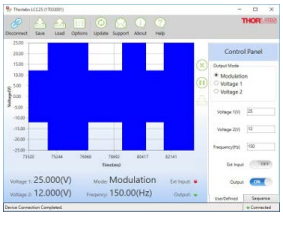
Software for the LCC25 Controller

Software

Version 3.2.0

GUI Interface for controlling the Liquid Crystal Retarder Controller via a PC. To download, Click the button below.

Click to Enlarge
Screen shot of the GUI interface in Modulation Mode.



GUI Interface

The GUI interface included with the software provides access to all of the settings of the liquid crystal retarder controller. For example, the user can select one of two user-defined voltages or a modulation mode that oscillates between these two voltages at a user-defined frequency. As shown in the above screen shot, the applied voltage is shown in a plot with respect to time. Both the output and external input can be turned on and off via the GUI. In addition, advanced features allow the user to define a custom waveform by specifying the starting voltage, ending voltage, the voltage step size, and the dwell time. The waveform may be previewed on the screen before it is output to the retarder, and it may be saved so that the LCC25 can be restarted quickly in the future. The GUI is available as a stand-alone or LabVIEW based version for flexibility in implementation.

Custom Software Development

Users may also use the provided C/C++ and LabVIEW software development kits for implementing the liquid crystal retarder controller with other instruments. Sample C++ code and LabVIEW programs help to illustrate how the C commands and LabVIEW VIs can be utilized. Full documentation on the available commands is provided with the software.

Empty Liquid Crystal Cells

Part Number	Description	Price	Availability
LCC1310-A	10 mm x 10 mm Empty Liquid Crystal Cell, 3 µm Gap	$239.70	Today
LCC1312-A	10 mm x 10 mm Empty Liquid Crystal Cell, 4 µm Gap	$239.70	Today
LCC1314-A	10 mm x 10 mm Empty Liquid Crystal Cell, 5 µm Gap	$239.70	Today
LCC1316-A	10 mm x 10 mm Empty Liquid Crystal Cell, 6 µm Gap	$239.70	Today
LCC1318-A	10 mm x 10 mm Empty Liquid Crystal Cell, 8 µm Gap	$239.70	Today
LCC1320-A	10 mm x 10 mm Empty Liquid Crystal Cell, 9 µm Gap	$239.70	Lead Time
LCC1322-A	10 mm x 10 mm Empty Liquid Crystal Cell, 10 µm Gap	$239.70	Today
LCC1324-A	10 mm x 10 mm Empty Liquid Crystal Cell, 20 µm Gap, No PI Layer	$239.70	Today

Liquid Crystal Controller

- Output Voltage Adjustment Range: ± 25 VAC (f = 2000 ± 5 Hz)
- Max Output Current: 15 mA
- Output Connector: BNC
- AC Power Requirements: 85 - 264 VAC, 47 - 63 Hz, 25 VA
- See the *LC Controller* Tab Above for More Information

The LCC25 is a liquid crystal controller compatible with all Thorlabs LC Variable Retarders and Polarization Rotators, as well as being is ideal for driving most other nematic liquid crystal devices. Nematic LC retarders must be driven with an AC voltage in order to prevent the separation and build up of charge, which can cause the device to burn out. In addition to the 2000 Hz AC drive voltage, the LCC25 controller automatically zeros the DC bias across the LC device in order to counteract the buildup of charges. The AC output voltage of the LCC25 controller can be adjusted using the front panel controls, an external 0 - 5 VDC TTL input, and via the USB interface. For more information about the LCC25 controller and for a complete list of its specifications, please see the *LC Controller* tab.

Part Number	Description	Price	Availability
LCC25	Liquid Crystal Controller, 0-25 VAC, Square Wave, 50% Duty Cycle	$1,324.98	Today