LCC1-100 High-Voltage Liquid-Crystal Driver

User's Manual

Manual revision
April 2012

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Made in USA

Description & Specifications

The LCC1-100 is a high-voltage, single-channel driver specifically designed to drive dispersed-polymer liquid-crystal (LC) shutter devices such as the Boulder Nonlinear Systems LF series non-polarizing optical shutter. LC voltages up to 100 V_{RMS} can be generated. The rugged output stage of the LCC1-100 can drive shutters up to 150 *x* 150 mm^2 in size. The output can be toggled between a preset high-voltage amplitude (shutter open) and zero volts (shutter closed) manually, or by external or internal trigger. The LCC1-100 is factory-adjusted to optimize open-state transmission for each shutter.

Features

- 2 kHz balanced AC waveform generation up to 100 V_{RMS}
- Ability to drive large-area cells up to 150 *x* 150 mm^2
- Switch-selectable External or Internal Modulation; Internal Modulation rates from 0.15 to 15 Hz
- Front-panel pushbutton for convenient manual operation
- RoHS compliant
- Compact size; 24VDC international power supply included

LC OUTPUT & INTERFACE

Number of LC channels	One
Output waveform	Bipolar DC-balanced square wave
Carrier frequency	2.00 $\pm$ 0.02 kHz
Amplitude range	50 to 96 V_{RMS} (root-mean-square) guaranteed
Amplitude control	By internal factory-set pot. Amplitude pre-optimized for open-state shutter transmittance
Residual DC	< 10mV at any amplitude level
Operating modes	- Manual pushbutton mode - Internal Modulation mode - External Modulation mode
Internal Modulation rate	0.15 to 15 Hz, 50% duty cycle shutter open/closed. Internal Modulation rate TTL signal can be optionally routed to back-panel BNC bulkhead
External Modulation	TTL logic-level controlled (arbitrary duty cycle), asynchronously to 30 Hz. Logic HI = shutter closed, logic LO = shutter open
Drive capability	Output can drive LF shutters up to 150 *x* 150 mm^2

PHYSICAL

Dimensions	4.1 in W *x* 4.2 in L *x* 1.7 in H (10.4 cm W *x* 10.7 cm L *x* 4.3 cm H)
Weight	1.6 lbs (0.7 kg), driver + power supply
Chassis material	- Black anodized aluminum, rubber bottom feet - Machined aluminum front & back panels, black-anodized and laser-etched
Front panel	- 50-ohm SMA female bulkhead for LC voltage output - Power and Status LEDs; Status LED lit when high voltage present at LC output - Two-position Internal/External Modulation toggle switch - Three-quarter turn Internal Modulation frequency knob - Pushbutton LC output switch (controls shutter in External Modulation mode with no external source present)
Back panel	- 50-ohm BNC female bulkhead for External Modulation - 2.1 mm power jack receptacle for 24VDC power supply - 24VDC power ON/OFF switch
RoHS compliance	100% compliant (no exemptions used)
CE compliance	Certification to FCC Class A emissions level upon special arrangement.
Operating temperature	5 to 45 ^oC
Power supply (separate, supplied with driver)	- International +24V, 25W, 100-240VAC 50-60Hz input, UL/CE listed - 2.1 x 5.5 mm center-positive plug
Warranty	One year

In keeping with our commitment to continuous product improvement, these specifications are subject to change without notice.

Safety Considerations

The following safety and maintenance considerations should be observed:

- The driver is for indoor use only, and not to be used in wet or moisture-laden environments. The driver should only be operated in relative humidities between 20-80% non-condensing, and at temperatures between 5 to 45 ^{o}C.

- 24V⎓1.0A The electrical input rating of this device is 24VDC/1.0A. Use only with supplied AC mains adaptor (international power supply).

-  The voltage at the exposed pin of the SMA "LC Output" receptacle, or the output terminations of a cable plugged into this receptacle pose a potential shock hazard, and must be enclosed so as to prevent contact.

-  Under no circumstances should the high-voltage LC output be shorted to ground. Doing so will seriously damage the output stage and could result in electrical shock.

-  Always insure that the driver is powered OFF prior to connecting the LC shutter device to the SMA bulkhead.

- The LC output cable should be jacketed, with a 150 V minimum insulation rating.

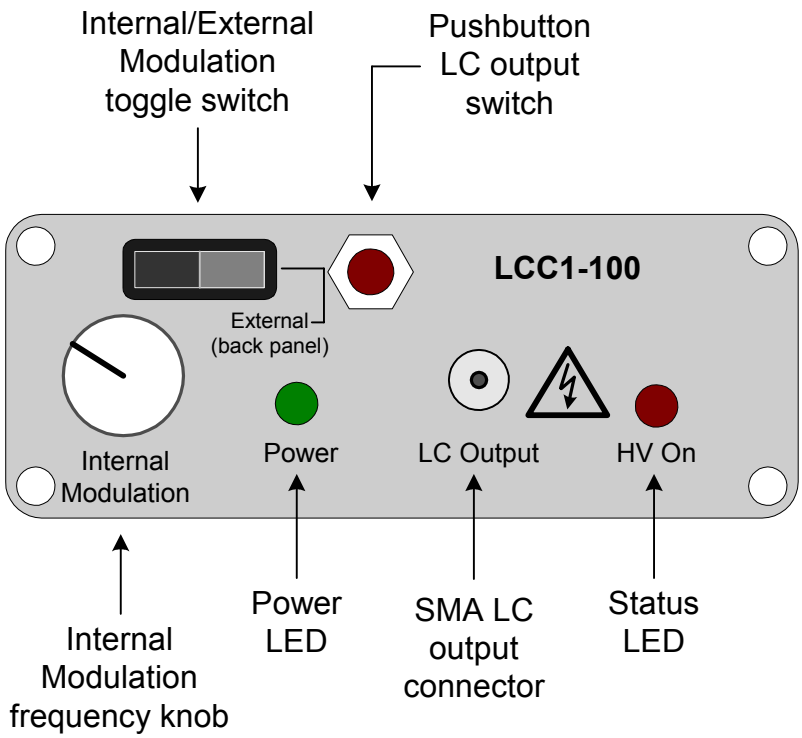
- The interior of the driver is not designed to be user accessible, and there are no user-serviceable parts inside. Contact Optical Finesse directly and return unit if maintenance or calibration is required.

- Clean the exterior of the unit with a soft dry cloth only.

Front & Back Panels

A brief description of the front & back panel controls and connections follows.

Front panel



- Power LED: lit green when driver is connected to 24VDC power supply and switched ON (normal operation).

- Status LED: Indicates whether high voltage is present on the LC output connector. When high voltage is present, this LED is lit red.

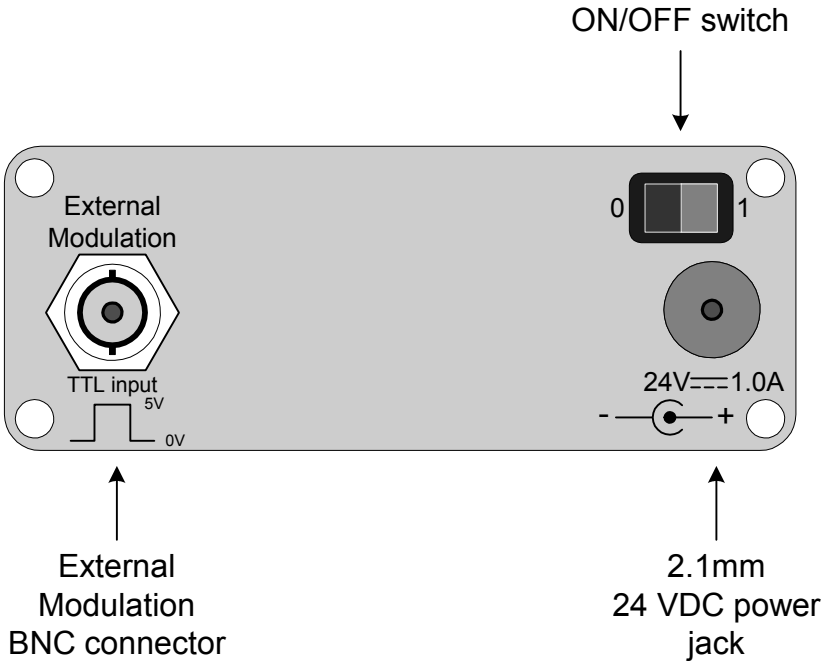
- SMA LC output connector: LC output voltage for driver. Shutter should be connected to this receptacle.

- Internal/External Modulation toggle switch: selects mode of operation. When set to Internal (to left), permits Internal Modulation, whose rate is controllable by the front-panel knob. When set to External (to right), permits use of a TTL-compatible External Modulation source on the back-panel BNC connector. The External setting also permits use of the front-panel pushbutton LC output switch for manual shutter operation.

- Internal Modulation frequency knob: when Internal Modulation is selected, sets rate of toggle between preset high-voltage output and ground. Full counter-clockwise is the slowest rate (~0.2 Hz). This modulation frequency can be optionally routed as a TTL output to the back-panel BNC connector—contact Optical Finesse for details.

- Pushbutton LC output switch: when External Modulation is selected, and no source is present on the back-panel BNC connector, this pushbutton may be used to manually open the LC shutter. Pressing the button enables high-voltage output; releasing the button restores the output to zero volts.

Back panel



- 2.1mm 24VDC power jack: accepts 2.1mm output power connector of supplied external 24VDC international power supply.

- ON/OFF switch: switches 24VDC power from external power supply ON/OFF.

- External Modulation BNC connector: left open for pushbutton manual operation or for Internal Modulation. For External Modulation mode, accepts 0-5V TTL-compatible logic signal. This connector is pulled to logic HI internally. Logic HI holds the LC output at zero volts (shutter closed); logic LO enables high-voltage output (shutter open).

Operation

The LCC1-100 outputs either a DC-balanced 2 kHz high-voltage bipolar square wave (shutter open) or zero volts (shutter closed). The amplitude of the high-voltage square wave is internally preset at the factory to 70 V_{RMS}. Toggling between the preset high-voltage amplitude and zero volts may be performed in three ways:

1. Manually, using the front-panel pushbutton switch.
2. Internally, by switching the LCC1-100 to Internal Modulation.
3. Externally, by using a function generator or other trigger source.

Preliminaries

Connect the external international power supply to AC mains with supplied AC power cord. Insure front-panel Internal/External Modulation switch is set to right (External).

Connect the LC shutter device to the front-panel SMA jack. Always insure that the driver is switched off before connecting or disconnecting any LC device.

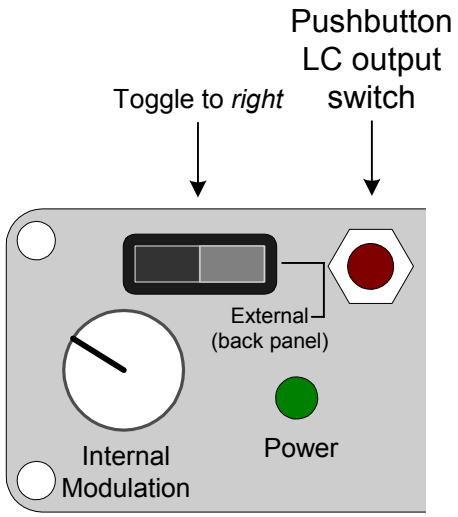
Connect the 2.1mm power connector to 24VDC power jack. Switch back-panel ON/OFF switch on. The front-panel green Power LED should be lit, and the red Status LED should be off.

Manual pushbutton mode

This is the most basic operating mode of the driver. In this mode, the front-panel pushbutton switch controls the LC output.

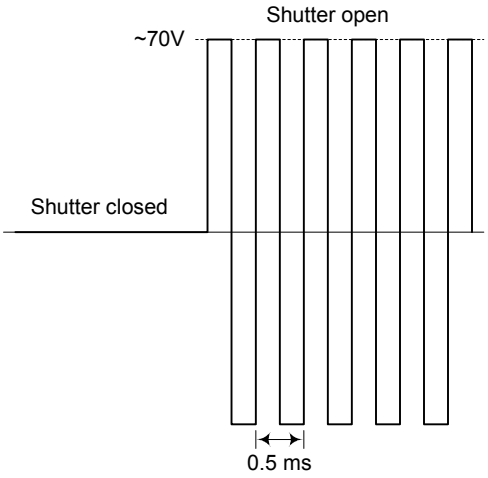
Set the Internal/External Modulation switch towards the right (External). With no external source attached to the back-panel BNC connector, manual pushbutton mode is enabled.

The LC output switch is a momentary, normally-open pushbutton. The default SMA output is zero volts. Pressing and holding the pushbutton will enable high-voltage output on the SMA, and the red Status LED will be illuminated. Releasing the pushbutton will restore zero volts on the SMA connector, and the Status LED will go off.



When the high-voltage output is enabled, it is normal for the driver to emit a quiet, high-pitched humming sound.

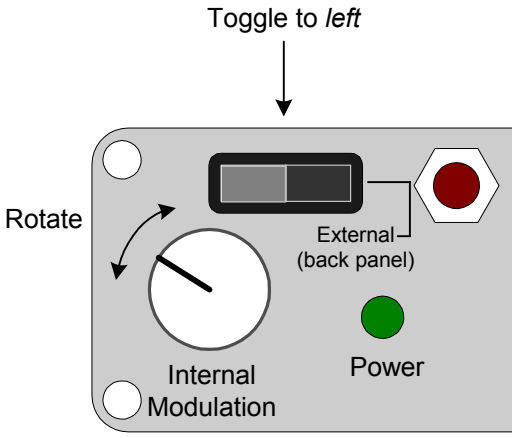
An example LC output waveform is shown at right, for a preset 70 V_{RMS} high-voltage amplitude (factory default). The 2 kHz AC carrier is shown, along with the state of the LC shutter device. The change in amplitude coincides with pushbutton operation of the LC output switch.



Internal Modulation mode

In this mode, the driver automatically toggles between high-voltage output and zero volts, at a rate determined by the front-panel Internal Modulation frequency knob.

To enable this mode, set the front-panel Internal/External Modulation switch towards the left (Internal). In this setting, the rate of toggle is controlled by rotating the Internal Modulation knob. Full counter-clockwise is the slowest setting (~0.2 Hz).



In Internal Modulation mode, the duty cycle for shutter-open and shutter-closed is always symmetrical (50-50). The red Status LED will illuminate whenever high voltage is present at the output. For the faster modulation rates, the Status LED will appear to be continuously illuminated.

It is possible to route the Internal Modulation frequency to the back-panel BNC connector as a driver output for synchronization purposes. Contact Optical Finesse for further details.

External Modulation mode

External modulation mode requires a TTL logic compatible source. This mode is suitable for automated test or measurement environments, where a digital output from a computer is used to control whether high voltage or zero volts is present at the SMA output.

To enable this mode, set the front-panel Internal/External Modulation switch towards the right. Connect a TTL-compatible logic source or computer logic output to the back-panel External Modulation BNC connector. Do not use the bipolar analog output of a function generator. If a function generator is to be used, many have a separate sync or logic output that is suitable for use.

External Modulation mode employs active-low logic. The BNC connector is pulled to 5V internally by a 10K pull-up resistor, and is thus compatible with open-collector output stages. A logic HI on External Modulation will select zero volts on the SMA output (shutter closed). Logic LO will select high-voltage output on the SMA (shutter open). As with Internal Modulation mode, the red Status LED will be illuminated whenever high voltage is present on the output connector.