Optical Finesse LLC

LCC1-33 Single-Channel Liquid-Crystal Controller

User's Manual

Manual revision
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Made in USA

Description & Specifications

The LCC1-33 is a versatile, single-channel liquid-crystal controller, designed to run continuously-variable liquid crystal (LC) devices such as variable retarders, polarization switches, shutters, attenuators, and tunable color filters. LC voltages up to 33 V_{RMS} are controlled by two preset amplitude knobs. True calibrated root-mean-square (RMS) voltage amplitude readout is provided by a front-panel display.

The rugged output stage of the LCC1-33 can drive cells up to 900 nF capacitance, and will withstand continuous shorts while recovering automatically when the short is removed. Output can be toggled between two preset amplitudes manually, or by either internal or external trigger.

Features

- 2 kHz balanced AC waveform generation up to 33 V_{RMS}
- Drives large-area cells up to 900 nF of capacitance
- Two 10-turn front-panel knobs for amplitude control
- True RMS LC output voltage readout on large 3-digit LED or LCD display
- Dual BNC and SMA bulkheads for LC output
- Automatic full-recovery short-circuit protection on LC output
- Switch-selectable External or Internal Modulation; Internal Modulation rates from 0.5 to 50 Hz
- RoHS compliant

LC OUTPUT & INTERFACE

Number of LC channels	One, with dual-connector output
Output waveform	Bipolar DC-balanced square wave
Carrier frequency	2.00 ± 0.02 kHz
Amplitude range	0.0 to 32.0 V_{RMS} guaranteed
Amplitude control	Two 10-turn preset amplitude knobs; toggling between amplitudes determined by operating mode.
Residual DC	< 5mV at any amplitude level
Voltmeter display	Calibrated 3-digit true root-mean-square measurement of LC output
Operating modes	- Manual toggle (External Modulation with no source connected) - Internal Modulation (toggle rate controlled by Internal Frequency knob) - External Modulation (with external source)
Internal Modulation rate	0.5 to 50 Hz, 50% duty cycle
External Modulation	TTL logic-level controlled, asynchronously to 500 Hz
Drive capability	Output can drive cells up to 900 nF capacitance
Short circuit	- Full-recovery short-circuit protection on LC output - Front-panel "Fault" LED will illuminate when output is shorted

PHYSICAL

Dimensions	4.6 in W *x* 6.0 in L *x* 1.9 in H
Weight	2.8 lbs (controller + power supply)
Chassis material	- Black anodized aluminum, rubber bottom feet - Machined aluminum front & back panels, black-anodized and laser-etched
Front panel	- Power and Fault LEDs - Two 10-turn amplitude preset knobs - Two-position preset toggle switch (selects amplitude in manual toggle mode) - 3-digit LED or LCD voltmeter display (specify when ordering)
Back panel	- 50-ohm BNC female bulkhead for LC voltage output (primary) - 50-ohm SMA female bulkhead for LC voltage output (secondary) - Two-position Internal/External Modulation toggle switch - Internal Frequency knob (three-quarters turn, controls amplitude toggle rate in Internal Modulation mode) - 50-ohm BNC female bulkhead for External Modulation source - 2.1 mm power jack receptacle - 12V 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 ^{o}C
Power supply	- Separate, supplied with controller - International +12V, 18W, 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 controller is for indoor use only, and not to be used in wet or moisture-laden environments. The controller should only be operated in relative humidities between 20-80% non-condensing, and at temperatures between 5 to 45 ^{o}C.

- 12V⎓1.5A The electrical input rating of this device is 12VDC/1.5A. Use only with supplied AC mains adaptor (international power supply).

- The LC output cable should be jacketed, with a 150 V minimum insulation rating. A RG 58 C/U BNC-to-alligator-clip adapter cable (e.g. Pomona 4532-C-36) is suitable for use.

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

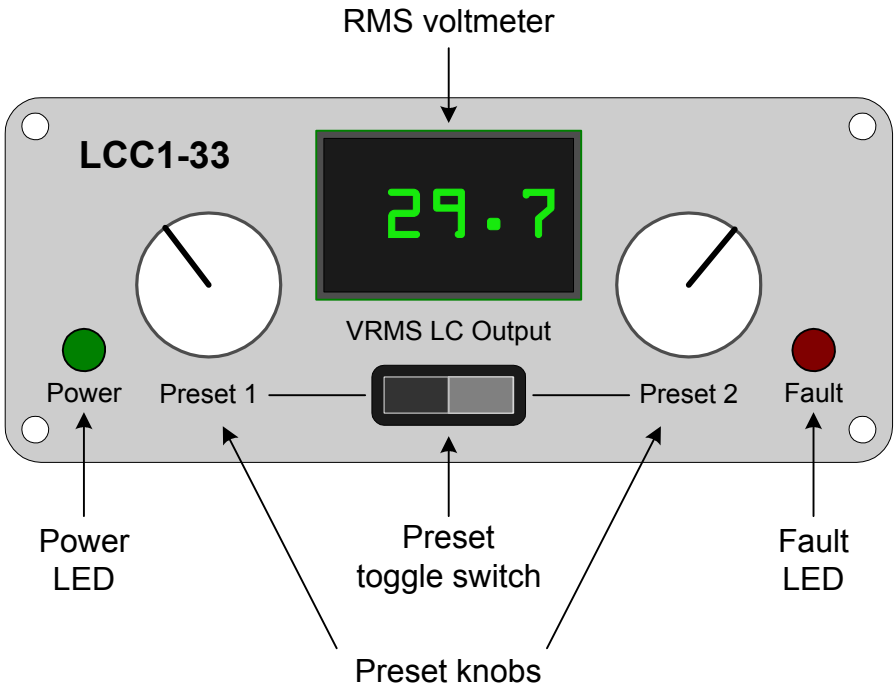
- Clean the exterior of the unit with a soft dry cloth only.

- The controller should be operated upright on a sturdy table or workbench, with clear access to both front & back panels.

Front & Back Panels

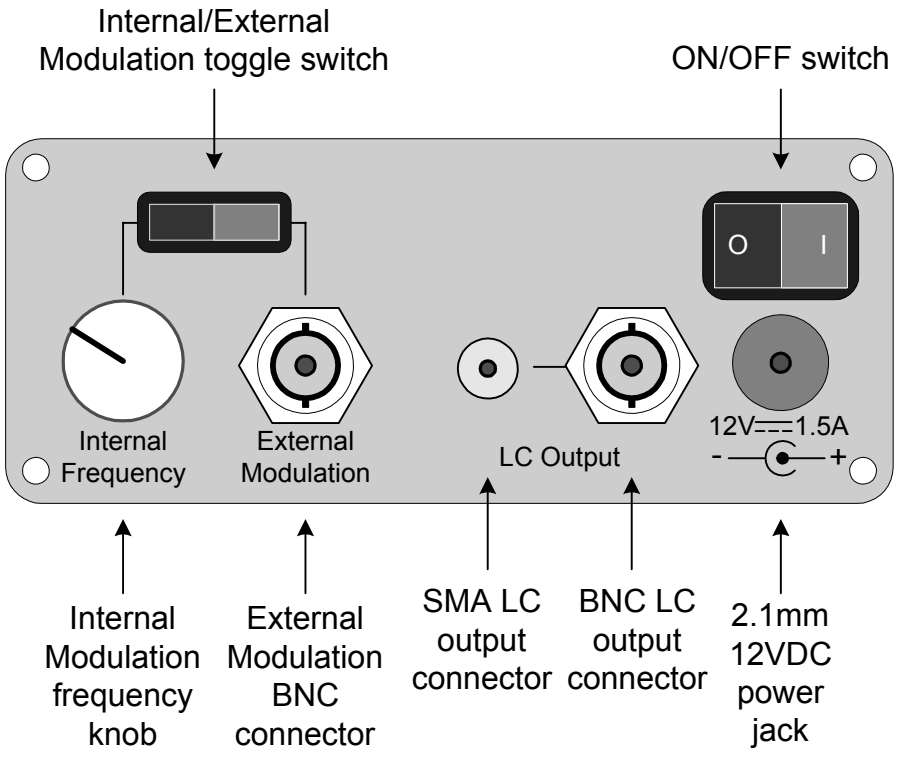
A brief description of the front & back panel controls and connections follows.

Front panel



- Power LED: lit green when controller is connected to power supply and switched ON (normal operation).
- Fault LED: In normal operation, this LED is off. Will be lit red when a short-circuit or other fault condition exists on LC output. When short-circuit or fault is removed, this LED will automatically turn off.
- Preset knobs: 10-turn knobs that control the voltage amplitude of each preset. Rotating the knobs clockwise increases the amplitude. Preset amplitudes are selected by either the preset toggle switch (manual toggling), or modulation mode (Internal or External).
- RMS voltmeter: 3-digit LED or LCD display that shows the currently-set root-mean-square (RMS) voltage amplitude of the LC output. The controller will produce amplitudes up to 33 V_{RMS}.

Back panel



- 2.1mm 12VDC power jack: accepts 2.1mm output power connector of supplied external 12VDC/1.5A international power supply.
- ON/OFF switch: switches 12VDC power from external power supply ON/OFF.
- BNC LC output connector: primary LC voltage output connection for controller.
- SMA LC output connector: secondary LC voltage output connection. This connector is tied internally to the BNC LC output.
- Internal/External Modulation toggle switch: selects mode of operation. When set to External (to right), permits manual toggling of amplitudes by front-panel preset toggle switch, or permits use of TTL-compatible External Modulation source. When set to Internal (to left), permits Internal Modulation.
- Internal Modulation frequency knob: when Internal Modulation is selected, sets rate of toggle between the two preset amplitudes. Full counter-clockwise is the slowest rate (~0.5 Hz).
- External Modulation BNC connector: left open for use in manual toggle mode or for Internal Modulation. For External Modulation mode, accepts 0-5V TTL-compatible logic signal. A logic LO selects Preset 1, a logic HI selects Preset 2.

Operation

The LCC1-33 outputs a DC-balanced 2 kHz bipolar square wave suitable for driving various liquid-crystal devices. The amplitude of the square wave is controlled by one of two front-panel preset knobs. Only one preset is active (in control of output) at any instant. Toggling between the two preset amplitudes may be performed in three ways:

1. Manually, using the front-panel preset toggle switch.

2. Internally, by switching the LCC1-33 to Internal Modulation.

3. Externally, by using a function generator or other trigger source.

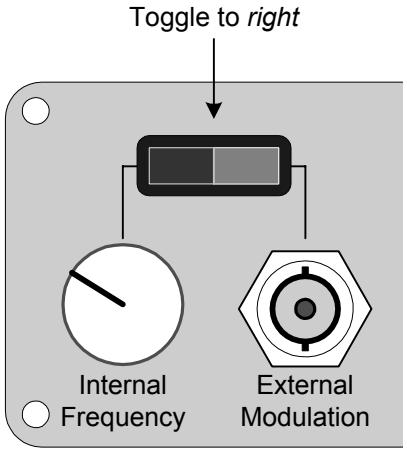
Preliminaries

Connect the external international power supply to AC mains with supplied AC power cord. Connect 2.1mm power connector to 12VDC power jack. Insure both front-panel preset knobs are rotated full counter-clockwise. Switch ON/OFF switch on. Front panel green LED should be lit.

Connect a jacketed cable to either the SMA or BNC LC output connectors. These connectors are connected internally, and either one or both may be used to drive LC devices. A RG 58 C/U BNC-to-alligator-clip adapter cable (e.g. Pomona 4532-C-36) is suitable for use in a test or production environment to connect to the ITO tabs of an LC device.

Manual toggle mode

This is the most basic operating mode of the controller. In this mode, the front-panel preset toggle switch controls which of the two preset knobs is currently active.



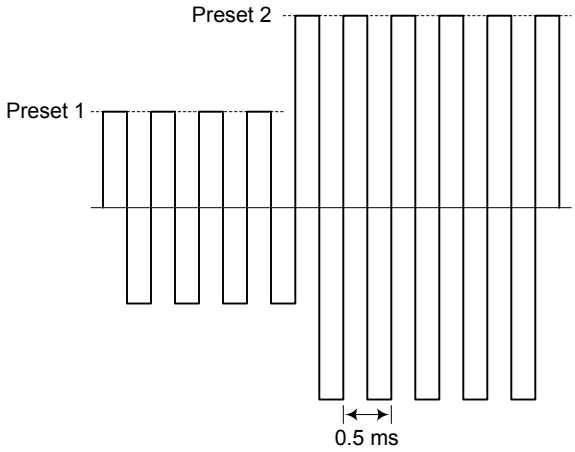
Set back-panel Internal/External Modulation switch towards right (External). With no external source attached, this will enable manual toggle mode.

Set front-panel preset toggle switch towards the left (towards Preset 1 knob). Rotate the Preset 1 knob. As the knob is rotated clockwise|counter-clockwise, the reading on the front-panel RMS voltmeter will increase|decrease.

Set front-panel preset toggle switch towards the right (towards Preset 2 knob). Rotate the Preset 2 knob and observe changes on the voltmeter.

Toggling the preset switch back to the Preset 1 position recovers the previously-set amplitude. Either preset may be adjusted when not active, although it is recommended that adjustments be made only when a preset is active.

An example LC output waveform is shown at right, for the case in which Preset 1 happens to be less than Preset 2. The 2 kHz AC carrier is shown, along with the set amplitudes for the two presets. The change in amplitudes shown coincides with a manual toggling of the preset switch.



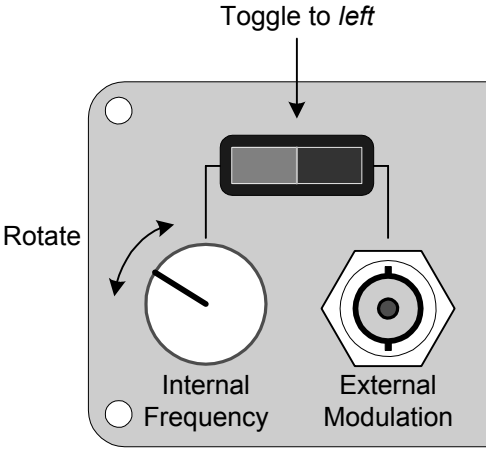
If the LC output connector is shorted to ground (e.g. if the two clips of a BNC-to-alligator clip adapter cable are contacted), the red Fault LED will turn on and the RMS voltmeter will read a low value. A fault condition will not harm the LC output. Once the short is removed, the Fault LED will turn off and the controller will automatically return to the last-set voltage.

Internal Modulation mode

In this mode, the controller automatically toggles between the two preset amplitudes, at a rate determined by the back-panel Internal Frequency knob.

To enable this mode, set back-panel Internal/External Modulation switch towards left (Internal). In this setting, the rate of toggle is controlled by rotating the Internal Frequency knob. Full counter-clockwise is the slowest setting (~0.5 Hz).

Adjustments to either preset knob may be made as the controller automatically toggles between them.



As the controller toggles, the RMS voltmeter reading will alternate between the two preset amplitudes. For faster modulations, the meter will be unable to keep up with the actual LC output, and will display an intermediate value. This is normal controller behavior. If an accurate reading is desired for either or both presets, switch the back-panel toggle switch to the External setting to return to manual toggle mode.

External Modulation mode

External modulation mode requires a TTL logic compatible source. This mode is suitable for automated test environments, where a digital output from a computer is used to control which of two preset amplitudes is selected.

To enable this mode, set back-panel Internal/External Modulation switch towards right. Connect a TTL-compatible logic source or computer logic output to the 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.

A logic LO on External Modulation will select the Preset 1 amplitude. A logic HI will select the Preset 2 amplitude. As with Internal Modulation mode, adjustments may be made to either preset as the controller toggles between them.