

Batlab LX0001-01 Batlab User Manual: Rev A

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1. Document Purpose

The purpose of this document is to act as a guide for operating the Batlab and its accompanying software Graphical User Interface (GUI). Notable precautions and ratings are also included to ensure that users are familiar with operational best practices and device tolerances.

2. Precautions

While the Batlab is designed to protect against common failure modes, there are still several things that users should bear in mind while operating the Batlab to avoid situations with the potential for hazardous outcomes.

- While handling Lithium Ion cells, care should be taken to avoid shorting the positive and negative terminals. Doing so can result in hazardous consequences.
- The Batlab is capable of charging and discharging cells at up to 4A based upon a user provided setpoint, but users shall bear the responsibility of ensuring that the selection is within the rated tolerance of the cells to be tested.
- The underlying Batlab circuitry (transistors) can achieve high temperatures during operation and should not be handled during and/or following test operations until they have had an opportunity to cool.

3. Device Ratings

It is important for users to be familiar with the operational limits of the Batlab device. Some safety thresholds are configurable by users to tailor tests to the technical specifications of the cells to be tested, but other ratings are inherent to the design architecture.

- The maximum current capable of being measured by the Batlab hardware is 4.096A, but thermal dissipation limits impose a 4A per channel max threshold.
- The maximum current synthesis for sine wave generation is 4A.
- Batlab communication with the PC is designed for USB 4.95 - 5.05V (a powered USB hub is recommended for usage cases with more than one Batlab).
- Charging operations of the Batlab are designed for 4.75 - 5.20V from an external PSU. External PSU voltages beyond 12V can result in irreparable damage to the unit. Discharge and impedance tests can occur without the use of an external power supply.
- The maximum cell voltage on any channel shall not exceed 4.5V. If voltages exceed 4.5V, measurement errors will occur. If cell voltages exceed 5.3V, damage to the unit may occur.

4. Hardware Setup

This section outlines device connections and operational configurations.

4.1 Device Power

The measurement and communications processors on the Batlab unit are powered by USB interface. The user may power the device by connecting the Batlab unit directly to a host computer or USB hub with the Midi B USB cable provided with the unit. A USB hub is recommended for testing configurations involving more than one Batlab unit. Once the device is powered by USB, the PWR LED will remain solid on. The PWR LED and communications port are depicted in Figure 1 below.

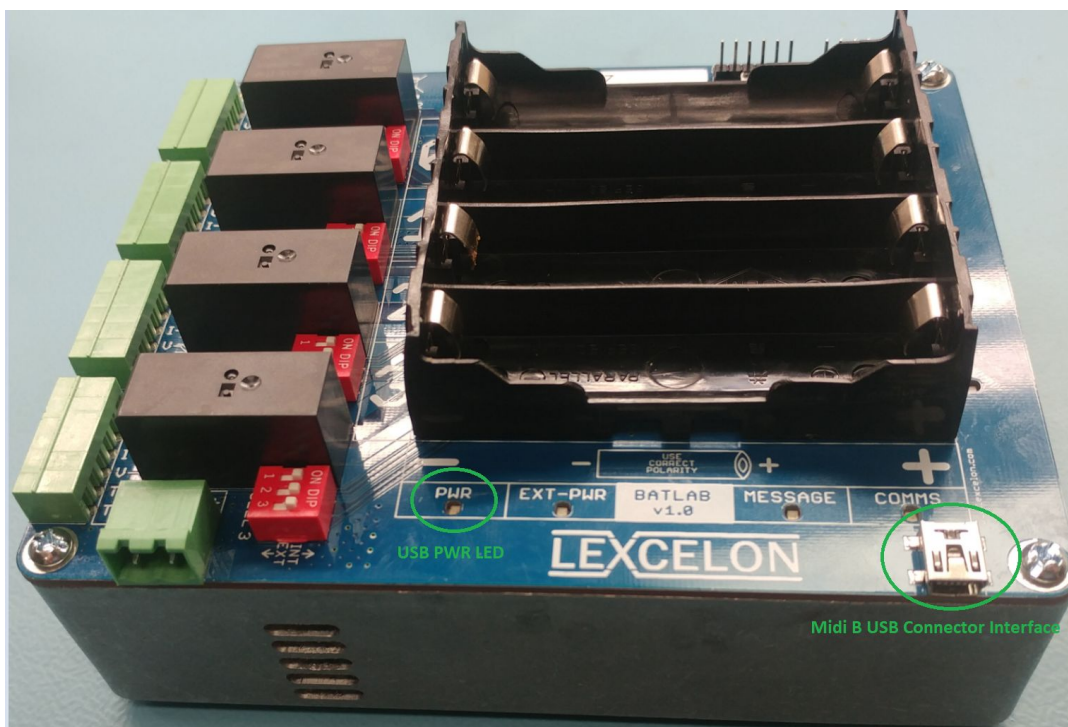


Figure 1. Batlab USB Power Connection

NOTE: Only USB power is required for measurement functionality and communications with the device. The external 5V PSU needed only to enable charge functionality.

4.2 External PSU Connections

If the user plans to operate the Batlab in a mode other than discharge or impedance, an external 5V power supply unit (PSU) is required. The positive and negative terminals of the external PSU may be wired into the external PSU screw terminal port that is provided with the Batlab. The user may then insert the port into the corresponding Batlab external PSU header, taking care to ensure that the positive wire and negative wire align with the terminal pins as depicted in Figure 2 below.

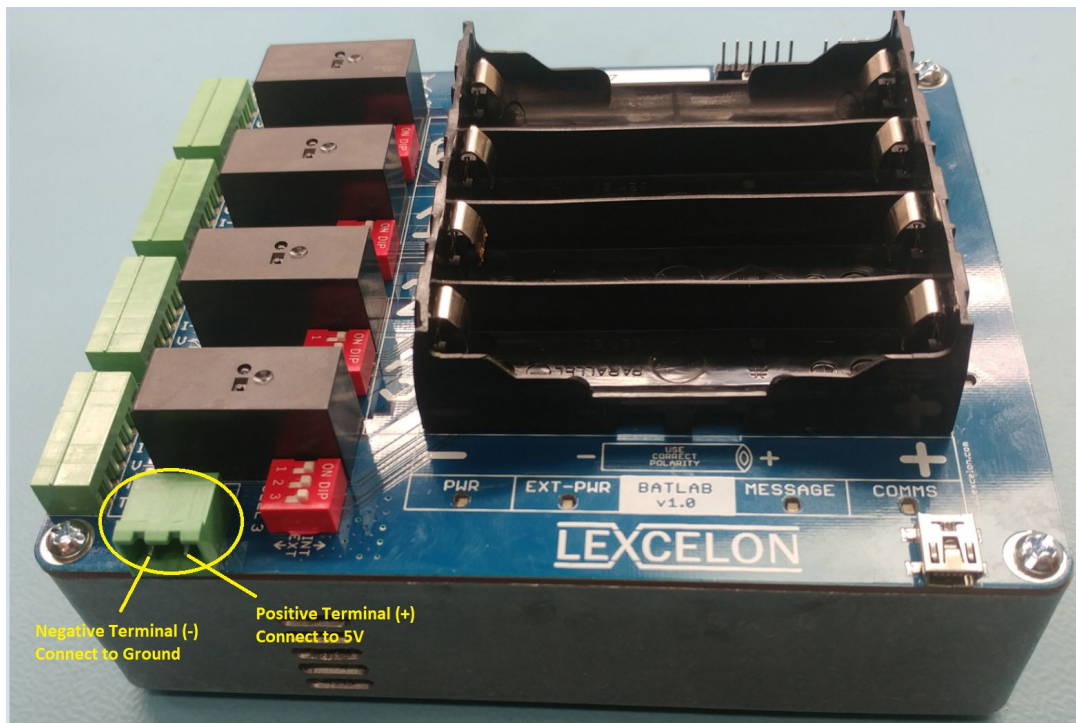


Figure 2. Batlab External PSU Header

NOTE: If the user is only interested in conducting discharge and impedance tests, only USB device power is required.

4.3 External Cell Trays

It is possible to leverage the Batlab device to perform testing on cell form factors other than 18650. This is achievable using the external cell headers. Each measurement channel can be configured to measure from the external cell input header rather than the on-unit cell tray by moving all three of the corresponding cell channel DIP switches into the downward (off) position. The two different possible configurations are exemplified in Figure 3.

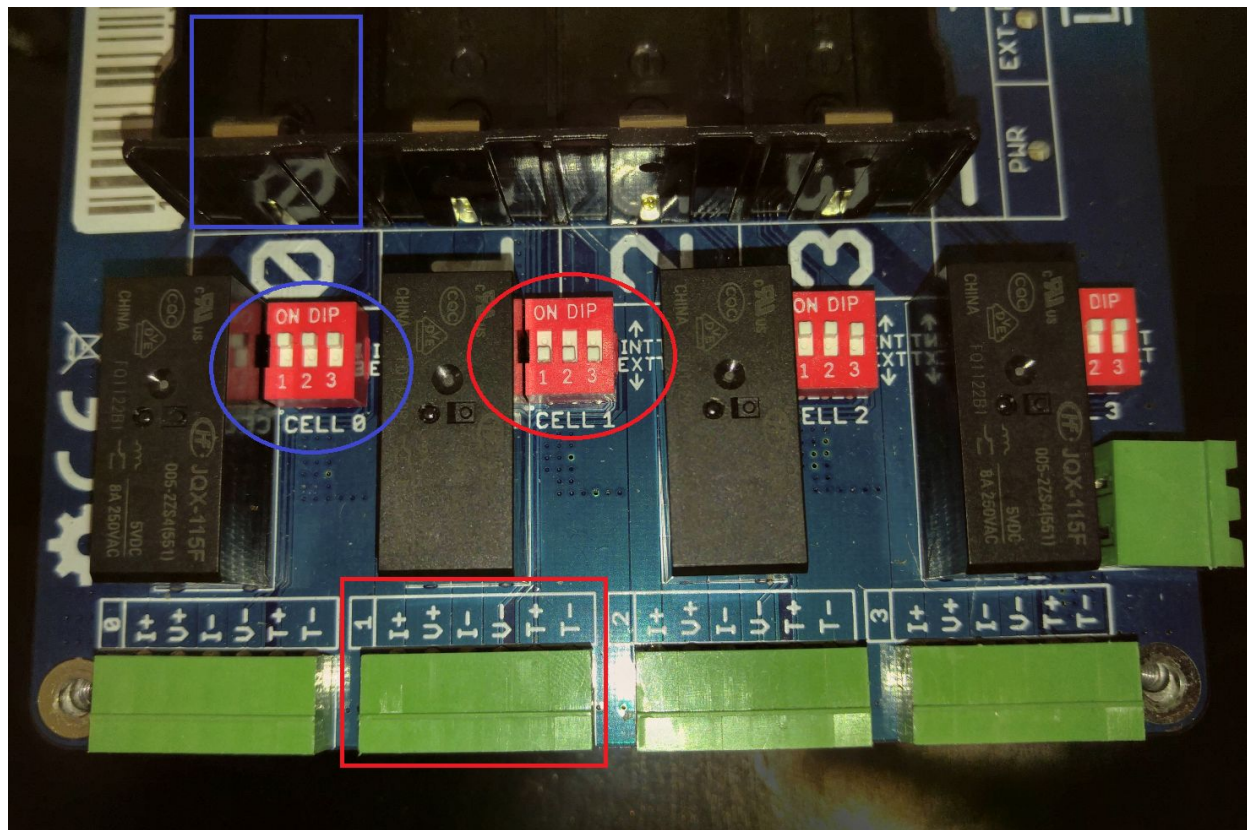


Figure 3. Cell Measurement Configurations

BLUE: The DIP switches circled in blue correspond to the CELL 0 channel. All three switches are in the upward position. In this configuration, measurements will be taken from the on-unit CELL 0 slot outlined in the blue rectangle.

RED: The DIP switches circled in red correspond to the CELL 1 channel. All three switches are in the downward position. In this configuration, measurements will be taken from the external cell header outlined in the red rectangle.

The characters next to the external cell headers on the PCB denote the variable measured on that particular pin. The I variable is current, V is voltage, and T is temperature.

5. LED Indicators

The Batlab has several LEDs on the PCB that are used to communicate a variety of information to the user. This section documents the LEDs and their meanings.

5.1 Status LEDs

Each Batlab unit has four LEDs that are used to relay information about the device operational status and external inputs. The the four status LEDs are boxed in red in Figure 4 below.

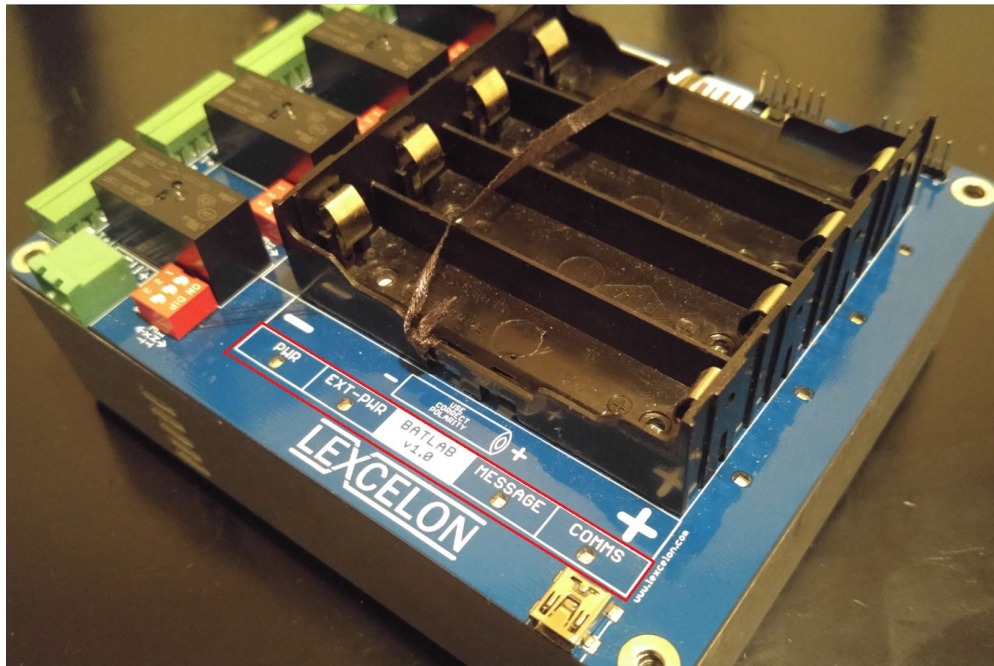


Figure 4. Cell Measurement Configurations

- 1) **PWR:** The PWR LED remains solid on with USB power is applied to the device.
- 2) **EXT-PWR:** The EXT-PWR remains solid on when external PSU voltage in the 4.75 - 5.20V range is provided to the 5V external PSU input terminal
- 3) **MESSAGE:** The MESSAGE LED is used in multi-unit configurations to indicate which unit should be populated with cells at a given time during testing. The LED remains solid on when the device is in Bootloader mode. See Programmer User's Manual for more details.
- 4) **COMMS:** The COMMs LED is used to signify when packets are being sent or received by the Batlab units. See Programmer User's Manual for more details.

5.2 Cell Channel LEDs

Each cell channel of the Batlab unit has a corresponding LED. The cell channel LEDs are depicted boxed in red in Figure 5 below.

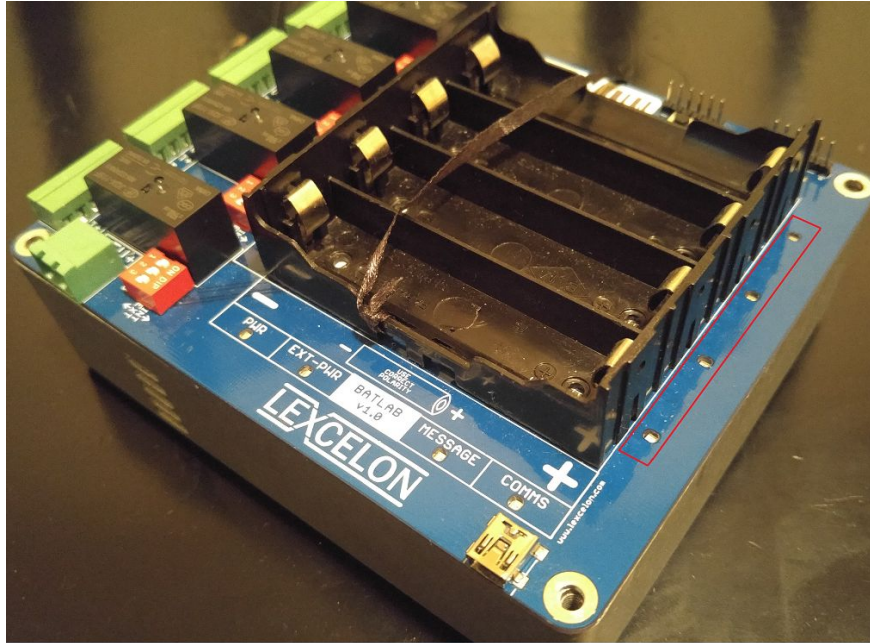


Figure 5. Cell Channel LEDs

The cell channel LEDs are used to communicate information about the channel MODE via blink patterns. A state machine internal to the Batlab firmware dictates the MODE that a cell channel should be in by monitoring parameters of the cell channel. Knowledge of the firmware MODE transitions is not needed to understand the meaning of the LED blink patterns. The names of each MODE are self-explanatory. The LED blink patterns for each possible mode are summarized in the Table below:

Mode	LED Blink Pattern
NO CELL	Off
IDLE	Blip
BACKWARDS	Fast Blink
CHARGE	Ramp Up
DISCHARGE	Ramp Down
IMPEDANCE	Sinusoid
STOPPED	Solid On

6. Device Operation

The GUI is still under development, but a Batlab Python Library has been developed and leveraged to create a Batlab utility script that can allow basic testing functions to be executed. A Quick Start Guide has been developed and is available on the Lexcelon Resources page:

<https://www.lexcelon.com/wp-content/uploads/2017/11/Batlab-Python-Script-Quick-Start-Guide-1.pdf>