Light Source User Guide

Hardware Specification

- Seven LEDs: 468nm, 410nm, 367nm, 295nm, 275nm, 255nm, 235nm
- LEDs flash for <1ns (FWHM)
- Seven (optional) LED cathode MMCX test points to observe LED cathode electronic pulse
- External desktop power adapter
- External Trigger input MMCX coax connector
- DAQ Sync output MMCX coax connector
- Computer control via Serial UART port of:
    - LED Bias Voltage setting (10 bit DAC)
    - LED Bias Voltage read back (12 bit ADC)
    - LED Channel selection
    - LED Trigger source (external, or internal)
    - Internal trigger rate (fast or slow)
    - Power Down (for standby, low power consumption)

General Description

The Light Source is designed to operate in a standalone fashion, or with integration to external systems. In standalone fashion, it only needs power, and a serial connection to a computer. If integrated to other systems, it can additionally accept an external trigger, and provides a sync output to DAQ electronics.

Seven LEDs of interest are placed in a row with 8.5mm pitch, spanning 51mm.

The primary calibration LED can accept a light guide assembly.

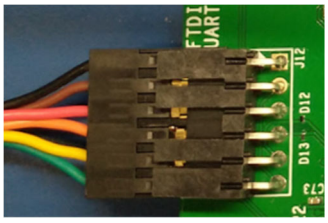
Typical Kit Contents

- Light Source Board
- 1 x MMCX-SMA Cable
- USB to Serial FTDI Cable (TTL-232R-3V3)
- +6V 1.2A Power Adapter (SWI6-5.9-N-P5R)
- Bivar light guide assembly (SMFLP36.0)
- Thorlabs fiber optic (M80L005) with modified Bivar base

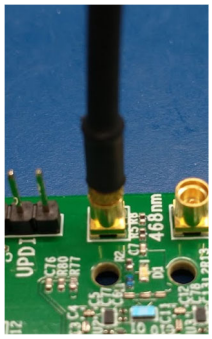
User Instructions

WARNING!! THESE LEDS EMIT POTENTIALLY HARMFUL UV LIGHT. ENSURE LED LIGHT OUTPUT IS CAREFULLY SHIELDED FROM EYES/SKIN.

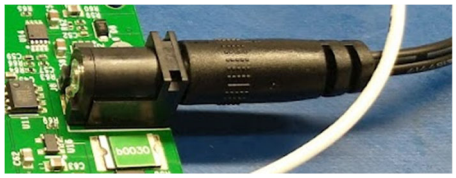
1. Please observe anti-static precautions while touching electronics: such as wearing a grounded protective wrist strap, and working on a grounded anti-static mat.
2. Cover the UV LEDs (367-235nm) gently with black electrical tape if temporarily operating in an area where eye/skin exposure can occur. Consider using UV protective eyewear.
3. Mount the board using four screw holes, or place on a non-conductive work surface (antistatic mat is ideal).
4. Plug the supplied USB FTDI cable into a computer. Ensure drivers work and it exists as a Com Port. (Consult www.ftdichip.com website for instructions). Plug FTDI receptacle into Light Source board with contacts facing up. Black wire is pin 1.



5. Connect MMCX co-axial cables if required:
    - To observe electronic LED pulse, plug into adjacent MMCX vertical receptacle. Connect to oscilloscope input set to 50 Ohms, and maximum bandwidth (>2GHz). Note signal amplitude is attenuated by 40x.
    - To provide external trigger, plug into 'Trig In' receptacle. Use 3.3V logic signal source set to drive 50Ohms.
    - Plug into 'Sync Out' receptacle for DAQ System synchronization. Note this produces 3.3V logic signal, but cannot drive 50 Ohms termination (must be high impedance termination).
    - Always plug/unplug these when the board power is disconnected.



6. Plug power adapter into a A/C outlet. Plug power adapter barrel connector into Light Source.



7. Open a terminal port in Putty or similar program.
    - Open a serial connection to the FTDI Com Port
    - Use the following settings:
        - Baud: 115,200
        - Data bits: 8
        - Stop bit: 1
        - Parity: None
        - Flow Control: None
        - Local Echo: On
8. In terminal program, enter any lower case letter to produce ‘Command Menu’. Following is a description of each command:

```
Terminal ×
c
Invalid Command!                                   Pause Scrolling

Commands:
E - (Enable) Board Active
D - (Disable) Board Standby
Tx - (Trigger) Enter Trigger Source: I - Internal, E - External
Rx - (Rate) Enter Trigger Rate: S - 1.5kHz, F - 8MHz
Lx - (LED) Enter LED number: 1-7 (465nm-235nm), or 0 for all off
Sxxxx - (Set) Enter 10 bit Bias DAC Value: 0000-1023
Q - (Query) Bias 12bit ADC Value is:
```

    - **E** – Enables the Board power, but LEDs are off by default. Current is 350mA maximum.

```
Terminal ×
E
Board Active
```

    - **D** – Disables the Board power (except microcontroller). This drops current to 5mA. Board is disabled by default on power up.

```
Terminal ×
D
Board Standby
```

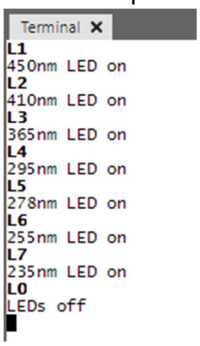
    - **T**x – Selects Internal or External LED trigger source. Internal is produced by the microcontroller at one of two optional rates. External is introduced by way of the ‘Trig In’ connector. x = **I** for internal, or **E** for external.

```
Terminal ×
TI
Trigger Source: Set Internal
TE
Trigger Source: Set External
```

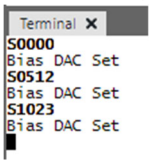
    - **R**x – Selects Internal trigger rate. x = **S** for slow 1.5kHz, or **F** for fast 8MHz. Use slow trigger rate for all regular data acquisition. Fast rate is used to produce high average light intensity, and can be used for optical alignment procedures.

```
Terminal ×
RS
Trigger Rate: Set 1.5kHz
RF
Trigger Rate: Set 8MHz
```

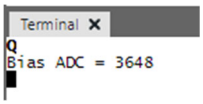
- **L**x – Selects LED, or all off. x = **0**,**1**,**2**,**3**,**4**,**5**,**6**,**7**. **0** turns all LEDs off. **1**-**7** selects LEDs 468-235nm respectively. Only one LED will be flashed at a time.



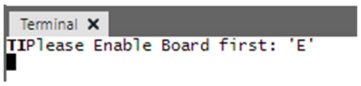
- **S**xxxx – Sets the Bias DAC. The Bias DAC is used to control the LED Bias Voltage. It ranges from ~14.7V to 2.6V. The Bias DAC is 10 bit, so accepts values from **0000**-**1023** (2^10). Note the lowest DAC setting is the highest Bias voltage. Bias voltage can be calculated as a function of the DAC setting as follows: Vbias = ((-12.1v/1023)*DAC)+14.7V. Allow 2 seconds for Bias to stabilize.



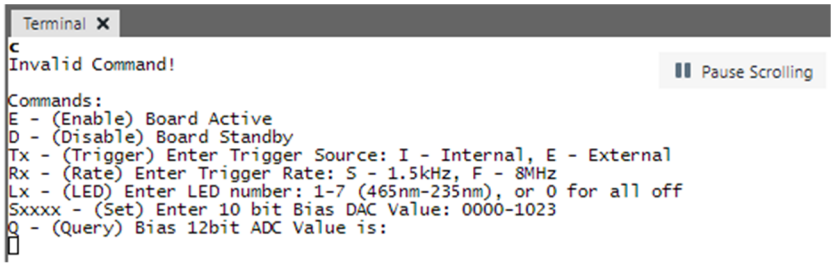
- **Q** – Reads the Bias ADC. The Bias ADC is used to read back LED Bias Voltage. The Bias ADC is 12 bit, so produces values from **0-4095** (2^12). Bias voltage can be calculated from the ADC value as follows: Vbias = ((16.5V/4095)*ADC).



- If some commands are entered when the board is disabled, a message is produced:



- If an invalid character is sent, a message is produced, along with the Command Menu:



9. When work is complete always disable the Light Source via the Serial Control before unplugging power.

General usage notes

Communication

- If automated control is used to the serial port, some small delays may be required between commands/characters:
    - Allow 500ms after 'Enable' for power to stabilize.
    - Allow 100ms between commands, and 10ms between characters.
- Note that incomplete commands will time out after a few seconds.

LED Intensity

- LED Intensity can be changed on the fly while the LED is actively flashing, but may take 2 seconds to stabilize.
- Note that LED light intensity is proportional to current. LED current increases exponentially with LED bias voltage.
- LED intensity for a given bias voltage will vary depending on the LED model.
- All LEDs are low intensity models. Maximum average intensity will be equivalent to 20mA current; typical of a regular indicator LED.

Bias Voltage

- Bias voltage Set/Read values might be out by 1% from actual voltage due to resistor tolerance. This can be improved if it's a problem.
- Light Source board temperature should be allowed to stabilize before beginning flashing. Allow 5 minutes.

Trigger Rate

- Slow trigger rate is highly recommended when possible: <100kHz. A bias voltage of less than 12V should be used at frequencies >100kHz; these LEDs have small dies and a low power rating.
- Although the board will function to 40MHz trigger rate, it is not recommended. Please use <10MHz.

Light Guide and Fiber Coupling

- In PMT testing applications, either the Bivar Light Guide (most efficient) or Thorlabs Fiber Optic can be used.
- Press the fiber coupler into the PCB over the LED.
- Mount circuit board in a dark location, or block light with electrical tape or a minimal amount of electronics compatible silicone around the Bivar LED adapter (gaps in sides).