Precision LED driver

EPFL SB ISIC-GE AECH, Benjamin LeGeyt, August 2016

The Precision LED driver board was designed to accurately regulate the current through an array of LEDs based on an external setpoint. The board can also take a photodiode current as a secondary input in order to linearize the LED response and effectively regulate the light output from the LEDs rather than simply regulating the current.
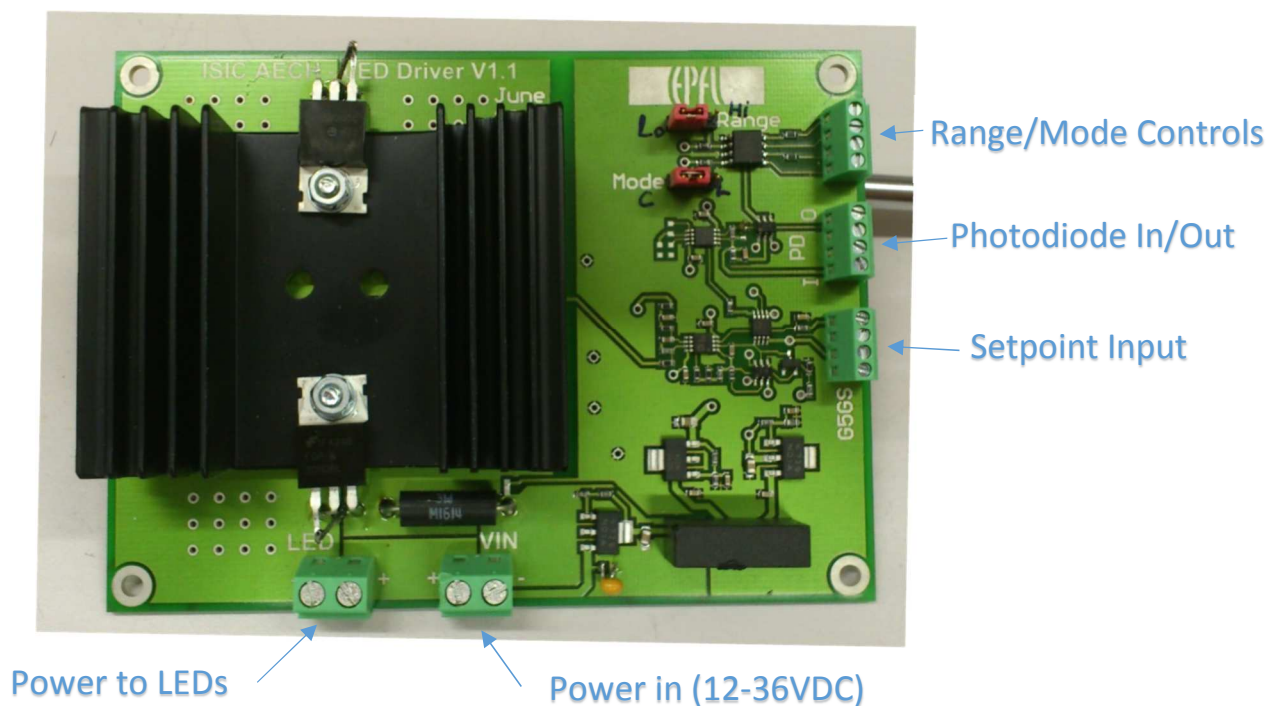
The inputs and outputs are listed below, along with their ranges. The pin numbering convention is that pin #1 is the left-most pin when looking at the connector from the side where the wires enter.

LED Connector	Pin name	In/Out	Comment
1	LED out -	Out	0-Vin, 6.6A Max
2	LED out +	Out	
VIN Connector			
1	Vin +	In	12-36VDC, 7A Max
2	Vin -	In	
Setpoint			
1	Ground	-	5V output to power potentiometer
2	5V	Out	
3	Ground	-	
4	Setpoint	in	0-5V
Photodiode			
1	Anode	In	0-22mA
2	Cathode (Ground)	In	
3	Ground	-	
4	PD Monitor	Out	0-5V
Range / Mode			
1	Mode +	In	Apply 2.5 – 5V between pins to activate
2	Mode -	In	
3	Range +	In	Apply 2.5 – 5V between pins to activate
4	Range -	In	

Performance and Operating Modes

This board has two operating modes: constant current and constant light. Constant current mode is default. In constant current mode, the current at the LED output is regulated and the photodiode input is ignored though the photodiode monitor output is still active when in constant current mode. The output current in this mode is related to the setpoint in the following way:

Constant current mode setpoint conversion: 1.32 A/V (5V = 6.6A).

Constant light mode can be activated either by placing the 'Mode' jumper in the position towards the connectors, or by applying 2.5 – 5V across the 'Mode' pins of the Range/Mode connector. In constant light mode a photodiode which is illuminated by the LED under control should be attached to the photodiode input. In this mode, the quantity that is regulated is the photodiode current. The diode current is related to the setpoint in the following way:

- Low light mode: 45.5µA / V
- High light mode: 4550µA / V

The photodiode input has two sensitivity ranges: low light and high light. In low light mode, the monitor output will show 22mV per µA of diode current and in high light mode the monitor will show 0.22mV per µA of diode current. Low light mode is default. High light mode can be activated by either setting the 'Range' jumper in the position near the connectors, or by applying 2.5 – 5V across the 'range' pins of the range/mode connector.

The minimum current that can be effectively regulated with this board is 100µA and the maximum is 6.6A.

Reverse Bias Modification

The board was modified in Nov 2016 to apply reverse bias to the photodiode. This was found to be necessary at high light levels (> ~0.75 sun) for the BPW21 photodiode used in the LSPM aging setup. A spare amplifier channel was used to buffer the negative supply for this purpose. Pictures of the modification as well as the implemented circuit are shown below: