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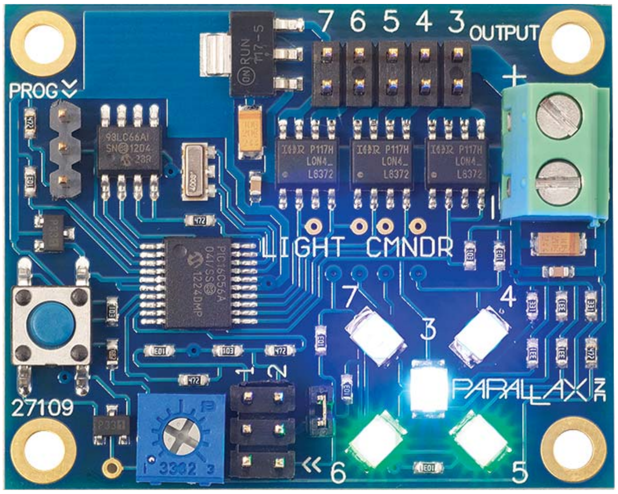
Light Commander (#27109)

The Light Commander is a multi-output user programmable power controller. Originally designed for use as a light controller on the Parallax ELEV-8 Quadcopter, it is equally well suited for any application requiring the switching of high current under programmable control. Based on the proven technology of our BASIC Stamp 1 microcontroller, this product is both simple to use and incredibly versatile in its capabilities.



Features

- Simple to program with PBASIC
- Two programmable I/O ports
- Five high power outputs (MOSFET)
- Adjustable voltage sensor
- Regulated 5 V output for external devices
- Onboard switch with programmable functions

Key Specifications

- Power Requirements: 6–18 VDC @ 8 mA (idle)
- Power outputs: Port 3 = 4 A Port 4,5,6,7 = 2 A
- Communication: Standard BASIC Stamp 1 programming port
- Dimensions: 1.9 x 1.5 in (50 x 38.4 mm)
- Operating temperature: 0 to +130 °F (-18 to +54 °C)

Application Ideas

- Intelligent lighting, animation, and control
- Remote control and scale lighting systems
- Night flying of multirotors and other model aircraft

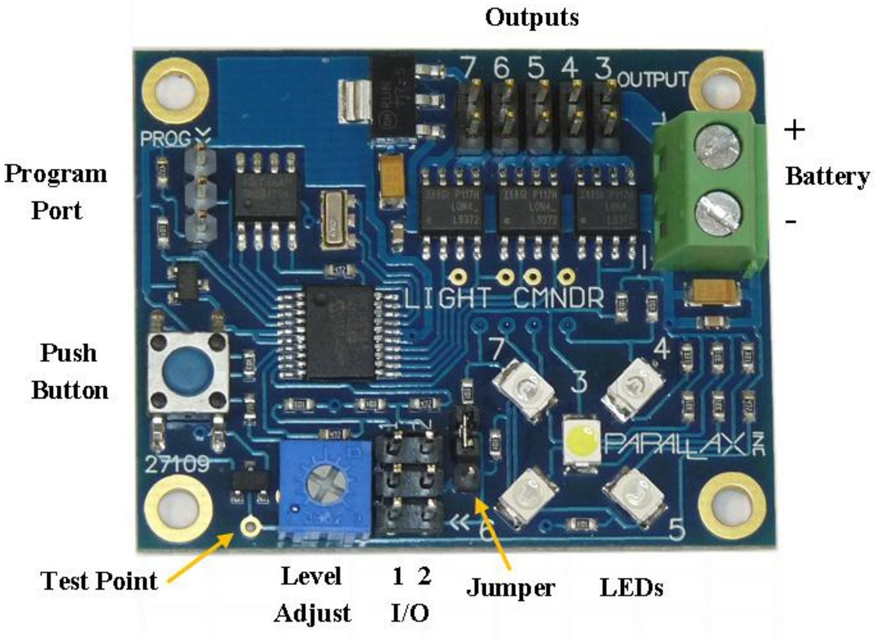
Description

The Light Commander has five high-power MOSFET outputs available to switch heavy loads. One output has twice the power of the others for applications that require unusually high surge currents like DC motors, rocket squibs, or solenoids. In addition to the high-power outputs, the board provides two undedicated I/O ports from the microcontroller. The applications for these ports are only limited by your imagination, creativity, and ability to program new functions. On the ELEV-8 we connected one port to the Auxiliary Channel of our R/C receiver to read PWM. This allows us to select different light patterns that we've programmed into the board during flight by simply turning a knob on the transmitter. We've used the second port to activate all kinds of other devices like our bomb drop servo and camera shutter. The I/O ports are laid out in a standard servo pin format and there is a jumper available to feed modest amounts of +5V power to external devices. We have also included an on-board adjustable battery sensor that can trigger any event that you program. We have often used this to flash lights or activate a piezo buzzer when the battery voltage gets low. Lastly, we have a push button switch available that can be programmed for anything from simple On/Off functions to selecting different programs within the BS1 memory. The Light Commander was designed for maximum versatility so it adapts easily to a multitude of applications.

Testing your Board

The Light Commander comes pre-installed with a demo program that allows you to test the operation of the board and any external loads that you might like to attach. Refer to the Board Layout below to connect a battery or other power source to the board. Once power is connected, pressing the push button switch will start the program. You should see a series of ten lighting animations displayed on the LEDs. Notice that there is a number next to each LED. These numbers correspond to the actual BS1 port numbers as well as the numbers printed next to each set of pins on the output connector. When an LED is lit, the MOSFET for that port is turned on and power is available at the output pins. This Demo Program will allow you to verify that the board is operational. A printout of this program is included on the last page of this document for your reference. It is also available for download on our site. Analyzing this program will help you to understand the basic programming techniques used with the board and serve as a template for writing your own programs.

Board Layout



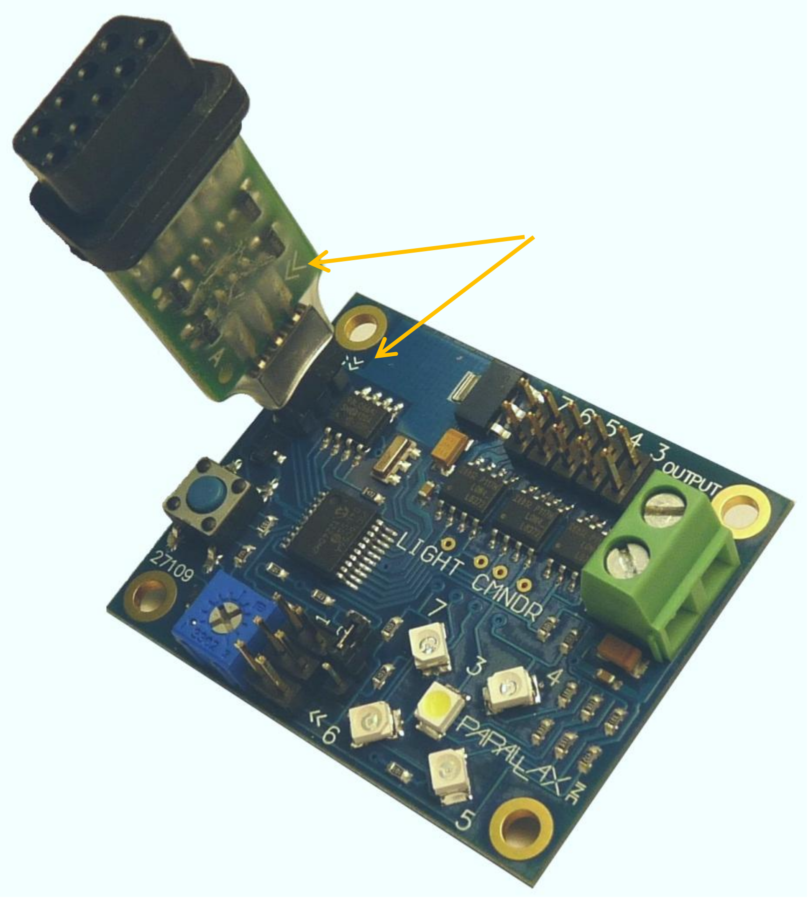
Writing and Loading Your Program

The Light Commander can be programmed for almost any application by writing and installing your own program. The on-board BASIC Stamp 1 (BS1) microcontroller is programmed with PBASIC using the BASIC Stamp Editor, a free download from www.parallax.com/basicstampsoftware. If you are not familiar with writing programs for the BS1, you should first study the documentation on our BS1 page and then review the Light Commander sample programs. You will find that only a few simple commands are required for most applications. Sometimes the easiest way to start your first program is to modify an existing one to suit your needs.

To load a new program into the Light Commander, you will need the BASIC Stamp 1 Serial Adapter (#27111). If you want to download your program via USB, you will also need a USB to Serial Adapter (#28030).

Connect the programming adapter to the three-pin programming port in the upper left hand corner of the board as shown below. Note that the ">>" symbols on the board and the adapter must be aligned for correct polarity. Apply power to the Light Commander board and then follow the standard programming procedures provided with the BASIC Stamp Editor to download your program.

CAUTION: Disconnect everything attached to the Output Connector before programming to avoid inadvertent activation. Under no circumstances should high-current or mechanical devices (motors, solenoids, etc.) remain connected during programming.



BASIC Stamp Port Assignments

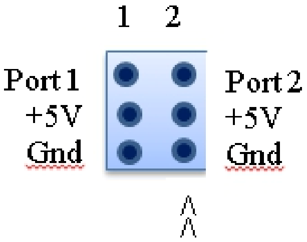
Below is a list of port assignments that you will need to program the BS1. Note that Port 0 is used by both the battery level sensor and the push button switch. This is possible because the switch is generally only used to make a program selection or activate the board at startup when the battery is at full power. Once your program initializes and starts to run, it will normally not be looking at the switch so there is no conflict in sharing the port. Note that you can use the switch to simulate a low battery condition when you are developing your software.

Port	Assignment
0	Switch/Batt Level
1	I/O Port 1
2	I/O Port 2
3	Output 3 **
4	Output 4
5	Output 5
6	Output 6
7	Output 7

** Port 3 has two MOSFETs in parallel and can handle much higher current. This port is recommended if one of your load requires high surge currents like motors or capacitive loads.

Using the I/O Ports

Two of the BS1 bidirectional I/O ports (1 & 2) are brought out to connectors for general use. Each connector has three pins and is arranged in a servo-type configuration as shown below.



These ports offer a multitude of options for control of the Light Commander and for its monitoring of external commands and events. For example, these pins can be monitored for feedback from external devices or to receive PWM commands from a radio receiver or microcontroller to change what the Light Commander is doing. Used in the opposite direction, these ports can send commands or coded information to an external device. Almost anything the BS1 is capable of doing can be communicated to and from other devices through these ports.

The center pin on both ports can optionally be connected to the regulated +5 V supply by inserting the small 3 mm jumper provided (See Figure-1). Note that if the jumper is installed, BOTH ports receive the +5 V power. By default this jumper is not installed (seated on only one pin), because of the risk of overloading the power supply or allowing external power from being fed back into the board.

CAUTION: Improper use of this option can damage both the Light Commander and anything it is connected to. Do not install this Jumper unless you are absolutely certain that you understand the consequences.

Limitations On +5 Volt Power

The +5 volt regulator in the Light Commander can provide modest amounts of power to external devices. How much power is largely dependent on the battery voltage and the type of load that you attach. The board utilizes a linear LDO regulator which means that the regulator has to dissipate any voltage drop across it as heat. As a result, the higher the applied voltage, the more heat is generated (power = voltage dropped times current). The ability to dissipate this heat is what limits the power the regulator can supply safely. At low input voltage, the regulator is rated for several hundred milliamps. However, with high input voltage, the limit drops to about 100 mA. When considering your load, keep in mind that some kinds of devices have high surge currents and should be avoided. We have experienced no trouble with smaller motors such as servos when operating on low battery voltage.

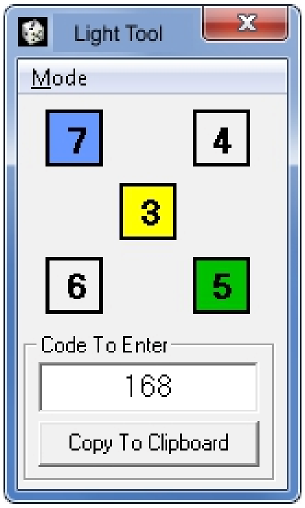
Light Tool for the Light Commander

During the development of the Light Commander, we found that the most cumbersome task during programming was constantly needing to compute what decimal value to enter into the “PINS” command to get the light display we wanted. In an effort to simplify that process for you, we have written a simple Windows program to compute the number based on your clicking on a simulated LED display. This program is called Light tool; Light_Tool.exe is available for download on the 27109 product page. This program does not require installation. It is a single executable file that displays in a window on top of the BASIC Stamp Editor when it runs. To use it, simply click on the LEDs you wish to turn ON or OFF and enter the number displayed into your “PINS” command.

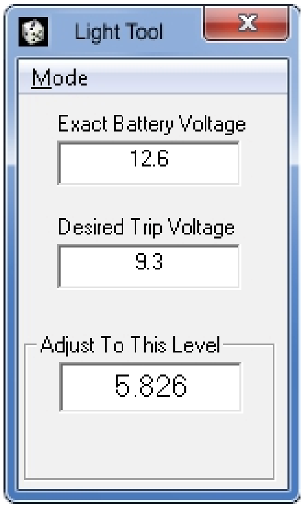
The Light Tool program also has a second function that will save you considerable time if you are using the Battery Voltage Sensor. If you click the “Mode” button on the Light Tool and select “Trip Voltage”, you will go to a screen that helps you calculate the voltage needed at the board’s Test Point to calibrate the voltage sensor. Calibration requires that you be able to accurately measure the battery voltage and the Test Point voltage, so a digital voltmeter is recommended.

Once you have measured the exact battery voltage, enter it into Light Tool. Then enter the Trip Voltage that you desire. Finally, move your voltmeter to the Test Point and adjust the board’s Level Adjust potentiometer until the meter reads the Set Level calculated by Light Tool.

If you do not have the equipment necessary to make these voltage measurements, it is also possible to make the level adjustment by writing a short program that monitors the sensor circuit (Port 0) and lights an LED when the Trip Voltage is reached. Before you can use this procedure, you will need to apply the exact trip voltage you desire to the battery input. This is actually the most accurate way to set the trip point, but it does require a precise variable voltage supply.



Code To Enter
168



Exact Battery Voltage
12.6

Desired Trip Voltage
9.3

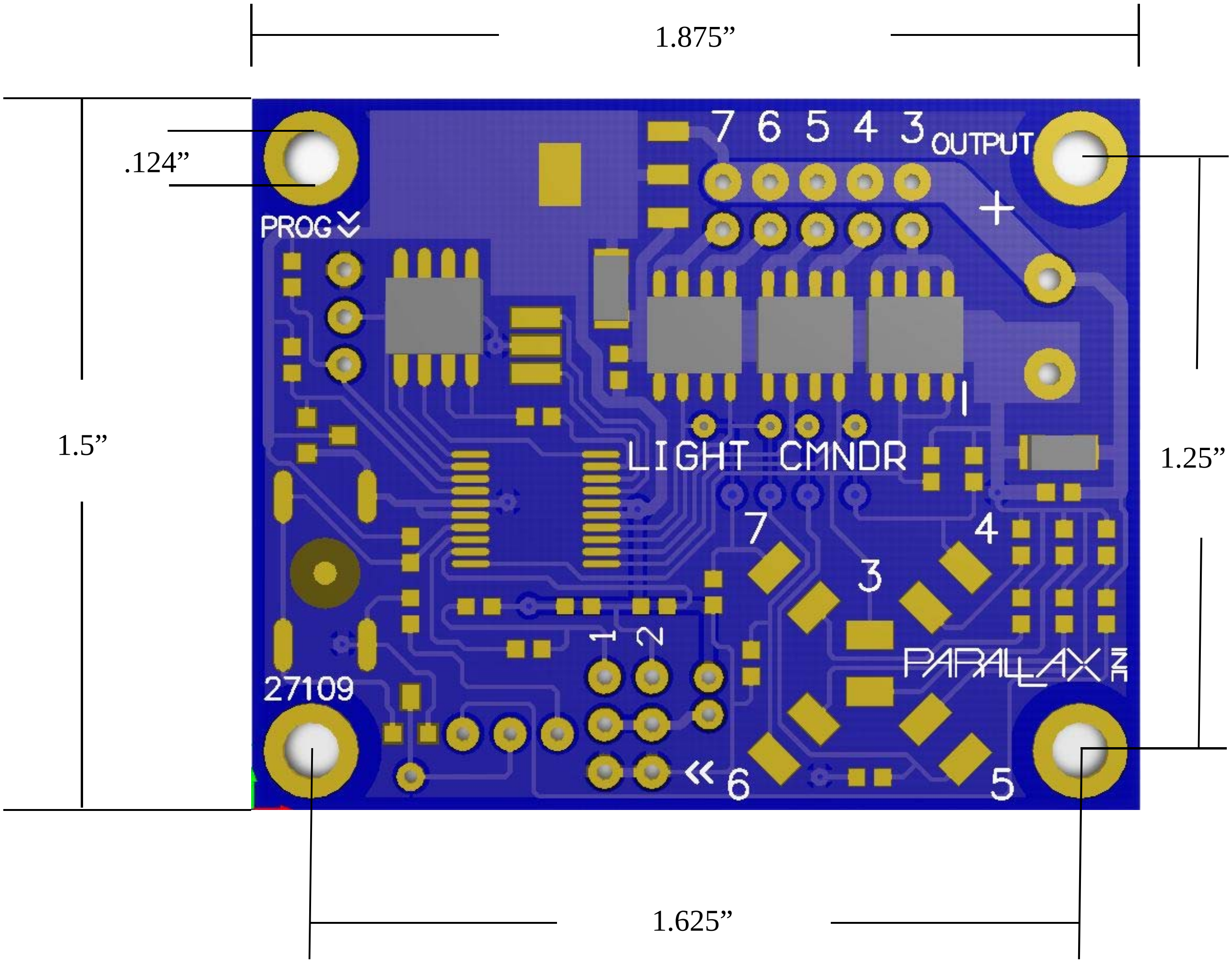
Adjust To This Level
5.826

IMPORTANT: If you are not using the Voltage Sensor feature, turn the Level Adjust fully counterclockwise to avoid accidental triggering.

Resources and Downloads

Check for the latest version of this document, free Light Tool software, and sample programs on the Light Commander product page. Go to www.parallax.com and search “27109”.

Board Dimensions



BASIC Stamp$^{®}$ Example Code

The Demo Program below is preloaded into the Light Commander. This is a BS1 program written with the BASIC Stamp Editor. The editor is a free download from www.parallax.com/basicstampsoftware.

```
' {$STAMP BS1}
' Demo Program sequences ten different led patterns
' Press the switch to start the display sequence

Init:
DIRS = 248  'Set ports 3-7 to Outputs
            'Ports 0-2 default to Inputs

SYMBOL loops = B0  'Loop counter
SYMBOL dly = B1    'Delay time

WaitHere:
BUTTON 0,0,0,0,B0,1,main  'Wait here for button press
GOTO waithere


Main:
PINS = 0    'Clear then blink LED3 5 times
FOR loops = 1 TO 5
HIGH 3
PAUSE 150
LOW 3
PAUSE 150
NEXT

FOR loops = 1 TO 5 'Flash all LEDs
PINS = 248
PAUSE 200
PINS = 0
PAUSE 500
NEXT

FOR loops = 1 TO 5 'Rotate pairs
PINS = 192
PAUSE 400
PINS = 96
PAUSE 400
PINS = 48
PAUSE 400
PINS = 144
PAUSE 400
NEXT

FOR loops = 1 TO 5 'Rotate around center
PINS = 88
PAUSE 400
PINS = 168
PAUSE 400
NEXT

FOR loops = 1 TO 5 'Vertical pairs
PINS = 144
PAUSE 400
PINS = 96
PAUSE 400
NEXT
```

```
FOR loops = 1 TO 5 'Horizontal pairs
PINS = 48
PAUSE 400
PINS = 192
PAUSE 400
NEXT

FOR loops = 1 TO 5 'Rotate single right
PINS = 16
PAUSE 200
PINS = 32
PAUSE 200
PINS = 64
PAUSE 200
PINS = 128
PAUSE 200
NEXT

FOR loops = 1 TO 5 'Rotate single left
PINS = 128
PAUSE 200
PINS = 64
PAUSE 200
PINS = 32
PAUSE 200
PINS = 16
PAUSE 200
NEXT

FOR loops = 1 TO 5 'Rotate right with center
PINS = 24
PAUSE 100
PINS = 40
PAUSE 100
PINS = 72
PAUSE 100
PINS = 136
PAUSE 100
NEXT

FOR loops = 1 TO 5 'Rotate left with center
PINS = 136
PAUSE 100
PINS = 72
PAUSE 100
PINS = 40
PAUSE 100
PINS = 24
PAUSE 100
NEXT

GOTO main
END
```