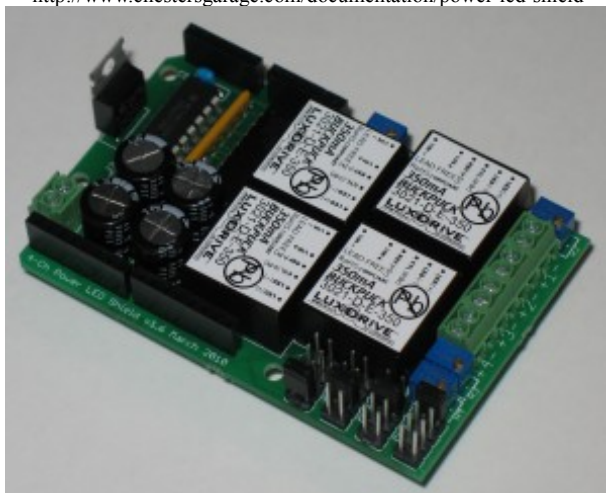


Chester's Garage - Power LED Shield Kit

Version 1.6

<http://www.chestersgarage.com/documentation/power-led-shield>



Introduction

The Power LED Shield is a circuit board that fits directly onto the Arduino Duemilanove and other physically compatible Arduino boards and clones. It provides four Pulse Width Modulation (PWM) dimmable, optically isolated power LED driver channels. The board was designed around LED Dynamics' BuckPuck™ and BoostPuck™ power LED driver modules.

Each channel can be addressed by any one of pins 3, 9, 10 or 11 on the Arduino, which is selectable on jumpers CH1-CH4 on the shield. The Arduino pin drives a CMOS buffer to minimize current drain on the pin. The buffer drives an opto-isolator input, which in turn controls the dimmer pin on the driver module. Opto-isolation protects the driving logic from voltage differences present in the driver modules.

For further flexibility, each channel also has a current-limiting trim-pot. The trim-pot works in conjunction with the PWM control to define the maximum current through the LED in cases where the driver module can deliver more current than is desirable for the LEDs. This allows the user to fine-tune the brightness of each LED for color balance or any other need. The trim-pots can be omitted if current limiting is not necessary.

The shield has its own power input that accepts between +6 VDC and +32 VDC and draws up to 4.5A. The 7805 three-pin regulator powers the Arduino from the shield.

Specifications

- Duemilanove and MEGA compatible
- Up to 4 individually addressable channels
- Any combination of colors
- Max output manually adjustable from 50 mA to 1000 mA per channel
- Opto-isolation on the PWM pins
- 5 V regulator to power the Arduino from the shield
- Drives up to 90 Watts of LEDs
- Stackable (includes additional stacking headers for clearance)
- Input voltage range 6-32 VDC
- Requires no special code or libraries in your Arduino sketch.

Building the Kit

Choosing Driver Modules

You may use any combination of the following driver modules.

- BuckPuck 3021-D-E-350
- BuckPuck 3021-D-E-500
- BuckPuck 3021-D-E-700
- BuckPuck 3021-D-E-1000
- BoostPuck 4015-D-E-350

Whether to use buck or boost modules is determined by how you connect your LEDs compared to the voltage of your power supply. For example, if you have 5 LEDs at 3.6 volts each, all connected in series, then the driver module will have to output 18 volts to light the LEDs. You will need a boost driver module if your power supply provides less than 16 volts or a buck driver module if your power supply provides more than 20 volts. You will need to change your LED configuration if your power supply provides between 16 and 20 volts because the driver modules require at

least 2 volts difference between the input and output voltage.

NOTE: While any of the BuckPuck modules above will work, it makes little sense to use anything other than the 1000mA modules. They are all about the same price and the Power LED Shield allows you to adjust the output of the BuckPucks for your needs. Using a lower value module will only serve to limit the flexibility of the Power LED Shield.

CAUTION! ESD sensitive devices!

Make sure to ground yourself by touching a bare metal area of the case of your computer or other electric device that is plugged into a three-prong wall outlet. Work in an area free of sources of static electricity. Static Electric Discharge can destroy many parts in this kit. You won't know it has happened until you test your build.

Get organized

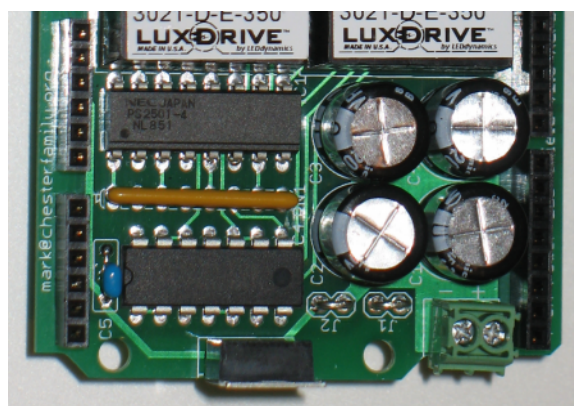
Unpack the kit and organize the parts in front of you for easy access. Make sure all parts are included and that you have obtained the correct LuxDrive modules for your needs.

Parts list:

- Qty 1: Power LED Shield PCB
- Qty 1: PS2501-4 4-Channel Opto-isolator
- Qty 1: MC74AC132NG Quad 2-input NAND Gate
- Qty 1: 7805 +5V Regulator
- Qty 1: Resistor Network, 4 x 330 Ohms, 8-pin
- Qty 4: 5K Ohm Multi-turn Trim-pot
- Qty 4: 220uF 35V Electrolytic Aluminum Capacitor
- Qty 1: 0.1uF 50V Ceramic Capacitor
- Qty 4: 6-pin Stackable Header
- Qty 4: 8-pin Stackable Header
- Qty 2: 1x2-pin Male Header
- Qty 4: 2x4-pin Male Header
- Qty 6: Header Shunt
- Qty 1: 8-pos 3.5mm Terminal Block
- Qty 1: 2-pos 3.5mm Terminal Block
- Qty 1: Heat-sink
- Qty 1: 16 pin DIP IC socket
- Qty 1: 14 pin DIP IC socket

Assembly

Pay close attention to the IC orientation. The silkscreen on the circuit board is a bit misleading because the text is upside down. Reference the picture below for proper orientation. Both ICs must have their "Pin 1" marking toward the LEFT side of the PCB as show below. Also notice the orientation of the 5V regulator and the electrolytic capacitors.



For easy assembly, solder the parts into the circuit board in the following order:

1. IC sockets
2. Resistor network and small ceramic capacitor
3. All jumper pins
4. Stacking headers
5. Screw terminals
6. Trim-pots
7. LuxDrive modules
8. Large capacitors
9. 5v regulator

Once all parts have been soldered into the circuit board, insert the ICs into their sockets and attach the heatsink to the 5V regulator.

Initial Power-On

The Power LED Shield can be powered up without being connected to an Arduino. This allows you to test your build without risking damage to your Arduino.

1. Do not attach the shield to an Arduino
2. Assure all power is turned off or disconnected
3. Disconnect all LEDs from the shield
4. Set all channel jumpers to pin 3
5. Close jumpers J1 and J2
6. Run a wire from pin 3 to the 5v pin
7. Turn all trimpots all the way counter-clockwise until you hear the faint click
8. Connect the anode (+) of an LED to the "+" screw terminal of the first channel
9. Connect the negative (black) lead of an ammeter to the "-" screw terminal of the first channel
10. Connect the cathode (-) of the LED to the positive (red) lead of the ammeter
11. Turn on the power
12. Adjust the trimpot on the first channel until the desired current level is reached
13. Turn off the power
14. Disconnect the ammeter and LED
15. Repeat steps 8 through 14 for the remaining channels
16. Remove the wire between pin 3 and the 5v pin
17. Connect your LEDs

Your Power LED Shield is now ready to be attached to your Arduino!

Setup and Adjustment

Jumpers

J1 and J2 must be **open** (remove the jumper caps) when you are powering the Arduino from the USB port, DC jack or other power source. Place jumpers on J1 and J2 to power the Arduino from the +5V regulator on the Power LED Shield. Always open or close BOTH of J1 and J2 for proper operation.

CH1-CH4 determine which of pins 3, 9, 10 or 11 will be used to drive each channel on the Power LED Shield. Place a jumper on the outer-most pair to use pin 3 for that channel, the next pair inward for pin 9 and so on. You may drive any channel from any pin and multiple channels may be driven from the same pin. **DO NOT** jumper more than one pair on each set of channel jumpers or you may damage your Arduino.

LED Maximum Current Adjustment

Multi-turn trim-pots R1-R4 set the maximum brightness of the LEDs by limiting the output current of the driver module on the corresponding channel. With the trim-pot turned fully counter-clockwise, the LED for that channel will be completely off. Turn the trim-pot fully clockwise for 1000 mA of output current on that channel. The LED will transition from off to about 50mA at minimum brightness and will reach full brightness about 1-2 turns before the trim-pot's maximum travel. At both ends of travel, the trim-pots will make a very faint click as the clutch disengages to allow overturn. This is normal and won't harm the trim-pots.

If your driver modules are capable of more current than your LEDs can tolerate, you **must** adjust the output current to a safe level before connecting the LEDs. Please see the Quick Start instructions above.

LEDs

When you apply power to the shield without it connected to an Arduino, the LEDs may flicker erratically. This is normal and the LEDs can be stabilized by setting all channel jumpers to pin 3 and running a wire from pin 3 to the 5v pin.

There are 4 LED output connections; one for each driver channel. Each output is completely separate from all other outputs. **NONE OF THE CONNECTIONS ARE COMMON.** Do not use common cathode or common anode LED arrays with the Power LED Shield. And do not connect any of the output "-" (negative) connections to ground. Each output can drive one or more LEDs in series, parallel and series-parallel configurations.

Connect the negative or cathode connection of the LED to the "-" screw terminal of one channel. Connect the positive or anode connection of the LED to the "+" screw terminal of the same channel. Do this for each channel. If you wish to run more than one LED per channel (very common), you will need to connect your LEDs to each other in series or parallel before connecting them to the shield.

Power

The shield is powered through the pair of screw terminals closest to the 4 large capacitors. Pay attention to the polarity when connecting your power supply. Positive (+) and negative (-) signs are printed on the PC board for clarification.

The voltage input requirements of the shield should be taken as the most

restrictive of the driver modules selected. Calculate the total current draw of the shield from the total wattage of the LEDs, divided by the power supply voltage, plus 25-40% for inefficiency and overhead.

Software Control

The shield is controlled by either the digital state or the PWM signal available on pins 3, 9, 10 and 11. Changing the LED brightness is simply a matter of issuing an 'analogWrite()' command to the correct pin in your sketch. A value of 0 (zero) shuts off the LED completely and a value of 255 sets full brightness.