Ironman Helmet Visor/Jaw Servo Controller Board

With LED Driver Circuit for External Eye Array

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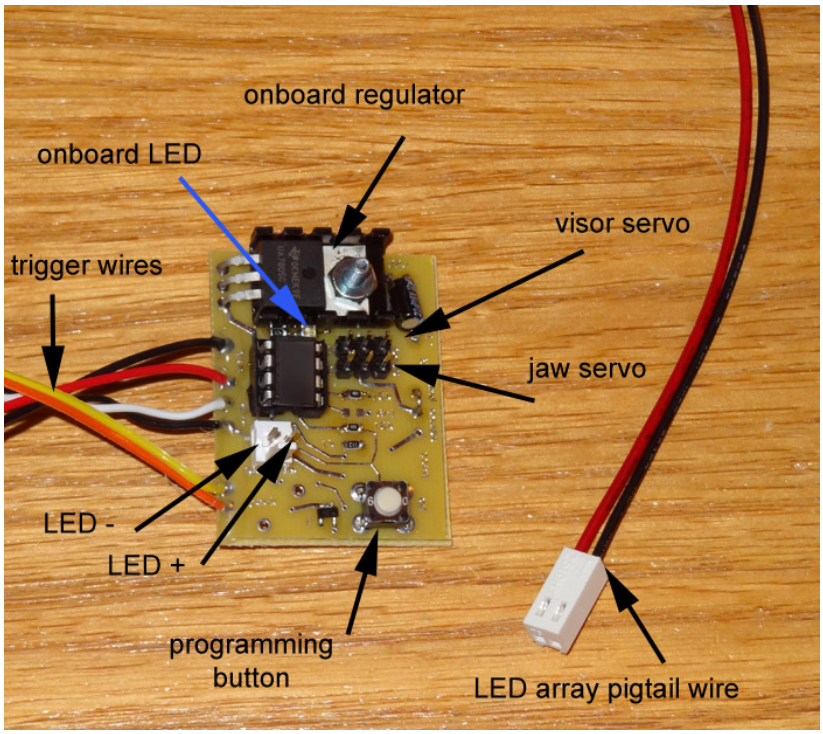
Overview

The controller board will fit inside a helmet and allow you to motorize the visor and jaw pieces using standard off-the-shelf hobby servos. An optional LED circuit can be powered automatically when the visor is in the down position. When the visor is raised, the LEDs turn off. Here is a pic of the unit:



When the trigger wires are shorted together and released, the visor servo will open followed by the jaw servo. When the trigger wires are shorted together a second time, the jaw servo will close first followed by the visor servo. You can use a pushbutton switch and mount it in the helmet to activate the visor. The delay between the jaw and visor servos activating is selectable using the programming button.

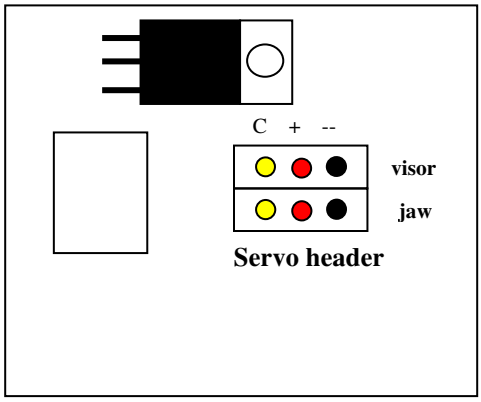
Servo Connections

Any off-the-shelf 4.5-6V servo will work, as long as it has enough torque to lift your visor and jaw pieces. You can plug your servo right onto the controller board. A 3-pin header is there to connect the servo**.**

NOTE THE POLARITY! The servo ground is near the small resistor on the end of the board, and the servo control line is near the main chip. Make sure you plug the servo in correctly or it can be damaged!

The black wire on the servo is GROUND (-). The red is POWER (+). The control wire is typically yellow or white. A picture is shown below.

Top of servo board (not to scale)



NOTE: The top servo header is for the visor servo. The bottom servo header is for the jaw servo. If you need to use 2 servos for the visor, you can use a servo y-cable to connect 2 servos up to the visor servo header. This allows you to drive both sides of the visor if need be. This will also depend on the mechanical linkage you use to connect the servo horn to the actual visor mechanism!

Servo Direction

Depending on the setup of your mechanical linkage to the helmet visor and jaw pieces, you may need the servo down position to be reversed on either or both servo outputs. That is, you want the up and down position of the servo to be reversed to match your linkage. This can be done using the programming button, so you can electrically reverse the direction of either servo outputs.

By pressing the onboard pushbutton for 2 sec then releasing, the jaw servo output will be reversed. You will be able to tell as the jaw servo will slew to the other extreme when this happens.

By pressing the onboard pushbutton for 3 sec then releasing, the visor servo output will be reversed. Again it will slew to the other extreme when this happens.

Pressing the pushbutton again for the above times will cycle back to normal direction for that servo.

Changing settings

The following table shows you how to change the different settings on the board. All the settings are accessed by holding down the pushbutton for a set time and then releasing. The board will acknowledge the changed setting by blinking the onboard LED a certain number of times.

Settings allow you to change the delay between jaw and visor servo activation and reverse the jaw and visor servo directions.

Length of time to hold the programming button before releasing	Description of Setting	Available Settings	Onboard LED blinks
1 sec	Increase time delay between visor and jaw servo activations	0 – 1 sec (in 150ms steps)	2x
2 sec	Reverse the jaw servo direction	Normal, reverse	3x
3 sec	Reverse the visor servo direction	Normal, reverse	4x
10 sec	Reset the board to default settings		8x

The default settings are 0 sec delay between servo activations (servos open and close simultaneously), and normal servo direction for jaw and visor.

NOTE: When the time delay is at the last setting (1 sec), the onboard LED will also blink extra to let you know that the next setting will cycle back to the fastest setting (simultaneous activation).

Onboard LED

During normal operation, the onboard LED will also blink once every 4 sec. This tells you that the micro is operating. Any time the programming button or trigger wires are activated, the LED will also light up.

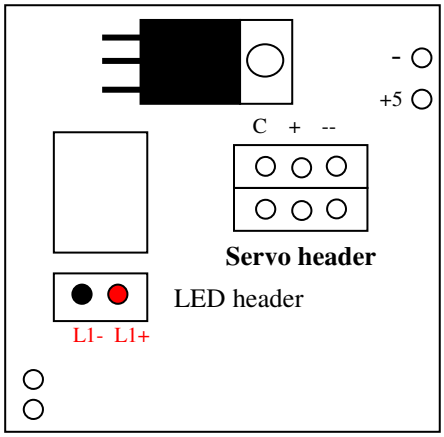
Eye light array hookup

The board can handle sourcing 600mA of current through an LED eye array (not included).

The board has a white header with wire pigtail to connect up to your LED array. The board puts the battery voltage to the external eye LED array. The current needed to light your array depends on the LED hookup. Consult the manufacturer's data sheet for proper information.

NOTE: You need to connect an inline resistor to your eye light array in order not to damage it! The eye light array draws power directly from the battery, and you need to compute a proper resistor value to get the brightness you want. Read below for details.

Top of servo board



Solder your LED array positive lead to the red + side of the pigtail. Solder your LED array negative lead to the black – side of the pigtail. The resistor can be put inline with either the positive or negative wire.

LED resistor value:

The resistor you should put inline with your LED eye array is a function of the battery voltage. The resistor value is calculated via:

$$R=(Vbatt-Vled)/I$$

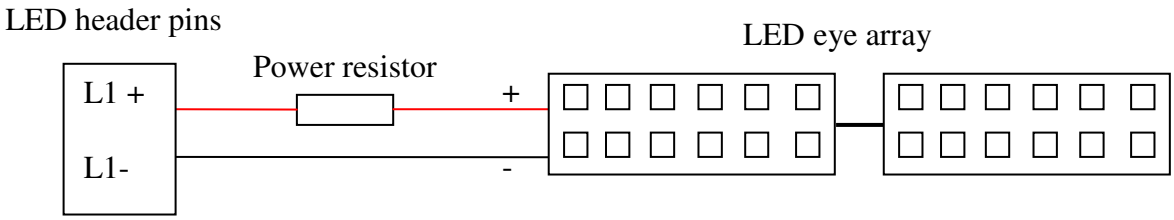
Example: An available eye light array specs are Vled=6V, I=0.25A. With a 9V battery, you would need R = 12 ohms. You would need to make sure the resistor was rated for 1 watt! Your battery would also need to be able to source 0.25A of current continuously (a standard alkaline 9V batt will not do this for long).

You can use a lithium 9V batt, 6AA batts, or a Li-ion battery pack. The Li-ion packs will be 2-cell 7.4V, so the resistor value above needs to be around 6 ohms.

The kit comes with a 36 ohm 3W resistor, which is a good start for most available battery types in this voltage range. The driver circuit on the servo board can deliver up to 600mA of current.

WARNING: Overdriving the LEDs or not using a resistor inline with your eye array can destroy the LEDs and the driver circuit! Make sure you understand if the array needs a resistor and compute the correct value. If you are not sure, use a larger resistor. The smaller the value of the resistor, the more current is sent to the eye LEDs. See the LED manufacturer's data sheet.

Eye LED array wiring diagram to board



You can also use discrete LEDs for the eye array, as long as you use a proper resistor based off your battery and the forward voltage of the LEDs (Vf).

Servos Tested

Here is a list of the tested servos with the board. For helmet applications, the Hitec 77BB is a good low-profile servo that has a good amount of holding torque.

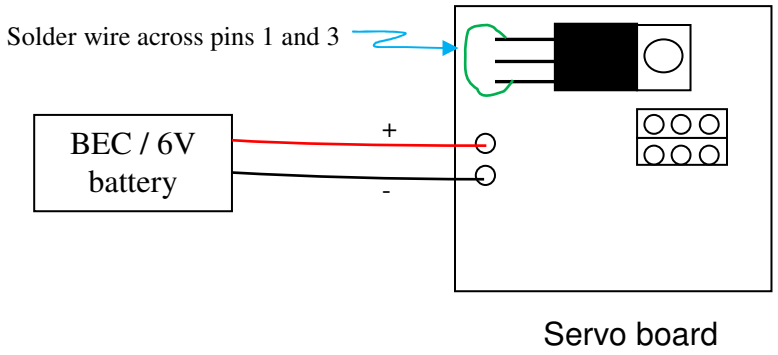
Tower Hobbies: Hitec HS-77BBJ, http://www2.towerhobbies.com/cgi-bin/WTI0001P?Q=1&I=LXN620
Jameco: #157067 - HS303 robotic servo, http://www.jameco.com
Spektrum DS821 Digital servo
Hitec HS-485HB servo

External Servo Power / Regulator Bypass

The board automatically powers the servos using the onboard 5V regulator. The regulator can only source a max of 1.5A of current. Make sure your mechanical linkage does not bind up the servo, as this will cause the regulator to heat up and potentially go into shutdown. The regulator can get warm with increased power draw and this is normal. Make sure the linkage results in smooth travel and no binding so the servos do not have to work harder.

If your servos need more current, you can augment the servo board with a BEC (battery eliminator circuit). The BEC will be powered off the main battery and supply current and voltage to the servos.

By default, the board is set to power the servos from the onboard regulator. If you want the servos to be powered off the battery (or optional BEC), you can simply bypass the onboard regulator to power both the servo and board electronics off a 6V battery or a BEC circuit that delivers no more than 6V. You can do this by soldering a shunt wire to the board across the regulator pins 1 and 3 as follows (pin 2 is ground, do not touch wire to it!):



BOARD SPECS

- Size: 1.25” x 1.6”"
- Input voltage to board: 7 - 15V DC (using onboard regulator)
- Onboard LED eye light driver: Delivers battery voltage to LED(s) up to 600mA max (with proper resistor)
- Servo outputs: 1-2 ms pulses every 16ms. Max current for all servos: 1A (with onboard regulator)
- Max input voltage to board (bypassing onboard regulator): 6V DC

NOTICE: There is no warranty on kits!! It is your responsibility to install the board. Kits cannot be returned! This kit can consume a lot of current. Be careful if you plan to use a battery source that is capable of delivering alot of current. Contact a professional if you need assistance. Hyperdyne Labs assumes no responsibility for the misuse of this kit.