

Alien Xeno Flasher Board

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Introduction

The Highway Alien Flipper starts the Ambush multiball by pulling a ball into the Xenomorph head on the playfield. When extending the tongue (a rack with a permanent magnet, which is moved by a stepper motor), the playfield lighting is completely switched off. This led to the idea of enhancing this process with a stroboscopic light effect.



After preliminary tests, I have developed a circuit that evaluates the control signals for the tongue mechanics. When detecting an extension movement, the circuit generates short pulses (with adjustable frequency) activating bright LEDs as a flashlight. In the following video you can see the result when using three 5mm LEDs:

<https://www.youtube.com/watch?v=XInyemjNr00>

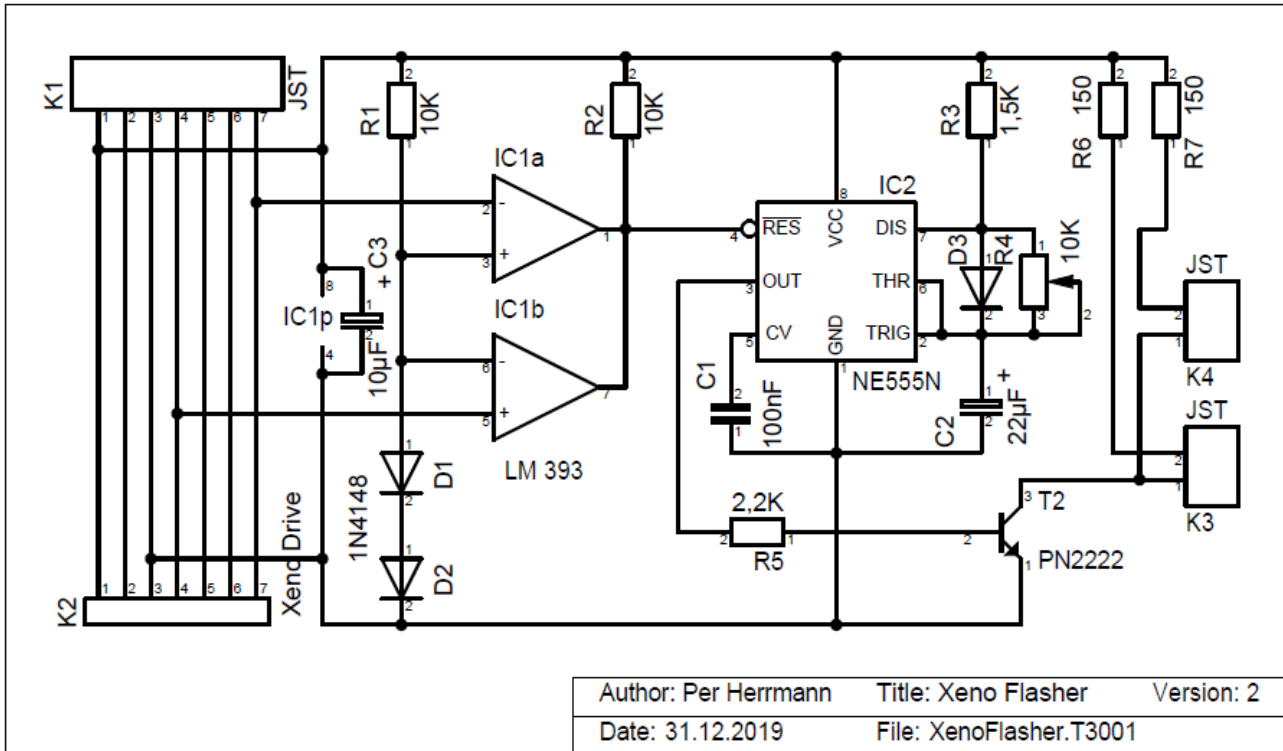
Schematic

All required signals and voltages are available at the 7-pin header labeled "Xeno Drive" at the lower left end of the alien playfield (when up-lifted):

Pin	Wire Color	Signal	I/O Board [Pin]
1	White	12 Volt	12V OUT [A28]
2	Yellow	5 Volt	5V LED [A16]
3	Blue	GND	GND [A32]
4	Blue	Tongue Switch (Low=End Stop)	SW 1 [C9]
5	Orange	Motor Enable (Low=Power On)	Out 4 [C15]
6	Green	Motor Step (Low to High Edge)	Out 5 [B15]
7	Purple	Motor Dir (Low=Move Out)	Out 6 [A15]

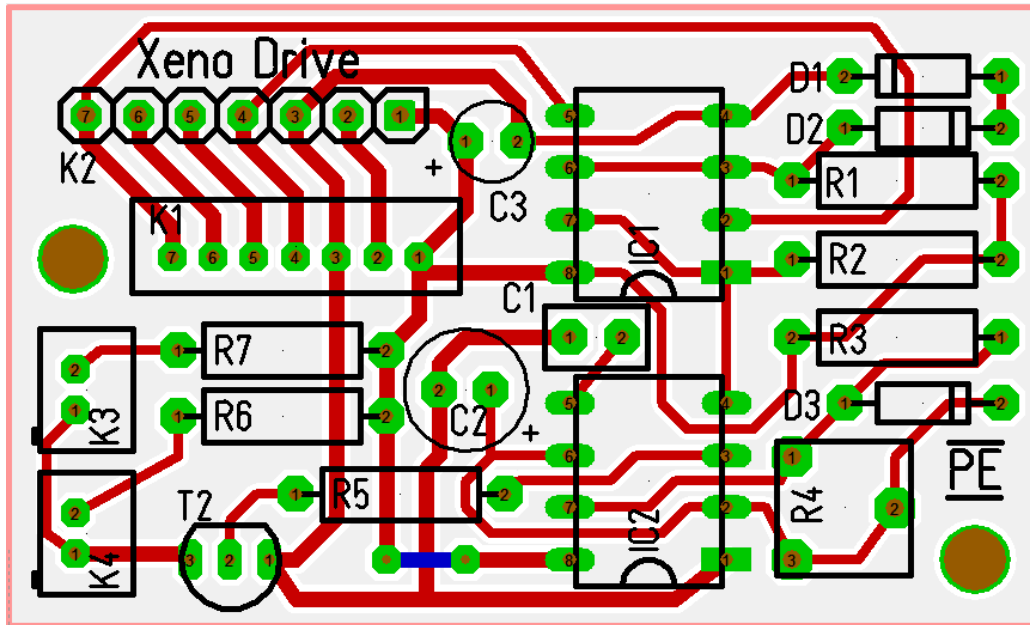
The components are located on a small board which picks up all Xeno Drive signals at connector K2 and passes them on to the pin header K1 with the same pin assignment.

Two comparators (IC1) evaluate whether the tongue has left the end position (Tongue Switch = High) and whether it is moving forward (Motor Dir = Low). If both conditions are true, the oscillator IC2 is enabled (RES = High) to generate short pulses of adjustable frequency at the output OUT (for details see: [555 Oscillator Tutorial](#)). It controls the transistor T2 to switch the ground line of light emitting diodes on the jacks K3 and K4.



Printed Circuit Board

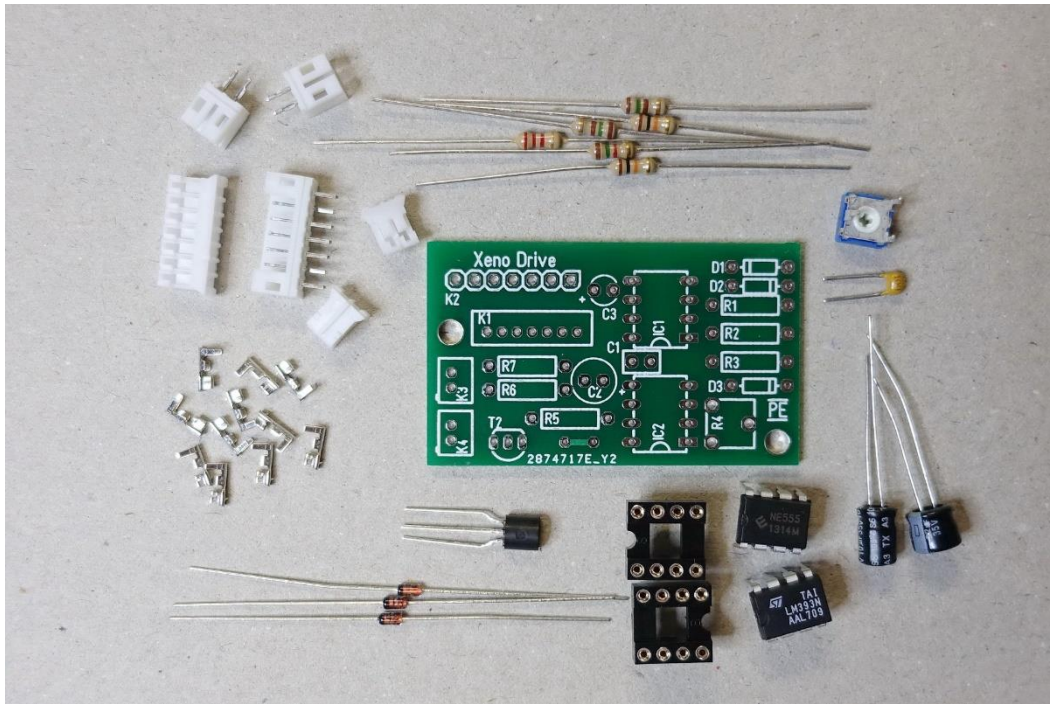
All components fit on a 30 x 50 millimeters PCB. With one exception, all copper traces run on the soldering side of the board (shown in red) so that a single sided board can also be used - in this case a wire bridge replaces the blue connection.



Components and Assembly

The following components are required build the flasher:

Name	Value	Type & Package	Count
C1	100nF 50V	Pitch 2.54 mm	1
C2	22µF 25V	Radial capacitor, 2.54 mm	1
C3	10µF 25V	Radial capacitor, 2.54 mm	1
D1, D2, D3	1N4148	DO35	3
IC1	LM393	DIL8	1
IC2	NE555	DIL8	1
K1	7 pol	JST header B7B-PH-K-S	1
K3, K4	2 pol	JST header B2B-PH-K-S	2
R1, R2	10K 0,25W	0207	2
R3	1,5K 0,25W	0207	1
R4	10K 0,1W	Mini trimmer Weltron CA6 V	1
R5	2,2K 0,25W	0207	1
R6, R7	150 0,25W	0207, value depends on LED	2
T2	PN2222	TO92	1
K2		JST housing PHR-7	1
K3, K4		JST housing PHR-2	2
		JST crimp contact PH	11
		Socket DIL-8	2
		High efficiency LED 5 mm white	6

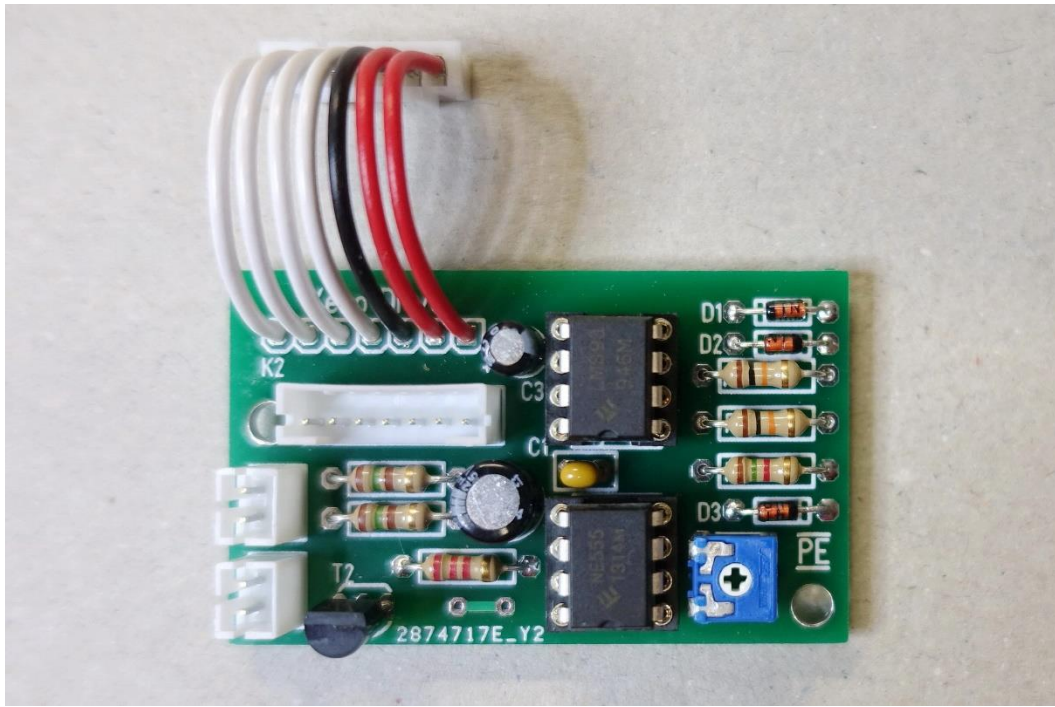


Please regard the following hints when soldering the board:

- Select suitable small designs for the capacitors C2 and C3. Pay attention to the correct polarity, the negative pole is marked with a gray stripe
- For the diodes, black or yellow rings mark the position as indicated in the PCB imprint.
- The mark or notch of the two ICs (indicating pin 1) points downwards on the pictures.
- Take care to mount the transistor T2 as shown on the PCB: Flat side up.
Caution: The first run of the PCBs had a wrong imprint, showing the transistor (named T1 there) in the opposite orientation!
- The sockets for the ICs are optional. In fact, there is some risk that socketed ICs will loosen on vibrating pinball fields.
- Adjust the trimmer R4 approximately at middle position
- Resistors R6 and R7 (150 ohms) are selected for 3 LEDs in series, see section "LEDs".
- The PHR-7 housing is connected to K2 with approximately 4 cm long pieces of cable. I have soldered the crimp contacts (saves the crimping tool)

I recommend soldering the small / low components first: Diodes, resistors, C1, then IC sockets and the trimmer.

The layout on page 3 and the following photo of the finished board show the correct installation of all parts.

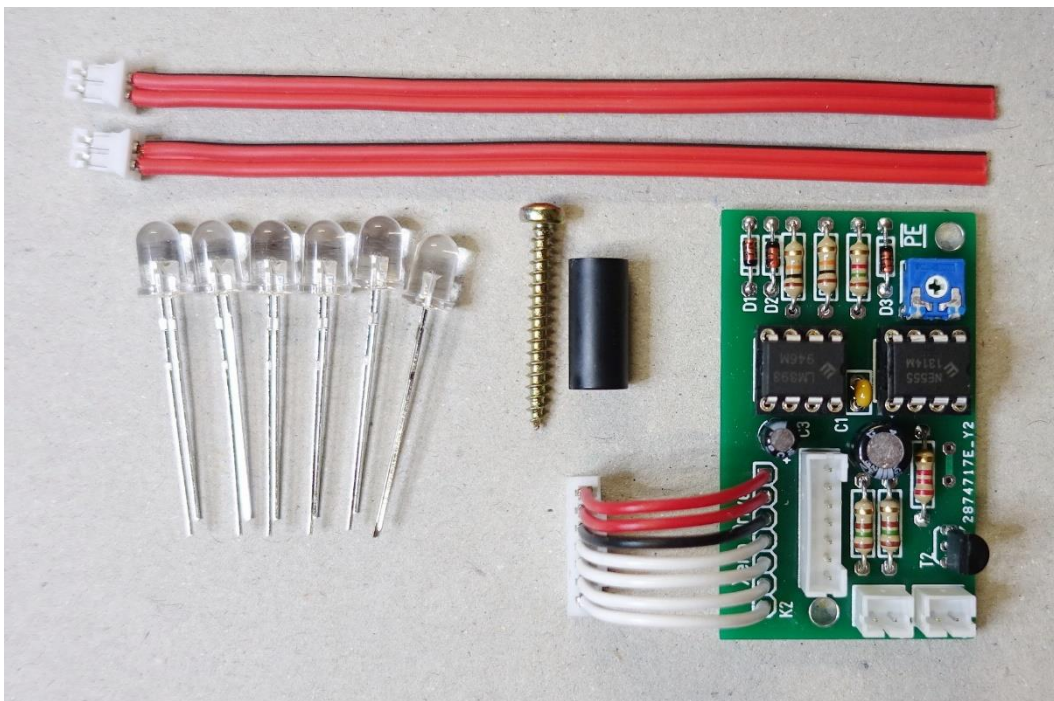


Don't forget to check finally your soldering joints for unwanted connections to prevent damage to the Alien boards. You should also check with an ohmmeter or continuity tester all pins of connector K1 to make sure that no two pins are connected somehow.

Assembled Board

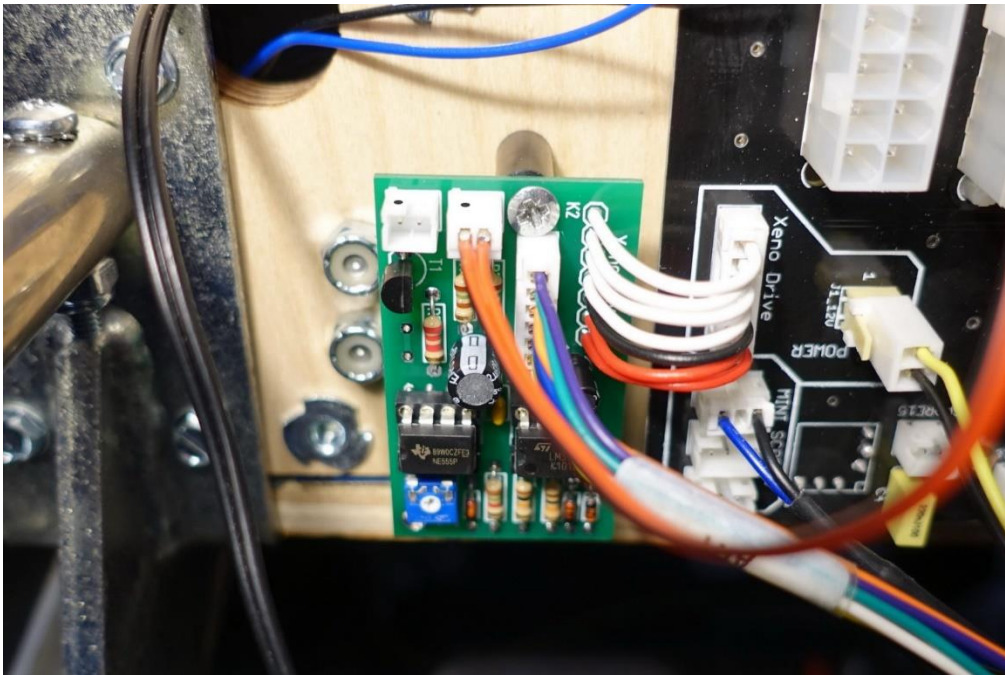
The build version of the Xeno Flasher Mod comes with the following parts:

- Assembled and tested PCB with attached Xeno Drive connector
- A wood screw and a spacer sleeve
- 6 bright white 5 mm LEDs
- Two cables with plugs to connect the LEDs to the headers K3 and K4



Installation

The board is attached to the underside of the Alien play field next to the "Xeno Drive" port. There are two holes to mount the board with wood screws and spacers – in fact one screw nearby the board connectors is good enough.

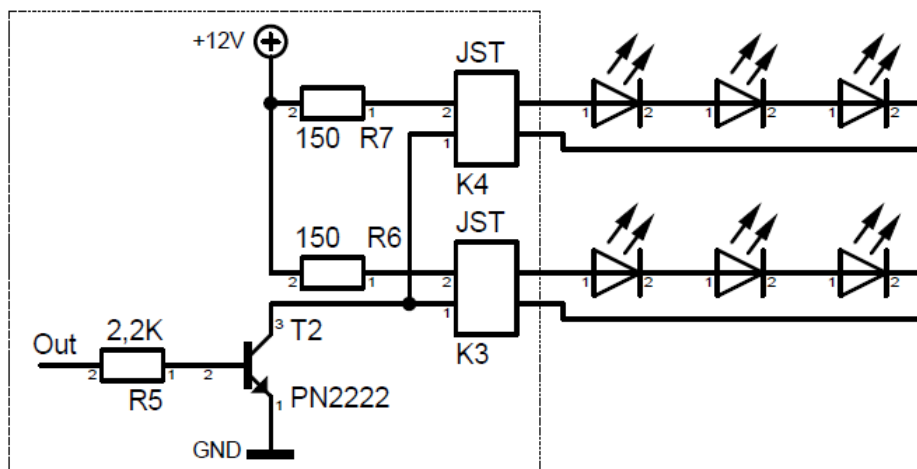


Remove the original Xeno Drive connector carefully (!) and plug it into the Flasher board (K1), which in turn is connected to the Xeno Drive header.

LEDs

Finally, you can connect one or two groups of light-emitting diodes to the two headers K3 and K4 to illuminate the Xeno head.

The board delivers 12 Volt, which allows to line up 3 LEDs for highest efficiency. A 150 Ohm resistor limits the LED current to the specified 20mA per header. The transistor is switching both LED groups to ground.



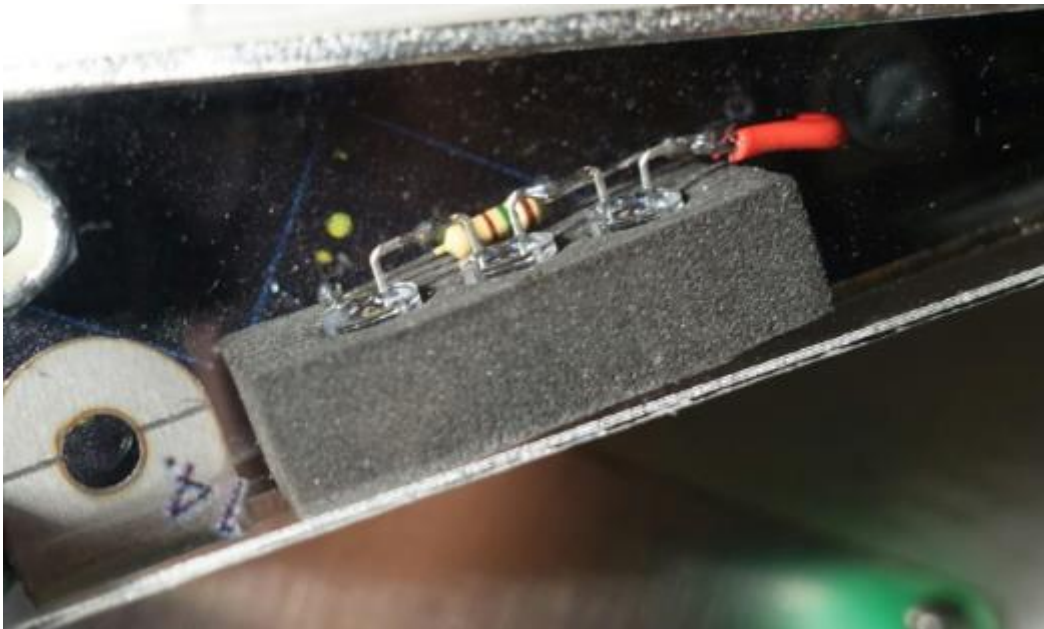
If you would like to use other combinations of LEDs, you must adapt the resistors R6 and R7 to ensure correct supply currents. You may also replace the resistors with wire bridges on the circuit board and install the resistors together with the LEDs instead. The transistor can handle a total of about 500 mA, however you shouldn't strain the Alien power lines.

The provided LEDs have a small radiation angle and high luminous intensity (e.g. HuiYuan 5034W2C-CUA-C with 20 degree angle and 12.5000 mcd at 20 mA). They behave like spotlights and should aim at the Xeno head.

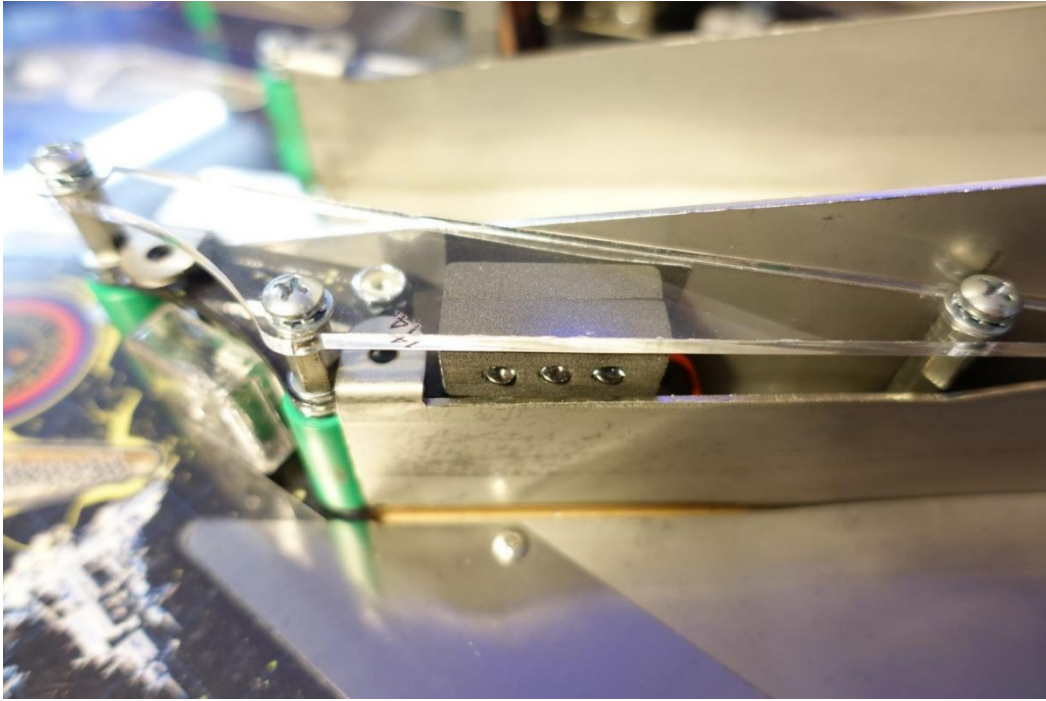
When connecting them in series the longer LED wire (plus) is soldered to the shorter one (minus). The outer LED wires are connected to the flasher PCB by extending the provided cable as needed. The plus lead is red, and the minus lead is black (reversed connections will not work, but nothing will be damaged).



A hidden and well protected (!) location for one LED group is located between the plastics behind the front left ramp. I've cut a foam block to fit and provided holes for the LEDs (the picture shows an resistor in the lead during my tests).

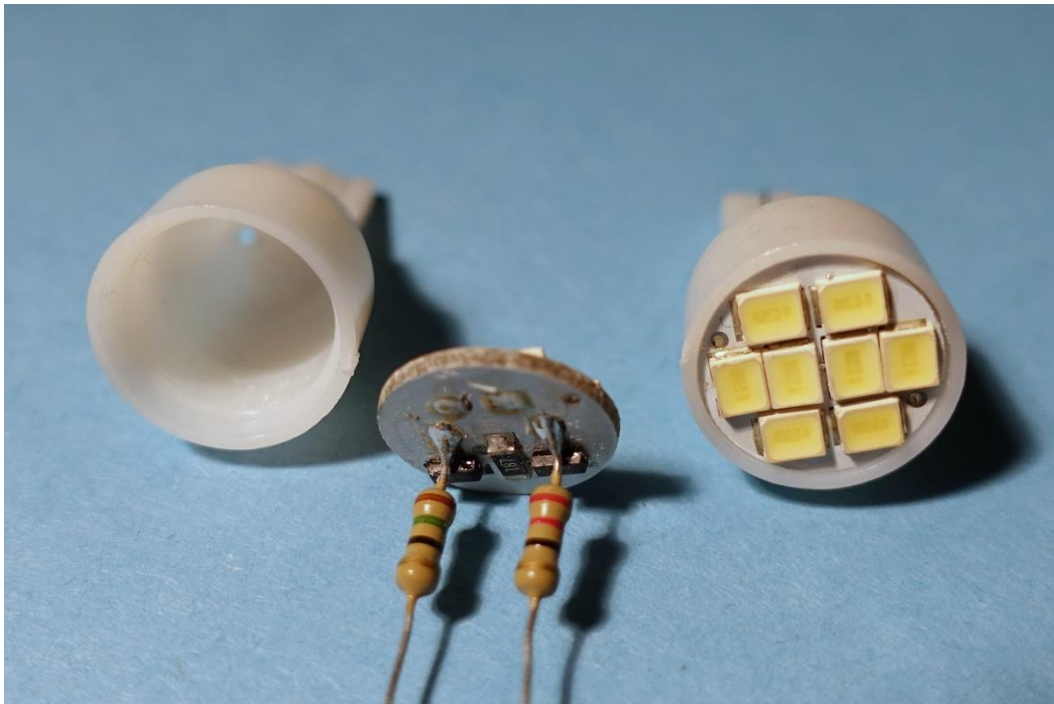


A second piece of foam with corresponding recesses forms the rear end, the whole construction is then clamped together between the plastics.



LED Flasher

An alternative to the 5mm LEDs are #906 LED Flashers. There are models with groups of bright SMD LEDs which provide a lot of light, but not much focused. Reflector sockets with brackets are ideal for mounting.



The #906 flashers are designed to operate from 12 volts up to 20 volts when pulsed. The flashers have internal resistors - therefore R6 and R7 on the PCB should be replaced by wire bridges (see below). As the Xeno flasher board delivers only 12 Volt, you can “tune” a #906 flasher by replacing one (not both!) of the two internal resistors in the flasher housing with a wire of the same length.



First Use

After switching on the Alien Flipper, the Xeno head and the tongue mechanics are initialized. This should not change with the built-in Xeno Flasher board, but the connected LEDs should blink when the tongue is extended.

The Xeno test in the Alien test menu also allows a check of the flawless function of the tongue mechanism and the LEDs. By adjusting the trimmer with a small screwdriver, the time interval between the light flashes resp. the frequency can be changed. The flash duration is fixed to approx. 25 milliseconds.

Note: When the Alien pin is switched on, the drive signals of the Xeno head are undefined, sometimes the LEDs will flash until the I/O boards have been activated.

And now have fun with the new lighting effect!

Per Herrmann

Attention: This is a private development without commercial interest, I assume no liability for any damage caused by the installation of the board.