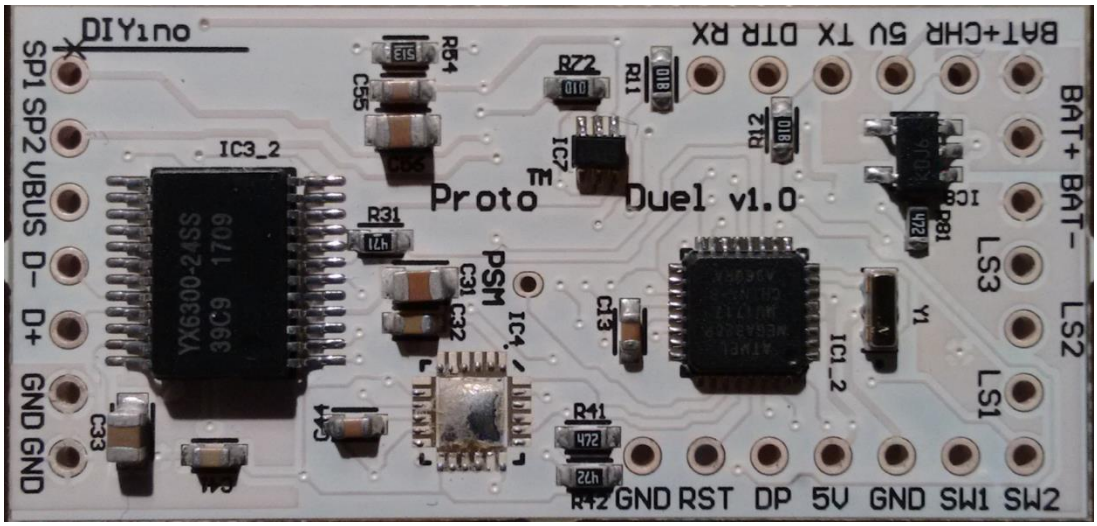


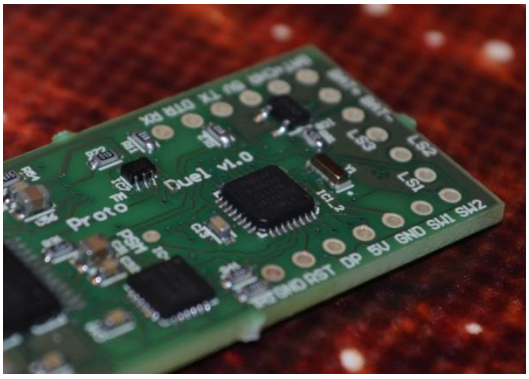
PROTO BLASTER™
USER MANUAL

BLASTER ELECTRONICS-KITS
MK1 TO MK5

Table of Contents

1 INTRODUCTION

The **Proto Blaster** boards are ready to use, plug&play blaster electronics cores with a scalable set of features. They are offered either as kits with the most important components included in the package or as standalone boards to ease integration into any blaster prop.



Board features at a glance:

Proto Blaster Cores Feature Overview Table

		MK-1	MK-2	MK-3	MK-4	MK-5	
Subsystems	Nozzle Flash (1 pixel)	√	√	√	√	√	LED in the nozzle
	Barell Light Effects (0-30 pixels)		√	√	√	√	LEDs in the barell
	PLI/Status Bar (0-10 pixels)			√	√	√	LEDs for the status bar
	OLED display				√	√	a 128x32 dot display
	Aux button				√	√	a 2nd button
	USB Charger on-board	√	√	√	√	√	charge your blaster via USB
Sound	Sound fonts (all exclusive to Proto Blasters)	1: Proto DL-44	1: Proto DL-44 2: Proto E11 OT	1: Proto DL-44 2: Proto E11 OT	1: Proto DL-44 2: Proto E11 OT 3: Proto Bounty Hunter	1: Proto DL-44 2: Proto E11 OT 3: Proto Bounty Hunter	exclusive sound files from a sound font artist
	Sound Quality	16-bit digital audio, 22.050ksample/sec	16-bit digital audio, 22.050ksample/sec	16-bit digital audio, 22.050ksample/sec	16-bit digital audio, 22.050ksample/sec	16-bit digital audio, 22.050ksample/sec	best sound quality on the market
	Speaker performance	3W @ 8/4Ohms	3W @ 8/4Ohms	3W @ 8/4Ohms	3W @ 8/4Ohms	3W @ 8/4Ohms	loudest on the market
	Ghetto-Blaster©					√	a built-in MP3 player with light effects
Control	1-button (trigger)	√	√	√			trigger as switch
	2-button (trigger + aux)				√	√	a secoundary switch
Config Mode Items	Volume Control	√	√	√	√	√	set the speaker volume in 32 steps
	Sleep Mode	√	√	√	√	√	power saving mode
	Blast Color		√	√	√	√	set the color of the Blast FX
	Stun Color		√	√	√	√	set color of the Stun FX
	Barell Pixel Length		√	√	√	√	set the length of the barell LED stripe
	PLI/Status Bar Length			√	√	√	set the length of the status bar LED stripe
	Sound Font Selection		√	√	√	√	select from the available sound fonts
	OLED Skin Selection				√	√	select the layout of the display
Light/Sound Effects	Blast	√ (single color)	√ (3 colors)	√	√	√	Blast FX
	Stun	√ (single color)	√ (3 colors)	√	√	√	Stun FX
	Repeater			√	√	√	Repeated blasts
	Megablast-FX©				√	√	Charge&Blast FX
	Flamethrower-FX©					√	make a flamethrower out of your blaster
Others	Display Skins©				√	√	3 display layouts to select from
	Board size	44mm x 21mm x 4.5mm	44mm x 21mm x 4.5mm	44mm x 21mm x 4.5mm	21mm x 51mm x 6mm	21mm x 51mm x 6mm	size of the Proto Blaster board
	Deep Sleep Current Consumption	<400uA	<400uA	<400uA	<400uA	<400uA	affects shelf life (several months without being charged)

2 PROTO BLASTER OPERATION

- Interaction with the Proto Blaster Cores:
  - After powering the blaster or waking it up from Deep Sleep mode, the blaster boot sound will be played and the blaster will enter Idle Mode.
  - A short press on the Main Switch will activate the blaster. Power-on sound will play, followed by a single beep to signal Blaster Mode.
  - In Blaster Mode a short press on the Main Switch will trigger a single blast.
  - [MK1, MK2, MK3] In Blaster Mode a long press on the Main Switch will advance the blaster to the Repeater Mode.
  - [MK1, MK2, MK3] In Repeater Mode a short press on the Main Switch will trigger a continuous blast fire. Pressing the Main Switch again will cease the fire.
  - [MK4, MK5] In Blaster Mode keeping the Main Switch depressed will trigger repeated blasts (see Repeater Mode above).
  - [MK4, MK5] In Blaster Mode a short press on the Aux Switch will advance the blaster to the Stun Mode.
  - [MK1, MK2, MK3] In Repeater Mode a long press on the Main Switch will advance the blaster to the Stun Mode.
  - In Stun Mode a short press on the Main Switch will trigger a single stun.
  - [MK1, MK2, MK3] In Stun Mode a long press on the Main Switch will advance the blaster to the Power-Down Mode.
  - [MK4, MK5] In Stun Mode a short press on the Aux Switch will advance the blaster to the Special Fire Mode.
  - [MK4, MK5] In Special Fire Mode a short press on the Main Switch will trigger a MegaBlast-FX.
  - [MK4, MK5] In Special Fire Mode keeping the Main Switch depressed will activate the Flamethrower-FX for the duration of the trigger being depressed.
  - [MK4, MK5] In Special Fire Mode a short press on the Aux Switch will advance the blaster to the Power-Down mode.
  - In the Power-Down mode a short press on the Main Switch will power down the blaster, entering Idle Mode.
  - [MK1, MK2, MK3] In the Power-Down mode a long press on the Main Switch will return the blaster to Blaster Mode.
  - [MK4, MK5] In the Power-Down mode a short press on the Aux Switch will return the blaster to Blaster Mode
  - [MK4, MK5] Pressing the Aux Switch repeatedly two times (so called double click) will return the Blaster to Idle Mode from any of the active blaster modes.
  - A long press on the Main Switch in Idle Mode will start the Configuration Mode.
  - The Configuration Mode has several menu items. Changing between the items can be done with a long press on the Main Switch. The menu items are:
    - [MK2, MK3, MK4, MK5] Sound font selection: short press on the Main Switch will toggle between the available sound fonts. The saber will announce the new sound font selected by playing its font ID sound.
    - [MK2, MK3, MK4, MK5] Blast Color selection: short press on the Main Switch will let you browse the color profiles of your blaster board (10 for MK3, MK4 and MK5 and 7 for MK2) to define the color of blaster fire.

- [MK2, MK3, MK4, MK5] Stun Color selection: short press on the Main Switch will let you browse the color profiles of your blaster board (10 for MK3, MK4 and MK5 and 7 for MK2) to define the color of stun fire.
- Sleep Mode Entry: a short press on the Main Switch will put the blaster to Deep Sleep mode with a very low power consumption
- [MK4, MK5] Display Skin selection: lets you select from 3 predefined OLED display skins. The layout of the display skin will be shown when browsing through this menu item. You can select a different display skin for each sound font.
- Volume settings: you can choose between 30 different volume setting, 0 gives you a muted blaster. After reaching the max setting, a different beep is played to notify you. Pressing the Main Switch again will set back the volume again to 0. In order not to lose track of where you are in the Configuration Menu, if the volume setting is below 15, the blaster will maintain the volume setting at 15 in order to make interaction with it possible. Upon leaving the Config Mode the set volume will be stored and become active.
- [MK2, MK3, MK4, MK5] Barrel Pixel Blade Length: let's you define the length of your barrel Neopixel stripe. A short press will increase the count by one, up until a maximum of 31, the last of the LED is always the nozzle or front light. Upon reaching the max value a new press of the Main Switch will reset the length to 0 (no barrel stripe).
- [MK3, MK4, MK5] Status Bar Pixel Blade Length: let's you define the length of your status bar Neopixel stripe. A short press will increase the count by one, up until a maximum of 10, then starts again at 0 (no status bar/PLI).

- Exiting Configuration Mode is done via a long press on the Main Switch after the last menu item.
- [MK4, MK5] Config Mode can be exited any time by a long press of the Aux Switch.

3 Getting started with the Proto Blaster board

Warning: the Proto Blaster core is an electronic board containing parts sensitive to ESD. Final wiring & assembly is under the responsibility of the user with the appropriate tools and ESD protection. If you're not familiar with ESD, please visit : http://en.wikipedia.org/wiki/Electrostatic_discharge
The manufacturer cannot be held liable or responsible for any damage arising from improper use or assembly of the Proto Blaster board.

3.1 Board Supply

The Proto Blaster board shall be supplied from a single Li-Ion battery cell with a nominal voltage of 3.7V.

Warning: Please note that the Proto Blaster board does not implement a reverse polarity protection. Reversing the polarity of the supply will lead to board damage! The manufacturer cannot be held liable or responsible for any damage arising from improper use or assembly of the Proto Blaster board, including but not limited to connecting the battery with reverse polarity.

3.2 USB-RECHARGE WIRING

It is very convenient if the battery does not have to be removed from the blaster prop every time it needs recharging. Therefore so called in-hilt recharge ports finds a wide-spread use together with rechargeable batteries (most common type being the 3.7V type 18650). The Proto Blaster board has an integrated Li-Ion USB charger module which can be used to charge the battery directly from USB, thus eliminating the need to include a bulky recharge port. The USB breakout board provided with the Proto Blaster board can be used to connect the USB signals to a port in the hilt.
Figure 1 shows wiring of the battery to supply the board. If the USB cable is plugged in, the circuit will be supplied both by the battery and by the USB port, with any surplus current used to charge the battery. If there is no battery connected to the board, it can be supplied via USB through the USB charger circuitry, providing ~4.2V to the board with a maximum charging current of 250mA. Please note that if you connect a 2W 8/4Ohm speaker to the board and supply it only via USB (i.e. no battery connected), depending on the set volume the USB might not be able to supply the powerful on-board audio amp and you might hear a static noise from the speaker, as well as the board resetting due to under-voltage. Therefore it is recommended to connect the battery to the board if you want to use the speaker at full volume.

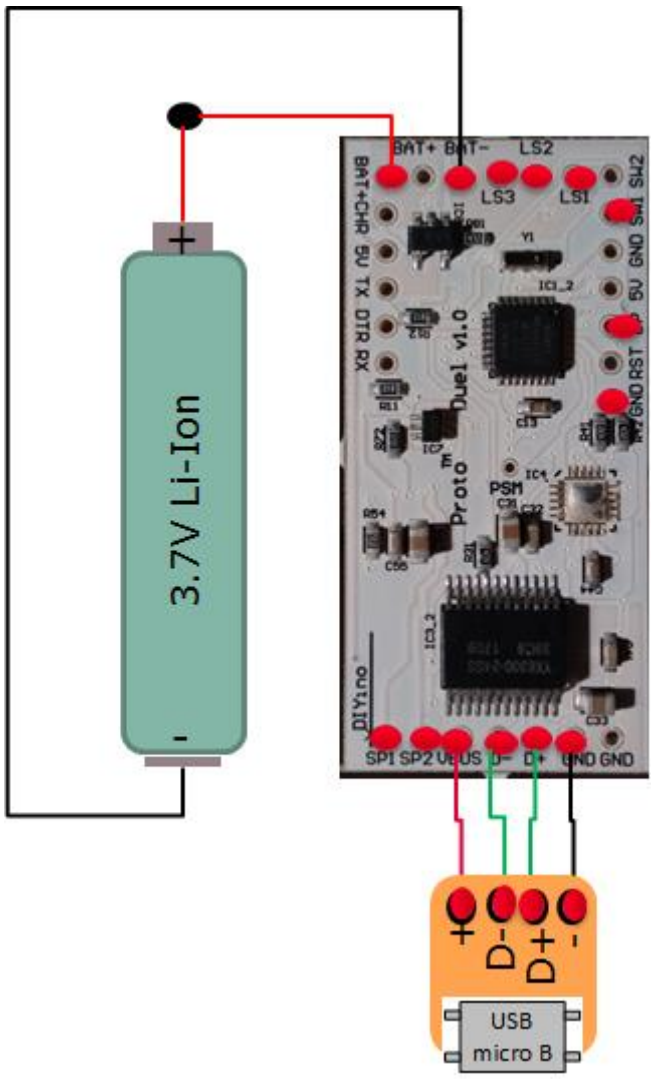


FIGURE 1: IN-HILT RECHARGE USING AN USB BREAKOUT-BOARD

Warning: before connecting any Li-Ion battery to the Proto Blaster board, please ensure that your selected battery complies to the charging characteristic of the USB on-board charger (CCCV with 250mA average charge current at 4.2V charge voltage). In case of doubt please consult your battery vendor. The board manufacturer of the Proto Blaster board cannot be held liable for any injury or damage caused due to incompatibility of the used battery with the on-board Li-Ion charger.

3.3 In-hilt recharge using Recharge Port

To make the Proto Blaster board compatible with prop designs having a so called recharge port (see for example link), you can use a conventional 2.1mm Recharge Port (or technically equivalent) to charge your single Li-Ion battery.
Wiring of the 2.1mm recharge port can be seen on Figure 2.

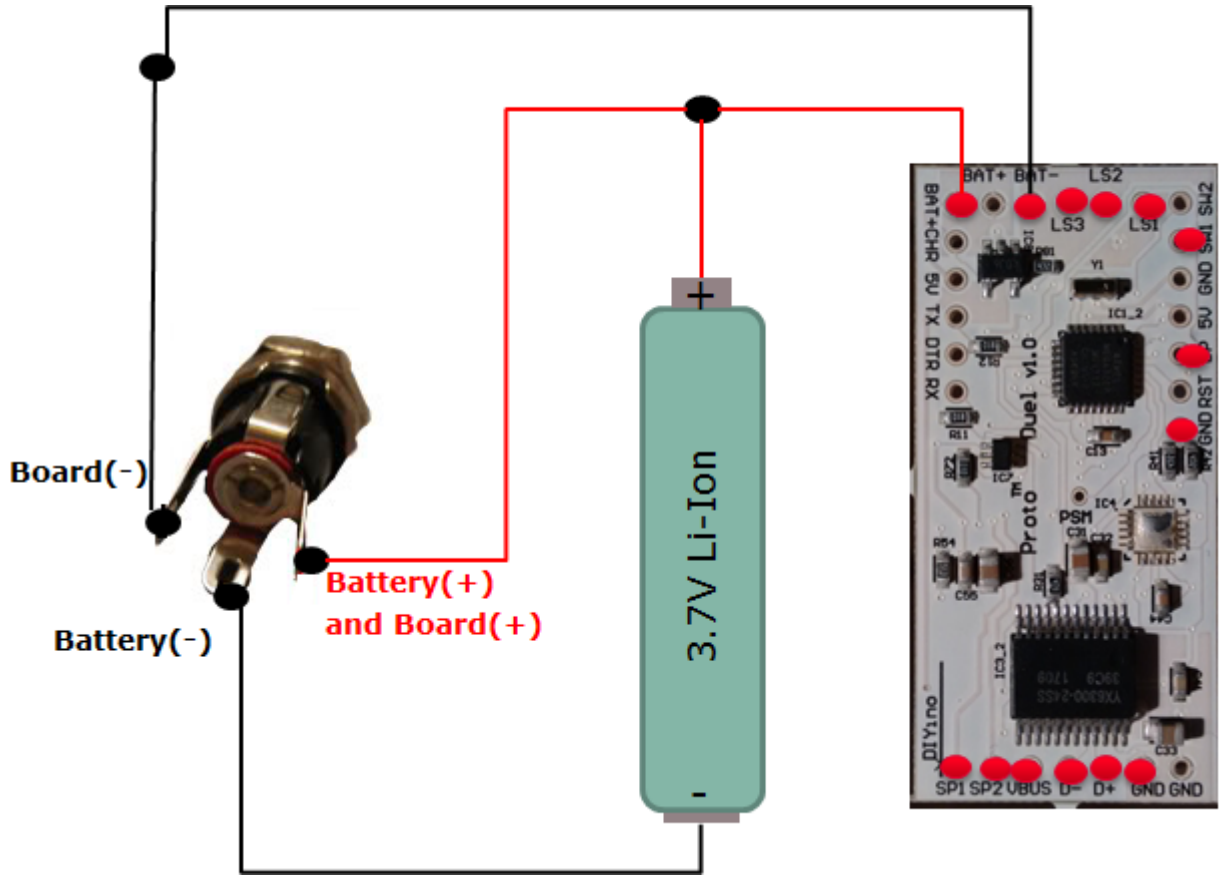


Figure 2: Wiring a 2.1mm recharge port

3.4 Dual Recharge Setup

The Proto Blaster board is designed for dual-charging, i.e. the single Li-Ion cell can be charged either via USB or via Recharge Port, making it ideally suited for different circumstances like charging at home, quick recharge in the car or on an event/Con.

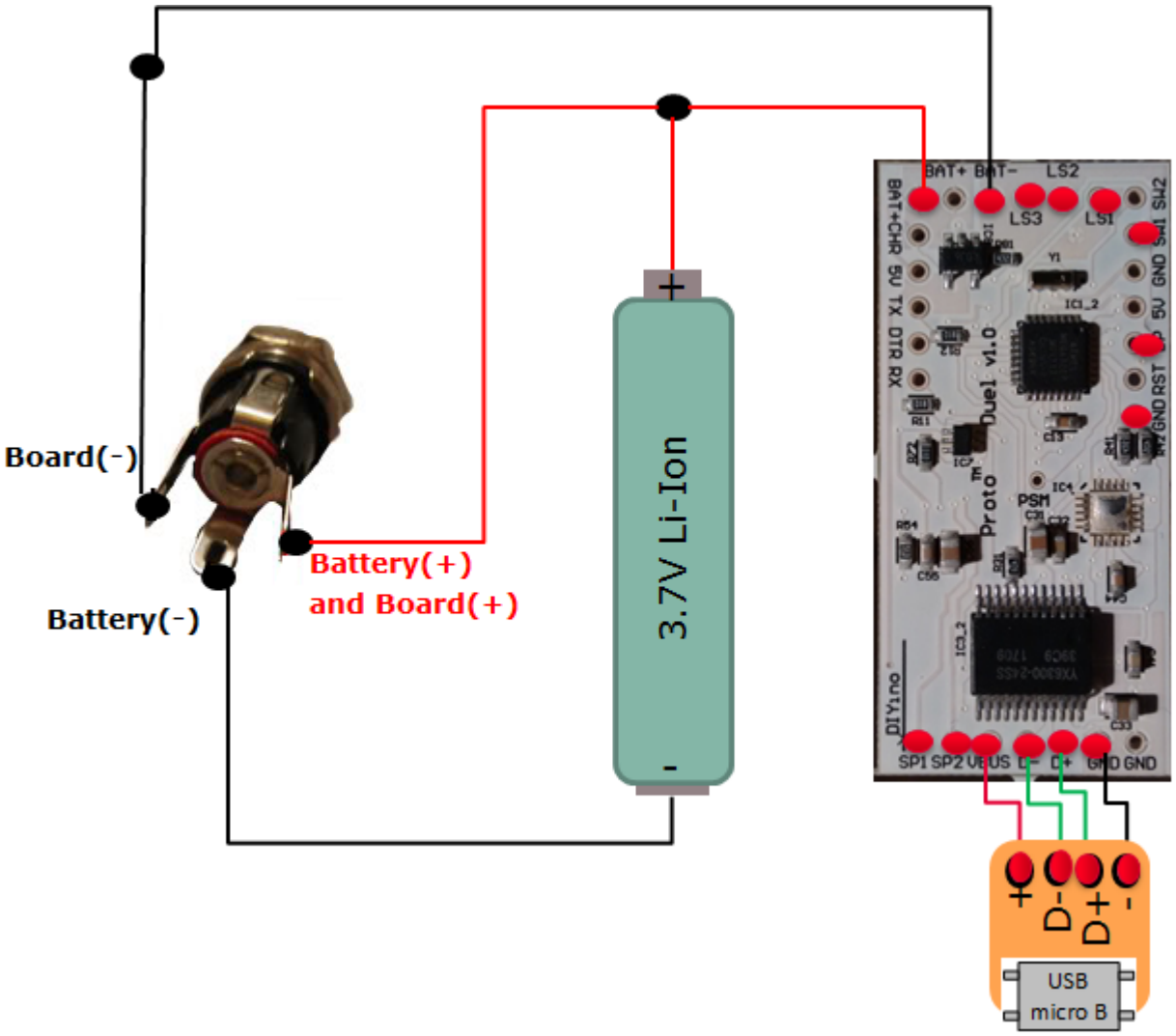


Figure 3: Dual Charging Setup with both a 2.1mm recharge port and external USB port

3.5 Wiring buttons and speaker

Figure 4 shows wiring of the switches and that of the speaker.
The speaker has to be connected between the SPK1 and SPK2 terminals/pins of the board. 4Ω/8Ω speaker can be used, up to 3W output power. It does not matter which terminal of the speaker you connect to which pin.
The main switch shall be connected between SW1 and GND. Only momentary switches are supported.

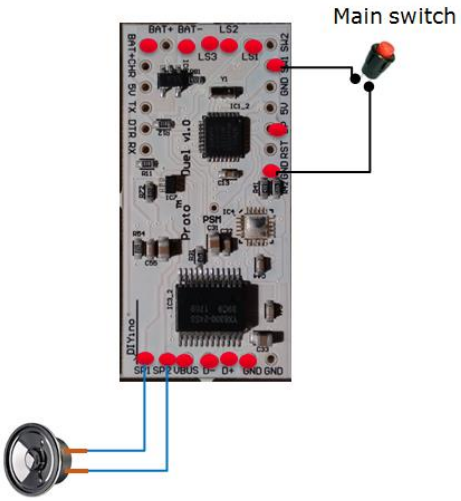


Figure 4: Wiring switches and the speaker.

3.6 Charge Status indication LED connection

The on-board USB charger includes a charge status indication signal which can be accessed on the board via the CHR signal. The signal remains logic low during charging and changes to logic high when the battery is fully charged. This signal can be used to connect a charge indication LED via a proper resistor to light up when charging completes. Connect the LED anode (+) to the CHR signal (via a resistor if needed) and the cathode (-) of the LED to board GND.

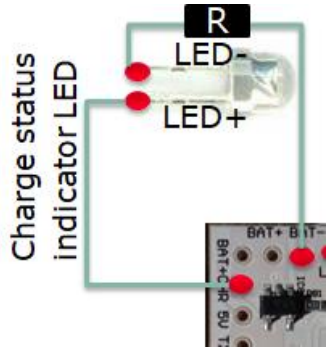


Figure 5: Wiring of the charge status indication LED

4 FULL WIRING DIAGRAMS

Warning : High-power LEDs (such as the Luxeon, Cree etc.) and strings/stripes of LEDs (such as LED strings composed of many single LEDs or neopixel LED moduls such as WS2812B) are extremely bright. Especially High-power LEDs are considered “class 2 lasers”! You should neither look directly to the beam nor point someone with it when the light source is not diffused/blocked, just like a powerful lamp or flashlight. Manufacturer of the Proto Duel board could not be held responsible or liable for any injury resulting from the use of high-power or other type of LEDs/LED modules. To avoid injuries and retina damage due to the high brightness of LEDs, always use protective googles or other means to avoid looking directly into the light source and also take care to protect others (like children) from being able to look directly into the light source.

4.1 FULL WIRING DIAGRAM OF THE MK1

The Figure 6 the full wiring diagram can be seen for the Proto MK1 board.

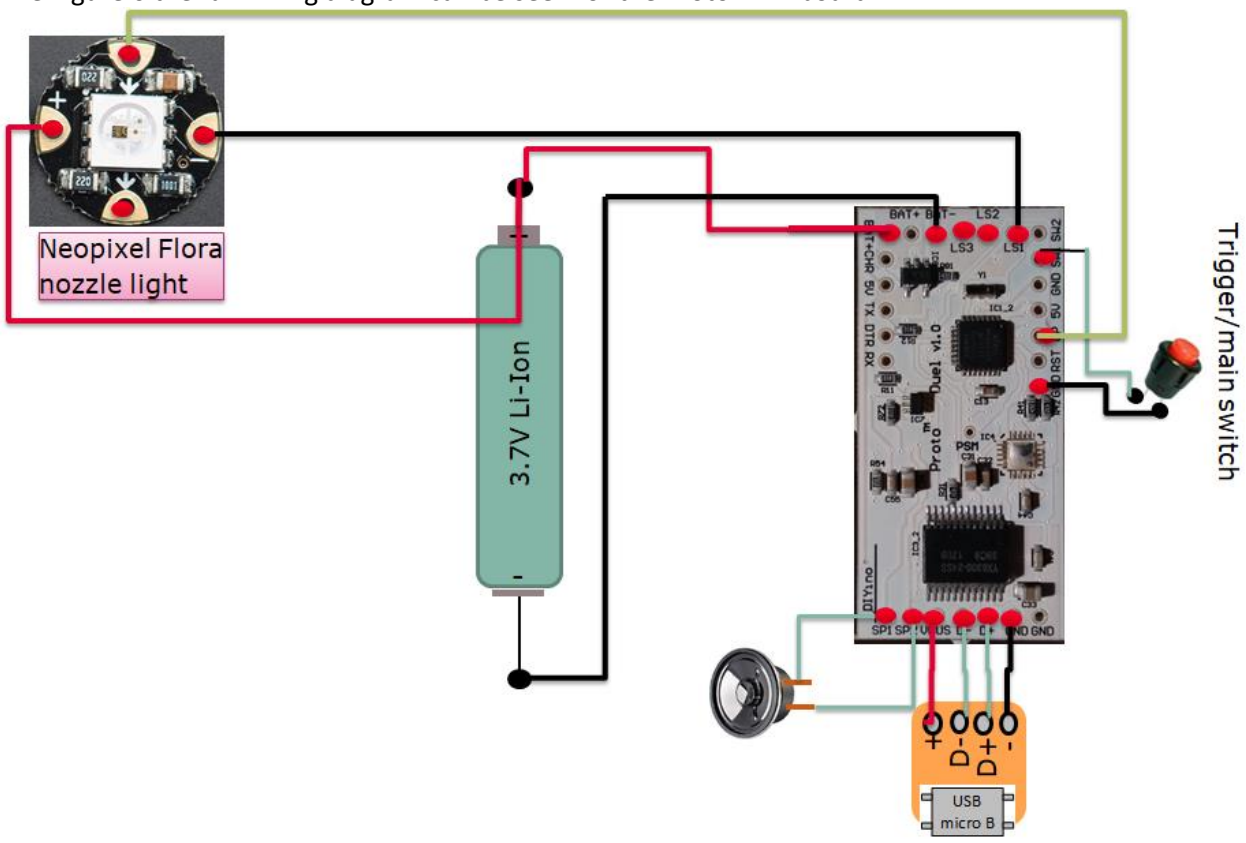


FIGURE 6: FULL WIRING DIAGRAM OF A PROTO MK1 BOARD

4.2 Full wiring diagram of the MK2

On Figure 7 the full wiring diagram can be seen for the Proto MK2 board.

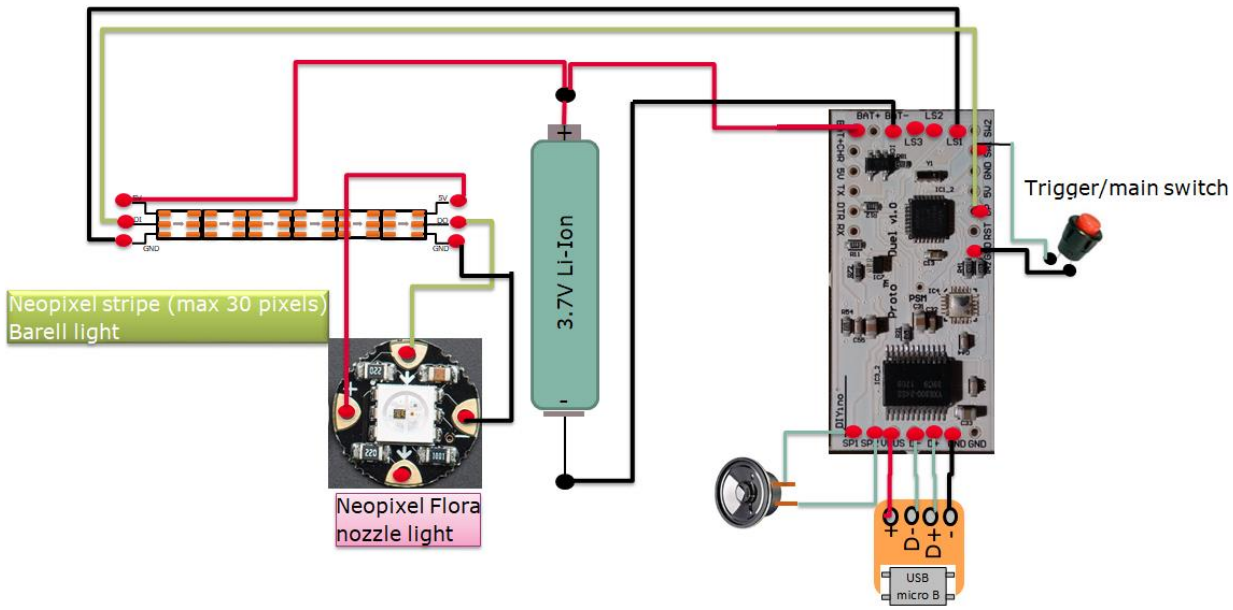


Figure 7 full wiring diagram of a Proto MK2 board

4.3 Full wiring diagram of the MK3

On the Figure 8 the full wiring diagram can be seen for the Proto MK3 board.

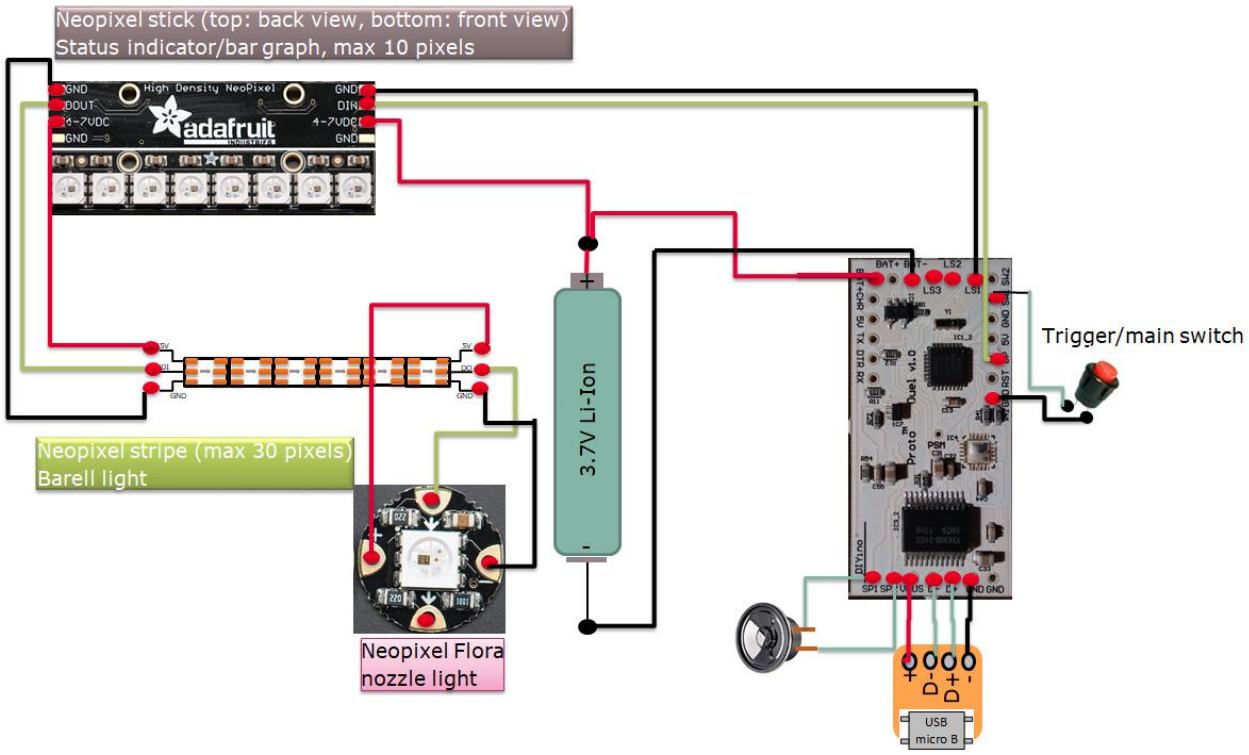


Figure 8: full wiring diagram of the Proto MK3 board

4.4 Full wiring diagram of the MK4 and MK5 boards

On the Figure 9 the full wiring diagram can be seen for the Proto MK4 and MK5 boards. Please note that the MK4 and MK5 boards are differently layouted to support the additional OLED display. You can also connect an optional vibration motor between battery+ and LS3, properly resistored. The motor will be activated at each shot to give you an even more realistic feeling of holding a real blaster in your hands.

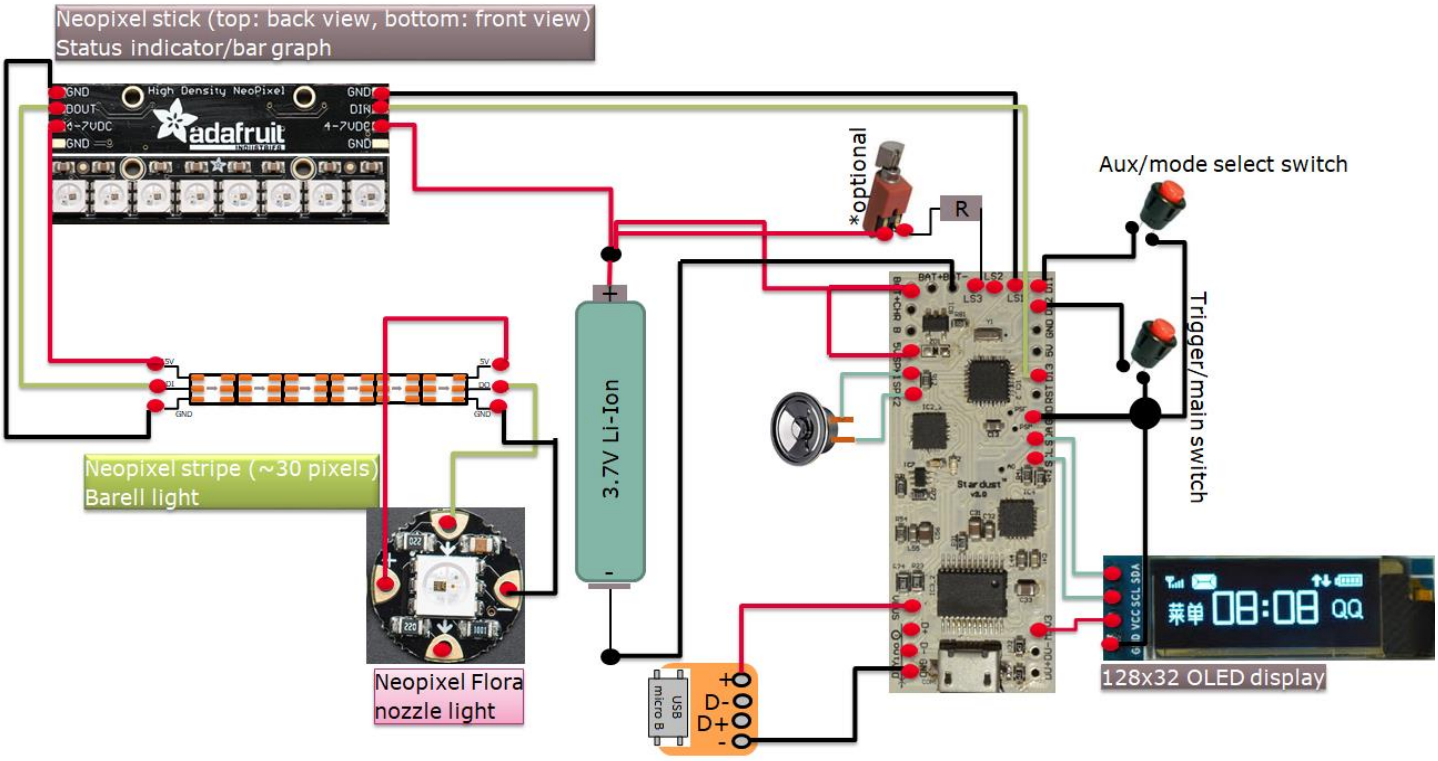


Figure 9: Full wiring diagram of the Proto MK4 and MK5 boards

5 Related links

Protowerkstatt Web Site: www.protowerkstatt.com
Free downloadable, 3D printable Protowerkstatt Chassis designs on Thingiverse:
https://www.thingiverse.com/Protowerkstatt/designs