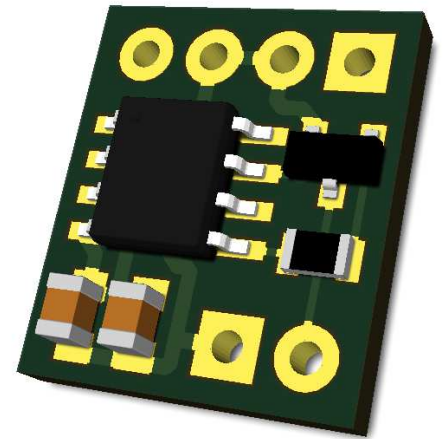


- flexible electronics for building laser guns and rifles
- small dimensions (11.5 mm x 13.3 mm)
- flexible input voltage (2.7 V – 5 V)
- debouncing of the trigger switch
- defined and fast laser control
- adjustable pulse time (10 ms – 200 ms)
- continuous laser beam for adjustment
- very low power consumption in standby (approx. 3 μ A)



ESD-Warning

The laser controller is a sensitive device that has to be protected from electrostatic discharges. Before touching the laser controller we highly recommend touching a metallic earthed object to dissipate possible charges. This could be a radiator or the grounding contact of a socket.



Description

The ProjektARES laser controller is an electronic component that gives every technically adept person the ability to build a laser gun or rifle for a homemade video shooting gallery. The device reads the trigger switch and controls the laser. It works with every suitable laser module switch and battery, giving the user great flexibility in the design of the gun.

The board has six soldering pads for either soldering wires directly in them or connecting pin headers and other connectors to be able to disassemble the system if needed. On one side 4 pads are located of which two are for the power supply and two for the trigger switch. On the other side there are two pads to connect the laser. The pin assignment is marked on the back of the circuit board. **BAT** stands for battery, **TRIGGER** for the trigger switch and **LASER** for the laser module. For the laser and battery connector there are also symbols marking the **polarity** which **need to be observed**. The trigger switch is a simple closing contact whose polarity is not important.

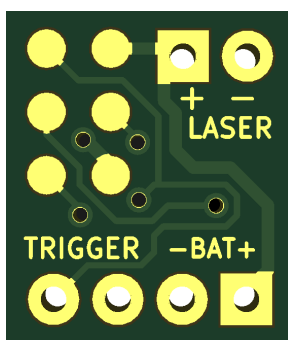


Image 1: Backside with pin assignment markings

Construction of a laser gun

Besides the laser controller the following components are required:

- laser module
- trigger switch
- batteries
- on-off-switch (optional)
- case

The construction is drawn in image 2 where a sliding switch is used as an on-off-switch and a microswitch with a small lever is used as a trigger.

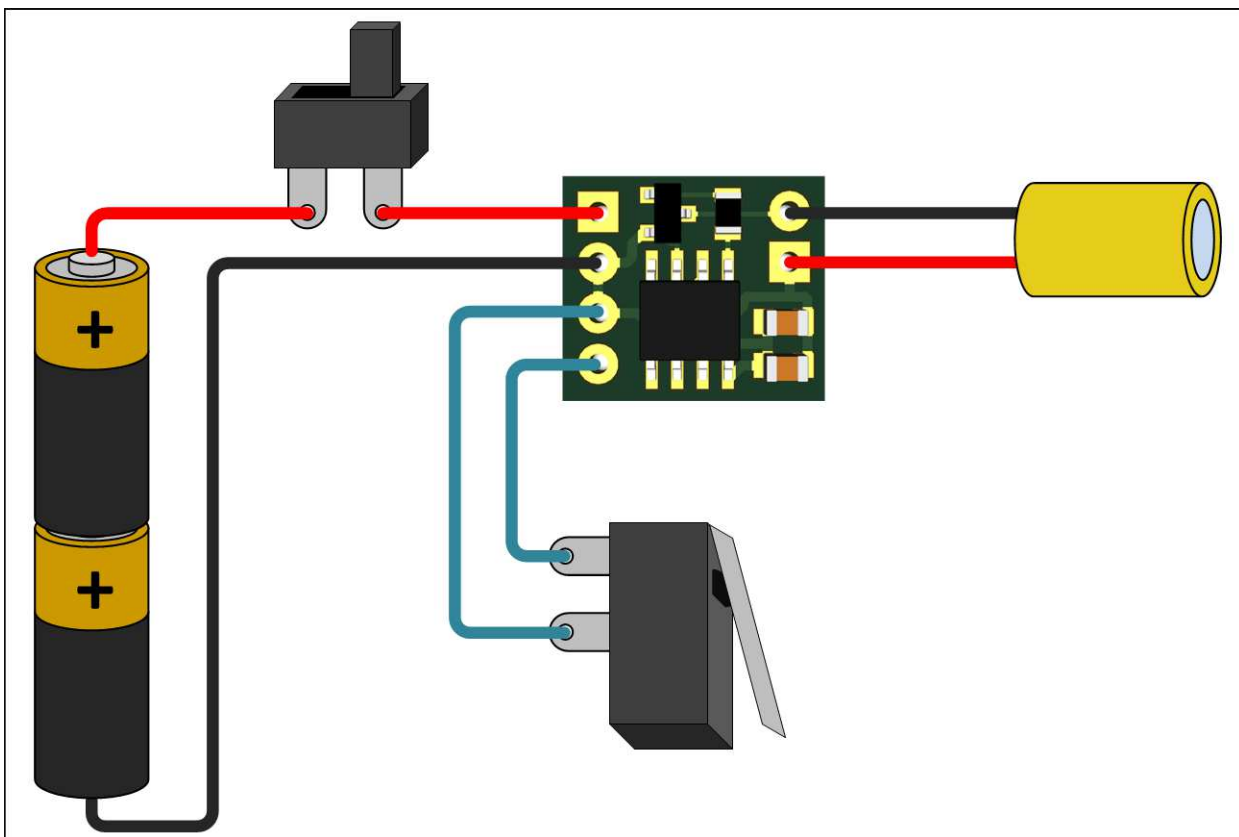


Image 2: Wiring of the laser gun

The laser module

As a laser module every simple diode laser with a dot shaped beam is suitable. The operating voltage of the laser has to match the voltage of the batteries. A red laser module ($\lambda = 650 \text{ nm}$) is recommended because they are cheap, widely available and normally need an operating voltage of 3 volts. This is the voltage of two normal batteries connected in series. The colour of the laser also matches the filter foil for the camera. When using other lasers equivalent filter foils must be used.

The output power of the laser is an important factor. It determines how well the shots can be detected by the system and therefore which pulse duration must be set to ensure good detection. In general a short pulse duration is desired because it reduces a blurring of the laser dot caused by shaking the laser gun. But more powerful lasers are also more dangerous. The two most common



types of modules have an output power of 1 mW (class2) and 5 mW (class 3R). The latter are considered dangerous if there is direct eye exposure. In normal operation the laser is only active for very short periods of time which reduces this risk but in calibration mode it is possible to generate a continuous laser beam. Of course, you should never point the laser gun at people or animals and shooting at mirrors or other reflecting surfaces should be avoided, too, due to safety issues. But in the end it is left to the user which laser is used and how it is handled.

It is also possible to use **infrared lasers** so the laser is not visible on the target. However, besides a suitable camera and filter foil some additional safety measures should be applied. It is highly recommended to connect a warning LED in parallel with the laser, ensuring a visual feedback on whether the laser is active or not at all times. The use of a powerful infrared laser is **not recommended** at all.

Trigger switch

As a trigger switch any closing contact is suited. This component should be selected according to the mechanical requirements. The easiest way is to build a laser gun from an electric airsoft gun and re-use the internal switch. Furthermore, microswitches with levers are suitable to be incorporated in mechanical airsoft guns.

Batteries

The batteries are chosen to fit the laser module and the space available. For normal laser modules two simple AA or AAA batteries in series work. If there is very little space the usage of button cell batteries is possible. However, these have a much shorter lifespan.

On-off-switch

The On-off-switch is for securely turning off the device as well as for configuration. If the trigger switch is pressed at the same time as the controller is turned on, it starts in configuration mode allowing the user to set the pulse duration. However, if the configuration is not necessary anymore an on-off-switch is not needed at all. The laser controller's standby power consumption is so low that normal batteries could last for decades.

Tip: a magnetic switch inside the laser gun combined with a magnet in the magazine provides the option to turn the laser gun on by simply inserting the magazine.

Case

The laser controller is very small to fit in as many cases as possible. In order to build a laser gun it is a good idea to use an airsoft gun and remove the mechanical parts in the inside. Electric airsoft guns have the advantage of already having a trigger switch and a battery compartment. However, it is also possible to build a completely custom made case.

Operation

The functionality of the laser controller is described in the diagram at the bottom of this page. When the laser controller is turned on, first it checks whether the trigger is pulled or not. If it is not pulled the laser controller enters its normal state of operation, generating a short laser pulse every time the trigger is pulled.

If the trigger is pulled when the controller is turned on, the laser is turned on permanently. This can be used to adjust the laser or test the detection of the laser dot. The laser stays turned on when the trigger switch is released. By pulling the trigger switch briefly a second time the controller enters the normal operation state.

If the laser is active permanently and the trigger switch is pressed not briefly but longer than one second, the controller switches into configuration mode allowing the setting of the pulse duration. In this mode the laser starts flashing to show the current pulse time. The correlation between the patterns and the pulse duration can be found in the diagram. Every short pressing of the trigger switch selects the next pulse duration. When the desired pulse duration is selected, the menu can be exited by holding the trigger switch for a period of time. The selected pulse duration is saved permanently and the laser controller enters its normal state of operation.

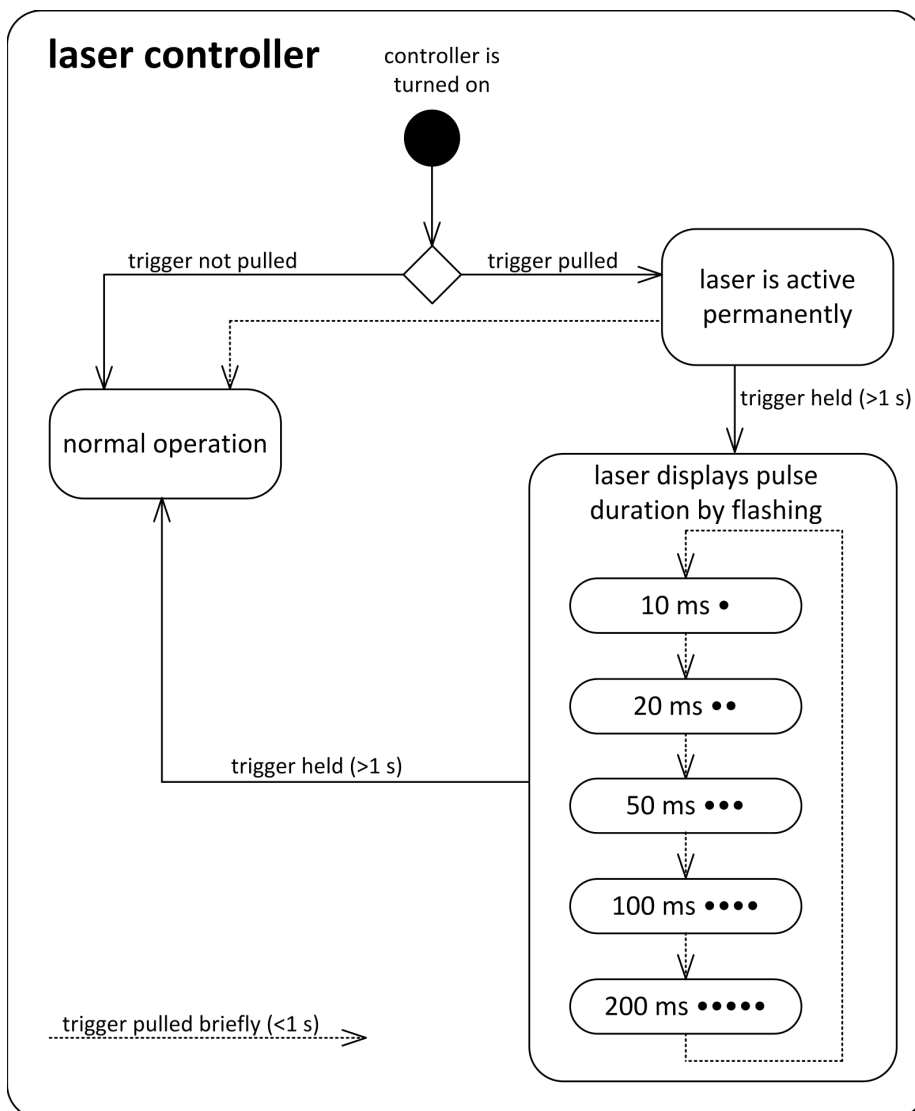


Image 3: Functional diagram of the laser controller