

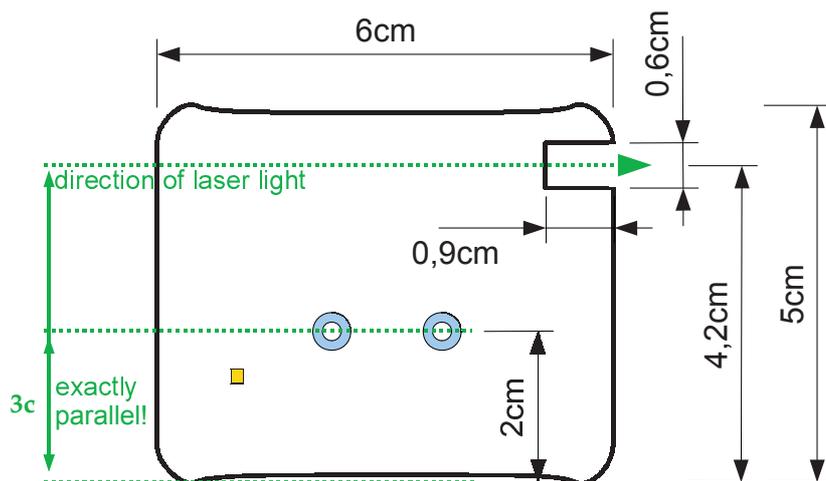
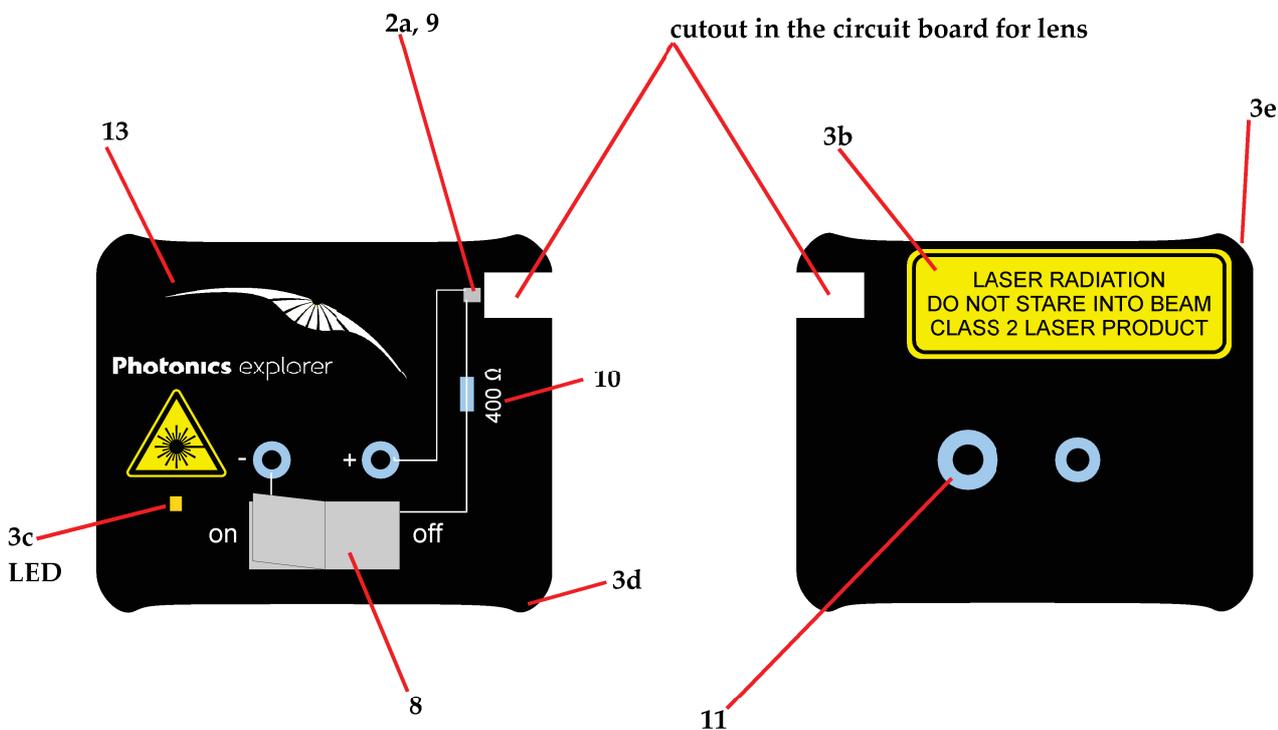
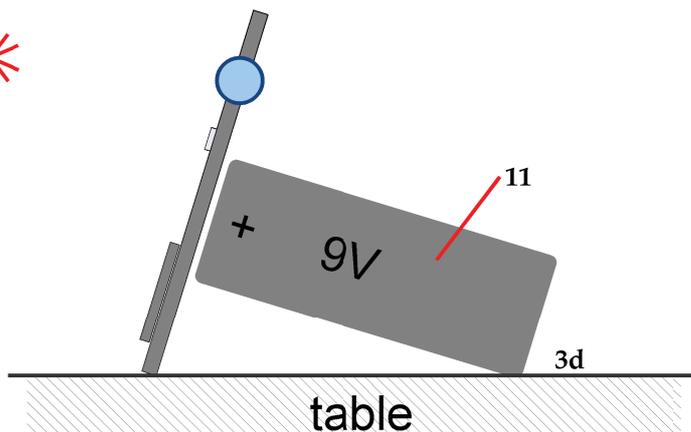
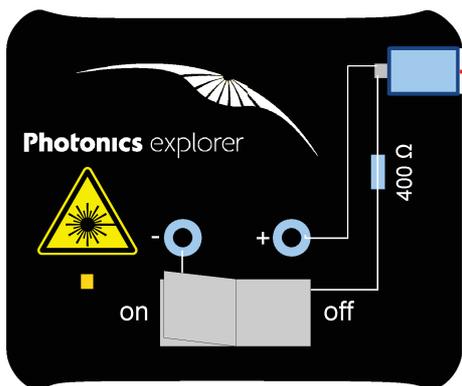
Please find below the target specifications of the Laser module. Attached you will find an explanatory drawing, including the dimensions of the product.

- (1) The module is meant for educational purposes at secondary schools in Europe. It will be used by young adults between ca. 16 and 19 years of age. It will be placed on the table so that it stands on the 9V battery and the circuit board (the circuit board thus stands slightly tilted to the vertical). The laser light is emitted at the side of the circuit board, in the plane of the circuit board, and parallel to the table.
- (2) The module will be employed for:
 - a. The illustration of a laser. Therefore the technology and esp. the actual laser should be visible to the student and not be hidden by the lens housing.
 - b. Teaching of basic laser safety rules. Therefore the safety issues in point (2) are mandatory.
 - c. Diffraction experiments where the laser beam diffracts e.g. on a small slit of 50 micrometer width. Therefore the beam diameter should be small and the power as close to 1 mW as possible.
 - d. The illustration of Diffractive Optical Elements
- (3) Safety has priority!
 - a. The product has to be eye safe. It has to be guaranteed that the output power is not more than 1mW. On the other hand, it should not be much less than 1 mW.
 - b. The laser warning symbol should be placed on the front side and the laser warning message on the back side (so that it is not concealed by the battery).
 - c. The laser should be absolutely stable when placed on the table. This means especially that the axis between the two connectors to the battery is exactly parallel to the base line of the circuit board (see drawing, bottom), and that the laser beam is parallel to the table.
 - d. The edges of the circuit board have to be rounded – just as for the RGB LED module.
- (4) The cost of the product should be less than 0.90 Euro per module.
- (5) The colour of the laser light source should be visible. All the lasers produced for the Photonics Explorer should have the same wavelength within a range of not more than 10 nm. 
- (6) The beam profile should be Gaussian (a small oval shape is OK). The beam diameter should be between 1 and 1.5 mm and the beam divergence less than 1.5 mrad. The beam has to be parallel to the table surface. If you have problems with these specifications please let us know.
- (7) A button with at least 10 mm size allows switching the laser on and off. It should NOT be necessary to press the button continuously. It should be visible from the switch if the laser is

switched on or off – if the students connect the module to the battery they have to make sure that it is switched off.

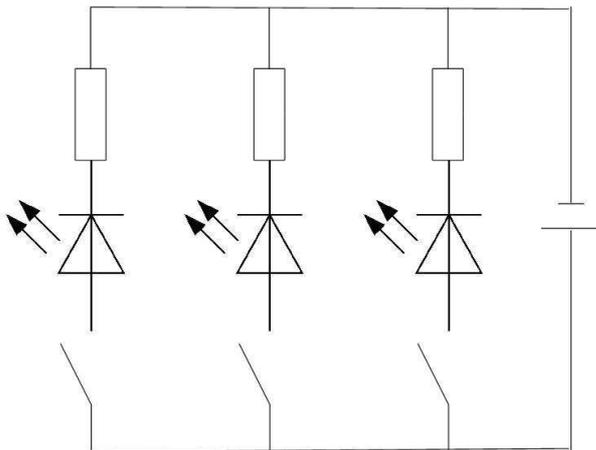
- (8) If in any way possible, the actual laser source should be visible to the student and not be hidden by the lens holder. This would require a smart protection of the laser to keep the product robust.
- (9) The electric circuit should be directly visible on the board. This will help the students. For instance, the resistance of the resistor should be written next to the resistor.
- (10) The board has a connector for a 9-V-battery (PP3) to power the module. This connector is integrated in the backside of the board just as for the RGB-LED module.
- (11) The module needs a CE marking to certify that it meets the EU consumer safety, health and environmental requirements. This is absolutely mandatory; otherwise it is not allowed to use the product in schools! This is not yet required for the prototypes, but definitely for the serial production.
- (12) The Photonics Explorer logo should be printed on the front side of the module, just as for the RGB-LED module. Similarly you may, if you wish, print the YESled.com logo on the backside (will provide a great visibility for your company!). However, it should be clearly smaller than the Photonics Explorer logo – just as for the RGB-LED module.
- (13) The colour of the circuit board should be black. The print would be in white and yellow (for the warning sign) at the front and in yellow only on the back (for the warning sign).

The numbers refer to the corresponding points in the target specifications

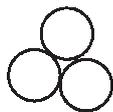


Please find below the target specifications of the RGB LED module:

- (1) The module is meant for educational purposes at secondary schools in Europe. A red, a green and a blue LED are independently switchable and can be used by the children to
 - a. Illustrate colour mixing (also RGB screen)
 - b. Generate light signals that can be sent e.g. through an polymer optical fiber
 - c. Learn how an LED works
 - d. Other applications
- (2) The electric circuit is very simple. When choosing the resistors, please consider that the 3 LEDs should have the same brightness (as perceived by the human eye).



- (3) Preferably, the electric circuit is directly visible on the board. This will help the students. For instance, it would be good if the resistance of each resistor is written next to the resistor.
- (4) The circuit has to be protected, e.g. by a clear lacquer/vanish. The module has to be robust in general. This would also mean that the LEDs are mounted as low as possible on the board.
- (5) The LEDs should be as close to each other as possible. They should build a triangle (top view).



- (6) The 3 buttons should be large enough to be handled easily by a child. The pushable area of each button should have a diameter of at least 5 mm. It has to be obvious for the child which button switches which LED.

- (7) The board has a connector for a 9-V-battery (PP3) to power the module. This connector is integrated in the backside of the board as in this example:



It should be placed approximately in the middle of the backside, so that the whole module can be hold by a child by holding the 9-V battery:



The module needs a CE marking to certify that it meets the EU consumer safety, health and environmental requirements. This is absolutely mandatory; otherwise it is not allowed to use the product in schools! The LEDs have to be eye-safe according to EU regulations.

- (8) The Photonics Explorer logo should be printed on the front side of the module (see attached file). You may, if you wish, print your logo on the back.