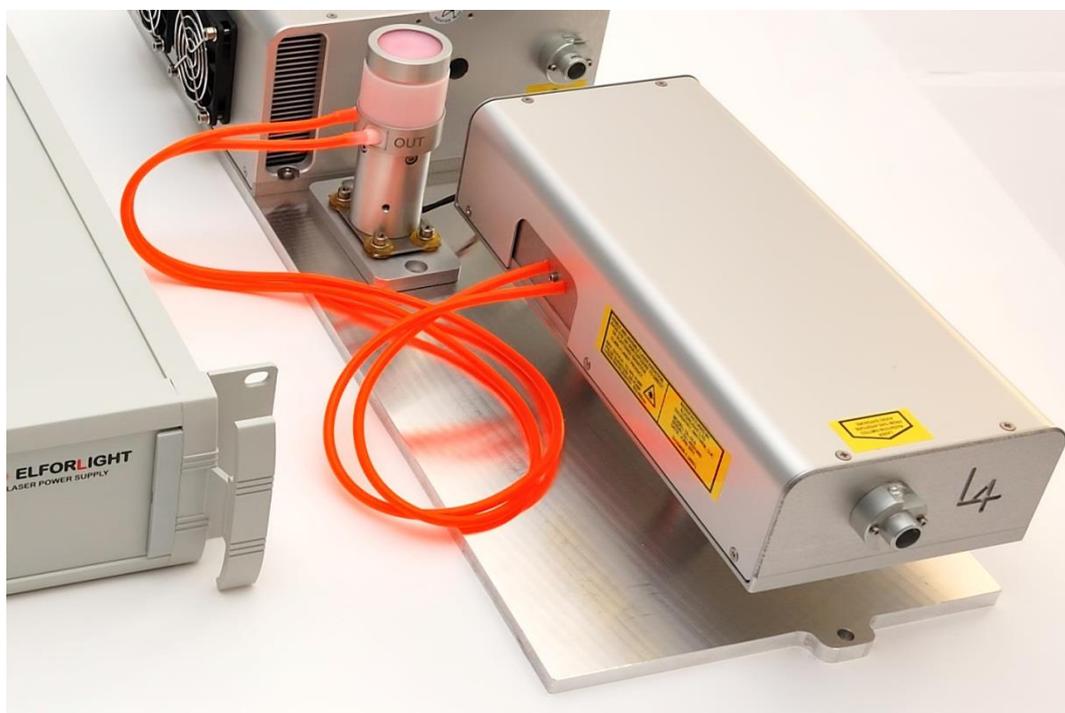


## DL Series Dye Lasers



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## 1. Basic User Manual

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## 1.1. Laser Safety

Refer to pump laser safety and operating instructions prior to operating the dye laser.

Elforlight dye lasers are designed and optimised to operate with FQS and SPOT lasers as manufactured by Elforlight. These Q-switched lasers have outputs at 532nm for dye laser pumping.

The dye laser operates at a range of wavelengths dependant on the dye used. All Elforlight dye lasers are set up and specified using Pyrromethene 597, which will give a laser output in the range 560 – 610nm.

Refer to dye manufacturer's instructions and precautions prior to handling and mixing a solution. **Laser dyes and solvents are hazardous materials** and necessary protective clothing and eye ware should be used when mixing dye, filling the reservoir and connecting the supply tubes.

The laser should be used in an enclosed area with access restricted to trained personnel. The area should be clearly labelled and the entrance marked with the class of laser.

Only trained personnel should be allowed to use the laser.

The key must be inserted in the key switch on the pump laser power supply front panel and turned to enable the laser to operate. The key is captive in the operational position. As such, the key should be removed from the laser when not in use, and / or unattended, and stored in a safe place.

Eye and skin exposure to direct or scattered laser radiation is hazardous and should be considered potentially extremely harmful.

Suitable eye protection should be worn at all times whilst laser output is possible.

The laser beam path should be terminated with a non-reflecting beam stop. Beam paths should be enclosed where possible, and should not be at eye level if practical.

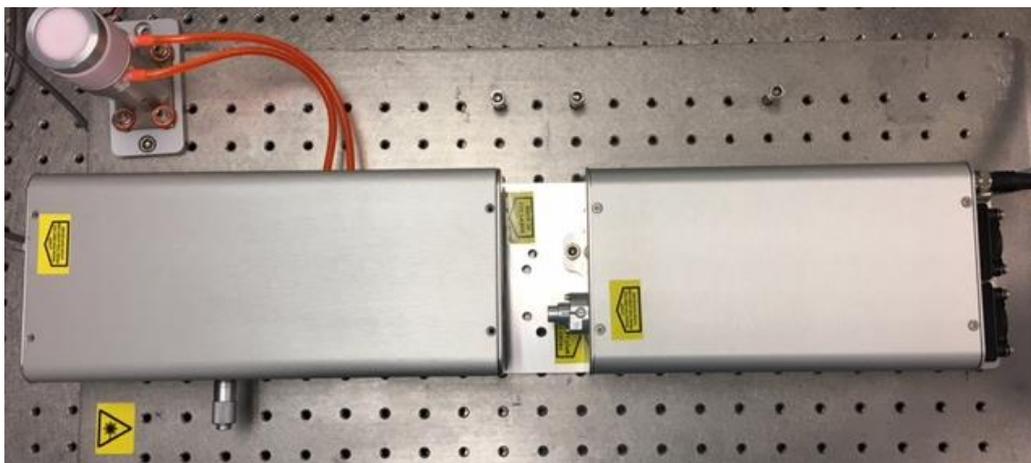
Care should be taken that all external mirrors and optics used are securely positioned and fixed to prevent movement. Care should be taken at all times to prevent stray reflections from surfaces.

## 1.2. Dye laser operation

The Elforlight dye laser is normally supplied with an Elforlight pump laser. The pump/dye laser combination will be pre-aligned in the factory and should need minimal alignment at installation.

Prior to operation a dye solution will be required. See Appendix 1 for mixing dye solution procedure.

For use with a SPOT laser, the SPOT head and PSU and dye laser head are shipped separately. A mounting plate is also provided to mount the dye and SPOT laser heads.



The position of the two heads, as factory tested, is marked by labels. Bolt down the SPOT and Dye laser heads to the plate using M6 bolts. (It will be necessary to take the lid off the dye laser to access the bolt holes). Align the edges of the heads to the edges of the plate. The heads could also be mounted directly to an optical table or breadboard with similar spacing.

With all components in place the pump laser should be switched on. The dye pump should be switched on and run while the pump laser is warming up.

On completion of 'warm up' open the manual shutter on the pump laser. Gradually increase the output of the pump laser until an output is achieved from the dye laser.

The output of the dye laser is controlled by adjusting the pump laser.

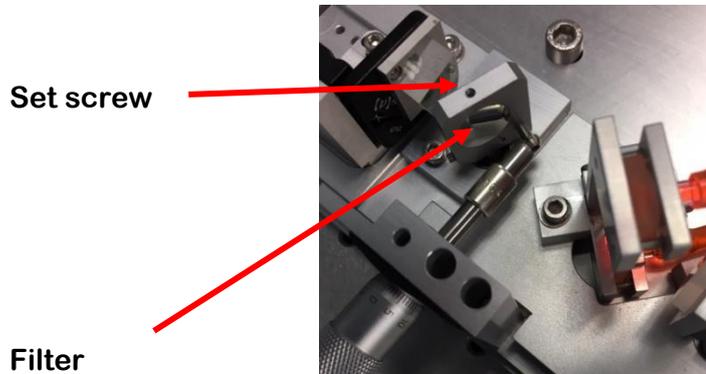
If the dye laser has a tuning option, adjustment can be made to select a specific wavelength.

## Tuning Filters:

The dye laser is shipped with either one or two filters to cover the tuning range, depending on type of pump laser supplied.

One extends up to 589nm, and the other above 589 to 610nm or further.

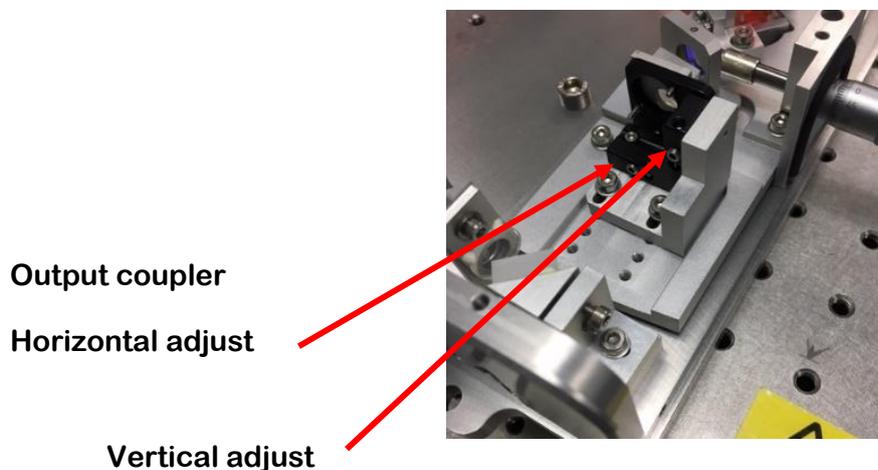
The filter is held in its mount with an M2 set screw, which takes a 0.9mm wrench.



To change the filter, whilst wearing gloves or finger cots, loosen the set screw and carefully remove the filter, then replace with the other filter, and gently nip the set screw. **DO NOT** overtighten as this may crack the filter.

The dye laser is tuned by adjusting the angle of the filter using the micrometer. The test data provides an approximate calibration of wavelength vs micrometer reading.

Alignment optimisation may be required, particularly upon first installation. Also, on changing repetition rates, the output coupler may need realigning in the vertical plane. A 1/16" Hex wrench is used.



## Appendix 1

The test dye is Pyrromethene 597. A solution should be prepared with 40mg of dye in 30ml of Ethanol.

The dye tubes should be connected between the dye pump and the dye cell.

Turn on the dye pump and ensure there are no leaks in the system.

Check that there are no air bubbles in the system.

Open the pump laser shutter and allow a reduced level of pump light into the dye laser. Adjust the power level of the pump laser until there is an output from the dye laser. This will be the dye laser threshold.



Dye concentration optimisation can be performed as below:-

Ensure the dye is flowing correctly in the system.

Set the pump laser to its specified energy level and repetition rate

Monitor the energy level of the dye laser output.

Remove a quantity of the dye solution from the reservoir using a syringe.

Add a quantity of Ethanol using a syringe.

Check the dye laser output on the energy meter.

Repeat the process until an energy peak has been achieved.

It may be necessary to top the reservoir level up (to the brim) with ethanol periodically (~day to day).



## **New dye solution:**

The Elforlight dye laser pumped by a SPOT laser is tested with Pyrromethene 597 dye in a solution in ethanol.

The test solution of dye has been drained and is shipped in the bottle labelled "Test Solution". To run the laser simply open the reservoir, pour the whole contents of the bottle into the reservoir, replace the lid and check that the dye flows on powering up the pump.

A bottle of concentrated dye solution needs to be mixed. This is as saturated a solution as possible at room temperature. Measure approx. 50ml ethanol into a conical flask. Add dye powder incrementally and shake the flask to dissolve it. An ultrasonic bath may be used to provide vibration and heating to aid dissolution. Keep adding until no more dye can be dissolved. A small amount of undissolved dye may be present in the bottom of the flask.

Once power degrades, usually after several days' operation, a short term recovery can be achieved by adding a few ml of concentrate to the circulating dye. Using a syringe, remove say 5ml from the reservoir and then add concentrate 1ml at a time until a peak in power is reached. Typically 3ml achieves this. Allow time for the dye to mix by circulation.

To make a new dye mix, drain the old solution totally from the laser. Fill the reservoir with ethanol and circulate to rinse dye out. Drain this rinse solution and discard too.

Refill with fresh ethanol leaving a gap at the top of the reservoir and circulate. Add dye concentrate from the syringe whilst the green pump beam is entering the dye cell until the green beam is fully absorbed and no (or very little) light passes through the dye cell. Approx. 3x3ml syringes full will be needed. Test the dye laser for power. If low, add more concentrate 1ml at a time until the power peaks. If too much is added and power drops, add more ethanol to dilute the solution.