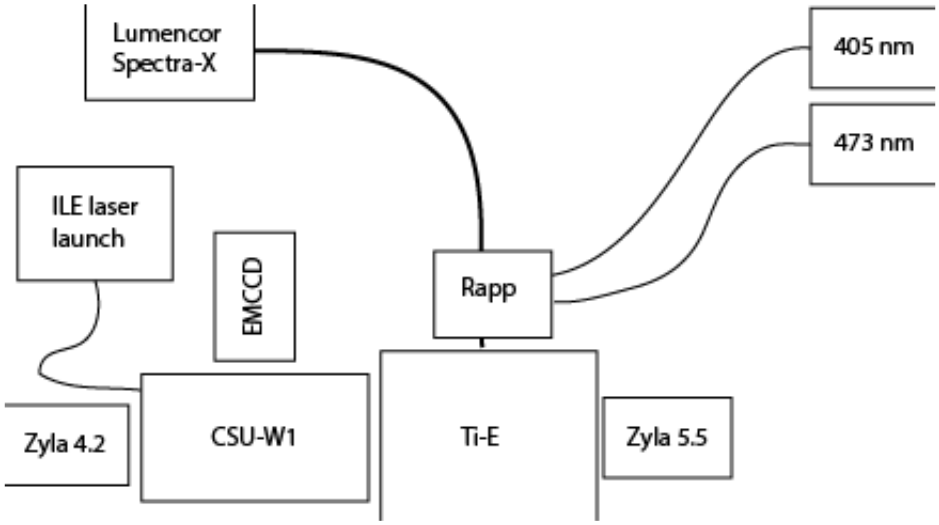
Interlocking multiple devices on a microscope

By admin · February 3, 2016

Over the last few years, we have been building out a progressively more complex microscope. It started life as a high speed widefield microscope (posted about here and here), was later upgraded to include a photoactivation and photobleaching system (see this post), and now has had a CSU-W1 spinning disk confocal added to it, courtesy of an S10 we were awarded.

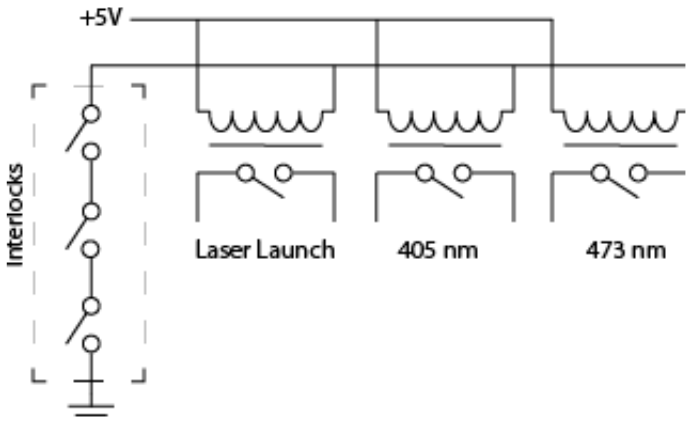


A sketch of the overall microscope. The CSU-W1 has two camera ports, one with an Zyla 4.2 sCMOS camera and one with an EMCCD. The laser light for the CSU-W1 is delivered by fiber from the ILE laser launch. The box labeled Rapp is the photobleaching scanner, which has fiber connections to the 405 and 473 nm lasers. The Lumencor Spectra-X provides brightfield illumination, and the Zyla 5.5 is used for widefield imaging.

We now are working to set up laser safety interlocks on this system. There are three lasers to interlock – the laser launch (from Spectra Applied Research), and the 405 nm and 473 nm lasers for photobleaching (from Vortran Laser Technology). There are also three interlock switches – one that opens when the Ti is set to send light to the eyepieces, one that opens when the Ti brightfield arm is tipped back, and one that opens when the CSU-W1 case is opened. These are all wired in series, so that opening any one open circuits the interlock.

The challenge comes when we want to connect the interlock circuit to all three lasers at the same time. The laser manufacturers don't specify how their interlock circuits sense whether the interlock circuit is open or closed, but presumably it's done by applying a voltage on one side of the circuit and seeing if it shorts to ground. However it's done, it turns out that the Vortran lasers and the Spectral Applier Research Launch do it in incompatible ways and we can't get the interlocks on all three lasers to work when we simply parallelize their interlock inputs and attach them to the interlock loop on the microscope.

The solution is to build our own interlock distribution box, by using relays to isolate the interlock inputs on each device from the others.



The proposed interlock distribution circuit. (The electrical symbols can be found at Wikipedia).

The relays are low power 5V relays that only draw 10 mA each. The parts are on order and I plan to assemble it next week. Hopefully it provides a straightforward solution to our interlock problems.