

Design and Prototype of the EIC–DIRC Laser Interlock Circuit

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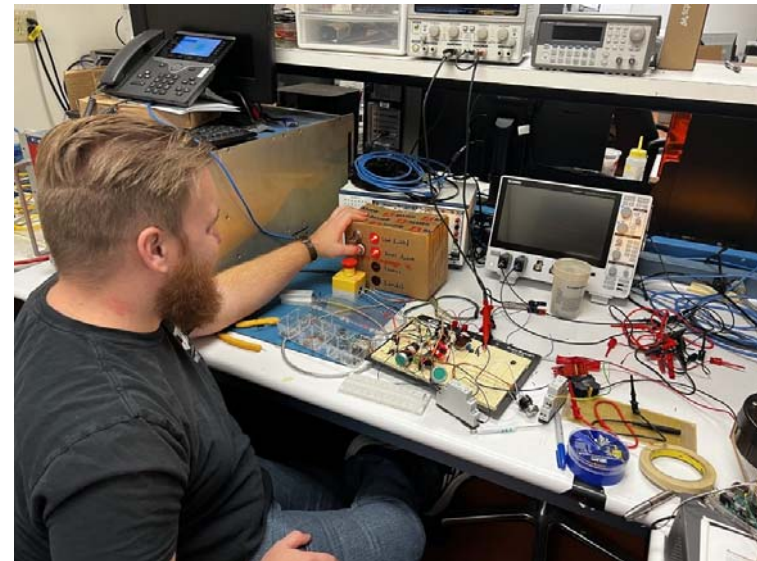
EIC-DIRC’s laser test area must have an interlock system to ensure that the area’s occupancy is controlled and the laser can be quickly and easily disabled in an emergency. One of JLab’s requirements for such an interlock system is that the system cannot rely on software. To adhere to this requirement, a circuit that uses 5-VDC logic gates was designed and prototyped.

At first, the circuit was designed on paper using logic gates and truth tables. Next, this circuit was designed in Multisim to verify its functionality before procuring parts to physically prototype the circuit. This first version of the circuit contained only the interlock input, set-reset latch, and 24-VDC output in the final circuit.

At this point, logic gates (specifically 8-input NAND gates and quad 2-input NOR gates), timed relays, and key switches were procured to prototype the circuit on a breadboard. During this prototyping effort, the scope of the interlock system increased to require the use of internal and external keyed control units, a sweep button, and a low-power filter. Despite these features using logic gates or devices other than NAND or NOR gates in the final circuit, they were able to be physically prototyped on the breadboard because NOR gates are considered “universal logic gates” and can be used to create all other types of gates or basic logic devices.

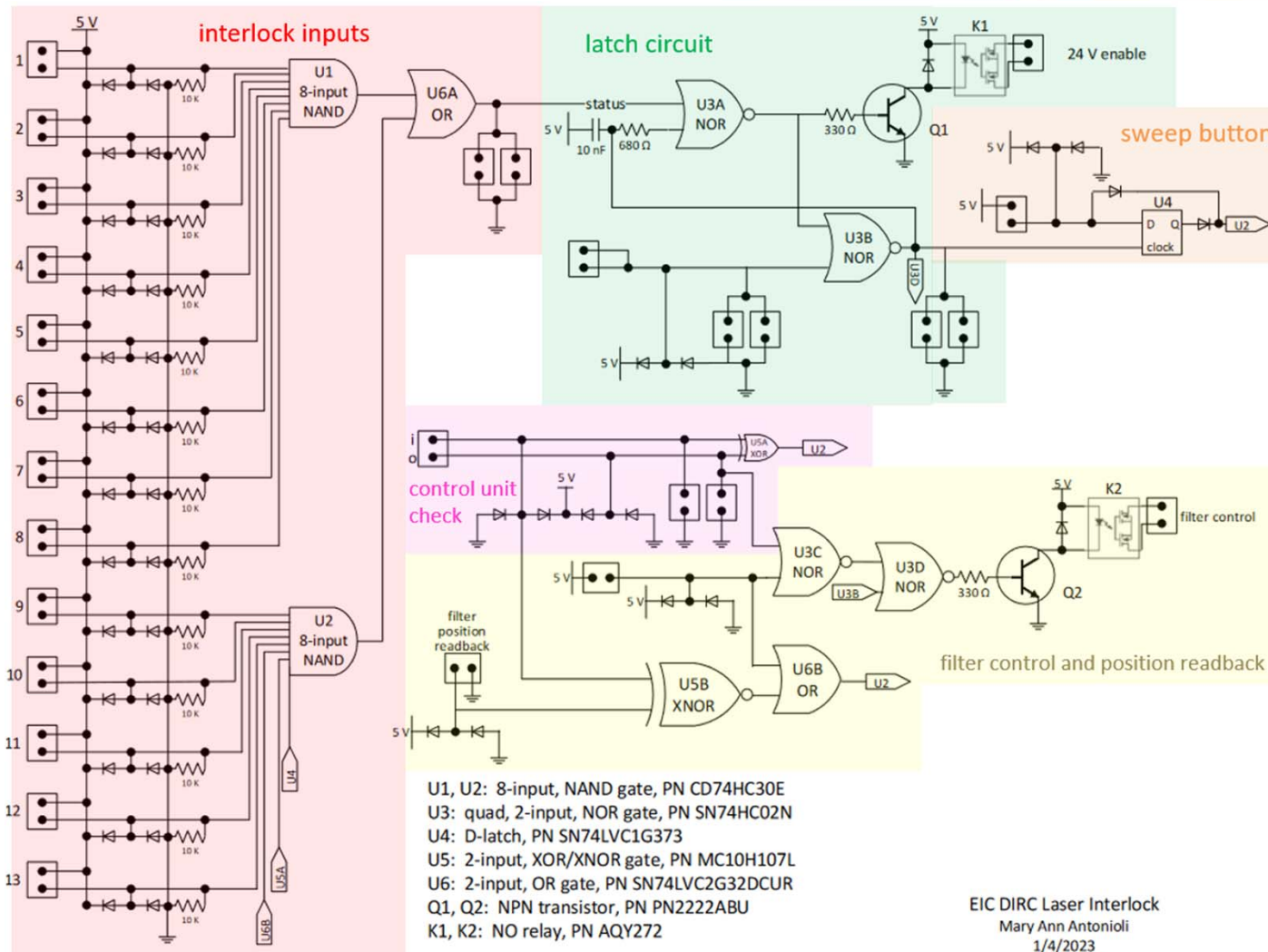
Presently, the circuit has been refined and finalized (circuit schematic on slide 2) and is ready for design in Altium. Once it has been designed in Altium, the circuit will be fabricated into custom PCBs that will then be assembled into the finished EIC-DIRC laser interlock system.

- **EIC–DIRC’s laser controlled area requires a hardware-based interlock system to control the area’s occupancy and allow the laser to be quickly and easily disabled**
- **Circuit for interlock system first designed on paper and its functionality verified in software**
- **Circuit prototype created with breadboard and its functionality verified**



Tyler Lemon testing reset functionality of the laser interlock circuit’s breadboard prototype.

Design & Prototyping of the EIC – DIRC Laser Interlock Circuit



Finalized EIC-DIRC laser interlock circuit. Sections of the circuit with different functions are noted by different color highlights