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Doc. No: Doc DB # 3885 UV Laser\_system\_ORC

Subject: ORC Documentation for Microboone Laser-R2 Rack

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**Introduction:**

This is a follow up request on a p-ORC done at DAB, internal document #3698. The Microboone Collaboration has assembled a rack labeled “Laser-R2” that is located at the LArTF Building. Most of the electronics in the rack are associated with the MicroBooNE UV laser group. The rack infrastructure consists of a custom designed Rack Protection System and AC Distribution Switch Box. This document describes the current contents of the rack for the purposes of a Operation Readiness Clearance review. Most of the rack components are commercially available. Some rack components are custom pieces of equipment that have passed EDR review. These latter pieces of equipment will be described in detail at the end of this document. We request approval for unattended operation of the existing components in the rack.

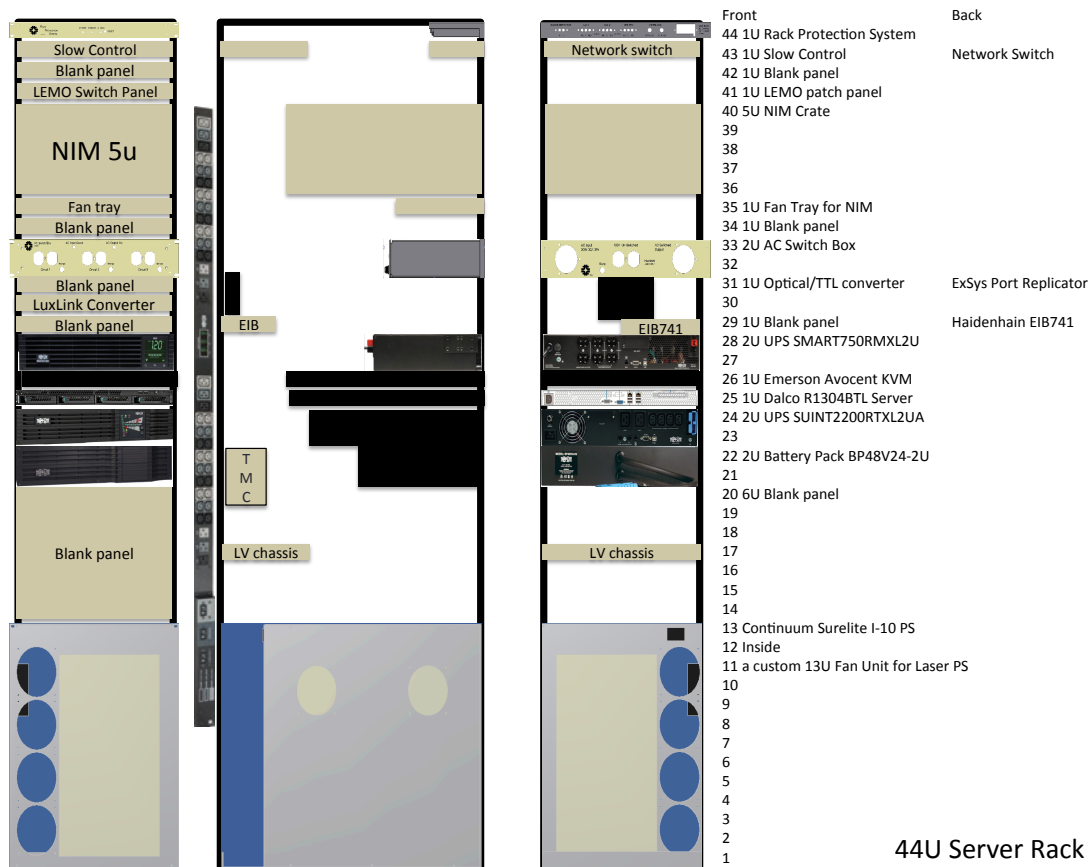


Figure 1: Rack Layout

## **Equipment:**

The Laser-R2 Rack contains two main groups of components: the AC Distribution/Rack Protection System, and the components controlling and reading data from the MicroBooNE UV laser. The contents of the rack are listed below. Descriptions of custom components are given after providing a layout and inventory of each rack. Future updates of this p-ORC are expected to include commercial components in shipping from Switzerland, namely a UV laser which operation will require LSO approval.

### ***Rack Protection System and AC Distribution Equipment***

EED Custom Designs

- Rack Protection System
- Slow Control Box
- AC Switch Box

Commercial Equipment

- System Sensor Smoke Detector
  - Model #: SW-B
- Rack Fan
  - Make: AMCO Engenering
  - Model #: BTA10 Fan
- Power Distribution Unit
  - Make: Triplite
  - Model #: PDU3MV6L2130

### ***UV laser Readout Equipment***

LHEP University Bern Custom Designs

- Fan Unit 13U for laser PS
- Low Voltage PS distribution chassis

Commercial Equipment

- Network switch
  - Make: Cisco
  - Model #: 2960
- 1 NIM Crate
  - Make: B. L. Packer
  - Model #: 1012P
- Fan Unit 1U
  - Make: Schroff
  - Model #: 10713-110
- Serial Port Replicator
  - Make: Exsys
  - Model #: EX-1338HM
- Portable Interface Box
  - Make: Haidenhain
  - Model #: EIB741
- Back Up Power
  - Make: TripLite
  - Model #: SMART750RML2U
- KVM + LCD
  - Make: Avocent Emerson
  - Model #: ECS17KMM-001
- Server
  - Make: Dalco
  - Model #:R1304BTLSHBNR
- Back Up Power
  - Make: TripLite
  - Model #: SUINT2200RTXL2UA
- Extra Battery for Back Up Power
  - Make: TripLite
  - Model #: BP48V24-2U
- Motor Controller

Make: Thermionics  
 Model #: TMC-2  
 UV Laser Continuum Surelite I-10  
 Fiber – Optical/TTL Converter  
 Make: Luxlink  
 Model#: DT-7201

## AC Distribution

The AC distribution is shown in the Figure 2 below. The Service plugs into a custom AC Switch Box and distributed with a commercial PDU, it is protected with a custom Rack Protection System. A custom Slow Control allows the remote monitoring of the system. A rack fan ensures that no overheating occurs.

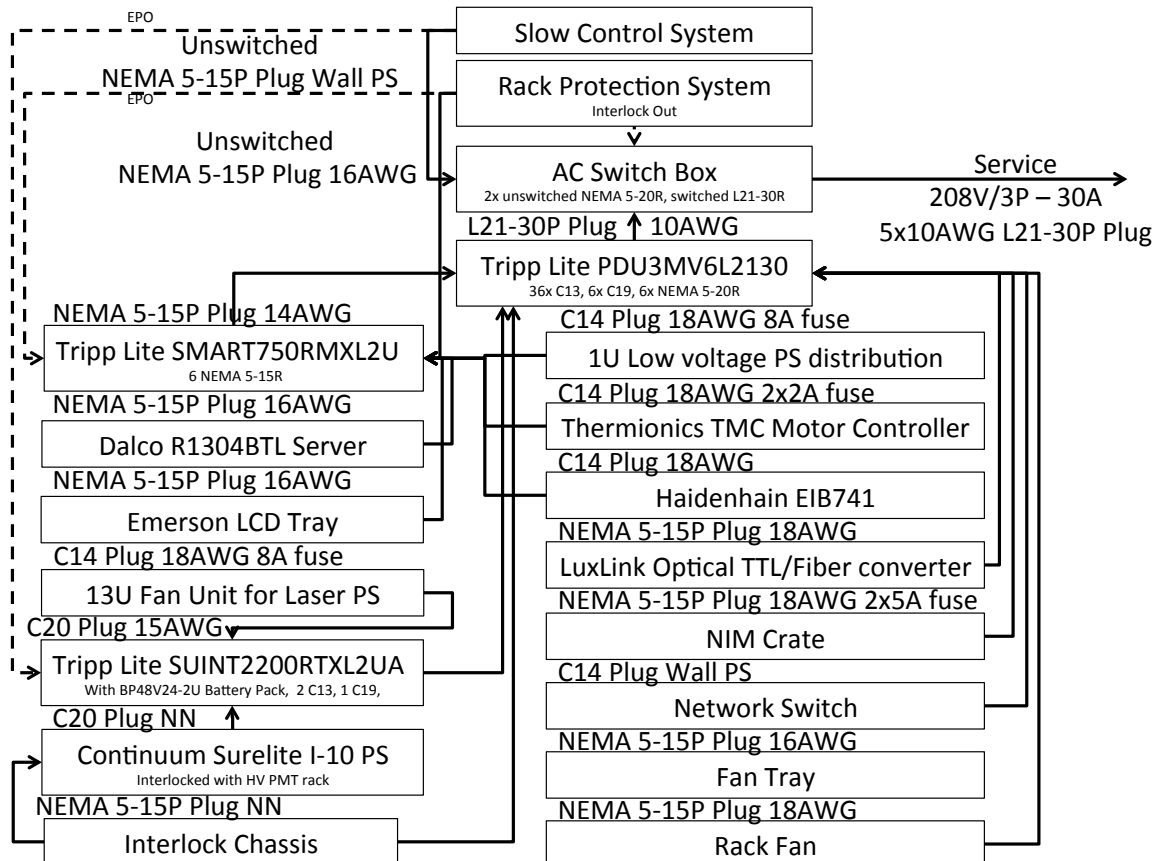


Figure 2: AC distribution

## Custom Designed Equipment

### Rack Protection System:

The Rack Protection System is composed of a custom designed Rack Protection Unit (RPS). This unit was designed by Dave Huffman and is documented at the following link under Item 9. RPS (Rack Protection System). The MicroBooNE production version of the unit is Revision B. An EDR was performed on production chassis of which all subsequent chassis constructions were modeled. The design has been approved by Steve Chappa.

[http://www-ppd.fnal.gov/EEDOffice-w/Infrastructure\\_group/Huffman/Web/uboone/default.html](http://www-ppd.fnal.gov/EEDOffice-w/Infrastructure_group/Huffman/Web/uboone/default.html)

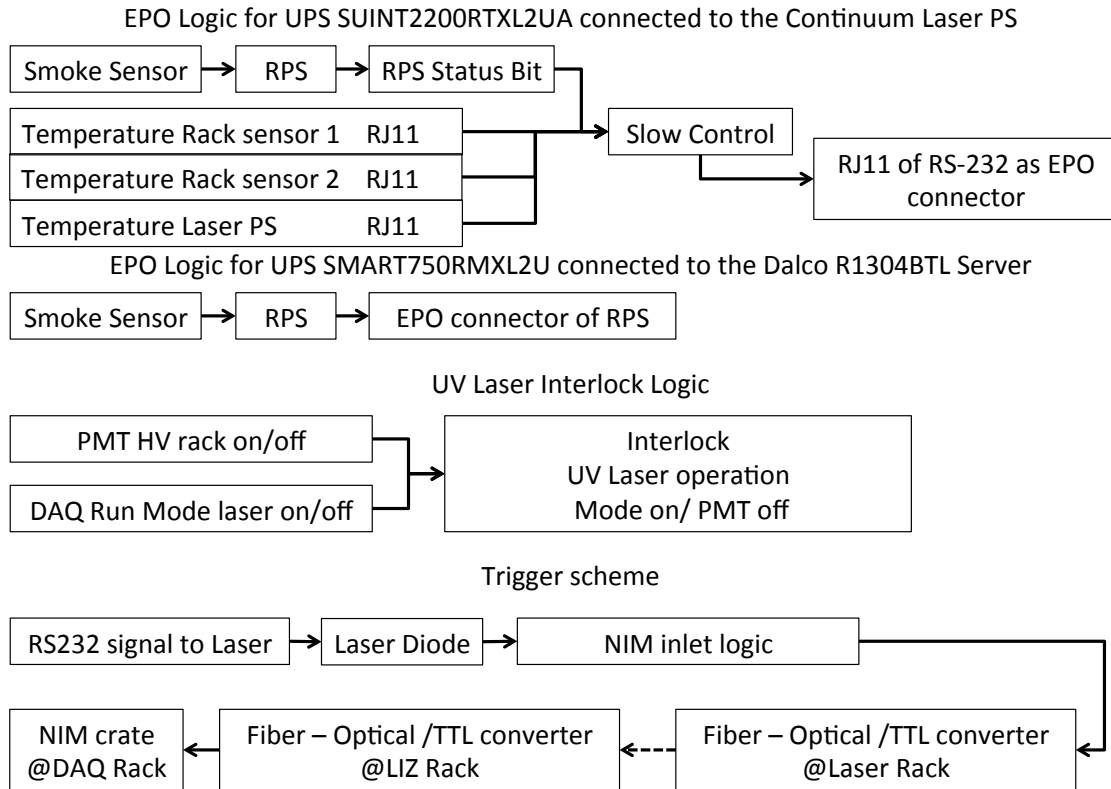
The 2W-D smoke detector specifications can be found here

<http://www.systemsensor.com/pdf/A05-0318.pdf>

The RPS provides an interlock signal to the AC Switch box. If smoke is detected, the interlock is dropped, removing AC power to the PDU. The RPS is powered from an unswitched outlet on the TripLite UPS SMART750RML2U.

**Interlock:**

The rack can send a trigger signal via an onptical link to the DAQ system, and receives a hardware interlock via a dry wire connection to avoid accidental turning on off the UV laser. Additionally, the RPS temperature sensors are monitoring the temperature inside the rack, as shown in the picture below:



**Figure 3: Interlock and Trigger schematics**

**Slow Control Box:**

The Slow Control system is composed of a custom-designed Slow Control Box containing a Glomation single-board computer, power supply, and various inputs and indicator lights. This unit was designed by Dave Huffman and Glenn Horton-Smith and is documented at the following link:

[http://www-ppd.fnal.gov/EEDOffice-w/Infrastructure\\_group/Huffman/Web/uboone/SlowControl.html](http://www-ppd.fnal.gov/EEDOffice-w/Infrastructure_group/Huffman/Web/uboone/SlowControl.html)

The Slow Control Box has undergone an Engineering Design Review, and approval for operation was granted:

[http://www-ppd.fnal.gov/EEDOffice-w/Projects/MicroBoone/EDR/Round\\_5.html](http://www-ppd.fnal.gov/EEDOffice-w/Projects/MicroBoone/EDR/Round_5.html)

Slow Controls chassis is powered from an unswitched outlet on the AC Switch Box.

**AC Switch Box:**

The AC Distribution consists of two components; a commercial TrippLite PDU3MV6L2130, 208 3-phase power strip and a custom designed AC Switch Box. Figure 3 is the line drawing for the AC distribution circuit. Five conductor, 10AWG cable is used with NEMA L21-30R and L21-30P plugs and receptacles. Figure 3 is the AC Switch Box schematic. An Engineering Design Review was performed on the chassis and approval for operation was granted by Steve Chappa. More information can be found on Dave Huffman’s site under AC Distribution and AC Switch Box.

The device is powered by the building service 208V-3p -30A.

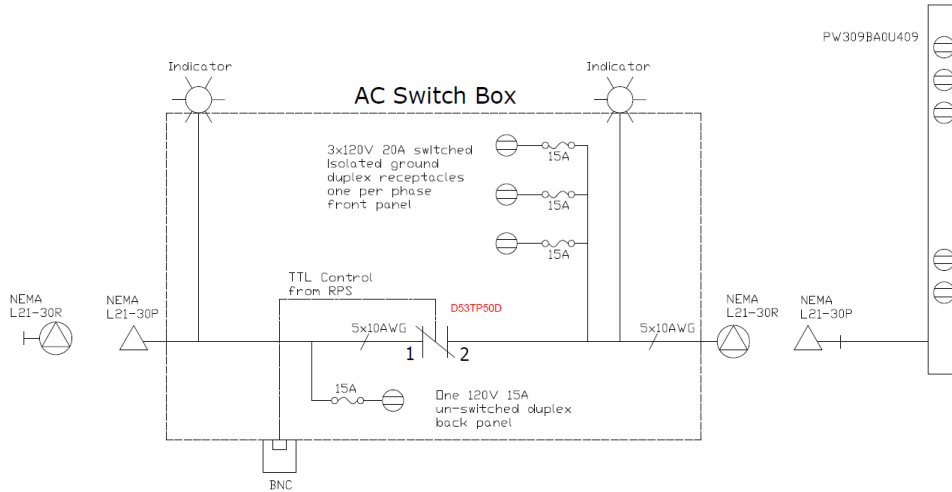


Figure 4: AC Switch Box Line Drawing

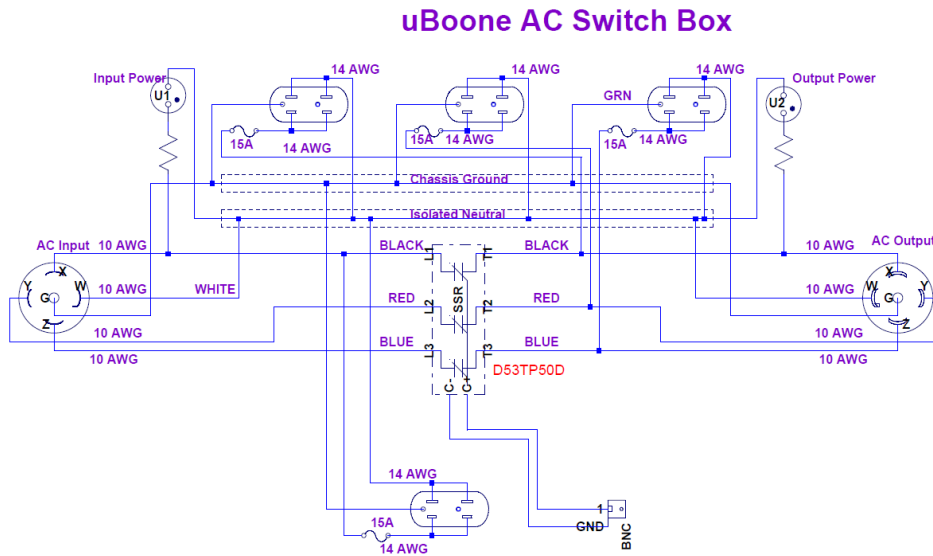


Figure 5: AC Switch Box Schematic

### 13U Fan Unit for Laser PS:

The power supply of the laser is in a custom build fan housing to control the heat produced and direct the air flow out of the rack. An Engineering Design Review was performed on the chassis and approval for operation was granted by Dave Huffman.

More details and the EDR can be found at [http://www-ppd.fnal.gov/EEDOffice-w/Projects/MicroBoone/EDR/Round\\_6.html](http://www-ppd.fnal.gov/EEDOffice-w/Projects/MicroBoone/EDR/Round_6.html)

The device is powered by the Back Up power UPS TripLite SUINT2200RTXL2UA.

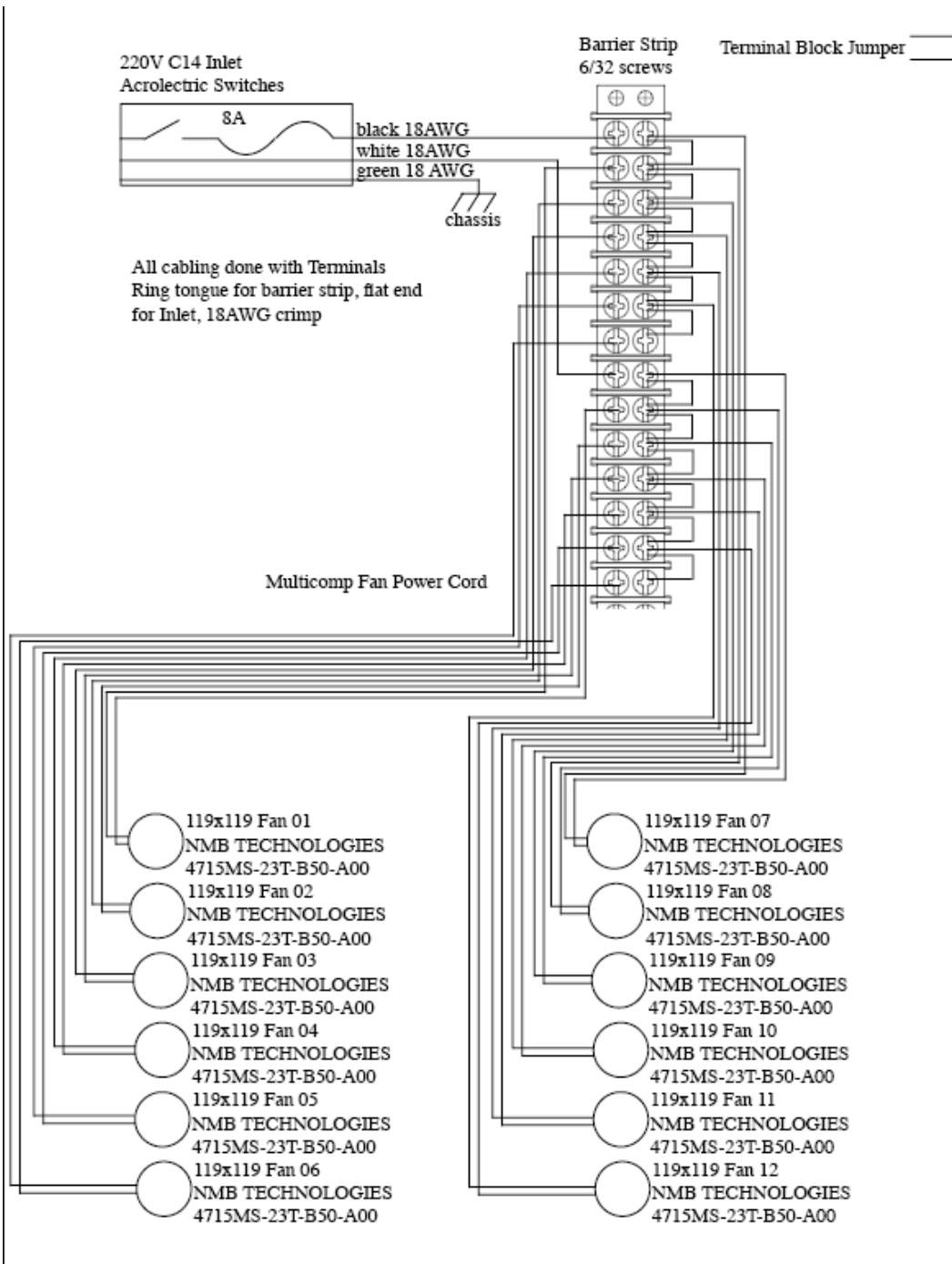


Figure 6: Electrical drawing of the UV laser fan unit chassis.

**Low voltage PS distribution box:**

The distribution of the low voltage for the UV laser system is done with a custom made low voltage PS distribution box, the DC schema is shown in the Figure below. An Engineering Design Review was performed on the chassis and approval for operation was granted by Steve Chappa.

More details and the EDR can be found at [http://www-ppd.fnal.gov/EEDOffice-w/Projects/MicroBoone/EDR/Round\\_6.html](http://www-ppd.fnal.gov/EEDOffice-w/Projects/MicroBoone/EDR/Round_6.html)

The device is powered by the Rack PDU Triplite PDU3MV6L2130.

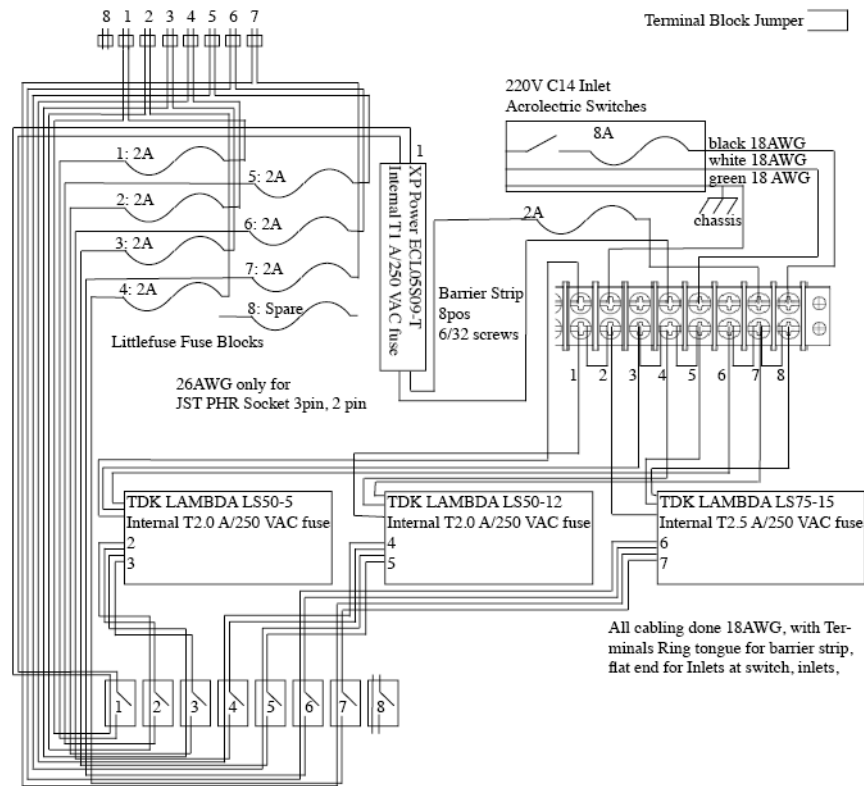


Figure 6: Electrical drawing of the UV laser low voltage PS distribution box.

## Commercial Equipment

### Network Switch:

We use a NETGEAR switch with fiber/copper SFP GS110TP.

The device is powered by the Rack PDU Triplite PDU3MV6L2130.

### NIM crate + Fan Tray:

We use a standard NIM crate with a 1U Fan tray from the Fermilab Prep pool, see <http://www-esd.fnal.gov/esd/catalog/nimdir.htm>

The devices is powered by the Rack PDU Triplite PDU3MV6L2130.

### Haidenhain EIB741:

To monitor the UV laser position in the MicroBooNE LArTPC we use a special position measurement device, which is read out by the Haidenhain EIB741 portable interface box. More details can be found at <http://www.heidenhain.us/Portable-Interface.htm>

The device is powered by the Back Up power UPS TripLite SMART750RMXL2U.

### Tripp Lite UPS SMART750RMXL2U:

We use a Tripp Lite UPS for covering power outages of the DAQ system, more details can be found at <http://www.tripplite.com/en/products/model.cfm?txtModelID=3020>

The devices is powered by the Rack PDU Triplite PDU3MV6L2130.

### Emerson Avocent LCD Console Tray:

The monitor and keyboard interface of the server in the UV laser rack is done with the Emerson LCD console tray. More details can be found at <http://www.emersonnetworkpower.com/en-US/Products/InfrastructureManagement/LCDConsoleTrays/Pages/AvocentLCDConsoleTray.aspx>

The device is powered by the Back Up power UPS TripLite SMART750RMXL2U.

### ***DALCO R1304BTL 1U Rackmount Server:***

The monitoring and DAQ of the UV laser system is steered with the Dalco R1304BTL server, more details can be found at <http://www.thinkmate.com/system/intel-r1304btl>

The device is powered by the Back Up power UPS TripLite SMART750RML2U.

### ***Tripp Lite UPS SUINT2200RTXL2UA with added Tripp Lite BP48V24-2U External Battery Pack:***

We use a Tripp Lite UPS with battery pack attached for covering power outages when cooling the UV laser, more details can be found at <http://www.tripplite.com/en/products/model.cfm?txtModelID=3970> and <http://www.tripplite.com/en/products/model.cfm?txtModelID=2501>

The devices is powered by the Rack PDU Triplite PDU3MV6L2130.

### ***Thermionics Stepper Motor Controller TMC-3.0-2 (C14 plug):***

We use the 2-axis Thermionics Stepper Motor Controller, which is used to steer the one RNN-400/MS/LS-36 stepper motor (Power from DC) and one FLMR-133-25-2/MS/LS stepper motor (Power from DC), more details can be found at <http://www.thermionics.com/en-us/Desktop/Knowledge/View/Articles/8f9d3d35-2727-4a64-93b6-373dd1fdf075/42119e46-8642-473e-b774-6f973b8a7ac9/>

The device is powered by the Back Up power UPS TripLite SMART750RML2U.

### ***Continuum Surelite I-10 UV laser power supply:***

We use a UV Laser for generating ionizing tracks in the MicroBooNE liquid Argon TPC, more details on the laser can be found at [http://www.continuumlasers.com/products/pulsed\\_surelite\\_series.asp](http://www.continuumlasers.com/products/pulsed_surelite_series.asp)

The device is powered by the Back Up power UPS TripLite SUINT2200RTXL2UA.

### ***LuxLink DT-7201 Optical/TTL Transmitter:***

We use a TTL to optical fiber transmitter to send our trigger signal from Building ground to the DAQ racks, using detector ground. More details can be found at: <http://www.luxlink.com/support/manuals/pdf/DX7201.pdf>

The devices is powered by the Rack PDU Triplite PDU3MV6L2130.

## **DC distribution**

The DC distribution is done with a custom build low voltage PS distribution box (see in the custom component section above). The DC scheme is shown in the Figure below. The components are all commercially available.



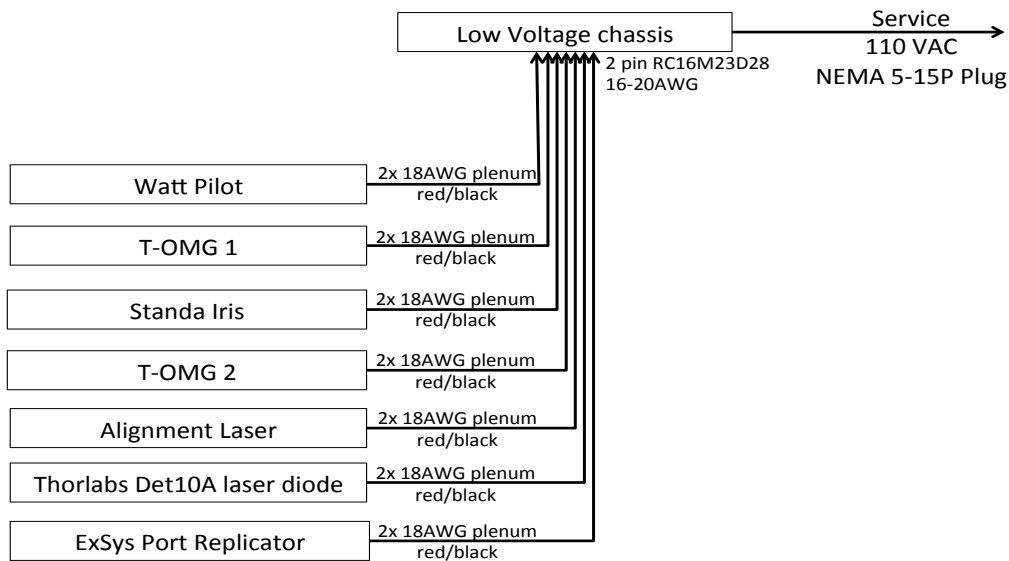


Figure 7: DC distribution

## Commercially available DC components:

### *ExSys Port Replicator:*

A USB to RS232 port multiplier is used to control all the automatic equipment. More details can be found at [http://www.exsys.ch/index.php?main\\_page=product\\_info&products\\_id=398&language=en&zenid=421e59c30029a07ff9c4e281e3196f89?disp\\_order=1](http://www.exsys.ch/index.php?main_page=product_info&products_id=398&language=en&zenid=421e59c30029a07ff9c4e281e3196f89?disp_order=1)

### *T-OMG (2 units, labeled 1 and 2 for convenience):*

Two small motorized gimbal mounts are used to steer the UV laser from the optical bench towards the cryostat. More details can be found at <http://www.zaber.com/wiki/Manuals/T-OMG>

### *Standa Iris:*

An automatic iris is used to control the beam aperture of the UV laser system. More details can be found at [http://www.standa.lt/products/catalog/motorised\\_positioners?item=421](http://www.standa.lt/products/catalog/motorised_positioners?item=421)

or [http://standa.lt/products/catalog/motorised\\_positioners?item=230&prod=stepper\\_motor\\_controllers\\_rs232](http://standa.lt/products/catalog/motorised_positioners?item=230&prod=stepper_motor_controllers_rs232)

### *Watt Pilot:*

An automatic attenuator is used to control the UV laser beam power. More details can be found at [http://www.altechna.com/product\\_details.php?id=824](http://www.altechna.com/product_details.php?id=824)

### *Thorlabs Det10A laser diode:*

To trigger on the UV laser puls, the Thorlab Det10A laser diode is used, More details can be found at <https://www.thorlabs.com/thorproduct.cfm?partnumber=DET10A>

### *Alignment laser:*

A green laser is used to do the beam path alignment of the UV laser system. More details on the green laser can be found at <http://www.edmundoptics.de/lasers/laser-diode-modules/green-laser-diode-modules/fixed-focus-green-laser-modules/84-928?&pModal=false&site=US&countryid=232>