

# LAMP Vacuum System Documentation

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## Introduction

The dual purpose is to support users running experiments autonomously and also to document the entire LAMP system for future references. Users can jump straight into their experiment without having to fully understand the complexity and flexibility of the LAMP system by referring to the documentation. Further documentation is provided for power users and other hutch scientist.

The documentation can be the first and foremost pillar to lean on when problems arise. If the LAMP Vacuum system needs a redesign or someone would like to understand its intricacies, the documentation is available for all to learn.

## Background

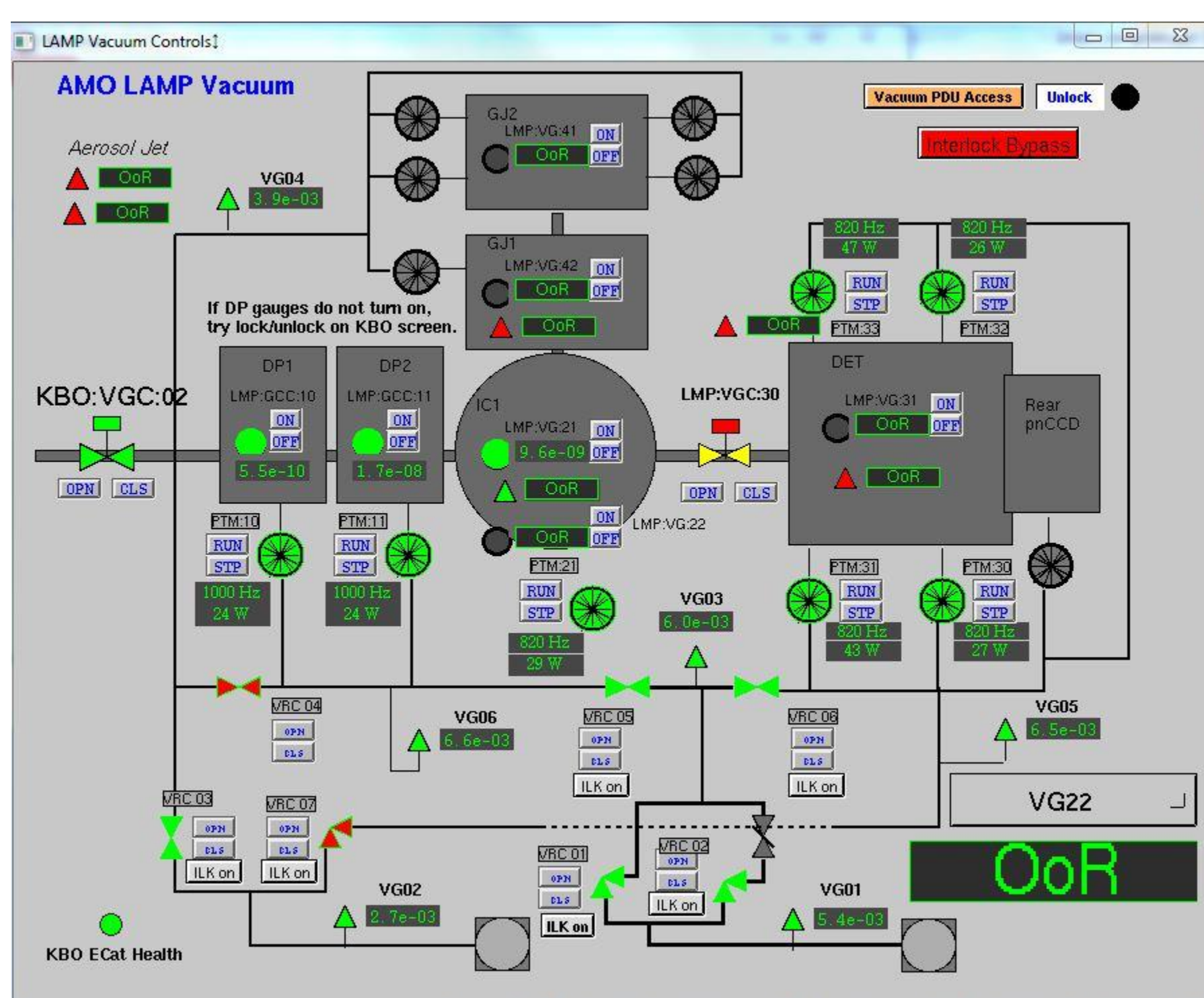


Fig 1. EDM Screen for LAMP Vacuum

In the AMO hutch, the vacuum system controls the pressure required to run soft X-ray experiments. Because soft X-rays can interact with air, high vacuum ( $10^{-9}$  Torr) is vital for the x-ray beam to hit the target. The LAMP system consists of the Interaction Chamber, Detection Chamber, and Gas Jet Source. The LAMP system is prized for its flexibility to adjust to different configurations.

In Figure 1, the vacuum system consists of pumps, valves, and pressure gauges placed in strategic areas for flexibility. Almost all chambers can be taken off for certain experiments. The vacuum system was designed to maintain low pressure even when certain chambers are not in play.

Users would like their experiments to run during their allotted beam time. They may have plans A, B and C in place just to make sure their tests yield results while using SLAC Facilities. Systems and Support Engineers try to reconfigure, create, and improve instruments to meet the users' needs.

## Documentation

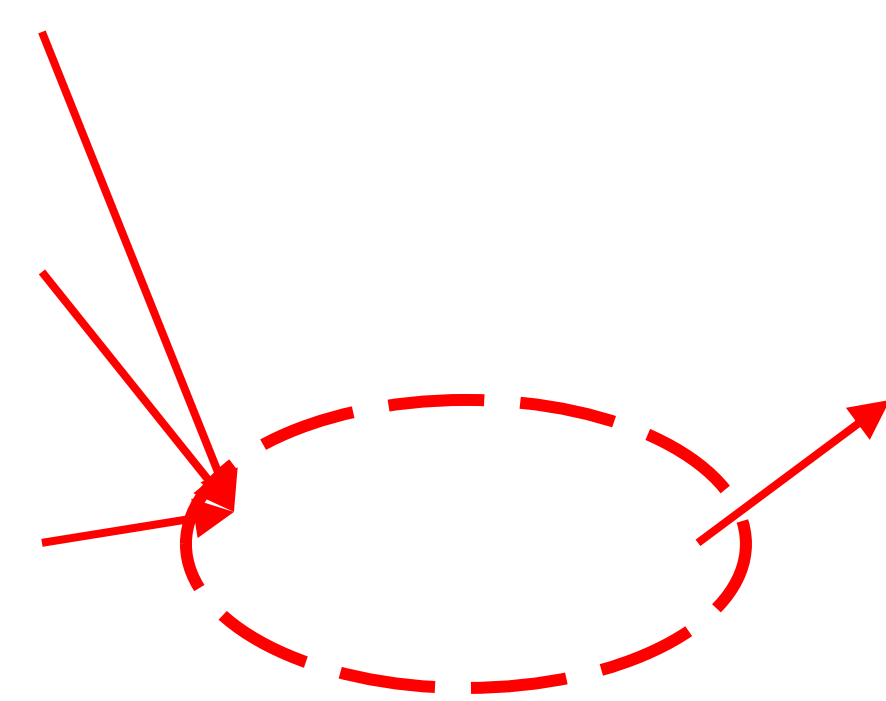


Fig 2. User Experience Flow Chart

LAMP Vacuum System requires knowledge of Beckhoff PLC software, hardware (from gauges, pumps, valves, and I/O boxes), and EDM. Documentation covers these three components in supporting users to connect and operate the LAMP Vacuum system. Currently, the systems/support Engineer interfaces between the two but with up-to-date Documentation, the load of the support Engineer can be greatly diminished and redirected.

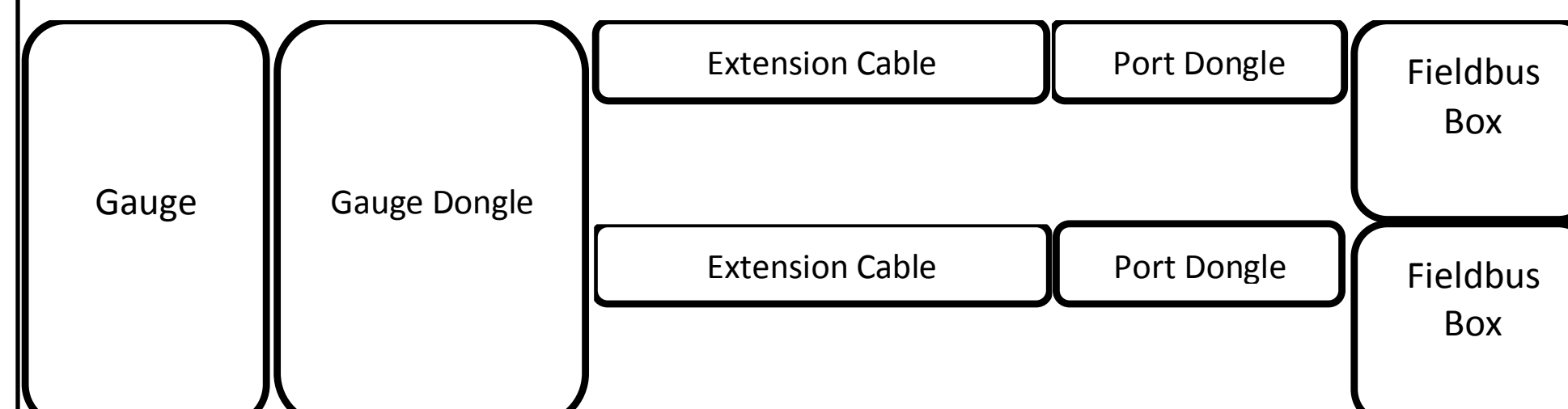


Fig 3. Cold Cathode Connection

The LAMP Documentation was created to first teach the users how to hook up gauges but also transformed into a revamp of the LAMP System. In Figure 3, the components related to connecting a cold cathode gauge to the fieldbus are shown. Now, the document shows how to connect different types of gauges, pumps, and valves physically and also control them on the GUI. The PLC logic (Magic behind the Motors) was also mapped out for the users.

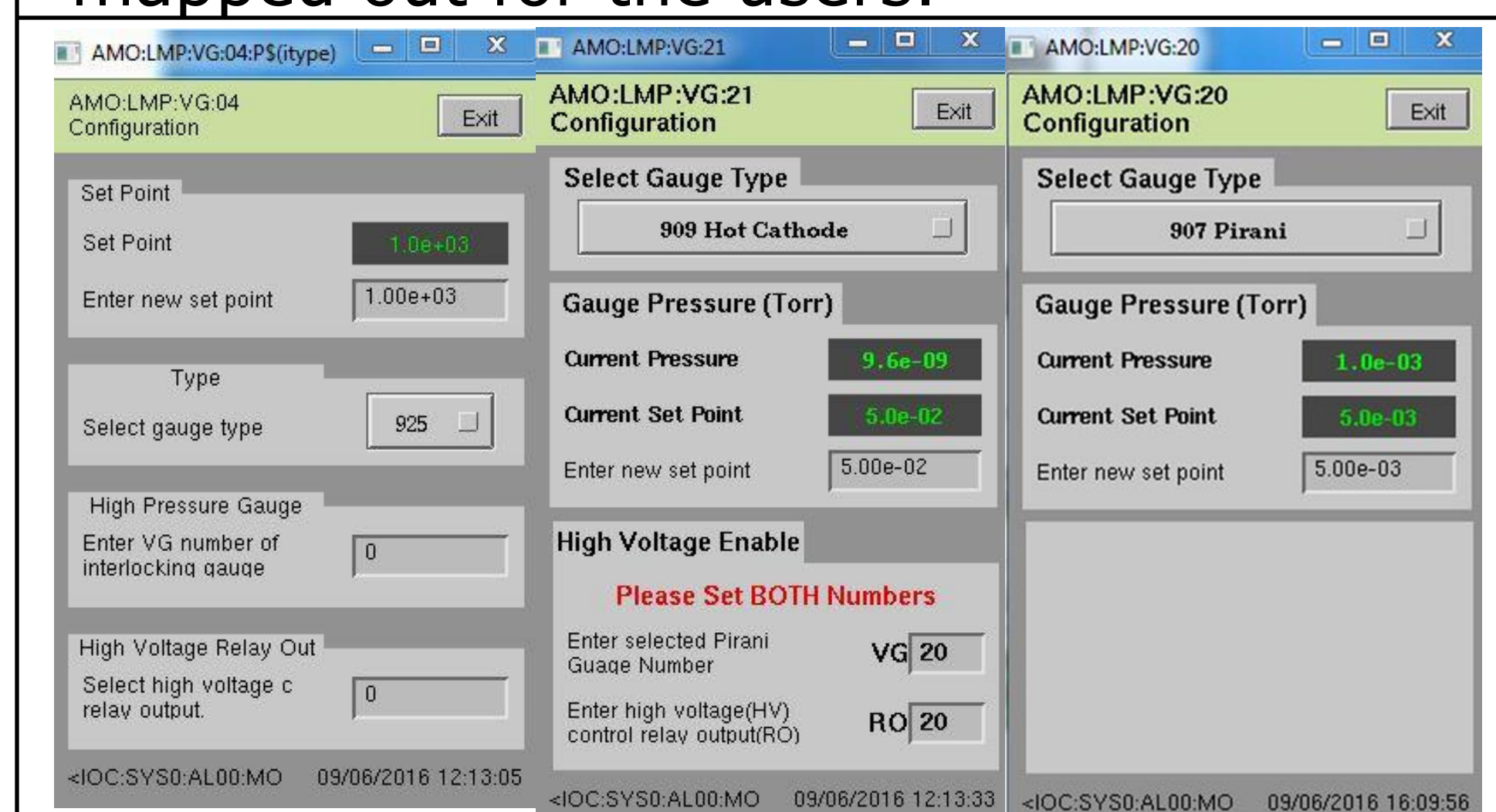


Fig 4. GUI Revamp (Left:Old, Right:New)

The GUI has been edited to reflect a better user experience. Based on the gauge type chosen, the GUI adjusts accordingly. Current Pressure has been added to simplify monitoring.

The PLC Logic was revamped internally with better coding style. Bugs in the PLC were stamped out. The setpoint triggering process was corrected after referring to source code. Function blocks were simplified to increase readability. Pressure states were added to give better readback of the PLC for EPICS.

In Figure 5, LAMP Fieldbus shows the physical connections of the Beckhoff modules. Areas of the Topology were edited for better user readability.

The documentation serves to upgrade the user's knowledge of the LAMP system from black box to a tool.

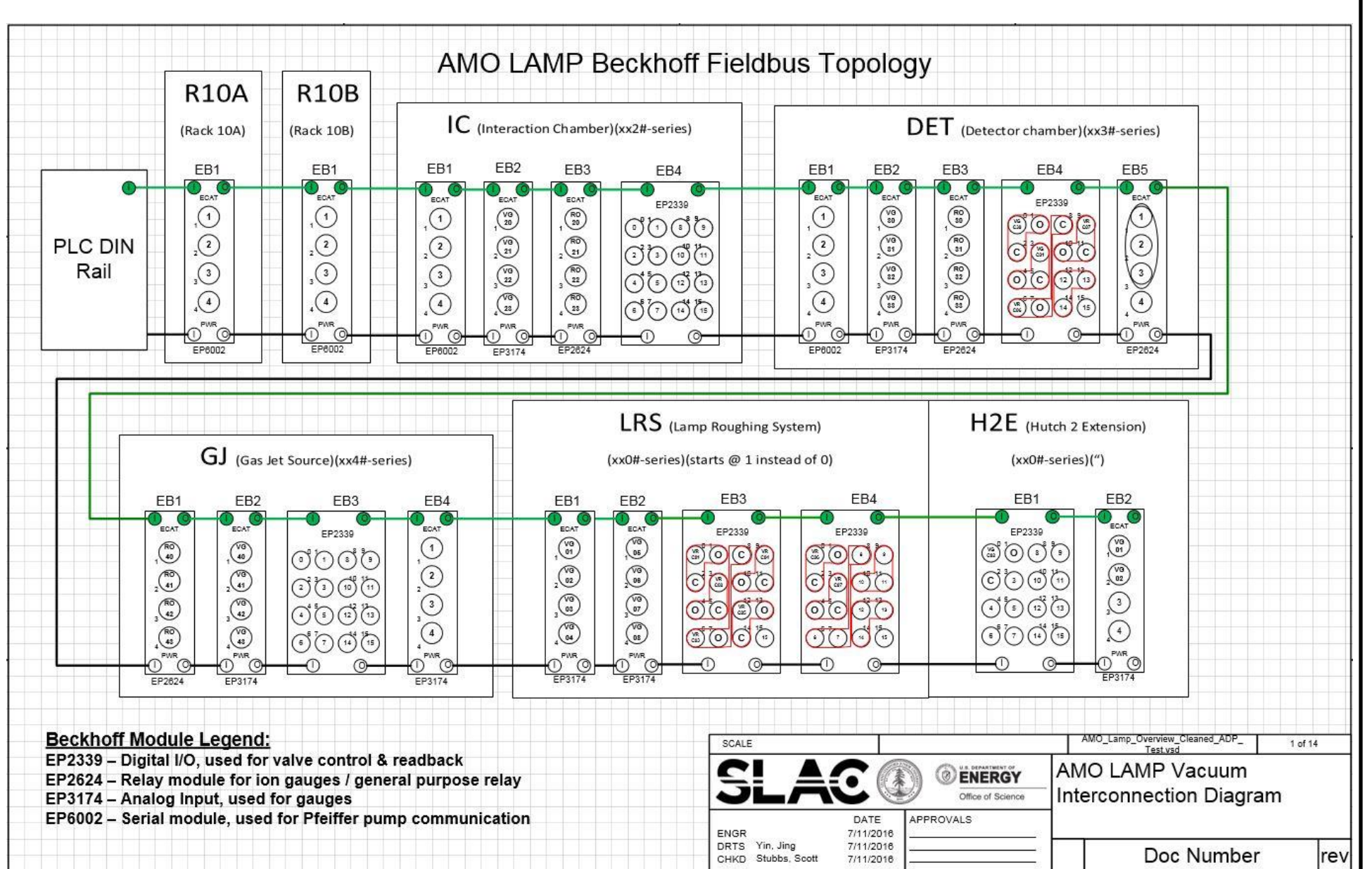


Fig 5. LAMP Fieldbus

## Conclusions

The LAMP Documentation serves to provide another leg of support for the users in the AMO Hutch. Documentation also serves as a catalyst for system engineers to review their work and to reduce training loads for the future. Knowledge can be referenced by the user manual while allowing the now well rested systems engineers the time to upgrade existing hardware and software for future projects.

I hope to create a goal to finish the documentation and see it implemented before continuing to upgrade it for the future.

## Acknowledgments

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