

Annunciator

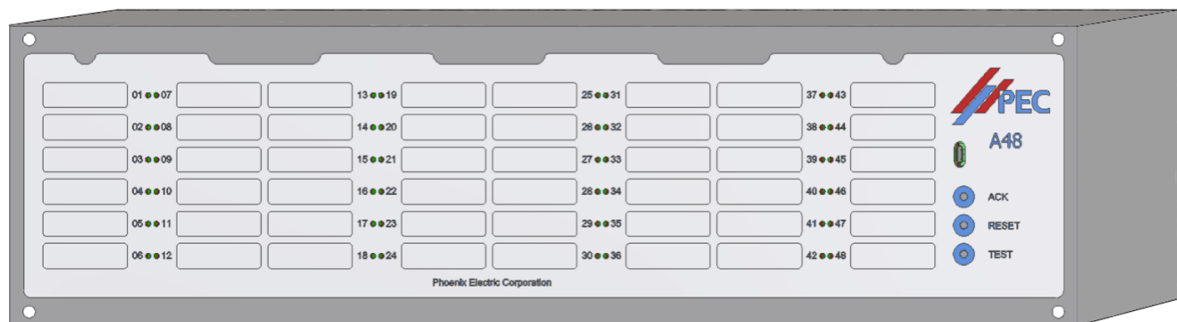
ELECOMP Capstone Design Project 2022-2023

Sponsoring Company:

Phoenix Electric Corporation

40 Hudson Road
Canton, MA 02021
781 821 0200

WWW.PEC-USA.BIZ



Company Overview:

PEC specializes in developing custom products, systems and solutions for the power transmission and distribution industry.

PEC custom engineers control, protection, and interlocking systems for leading medium and high voltage gas insulated switchgear manufacturers worldwide. These systems provide a reliable, user-friendly control interface for SF6 gas-insulated switchgear and generator/transmission power circuit breakers in accordance with ANSI/IEEE requirements. Control systems range in size and complexity from relatively small motor control equipment to large complex substation control and protection installations.

All control philosophies and interlocking protocols conform to US utility standards and procedures for safe, reliable operation. Controls are manufactured using only readily available heavy-duty UL listed components. Provided with the control equipment, complete ANSI drawings facilitate installation, commissioning, testing, maintenance, and troubleshooting.

PEC headquarters and manufacturing facility are located in Canton, MA.

Technical Director:

Sandro Silva '02

Director of Engineering

401 258 2457

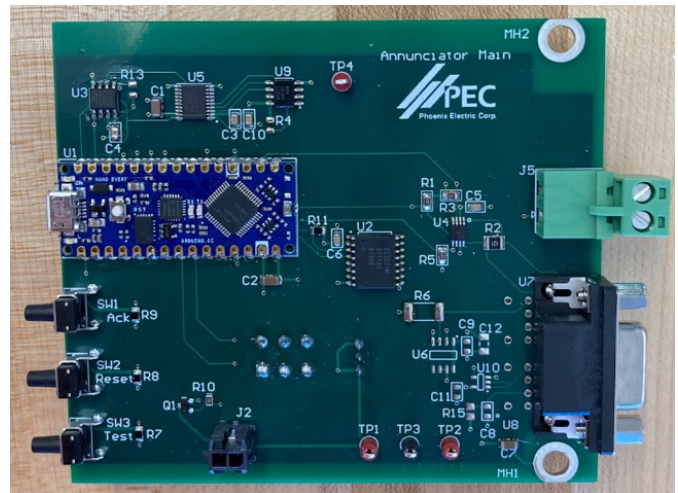
sandro.silva@pec-usa.biz

Consulting Technical Director:

Mike Smith '01

Consulting Technical Director

mike@boldcircuits.com



Project Motivation:

Our control circuits are monitored by third party annunciators that collect data, alarm signals, and the health of our circuits and display that information locally via LED lights. Having an internally designed annunciator would reduce our dependence on third party hardware and allow tighter integration with our other equipment.

Anticipated Best Outcome:

PEC expectation for April 2023 is to have the team present a functional prototype of the Annunciator system that would be functionally equivalent and reliable in comparison to current options available on the market at a significantly lower cost. Last year's Capstone team developed the baseline prototype. This year's team will improve on that design, add new features, and develop a new power conversion board for the front end. The GUI will also be improved and updated to incorporate the latest features.

Engineers will choose proper components, design, program, and build an appropriate system, and test at the components and system level.



Major accomplishment expected for 2022/2023 Capstone:

- Design and Build a universal PCB power converter using COTS hardware on a breadboard (Fall 2022)
 - Input: 125VDC or 120VAC
 - Output: 12VDC
- Expand flash Memory
- Implement and test Modbus
- Fabricate, build, and test power converter PCB (April 2023)
- Update the Graphical User Interface (GUI) for Configuring System Parameters
- Incorporate more industry alarm sequences
- Update Display Board PCB design from last year's Capstone team
- Update Main Board PCB design from last year's Capstone team

Project Details:

PEC expectations for April 2023 is to have the team present working prototypes of the boards and control GUI and demonstrate their full functionality.

The basic functions of the Annunciator are:

- DC/DC Conversion:
 - Input 125VDC or 120VAC, output 12VDC
- 12 to 48 Channels of Configurable (NO/NC) Continuity Checks
- Non-Volatile Memory for storing system configuration
- Real Time Clock
- User Interface to GUI
- Alarm Sequences
- Time Delays
- Pushbutton interfaces
- 12 LED Display
- 3 User Pushbuttons
- Alarm Horn



The GUI will allow the user to set the continuity type (NO or NC) and alarm delay for each of the 48 channels as well as the alarm sequence to use.



Composition of Team:

The team for this project will be composed of one(1) or two(2) electrical engineers and one computer engineer. The electrical engineer(s) should be familiar with design, testing and debugging electrical circuitry. Concurrent enrollment in ELE391 is required. The computer engineer should have experience with python/tkinter GUI development and Arduino coding. This project will require the use of such lab equipment as oscilloscopes, multi-meters, and soldering tools along with being able to understand data sheets. The engineers should have knowledge of communications, analog and digital electronics. These team members will be responsible for designing, testing and resolving any related electrical or coding issues.

The URI Engineers will be supported by PEC Engineers and URI circuit board and component specialists.

Skills Required:

- Arduino IDE and Python/tkinter GUI Development experience
- Knowledge in digital and analog circuit design with Spice simulation experience.
- Interested in PCB layout and design.
- At least one team member must be concurrently enrolled in ELE391, Printed Circuit Board (PCB) Design

Anticipated Best Outcome's Impact on Company's Business and Economic Impact:

PEC's vision is to be the recognized leader in the electric power industry for providing customized solutions tailored to specific customer transmission and distribution requirements, backed by unwavering customer service.

The best outcome for this project is to have a fully working Annunciator system that will help PEC diversify our product portfolio and will allow us to be more competitive and less dependent on other companies.

Broader Implications of the Best Outcome on the Company's Industry:

With further development and expansion of our system and circuits, we can see that this essential device being utilized to increase power grid safety and even municipal safety. We would envision improving the reliability of numerous electrical applications in the power grid workplace, and home for a more reliable and safer electrical supply system.