



# Programmable Logic Controllers (PLCs)

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## Abstract

Our team created introductory and advanced lessons, activities and research projects using OMRON CP1L and Allen Bradley MicroLogix 1200 Programmable Logic Controllers (PLCs).

The introductory work focused on Examine of Closed (XIC), Examine if Open (XIO) and Output Energized (OTE) programming instructions.

The advanced work focused on establishing wireless communications with the PLC. The motivation to control and monitor PLC activity is being driven by industry using this technology to control manufacturing processes. Potential employers are requesting these skill sets in our students.

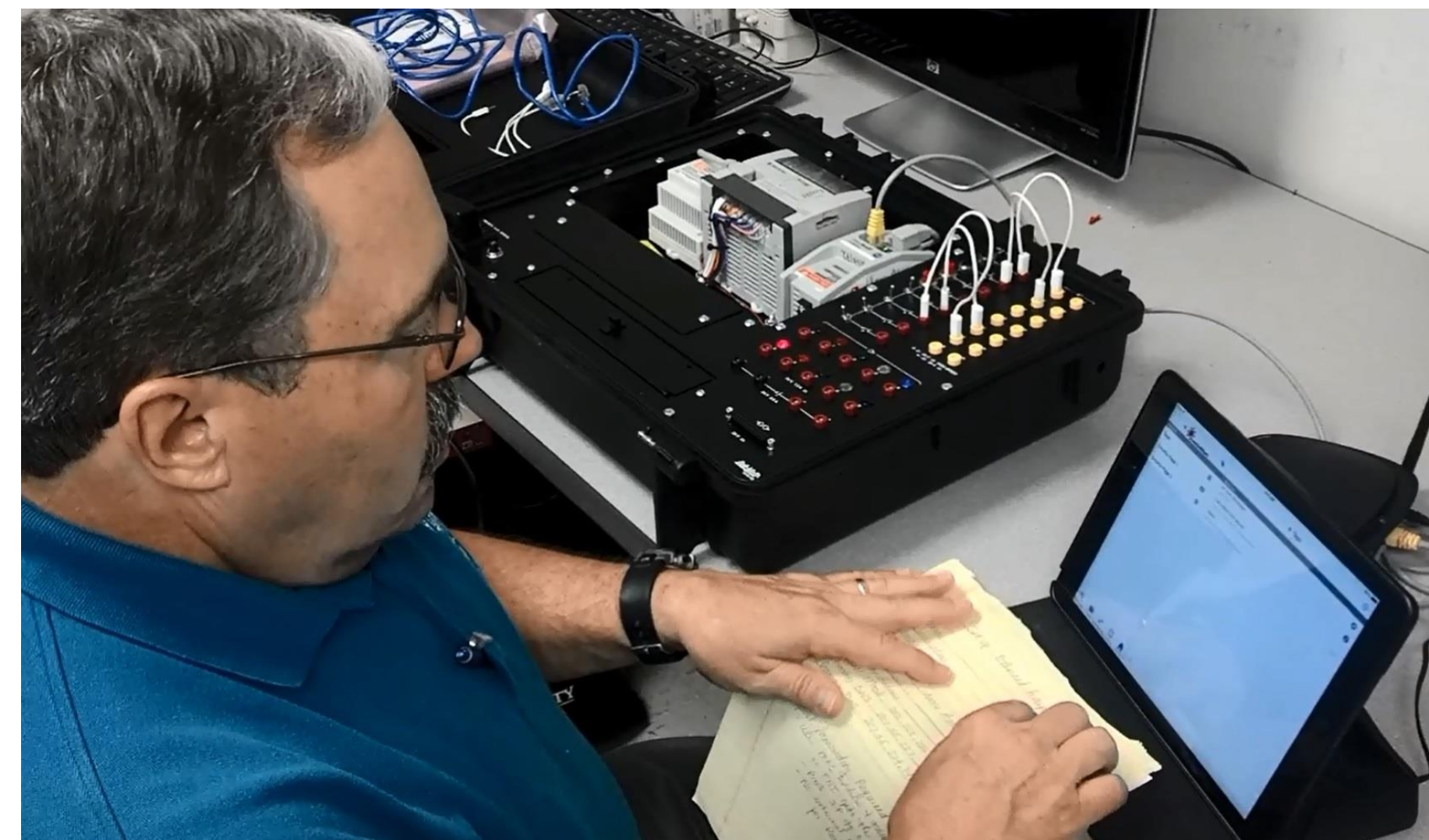
## Research Objective

The objective of the introductory research is to demonstrate that PLCs have the ability to interpret inputs and activate outputs in various ways while inputs and outputs in electrical circuits are constrained by the wiring itself.

The objective of the advanced research is to demonstrate the ability to control PLCs using wireless devices. This includes software set up of the router, Ethernet adapter and wireless device. ScadaMobile was the software chosen to be installed upon the wireless devices, Smartphone and tablet. Communication protocols had to be established between all of these devices.



## Methodology

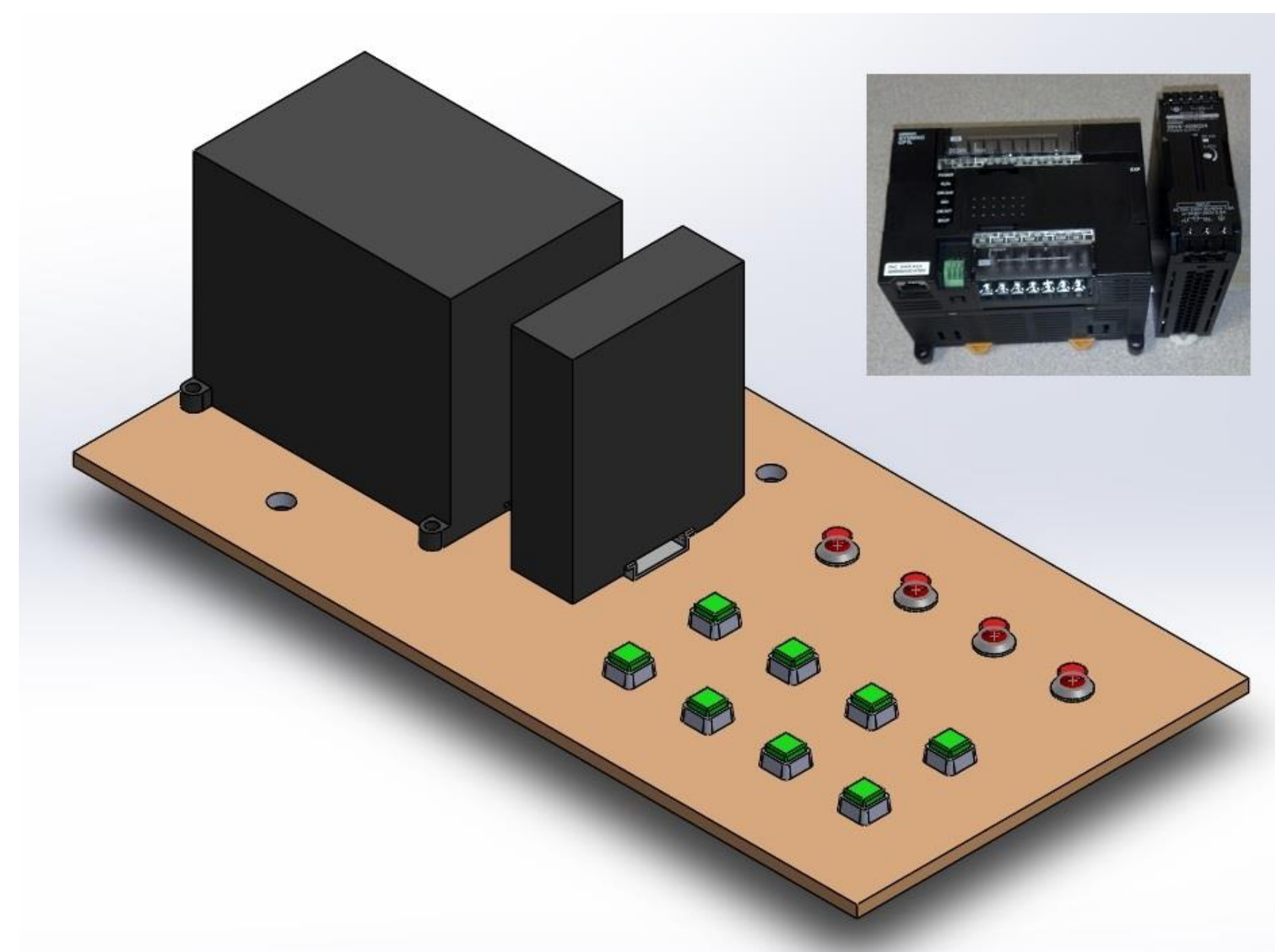


The introductory research required construction of a PLC training unit using an OMRON CP1L PLC donated by GEA of Texas, Inc. The unit has 8 inputs (momentary switches) and 4 outputs (lamps).

The advanced research required setting up a Belkin router to allow communication between the PLC and the wireless device. In addition to the router, an Ethernet interface adaptor was required.

The research used ScadaMobile software to communicate with the hardware. This required creation of a setup file to address the PLC.

All the process steps were documented.



## Results and Conclusions

The introductory PLC research enables students studying electrical circuits to see the significant improvements to automation brought by PLCs using logical circuits and electrical circuits based on hard-wired inputs and outputs.

Without any changes to the trainer wiring, lamps could be both illuminated and extinguished at the touch of a button.

Results of the advanced PLC research will enable the students to have a better understanding of the application of IP addressing when connecting the PLC, router, Ethernet adapter, and wireless device. The conclusion verifies the need for a good understanding of networking and the ability to troubleshoot both the communication software and network protocol.

## References & Acknowledgements

1. Omron Users Manual
2. LogixPro Software Simulator
3. For the advanced PLC wireless research project, the following references were used:
  - a. ScadaMobile 2.4.0 Users Manual
  - b. SCADA Architectures Wikipedia
  - c. ScadaMobile One
  - d. 1761-NET-ENI Configuration Utility
  - e. MicroLogix Ethernet Interface
  - f. Belkin Router Users Guide

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