

LISTEN.
THINK.
SOLVE.®

L09 - Basic PLC Programming

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PLC Basics Agenda

1. Introduction to Terms / Concepts


2. Programming a PLC

3. Application Example

4. Hands-On Lab

How did the “PLC” get started?

- 1968 -> GM (Hydramatic Division) approached suppliers to help with a problem:
 - Relay “walls” covered the plant floor.
 - Changes and Troubleshooting took weeks/months. High costs
 - Every change (model year) was major destruction and re-wiring.

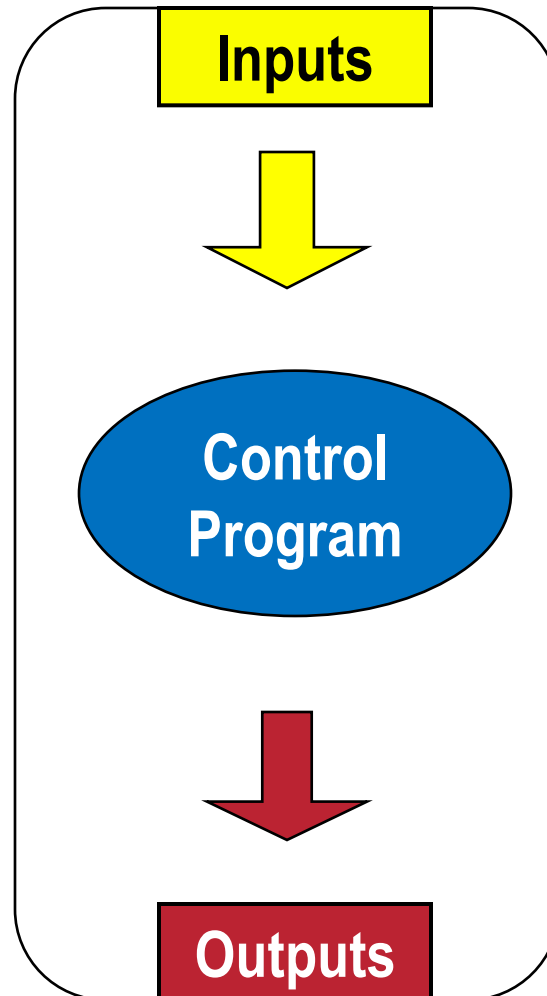


GM needed the flexibility of “solid state”; a controller that could be programmed and maintained by plant engineers; and was rugged enough to withstand the factory environment and provided easy troubleshooting...

✓ **Allen-Bradley PLC**

What is a PLC?

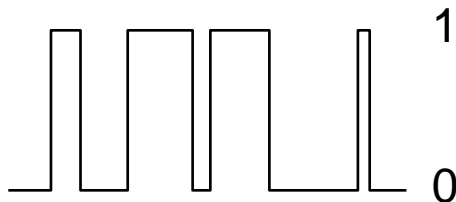
- A solid state (electronic) device that controls output devices based on programming and input signals.



Two types of I/O (Inputs & Outputs)

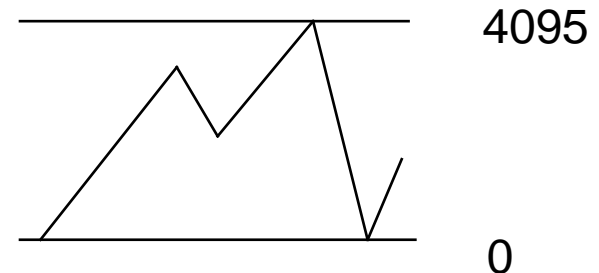
- **Digital**

- Also called Discrete
- Has two possible states
- Represented by “1” or “0”
- Electrically:
 - “0” is usually 0 Volts (AC or DC)
 - “1” is a fixed voltage value such as 5VDC, 24VDC, 120VAC, etc.
- Technology: Relays, Triac, Transistor, MOSFET, TTL



- **Analog**

- Has many possible states between two values.
- Example: Temperature sensor.
- Range of values between two limits. For example:
 - 0°F represented by “0”
 - 100°F represented by “4095” (example)
- Electrically: 4-20mA, 0-5VDC, -10 to 10VDC



PLC Control Program

- **Program**

- Instructions used to process inputs and set outputs
 - Primarily written as (Relay) Ladder Diagram:



- Programs can also be written in other languages
 - Function Block or Structured Text
- **Data (Variables)**
 - Examples
 - Start_Button is assigned to a digital input
 - Light is assigned to a digital output

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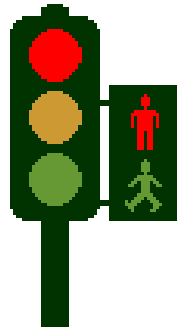
Today's applications require a high level of control capability and advanced features



- Arithmetic (Addition, Subtraction, Multiplication, Division, etc)
- Data Comparison (Equal, Greater Than or Equal, Less Than or Equal)
- Word Manipulation (Copy, Move, etc)
- Communications or Messaging data between PLC's

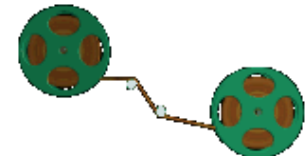
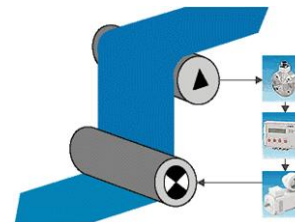


- Sequencing
- Data Manipulation



• Motion and Process Control

(Used for Temperature, Pressure, Speed, Flow regulation)



Simple PLC Instructions (IEC 1131)

- Contacts

- Direct 

- Reverse 

- Coils

- Direct 

- Reverse 

- Set 

- Reset 

- Instruction Blocks

- Arithmetic (+ - * / COS SIN TAN)

- Binary (Mask, Shift)

- Boolean (AND,OR,NOT,XOR)

- Comparator (< > = CMP)

- Counter (CTD, CTU, CTUD)

- Data Conversion (ANY_TO_**)

- Process (PID, SCALER, more...)

- String (FIND, REPLACE, more...)

- Time (TON,TOF,TONOFF)

Ladder Logic Example

This is a very simple rung of logic, from a PLC program:



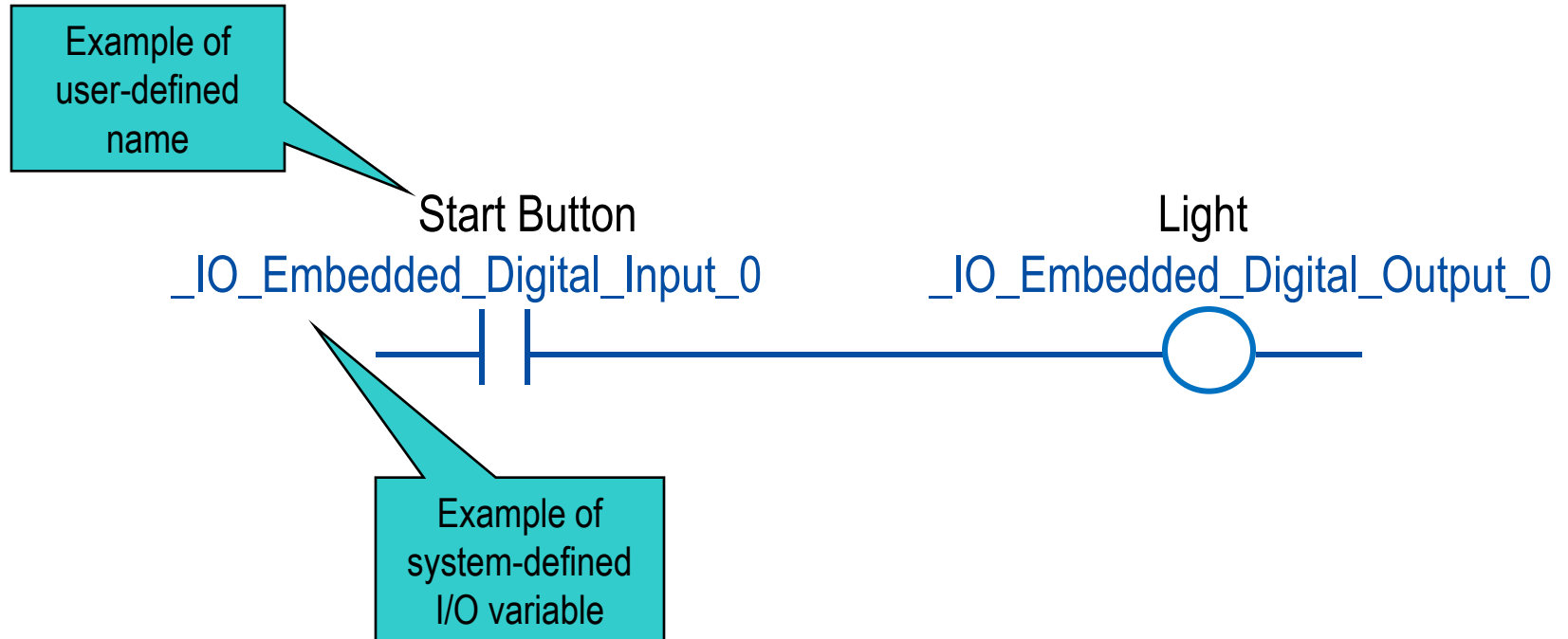
The rung is read as:

If the Start Button is on, turn the Light.

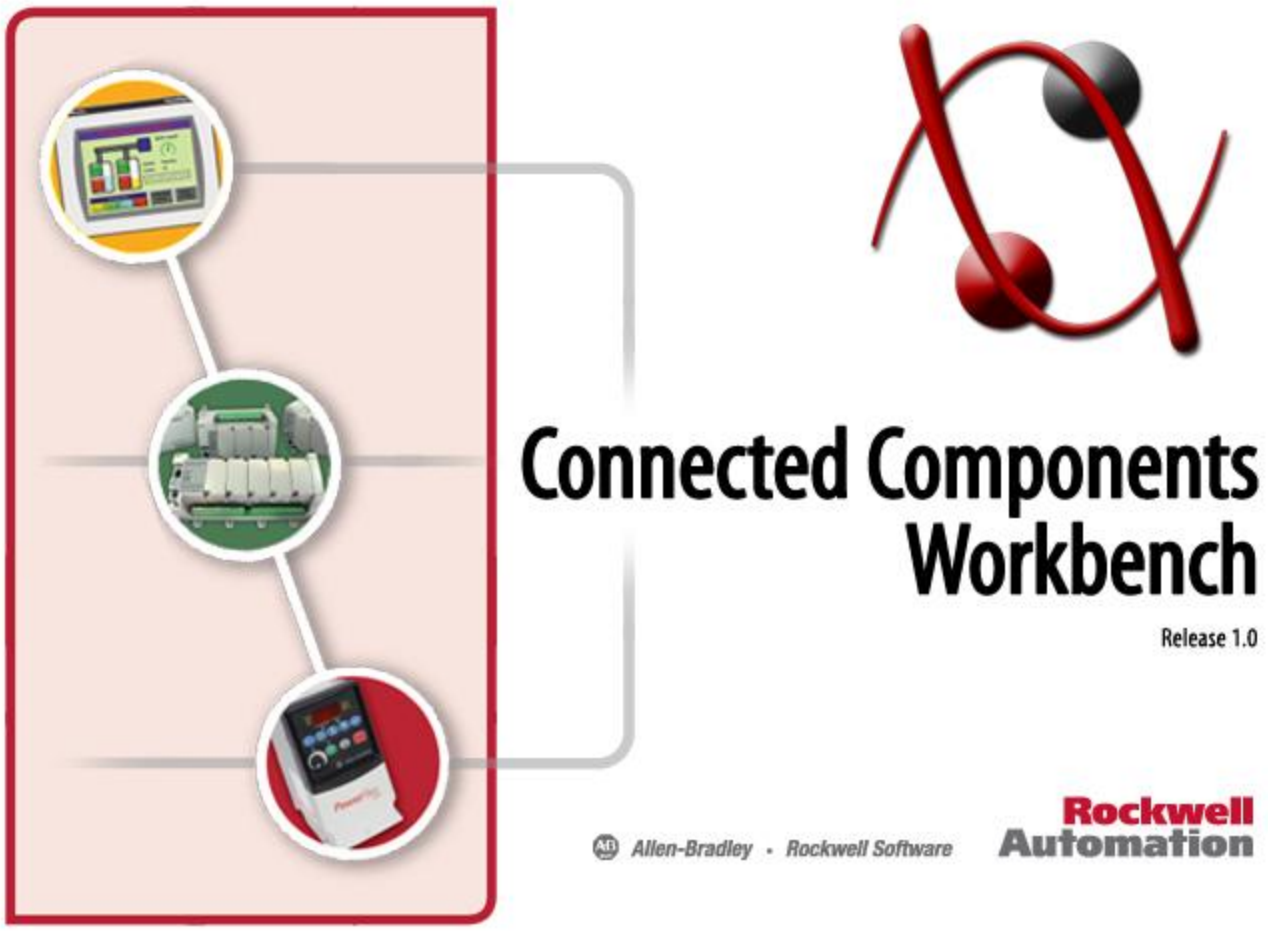
If the Start Button is off, then turn the Light off.

I/O Addressing

Often, a descriptive name of the device connected to the I/O point is used in addition to, or in place of the I/O variable which describes the physical location on the controller.



Software Introduction



**Connected Components
Workbench**

Release 1.0

**Rockwell
Automation**

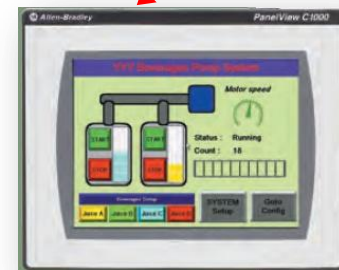
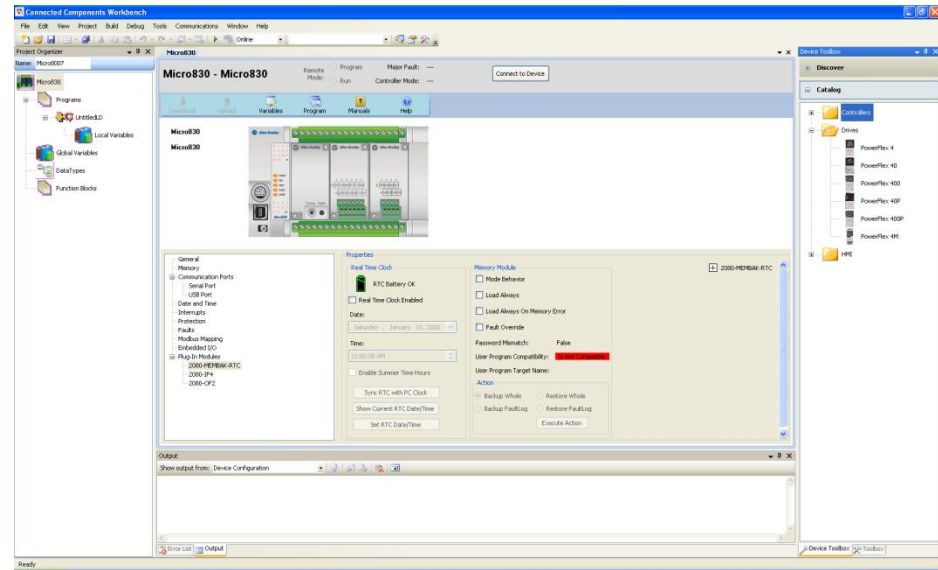
Allen-Bradley • Rockwell Software

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Powered by Visual Studio

Connected Components Workbench Software

- **Easy to Acquire/Install**
 - Free Internet download
- **Easy to Configure**
 - Single software for component class products
 - Graphical Device Configuration
- **Easy to Program**
 - Extensive use of Microsoft and IEC-61131 standards
 - Symbolic Programming
 - Rockwell Automation and user-defined function blocks
- **Easy to Update**
 - Software updates available via Internet



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So where could you use a PLC?

- Conveyor control
 - Printed circuit board handling equipment
- SCADA(Supervisory Control And Data Acquisition)
 - Remote pump/lift station (water/wastewater)
 - Flow monitoring for leak detection (Oil & Gas)

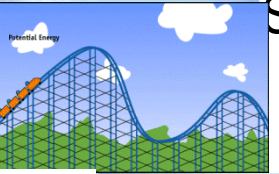


Strapping machinery / trash compactors



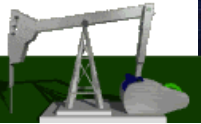
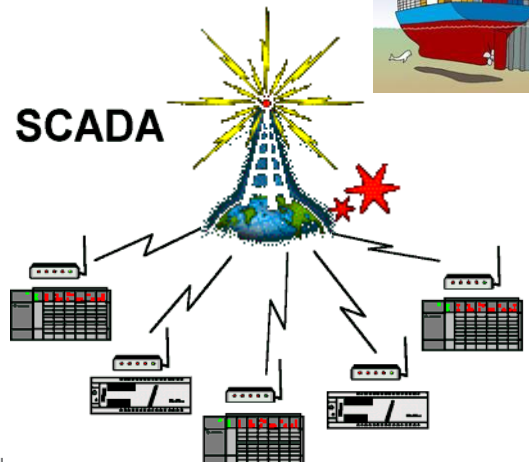
- Palletizers
- Compressor control

Amusement park rides and attractions



- Hard-wired relay panels or Single Board Computers

- Many, many more



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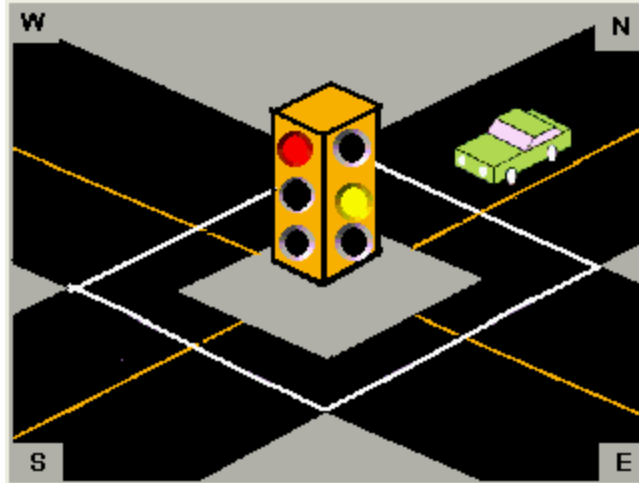
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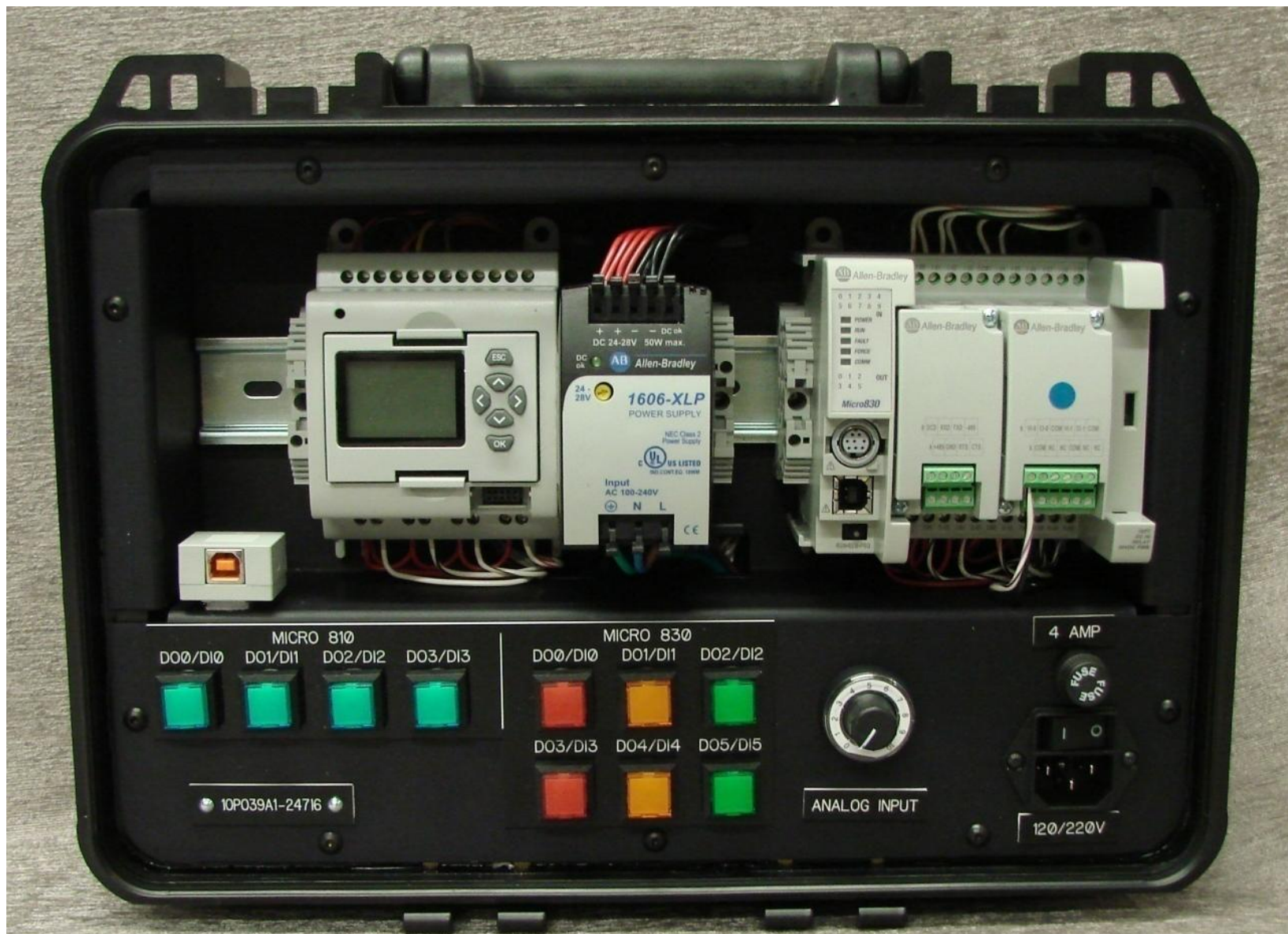
4. Hands-On Lab

Programming a PLC - Traffic Light example



Now let's take a look at a modern traffic light application. With sensors to determine the presence of a car at the various parts of the intersection, the traffic light controller must determine the lighting sequencing and timing to allow traffic to flow in a orderly fashion. In your lab, you will learn to program a Micro800 to control a traffic light and use it and our PanelView Component operator interface to test the program.

Your Lab box



For more information on the
Micro800 and Connected
Components Workbench, please
visit the Essential Components
Booth



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