

# Embedded System Design Techniques™

## Building Your Own Internet Connected PLC

### Class 5: PLC Application Design

April 27<sup>th</sup>, 2018  
Jacob Beningo

# Course Overview

## Topics:

- PLC Fundamentals
- Designing a PLC
- PLC Software Design Part 1
- PLC Software Design Part 2
- **PLC Application Design**



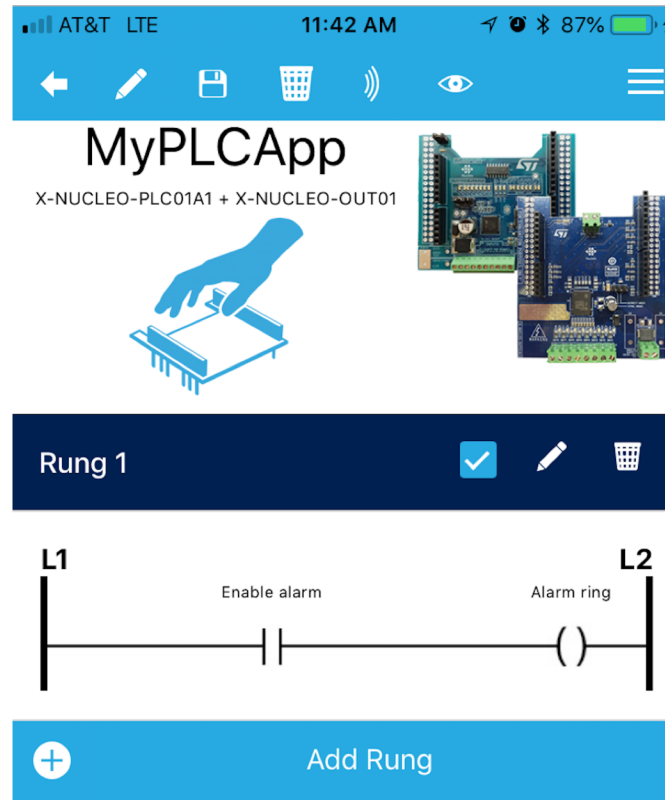
# Session Overview

- Our First Application Review
- Building a Latch
- Experimenting with Counters

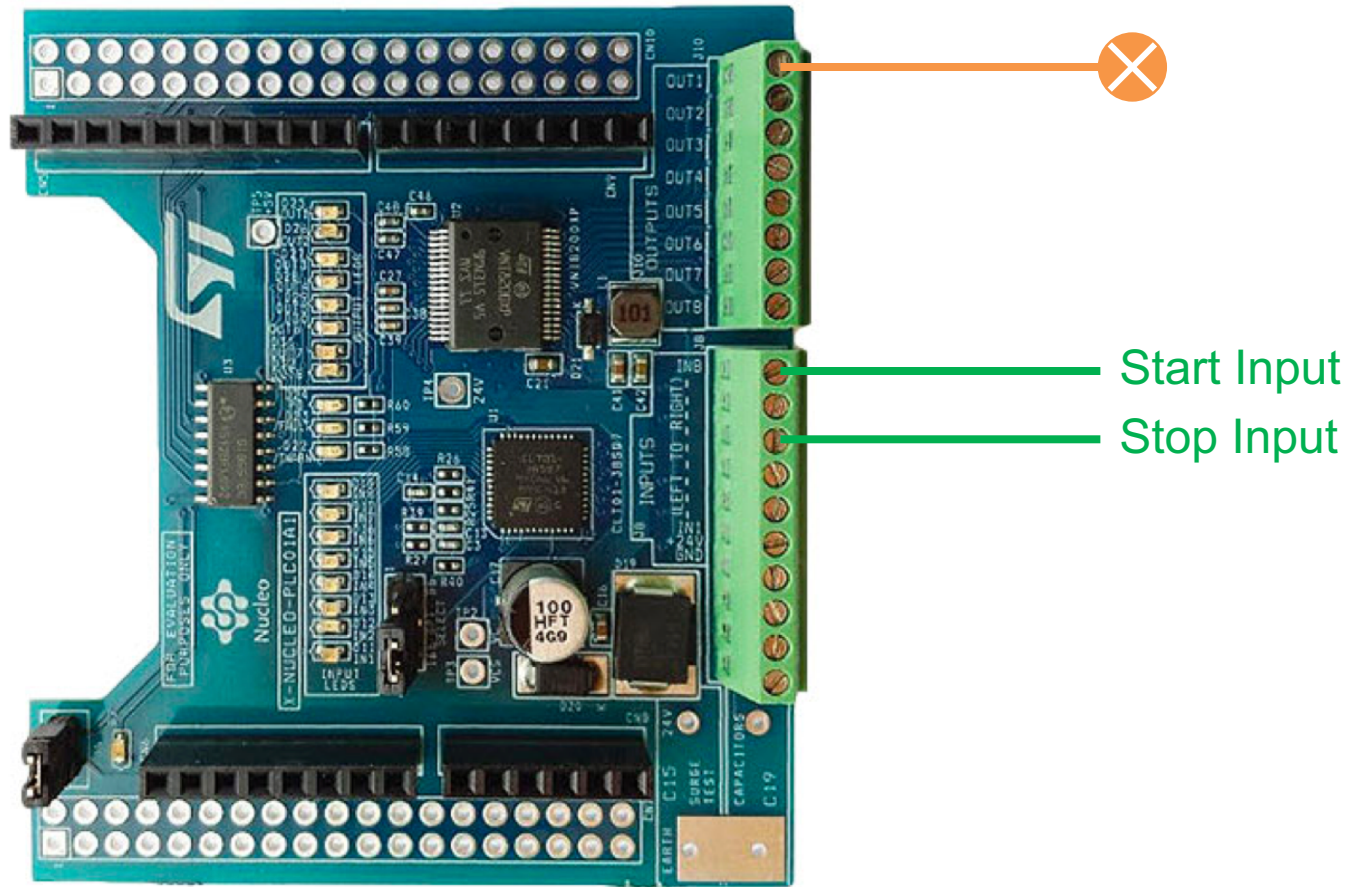


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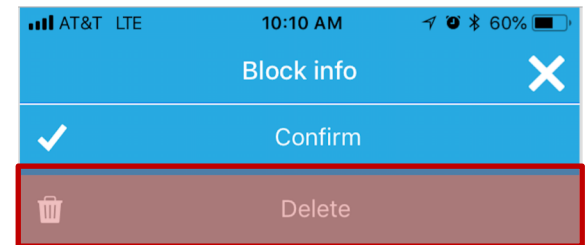
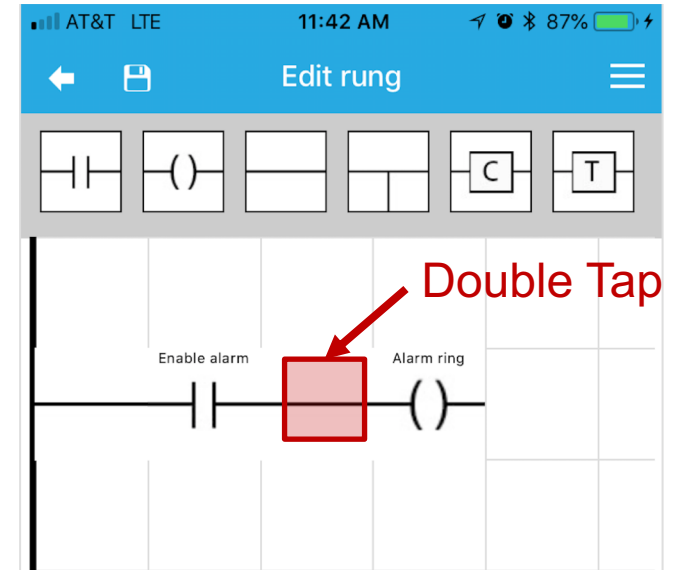
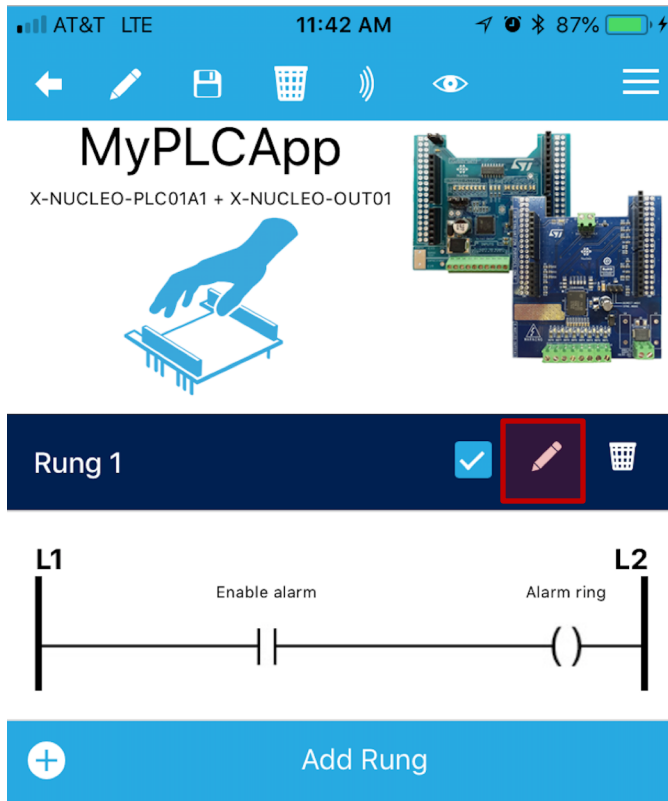
# Our First Application



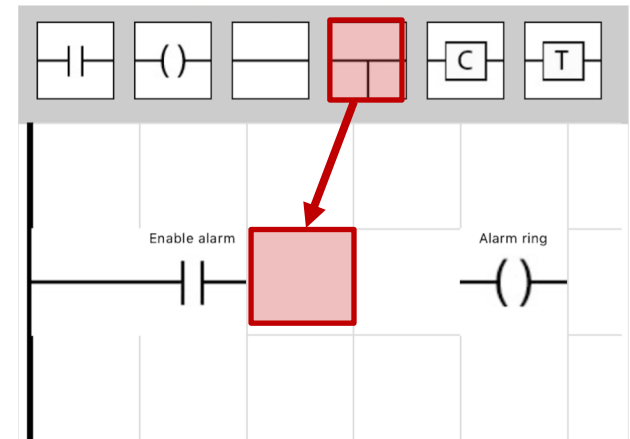
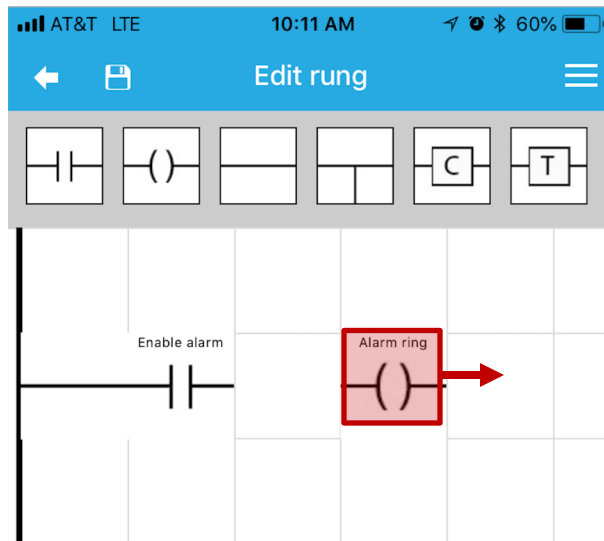
# Building a Latch



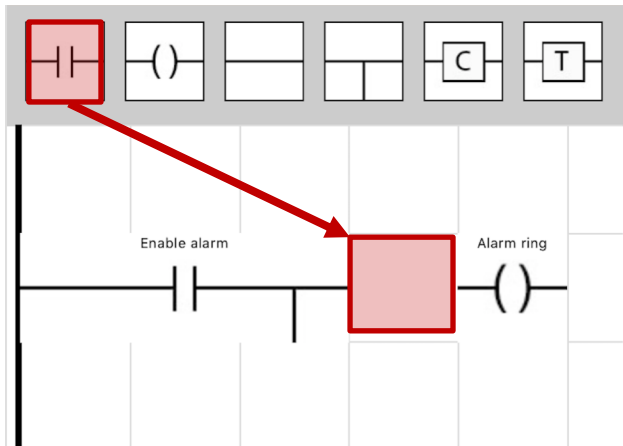
# Building a Latch



# Building a Latch



# Building a Latch



The "Block info" menu is displayed on a mobile device. The status bar at the top shows "AT&T LTE", "10:13 AM", and "60%". The menu has a blue header with "Block info" and a close button (X). The "Input" dropdown is highlighted with a red box. Below it are fields for "Label" and "Free text". The "Type" section has a dark blue header. Under "Type", "Normal" is selected with a checkmark, and "Negated" is unselected. At the bottom, there is a blue "Confirm" button with a checkmark, and a "Done" button. A red box highlights the bottom of the menu, showing the values "I2" and "I3".

# Building a Latch

AT&T LTE 10:13 AM 60%

Block info X

Input I2

Label

Free text

Type

Normal ✓

Negated

✓ Confirm

Done

Enable alarm  
Pressure sensor  
Electric valve

Free text



Input I2

Label Free text

Stop Alarm

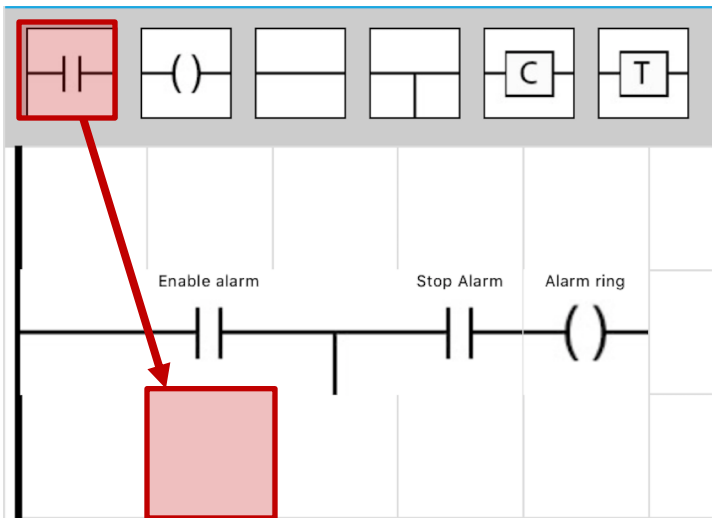
Type

Normal ✓

Negated

✓ Confirm

# Building a Latch



Input

Label

Free text

Type

Normal ☒

Negated ☐

☒ Confirm

☐ Done

16

17

18

08



# Building a Latch

Input 08 ▼

Label ▼

Free text

Type

Normal ✓

Negated

✓ Confirm

^ v Done

Enable alarm  
Pressure sensor  
Electric valve

Free text



Input 08 ▼

Label Free text ▼

Latch Alarm

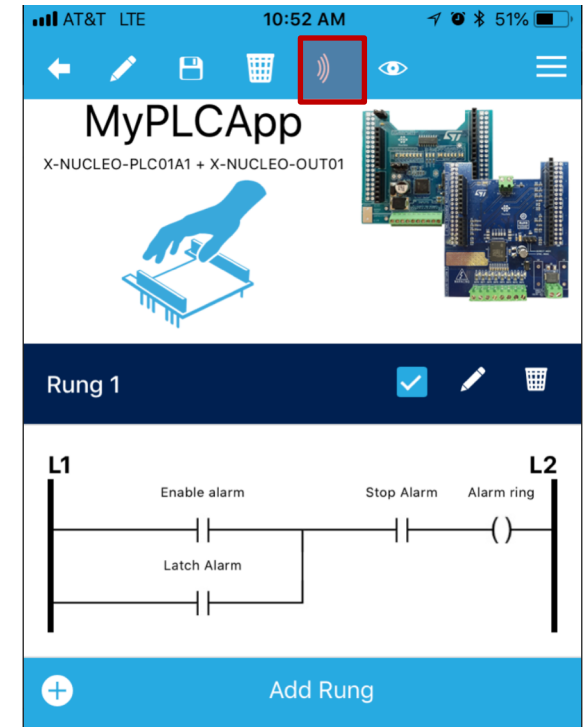
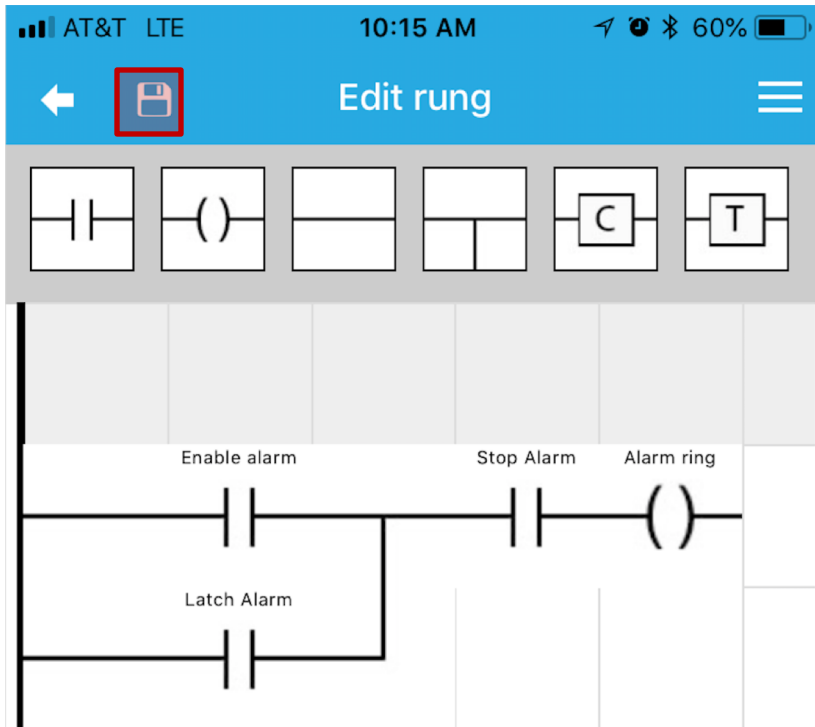
Type

Normal ✓

Negated

✓ Confirm

# Building a Latch

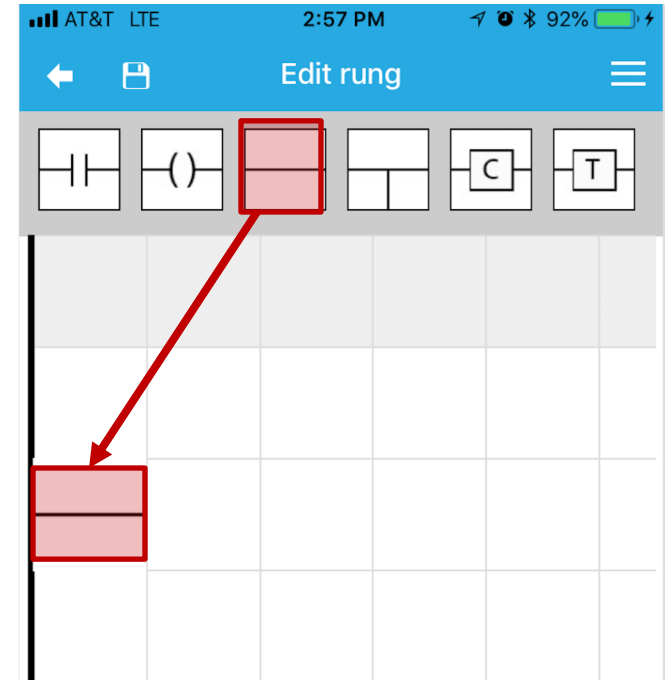
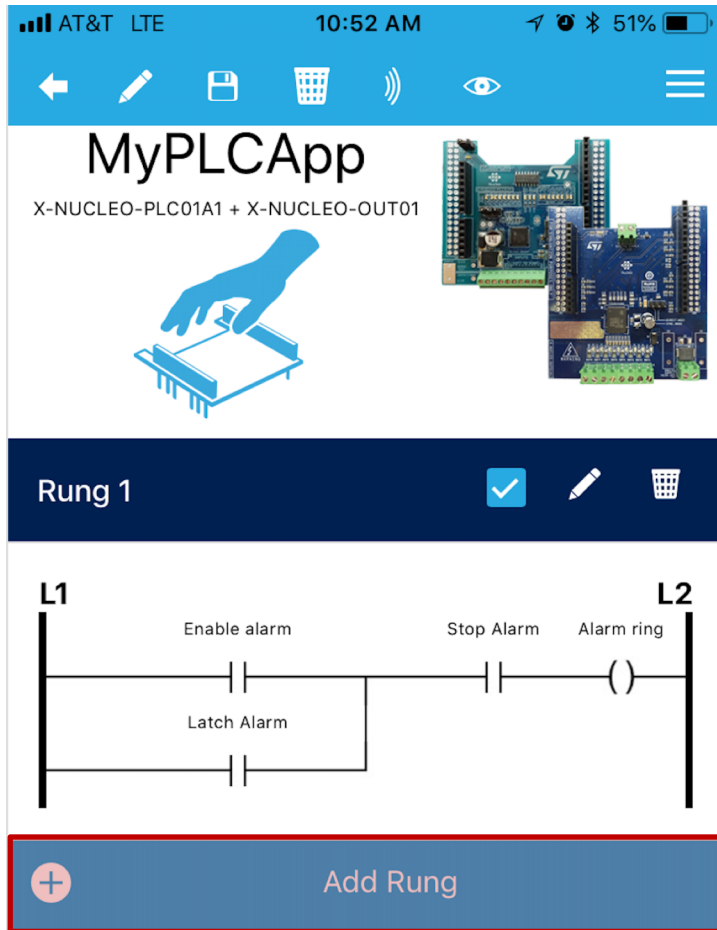


# Experimenting with Counters

Counters are used to increment, decrement or index values.

- Requires an input
- Requires an output
- Output is true when the specified value is reached

# Experimenting with Counters



# Experimenting with Counters

Input 18 ▾

Label ▾

Free text

**Type**

Normal ✓

Negated

✓ Confirm

⏮ ⏭ Done

15  
16  
17  
18



Input 18 ▾

Label Free text ▾

Button

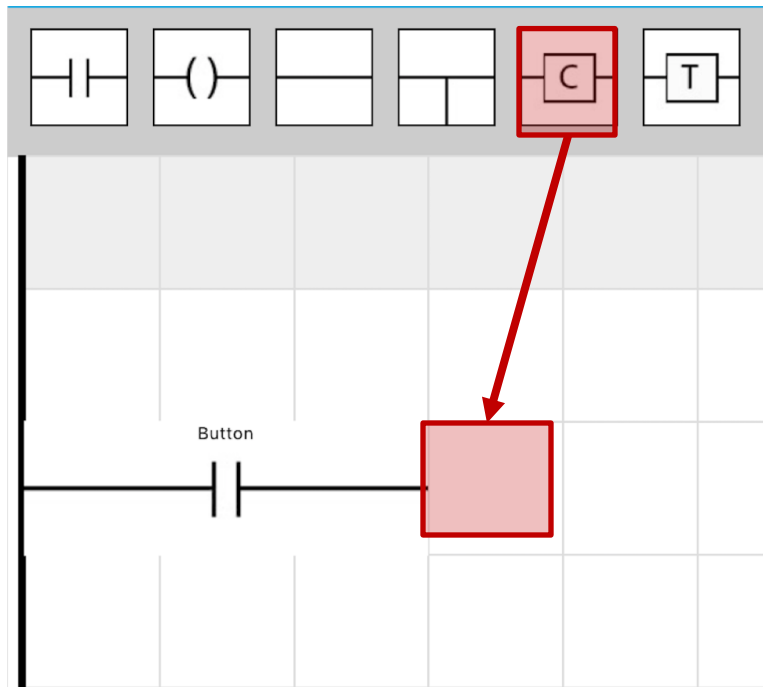
**Type**

Normal ✓

Negated

✓ Confirm

# Experimenting with Counters



A screenshot of a digital counter configuration interface. The interface has a red border. At the top, there is a header bar with the text 'Counter' and a dropdown menu showing '022'. Below this is a section with a dark blue header 'Counter Id' and a white input field containing 'Counter Id'. This is followed by another section with a dark blue header 'Value' and a white input field containing 'Value'. Below that is a section with a dark blue header 'Up-Down' and two white input fields: 'Up' and 'Down'. At the bottom of this section are two small blue arrows pointing up and down, and a blue 'Done' button. Below the 'Up-Down' section is a list of output addresses: 'O19', 'O20', 'O21', and 'O22' (highlighted with a red border). The entire interface is set against a light gray background.

# Experimenting with Counters

Counter O22 ▾

Counter Id

0

Value

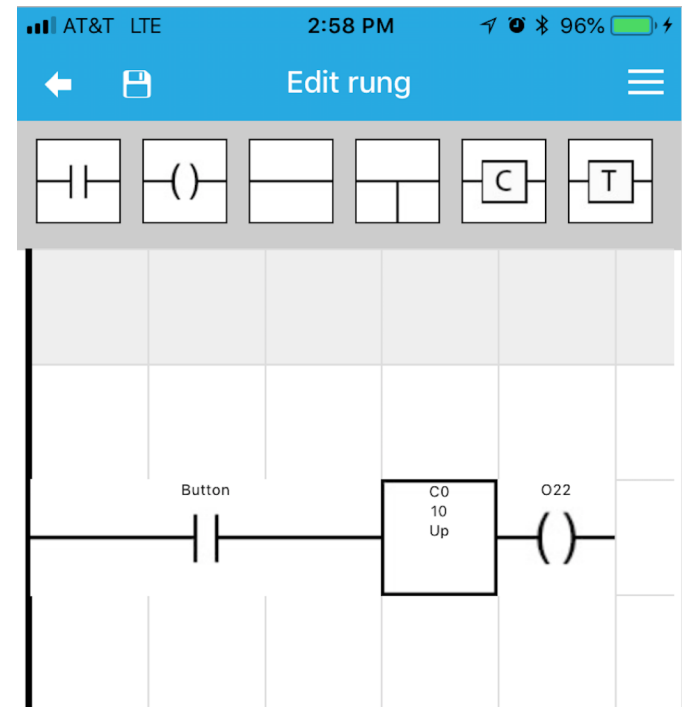
10

Up-Down

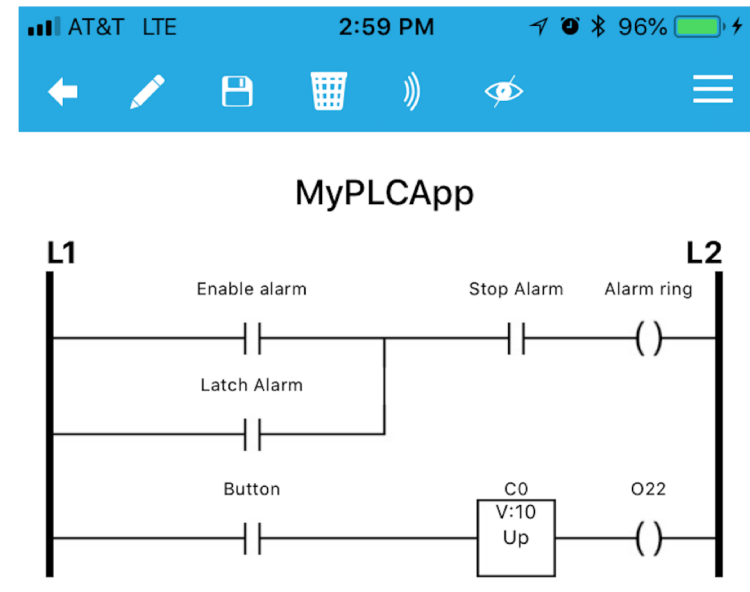
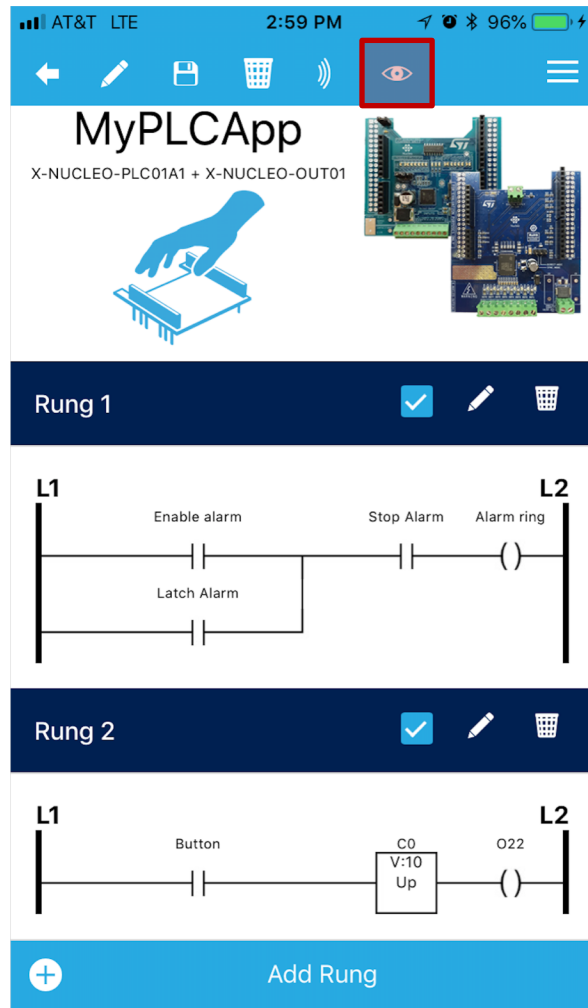
Up ✓

Down

✓ Confirm



# Experimenting with Counters





# Issues with the PLC

- Security
  - Anyone can connect to the PLC wirelessly
  - No encryption
  - Open Network
- Symbol Support
  - Limited symbols and capabilities
- Limited timer and counter functionality compared to a traditional PLC

# Going Further

- Update controller to toggle Wi-Fi state from AP to STA mode.
- Add additional industrial communications
  - RS485
  - MODBUS
- Find an interesting problem and try to solve it using ladder logic
- Experiment with the timer function

## Additional Resources

- Download Course Material for
  - C/C++ Doxygen Templates
  - Example source code
  - Blog
  - YouTube Videos
- Embedded Bytes Newsletter
  - <http://bit.ly/1BAHYXm>



From [www.beningo.com](http://www.beningo.com) under

- Blog > CEC – Building Your own Internet Connected PLC