

# Embedded System Design Techniques™

## **Building Your Own Internet Connected PLC**

### **Class 4: PLC Software Design Part 2**

April 26<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

- Connecting to the PLC
- Creating a Project
- A First Application



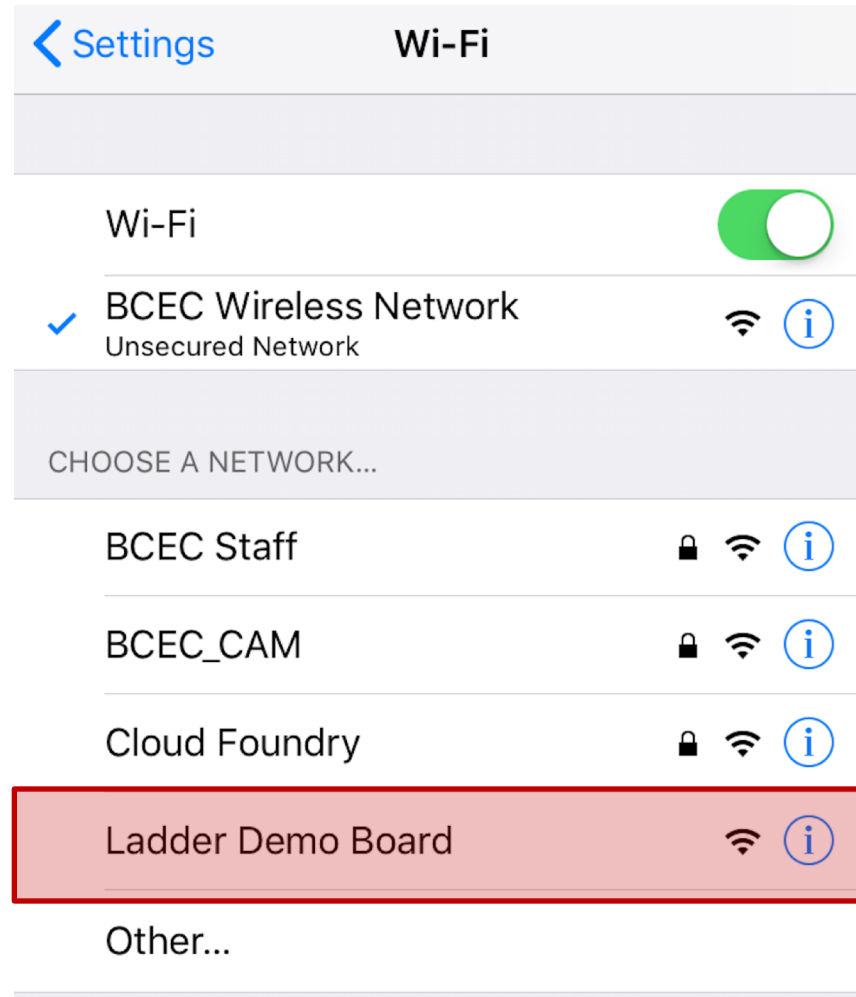
Presented by:

# Connecting to the PLC

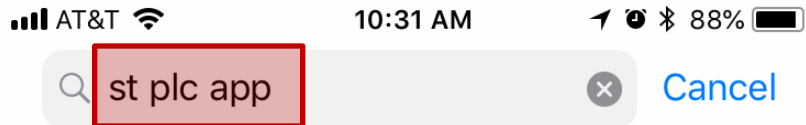
The PLC acts as a wireless access point. In order to connect to program the PLC application:

- Make sure that the PLC firmware is programmed and running
- Open your mobile devices wireless settings
- Select the “Ladder Demo Board” SSID

# Connecting to the PLC

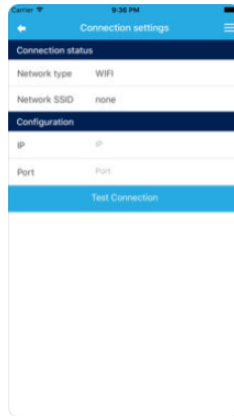


# Connecting to the PLC

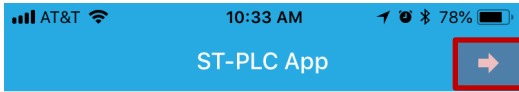


ST PLC App  
Productivity

GET



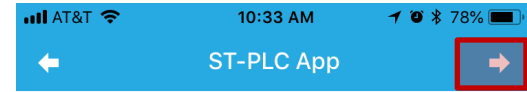
# Connecting to the PLC



## PLC programming: never been so easy

This powerful app lets you manage a PLC (Programmable Logic Controller) via Wi-Fi thanks to the capabilities of an STM32 Nucleo board. All you need is an STM32 Nucleo board Nucleo-F401RE, an Industrial I/O expansion board (X-NUCLEO-PLC01A1) and a Wi-Fi expansion board (X-NUCLEO-IDW01M1). With these boards you have full control and can access the industrial devices for IO management at 24 V as well as timers and counters.

The industrial I/Os are managed on the input side by a high-speed digital input current limiter (CLT01-38SQ7) that provides an 8-line protected termination and an octal high-side smart-power solid-state relay with serial/parallel selectable on-chip interface (VNI8200XP), for the output. For getting started in the Smart Industry domain, a Wi-Fi connection is provided for the PLC using the dedicated X-NUCLEO-IDW01M1 expansion board. You can further explore PLC applications using our X-NUCLEO-OUT01A1 expansion board that includes a galvanic isolated intelligent power switch (ISO8200BQ) capable of driving 8 different loads and delivered in a compact QFN



To get more information on the ST-PLC App and its related accessories, visit to [www.st.com](http://www.st.com) and search for the following part numbers:



**NUCLEO-F401RE:** STM32 Nucleo-64 development board with STM32F401RE MCU, supporting Arduino and ST morpho connectivity



**X-NUCLEO-IDW01M1:** Wi-Fi expansion board based on SWPF01SA module for STM32 Nucleo

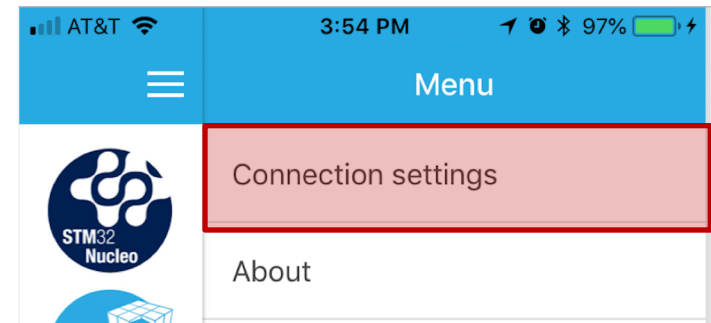
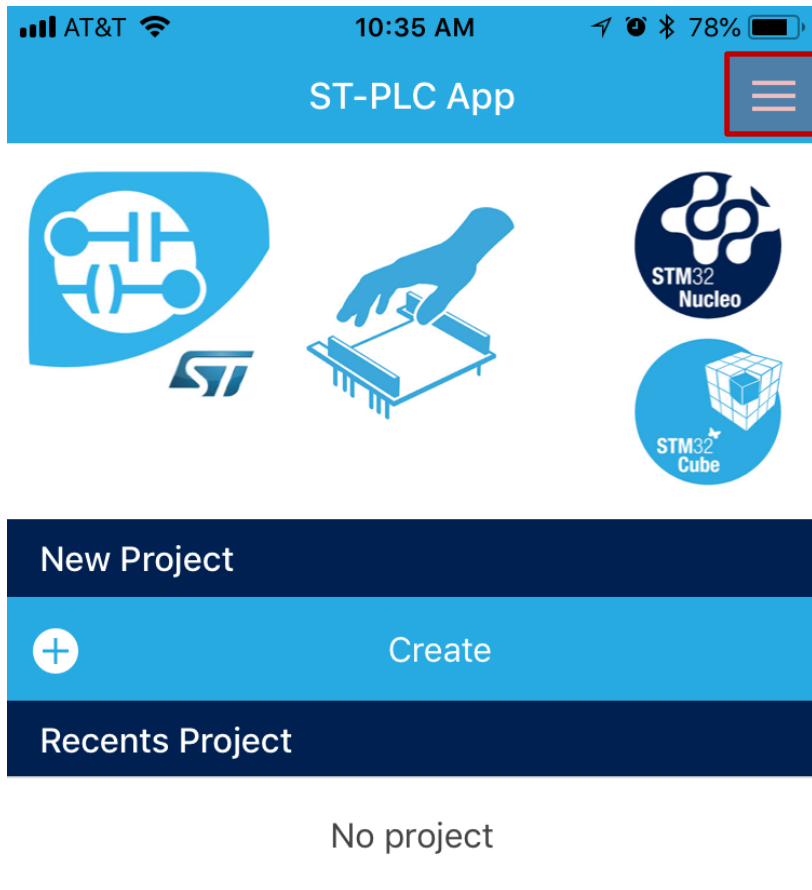


**X-NUCLEO-PLC01A1:** Industrial input/output expansion board based on VNI8200XP and CLT01-38SQ7 for STM32 Nucleo

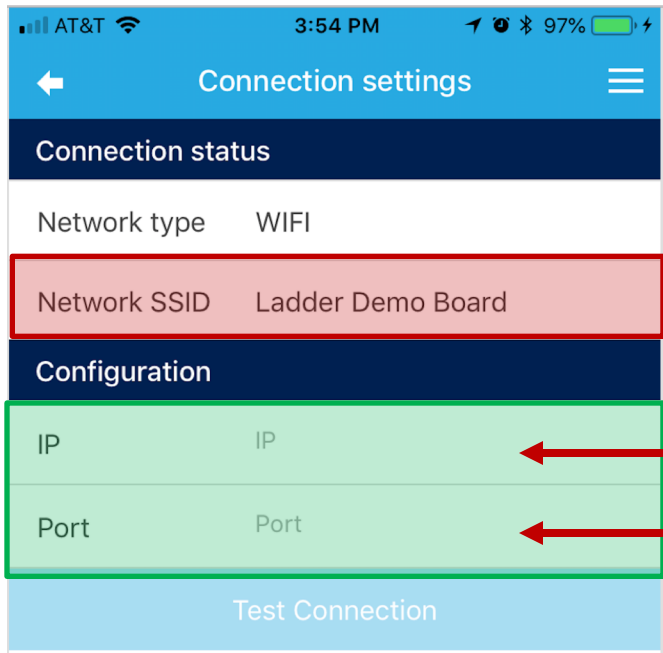


**X-NUCLEO-OUT01A1:** Industrial digital output expansion board for STM32 Nucleo based on ISO8200BQ galvanic isolated octal high-side smart power solid state-relay

# Connecting to the PLC



# Connecting to the PLC



IPv4 ADDRESS	
Configure IP	Automatic >
IP Address	172.24.155.2
Subnet Mask	255.255.255.0
Router	172.24.155.1

32000

# Connecting to the PLC

Connection status	
Network type	WIFI
Network SSID	Ladder Demo Board

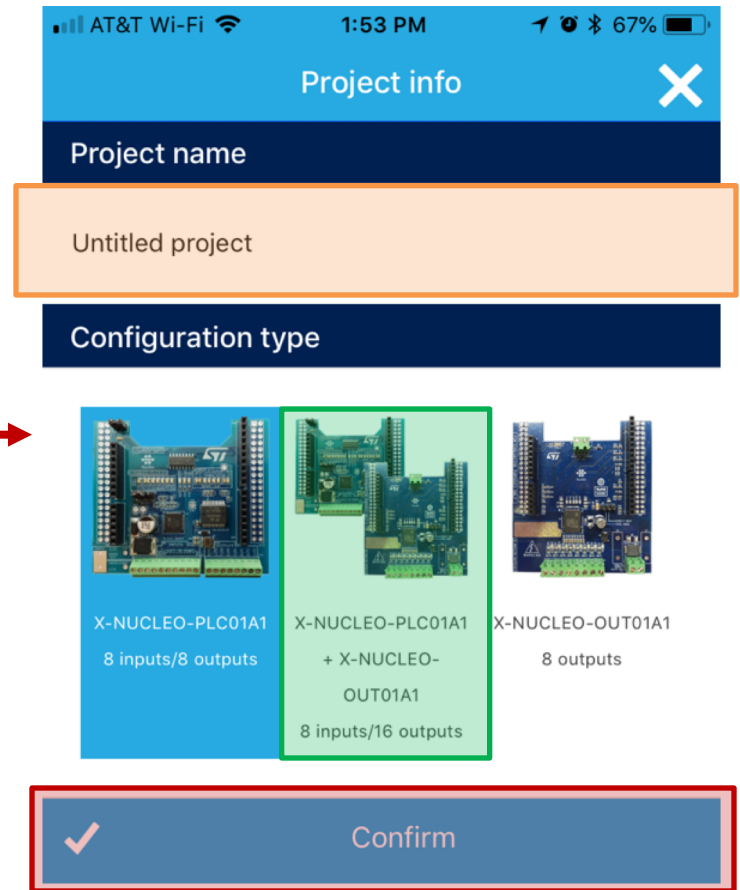
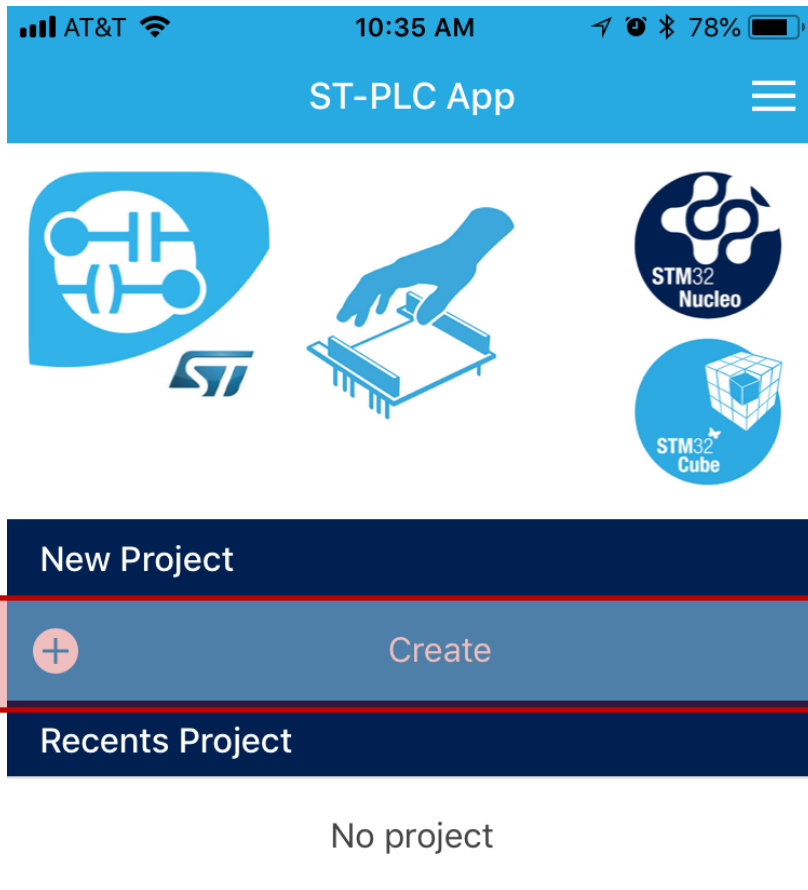
Configuration	
IP	172.24.155.1
Port	32000

Test Connection

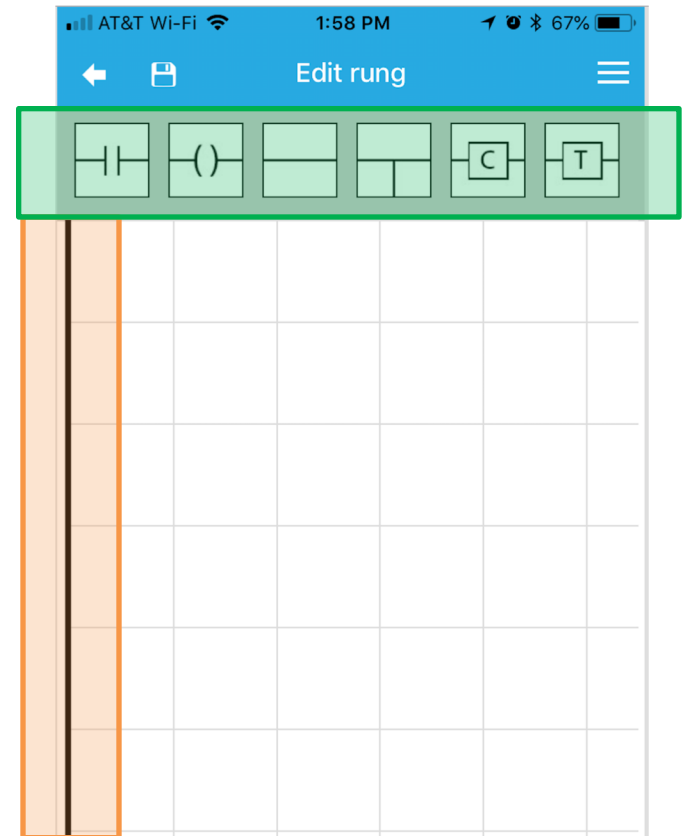
Logs	
Connection attempt...	
Connected	
Device answer "<OK>"	



# Creating a Project



# A First Application



# A First Application

Save

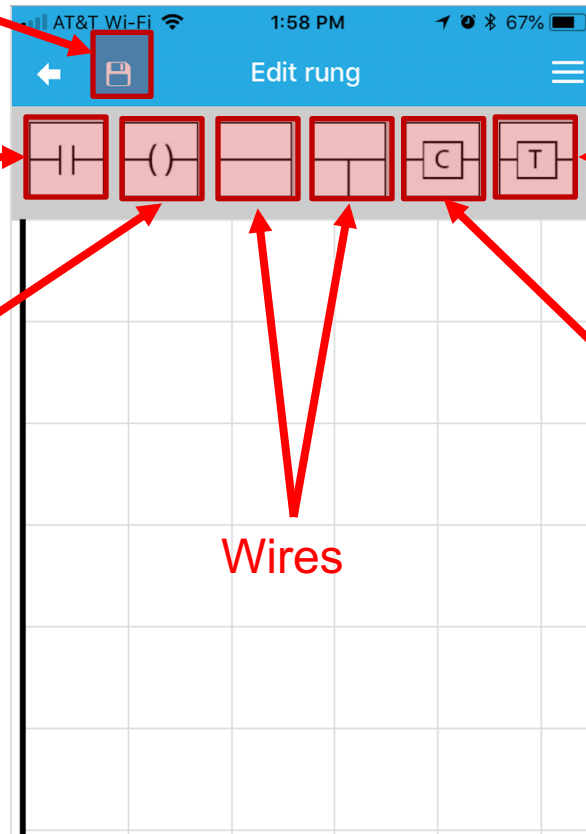
Input  
Logic

Output  
Logic

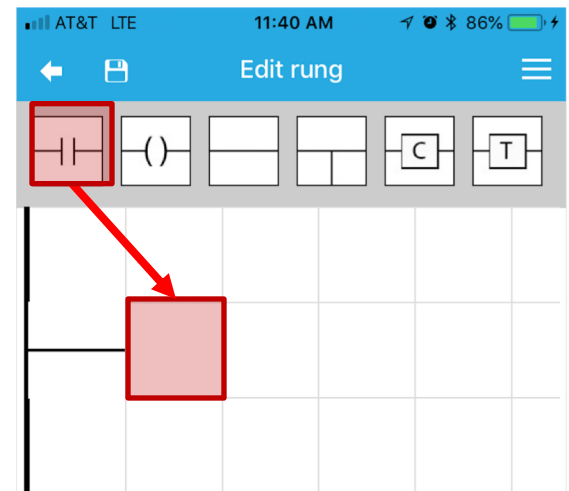
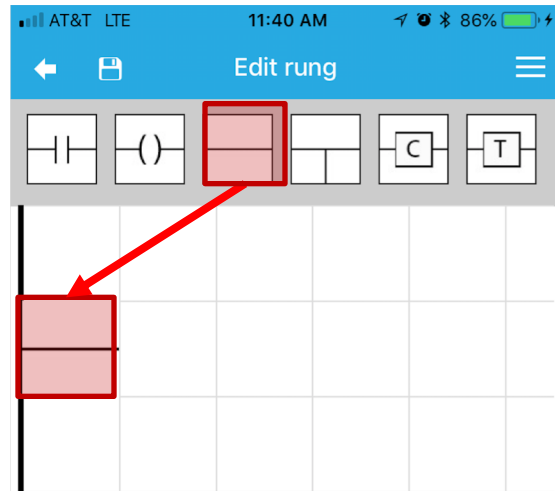
Wires

Counters

Timers



# A First Application



# A First Application

AT&T LTE 11:40 AM 86%

Block info

Input

Label

Free text

Type

Normal ✓

Negated

Confirm

AT&T LTE 11:41 AM 86%

Block info

Input

Label

Free text

Type

Normal ✓

Negated

Confirm

Done

I1

I2

I3

I4

# A First Application

AT&T LTE 11:41 AM 86%

Block info

Input I1

Label

Free text

Type

Normal ✓

Negated

✓ Confirm

Done

Start motor

Enable alarm

Pressure sensor

Electric valve

Free text

# A First Application

AT&T LTE 11:41 AM 86%

Block info

Input I1

Label Enable alarm

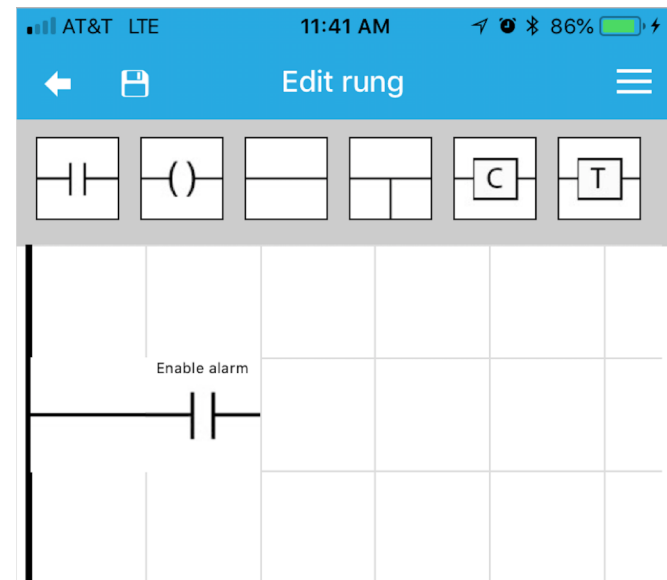
Free text

Type

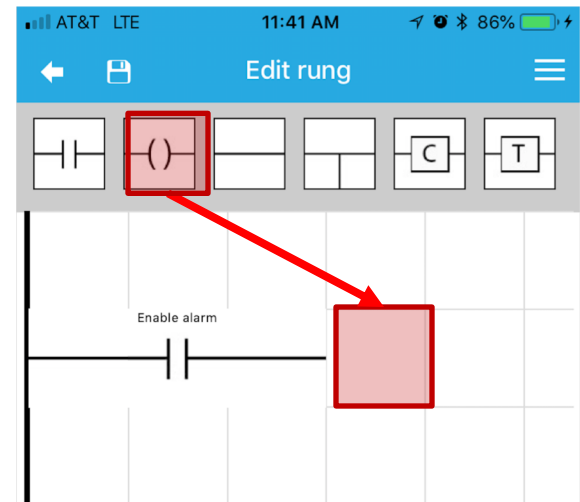
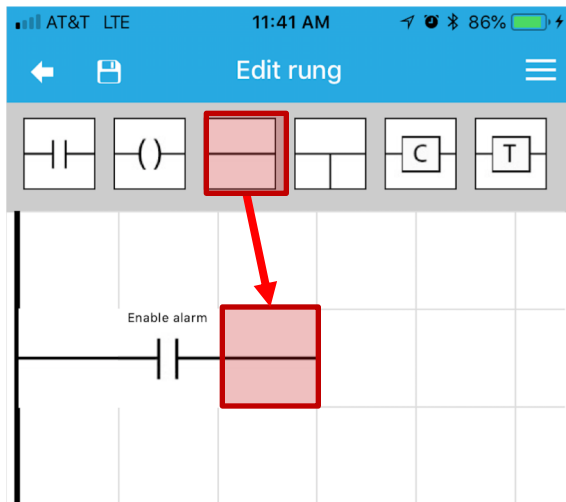
Normal ✓

Negated

✓ Confirm



# A First Application





# A First Application

AT&T LTE 11:41 AM 86%

Block info

Output

Label

Free text

Type

Normal

Negated

Confirm

AT&T LTE 11:42 AM 87%

Block info

Output

Label

Free text

Type

Normal

Negated

Confirm

Done

05

06

07

08

09

010

011

# A First Application

AT&T LTE 11:42 AM 87%

Block info

Output 08

Label

Free text

Type

Normal ✓

Negated

✓ Confirm

Done

Stop motor

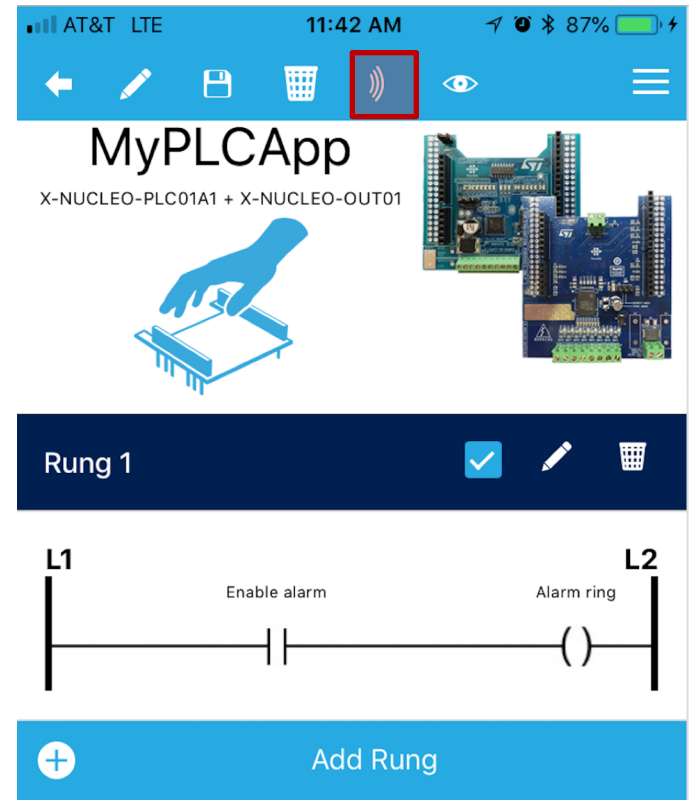
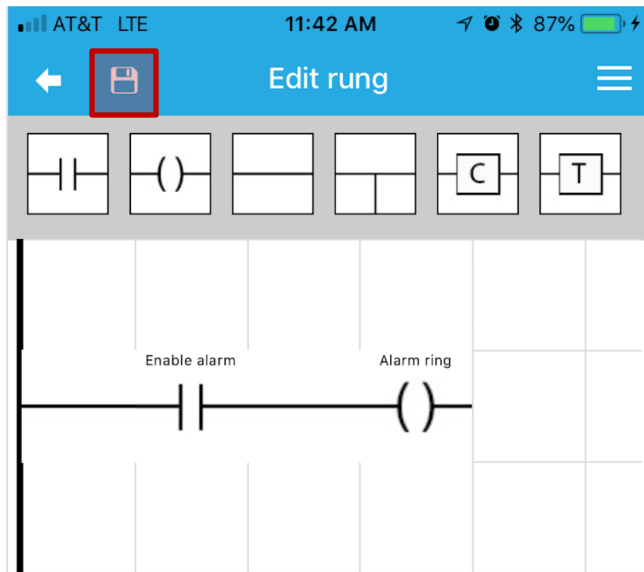
Alarm ring

Close valve

Flush the tank

Free text

# A First Application



## 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