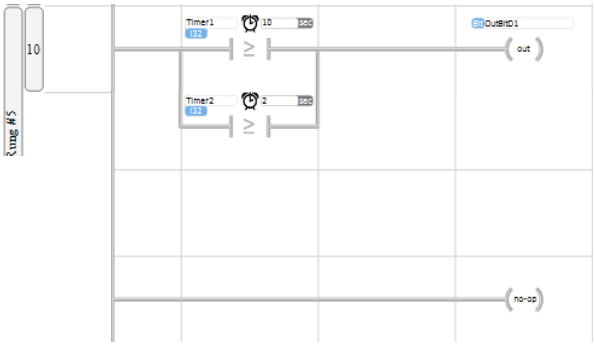
Programmable Logic Controllers:

Hands On Introduction to Industrial Controls

Class 1: PLC Basics

March 27, 2017 – Don Wilcher



DesignNews

CEC CONTINUING EDUCATION CENTER

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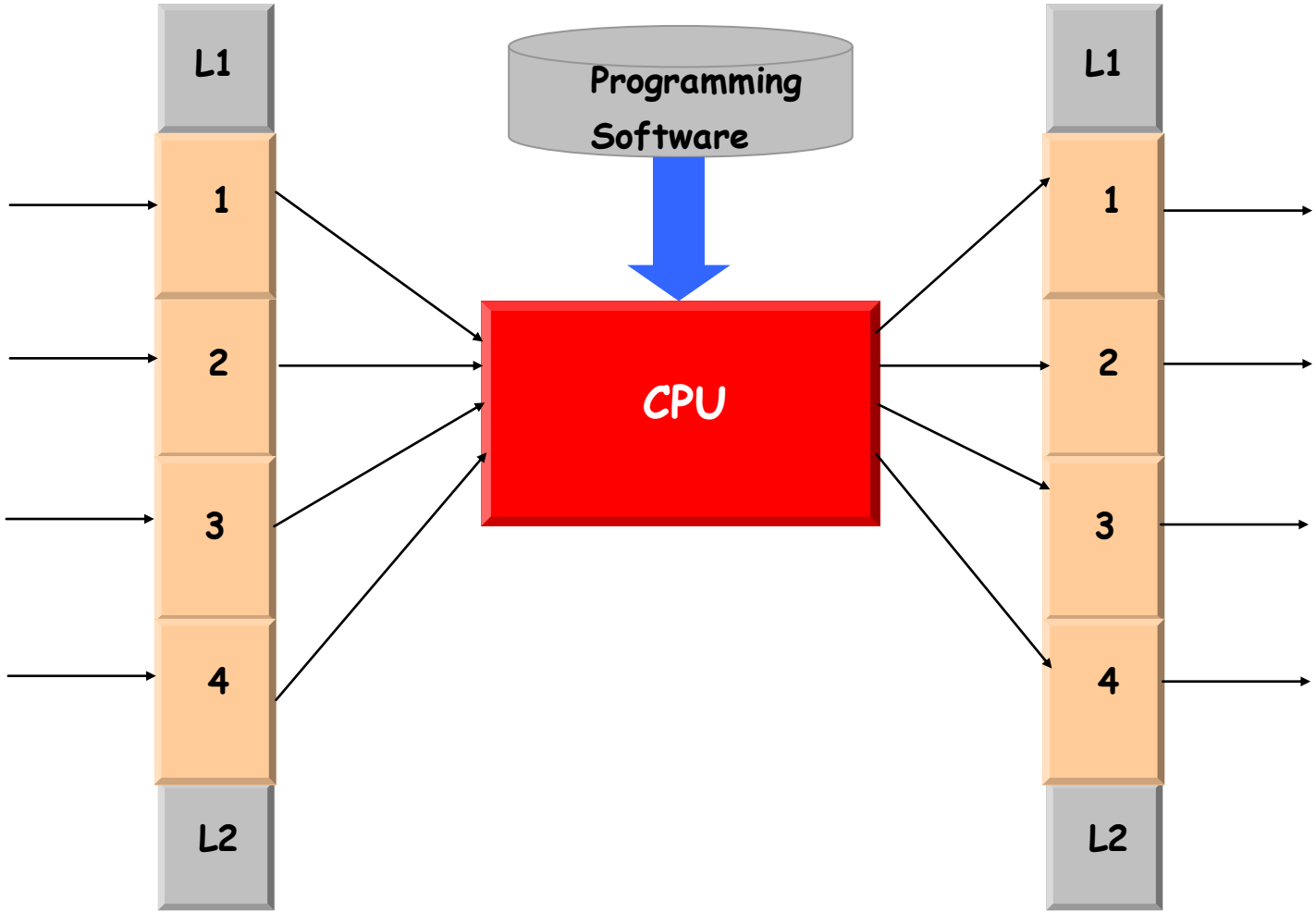
PLC Basics

Topics

- PLC Architecture
- Introduction to the Velocio PLC
- Setting up the Velocio "vBuilder" software (Flowchart)
- Hands-On Project: Build a basic ON/OFF Controller

PLC Architecture



PLC Architecture…

BASIC COMPONENTS OF A PLC CONSIST:

- CPU (Central Processing Unit)
- I/O (Input/Output) Section
- Power Supply
- Programming Device

Question 1

Name the 4 basic components of a PLC Architecture.

PLC Architecture…

CPU (Central Processing Unit)

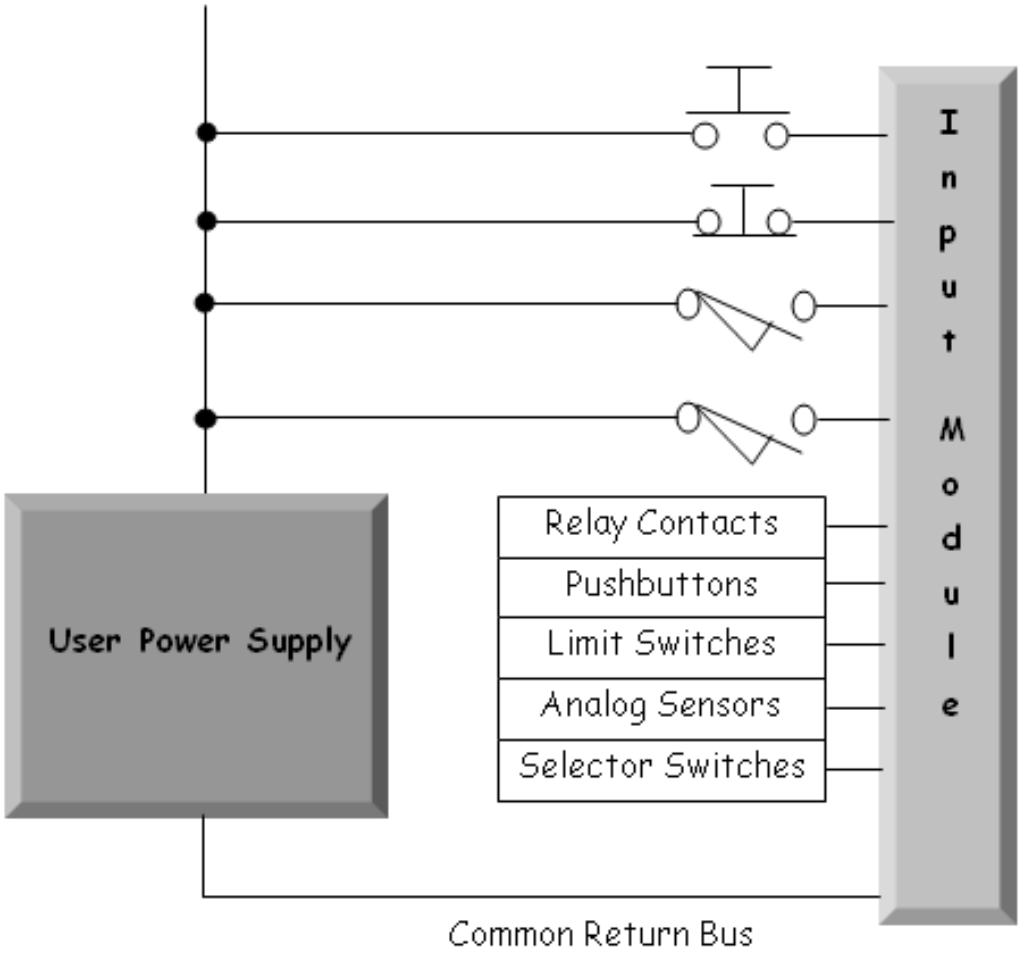
- The brain of the PLC
- Usually consists of a microprocessor for implementing the logic and controlling the communication among the modules.
- The processor requires memory for storing the results of the logical operations performed by the microprocessor.
- Memory is also required for the program EPROM or E^2PROM plus RAM.

PLC Architecture…

I/O (Input/Output) Section

- Consists of Input and Output Modules
- I/O System forms the interface field devices are connected to the controller.
- Purpose of the Interface is to condition the various signals received from or sent to external field devices.
- Input devices such as pushbuttons, limit switches, sensors, selector switches are hardwired to terminals on the input modules.

PLC Architecture…



Typical Input Module Wiring Diagram

PLC Architecture…

I/O (Input/Output) Section…

- Output devices such as small motors, motor starters, solenoid valves, and indicator lights are hardwired to the terminals on the output modules.

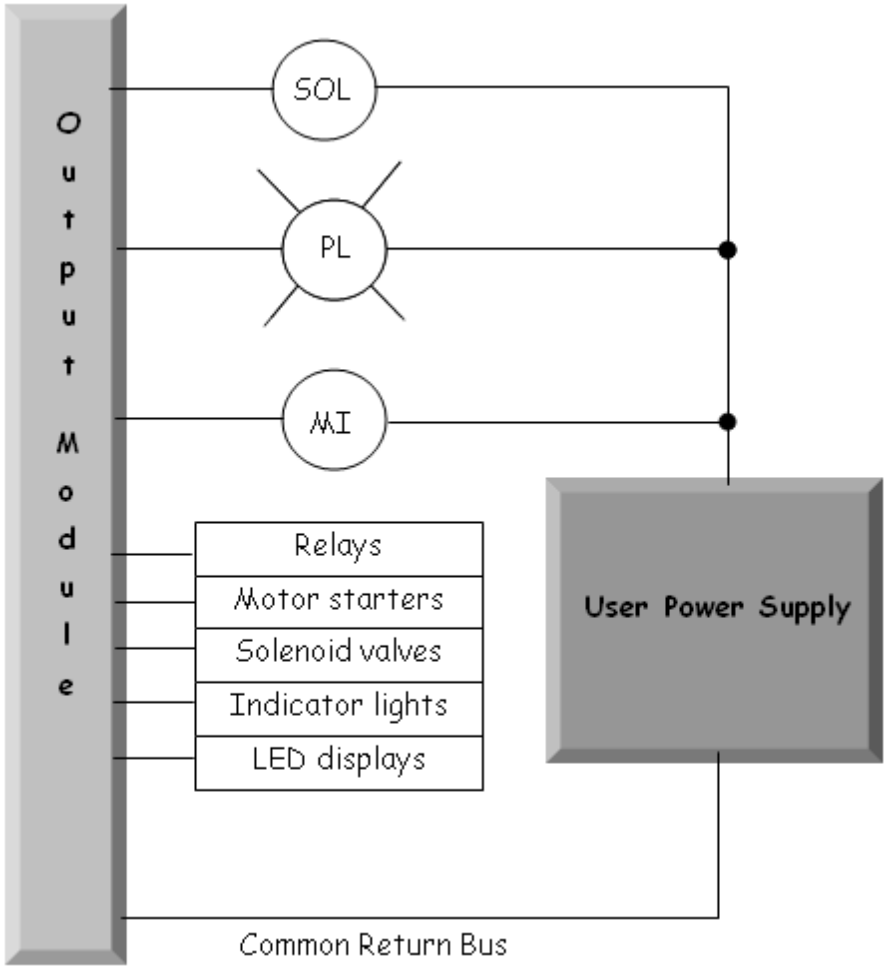
- To electrically isolate the internal components from the input and output terminals, PLCs employ an optical isolator.

- "Real World" or "Field" inputs and outputs are used to refer to devices mentioned earlier.

Question 2

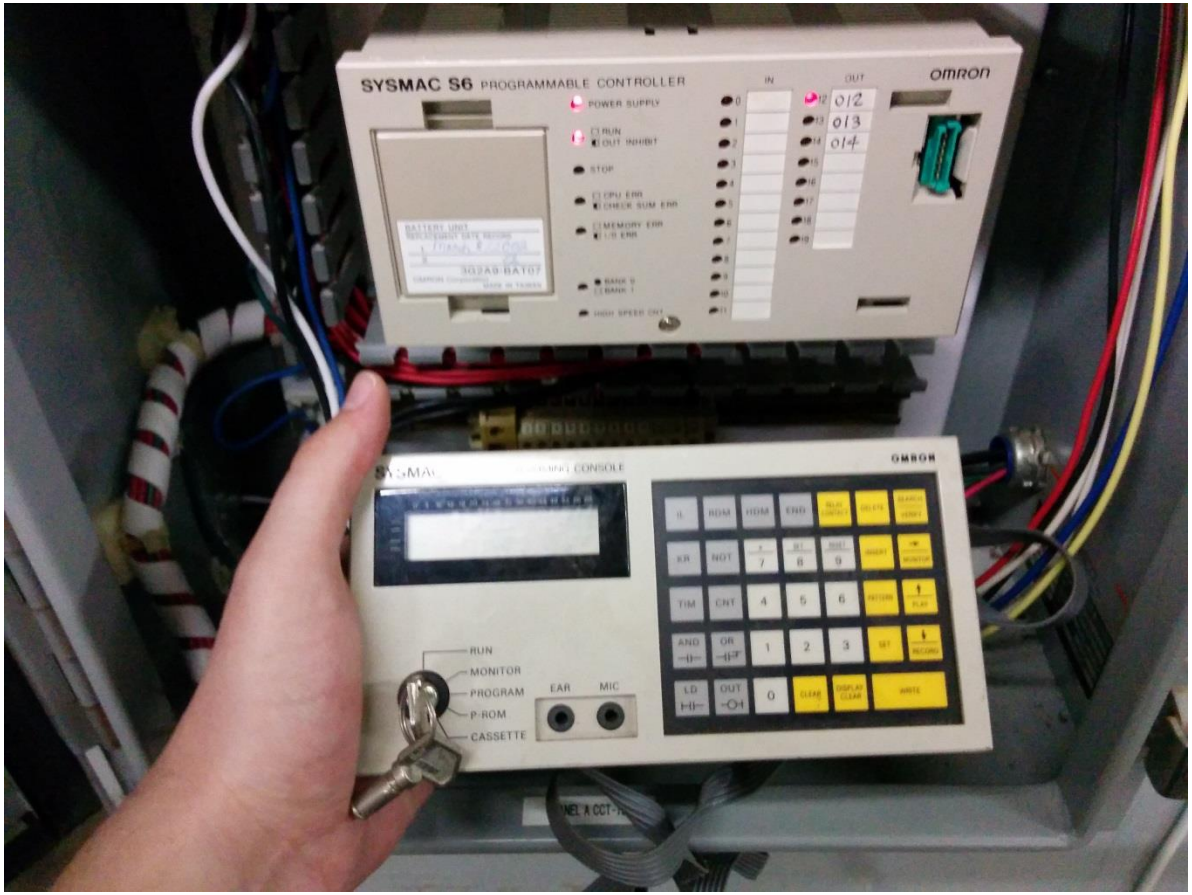
Name the two wiring methods of attaching I/O devices to a PLC.

PLC Architecture…



Typical Output Module Wiring Diagram

PLC Architecture…



PLC Handheld Terminal/Programmer

PLC Architecture…

Programming Device (or Terminal)…

- All leading brands of PLCs have software available so that a PC can be used as the programming device.
- Software allows the user to create, edit, document, store, and troubleshooting ladder logic programs and to generate printed reports.
- Computer monitor able to display more logic on the screen than handheld types (Programming Device).

PLC Architecture…

Power Supply

- Supplies DC power to other modules that plug into the rack.
- For large PLC systems, the power supply does not normally supply power to the field devices.
- With larger systems, power to field devices is provided by external AC or DC supplies.
- For small and micro PLC systems, the power supply is used to power field devices.

Question 3

A handheld programming is capable of displaying as much logic information than a traditional computer monitor?

a) True

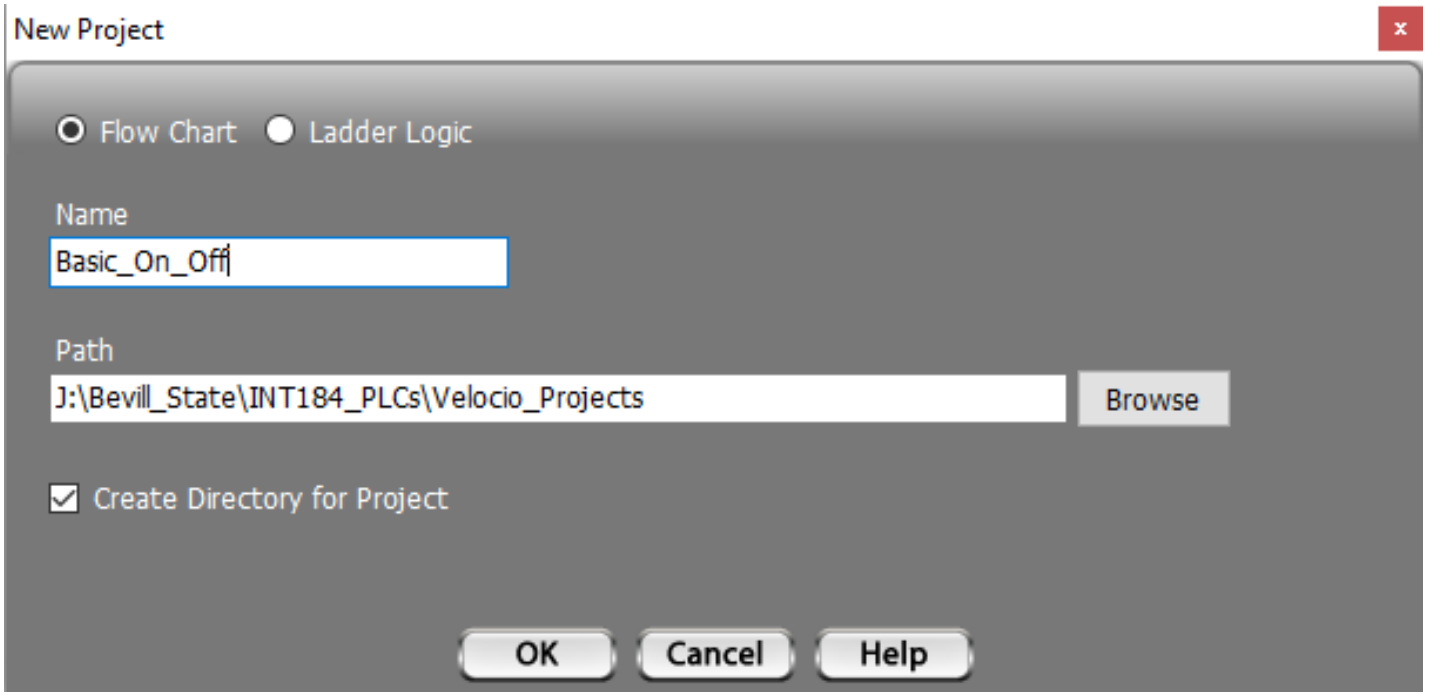
b) False

Setting Up the Velocio "vBuilder" Software (Flowchart)

Reference

http://velocio.net/vbuilder/

Setting Up the Velocio "vBuilder" Software…

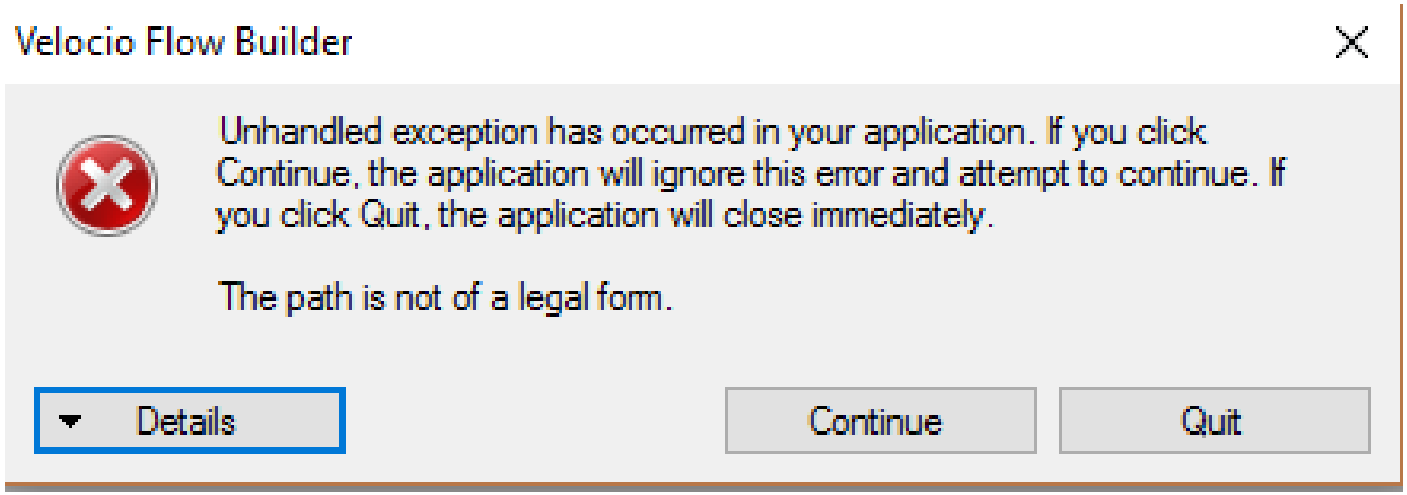


Creating the Flow Chart program for a Basic ON/OFF Controller.

Setting Up the Velocio "vBuilder" Software…

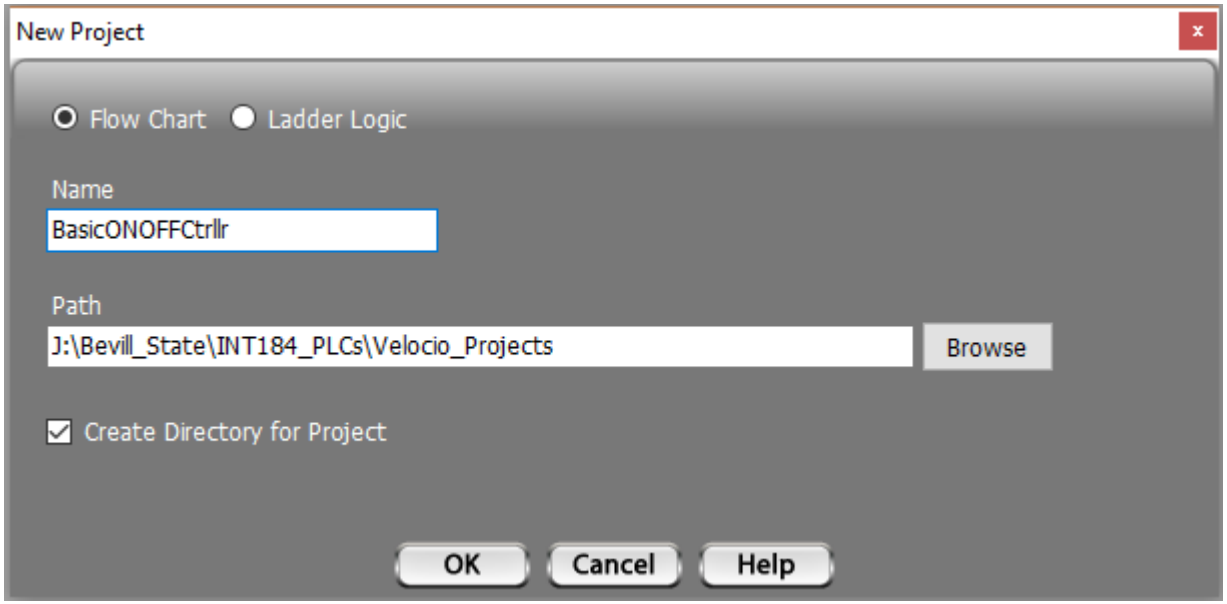
NOTE: Traditional Software Naming Convention is not recognized in Velocio vBuilder when creating the name for the Flowchart project.

Basic_ON_OFF will produce the following error message:



Setting Up the Velocio "vBuilder" Software…

Correct Naming Convention: BasicONOFFCtrllr.



Creating the Flow Chart program for a Basic ON/OFF Controller.

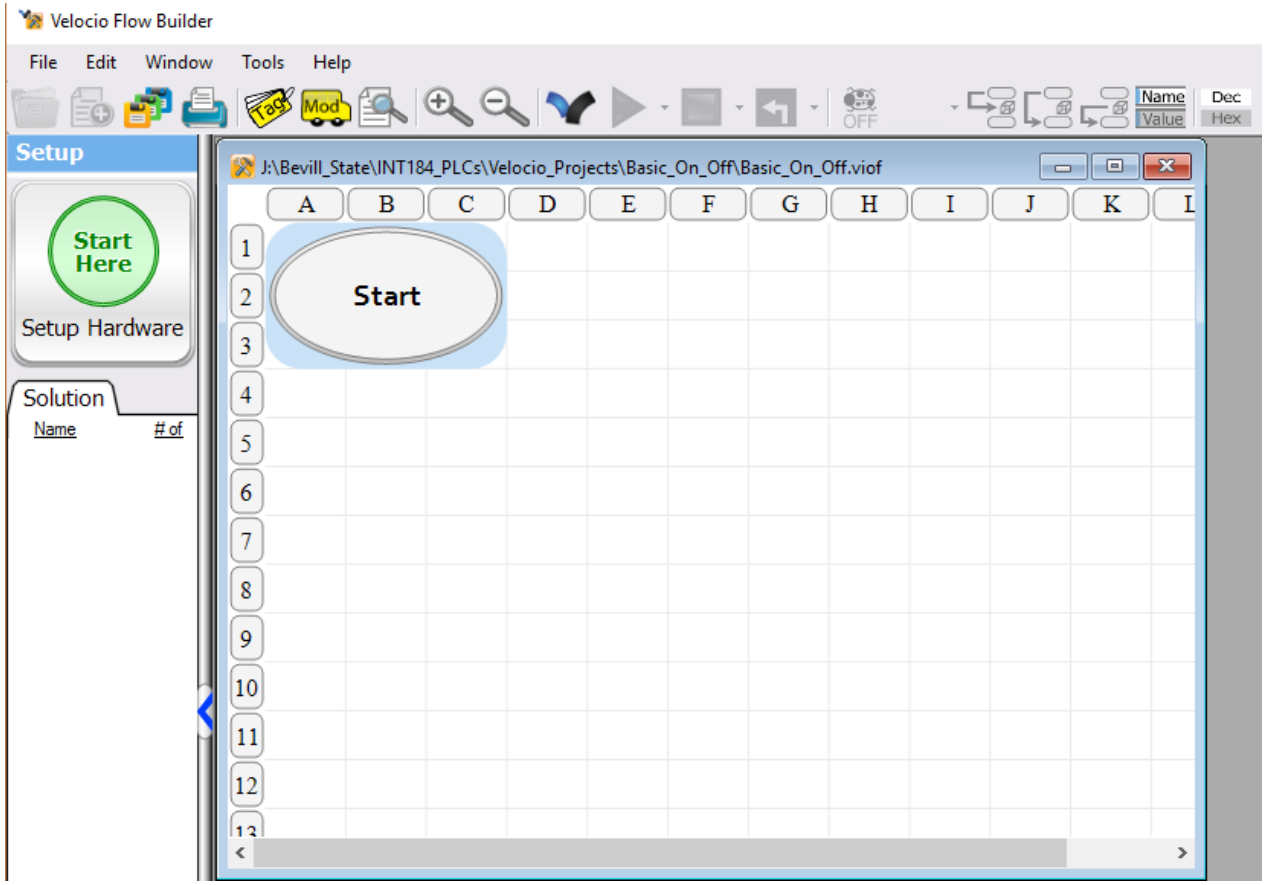
Question 4

The naming convention Raw_Temp is acceptable for a vBuilder Flowchart project name.

a)False

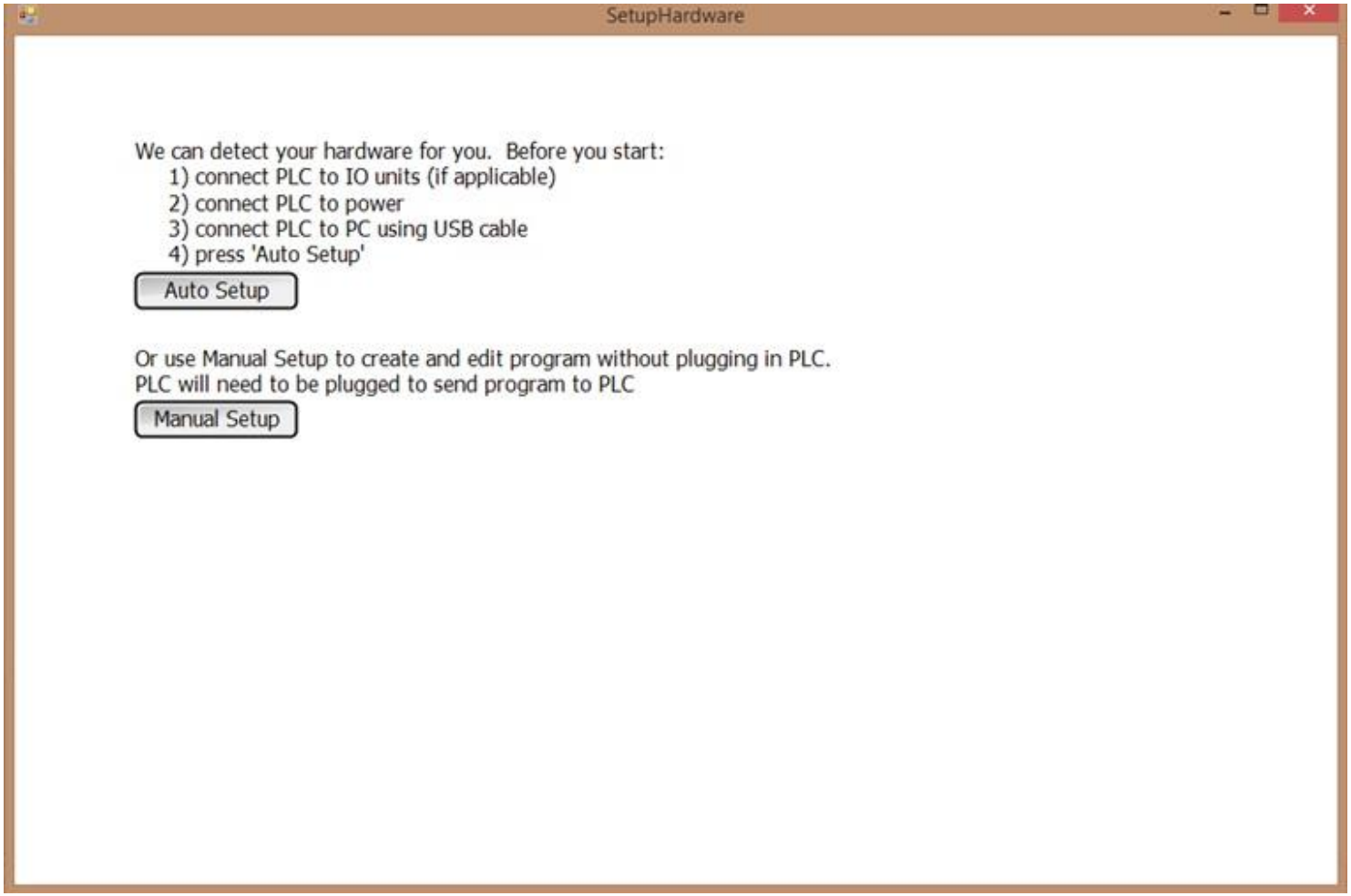
b)True

Setting Up the Velocio "vBuilder" Software…



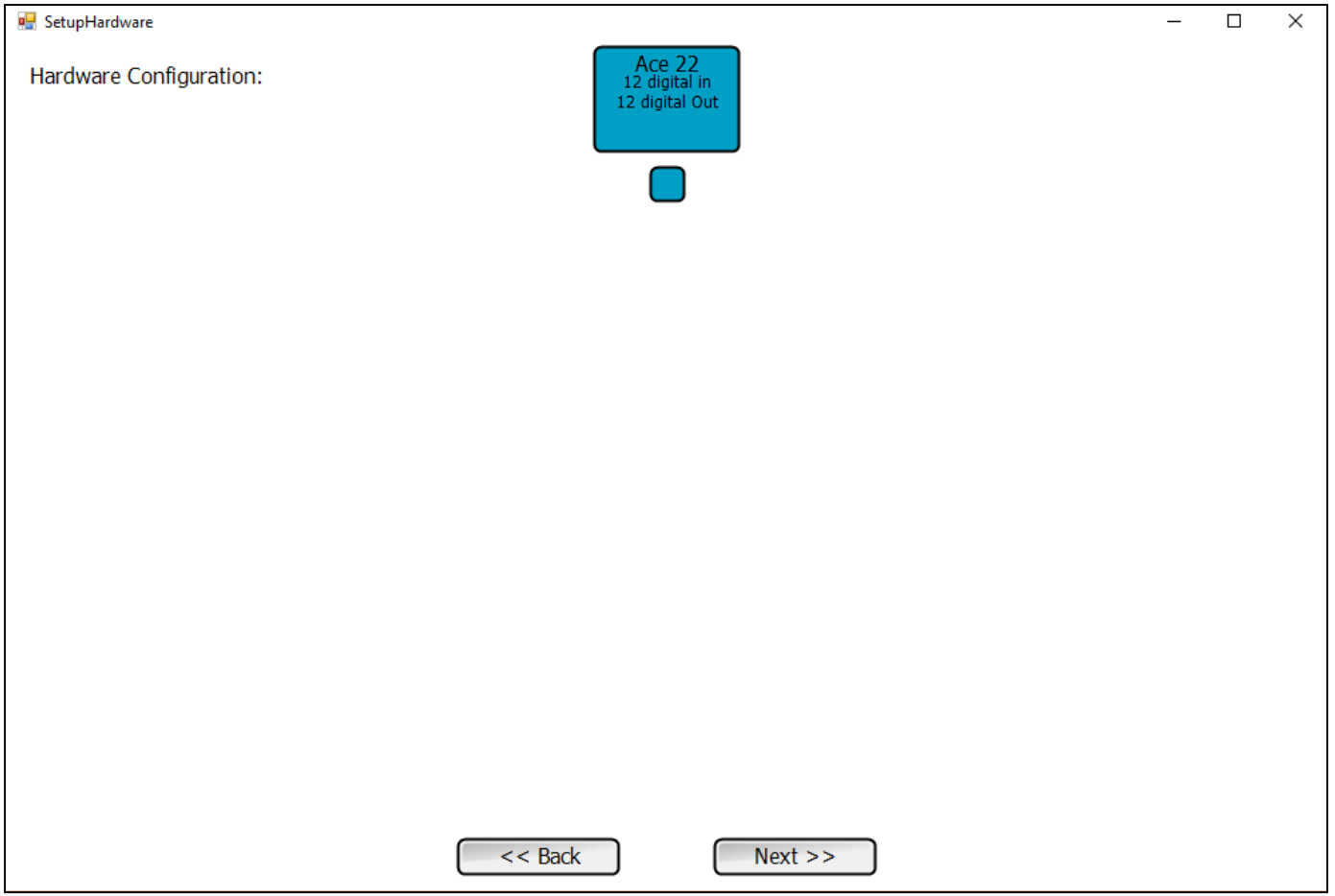
Setup Hardware Window for configuring the Ace 22 PLC.

Setting Up the Velocio "vBuilder" Software…



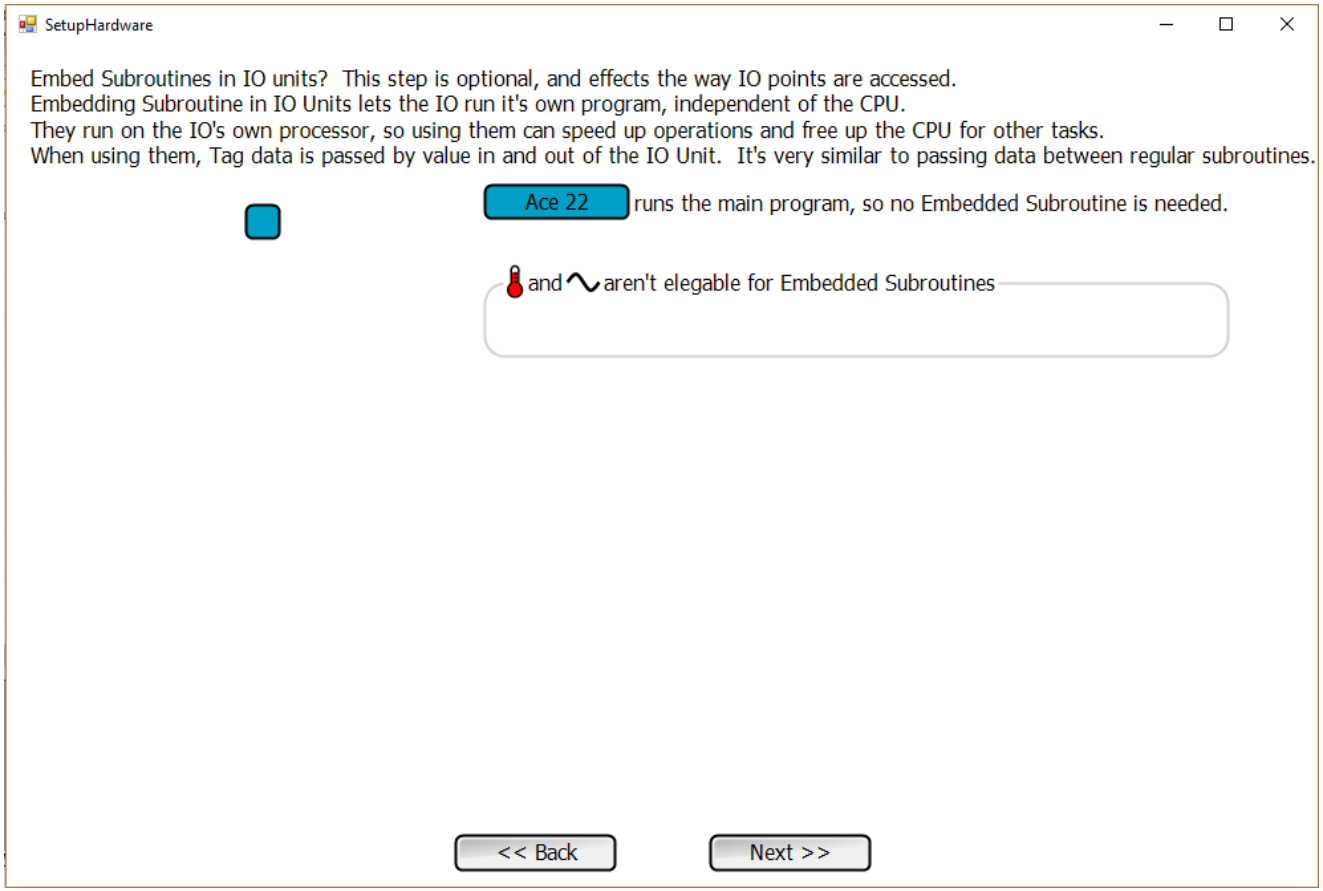
Setup Hardware Window for configuring the Ace 22 PLC.

Setting Up the Velocio "vBuilder" Software…



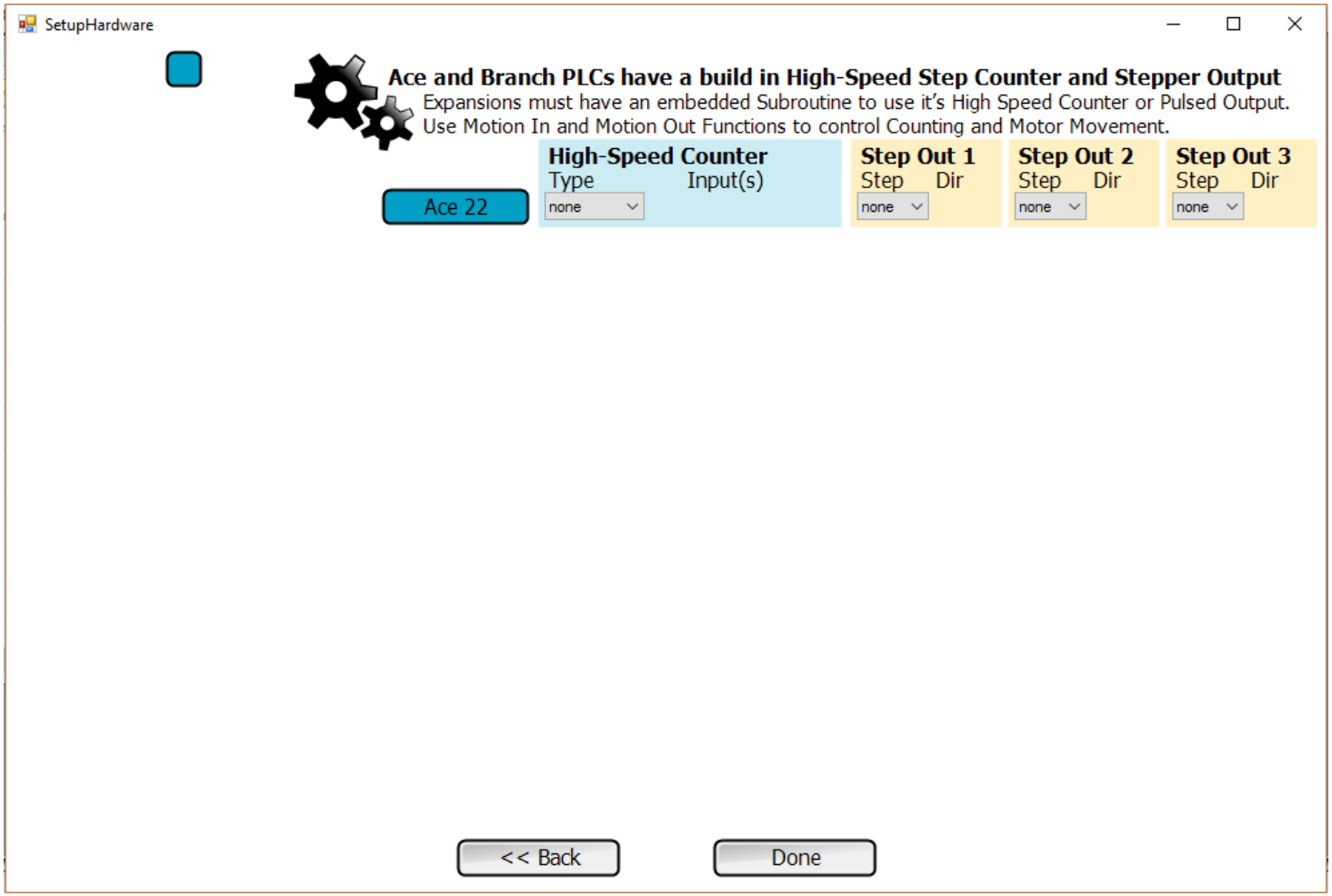
Ace 22 PLC detected by vBuilder software.

Setting Up the Velocio "vBuilder" Software…



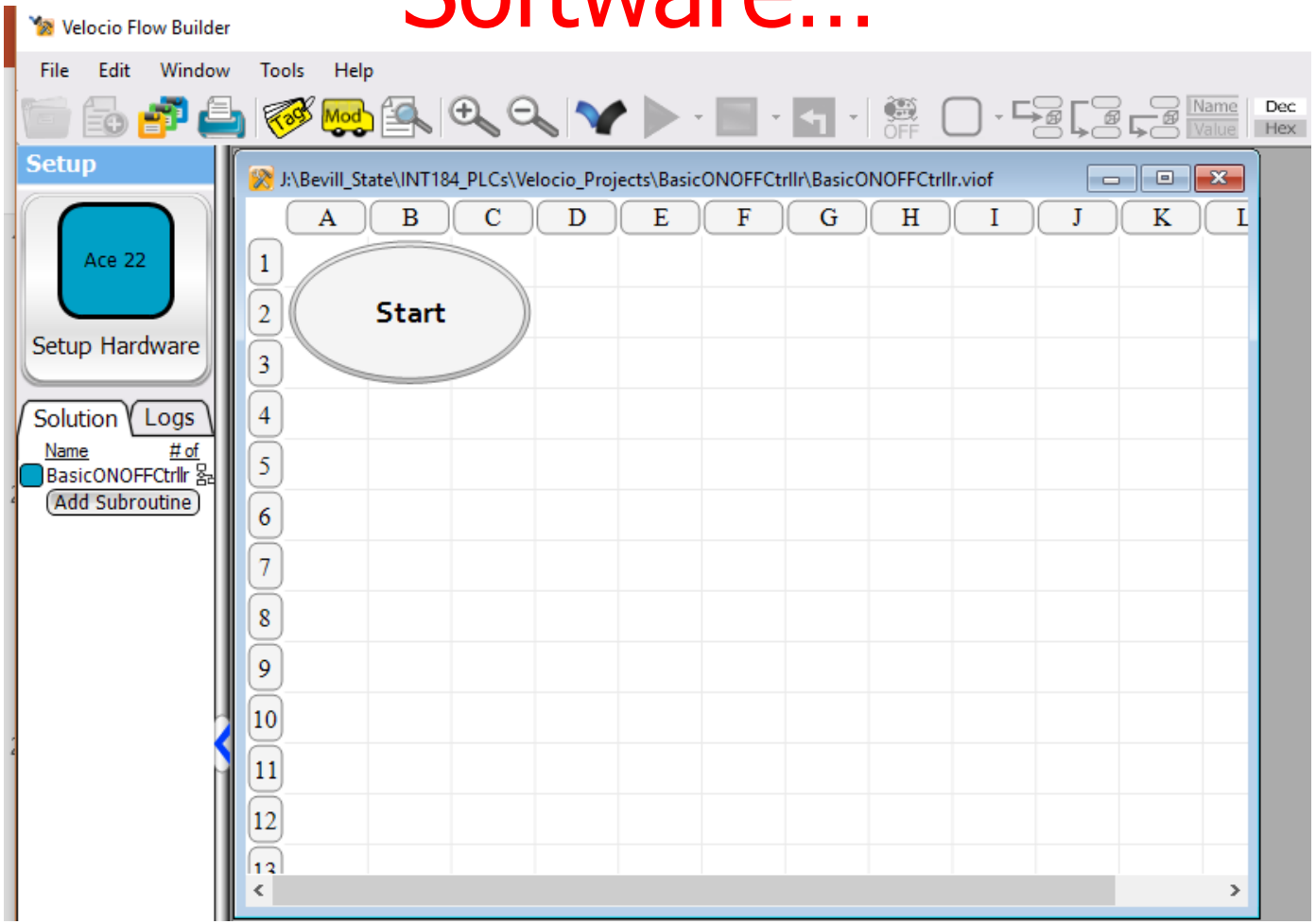
Continuation of the Ace 22 PLC Hardware setup step.

Setting Up the Velocio "vBuilder" Software…



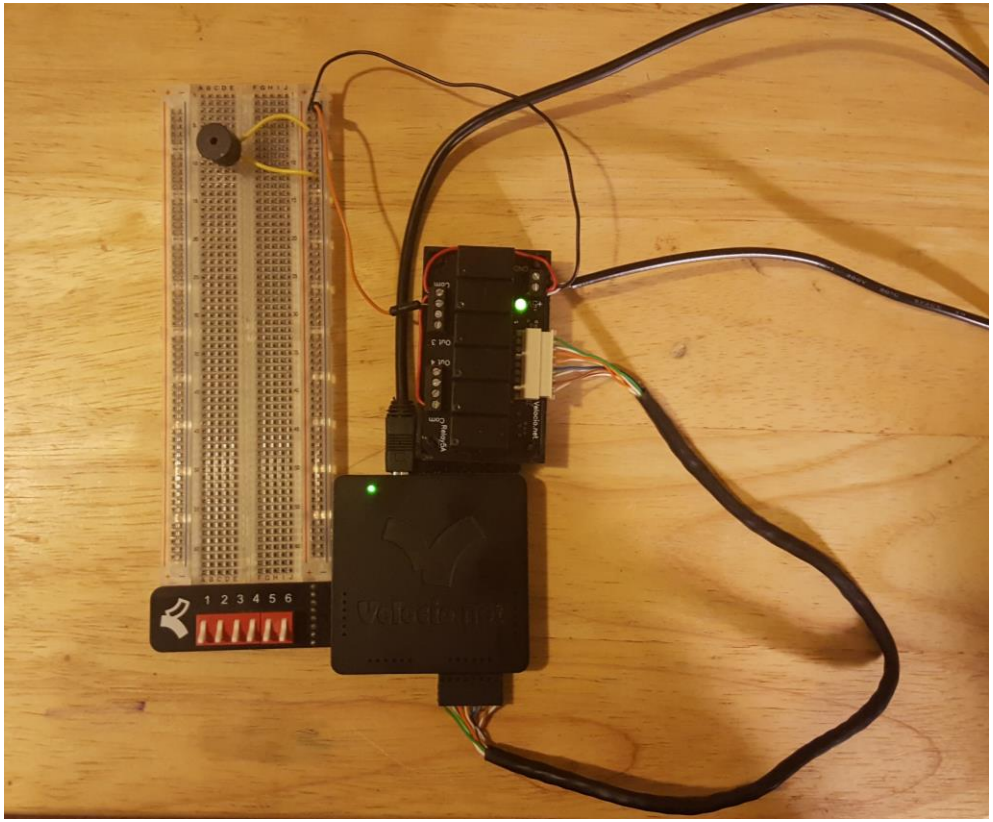
The Ace 22 PLC Hardware setup continuation.

Setting Up the Velocio "vBuilder" Software…

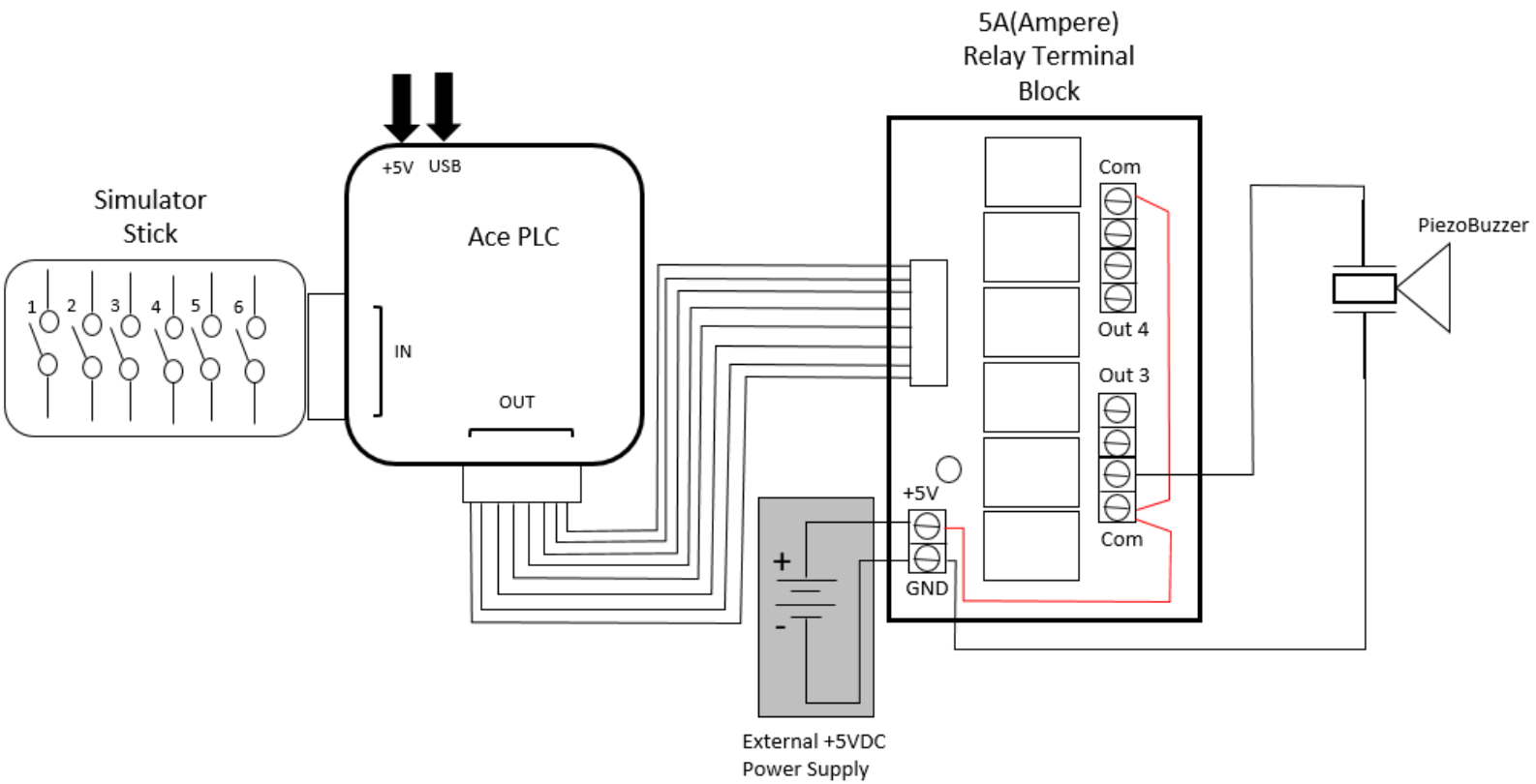


The Ace 22 PLC Hardware setup is completed.

Hands-On Project: Build a Basic ON/OFF Controller

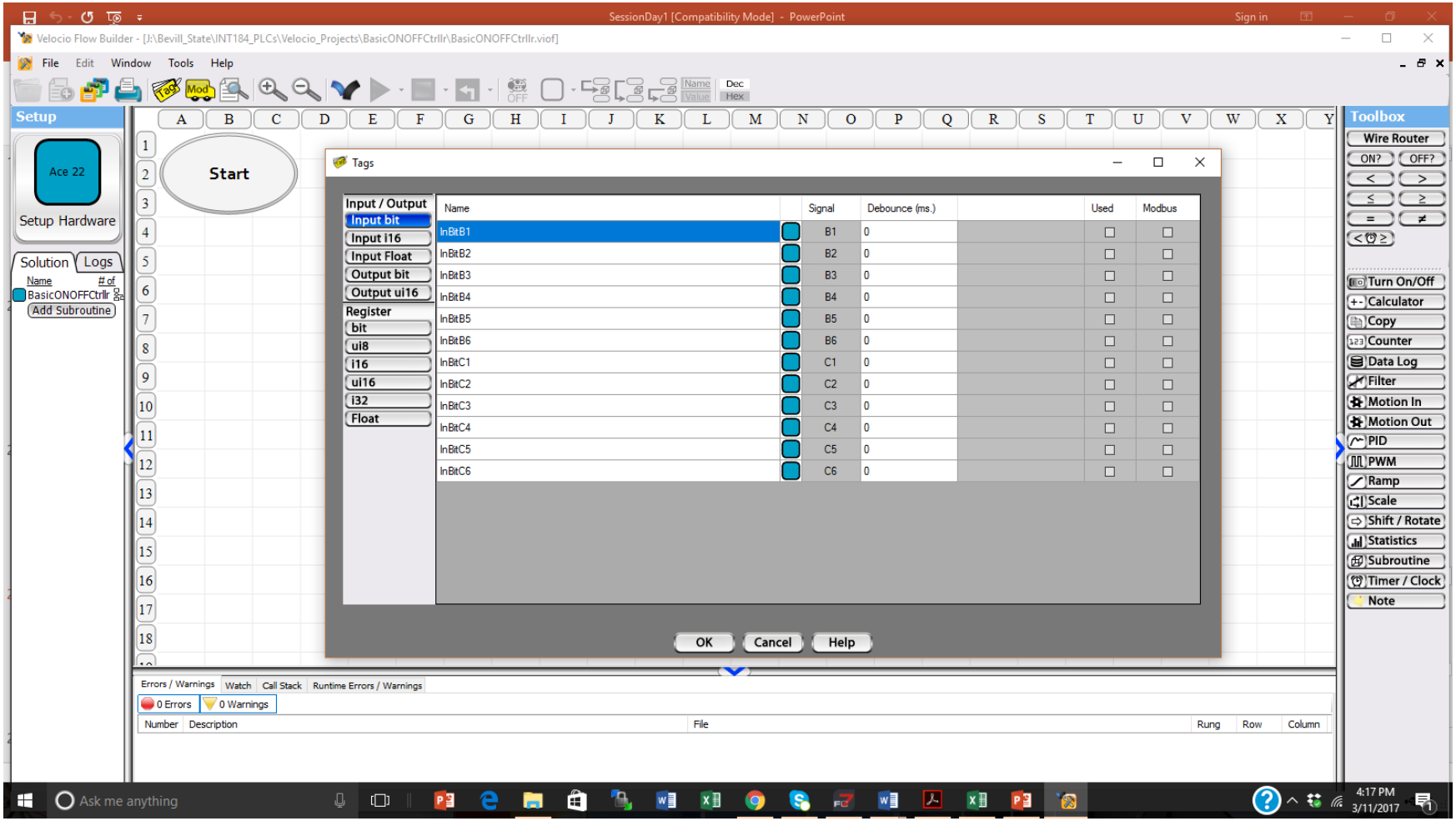


Hands-On Project: Build a Basic ON/OFF Controller…



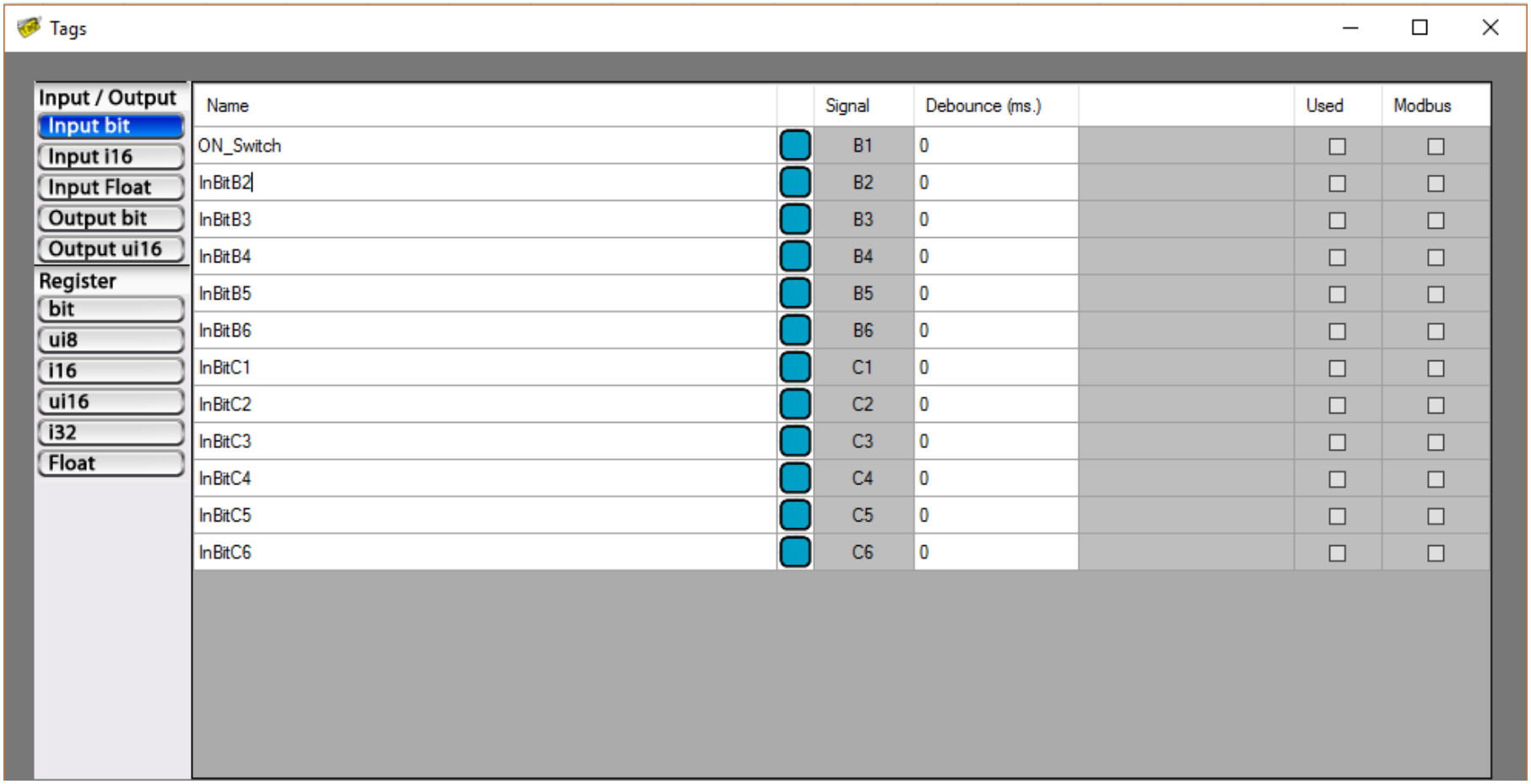
Electrical Wiring Diagram

Building the ON/OFF Controller Flowchart



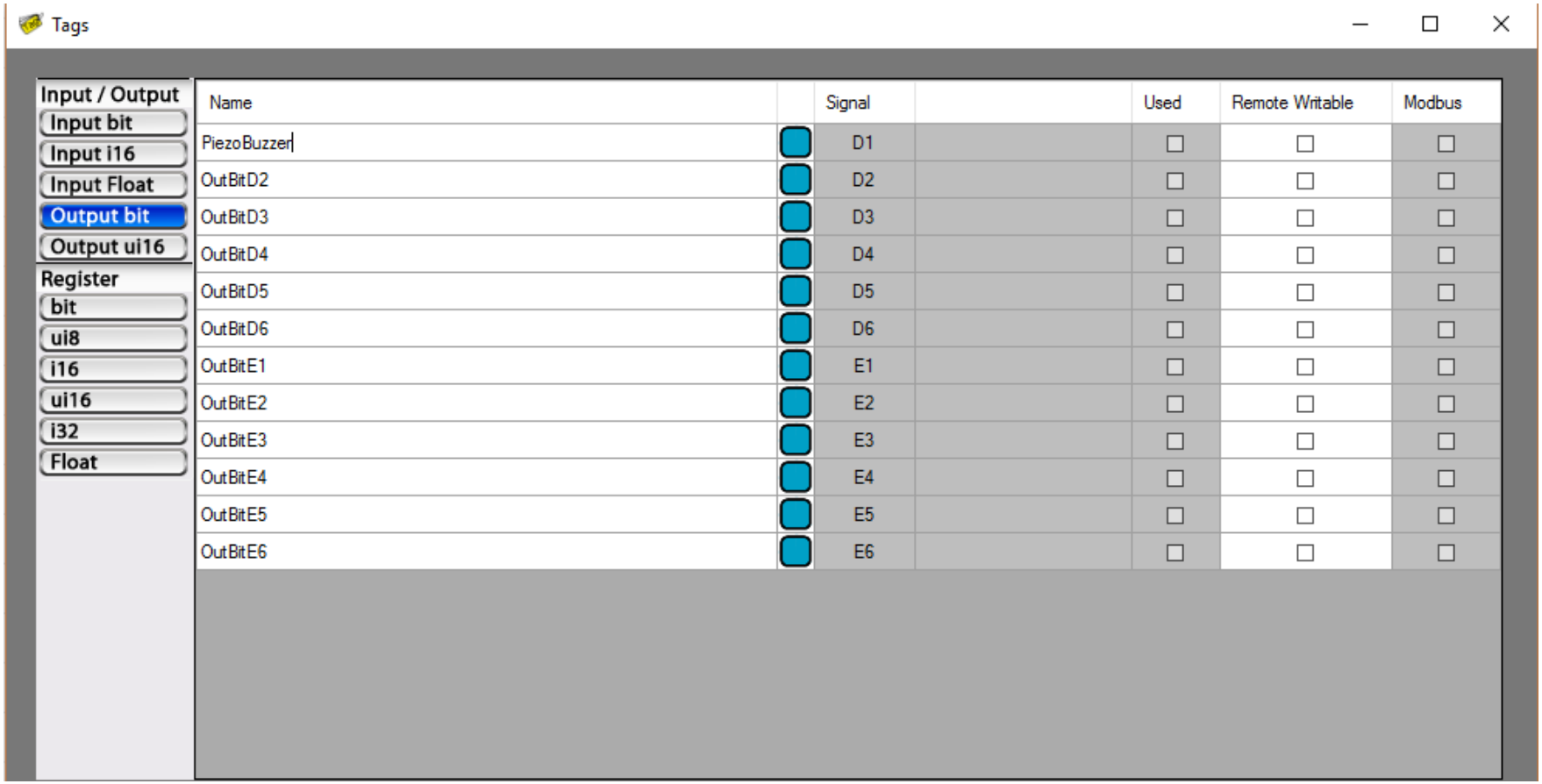
Creating Tags for Input and Output port pins of the Ace 22 PLC.

Building the ON/OFF Controller Flowchart…



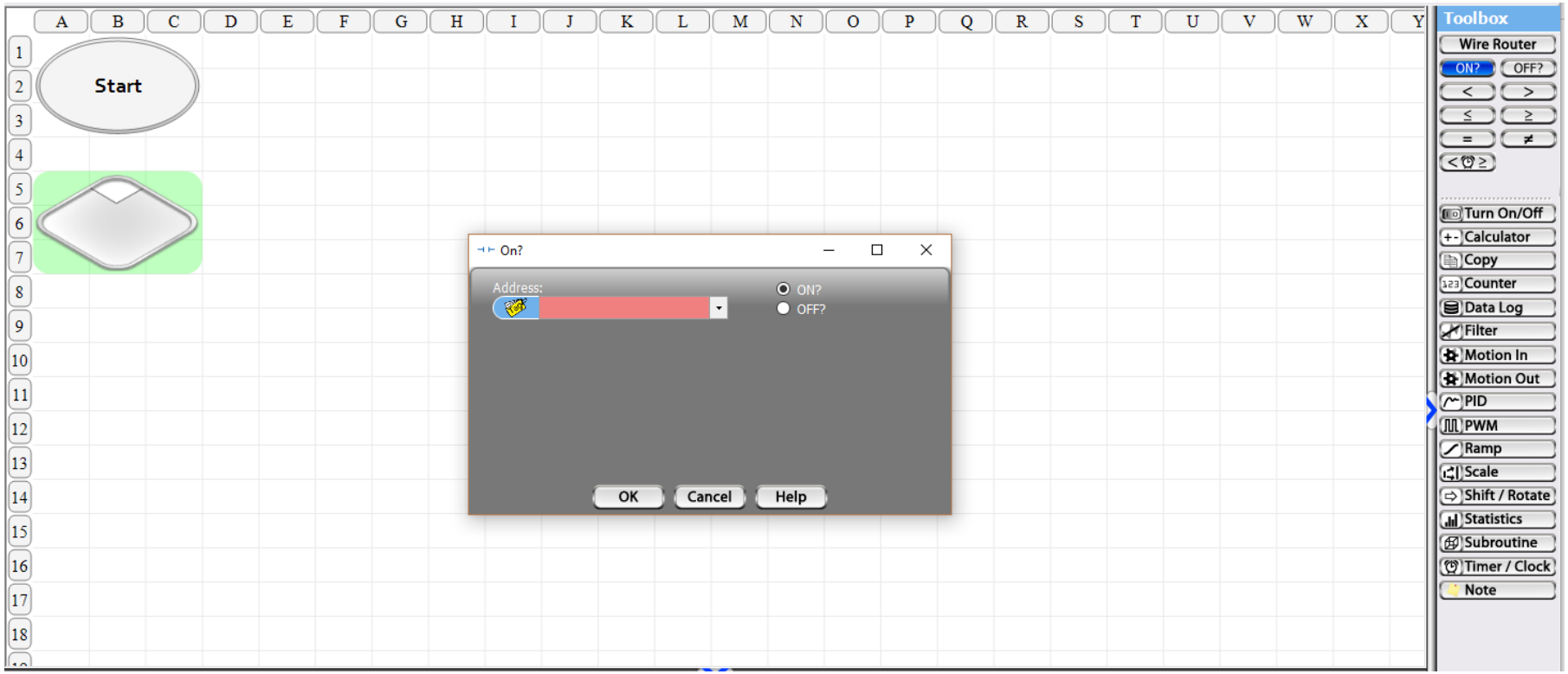
InBitB1 address renamed to ON_Switch tag

Building the ON/OFF Controller Flowchart…



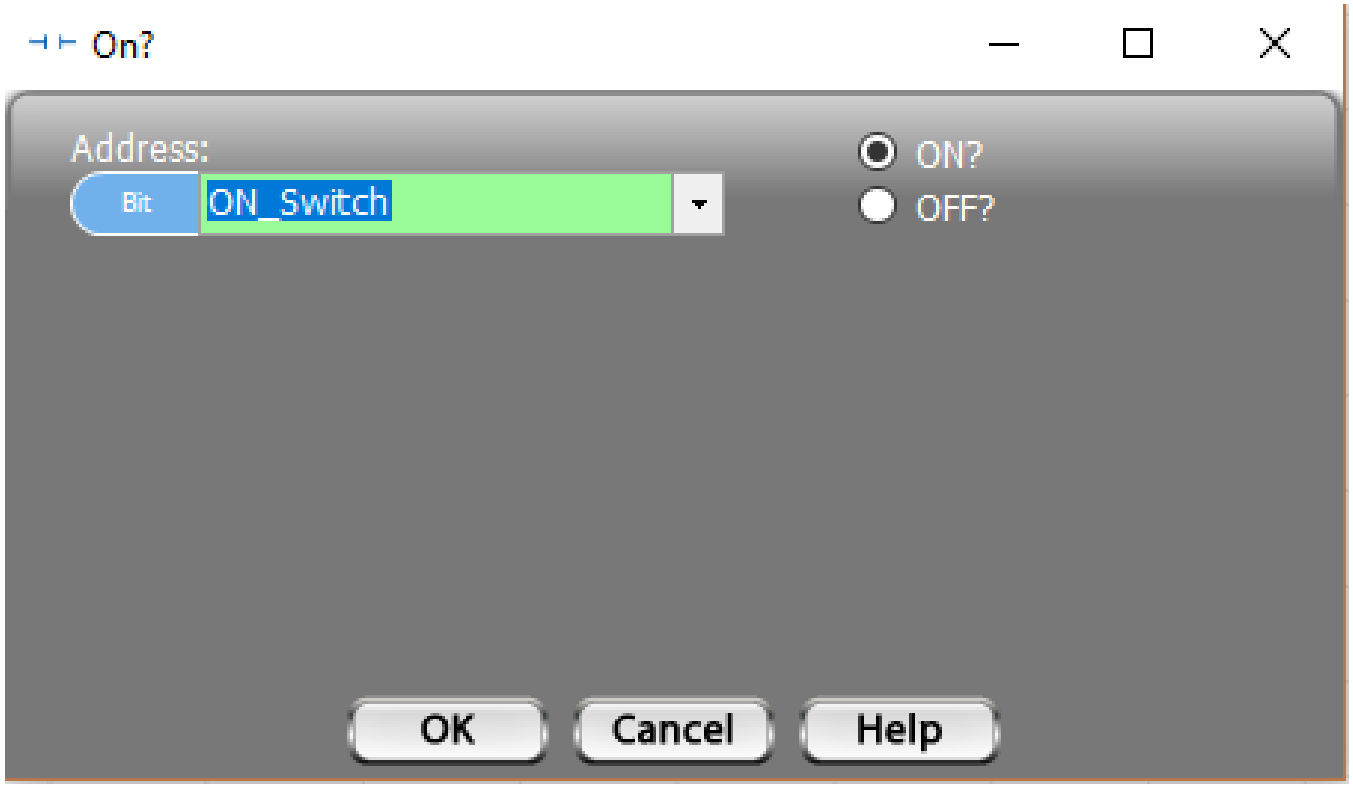
OutBitD1 address renamed to PiezoBuzzer tag.

Building the ON/OFF Controller Flowchart…



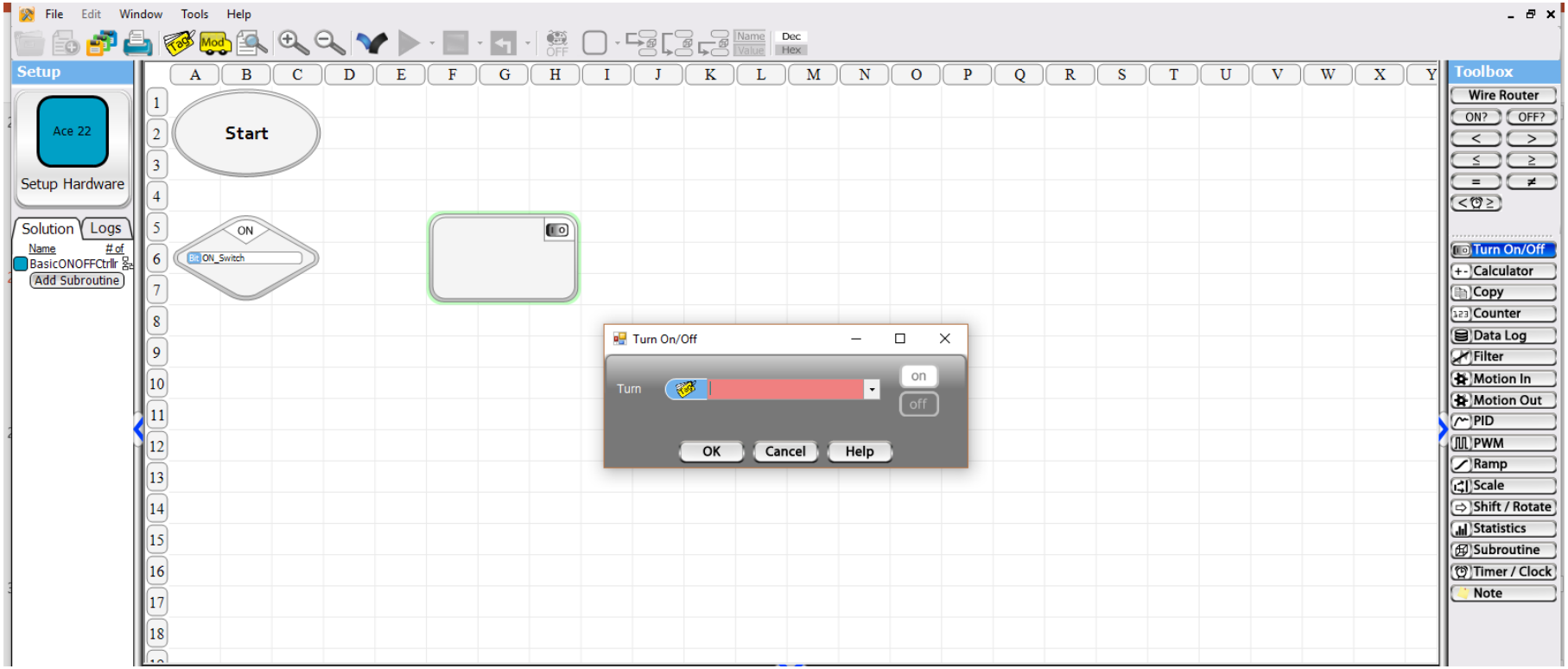
Select the ON Decision Block from the right side of Toolbox under Wire Router button.

Building the ON/OFF Controller Flowchart…



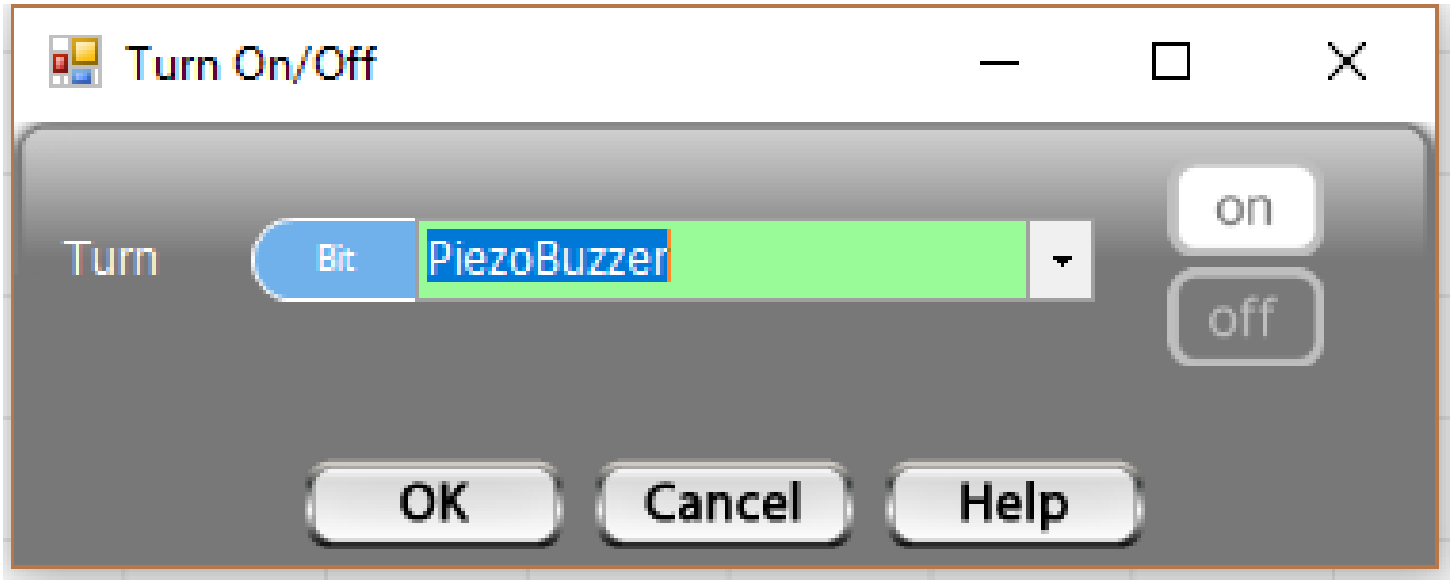
Selecting the ON_Switch Tag for the Turn ON/OFF Decision Block.

Building the ON/OFF Controller Flowchart…



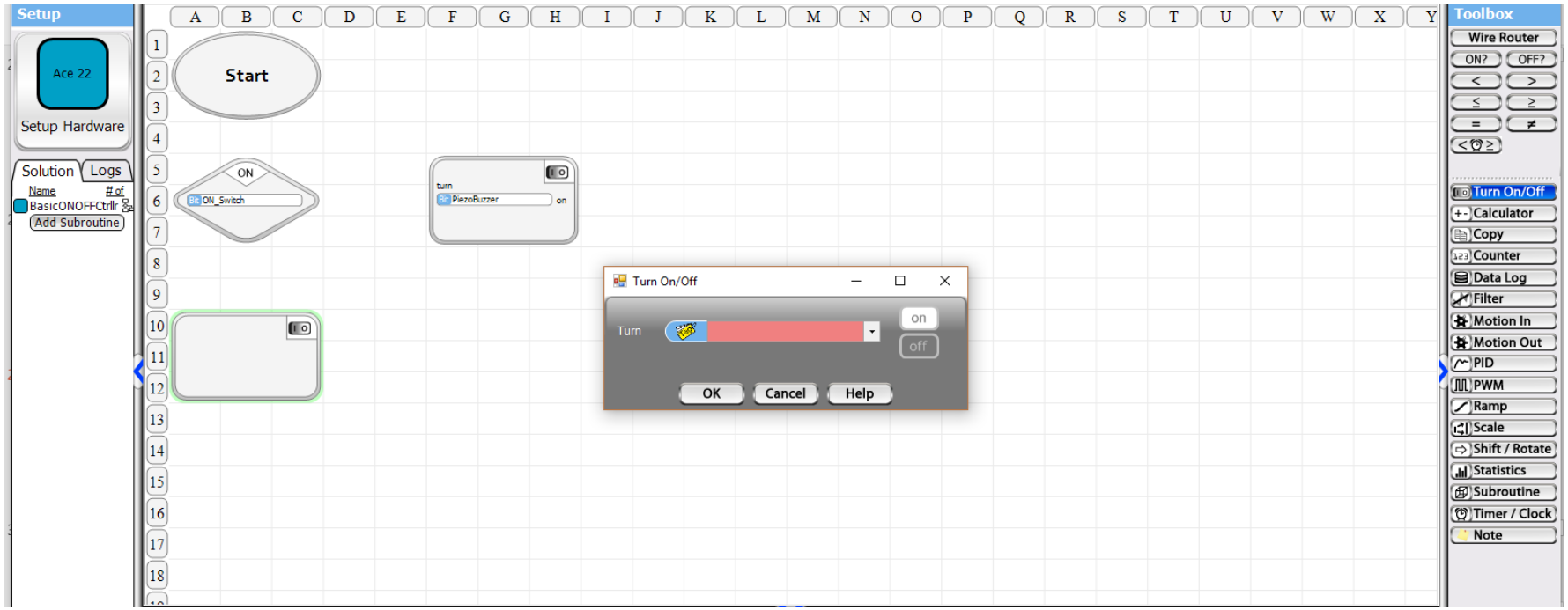
Selecting theTurn ON/OFF Process Block.

Building the ON/OFF Controller Flowchart…



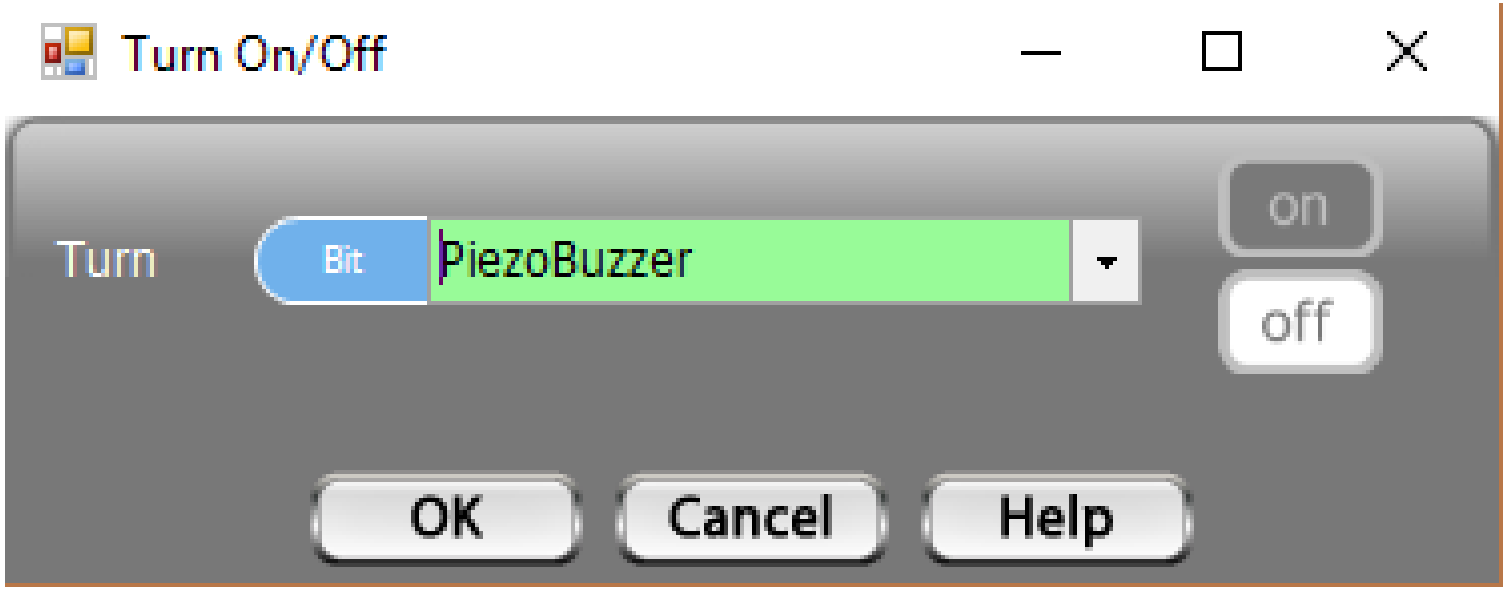
Selecting the PiezoBuzzer Tag for the Turn ON/OFF Decision Block.

Building the ON/OFF Controller Flowchart…



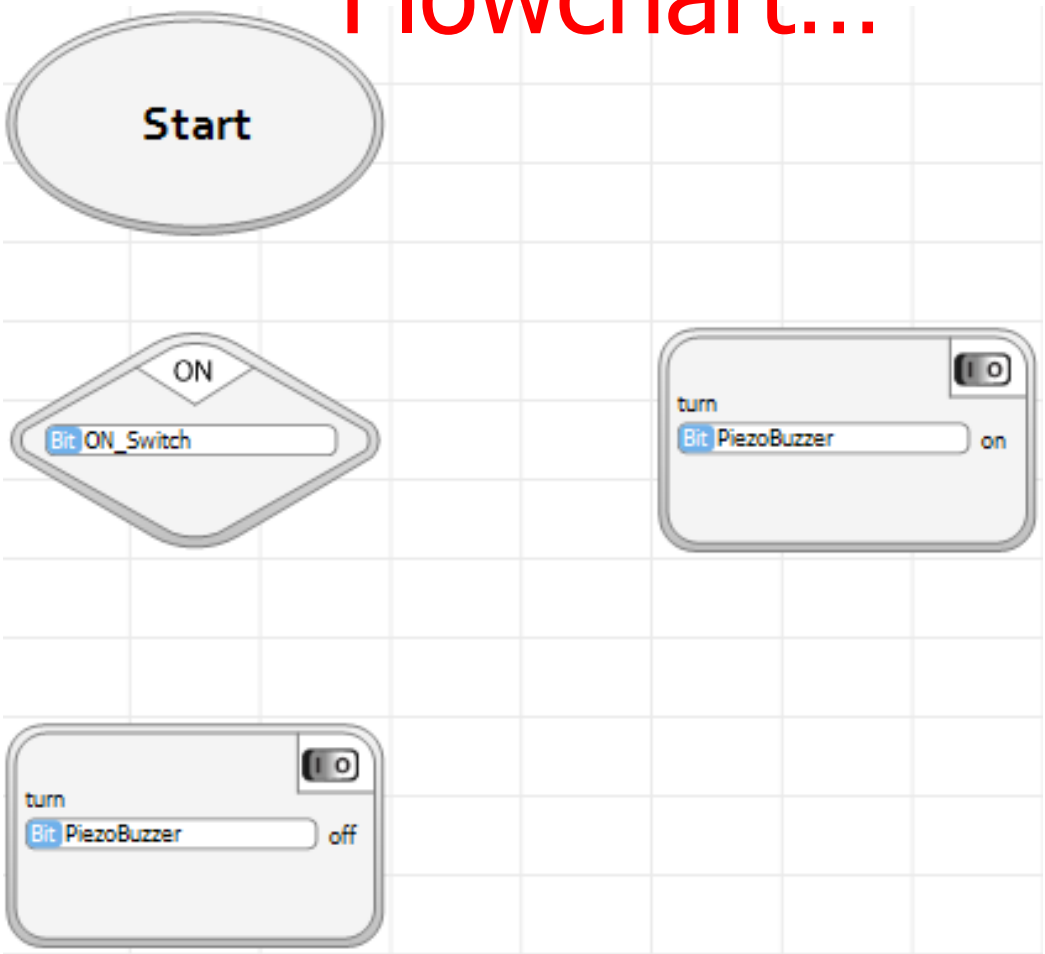
Selecting another Turn ON/OFF Process Block.

Building the ON/OFF Controller Flowchart…



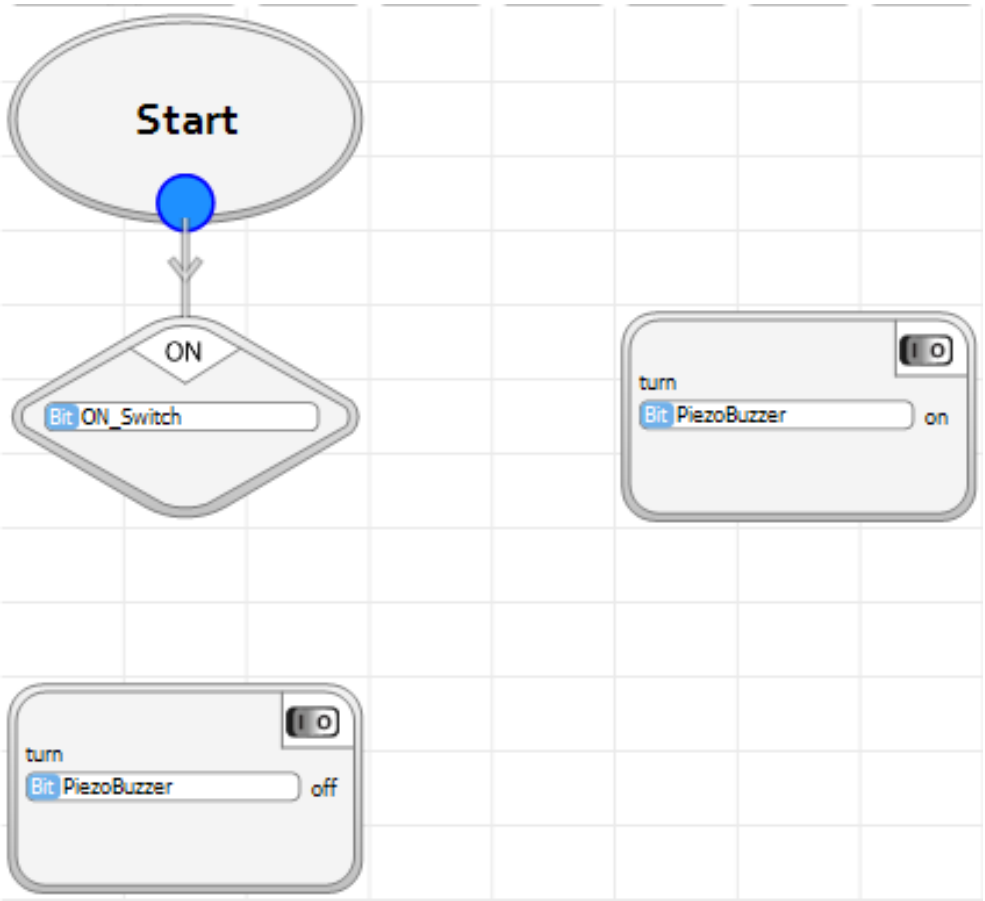
Selecting PiezoBuzzer Tag for the Turn ON/OFF Process Block. Select the OFF button for this Process Block.

Building the ON/OFF Controller Flowchart…



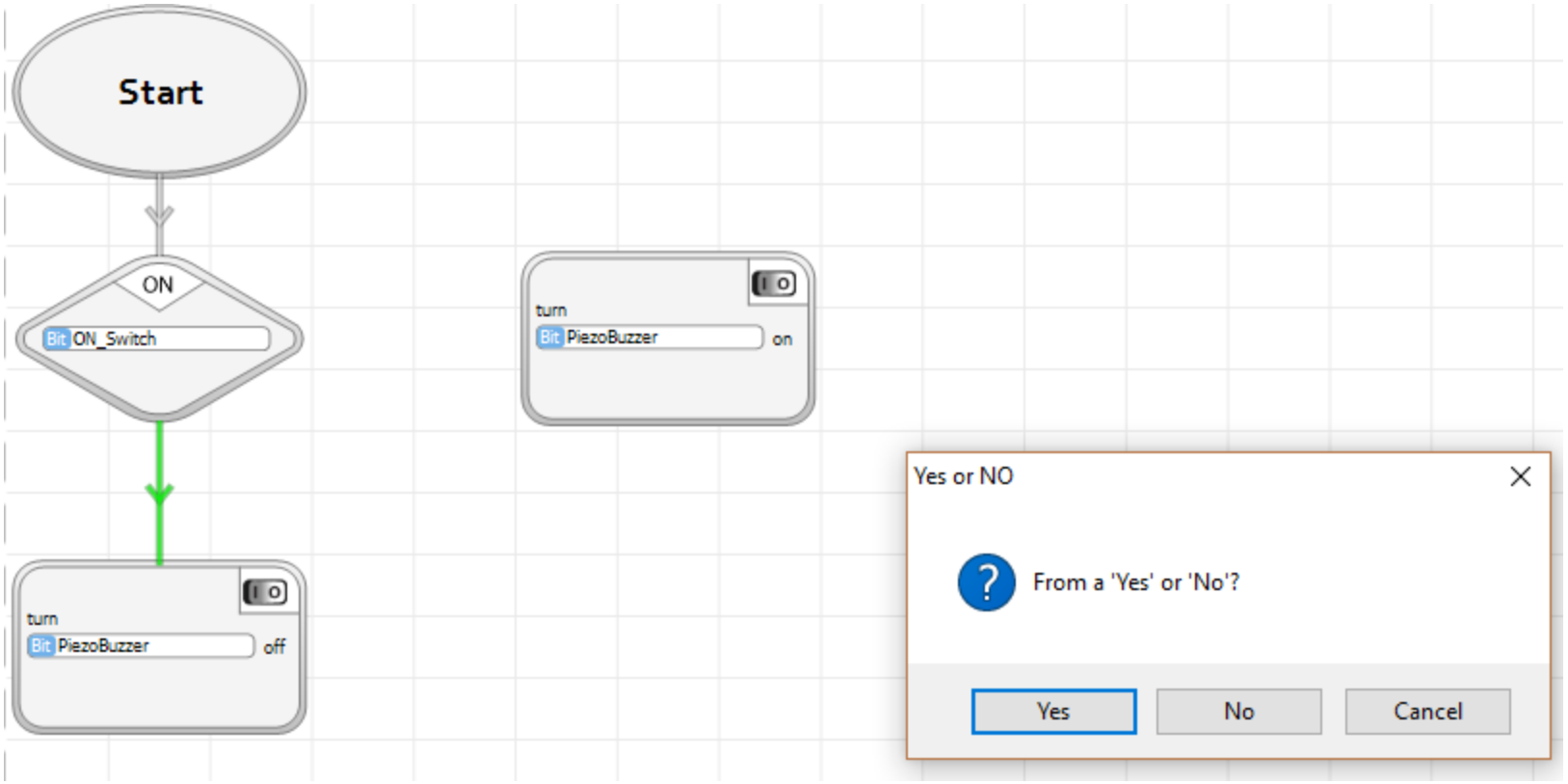
The Piezo Buzzer Turn ON/OFF Process and ON Decision Blocks for the ON/OFF Controller Flowchart have been configured.

Building ON/OFF Controller Flowchart…



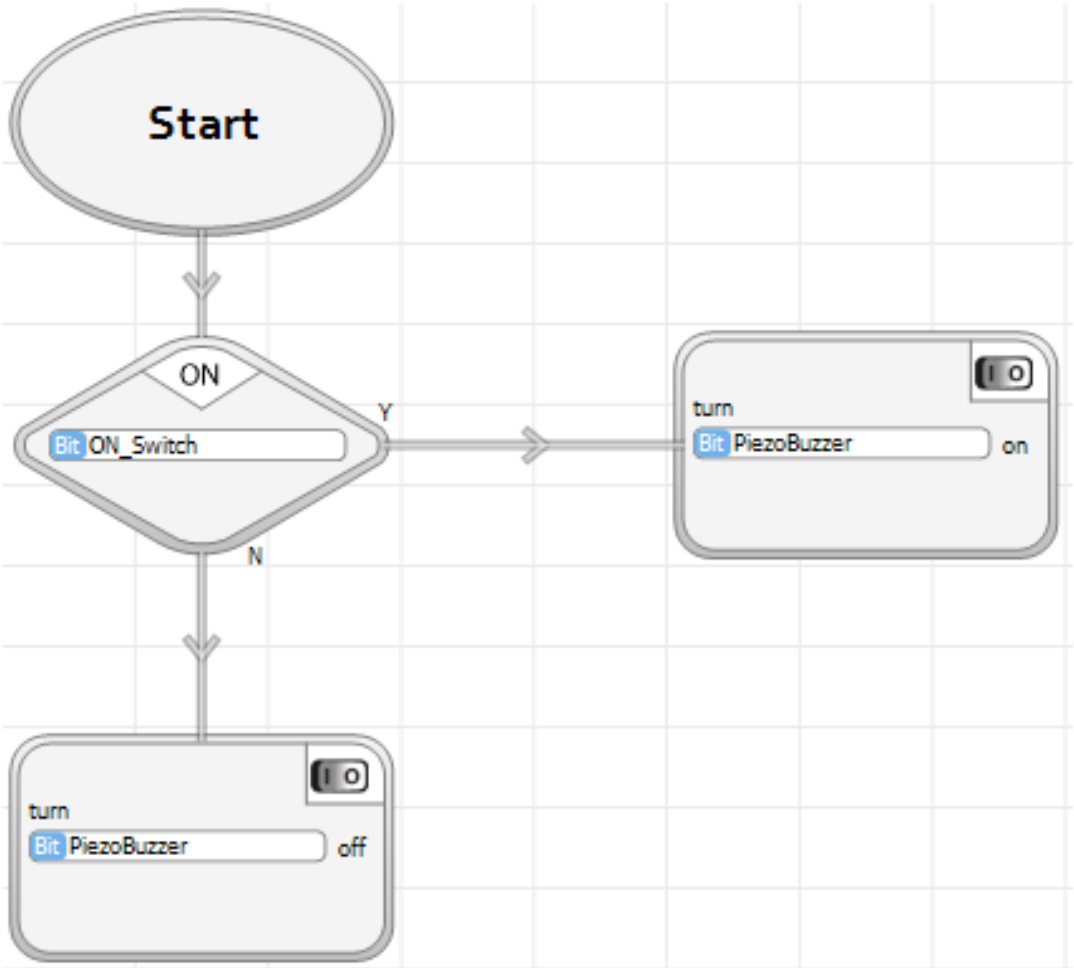
Select the flowchart symbol you want to attach with a click and drag motion of the mouse.

Building ON/OFF Controller Flowchart…



Select NO to finalize this connection to the Turn ON/OFF Process Block .

Building ON/OFF Controller Flowchart…

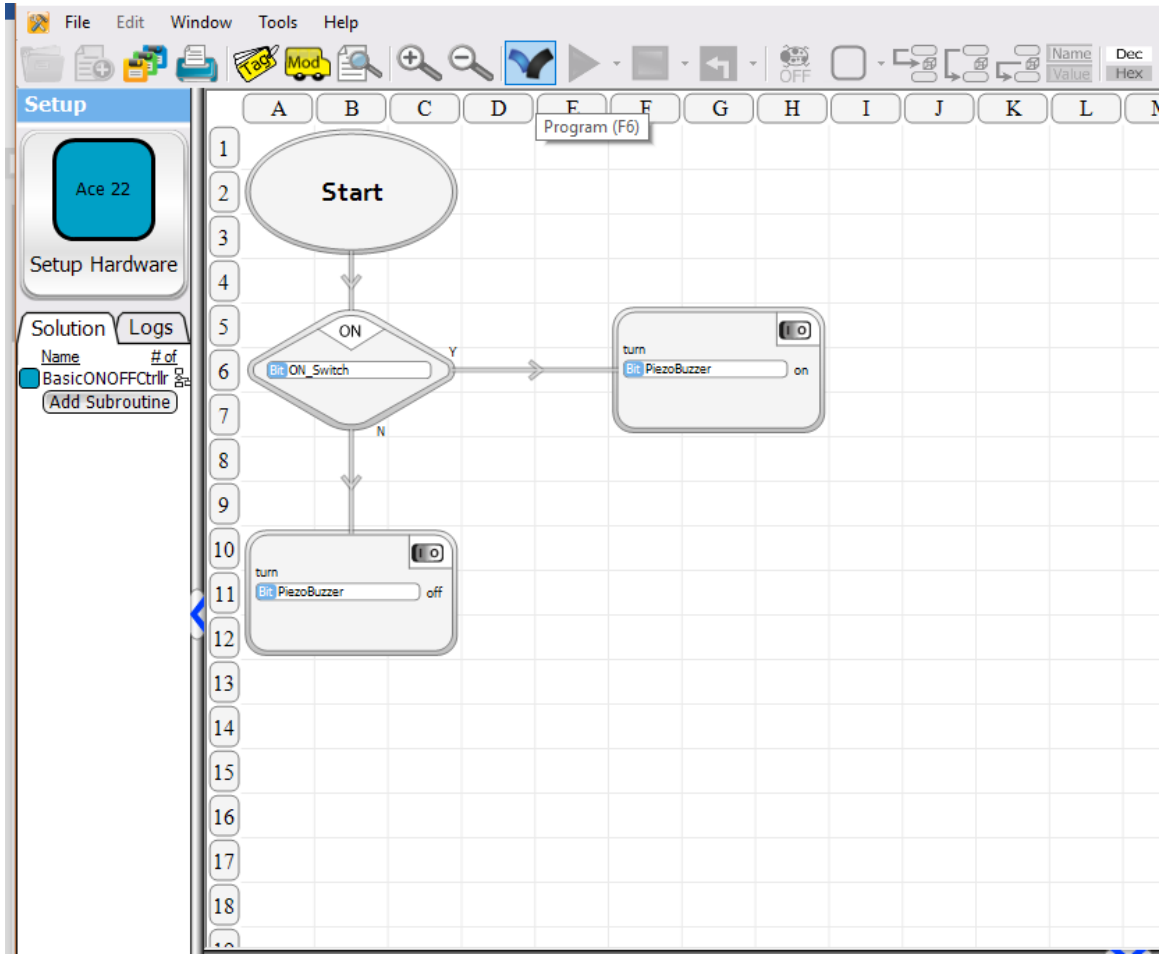


Dragging the arrow to the Turn ON/OFF (ON) Process Block will define this decision action as a Yes (Y).

Question 5

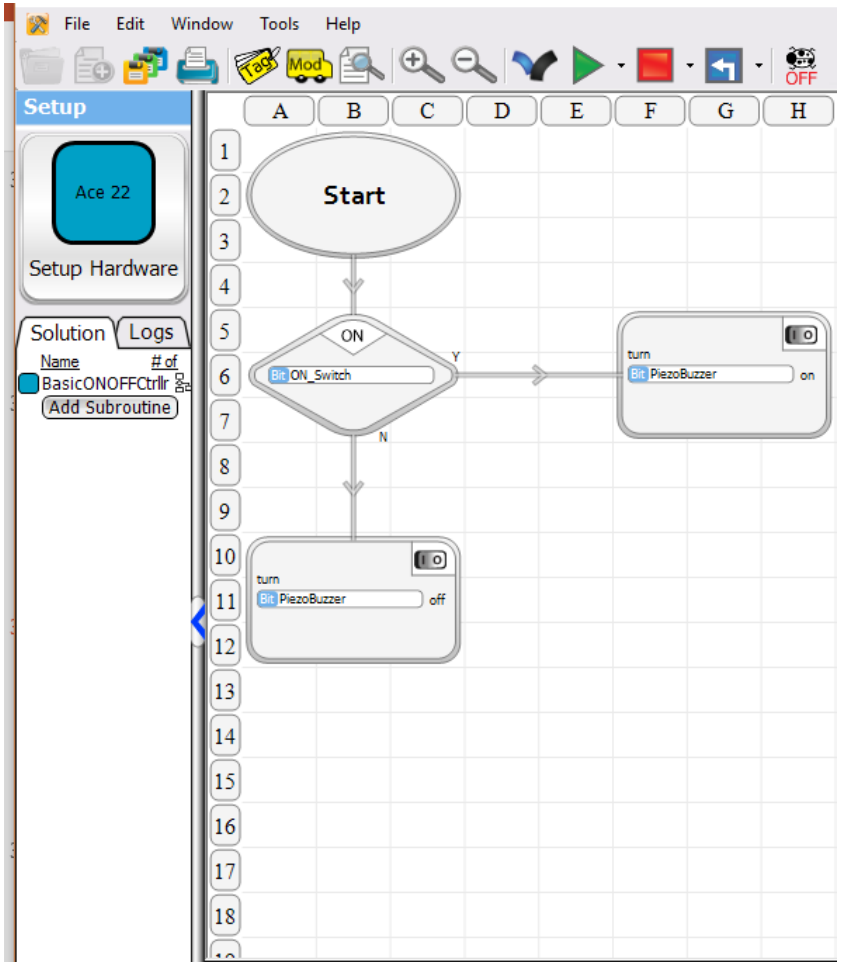
Describe how to create an inverting switch using the ON/OFF Controller Flowchart.

Building ON/OFF Controller Flowchart…



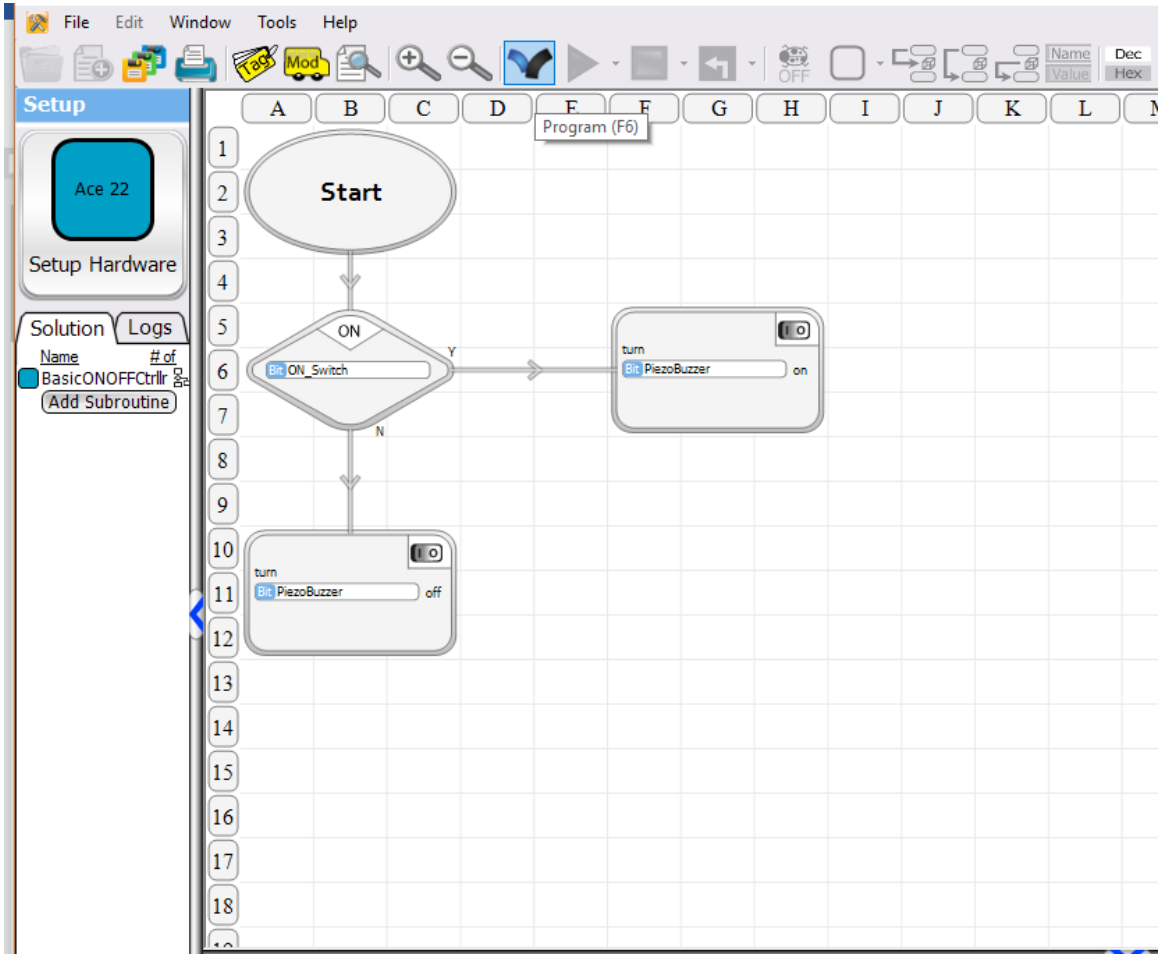
Click on the Velocio Icon to program the Ace 22 PLC.

Building the ON/OFF Controller Flowchart…



The tool taskbar will become active once the PLC is programmed.

Programming the Ace 22 PLC



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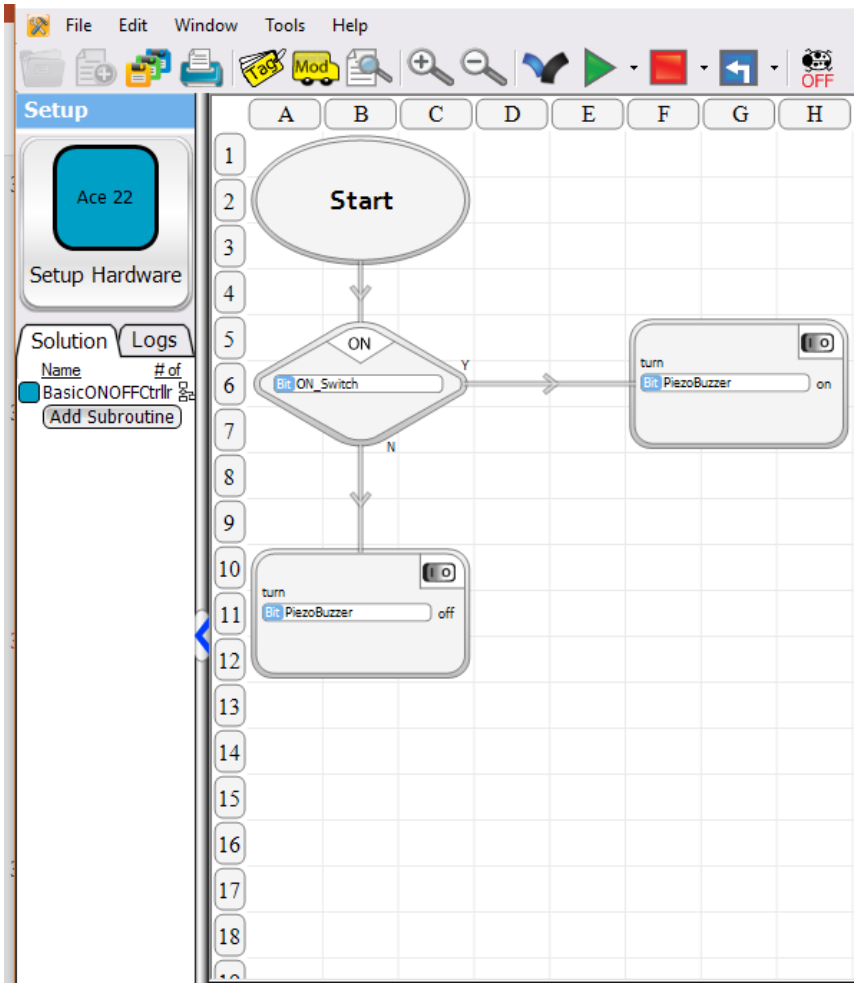
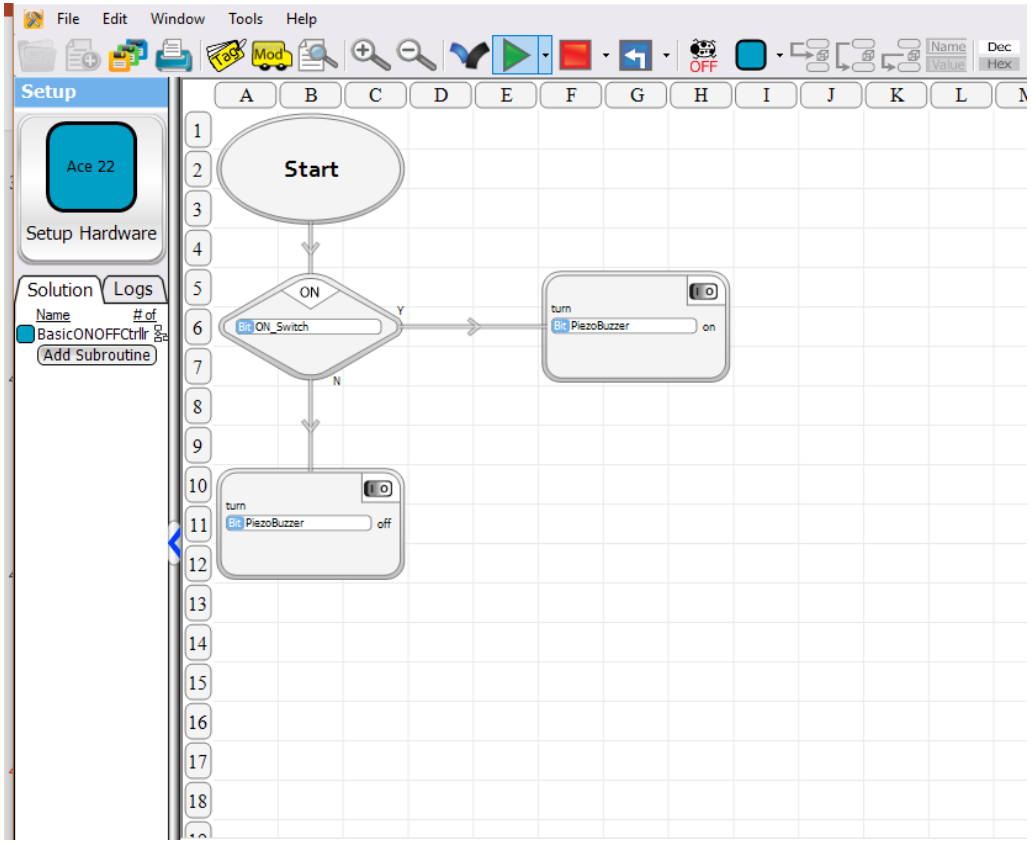
Programming the Ace 22 PLC…



The tool taskbar will become active after once the PLC is programmed.

Running the Basic ON/OFF Controller Flowchart



Click the "Green" run button to operate the Piezo Buzzer with the Simulator switch.