

# Using Boolean Logic Part 1

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BAT-212: BAT Logic and Programming



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## Using Boolean Logic Part 1

## OBJECTIVES

Upon completion of this activity the student will be able to:

1. Identify physical signal values corresponding to Boolean logic values.
2. Use Sedona blocks to implement Boolean logic.

## PARTS AND EQUIPMENT

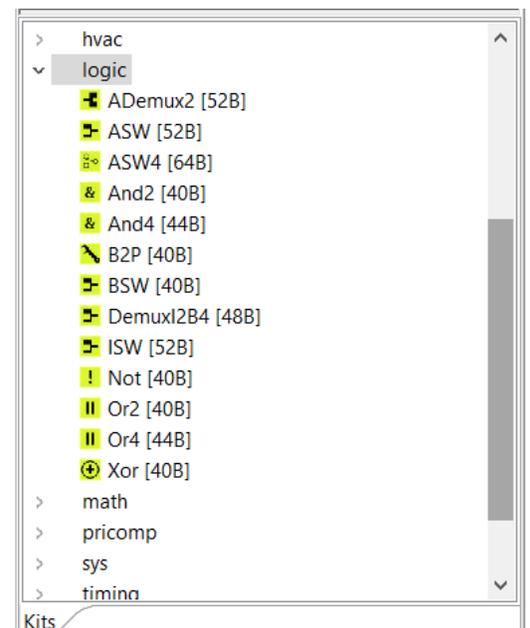
- Sedona Application Editor from Contemporary Controls
- BAS22controller or BASemulator
- Lab field devices

## REFERENCES

- BAScontrol22 User Manual: <https://www.ccontrols.com/pdf/um/UM-BASC22V4.pdf>
- Sedona Open Control Reference Manual <https://www.ccontrols.com/pdf/RM-SEDONA00.pdf>

## BACKGROUND

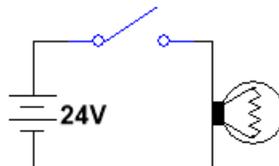
Today you will experiment with basic logic gates using the blocks available in the Sedona Application Editor. The basic gates are AND, OR, NOT, NAND, NOR, XOR, XNOR. The blocks available in the editor are AND, OR, NOT, and XOR. NAND, NOR, or XNOR can be formed by combining AND, OR, or XOR with a NOT. The logic blocks are found in the bottom left pane of the editor under logic. Other logic blocks available include switches and demultiplexers. You will not use these for this lab. Refer to the Sedona reference manual 2.5 for explanation of the blocks and 3.1 – 3.10 for examples of use of the basic gate blocks.



## PROCEDURES

### **Building the circuit:**

You will need two input circuits and one output circuit. Connect two binary inputs from the controller with the toggle switches. Test which poles on the switches are connected and disconnected by the switch action. You may use either the UI inputs or the specialized binary inputs. Drive lamp of the trainer with a binary output from the controller. Note that the circuit for the binary output requires that you wire a power source in series with the relay. 24 volts is available on the trainer. The schematic is included below. The controller binary output is the switch in the schematic. So BO1A should go to the 24-volt supply from the trainer, and BO1B should go to the connection for the lamp. Verify that your circuits make sense given the electrical specifications for I/O given in the controller user manual. **Include electrical specifications in your lab report. Include photos of your wiring in your lab report.** This wiring setup will be used for each of the 9 logic tests below.



### **Building and testing the logic:**

For each exercise:

- Build the logic needed in Sedona.
- Take at least one screen snip of the working wiresheet with a one sentence description of the state shown for each snip.
- Fill in the tables provided for all input combinations. Note that for Boolean values, 0 is equivalent to false and 1 is equivalent to true.
- **Include screen snips, descriptions and tables in your lab report.**

1. NOT(BI1):  $A' = X$

| DMM Volt Measurement |   | Sedona block value |   |
|----------------------|---|--------------------|---|
| A                    | X | A                  | X |
|                      |   | 0                  |   |
|                      |   | 1                  |   |

2. BI1 AND BI2:  $AB=X$ 

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

3. BI1 OR BI2:  $A+B=X$ 

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

## 4. NOT(BI1) AND NOT(BI2)

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

## 5. NOT(BI1) OR NOT(BI2)

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

## 6. NOT(BI1AND BI2)

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

## 7. NOT(BI1OR BI2)

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

## 8. BI1 XOR BI2

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

## 9. NOT(BI1 XOR BI2)

| DMM Voltage Measurement |   |   | Sedona block value |   |   |
|-------------------------|---|---|--------------------|---|---|
| A                       | B | X | A                  | B | X |
|                         |   |   | 0                  | 0 |   |
|                         |   |   | 0                  | 1 |   |
|                         |   |   | 1                  | 0 |   |
|                         |   |   | 1                  | 1 |   |

**Questions:**

**Include a paragraph in your lab report** that responds to the following questions.

Compare the results of tables 4 and 6. Are they equivalent?

Compare the results of tables 5 and 7. Are they equivalent?

Compare the results of tables 4 and 7. Are they equivalent?

Compare the results of tables 5 and 6. Are they equivalent?

For the tables that are equivalent, write the Boolean equations to show that relationship.

Also, make note of anything that surprised you or was counter-intuitive.