WAKE TECH
Building, Engineering, & Skilled Technologies

Using Boolean Logic Part 2

BAT-212: BAT Logic and Programming

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Using Boolean Logic Part 2

OBJECTIVES

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

Use Sedona blocks to implement Boolean combinational logic.

PARTS AND EQUIPMENT

- Sedona Application Editor from Contemporary Controls
- BAS22controller or BASemulator
- BAT trainer (optional)

REFERENCES

- Contemporary Controls product page: https://www.ccontrols.com/basautomation
- Sedona Open Control Reference Manual: Course Resources or https://www.ccontrols.com/pdf/RM-SEDONA00.pdf

BACKGROUND

The basic logic gates can be combined to form more complicated logic systems. Combinational logic refers to combinations of the basic gates and has the property that any change in input affects the output immediately, allowing for propagation delay. This contrasts to sequential logic, where the effect of a change in input depends on the current state of the system.

PROCEDURES

Part 1:

We will use the webpage of the controller to force inputs and display outputs instead of connecting to physical I/O. You can work on the controller or the emulator. (If you work on the controller, it will be easy to wire to the trainer after testing with the webpage.)

The scenario for the lab is control for a room VAV box. The inputs for control will be 5 binary threshold sensors or switches: CO2 too high true/false, relative humidity too high true/false, occupancy true/false, temperature too high true/false, temperature too low true/false. The output control will be 3 binary outputs: fan off/on, heat off/on, cool off/on. Draw the schematic representation of each output in terms of the relevant binary inputs and give the Boolean equation. **Include these in your lab report.** Then build logic in the Sedona wiresheet to control each output.

Heat off/on: Heat should be on if temperature is too low and relative humidity is not too high.

Cool off/on: Cool should be on if temperature is too high or relative humidity is too high and the room is occupied.

Fan off/on: The fan will be on if the heat is on, if the cool is on, or if heat and cool are off, but the room is occupied and CO2 is high.

Record the responses of your logic in the function tables below. Demonstrate your working wiresheet to the instructor. **Include tables and screen shots of wiresheets in your lab report.**

Cool function			
Temp high	Occ	RH high	Cool on
False	False	False	
False	False	True	
False	True	False	
False	True	True	
True	False	False	
True	False	True	
True	True	False	
True	True	True	

Heat function		
Temp low	RH high	**Heat on**
False	False	
False	True	
True	False	**1**
True	True	

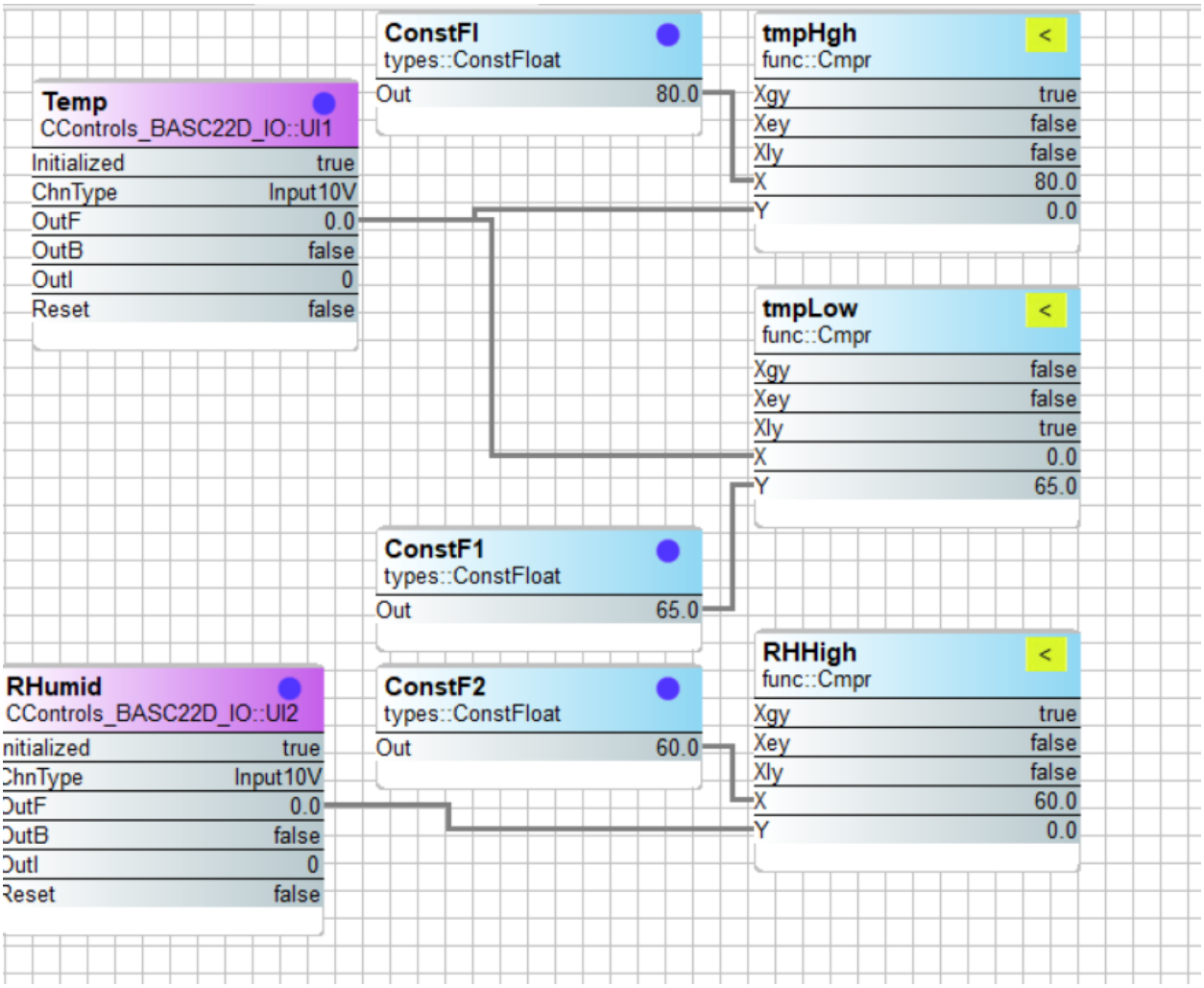
Fan function				
Heat on	Cool on	Occ	CO2 high	Fan on
False	False	False	False	
False	False	False	True	
False	False	True	False	
False	False	True	True	
False	True	False	False	
False	True	False	True	
False	True	True	False	
False	True	True	True	
True	False	False	False	
True	False	False	True	
True	False	True	False	
True	False	True	True	
True	True	False	False	
True	True	False	True	
True	True	True	False	
True	True	True	True	

Part 2:

Now use the trainer to wire the controller to physical inputs and outputs. If you did Part 1 on the emulator, you will need to backup your wiresheet from the emulator and restore it to the controller. You will use the BASbackup program and create a backup file from the emulator. Name and store the file so you can find it again. Then connect to the controller and use BASbackup to restore the file to the controller.

The occupancy sensor input and the CO2 input can be wired to the switches on the controller. You will use actual sensors for the humidity and temperature inputs. Refer to the data sheet for the humidity sensor for wiring. These are both analog inputs, so you will need to change the input type on the wire sheet and add comparison blocks to generate a binary signal from the analog input, as in the figure below. You will need to determine which of the outputs from each compare should be used for your combinational logic. Record the operation of the wired circuit (take the data from the sensors that occurs naturally first) and verify against the tables in Part 1.

Include screenshots of wiresheets, copies of tables, and photo of wiring in your lab report.



Heat function		
Temp low	RH high	Heat on
False	False	
False	True	
True	False	
True	True	

Cool function			
Temp high	Occ	RH high	Cool on
False	False	False	
False	False	True	
False	True	False	
False	True	True	
True	False	False	
True	False	True	
True	True	False	
True	True	True	

Fan function				
Heat on	Cool on	Occ	CO2 high	Fan on
False	False	False	False	
False	False	False	True	
False	False	True	False	
False	False	True	True	
False	True	False	False	
False	True	False	True	
False	True	True	False	
False	True	True	True	
True	False	False	False	
True	False	False	True	
True	False	True	False	
True	False	True	True	
True	True	False	False	
True	True	False	True	
True	True	True	False	
True	True	True	True	