WAKE TECH
Building, Engineering, & Skilled Technologies

Thermostat Lab

BAT-111: Building Automation Systems

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Name: _____ Section: _____

Thermostat Lab

BAT-111: Building Automation Systems

SYNOPSIS

In the previous labs, we started examining inputs and outputs for the BAScontrol22 controller. We will now simulate a thermostat using simple switches, a thermistor, pilot lights, and a controller.

OBJECTIVES

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

- Understand input and outputs for a device.
- Understand the various inputs the BASControl22 can read.
- Wire a voltage source, thermistor, switch, and resistor as an input to our controller.

PARTS AND EQUIPMENT

- Contemporary Controls BAScontrol22 or BAScontrol22S [https://www.ccontrols.com/basautomation/bascontrol.htm]
- Ethernet cable
- Windows Laptop
- Wiring of assorted colors
- Thermostat Enclousre
- Thermistor

REFERENCES

-

MANUALS

- Contemporary Controls BAScontrol22 User Manual [https://www.ccontrols.com/pdf/um/UM-BASC22V4.pdf]

BACKGROUND

PROCEDURES

Part 1: Thermostat Enclosure

We are going to examine the thermostat enclosure. We need to determine which color conductors are used for which thermostat function. We are also going to determine if the hardware is working properly.

1.1 - Overview

The simulated thermostat is made up of four switches:

- Heat/Cool mode: On/Off/On switch
- Fan mode: On/Off switch
- Set Point Up & Down: 2 momentary switches

1.2 - Set Point – Up push-button

The Set Point (SP) for the thermostat can be adjusted by two momentary switches.

What are the color wires for the SP Up push-button?_____

We are going to use the continuity checker of our multimeter to check that the switch is operating correctly.

Using our continuity checker, is there continuity when the push-button is depressed?_____

- If there is not continuity, check the wires and troubleshoot the issue.

Using our continuity checker, is there continuity when the push-button is *not* depressed?_____

- If there is continuity without depressing the switch, there could be an issue with the switch; check the switch and troubleshoot the issue.

1.3 - Set Point – Down push-button

What are the color wires for the SP Down push-button?_____

We are going to use the continuity checker of our multimeter to check that the switch is operating correctly.

Using our continuity checker, is there continuity when the push-button is depressed?_____

- If there is not continuity, check the wires and troubleshoot the issue.

Using our continuity checker, is there continuity when the push-button is *not* depressed?_____

- If there is continuity without depressing the switch, there could be an issue with the switch; check the switch and troubleshoot the issue.

1.4 - Fan Mode

The fan switch is a two-way switch:

- On – switch closed
- Auto – switch open

What are the color wires for the Fan switch?_____

We are going to use the continuity checker of our multimeter to check that the switch is operating correctly.

Fan Mode - On

Set the Fan switch to the On state.

Using our continuity checker, is there continuity when the Fan switch is set to On?_____

- If there is not continuity, there could be an issue with the switch; check the switch and troubleshoot the issue.

Fan Mode - Auto

Set the Fan switch to the Auto state.

Using our continuity checker, is there continuity when the Fan switch is set to Auto?_____

- If there is continuity, there could be an issue with the switch; check the switch and troubleshoot the issue.

1.5 - Cool/Heat/Off Mode

The Cool/Heat/Off Mode is controlled by an On/Off/On switch.

What are the color wires for the Cool/Heat Mode switch?_____

Cool/Heat – common wire

There are three wires going to the switch and we need to figure out which wire is the common wire.

Using our continuity checker and setting the switch to Cool Mode, which two wires have continuity?_____

Using our continuity checker and setting the switch to Heat Mode, which two wires have continuity?_____

The common wire will exist in both the Cool and Heat Mode.

Which color wire is the common wire?_____

Cool Mode

What is the color wire for Cool Mode besides the common wire?_____

Heat Mode

What is the color wire for Heat Mode besides the common wire?_____

Off Mode

Set the Cool/Heat switch to Off.

Using our continuity checker and setting the switch to Off, is there continuity between the Cool Mode wires?_____

Using our continuity checker and setting the switch to Off, is there continuity between the Heat Mode wires?_____

- With the switch set to Off, there should be no continuity between any of the wires.

1.6 - Thermistor

We need to know what type of thermistor we are using.

Our controller can handle the following thermistors:

- 10KT2
- 10KT3
- 20K
- 100K

What type of thermistor are we using?_____

Part 2: Lab Setup

2.1 - Laptop

Set your ethernet adaptor to the following configuration:

- IP address: 192.168.92.45
- Subnet mask: 255.255.255.0
- Default gateway: 192.168.92.1

2.2 - Controller

Wire the controller using 24 VAC.

Stop! Before proceeding to the next step, have your instructor inspect your wiring.

Use the static default IPv4 address of 192.168.92.68 and install the Lab configuration files.

Part 3: Wire Thermostat - Inputs

We are now going to wire the thermostat inputs to our controller and fill out our Points List.

3.1 - Up push-button

The Set Point (SP) can be raised by depressing the Up push-button.

Type

The Up push-button has two states:

- Depressed
- Not depressed

Is the Up push-button a binary or analog device?_____

- ➢ The Up push-button has two states, so it is a binary device.

When we depress the push-button, we want the controller to know the push-button was depressed. This is information coming into the controller

Is the Up push-button an input or output device?_____

- ➢ The controller wants to know that the push-button was depressed so this information goes into the controller. Information going into the controller is an Input.

Is the Up push-button an AI, BI, AO, or BO device?_____

Wire BI1

Wire the Up push-button to BI1 since the push-button is a binary input (BI).

Points List

For every lab, we need to record the IO for our controller.

Record the Up push-button on a row of the Points List sheet on page 32:

- Point Description: Up push-button
- Binary Input: BI1

3.2 - Down push-button

The Set Point (SP) can be raised by depressing the Down push-button.

Type

Is the Down push-button a binary or analog device?_____

- ➢ The Down push-button has two states, so it is a binary object.

Is the Down push-button an input or output device?_____

- ➢ The Down push-button is an Input.

Is the Down push-button an AI, BI, AO, or BO device?_____

Wire BI2

Wire the Down push-button to BI2 since the push-button is a binary input (BI).

Points List

Record the Down push-button on a row of the Points List sheet on page 32:

- Point Description: Down push-button
- Binary Input: BI2

3.3 - Heat Mode

Our simple thermostat has a Heat/Cool/Off switch, and the controller needs to know which mode to function in.

Heat Mode is determined by there being continuity between the Heat Mode wires. If there is continuity, then the Heat Mode is On, otherwise Heat Mode is Off.

Type

Is the Heat Mode a binary or analog choice?_____

- Heat Mode is either On or Off so it is binary. While the switch has multiple states, we are using continuity between two wires to determine that we are in Heat Mode. Since there are only two states, this is binary.

Is the Heat Mode an input or output?_____

- The controller wants to know if we are in Heat Mode, so this information goes into the controller. Information going into the controller is an Input.

Is the Heat Mode an AI, BI, AO, or BO device?_____

Wire BI3

The Heat Mode is a binary input, so we are going to wire it to BI3.

When wiring these conductors, make sure the common wire is wired to the BI3-C terminal.

Points List

Record the Heat Mode on a row of the Points List sheet on page 32.

3.4 - Cool Mode

Cool Mode is determined by there being continuity between the Cool Mode wires. If there is continuity, then the Cool Mode is On, otherwise Cool Mode is Off.

Type

Is the Cool Mode binary or analog choice?_____

- Cool Mode is either On or Off so it is binary. While the switch has multiple states, we are using continuity between two wires to determine that we are in Cool Mode. Since there are only two states, this is binary.

Is the Cool Mode an input or output?_____

- Cool Mode is an Input.

Is the Cool Mode an AI, BI, AO, or BO device?_____

Wire BI4

The Cool Mode is a binary input, so we are going to wire it to BI4.

> Remember there is continuity between the C terminals on the controller so there is continuity between BI3-C and BI4-C. Since you already wired the common wire of the three-way switch to BI3-C and there is continuity between BI3-C and BI4-C, you do *not* need to wire the common wire to BI4-C.

When wiring these conductors, make sure the common wire is already wired to the BI3-C terminal.

Why is nothing wired to BI4-C?_____

_____

_____

_____

Points List

Record the Cool Mode on a row of the Points List sheet on page 32.

3.5 - Thermistor

The thermostat needs to know the current space temperature and we are going to use a thermistor for that.

Type

Is the Thermistor a binary or analog device?_____

- The thermistor shows the current temperature, so it is a range of values. A range of values has more than two states, so the thermistor is an analog device.

Is the Thermistor an input or output device?_____

- The controller wants to know the current space temperature, so this information goes into the controller. Information going into the controller is an Input.

Is the thermistor an AI, BI, AO, or BO device?_____

- The thermistor is an analog input (AI), so we are going to wire it to UI1.

Universal Input

The thermistor is an Analog Input (AI), and we wire AI devices to the Universal Input (UI) terminals on the controller.

A Universal Input defaults to functioning as an Analog Input (AI); however, a Universal Input (UI) can also be used to read:

- Binary Input (BI)
- Thermistor (10KT2, 10KT3, or 20K)
- Resistance

For a UI, we record the Channel Type which tells us how to handle the UI. The default Channel Type for a UI is "Analog Input". Later in the lab, we will configure the UI1 Channel Type to be a thermistor.

Wire UI1

Wire the thermistor to UI1.

Points List

When recording a Universal Input, we also need to record the Channel Type because the UI can be used to read more than just AI devices.

Record the thermistor on a row of the Points List sheet on page 32:

- Point Description: Thermistor
- Universal Input: UI1
- Universal Channel: Therm 10KT2 (or appropriate thermistor type)

3.6 - Fan Switch

Our simple thermostat has an Auto/On switch for the Fan.

When the thermostat Fan switch is set to On, there should be continuity between the wires and Auto is determined when there is *no* continuity.

Type

Is the Auto/On Fan switch a binary or analog device?_____

- ➢ The Auto/On Fan switch is a binary device.

Is the Auto/On Fan switch an input or output device?_____

- ➢ The Auto/On Fan switch is an input device.

Is the Auto/On Fan switch an AI, BI, AO, or BO device?_____

Wire UI2

The Auto/On Fan switch is a binary input (BI) device.

Are there any other BI terminals available to be used?_____

- ➢ There are only four BI terminals for this controller, and we are already using them all.

Universal Inputs (UI) can also be configured to function as a binary input (BI). This configuration is done through the controller's webpage and will be done later in the lab.

Wire the Auto/On Fan switch to UI2.

Points List

Record the Fan Switch on a row of the Points List sheet on page 32:

- Point Description: Fan Switch
- Universal Input: UI2
- Universal Channel: Binary

Part 4: Configure input devices

We have now wired all the IO devices to our controller, and we now need to configure our controller for these Inputs.

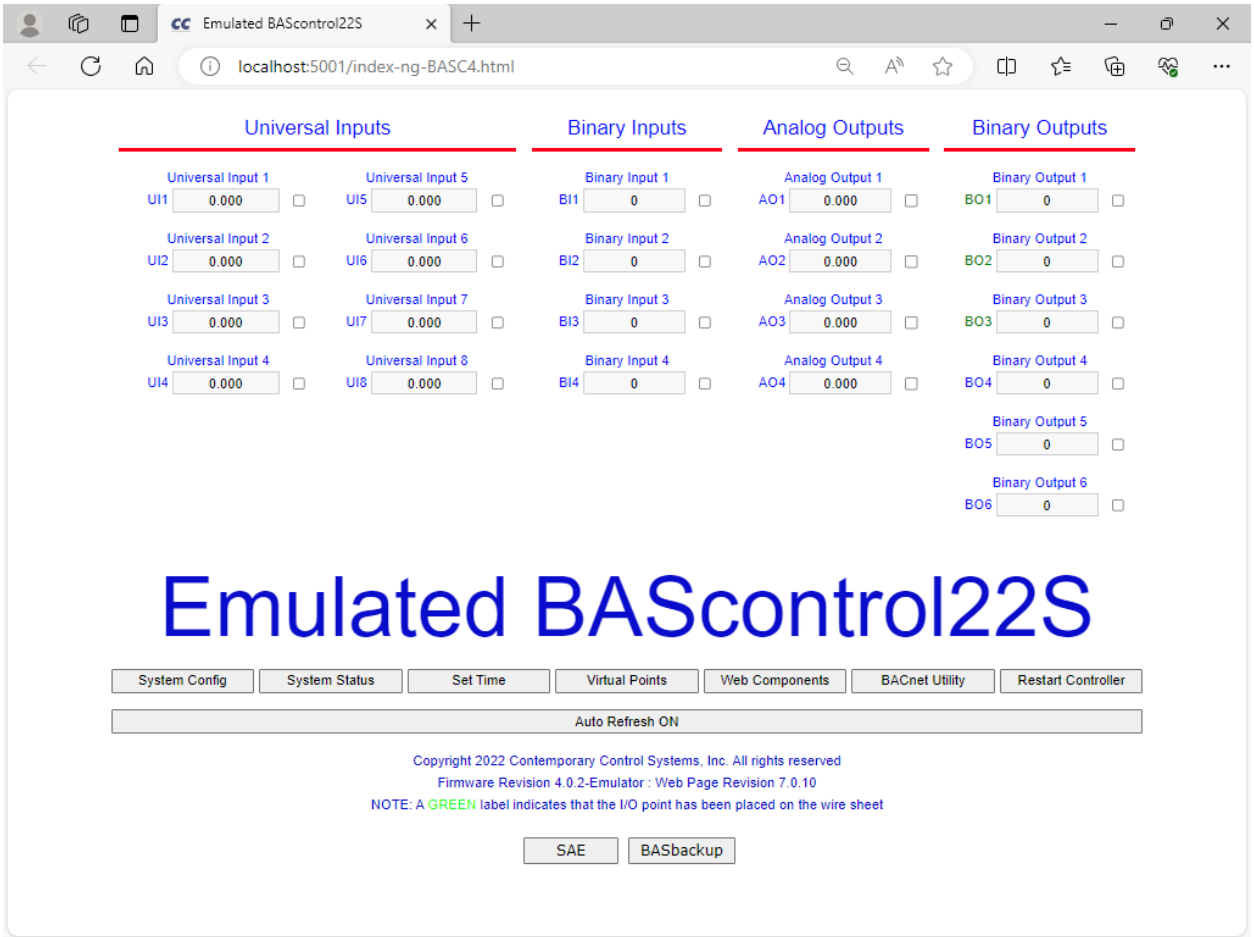
4.1 - Power

The instructor must check all wiring, before power is applied to the controller.

After the instructor has checked the wiring, apply power to the controller and wait until the startup sequence has finished and refresh the browser.

4.2 - Auto Refresh On

While working with the controller's webpage, turn Auto Refresh On.



4.3 - Up push-button – BI1

We want to customize the webpage so that our devices are properly labelled. Instead of BI1 being labeled “Binary Input 1”, it should say “Up push-button.”

On the webpage, click “Binary Input 1” in order to customize BI1.

Channel Type

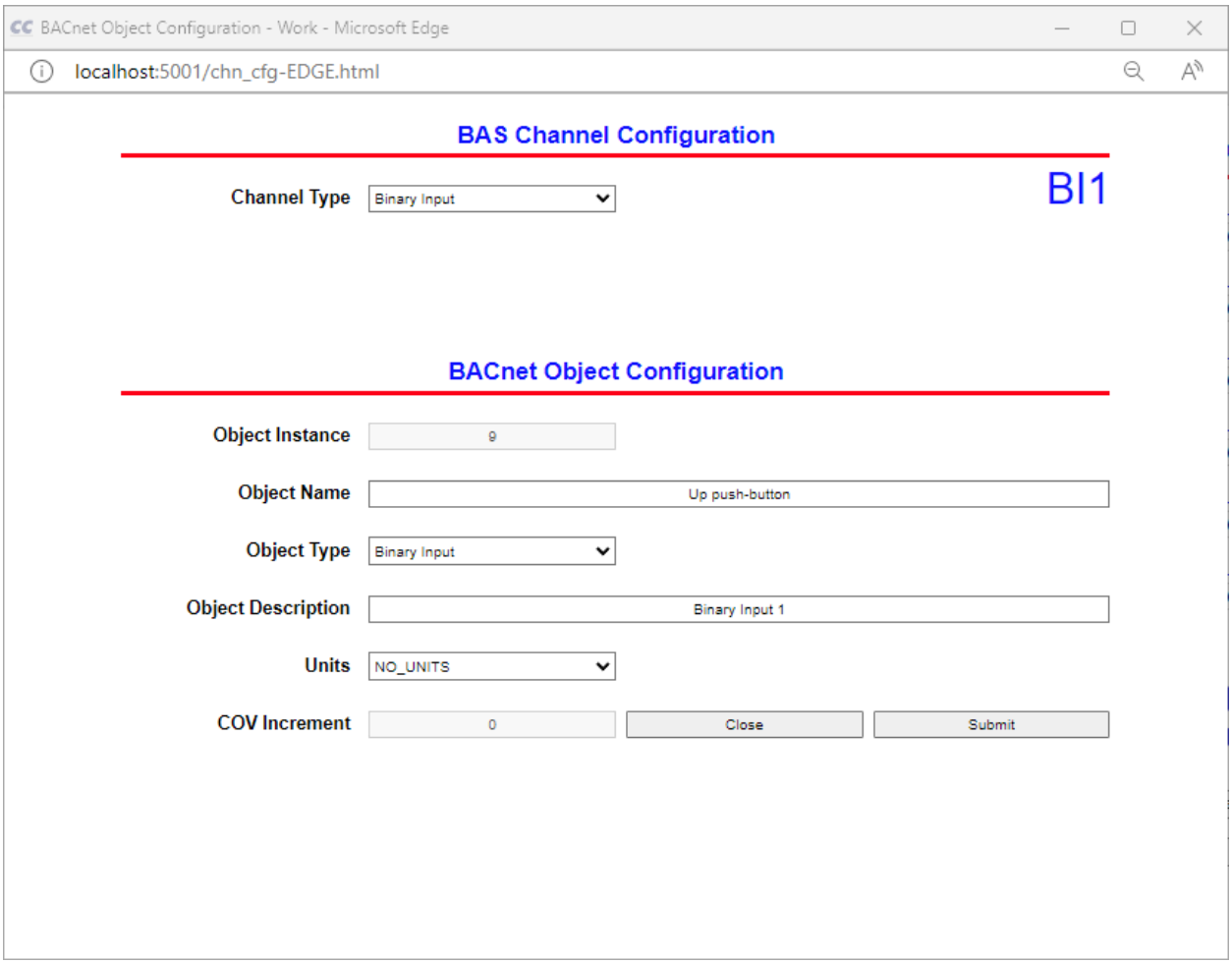
On the pop-up, what is the initial Channel Type?_____

By clicking the Channel Type dropdown, are there other options for the Channel Type?_____

- The BI1 can only be configured as a Binary Input.

Object Name

Change the Object Name to be “Up push-button” (without the quotes).



Submit the changes by clicking the "Submit" button and then close the pop-up by clicking the "Close" button.

On the webpage, is BI1 now labeled "Up push-button"?_____

- If your label change is not visible you might need to turn Auto Refresh On or refresh the webpage.

4.4 - Down push-button – BI2

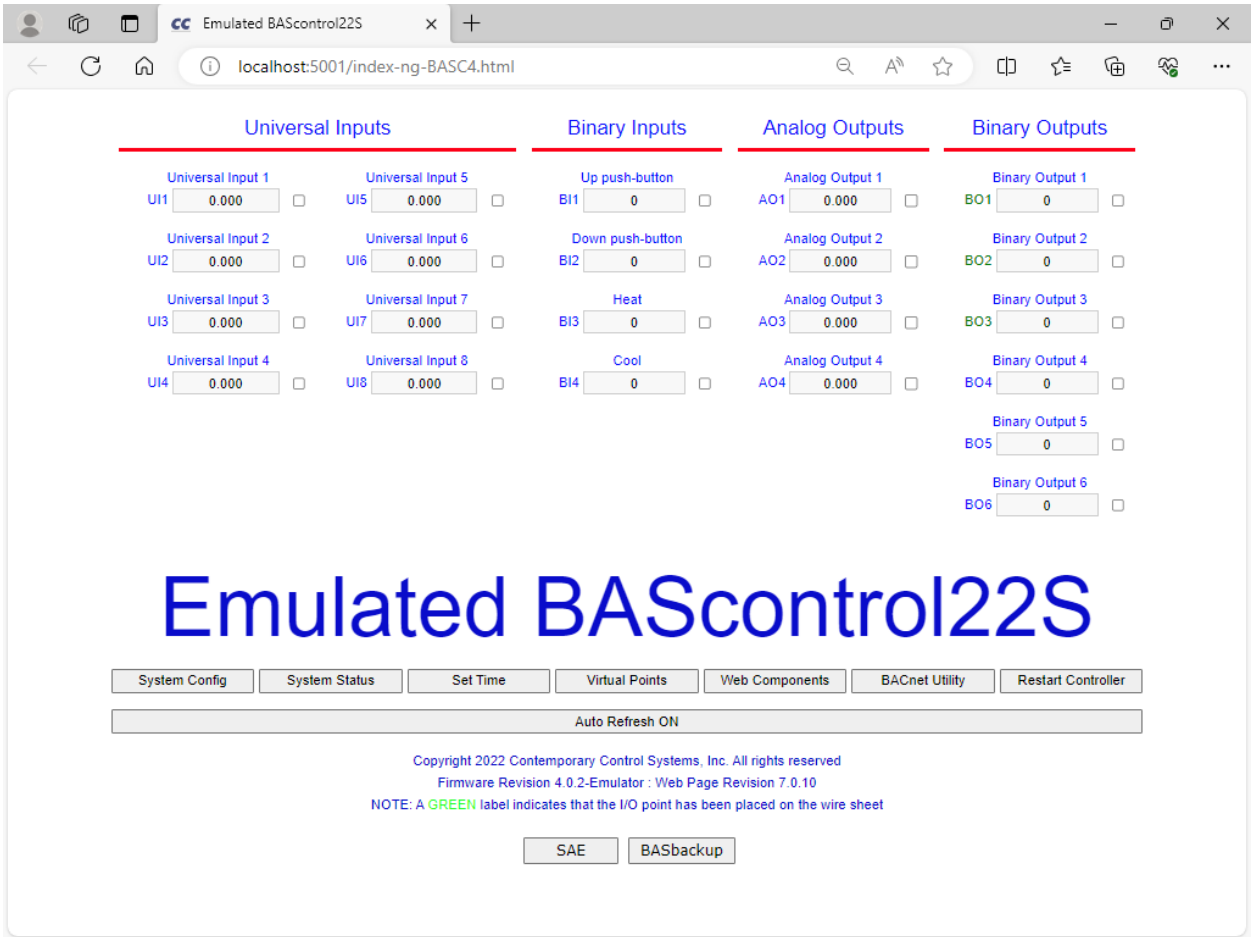
Change the label of BI2 to "Down push-button".

4.5 - Heat Mode – BI3

Change the label of BI3 to "Heat".

4.6 - Cool Mode – BI4

Change the label of BI4 to "Cool".



4.7 - Thermistor – UI1

The thermistor is used to read current space temperature. It does this by changing the resistance of the object based upon the current space temp. We need to make sure we are configuring our controller to use the proper thermistor type.

What type of thermistor are we using?_____

Click "Universal Input 1" to configure the thermistor.

Channel Type

On the pop-up configuration, what is the initial Channel Type?_____

By clicking the Channel Type dropdown, are there other options for the Channel Type?_____

What are the options for the Channel Type?_____

_____

_____

- A Universal Input (UI) can be configured to act as a BI, read a thermistor, or read resistance.

Change the Channel Type for the thermistor type you are using.

Object Name

Change the Object Name to "Space Temperature."

Submit and Close the UI1 configuration pop-up.

- Notice that UI1 should now be a temperature.

4.8 - Fan Switch – UI2

Click "Universal Input 2" to configure the Fan switch.

Channel Type

On the pop-up configuration, what is the initial Channel Type?_____

By clicking the Channel Type dropdown, are there other options for the Channel Type?_____

What are the options for the Channel Type?_____

_____

_____

- A Universal Input (UI) can be configured to act as a BI, read a thermistor, or read resistance.

Change the Channel Type to Binary Input.

Object Name

Change the Object Name to "Fan."

Submit and Close the UI2 configuration pop-up.

Value

Looking at the webpage, what is the value of the Fan (UI2)?_____

- Notice that UI2 has a value of 0 or 1 (depending on whether the fan switch is closed) which is an integer, while UI3 (which we have not configured) is a decimal. Since we changed the Channel Type of UI2 to a Binary Input, UI2 can now only be 0 or 1.

Part 5: Validate input devices

We have now configured our input devices with our controller and now we need to make sure that our controller can receive these inputs correctly.

5.1 - Controller Point Indicators

While validating that our input devices are functioning properly and we have wired them correctly, we will look at the Point Indicators on the Controller board.

5.2 - Up push-button – BI1

A momentary switch is a switch that is Normally Open (NO) and closes when it is depressed. Our push-button switch is a momentary switch.

We are going to start by examining the default state of the Up push-button. This device defaults normally to open (0 or false) and when the device is depressed should show closed (1 or true).

Which terminal is the Up push-button connected to?_____

BI1 Open

In the default state of the Up push-button, answer the following questions:

Is the BI1 Indicator illuminated on the controller?_____

- The BI1 Indicator should not illuminate when the push-button is not depressed.

What is the value of BI1 on the controller webpage?_____

- The value of BI1 should be "0" when the push-button is not depressed.

BI1 Closed

While depressing the Up push-button, answer the following questions:

Is the BI1 Indicator illuminated on the controller?_____

- The BI1 Indicator should illuminate when the push-button is depressed.

What is the value of BI1 on the controller webpage?_____

- The value of BI1 should be "1" when the push-button is depressed.

If the value of BI1 is not 1, make sure Auto Refresh is turned On.

5.3 - Down push-button – BI2

Which terminal is the Down push-button connected to?_____

BI2 Open

In the default state of the Down push-button, answer the following questions:

Is the BI2 Indicator illuminated on the controller?_____

- The BI2 Indicator should not illuminate when the push-button is not depressed.

What is the value of BI2 on the controller webpage?_____

- The value of BI2 should be "0" when the push-button is not depressed.

BI2 Closed

While depressing the Down push-button, answer the following questions:

Is the BI2 Indicator illuminated on the controller?_____

- The BI2 Indicator should illuminate when the push-button is depressed.

What is the value of BI2 on the controller webpage?_____

- The value of BI2 should be "1" when the push-button is depressed.

5.4 - Heat Mode – BI3

The Cool/Heat/Off switch determines the thermostat mode.

Which terminal is the Heat Mode connected to?_____

We consider out thermostat to be in Heat Mode if BI3 is true.

BI3 Closed – Mode Switch set to Heat

With the Mode switch set to Heat, answer the following questions:

Is the BI3 Indicator illuminated on the controller?_____

- The BI3 Indicator should illuminate when the Mode switch is set to Heat.

What is the value of BI3 on the controller webpage?_____

- The value of BI3 should be "1" when the Mode switch is set to Heat.

BI3 Open – Mode Switch set to Off

With the Mode switch set to Off, answer the following questions:

Is the BI3 Indicator illuminated on the controller?_____

- The BI3 Indicator should not illuminate when the Mode switch is set to Off.

What is the value of BI3 on the controller webpage?_____

- The value of BI3 should be "0" when the Mode switch is set to Off.

BI3 Open – Mode Switch set to Cool

With our thermostat design, we cannot be in Heat and Cool Mode at the same time as it is a manual switchover. When the Mode Switch is set to Cool, we should not be in Heat Mode and BI3 should be open.

With the Mode switch set to Cool, answer the following questions:

Is the BI3 Indicator illuminated on the controller?_____

- The BI3 Indicator should not illuminate when the Mode switch is set to Cool.

What is the value of BI3 on the controller webpage?_____

- The value of BI3 should be "0" when the Mode switch is set to Cool.

5.5 - Cool Mode – BI4

The Cool/Heat/Off switch determines the thermostat mode.

Which terminal is the Cool Mode connected to?_____

We consider out thermostat to be in Cool Mode if BI4 is true.

BI4 Closed – Mode Switch set to Cool

With the Mode switch set to Cool, answer the following questions:

Is the BI4 Indicator illuminated on the controller?_____

- The BI4 Indicator should illuminate when the Mode switch is set to Cool.

What is the value of BI4 on the controller webpage?_____

- The value of BI4 should be "1" when the Mode switch is set to Cool.

BI4 Open – Mode Switch set to Off

With the Mode switch set to Off, answer the following questions:

Is the BI4 Indicator illuminated on the controller?_____

- The BI4 Indicator should not illuminate when the Mode switch is set to Off.

What is the value of BI4 on the controller webpage?_____

- The value of BI4 should be "0" when the Mode switch is set to Off.

BI4 Open – Mode Switch set to Heat

With our thermostat design, we cannot be in Heat and Cool Mode at the same time as it is a manual switchover. When the Mode Switch is set to Heat, we should not be in Cool Mode and BI4 should be open.

With the Mode switch set to Heat, answer the following questions:

Is the BI4 Indicator illuminated on the controller?_____

- The BI4 Indicator should not illuminate when the Mode switch is set to Heat.

What is the value of BI4 on the controller webpage?_____

- The value of BI4 should be "0" when the Mode switch is set to Heat.

5.6 - Fan Switch – UI2

Which terminal is the Fan switch connected to?_____

UI2 Closed – Fan Switch set to On

With the Fan switch set to On, answer the following questions:

Is the UI2 Indicator illuminated on the controller?_____

- The UI2 Indicator should illuminate when the Fan switch is set to On.

What is the value of UI2 on the controller webpage?_____

- The value of UI2 should be "1" when the Fan switch is set to On.

UI2 Open – Fan Switch set to Auto

With the Fan switch set to Auto, answer the following questions:

Is the UI2 Indicator illuminated on the controller?_____

- The UI2 Indicator should not illuminate when the Fan switch is set to Auto.

What is the value of UI2 on the controller webpage?_____

5.7 - Thermistor

Which terminal is the thermistor connected to?_____

On the webpage, what is the space temperature?_____

Is this space temperature reasonable for the current space?_____

- If the answer is not "Yes", troubleshoot the issue.

Part 6: Wire Thermostat – Outputs

We are now going to wire the thermostat outputs to our controller and fill out our Points List.

The thermostat is going to use pilot lights to show output.

- White – Call for Heat
- Yellow – Call for Cool
- Green – Call for Fan

We are going to power the pilot lights with 24 VDC and switch them by a relay contact on the controller.

6.1 - White Pilot Light – BO1 (Call for Heat)

We are going to illuminate the White pilot light when we have a call for Heat.

Type

Is the pilot light a binary or analog device?_____

- The pilot light is either illuminated or not, so it is a binary object.

Is the pilot light an input or output device?_____

- The pilot light is an output device.

Is the pilot light an AI, BI, AO, or BO device?_____

Wire BO1

Wire the BO1 to the white LED pilot light with 24 VDC.

Remember the BO object is just a relay and does not supply power to the LED. We need to wire the LED in series with the BO and the power supply.

Have the instructor check the wiring, prior to wiring the other BO devices to verify that you have properly wired it.

Points List

Record the White Pilot Light on a row of the Points List sheet on page 32:

- Point Description: White Pilot Light
- Binary Input: BO1

6.2 - Yellow Pilot Light – BO2 (Call for Cool)

We are going to illuminate the Yellow LED pilot light when we have a call for Cool.

Type

Is the pilot light an AI, BI, AO, or BO device?_____

Wire BO2

Wire the BO2 to the yellow LED pilot light with 24 VDC.

Points List

Record the Yellow Pilot Light on a row of the Points List sheet on page 32:

- Point Description: Yellow Pilot Light
- Binary Input: BO2

6.3 - Green Pilot Light – BO3 (Call for Fan)

We are going to illuminate the Green LED pilot light when we have a call for Cool or the Fan switch is set to On.

Type

Is the pilot light an AI, BI, AO, or BO device?_____

Wire BO3

Wire the BO3 to the green LED pilot light with 24 VDC.

Points List

Record the Green Pilot Light on a row of the Points List sheet on page 32:

- Point Description: Green Pilot Light
- Binary Input: BO3

Part 7: Configure output devices

Ultimately, we want our thermostat to decide to make a call for heat or cool based upon our inputs (space temperature, set point, and whether we are in heat/cool mode).

Our outputs are going to be:

- W
- Y
- G

Each of these are either on or off so these are binary and since they are outputs, we are going to use BO.

7.1 - W - BO1 (Call for Heat)

We are going to use BO1 for a call for Heat.

On the controller webpage, click "Binary Output 1."

Channel Type

On the pop-up, what is the initial Channel Type?_____

By clicking the Channel Type dropdown, are there other options for the Channel Type?_____

- The BO1 can only be configured as a Relay Output.

Object Name

Change the Object Name to be "W" (without the quotes).

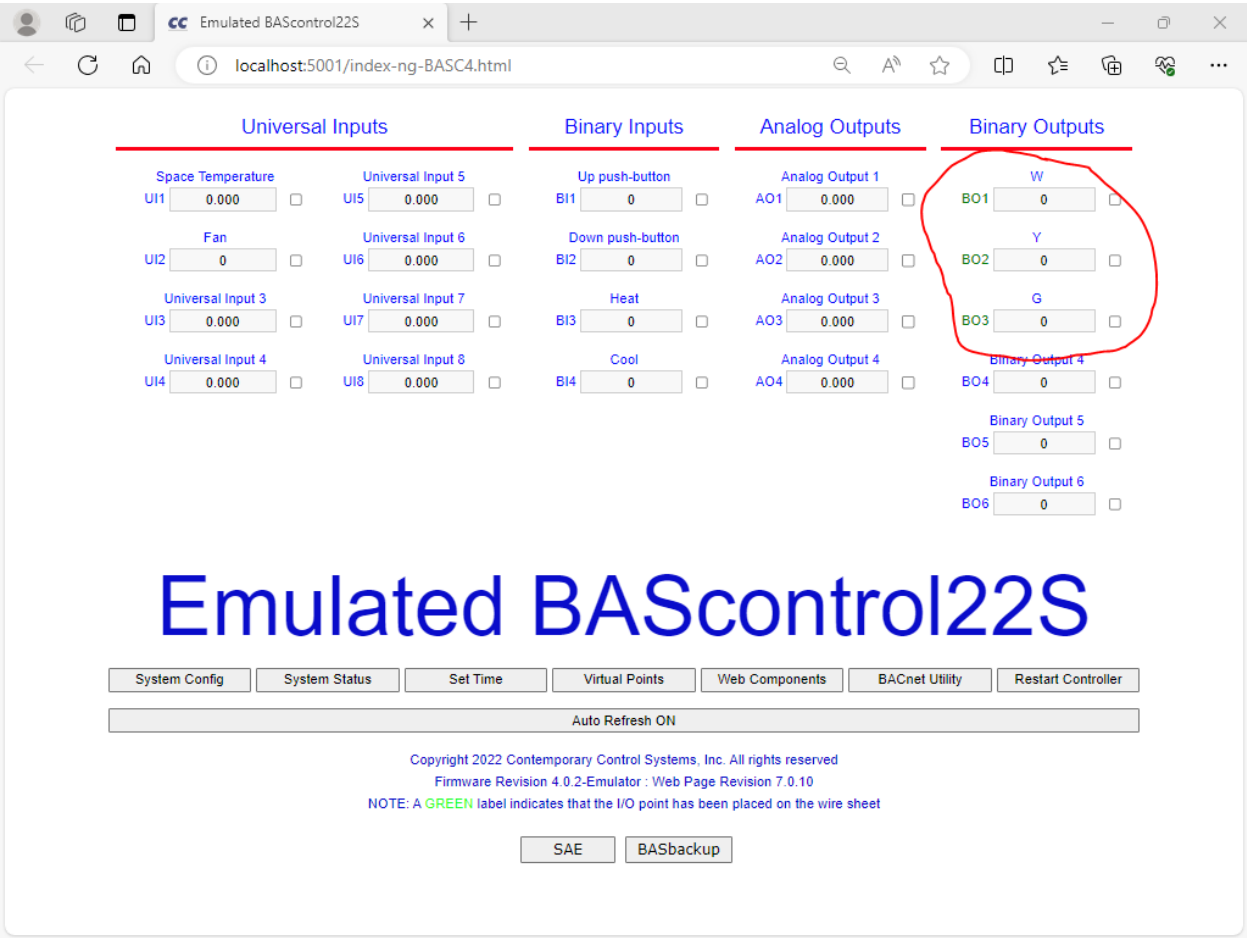
Submit and Close the BO1 configuration pop-up.

7.2 - Y – BO2 (Call for Cool)

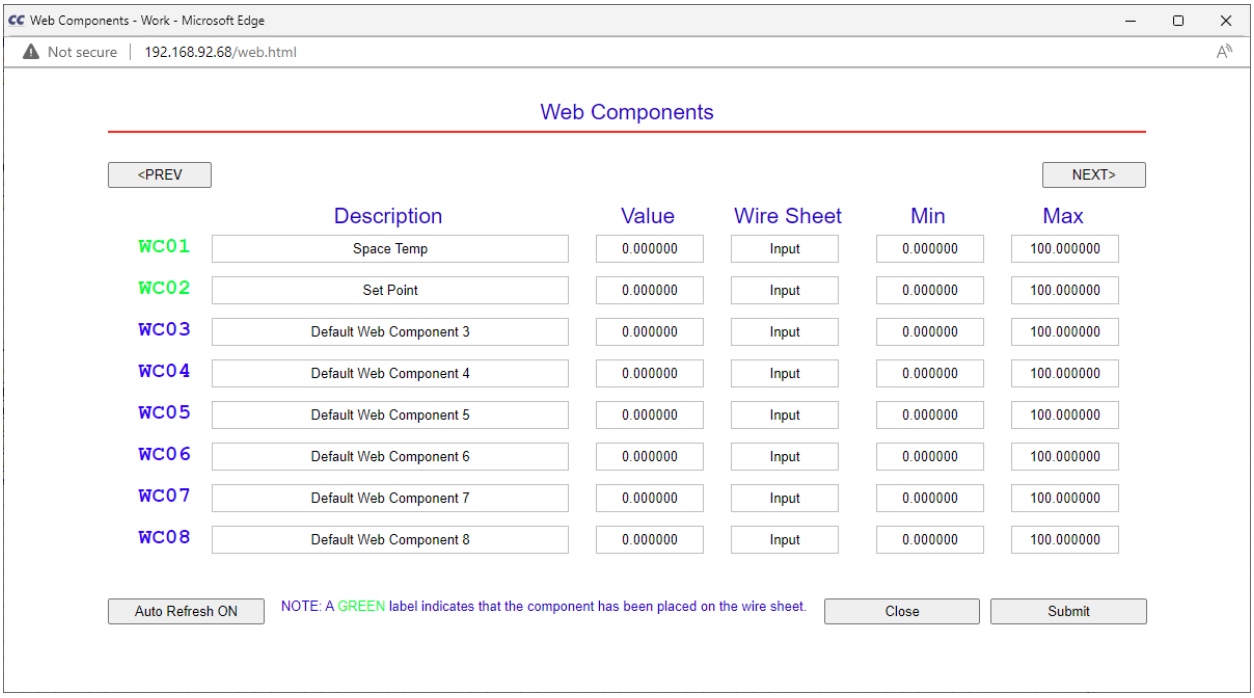
Change the label of B02 to "Y".

7.3 - G – BO3 (Call for Fan)

Change the label of BO3 to "G".


Emulated BAScontrol22S
localhost:5001/index-ng-BASC4.html
Universal Inputs
Binary Inputs
Analog Outputs
Binary Outputs
Space Temperature
UI1 0.000
Universal Input 5
UI5 0.000
Up push-button
BI1 0
Analog Output 1
AO1 0.000
W
BO1 0
Fan
UI2 0
Universal Input 6
UI6 0.000
Down push-button
BI2 0
Analog Output 2
AO2 0.000
Y
BO2 0
Universal Input 3
UI3 0.000
Universal Input 7
UI7 0.000
Heat
BI3 0
Analog Output 3
AO3 0.000
G
BO3 0
Universal Input 4
UI4 0.000
Universal Input 8
UI8 0.000
Cool
BI4 0
Analog Output 4
AO4 0.000
Binary Output 4
BO4 0
Binary Output 5
BO5 0
Binary Output 6
BO6 0
Emulated BAScontrol22S
System Config
System Status
Set Time
Virtual Points
Web Components
BACnet Utility
Restart Controller
Auto Refresh ON
Copyright 2022 Contemporary Control Systems, Inc. All rights reserved
Firmware Revision 4.0.2-Emulator : Web Page Revision 7.0.10
NOTE: A GREEN label indicates that the I/O point has been placed on the wire sheet
SAE
BASbackup

Part 8: HMI



We are going to use the Web Components to show the current Space Temp and Set Point.

Add the following Descriptions:

- WC01: Space Temp
- WC02: Set Point

8.1 - Space Temp – WC01

When setting out Set Point, we need to display the current Space Temp.

Points List

Record the Space Temp on a row of the Points List sheet on page 32:

- Point Description: Space Temp
- Web Analog: WC01

8.2 - Set Point – WC02

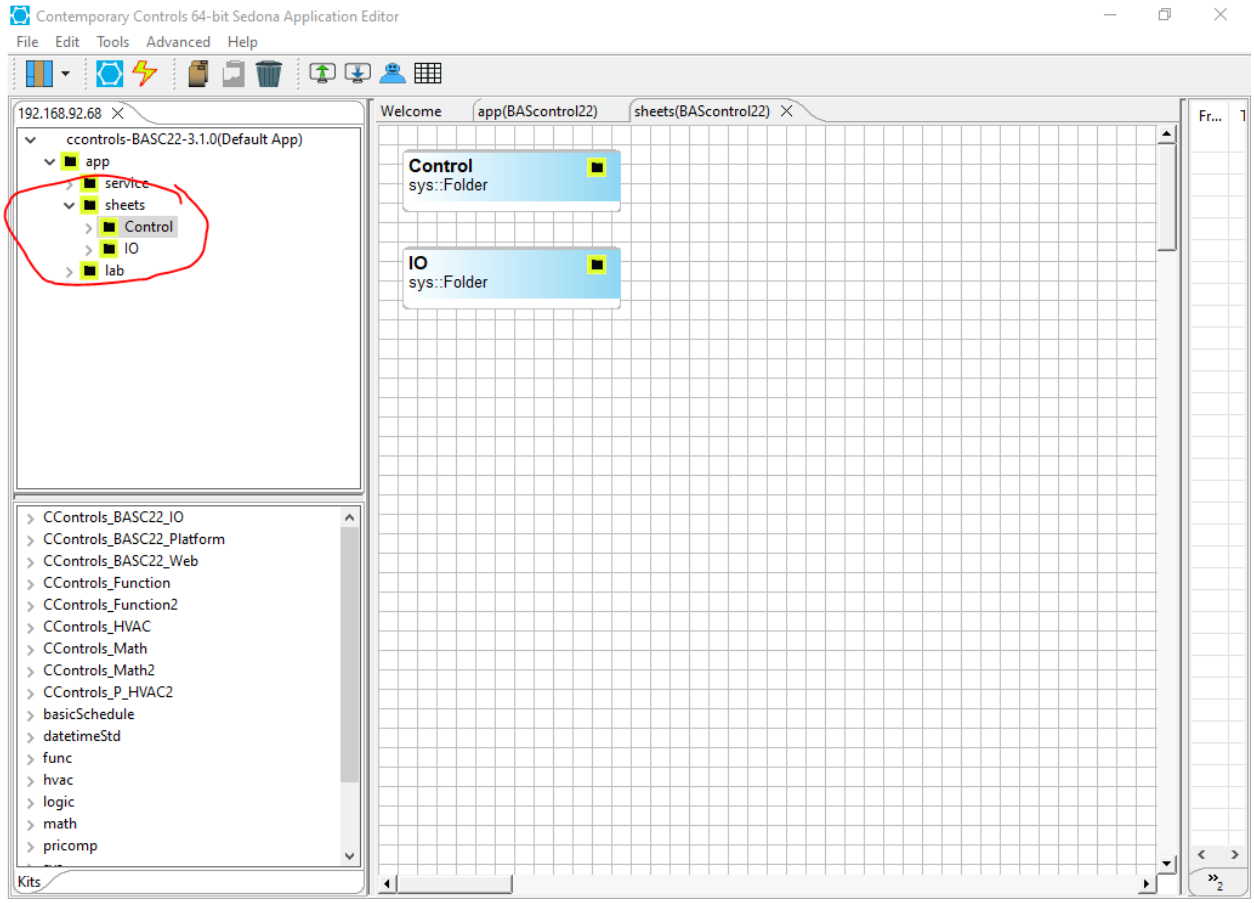
We need to display the current Set Point.

Points List

Record the Set Point on a row of the Points List sheet on page 32:

- Point Description: Set Point
- Web Analog: WC02

Part 9: Sedona - folders



Create two folders under the sheets sheet.

9.1 - Control block

Block: sys::Folder

Properties:

- Name: Control

9.2 - IO block

Block: sys::Folder

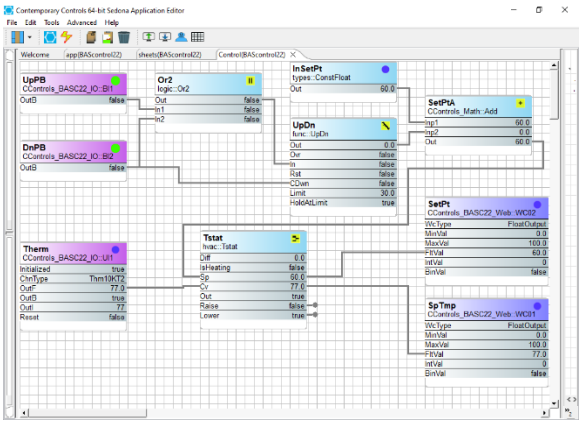
Properties:

- Name: IO

Have the instructor check your folders to make sure you are creating these blocks in the proper location.

Part 10: Sedona – Control sheet

10.1 - Control wire sheet



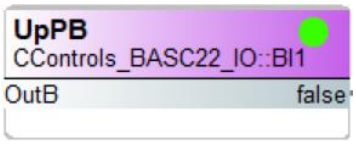
We are going to place the programming blocks in the Control folder we just created.

Double-click on the Control folder to open a blank wire sheet.

Verify the tab in focus above the blank wire sheet says “Control.”

In the Control sheet, create the following objects

10.2 - UpPB block



The UpPB is connect to the Up pushbutton on the Thermostat Enclosure. When the pushbutton is not depressed, OutB should be false. While the pushbutton is depressed OutB should be true.

Block: CControls_BAS22_IO::BI1

Properties:

- Name: UpPB

We need to test the UP pushbutton to make sure it works properly, and we can see it in our code.

Is the OutB block set to false by default?_____

When pushing the Up pushbutton does the OutB change to true?_____

10.3 - DnPB block

The DnPB is connect to the Down pushbutton on the Thermostat Enclosure.

Block: CControls_BAS22_IO::BI2

Properties:

- Name: DnPB

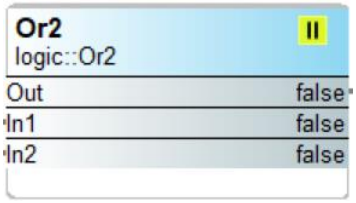
We need to test the Down pushbutton to make sure it works properly, and we can see it in our code.

Is the OutB block set to false by default?_____

When pushing the Down pushbutton does the OutB change to true?_____

10.4 - Or2 block

The Or2 block is an OR statement and so if either of the inputs is true then the output is true.



Block: logic::Or2

Properties:

- Name: Or2

Connections:

- UpPB::OutB → Or2::In1
- DnPB::OutB → Or2::In2

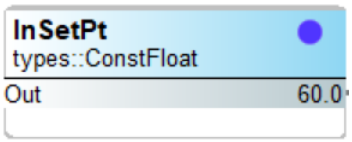
Is the Or2::Out property set to false by default?_____

When pushing the Up pushbutton does the Or2::Out change to true?_____

When pushing the Down pushbutton does the Or2::Out change to true?_____

10.5 - InSetPt block

The InSetPt block controls the minimum and starting Set Point.



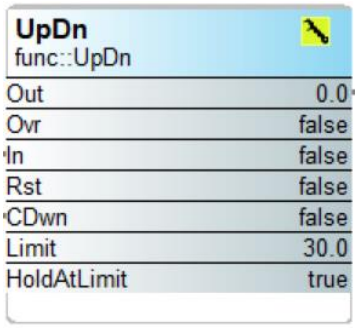
Block: types::ConstFloat

Properties:

- Name: InSetPt
- Out: 60

10.6 - UpDn block

The UpDn block controls increasing or decreasing Set Point by the Set Point pushbuttons.



Block: func::UpDn

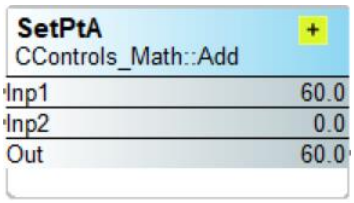
Properties:

- Name: UpDn
- Limit: 30.0
- HoldAtLimit: true

Connections:

- Or2::Out → UpDn::In
- DnPB::OutB → UpDn::CDown

10.7 - SetPtA block



The SetPtA::Out represents the Set Point. We change the Set Point by pushing the Up or Down pushbutton.

Block: CControls_Math::Add

Properties:

- Name: SetPtA

Connections:

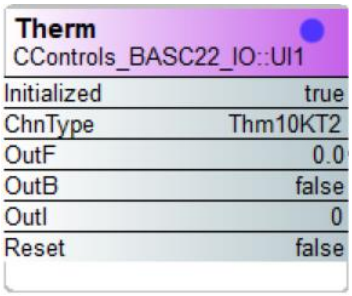
- InSetPt::Out → SetPtA::Inp1
- UpDn::Out → SetPtA::Inp2

Based upon the InSetPt and UpDn block, the Set Point can be configured between 60 and 90 degrees.

When pushing the Up pushbutton does the Out increment 1 degree?_____

When pushing the Down pushbutton does the Out decrement 1 degree?_____

10.8 - Therm block



The Therm block is the AI for current Space Temp as read by the thermistor.

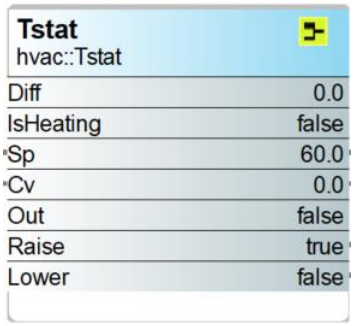
Block: CControls_BASC22_IO::UI1

Properties:

- Name: Therm

What is the OutF value?_____

10.9 - Tstat block



The Tstat block is the code that makes a call on whether we need to raise or lower the temperature to reach the set point.

Block: hvac::Tstat

Properties:

- Name: Tstat

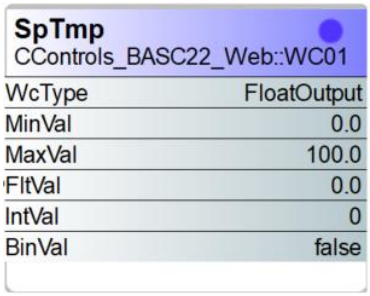
Connections:

- SetPtA::Out → Tstat::Sp
- Therm::OutF → Tstat::Cv

It does not take into account on whether we are in Cool/Heat/Off mode as the Tstat block just tells us what to do to get to the set point. The Call for Heat or Cool is dependent on both the Cool/Heat mode and whether we need to raise or lower the temperature.

10.10 - SpTmp block

The SpTmp block is used to show the current Space Temp on the Web Component browser as read by the thermistor.



Block: CControls_BASC22_Web::WC01

Properties:

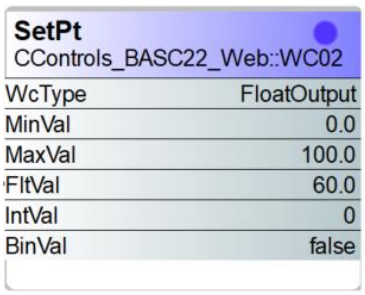
- Name: SpTmp
- WcType:: FloatOutput
- MinVal: 0
- MaxVal: 100

Connections:

- Tstat::Cv → SpTmp::FltVal

10.11 - SetPt block

The SetPt block is used to show the current Set Point on the Web Component browser.



Block: CControls_BASC22_Web::WC02

Properties:

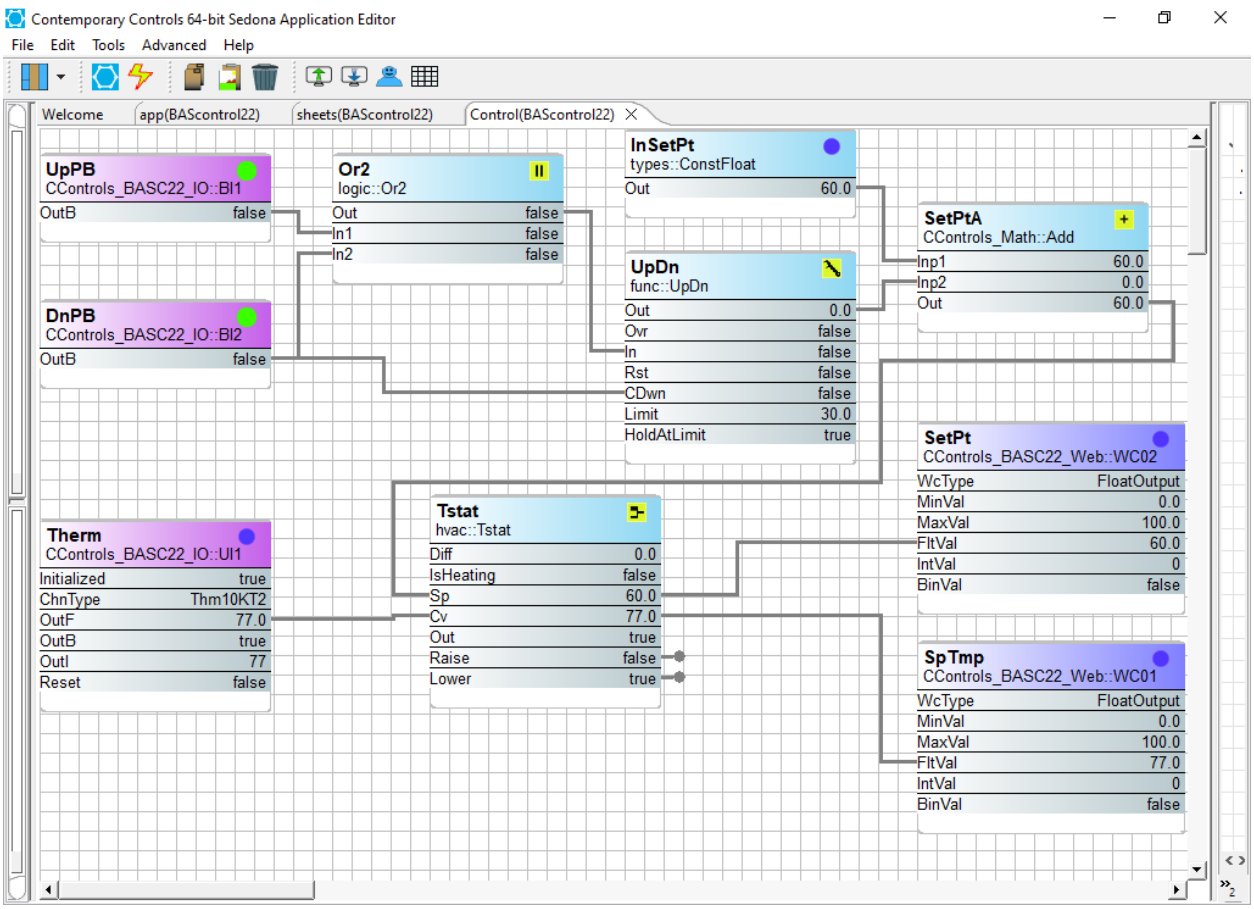
- Name: SetPt
- WcType:: FloatOutput
- MinVal: 0
- MaxVal: 100

Connections:

- Tstat::Sp → SetPt::FltVal

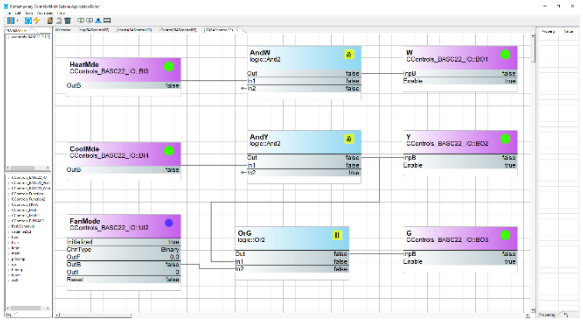
10.12 - Wire sheet

Organize the wire sheet so that it is clear how the blocks work with each other.



Part 11: Sedona – IO sheet

11.1 - IO wire sheet



We are going to place the programming blocks in the IO folder we created previously.

Double-click on the IO folder to open a blank wire sheet.

Verify the tab in focus above the blank wire sheet says “IO.”

11.2 - HeatMde block

The Heat BI is true when the Mode switch is set to Heat.

Block: CControls_BAS22_IO::BI3

Properties:

- Name: HeatMde

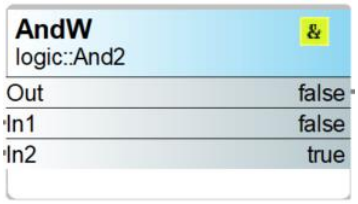
We need to test the mode switch to make sure it works properly, and we can see it in our code.

When the Mode switch is set to Cool, what is OutB?_____

When the Mode switch is set to Off, what is OutB?_____

When the Mode switch is set to Heat, what is OutB?_____

11.3 - AndW block



The Call for Heat is dependent on the mode switch set to Heat *and* the space temp below the set point.

Block: logic::And2

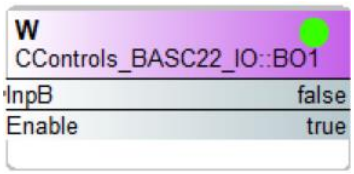
Properties:

- Name: AndW

Connections:

- HeatMde::OutB → AndW::In1
- Tstat::Raise → AndW::In2

11.4 - W block



The W block controls the BO for the white pilot light.

Block: CControls_BAS22_IO::BO1

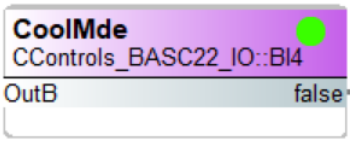
Properties:

- Name: W
- Enable: true

Connections:

- AndW::Out → W::InpB

11.5 - CoolMde block



The CoolMde BI is true when the Mode switch is set to Cool.

Block: CControls_BAS22_IO::BI4

Properties:

- Name: CoolMde

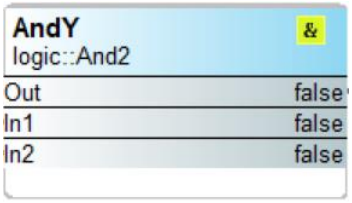
We need to test the mode switch to make sure it works properly, and we can see it in our code.

When the Mode switch is set to Cool, what is OutB?_____

When the Mode switch is set to Off, what is OutB?_____

When the Mode switch is set to Heat, what is OutB?_____

11.6 - AndY block



The Call for Cool is dependent on the mode switch set to Cool *and* the space temp above the set point.

Block: logic::And2

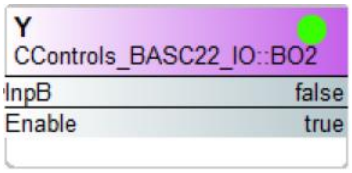
Properties:

- Name: AndY

Connections:

- CoolMde::OutB → AndY::In1
- Tstat::Lower → AndY::In2

11.7 - Y block



The Y block controls the BO for the yellow pilot light.

Block: CControls_BAS22_IO::BO2

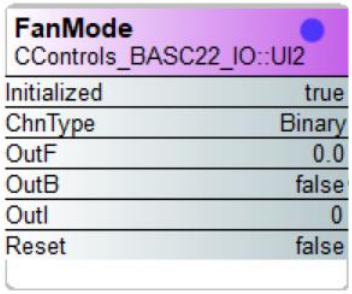
Properties:

- Name: Y
- Enable: true

Connections:

- AndY::Out → Y::InpB

11.8 - FanMode block



The FanMode block represents when the Fan Auto/On switch. If the switch is set to On, OutB should be true. We need to Fan switch to make sure it works properly, and we can see it in our code.

Block: CControls_BAS22_IO::UI2

Properties:

- Name: FanMode

When the Fan switch is set to Auto, what is OutB?_____

When the Fan switch is set to On, what is OutB?_____

11.9 - OrG block

The Call for Fan is dependent on the Fan On switch *or* there is a Call for Cool.

Block: logic::Or2

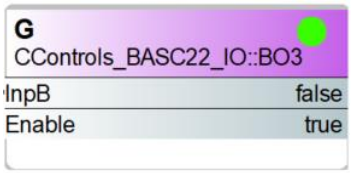
Properties:

- Name: OrG

Connections:

- AndY::Out → OrG::In1
- FanMode::OutB → OrG::In2

11.10 - G block



The G block controls the BO for the green pilot light.

Block: CControls_BAS22_IO::BO3

Properties:

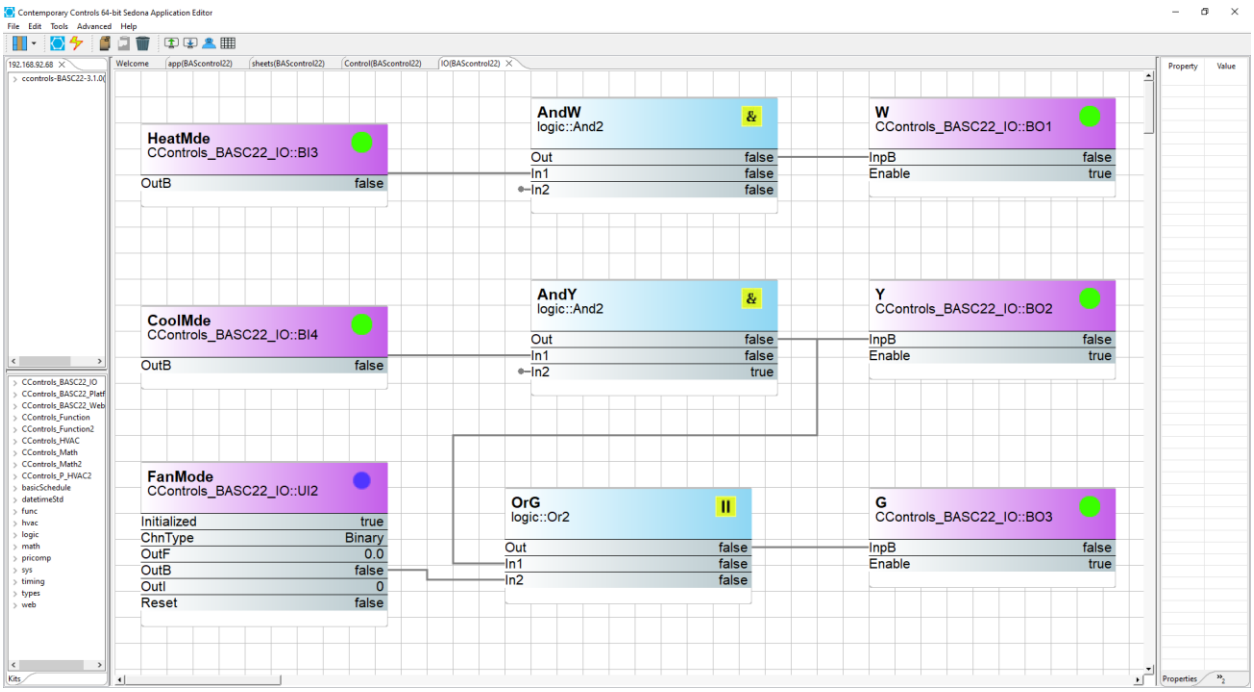
- Name: G
- Enable: true

Connections:

- OrG::Out → G::InpB

11.11 - Wire sheet

Organize the wire sheet so that it is clear how the blocks work with each other.



Part 12: Points List

Fill out the Points List for every physical IO connected to the controller as well as the Web/Virtual Points. For Universal Inputs include the Channel Type. Sum the columns to give the number of Points used per Point Type.

Table 1 Points List

Point Description	Point Type						
	Universal		Binary Input	Analog Output	Binary Output	Web/Virtual	
	Input	Channel				Analog	Binary
Point Totals:							

Do you have 2 Universal Inputs?_____

Do you have 4 Binary Inputs?_____

Do you have 3 Binary Outputs?_____

Do you have 2 Web Channels?_____

Did you calculate the Point Totals per Point Type column?_____

- If you answered No to any of these questions, go back and fix the Points List.

Part 13: Instructor Verification

Demonstrate to your instructor that you have completed the lab successfully.

Instructor Signature: _____

Part 14: Backup

You will be electronically submitting the work for this lab.

Create a Backup using BASbackup. Make sure you save a copy of this lab.

14.1 - Backup

You are going to use BASbackup to make a backup for submission. The output is a zip file.

Part 15: Submission

You need to turn in your lab packet as well submit files electronically.

If you do not turn in your lab packet or submit the required files, you will receive a zero for that part of the lab.

15.1 - Electronic lab submission

Electronically submit your lab:

- Backup (zip file)

15.2 - Lab packet

Before leaving class, you must turn in your completed lab packet.

Part 16: Tear-down

Stop! Do not start the tear down process until you have electronically submitted your lab.

16.1 - Controller Factory Reset

Factory reset the controller and show your instructor the controller's webpage.

Instructor Signature: _____

16.2 - Laptop IP address

Show your instructor that you have successfully changed the IP address to use DHCP.

Instructor Signature:_____

16.3 - Controller Tear-down

When disassembling your work, make sure there is no power to the controller or any other device.

When removing conductors from the terminal blocks, unscrew them enough so you can gently remove the wires. Do not forcefully yank the wires out as this will damage the terminals.

After removing a conductor, please make sure the screw is seated in the threads by tightening the screw two turns.