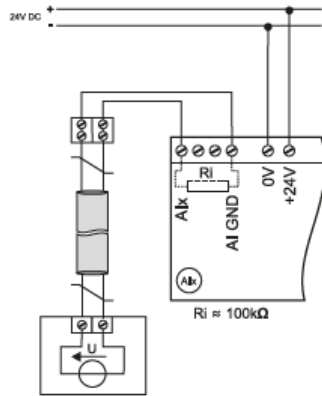


## TT190103 - FUP - PID Control

1. We're going to control the cooling valve with PID control using the return air temperature sensor. First, connect your sensor to the controller AI00 like below

Connection 0 ... 10 V (AI)



Ⓐ Analog inputs AIx = AI0 ... AI7

2. In this program, we use a 0-10V temperature sensor. If you use a PT1000 sensor, you need to change the sensor type in the Excel spreadsheet and import it again. Or, you can double click on the AI8AO4 module, go to sensor type for AI00 (around line 156), and change it to "AS\_T\_Pt1000\_2"

155					
156	defftyp00	AS_V_10V_2		sensor type for analog input terminal >> AI00	
157	defftyp01	Selection		analog input terminal >> AI01	
158	defftyp02	AS_Status_00	input not connected	analog input terminal >> AI02	
159	defftyp03	AS_V_10V_2	voltage input (0...10V)	analog input terminal >> AI03	
160	defftyp04	AS_T_10mV_K_2	M-sensor with 2-wires (-50° C...130° C)	analog input terminal >> AI04	
161	defftyp05	AS_T_Ni1000_2	Ni-1000 DIN (-50° C...650° C)	analog input terminal >> AI05	
162	defftyp06	AS_T_Ni1000L_2	Ni-1000 Tk5000 (-50° C...650° C)	analog input terminal >> AI06	
163	defftyp07	AS_T_Pt1000_2	Pt-1000 (-50° C...650° C)	analog input terminal >> AI07	

3. Once you connect the sensor correctly, you should see the value in the AI8AO4 module

▼ 01: DCS.Open

- AHU
- AHU
- Events
- Password
- ▼ COSMOS IO modules
- ▼ AI8AO4 DDC100
  - analog inputs (DDC100)
  - analog outputs (DDC100)

analog inputs | digital inputs | digital outputs | analog outputs

**Analog inputs (COSMOS\_IO\_modules)**

General | scale | damping | limitation | monitoring | terminal status

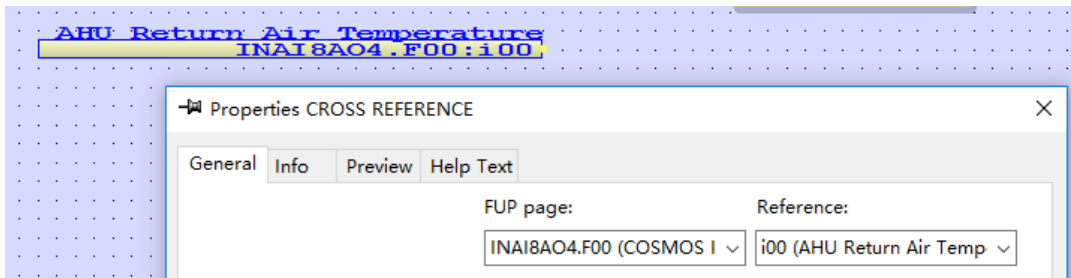
Identifier	rawdata	sens. type	Offset	hand	hand value	process Value
AI00 AHU Return Air Temperature	4.07	0017	0.00		4.07	4.07

4. The value you see now is the voltage we got from the sensor (0-10V). To convert it to temperature, go to "scale" tab, change the "sensor value", "MAX-value" to 50, and now you should see the correct temperature (assuming your sensor is 0-50 degree). You don't need this step if you're using PT1000 sensor

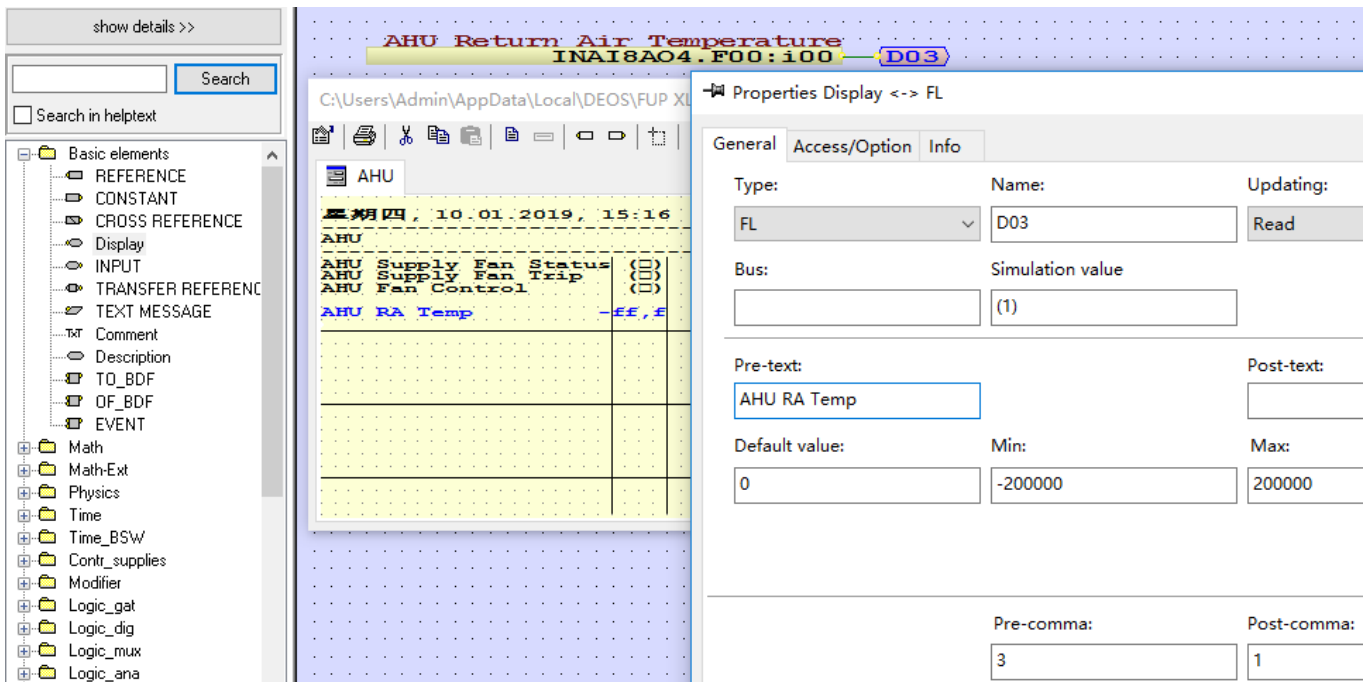
General | **scale** | damping | limitation | monitoring | terminal status

Identifier	input Value	sensor Value	input Value	sensor Value	MIN limit	MAX limit	Value (scaled)
AI00 AHU Return Air Temperat	0.00	0.00	10.00	50.00	-9999.00	99999.00	20.35

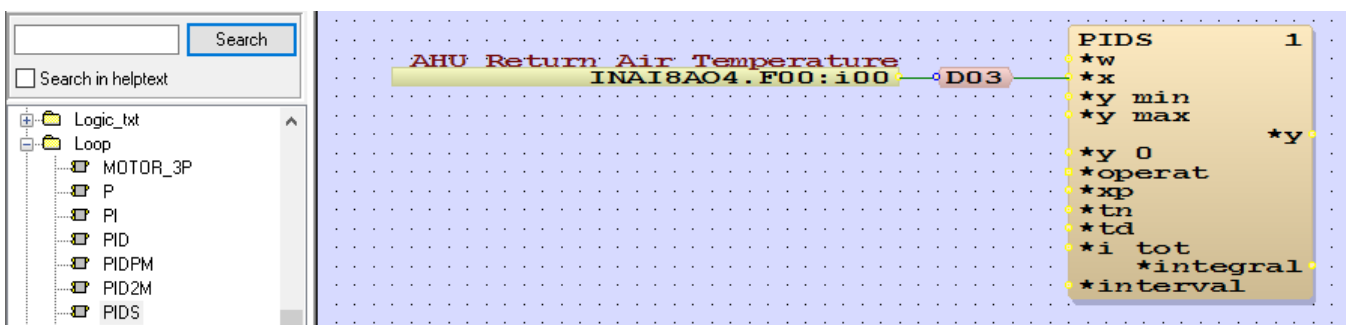
5. Now, we will get this sensor value in your program to control the cooling valve. Open “ahu.f”, drag and drop a “CROSS REFERENCE” and select “INAI8AO4.F00” and “i00 (AHU Return Air Temperature)”



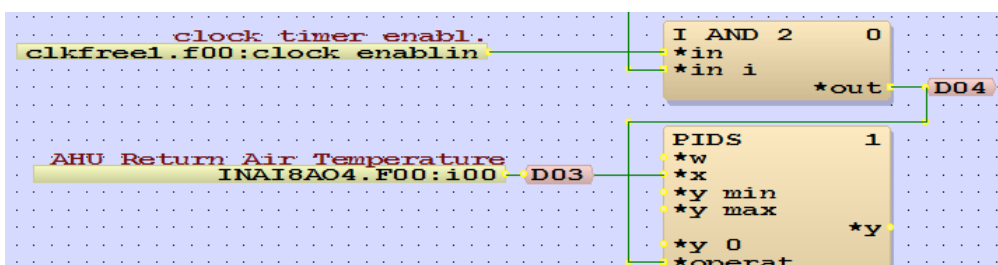
6. Drag and drop a “Display”, open the HTML page, double click on it and change the “Type” to “FL”, change “Pre-text” to “AHU RA Temp”, change “Post-comma” to 1 to show 1 decimal place. Then connect it to the “AHU Return Air Temperature” like this



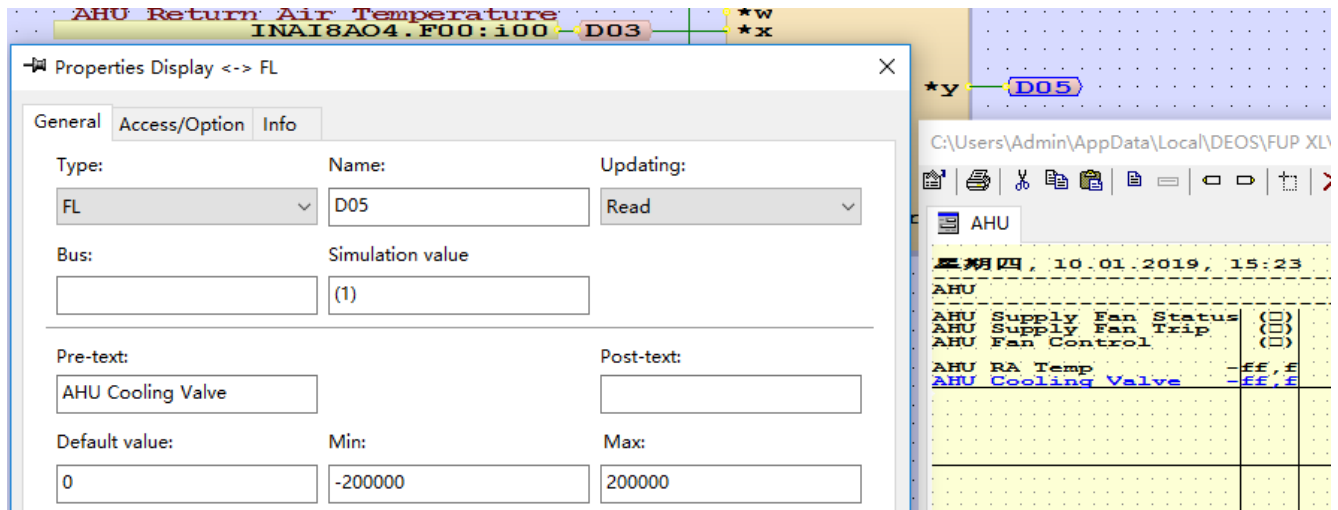
7. Under the “Loop” modules, drag and drop the “PIDS” module to your page. Connect the “RA Temp” to the “x” input of the “PIDS” module



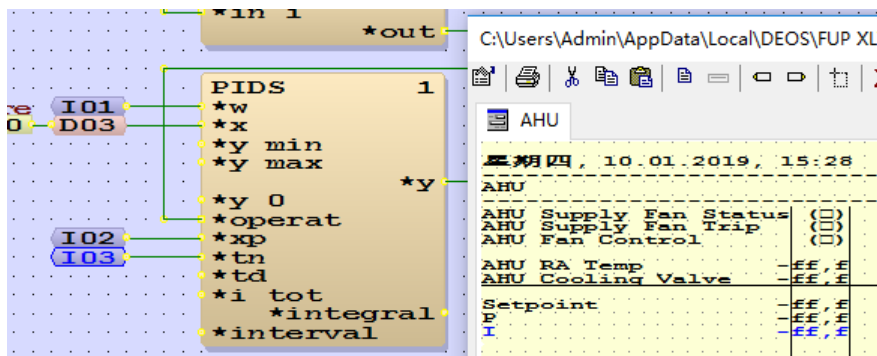
8. Connect the “I\_AND\_2” output to the “PIDS” “operat” input, so that it operate when AHU is ON



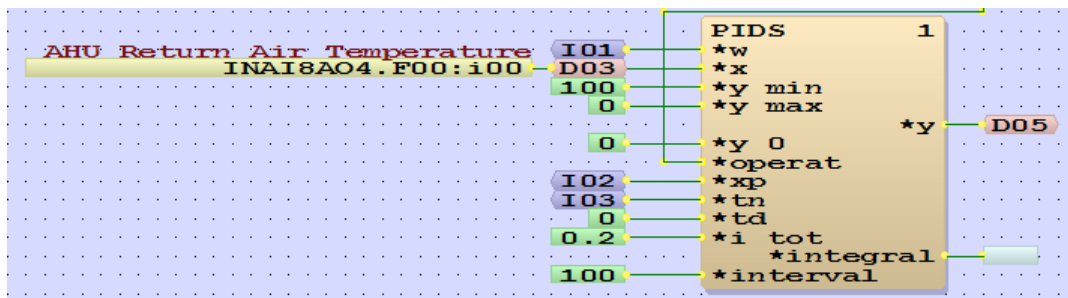
9. Add another Display called “AHU Cooling Valve” with Type “FL”, and connect it to the “y” output of the “PIDS” module



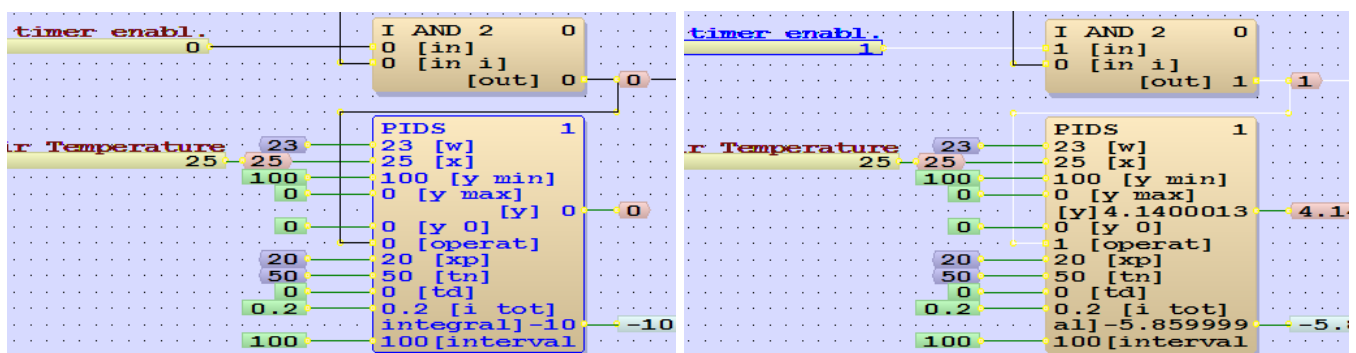
10. Add 3 “INPUT” with type “FL”, change the “Pre-text” to “Setpoint”, “P” and “I” and connect them to the “x”, “xp” and “tn” inputs of the “PIDS” module







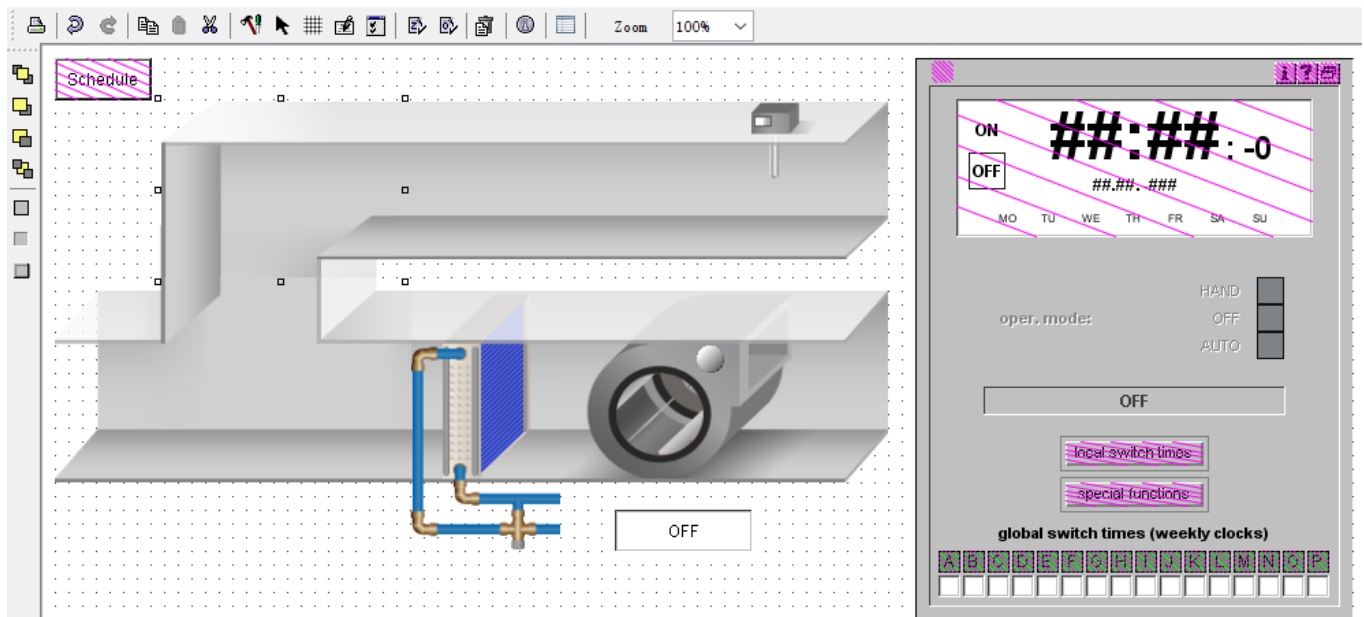
11. Now, drag and drop some “CONSTANT”, change the values and connect to the “PIDS” module like this. Add an empty “REFERENCE” and connect it to the “integral” output. The “y\_min” and “y\_max” is swapped, because it is a cooling control



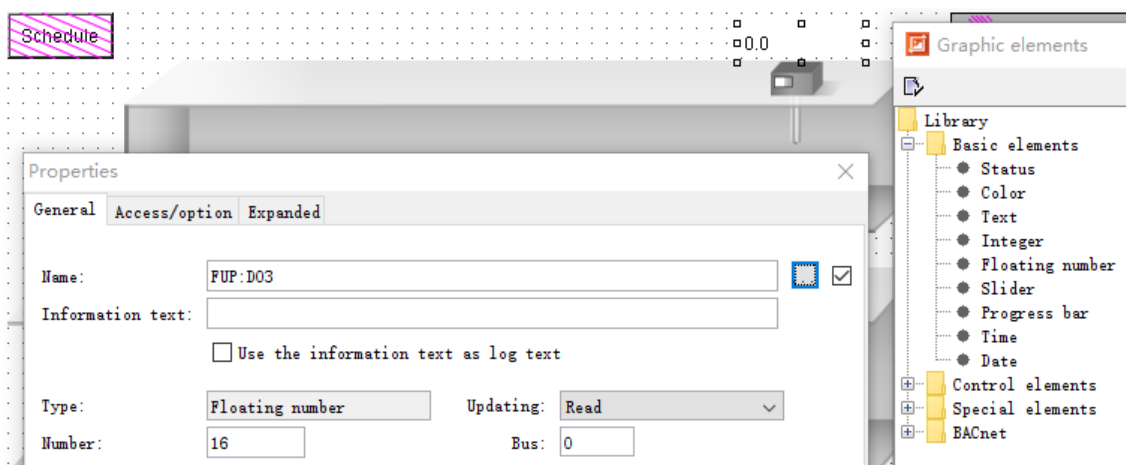
12. Try simulation and set the parameters like below. When AHU stop (i.e. 0), the PID output is 0. When it start, the PID goes up slowly, because the temperature is higher than setpoint



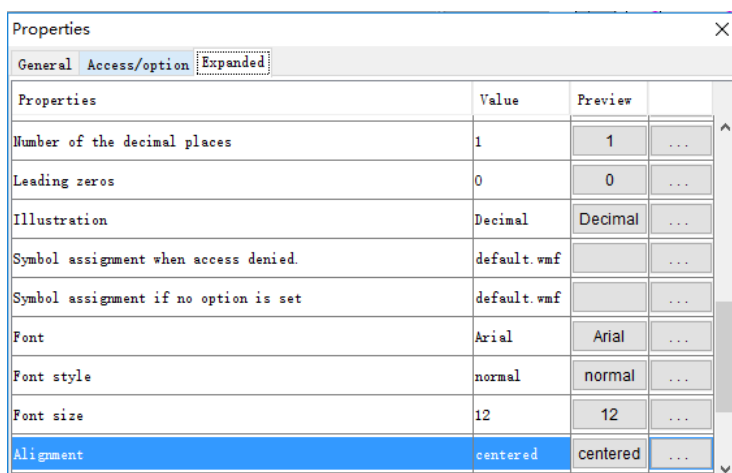
13. If you set the Temperature to the same as the setpoint, the output will keep the same value. If you want to have faster response of the output, you can change the “P (xp)” and “I (td)” parameters smaller. But if the value is too small, the output will become very unstable
14. Open the graphic “AHU”, and change it like below. You should be able to find the graphics from our 3D library. You can use the button on the left     to move the graphic element to background or foreground



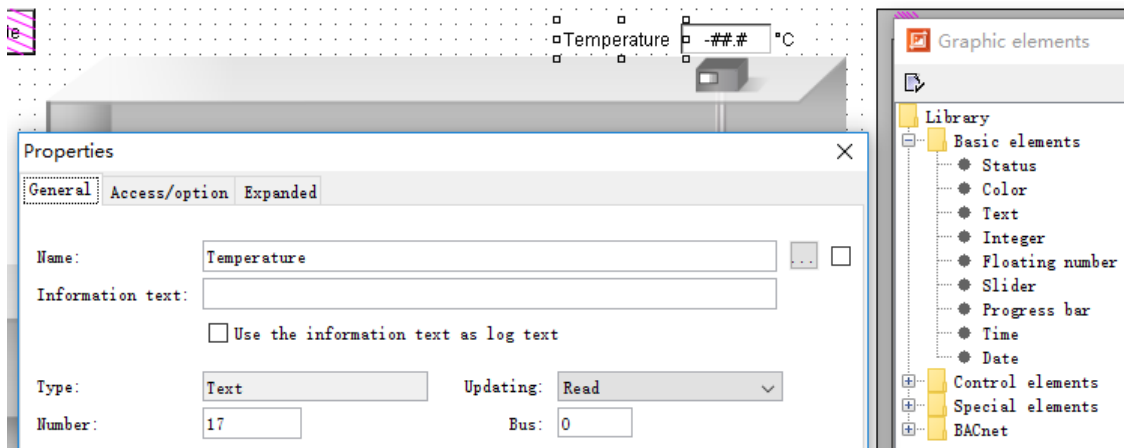
15. Now add a “Floating number” element above the sensor, and link it to the display of the temperature sensor “D03”



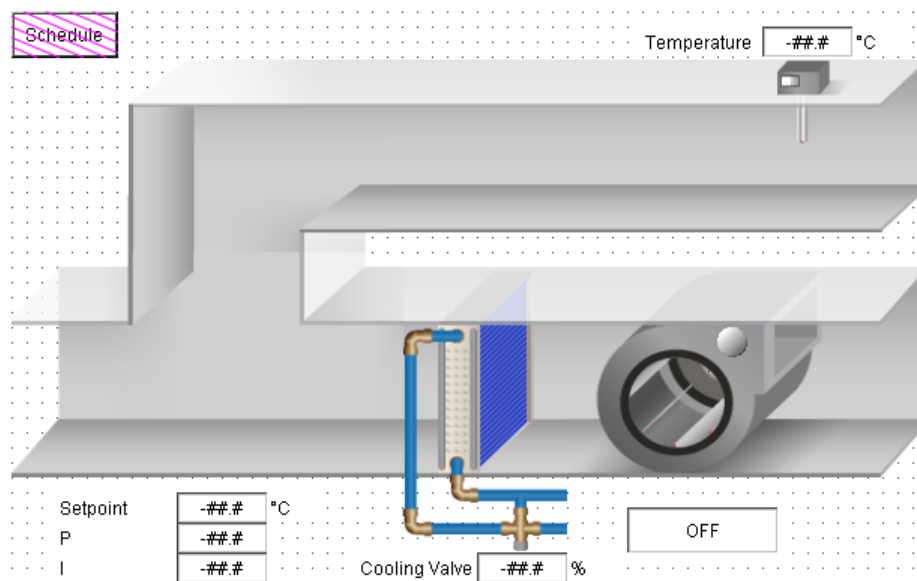
16. Then change the properties as you like, e.g. 1 decimal place, centered alignment, etc.



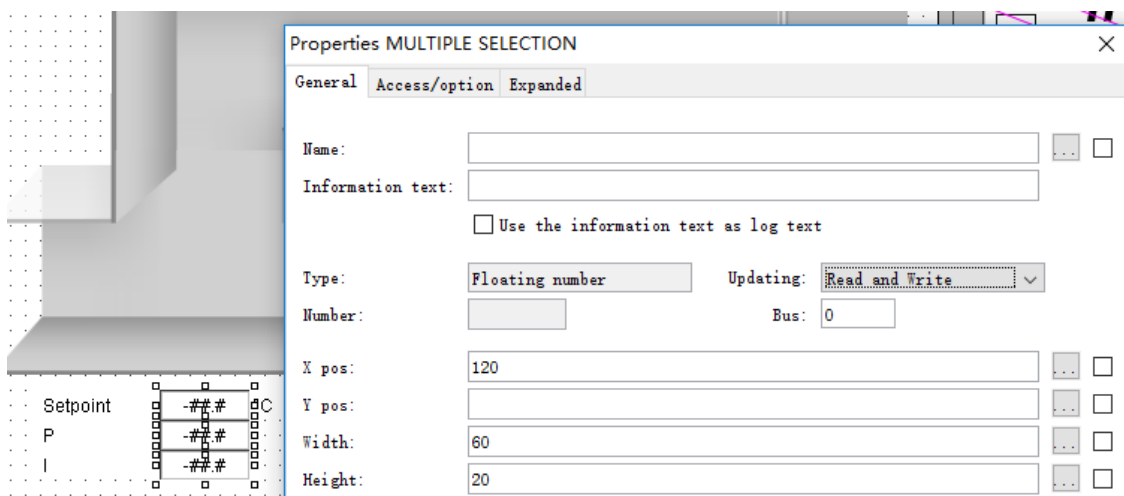
17. Add 2 “Text” elements, change the name to “Temperature” and “C”



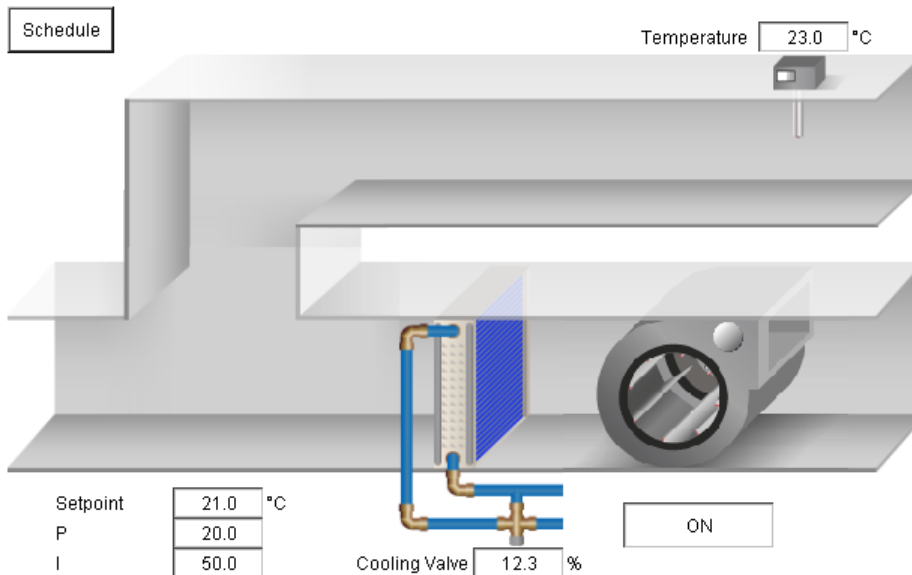
18. Do the same for the “Cooling Valve”, “Setpoint”, “P”, and “I” value, like below, and then link it to the corresponding points in your FUP page



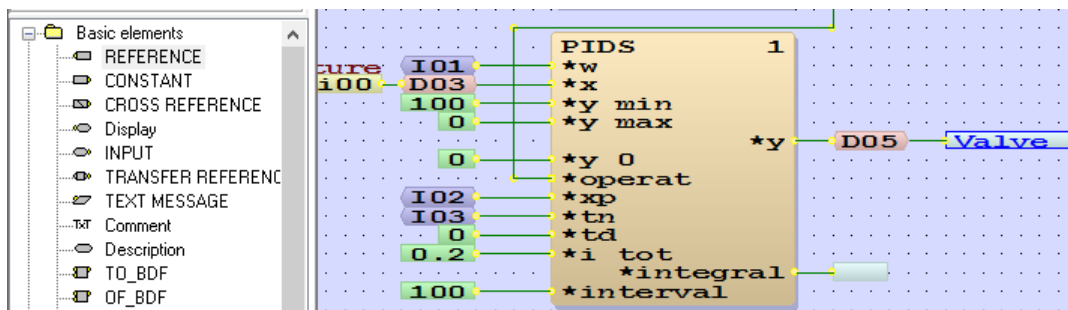
19. For the “Setpoint”, “P” and “I”, which operator can change the value, we need to change the “Updating” setting to “Read and Write”. To do this, select all the 3 elements, right click, change the property, and click OK



20. After finish, you can test your graphic by pressing the simulation button. You can change the parameters like setpoint, and check the output. Because simulation mode can only test 1 FUP page at a time, so the “Schedule” button will not work as it is in another FUP page (marco)



21. Close the graphic page. Add a “REFERENCE” called “Valve” and connect to the output “y”. Save and close the FUP page



22. Double click on the AI8AO4 macro, go to AO Cross Reference (about line 240). Change the AO02 to “AHU.F:Valve” so that the valve control will go to Analog Output 02

240	declare FUP page > cross references ( maximum 13		
241			
242			
243	def_xao00 const.f:fl_0 "assignment of the constants:	cross reference	{{def08}} -> (AHU\Return Air Temperature - Sim)
244	def_xao01 const.f:fl_0 "assignment of the constants:	cross reference	{{def09}} -> (AHU\Return Air C02 - Sim)
245	def_xao02 AHU.F:Valve	cross reference	{{def10}} -> (AHU\Cooling Valve)
246	def_xao03 Object tree	cross reference	{{def11}} -> (AHU\Damper)
247			
248	AHU.F		

23. If everything OK, then you should see the AO02 LED on your controller flash, when the cooling valve control output is more than 0. For example, it will flash 5 times when the output is 50%

