

2225871

by Hugo Davies

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1. Work Plan for Lifelong Learning

No workplan?

2. Research

Brief explanations given

The five IEC languages are Ladder Diagram, Function Block Diagram, Instruction List, Sequential Function Chart and Structured Text. Each language has its pros and cons depending on what the engineer plans to do with it (Petrotechnic, ND)

Only four languages considered

Ladder Diagram, Ladder Logic is a great language to use if you like to visualise the program as you're building it which makes it easier to learn for many people. The clever thing about the ladder language is that it looks very similar to electrical relay circuits, which can be helpful. (PLC Academy, 4th September 2017)

full date not needed in citation

Function block diagrams are widely used in programming PLCs, and is essential to know when programming PLCs, it's a good way to include everything, timers, PID controllers and even SCADA systems. (PLC Academy, 13th March 2018)

Instruction Lists are more worded than a visual way of programming meaning it is not used as often. That being said because its not as graphical it can be processed quicker by the PLC giving a more responsive output. (Motion Control Tips, 19th May 2017)

Sequential function charts are a series of scrips that are typically defined within a single location and then are called in sequential order. This will help to determine where each flow will lead within the chart. (Inductive Automation, ND)

You must use the third person

3. Hardware Design and I/O List

The Table below shows the I/O List

%M2500.1	HMI Start Level
%M2500.2	HMI Stop Level
%M2500.3	HMI Start Flow
%M2500.4	HMI Stop Flow
%M2500.5	Level Run
%M2500.6	Level Inc Valve
%M2500.7	Level Dec Valve
%M2501.0	Flow Run
%M2501.1	Flow Inc Valve
%M2501.2	Flow Dec Valve
%M2501.3	Level Manual Mode
%M2501.4	Level Semi-Auto Mode
%M2501.5	Auto Mode
%M2501.6	Flow Manual Mode
%M2501.7	Flow Semi-Auto Mode
&MD3000	Tank Level
%MD3004	Level Setpoint
%MD3008	Flow Setpoint

These are memory addresses, IO addresses begin with %I or %Q

Where is your PLC hardware design

4. Program Design and Explanation

No explanation?

5. System Testing

Description of the test	Expected result	Actual result	Pass or Fail decision	Evidence
Manual Mode Level Start button	Valve opens on Factory IO to allow water into tank and green light illuminates	The valve opened on Factory IO to allow water into tank and the green light on the HMI lit up	Pass	Figure 1
Manual Mode Level Stop button	Valve closes on factory IO and the green light turns off	Valve Closed on Factory IO and the green light turned off	Pass	Figure 2
Manual Mode Level Increment button	When pressed the valve should open gradually between a range of 0-10 depending on the position of the valve	When pressed the valve opened in increments of 1 up to a maximum of 10 adjusting the position of the valve	Pass	Figure 3
Manual Mode Level Decrement button	When pressed the valve will gradually close in increments of 1 depending on the position of the valve down to a value of 0 where the valve is closed.	When pressed the valve closed in increments of 1 down to a value of 0 where the valve was then closed.	Pass	Figure 4
Manual Mode Flow Start button	Valve opens on Factory IO to allow water out of the tank and green light illuminates	The valve opened on Factory IO to allow water out of the tank and green light on the HMI lit up.	Pass	Figure 5
Manual Mode Flow Stop button	Valve closes on Factory IO and the green light turns off	The valve closed on Factory IO and the green light turned off	Pass	Figure 6
Manual Mode Flow Increment button	When pressed the valve should open gradually between 0-10 depending on the position of the valve	When pressed the valve opened in increments of 1 to a maximum of 10 adjusting the position of the valve	Pass	Figure 7

Manual Mode Flow Decrement button	When pressed the valve will gradually close in increments of 1 depending on the position of the valve down to a value of 0 where the valve is closed.	When pressed the valve closed in increments of 1 down to a value of 0 where the valve was then closed.	Pass	Figure 8
Level Semi button	When pressed the mode should change into Semi Auto mode and reset all other modes	When pressed the mode changed from manual to semi auto and reset the other modes	Pass	Figure 9
Level Semi Auto Start Button	When pressed the semi auto mode starts running and tries to match the set point inputted by the user	When pressed the semi auto mode begins and open and closes the valve automatically to keep the level as close to the setpoint as possible	Pass	Figure 10
Level Semi Auto Stop Button	When pressed the semi auto mode stops and the green light turns off	When pressed the semi auto mode turned off and the green light turned off	Pass	Figure 11
Flow Semi Auto button	When pressed the mode should change into Semi Auto mode and reset all other modes	When pressed the mode changed from manual to semi auto and reset the other modes	Pass	Figure 12
Flow Semi Auto Start Button	When pressed the semi auto mode starts running and matches the flow rate set by the user	When pressed the semi auto mode begins and open and closes the valve automatically to keep the flow as the chosen rate.	Pass	Figure 13
Flow Semi Auto Stop Button	When pressed the semi auto mode stops and the green light turns off	When pressed the semi auto mode turned off and the green light turned off	Pass	Figure 14
Level Setpoint	When set in Semi-Auto mode the tank should fill to the	The tank filled to the set level, overfilled slightly but held	fail	Figure 15 Figure 16, When the flow out was set.

	level setpoint and hold there until adjusted	when there was a flow out		
Flow Setpoint	When set the flow rate should match the setpoint	The tank was draining at the flowrate set at the setpoint	pass	Figure 17
Level Error	When there is a difference between the setpoint and level in the tank the error should show the correct difference.	When the tank was filling the error screen was producing the correct difference.	pass	Figure 18
Flow Error	When there is a difference between the setpoint and the actual flowrate the error should show the correct difference.	When the flowrate setpoint was adjusted the error showed the difference between the setpoint and the actual flow rate.	pass	Figure 19

6. Meeting the Customer Needs

7. Conclusions and Recommendations

8. Team Working

9. Citation List

Petrotechinc, ND. What are the types of IEC programming languages. [Online]
Available at: <https://petrotechinc.com/why-is-the-iec-61131-the-standard-programming-language-in-open-architecture-control-systems/#:~:text=The%20IEC%2061131's%20five%20programming,a%20control%20engineer's%20desired%20application.>
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[Accessed 17th April 2023].

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Available at:
<https://docs.inductiveautomation.com/display/DOC81/Sequential+Function+Charts#:~:text=A%20Sequential%20Function%20Chart%20%28SFC%29%20is%20a%20series,execute%20a%20set%20number%20of%20times%20before%20ending.>
[Accessed 17th April 2023].

10. Appendix

Figure 1

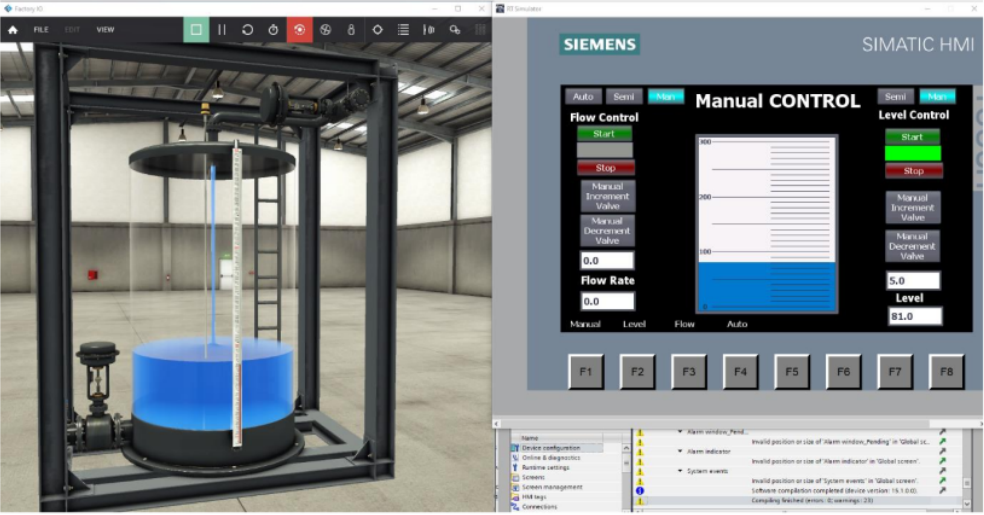


Figure 2

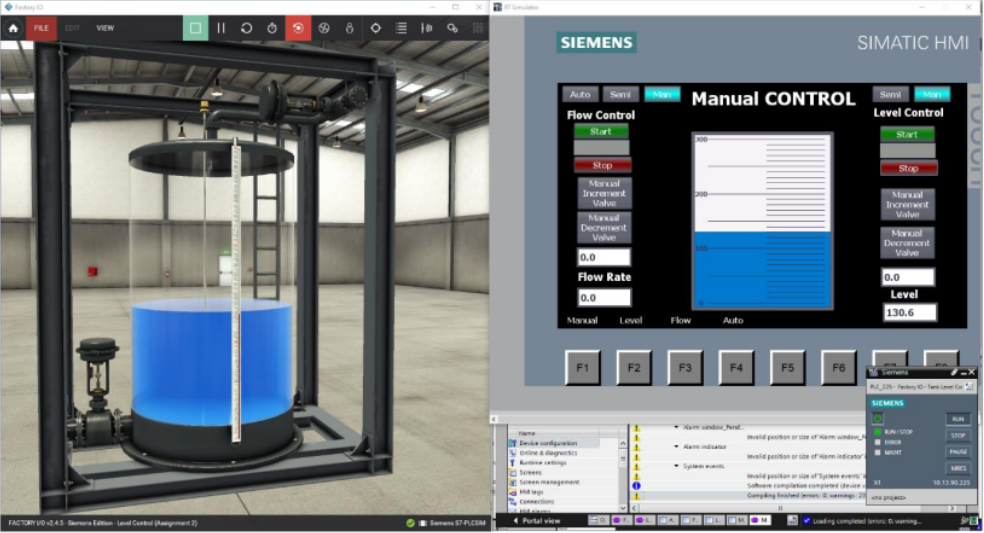


Figure 3

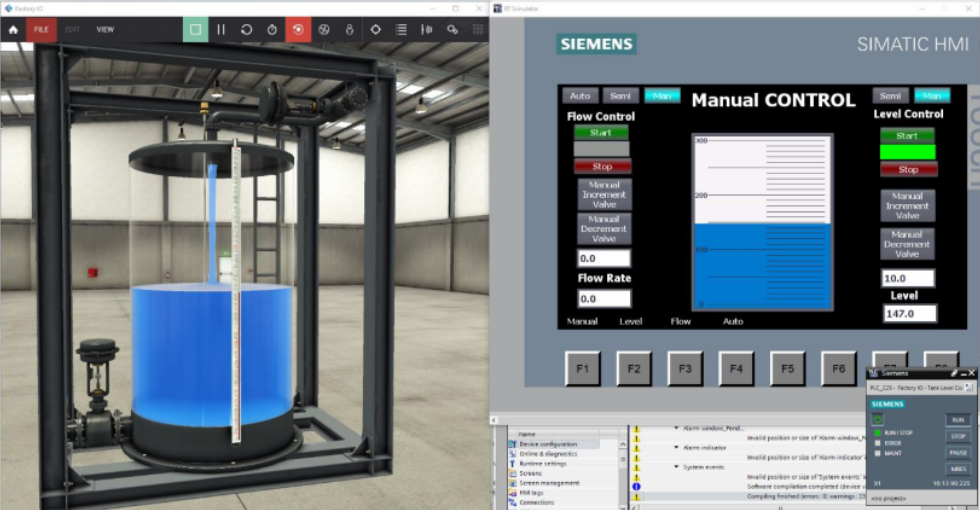


Figure 4

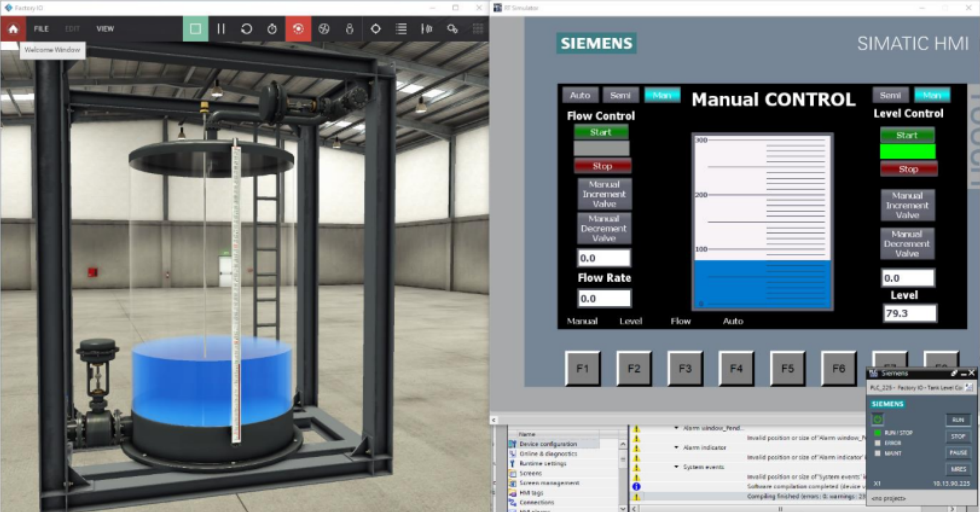


Figure 5

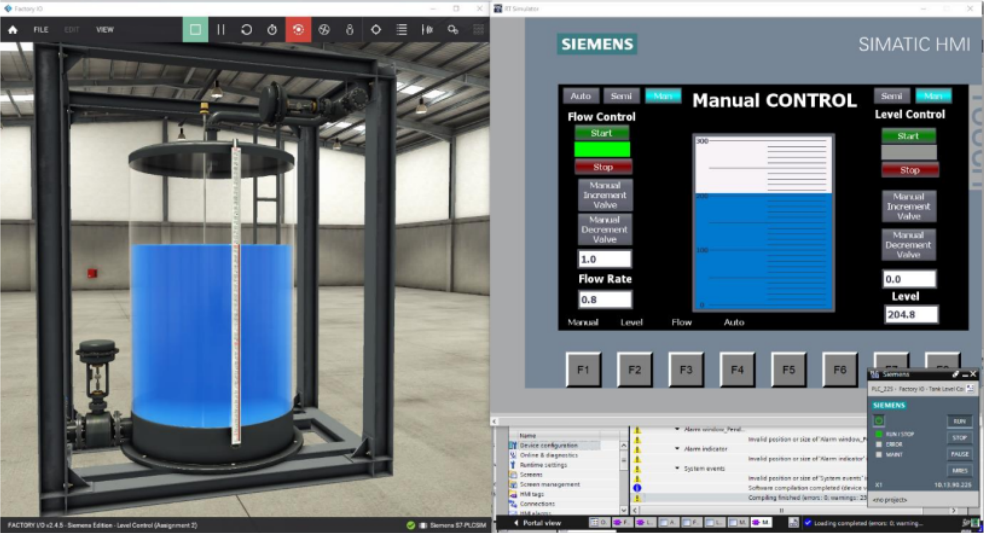


Figure 6

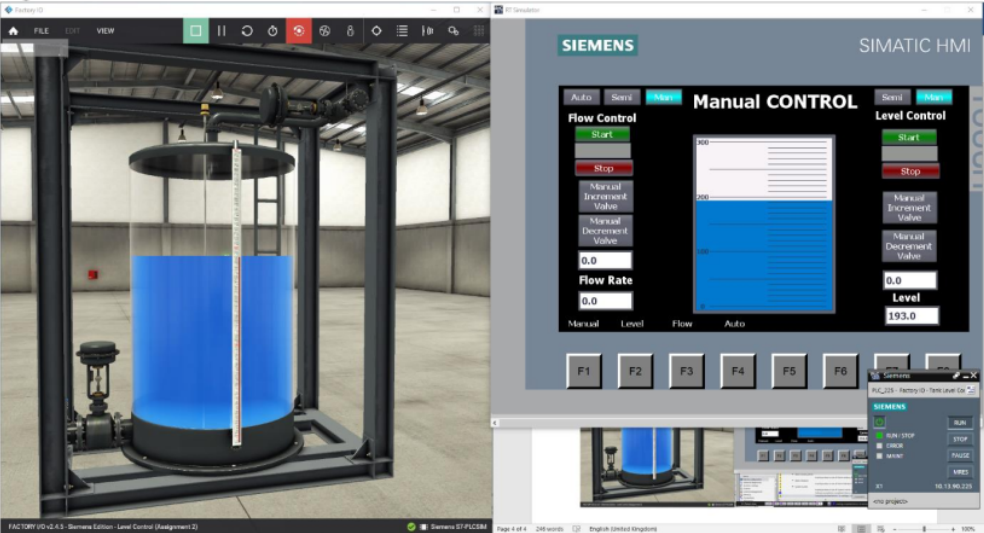


Figure 7

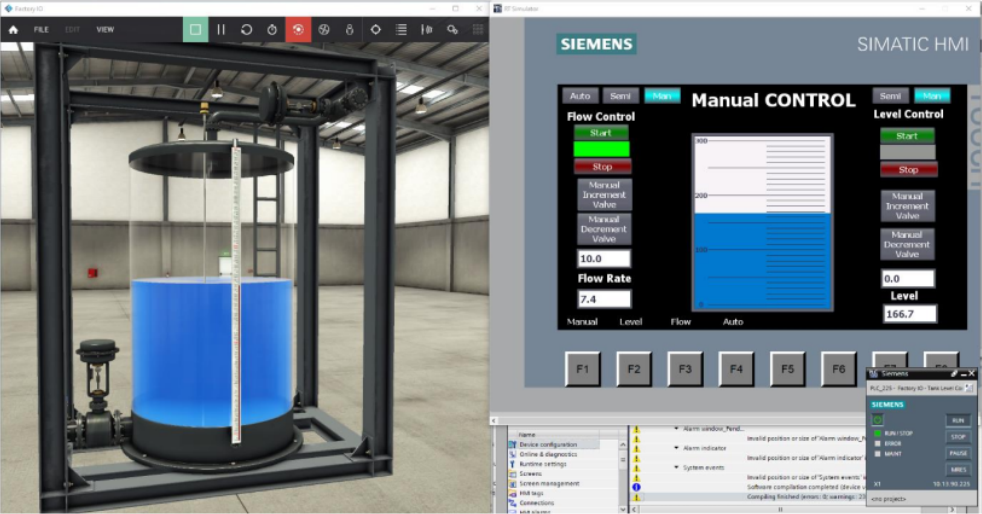


Figure 8

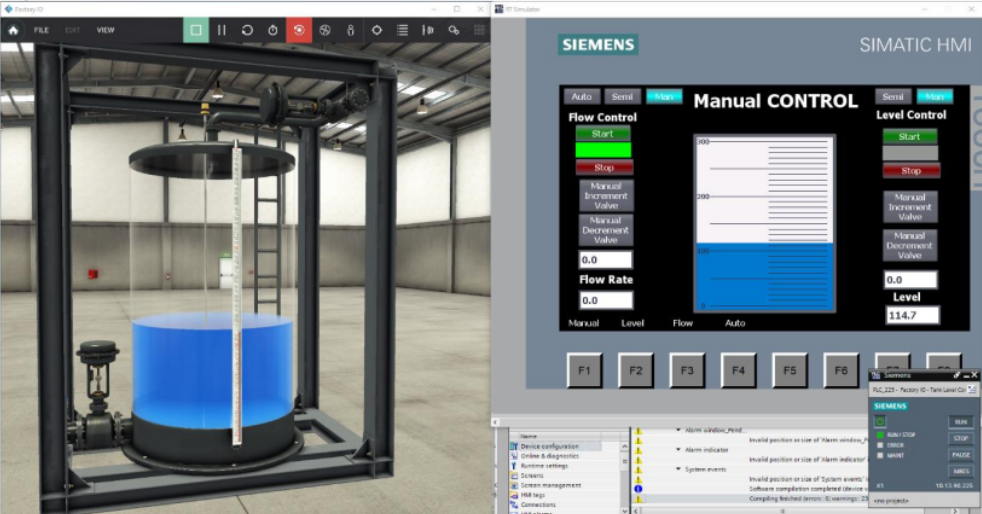


Figure 9



Figure 10



Figure 11



Figure 12



Figure 13

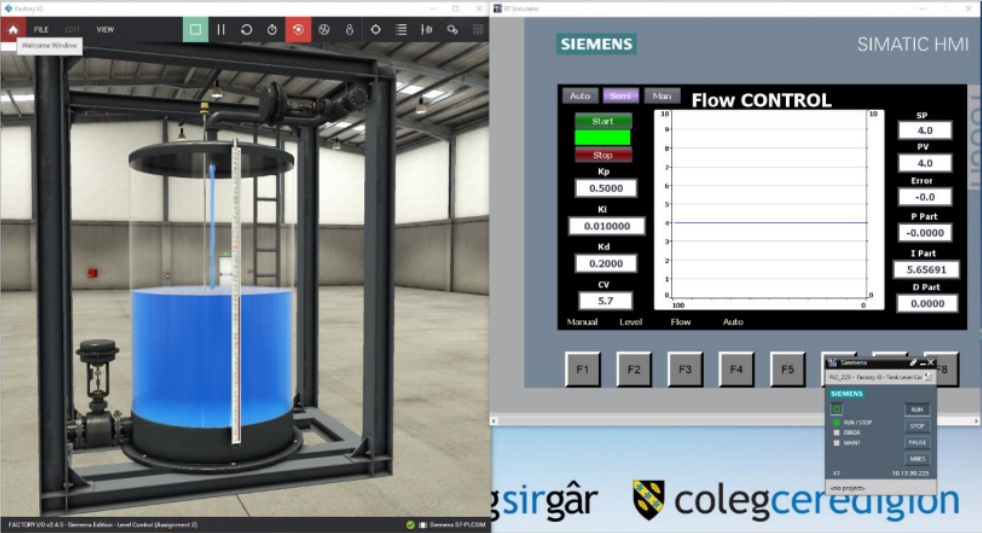


Figure 14



Figure 15

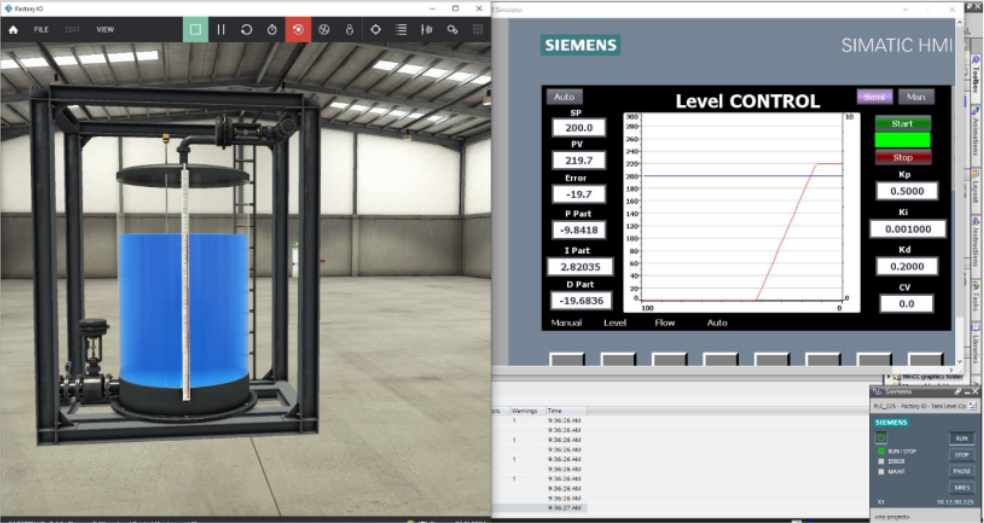


Figure 16

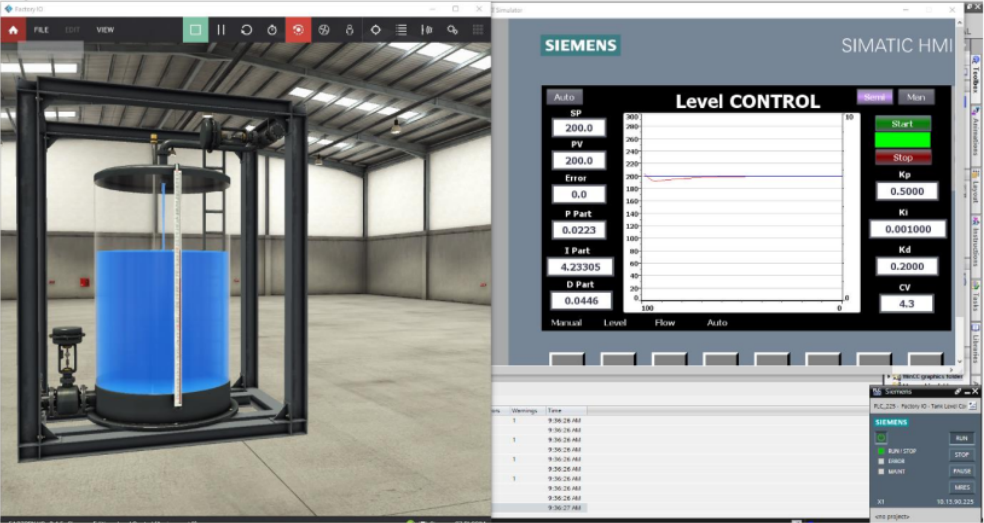


Figure 17

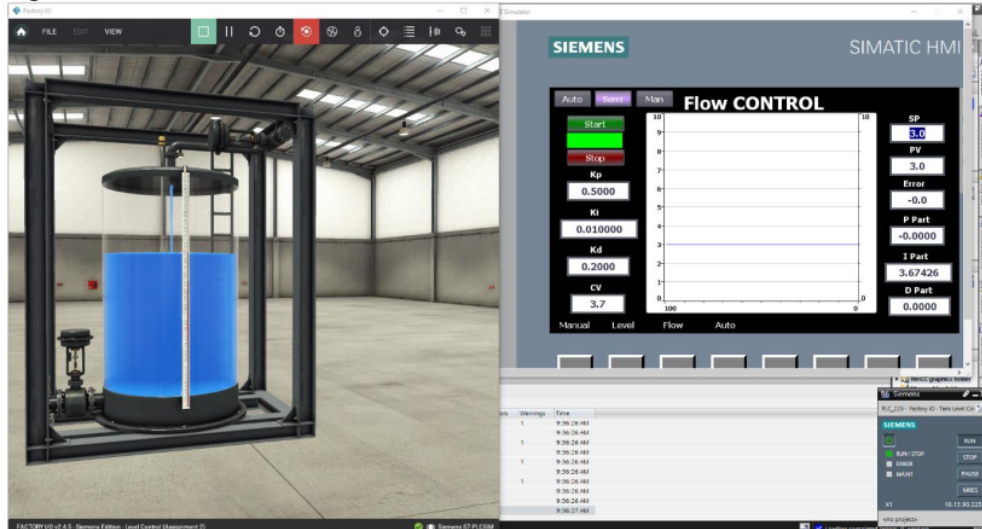


Figure 18

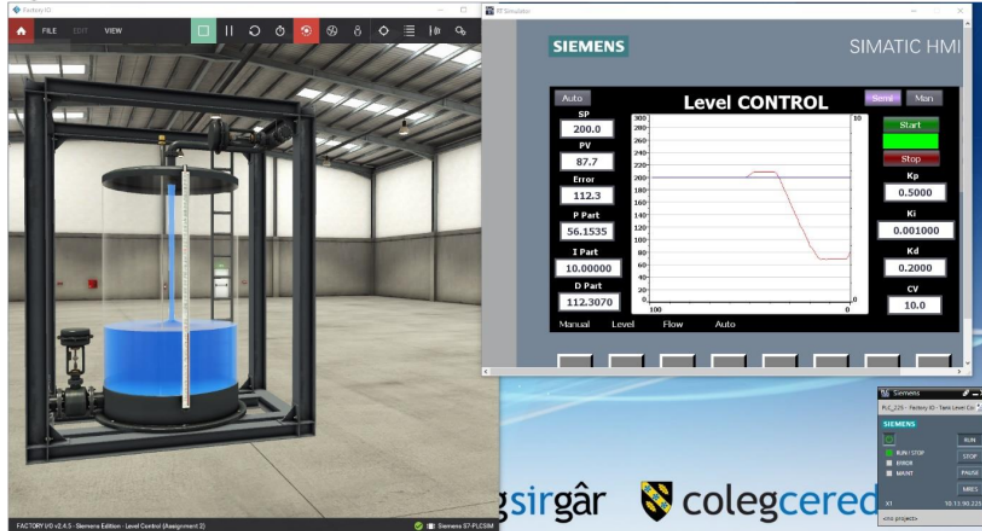
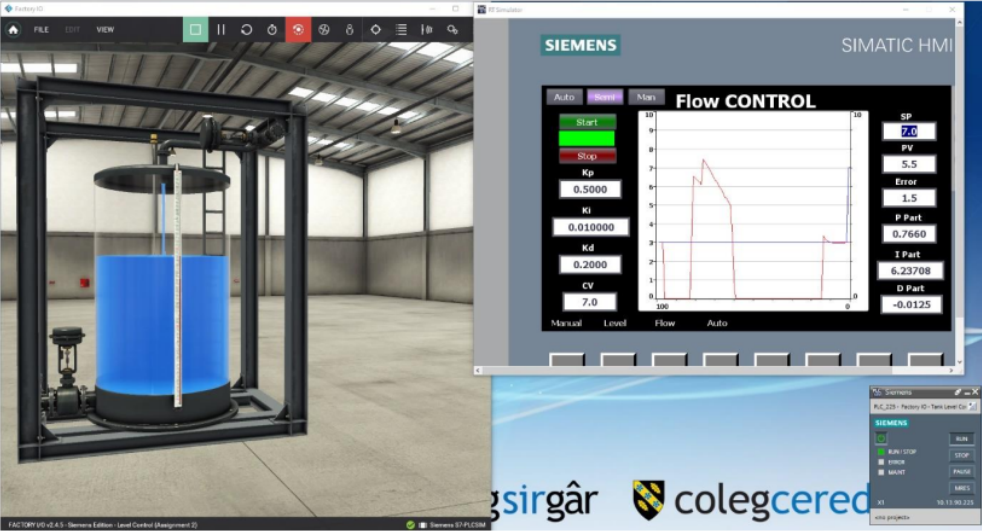
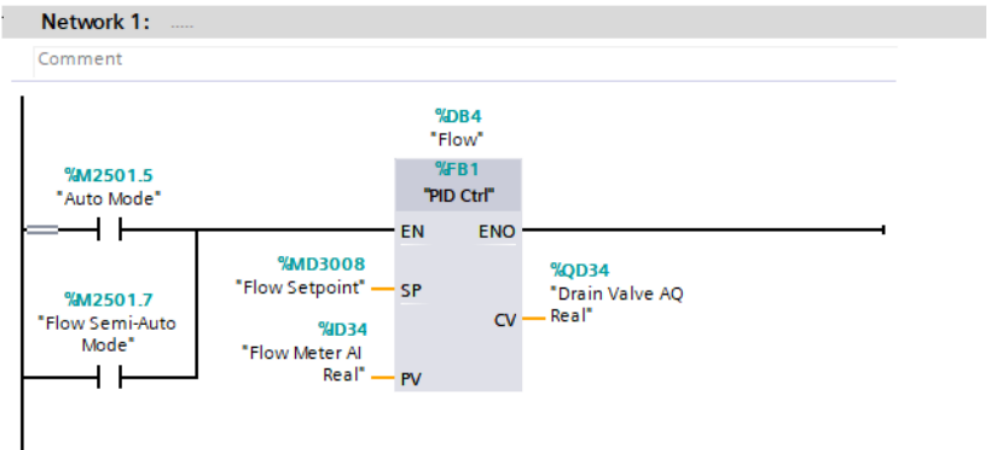


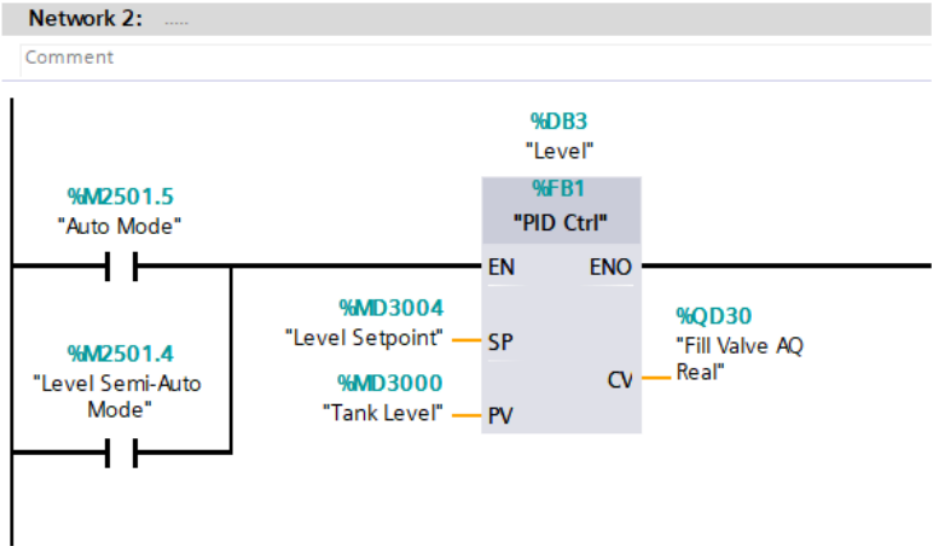
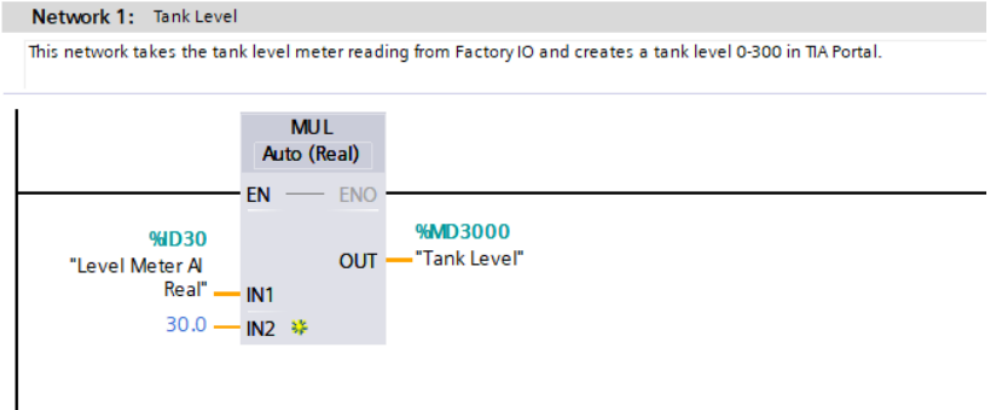
Figure 19



Flow Cyclic interrupt



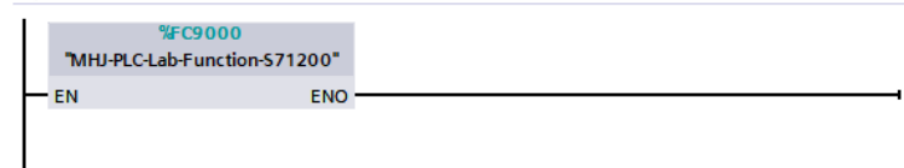
Level Cyclic Interrupt



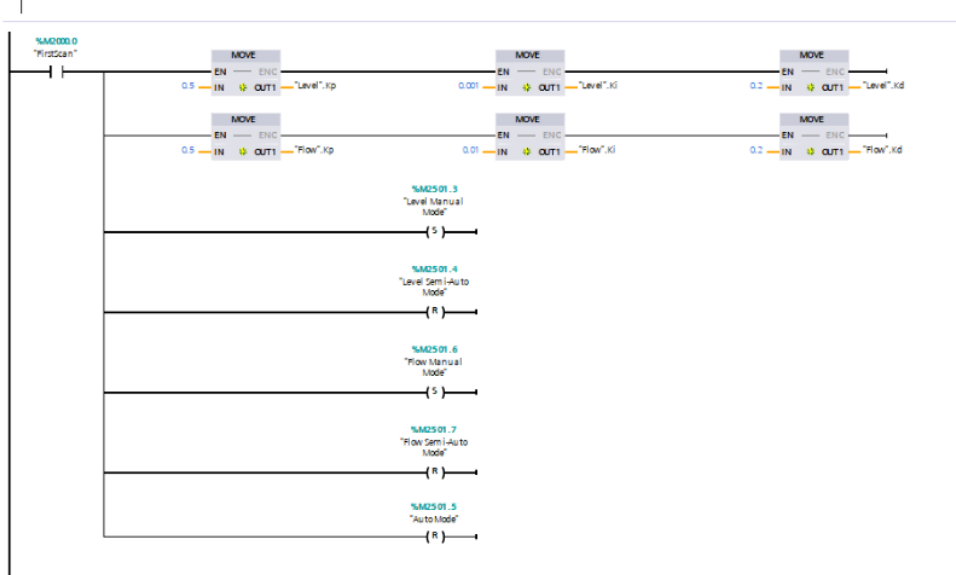
Main Block

Network 1: Factory IO PLC driver

This Network allows for TIA Portal to connect to Factory IO

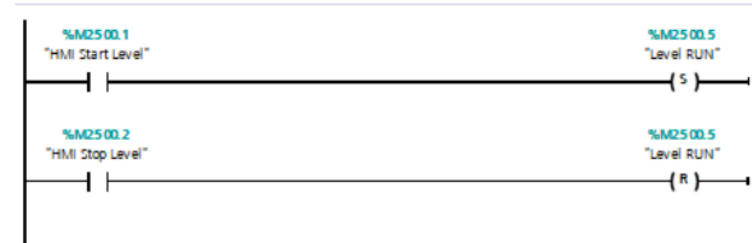


Network 2: First Scan



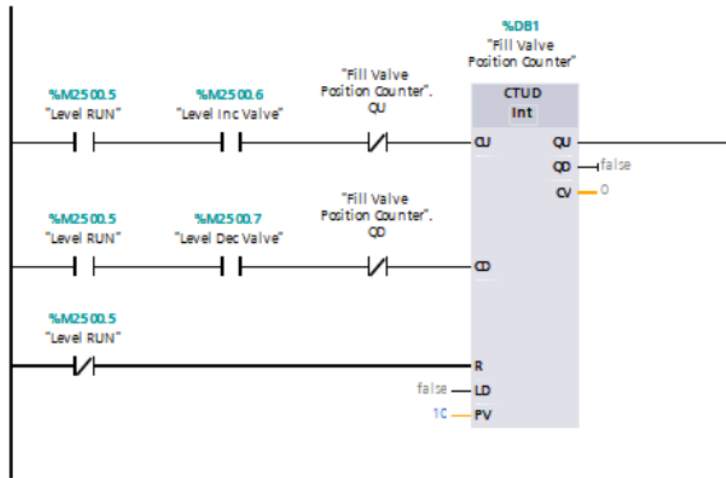
Network 3: Level RUN

This network connects the HMI to the Level Run.



Network 4: Fill Valve Position

- ▼ This network tells the fill valve when to open and can adjust the valve into 11 different positions 0 = Off, 1-10 = different flow rates of liquid entering the tank.



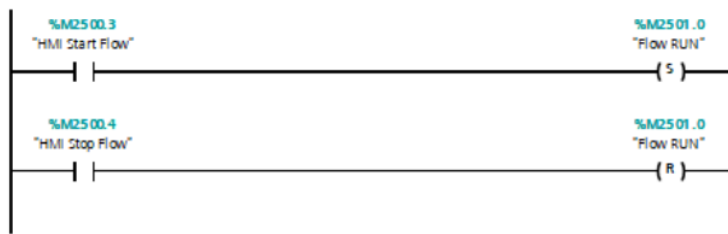
Network 5: Convert and Limit

This network converts the counter into a real value and limits the real value between 0-10.



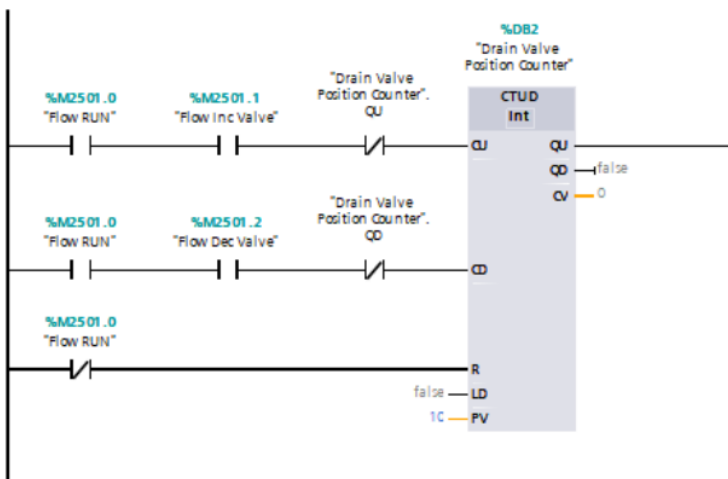
Network 6: Flow RUN

This network connects the HMI to the Flow Run.



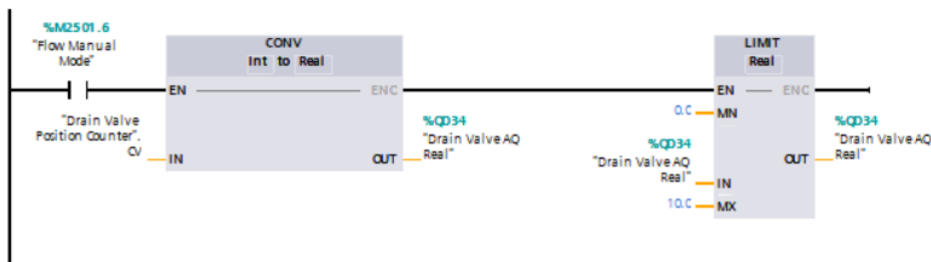
Network 7: Drain Valve Position

- ▼ This network tells the drain valve when to open and can adjust the valve into 11 different positions 0 = Off, 1-10 = different flow rates of liquid exiting the tank.



Network 8: Convert and Limit

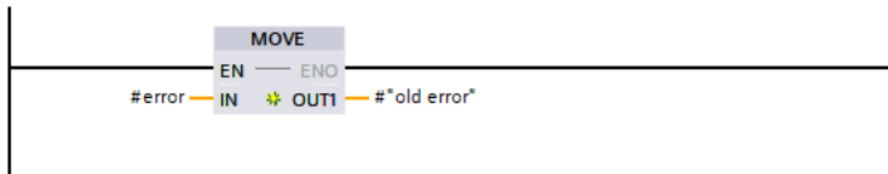
This network converts the counter into a real value and limits the real value between 0-10.



PID Control

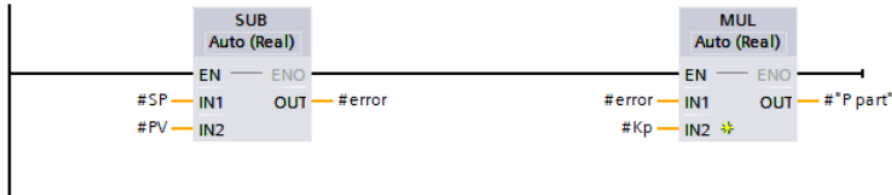
Network 1: store the old error

Comment



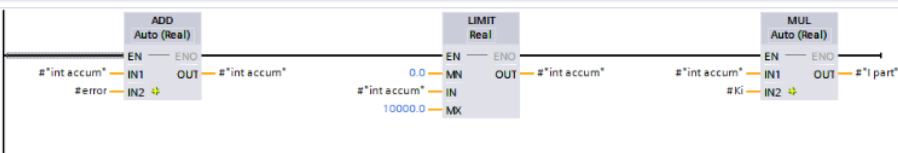
Network 2: Calculate the error and the P part

Comment



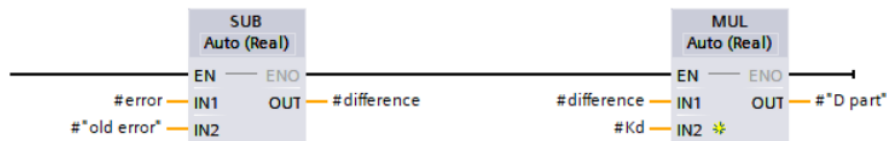
Network 3: I Part

Comment



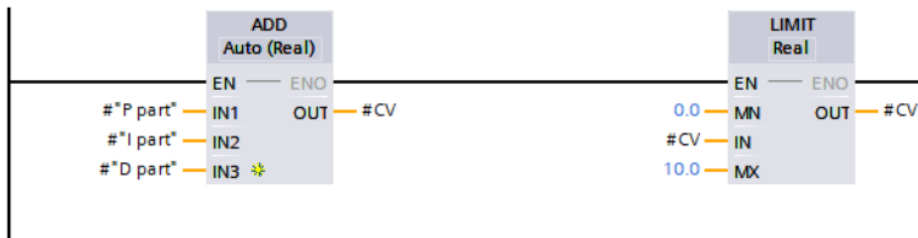
Network 4: D Part

- This network takes the error and old error and calculates the difference. It then multiplies the difference by Kd to create the D Part.



Network 5:

Comment



Flow Data Block

Flow									
	Name	Data type	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint	Comment
1	▼ Input			☐	☐	☐	☐	☐	
2	■ SP	Real	0.0	☐	☒	☒	☒	☐	
3	■ PV	Real	0.0	☐	☒	☒	☒	☐	
4	▼ Output			☐	☐	☐	☐	☐	
5	■ CV	Real	0.0	☐	☒	☒	☒	☐	
6	InOut			☐	☐	☐	☐	☐	
7	▼ Static			☐	☐	☐	☐	☐	
8	■ error	Real	0.0	☐	☒	☒	☒	☐	
9	■ old error	Real	0.0	☐	☒	☒	☒	☐	
10	■ int accum	Real	0.0	☐	☒	☒	☒	☐	
11	■ difference	Real	0.0	☐	☒	☒	☒	☐	
12	■ Kp	Real	0.0	☐	☒	☒	☒	☐	
13	■ Ki	Real	0.0	☐	☒	☒	☒	☐	
14	■ Kd	Real	0.0	☐	☒	☒	☒	☐	
15	■ P part	Real	0.0	☐	☒	☒	☒	☐	
16	■ I part	Real	0.0	☐	☒	☒	☒	☐	
17	■ D part	Real	0.0	☐	☒	☒	☒	☐	

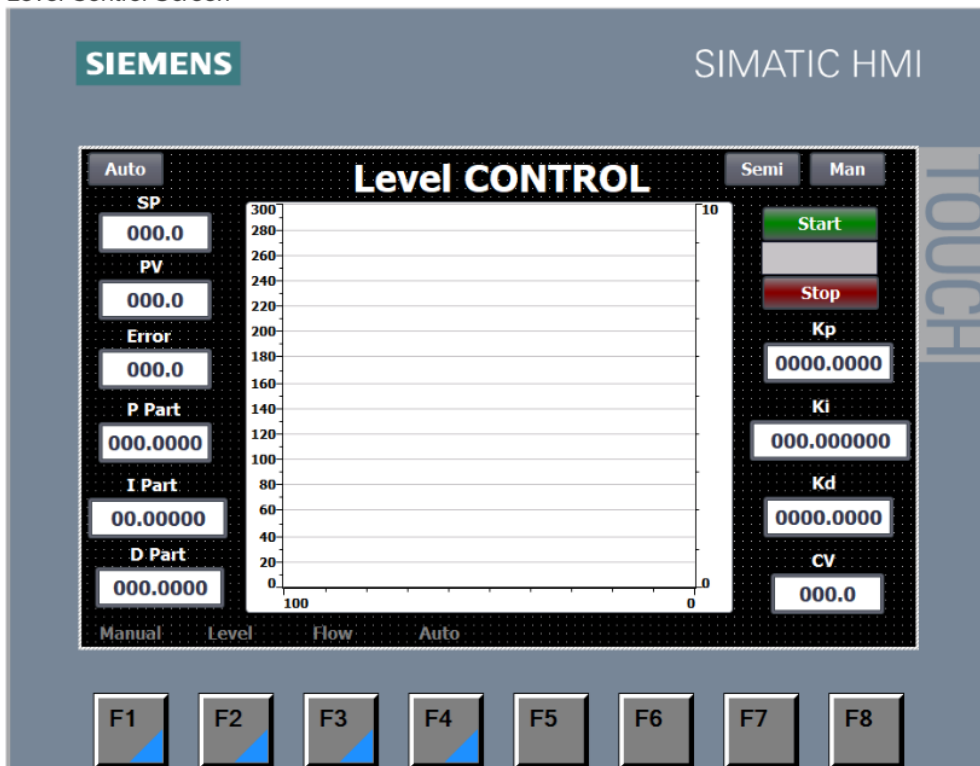
Level Data Block

Level									
	Name	Data type	Start value	Retain	Accessible f...	Writa...	Visible in ...	Setpoint	Co
	▼ Input			☐	☐	☐	☐	☐	
	■ SP	Real	0.0	☐	☒	☒	☒	☐	
	■ PV	Real	0.0	☐	☒	☒	☒	☐	
	▼ Output			☐	☐	☐	☐	☐	
	■ CV	Real	0.0	☐	☒	☒	☒	☐	
	InOut			☐	☐	☐	☐	☐	
	▼ Static			☐	☐	☐	☐	☐	
	■ error	Real	0.0	☐	☒	☒	☒	☐	
	■ old error	Real	0.0	☐	☒	☒	☒	☐	
0	■ int accum	Real	0.0	☐	☒	☒	☒	☐	
1	■ difference	Real	0.0	☐	☒	☒	☒	☐	
2	■ Kp	Real	0.5	☐	☒	☒	☒	☐	
3	■ Ki	Real	0.01	☐	☒	☒	☒	☐	
4	■ Kd	Real	0.0	☐	☒	☒	☒	☐	
5	■ P part	Real	0.0	☐	☒	☒	☒	☐	
6	■ I part	Real	0.0	☐	☒	☒	☒	☐	
7	■ D part	Real	0.0	☐	☒	☒	☒	☐	

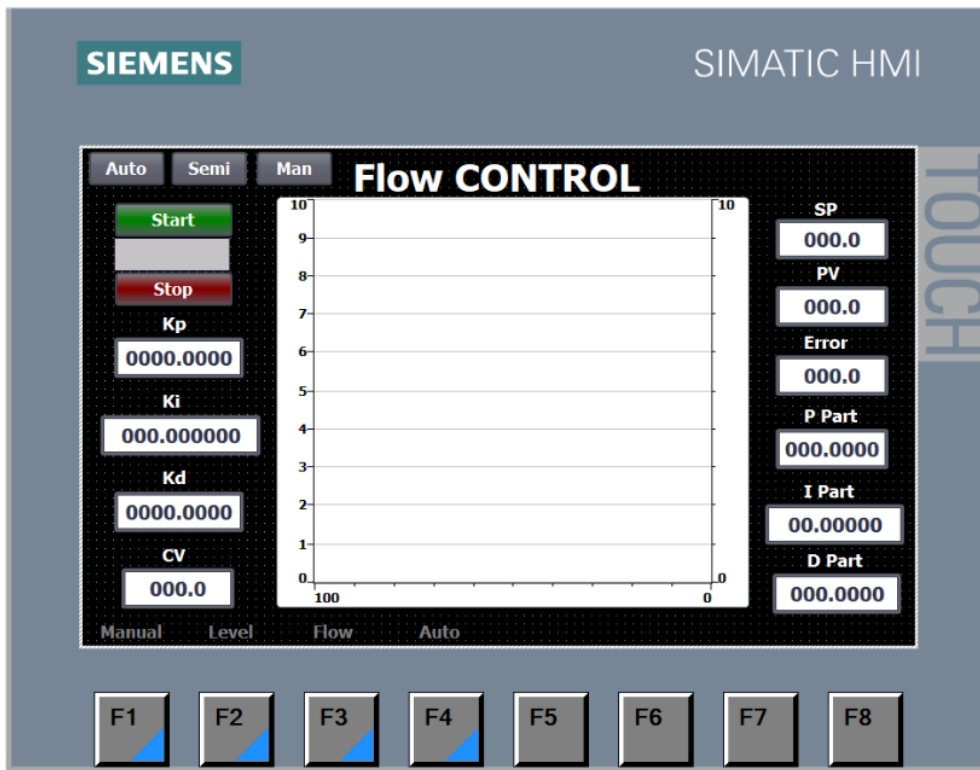
My Tags

My Tags							
	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...
	HMI Start Level	Bool	%M2500.1	☐	☒	☒	☒
	HMI Stop Level	Bool	%M2500.2	☐	☒	☒	☒
	HMI Start Flow	Bool	%M2500.3	☐	☒	☒	☒
	HMI Stop Flow	Bool	%M2500.4	☐	☒	☒	☒
	Tank Level	Real	%MD3000	☐	☒	☒	☒
	Level RUN	Bool	%M2500.5	☐	☒	☒	☒
	Level Inc Valve	Bool	%M2500.6	☐	☒	☒	☒
	Level Dec Valve	Bool	%M2500.7	☐	☒	☒	☒
	Flow RUN	Bool	%M2501.0	☐	☒	☒	☒
	Flow Inc Valve	Bool	%M2501.1	☐	☒	☒	☒
	Flow Dec Valve	Bool	%M2501.2	☐	☒	☒	☒
	Level Manual Mode	Bool	%M2501.3	☐	☒	☒	☒
	Level Semi-Auto Mode	Bool	%M2501.4	☐	☒	☒	☒
	Auto Mode	Bool	%M2501.5	☐	☒	☒	☒
	Flow Manual Mode	Bool	%M2501.6	☐	☒	☒	☒
	Flow Semi-Auto Mode	Bool	%M2501.7	☐	☒	☒	☒
	Level Setpoint	Real	%MD3004	☐	☒	☒	☒
	Flow Setpoint	Real	%MD3008	☐	☒	☒	☒
	<Add new>			☐	☒	☒	☒

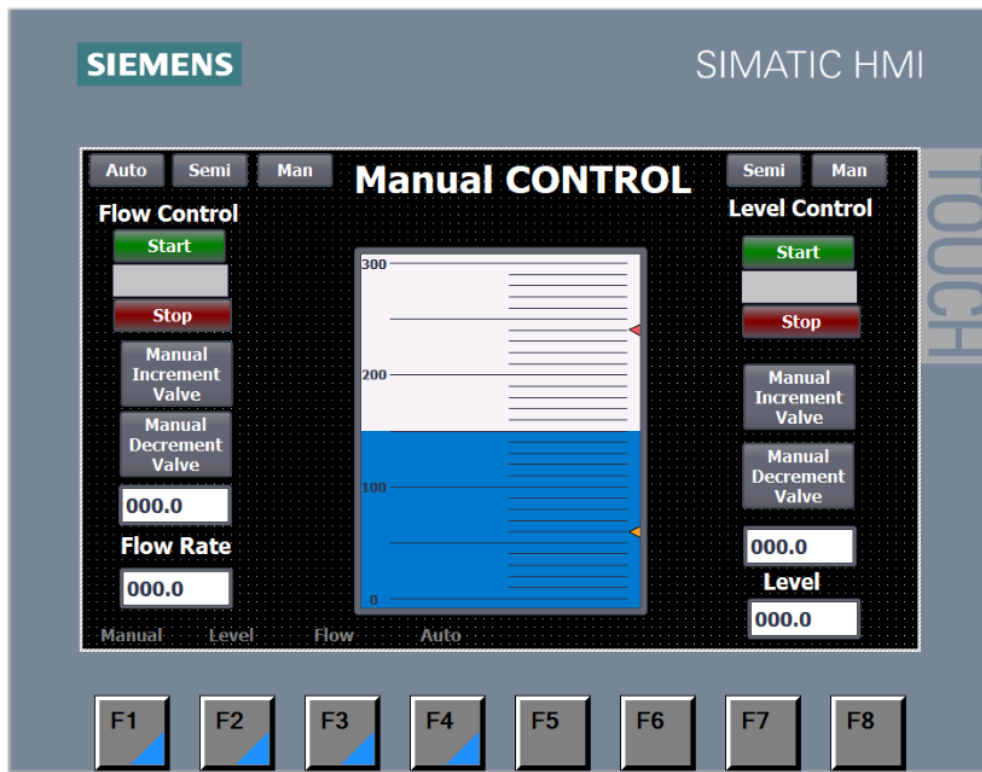
Level Control Screen



Flow Control Screen



Manual Control Screen



11.

2225871

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

42/100

PAGE 1

PAGE 2

PAGE 3

Text Comment. No workplan?

PAGE 4

Text Comment. Brief explanations given

Text Comment. Only four languages considered

Text Comment. full date not needed in citation

Text Comment. You must use the third person

PAGE 5

Text Comment. These are memory addresses, IO addresses begin with %I or %Q

Text Comment. Where is your PLC hardware design

PAGE 6

Text Comment. No explanation?

Text Comment. A good testing table with evidence supplied

GRADING FORM: NEW CSG-RUBRIC

HUGO DAVIES**42****1. ENGAGEMENT WITH LITERATURE**

A brief research section with some evidence of reading from a small range of sources cited and listed correctly using the Harvard method. Actual date not needed in citation. 8/20

8**2. KNOWLEDGE AND UNDERSTANDING**

Hardware IO list is incorrect as it shows only memory addresses. No program explanation but ladder code does contain some comments 8/20

8**3. COGNITIVE AND INTELLECTUAL**

Good testing but no conclusion or recommendations 8/20

8**4. PRACTICAL APPLICATION**



Good program design with evidence of testing.
12/20

12

5. TRANSFERABLE SKILLS



Well structured, pages are numbered. Some sections are missing and no team working included. No work plan. You must learn to write in the third person. 6/20

6