

Jonathan Morgan PLC PSDE4005 Assignment 3

by Jonathan Morgan

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1. System Description

The Bytronic Process Rig is a self-contained, fully integrated system, which is designed to heat, transfer and cool liquid (water) with the relevant indicators to show the process. The systems automation is controlled by a PLC and contains a number of electrical components to provide the inputs and outputs. Process tanks and pipework are used for the transportation and storage of the water. Figure 1 shows the overview of the Bytronic Process Rig.



Figure 1. Bytronic Process Rig

Software

The software that is used for the programming of the Bitronic Process Rig is Siemens TIA portal (See Figure 2).



Figure 2. Siemens TIA Portal

Hardware

The Hardware used for the system is as follows:

PLC

The PLC used for the Bytronic Process Rig is a Siemens S7-1214 PLC (See Figure 3).

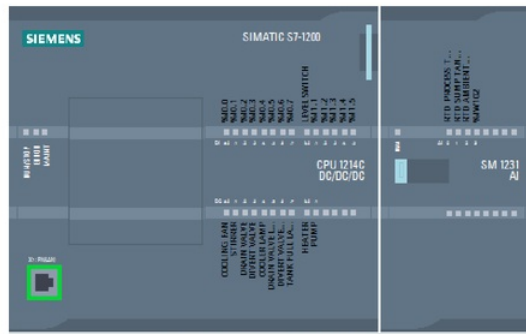


Figure 3. Siemens S7-1214 PLC

Heater Tank

The heater tank collects water in the system for heating. It contains elements for the heating process and has an infeed and outfeed pipes connected to the side walls of the tank. (See Figure 4)



Figure 4. Heater Tank

Heater Tank Level and Temperature

The heater tank has a level sensor fitted into the tank housing. This sensor sends an input to the PLC, where it is then programmed to determine an output. When the level sensor is actuated, the program will prevent anymore water to fill the tank to prevent overflow. It will also send a signal to the 'Tank Full Indicator' to switch on/off.

The temperature probe sensor fitted to the tank housing gives will give a feedback signal to the PLC and the temperature of the tank is indicated on the 'Process Tank Temperature' digital display. (See Figure 5).



Figure 5. Heater tank level and temperature sensors

Flow Rate

The flow rate and the temperature of the water at the inlet of heater tank is measured using a flow meter and a temperature sensor. The value shown on the digital displays are determined by the PLC program. (See Figure 6).



Figure 6. Flow rate temperature and flow rate value

Stirrer

The Stirrer is located at the head of the heater tank. It is a rotary 24v DC motor with a paddle to stir the water inside the heating tank. (See Figure 7).



Figure 7. Stirrer

Drain Valve

The drain valve is actuated when a 24V supply is given from the PLC. When actuated, the valve allows the water to drain from the heater tank into the sump tank. When the drain valve is opened, the 'Drain Valve Open' lamp will indicate. (See Figure 8).



Figure 8. Drain Valve

Manual Drain Valve

This valve is a rotational device which requires manual operation. This will drain the water from the heater tank to the sump tank and act as a bypass of the automatic drain valve. (See Figure 9).



Figure 9. Manual Drain Valve

Sump Tank Temperature Sensor

This sensor is a 24V temperature probe sensor. It is fitted into the sump tank and designed to give a feedback signal to the PLC. The temperature value is then displayed on the digital screen. (See Figure 10).



Figure 10. Sump tank temperature sensor

Pump

This 12V pump will transfer the water from the sump tank at a flow rate of up to 4 litres per minute. It is located at the outlet of the base of the sump tank. The water is pumped to the divert valve, where it is then diverted to the cooling unit or the heating tank. (see Figure 11).



Figure 11. Pump

Overflow

A manually operated rotation valve is fitted to the sump tank to relieve overflow. This is used as a safety feature in case of failure of the motorised pump. (See Figure 12).



Figure 12. Manual Valve

Divert Valve

The divert valve is located between the sump tank outlet and the cooler unit inlet. It will allow flow of water from the sump tank to divert between the cooler unit and return to the heater tank. It is a 24V automated valve, which is actuated by an output from the PLC. (See Figure 13).



Figure 13. Divert Valve

Cooler Unit

The purpose of the cooler unit is cool water within the system. Water is diverted from divert valve to the cooler where it is cooled by the intake of ambient temperature. (See Figure 14).

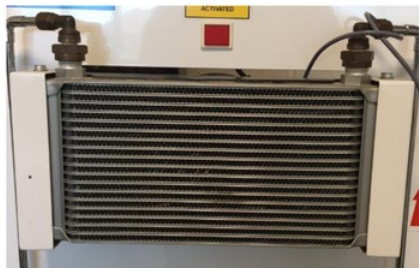


Figure 14. Cooling Unit

The following table shows the assigned input and output addresses for the PLC.

INPUTS		OUTPUTS	
Address	Tag Name	Address	Tag Name
I 1.0	Level Switch	Q 0.0	Cooling Fan
IW66	Flow Rate Sensor	Q 0.1	Stirrer
IW96	RTD Process Tank Temp Sensor	Q 0.2	Drain Valve
IW98	RTD Sump Tank Temp Sensor	Q 0.3	Divert Valve
IW100	RTD Ambient Temp Sensor	Q 0.4	Cooler Lamp
		Q 0.5	Drain Valve Lamp
		Q 0.6	Divert Valve Lamp
		Q 0.7	Tank Full Lamp
		Q 1.0, QW1002	Heater, Process Temperature
		Q 1.1, QW1001	Pump, Flow

2. Program Design and Explanation

The PLC tag table below is split into 3 sections showing the PLC input tags, Output tags and Memory bits.

The following tag table contains the sensors and switches mounted on the system that provide the PLC with an input signal. The table also shows the given input address. (See Figure 15).

	Name	Data type	Address
1	LEVEL SWITCH	Bool	%I1.0
2	FLOWRATE SENSOR	Word	%IW66
3	RTD PROCESS TANK TEMP SENS...	Word	%IW96
4	RTD SUMP TANK TEMP SESNOR	Word	%IW98
5	RTD AMBIENT TEMP SENSOR	Word	%IW100

Figure 15. PLC Input tag list

The following contains the list of components that provide the process with the required outputs. The PLC provides these components with the output signal in order to actuate. The table also shows the given output addresses. (See Figure 16).

6		COOLING FAN	Bool	%Q0.0
7		STIRRER	Bool	%Q0.1
8		DRAIN VALVE	Bool	%Q0.2
9		DIVERT VALVE	Bool	%Q0.3
10		COOLER LAMP	Bool	%Q0.4
11		DRAIN VALVE LAMP	Bool	%Q0.5
12		DIVERT VALVE LAMP	Bool	%Q0.6
13		TANK FULL LAMP	Bool	%Q0.7
14		HEATER	Bool	%Q1.0
15		PUMP	Bool	%Q1.1
16		FLOW %CV PWM DUTY CYCLE	UInt	%QW1000
17		PROCESS TEMPERATURE %CV P...	UInt	%QW1002

Figure 16. PLC Output tag list

The following contains the tag list for the memory bits. These are used for automation requests for the PLC. (See Figure 17).

18		HMI COOLER	Bool	%M0.1
19		HMI STIRRER	Bool	%M0.2
20		HMI DRAIN VALVE	Bool	%M0.3
21		HMI DIVERT VALVE	Bool	%M0.4
22		LAMP TEST	Bool	%M0.5
23		AUTO	Bool	%M0.0
24		HMI HEATER	Bool	%M0.6
25		HMI PUMP	Bool	%M0.7
26		Auto Start	Bool	%M1.0
27		Auto Flow	Bool	%M1.1
28		Auto Heater	Bool	%M1.2
29		HMI Auto Start	Bool	%M1.3
30		HMI Auto Stop	Bool	%M1.4
31		Auto Run	Bool	%M1.5

Figure 17. PLC Memory bits tag list

Screen Layout

The HMI contains 3 separate screens. The 'Operator' screen is the screen that appears on the HMI when the machine is switched on, (See Figure 13). It contains access buttons to the 'Engineer Screen', 'PID Flow Rate' and the 'PID Process Temperature' screens.

The 'Operator' screen allows the user to start the machine in automatic mode by pressing 'Auto', and by pressing the 'Start' button. The push button switch is labelled Auto and Manual to show which state the machine is currently in. When the 'Start' button is pressed, the pilot light will light up during the running of the process. The 'Stop' button will allow the user to 'Stop' the process. This will switch the pilot light of. This screen also contains a pilot light for to indicate that the level switch has been actuated and the heater tank is full.

Additional information for flow rate and temperature are visible on this screen. (See Figure 18).

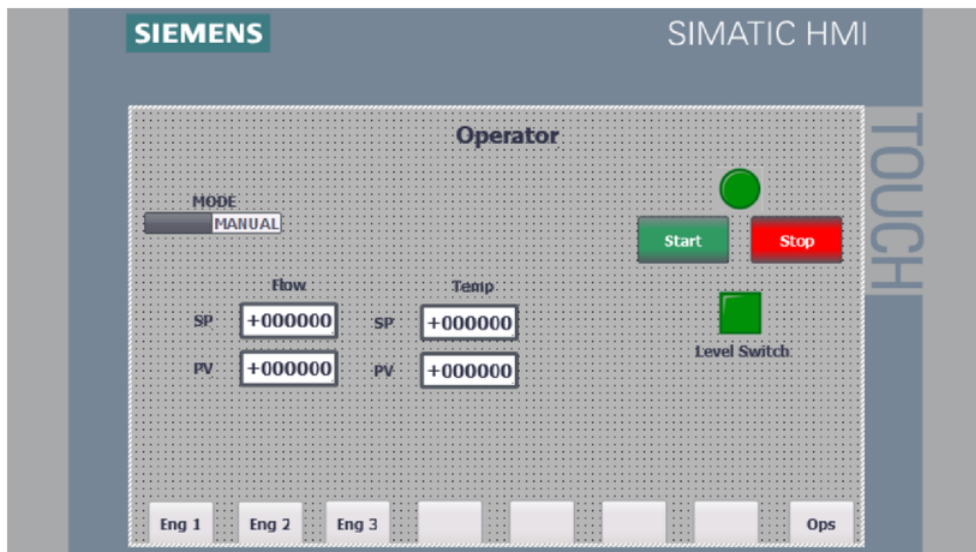


Figure 18. Operator Screen

The Engineer screen allows for the testing and diagnostics of the process rig. When the automatic sequence is switched off, the manual operation of components is possible, allowing the engineer to carry out checks on each component and that they are working correctly. Each pilot light on the system can be manually switched on to test the light. This screen also allows the engineer to start and stop the automatic sequence. The level switch pilot light will indicate to the engineer that the heater tank is full. (See Figure 19).

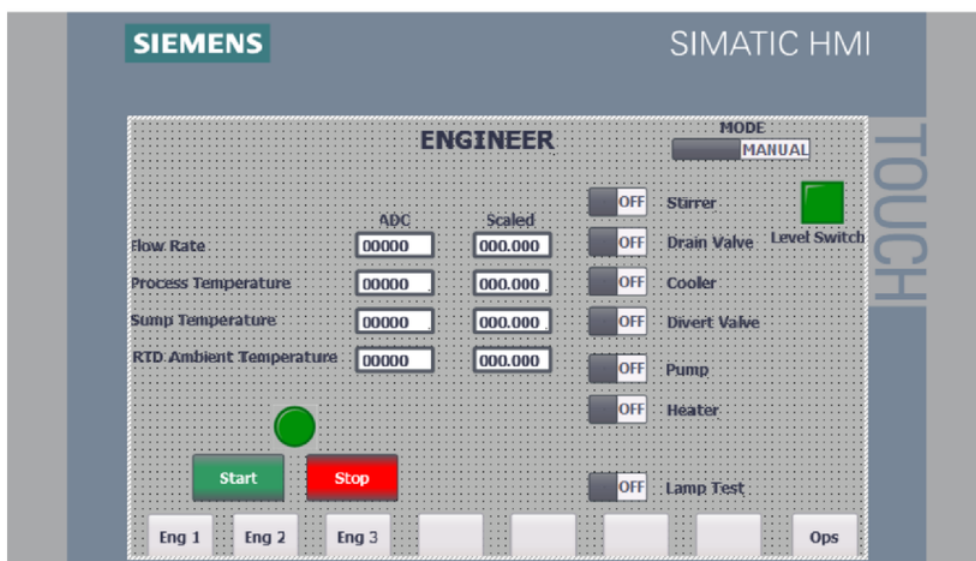


Figure 19. Engineer Screen

The 'PID Flow Rate' screen will show the values of the components within the system to control and regulate the flow rate of water. The actual value and the set point value will determine the output value to the device. (See Figure 20).

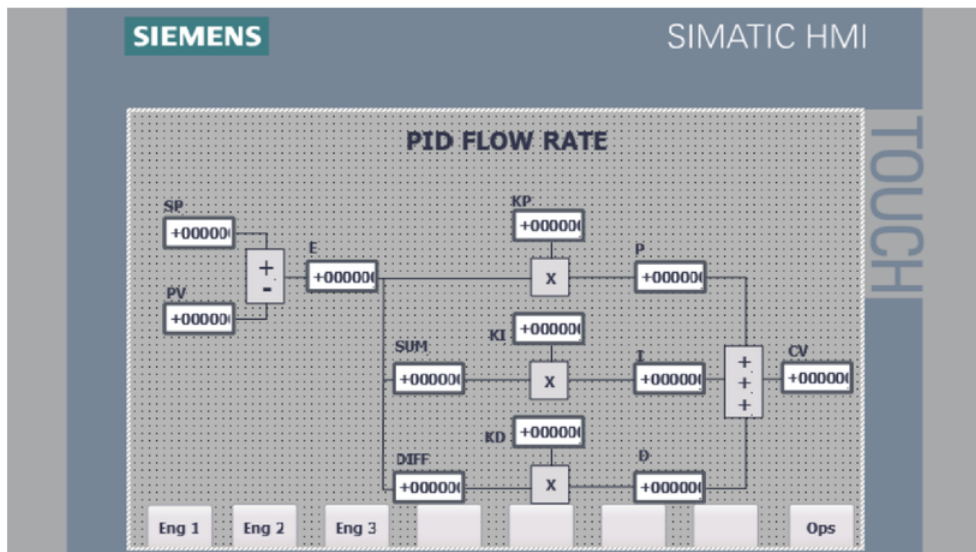


Figure 20. PID Flow Rate Screen

The 'PID Process Temperature' screen will show the values of the components within the system to control and regulate the temperature of water within the heating tank. The actual value and the set point value will determine the output value to the device. (See Figure 21).

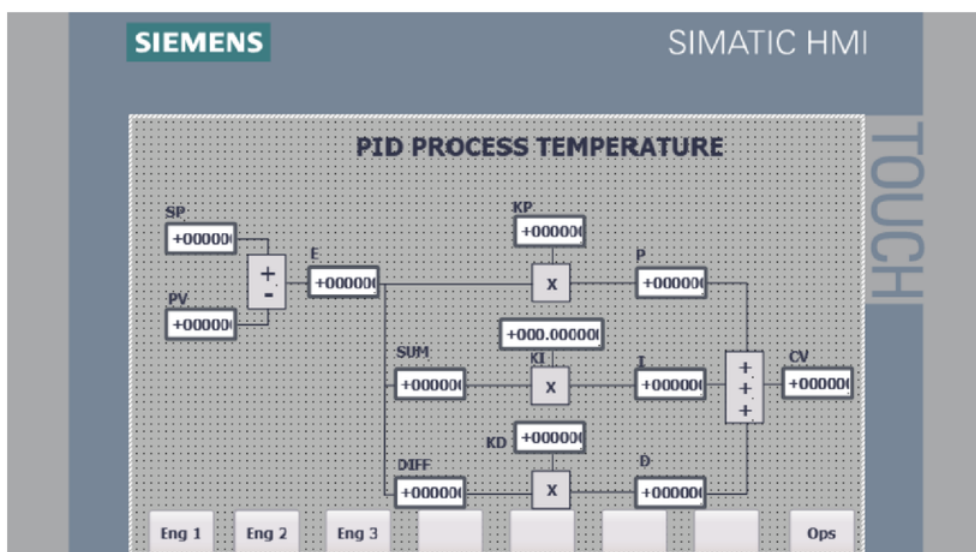


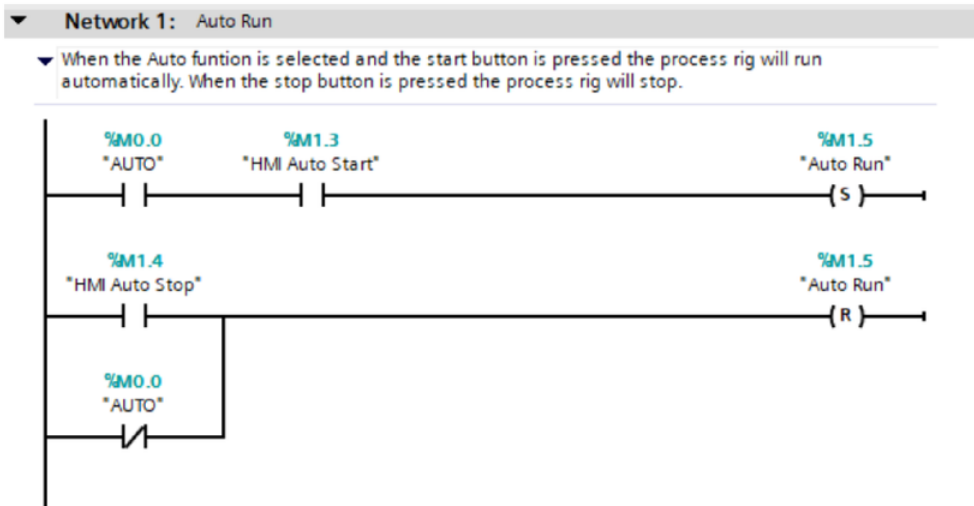
Figure 21. PID Process Temperature Screen

The following table is the tag list required for the HMI screens, with the corresponding PLC tags listed alongside. These tags allow the control of the equipment using the HMI screens. When a button is pressed on the HMI, the link between the HMI and PLC tags allows control of the process rig, or access to the information such as the flow rate and water temperature. (See Figure 22).

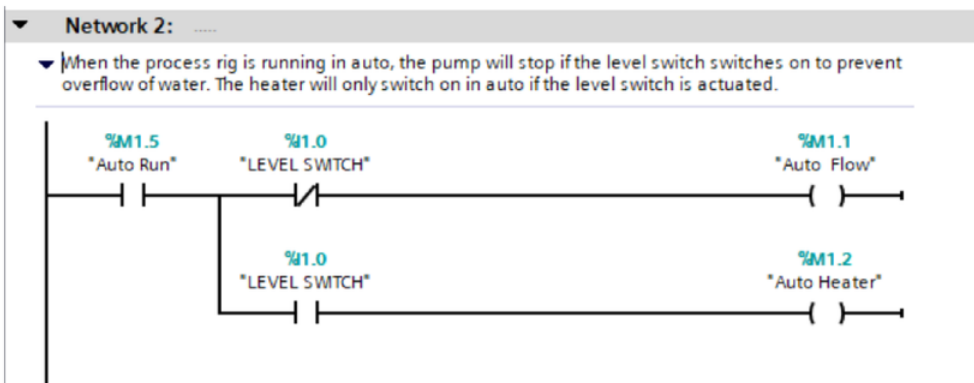
Name	Data type	Connection	PLC name	PLC tag
AUTO	Bool	HMI_Connection...	PLC_107_Process_Rig	AUTO
Auto Run	Bool	HMI_Connection...	PLC_107_Process_Rig	"Auto Run"
FLOWRATE SENSOR	Word	HMI_Connection...	PLC_107_Process_Rig	"FLOWRATE SENSOR"
HMI Auto Start	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI Auto Start"
HMI Auto Stop	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI Auto Stop"
HMI COOLER	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI COOLER"
HMI DIVERT VALVE	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI DIVERT VALVE"
HMI DRAIN VALVE	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI DRAIN VALVE"
HMI HEATER	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI HEATER"
HMI PUMP	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI PUMP"
HMI STIRRER	Bool	HMI_Connection...	PLC_107_Process_Rig	"HMI STIRRER"
LAMP TEST	Bool	HMI_Connection...	PLC_107_Process_Rig	"LAMP TEST"
LEVEL SWITCH	Bool	HMI_Connection...	PLC_107_Process_Rig	"LEVEL SWITCH"
PID_flow_DB_CV	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.CV
PID_flow_DB_D part	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB."D part"
PID_flow_DB_diff	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.diff
PID_flow_DB_error	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.error
PID_flow_DB_I part	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB."I part"
PID_flow_DB_int_accum	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.int_accum
PID_flow_DB_kd	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.kd
PID_flow_DB_ki	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.ki
PID_flow_DB_kp	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.kp
PID_flow_DB_P part	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB."P part"
PID_flow_DB_PV	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.PV
PID_flow_DB_SP	Real	HMI_Connection...	PLC_107_Process_Rig	PID_flow_DB.SP
PID_heat_DB_CV	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.CV
PID_heat_DB_D part	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB."D part"
PID_heat_DB_diff	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.diff
PID_heat_DB_error	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.error
PID_heat_DB_I part	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB."I part"
PID_heat_DB_int_accum	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.int_accum
PID_heat_DB_kd	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.kd
PID_heat_DB_ki	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.ki
PID_heat_DB_kp	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.kp
PID_heat_DB_P part	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB."P part"
PID_heat_DB_PV	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.PV
PID_heat_DB_SP	Real	HMI_Connection...	PLC_107_Process_Rig	PID_heat_DB.SP
RTD AMBIENT TEMP SENSOR	Word	HMI_Connection...	PLC_107_Process_Rig	"RTD AMBIENT TEMP SEN...
RTD PROCESS TANK TEMP SENS...	Word	HMI_Connection...	PLC_107_Process_Rig	"RTD PROCESS TANK TEM...
RTD SUMP TANK TEMP SESNOR	Word	HMI_Connection...	PLC_107_Process_Rig	"RTD SUMP TANK TEMP S...
Scale_ambient_tank_temperat...	Real	HMI_Connection...	PLC_107_Process_Rig	Scale_ambient_tank_tem...
Scale_Flow_Rate_DB_Value	Real	HMI_Connection...	PLC_107_Process_Rig	Scale_Flow_Rate_DB.Value
Scale_Sump_tank_Temperatur...	Real	HMI_Connection...	PLC_107_Process_Rig	Scale_Sump_tank_Temp...
Scale_Temperature_DB_Value	Real	HMI_Connection...	PLC_107_Process_Rig	Scale_Process_Tempera...

Figure 22. HMI Tag Table

The following ladder logic is written to for the control of the process rig. Network 1 contains the automatic run set and reset outputs. When 'Auto' has been selected and 'Start' is pressed on the HMI the system will run. When the 'Stop' button is pressed on the HMI, the system will stop.

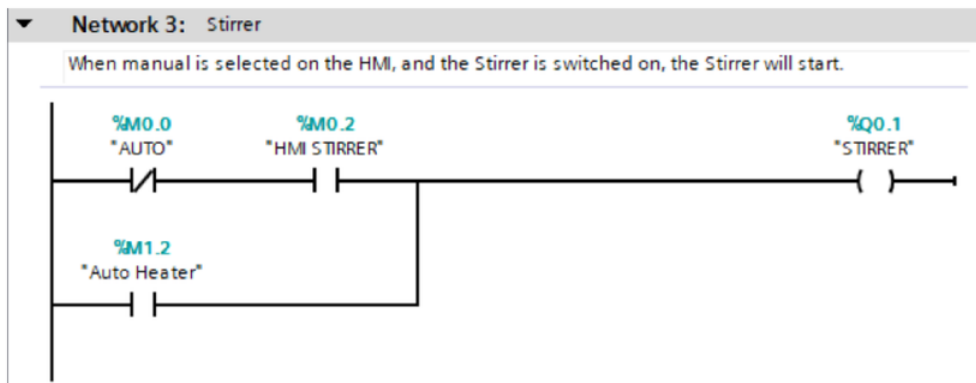


Network 2 contains control of the pump and heater. If the level switch sensor is actuated, the pump will stop delivering water to the heater tank to prevent the tank from overflowing. The heater will switch on if the level switch sensor is actuated, which will prevent the heater from switching on with no water in the system to protect the heating elements.

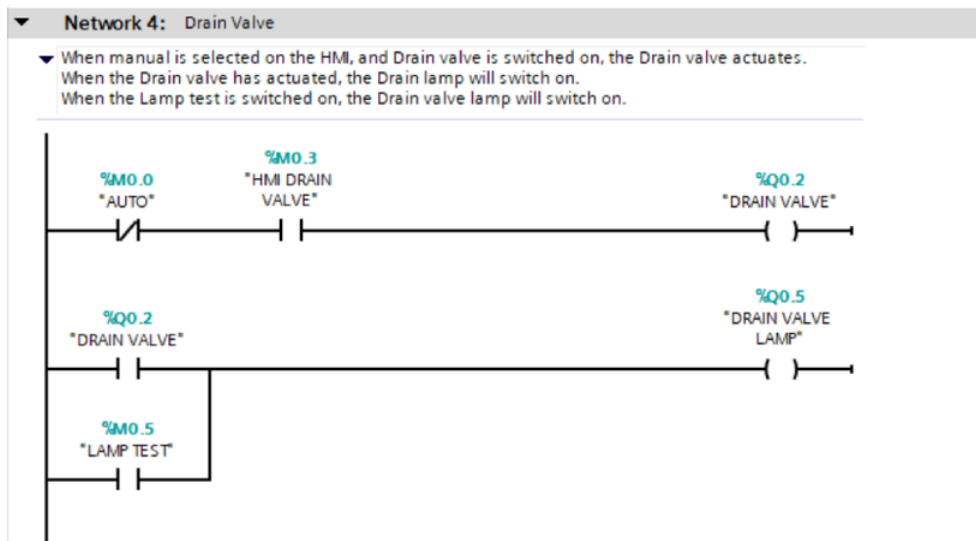


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Network 3 is the control of the stirrer inside the heater tank. If the 'Stirrer' is switched on via the HMI screen, the stirrer motor will spin. If the heater is switched on, the stirrer will automatically start.



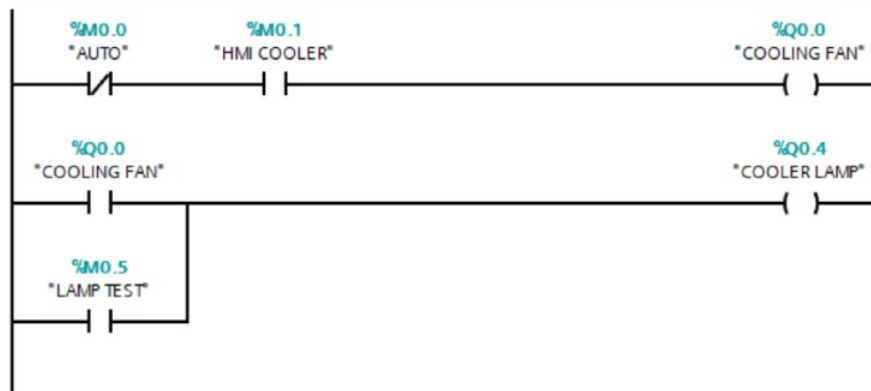
Network 4 is the manual control for the drain valve. When the 'Drain Valve' is selected on the HMI, the tank will begin to drain the water. When the valve is open, the 'Drain Valve Lamp' will switch on to indicate its position. When the 'Lamp Test' is selected on the HMI, the 'Drain Valve Lamp' switches on for testing purposes.



Network 5 controls the cooler unit on the system. When 'Cooler' is selected in manual mode, the cooler unit switches on. When the cooling unit switches on, the cooler lamp also switches on. When the 'Lamp Test' is selected on the HMI, the 'Cooler Lamp' switches on for testing purposes.

▼ Network 5: Cooler

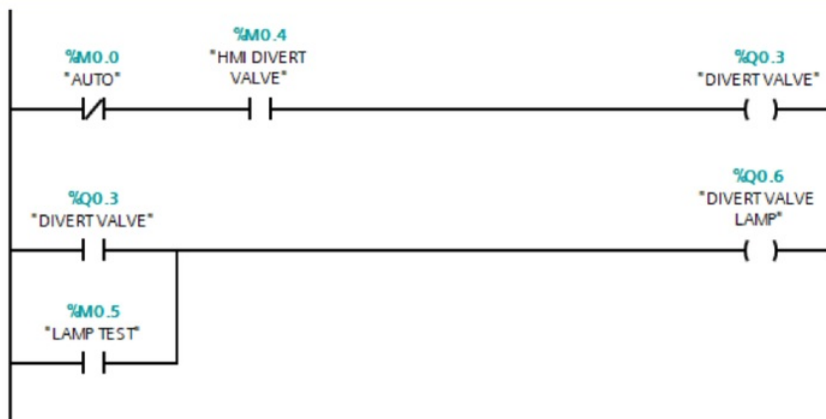
- ▼ When manual is selected on the HMI, and the Cooler is switched on, the Cooling fan switches on.
When the Cooling fan switches on, the Cooler lamp will switch on.
When the Lamp test is switched on, the Cooler lamp will switch on.



Network 6 is the manual control of the divert valve. When the 'Divert Valve' is selected on the HMI, the divert valve actuates. When the divert valve actuates, the 'Divert Valve Lamp' switches on. When the 'Lamp Test' is selected on the HMI, the 'Divert Valve Lamp' switches on for testing purposes.

▼ Network 6: Divert Valve

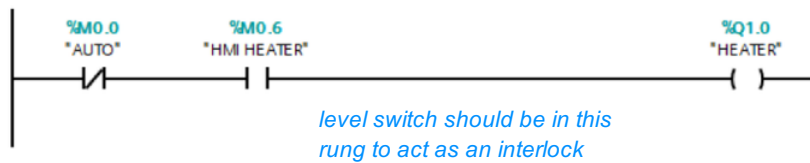
- ▼ When manual is selected on the HMI, and Divert valve is switched on, the Divert valve actuates.
When the Divert valve has actuated, the Divert valve lamp will switch on.
When the Lamp test is switched on, the Divert valve lamp will switch on.



Network 7 is the manual control of the heater. When the 'Heater' is switched on, the temperature starts to rise in the heater tank.

▼ Network 7: Heater

When manual is selected on the HMI, and Heater is switched on, the Heater switches on.



Network 8 is the manual control of the pump. When the 'Pump' is switched on, water starts to transfer from the sump tank to the divert valve.

▼ Network 8: Pump

When manual is selected on the HMI, and Pump is switched on, the Pump switches on.



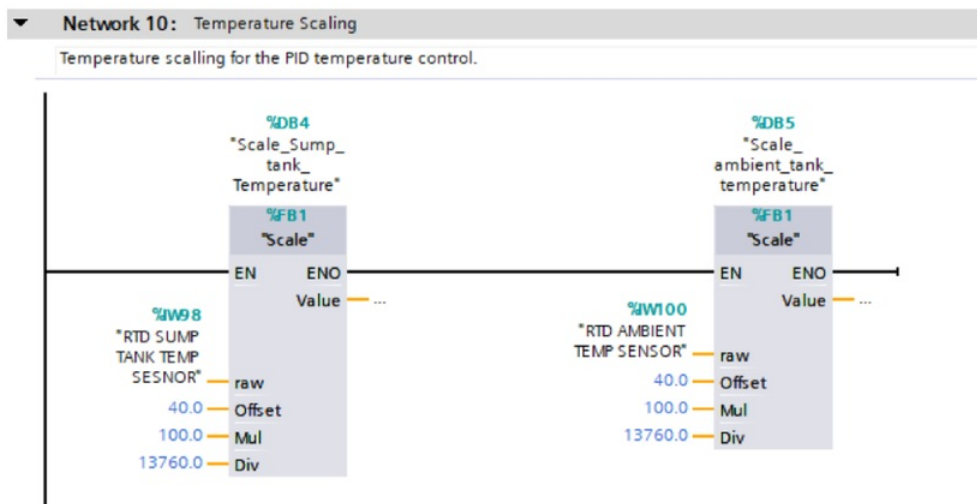
Network 9 is the indication for the heating tank full signal. When the level switch sensor is actuated, the 'Tank Full Lamp' switches on. When the 'Lamp Test' is selected on the HMI, the 'Tank Full Lamp' switches on for testing purposes.

▼ Network 9: Tank Full

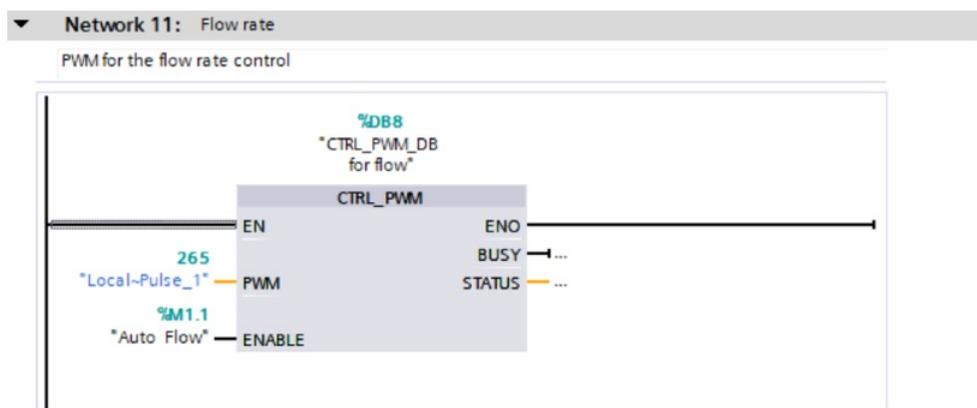
▼ When the Level Switch actuates, the Tank Full Lamp indicates that the tank is full.
When the Lamp test is switched on, the Tank Full Lamp will switch on.



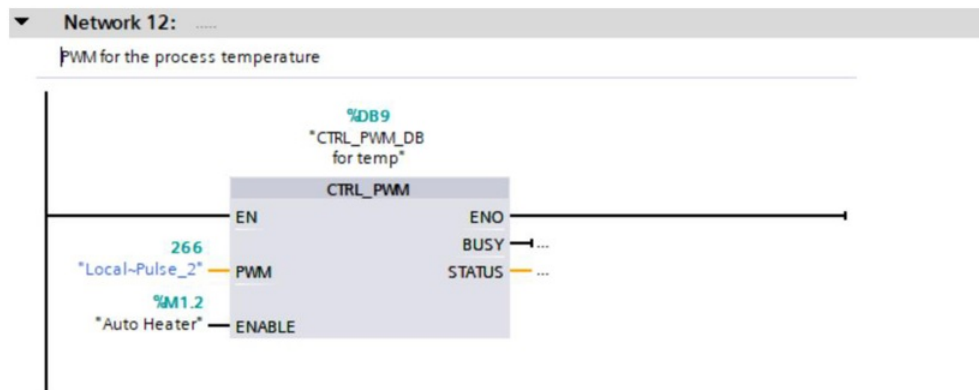
Network 10 is the control for the scaling of the sump tank and ambient temperature. The value that the sensors give to the PLC, will be calculated and an output is given to control the temperatures.



Network 11 is the PWM control for flow rate of the pump. When the local pulse reaches a set value, auto flow will start, starting the pump.

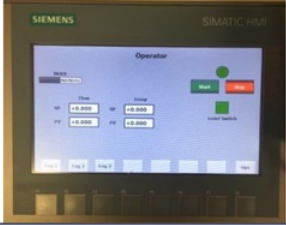
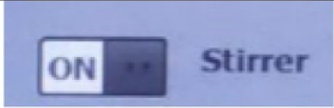
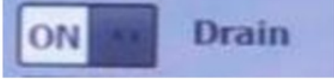
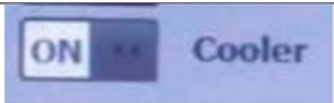
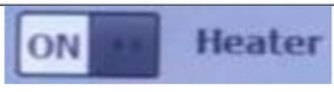


Network 12 is the PWM control for the temperature within the heating tank. When the local pulse reaches a set value, auto heater will start, starting the heater.

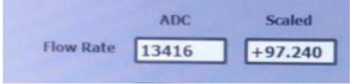
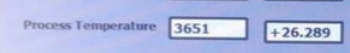
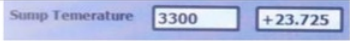
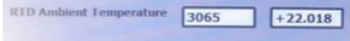
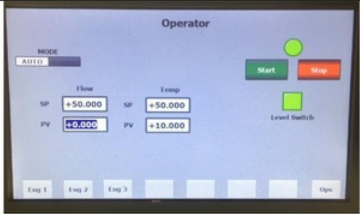
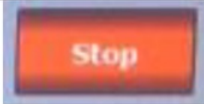
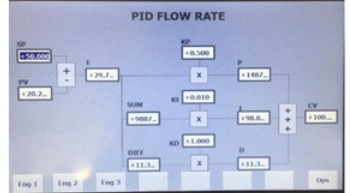


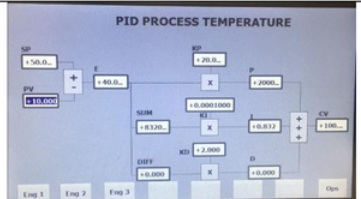
3. Program Testing, Results and Evaluation

pass/fail statement needed

Test Number	Test Description	Expected result	Actual result	Image
1	Test to switch between the different HMI screens.	Correct screen should load when selected on the HMI.	The correct screen loads when selected on the HMI.	N/A
2	Switch between Automatic and Manual modes.	When the switch for Auto/Manual is pressed, the program should switch to Automatic or Manual modes.	When the switch for Auto/Manual is pressed, the program switches to Automatic or Manual modes.	
3	Stirrer manual operation test.	When the switch for the Stirrer is switched on, the Stirrer should begin to rotate.	When the switch for the Stirrer is switched on, the Stirrer begins to rotate.	
4	Drain Valve manual operation test.	When the switch for the Drain Valve is switched on, the Drain Valve should actuate.	When the switch for the Drain Valve is switched on, the Drain Valve actuates.	
5	Cooler manual operation test.	When the switch for the Cooler is switched on, the Cooler should switch on.	When the switch for the Cooler is switched on, the Cooler switches on.	
6	Divert Valve manual operation test.	When the switch for the Divert Valve is switched on, the valve should actuate.	When the switch for the Divert Valve is switched on, the valve actuates.	
7	Pump manual operation test.	When the switch for the Pump is switched on, the Pump should switch on.	When the switch for the Pump is switched on, the Pump switches on.	
8	Heater manual operation test <i>interlock with level switch</i>	When the switch for the Heater is switched on, the Heater should begin to warm up.	When the switch for the Heater is switched on, the Heater begins to warm up.	

don't crop images, these are meaningless without the rest of the image

9	Lamps manual operation test	When the switch for the Lamp test is switched on, all Lamps should light up.	When the switch for the Lamp test is switched on, all the Lamps successfully light up.	
10	Flow Rate test in manual mode.	The flow rate value should be indicated on the HMI when the pump is switched on.	The flow rate value is shown on the HMI when the pump starts.	
11	Process Temperature test in manual mode.	When the heater is switched on, the Process Temperature display should read the tank temperature.	When the heater is switched on, the Process Temperature display shows the value of the tank temperature.	
12	Sump Temperature test in manual mode.	The Sump Temperature display should show the value of the temperature within the tank.	The Sump Temperature display shows the value of the tank temperature.	
13	RTD Ambient Temperature test in manual mode.	The RTD Ambient temperature value should show on the HMI screen.	The RTD Ambient temperature value shows on the HMI screen.	
14	Automatic Run	The system should start when the start button is pressed.	The System starts when the start button is pressed.	
15	Automatic Stop	The system should stop when the stop button is pressed.	The system stops when the stop button is pressed.	
16	Automatic Flow	When in Auto, the Automatic Flow should start and the display should show the flow value.	In Auto mode, flow starts automatically, and the display reads the flow rate value.	

17	Automatic Heater	When in Auto, the heater should start and the display should show the temperature value.	In Auto mode, heater starts automatically, and the display reads the temperature value.	 The diagram shows a PID control loop for temperature. It includes a Setpoint (SP) of 50.0, a Process Variable (PV) input, and a feedback loop. The error signal (E) is calculated as SP minus PV. This error is then processed by Proportional (P), Integral (I), and Derivative (D) blocks. The P block has a gain of 0.0001, the I block has a gain of 0.0001, and the D block has a gain of 0.0001. The outputs of these blocks are summed to produce the Control Variable (CV), which is then used to drive the heater. The diagram also shows a manual override switch and a display for the temperature value.
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4. Safety, Maintenance, Reliability and Sustainable Development

The Bytronic Process Rig contains components within the system that allow for maintenance to be carried out. The heating tank can be manually drained to inspect and carry out maintenance on the heating elements and the stirrer. The Issues with the system include the inability to manually drain the sump tank. If the pump fails during operation, water would not be able to be drained from the tank. If the pump needed to be removed, there is no manual shut off valve to prevent the water from draining out of the tank which is a potential hazard if the water is hot. If the Divert valve was to fail during operation, there is a possibility that the water could flow in the unintended direction. The heater tank contains an overflow pipe to prevent the tank from over filling and potentially causing harm to the operator and engineer.

Due to the system having the suitable programming in place, the Bytronic Process Rig contains energy saving features. Unnecessary heat loss is avoided in the heating tank as the water is only heated the tank level switch is actuated.

Below is a risk assessment carried out on the Bytronic Process Rig.

you could have said what the energy saving features are

Risk Assessment Form									
ACTIVITY	HAZARD	RISK	PERSONS IN DANGER	EXISTING CONTROL MEASURES IN PLACE	S	L	R	CONTROL MEASURES REQUIRED	C
Heating of liquid inside the heating tank.	Hot water and steam.	Potential risk of burning if contact to skin.	Operator and Engineer. Any person operating the system.	Covered, sealed tank to prevent leakage of liquid and steam. Signage to indicate a warning of the liquid may be hot within the tank and pipework.	2	2	4		A
Pumping of hot water through the pipework and sumptank within the system.	Hot water.	Potential risk of burning if contact to skin.	Operator and Engineer. Any person operating the system.	Sealed pipework with no leakage of liquid or steam through tight joints. Digital indicator showing the temperature within the sump tank.	2	2	4	Signage required to provide a warning of potential hot liquid.	A
Assessed by: Jonathan Morgan			Assessment for: Bytronic Process Rig			Assessment Date: 05/05/2018			

Risk Severity Matrix

Likelihood	5	4	3	2	1
Certain	Extreme	Extreme	Extreme	Extreme	Extreme
Likely	High	High	High	High	High
Possible	Moderate	Moderate	Moderate	Moderate	Moderate
Unlikely	Low	Low	Low	Low	Low
Rare	Low	Low	Low	Low	Low
					Consequence
					1 2 3 4 5
					Insignificant Minor Moderate Major Critical

good

5. Conclusions and Recommendations

this evaluation could have been placed in the testing section

From considering the table of results for the testing process, each test passed and achieved the required outcome. When selecting and switching on the different components on the engineer screen in manual mode, each performed the desired output. When the heater is switched on during the automatic or manual sequence, it is important that there is water inside the heating tank. This will ensure that the heating elements don't run dry which could potentially cause damage to the elements. The stirrer will also be switch on when the heater is switched on. This will keep the water inside the tank moving and will also act as an indicator that the water inside the tank is heating up along with the digital display showing temperature of the heating tank. The system has the ability to stop and start at any given time with the buttons on the HMI display. The PID flow rate and PID process temperature screens show the current and set point values and the calculated output value for the running of the system. Following a risk assessment of the system, safety improvements can be made in the form of signage on the sump tank to warn of the potential hazard of hot water and steam.

6. Description of Teamworking

The program design of the process was a teamworking project. Initially the team split to design the PLC program and the HMI screens. These where then combined to produce a fully designed program. The testing table was then produced, and the program was tested on the Bytronic Process Rig. During the testing stage, minor adjustments were needed to improve both the program and HMI screen design which required additional functions and information for the operator. The finished program worked correctly to the design specification and proved to be a successful teamworking project.

who was in your team?

what did you do?

Jonathan Morgan PLC PSDE4005 Assignment 3

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

59/100

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PAGE 15

Text Comment. good commenting

PAGE 16

PAGE 17

PAGE 18

Text Comment. level switch should be in this rung to act as an interlock

Text Comment. pass/fail statement needed

Text Comment. interlock with level switch

Text Comment. don't crop images, these are meaningless without the rest of the image

Text Comment. you could have said what the energy saving features are

Text Comment. good

Text Comment. this evaluation could have been placed in the testing section

Text Comment. who was in your team?

Text Comment. what did you do?

GRADING FORM: CSG-RUBIC

JONATHAN MORGAN

59

RESEARCH-INFORMED LITERATURE



n/a

KNOWLEDGE AND UNDERSTANDING



Section 1: System description – System is briefly described with supporting photos and a good I/O list. System requirements not explained. (10/15)
Section 2: Program explanation – Networks included have titles and comments built in. However, not all networks are in the report. Ladder for PID control is missing. Good explanations given for program networks and screens. (6/15)

16

ANALYSIS



Section 3: Testing – A good set of testing in table form. You could have tested the interlock between the heater and level switch. (8/10) Section 3: Results and Evaluation – Many results provided are cropped images which is not ideal. It would be better to use full images and label with figure numbers. Evaluation needed to show pass/fail for each test. (6/10) Section 4: Conclusions and Recommendations – Some offered (5/10)

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PRACTICAL APPLICATION AND DEP.



Section 2: Program design – Generally well designed, including screens, but PID networks are missing. (6/10) Section 4: Safety, Maintenance, Reliability and Sustainable development – Some consideration given to these issues and a detailed risk assessment. (9/15)

15

SKILLS FOR PROFESSIONAL PRAC.



All sections – Report is well structured, pages and

figures have been numbered correctly. (7/10)
Section 6: Team working – Briefly stated but it
would be useful to know who were your team
members and your exact role. (2/5)