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by Jack Evans

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Good Structure

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1. System investigation

Firstly, the P+ID included with this assignment will be analysed to state all the included instruments and their associated loops. By analysing the P+ID, a further understanding of the process station can be obtained. The P+ID can be seen below.

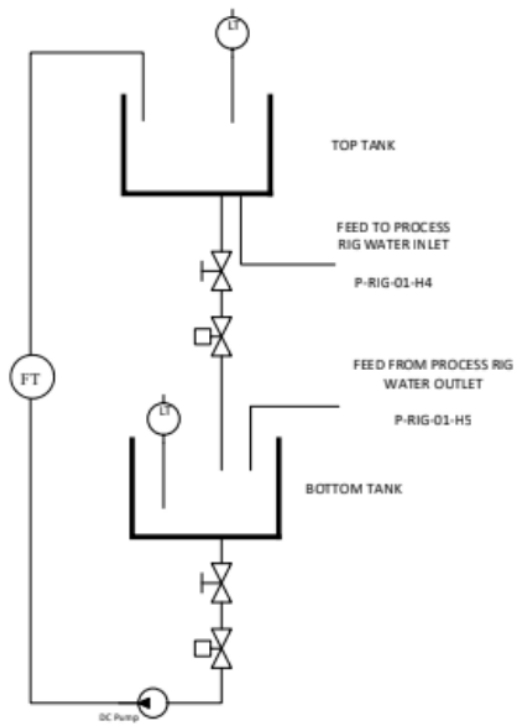


Figure 1-recirculation system P+ID

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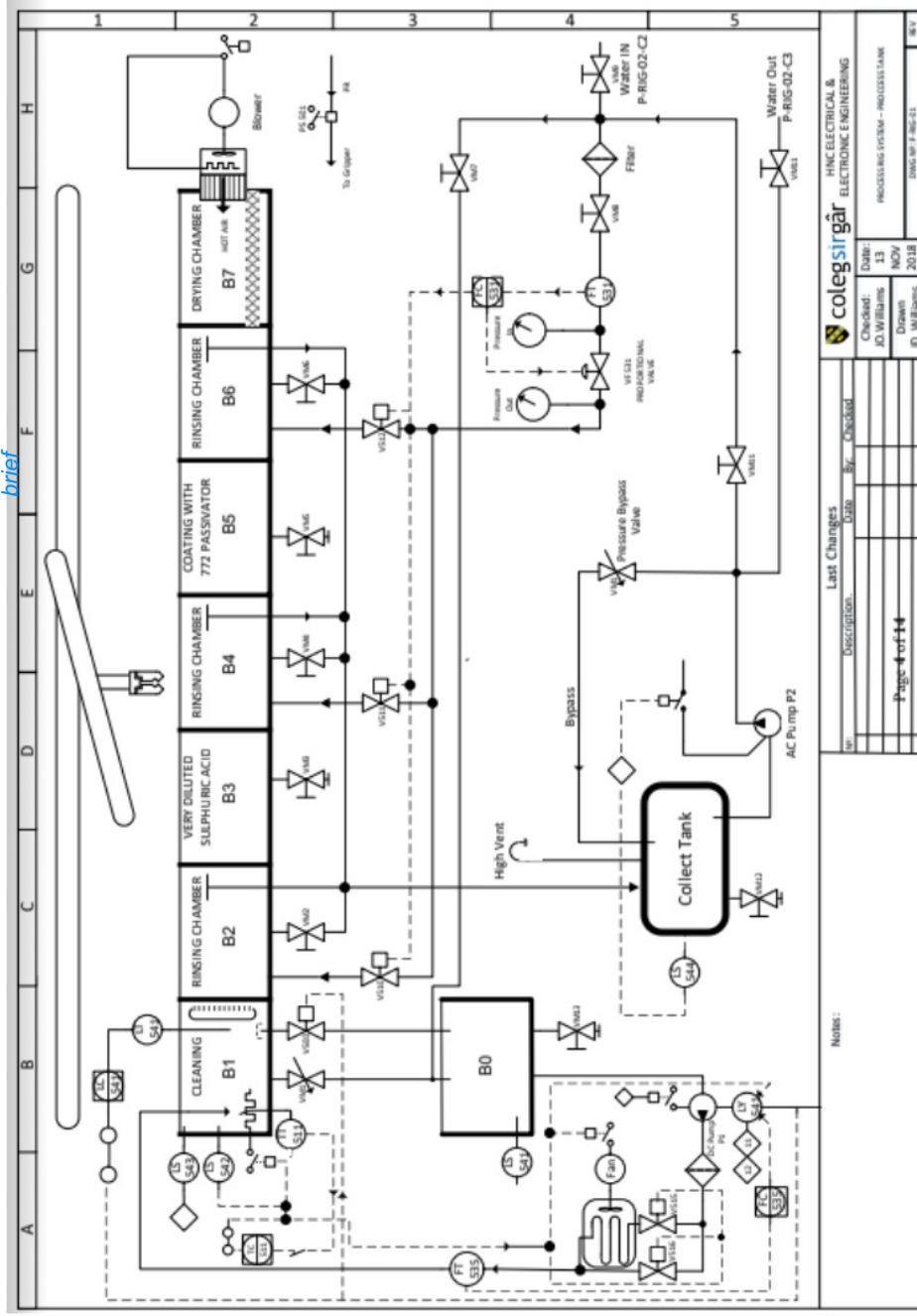


Figure 2-P+ID for process station

From analysing the P+ID, the following instrument loops can be obtained:

- Pressure sensor (Gauge)
- Temperature sensor (TT511)
- Level sensor (LT541)
- Flow sensor (FT535)

The general purpose of this system is level control of B1 through circulating and controlling of the cleaning water. LY541 is the duty cycle controller which takes inputs from LT541 and FT535 in either auto or cascade. This controls the speed of the pump which has an affect on the level and flow rate when the valves are open. V500 opens upon a high level detected by LT541. TT511 controls the temperature of the cleaning fluid.

Each of the following instrument sensors will be researched to find out their technical data.



This image could be much smaller

Figure 3-Pressure sensor

As seen in figure 3, the pressure sensor used is the 'DRUCK LPM5380'. Its serial number is 2493052 and the range is 0-5 bar. It has a 18-30V dc supply and a 0-10V output. This Druck has an accuracy of "better than 0.1%". (Total Temperature Instrumentation, 2020) [Correctly cited](#)



Figure 4-Level sensor

As seen in figure 4, the level sensor used is 'Endress + Hauser PMC 133'. The PMC 133 has a 'measuring range from vacuum to 400 bar. It has an accuracy of 0.5% and a hysteresis of 0.1% of full scale. Its linearity is 0.5% of full scale.' (Endress + Hauser, 1993) [Correctly cited](#)

The next instrument to be discussed is the temperature sensor.

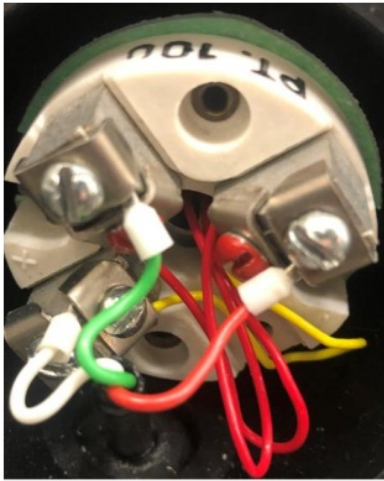


Figure 5-PT100 RTD



Figure 6-Temp signal conditioner

As pictured in figure 5 and 6, the 3-wire PT100 RTD obtains its reading from the system which then gets sent to the signal conditioner. From the signal conditioner, the loop goes to the PLC. The 'CONLAB RTT2' outputs a 4-20mA signal. It has a supply voltage of 10-36V dc and a max temperature rating of 70°C. This transmitter also has a accuracy, linearity and hysteresis of 0.1% of the span'. (Zacay, 2020) [Correctly cited](#)

2. Research

Industry 4.0 *Marr states that "....." (2018, page ?)*

Industry 4.0 can be described by how “computers are connected and communicate with one another to ultimately make decisions without human involvement. A combination of cyber-physical systems and the Internet of Systems make Industry 4.0 possible and the smart factory a reality. Smart machines allow access to more data and allow factories to become more efficient and productive whilst creating less waste.” (Marr, 2018) Improper Citation

It can be concluded that the full network of these systems, are connected digitally to each other which allows information to be created and shared. In relation to the instruments used in the system, a way the instruments can communicate with each other is to make them HART compatible. HART can be described as “a tool for communicating with process instruments. They rely upon open communications protocol, HART communicators interface with HART-enabled devices over common 4-20mA analog wiring making it much easier to configure and calibrate instruments as well as diagnose issues before they become serious. HART communicators are ideal for processes with multiple instruments that need monitoring or calibration, or when those instruments are located in hazardous locations.” (Total Temperature Instrumentation, 2020) Improper Citation

By using HART compatible instrumentation, the device can communicate with the instrument without any physical interruptions, meaning calibrations can be carried out through simulation.



Figure 7-Flow Transmitter

Emerson states that " "
(2018, page 2)

A suitable replacement for the flow sensor can be seen in figure 7 above. The transmitter pictured is the 'Rosemount 8732EM' model which is primarily used to monitor flow. The flow sensor contains "two magnetic coils located on opposite sides of the sensor. Two electrodes, located perpendicular to the coils and opposite each other, make contact with the liquid. The transmitter energizes the coils and creates a magnetic field. A conductive liquid moving through the magnetic field generates an induced voltage at the electrodes. This voltage is proportional to the flow velocity. The transmitter converts the voltage detected by the electrodes into a flow reading." (Emerson, 2018) Improper Citation

This transmitter is also HART compatible which enables it to meet the modern standards of industry 4.0. By being HART compatible it can be easily communicated with from a connected device.



Figure 8-Temperature Transmitter

As seen in figure 8 is the 'WIKAI' temperature transmitter, model 'TIF50'. This transmitter can be connected to any type thermocouple/ 2 wire RTD which then displays its reading digitally on the transmitter. This would be a suitable replacement for the current model as it removes the need for a signal conditioner which overall means less components have to be relied upon. A PT100 RTD would be used which range is "-200°C-850°C" (WIKAI, 2019) which makes it suitable for its current purpose. The transmitter is also HART compatible which enables open communication. A loop diagram of the transmitter can be seen in figure 9. This reveals field mount position of the transmitter where the HART device would be connected on to the +/- terminals before the 250Ω resistor.

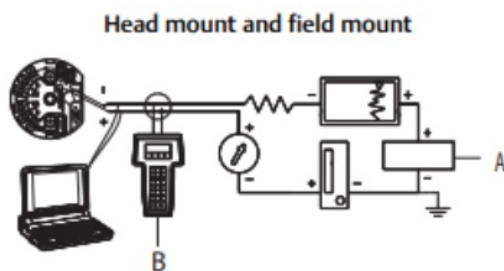


Figure 9-Temperature loop (Emerson, 2020)

A suitable replacement for the level sensor is the 'VEGAPULS 64' which is a radar level sensor built specifically for "small tanks" which makes it the perfect sensor to use on the system. It has a range of "-196°C to 200°C" which is within the range needed for the system. It also has an accuracy of "+/-1mm" which makes it extremely useful for its purpose. The level sensor is also HART compatible enabling open communication and meeting the modern standards of industry 4.0. It can also be connected via Bluetooth meaning calibrations can occur from a workstation. The level sensor can be seen pictured in figure 10. (VEGAPULS, 2020) Correctly cited



Figure 10-Level sensor

3. Environmental, Sustainable Development, Commercial Risk and Codes of Practice

There are a number of factors that the two subsystems have upon the environment. The first factor is that within the system sulphuric acid is used. With this substance being used, the system will fall under the COSHH regulations. COSHH stands for the 'Control of Substances Hazardous to Health'. *HSE states that "....."* "COSHH is the law that requires employers to control substances that are hazardous to health and includes nanomaterials." (HSE, 2020) Improper Citation

A way to control the hazards associated with the sulphuric acid is to place the substance in a storage container which has to be locked so no unauthorised person can access it. When handling the substance, suitable PPE should be worn. Therefore, in respects to the system, when a person is in contact with the acid, suitable chemical gloves and safety glasses should be worn. Prior to using the system, a basic training session on the risks associated with COSHH can be utilised so any operators have a basic understanding on hazards in place.

Another factor associated with sustainable development is that all development that takes place with the system uses parts and components from renewable sources so less damage occurs to the environment. This involves maintaining all equipment frequently, so failure does not occur. Less failures means less parts have to be ordered which overall saves costs and further impact on the environment. An example of sustainable development could be running the subsystems from solar energy which creates a local energy source and reduces the number of emissions from greenhouse gases. By having a self-sufficient power source, this will reduce the need for power from mains which overall results in less running costs. Another example of sustainable development is to capture and recycle any water used in the system. This can be cleaned and reinserted into the system which reduces the need for additional water.

If this system were to be built on a commercial size scale, the area and place it would be built would have to come into consideration so no local eco-environments would be destroyed in the making. This would protect species and wildlife.

The subsystems would also have to follow the associated ACOPs which stands for 'Approved Codes of Practice'. These represent the methods that should be used to comply with Health

and Safety legislation. These impose regulations and duties which should be followed to comply with the law. An example of an ACOP for the subsystems would be a risk-assessed procedure of how to run the system identifying any potential issues and aspects such as how to stop the system.

More information on PUWER can be found in the **appendix**.

4. Calibration of Pressure Sensor

Set up of the pressure calibration can be seen below. This consists of a pressure gauge, pressure transmitter, valve, and multi-meter. The valve and pressure gauge have a set air supply which is put onto the pressure transmitter pictured below. The multi-meter is used to display the reading of the transmitter for the relevant amount of pressure applied. This can be compared to a desired value. The transmitter can be adjusted with the zero and span terminals inside the transmitter head. This can be used to adjust until the desired value is reached. By using these terminals, the transmitter can be calibrated to suite.



Figure 11- pressure calibration set up

The calibration results are inputted into the suitable table below. The pressure readings were taken at increments of 0.5bar with a range of 0-5bar. The measured value to be measured is the output voltage. Any error/hysteresis will be calculated and inserted to the table below.

Pressure (bar)	Measured Rising	Measured falling	Linear Voltage	Rising error (v)	Falling error (v)	Hysteresis (%)
0	0	0	0	0	0	0
0.5	1.1	1	1	0.1	0	0.1
1	2.05	2.03	2	0.05	0.03	0.02
1.5	3	3	3	0	0	0
2	4.01	4.01	4	0.01	0.01	0
2.5	5.01	4.98	5	0.01	0.02	0.01
3	5.99	5.99	6	0.01	0.01	0
3.5	6.98	6.98	7	0.01	0.02	0.01
4	8.02	7.99	8	0.02	0.01	0.01
4.5	9	9	9	0	0	0
5	10.01	10.01	10	0.01	0.01	0

Table 1-pressure calibration table

The first result to analyse is the measured voltage rising which can be seen below.

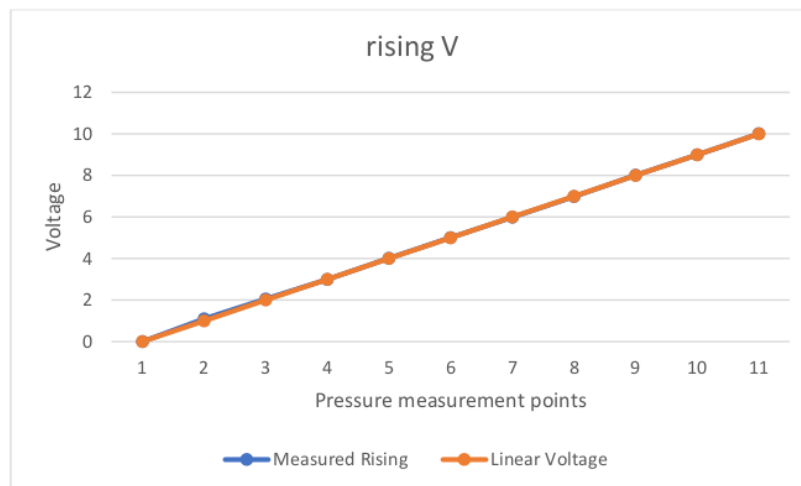
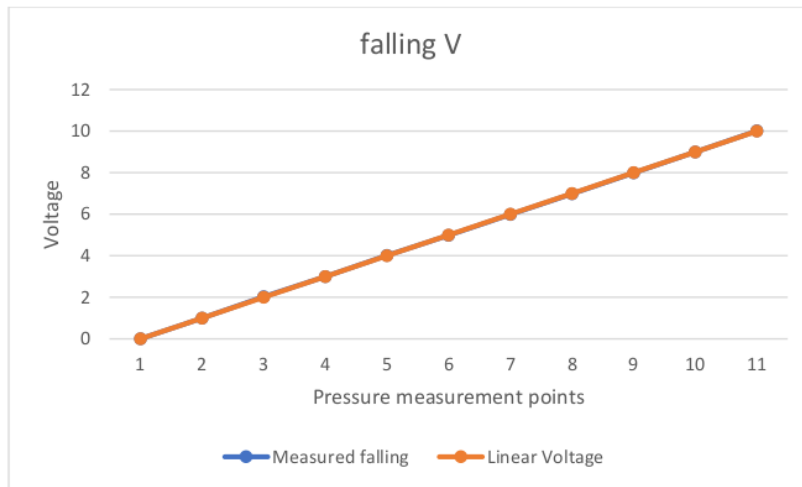


Figure 12-pressure rising V

The X-axis scale should be 0 to 5 bar

As seen in figure 12, the instrument was accurate in calibration. Minimal error/hysteresis occurred meaning the instrument is in good working order. The 2nd result to analyse is the falling voltage which is seen below.



Both lines should be on the graph

Figure 13-Pressure falling V

As seen in figure 13, the calibration was accurate with minimal error. The calibration is completed twice (rising/falling) to ensure the testing taken place was 100% accurate and proves competency within the instrument.

5. Calibration of Temperature Sensor

The temperature sensor (TC511) was calibrated by using a temperature source and reading the output mA using a multi-meter. The measurements were taken at increments of 10°C. Any error/hysteresis will be calculated and included in the associated table. The linear mA value can be calculated using the following equation.

$$Y = mx + c$$

$$Y = 0.16x + 4$$

The temperature range is 0-100°C.

Source Temp	Rising measured mA	Falling measured mA	Linear Value mA	rising error	falling error	Hysteresis
0	3.7	3.8	4	0.3	0.2	0.1
10	5.3	5.3	5.6	0.3	0.3	0
20	7	7	7.2	0.2	0.2	0
30	8.6	8.6	8.8	0.2	0.2	0
40	10.2	10.2	10.4	0.2	0.2	0
50	11.8	11.8	12	0.2	0.2	0
60	13.4	13.4	13.6	0.2	0.2	0
70	15.1	15	15.2	0.1	0.2	0.1
80	16.7	16.6	16.8	0.1	0.2	0.1
90	18.3	18.3	18.4	0.1	0.1	0
100	19.9	19.9	20	0.1	0.1	0

Table 2- temp calibration table

The first result to analyse is the mA rising which can be seen below.

The x-axis should be 0 to 100 degrees

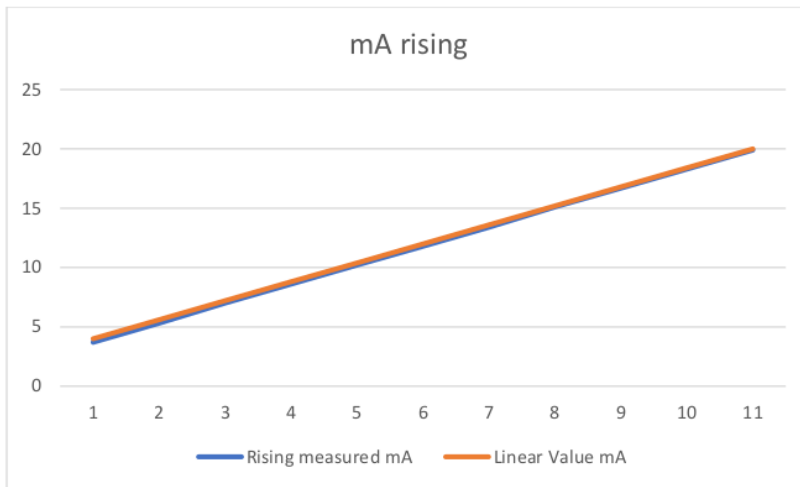
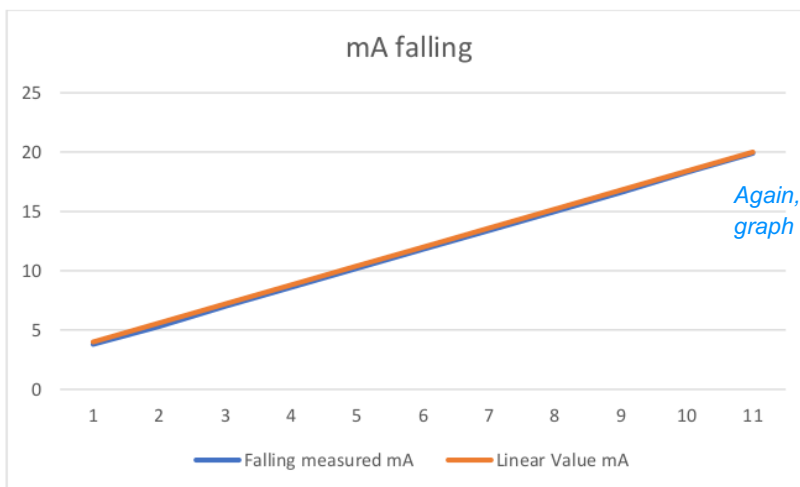


Figure 14- Temp mA rising

As seen in figure 14, the temperature rising was accurate with only a slight zero error. The zero can be adjusted on the instrument if necessary. With modern transmitters,

a communication device could be connected to zero the transmitter digitally. The 2nd result to analyse is the mA falling which can be seen below.



Again, both lines should be on the same graph

Figure 15- temp mA falling

Upon the temperature falling in figure 15, more accurate calibration points were obtained meaning further accuracy within the transmitter. From these graphs, any hysteresis can be calculated. However, these are good results and are within tolerance, meaning the temperature sensor is fit for purpose.

6. Calibration of Level Sensor

The level sensor (LT541) was calibrated by filling up the system with water and taking measurements at certain level points. The measurements were taken at increments of 1cm. The mA reading was recorded by connecting a multi-meter to the system. Any error/hysteresis will be calculated and recorded in a suitable table. The linear mA value can be calculated using the following equation.

$$\frac{mA(23) - mA(7)}{23 - 7}$$

$$M = \frac{12.6 - 6.3}{23 - 7} = 0.39375$$

$$6.3 = 0.39375 \times 7 + C$$

$$C = 6.3 - (0.39375 \times 7)$$

$$C = 3.54375$$

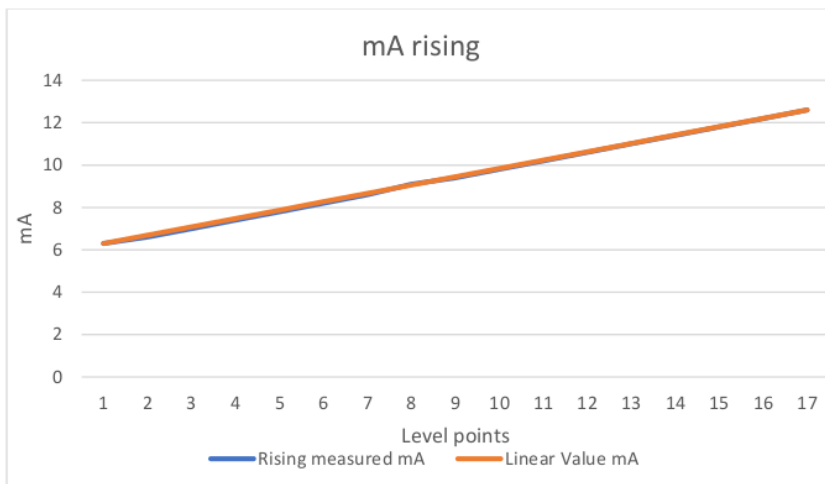
$$Y = 0.39375x + 3.54375$$

The first measurement point is 7cm which is the lowest point on the visual sight container and 23cm is the max point.

Calibration results:

Level cm	Rising measured mA	Falling measured mA	Linear Value mA	rising error	falling error	Hysteresis
7	6.3	6.1	6.3	0	0.2	0.2
8	6.6	6.5	6.69375	0.09375	0.19375	0.1
9	7	6.9	7.0875	0.0875	0.1875	0.1
10	7.4	7.3	7.48125	0.08125	0.18125	0.1
11	7.8	7.7	7.875	0.075	0.175	0.1
12	8.2	8.1	8.26875	0.06875	0.16875	0.1
13	8.6	8.5	8.6625	0.0625	0.1625	0.1
14	9.1	8.9	9.05625	0.04375	0.15625	0.1125
15	9.4	9.3	9.45	0.05	0.15	0.1
16	9.8	9.6	9.84375	0.04375	0.24375	0.2
17	10.2	10.1	10.2375	0.0375	0.1375	0.1
18	10.6	10.4	10.63125	0.03125	0.23125	0.2
19	11	10.9	11.025	0.025	0.125	0.1
20	11.4	11.2	11.41875	0.01875	0.21875	0.2
21	11.8	11.6	11.8125	0.0125	0.2125	0.2
22	12.2	12	12.20625	0.00625	0.20625	0.2
23	12.6	12.6	12.6	0	0	0

Table 3 - Level calibration



The x-axis should be cm

Figure 16- level mA rising

As proven in the mA rising graph above, the calibration results reveal accuracy within the testing as all measured values matched the linear value. The 2nd results to analyse is the mA falling which can be seen below.

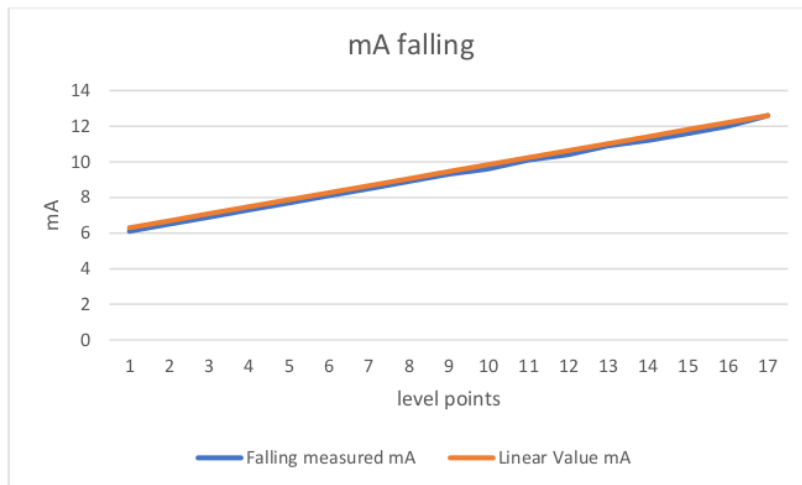


Figure 17- level mA falling

As seen in figure 17, the measured values of the mA falling matched the linear value with only a slight zero error. This error was probably due to human error as the points at which the levels were recorded at were off visual sightings so this could have been misinterpreted slightly.

7. Calibration of Flow Sensor

With the flow calibration, the following equation is used to work out the total litres.

$$0.098 \times 0.14 \times 0.138 (\times 1000) = 1.89 \text{ litres}$$

By using this total value, the total time it took for the high-level alarm to initiate can be divided by 60s in order to give a time in minutes. The total value can then be divided by the time(min). The following equations are carried out in order to find the calculated litres/min. These values will then be placed in a table for easy comparison compared to the measured value.

$$\frac{171}{60} = 2.85 \text{ min} \quad \frac{1.89}{2.85} = 0.67 \text{ l/min}$$

$$\frac{118}{60} = 1.97 \text{ min} \quad \frac{1.89}{1.97} = 0.959 \text{ l/min}$$

$$\frac{87.6}{60} = 1.46 \text{ min} \quad \frac{1.89}{1.46} = 1.29 \text{ l/min}$$

$$\frac{68}{60} = 1.13 \text{ min} \quad \frac{1.89}{1.13} = 1.67 \text{ l/min}$$

Flow		
Measured L/min	Time (min)	Calculated L/Min
0.6	2.85	0.67
1	1.97	0.959
1.4	1.46	1.29
1.8	1.13	1.67

Table 4-Flow calibration

These values can then be placed in a graph for analysis. This graph can be seen in the **appendix** of this report.

8. Design adaption for maintenance and reliability

Using the CIM system programme on TIA Portal, the relevant screens had to be adapted in order to improve maintenance reliability. It was identified that the local HMI for the process station currently had no maintenance screens. Therefore, the screens on HMI 133 were designed to account for a technician to carry out maintenance. These included analysing the process and making any adjustments, as necessary.

Resulting from this, the technician could access the control loops of the following instrumentation.

- TC511 (Temperature Control)
- LC541 (Level Control)
- FC535 (Flow Control)

Use of 11pt Arial, full justification with 1.5 line spacing allows easier reading and marking

Due to the current situation of a pandemic (COVID-19), the adapted screens could not be uploaded to the VPN to access the local HMI on the process station. However, the outcome of this was discussed so knowledge was gained if the current climax was normal.

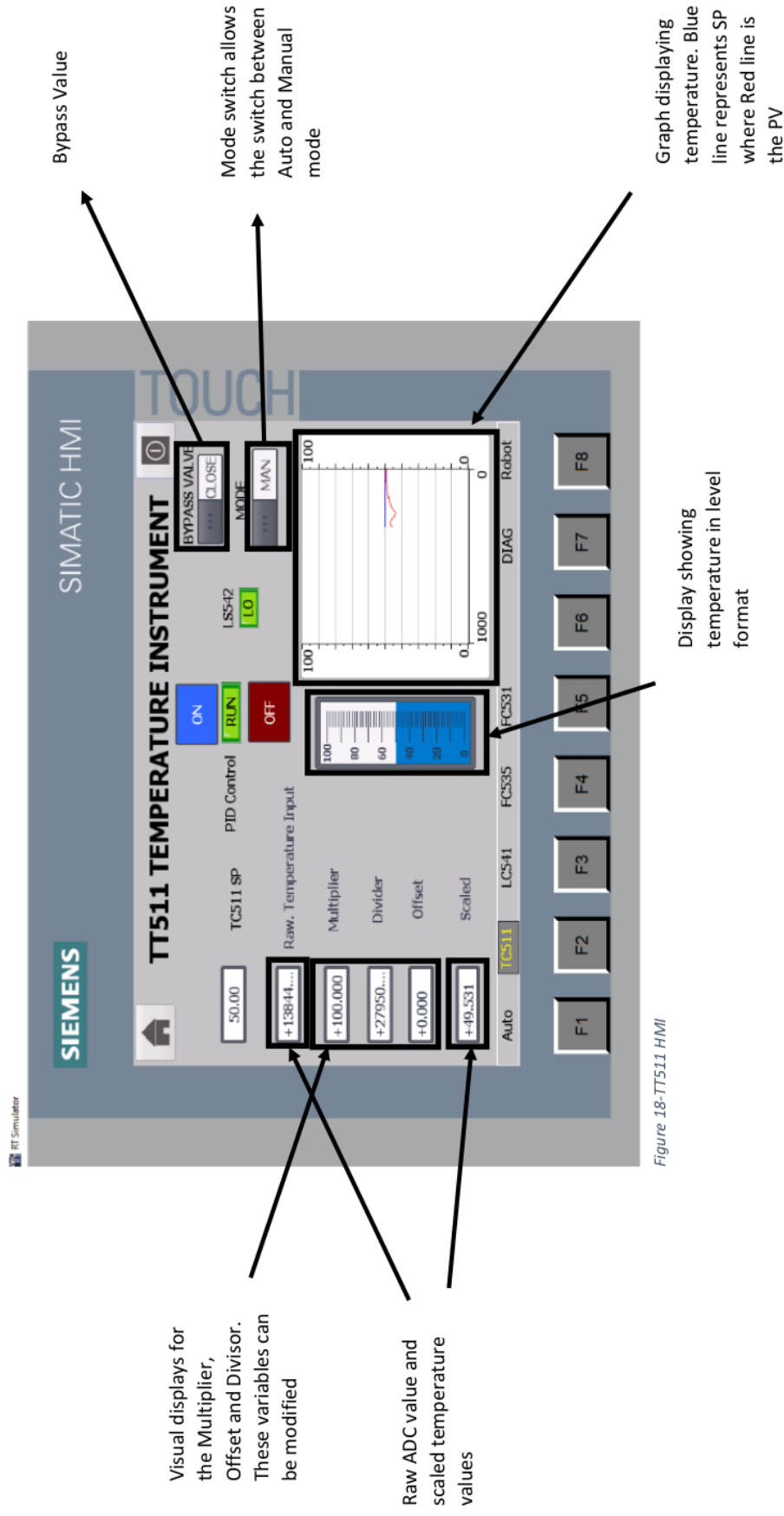


Figure 18-TT511 HMI

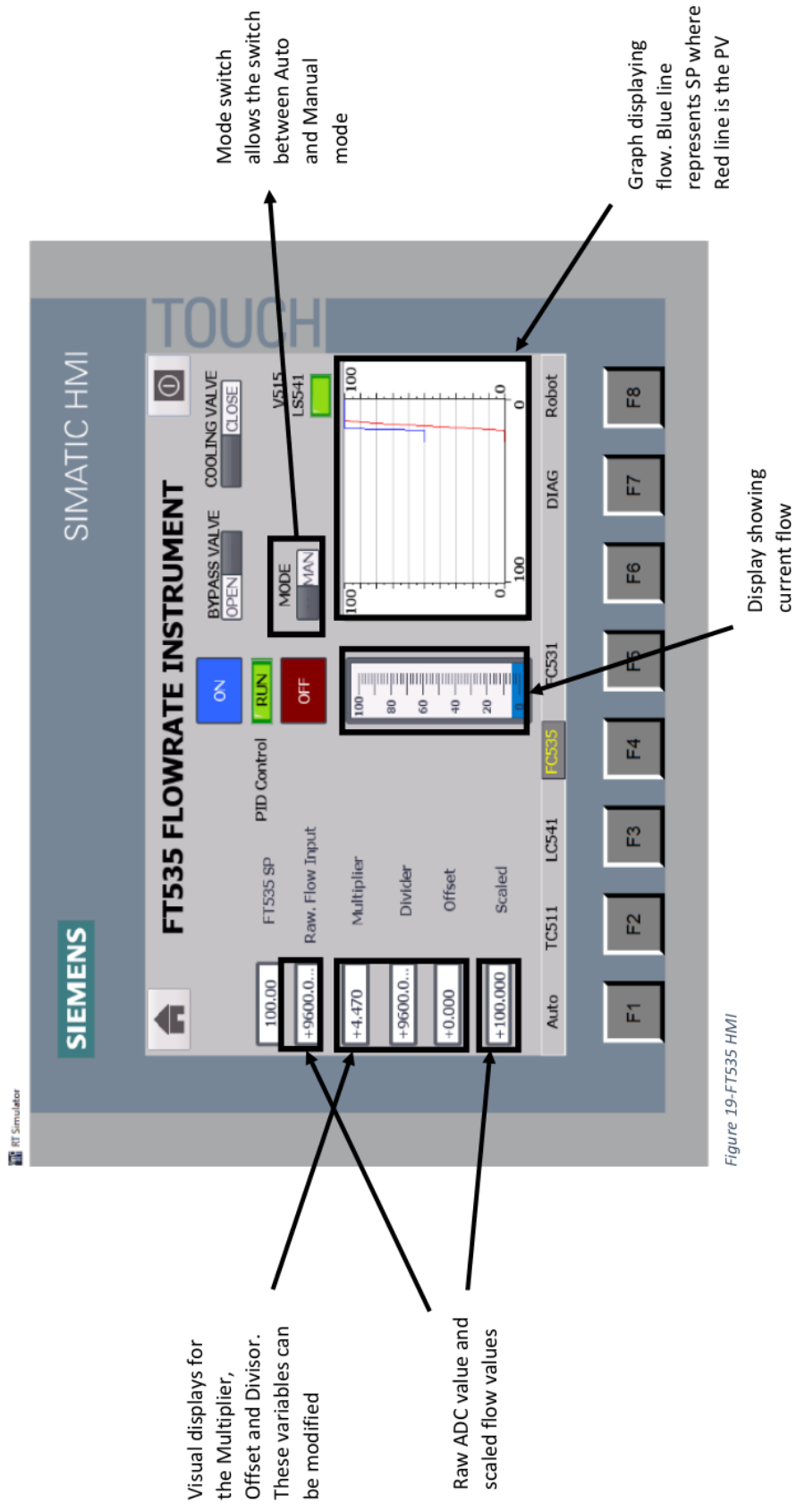


Figure 19-FT535 HMI

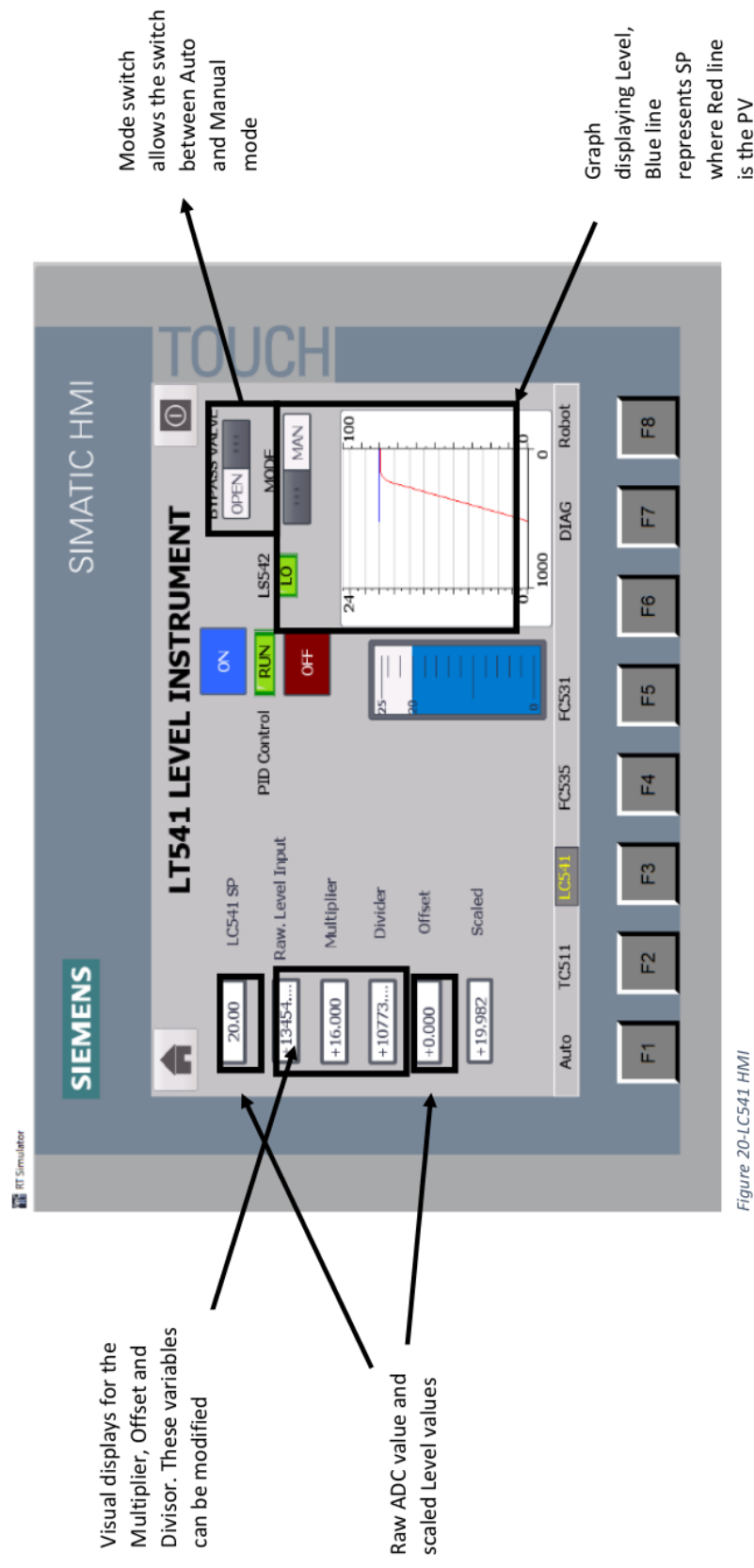


Figure 20-LC541 HMI

9. Conclusions and recommendations

The main purpose of this report was to understand how instrumentation and integrated automation systems are used within modern manufacturing industries. Overall, this was achieved by working on the two sub-systems, the process station and water re-circulation, by researching modern standards such as industry 4.0, calibrating and analysing the instrumentation used on the system and finally adapting the HMI design to allow the need for a technician to work on the system.

With the HMI adjustments, this allowed auto/ manual control, PID control and physical controlling of the multiplier/offset. These adaptations were carried out for each relevant instrument, in this case, the level, flow and temperature. These screens were completed by using the software to select the relevant HMI tags to assign them to the necessary object on the HMI. Visual representations such as bar charts and graphs were used so a technician could see the trend of an instrument and identify any issues. The technician can adjust the set point as required, where the PID will maintain the process to that value. This control allows the engineer to easily identify errors, allowing easier maintenance, which leads to a better reliability of the system.

Another requirement was to use a P+ID provided and identify each control loop to allow explanation of the instrumentation. This was achieved by portraying each control loop and describing how the system works to allow an easier understanding of the system. Each instrument within these loops were thoroughly researched to identify their parameters such as accuracy, range, and sensitivity.

As required, the main principle of industry 4.0 was researched where it can be concluded that instrumentation used in systems can communicate with a technician from the ease of their workspace. This allows an ease for any maintenance work required. All suitable instrument replacements were included in this report making sure they were HART compatible and had exactly the same parameters as previously installed on the system. A like for like allows easier installs of the instruments where the modern standards of them are met as required per brief. Also, to meet the growing demand of having a sustainable industrial environment, aspects

where the system could improve were discussed such as having a local power source for the system such as solar panels. In addition to this, the WEEE principle could be used where electronic waste can get recycled which means the impact to the environment is far less.

The recommendations of this report can be found in the **appendix**.

10. Team working

The author worked with Matthew Davies, Ethan Joel, and Will Carey. Teamwork was carried out through this task to create the relevant HMI adaptations needed for a technician to understand the system. Due to COVID-19, the work was carried out virtually. The author's role was to create design and layout of the screens ready for simulation and evaluation. This was achieved by labelling the relevant design tools needed to create visual representations such as graphs. Ethan focused on running the simulation for the HMI screens, Matthew was responsible for carrying out the calibrations and Will's role was to record the results and carry out the relevant formulas for any errors.

11. Citation list

References

- Emerson, 2018. *Manual 8732EM*. [Online]
Available at: <https://www.emerson.com/documents/automation/manual-8700m-sensor-8732em-hart-en-78020.pdf>
[Accessed 21 December 2020].
- Emerson, 2020. *emerson manual*. [Online]
Available at: <https://www.emerson.com/documents/automation/manual-manual-rosemount-644-temperature-transmitter-hart-protocol-en-89604.pdf>
[Accessed 21 December 2020].
- Endress + Hauser, 1993. *portal.endress*. [Online]
Available at: <portal.endress.com/wa001/dla/5000000/1746/000/00/KA004PA3.PDF>
[Accessed 06 12 2020].
- HSE, 2020. *HSE COSHH*. [Online]
Available at: <https://www.hse.gov.uk/nanotechnology/coshh.htm>
[Accessed 21 Dec 2020].
- Marr, B., 2018. *forbes industry 4.0*. [Online]
Available at: <https://www.forbes.com/sites/bernardmarr/2018/09/02/what-is-industry-4-0-heres-a-super-easy-explanation-for-anyone/?sh=2ff03a0a9788>
[Accessed 15 12 2020].
- SpiersSafety, 2019. *PUWER ACOP*. [Online]
Available at: <https://www.spierssafety.co.uk/resources/what-is-acop-puwer>
[Accessed 21 Dec 2020].
- Total Temperature Instrumentation, 2020. *instrumart*. [Online]
Available at: <instrumart.com/products/23300/druck-lpm-lpx-9000-series-pressure-sensor>
[Accessed 06 12 2020].
- Total Temperature Instrumentation, 2020. *Instrumart*. [Online]
Available at: <https://www.instrumart.com/categories/5695/hart-communicators>
[Accessed 15 12 2020].
- VEGAPULS, 2020. *VEGAPULS 64 datasheet*. [Online]
Available at: <file:///C:/Users/Shado/Downloads/51145-EN-specification-sheet-VEGAPULS-64-4-20-mA-HART-two-wire.pdf>
[Accessed 21 December 2020].
- WIKA, 2019. *WIKA TIF50 datasheet*. [Online]
Available at: https://www.wika.co.uk/upload/DS_TE6201_en_co_33395.pdf
[Accessed 21 December 2020].
- Zacay, M. E., 2020. *exportersindia.com*. [Online]
Available at: <exportersindia.com/conlab/temperature-measurement-transmitter-rtt-2-azol-isreal-1304399.htm>
[Accessed 06 12 2020].

12. Appendix

PUWER

“The Provision of Work Equipment Regulations (PUWER) 1998 has its own ACOP. This ACOP defines what is needed to comply with PUWER, and is aimed at duty holders, employers, and anyone else who is responsible for the safe use of work equipment. This may also include managers and supervisors. PUWER '98 regulations places duties on people and companies who own, operate and have control over work equipment. It also places responsibilities on organisations whose employees use work equipment regardless of whether they own them or not.” (SpiersSafety, 2019)

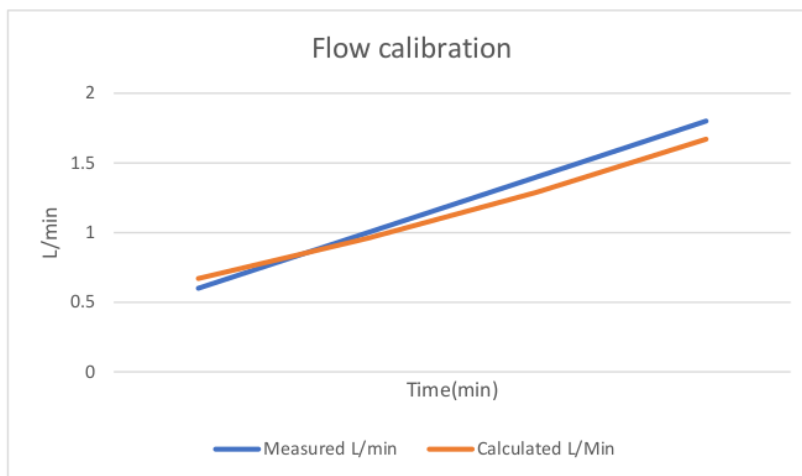


Figure 21-Flow graph

As seen in figure 21, the flow calibration response was poor and the measured against calculated were out of tolerance. The results revealed a higher figure compared to the calculated value. Again, the results could be down to human error where the timings were misinterpreted which would give different results. However, due to the severity with the results, a new flow sensor would be needed. This would be replaced and calibrated to ensure the new sensor is fit for purpose. For example, if an inaccurate flow meter were installed on a working plant, it could cost a company a lot of money due to the incorrect amount of product flowing through.

Recommendations

In regard to recommendations, a password should be included on the HMI screens which allows only authorised personnel to access the system. Another recommendation is to change the flow sensor immediately as it gave bad results when calibrated. These results can lead to inaccurate measurements throughout the system which could cause losses in profit for a company. A final recommendation would be to install a local power source which runs on renewable energy in order to create a sustainable system.

FINAL GRADE

GENERAL COMMENTS

Instructor

61 / 100

PAGE 1

PAGE 2



Good Structure

Report is structured exactly as stated in the assignment brief.

PAGE 3

PAGE 4

PAGE 5

Text Comment. No need to copy images directly from the brief

PAGE 6

Text Comment. This image could be much smaller

PAGE 7



Correctly cited

Citation method conforms to Harvard standard, well done.



Correctly cited

Citation method conforms to Harvard standard, well done.

PAGE 8



Correctly cited

Citation method conforms to Harvard standard, well done

Text Comment. Marr states that " " (2018, page ?)

QM

Improper Citation

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Text Comment. Emerson states that " " (2018, page ?)

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QM

Correctly cited

Citation method conforms to Harvard standard, well done.

Text Comment. HSE states that "

QM

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Text Comment. The X-axis scale should be 0 to 5 bar

PAGE 17

Text Comment. Both lines should be on the graph

PAGE 18

PAGE 19

Text Comment. The x-axis should be 0 to 100 degrees

Text Comment. Again, both lines should be on the same graph

PAGE 20

PAGE 21

PAGE 22

Text Comment. The x-axis should be cm

PAGE 23

PAGE 24

PAGE 25

QM

Use of 11pt Arial, full justification with 1.5 line spacing allows easier reading and marking

Your presentation could be improved making the text easier to read and mark. Your tutor will then be able to add comments between lines

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GRADING FORM: NEW CSG-RUBRIC

**JACK
EVANS****61****1. ENGAGEMENT WITH LITERATURE**

Engagement with a wide range of literature, including sources retrieved independently. Selection of relevant and credible sources. Referencing may show minor inaccuracies or inconsistencies. There is a problem with your method of direct quotations. (12/20)

12**2. KNOWLEDGE AND UNDERSTANDING**

Competent knowledge of the basic underlying concepts and principles. Exhibits very good understanding. (12/20)

12**3. COGNITIVE AND INTELLECTUAL**

of the underlying concepts and principles. Can



interpret qualitative and quantitative data, with minor errors. An emerging ability to use evidence to support the argument. Mostly valid arguments and logical judgements. (11/20)

11

4. PRACTICAL APPLICATION



A very good application of a range of basic methods, materials, tools and/or techniques. Very good consideration of the context of the application. Very good evidence of different approaches to problem-solving in particular contexts and proposes appropriate solutions. (13/20)

13

5. TRANSFERABLE SKILLS



Work is accurate, coherent, fluent, well-structured and organised. Can work effectively independently and/or as part of a team, with very good contribution to group activities. Demonstrates very good skills for employment requiring the exercise of some personal responsibility, with just occasional minor weakness. (13/20)

13