

2119237

by Joshua Thomas

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1. Work Plan for Lifelong Learning and Risk Assessment

This assignment will be approached by starting with carrying out a risk assessment (Figure 4) and then learning all the necessary background knowledge to be able to understand the application of instrumentation and integrated automation systems which are commonly used in industry. Some instrumentation equipment that has been looked at are speed, flow, and temperature. It is important to be able to understand the various instrumentation equipment and the different types as this will help to carry out this assignment. Having understood this, an investigation into each control loop, which are provided within the assignment, can take place and the instrumentation used in the two sub-systems can be looked at and described in detail. Technical data, applications, the range, and any other relevant parameters must be provided for each of the sensors. Calibrations must be carried out for all the various sensors.

Sounds like a good plan

Where is your risk assessment?

2. System Investigation

For this system investigation task, there are 7 upper tanks, these are B1 to B7. Each of these tanks does something different. B1 uses hot water to clean, B2 rinses using cold water, then in tank B3, a diluted sulphur acid solution is used for cleaning and the sulphur acid gets rinsed off with cold water in tank B4. Inside of tank B5 a coating of 772 passivator is put on and cold water is used again to rinse inside of tank B6. Finally, a drying chamber that uses hot air is used in tank B7.

There are 4 control loops which are being investigated. These are the TC353, TC511, TC541 and TC531.

The TC535 control loop is what controls the flow of water into the tank. A flow controller (FC535) produces a CV that is then fed into the pump/amplifier (LY541). The Flow transmitter (FT535) produces the PV and one of the solenoid valves either V516 or V515 need an interlock which ensures that water that is pumped is able to flow up towards tank B1.

The TC511 control loop has the job of controlling the temperature of the water in tank B1. A Temperature controller (TC511) creates a CV that is fed into a solid-state relay that uses pulse width modulation to control the water heater. The PV for this control loop comes from the Temperature Transmitter (TT511) and the interlock comes from the low water level switch (LS542). The temperature is affected by many factors that add cold water to the system such as the cooling fan, the solenoid valves V516 and V515 and the pump/amplifier (LY541).

The next control loop in the system is TC541 and its job is to control the water level in the tank B1. The level of water in the tank B1 is controlled by a level controller (LC541) which is sensed by the level transmitter (LT541). To empty the tank, a drain solenoid valve (V500) is used and the pump/amplifier (LY541) is what allows the control of the water flow. The interlock is with the low water limit switch (LS541) for this control loop.

The final control loop being looked at in the system is TC531 and its job is to control the flow of water into the tank. Firstly, a flow of water is sensed by the Flow transmitter (FT531) and the pressure of water will come from the recirculating water system and the flow of water is controlled by a proportional valve (VF531) that comes from the flow controller (FC531). The water gets into each of the tanks by using the solenoid valves V510, V511 and V512.

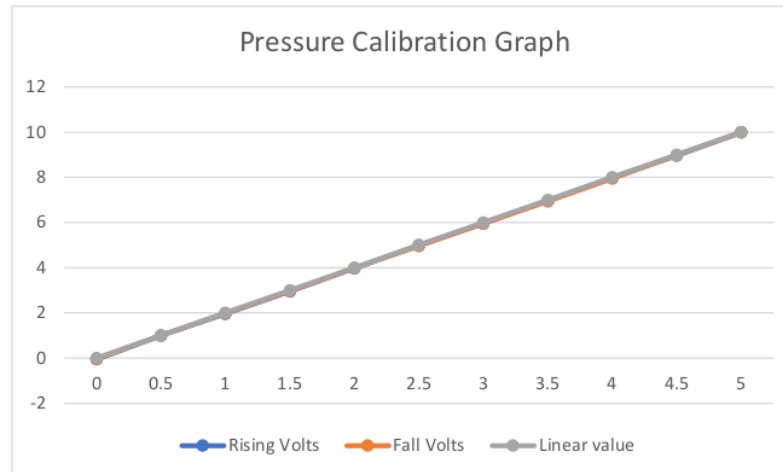
What about investigating the sensors used in the subsystems?

3. Calibration of Pressure Sensor

The device that was calibrated was a Druck LP 5000 series. It has a range of 0 to 5 bar. The output is 0 to 10V. The accuracy is $\pm 0.25\%$. All this information was taken from the manual.

(Yumpu, 2013) Correctly cited *This sentence is not needed as you have cited your source in brackets.*

Pressure was changed in increments of 0.5 bar up to 5 bar starting from 0 and a voltage reading was measured at each increment. After reaching 5 bar readings were taken again going in decrements to 0 bar. The readings were taken using a multimeter.



What is the static sensitivity? How did you get your linear values?

Max rising error = $(0-0.05)/10 \times 100 = 0.5\%$

Max falling error = $(7-6.94)/10 \times 100 = 0.6\%$

Max hysteresis error = 1.1%

From the graph (Figure 1) we can see that the Rising, Falling and Linear values all rise linearly all with little to no error. We can look at the graph and see that there are not any major anomalies that stand out. If this device did need to be calibrated, then a screwdriver could be used to adjust the potentiometer until the readings shown are more accurate to the linear value. For this task, some of the readings could be out due to the fact that the human eye had to determine if the analogue pressure gauge was at the correct pressure reading. Therefore, this could have caused some of the inaccuracies within the results.

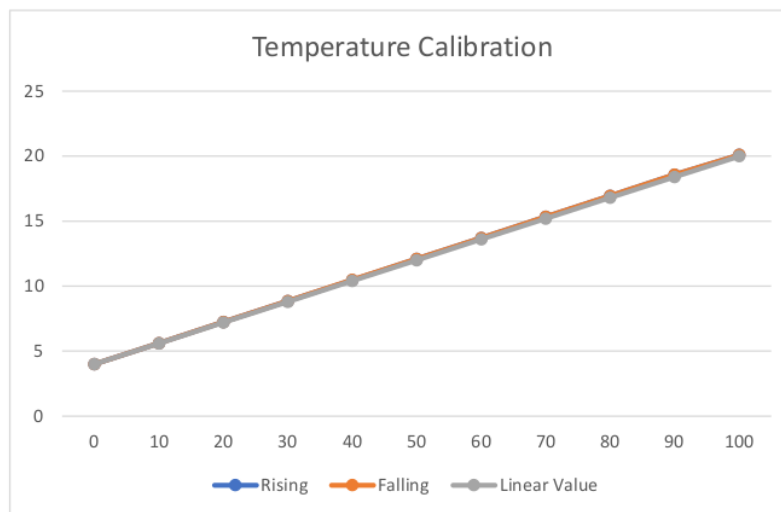
From the manufactures manual it can be found that the accuracy figures quoted by the manufacturer was $\pm 0.25\%$ and the max hysteresis error that was calculated come out to be 1.1% which is fairly high above the tolerance quoted from the manufacturer. (Yumpu, 2013)

4. Calibration of Temperature Sensor

Write in the third person

The device that we calibrated was the ConLAB RTT-2 Pt100. The RTT-2 converts the measuring signal of a resistance temperature detector (RTD) into a standardised load independent current, linearly proportional to the measured temperature. The RTT-2 has an accuracy of 0.1%. It has an output current of 4-20mA. [Citation Needed](#)

To carry out the task, the temperature was increased in increments of 10 from 0 to 100 degrees Celsius. A current reading is taken at every increment and once it reached 100 degrees the current readings were taken again but going in decrements of 10 down to 0.



Max rising error = $18.4 - 18.57 / 10 \times 100 = 1.7\%$

Max falling error = $18.4 - 18.57 / 10 \times 100 = 1.7\%$

Max hysteresis error = 3.4%

Static Sensitivity = $16 / 100 = 0.16$ units?

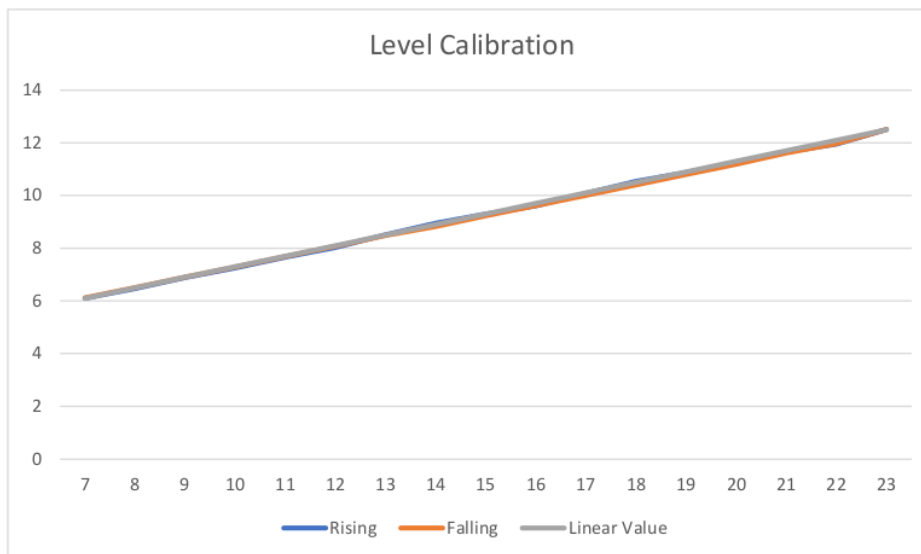
From the graph (Figure 2) it is observed that all the values plotted look like they are almost in the exact same place with only very small errors. The largest of these errors being 0.17 for both Rising and Falling. The max hysteresis error was calculated to be 3.4%. However, by looking at datasheet for the RTT-2 it states that the max hysteresis error should be $< \pm 0.1\%$ of span. To calibrate the RTT-2 the first step is to set the calibrator to Tmax and adjust the Zero trimmer to obtain an output current of 4.000mA. Next you will need to set the calibrator to Tmax and adjust the Span trimmer to obtain an output current of 20.000mA. (ConLAB, n.d)

Correctly cited

5. Calibration of Level Sensor

The device that we calibrated was a Pressure Transmitter Cerabar PMC 133. There must be a minimum voltage of 13 V across the terminals. The maximum possible total resistance is dependent on the voltage at the transmitter power supply unit. [Citation Needed](#)

To carry out the task the tank was increased in increments of 1cm up to 23cm starting at 7cm. After getting a current reading from each increment up to 23cm, the task had to be done again but going in decrements from 23cm. Again, current readings were gathered from each stage and put into an Excel spreadsheet. An HMI in manual mode is used to set the level set points.



Max rising error = $12.1 - 11.95 / 10 * 100 = 1.5\%$ *What was your static sensitivity, how did you work out your linear values?*

Max falling error = $12.1 - 11.97 / 10 * 100 = 1.3\%$

Max hysteresis error = 2.8%

Multiplier = 6.41

Divisor = 16

Offset = 2.295625

Percentage Hysteresis Error = 0.64%

From the graph (Figure 3) for this task, it is visible that Rising, Falling and Linear Value all appear to follow the same trend with low errors. However, at 22cm for both the rising and falling errors, the values seemed to be higher than others as the rising error was 0.15 and falling was 0.13. There are a few factors that can be considered for these errors such as the

human eye had to determine if the level scale was at the desired value. As the max hysteresis error is 2.8%, the user manual for the pressure transmitter states that the error should be $\pm 0.5\%$ (Manuaizz, 2023). To calibrate the device all we would need to do is find out if adjustment of the zero point or measuring span is required, if it is then there are two calibration potentiometers under the sliding cover that can be adjusted.

6. Calibration of Position Sensors

The device that was calibrated was a Laser distance sensor ifm electronic O1D100 - O1DLF3KG. This sensor has max range of 10m and has an output of 4-20mA/0-10V. (Automation24, 2023) Correctly cited

For this task to be carried out an HMI was used to move an object and the sensor then displays the distance of how far the object is. The task was done in increments of 100mm starting from 0mm up to 1300mm. After the object moved from left to right up to 1300mm it then went from right to left in decrements down to 0mm. It was very difficult to get the increments to an exact number as you had to hold down the button on HMI and then release once near the value, so it was challenging to get an exact whole number. To overcome this issue, you could add a set point function to the HMI so that you can input a number and the object would move to that exact amount and a perfect reading would show.

How do you results compare with the manufacturer's data?

From the results (Table 4) it is clearly visible that it was difficult to be able to get an exact measurement. You can tell this by looking at the errors and seeing large values. This could have been because for this calibration you couldn't set a specific value for the object to move to. So, for these results that is where any major anomalies would have come from.

7. Research

Industry 4.0 refers to the newest phase within the industrial revolution which aims its focus on automation, interconnectivity, real-time data, and machine learning. (Epicor, 2022) [Correctly cited](#)

With Industry 4.0, it describes the growing trend towards automation and data exchange in technology and processes within the manufacturing industry, which includes things such as:

- *The internet of things (IOT)
- *Smart Factories
- *Cognitive computing
- *Artificial intelligence (TWI, 2023)

I-O Link is an increasingly deployed point-to-point serial communication protocol which is used to talk to different sensors or actuators. Whilst I-O Link is spreading globally, it allows three different types of to be interchanged, Process data, service data and events. I-O Link is a very powerful but also easy and simple protocol that has wide support in industry. Wherever a digital or analogue sensor is used, an I-O Link sensor would be able to provide much more information (Comtrol, 2023). [Correctly cited](#)

Manufacturing is now turning more digitised and mechanised this is due to large amounts of data, robotics, and virtual reality. Typical and traditional production facilities are now changing into what is called Smart Factories in which everything is connected. So traditional sensors now become smart with I-O Link, and this allows them to connect with many different parameters (Matuszak, 2022). [Correctly cited](#)

The current Laser distance sensor could be replaced by an IFM OID200. This sensor has a measuring range of 0.03m to 2m, with a background suppression of up to 20m. It also has I-O Link, and this will enable user friendly communication and has a manually adjustable parameter setting (RS, 2023). [Correctly cited](#)

The pressure transmitter that is currently being used can be replaced with an IFM PN2094. This specific sensor has a measuring range of -1 to 10 bar, has 2 switching outputs, one programmable as an I-O Link and the other as an analogue output. (ifm, 2023)

The current RTD could be replaced by an IFM TV7105. This RTD has a measuring range of -50 degrees to 150 degrees Celsius. It also has an I-O Link communication interface, 2 programmable switching outputs and a pressure rating of 400 bar. (ifm, 2023) [Correctly cited](#)

The current pressure sensor in place could be replaced by an IFM PV7000. This pressure sensor has a range of 0 to 400 bar, has 2 programmable switching outputs with one of those being an I-O Link communication interface and it also has a lifespan of more than 60 million pressure cycles. (ifm, 2023)

Correctly cited

8. Health and Safety, Environmental, Maintenance and Reliability

Whilst using the subsystems, all health and safety practices and protocols must be followed. You must be sure that any PPE needed is worn and you must ensure that if you are performing a task on your own or in a small group that you are competent enough to carry it out. If there is anything you are unsure about then a lecturer should be spoken to so that they can help and guide you in the right direction.

Write in the third person

Write in the third person

Maintenance should be carried out regularly on these subsystems to ensure that everything can run efficiently. (FMHOUSE, 2020) To ensure that no one is put at risk it is required by the Provision and Use of Work Equipment Regulations 1998 (PUWER) that any equipment is maintained in efficient state, order and in good repair. (HSE, 2023)

The frequency of how often something should have maintenance depends on many factors such as:

- *How often it is used
- *The intensity of its use
- *User knowledge
- *Manufacturers recommendations (HSE, 2023)

Whilst undertaking a maintenance activity, there should be steps in place that are there to minimise any risks from arising. By looking at the manufacturers instructions there should be recommendations on how to carry out the maintenance of the equipment. These recommendations should be looked at and followed unless there's a specific reason why it cannot. (HSE, 2023)

Finally, maintenance work must be undertaken by individuals who are competent enough to do so. The individual should be provided with all the correct information, instruction and training. (HSE, 2023)

To help with the reliability, the equipment must be checked regularly, and the maintenance should be carried out when needed. Before using equipment, you should look for any defects, marks or damage and if you see anything it must be reported to a supervisor immediately. This is because if a part breaks or not in working order it can be ordered before hand when you can see wear and tear on it and then when it finally needs to be replaced the part will be in your possession already and there will be no need to wait for the delivery of the part which can delay the task at hand.

9. Conclusions and Recommendations

Since taking part in this assignment, many things have been learnt, such as research skills. For this assignment research was a big aspect and research skills have been developed as many different things had to be looked into. Other things which have been learnt are how to carry out calibrations of different sensors efficiently and effectively. Another thing learned is how important maintenance is. It is important that equipment is regularly maintained so that everything is in working order and no one can get hurt.

If this task was to be carried out again then a few things could be changed. For example, having a setpoint function on the HMI so that the values are exact and better sensors so that results can be more accurate. Also, if this task was done again repeating the calibration 3 times would help get a more accurate set of data as you can get an average of the 3 and this will help spot any anomalies and those can be discarded from the results.

10. Team Working

To carry out the calibration tasks, we were put into small groups. Within the group was me, Carlo and Bryn. The reason groups were used for the calibration tasks is to be able to use team working skills and carry out tasks efficiently and effectively.

For each of the tasks we had, we ensured that everyone had a different role within the group. For example, for the pressure calibration I had the Excel spreadsheet open and inputted the results that Carlo was reading out from the multimeter and Bryn was adjusting the pressure gauge. So, in my opinion I believe that we worked very well in a team, and we were able to carry out the tasks very well and quick with no issues.

11. Citation List

References

- Automation24, 2023. *Laser distance sensor ifm electronic O1D100 - O1DLF3KG*. [Online]
Available at: <https://www.automation24.co.uk/laser-distance-sensor-ifm-electronic-o1d100-o1dlf3kg>
[Accessed 17 January 2023].
- Control, 2023. *What is IO-Link?*. [Online]
Available at: <https://control.com/io-link-master-gateways/what-is-io-link>
[Accessed 20 January 2023].
- ConLAB, n.d. *2-Wire Transmitter*. [Online]
Available at: [https://www.2all.co.il/web/files/Sites19/sales20/Files_492730_\(15713\).pdf](https://www.2all.co.il/web/files/Sites19/sales20/Files_492730_(15713).pdf)
[Accessed 17 January 2023].
- Epicor, 2022. *What is Industry 4.0—the Industrial Internet of Things (IIoT)?*. [Online]
Available at: <https://www.epicor.com/en-us/blog/what-is-industry-4-0/>
[Accessed 22 November 2022].
- FMHOUSE, 2020. *What is maintenance and why do we do it?*. [Online]
Available at: <https://www.fm-house.com/en/what-is-maintenance-and-why-do-we-do-it/#:~:text=Ideally%2C%20maintenance%20is%20carried%20out,a%20function%20based%20on%20time>
[Accessed 20 January 2023].
- HSE, 2023. *Maintenance of work equipment*. [Online]
Available at: <https://www.hse.gov.uk/work-equipment-machinery/maintenance.htm>
[Accessed 24 January 2023].
- ifm, 2023. *Pressure sensor with display*. [Online]
Available at: <https://www.ifm.com/gb/en/product/PN2094>
[Accessed 20 January 2023].
- ifm, 2023. *Pressure switch with IO-Link*. [Online]
Available at: <https://www.ifm.com/il/en/product/PV7000>
[Accessed 20 January 2023].
- ifm, 2023. *Temperature sensor with IO-Link*. [Online]
Available at: <https://www.ifm.com/gb/en/product/TV7105>
[Accessed 20 January 2023].
- Manualzz, 2023. *Endres+Hauser Cerabar PMC 133 User manual*. [Online]
Available at: <https://manualzz.com/doc/en/61111439/endres-hauser-cerabar-pmc-133->

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[Accessed 17 January 2023].

Matuszak, J., 2022. *IO-Link and its Importance in Industry 4.0*. [Online]

Available at: [https://knowhow.distrelec.com/automation/io-link-and-its-importance-in-industry-4-](https://knowhow.distrelec.com/automation/io-link-and-its-importance-in-industry-4-0/#:~:text=Meaning%20of%20IO%2DLink%20in%20Industry%204.0&text=Thus%20traditional%20sensors%20become%20'smart,temperature%20measurement%20in%20real%2Dtime)

[0/#:~:text=Meaning%20of%20IO%2DLink%20in%20Industry%204.0&text=Thus%20traditional%20sensors%20become%20'smart,temperature%20measurement%20in%20real%2Dtime](https://knowhow.distrelec.com/automation/io-link-and-its-importance-in-industry-4-0/#:~:text=Meaning%20of%20IO%2DLink%20in%20Industry%204.0&text=Thus%20traditional%20sensors%20become%20'smart,temperature%20measurement%20in%20real%2Dtime)

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[Accessed 20 January 2023].

RS, 2023. *ifm electronic Background Suppression Distance Sensor, Barrel Sensor, 30 mm → 2 m Detection Range IO-LINK*. [Online]

Available at: <https://au.rs-online.com/web/p/photoelectric-sensors/8140361>

[Accessed 20 January 2023].

TWI, 2023. *What is Industry 4.0?*. [Online]

Available at: <https://www.twi-global.com/what-we-do/research-and-technology/technologies/industry-4-0>

[Accessed 14 January 2023].

Yumpu, 2013. *Measurement & Control Solutions*. [Online]

Available at: <https://www.yumpu.com/en/document/read/21491425/druck-lpm-lpx-5000-series-wet-wet-differential-pressure->

[Accessed 22 November 2022].

12. Appendix

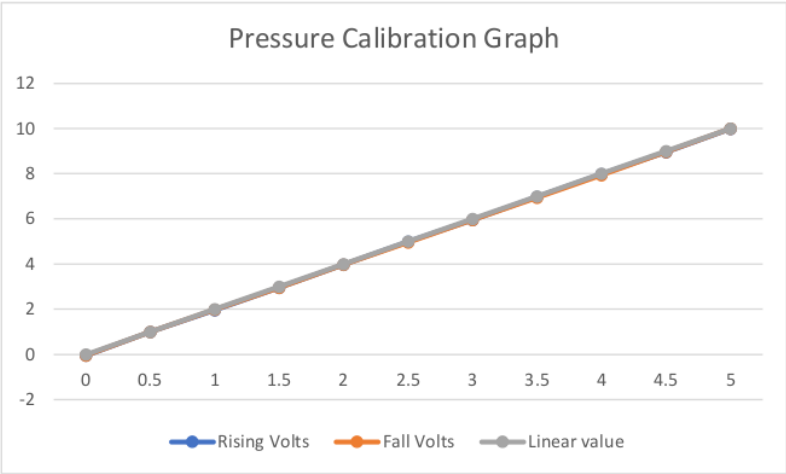


Figure 1 Pressure Calibration Graph

Table 1 Pressure Calibration

	Rising	Fall	Linear	Rising	Falling	Hysteresis
Pressure	Volts	Volts	value	Error	Error	Error
0	-0.05	-0.04	0	0.05	0.04	0.01
0.5	1	1	1	0	0	0
1	1.96	1.98	2	0.04	0.02	0.02
1.5	2.95	2.96	3	0.05	0.04	0.01
2	3.97	3.98	4	0.03	0.02	0.01
2.5	4.99	4.96	5	0.01	0.04	0.03
3	5.95	5.95	6	0.05	0.05	0
3.5	6.97	6.94	7	0.03	0.06	0.03
4	7.98	7.94	8	0.02	0.06	0.04
4.5	8.96	8.97	9	0.04	0.03	0.01
5	9.99	10	10	0.01	0	0.01

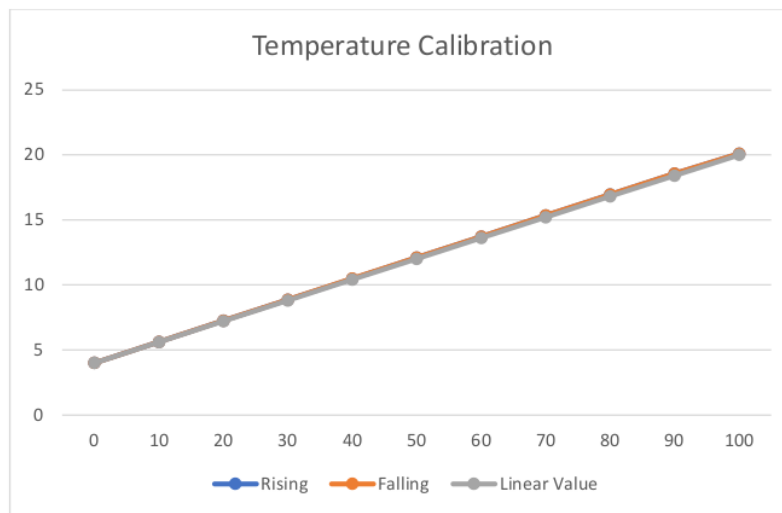


Figure 2 Temperature Calibration Graph

Table 2 Temperature Calibration

Temperature	Temperature Rising (mA)	Temperature Falling (mA)	Linear Value	Rising Error	Falling Error	Hysteresis Error
0	4	4	4	0	0	0
10	5.62	5.62	5.6	0.02	0.02	0
20	7.24	7.24	7.2	0.04	0.04	0
30	8.85	8.86	8.8	0.05	0.06	-0.01
40	10.47	10.48	10.4	0.07	0.08	-0.01
50	12.09	12.1	12	0.09	0.1	-0.01
60	13.71	13.71	13.6	0.11	0.11	0
70	15.33	15.33	15.2	0.13	0.13	0
80	16.95	16.95	16.8	0.15	0.15	0
90	18.57	18.57	18.4	0.17	0.17	0
100	20.1	20.1	20	0.1	0.1	0

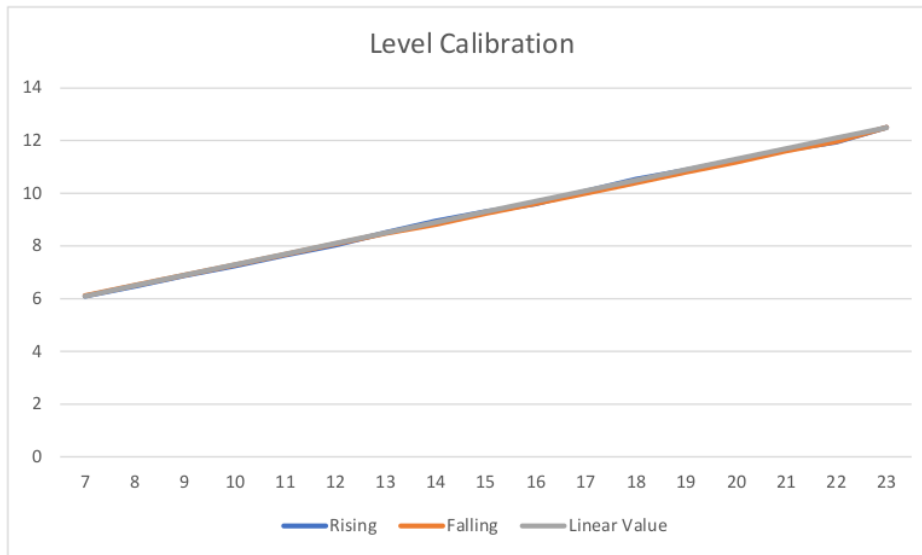


Figure 3 Level Calibration Graph

Table 3 Level Calibration

Level (cm)	Iout (mA) Rising	Iout (mA) Falling	Linear Value	Error Rising	Error Falling	Hysteresis Error
0	4.01	4.01				
7	6.1	6.12	6.1	0	0.02	0.02
8	6.47	6.51	6.5	0.03	0.01	0.02
9	6.88	6.9	6.9	0.02	0	0.02
10	7.25	7.29	7.3	0.05	0.01	0.04
11	7.66	7.69	7.7	0.04	0.01	0.03
12	8.03	8.08	8.1	0.03	0.02	0.01
13	8.51	8.48	8.5	0.01	0.02	0.01
14	8.95	8.82	8.9	0.05	0.08	0.03
15	9.3	9.23	9.3	0	0.07	0.07
16	9.6	9.61	9.7	0.1	0.09	0.01
17	10.08	10	10.1	0.02	0.1	0.08
18	10.54	10.4	10.5	0.04	0.1	0.06
19	10.88	10.8	10.9	0.02	0.1	0.08
20	11.26	11.18	11.3	0.04	0.12	0.08
21	11.65	11.61	11.7	0.05	0.09	0.04
22	11.95	11.97	12.1	0.15	0.13	0.02
23	12.51	12.51	12.5	0.01	0.01	0

Table 4 Distance Calibrations

Encoder (mm)	Laser Right	Encoder minus off	Laser Minus off	Error		Encoder (mm)	Laser left	Encoder minus off	Laser Minus off	Error
4.7	205.13	0	0	0		-1	202.01	1299.3	1309.78	-10.48
85.1	278.7	80.4	73.57	6.83		99.8	296.89	1198.5	1214.9	-16.4
209.2	406.63	204.5	201.5	3		202.1	403.9	1096.2	1107.89	-11.69
299.8	502.27	295.1	297.14	-2.04		301.8	503.13	996.5	1008.66	-12.16
407.4	610.43	402.7	405.3	-2.6		401.1	600.5	897.2	911.29	-14.09
501	709.7	496.3	504.57	-8.27		500	706.4	798.3	805.39	-7.09
601.1	813.83	596.4	608.7	-12.3		601.8	812.4	696.5	699.39	-2.89
700.5	915.7	695.8	710.57	-14.77		699	911.3	599.3	600.49	-1.19
810	1025.3	805.3	820.17	-14.87		800.1	1012.7	498.2	499.09	-0.89
900.3	1114.81	895.6	909.68	-14.08		900.1	1111	398.2	400.79	-2.59
1002.5	1216.46	997.8	1011.33	-13.53		999.3	1212.03	299	299.76	-0.76
1100.9	1314.48	1096.2	1109.35	-13.15		1100	1314.9	198.3	196.89	1.41
1200.4	1411.28	1195.7	1206.15	-10.45		1198.7	1410.2	99.6	101.59	-1.99
1315.2	1528.01	1310.5	1322.88	-12.38		1298.3	1511.79	0	0	0

		Severity/Consequence		
		Slightly harmful (1)	Harmful (2)	Extremely harmful (3)
Likelihood	Highly unlikely (1)	Trivial risk (Score 1)	Tolerable risk (Score 2)	Moderate risk (Score 3)
	Unlikely (2)	Tolerable risk (Score 2)	Moderate risk (Score 4)	Substantial risk (Score 6)
	Likely (3)	Moderate risk (Score 3)	Substantial risk (Score 6)	Intolerable risk (Score 9)

Figure 4 Risk Assessment

This is not a risk assessment, it is a scoring chart!

Instructor

68/100

PAGE 1

PAGE 2

QM

Good Structure

Report is structured exactly as stated in the assignment brief.

PAGE 3

Text Comment. Sounds like a good plan

Text Comment. Where is your risk assessment?

PAGE 4

Text Comment. What about investigating the sensors used in the subsystems?

PAGE 5

Text Comment. This sentence is not needed as you have cited your source in brackets.

QM

Correctly cited

Text Comment. What is the static sensitivity? How did you get your linear values?

PAGE 6

QM

Write in the third person

Avoid personal pronouns such as I, me, we, my, our you, your etc

QM

Citation Needed

Cite Source:

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Text Comment. units?

QM

Correctly cited

PAGE 7

QM

Citation Needed

Cite Source:

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Text Comment. What was your static sensitivity, how did you work out your linear values?

PAGE 8

QM

Correctly cited

Citation method conforms to Harvard standard, well done.

PAGE 9

QM

Correctly cited

Text Comment. How do you results compare with the manufacturer's data?

PAGE 10

QM

Correctly cited

QM

Correctly cited

Citation method conforms to Harvard standard, well done.

QM

Correctly cited

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Correctly cited

Citation method conforms to Harvard standard, well done.

QM

Correctly cited

Citation method conforms to Harvard standard, well done.

PAGE 11

QM

Correctly cited

Citation method conforms to Harvard standard, well done.

PAGE 12

QM

Write in the third person

Avoid personal pronouns such as I, me, we, my, our you, your etc

QM

Write in the third person

Don't refer to your self as I, me, my or others as you etc. Avoid personal references. If absolutely necessary, refer to self as "the author".

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Text Comment. This is not a risk assessment, it is a scoring chart!

GRADING FORM: NEW CSG-RUBRIC

JOSHUA THOMAS

68

1. ENGAGEMENT WITH LITERATURE

-  A good research section with evidence of reading from a wide range of sources cited and listed correctly using the Harvard method. 14/20 **14**

2. KNOWLEDGE AND UNDERSTANDING

-  Good knowledge demonstrated in your system investigation, explanation of calibration procedure and environment/maintenance section. However, you could have investigated the existing sensors in section 2 yet there is information in section 4. 12/20 **12**

3. COGNITIVE AND INTELLECTUAL

-  Good analysis of results and conclusions/recommendation presented. However, you could have not explained where your linear values came from and related your results to manufacturer's data. 13/20 **13**

4. PRACTICAL APPLICATION

-  Good use of calibration equipment and presentation of results 15/20 **15**

5. TRANSFERABLE SKILLS



A good work plan and explanation of team working. Report is well structured, mostly well written and presented with clear diagrams. Word count not exceeded. However, there is no work plan. Always write in the third person. 14/20