

Philip Hockin Final Project & Log Books

by Philip Hockin

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Engineering Project Final Report



Dŵr Cymru
Welsh Water

**Replacing a float system with a level
Controller with 4-20mA output.**

Philip Hockin

PSDE4033: Engineering Project

HNC

01/10/2018 - 07/05/2019

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*List of figures is clear
and well presented.*

1: Specifications and Procedures

Specification

i) Type of project

This project will be an industry based project which will involve the installation of an ultrasonic head and level controller system at Knoll Gardens Sewage Pumping Station. The system will monitor the level of a wet well and will activate a telemetry alarm if a certain level is reached. The chosen method to monitor the level will be the use of an ultrasonic head and level controller system.

ii) Monitoring the reliability of the project

To ensure the proposed projects reliability the results recorded by the Ultrasonic head under 2 different weather conditions and the level between the head and a solid surface and the head and a liquid surface will be analysed. On a dry day there will be a measured distance of 2/4 and 6 meters between myself and a flat wall using a tape measure. Using the ultrasonic head and level controller I will then measure the same distances. This test will then be repeated on a day with rain, and see if this affects the reading of the ultrasonic head. This test will be repeated with the depth of well containing water. Measurement of the depth of the well and the current liquid level will be done using a tape measure conducting the same reliability test as previously done against the wall ensuring the correct results were given.

Avoid using first person terms

iii) Operational conditions

The reason for conducting the experiment in different weather conditions is the level controller will be placed in a well where the level will very dependent on external weather factors. The DB6 ultrasonic head which is going to be used for this project is suitable to be used in outdoor weather conditions in the unlikely event of submersion.

iv) Size of the project

The project will not take up too much space in terms of surface area. There will be approximately 10 meters of 1mm 4 core cable running from the ultrasonic head to the controller in the pumping station kiosk. The controller is approximately 2 inches deep, 6 inches tall and 10 inches wide.



Figure 1: An Ultrasonic Head and Level Controller

v) *Budget*

The budget agreed Welsh Water, Dwr Cymru is £500. This will include the designing of the support brackets for the ultrasonic head over the pumping station wet well.

vi) *Ergonomics, ease of use.*

Once the ultrasonic head has been installed and the level controller up and running in the pumping station kiosk it will be extremely straight forward to use. Should any parameters require changing, such as the level in which the alarm is triggered, they can be amended on the controller which is installed at eye level in the main kiosk.

vii) *Health & safety standards followed*

When starting this task all health and safety standards must be adhered to. These standards range from the wearing of PPE Personal Protective Equipment at Work Regulations 1992, Health and Safety at Work act 1974 and the Electricity at Work regulations 1989.

Codes of practice followed

viii) *Environmental impact*

Although the installation of this device will not save energy it will however protect the environment. Where previously this pumping station had the possibility to overflow causing issues, this alarm will now trigger a telemetry call which will allow an operator to visit site and arrange a tanker or repair an issue if needed.

Environmental issues mentioned here.

ix) *Sustainability issues*

The bracket used to house the ultrasonic head could potentially be used from recycled material that is available in the waste metal area of our depot. This will reduce costs and have a positive impact on the environment.

Sustainability and recycling

x) *Timescale for completion*

Not including the planning and proposal of the project, the manufacture of the bracket to house the ultrasonic head and the installation should take approximately six weeks. The projected completion date for this installation is April 2019. This date takes into account the timescale in gathering the appropriate materials, and the completion of the relevant research and project proposals.

Specification has all the relevant information and due to the industrial environment has to comply with relevant legislation regarding codes of practice.

Procedures

First person terms should be avoided. This part should be in an acknowledgement section.

1) Who is responsible for what on the project?

Through this project there will be 3 people assigned to ensuring its completion. The first person is myself. This was my own proposed project and I will also be part of the team installing and constructing the items needed for its completion.

The second person involved will be my senior craft, Ross Gorman. Ross has exceptional experience in his role and will be a valuable asset when it comes to assisting me with any information I require during the installation of the level controller system.

The final person involved with the project is the operational supervisor, Richard Davies. If we require any materials that are outside of our personal budget allocation, we must send these requests to Mr Davies who can approve or deny them. It is Mr Davies who has already authorised a £500 budget for this project.

2) How will the components required be obtained?

There are three main sources of supply where equipment will be obtained from to complete the project. The first source is City Electrical Factors (CEF). CEF are an electrical wholesaler which has branches in Swansea, Carmarthen and Port Talbot where we can collect materials and tools if needed. We have a limit spend of £100 in any CEF store against one job, before requiring supervisory authorisation.

The second source is using the online RS catalogue. There is a £500 limit before supervisory authorisation is required, however delivery of items can vary which may lead to the project being delayed.

The final source of materials, which is good for sustainability, is to re-use materials that are made redundant on site. There may be old pieces of strut, and even potentially level controllers, on site which have been replaced in previous months. They may still be functioning and could be potentially used to complete this project.

A list of the components and a final budget value will do for this part.

3) How will spending, timescales and the progress of the project be monitored?

Spending will be monitored through the use of the Microsoft Excel Package a column will be started with the budget amount of £500 and every time an expenditure is made, that amount along with what it was for, are listed and deducted from the £500. This will allow us to monitor the amount spent and the amount remaining.

The timescales and progress of the project will be monitored through a Gantt chart and a diary. The Gantt chart will show us where we should be at a specific week of the project whereas a log book, signed by my tutor, will record the actual time progress.

4) What resources are needed?

The resources required to complete the project are listed below and their purpose for use:

Tool box & Tools – To complete the physical installation of the project. There will be a wide variety of tools needed. They include, spirit level, SDS drill, Philipps and Flat Head screwdrivers.

Testing Equipment – this includes a multi meter and voltage indicator.

A PC or Laptop – To complete documentation and stock ordering.

Internet Access – To allow the ordering of stock and tools as and when required.

5) How will health and safety standards be observed, what PPE will be used and what precautions will be taken?

I will ensure that the health and safety at work act 1974 and the electricity at work regulations 1989 are followed during the project. The Health and Safety at Work Act 1974, often referred to as HASAW or HSW, is an Act of Parliament. It is the main piece of UK health and safety legislation. It places a duty on all employers "to ensure, so far as is reasonably practicable, the health, safety and welfare at work". Section one part seven of the HASAW act states the general duties of employees at work.

Must avoid first person terms in the report

"It shall be the duty of every employee while at work—

(a) to take reasonable care for the health and safety of himself and of other persons who may be affected by his acts or omissions at work; and (b) as regards any duty or requirement imposed on his employer or any other person by or under any of the relevant statutory provisions, to co-operate with him so far as is necessary to enable that duty or requirement to be performed or complied with." This content is taken very seriously within the work place. PPE will be used throughout; this includes High visibility clothing, safety footwear, safety glasses and safety helmet. There will be a further risk assessment compiled on completion and the project will be tested accordingly to Welsh Water standards. On the following page, please find enclosed a completed risk assessment form signed off by myself and my employer.

6) How will the project be tested to ensure it meets the specifications?

Once the project has been completed we will test the validity of the readings given out by the ultrasonic head and the level controller. If they match the actual levels, we will then connect it to the telemetry system which will provide the suitable alarms should the levels get to high in the pumping station. The test will be done under various weather conditions to ensure accurate readings. We will perform a voltage test on the head to ensure it's being powered correctly, and to ensure the controller is operating correctly we will ensure we will manipulate the level on the ultrasonic head and ensure that the appropriate relays open on the level controller.

These procedures have been approved and agreed by the following:

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:

Date:

10/09/2018

*This belongs in
an appendix and
referenced from
the main report*

Risk assessment



All employers must conduct a risk assessment. If you have fewer than five employees you don't have to write anything down.

Company name: **Dŷr Cymru Welsh Water**

Date of risk assessment: 20/10/2018

What are the hazards?	Who might be harmed and how?	What are you already doing?	Do you need to do anything else to control this risk?	Action by who?	Action by when?	Done
Slips and trips	Staff and visitors may be injured if they trip over objects or slip on spillages.	General good housekeeping is carried out. All areas well lit, including stairs. No trailing leads or cables. Staff keep work areas clear. No boxes left in walkways, deliveries stored immediately.	Better housekeeping in staff kitchen needed, eg on spills. Arrange for loose carpet tile on second floor to be repaired/replaced.	All staff. supervisor to monitor. Manager	ongoing	20/10/2018
Working with 4 tcy in well environment.	Electrician and support staff	Isolating equipment by locking off supply. Warning signs put up.	Complete task as promptly as possible	Electrician	01/05/2019	n/a
Working over a flowing water channel	Fitter, public, Electrician or Ops Supervisor	Cordoning off area ensuring no visitors will get near the installation		Electrician	01/05/2019	n/a

You should review your risk assessment if you think it might no longer be valid (eg following an accident in the workplace or if there are any significant changes to hazards, such as new work equipment or work activities)

For information specific to your industry please go to <http://www.hse.gov.uk>

For further information and to view our example risk assessments go to <http://www.hse.gov.uk/hseic/resources/>

Combined risk assessment and policy template published by the Health and Safety Executive DS14

Figure 2: Copy of a Risk Assessment

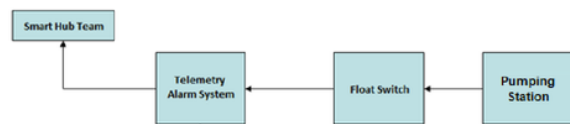
2: Three Possible Solutions

This section of the report will evaluate the 3 possible solutions which will be used to establish which method will be chosen during the installation of level controller and ultrasonic head at Knoll Gardens Sewage Pumping Station. The 3 solutions being analysed are:

1) Float Switch 2) Ultrasonic head and Level Controller 3) Level Probes

To assist with the evaluation a block diagram will be provided for each solution. At the end of the report a table will be created showing briefly all included results and a method will be chosen to complete the project.

Solution 1 – Float Switch



Block diagram is good and shows how the system is configured.

Figure 3: Block Diagram of a Float Switch

Tools & Equipment Required to be Purchased

Float switch: £49.61 inc VAT each

The mid priced item of the 3 solutions, the float switch cost comes in at a cost of £49.61 inc VAT each. Although this does not include the cost of tool acquisition and labour to complete the job as these are provided by my employer at no cost. So when evaluating the costs of the other potential solutions it also will not include these factors. It is purely the cost of the equipment, in this case, the float switch itself. The float switch is also very accessible and can be picked up at numerous local wholesalers in the Carmarthenshire area within 24 hours. "This type of float switch does not depend on a float rod or chain to operate. The mercury bulb switch appears to be a rubber bulb connected conductor." (Herman, 2009)

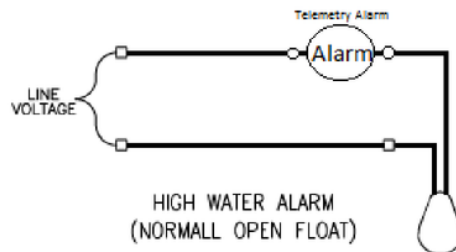


Figure 4: Diagram of Alarm System and Float Switch

As can be seen in the above drawing of a float switch being operated, there is an initial line voltage supply, low voltage, required to make the device work. It is a simple mechanical switch that when the level of the storm channel gets too high, it will topple over, make a connection and close the normally open switch. It would be an exceptionally easy install. As with the diagram above, the float switch itself will be connected to a low voltage system and will close a relay on the telemetry system allowing it to alarm out with a specific fault code. The other floats would have mains voltage running through and would operate the pumps on directly. The switch would be reliable if it was serviced and maintained on a regular basis. With the location of it being in a sewage well, it may cause issues if not maintained. The size of the float is approximately 10cm² and comes with up to 50m of cable to connect it to the device required in the kiosk. The positives from this method are the costs, timescale to gather materials and the actual installation timescale. The negatives would be the reliability and maintenance. Maintenance would need to be conducted regularly and the safety aspect of this may need to be seriously considered before this choice selected.

A good evaluation for this method.

Solution 2 – Ultrasonic Head and level Controller

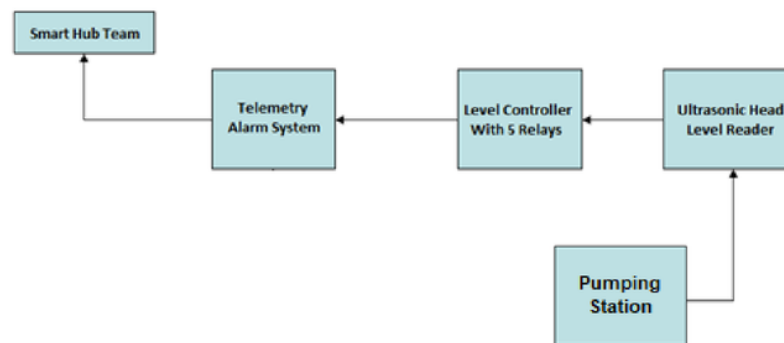
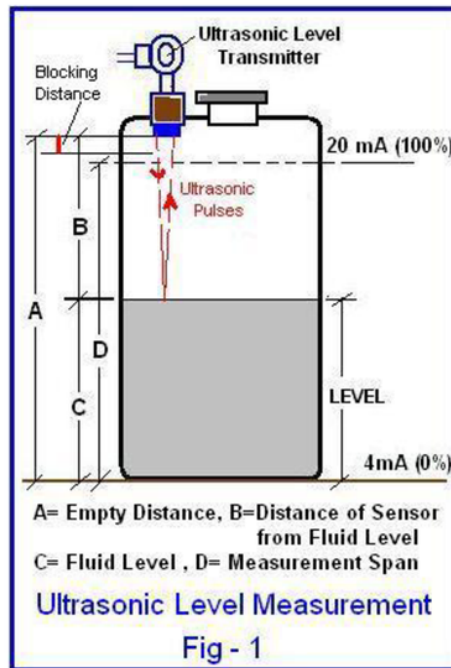


Figure 5: Ultrasonic Head and Level Controller Block Diagram

Tools & Equipment Required to be Purchased

Ultrasonic head and Level Controller: £290.99 + VAT

The ultrasonic head was the mid-price solution of the three and this came in at £290.99 + VAT. As was previously stated, this cost does not include the cost of tool acquisition and labour to complete the job, my employer has given me these to do so at no cost. In order to acquire the ultrasonic head, an order is required to be placed with RS, our online catalogue, and this could potentially take 7-14 days before we receive the delivery at site.



Good image of sensor operation.

Figure 6: Ultrasonic head and level controller diagram with parameters

“Water level control provides another simple platform to illustrate both manual and automatic control.” (Mutambara, 1999)

The above drawing shows the parameters available during the operation of the ultrasonic head and level controller. It has 5 output relays, which can be set at either normally open or normally closed, which can set levels of alarms at different readings. This in turn could also alarm out if the flow has dropped below a certain level, to ensure there is no need for a member of staff to attend site. The system would be relatively easy to install. There would be no need to drop a device into the sewerage, such as the float switch, but it can overhang on a bracket and monitor the level from a safe distance. The level controller is operated at either 240v or 110v. With the kiosk already receiving a 3phase supply where we would intend to install the product, in our case the supply to the unit would be 240v. There also wouldn't be a requirement for much maintenance on the ultrasonic head as it is not in the sewerage unlike the float and flowmeter. There would however be more initial calibration required to ensure the ultrasonic is reading the correct levels. The size of the level controller is 15x20cm³ and has a 20meter cable length to the ultrasonic head. This distance is more than sufficient for the requirements of this project. As with the float switch and the flowmeter the signal which is sent to telemetry is updated every 90 seconds. With regards to safety it may be considered a little less safe than the float due to there being a 240v supply onto the unit, but this would also affect the flow meter.

The Positives for this method are the cost comes within budget, the timescale is not too long to present a problem with ordering or installation. The only negatives I can foresee

with this method are if any fault finding is required with the readings it could be a problem for either the head or the controller. But until both are separately tested it won't become clear and this could be time consuming.

Solution 3 – Level Probes

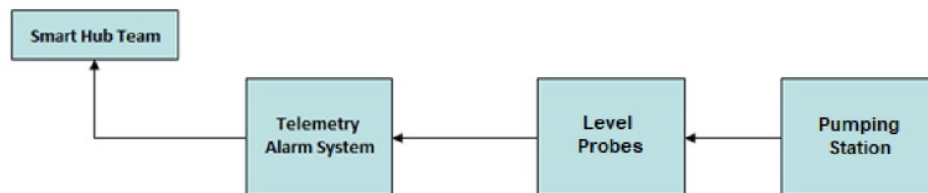
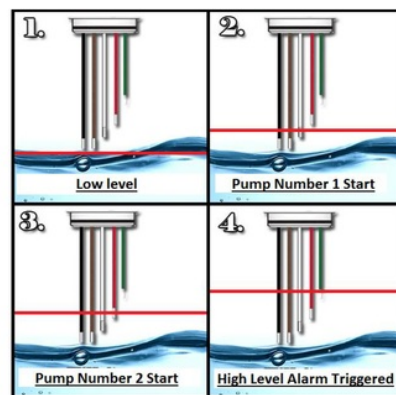


Figure 7: Block Diagram of level probes

Tools & Equipment Required to be Purchased

Flow meter: £27.41 inc VAT

The level probes are by far the cheaper priced method of the 3 solutions coming in at a price of £27.41. Again this is without the cost of tools and manpower as it is provided by my employer.



Good image of sensor at different levels.

Figure 8: Image shows how a set of level probes operate

The above diagram shows the operational process of the level probes. A series of probes will close relevant circuit relays determined by the level of the water in the pumping station. This system would be very effective in a situation where there would be purely clean water in the well. With the probes taking the main flow of sewage, there may be foreign bodies which could mean false readings are given so maintenance will be required regularly. This means the flowmeter needs to be installed somewhere accessible. The size of the flow meter is 50x50cm³ for the full unit.

"These controllers have probes or rods that come in contact with the solution. A small DC current, usually 9 volts is applied across each pair of probes." (Roy, 1988)

The positives for this method are the cost, it's a relatively cheap design. If fully operational it can give alarms out and operate the pumps when the level of flow coming into the works is high. A huge negative with this technique is the foreign bodies connecting probes and causing long term damage with pumps running dry.

Arguments are good for each solution.

Chosen Solution.

Below is a table showing the results of important questions which needed answering before deciding which solution to complete the project with.

	Selection Criteria	Solution 1	Solution 2	Solution 3
	Cost	£49.61	£290.90	£27.41
	Size	10cm ²	15x20cm ²	50x50cm ²
	Estimated Completion Time	07/05/2019	07/05/2019	07/05/2019
	Results Accuracy	60%	100%	95%
	Life expectancy	5 Years	10 Years	5 Years
	Reliability	70%	95%	50%
	Availability	Next Day	7-14 Days	Next Day

Table of comparison is good.

Cost

We have a budget of £500 to complete the task, and after comparing the 3 methods it was decided that the ultrasonic head and level controller was the most suitable option. Although the float switch and level probes were cheaper, the ultrasonic head and level controller was decided to be better value for money.

Size

With the space we have above the wet well and in the kiosk for any instrumentation required the level controller's size was suitable. Also the safety aspect of installing the head as opposed to the float was a contributing factor so it was decided the ultrasonic head was the best size for the task.

Estimated Completion Time

The estimated completion time was set to the same required finish date for all 3 possibilities. So this was a factor which did not bear any consideration.

Results Accuracy

The only device that would give a true reflection most accurately is the ultrasonic head and level controller. The level probes were less accurate but it was determined that the float switch wouldn't be reliable enough in the long term also.

Life Expectancy

There is warranty offered on all three products however the life expectancy for the ultrasonic head and level controller is 10 years. The float switch and level probes are 5 years but for the price we feel that would also be sufficient.

Availability

All timescales would be sufficient with the longest delivery time being that of the ultrasonic head and level controller. The level probes and floats can be sourced within a 24 hour period.

Final Choice

After assessing each solution, it was decided that the most viable solution to complete the project would be the Ultrasonic head and level controller. None of the information provided in the table or the research of the project offered any barriers negative enough to warrant any caution about the product. Unlike the float switch and level probes which had reliability issues although they had no had cost implications. The option that is most suited to installing a control system on a sewerage pumping station is the ultrasonic head and level controller.



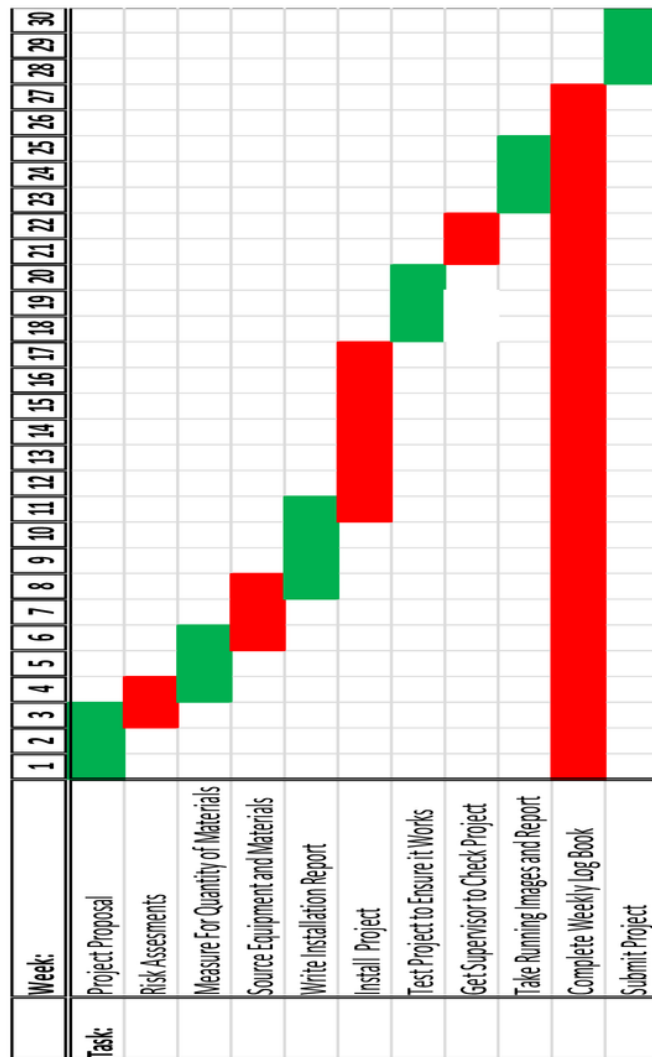
Good evaluation and comparison for selection.



Figure 9: A Selection of Possible Ultrasonic Heads and Level Controllers

3: Outline of Chosen Solution

As previously stated the chosen solution for completing the project was option two, the Ultrasonic head and Level controller by Pulsar. Please see the following Gantt chart which will clearly outline my desired timescale for the completion of this project.



Good use of Gantt chart

4: Project Planning and Monitoring of Achievement

The log books submitted at the end of this project will show how close the project lined up to the original plan with regards to time scale. This was monitored on a weekly basis to ensure completion occurred on time.

5: Implementation

Before we could order the equipment, it was important to ensure we were aware of everything that was needed and to ensure we could keep it within budget. Therefore, a diagram was created showing the process of the circuit.

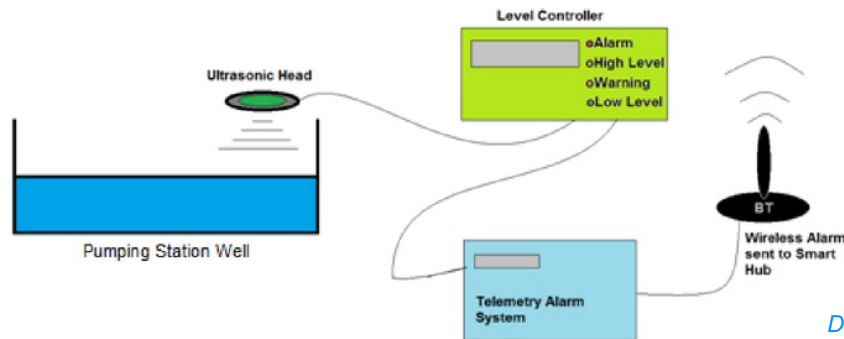


Diagram is good and informative.

Figure10: Figure 10: Finalised Construction of the Circuit

The diagram does not show the mechanical elements of this installation and were considered separately. Below shows an example of what would be required to house the ultrasonic head over the storm inlet channel.

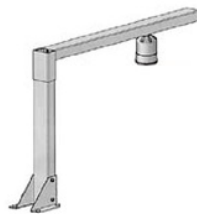


Figure 11: Example of the bracket constructed in Parc y Splott WWTW for Knoll Gardens SPS

To ensure the appropriate devices were ordered we viewed online the Ultrasonic heads and level controllers available to purchase within our £500 budget. These products were purchased direct from the manufacturer.



This should be in the appendix

Figure 12: Screenshot from the Pulsar Website

To implement the project the components have been ordered and delivered to Carmarthen, the stock was then transported from Parcy y Splott Wastewater Treatment Works in Carmarthen to Knoll Gardens SPS in the main town centre every time an item was required.

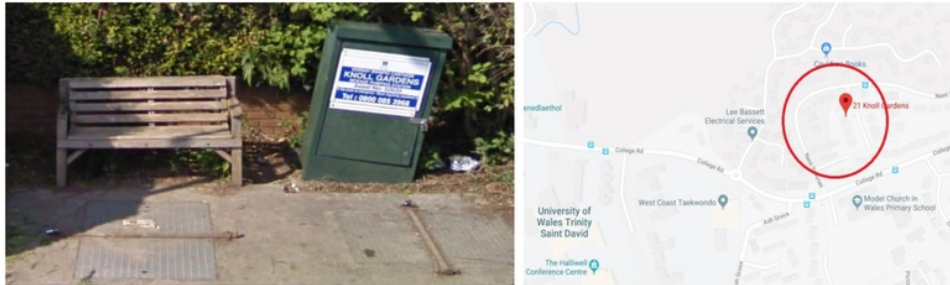


Figure 13: Aerial View of Knoll Gardens Sewage Pumping Station

After receiving the invoice for the delivery I checked it against the stock which was delivered. Everything which was ordered had been received. I then take the product book and read about the devices to gain an improvement in this products knowledge



Figure 14: Delivery Storage Area in Parcy y Splott WWTW

Once I had gained sufficient knowledge regarding the operating instructions and parameters of the product, I composed a list of the required tools and equipment I would need to complete the task, my supervisor then verified this and I independently gathered all tools and equipment. On the following page is a picture of my tool bag which was used to conduct the installation.



Figure 15: Tool Bag Used to Complete the Installation

Once all tools and equipment had been gathered the next task was to draw an installation diagram, explaining to my supervisor where every piece of equipment would be placed and which tools would be used to complete the job. Once he was satisfied the products were being put to their correct use, he was given the go head to install the ultrasonic head and level controller on my own.

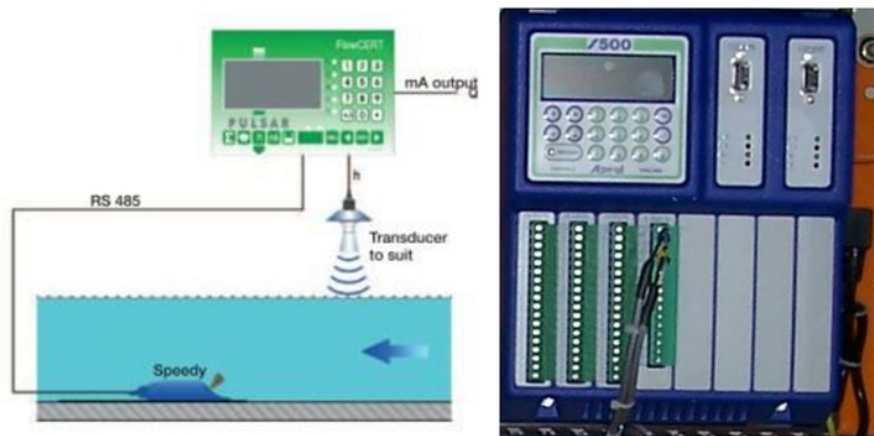


Image is good and easy to follow.

Figures 16 & 17: Examples of Ultrasonic head in use with level controller (Shown on Left). The RS485 Speedy is not used in my installation and the mA output is sent to a telemetry outstation, which transmits an alarm to our SmartHub helpdesk (Shown on the right).

The first stage of the installation required me to create a bracket to house the ultrasonic head. This bracket was constructed from recycled material which was available from our scrap area which is housed at the back of Parc y Splott WWTW. With the gathering of recycled material was able to complete the construction of the bracket.



Figure 18: As can be seen, spring washers, nuts and bolts have been used to construct the bracket. All came at no extra cost as these spares are kept on site.

Now that the bracket has been completed, using a drill and fixings, I attached it to the pumping station wet well and housed the ultrasonic head. The wire then used to supply the ultrasonic head was then cable clipped to the bracket and coiled up ready for next week's installation of the level controller in the green kiosk just behind it. The installation was the fixing of the device securely to the wall of the cabinet and ensuring that all cables were connected correctly as indicated in the design and specification booklet. Once this was done we required an instrument tech to arrive to connect the ultrasonic level controller to the telemetry alarm system.



Good image

Figure 19: Connection of the Level Controller to a 240V supply, fixing it to the wall and connecting the ultrasonic head to the controller.

6: Testing and Results

At this stage, we conducted offline tests and the first test we done was to ensure the main protection for the device worked correctly.

We checked that the earth bonding between the 240v supply and the main consumer panel to ensure the device was suitably protected. After nulling the needs on the multi meter, we connected the red lead to the main earth bonding on the panel to the earth terminal on the level controller. We received a reading of 0.1 Ohms which we deemed was sufficient for the task at hand.



Figure 20: Multi Meter reading on earth bonding resistance check

We measured a distance of 1 meter using a tape measure from a flat surface and inputted this value into the level controller's parameters. We requested it alarmed out if the distance between the flat surface and us reduced to less than 0.5m. We slowly walked towards the wall holding the ultrasonic head and we received an accurate reading back, and when we walked, close enough to the wall a 4-20 Ma relay switched on the level controller. We conducted this test at 3 different measurements to ensure accuracy when recording the results which can be seen in the table below. These results were measured in good and bad weather conditions.

Explanation is good

apart from the use of first person.

Distance from Surface (Tape Measure)	Distance from Surface (Ultrasonic Head)	Did the device alarm out appropriately?
1.0m	1.0m	yes
1.5m	1.499m	yes
2.0m	1.988m	yes

The table of results shows the accuracy of the sensor

Now that the installation has been completed and the offline tests have all come back with positive results, my supervisor personally inspected the work. After the inspection he was satisfied the installation was successful and we were ready to test. Now the work has been tested and my employer are satisfied that it is a working model, we have put the unit live and will monitor it over the coming months, specifically when it is during stormy conditions to ensure the level controller is reading correctly and the relevant alarms are sent out. A week after initially verifying the work we revisited the site to ensure that the parameters were still reading accurately, by conducting the same test as previously, and they were. This ultrasonic head, level controller and telemetry system is now in full flow and will be revisited monthly to ensure its successful operation. This project finished 2 weeks ahead of schedule.

Budget

Now that the project has concluded, we can go back and visit the costs in comparison to our budget. It also shows, if any, changes in size, completion time, results accuracy, life expectancy, reliability and the availability of the product and its completion of installation. This is going to be shown in the form of a table. The budget which was given was £500 However an original plan forecasted spending 290.00 on the project. The table below shows the planned details and the actual details. This will show up any significant variations.

	Selection Criteria	Budget/plan	Actual
	Cost	£290.99	£290.99
	Size	15x20cm2	15x20cm2
	Completion Time	01/05/2019	01/05/2019
	Results Accuracy	100%	98%
	Life expectancy	10 Years	10 Years
	Reliability	100%	100%
	Availability	7-14 Days	7-14 Days

Comparing Specification to Solution

i) Type of project

The type of project selected more than matched the requirements for the solution and were exactly in line with the industrial specification.

ii) Monitoring the reliability of the project

Completing the off line tests further confirmed the reliability of the test.

iii) Operational conditions

The offline tests were completed in various weather conditions to ensure accuracy and reliability as stated above.

iv) Size of the project

The dimensions of the project were previously researched for the specification so these were already made aware as being suitable for the solution.

v) *Budget*

The solution of the product was achieved by meeting the same cost as the specification and significantly below budget.

vi) *Ergonomics, ease of use.*

The solution has allowed the product to run automatically and there is no need for manual assistance for this project to operate.

vii) *Health & safety standards followed*

All health and safety standards were met when completing the solution for this project.

viii) *Environmental impact*

Environmentally friendly system.

Due to the solution, working as correctly and efficiently as designed, it will prevent any environmental issues occurring from overflowing sewerage

ix) *Sustainability issues*

Recycling where possible is good practice.

Recyclable materials were used in the construction of the final solution.

x) *Timescale for completion*

Project has been completed ahead of schedule. We had a time limit of 01/05/2019 but was completed 21/04/2019

After readdressing the specifications from this assignment it is clear that the solution implemented has met the specification.

7: Conclusions and Recommendations

This part of the assignment requires my evaluation of the project solution and suggest improvements that could be made to improve it. To do this I will revisit the comparison between specification and solution and evaluate each section to see where vital improvements could be made.

Evaluating between Specification and Solution

i) Type of project

Although the project type matched what was required and was in line with industrial specification there were still other options available ranging from an automated actuator system to open the valve, or a flow meter being installed, it was still the most suitable type of solution to undertake due to budgeting restrictions.

ii) Monitoring the reliability of the project

There really is only a manual method for checking the reliability of the project at present where someone will periodically check the device to ensure it is giving out the correct readings at certain levels. To improve this aspect it may have been a possibility to place an automatic level checking system. Although it would have increased cost on the project, to save the time of people having to manually check the reliability, an automated device would have saved a lot of time on manpower.

iii) Operational conditions

The operational conditions will not do any short-term damage to the installation. It is designed to be all weather and was tested in various conditions to ensure a successful reading. However, another solution, such as a flow meter would eradicate this potential issue. However, back to the funding situation, it would not have been affordable to do a solution, which would not have been impacted by operational conditions. So it would appear the solution which was chosen was the best for the task.

iv) Size of the project

The size of the project was sufficient for the specification and any other possible alternatives would not have had any real change in outcome to the solution. In this instance it appears the best solution was used for the task.

v) Budget

With the budget being matched, it did run the task tight. This could have been extended to allow us some flexibility. However the task was completed, and being 2 weeks in advance, the budget was suitable for the solution suggested.

vi) *Ergonomics, ease of use.*

The solution, once installed, is incredibly easy to use. The project is free standing and doesn't require any maintenance on the supporting structure when installed. This shows that the solution chosen for the specification was the best option.

vii) *Health & safety standards followed*

All PPE was readily available to complete this task and all equipment to do the job safely was present. If we were unable to do anything safely it is Welsh Water's policy to stop and reassess the situation. If the solution was to install a flow meter, a 3rd party construction team would be required to allow us to install the device and this could cause unnecessary health and safety issues.

viii) *Environmental impact*

With the chosen solution being hung over the storm inlet, it does not affect anything in the environment and its surroundings. If the flow meter option was selected, some of the environment may have required being destroyed to require installation of the system. The ultrasonic head solution appeared also to be the best solution for this task.

ix) *Sustainability issues*

With the device requiring to be a new purchase that reads the water level, it only left the opportunity to use recyclable materials in the construction of the bracket housing the ultrasonic head. This opportunity would not have been available to any of the other solution.

x) *Timescale for completion*

The project was completed ahead of schedule so the solution was sufficient in this area. However if there was an automated penstock in place, which would automatically open and close in conjunction with the flow in the storm channel, it would save time in the long run of people attending site to open the flow. But with the budget in place and the timescale for delivery, this was solution was the best possible solution.

After evaluating the projecting solution it does indicate that the selected option was the best solution to meet the specifications. There would have been minor changes, including the requested budget be available to us, but in general the solution was suitably matched to meeting the specifications.

8: Log Books

Conclusion is reasonable for the project and you have addressed environmental and sustainability issues. Recommendations have been put forward with contaminants such as budget and third party involvement.

<u>Log Book</u>	<u>Date Submitted</u>	<u>Hours Taken for Log</u>	<u>Accumaltive Hours Taken</u>	<u>Signed by Myself</u>	<u>Signed By R. Jenkins</u>	<u>Signed By DCWW</u>
<u>1</u>	18/09/2018	4hr	4hr	X	X	X
<u>2</u>	25/09/2018	4hr	8hr	X	X	X
<u>3</u>	02/10/2018	4hr	12hr	X	X	X
<u>4</u>	09/10/2018	4hr	16hr	X	X	X
<u>5</u>	16/10/2018	4hr	20hr	X	X	X
<u>6</u>	23/10/2018	4hr	24hr	X	X	X
<u>7</u>	30/10/2018	4hr	28hr	X	X	X
<u>8</u>	06/11/2018	4hr	32hr	X	X	X
<u>9</u>	13/11/2018	4hr	36hr	X	X	X
<u>10</u>	20/11/2018	4hr	40hr	X	X	X
<u>11</u>	27/11/2018	4hr	44hr	X	X	X
<u>12</u>	04/12/2018	4hr	48hr	X	X	X
<u>13</u>	11/12/2018	4hr	52hr	X	X	X
<u>14</u>	08/01/2019	4hr	56hr	X	X	X
<u>15</u>	15/01/2019	4hr	60hr	X	X	X
<u>16</u>	22/01/2019	4hr	64hr	X	X	X
<u>17</u>	29/01/2019	4hr	68hr	X	X	X
<u>18</u>	05/02/2019	4hr	72hr	X	X	X
<u>19</u>	12/02/2019	4hr	76hr	X	X	X
<u>20</u>	19/02/2019	4hr	80hr	X	X	X
<u>21</u>	26/02/2019	4hr	84hr	X	X	X
<u>22</u>	05/03/2019	4hr	88hr	X	X	X
<u>23</u>	12/03/2019	4hr	92hr	X	X	X
<u>24</u>	19/03/2019	4hr	96hr	X	X	X
<u>25</u>	26/03/2019	4hr	100hr	X	X	X
<u>26</u>	02/04/2019	4hr	104hr	X	X	X
<u>27</u>	09/04/2019	4hr	108hr	X	X	X
<u>28</u>	16/04/2019	4hr	112hr	X	X	X
<u>29</u>	23/04/2019	4hr	116hr	X	X	X
<u>30</u>	30/04/2019	4hr	120hr	X	X	X

Log Book Contents Page

Good running log book showing work breakdown.



Replacing a float system with a level controller with 4-20mA output

Log Entry
1

Log Entry Provided By Philip Hockin

Log Duration :4 Hours

Accumulated Log Duration : 4 Hours

Date : 18/09/2018

Description of Activities

The first entry in this log for our project has been completed after attending our first project lecture of the academic year. We discussed what projects were suitable to be used and whether we were employed and doing the project with work or in our own time. We also discussed research proposals and what elements need to be considered, such as:

Where? Why? What? When? How Much? And How?

We also went through the course structure and decided what needed to be achieved within the time scale available to us. We then went through a detailed introduction and the criteria required for the project proposal, the final report and the presentation part of the module.

What is to be achieved?

Along with the submission of this log entry I will discuss with my employer what budget restraints there are to complete this project. I will also make a start on my project proposal to ensure it is completed in a timely manner.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry

2

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 8 Hours

Date: 25/09/2018

Description of Activities

This week the project proposal was submitted to Rob Jenkins to ensure we were on the correct tracks with our task selection and planning methods suitable for the proposal. Discussions also took place with my employer with a range of solutions for the chosen project and a decision was made on the ultrasonic head and level controller.

What is to be achieved?

By the next log entry, I fully anticipate to have had my project proposal signed off and completed. This will include a time scale on when the overall project is scheduled for completion. And also the method to complete the task would also be selected and finalised by my employer. Although during the research proposal preliminary prices were gathered for each item, by next week a full plan will be drawn up with a more in depth cost analysis. This will be discussed with other engineers with welsh water with regards to brand name and reliability.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output

Log Entry
3

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 12 Hours

Date: 02/10/2018

Description of Activities

Project proposal is awaiting being signed off and work has commenced on my presentation which is due to be presented in December 2019. Cost analysis is drawn nearer completion with my employer and it has been confirmed by Welsh Water that the chosen method for this control will be the installation of an ultrasonic head and level controller.

What is to be achieved?

I hope to continue work on my presentation for December and also receive feedback on my project proposal to ensure I have covered all the necessary criteria. Once this has been received I can continue further with my Project and ensure any time provisions in place will be met.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry

4

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 16 Hours

Date: 09/10/2018

Description of Activities

Project proposal has been signed off and work has continued on my presentation which is due to be presented in December 2019. Cost analysis is drawn nearer completion with my employer and it has been confirmed by Welsh Water that the chosen method for this control will be the installation of an ultrasonic head and level controller.

What is to be achieved?

Finalise total cost of project for the employer, inclusive of materials and labour. Continue to work on my presentation which is due in December 2019.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output

Log Entry
5

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 20 Hours

Date: 16/10/2018

Description of Activities

Cost analysis has been completed for the project proposal, with figures gathered for all three possible outcomes of the successful completion of the task. These figures have been incorporated into the presentation due in December 2019. Even though the ultrasonic has already been selected and agreed by my employer, there is still a lot of interest involved with the variation in costs and reliability of the project.

What is to be achieved?

I aim to complete the first draft of the presentation and liase with Rob Jenkins by the next log book entry.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
6

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 24 Hours

Date: 23/10/2018

Description of Activities

Lecturer is happy with the progress being made with the project. He is satisfied that the criteria required to be completed on time is being met and the standard of the presentation is suitable for this stage of the development. The three costs of each project have been fed back to my employer and it has been reaffirmed that the correct solution was chosen.

What is to be achieved?

This week will be a cost saving exercise as I look at numerous different suppliers of level controllers and ultrasonic heads to see what the best option for the business is. I will shop around with a comparison of price and service and discuss with my supervisor which option would be the best going forward. I will also continue to work on my presentation which is due in December 2019.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
7

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 28 Hours

Date: 30/10/2018

Description of Activities

During this week there was no attendance at college due to it being a reading week. This allowed me to spend more time in my place of work, planning the project. I took the time to visit site where the work will take place, and do a drawing of exactly where the components will be placed in the well. I have also gathered the component specification from Pulsar (ultrasonic and Level controller) supplier to ensure their compatibility with the task. On the next page is an image of the brochure used to select the product.

What is to be achieved?

Hopefully next week the final design will be complete and the commencement of ordering the materials can take place. There will also be a submission of the drawing for the installation of the ultrasonic head, and I will also attend site to conclude a drawing of where the level controller will be installed.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____

Product Guide



Level and Flow Measurement

Ultra Range

Ultra 3, Ultra 5
and UltraTwin



Replacing a float system with a level controller with 4-20mA output

Log Entry
8

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 32 Hours

Date: 06/11/2018

Description of Activities

Back into lectures this week and we have discussed the upcoming presentation required as part of the project assessment. This will need to be concluded in preparation for the delivery in the early part of December. The final design is concluded and has been put forward to my supervisor to confirm suitability.

What is to be achieved?

In the coming week I fully expect the design to be signed off and then look further into the tools and equipment required to complete the project. Also in next week's project class we will go through a template of a presentation to ensure we cover all aspects in preparation for delivery.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output

Log Entry

9

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 36 Hours

Date: 13/11/2018

Description of Activities

Design has been signed off and work has started in pricing up the tools and equipment required to complete the job. We have also received a supplementary template to assist us in the completion of our project presentation.

What is to be achieved?

In the coming week I fully anticipate completing the cost gathering of the tools and equipment required to complete the task in hand. I also anticipate being almost finished with my presentation preparation and it will be ready for delivery.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output

Log Entry
10

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 40 Hours

Date: 20/11/2018

Description of Activities

The presentation has now been complete and has been seen by my college lecturer who has approved its finalisation. A copy of the presentation is attached to this log entry as evidence of its completion. I have received one quote back for the tools required and I am awaiting a second quote back before any decisions are made. The following page shows screenshots of my presentation slides.

What is to be achieved?

I hope to receive my second quote with the view to my employer authorising my acquisition of the relevant tools and materials.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____

An Alternative Control Method For Knoll Gardens SPS



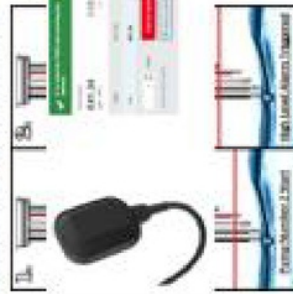
Oŵr Cymru
Welsh Water

By Philip Hockin

Present Control System in Place

- **Budget to Replace Current Float Switch System is £500**
- 1) Current Float System is faulty**
- 2) Replacing Current Floats Not Suitable**
- 3) Other Systems Could Save Money In the Long Term**

Possible Solution #1



Possible Solution #2



Possible Solution #3



- SOLUTION 3**
Is the chosen solution
- 1) Within Budget
 - 2) Reading Accuracy
 - 3) Reliability



Replacing a float system with a level controller with 4-20mA output

Log Entry
11

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 44 Hours

Date: 27/11/2018

Description of Activities

As can be seen on the following page there is a list of tools required to tackle the project. After taking this list to my employer it was not deemed feasible to have all this equipment specifically to complete the task as much of the equipment was already used by other members of staff within my team. I was advised that the tools listed on the previous page were not required to be purchased and they can be loaned to myself keeping costs to a minimum.

What is to be achieved?

Establish if the tools can be sourced early in the New Year to complete the task in Knoll Gardens SPS. This issue will be brought up in the team meeting next week.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____

✓ 1 In stock for FREE next working day delivery			
 Bosch GBH 4-32 DFR SDS Hammer Drill, 0 → 760rpm, 240V, 900W, 4.7kg, Type G - British 3-pin RS Stock No. 560-921 Brand: Bosch Mfr. Part No. NMD2 RoHS status: Compliant Show accessories	1 Update Remove	€423.32 Each	£423.32
✓ 1 In stock for FREE next working day delivery			
 RS PRO Nut Driver Set, 7 Piece - Engineers Nut Spinner RS Stock No. 460-1758 Brand: RS Pro RoHS status: Not applicable Show accessories	1 Update Remove	£37.43 1 Set	£37.43
i 1 Available to back order for despatch 17/01/2019			
 Bahco Screwdriver Set, 7 Piece - Interchangeable Pozidriv, Slotted RS Stock No. 806-4835 Brand: Bahco Mfr. Part No. 808062 RoHS status: Not compliant	1 Update Remove	€90.89 Each	£90.89
✓ 1 In stock for FREE next working day delivery			
 Fluke 115 Handheld Digital Multimeter, 10A ac 600V ac 10A dc 600V dc RS Stock No. 616-1454 Brand: Fluke Mfr. Part No. FLUKE-115 EUR RoHS status: Not applicable Show accessories	1 Update Remove	€169.00 Each	£169.00



Replacing a float system with a level controller with 4-20mA output

Log Entry
12

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 48 Hours

Date: 04/12/2018

Description of Activities

After consultation with my supervisor it has been established that the order can take place for the tools and this will be done this week.

The ultrasonic head and level controller which is the chosen method to resolve the issue in Knoll gardens Sewage pumping Station can also be ordered however this requires authorisation from senior management. I have sent of the relevant requests and this will be returned with an order number hopefully by next week.

What is to be achieved?

Once a purchase order number has been received for the ultrasonic head and level controller place the order with pulsar.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
13

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 52 Hours

Date: 11/12/2018

Description of Activities

The purchase order from senior management has not yet been received however we have been in receipt of the tools to complete the job. These items were delivered this week.

There will be an e-mail sent to my catchment manager chasing up the purchase order number so we can get the stock in place before the Christmas break.

What is to be achieved?

The email sent to the catchment manager and the preparation of the tools and stock we have received to continue with the task. There is now an extended break until early January which is where we will pick up with the project.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
14

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 56 Hours

Date: 08/01/2019

Description of Activities

Over the Christmas period the purchase order was received and the order now placed for the pulsar ultrasonic head and level controller. The scheduled date for delivery is 10/01/2019 and it will be delivered to our Parc Y Splott WWTW in Johnstown Carmarthen.

What is to be achieved?

Once we have received delivery, we will sit down with our instrument technician and discuss a suitable date for our combined pre installation checks. The instrument tech in our team is Kevin Thomas and he will be installing the telemetry part of the project. This is what transmits the readings to our central monitoring team in Cardiff's head office "Smart Hub".

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
15

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 60 Hours

Date: 15/01/2019

Description of Activities

This week we received all the components to complete the job and we met with the instrument technician to arrange a date where we would go to site and make our pre installation checks which included a risk assessment and plan to be put in place. It was decided we would visit site on the 18th January 2019 and make the appropriate checks.

What is to be achieved?

Once the risk assessment is complete and a plan put forward we can then look at starting the installation phase. Further to this the delivery of our project proposal presentation will take place next week and this will be graded according to its content and delivery.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
16

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 64 Hours

Date: 22/01/2019

Description of Activities

After the conclusion of the pre installation visit last Friday, a risk assessment has been completed and the work is ready to commence at the installation phase. A copy of the risk assessment can be found on the next page. Further to this the presentation of my project proposal has taken place, to what I believe successfully.

What is to be achieved?

I will now be awaiting the results of the presentation assessment. Throughout the week I will ensure that all tools and equipment required to do the job will be ready to commence.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:

Risk assessment



All employers must conduct a risk assessment. If you have fewer than five employees, you don't have to write anything down.

Company name: **Dŵr Cymru Welsh Water**

Date of risk assessment: 10/02/2019

What are the hazards?	Who might be harmed and how?	What are you already doing?	Do you need to do anything else to control this risk?	Action by who?	Action by when?	Done
Slips and trips	Staff and visitors may be injured if they trip over objects or slip on spillages.	General good housekeeping is carried out. All areas well lit, including stairs. No trailing leads or cables. Staff keep work areas clear, eg no boxes left in walkways, deliveries stored immediately.	Better housekeeping in staff kitchen needed, eg on spills. Arrange for loose carpet tile on second floor to be repaired/replaced.	All staff supervisor to monitor Manager	ongoing	10/2/19
Working with 415v in wet environment	Electrician and support staff	Isolating equipment by locking off supply. Warning signs put up.	Complete task as promptly as possible	Electrician	01/05/2017	n/a
Working over a flowing water channel	Fitter, public, Electrician or Ops Supervisor	Cordon off area ensuring no visitors will get near the installation		Electrician	01/05/2017	n/a

You should review your risk assessment if you think it might no longer be valid (eg following an accident in the workplace or if there are any significant changes to hazards, such as new work equipment or work activities)

For information specific to your industry please go to <http://www.hse.gov.uk>.

For further information and to view our example risk assessments go to <http://www.hse.gov.uk/risk/casestudies/>

Combined risk assessment and policy template published by the Health and Safety Executive DS/14



Replacing a float system with a level controller with 4-20mA output

Log Entry
17

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 68 Hours

Date: 29/01/2019

Description of Activities

Results of the presentation came back and they were sufficient to pass this assessment of the course. Even though we were due to start the installation phase this week, our Instrument tech was not in work due to illness. This led to the start of the job being postponed until next week.

What is to be achieved?

We anticipate our Instrument tech being back in next week. So more hours were spent this week completing the academic side of this project and catching up with log books and final report administration.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output

Log Entry
18

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 72 Hours

Date: 05/02/2019

Description of Activities

With the Instrument Technician back in the business following illness the installation phase of the project will begin. The first phase which needs to be completed is the housing bracket to hold the ultrasonic head in place in the well. This is made of stainless steel to prevent as much as is possible corrosion caused by the waste water in the well.

An image of the bracket which was constructed is shown on the next page.

What is to be achieved?

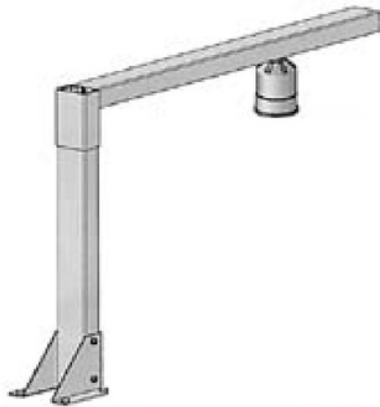
Now the bracket is in place we will remove one of the current float system (Hi level alarm) and use the current cable to draw through the new supply cable to the ultrasonic head.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____





Replacing a float system with a level controller with 4-20mA output

Log Entry
19

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 76 Hours

Date: 12/02/2019

Description of Activities

Using the float system cabling as a draw cable the new ultrasonic head has been attached to the newly installed bracket. Once the full installation had taken place the exact measurements of the well were taken in order to prepare for the entry of the parameters into the level controller once installed.

What is to be achieved?

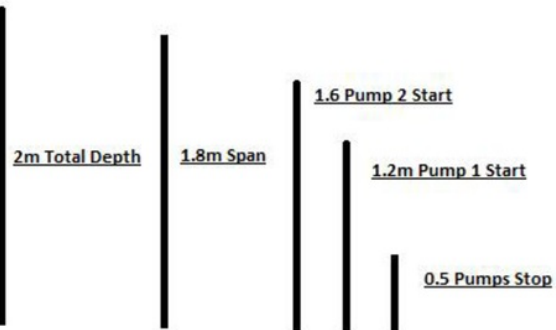
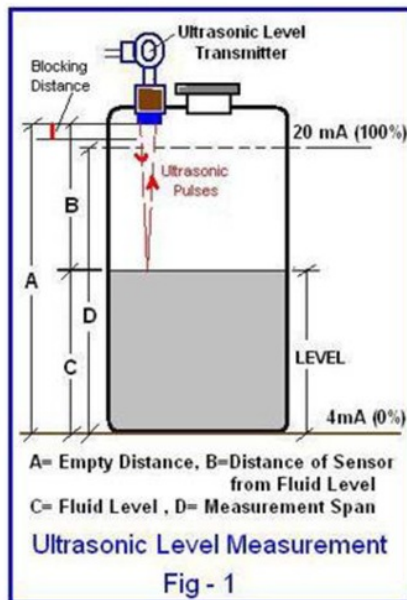
Next week we will install the level controller before we input the parameters and calibrate its options available from the relays. On the next page is a diagram showing the readings recorded.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:





Replacing a float system with a level controller with 4-20mA output

Log Entry
20

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 80 Hours

Date: 19/02/2019

Description of Activities

Due to unforeseen circumstances the level controller was not installed this week due to illness and will be completed next week.

What is to be achieved?

Pick up next week where left off. Installing the level controller.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output.

Log Entry
21

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 84 Hours

Date: 26/02/2019

Description of Activities

Due to technical issues occurring at another site, once again the level controller installation has had to be delayed. This will continue next week.

What is to be achieved?

Continued installation of level controller system.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output

Log Entry
22

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 88 Hours

Date: 05/03/2019

Description of Activities

Installation has been completed on the level controller. It has been connected to the mains supply and the ultrasonic head, and the span readings along with relay parameters have been added to the memory of the controller.

What is to be achieved?

Once the parameters have been entered and there is correspondence of the 4-20mA reading from the ultrasonic head to the level controller, connection to the smart hub telemetry system is required.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:





Replacing a float system with a level controller with 4-20mA output

Log Entry
23

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 92 Hours

Date: 12/03/2019

Description of Activities

With the controller working in conjunction with the ultrasonic head it was now time to connect the high level warning relay to the telemetry system. When this relay is closed at the high level set point it creates 10v closed switch which sends a digital alarm to our central monitoring team the smart hub. It is our instrumentation, control and automation engineer who set this relay up between the level controller and telemetry system.

What is to be achieved?

Next week another round of testing will take place to ensure the alarms are being read by the telemetry alarm system. This will be done by the assistance of the Automation, telemetry and control team.

SIGNED BY:

STUDENT:

LECTURER:

SUPERVISOR:



Replacing a float system with a level controller with 4-20mA output.

Log Entry
24

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 96 Hours

Date: 19/03/2019

Description of Activities

The automation telemetry and control team attended site for final testing on the device to ensure the correct signals were being sent to the monitoring team in our smart hub department. These were all confirmed and stored for their own records.

What is to be achieved?

With offline testing complete, we will monitor next week a period of time of online testing to ensure the relevant parameters are being used and realise energise when they are supposed to.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
25

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 100 Hours

Date: 26/03/2019

Description of Activities

After initial online testing with previous control methods in place, it was deemed the parameters chosen were not suitable for the well (pumping station) in question. After a series of online tests we adjusted the parameters and left the old control methods in place ready for further testing next week.

What is to be achieved?

Return next week to ensure a successful online test where the old control methods can then be removed.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
26

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 104 Hours

Date: 02/04/2019

Description of Activities

After this week's round of live testing it was determined that the new parameters installed were to a suitable standard for the continued success of the pumping stations requirements. Once these were signed off and recorded in the stations kiosk, the commencement of removing the old control system has started taking place.

What is to be achieved?

Next week the continued removal of the old control system will take place.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
27

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 108 Hours

Date: 09/04/2019

Description of Activities

Due to the tangling of some cables, the old control system could not be fully removed. This was a long and arduous task which needed to be completed adhering to strict health and safety regulations.

What is to be achieved?

Removal and final testing of pumping station under new control method

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
28

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 112 Hours

Date: 16/04/2019

Description of Activities

The final testing takes place after the completed installation and the removal of previous control methods is also finalised. The ultrasonic head put in test mode where figures are manipulated to ensure the relays come in as directed. The installation is commissioned and observations take place of the system in full auto mode controlling alarms and pumps.

What is to be achieved?

After the successful commissioning of the install, a revisit will take place next week to conduct follow up testing. This will happen on 2 occasions.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
29

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 116 Hours

Date: 23/04/2019

Description of Activities

First visit back to site after commissioning to ensure its continual functioning success. Ultrasonic head put in test mode where figures are manipulated to ensure the relays come in as directed. The site was then monitored to ensure successful operation in auto mode monitoring the well level to ensure pumps come in and switch off at their appropriate set point. This site test passed its inspection.

What is to be achieved?

A final revisit will take place next week to check the site and ensure its continued success.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____



Replacing a float system with a level controller with 4-20mA output

Log Entry
30

Log Entry Provided By Philip Hockin

Log Duration: 4 Hours

Accumulated Log Duration: 120 Hours

Date: 30/04/2019

Description of Activities

The site has been revisited to ensure its continual success during operation. The parameters are all operating correctly and the job has been successfully concluded.

What is to be achieved?

This report has now been concluded and submitted to the college for grading.

SIGNED BY:

STUDENT: _____

LECTURER: _____

SUPERVISOR: _____

10: ANNEX

Project Proposal

Lecturer: Rob Jenkins



**Replacing a float system with a level
controller with 4-20mA output.**

Philip Hockin

Contents:

- i) Where the project will take place.
- ii) Why this project was chosen.
- iii) Specification and procedures to solve the problem.
- iv) Problem solving time scale.
- v) Budget to complete the problem solving project.
- vi) The chosen solution of a possible three to complete the project.

i) Where the project will take place

This HNC project has been chosen to take place with my current employer Dwr Cymru Welsh Water. There are numerous benefits with completing the project with Welsh Water. Firstly, the project would be industry related and serve a purpose, It would be funded internally to complete the task which would enhance budget dealing abilities, although there is no direct assistance from college lecturers, members of the team in my industry will assist should any problems arise and finally should any issues arise with the project Welsh Water are available to look at any faults, analyse them and repair them along with completing any maintenance on the project.

ii) Why this project was chosen

A new level controller system needs to be installed at one of our pumping stations called Knoll Gardens Sewage Pumping Station.

At present there is a 3 float system in place. The lower float brings in Pump 1, the second float brings in Pump 2 and the third float operates an alarm. The alarm triggered to our SmartHub control desk, is a direct high level alarm. There has been issues as of late where this float has been faulty and has led to alarms being raised unnecessarily for the site. Also there has not been alarms sent out when the well has been dangerously high almost causing pollution incidents. The project I have proposed is an alternative method of monitoring the level of the well and alarms being raised.



As can be seen from the image on the left, the well has the three floats situated close together which can also cause tangling of the supporting cables. With human waste and other objects being disposed through the sewer system it can sometimes cause the floats to fail to tilt and make their connections. Also the vibrations caused by potential blockages may damage the float switches.

iii) Specification and procedures to solve the problem

There are several problems which arise at this specific location. They are:

- No level measurement.
- Failure of the alarm on high level, intermittently.
- False high level alarm when level is low.
- Wasted staffing resources attending site unnecessarily.

After reviewing the problems which arise at this site it was deemed that a functional alarm for a high level with telemetry alarm call out, would be most suited to the task. Showing the well level remotely.

There are 3 possible solutions for installing the control and alarm system should the level be so high. They are listed below:

1) New and Improved Float Switch



A float switch would be a cheaper option of the three possible solutions. The float switch would be fixed to the side of the inlet and when the flow gets to high it would trigger the normally closed switch allowing an alarm to be generated. This would be also the easiest system to install. It would however not be ideal for level monitoring remotely.

2) Ultrasonic Head & Level Controller



The ultrasonic head would be the most expensive of the three solutions. A bracket would need to be constructed over the inlet to house the level controller head. When the inlet flow reaches a certain level, the controller head would recognise this and send out an alarm to whatever parameters are installed. This would be a more all rounded solution covering the remote level monitoring and level control.

3) Level Probes



The level probes would be the mid ranged price of the options but these to have their limitations. Without knowing the amount to probes to use, an accurate level measurement would be extremely difficult. This option may cause issues similar to that of the current system. With certain objects appearing in the sewer system. It may make contact between the probes causing alarms unnecessarily.

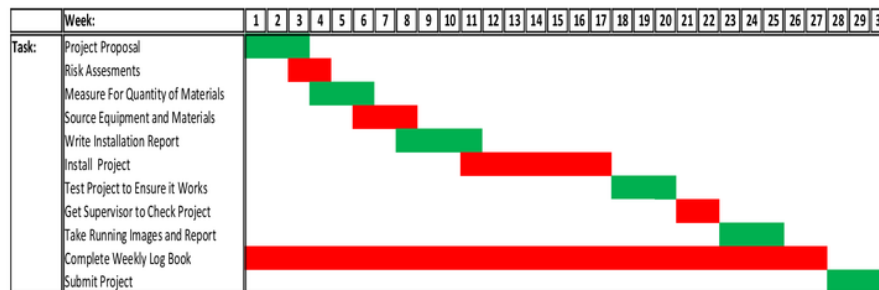
All 3 of these possibilities above are directly linked to a telemetry alarm system. When there is a requirement for an alarm to be raised, a signal will be sent to a central help desk called “SmartHub” within Welsh Water. It will be down then to the individual on the help desk to either raise the alarm, or wait for the morning shift to start to resolve the issue.



The 3 possibilities listed above, whichever selected, would still require to be completed within the appropriate timescale. The next section of this proposal will be a problem solving timescale.

iv) Problem Solving Time Scale

The time scale agreed, with the college and my employer is 30 weeks. The finish date for this project is projected at April 30th 2019. This should give me enough time to source the materials required and complete the necessary installation work. Below is a Gant chart with the proposed time scale of each element of the installation.



v) Budget to complete the problem solving project

To receive a budget for the for the possible solutions to the inlet problem the three possible options were taken to the operations supervisor. After lengthy discussions it was decided that the budget available for this project was £500.

vi) Chosen solution of the possible three to complete the project.

After lengthy discussions with my supervisor at Welsh Water it was decided that the solution which would be used is the Ultrasonic Head and Level Controller.



There are several reasons this method was chosen. The first being it's all round usefulness. Whereas the float switch would be used to send us out and immediate alarm, using the ultrasonic head we can monitor the level of the inlet in real time, and this can also avoid any unnecessary call outs where a resolution to the potential threat may not be necessary. This could also be achieved by the level probes, however with the delicacy

required of dealing with sewerage in a public place, the reliability and accuracy of the ultrasonic head and level controller was chosen.

The ultrasonic head and level controller option is within the budget available to me with this project. With the £500 on offer from my supervisor it was an option which was deemed cost effective, along with the potential long term savings on staffing charges.

10: References

Bibliography

Herman, S. (2009). Electric Motor Control. In Herman, *Electric Motor Control* (p. 119). Delmar: Cengage Learning.

Mutambara, A. (1999). Design Analysis of Control Systems. In Mutambara, *Design Analysis of Control Systems* (p. 12). USA: CRC Press LLC.

Roy, C. (1988). The Operation and Maintenance of Surface Finishing Wastewater Treatment Systems. In Roy, *The Operation and Maintenance of Surface Finishing Wastewater Treatment Systems* (p. 73). Orlando: Noyes Publications.

Philip Hockin Final Project & Log Books

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

51 /100

PAGE 1

PAGE 2

Text Comment. Contents would look more professional if you subdivided the main headings

PAGE 3

Text Comment. List of figures is clear and well presented.

PAGE 4

Text Comment. Avoid using first person terms

PAGE 5

Text Comment. Codes of practice followed

Text Comment. Environmental issues mentioned here.

Text Comment. Sustainability and recycling

Text Comment. Specification has all the relevant information and due to the industrial environment has to comply with relevant legislation regarding codes of practice.

PAGE 6

Text Comment. First person terms should be avoided. This part should be in an acknowledgement section.

Text Comment. A list of the components and a final budget value will do for this part.

PAGE 7

Text Comment. Must avoid first person terms in the report

PAGE 8

Text Comment. This belongs in an appendix and referenced from the main report

PAGE 9

Text Comment. Block diagram is good and shows how the system is configured.

PAGE 10

Text Comment. A good evaluation for this method.

PAGE 11

Text Comment. Good image of sensor operation.

PAGE 12

Text Comment. Good image of sensor at different levels.

PAGE 13

Text Comment. Arguments are good for each solution.

Text Comment. Table of comparison is good.

PAGE 14

Text Comment. Good evaluation and comparison for selection.

PAGE 15

Text Comment. Good use of Gantt chart

PAGE 16

Text Comment. Diagram is good and informative.

Text Comment. This should be in the appendix

PAGE 17

PAGE 18

Text Comment. Image is good and easy to follow.

PAGE 19

Text Comment. Good image

PAGE 20

Text Comment. Explanation is good apart from the use of first person.

Text Comment. The table of results shows the accuracy of the sensor

PAGE 21

PAGE 22

Text Comment. Environmentally friendly system.

Text Comment. Recycling where possible is good practice.

PAGE 23

PAGE 24

Text Comment. Conclusion is reasonable for the project and you have addressed environmental and sustainability issues. Recommendations have been put forward with contaminants such as budget and third party involvement.

PAGE 25

Text Comment. Good running log book showing work breakdown.

PAGE 26

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GRADING FORM: CSG-RUBIC

PHILIP HOCKIN

12

RESEARCH-INFORMED LITERATURE

The research is limited with no background



research. The report start out with the specification. There should be at least an outline summary and background to set the scene for the project. 3/10
The number of references is not enough for the report. There should more included in the research. 3/10

6/20

KNOWLEDGE AND UNDERSTANDING



The specification explains the requirements and has environmental and sustainability built in. However the solution should not be in the specification. 5/10
Solutions considered shows a good comprehensive understanding of what is needed for the system and alternative methods. The effort made here is good and you have offered three possible solutions with evaluations for each. 6/10

11/20

ANALYSIS



Testing and results is comprehensive and the alternative system has been justified. There has been a reasonable effort made in this section and underpins the understanding. 6/10
The conclusion does evaluate the outcomes in comparison to the spec. The recommendations are valid and the constraints for these are mentioned. 6/10

12

PRACTICAL APPLICATION AND DEP.



The planning for the project using Gantt chart is good but should include the actual timeline for comparison as well as an explanation. 2.5/5

15/25

Solutions considered are very good and explained well. Practical testing has been carried out on the chosen solution only but you have carried out a good evaluation of the two solutions which shows a good effort made. 6/10 Implementation has been completed for the chosen solution and explained well. 6.5/10

SKILLS FOR PROFESSIONAL PRAC.



The overall quality of the report could have been better. There is not enough research in the report and far too many first person terms used. There are also many spelling and grammatical errors. However there good technical points with evaluations. 7/15

7/15