1910602

by Jack Evans

A well written report which satisfied most requirements of the brief.

Extensive constructive feedback given.

Mark Agreed

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HNC PROJECT REPORT
06-H-101 HEATER UPGRADE (TDR'S)

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VALERO Coleg Sir Gar

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A good level of detail in the contents table

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List of figures is extensive for the project

1. Introduction

Reason for the project

Has taken place

06-H-101 is a heater on the Butamer unit. Research into potential solutions was taken place. Ideas which were looked at for the heater upgrade were as follows. Incorporating the timer delays for the purge system into the PLC programme. This will affectively make the system more efficient and up to modern standards. Instrument PM's were looked at to find any previous issues with the time delay relays. As seen below, there had been an issue where the timers were set incorrectly which could cause potential issues. This reinforces my project ideas to get rid of these delay relays and incorporate them into a PLC programme.

effectively

Do not use first person terms

Problem to be solved

The TDR's incorporated in the heater purge sequence were found to be switching at incorrect times during an instrument PM. This will be solved by incorporating the timers into a PLC sequence. This way, there will be no errors and it will meet modern industry standards.

Clear problem definition

Background information

To have a better understanding of the heater project, photos were taken of the heater system to understand how the instrumentation works and what is affected once the fuel and pilot gas valves shut, setting off the timer sequence.

Photos can be seen below;

Picture of the heater, along with the fuel, pilot, and fuel vent valve.



Figure 1- 06-XV-149 pilot gas



Figure 2- 06-XV-186A/B fuel gas and vent valve



Figure 3-06-H-101

To have a better understanding of the heater project, the P+ID of the heater was looked at to obtain all the instruments that run off it and what shutdown loops there may be. Looking at the P+ID, an understanding of how the heater will work/shutdown can be analysed.

In regard to the problem, this project will look at these possible solutions. Relay Timer Software is a programmable timer software to control relays according to a time schedule. The software can be installed on a server and will gather the timing for the purge from that system.

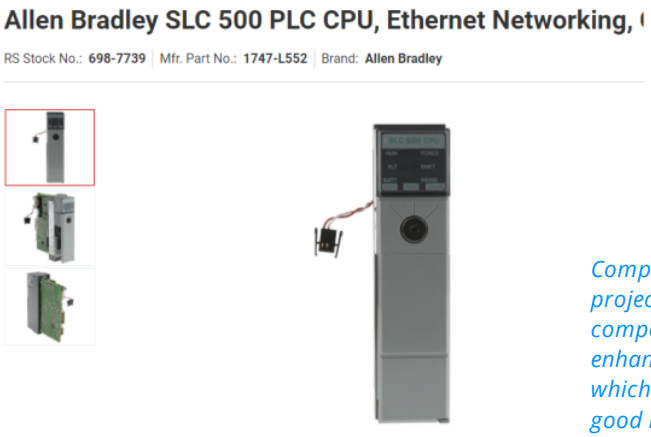
Another solution is to improve the current time delay relays. Time Delay Relays can be configured in accordance with different timing functions. Bright red and green LED's indicate whether the input has been triggered and if the output is active. This sequence would be timed during an instrument PM to ensure they match the exact timing required for the purging. These TDR's can be adjusted using the potentiometer.

Researched various components for project. Based on specifications, the following relays and PLCs were looked at to incorporate into project.



Figure 4- TDRs to be mounted (RS components, 2021)

TDR to potentially replace existing one can be seen above, digital interface, same range.



Components are valid for this project. The research of these components could have been enhanced with a simple case study which would have also provided good relevant reference sources

Figure 5-Potential PLC to be used (RS Components, 2021)

To match site standards, the PLC to be used is as pictured. This will be programmed using software at Valero.

2. Specification

Project achievements

The main aim with this project is to create a successful PLC programme including the time delay relays which can be directly inputted to the field. With succession of the project, the PLC can be mounted in a cabinet in the rack room, and the relevant instruments and trip amps can be inputted where necessary.

Customer/user needs, expected operation, maintenance, and reliability requirements

Expectations of the project:

To provide indication of when a trip has activated. Should alarm an operator to visually see on DCS. Relay a signal back to the control room to bring in an alarm when met.

Performance:

The following steps are to be adhered to, to ensure that the system works effectively and also in a timely manner. The steps are all listed below:

1. The system will provide adequate time to sufficiently bring in an alarm to reveal that the heater is in a trip state.
2. The timers will allow enough purging of the heater to avoid potential danger.
3. IPC Honeywell software used as this can be easily inputted using site equipment.
4. This process will be simulated on a PLC programme. This will automate the onset of a trip in conjunction with the relevant instrumentation.

Environment

1. Weather would not affect this project as it would be situated and created indoors.
2. Noise levels created by this project should not exceed 90dB at a distance of 1m away from project.
3. Corrosion resistance of materials will have to be considered because of the constant presence of lube in the system.
4. **Product Life Span**

1. Product will be expected to be on site and running until a relevant upgrade project, product will be tested every yearly to check functionality.
2. Spare parts will be available for a further 3 years following this.

Life in Service

1. Should withstand operating hours 24/7 without fail.
2. Throughout product life span, project should be assessed against the performance criteria noted above.

Target Costs

1. Overall cost of the system should not exceed £800, as most components that make up the system can be found in work. The PLC will be a recycled one, the cost will come with the trip amp and relevant instrumentation.
2. No manufacturing cost as it is getting simulated.

Quantity

1. This is a one-off design required for a specific purpose.

Maintenance

1. Require planned preventative maintenance every 3 months.
2. Prior to use, alarms should be checked.
3. Additional visual checks carried out.
4. No special tools should be required for maintaining the product.

Marketing

1. Product will be marketed as a one off initially, however more could be created if needed.
2. Product will be used as a template for simulation.
3. Summary of market requirements: TDRs included in software and relevant trips to activate relevant I/Os.

Packaging

1. Product will be transported in a wooden container to the rack room.

Size/Weight Restrictions

1. The size and weight should not exceed 50kg and no wider than 2 metres long as this is to be fitted in a cabinet in the rack room.

Manufacturing Processes

1. No manufacturing required as hardware used is recycled.

Quality and Reliability

1. Quality of components should be of a standard that they do not fail within 5 years.

Standards

1. Following site standards to be adhered too:
    - BS 2754 Electrical Insulation
    - BS EN 60079-22-2 explosive atmosphere regs.
    - CTEMS-INST-MGT-1

- DEP32.80.10.10Valero
- CTEMS 4.2.1
- ATEX regs
- BS 6105 and BSEN 20898(1) Bolts

H+S requirements

The 'Health and Safety at Work Act 1974' applies to this project as the employer and employee has responsibilities to carry out this project safely. For the employer, these include, "provide information, training, instruction and supervision - ensure staff are aware of instructions provided by manufacturers and suppliers of equipment and provide a safe place of employment" (The Royal Borough of Kensington and Chelsea, 2021). The employee has a responsibility to adhere to these rules and respect any equipment given to them.

Another requirement is to stick to the 'Provision and Use of Work Equipment Regulations 1998'. "This means any activity involving work equipment and programming". (HSE, 2021)With this project, software will be used to programme the PLC needed to meet the project requirements.

Environmental protection and sustainability

All waste materials will be collected and separated to minimise the effect on the environment. On site, there is an efficient recycling system where all types of materials such as plastic, wood and metal can be separated and brought the relevant recycling centre. Also, all electronic waste can be recycled using the WEEE principle. "The purpose of the Directive was to set targets for the collection, recovery and recycling of waste electrical and electronic equipment across Europe and divert volumes of waste electrical equipment from landfill" (complydirect, 2021)

Another improvement with electronic components is that companies are improving the lifespan of their products. By improving the lifespan, less material is needed which overall creates a more sustainable environment.

There are many sectors that have to comply with the specification and these are probably down

3. Planning

Gantt Chart

The project has been planned using a Gantt chart. This chart can be seen figured in the appendix. The Gantt chart reveals all the dates the relevant tasks have to be completed by in order to stay on track. The actual completion date is also noted.

There are two main testing stages required during the project. This includes initial testing before the trio amp and transmitter is added. This is to confirm the software is correct before additional instruments added. The 2nd stage of testing includes all the associated instruments/ equipment. The trip amp and transmitter will be set up in reference to the associated documentation. Once these are added, a simulation of the sequence can be carried out to ensure the correct functionality.

On the Gantt chart, it can be seen that all deadlines have been met and the majority of it has been completed early. This is due to the fact of a turnaround at Pembroke refinery. The shutdown required the author to participate in a busy few months of work meaning that the project had to be completed early so it could be finished without any interruption. Therefore, all the design and testing stage of the project was completed before the end of February 2021. With current progress, the original timescale should be adhered too. This will only be achieved by ensuring that good organisational and time management skills were used throughout the construction of the solution.

A necessary explanation of the timeline and reasons for the abnormalities in the sequence of events.

4. Solutions considered

The main problem is down to the unreliability of the timer delay relays associated with the heater. As proven, these do not always function correctly. The risk with this issue is the potential for the heater to explode due to insufficient purge time. To address this issue, the following solutions will be looked at.

- Upgrading the current TDR's
- Incorporating the TDR's into a PLC sequence – Allen-Bradley
- Incorporating the TDR's into a PLC sequence – IPC Honeywell

Possible solutions are identified

Modern TDR'S were researched thoroughly and it was decided that the best option was the 'RS PRO Multi-Function Timer Relay'. This was a suitable replacement as it has the same range as the previous one and can be adjusted on the digital interface. Being a digital interface, this avoids fellow workers accidently adjusting the TDR's by knocking them. The existing model has a dial on the front which causes the potential for this to occur.

Installation time

With each option considered, the TDR replacements would take minimal time as these can be directly swapped for the existing TDR's. These would have to be loop tested to ensure they function with the current system.

Cost

The cost of each solution is as follows,

- RS PRO multi-function timer relay - £81.06 (exc. VAT) per unit. Two are needed so this would be £162.12 (exc. VAT).
- Allen-Bradley SLC 500 - £6696 (exc. VAT)
- IPC Honeywell – disinvested to buy. However, disused ones on site which can be used.

Availability of parts

For the RS PRO relays, these can be ordered directly from 'RS components' and should arrive without delay.

For the Allen-Bradley SLC 500, this can be ordered directly from 'RS components' and should arrive without delay.

For the IPC Honeywell, this is readily available on site and can be implemented straight away.

Reliability

The RS PRO TDR's reliability would yet to be tested. These would have to be inputted into service and maintained regularly to prove their reliability.

The Allen-Bradley SLC 500 has proven to be a reliable modern PLC. Being a well trusted brand, they provide an optional solution to the project problem, however, at a heavy cost.

The IPC Honeywell PLC has been used in industry for 20+ years proving its reliability. Speaking to experienced technicians on site, they can back the IPC to be a viable option for the project problem.

Chosen Solution

Having analysed each of the three solutions, it has been decided that the best option is the IPC Honeywell. The fact that it is readily available on site means it can be implemented immediately. It also comes at a small price as all the software and hardware is situated at Valero. The final deciding factor to choose this PLC was the fact that many colleagues back the use of these.

The solutions considered should each have a section with their own heading and these should be individually researched with reference to reference sources.

An evaluation table would have been the better method to justify A chosen case study or solution examples from industrial applications should have been included which would have given good relevant reference sources.

5. Final solution and implementation

The final solution was to use the IPC Honeywell software situated at Valero and build a PLC programme to incorporate the timers as part of a sequence. This way, minimal error would occur with the trip sequence of the heater as the timers within the programme cannot fail.

Initially, it was researched to use the Allen-Bradley PLC as this was the most modern PLC situated on site. However, due to ease of access and knowledge of the IPC system, it made sense to use this software. By using the IPC Honeywell software, the majority of the work could be completed before the turnaround maintenance event in work which would constraint my time to complete the project.

Firstly, all the information associated with the heater 06-H-101 was gathered so the appropriate inputs/outputs could be identified. The perfect way to identify this information was to thoroughly analyse the P+ID. This P+ID can be seen below.

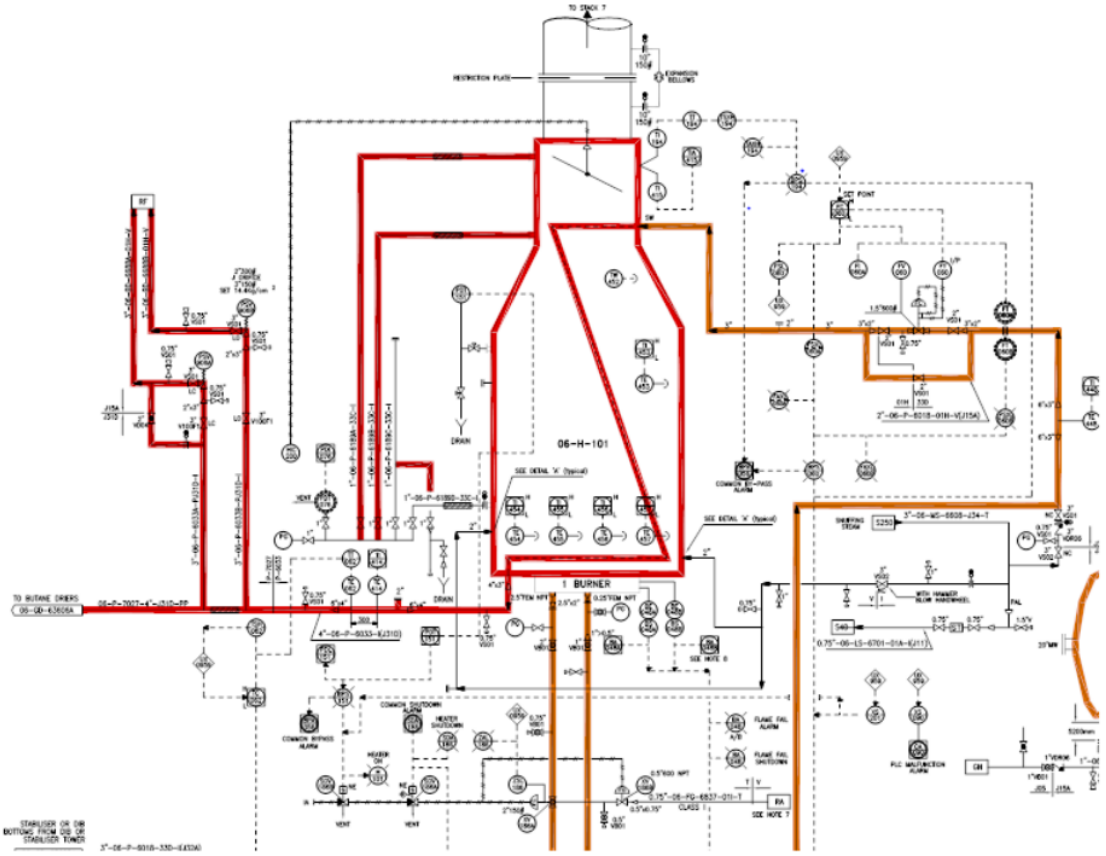


Figure 6- 06-H-101 P+ID

The following instruments and loops can be identified from the P+ID:

Fuel gas XV / fuel gas vent

Pilot gas XV

Once flame eye scanners are removed (both), this sets off the timer sequence to close the XV's. Time delays reset the pilot and fuel gas XV's at specific times to ensure the heater has been sufficiently purged.

If low fuel gas pressure detected (06-PT-56), the pilot and fuel gas XV's close.

06-TSXH-194 is a high temperature shutdown which will activate the SOV's to shut the pilot and fuel gas XV's.

When instrument PM's are completed, there *are* is bypasses for these shutdowns which means that checks can be carried out without the heater actually going into shutdown state.

06-FT-060A/B will shut down the heater if there is a low flow going through the heater. A low flow of product means that the heater would become damaged as there is no product flowing through.

A good explanation of implementation which is consistent with the log book

The relevant input and output cards were slotted into the rack. The necessary power module was researched as multiple modules are associated with this particular rack. The rack I needed was a 620-0043 module.

A control module was also fitted so the IPC software could communicate with the hardware.

A photo of the completed rack can be seen below.



Good image to support explanation

Figure 7-IPC Honeywell PLC rack

After the PLC was built, the logic was created. The main purpose of this assignment was to include timers within the logic. This would then be part of the sequence for the heater. All the associated inputs, outputs and internal addresses were tagged in accordance the IPC software. The list of the addresses can be seen below.

Inputs:

1. Start Button
2. Stop Button
3. Reset
4. 06-TT-194
5. 06-PDT-151
6. 06-FT-060A
7. 06-FT-060B
8. 06-BE-048A
9. 06-BE-048B
10. 06-PT-056

Outputs:

33. Alarm A
34. Alarm B
35. FG SOV 186A
36. FG SOV 186B
37. PG SOV 149

Internal addresses:

111. Start Flag
112. Timer Flag
113. FG Timer output
114. Output to FG flag
115. FG Timer Reset
116. Valves closed
117. Healthy state
118. PG Timer Output
119. Output to PG Flag
120. PG Timer Reset
121. High temp trip flag
122. High pressure trip flag
123. Low flow A trip flag
124. Low flow B trip flag
125. Flame out flag 1
126. Flame out flag 2
127. Flame out trip flag
128. Low pressure trip flag
129. Trip A
130. Trip B
131. Trip C
132. FG Done
133. PG Done

The completed IPC logic can be seen below.

```
                HONEYWELL      623-60  MS-DOS      620 LOADER
                                Version 5.4
                                      P4
                             Mon Jan 18 14:05 2021

          +-----------------------------------------------------+
          ! Title: HNC PROJECT   06-H-101 UPGRADE
          +-------------------------------------------+---------+
          !                                                     !
          +--------------+--+----------------------------+---------+
          ! Date:  19/01/21      !  !Programmer:  JACK EVANS
          +--------------+--+-----------------------------------+
```

Start Sequence

Each of the contacts below are labelled in reference to the numbered list of addresses on the previous pages.

Here we have a NO start button in an OR gate with the start flag. If the start is pressed, and no stop or active trip is in, then the start flag will output.

```
     1          2        131                                    111
+---] [---+---]/[-------]/[-----------------------------------( )--+
!          !
!
!          !
!
!          !
!                                 Ladder logic is explained
!          !
!
!          !
!
!   111    !
!
+---] [---+
```

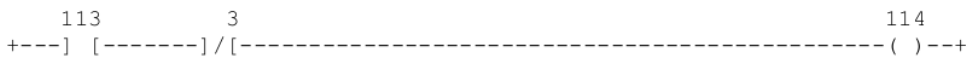
Reset Sequence

This rung consists of the start flag going to the reset in an OR gate with the timer flag. This reveals that In order for the sequence to start, the start and reset have to be pressed.

```
   111          3                                                112
+---] [---+---] [---+-------------------------------------------( )--+
          !         !
          !   112   !
          +---] [---+
```

Fuel Gas Timer Output

This rung consisted of the FG timer output, with a NC reset contact, which go to coil 'output to FG flag'. This will output once the timers have completed. The use of the NC reset is to stop the output to the coil which will stop the sequence if pressed.



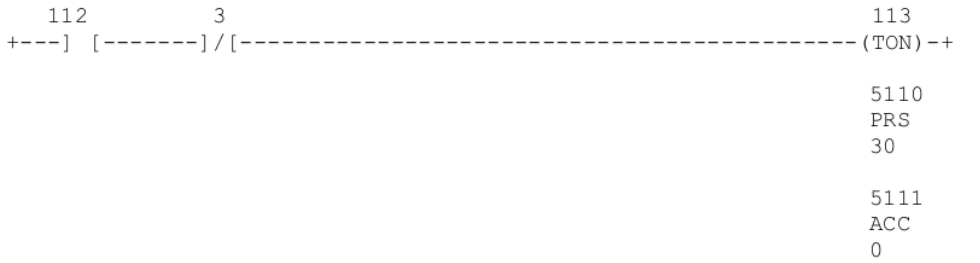
Pilot Gas Timer Output

This rung consisted of the PG timer output, with a NC reset contact, which go to coil 'output to PG flag'. This will output once the timers have completed. The use of the NC reset is to stop the output to the coil which will stop the sequence if pressed.



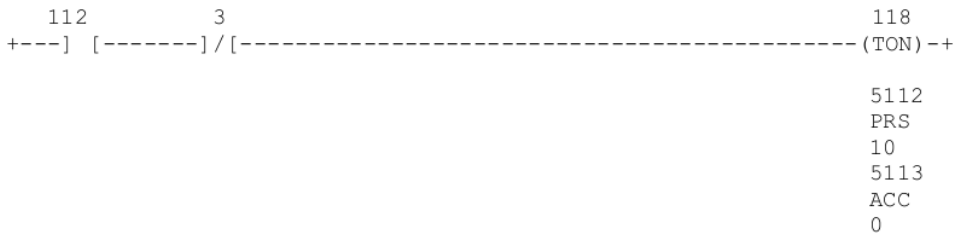
Fuel Gas Timer

This rung consists of the timer flag, with a NC reset, and the fuel gas timer. Once the sequence has started, this will output to the timer flag, and with no reset in, the timer will start. The timer has been pre-set to 30s as required per the instrument PM. The 'ACC' on the timer is the actual count which once completed, will output. '5110' and '5111' represent the internal timer addresses.



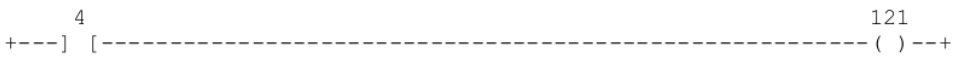
Pilot Gas Timer

As before, this rung represents the pilot gas timer. It consists of the same logic but with the relevant addresses. These Timers represent the main solution to the initial issue. These timers eliminate the need for the time delay relays.

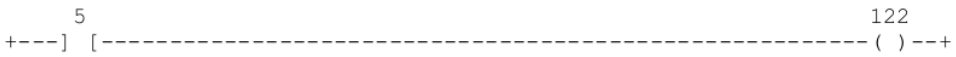


Instrument inputs

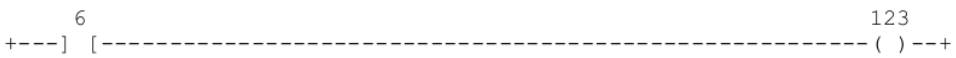
06-TT-194 input going to the high temp trip flag.



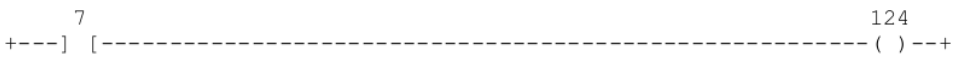
06-PDT-151 input going to the high-pressure trip flag.



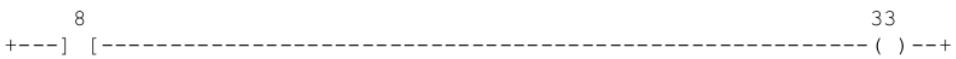
06-FT-060A input going to the low flow A trip flag.



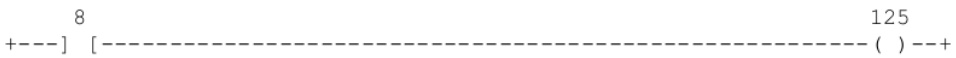
06-FT-060B input going to the low flow B trip flag.



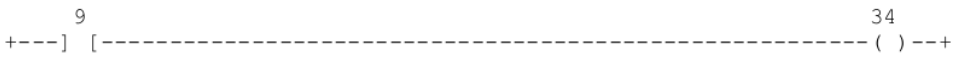
06-BE-048A input going to the alarm 1 output.



06-BE-048A input going to the flame out flag 1.



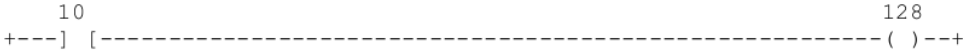
06-BE-048B input going to the alarm 2 output.



06-BE-048B input going to the flame out flag 2.

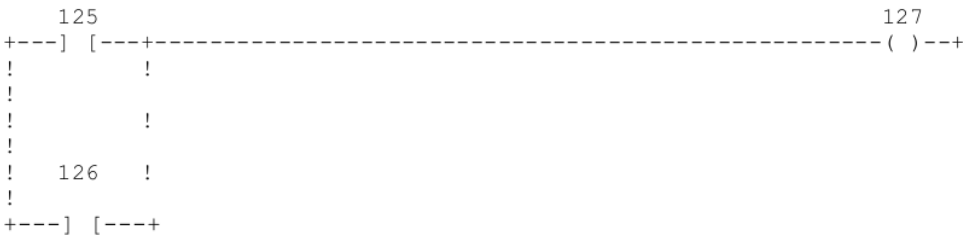


06-PT-056 input going to the low-pressure trip flag.



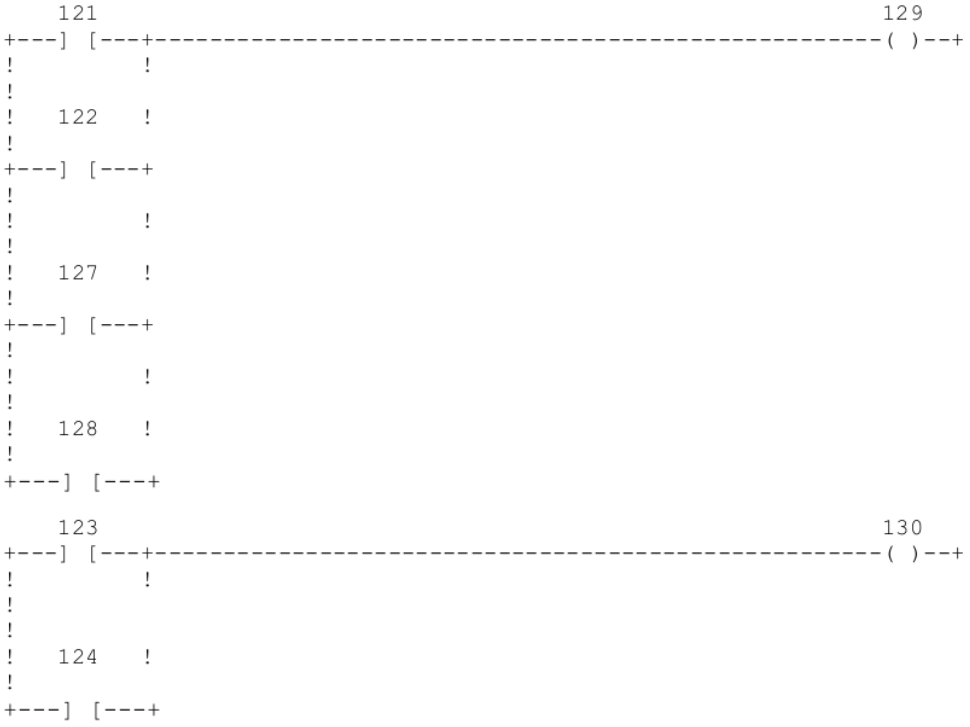
Flame Out Trip

The heater set up requires a trip if both flame eyes drop out. Both flame out flags can be seen below going to the trip flag.



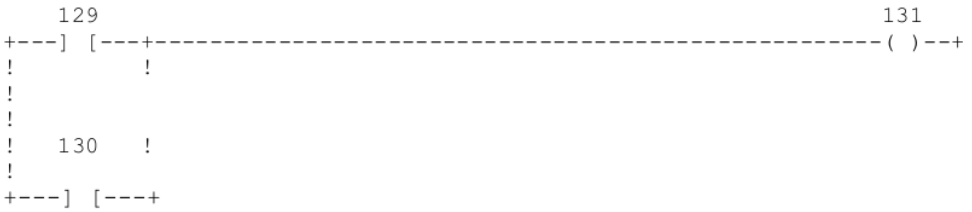
Trip flags

This rung consists of the instrument trip flags going to the actual trip coils. The trips were separated A and B as the software only allows 4 contacts per page. If either of the trip flags come in, then the trip will output.



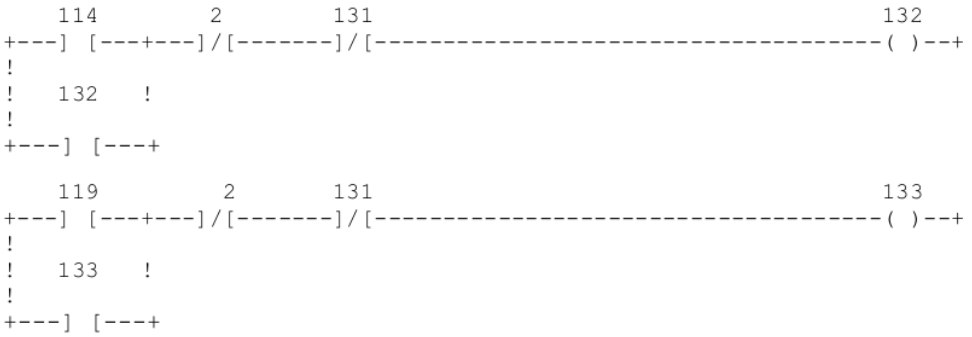
Final Trip

If either of the trips A and B initiate, then this will bring in the coil trip C which starts off the trip sequence.



Fuel and Pilot Gas Sequence

This rung consists of the various state's certain aspects of the heater have to be in before the output to the FG/PG done flags. If the timer is complete, and either the stop or trip is in, then the coil will energise.



SOV sequence

These rungs consist of the states which are required for the SOVs to initiate. If the start has been pressed and the FG/PG sequence is complete, then the SOVs will initiate. Upon a trip, these de-energise causing the valves to react to their fail states. Fail close for the FG and PG and fail open for the FG vent.



The logic sequence is explained and follows the PLC ladder logic

6. Testing and Results

Initial testing was carried out by connecting the laptop with the software, directly to the PLC rack through a comms cable. This initial testing was carried out by directly applying 24v onto each input to ensure the sequence functioned correctly. Any problems found have been addressed as seen below.

Initial Testing

After initial testing, it was found that the SOVs would reset upon the stop being pressed and then the start being pressed. This should not happen unless the reset has been pressed. Evidence of this issue can be seen below.



Figure 8-SOV issue

Problem has been identified

Stop button being pressed.



Figure 9-Stop input being pressed

SOVs resetting upon start being pressed.

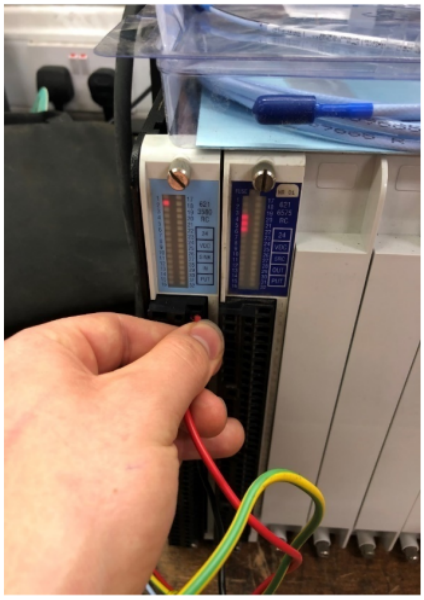


Figure 10-Reset being pressed

This problem was solved by adding stops to rungs 22 and 23. Originally, it was found that once the stop was pressed, the valves would re-open upon pressing the start. By adding NC stop logic at these rungs, the sequence will only start when the reset is pressed and the purge sequence has been completed.

The following images reveal the PLC functioning correctly. All the logic will be portrayed, replicating what would happen upon a trip to the system.

Start being pressed and logic:

Problem resolved with image to support the evidence

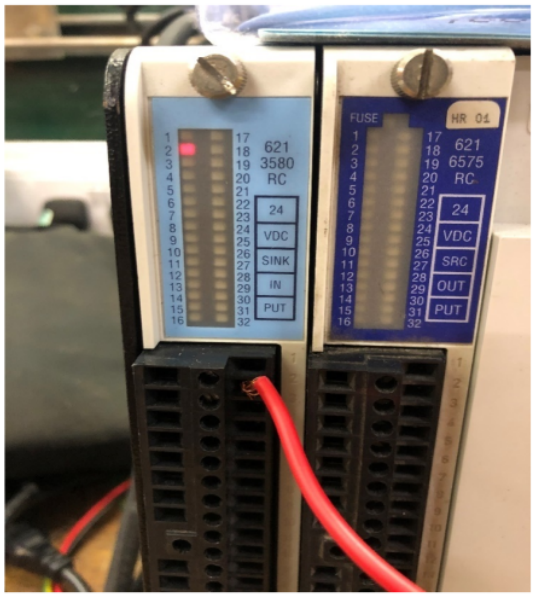


Figure 11- Start input

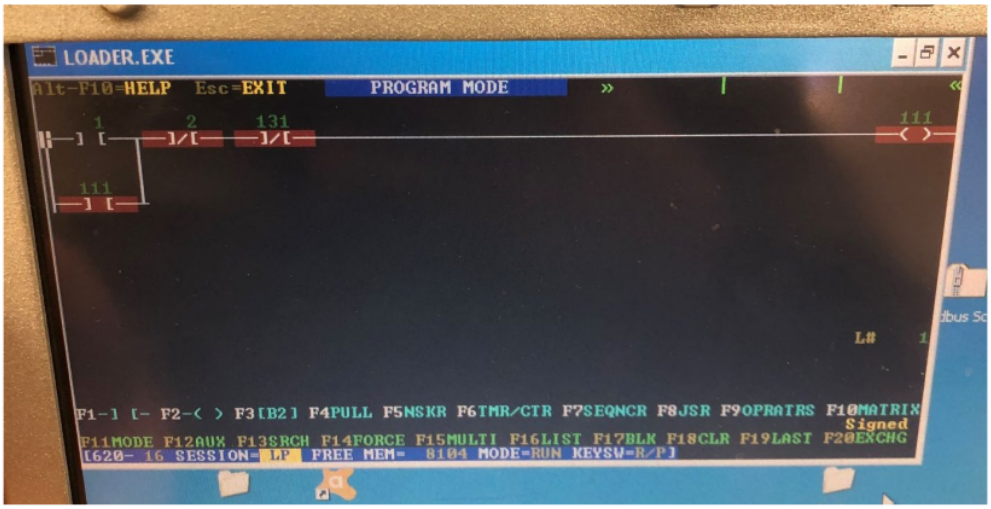


Figure 12-start logic

Reset being pressed and logic, this will start the sequence:



Figure 13-reset input

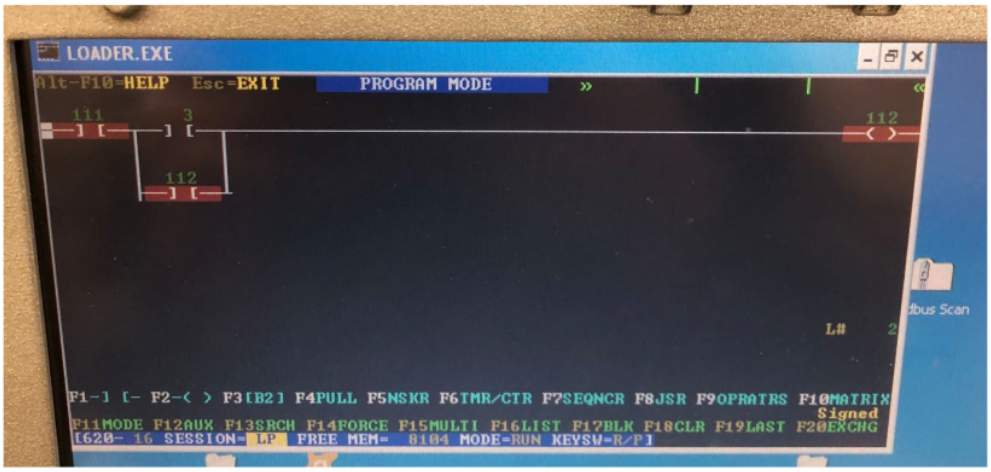


Figure 14-Reset logic

Pilot Gas timer activated which then outputs to SOV149 as seen below:

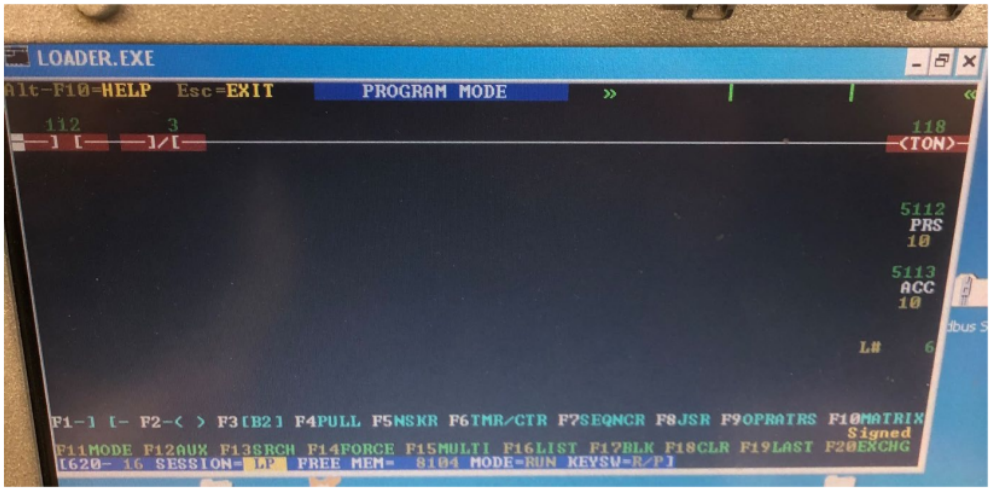


Figure 15-Pilot Gas timer complete



Image showing sequence started

Figure 16-Pilot Gas outputting

Fuel Gas timer activated and SOV186A and B both outputting.

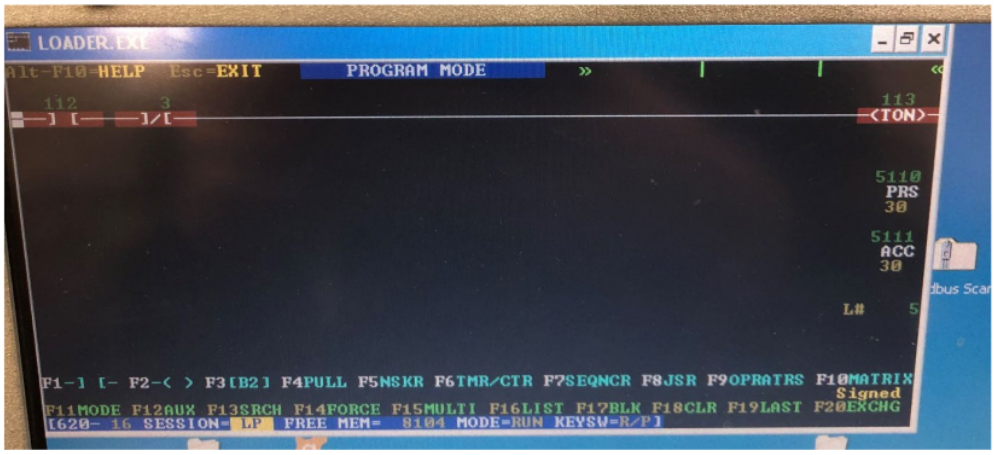


Figure 17-Fuel Gas timer complete



Figure 18-Fuel Gas and vent energised

With all the SOVs energised, the next step is to bring in a simulated trip, this is done by connected straight onto the input terminal. For this example, a high temperature trip is used.

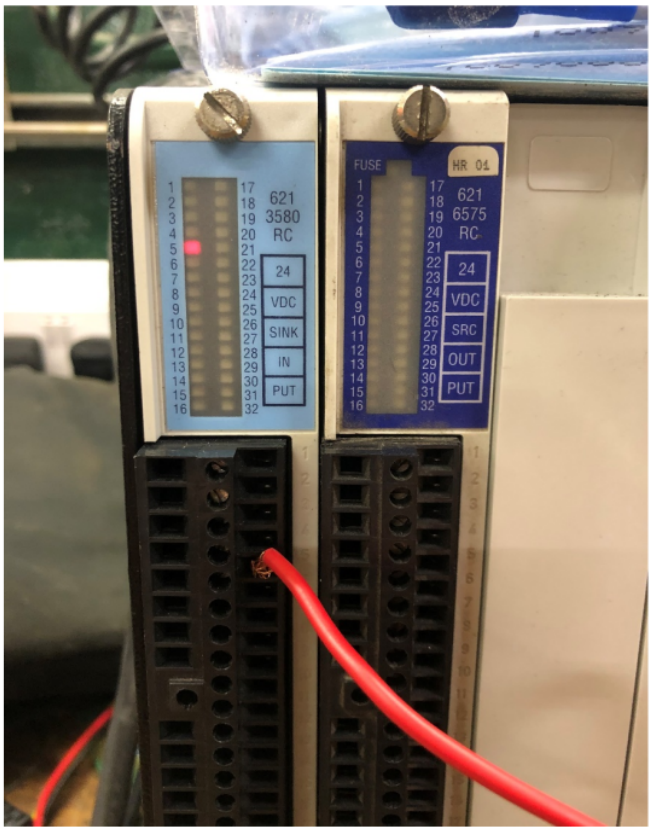


Figure 19-Temp trip

The timers latch and stop outputting as seen below.

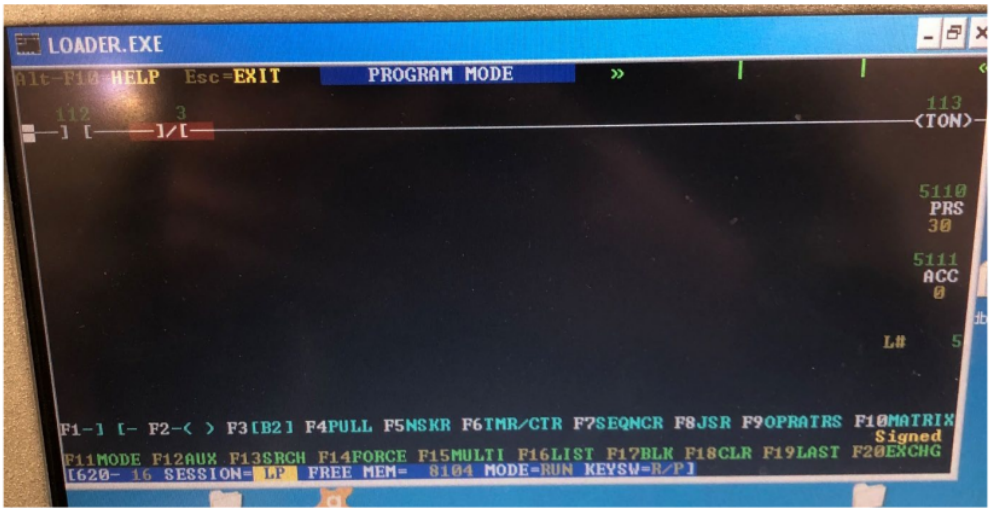


Figure 20-Timers latched

The next images reveal the sequence upon a trip. This shows the trip flag energised, which energises trip A which energises trip C.

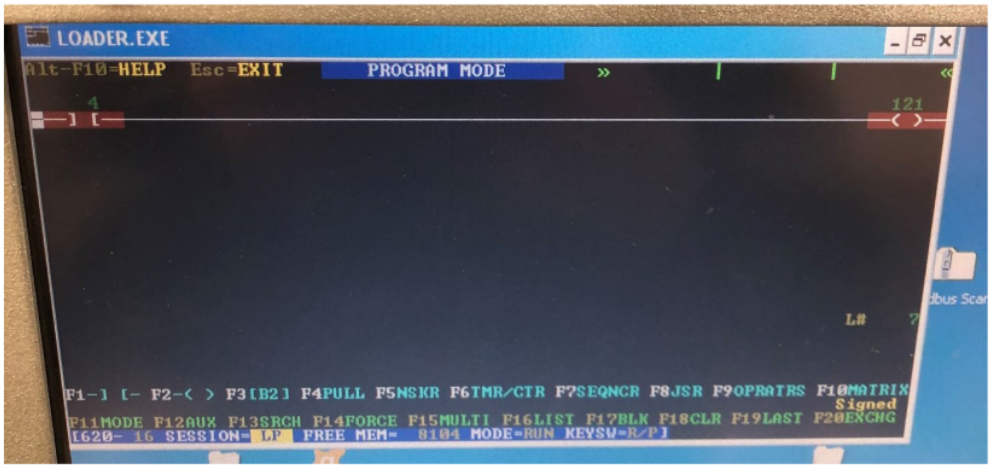


Figure 23-temp trip flag

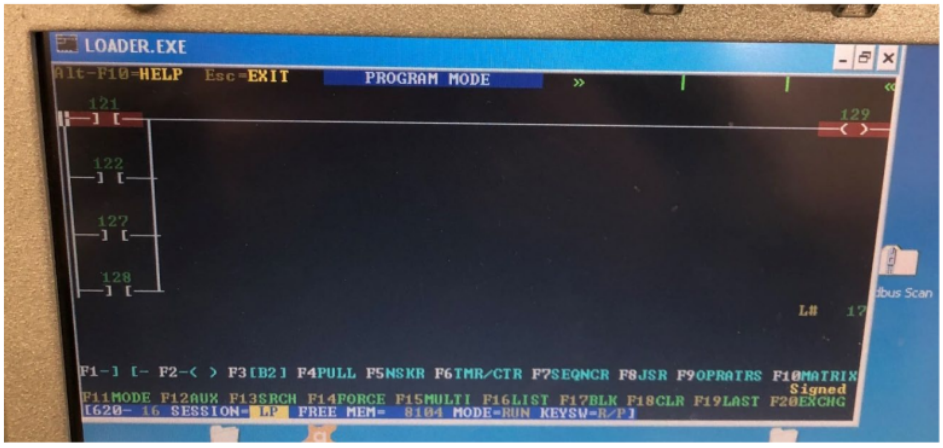


Figure 22-Trip A

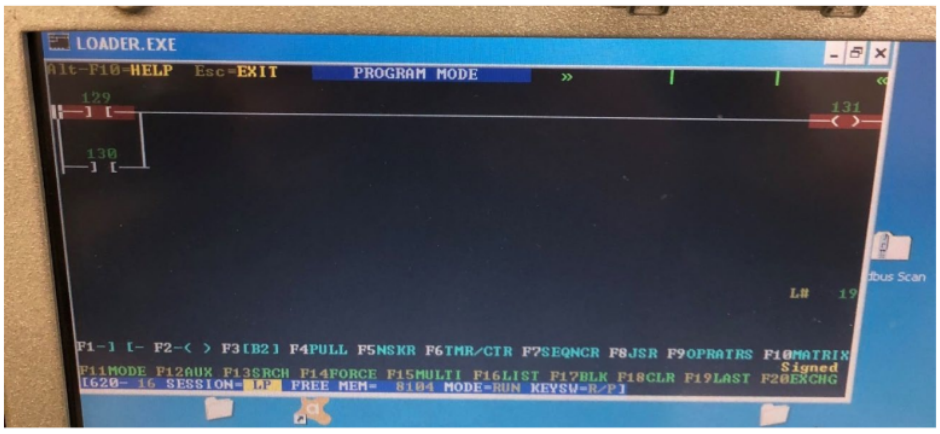


Figure 21-Trip C

Upon trip C coming in, this latches the rung which allows the SOVs to energise to their fail states.

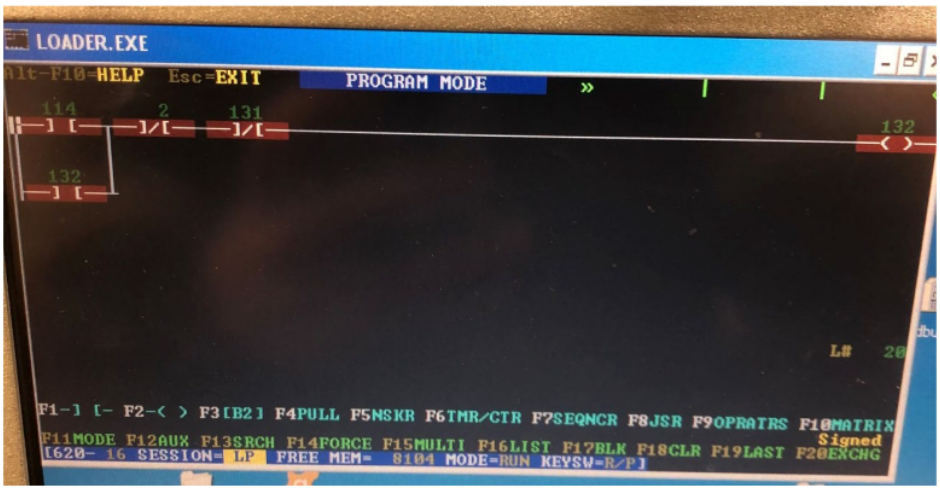


Figure 24-SOVs energised to fail states

Fuel Gas valve fail state is closed.

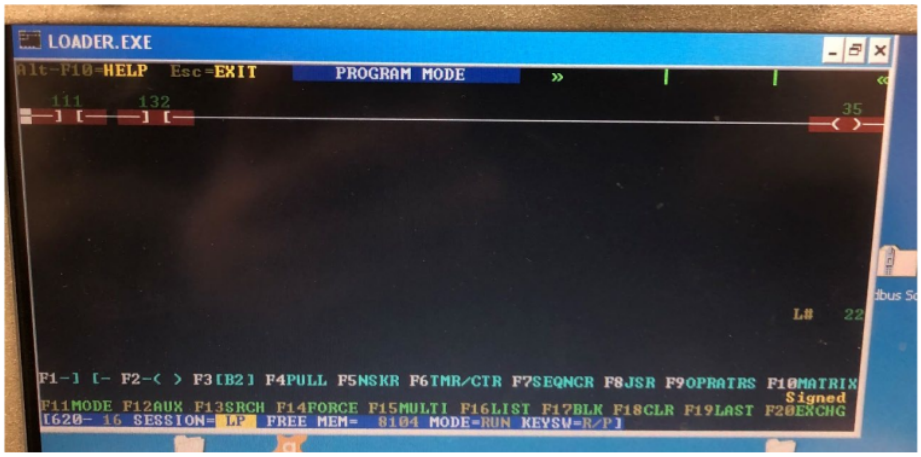


Figure 25-Fuel gas fail state

Vent valve fail state is open.

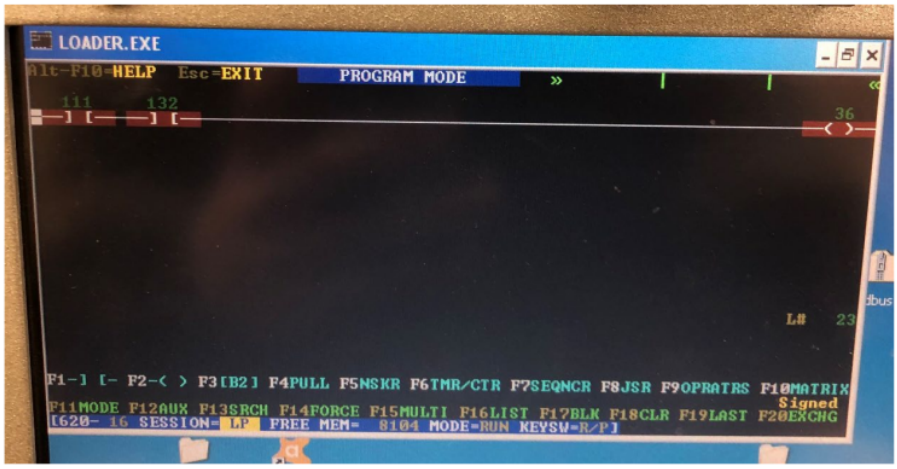


Figure 26-Vent valve fail state

Pilot Gas valve fail state is closed.

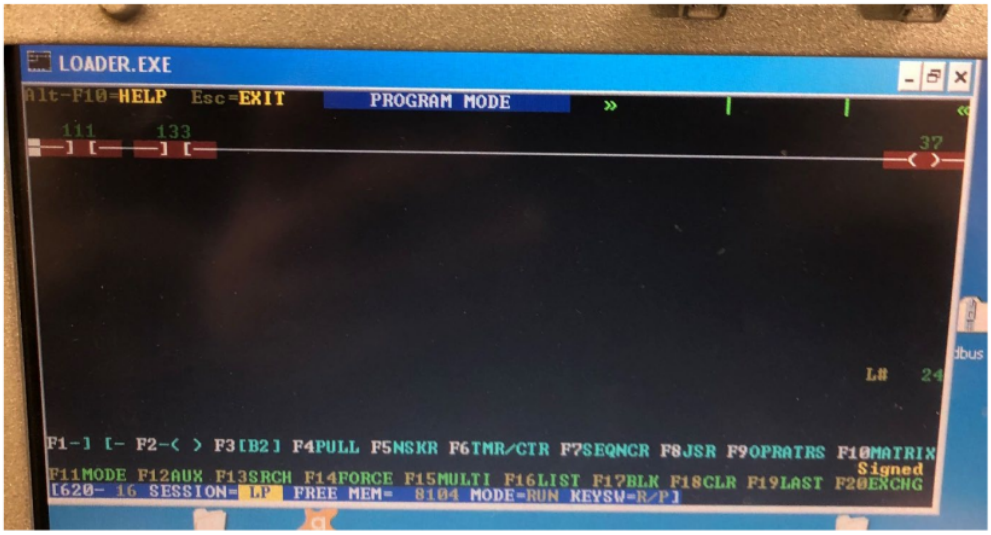


Figure 27-Pilot gas fail state

Sequence has been completed and no errors are prese

The next part of testing was to include the full set up of a transmitter, trip amp and the PLC. The first equipment to set up was the transmitter. For an example, this transmitter was set up to replicate the flow transmitter 06-FT-060A. This instrument was chosen as all the relevant information regarding the flow could be accessed by the metering system.

06-FT-060A can be seen below. This TX was selected as it had the required range. This transmitter could then be used for the simulation.



Explanation is clear

Figure 28-06-FT-060A TX



Figure 29-TX information

The flow transmitter was chosen for an example as all the relevant information regarding its range etc could be accessed using the metering system. The flowing information was used to set up the TX.

follo wing

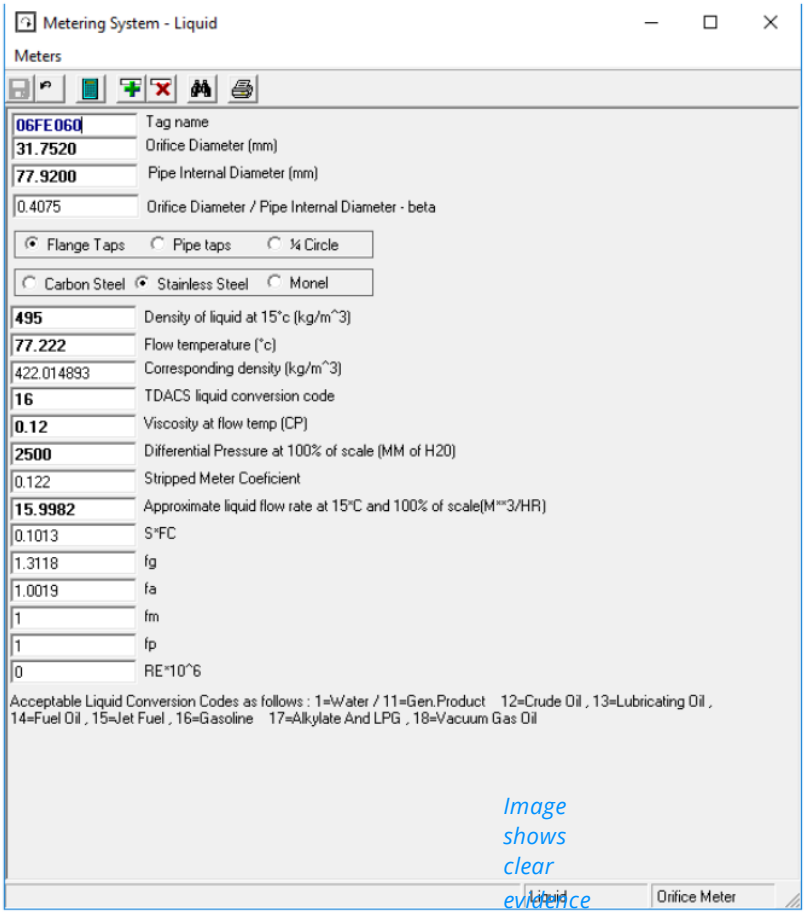


Figure 30-Metering system for flow information

Image shows clear evidence of flow transmitter configuration

The orifice plate has a diameter of 31.75mm.

This equates a diff pressure at max flow rate of 2500mmH20, therefore, the transmitter will be ranged from 0-2500mmH20.

The max flow in the pipe is 16M^3/HR. with this figure, the flow rate and mA output can be worked out.

For the low flow rate trip, this is to be set at 2M^3/HR. This equates to 12.5% of a 16M^3/HR. As the transmitter is to be square rooted in the head, the following calculations are carried out.

(0.125 x 16) + 4 = 6mA

(0.125^2) = 0.015626 *Good explanation*

0.015626 x 2500 = 39mm/H20.

These figures will be inputted to the transmitter. The set point on the trip amp will be set to 6mA. The trex device is used to set up the flow transmitter. The trex will also be used to simulate a reading. This can be seen below.



Image supports the explanation

Figure 31-TREX device connected to TX

The following documents were used to set up the trip amp. These documents explain how to go through the settings on the interface in order to set up a trip. They also illustrate where the power and transmitter should be connected to. This will then be inputted into the PLC.

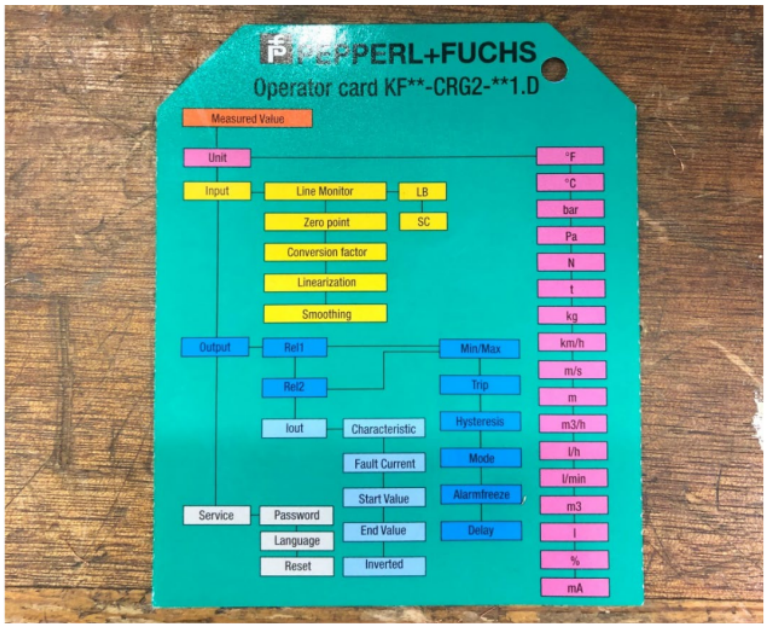


Figure 32- Trip Amp operating card

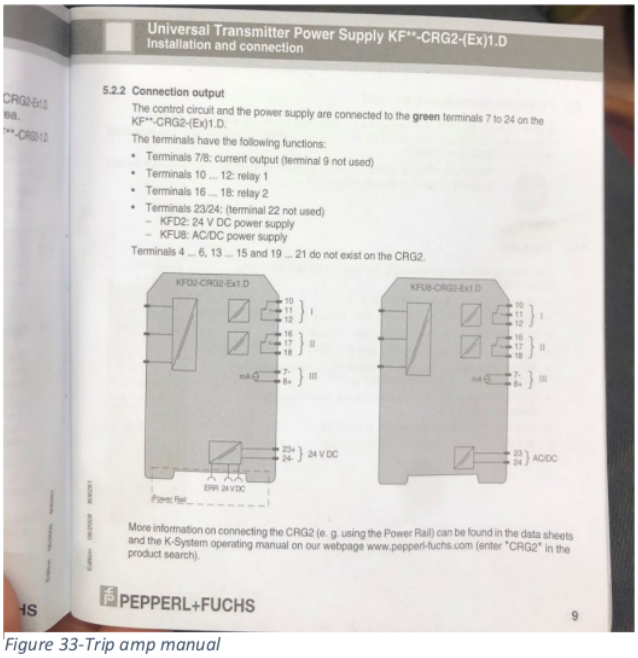


Figure 33-Trip amp manual

Once set up, the TX and trip amp were inputted. The full loop can be seen below.

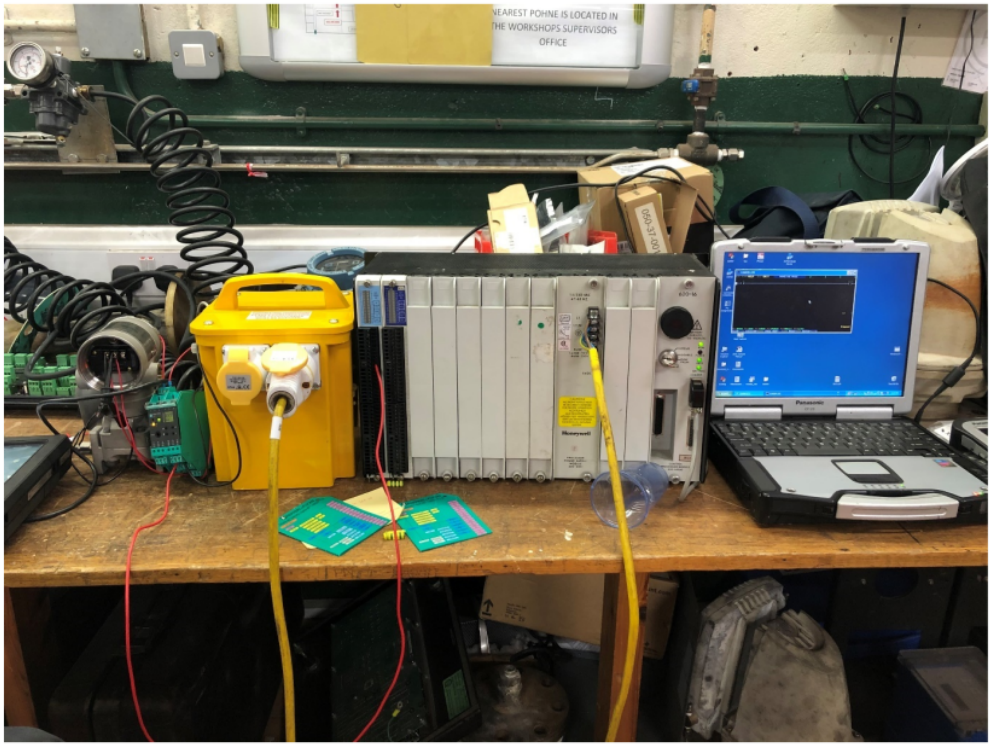


Figure 34-Final set-up

Good image of system under test

From left to right. Flow TX, trip amp, PLC, IPC software.

With everything now in place, the PLC was set to run, and a simulation was to be carried out. Once the logic had completed its timing sequence, the system was in a healthy state as seen below.



Figure 35-Healthy state-valves energised

The trex was then used to simulate a reading of 10mA which is above the trip.

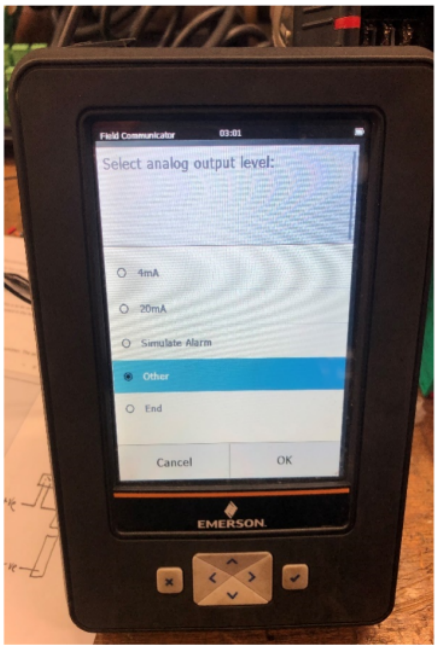


Figure 36-Trex 10 mA simulation

Trip amp reading simulated value.



Image supports explanation and test result

Figure 37-Trip Amp reading simulated value

The trip amp was then simulated below the trip value of 6mA. The trip amp can then be seen to 'output' which energises the input.



Figure 38-Trip amp outputting once below trip value

The input is now energised as seen on the input card. The outputs have also activated meaning the valves have hit their failure states. The trip has been successful.



Figure 39-Trip activated and valves de-energised to hit fail states

The images sequence supports the test procedure

7. Discussion, Conclusion and Recommendations

Firstly, the main discussion is the restrictions with the on going pandemic (COVID-19) and the turnaround maintenance event happening at Pembroke Refinery. This threatened the completion of the project on time, meeting all the requirements, and completing all the relevant documents associated with the report. However, to avoid this issue, the project was fast-tracked and completed by February 2021. This allowed all requirements to be met without disruption of outside factors. All discussions were carried out virtually as the college was shut due to the pandemic.

In regard to implementing the project into the workplace environment, this can potentially happen straightaway, however, due to the turnaround event, any approval has been halted until the event is over. This approval will be discussed in the summer of 2021.

The first requirement as part of the specification was to successfully implement timers into a PLC sequence to upgrade the current layout of the TDR's. With evidence within this report, this has been completed successfully as proof of the logic working can be seen under the testing stage. These timers correctly outputted at the required times meaning the heater had been purged and was ready for a start.

Another requirement was for an operator to visually see if the heater had tripped or was in an alarm. As proven under the testing stage, this has been completed as the trip sequence was simulated which affected the outputs as it would if live in the field. The associated alarms for the flame eye instrumentation were included which if one fails, will give the operator an initial alarm.

Another requirement was to prove the project in a live system and parts to be available for at least 3 years. This was completed by adding the transmitter and trip amp as if it were in a live system. Parts were also confirmed not to leave site for the next 10 years which meets this criteria.

The specification stated that the project would not cost more than £800. This project actually met this limit of £800 as the transmitter and IPC PLC used were gained from storage on site. The Trip Amp was ordered in which had a cost of £800 charged to the company.

Also required was for maintenance to be carried out on the system every 3 months. After a discussion with the Instrumentation Manager and planners, it was confirmed that maintenance would be carried out every 3 months in order to prove functionality.

All equipment used had to meet the relevant standards as discussed in the specification. As the refinery is classed as a explosive atmosphere, all equipment used was ensured to be ATEX certified and intrinsically safe. They also met suitable site standards.

The project itself was an overall success as all requirements were met and a viable solution was created to tackle the issue with the current system. Therefore, including the timers in the IPC software is a viable option for the heater to be upgraded.

In regard to the project plan, all planned events for the successful completion of the project were actually completed months in advance, evidence of this can be seen in the Gantt chart in the appendix. The success of this project to be completed before the turnaround event came down to the much-appreciated help of fellow colleagues at work. Their experience provided much needed knowledge on how to identify a solution and implement it.

The use of the IPC Honeywell PLC allowed all the relevant logic to be drawn to give the required input and outputs associated with the heater. There was a risk with using this equipment as it is pre-dated equipment and newer PLCs are used around site. However, with the experience of colleagues and the need for them in certain units of the refinery, the IPC deemed a necessary choice.

Initial testing of the project allowed any issues to arise so they could be tackled before the transmitter and trip amp were added. This turned out to be successful as an issue with the valves resetting upon the stop/start being pressed. This was tackled by re-analysing the logic and identifying where additional logic should be placed to overcome this problem.

In regard to recommendations, the Allen-Bradley SLC 500 was probably a more effective option for this project. This PLC is compliant with modern-day standards and is effectively 'more up to date'. However, due to timing issues of completing this project before the turnaround maintenance event, the IPC Honeywell PLC seemed the best option as it was readily available on site and came at no cost.

A good justifiable recommendation

Another recommendation lies with the software. In order to prevent any worker coming along and changing the logic, access should be limited where only a selected few maintenance personnel can access this via a login and password. This provides security for the system.

Another recommendation is to alter the timer rungs to remove the reset contacts as they are not necessarily needed. This conclusion came from analysing the finished logic and noticing that the reset had been included twice on the associated rungs. However, this does not directly affect any outcome in the logic as this is seen as an additional measure.

A final recommendation is to duplicate the project made and situate it in the workshop. With a test rig situated in the workshop, other colleagues can gain knowledge of how similar systems work and how the IPC software functions. Knowledge of this system will gain massive experience when working on live plant.

A very god conclusion and recommendations are valid and advisable.

8. Reference List

References

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[Accessed 1 February 2021].

There should be more relevant source in the list and referenced in the text

9. Appendix

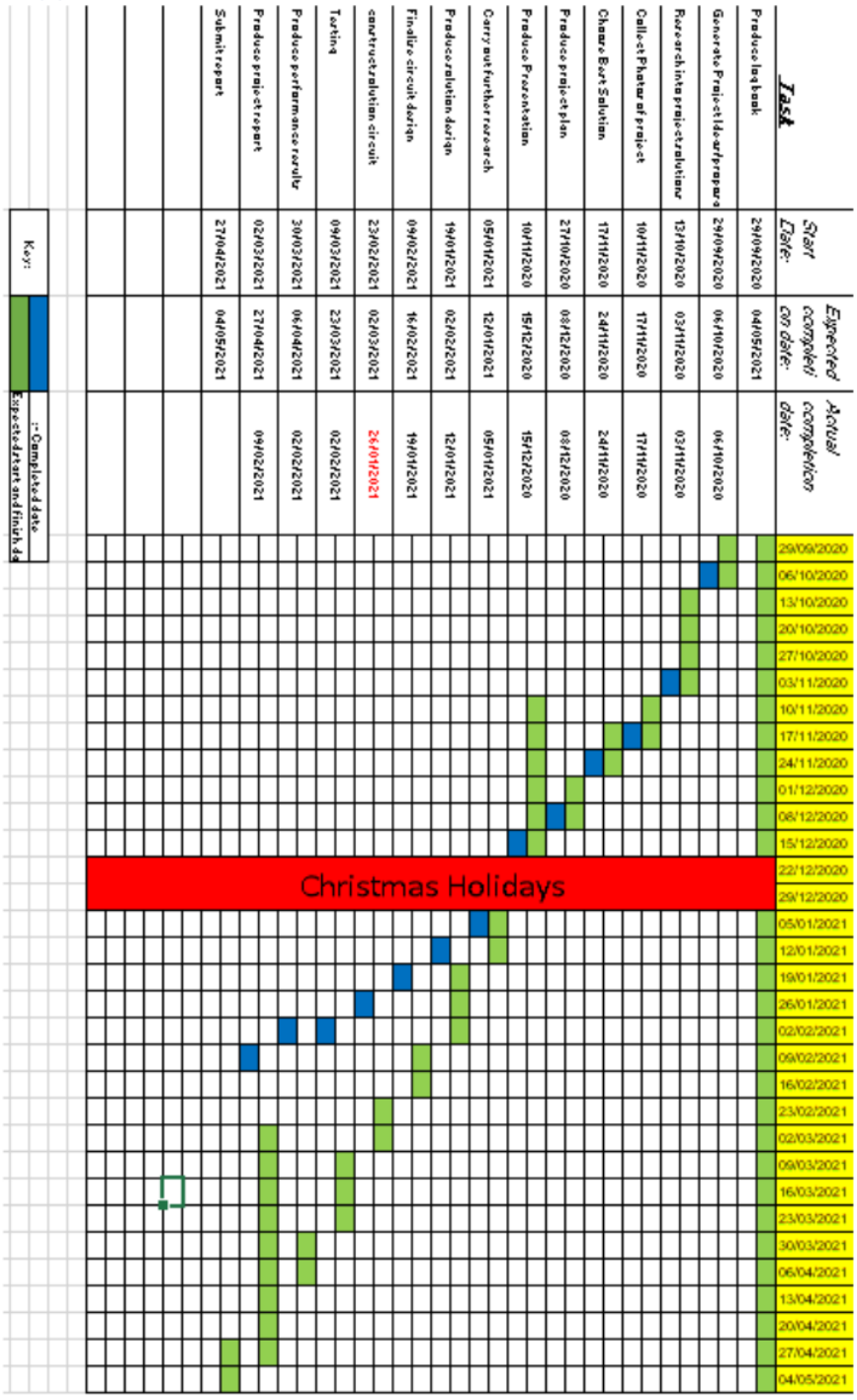


Figure 40- Gantt Chart

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GRADEMARK REPORT

FINAL GRADE

63/100

GENERAL COMMENTS

Instructor

PAGE 1

PAGE 2

Text Comment. A good level of detail in the contents table

PAGE 3

Text Comment. List of figures is extensive for the project

PAGE 4

Text Comment. Has taken place

Text Comment. effectively

Text Comment. Do not use first person terms

Text Comment. Clear problem definition

PAGE 5

PAGE 6

PAGE 7

Text Comment. Components are valid for this project. The research of these components could have been enhanced with a simple case study which would have also provided good relevant reference sources

PAGE 8

PAGE 9

PAGE 10

Text Comment. There are many sectors that have to comply with the specification and these are probably down to the industry environment at Valero. All contingencies have been accounted for.

PAGE 11

Text Comment. A necessary explanation of the timeline and reasons for the abnormalities in the sequence of events.

PAGE 12

Text Comment. Possible solutions are identified

PAGE 13

Text Comment. The solutions considered should each have a section with their own heading and theses should be individually researched with reference sources. A case study or examples from industrial applications should have been included which would have given good relevant reference sources.

Text Comment. An evaluation table would have been the better method to justify chosen solution

PAGE 14

PAGE 15

Text Comment. are

Text Comment. A good explanation of implementation which is consistent with the log book

PAGE 16

Text Comment. Good image to support explanation

PAGE 17

PAGE 18

Text Comment. Ladder logic is explained

PAGE 19

PAGE 20

PAGE 21

PAGE 22

Text Comment. The logic sequence is explained and follows the PLC ladder logic

PAGE 23

Text Comment. Problem has been identified

PAGE 24

PAGE 25

Text Comment. Problem resolved with image to support the evidence

Text Comment. Logic changes in program are identified

PAGE 26

PAGE 27

Text Comment. Image showing sequence started

PAGE 28

PAGE 29

PAGE 30

PAGE 31

PAGE 32

PAGE 33

Text Comment. Sequence has been completed and no errors are present

PAGE 34

Text Comment. Explanation is clear

PAGE 35

Text Comment. following

Text Comment. Image shows clear evidence of flow transmitter configuration

PAGE 36

Text Comment. Good explanation

Text Comment. Image supports the explanation

PAGE 37

PAGE 38

Text Comment. Good image of system under test

PAGE 39

PAGE 40

Text Comment. Image supports explanation and test result

PAGE 41

Text Comment. The images sequence supports the test procedure

PAGE 42

PAGE 43

Text Comment. A good justifiable recommendation

Text Comment. A very god conclusion and recommendations are valid and advisable.

PAGE 44

Text Comment. There should be more relevant source in the list and referenced in the text

PAGE 45

Text Comment. The chart identified what the report has explained about the timing issues

PAGE 46

JACK EVANS

0

RESEARCH-INFORMED LITERATURE

There is evidence that research has been carried out and using relevant sources. The research should have more content. 5/10 More images and sources should have been included to support the research. 5/10

10/20

KNOWLEDGE AND UNDERSTANDING

Good specification with a good level of detail. The spec is in a logical sequence and clear. 7.5/10 The possible solutions have only been briefly explained. They should have been covered separately and include some examples from industry (case studies). The justification of the chosen solution is explained. 5.5/10

13/20

ANALYSIS

Testing and results are clear and presented using a good method. Images are included as evidence and a good test plan has been followed. Tables would have improved this section. 6.5/10 Conclusion is very good but is very specific to the

14/20

industry. There are good recommendations included. 7.5/10

PRACTICAL APPLICATION AND DEP.



Good planning methods have been implemented and a comparison of the actual and predicted plan timeline is included and explained. 3.5/5 Solutions considered are valid for the project. There should be more content on the possible solutions. The solution choice is justified in the report. 5.5/10 There is good evidence that the project has been implemented using logical methods. The implementation section has a clear sequence which is consistent with the log book. 7/10

16/25

SKILLS FOR PROFESSIONAL PRAC.



Quality of the report is good. There is a logical sequence in the report even though some sections are in an incorrect order.

10/15