

2119238

by Kyran Pritchard

MARK OF 65% AGREED
by

Submission date: 23-May-2023 11:41AM (UTC+0100)

Submission ID: 207303923

File name: 11227_Kyran_Pritchard_2119238_181809_1548232891.pdf (2.75M)

Word count: 3814

Character count: 23221

Course: HNC Electrical and Electronic Engineering

Module: HNC Electrical and Electronic Engineering Project

Assignment: Final Report and Log Book

Name: Kyran Pritchard

University number: 2119238

Date submitted: 23/05/2023

Word count: 3645

Contents

1 - Introduction and Background Research	5
Timet UK.....	5
The Project	5
Research	6
2 – Specification	9
3 – Planning	11
4 – Solutions Considered	13
Solution 1 – Fortress Key and Gate.....	13
Solution 2 – Light Beam.....	14
Solution 3 – Key Card Gates	15
Comparison	16
5 - Final Solution and Implementation	17
6 - Testing and Results	26
7 - Discussion, Conclusions and Recommendations	28
8– Appendix	30

Good table of contents

Figure 1 Timet Logo	5
Figure 2 Risk Assessment.....	5
Figure 3 RA 'Nip' Point	5
Figure 4 Flame Cutter Animation	6
Figure 5 Modular PLC	6
Figure 6 Ladder Logic	7
Figure 7 PILZ Unit.....	7
Figure 8 PILZ Data Sheet.....	8
Figure 9 Gate Budget.....	9
Figure 10 Test Table	11
Figure 11 Gantt Chart.....	12
Figure 12 Block Diagram Solution 1	13
Figure 13 Block Diagram Solution 2.....	14
Figure 14 Block diagram solution 3	15
Figure 15 Key lock and E-stop dimensions	17
Figure 16 Gate dimensions	18
Figure 17 E-stops mounted.....	19
Figure 18 Mounting posts for gates	19
Figure 19 CAD design	20
Figure 20 Gate invoicing #2	21
Figure 21 Gate invoicing #1	21
Figure 22 Access key wiring.....	22
Figure 23 Access key panel at operators' desk.....	22
Figure 24 Gate installation #1	23
Figure 25 Gate installation #2	23
Figure 26 Gate installation #3	24
Figure 27 E-stop relay	24
Figure 28 PLC wiring.....	25
Figure 29 Testing table.....	26
Figure 30 Flame set up	27
Figure 31 Controls disabled	27
Figure 32 RA #1	30
Figure 33 RA #2	31
Figure 34 RA #3	32

Figure 35 RA #4 33

Figure 36 RA #5 34

Figure 37 RA #6 35

Figure 38 RA #7 36

Figure 39 E-stop relay graph 37

Figure 40 E-stop relay data 37

Figure 41 E-stop relay technical sheet 38

Extensive list of figures

1 - Introduction and Background Research

Timet UK

Timet, since the 50's has been one of the world leaders in mill and melted products. Timet also supplies nearly one-fifth of titanium used globally. There are factories in both the UK and America to support the multinational customer base. Also, Timet invests in the development and research that is advancing the titanium industry (Corp, 2023). As seen on the website Timet state "We quickly move products using qualified raw material and routings that meet stringent customer requirements and Timet operates a fully integrated supply chain from raw material through mill product." (2023)



Good research carried out with supporting ref sources

Figure 1 Timet Logo

The Project

This project is one to upgrade the Flame Cutter already located at Timet Waunarlwydd. The upgrade is one that will improve the health and safety of the machine overall and make it more user friendly. The reasoning the need to upgrade was due to the 'nip' points were someone could get a piece of clothing or body part stuck in the long or cross travel of the machine during operation. As well as this, it was brought to attention, that the naked flame was accessible during operation also. A third reason was, that a nearby walkway could potentially be exposed to flying debris off the machine. These were found by the carrying out of a risk assessment on the machine, as seen below.

TITANIUM METALS CORPORATION Machine Safeguarding HAZARD and RISK Assessment			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarlwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	8		
Hazard:	Rotating motion - nip points		
Hazard Type:	Nip point from moving head		
Hazard Location and Description:	Cutter head long travel - Possible nip points to hand and fingers.		
Current Guarding:	None		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	1		
Frequency:	1		
Probability:	2		
RISK RATING:	B		

Figure 2 Risk Assessment



Good explanation and evidence

Figure 3 RA 'Nip' Point

This project must improve the safety during operation of the machine whilst not having a major impact on the rate of production. The two main objectives were to stop the traffic of pedestrians and FLT's passing through the striped area (seen below) and cover the pedestrian walkway.

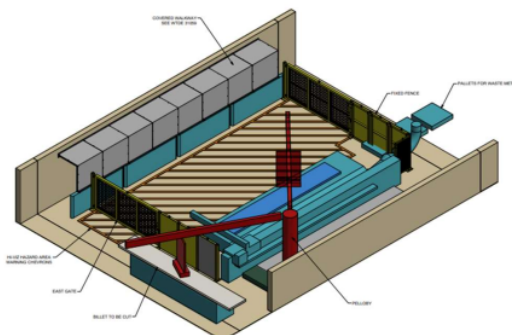


Figure 4 Flame Cutter Animation

These objectives will be solved by the insertion of a Fortress Key and Gate system. There is tow interlocked gate on each side of the striped area to control the traffic in this area during operation. The walkway will be enclosed to protect from debris.

Research

Research into various methods on how to execute the objectives were carried out. Firstly, into programmable logic controllers (PLCs) AMCI states a PLC “is an industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices”. PLCs are mainly of the modular type, this means expansion cards can be added onto the PLC to perform different functions for example extra output cards and analogue cards (Ultrasonics, 2023). PLC mainly couple up with HMI to record and display data, as well as controlling machinery through communication with other components.

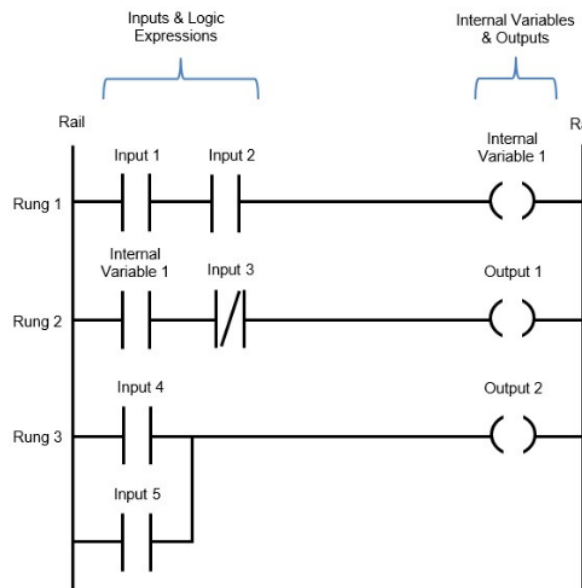


Figure 5 Modular PLC

Good supporting image

Good explanation with supporting image and ref source

PLCs under the IEC 61131-3 standard are programmed in 5 different languages list, function, block, structured and SFC. Ladder is the most common used throughout industry, the language is graphical and uses symbols based on circuit diagrams of relay logic hardware for outputs and inputs. (Logic, 2023)



Good application example

Figure 6 Ladder Logic

Safety relays come in a variety of versions, the more modern ones that can be found in industry are programmable/configurable via controllers on the unit. A safety relay has a variety of functions PILZ.com states it can “monitor safety functions such as emergency stop, safety gates, light barriers, light curtains, two-hand controls, speed, standstill and much more besides” (2023). They units are customisable and are easy to set up as you can plug into them and remotely configure them to the preference of the application.

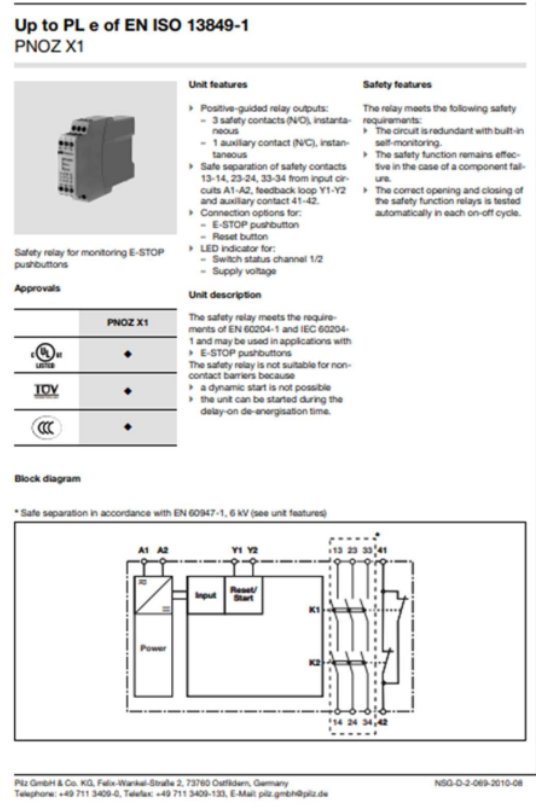


Figure 7 PILZ Unit

Good relevant explanations with supporting image and ref source

Safety relays come in multiple specs, most being dual-channel and will have multiple safety contacts, some up to as many as 8. Single channel expansion modules are available for further upgrading on current implanted units and once again are set up via plug and play. Most commonly these relays are 24Vac/dc but some will accommodate 240ac/dc.

Good clear explanation and relevance



Good supporting data sheet as evidence

Figure 8 PILZ Data Sheet

2 – Specification

The project must control the traffic of everyone on site and FLT's past the flame cutter when in operation but must not affect the rate of production badly. It must also allow the operator to set up the flame before existing the gated area and starting the operation. Also, it must achieve the safety of passers-by in the pedestrian walkway adjacent to the cutter. This project will include a variety of electrical components including safety relays, PLC, and MCBs as well as mechanical components such as a castell key system and fortress gates. A combination will allow the operation of the flame cutter to be safer and less likely to cause any injury.

The time management of the project must be monitored as the upgrade to the system is one of safety. It must be efficient but not rushed as it should be correct and operational first time to save on time and budget. Budgeting is based on a product-to-product basis where there is no limit, but everything must be applied for and granted if necessary to the project and is the best option available. Below the budgeting for the gates can be seen.



The user needs and expectations are to allow a safer working and operation environment for both the operator and everyone in the area, whilst not affecting plant wide production. The reliability of the project is important as it is a safety feature of the machine and will not allow operation without it working when implemented. The mechanical features and robustness of the gates should be highly reliable for the requirements of the project. Both the mechanical and electrical sides to the project will be added to the safety schedules on site. These are completed on a weekly basis and a more in-depth maintenance undertaken quarterly. This therefore improving the overall reliability of the project.

During the project the health and safety at work act, PUWER, the electricity at work regulations and the IET wiring regulations are followed. The required PPE worn and all required isolations and lock of tag of procedures followed. Risk assessments were carried out prior to the project as seen in the appendix. Most of the work required to complete the project was carried out on site, however for stuff installation of the gates this was contracted out due to the correct equipment and training be required.

Any components/parts needed were taken from the stores not ordered in to reduce waste and delivery. All parts required to be ordered in were all done at once to reduce the number of deliveries needed. All spares and waste material will be disposed of in the relevant recycling bins. No harmful substances or chemicals were used that would damage the ecosystem. All power will be taken from existing sources and run efficiently as possible.

A good detailed spec with constraints identified

3 – Planning

A Gantt chart was created, seen in figure 11 below to monitor the progression of the project and meetings were regularly had to review time keeping. The green bar is the expected duration of the specific tasks, and the red represents the actual completion period. This will be useful for when reviewing the project and for future projects to see the realistic time needed. Firstly, the project decision was discussed and made. Next a full risk assessment was carried out on the machine, the operation and surrounding area. When all this information was gathered research and investigation was undertaken into the potential solutions. Now all the solutions were considered a decision was made on what would be best and now the budgeting could begin. Once all components were attained wiring and installation was carried out before testing it. During this period the investigation into the production effect was looked at. The final stage was to hand it back to production for a trial period.

As seen in figure 11, the Gantt chart, testing was planned in between week 25-30. Testing was delayed by 1 week but was then carried out as follows seen in the testing table below.

Good test plan using table

Test Plan		
Test	Test Description	Planned Week
Earthing tests	To ensure the resistance value between conductive materials and earth is less than 0.5 ohms	25
Wiring	Check all wiring is correct as per drawing and regulations	26-27
Safety elements	Ensure all safety features such as e-stops are functioning as required	28
Mechinacal componets functional	All gates and locks must line in order to be closed and the interlock to work	29
Sequence testing	The sequencing of the gates must be completed in order allowing the machine to be set up and operated.	30

Figure 10 Test Table

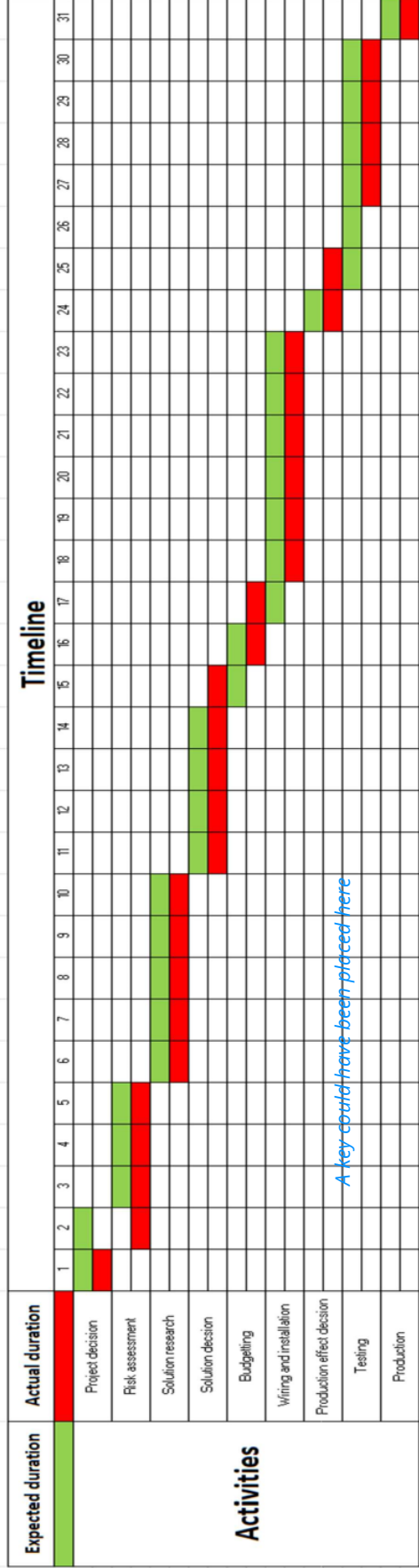


Figure 11 Gantt Chart

Good Gantt chart that includes comparison timelines

4 – Solutions Considered

Solution 1 – Fortress Key and Gate

Good block diagram of system

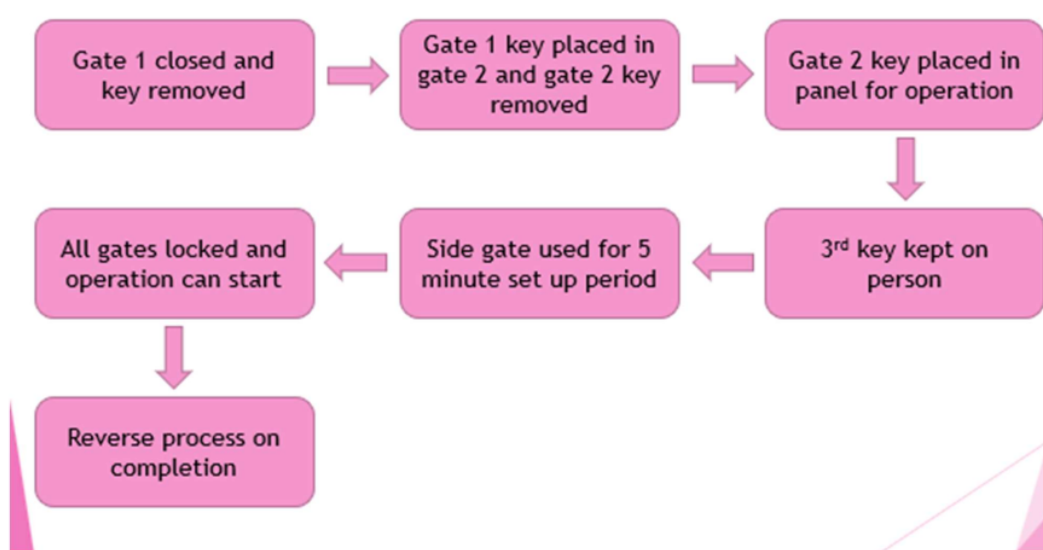


Figure 12 Block Diagram Solution 1

Solution 1 will work as seen above in the block diagram above, this allowing the operator to safely set up the flame and operate the machine with no traffic passing. This will be controlled and communicated using a PLC and Profinet, talking to a e-stop relay to say if the system is healthy or not. This meets the specification required by the company and purpose of the upgrade.

This solution would be slightly more expensive as the fitting of the mechanical gates will be contracted out to an external company, therefore labour prices come into it. The overall efficiency of this solution is moderate as there is potential for loss of time, like when waiting on parts or contractors. As the traffic control element is mechanical it is very reliable and will be easy to maintain. Also, fault finding on any reason the sequence won't work will be reliable as the PLC can be plugged into.

Advantages

- A robust solution
- Operation can't be stopped on accident and effect production
- Complete safety of all operations

Disadvantages

Good argument for the solution

- Solution takes longer to put in place
- Could potentially slow down other production
- Gate keys may be lost therefore causing down time

Solution 2 – Light Beam

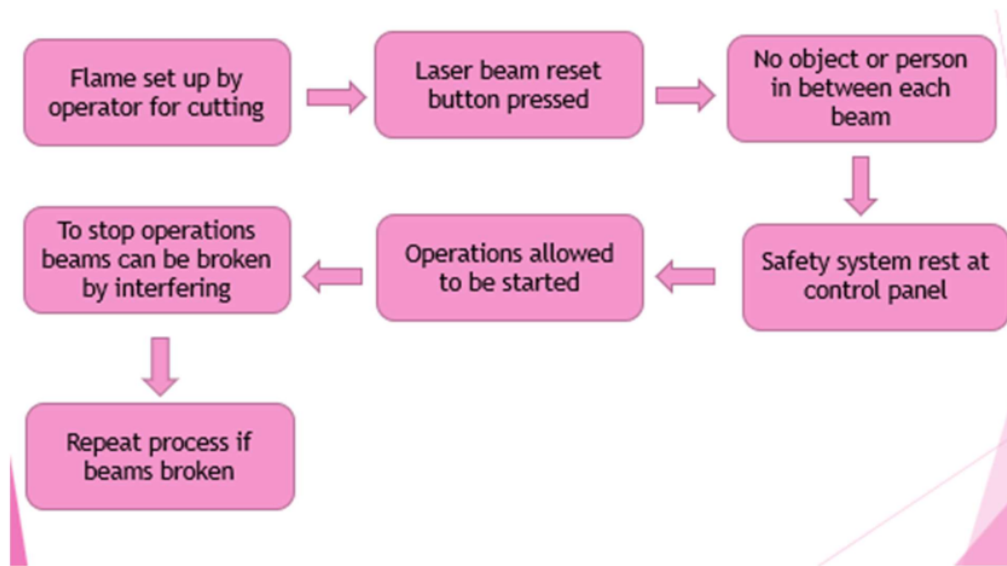


Figure 13 Block Diagram Solution 2

Solution 2 works by the installation of two light beams either side of the gridded area in figure 4. One side will emit the laser and the other will reflect the laser back. As long as the receiving unit sees the return the system stays healthy allowing operation. If it doesn't see the return, it will communicate this with the PLC therefore dropping out the safety relay disabling control. The beam is reset via buttons station each side and the safety circuit rest at the control desk. Therefore, fulfilling the specification and requirements of the upgrade.

The cost of the lasers and reflectors would not be very much in comparison to solution 1 but may end up costing more in spares and downtime due to reliability issues. This solution would be efficient to put in place but cause production problems if the beam keeps getting broken on accident as it is not physical. Overall not a very reliable issues as the flame cutter is heavy industry that uses heat and the lasers are not very robust.

Advantages

- Easier and quicker to put in place and into production.
- Less cost as parts are cheaper and labour is less
- Can go through them quickly if needed as they are not physical in case of an emergency

Disadvantages

Good argument for the solution

- Heat of the flame will effect the lasers causing reliability issues
- Can accidentally be broken stopping the machine and slowing down production
- Fragile and not very robust in comparison to solution 1

Solution 3 – Key Card Gates

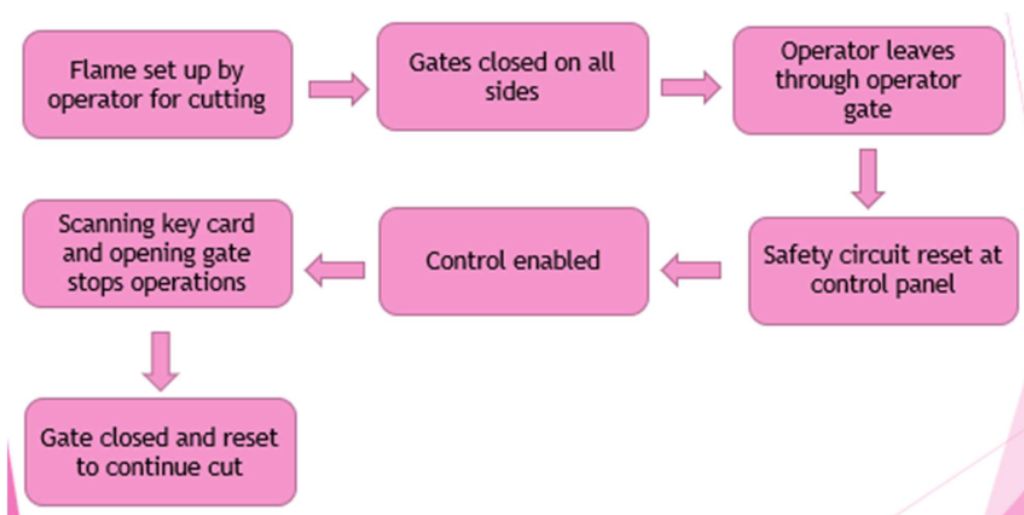


Figure 14 Block diagram solution 3

This solution by each gate that allows access to the flame and cutting area, will be controlled by a key card system. Each operator and maintenance would be granted a key card to have access. When all gates are closed full control enable, when a gate is open only set up controls enabled.

This solution would not be expensive initially to put in production but may cost more as time goes on due to potential spares being needed or the constant replacement of cards. For maintenance and operators this solution would be moderately efficient

especially in set up. There would be a few reliability issues with this solution are there many aspects to go wrong.

Advantages

- Quick access for production and engineering
- A cheap solution that could into production in a short period
- Only competent and the people required could access.

Good argument for this solution

Disadvantages

- Would require a card to pass through even in an emergency.
- Key cards can be unreliable and would need replacing if lost or overused.
- Fragile and not very robust in comparison to solution 1

Comparison

Solution 1 was the selected solution to carry through. One reason for this is that in comparison to the other two it is far more robust for the type of industry. This meaning it is far more reliable and will require less maintenance and costs in the future. It will cost more initially but will likely end up being cheaper in the long run as it will have less down time for production and need less spares to repair. Solution 1 also fully meets the specification required of the project, meets the needs of the company and abides by all regulations.

Good argument for the chosen solution

5 - Final Solution and Implementation

The solution selected, as stated previous, is the Fortress key and gate system controlled by a PLC in communication with a safety relay. This will allow the traffic in the controlled area to be controlled during operation. This making the flame cutter a complete safe working space for the operator and those around. Another reason for this solution be selected is all the components and methods used in it are used throughout the company, making it more efficient to complete and would not require any further training on how to install and use. Solution 1 will cause far less downtime and require less maintenance compared to solution 2 and 3. Seen below is a plan and dimensions of the installation of the gates.

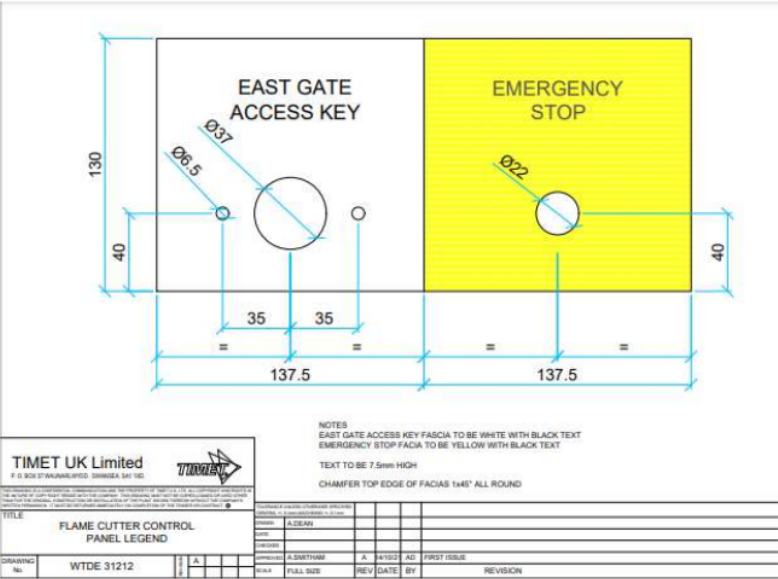


Figure 15 Key lock and E-stop dimensions

These are the dimensions of the east side gate access gate and emergency stop, these will be the same for the west side and the operators access gate.

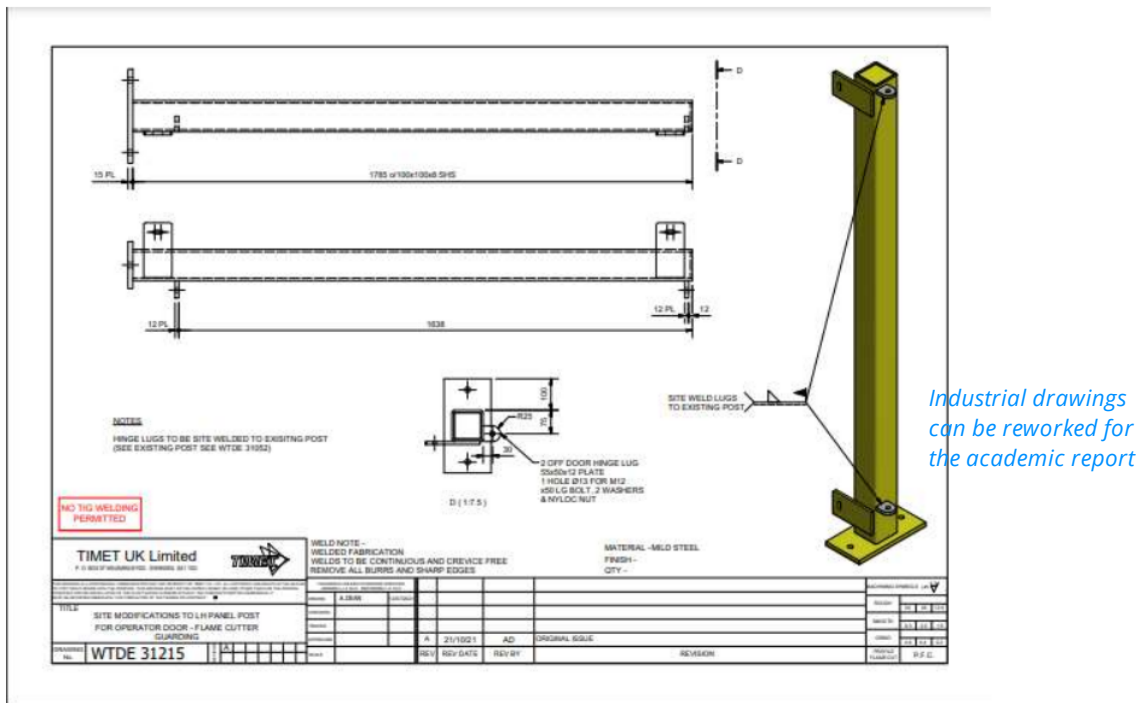


Figure 18 Mounting posts for gates

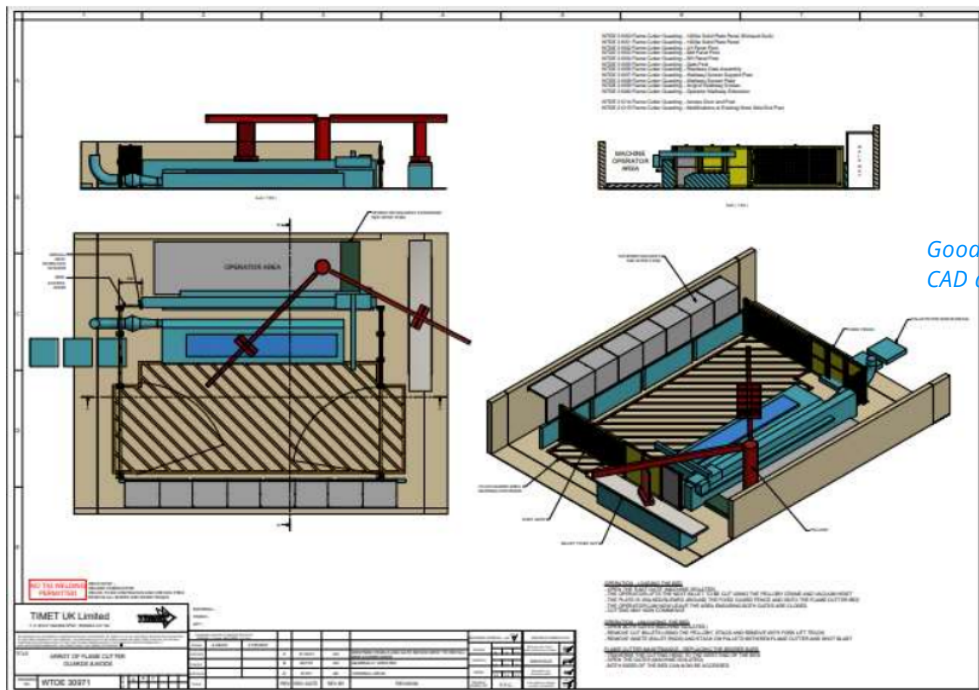
These are the dimensions or the gate posts used for all access gates to be mounted to and half of the lock to be mounted to allowing the gates to be interlocked during operation.



Good example of E-stop

Figure 17 E-stops mounted

This is an example of one of the e-stops mounted on near the gates. The same is on the other gates located around the machine.



Good example of
CAD design

Figure 19 CAD design

A CAD design was made up to plan the positioning of all the components and to demonstrate the area that needed to be controlled.

The circuit controlling the solution is powered by 240V and 24V already existing in the panel. Protection of the circuit will be monitored using MCB's throughout. 1.0mm, 1.5mm and SWA cable will be used for the wiring throughout. The safety relay used to monitor the enable/disable controls is a dual channel 24Vdc safety relay with 3 contacts. E-stops will be located at all 3 gates and on the control panel in case of a failure and someone or something in the operation area.

The budget for this project had no maximum cap set as it was an upgrade of safety, all parts and expenses had to be made a case for through the capital project funds. Expenses as can be seen below for the gate and key system. A lot of components and labour was used on site so was there for budgeted internally and parts prices deducted from stores.

Good explanation of procedure

Fortress Interlocks

Quotation

FSQ-01018600 / 2

Fortress Interlocks Ltd
2 Inverlyde Drive
Wolverhampton
West Midlands
WV4 6PB
t: +44 1902 349000
e: sales@fortressinterlocks.com
w: www.fortressinterlocks.com
VAT Reg No: GB101979766

Invoice To:
Timet Ltd,
Aeron Smitham
Swansea
SAS 4SF
Great Britain

Ship-to Address:
Timet Ltd,
Swansea
SAS 4SF
Great Britain

Page 1

Customer Order No.	Account Code	Contact - Sales Person	Date Printed
		Matt Cooper	12/08/21

Fortress Item No. - Item No.	Description	Quantity	Unit Price	Amount
S-CLSS-A02022	END USER - Timet Ltd, Swansea, SAS 4SF			
ITM-00020364	S-CLSS-A02022 S - SWITCH FOR PANEL MOUNTING WITH CLS BASIC LOCK WITH STAINLESS STEEL DUST COVER. SWITCH RATED 25A AC 2NO 2NC. FLAME CUTTER 1	1	327.00	327.00
DMS2E-1-1-CLSS-H-LE	DMS2E-1-1-CLSS-H-LE DMS WITH EXTRACTED KEY MECHANISM CLS FULL XMSA STAINLESS STEEL ADD ON MODULE CAMS FOR CL stainless steel sprung loaded DM HAND-OPERATED ACTUATOR. XM BOTTOM CAP & FIXINGS NIL FLAME CUTTER 2 NOL FLAME CUTTER 1 NIL FLAME CUTTER 3 NOL FLAME CUTTER 1	2	681.50	1,363.00
CLK-SUSS	CLK-SUSS CL stainless steel key, uni-directional (clock), standard cut, with silver seal. FLAME CUTTER 1 FLAME CUTTER 2 FLAME CUTTER 3 DESPATCH IN 2.5 WEEKS It is the user's responsibility to implement proper management controls and risk assessment for master and spare keys, to mitigate the defeat of trapped key systems. ISO/TS 18637 can offer further guidance.	3	27.00	81.00

Figure 21 Gate invoicing #1

Fortress Interlocks

Quotation

FSQ-01018600 / 2

Fortress Interlocks Ltd
2 Inverlyde Drive
Wolverhampton
West Midlands
WV4 6PB
t: +44 1902 349000
e: sales@fortressinterlocks.com
w: www.fortressinterlocks.com
VAT Reg No: GB101979766

Invoice To:
Timet Ltd,
Aeron Smitham
Swansea
SAS 4SF
Great Britain

Ship-to Address:
Timet Ltd,
Swansea
SAS 4SF
Great Britain

Page 2

Customer Order No.	Account Code	Contact - Sales Person	Date Printed
		Matt Cooper	12/08/21

Fortress Item No. - Item No.	Description	Quantity	Unit Price	Amount
CARSPACK	Carriage & Packaging	1	44.28	44.28
Total GBP Excl. VAT				1,815.28
20% VAT				363.06

Figure 20 Gate invoicing #2

Budget is established



Good evidence

Figure 23 Access key panel at operators' desk



Good evidence

Figure 22 Access key wiring

This is where the key from the access gate (east) is taken and placed at the operator's desk as the final part of the sequence to allow the safety circuit to be reset and controls enabled.

Below are the images of the gates and locks after they were installed.



Figure 24 Gate installation #1



Figure 25 Gate installation #2



Good images

Figure 26 Gate installation #3



Good supporting image

Figure 27 E-stop relay

This image demonstrates the wiring for the safety circuit of the solution. The channels will only become live when the sequence is complete in order therefore allowing the controls to be enabled.



Good explanation and supporting images

Figure 28 PLC wiring

This solution is overall quite sustainable and environmentally friendly. This is due to a lot of the components already being on site and a lot of the work done by the maintenance department. It is sustainable as it is robust not needing to often be replaced or repaired. There was no harmful to the environment chemicals used during the project.

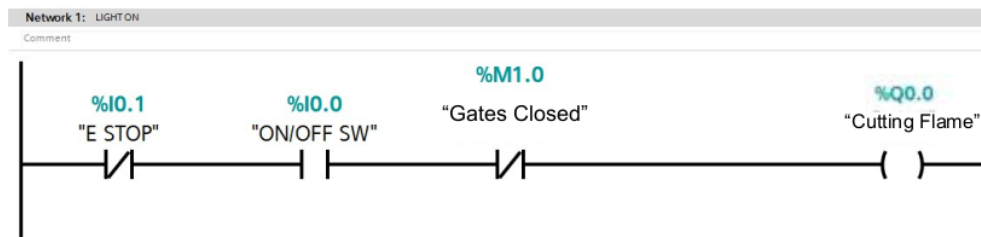


Figure 29 Programme

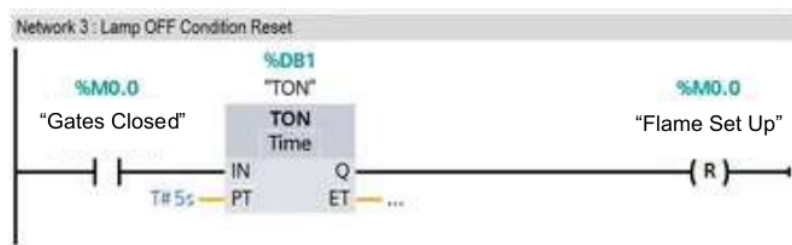


Figure 30 Flame Set Up

Good sample of PLC program

6 - Testing and Results

Good test table with results

Test	Expected Result	Actual Result	Pass/Fail
Can the flame cutter operate when any of the gates are open	No operation on any axis or the flame	There was no operation on any axis or the flame	Pass
Gates all closed the what operations are available	For the first 5 minutes the only operation should be the flame to allow set up	The first 5 minutes only allowed operation for the flame to allow set up	Pass
Operations available after 5 minutes	Providing all gates are still close all operations available	All gates were closed all operations available	Pass
If any of the keys are removed or gates are opened what happens	All operations to stop	All operations stopped	Pass

Figure 31 Testing table

The tests carried out all passed and met the specification. Firstly, when all gates or even one of the east or west gates were open 0 controls were enabled for operation. When they are both closed, access to set up the flame was via the operator's gate where the flame only controls were enabled for 5 minutes. After the 5 minutes were up the controls were once again disabled. When the operators gate was then shut the key could be placed in the control panel and the safety circuit successfully reset allowing full operation. If the key was removed from the control panel or any door all control was disabled.

Explanation supports table of results

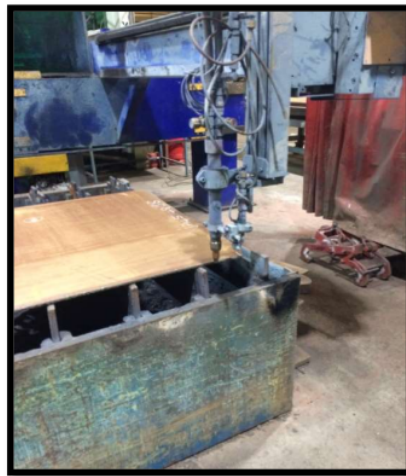


Figure 32 Flame set up

Good supporting image



Figure 33 Controls disabled

7 - Discussion, Conclusions and Recommendations

As an overall the project outcomes were all met as per the specification. The area that needed to be guarded has been done so and now doesn't present any hazards in the way of nip points and flying debris. The project success level was high, the success was maintained throughout the project by having regular meetings to ensure everything was on track and to rectify any delays or budgeting issues. All materials and components ordered were delivered on time without any issues and all parts from stores were available so the building phase had a high success rate. Having a clear plan of what needed to be achieved helped the success during all stages of the project. As part of the plan a Gantt chart was produced to ensure all aspects of the project met the time restraints. As seen in figure 11 the project decision was made earlier than expected, this meaning the risk assessments could begin a week earlier. It can also be seen that the budgeting was delayed by a week due to holidays, so the wiring installation couldn't start on time. Figure 11 also shows that testing took less time than expected due to all tests running smoothly meeting the spec and not needing altering. All budgets were accepted when applied for as the projected costed less than originally planned. With regards to sustainability and environmental issues there none as the system proved to be robust as projected and no harmful materials to the environment were used, as well as deliveries being kept to a minimum. After the testing was carried out it was clear the solution was fit for purpose in practice as well as theory. From a maintenance standpoint this circuit and project has been added to the safety schedule list to ensure it keeps on performing. Within the team everyone's genders, beliefs and sexualities were respected to create a comfortable and happier working environment for all. All ideas were welcomed and listened to, so the team had an overall better understanding of the project and what needed to be achieved. Recommendations for this project would be to add an HMI to the control panel for easier operator use and modernisation. Another could be to add pressure plates inside the guarded system as a back up to the gates in case of failure to be able to see if there is anyone in this area during operation.

Good conclusion and valid recommendation

8 - Bibliography

Corp, P. C., 2023. *Timet*. [Online]

Available at: <https://www.timet.com/about/>

[Accessed 08 05 2023].

Logic, L., 2023. *Ladder Logi World*. [Online]

Available at: <https://ladderlogicworld.com/ladder-logic-basics/>

[Accessed 08 05 2023].

PILZ, 2023. *PILZ*. [Online]

Available at: [https://www.pilz.com/en-GB/products/relay-modules/safety-relays-protection-](https://www.pilz.com/en-GB/products/relay-modules/safety-relays-protection-relays#:~:text=The%20safety%20relays%20PNOZ%20monitor,in%20millions%20of%20applications%20worldwide.)

[relays#:~:text=The%20safety%20relays%20PNOZ%20monitor,in%20millions%20of%20applications%20worldwide.](https://www.pilz.com/en-GB/products/relay-modules/safety-relays-protection-relays#:~:text=The%20safety%20relays%20PNOZ%20monitor,in%20millions%20of%20applications%20worldwide.)

[Accessed 08 05 2023].

RS, 2023. *RS*. [Online]

Available at: <https://docs.rs-online.com/da1a/0900766b8002f961.pdf>

[Accessed 08 05 2023].

Ultrasonics, 2023. *Ultrasonics*. [Online]

Available at: <https://www.unitronicsplc.com/what-is-plc-programmable-logic-controller/>

[Accessed 08 05 2023].

Limited number of sources

9- Appendix



Hazard and Risk Assessment Report

Machine:	Messer Flame Cutter
ID- Asset No:	1502246
Location:	<u>Waunarlwydd</u> , Y Bay
Assessment No:	SFC 01



Good supporting image

TIMET PROPRIETARY INFORMATION



1

Figure 34 RA #1

TITANIUM METALS CORPORATION			
Machine Safeguarding HAZARD and RISK Assessment 			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarlwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	8		
Hazard:	Rotating motion - nip points		
Hazard Type:	Nip point from moving head		
Hazard Location and Description:	Cutter head long travel - Possible nip points to hand and fingers.		
Current Guarding:	None		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	1		
Frequency:	1		
Probability:	2		
RISK RATING:	B		
Notes:	Install guarding in accordance with EN 953 & 13857		



Good evidence

Possible nip point when head moves

TIMET PROPRIETARY INFORMATION

2

Figure 35 RA #2

TITANIUM METALS CORPORATION			
Machine Safeguarding HAZARD and RISK Assessment 			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarlwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	9		
Hazard:	Rotating motion - nip points		
Hazard Type:	Nip point from moving head		
Hazard Location and Description:	Cutter head long travel - Possible nip points to hand and fingers.		
Current Guarding:	None		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	1		
Frequency:	1		
Probability:	2		
RISK RATING:	B		
Notes:	Install guarding in accordance with EN 953 & 13857		



Possible nip point when head moves

TIMET PROPRIETARY INFORMATION

3

Figure 36 RA #3

TITANIUM METALS CORPORATION			
Machine Safeguarding HAZARD and RISK Assessment 			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarlwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	10		
Hazard:	Rotating motion - nip points		
Hazard Type:	Nip point		
Hazard Location and Description:	Power supplies cable tray- Possible nip points to hand and fingers when in operation		
Current Guarding:	None		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	1		
Frequency:	1		
Probability:	2		
RISK RATING:	B		
Notes:	Install guarding in accordance with EN 953 & 13857		



Possible nip point when head moves

TIMET PROPRIETARY INFORMATION

4

Figure 37 RA #4

TITANIUM METALS CORPORATION			
Machine Safeguarding HAZARD and RISK Assessment 			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	15		
Hazard:	Point of operation – flame cutting		
Hazard Type:	Hot and airborne material		
Hazard Location and Description:	Cutter head- Possible access to hot and flying material from flame cutting operation, possible severe injuries.		
Current Guarding:	None		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	2		
Frequency:	1		
Probability:	2		
RISK RATING:	D		
Notes:	Install guarding in accordance with EN 953 & 13857		



Unauthorised access to hazard area
TIMET PROPRIETARY INFORMATION

5

Figure 38 RA #5

TITANIUM METALS CORPORATION			
Machine Safeguarding HAZARD and RISK Assessment 			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarlwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	22		
Hazard:	Non Mechanical hazards		
Hazard Type:	Heat sources		
Hazard Location and Description:	Cutter head- Possible access to hot material from flame cutting operation, possible severe injuries.		
Current Guarding:	None		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	2		
Frequency:	1		
Probability:	2		
RISK RATING:	D		
Notes:	Install guarding in accordance with EN 953 & 13857		



Unauthorised access to hazard area
TIMET PROPRIETARY INFORMATION

6

Figure 39 RA #6

TITANIUM METALS CORPORATION			
Machine Safeguarding HAZARD and RISK Assessment 			
Machine Name:	Messer Flame Cutter	Evaluator:	Herbert
Model #:	Messer	Date:	22/03/16
Asset #:	1502246	JSA/SOP #:	
Location & Dept:	Waunarlwydd, Y Bay	Assessment #:	SFC 01
Hazard #:	36		
Hazard:	Safety measures		
Hazard Type:	E stops		
Hazard Location and Description:	E stop s are the wrong colour code, possible confusion in operation in an emergency situation.		
Current Guarding:	n/a		
Engineering Controls:	No		
Administrative Controls:	SOP		
PPE:	Standard		
Adequate:	No		
Others Protected:	No		
Severity:	1		
Frequency:	1		
Probability:	2		
RISK RATING:	B		
Notes:	Install E stops in accordance with EN 60204		



Good supporting images

E Stop is the wrong colour code

TIMET PROPRIETARY INFORMATION

8

Figure 40 RA #7

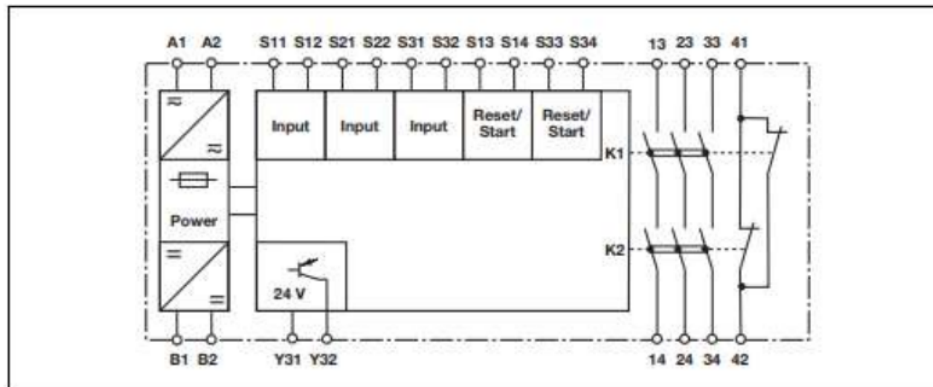


Figure 42 E-stop relay data

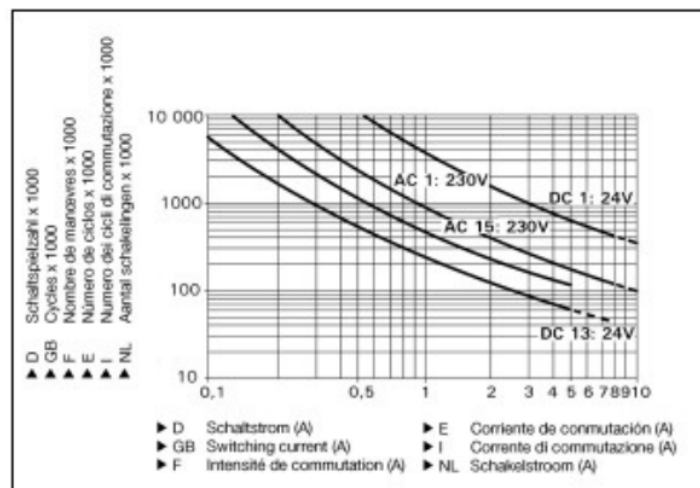


Figure 41 E-stop relay graph

Preparing for operation

► Supply voltage

Supply voltage	AC	DC

► Input circuit

Input circuit	Single-channel	Dual-channel
E-STOP without detection of shorts across contacts		
E-STOP with detection of shorts across contacts		
Safety gate without detection of shorts across contacts		
Safety gate with detection of shorts across contacts		

► Reset circuit

Reset circuit	E-STOP wiring Safety gate without position monitoring	Safety gate with position monitoring
Automatic reset		
Monitored reset		

Pilz GmbH & Co. KG, Felix-Wankel-Straße 2, 73760 Ostfildern, Germany
Telephone: +49 711 3409-0, Telefax: +49 711 3409-133, E-Mail: pilz.gmbh@pilz.de

1002406-EN-01-2012-02

Figure 43 E-stop relay technical sheet

Supporting docs are relevant

FINAL GRADE

GENERAL COMMENTS

Instructor

65/100

PAGE 1

PAGE 2

Text Comment. Good table of contents

PAGE 3

PAGE 4

Text Comment. Extensive list of figures

PAGE 5

Text Comment. Good research carried out with supporting ref sources

Text Comment. Good explanation and evidence

PAGE 6

Text Comment. Good supporting image

Text Comment. Good explanation with supporting image and ref source

PAGE 7

Text Comment. Good application example

Text Comment. Good relevant explanations with supporting image and ref source

Text Comment. Good clear explanation and relevance

Text Comment. Good supporting data sheet as evidence

Text Comment. A good detailed spec with constraints identified

Text Comment. Good test plan using table

Text Comment. A key could have been placed here

Text Comment. Good Gantt chart that includes comparison timelines

Text Comment. Good block diagram of system

Text Comment. Good argument for the solution

Text Comment. Good argument for the solution

Text Comment. Good argument for this solution

Text Comment. Good argument for the chosen solution

Text Comment. Industrial drawings can be reworked for the academic report

Text Comment. Good example of Estop

PAGE 20

Text Comment. Good example of CAD design

Text Comment. Good explanation of procedure

PAGE 21

Text Comment. Budget is established

PAGE 22

Text Comment. Good evidence

Text Comment. Good evidence

PAGE 23

PAGE 24

Text Comment. Good images

Text Comment. Good supporting image

PAGE 25

Text Comment. Good explanation and supporting images

Text Comment. Good sample of PLC program

PAGE 26

Text Comment. Good test table with results

PAGE 27

Text Comment. Explanation supports table of results

Text Comment. Good supporting image

Text Comment. Good conclusion and valid recommendation

Text Comment. Limited number of sources

Text Comment. Good supporting image

Text Comment. Good evidence

Text Comment. Good supporting images

Text Comment. Supporting docs are relevant

GRADING FORM: CSG-RUBIC

KYRAN PRITCHARD

0



Background research includes good significant points and supported with ref sources.
The solutions however, are not supported with ref sources.
Limited number of sources used.

11/20

KNOWLEDGE AND UNDERSTANDING



Specification is descriptive and requirements are clear. More technical requirements should have been included. 6/10
Solutions considered are explained and good arguments are presented. The final solution was chosen using evaluations of solutions.
There is a good understanding of requirements using a PLC. 7/10

13/20

ANALYSIS



Very good structured test method used with supporting evidence. The testing is successful and explained. This is evident in the report. 7/10
Good conclusion and recommendations. 7/10

14/20

PRACTICAL APPLICATION AND DEP.



Good planning methods demonstrated using Gantt chart for timeline plan and evaluation, and test plan using tables. 3.5/5
Solutions considered are explained and evaluated for purpose. 6/10

16/25

Implementation methods are demonstrated and supported with evidence. 6.5/10

SKILLS FOR PROFESSIONAL PRAC.



Good report overall and in good sequence

11/15