

2221114

by Kai White

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Your Name: Kai White

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Course: HNC Electrical / Electronic
Engineering

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Assignment Title: Final Report and Log
Book

Date Submitted:

No table of contents or list of figures

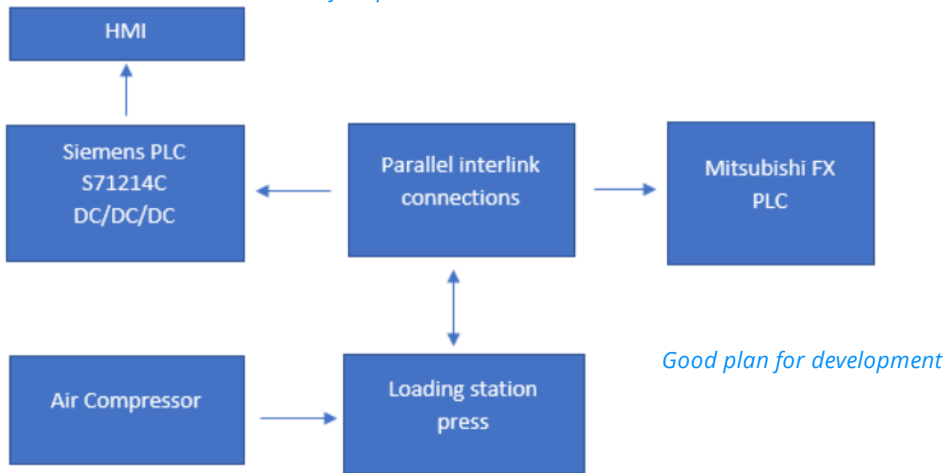
Introduction and Background Research

Introduction

The project will be situated in college on the Graig campus in Llanelli. The Loading system in G23 requires an installation to the system to automate the system in a sequence. This project is required to pick and place objects. The machine designer also requires a PLC programming for manual and automatic modes. The aim of the project is to make the system automatic by using TIA portal to program and control the PLC. The information will be available on the HMI.

The block diagram shows how my project will work;

Avoid first person terms



The air compressor will power the loading station press. The parallel interlink connections will link the loading press, Mitsubishi FX PLC and Siemens PLC together. Then the HMI screen will be fed by the Siemens PLC.

The cost of my project will be

HMI	£200
S71214C DC/DC/DC	£510
Mitsubishi FX PLC	£250
Loading station press	£200
Air compressor	£100
Estimated total	£1260

Good budget

(Components, 2024)Correct citation

The project will be completed by the 28th of April. A Gantt chart will be created with specific milestones to monitor progress.

Research

Solution 1 – Siemens PLC



TIA portal will be used to program the robot with ladder programming and SCL coding for auto sequencing.

Use more efficient

English

vocabulary

With a siemens PLC you have a massive variety of PLCs with various amounts of Dis, DQs, AIs, AQs. So, finding the right PLC depending on the budget and use would be easy.

Large

When programming the siemens PLC I would program the manual mode in ladder and the auto sequencing in SCL.

(Siemens, Programming Guideline, 2014)

correct citation

Good image of prac setup

This could have been annotated

this should be titles 1214C DC/DC/DC

14 Digital inputs

10 Digital Outputs

Ethernet connection

2 Analogue inputs

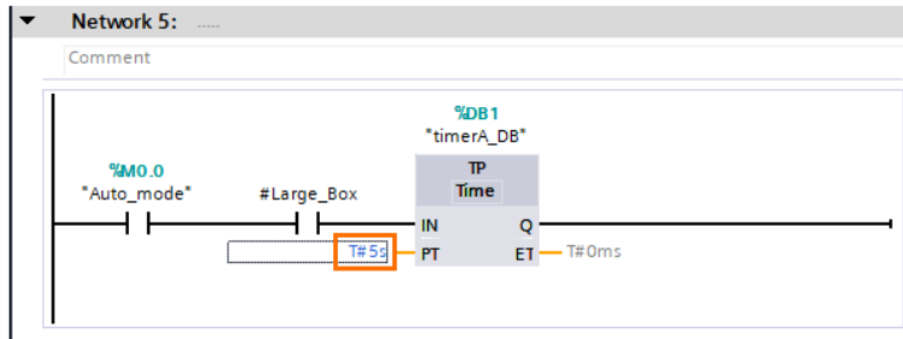
0 Analogue Outputs

(Siemens, 2022)



Avoid first person terms

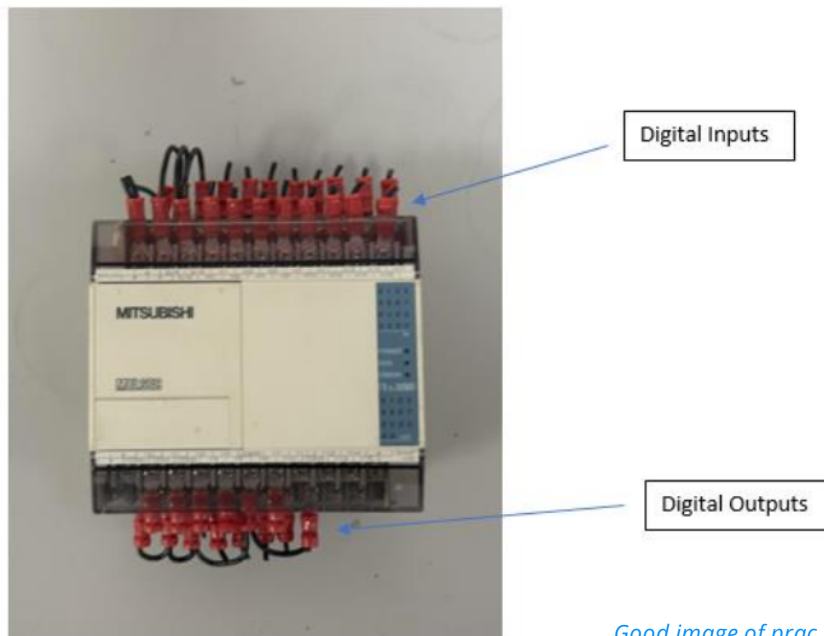
I will be programming in ladder logic using tutorials and guidance from (Yahia, 2023)*Correct citation*



The timer works on Siemens by editing 'PT' to the time in seconds needed. Programmed in TIA portal which is a very effective program.

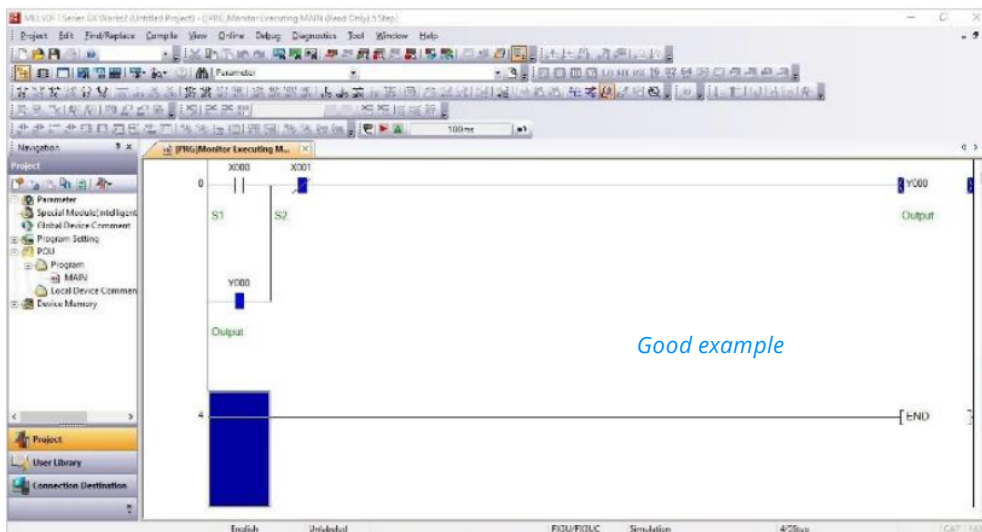
There should e more explanations here with some examples from industry.

Solution 2 – Mitsubishi



Good image of prac device

This will be programmed on GX Developer with ladder logic and code similar to the Siemens Tia portal



Good example

Figure 1 - The Mitsubishi will be programmed in ladder logic as shown. (Odhiambo, 2023)

When programming the Mitsubishi, a useful article to use would be the article from Mitsubishi. (Mitsubishi, 2011)

Correct citation

Purpose should be explained

Ladder logic is code using contacts, coils and function box (which has many of different functions that can be called). Which is a lot more basic than using codes like SCL for Siemens. I will use ladder logic for manual mode in the loading station and then code to program the automatic mode. (plcademy, 2017)

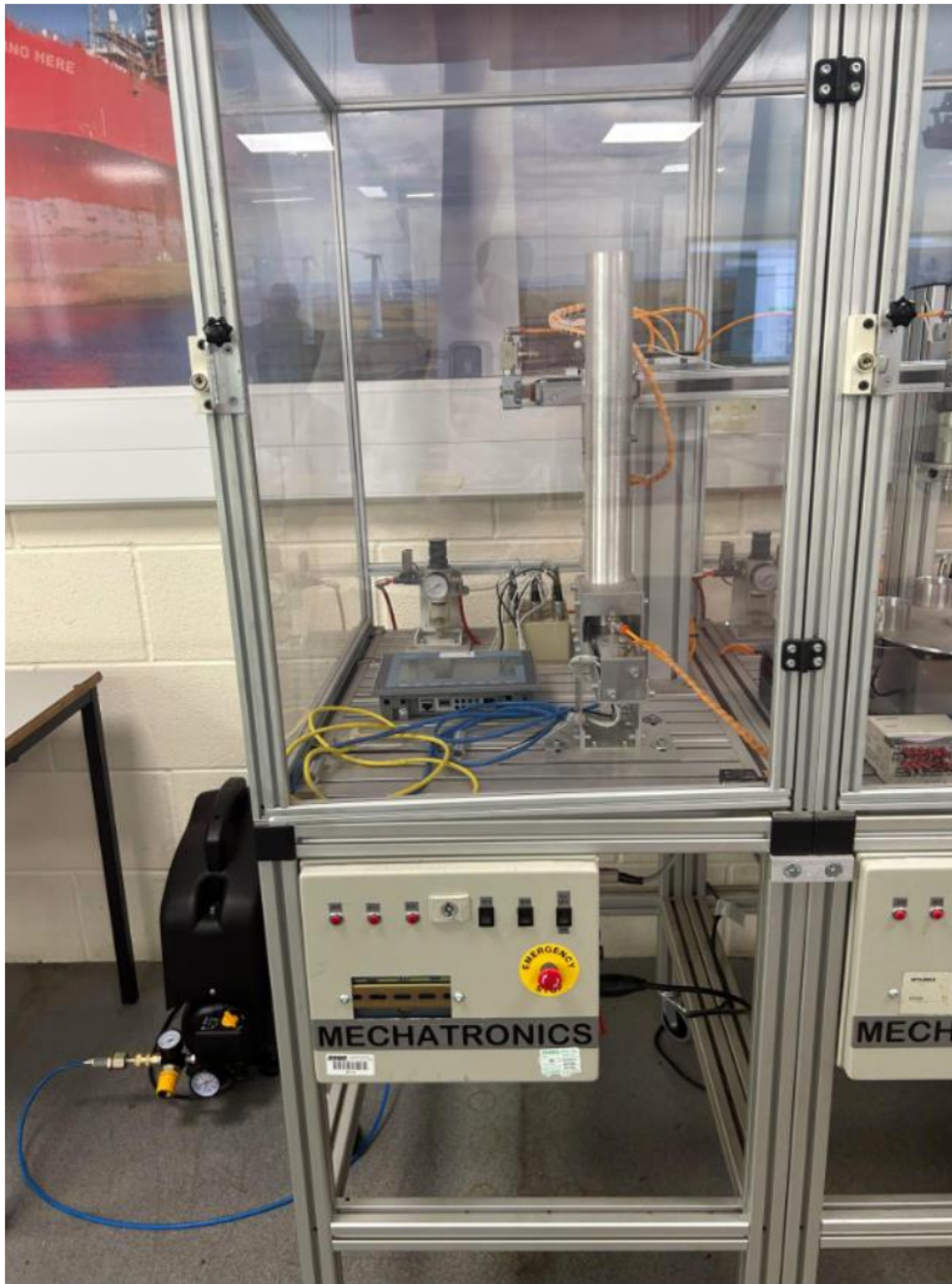
Correct citation

Avoid first person terms

This is the main reason and should be explained in detail, including advantages.

I have chosen to go with the Siemens PLC because it has an ethernet connection meaning that it can be addressed and has a hard connection with the machine meaning better efficiency. Both software has easy and navigable interface. So, either the Mitsubishi or Siemens can be used for the software because both are easy to use and both effective.

This explanation / discussion should be more in depth



This will be the machine that will be getting changed.

This should be annotated and explained

Specification *Avoid first person*

The project specification is that I need an automatic machine to pick and place components in a particular order using code and having a digital screen to go with the machine to see what is happening.

Name	Price (£)
Siemens s7 1214C PLC	420
HMI – £250	250
Tia portal (single use) - £300	300

Parts and budget are realised.

Total = £970

This is good as there was a budget of £1000 leaving £30 spare.

The project is projected to take up to 25 weeks until completion.

Avoid the first person

Grammatical error

There are a few safety risks in my project so there will have to be safety measures to stop the machine as soon as someone could be in danger this will be determined by sensors and buttons. My project will be sustainable because it can be modified in the future if any changes were to be made and software licences are permanent.

Manual Mode

Proposed test table – Manual sequence

Cylinder Action	Cylinder Position	Input Conditions	Output Address
A-	Loader RETRACTED	0.0 = 1 0.1 = 0	Q1
A+	Loader EXTENDED	0.1 = 1 0.0 = 0	Q0
B-	Gripper RAISED	0.2 = 1 0.3 = 0	Q3
B+	Gripper LOWERED	0.3 = 1 0.2 = 0	Q2
C-	Gripper OPEN	0.4 = 1 0.5 = 0	Q5

Good table of manual mode requirements IO

C+	Gripper CLOSED	0.5 = 1 0.4 = 0	Q4
D-	Travel LEFT	0.6 = 1 0.7 = 0	Q7
D+	TRAVEL RIGHT	0.7 = 1 0.6 = 0	Q6

Auto Mode

Proposed test table – Automatic sequence

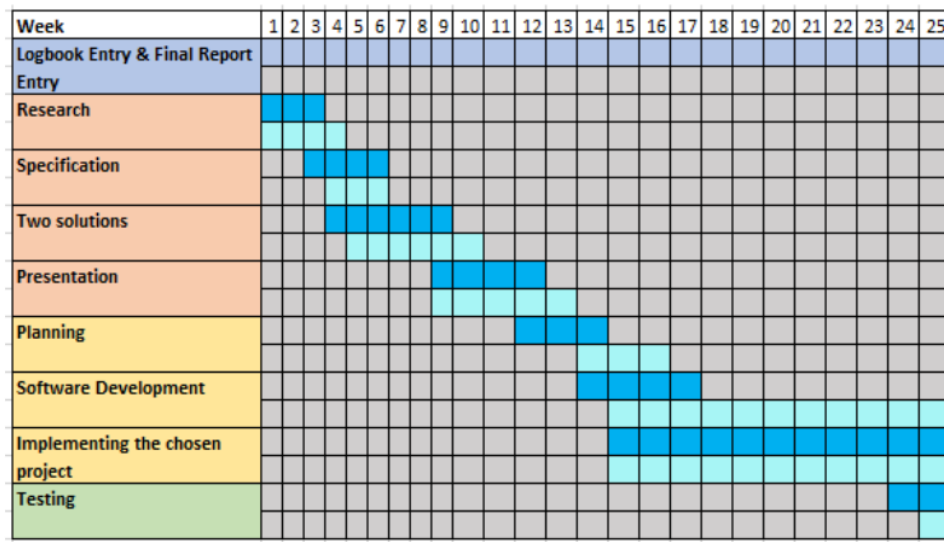
Step number	Condition No	Output Address	Expected action
STEP 0	1	Q0	Extend Switch, delay 2s
STEP 1	2	Q1	Retract Switch
STEP 2	3	Q5	Gripper OPEN
STEP 3	4	Q2	Gripper LOWERED
STEP 4	5	Q4	Gripper Closed
STEP 5	6	Q3	Gripper RAISED
STEP 6	7	Q6	Travel RIGHT
STEP 7	8	Q2	Gripper LOWERED
STEP 8	9	Q5	Gripper OPENED
STEP 9	10	Q3	Gripper RAISED

STEP 10	11	Q4	Gripper CLOSED
STEP 11	12	Q7	Travel LEFT

Good auto mode requirements IO

Planning

This is in the incorrect place



Gantt chart need to be more detailed

This chart shows when tasks are expected to be done and when they are actually completed, this helps get the project fully completed by the deadline.

Solutions Considered

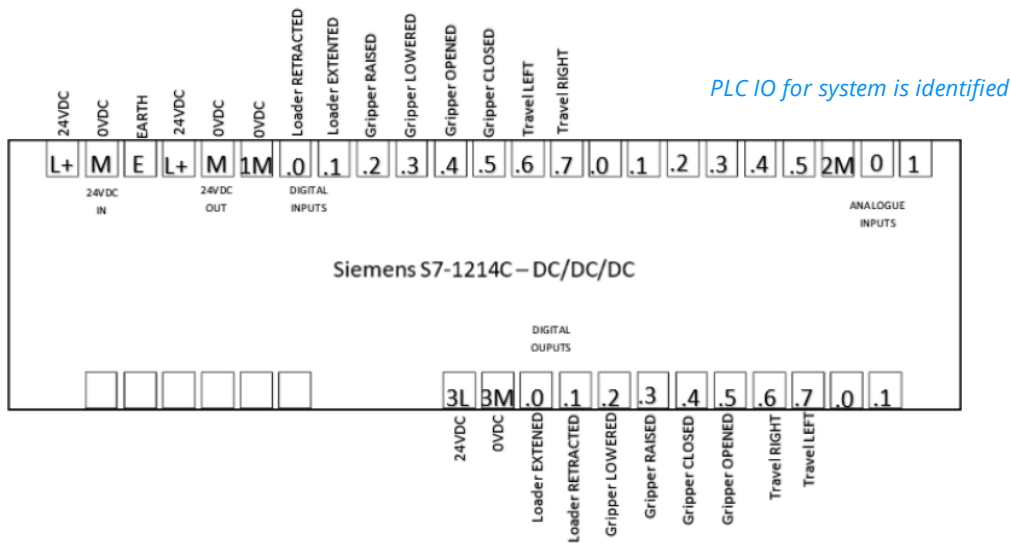
	Mitsubishi FX	Siemens 1214C DC/DC/DC
Software	GX Developer	TIA Portal
Updates	Older software/versions	Updatable software/versions
Screens	No	Yes
Component availability	Hard to acquire	easy
Safety interlocks	yes	yes
Ethernet	no	yes

Good use of table, but should be place with the two solutions

Final Solution and Implementation

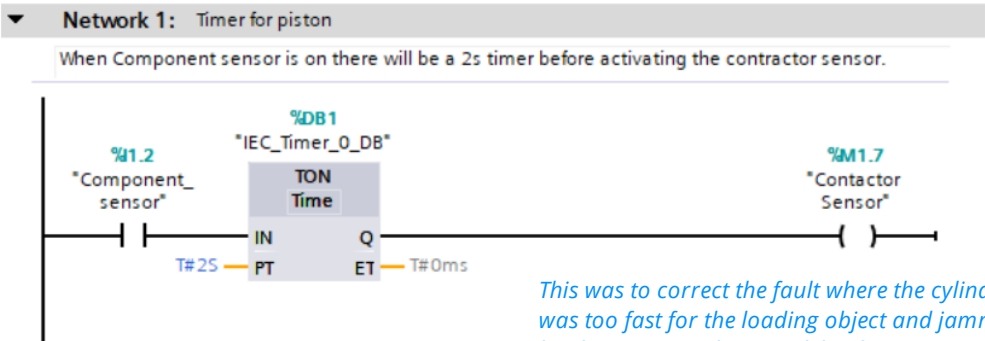
A siemens PLC is going to be used as it is more updated and easier to adapt code and logic. The Mitsubishi will still be a backup option but the machine way mainly run off the siemens. The siemens

will be connected to an HMI where all actions will take place by the operator. The fact that the siemens has an ethernet connection made the decision easier.



This will be how the siemens PLC will be connected according to the plan and will be checked when testing to see if the ports turn on when they activate accordingly.

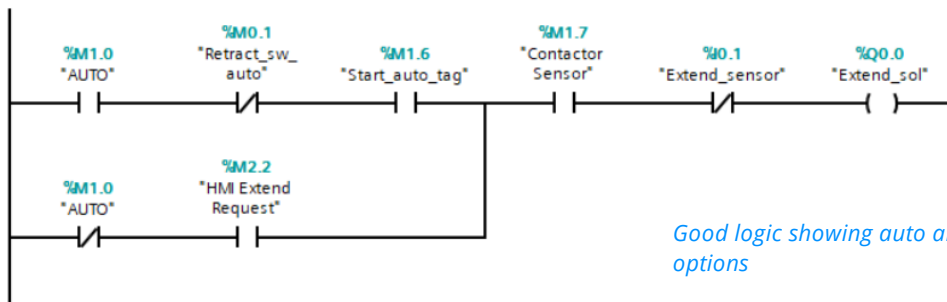
Program networks



This was to correct the fault where the cylinder extruder was too fast for the loading object and jammed the loading system. The time delay function rectified this problem and the testing went efficiently once implemented.

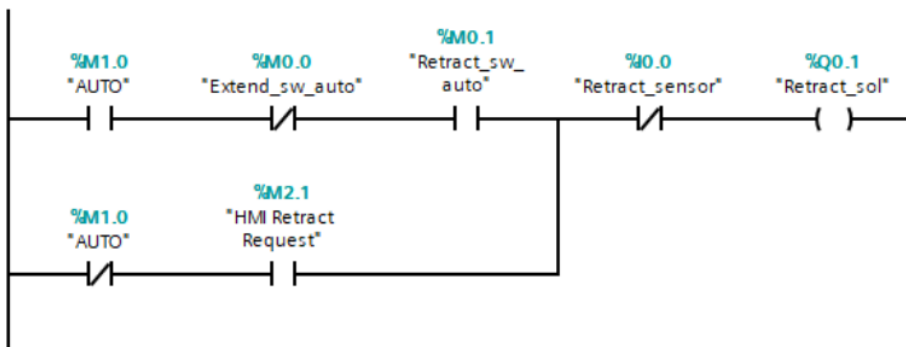
Network 2: Extend

The extend sol will activate when it is in manual mode, the contactor sensor is on and the extend sensor is off.



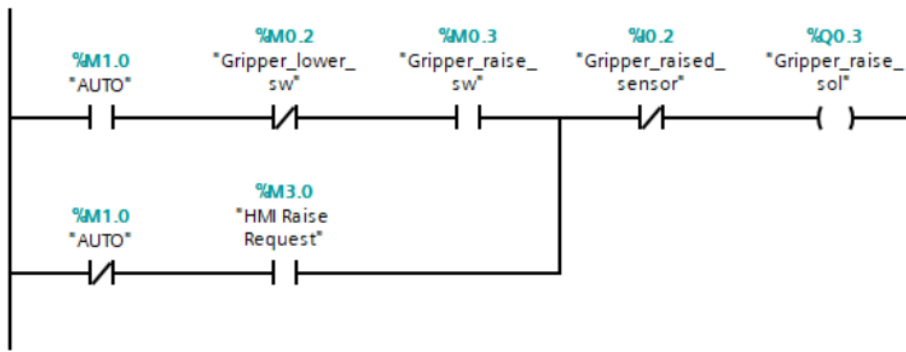
Network 3: Retract

The retract sol will activate when it is in manual mode and the retract sensor is off.



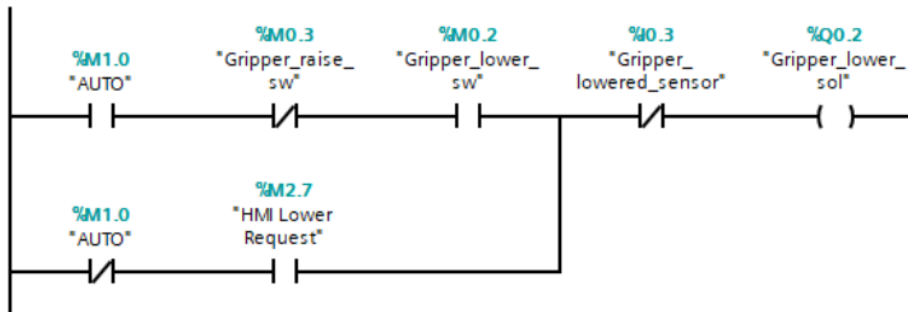
Network 4: Raise gripper

The raise gripper sol will activate when it is in manual mode and the gripper raised sensor is off.



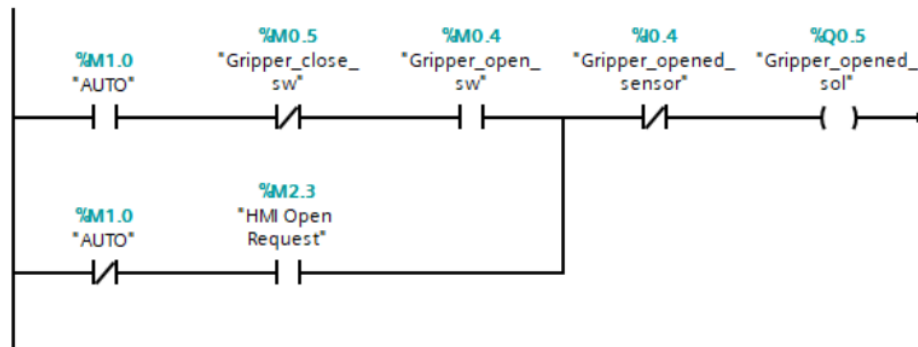
▼ **Network 5: Lower gripper**

The lower gripper sol will activate when it is in manual mode and the gripper lowered sensor is off.



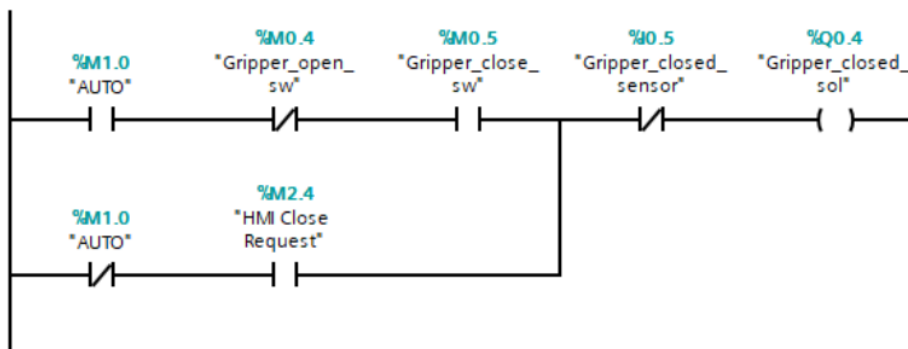
▼ **Network 6: Open gripper**

The open gripper sol will activate when it is in manual mode and the gripper opened sensor is off.



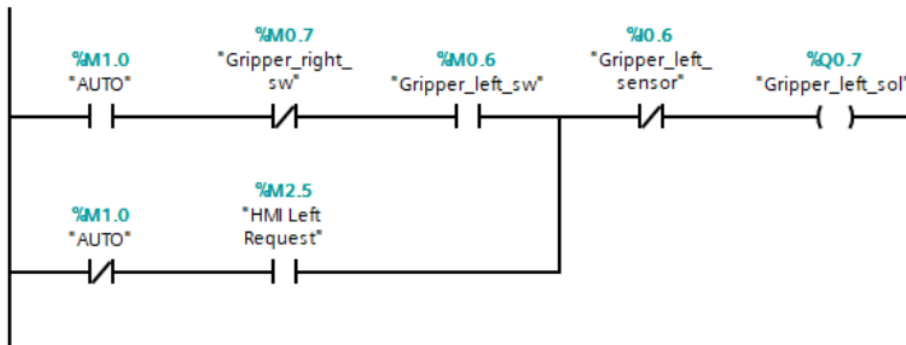
▼ **Network 7: Close gripper**

The close gripper sol will activate when it is in manual mode and the gripper closed sensor is off.



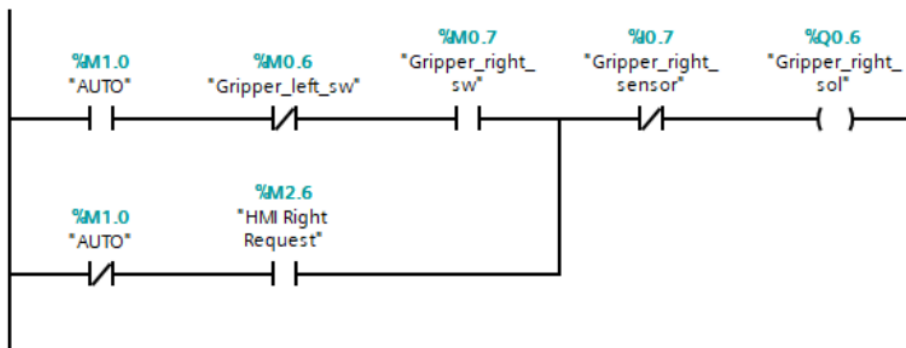
▼ **Network 8: Gripper left**

The left gripper sol will activate when it is in manual mode and the gripper left sensor is off.



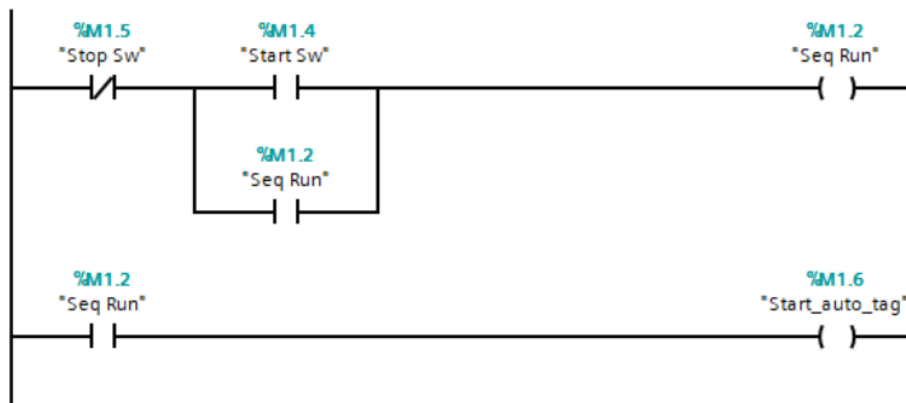
▼ **Network 9: Gripper right**

The right gripper sol will activate when it is in manual mode and the gripper right sensor is off.



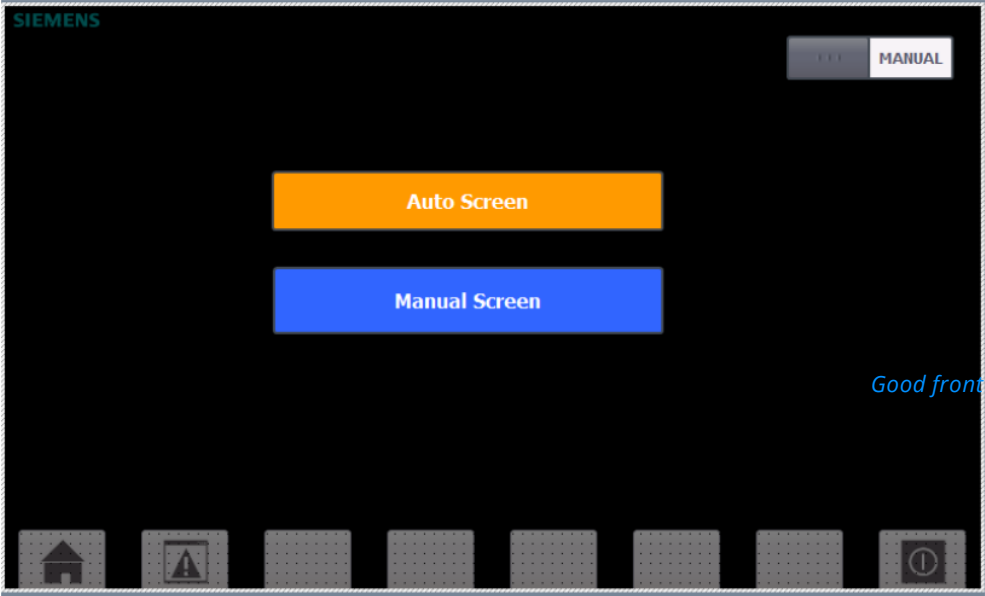
▼ **Network 10: Sequence run**

The sequence will run when start has been pressed.

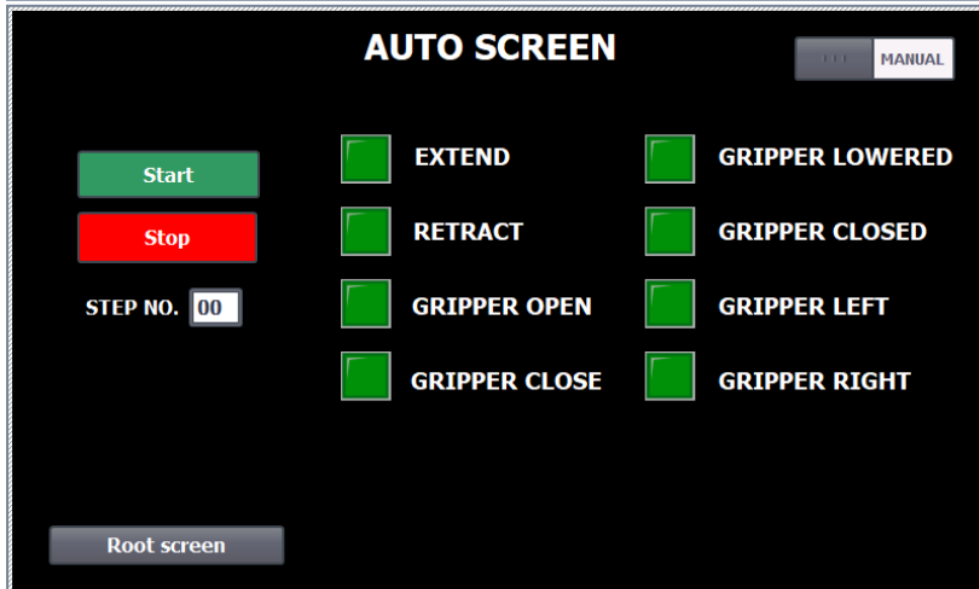
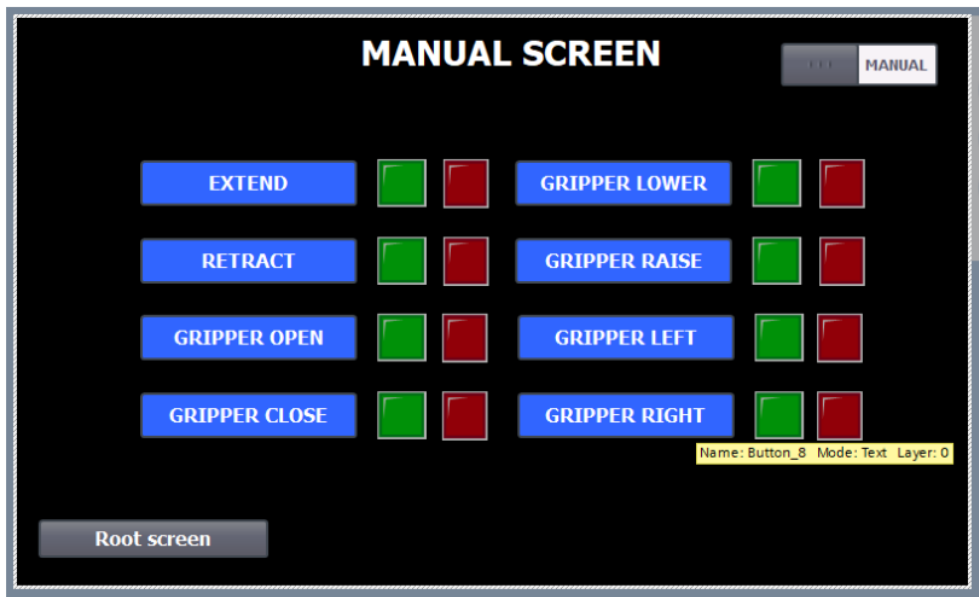


Networks are appropriately commented and labelled

HMI Screens



Good front screen



HMI screen designs are good. These could have been annotated

Auto sequence SCL code

```
1 IF ("Seq Run" = 0) THEN
2     "Stage" := 0;
3     "Next Stage" := 0;
4     "Retract_sw_auto" := 0;
5     "Extend_sw_auto" := 0;
6 END_IF;
7 IF ("Seq Run" = 1) THEN
8     CASE "Stage" OF
9
10
11         0:
12             "Retract_sw_auto" := 0;
13             "Extend_sw_auto" := 0;
14             IF ("Start_auto_tag" = 1) THEN
15                 "Next Stage" := 1;
16             END_IF;
17
18         1:
19             IF ("Component_sensor" = 1) THEN
20                 "Extend_sw_auto" := 1;
21             END_IF;
22             IF ("Extend_sensor" = 1) AND ("Retract_sensor" = 0) THEN
23                 "Extend_sw_auto" := 0;
24                 "Next Stage" := 2;
25             END_IF;
26
27         2:
28             "Retract_sw_auto" := 1;
29             IF ("Extend_sensor" = 0) AND ("Retract_sensor" = 1) THEN
30                 "Retract_sw_auto" := 0;
31                 "Next Stage" := 3;
32             END_IF;
33
34         3:
35             "Gripper_open_sw" := 1;
36             IF ("Gripper_opened_sensor" = 1) AND ("Gripper_closed_sensor" = 0) THEN
37                 "Gripper_open_sw" := 0;
38                 "Next Stage" := 4;
39             END_IF;
40
41         4:
42             "Gripper_lower_sw" := 1;
43             IF ("Gripper_lowered_sensor" = 1) AND ("Gripper_raised_sensor" = 0) THEN
44                 "Gripper_lower_sw" := 0;
45                 "Next Stage" := 5;
46             END_IF;
```

```

48 5:
49   "Gripper_close_sw" := 1;
50 IF ("Gripper_closed_sensor" = 1) AND ("Gripper_opened_sensor" = 0) THEN
51   "Gripper_close_sw" := 0;
52   "Next Stage" := 6;
53 END_IF;
54
55 6:
56   "Gripper_raise_sw" := 1;
57 IF ("Gripper_raised_sensor" = 1) AND ("Gripper_lowered_sensor" = 0) THEN
58   "Gripper_raise_sw" := 0;
59   "Next Stage" := 7;
60 END_IF;
61
62 7:
63   "Gripper_right_sw" := 1;
64 IF ("Gripper_right_sensor" = 1) AND ("Gripper_left_sensor" = 0) THEN
65   "Gripper_right_sw" := 0;
66   "Next Stage" := 8;
67 END_IF;
68
69 8:
70   "Gripper_lower_sw" := 1;
71 IF ("Gripper_lowered_sensor" = 1) AND ("Gripper_raised_sensor" = 0) THEN
72   "Gripper_lower_sw" := 0;
73   "Next Stage" := 9;
74 END_IF;
75
76 9:
77   "Gripper_open_sw" := 1;
78 IF ("Gripper_opened_sensor" = 1) AND ("Gripper_closed_sensor" = 0) THEN
79   "Gripper_open_sw" := 0;
80   "Next Stage" := 10;
81 END_IF;
82
83 10:
84   "Gripper_raise_sw" := 1;
85 IF ("Gripper_raised_sensor" = 1) AND ("Gripper_lowered_sensor" = 0) THEN
86   "Gripper_raise_sw" := 0;
87   "Next Stage" := 11;
88 END_IF;
89
90
91
92
93
94
95
96
97 12:
98   "Gripper_left_sw" := 1;
99 IF ("Gripper_left_sensor" = 1) AND ("Gripper_right_sensor" = 0) THEN
100   "Gripper_left_sw" := 0;
101   "Next Stage" := 0;
102 END_IF;
103 END_CASE;
104   "Stage" := "Next Stage";
105
106 END_IF;

```

SCL code looks in order, but code comments should be used

Testing and Results

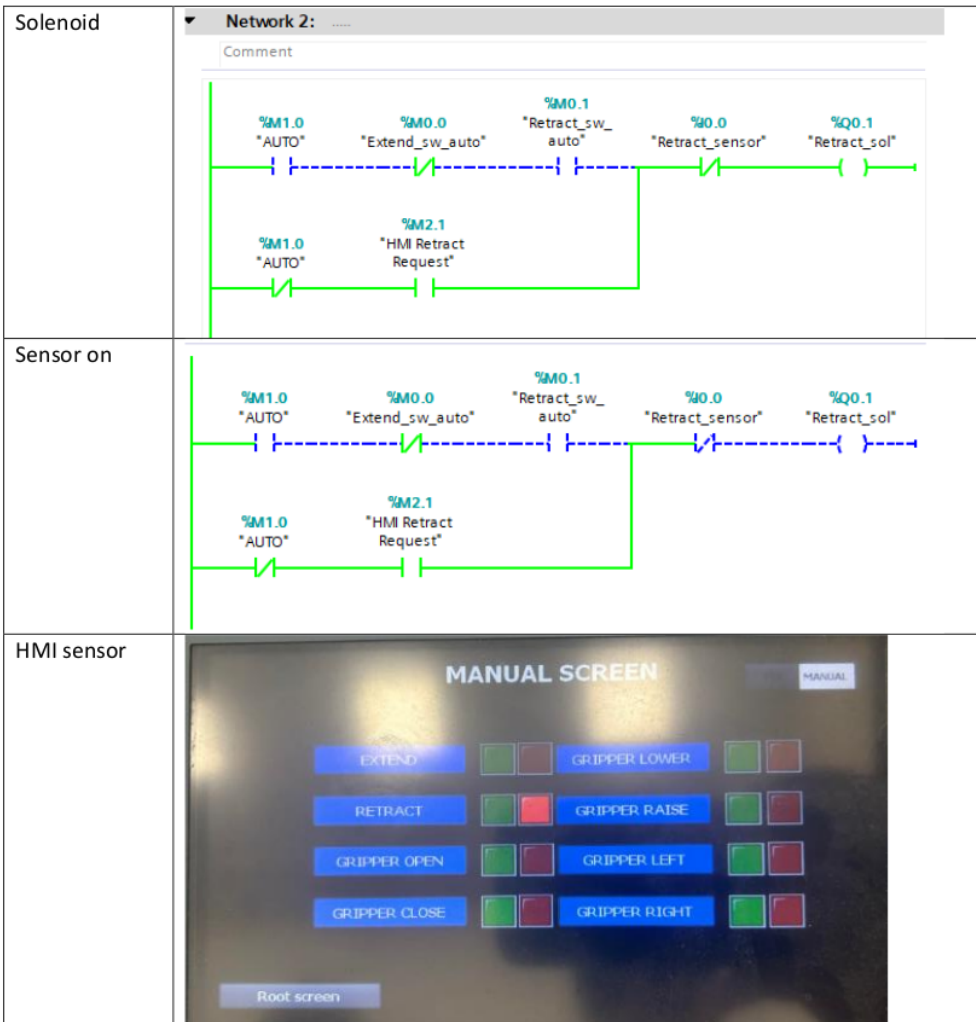
Manual Mode

Extend

Solenoid	Network 1: Comment %M1.0 "AUTO" %M0.1 "Retract_sw_ auto" %M0.0 "Extend_sw_auto" %I1.2 "Component_ sensor" %I0.1 "Extend_sensor" %Q0.0 "Extend_sol" %M1.0 "AUTO" %M2.2 "HMI Extend Request" Component sensor was changed to normally closed for testing.
Sensor on	Network 1: Comment %M1.0 "AUTO" %M0.1 "Retract_sw_ auto" %M0.0 "Extend_sw_auto" %I1.2 "Component_ sensor" %I0.1 "Extend_sensor" %Q0.0 "Extend_sol" %M1.0 "AUTO" %M2.2 "HMI Extend Request"



Retract *Good test evidence*



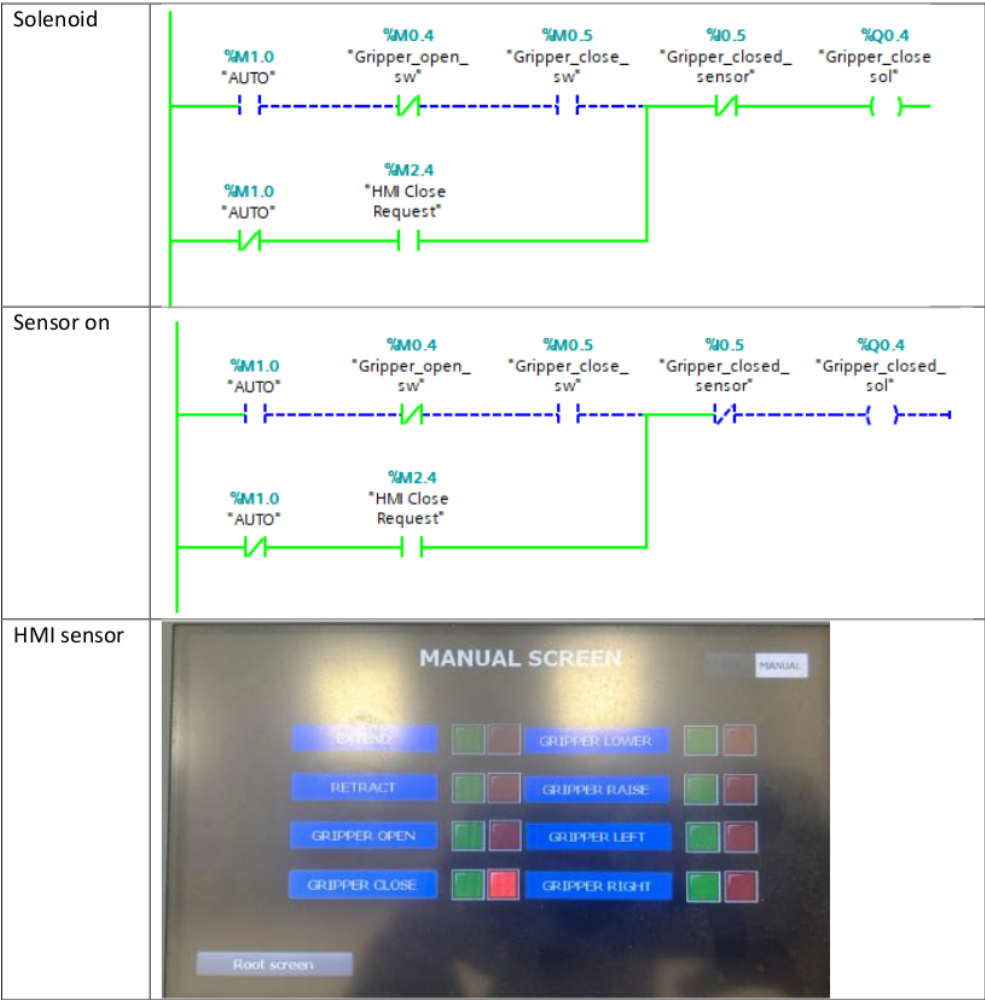
Good test evidence

Opened

Solenoid	
Sensor on	Comment
HMI sensor	

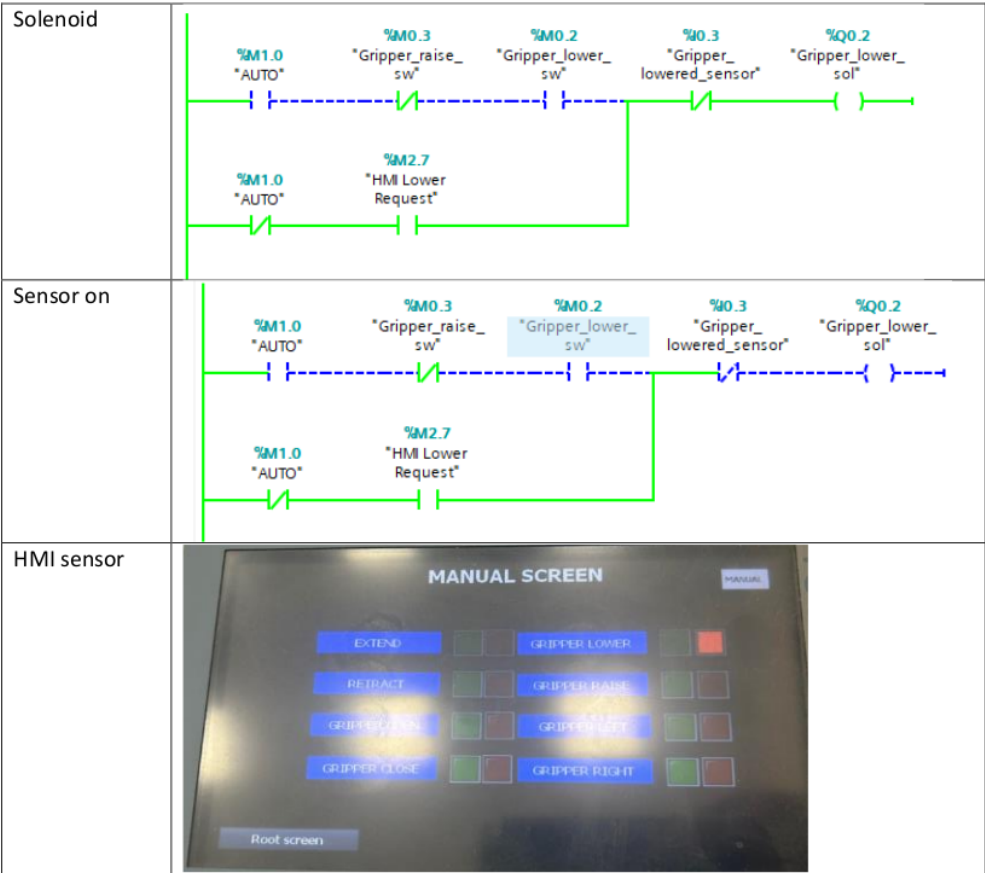
Good test evidence

Closed



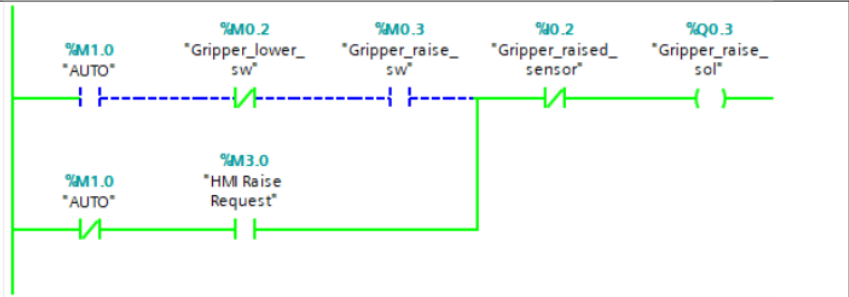
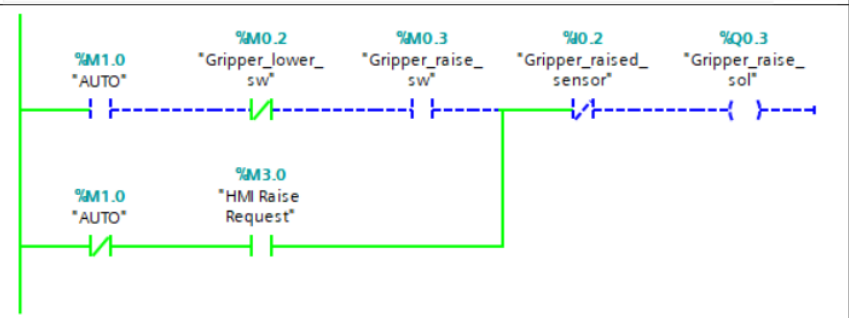
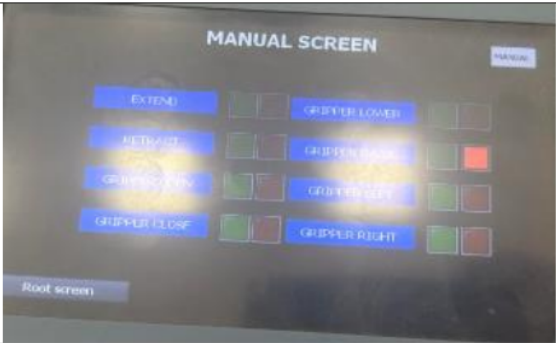
Good evidence

Lower



Good evidence

Raise

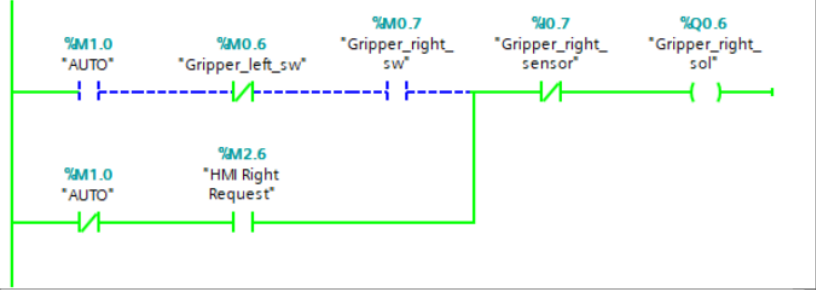
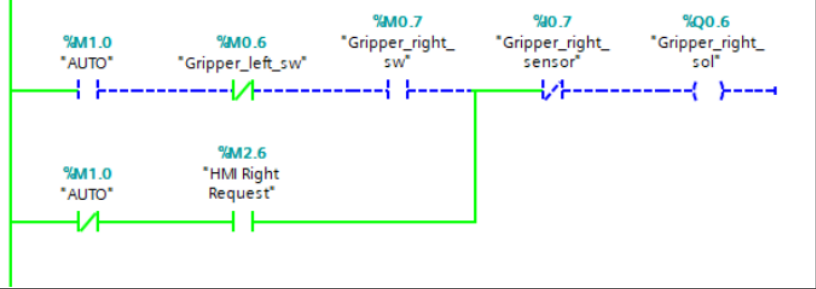
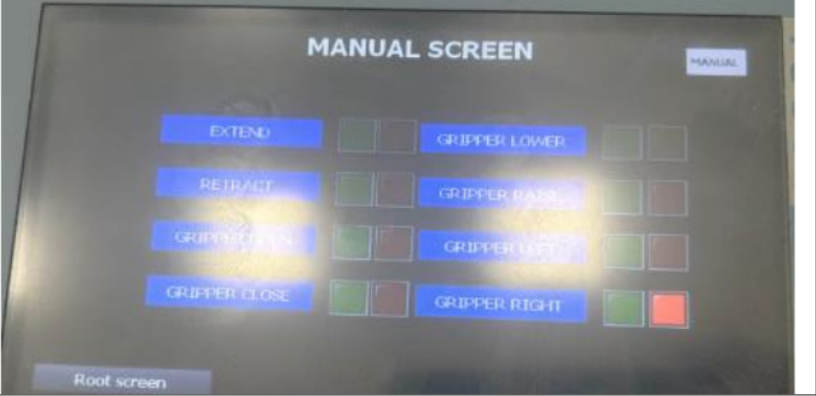
Solenoid	
Sensor on	
HMI sensor	 Good evidence

Left

Solenoid	
Sensor on	
HMI sensor	

Good evidence

Right

Solenoid	
Sensor on	
HMI sensor	

Good evidence

Automatic Mode

The testing plan from task 3 must be revisited with the inclusion of test results and must be supported

by photos, data tables, graphs or any other appropriate evidence. This task will form the basis of the next task and must be detailed enough to allow the project outcomes to be assessed.

Sentences should be linked.

Discussion, Conclusions and Recommendations

To conclude the project was successful as it fits the specification and works correctly. As the software is programmed in TIA portal any changes or modifications can simply be done by running and editing the program from any device. The components all came in time not interfering with the build time and kept the rest of the program on track.

The budget was £1000 and the project was under the budget with great condition parts.

The Siemens PLC is also eco-friendly because it can keep getting updated to the modern versions with updates to the software every so often. *Good point*

The testing went according to plan besides the piston jamming, this was solved by adding a delay to the piston after the sensor was triggered.

So now the machine can pick and place components accordingly.

There should be more details of how the test has been carried out using manual and auto methods. The time delay

Bibliography

Components, R. (2024, 02 20). *Catalogue*. Retrieved from RS Components: <https://uk.rs-online.com/web/>

for the rules not discussed and no recommendations made.

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Yahia, R. A. (2023, 10 02). *An Introduction to Basic Ladder Logic Instructions in Siemens Tia Portal*. Retrieved from Solis PLC: An Introduction to Basic Ladder Logic Instructions in Siemens Tia Portal

A reasonable number of sources

46

/100

PAGE 1

Text Comment. No table of contents or list of figures

PAGE 2

Text Comment. Avoid first person terms

Text Comment. Good plan for development

Text Comment. Good budget

Text Comment. Correct citation

PAGE 3

Text Comment. Use more efficient English vocabulary

Text Comment. Large

Text Comment. correct citation

Text Comment. Good image of prac setup

Text Comment. This could have been annotated

Text Comment. this should be titles 1214C DC/DC/DC

Text Comment. Avoid first person terms

Text Comment. Correct citation

Text Comment. There should e more explanations here with some examples from industry.

Text Comment. Good image of prac device

Text Comment. Good example

Text Comment. Purpose should be explained

Text Comment. Correct citation

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Text Comment. Ths explanation / discussion should be more in depth

Text Comment. This should be annotated and explained

Text Comment. Avoid first person

Text Comment. Parts and budget are realised.

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Text Comment. Grammatical error

Text Comment. Good table of manual mode requirements IO

PAGE 8

PAGE 9

Text Comment. Good auto mode requirements IO

Text Comment. This is in the incorrect place

Text Comment. Gantt chart need to be more detailed

Text Comment. Good use of table, but should be place with the two solutions

PAGE 10

Text Comment. PLC IO for system is identified

Text Comment. This was to correct the fault where the cylinder extruder was too fast for the loading object and jammed the loading system. The time delay function rectified this problem and the testing went efficiently once implemented.

PAGE 11

Text Comment. Good logic showing auto and manual options

PAGE 12

PAGE 13

Text Comment. Networks are appropriately commented and labelled

PAGE 14

Text Comment. Good front screen

PAGE 15

Text Comment. HMI screen designs are good. These could have been annotated

PAGE 16

PAGE 17

Text Comment. SCL code looks in order, but code comments should be used

Text Comment. Good test evidence

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Text Comment. Sentences should be linked.

Text Comment. Good point

Text Comment. There should be more details of how the test has been carried out using manual and auto methods. The time delay for the loader is not discussed and no recommendations made.

Text Comment. A reasonable number of sources

KAI WHITE

0

RESEARCH-INFORMED LITERATURE



Research with solutions is poor and explanations are not given in any detail.
A reasonable number of sources investigated, but not enough referenced in the text content.

7/20

KNOWLEDGE AND UNDERSTANDING



There is a spec and the system functions are evident using tables.
Solutions should be explained in more detail.
Explanations here are no more than comments.
There is a block diagram of implementation plan that indicates a good method.
Image of the practical setup should be annotated to indicate the components and explained in detail.
There is an understanding evident by the specific table content of system requirement IO.

10/20

ANALYSIS



Test results prove the system functions. Auto and manual test should have been tested further. Conclusion has some good points, but not enough detail for this project. No recommendataion are made.

10/20

PRACTICAL APPLICATION AND DEP.



The planning is dependant on a Gantt chart which does not have enogh detailed tasks. Two solutions considered that are only briefly covered. Impelementation is explained and logic networks are commented. SCL code is logicallly implemented, but there should be code comments. The implementation stages are structured.

12/25

SKILLS FOR PROFESSIONAL PRAC.



The report does not include a table of contents or list of figures. There is content in the incorrect areas.

7/15