

Alun Dion Gealy

by Alun Gealy

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*A good
detailed
list of
contents*

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1. Introduction and Background research.

Do not use first person terms

I work for a company Called TATA Steel, which is a Large steel making company. The site in which I am based, Port Talbot, Wales, Is a Integrated steel production plant capable of producing nearly 5 million tonnes of slab steel each year and employs over 4000 employees This makes it the largest steel production plant in the UK.

(TATAsteel.com, 2020)

Im employed at Sinter plant, which is part of the iron and burdening department. The sinter Plant mixes iron ore and other fine materials at a very high temperature to produce Sinter, the sinter is a small chunk of iron mixed with other minerals such as coke and limestone which can be used in the blast furnace to convert iron into steel.

1.1 Engineering Problem.

As part of the handling of materials, conveyors are used, run by AC motors. To make sure the correct amount of material is coming off a belt, its essential that the belts speed can be controlled. Adding speed control will allow the conveyor to run at different speeds. This will allow plant to continue running at a slower speed. For example, if one of the limestone weight feeders is down on breakdown, the plant could run at 50% off the other weight feeder. After speaking with my engineer and leading hand, it wasn't possible to do this project in the workplace. This was due to financial reasons and plant availability. So this project will be built in Coleg sir gar.

The report should only contain third person terms

1.2 Background Research.

Types of motor speed control.

Variable speed Inverter (VSD'S)- In AC induction motors an alternating current passed through a series of coils in the windings to create a rotating electromagnetic field which is used to drive the rotor. Thus, making the motor turn. The speed of the motor depends on the frequency and voltage of the supply. As most electrical supplies are a constant frequency, usually 50Hz, and voltage the speed of the motor will also be constant. A VSD can be connected in series with AC motor and intercept the incoming electrical supply. The VSD internal circuitry will modify the voltage and frequency based on the load requirements. In this way the motor speed and torque can be adjusted to suit the load it is servicing with high precision

(therma.com, 2020)



Figure 1, Example of VSD's

(Schneider, 2020)

An example of different VSD is shown in *Figure 1, Example of VSD's*

Servo motors – “A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism. If motor is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and light weight package. Due to these features they are being used in many applications like toy car, RC helicopters and planes, Robotics, Machine etc.”

(CircuitDigest, 2020)

Good research carried out here. An example scenario could have been discussed to aid your research.

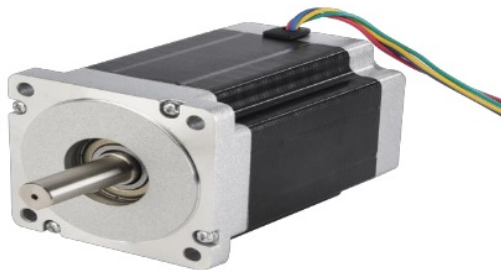
A servo motor is made up of a motor, a potentiometer, gear assembly and a control circuit. The gear assemble is to reduce the RPM.

The servo motor contains a encoder which converts the mechanical motion into digital pulses which are interpreted by a motion controller, the encoder paired with a driver make up a circuit which controls the speed, torque and position.



Figure 2, Servo Motor.

Stepper motors – Stepper motors are brushless, synchronous electric motors that converts digital pulses into mechanical shaft movements. The motors windings are divided into steps, typically 200, and the motor needs a pulse for each step. A motor with 200 steps, so 360 divided by 200 makes 1.8Degree per pulse. This makes it very precise for positioning. The stepper doesn't need any feedback such and encoder.



What about a driver for the stepper motor.

Figure 3, Stepper Motor

2. Specifications

The specification of this project is the following;

- To control the speed of the conveyor belt.
- To be able to change direction of the conveyor.
- Have a HMI screen programmed so a operator can control all of the above
- PLC program to go with the HMI screen.

The user needs is to have a fully controlled conveyor where they can move an object along , stop it in a position, so there is a station, an example would be to have a camera to check for faults, then move the object along again. Also with the speed control they could operate at a slower speed to be more energy efficient.

This project is being done in the college, so the budget is limited, this project will be done at lowest possible cost. The time scale of the project was around 8 months. Beginning September 2019 and all complete and final report submitted in April 2020.

To stay within the time, scale a gant chart was made to stick within the timescale.

This project must comply with all the relevant regulations to maintain a good standard of health and safety and environmental protection.

*A diagram of the system
would be helpful here*

3. Planning

As part of the project management. A gant chart was created. This was to help stick to a schedule, This can be seen below in Table 1, Gant chart

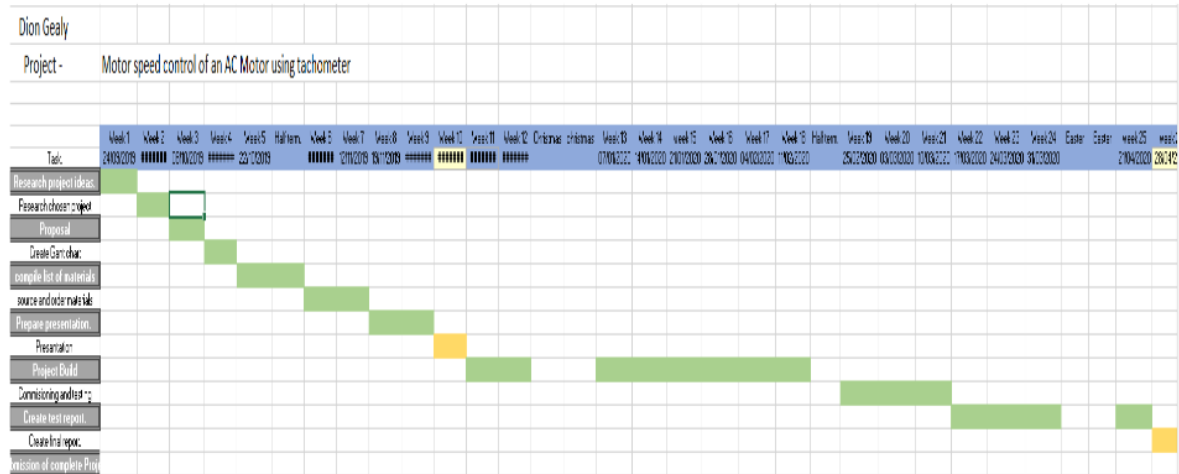


Table 1, Gant chart

All aspects of the project are covered. They are;

- Researching Project ideas
- Chosen project
- Proposal
- Compile list of materials.
- Source and order materials
- Prepare and present the presentation
- Project Build
- Commissioning and testing
- Create test report
- Create final report
- Submission of final report and logbook.

Good use of Gantt chart

All these have been designated a certain amount of time. Some of the timescales will have to be altered due to unforeseen circumstances such as materials not Arriving on time.

The Key milestones, Presentation and Submission of final report are marked yellow. And these are important and are not Flexible.

Along with the timescale, this project will also be fully costed, to make sure I remain in budget and not overspend. All costs will be noted, and receipts will be documented.

4. Solutions Considered

For the Final project, 2 solutions had to be considered.

4.1 Solution 1.

The first solution was to use a servo motor and drive. the motor would be coupled up to the conveyor. The motor would then be connected to a Drive. All this would be controlled by a TIA project using siemens PLC and HMI.



Figure 4, Siemens Sinamics V90



Figure 5, Siemens V90 Drive and motor

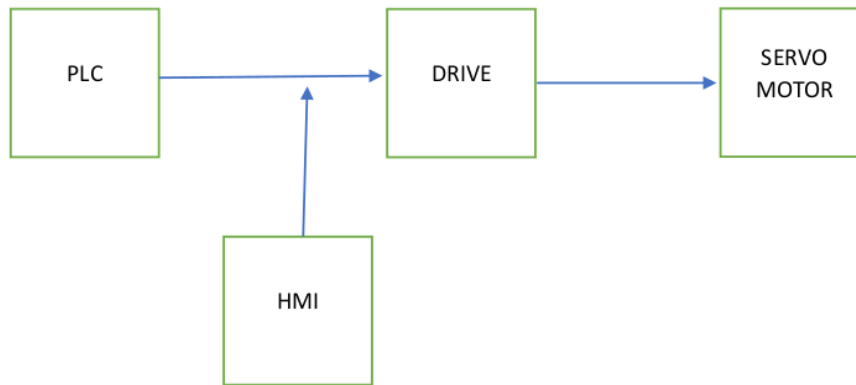
The siemens V90 would be the chosen drive and a compatible Servo motor.

Product Specification

Brand	Siemens
Current	2 A
Input Voltage	240 V
Input Phase	Single Phase
Accuracy	0.2 %
Storage Temperature	75 Degree C
Ambient Operating Humidity	80%
Series	V90

Figure 6, V90 Specifications

Block diagram



List of materials

Siemens S1200 PLC

Siemens HMI

Siemens V90 drive

Siemens V90 Servo motor

Cables.

Cost

The PLC and HMI can be borrowed from the college to be used on the project, so they'll be free.

The Siemens V90 Drive and servo motor will cost roughly £600. Also, cables will be available for free of charge from the college.

Total estimate Cost of solution 1 = £600

This is a relevant solution and some reference to an example scenario of this system in operation would have been useful here.

4.2 Solution 2.

Solution 2 will be similar to solution 1. But replacing the servo motor and drive with a stepper motor. It also be ran using a TIA portal program, combining a PLC and HMI for the controls. The stepper motor is less accurate than the Servo motor, but will be accurate enough for this application. A stepper Motor and driver can be seen below in

Figure 7, Nema 17 stepper motor and Figure 8, DMT320T Stepper driver



Electrical Specification

Manufacturer Part Number: 17HM19-2004S
Motor Type: Bipolar Stepper
Step Angle: 0.9 deg
Holding Torque: 46Ncm(65.1oz.in)
Rated Current/phase: 2.0A
Voltage: 2.9V
Phase Resistance: 1.45ohms
Inductance: 4.0mH $\pm$ 20%(1 KHz)

Figure 7, Nema 17 stepper motor

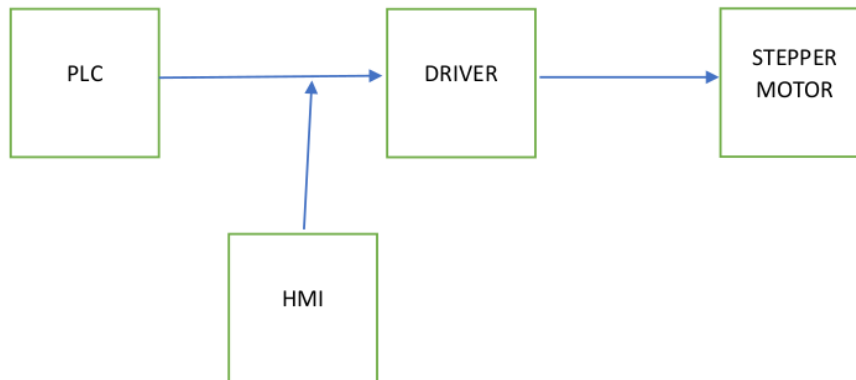


Electrical Specifications:

Output Peak Current: 0.3~2.2A (1.6 RMS)
Input Voltage: +10~30VDC
Logic Signal Current: 7~16mA (Typical 10mA)
Pulse Input Frequency: 0~60kHz
Isolation Resistance: 100M Ω

Figure 8, DMT320T Stepper driver

Block diagram



List of materials

Siemens S1200 PLC

Siemens HMI

DMT320 Stepper driver

NEMA 17 Stepper motor

Cables.

Cost

The PLC and HMI can be borrowed from the college to be used on the project, so they'll be free.

The DMT320 Driver Costs roughly £30 and stepper motor will cost roughly £30 also. Also, cables will be available for free of charge from the college.

Total estimate Cost of solution 2 = £60

The stepper motor is a relevant solution but for a conveyor a more powerful motor and drive could be an alternative. The options for this could be discussed here.

4.3 Deciding which solution.

After researching both solution. A list of pros and cons can be made for each solution.

Solution 1. Servo motor and Drive.

PROS –

- Accurate and easily adjustable
- Allows for adaptations
- Compatibility with siemens Soft wear.
Software

Cons –

- Costly
- Can be complicated as there are many configurations.

Solution 2. Stepper Motor and Driver.

PROS –

- Ease OF implementation
- Reduced wire complexity
- Low cost

The alternative of a more powerful setup could be discussed as part of the pros.

CONS –

- Lack of customizability
- Reduced configuration options.

After weighting up the pros and cons of both solutions, it was decided that solution 2 would be the better option. This was because the project would only cost roughly £60, rather than over £600 for solution 1. Also the stepper motor would be easier to assemble and connect, this will help make the project more realistic to finish within the time scale. As the motor will only be running a conveyor belt the lack of customisability would be much of a problem, as we only need basic use.

A table of comparison would be better here.

To Get the final solution started, the materials had to be ordered. An order had to be made to get the driver and the stepper motor. For the funds to be expected by Coleg sir gar, a requisition form needed to be filled in. a copy of the requisition form can be seen below in Figure 9, Requisition Form stepper drive.

Figure 9, Requisition Form stepper drive.

Another requisition form was completed for the stepper Motor. This can be seen in Figure 10, Requisition form stepper motor.

For the motors, as they were relatively cheap, at £11.35 per unit. A order for 2 motors was placed so we could have a backup motor if there was any issues with one motor.

The requests were accepted and orders were placed.

All other materials and equipment were to be used from Coleg sir gar stock.

Connecting Motor driver and PLC.



Figure 11, DM542T Driver

Looking at the manual for DM542T driver, The connection on the driver are as shown in Figure 11, DM542T Driver, a comprehensive description of each connection is shown from the snips from the manual, these are shown in Figure 12, Connector P1 Pin functions.and Figure 13, Connector P2 Pin functions.

Connector P1 Configurations

Pin Function	Details
PUL+	Pulse signal: In single pulse (pulse/direction) mode, this input represents pulse signal, each rising edge active; 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. The DM542T drive has no double pulse mode (pulse/pulse). For reliable response, pulse width should be longer than 2.5μs. Series connect resistors for current-limiting when +12V or +24V used (1K for +12V, 2k for +24V). The same as DIR and ENA signals.
PUL-	
DIR+	DIR signal: In single-pulse mode, this signal has low/high voltage levels, representing two directions of motor rotation; The DM542T drive has no double pulse mode (pulse/pulse). 4-5V when DIR-HIGH, 0-0.5V when DIR-LOW. Please note that rotation direction is also related to motor-drive wiring match. Exchanging the connection of two wires for a coil to the drive will reverse motor direction.
DIR-	
ENA+	Enable signal: This signal is used for enabling/disabling the drive. High level (NPN control signal, PNP and Differential control signals are on the contrary, namely Low level for enabling.) for enabling the drive and low level for disabling the drive. Usually left UNCONNECTED (ENABLED) .
ENA-	

Figure 12, Connector P1 Pin functions.

Connector P2 Configurations

Pin Function	Details
GND	Power Ground.
+V	Power supply, 20- 50 VDC, Including voltage fluctuation and EMI voltage.
A+, A-	Motor Phase A
B+, B-	Motor Phase B

Figure 13, Connector P2 Pin functions.

Now That each Pin on the driver has been identified we can start making connections

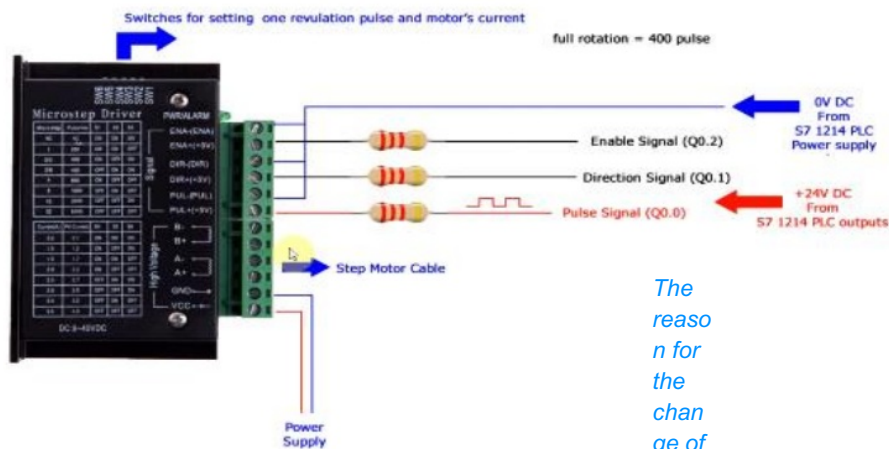


Figure 14, Driver connections

For the signal side of the driver, the 0V DC is connected and linked between ENA , DIR and Pulse connections.

The pulse signal (PUL) which is connected to Q0.0 of the PLC. With an inline 2.2kΩ resistor. This will be the first Output from the PLC. This sends the pulse signals from the PLC to the driver.

The second input , DIR (+5V), this is the direction signal, and will be connected , with an inline 2.2kΩ resistor, to Q0.1. This is to control the direction of the stepper motor.

And the final Output is the ENA (enable), This is to enable or disable to driver/motor. This is connected, again with an inline 2.2kΩ resistor, to Q0.2.

The reason for the change of driver should be explained. If the driver speed has been upgraded then the motor specification must have also.



Figure 15, Siemens PLC Output pin

Digital Outputs Q0.0, Q0.1 and Q0.2 Are the only outputs needed for this application. These are shown in Figure 15, Siemens PLC Output pins.

Now that the PLC and driver are connected, we can connect the motor. Below is the wiring diagram for the Nema 17 stepper motor.

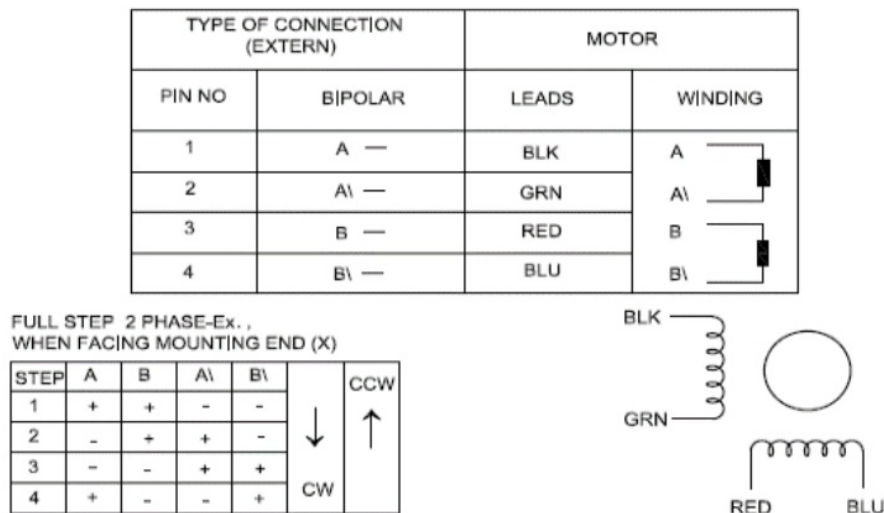


Figure 16, Nema 17 Wiring connections.

As shown in the connections, the motor contain 2 coils, and 4 wire out, the wire are in pairs. So coil 1 is BLK(black) and GRN (green) and coil 2 is RED and BLU (blue), The remaining to terminals, GND

(ground) and +V are for the positive and negative cables of a 24V DC supply. This supply was taken from the PLC.



Good explanation

Figure 17, Motor connection.

All the hardware are now connected. The fully connected system can be seen below in Figure 18, Full system connected



Image missing

Figure 18, Full system connected

To connect to the PLC from a laptop, a router was used. This was hardwired from the PLC using a ethernet cable, then connected wireless from the laptop.

The system is now at a stage where we can start creating a TIA portal program to control the system.

PLC Programming.

For this project Siemens TIA Portal was used. Totally Integrated Automation (TIA) is Siemens software to control all kinds of applications within automation.

Software

To use the Pulse train output which is needed to control a stepper motor I have to configure the pulse interface within the program.

First person should not be used

To configure the pulse interface

The pulse train for the drive is output through the PTO. The PTO has been assigned a fixed output in the controller. This has also been further assigned to a high-speed counter which counts the output pulses.

The PLC contains a pulse generator which can be configured for PTO. The program automatically assigns the hardware outputs automatically, pulse – Q0.0, direction Q0.1. as shown below in figure

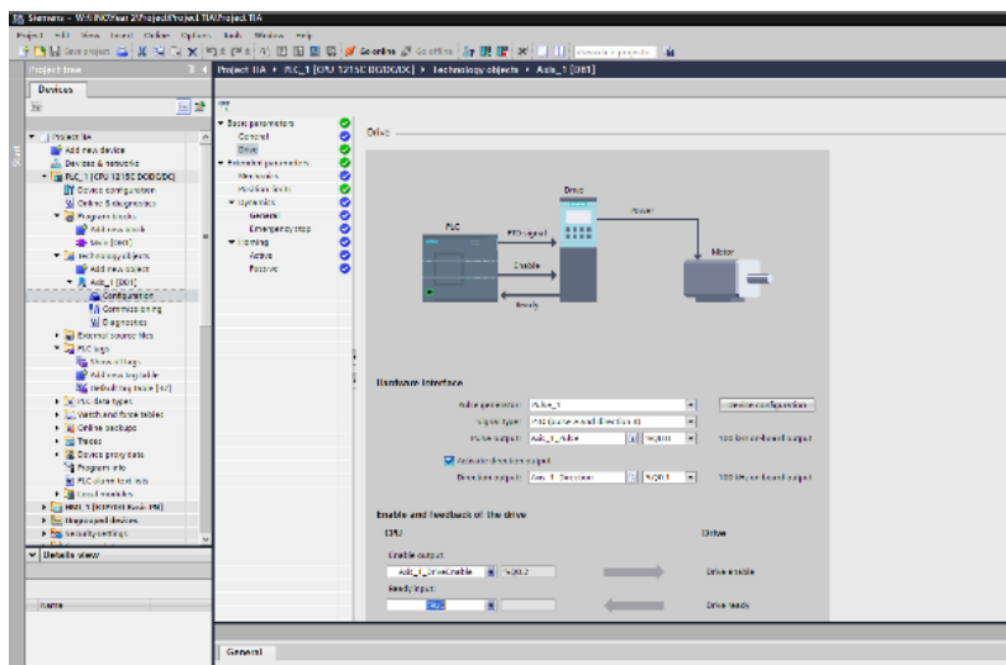


Figure 19, PTO Setup

As well as configuring the pulse interface I needed to create a new technology object for axis.

The generation of the pulse train is the responsibility of the axis technology object. This technology object forms the interface between user program and the drive. To create the axis a new data block is automatically created for the technology object. The axis parameters can then be set. As shown below.

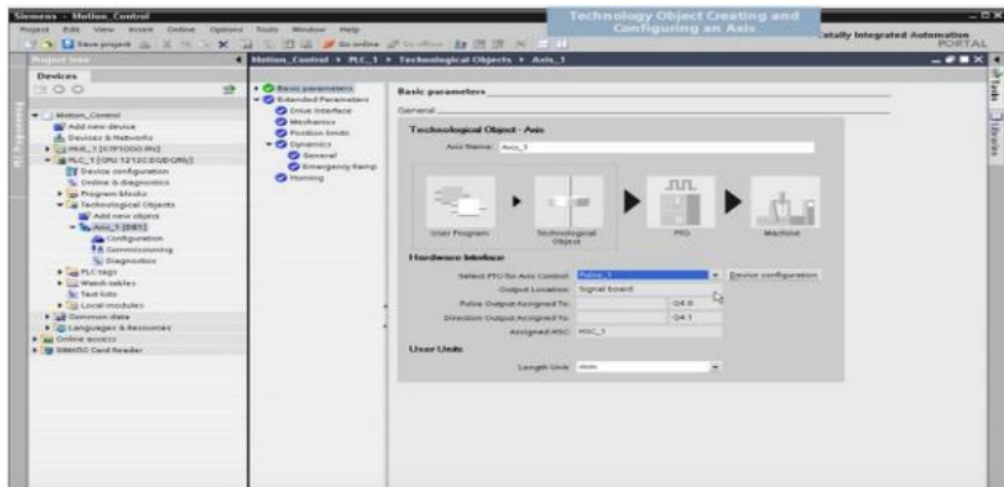


Figure 20, Axis technology block

Explanation is good but there are grammatical errors.

PLC Program.

The program to control the motor can now be created.

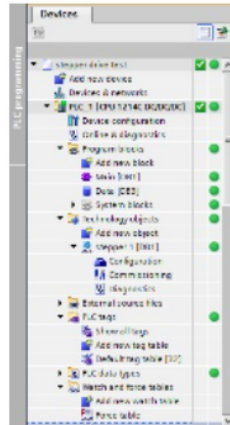


Figure 21, PLC Program Tree

The program tree can be seen in Figure 21, A list of all the data block are shown below in figure 22

Data									
	Name	Data type	Start value	Retain	Accessible f...	Write	Visible in	Setpoint	C...
1	Static								
2	servo_power_on	Bool	false		☒	☒	☒		
3	set_home	Bool	false		☒	☒	☒		
4	halt_stepper	Bool	false		☒	☒	☒		
5	step_for	Real	false		☒	☒	☒		
6	step_rev	Bool	false		☒	☒	☒		
7	jog_velocity	Real	0.0		☒	☒	☒		
8	position_stepper1	Real	0.0		☒	☒	☒		
9	absolute_move	Bool	false		☒	☒	☒		
10	abs_velocity	Real	0.0		☒	☒	☒		
11	abs_pos	Real	0.0		☒	☒	☒		
12	rel_move	Bool	false		☒	☒	☒		
13	rel_pos	Real	0.0		☒	☒	☒		
14	rel_velocity	Real	0.0		☒	☒	☒		
15	position1_done	Real	false		☒	☒	☒		
16	rel_pos1	Real	0.0		☒	☒	☒		
17	rel_velocity2	Real	0.0		☒	☒	☒		
18	abs_pos_true	Bool	false		☒	☒	☒		
19	position2_done	Bool	false		☒	☒	☒		
20	halt_done	Real	false		☒	☒	☒		
21	home_done	Bool	false		☒	☒	☒		
22	time_delay_done	Bool	false		☒	☒	☒		
23	abs_pos2_done	Bool	false		☒	☒	☒		
24	abs_pos2	Real	0.0		☒	☒	☒		
25	abs_velocity2	Real	0.0		☒	☒	☒		
26	power_on_true	Bool	false		☒	☒	☒		
27	home_time_delay_do...	Bool	false		☒	☒	☒		
28	abs_db7_time_delay_...	Bool	false		☒	☒	☒		
29	rel_db8_time_delay	Bool	false		☒	☒	☒		
30	sensor1	Real	false		☒	☒	☒		
31	<Add new>								

Figure 22, PLC Data Blocks

Asm mention previously, the Pulse and direction are automatically assigned tags. These tags are shown below in Figure 23

	Name	Data type	Address	Retain	Access...	Write...	Visibl...	Comment
1	stepper 1_Pulse	Bool	%Q0.0	☐	☒	☒	☒	
2	stepper 1_Direction	Bool	%Q0.1	☐	☒	☒	☒	
3	Tag_1	Bool	%M10.0	☐	☒	☒	☒	
4	Tag_2	Bool	%Q0.2	☐	☒	☒	☒	

Figure 23, PLC Tags

The Main block networks are shown below.



Figure 24, PLC Network 1

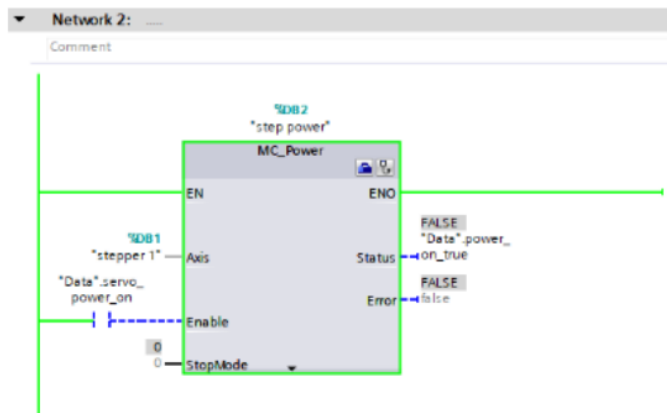


Figure 25, PLC Network 2

Network 2 is the power; this basically enables to power to be sent to the driver and Stepper motor. Acts as an on/off switch.

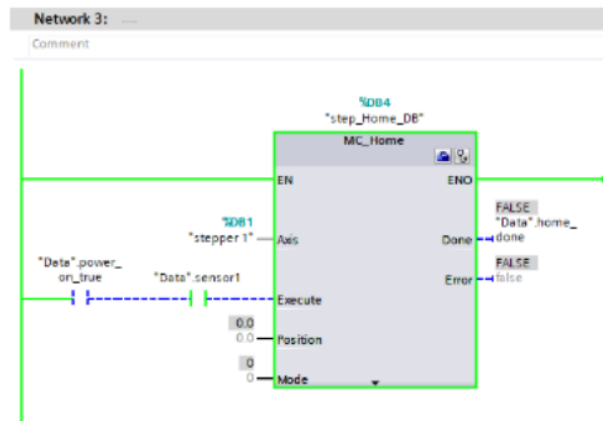


Figure 26, PLC Network 3

Network 3 is the home data block. This resets the sequence and takes the motor back to the home position.

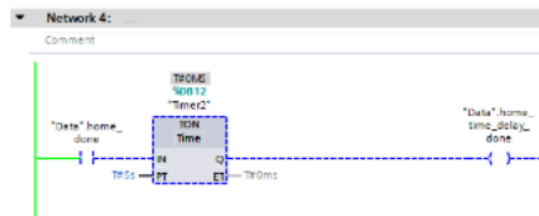


Figure 27, PLC Network 4.

Network 4 is the timer which delays the Home data block. Its set at 5 seconds.

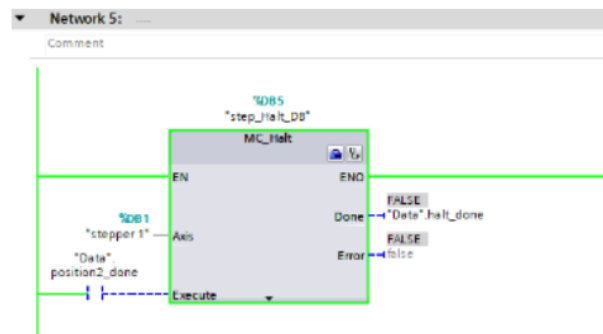


Figure 28, PLC Network 5

Network 5 is the halt data block. Halt stops all movement. This is a safety feature, and can act like an emergency stop.

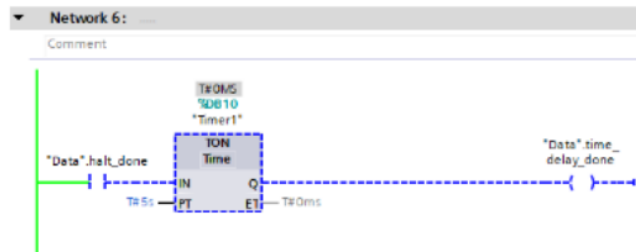


Figure 29, PLC network 6.

Network 6 is the timer for the halt data block

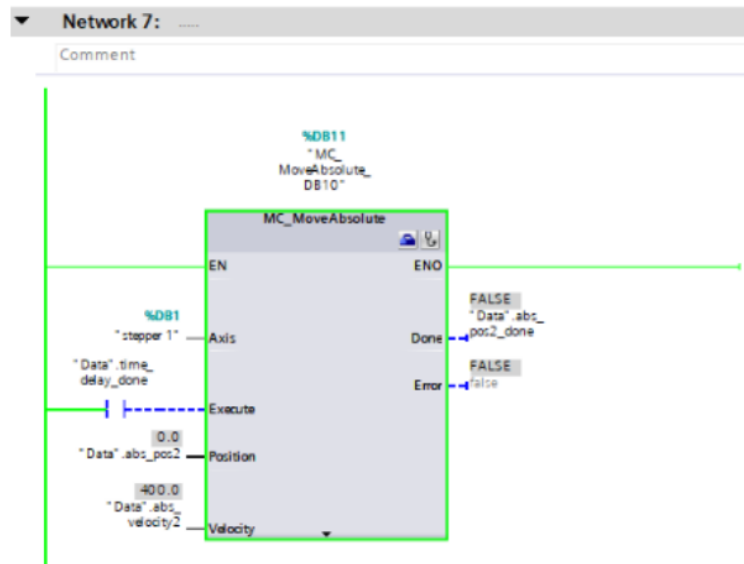


Figure 30, PLC Network 7

Network 7 contains the MOVEAbsolute data block, this is what controls the movement and velocity of the motor. This will control the movement, speed and distance, of the belt up until it stops at the set location.

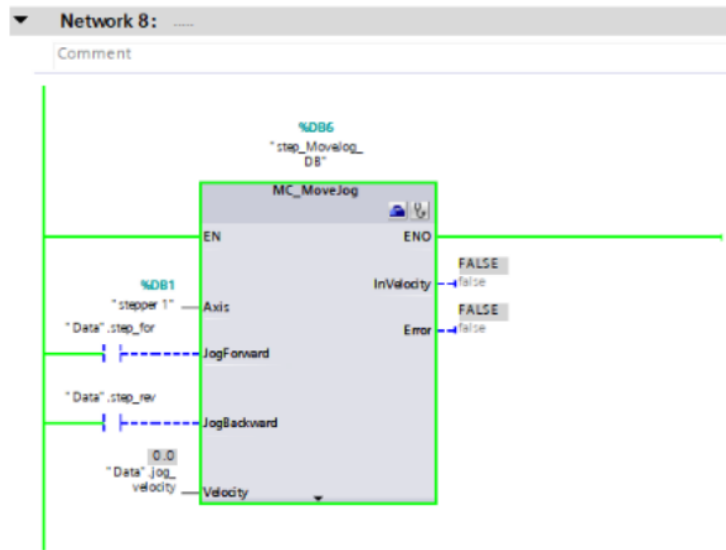


Figure 31, PLC Network 8

Network 8 is the MOVE data block, as you can see on the inputs on the left hand side it controls the directions.

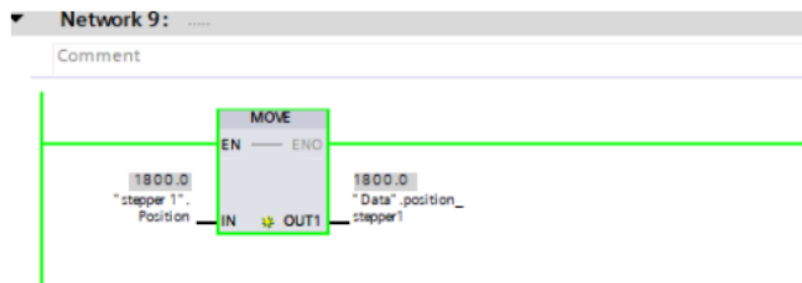


Figure 32, PLC Network 9

Network 9 is the move positioning. Its control how much the motor will turn, thus how far the conveyor belt will move.

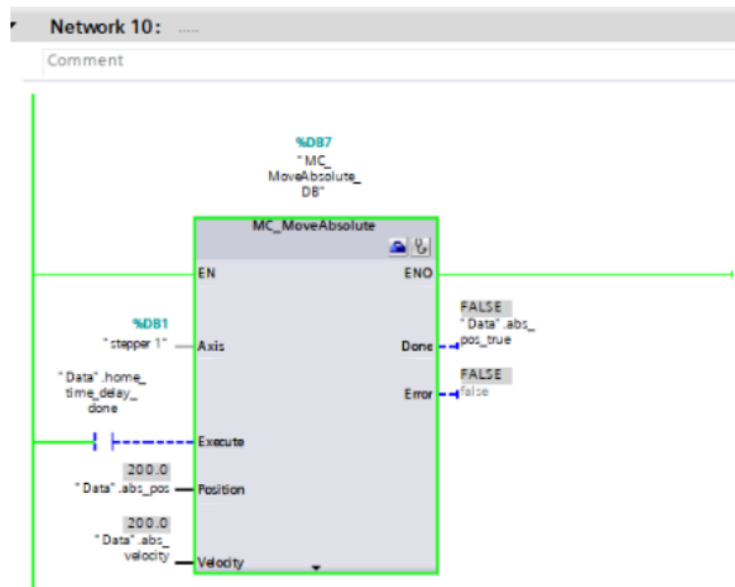


Figure 33, PLC Network 10.

This network is the second MoveAbsolute control the second movement. The first moveabsolute takes the conveyor up to the set location. Then stops, this data block controls the second movement.

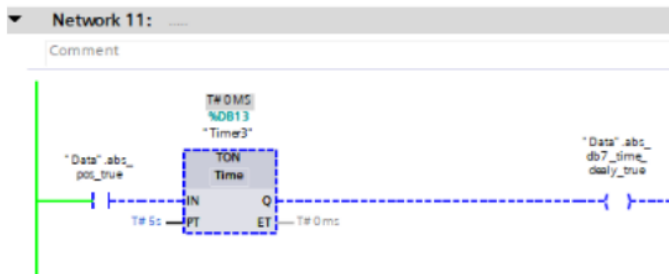


Figure 34, PLC Network 11

Network 11 is the on timer for the second moveabsolute data block.

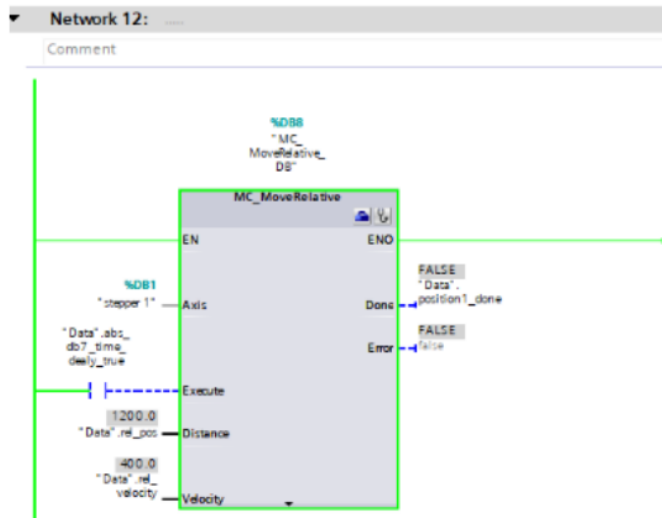


Figure 35, PLC Network 12

Network 12 contains the Moverelative data block. This positions the stepper axis

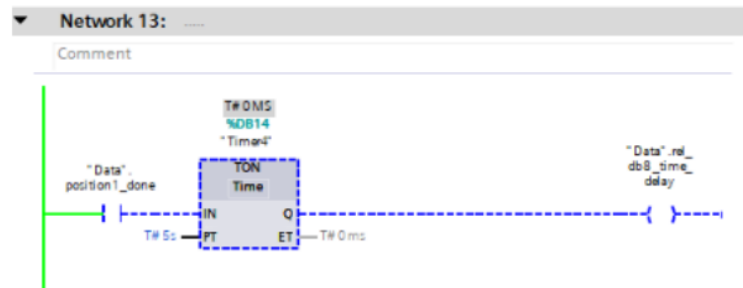


Figure 36, PLC Network 13

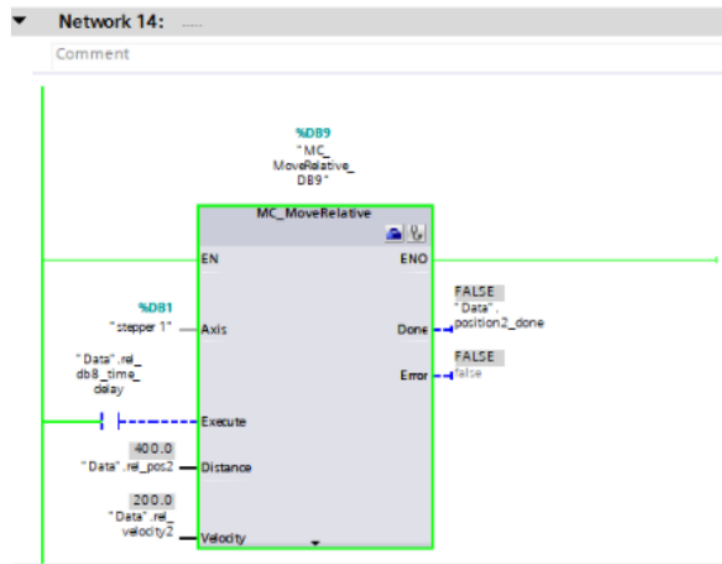


Figure 37, PLC Network 14

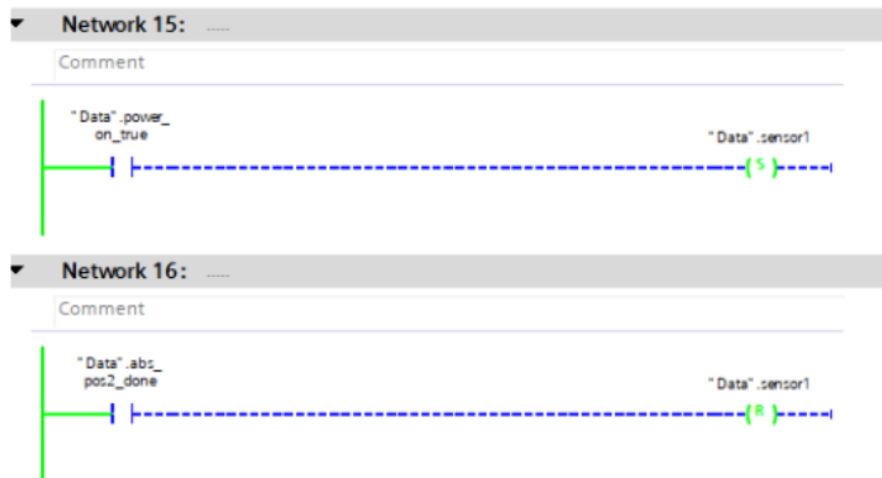


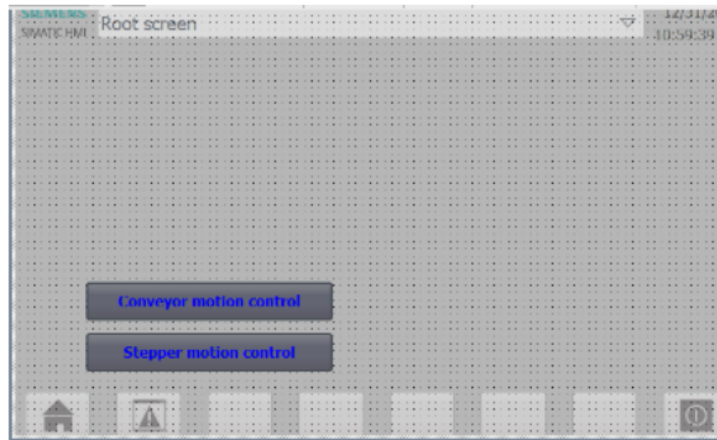
Figure 38, PLC Networks 15 and 16

The Set and Reset in Networks 15 and 16 keep the sequence running automatically by setting and resetting the 'Data'.sensor1 tag. This tag is on the Execute input to MC home block DB4. This sets the initial value distance to zero mm.

This is a good explanation of system operation and the program was tested initially using online testing which is a built in feature of TIA.

HMI Screens

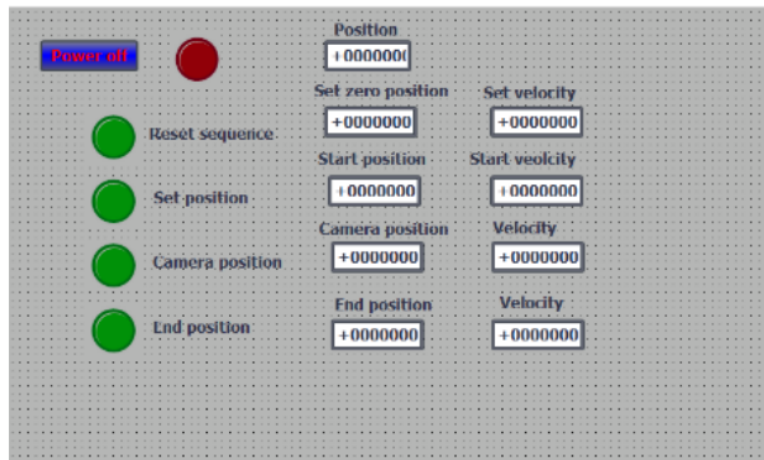
2 Screens were created for the control of the conveyor belt. A root screen and a conveyor control screen.



A good start with some navigation.

Figure 39, HMI Root screen

The root screen is a basic screen which acts as a sort of menu. There only 2 options at the minute, but this was created so that in the future extra screen could be added as the program was expanded.



HMI seems to have relevant features

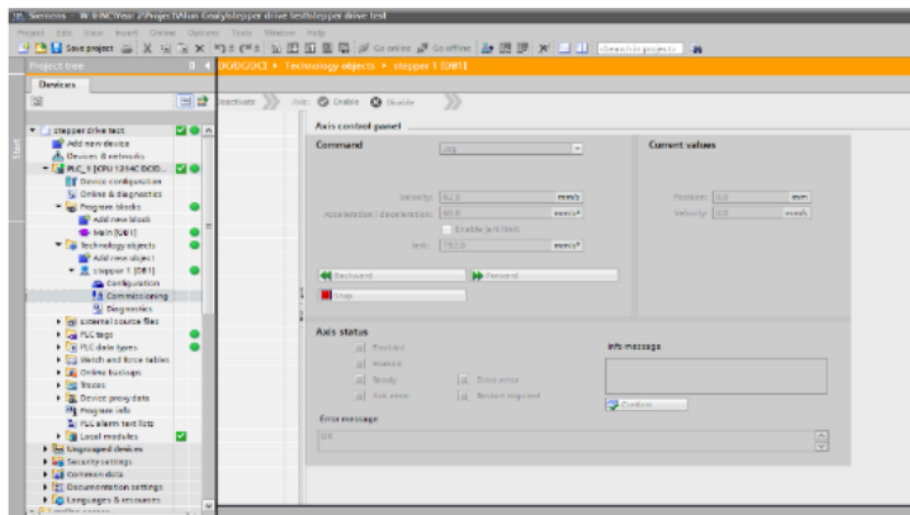
Figure 40, HMI Conveyor control screen

The conveyor control screen was created. On this screen the operator can adjust and see the velocity. A power on button controls the power. The position can be read from this screen. As well as indicators for each sensor.

6.0 Testing and results.

6.1 Commissioning the stepper motor

TIA portal has a commissioning tool within its program. This tool can be used to test a stepper motor. The tool can be found within the stepper DB. And by using this tool we can jog the motor forwards, reverse and change the velocity, and change the acceleration and deceleration. The tool can be seen below in



This is the essential part of testing and the axis operation before any sequence programming can be implemented.

Figure 41, Commissioning tool

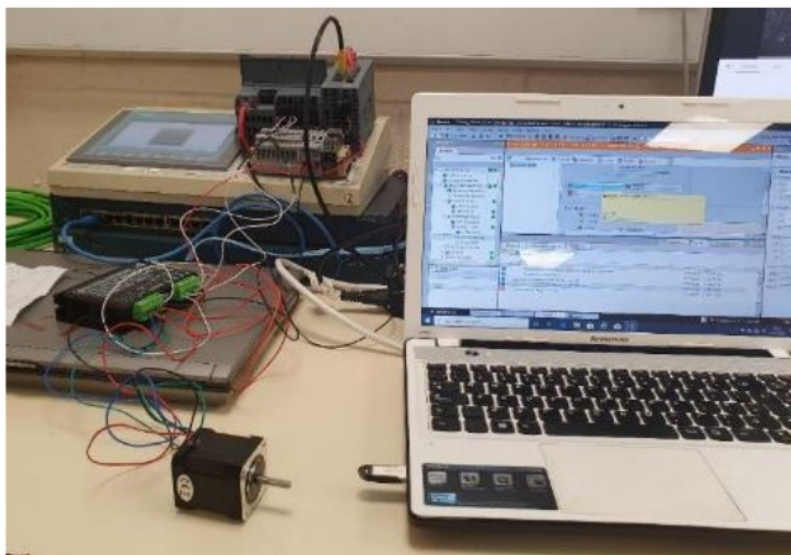
To fully commission the motor, I created a test table to record all the results. The results are recorded in Table 2, Test Table

You must avoid the first person terms.

Test carried out	Direction	Velocity (mm/s)	Acceleration/Deceleration(mm/s)	Results
Jog Forwards	Forwards	62.5	60	PASS
Jog Backwards	Reverse	62.5	60	PASS
Increase Velocity	Forwards	250	60	PASS
Decrease Velocity	Forwards	10	60	PASS
Acceleration Increase	Forwards	62.5	150	PASS
Acceleration Decrease	Forwards	62.5	10	PASS

Table 2, Test Table

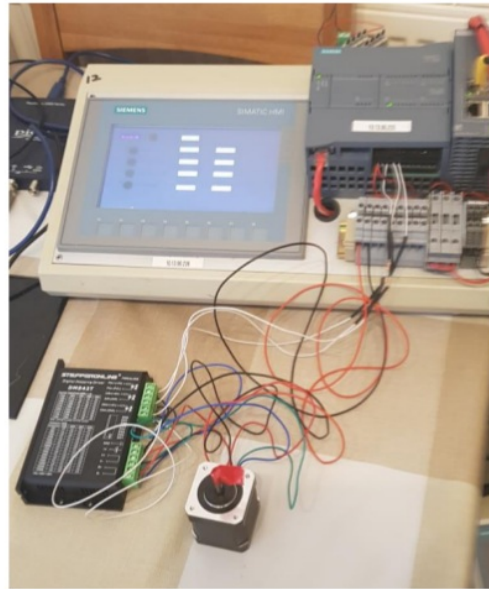
Test looks good and correct operation.



This is good evidence of the test setup for commissioning tests

Figure 42, Commissioning motor set up.

6.2 Testing the Sequence.



Good evidence of the sequence program tests.

Figure 43, Test Rig for sequence

For this test I will be checking if the sequence will work. The sequence should be

1. Conveyor start, move to camera position
2. Conveyor stop at camera position
3. Conveyor start and move to end position
4. Conveyor stop at end position
5. Reset sequence.

A representation of how the conveyor will operate is displayed in Figure 44, Conveyor set up

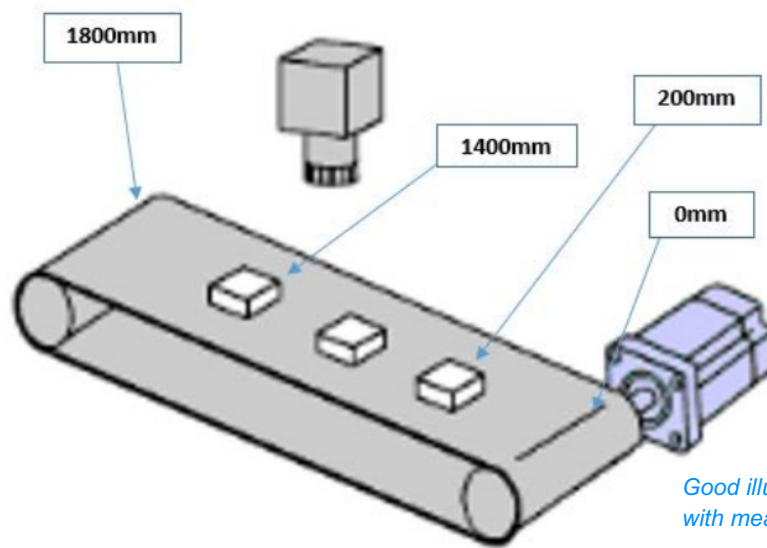


Figure 44, Conveyor set up

Initialising position to zero:

Name	Address	Display format	Monitor value
"Data".positio...		Floating-poin...	0.0

Strat sequence position 200mm:

All measurement settings are set from this absolute position

Name	Address	Display format	Monitor value
"Data".positio...		Floating-poin...	200.0

Next position to line up with camera for image test 1400mm:

Name	Address	Display format	Monitor value
"Data".positio...		Floating-poin...	1400.0
<Add new>			

Next position is to take the object off the conveyor 1800mm:

Name	Address	Display format	Monitor value
"Data".positio...		Floating-poin...	1800.0
<Add new>			

Next is back to the initial position zero:

This is where the conveyor pick up the next object.

Name	Address	Display format	Monitor value
"Data".positio...		Floating-poin...	0.0
<Add new>			

This sequence keeps repeating due to the set and reset in the program. The only way to stop the sequence is to switch the power off. The measurements were in mm to get it as accurate as possible.

Pictures of the screen were taken at each setpoint. This are included below.

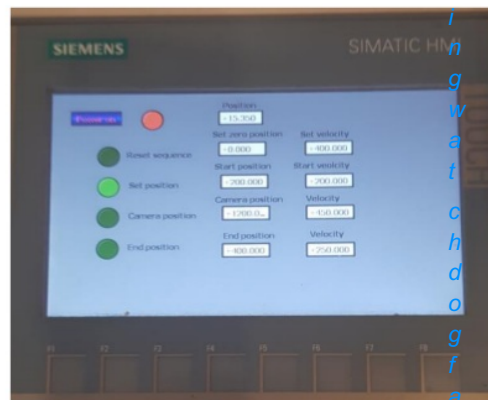


Figure 45, Test Home Position

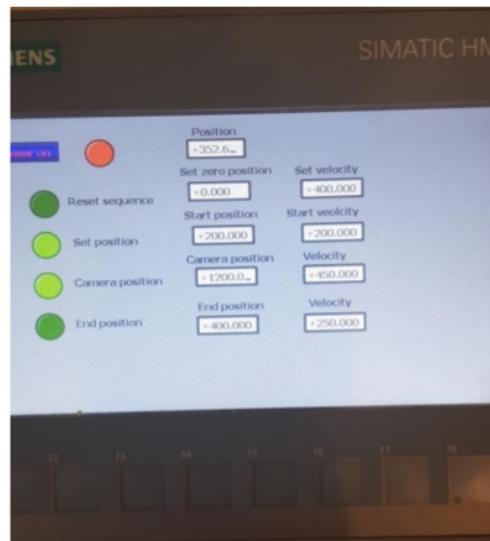


Figure 46, Test Camera position

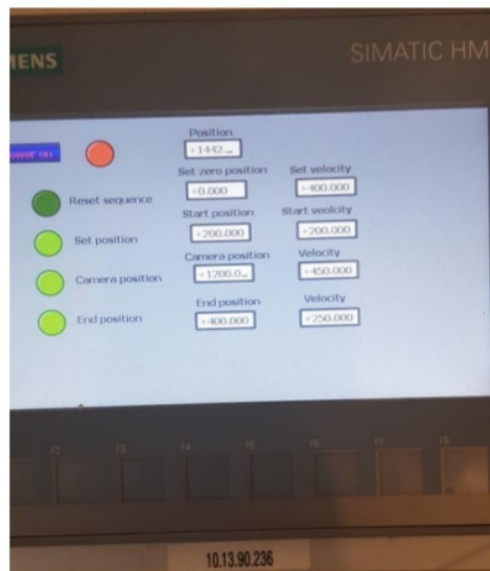
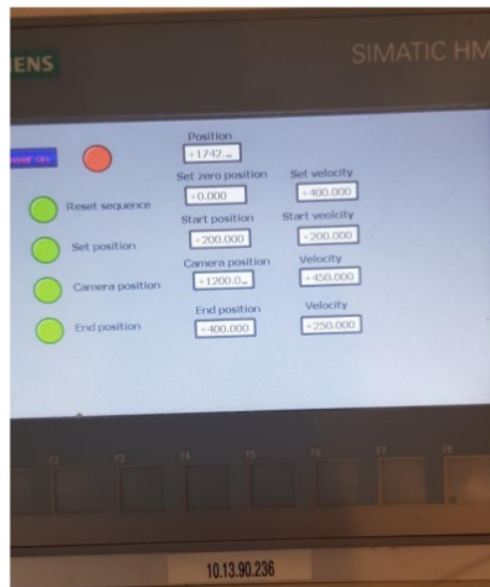


Figure 47 Test End Position



Good illustrations of the sequence running and is evidence that the sequence operation is successful.

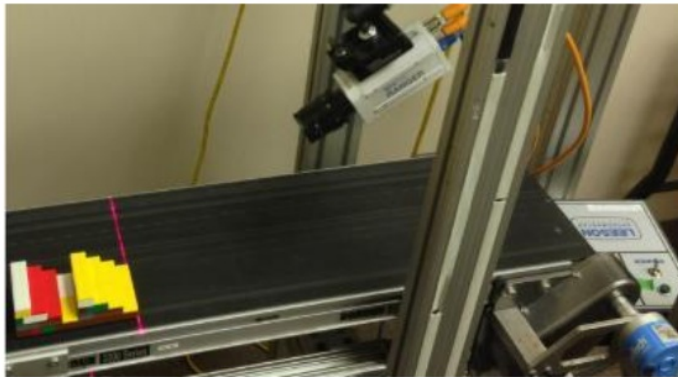
Figure 48, Test Reset sequence

The test was a success, as the sequence did what it was supposed to. And the sensor indication lights confirmed this on the HMI screen.

7.0 Discussion, Conclusion and Recommendation.

7.1 Discussion.

The project was a success, the only downfall was the fact it was completely finished. This was due to the covid-19 outbreak which closed the college and put the country into lockdown. This made it impossible to get the conveyor belt and wasn't possible for anybody to machine a coupling device to connect the motor to the conveyor. Below is an example of how the final set up would look. The camera is a part of another student's project. We would have worked together to integrate both projects.



Good scenario image of the end product.

Figure 49, Example of complete system

7.2 Conclusion

The aim of this project was to demonstrate practical investigation, planning and organisation and practical skills. For practical investigation, this was demonstrated when researching a project and coming up with 2 solutions. Extensive research was conducted through the project. As for planning and organisation this is evident in section 3.0 Planning, and the project was a success in both budget and time management. The gant chart was followed and the project was on time to finish. The deadlines of the presentation and final reports were also met.

The engineering problem which I identified was solved. This was done with minimum supervision. Health and safety were considered through out the project and also environmental impact was considered. Standards and codes of practise were followed through the project.

There is always an environmental element in this type of project and it is good that this is given consideration during the project creation.

7.3 Recommendation

Do not use the first person term

Some recommendation I would do to the project was to put some safety features in place, as the conveyor is a moving object, and has trapping points. Some guarding around the conveyor would be suffice, or a laser, and when the laser beam is cut when conveyor is turning it would come to a complete stop. Also another safety feature is to include a beacon, with green and red lights, this

would indicate if then conveyor is running in sequence or if its on stop. On start up the conveyor could sound a claxon, to give notice that the conveyors are about to start.

Another recommendation would be to create a reject bin, if the camera attached to the conveyor detects a defected part. A blast of air/or a arm could hit the part into a reject bin on the side of the conveyor.

*A fair point here about
safety due to moving
objects.*

8.0 Bibliography

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[Accessed 05 Apr 2020].

FINAL GRADE

GENERAL COMMENTS

Instructor

59/100

PAGE 1

PAGE 2

Text Comment. A good detailed list of contents

PAGE 3

PAGE 4

Text Comment. Good list of figures

PAGE 5

Text Comment. Do not use first person terms

Text Comment. The report should only contain third person terms

PAGE 6

Text Comment. Good research carried out here. An example scenario could have been discussed to aid your research.

PAGE 7

Text Comment. What about a driver for the stepper motor.

PAGE 8

Text Comment. A diagram of the system would be helpful here

PAGE 9

Text Comment. Good use of Gantt chart

PAGE 10

PAGE 11

PAGE 12

Text Comment. This is a relevant solution and some reference to an example scenario of this system in operation would have been useful here.

PAGE 13

PAGE 14

Text Comment. The stepper motor is a relevant solution but for a conveyor a more powerful motor and drive could be an alternative. The options for this could be discussed here.

PAGE 15

Text Comment. Software

Text Comment. The alternative of a more powerful setup could be discussed as part of the pros.

Text Comment. A table of comparison would be better here.

PAGE 16

PAGE 17

Text Comment. These order forms should be in an appendix

PAGE 18

PAGE 19

Text Comment. The reason for the change of driver should be explained. If the driver spec has been upgraded then the motor spec must have also.

PAGE 20

PAGE 21

Text Comment. Good explanation

Text Comment. Image missing

PAGE 22

Text Comment. Software

Text Comment. First person should not be used

PAGE 23

Text Comment. Explanation is good but there are grammatical errors.

PAGE 24

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PAGE 27

PAGE 28

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PAGE 30

PAGE 31

Text Comment. This is a good explanation of system operation and the program was tested initially using online testing which is a built in feature of TIA.

PAGE 32

Text Comment. A good start with some navigation.

Text Comment. HMI seems to have relevant features

PAGE 33

Text Comment. This is the essential part of testing and the axis operation before any sequence programming can be implemented.

Text Comment. You must avoid the first person terms.

PAGE 34

Text Comment. Test looks good and correct operation.

Text Comment. This is good evidence of the test setup for commissioning tests

PAGE 35

Text Comment. Good evidence of the sequence program tests.

PAGE 36

Text Comment. Good illustration if setup for system with measurement distances shown.

PAGE 37

Text Comment. Testing using watchdog facility in TIA is very good.

PAGE 38

PAGE 39

Text Comment. Good illustrations of the sequence running and is evidence that the sequence operation is successful.

PAGE 40

Text Comment. Good scenario image of the end product.

Text Comment. There is always an environmental element in this type of project and it is good that this is given consideration during the project creation.

Text Comment. Do not use the first person term

PAGE 41

Text Comment. A fair point here about safety due to moving objects.

PAGE 42

GRADING FORM: CSG-RUBIC

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RESEARCH-INFORMED LITERATURE



The research carried out mainly consists of component identification and would have benefited from an example scenario which would have provided relevant sources. 4/10 Sources are limited. 3/10

7/20

KNOWLEDGE AND UNDERSTANDING



Specification is clear with budget breakdown and cost comparison. 6/10 The solutions considered are the final solution which should have more depth especially regarding the stepper driver and motor requirements. The alternative solution should have a scenario and discussion. You have identified relevant components. 6/10

12/20

ANALYSIS



Testing and results are good and clearly explained. There is sufficient detail in this section. 7.5/10 Conclusion and recommendations make a relevant point. 6.5/10

14/20

PRACTICAL APPLICATION AND DEP.



Planning with the use of a Gantt chart is clear and the project seems to have run to the plan. It would have been useful to see a comparison on the actual timeline. 3/5 Final solution considered and the alternative solutions are relevant. 6.5/10
Implementation is explained very well with supporting images as evidence. 7.5/10

17/25

SKILLS FOR PROFESSIONAL PRAC.



The layout of the report is good. However, the use of first person terms is frequent and there are minor grammatical errors.

9/15