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by Matthew Perry

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1. Research

Industry 4.0 consists of integrating new technologies such as cloud computing, Internet of things (IoT), AI and machine learning into production facilities. Essentially, hardware such as advanced sensors, actuators or controllers with embedded software can analyse data for better decision making (IBM, 2020). Correctly cited

Machine-to-Machine (M2M) can be characterised as any technology that allows devices to communicate and perform tasks without manual support of information (Wolfgang Sattler, 2016). *You could have mentioned that M2M also allows for controls to be distributed*

Both M2M and Industry 4.0 technologies support networking of field devices and machines however they operate differently to create these solutions. M2M has a limited number of machines it can monitor whereas, IoT offers easy configuration of new services and configuration via cloud computing (Hakki Soy, 2020). Cloud computing can be defined as a general term for anything that involves delivering hosted services over the internet (Chai, 2019). Google offers these services which allow businesses to connect, store, and analyse data at the edge and in the cloud. These services could include predictive maintenance which automatically predicts when equipment needs maintenance and optimize its performance in real time while predicting downtime, detecting anomalies, and tracking device status, state, and location.

By utilising Industry 4.0 within Machine-to-Machine communications, this could lead to support more efficient industrial manufacturing systems. This would focus on Internet of Things. This would allow broader integration possibilities because it is not limited to device to device. This means gateway and bridging solutions allow the flow of data horizontally from the customer to the enterprise resource planning then to the machine but also vertically between the systems involved in the production (Inray Industries Software GmbH, 2018).

Information and data produced by the sensors which are interlinked to the machines could be displayed on a webpage such as Siemens V.O.T. By doing this, it is enabling remote monitoring opportunities which would be financially beneficial but also time saving for employees by reducing travel to different sites (Pultar, 2017). Simulation is possible by using an application such as View of Things. By doing this, automated sequences could be started, or individual components activated remotely via the webpage and then analysed.

Lastly, wireless sensors are becoming more popular because they are easier to maintain and cheaper to install (Sensor-Works, 2019). In addition to this, they can be implemented in

Correctly cited

difficult to access locations or where wired solutions are impractical (Banner, 2021). Sensors that are on a common network share data either through nodes that consolidate information at a gateway, or where each sensor connects directly to the gateway assuming it can achieve the necessary range. Gateways act as bridges that connect local sensors to the internet, functioning both as routers and wireless access points (Fruci, 2020).

Correctly cited

2. System Overview and Operation

Figure 1 shows an overview diagram of the system including the M2M links, these sub-systems are linked via PROFINET. This can be described as 100 percent industrial ethernet and Siemens states "PROFINET enables quick and secure data exchange on all platforms and creates the possibility of realizing innovative concepts for the production and processing industries" (Siemens, 2021). Additionally, PLC 106 has a communication card which supports RS232 connections which enables the PLC to communicate with the robot.

The current system is not configured like a traditional slave and master scenario, this is because each PLC has been configured as a slave and a master. This allows each PLC to utilise the put & get functions to input data to PLC 101 'Master'. PLC 101 has data/function blocks set up to receive the incoming data. This means each PLC has a duplicate data block for receiving and sending data to PLC 101.

2.1 Hardware Devices

There are stations contained within the CIM System, these are:

- Pneumatic Station and Vision Station (PLC 102)
- Hydraulic Station (PLC 104)
- Assembly Robot and Slider (PLC 106)
- Process Station (PLC 103)
- Water Recirculation (PLC 105)

By viewing Figure 3 the operation of the system starts with the pneumatic station (1) and then progresses clockwise.

The Pneumatic station consists of solenoids, sensors, pistons, grippers, and storage. This is the starting point of the sequence where the empty wagons can be loaded with different configurations of the handle and/or stamps. This is carried out by the different channels which can hold back the materials using various pistons or by using the gripper. The PLC hardware for the pneumatic station consists of a PROFINET switch, S7-1214c CPU, SM 1221 digital input module, SM 1222 relay module.

The vision station which uses an IFM camera which can inspect the quality of the material on the pallet before proceeding. The hardware for PLC 101 consists of a S7-1511F safety CPU, PROFINET switch, Digital I/O module, and a safety input module.

The hydraulic station consists of solenoids, position sensors, rotary pistons, a gripper, press table and a press piston. This station can store materials, but also press the handles into the stamp using the hydraulic press. The hardware for PLC 104 consists of a S7-1214c CPU, digital input module, analogue input module for the position sensors, PROFINET switch and HMI 134.

The assembly station consists of the assembly robot which can transfer materials and a slider which allows the robot to move horizontally. The hardware for PLC 106 consists of a S7-1212c CPU, Digital input module, relays for the sliders and an RS232 module to be able to communicate with the assembly robot controller.

The process station uses a pneumatic gripper which has x, y and z travel to be able to transfer the parts and dip into the process tanks. The hardware for PLC 103 consists of a S7-1212c CPU, Digital input module, relays for the sliders and an RS232 module to be able to communicate with the assembly robot controller.

The water recirculation system maintains the water in the process tanks such as pressure and level. The hardware used in this system consists of PLC 105 is a S7-1212c CPU with a PROFINET switch, IO link master module and HMI 135.

Lastly, a detailed list for each input/output and additional hardware module for each PLC can be seen in Table 8 & Table 9. *You could have given more details of the IFM vision system.*

2.2 Tracking System

At each station there is a piston which prevents the wagon from moving until the piston is released after a set amount unless the next station is 'busy' otherwise it will hold the wagon for longer. At each station are a set of 5 proximity sensors which are triggered by discs that are located underneath the wagon. The series of the discs will be above specific sensors which then produces a binary pattern. Once CIM is in 'Run' mode then timers are used to scan each station at different times for this pattern, as follows:

- Vision station - less than 0.05 seconds.
- Pneumatic station – Between 0.1 and 0.15 seconds.
- Assembly station – Between 0.2 and 0.25 seconds.
- Process station – Between 0.3 and 0.35 seconds.
- Hydraulic station – Between 0.4 and 0.45 seconds.

This pattern then relates to a number which allows the PLC to know which wagon is present, for example wagon (9) will activate 2 of the 5 sensors in a pattern of 01001.

In addition to this, the first digit of the binary pattern relates to what is present on the wagon as shown in Table 3. The second digit represents whether the stamp or the handle needs to be inspected by the vision system, see Table 4. The third digit is 10 or 20, this will decide whether the process station should be used, see Table 5. The final digit is for the result of the process whether it passed, or the optional failed codes, see Table 6.

Lastly, a diagram stating the overall process of the workflow can be viewed at Figure 4.

2.3 Software Description

The software being used for the TIA project is TIA Portal Version 17, this software has been recently upgraded which includes more features such as safety protocols and the ability to utilise VoT.

3. Health and Safety, Maintenance and Reliability Requirements

A risk assessment has been created and can be viewed at Table 7.

The system could be made safer and conform to current regulations by implementing the following suggestions:

- Additional guards with sensors which would immobilise the system if broken to prevent students, operators, and engineers from coming into contact with the moving conveyor. This would conform to BS EN ISO 14120 which specifies general requirements for the design, construction, and selection of guards provided to protect persons from mechanical hazards (ISO, 2021).
- Emergency stop sequence should be amended so the power is not cut to the whole system, just to each station. This will provide maximum safety as the e-stop circuits should not be wired to the controller, but instead should be left hardwired (Cyanasi, 2017). Otherwise, the emergency stops could be wired to the new safety PLC where the PLC would then decide the next action.
- Emergency stops should be able to be locked with a key which would allow engineers to follow lock off procedures. This would follow the Health and Safety Executives guidelines. Citation Needed
- Warning/Hazard signs could be implemented to make those aware of electrical hazards. This is required by law under the Health and Safety Legislation (Safety Signs and Regulations of 1996) (UK Safety Store, 2019).

3.1 Maintenance and Reliability Requirements

The system currently has measures implemented that aids engineers to resolve faults or carry out maintenance checks on the system. This is done by simulation and providing relevant data on the 'Engineer' HMI screens.

The system can be simulated within the TIA software. PLC simulation allows engineers to build, test and validate software simulations of controllers while eliminating the risk to machine operators or to the machine. Additionally, engineers can design, prototype and tune control algorithms such as PID Control. Another use of simulation which provides maintenance requirements to be met is the ability to verify control design via real time simulation, automated PLC testing, virtual commissioning, and formal verification methods (MathWorks, 2021)

Relevant data is included for each station on engineer screens which provides data such as PID control loop values (Control Variables, Process Variables and Setpoints). This means if

there is a fault within the water recirculation the PV (water pressure) may show a value which is low but also the CV (Water pump VFD speed) may be abnormal. This would help engineers to track the values while carrying out Automatic Control Tests or the data can be logged automatically by the system using graphs. There is also visual data which is shown by pilot lights such as 'Online', 'Busy' and a visual display of the assembly robot slider position. In conclusion, there is a mass amount of information displayed on the HMI screens which allow engineers to check the reliability and maintenance of the system.

4. System Design Adaptation

A series of modifications were made to the CIM system. These modifications were made to improve the performance and conformity to the needs of industry 4.0.

Grocer's apostrophe

The first amendment was in creating program blocks in PLC 101 named as the other PLC's. In this program block relevant ID names were created ready to receive the data from the other devices (GET), in addition to this, in all the other PLC's a program block was created 'PLC 101' ready to send the data (PUT). Evidence of these modifications can be seen from Figure 5 to Figure 14.

A Function Call was created in PLC 103 named 'Map Data to PLC 101' to move the process station data to PLC 101. This was done by using the data tags from 103 and utilising the 'move' function to send them to PLC 101. The move 'Move value' instruction was used to transfer the content of the operand at input IN to the operand at output OUT1. This can be viewed under Figure 15, Figure 16 and Figure 17.

On each station engineer screen communication signals were implemented which can be viewed in the appendix between Figure 19 & Figure 23.

The Main CIM Engineer screen on HMI 131 was modified by adding more information. A feedback signal was created for each PLC using I/O Fields and tagged to the 'PUT' CV counter for each PLC. This will display whether the PLCs are in communication by seeing the counter increase every time the 'PUT' function is used. Another feedback signal which was inserted was a green pilot light which displayed when the CIM was 'Online'. Lastly, a switch was added which enabled the simulation mode. This can be viewed at Figure 18.

Then by using the mapped data the I/O fields on all process loop screens were retagged from the data block in PLC 103 to the data block in PLC 101.

4.1 Personal Testing

Description	Expected	Actual	Pass/Fail	Evidence
Run simulation on PLC & HMI, Check Process Loop FC535.	No hashtags should be present in the I/O Fields. Value of 0 should be shown.	No hashtags shown, value of 0 displayed.	Pass	Figure 24
Run simulation on PLC & HMI, Check Process Loop LC541	No hashtags should be present in the I/O Fields. Value of 0 should be shown.	No hashtags shown, value of 0 displayed.	Pass	Figure 25
Run simulation on PLC 101 & HMI 131, Check Process Loop TC511	No hashtags should be present in the I/O Fields. Value of 0 should be shown.	No hashtags shown, value of 0 displayed.	Pass	Figure 26

Table 1; Personal Test Table

4.2 View of Things

In a group of 3, the students enabled the View of things feature which allows remote monitoring and control of the system via a webpage. This was done by creating the block on PLC 101, which is possible because it is a S7-1511F.

4.3 Group Testing

As a group, the program was downloaded to PLC 101 with VoT enabled. Then using an alternative computer, the IP address of the PLC was entered into the internet search browser which allowed the group to log into the used defined webpages via a password.

Test Table				
Description	Expected	Actual	Pass/Fail	Evidence
Start CIM from webpage	Press button and CIM should start.	Pressed button and CIM started.	Pass	Figure 27
Stop CIM from webpage	Press button and CIM should stop.	Press button and CIM should stopped.	Pass	Figure 28
Start Conveyor from webpage	Start Conveyor from webpage	Conveyor started.	Pass	Figure 29
Stop Conveyor from webpage	Stop Conveyor from webpage	Conveyor stopped.	Pass	Figure 30
Enable Online from HMI	Contact will close on PLC Program	Online activated, shown on screen and in the program.	Pass	Figure 27
Start CIM identifier	Light will go green when active	When active, the light went green.	Pass	Figure 27
Start Conveyor identifier	Light will go green when active	When active, the light went green.	Pass	Figure 29
All PX switches identifier change colour when active.	Grey to orange	Colours changed appropriately.	Pass	Figure 32
Release identifier should change colour.	Green to red	Colours changed appropriately.	Pass	Figure 32
Wagon position works	Relevant numbers are shown	Correct numbers were shown.	Pass	Figure 31
Move slider position; Webpage & HMI should identical.	Move slider position; Webpage & HMI should be identical.	HMI value: 286.51 Webpage Value: 286.51	Pass	Figure 33, Figure 34, Figure 35, Figure 36

Pneumatic Stations VOT Button on main CIM	Press Pneumatic Station button and go to that screen.	Pressed Pneumatic Station button and went to that screen.	Pass	Figure 38
Return to main CIM from Pneumatic Stations button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Vision Station VOT Button on main CIM	Press Vision Station button and go to that screen.	Pressed Vision Station button and went to that screen.	Pass	Figure 39
Return to main CIM from Vision Station button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Hydraulic Station VOT Button on main CIM	Press Hydraulic Station button and go to that screen.	Pressed Hydraulic Station button and went to that screen.	Pass	Figure 40
Return to main CIM from Hydraulic Station button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Assembly Station VOT Button on main CIM	Press Assembly Station button and go to that screen.	Pressed Assembly Station button and went to that screen.	Pass	Figure 41
Return to main CIM from Assembly Station button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Process Station VOT Button on main CIM	Press Process Station button and go to that screen.	Pressed Process Station button and went to that screen.	Pass	Figure 42
Return to main CIM from Process Station button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Water Station VOT Button on main CIM	Press Water Station button and go to that screen.	Pressed Water Station button and went to that screen.	Pass	Figure 43

Return to main CIM from Water Station button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Wagon Code VOT Button on main CIM	Press Wagon Code button and go to that screen.	Pressed Wagon Code button and went to that screen.	Pass	Figure 44
Return to main CIM from wagon code button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Material Selection VOT Button on main CIM	Press Material Selection button and go to that screen.	Pressed Material Selection button and went to that screen.	Pass	Figure 45
Return to main CIM from Material Selection button.	Press button and return to main CIM	Pressed button and returned to main CIM	Pass	
Password Protection for logging into webpage.	Before accessing webpage, Password must be entered.	Password was requested before accessing screen.	Pass	Figure 46
Animation of slider	As the slider moves, the animation should mimic the movement.	Slider animation did not mimic the actual slider.	Fail	N/A

Table 2; VoT Test Table

By analysing the test table, the new adaptations using VoT were successful however the last test to be carried out was unsuccessful and did not have time to resolve the fault.

5. Conclusions and Recommendations

Why the change in font size and spacing?

In conclusion, this assignment investigated into concepts of instrumentation and integrated automated systems. This included the emerging concepts of M2M connections and how it is pairing with Industry 4.0 to optimise the efficiency of a system.

The CIM system was examined explaining the M2M connections, hardware, operation of the software and current reliability of the system.

A risk assessment was created that explored the possible risks that could be present and how they could be reduced further. The commercial risk is very low. This is because the system is password protected against people accessing the information online & also the system is not being used for financial gain.

Suitable adaptations were made to the local HMI screens to improve the reliability but also the new VoT feature was enabled. Through testing the adaptations, it can be shown that the adaptations were successful and will provide useful information for students, operators, and engineers to utilise.

Lastly, there is a few alterations that could be made to improve the operation of the system. These are:

- Utilising alarm lists that are offered for Siemens basic, touch and comfort panels. This would increase the detail about what faults could be present, what time the faults occur and logging the frequency on how often it happens. In addition to this, information could be provided on how to rectify these faults.
- Renaming the Input/Output tags or including a description. This would allow students and engineers to locate and find information about the I/O without inspection a physical inspection of the CIM system. This could also be beneficial for communication to those on site while remote testing.
- Amending the emergency stop sequence. The power currently is isolated to the whole system if an emergency stop is activated, however with the new master PLC incorporating safety aspects it could now be hardwired to the controller & the controller could make the next decision.

6. Team Working

Matthew worked alongside his peers to create a View of things webpage. Each member discussed what information would be relevant and what data should be included on the main page.

Matthew imported the graphic for the background to use as a template which ensured information the group chose to include would not be forgotten. Also, Matthew created each I/O field to display the SP and PV values and creating custom colours for the pilot lights.

During the testing stage, Matthew constructed the table on excel and detailed the tests that should be carried out and documented the results within the table.

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Journal of Business and Economics, 7(10), p. 11.

Wide Range of Sources

8. Appendix

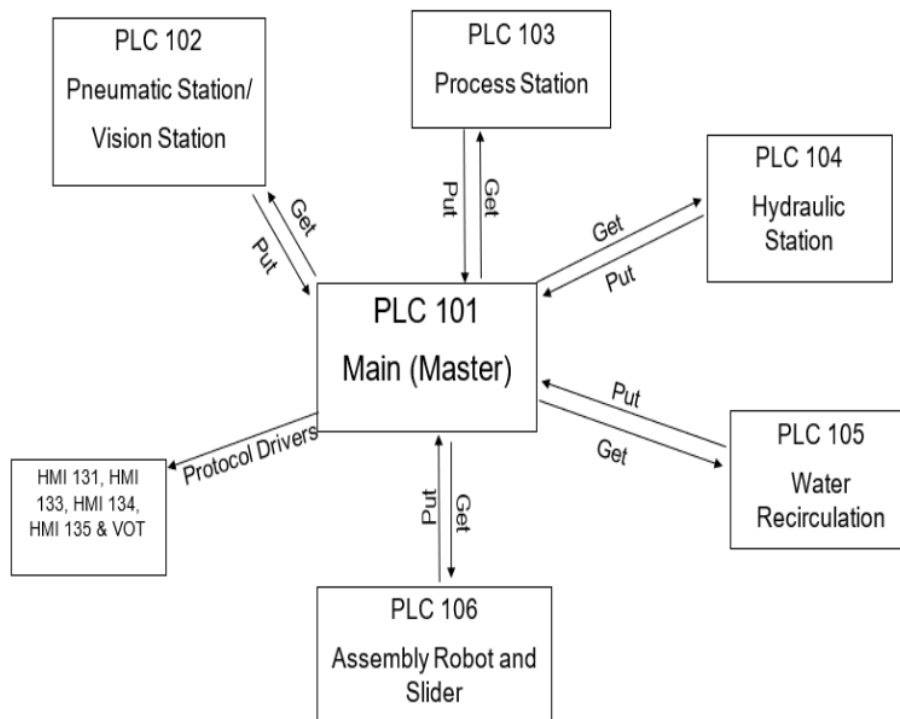


Figure 1; Overview of M2M - CIM System

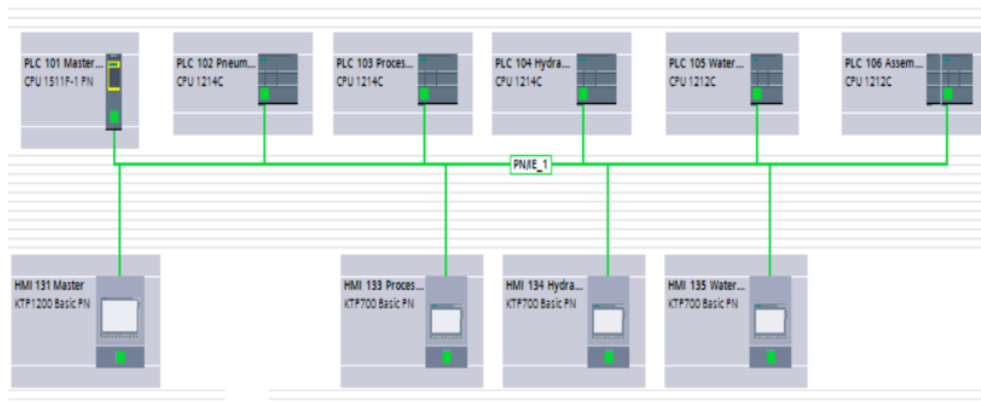


Figure 2; Overview of M2M - CIM System (PLC)

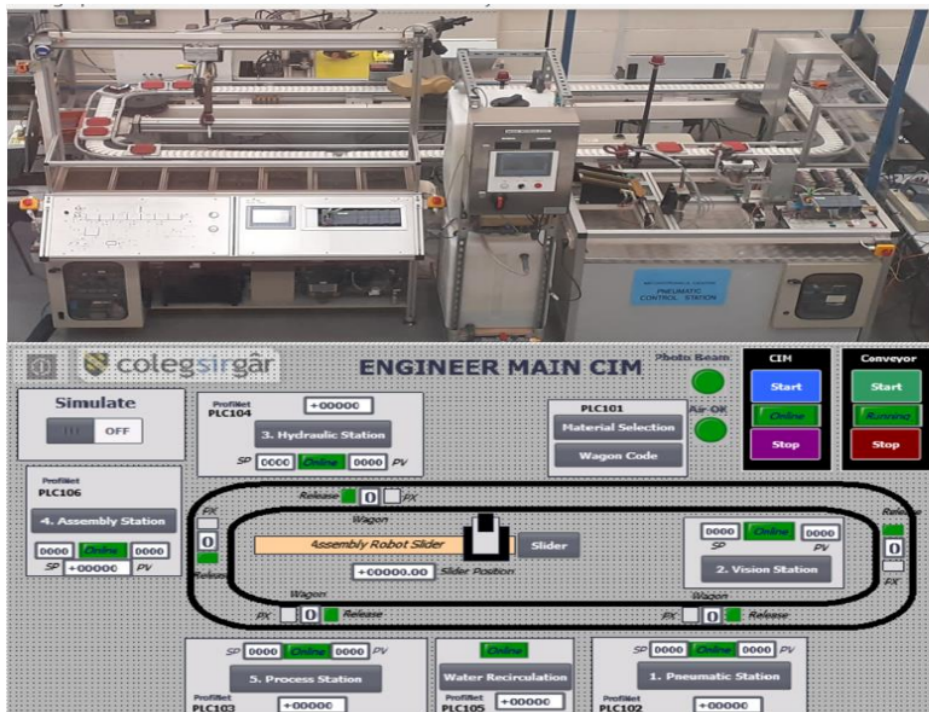


Figure 3; Overview of CIM System

1234 +1000	Empty Wagon
1234 +2000	Wagon + Pallet
1234 +3000	Wagon + Pallet + Stamp
1234 +4000	Wagon + Pallet + Round CH1
1234 +5000	Wagon + Pallet + Round CH2
1234 +6000	Finished Product

Table 3; Wagon Identifier

1234 +100	Vision Inspection required for Stamp
1234 +200	Vision Inspection required for CH1
1234 +300	Vision Inspection required for CH2

Table 4; Wagon Identifier - 2nd Digit

1234 +10	Process Required CH1
1234 +20	Process Required CH2

Table 5; Wagon Identifier - 3rd Digit

1234 +1	Vision Inspection Result Pass Stamp
1234 +2	Vision Inspection Result Failed Stamp
1234 +3	Vision Inspection Result Pass CH1

1234 +4	Vision Inspection Result Failed CH1
1234 +5	Vision Inspection Result Pass CH2
1234 +6	Vision Inspection Result Failed CH2

Table 6; Wagon Identifier - 4th Digit

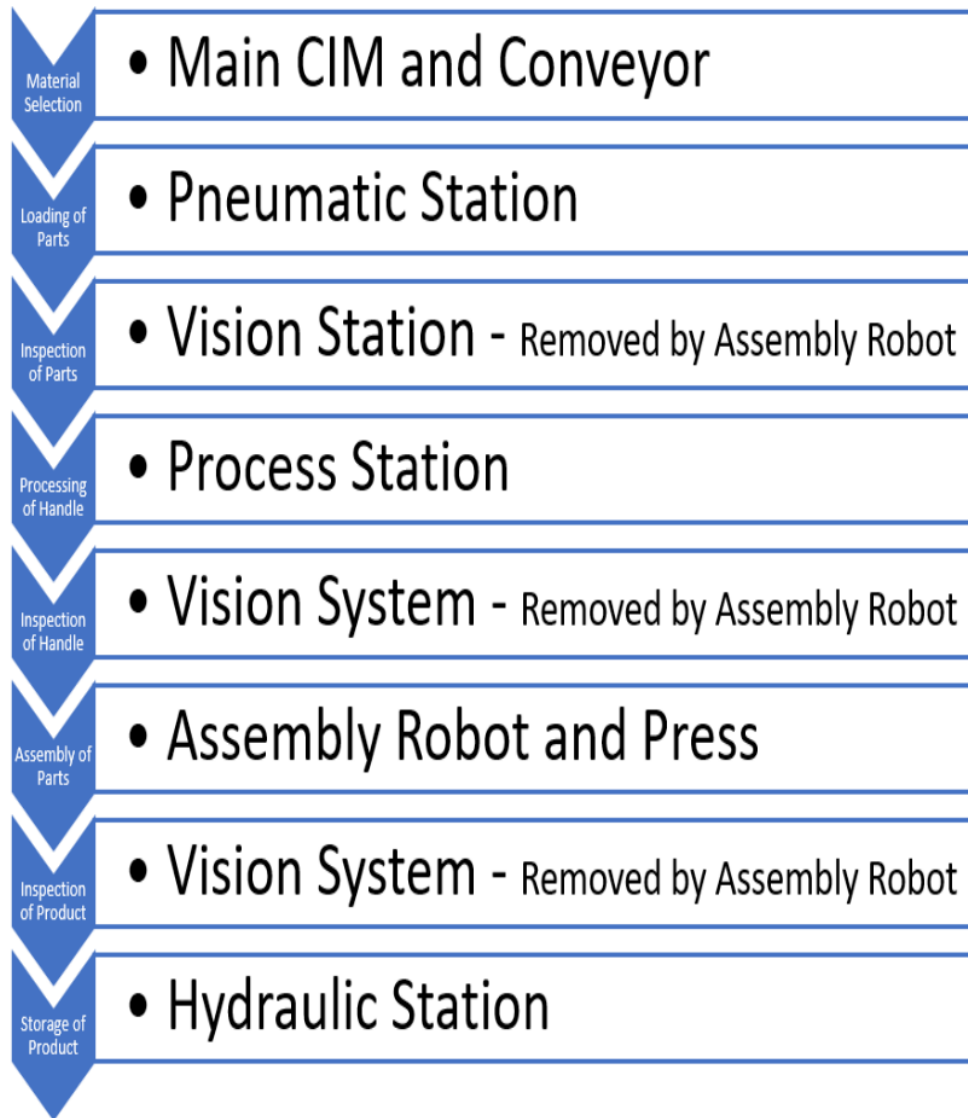


Figure 4; Process of Workflow

What are the hazards?	Who might be harmed and how?	What are you already doing to control the risks?	What further action do you need to take to control the risks?
Lack of capacity for the plant to be slowed, stopped, or immobilised	Operators; Engineers	Emergency Stops located around the system	More emergency stops.
Uncontrolled or unexpected movement of the plant or its load?	Operators; Engineers – Robot arm movement.	Verbal instructions.	A guard should be implemented to prevent engineers of being in the vicinity of the robot arm while active.
Body parts, clothing, equipment, or other materials being in contact with moving parts of the plant?	Operators; Engineers – Conveyor may catch clothes.	Some guards in place to block conveyor access.	More guards with sensors to immobilize the conveyor if they aren't secured.
Encountering moving parts of the plant during testing, inspection, operation, maintenance, cleaning or repair of the plant?	Engineers; Operators – Walking into moving parts.	Maintenance procedures ensures that activities should not be carried out while moving parts are active.	Beacons to become active while moving equipment is in use.
Parts of plant disintegrating? e.g cuts.	Operators; Engineers – Parts may become worn and sharp.	PPE such as gloves to be worn for maintenance activities.	Inspection of wagons to ensure they are in good condition for the operators to possibly handle sharp corners.
Plant, parts of the plant or work pieces disintegrating	Operators; Engineers – Unusual function of system.	When a failure occurs, alarm systems are implemented to make operators & engineers aware.	Scheduled inspection checks for preventative maintenance.
Work pieces being ejected?	Operators; Engineers – hydraulic press.	Distancing while press is in use.	Implement guards.
Fluids/Gases under high pressure in plant failure?	Operators; Engineers – Air supply hoses could become unsecure.	Emergency Stops located around the system	N/A

What are the hazards?	Who might be harmed and how?	What are you already doing to control the risks?	What further action do you need to take to control the risks?
Electrical Leads on the ground	Operators; Engineers - Trailing leads are present from the HMI stands.	Avoiding leaving leads in walking paths.	Signs should be implemented, or trailing leads should be eliminated. HMI could possibly be wall mounted.
Damaged or poorly maintained electrical components &/or cables?	Operators; Engineers – Process station cabinet is unorganised.	Lock on door.	Redesign.
Overload of electrical circuits?	Operators; Engineers	MCB, Fuses	N/A
Water near electrical equipment?	Operators; Engineers – Process station contains water; electric Shock	RCD, PLC alarms	Implementation of moisture sensor with a drip tray underneath the tanks to give a specific fault alarm.
Lack of isolation procedures?	Operators; Engineers – Electric shock while carrying out maintenance.	There are Emergency stops present, however they can be de-activated without a key.	Emergency stops with key locks and lock off procedure available near the machine.
Uneven or slippery work surfaces?	Operators; Engineers – Water recirculation or process station may leak water.	PLC alarms for water recirculation faults may show operators to proceed with caution.	Implementation of moisture sensor with a drip tray underneath the tanks to give a specific fault alarm.
Obstacles being placed in the vicinity of the plant?	Operators; Engineers – slips and trips.	Verbal warnings.	Signage to not block exits and entries should be displayed.
Encountering objects at high temperature?	Operators; Engineers – touching process station tanks while hot.	Temperature of tanks are displayed on the engineers HMI Page.	Non digital display could be used on the tanks for maintenance activities.

Table 7; Risk Assessment

Hardware & I/O					
PLC 101		PLC 102		PLC 103	
Hardware		Hardware		Hardware	
Power Supply PM 190W 120/230VAC		CPU 1214C DC/DC/DC		CPU 1214C DC/DC/DC	
CPU 1511F-1 PN		SM 1221 DI16 x 24VDC		SM 1221 DI16 x 24VDC	
DI 16x24VDC / DQ 16x24VDC/0.5A BA		SM 1222 DQ16 x relay		SM 1222 DQ16 x 24VDC	
KTP1200 Basic PN				SM 1231 AI4	
				SM 1234 AI4/AQ2	
				KTP700 Basic PN	
Inputs	Outputs	Inputs	Outputs	Inputs	Outputs
Wagon Code Bit 0 INPUT	Scan Vision Station	LSS1	C1MPM U	Laser Raw Analogue Sensor	LEFT_Contactor
Wagon Code Bit 1 INPUT	Scan Pneumat ic Station	LSS2	C2MPM L	LEFT_Sensor	RIGHT_Contactor
Wagon Code Bit 2 INPUT	Scan Assembly Station	LSCH	C3MPM F	LEFT_MID_Sensor	FORWARD_Contact or
Wagon Code Bit 3 INPUT	Scan Process Station	LS1MPU	C4MPCG	RIGHT_Sensor	BACK_Contactor
Wagon Code Bit 4 INPUT	Scan Hydraulic Station	LS2MPD	C5MRM D	BACK_Sensor	UP_Contactor
Conveyor Safety Photo Beam INPUT	Release Wagon @ Vision Station	LS3MPR	C6MRM R	FORWARD_Sensor	DOWN_Contactor
Spare Input %I0.6	Release Wagon @ Pneumat ic Station	LS4MPL	C7MRM F	UP_Sensor	Gripper CLOSE Solenoid
Conveyor Running Aux Contact INPUT	Release Wagon @ Assembly Station	LS5MPF	C8MRCG	DOWN_MID_Sensor	FAST_X- travel_Contactor_C XN
Spare Input %I1.0	Release Wagon @ Process Station	LS6MPB	C9HRM1	DOWN_Sensor	C14 DC Pump P1 Contactor

Wagon @ Vision Station INPUT	Release Wagon @ Hydraulic Station	LS1MRU	C10RRM 1	A pulse	C11 Heater Solid State Relay
Wagon @ Pneumatic Station INPUT	Power ON Output	LS2MRD	C11HRM 2	B pulse	LY541 Analogue Output DAC
Wagon @ Assembly Station INPUT	Conveyor Contacto r Output	LS3MRR	C12RRM 2	RIGHT_MID_Sensor	V516 Fill Tank B1 Valve
Wagon @ Process Station INPUT	Auto Lamp Output	LS4MRL	C13PRM	BACK_MID_Sensor	V510 Fill Tank B2
Wagon @ Hydraulic Station INPUT		LS5MRF	C14PS	FORWARD_MID_Sensor	V500 Drain Tank B1
		LS6MRB	C15PPLT	LS542 Tank B1 low	V511 Fill Tank B4
		LSPLT		LS543 Tank B1 high	V512 Fill Tank B6
		LSPLTS		LS541 Tank B0 low	V515 Divert Tank B1 cool through radiator
		LSSTAMP		LS544 Tank C low	VF531 Analogue Output DAC
		AIR_OK		PS501 Air Pressure Switch	
				LT541 Analogue Module Chan 0	
				TT511 Analogue Module Chan 1	
				FT531 Analogue Module Chan 2	
				FT535 Analogue Module Chan 3	

Table 8; PLC Hardware - 101 to 103

Hardware & I/O					
PLC 104		PLC 105		PLC 106	
Hardware		Hardware		Hardware	
CPU 1214C DC/DC/DC		CPU 1212C AC/DC/Rly		CPU 1212C AC/DC/Rly	
SM 1223 DI8/DQ8 x 24VDC		SM 1278, 4 X IO-LINK MASTER		CM 1241 (RS232)	
SM 1231 AI4		KTP700 Basic PN		SM 1223 DI8/DQ8 x relay	
KTP700 Basic PN					
Inputs	Outputs	Inputs	Outputs	Inputs	Outputs
Motor Auxiliary Contact	Motor Relay	Manual Mode Selected	Pump Output	Slider Encoder input	Slider Move_Right_RSR relay
A axis CW Request switch	Press Down Solenoid	Common tank level alarm	Fill Valve	Slider RES relay	Slider Move_Left_RSL relay
A axis CCW Request switch	Press UP Solenoid	Analogue Input Channel 0	Drain Valve	Slider Left_Limit	Slider Speed_RSN relay
B axis UP Request switch	Proportional Value PWM Output	Analogue Input Channel 1		Slider Right_Limit	Tag_1
B axis DN Request switch	Gripper Close Solenoid			OB8 - CMD_Slider_Pos_Bit0 from Robot	TB7 - Slider In_Position signal to Robot
C axis UP Request switch	Proportional Valve Amplifier Analogue Output			OB9 - CMD_Slider_Pos_Bit1 from Robot	TB0 - Assembly Robot Go Online
C axis DN Request switch	Axis A Move CW Solenoid			OB10 - CMD_Slider_Pos_Bit2 from Robot	TB1 - Assembly Robot Pick Prod or Prism
D axis CW Request switch	Axis A Move CCW Solenoid			OB11 - Move_To_Slider_Position from Robot	TB2 - Assembly Robot Pick Round
D axis CCW Request switch	Axis B Move UP Solenoid			OB0 - Assembly Robot Online	TB4 - Assembly Robot Pick Fail Prism or Round CH1

Auto Mode Selection Switch	Axis B Move Down Solenoid			OB1 - Assembly Robot Can Pick	TB6 - Assembly Robot Pick Fail Round CH2
Start Pump Request switch	Axis C Move UP Solenoid			OB2 - Assembly Robot Busy	
Stop Pump Request switch	Axis C Move Down Solenoid			OB4 - Assembly Robot Prismatic in place	
E Press Move UP Request switch	Axis D Move CW Solenoid			OB6 - Assembly Robot Round in place	
E Press Move DN Request switch	Axis D Move CCW Solenoid				
Gripper Open Request switch					
Gripper Close Request switch					
E Press Down Limit					
ADC Axis A raw					
ADC Axis B raw					
ADC Axis C raw					
ADC Axis D raw					

Table 9; PLC Hardware - 104 to 106

Totally Integrated Automation Portal			
PLC 102 [DB30102]			
PLC 102 Properties			
General			
Name	PLC 102	Number	30102
Numbering	Manual	Type	DB
		Language	DB
Information			
Title		Author	
Version	0.1	User-defined ID	
		Comment	
		Family	
Name			
Data type			
Start value			
Retain			
▼ Static			
Get Bit 0 - Clock test bit	Bool	false	False
Pneumatic - Go Online	Bool	false	False
Pneumatic - Place Stamp	Bool	false	False
Pneumatic - Place Handle CH1	Bool	false	False
Pneumatic - Place Handle CH2	Bool	false	False
Pneumatic - Place Pallet	Bool	false	False
Pneumatic - HMI Place Stamp	Bool	false	False
Pneumatic - HMI Place Handle CH1	Bool	false	False
Pneumatic - HMI Place Handle CH2	Bool	false	False
Pneumatic - HMI Place Pallet	Bool	false	False
Pneumatic - HMI Reset	Bool	false	False
Pneumatic - Simulate	Bool	false	False
Get Bit 12	Bool	false	False
Get Bit 13	Bool	false	False
Get Bit 14	Bool	false	False
Get Bit 15	Bool	false	False
Get Word 1	Word	16#0	False
Get Word 2	Word	16#0	False
Get Word 3	Word	16#0	False
Get Word 4	Word	16#0	False
Get Word 5	Word	16#0	False
Get Word 6	Word	16#0	False
Get Word 7	Word	16#0	False
Get Word 8	Word	16#0	False
Get Word 9	Word	16#0	False
Get Word 10	Word	16#0	False
Get Word 11	Word	16#0	False
Get Word 12	Word	16#0	False
Get Word 13	Word	16#0	False
Get Word 14	Word	16#0	False
Get Word 15	Word	16#0	False
Put Bit 0 - Clock test bit	Bool	false	False
Pneumatic Online	Bool	false	False
Pneumatic Can Place	Bool	false	False
Pneumatic Busy	Bool	false	False
Pneumatic Finished	Bool	false	False
Pneumatic - Air OK	Bool	false	False
Pneumatic - System Healthy	Bool	false	False
Pneumatic - Other Healthy	Bool	false	False
Pneumatic - Pallet Manipulator Healthy	Bool	false	False
Pneumatic - Round Manipulator Healthy	Bool	false	False
Put Bit 10	Bool	false	False
Put Bit 11	Bool	false	False
Put Bit 12	Bool	false	False
Put Bit 13	Bool	false	False
Put Bit 14	Bool	false	False
Put Bit 15	Bool	false	False
Pneumatic States Word - bits 0 to 15	Word	16#0	False
Pneumatic States Word - bits 16 to 31	Word	16#0	False
Pneumatic Solenoid Outputs Word - bits 0 to 15	Word	16#0	False
Pneumatic inputs Word 1	Word	16#0	False
Pneumatic inputs Word 2	Word	16#0	False
Put Word 6	Word	16#0	False
Put Word 7	Word	16#0	False
Put Word 8	Word	16#0	False
Put Word 9	Word	16#0	False
Put Word 10	Word	16#0	False
Put Word 11	Word	16#0	False
Put Word 12	Word	16#0	False
Put Word 13	Word	16#0	False
Put Word 14	Word	16#0	False
Put Word 15	Word	16#0	False

Figure 5; PLC 101 Data block '102'

Totally Integrated Automation Portal

PLC 103 [DB30103]

PLC 103 Properties

General

Name	PLC 103	Number	30103	Type	DB	Language	DB
Numbering	Manual						
Information							
Title		Author		Comment		Family	
Version	0.1	User-defined ID					
Comment							
Family							

Name	Data type	Start value	Retain
▼ Static			
Get Bit 0 - clock test bit	Bool	false	False
Process - Go Online	Bool	false	False
Process - Pick Handle CH1	Bool	false	False
Process - Pick Handle CH2	Bool	false	False
Process - Place	Bool	false	False
Process - Simulate	Bool	false	False
Get Bit 6	Bool	false	False
Get Bit 7	Bool	false	False
Get Bit 8	Bool	false	False
Get Bit 9	Bool	false	False
Get Bit 10	Bool	false	False
Get Bit 11	Bool	false	False
Get Bit 12	Bool	false	False
Get Bit 13	Bool	false	False
Get Bit 14	Bool	false	False
Get Bit 15	Bool	false	False
Get Word 1	Word	1680	False
Get Word 2	Word	1680	False
Get Word 3	Word	1680	False
Get Word 4	Word	1680	False
Get Word 5	Word	1680	False
Get Word 6	Word	1680	False
Get Word 7	Word	1680	False
Get Word 8	Word	1680	False
Get Word 9	Word	1680	False
Get Word 10	Word	1680	False
Get Word 11	Word	1680	False
Get Word 12	Word	1680	False
Get Word 13	Word	1680	False
Get Word 14	Word	1680	False
Get Word 15	Word	1680	False
Put Bit 0 - clock test bit	Bool	false	False
Process Online	Bool	false	False
Process Can Pick	Bool	false	False
Process Can Place	Bool	false	False
Process Busy	Bool	false	False
Process Finished	Bool	false	False
Put Bit 6	Bool	false	False
Put Bit 7	Bool	false	False
Put Bit 8	Bool	false	False
Put Bit 9	Bool	false	False
Put Bit 10	Bool	false	False
Put Bit 11	Bool	false	False
Put Bit 12	Bool	false	False
Put Bit 13	Bool	false	False
Put Bit 14	Bool	false	False
Put Bit 15	Bool	false	False
Put Word 1	Word	1680	False
Put Word 2	Word	1680	False
Put Word 3	Word	1680	False
Put Word 4	Word	1680	False
Put Word 5	Word	1680	False
Put Word 6	Word	1680	False
Put Word 7	Word	1680	False
Process Tank Level PV	Real	0.0	False
Process Tank Level SP	Real	0.0	False
Process Tank Level Error	Real	0.0	False
Process Tank Level KP	Real	0.0	False
Process Tank Level Ki	Real	0.0	False
Process Tank Level Kd	Real	0.0	False
Process Tank Level CV%	Real	0.0	False
Process Tank Level Volts%	Real	0.0	False
PTL Actual	Real	0.0	False
PTL Flow Rate	Real	0.0	False
PTL LPM Volume	Real	0.0	False
PTL Temp	Real	0.0	False
Put Real 13	Real	0.0	False

Figure 6; PLC 101 Data block '103'

Totally Integrated Automation Portal

PLC 104 [DB30104]

PLC 104 Properties

General

Name

PLC 104

Number

30104

Type

DB

Language

DB

Numbering

Manual

Information

Title

Version

Author

Comment

Family

0.1

User-defined ID

Name	Data type	Start value	Retain
▼ Static			
Get Bit 0 - clock test bit	Bool	false	False
Hydraulic - Go Online	Bool	false	False
Hydraulic - Pick	Bool	false	False
Hydraulic - Press	Bool	false	False
Hydraulic - Pick Finished Product from CH1	Bool	false	False
Hydraulic - Pick Finished Product from CH2	Bool	false	False
Hydraulic - Simulate	Bool	false	False
Get Bit 7	Bool	false	False
Get Bit 8	Bool	false	False
Get Bit 9	Bool	false	False
Get Bit 10	Bool	false	False
Get Bit 11	Bool	false	False
Get Bit 12	Bool	false	False
Get Bit 13	Bool	false	False
Get Bit 14	Bool	false	False
Get Bit 15	Bool	false	False
Get Word 1	Word	16#0	False
Get Word 2	Word	16#0	False
Get Word 3	Word	16#0	False
Get Word 4	Word	16#0	False
Get Word 5	Word	16#0	False
Get Word 6	Word	16#0	False
Get Word 7	Word	16#0	False
Get Word 8	Word	16#0	False
Get Word 9	Word	16#0	False
Get Word 10	Word	16#0	False
Get Word 11	Word	16#0	False
Get Word 12	Word	16#0	False
Get Word 13	Word	16#0	False
Get Word 14	Word	16#0	False
Get Word 15	Word	16#0	False
Put Bit 0 - clock test bit	Bool	false	False
Hydraulic - Can Pick	Bool	false	False
Hydraulic - Online	Bool	false	False
Hydraulic - Busy	Bool	false	False
Hydraulic - Finished	Bool	false	False
Put Bit 5	Bool	false	False
Put Bit 6	Bool	false	False
Put Bit 7	Bool	false	False
Put Bit 8	Bool	false	False
Put Bit 9	Bool	false	False
Put Bit 10	Bool	false	False
Put Bit 11	Bool	false	False
Put Bit 12	Bool	false	False
Put Bit 13	Bool	false	False
Put Bit 14	Bool	false	False
Put Bit 15	Bool	false	False
Put Word 1	Word	16#0	False
Put Word 2	Word	16#0	False
Put Word 3	Word	16#0	False
Put Word 4	Word	16#0	False
Put Word 5	Word	16#0	False
Put Word 6	Word	16#0	False
Put Word 7	Word	16#0	False
Put Word 8	Word	16#0	False
Put Word 9	Word	16#0	False
Put Word 10	Word	16#0	False
Put Word 11	Word	16#0	False
Put Word 12	Word	16#0	False
Put Word 13	Word	16#0	False
Put Word 14	Word	16#0	False
Put Word 15	Word	16#0	False

Figure 7; PLC 101 Data block '104'

Totally Integrated Automation Portal			
PLC 105 [DB30105]			
PLC 105 Properties			
General			
Name	PLC 105	Number	30105
Numbering	Manual	Type	DB
Language	DB		
Information			
Title		Author	
Version	0.1	User-defined ID	
Comment			
Family			
Name			
▼ Static			
Get Bit 0 - clock test bit	Bool	false	False
Water Recirc - Go Online	Bool	false	False
Water Recirc - Simulate	Bool	false	False
Get Bit 3	Bool	false	False
Get Bit 4	Bool	false	False
Get Bit 5	Bool	false	False
Get Bit 6	Bool	false	False
Get Bit 7	Bool	false	False
Get Bit 8	Bool	false	False
Get Bit 9	Bool	false	False
Get Bit 10	Bool	false	False
Get Bit 11	Bool	false	False
Get Bit 12	Bool	false	False
Get Bit 13	Bool	false	False
Get Bit 14	Bool	false	False
Get Bit 15	Bool	false	False
Get Word 1	Word	16#0	False
Get Word 2	Word	16#0	False
Get Word 3	Word	16#0	False
Get Word 4	Word	16#0	False
Get Word 5	Word	16#0	False
Get Word 6	Word	16#0	False
Get Word 7	Word	16#0	False
Get Word 8	Word	16#0	False
Get Word 9	Word	16#0	False
Get Word 10	Word	16#0	False
Get Word 11	Word	16#0	False
Get Word 12	Word	16#0	False
Get Word 13	Word	16#0	False
Get Word 14	Word	16#0	False
Get Word 15	Word	16#0	False
Put Bit 0 - clock test bit	Bool	false	False
Water Recirc - Online	Bool	false	False
Water Recirc - Auto Mode	Bool	false	False
Water Recirc - Manual Mode	Bool	false	False
Water Recirc - Common Alarm	Bool	false	False
Water Recirc - Top Tank Full Alarm	Bool	false	False
Water Recirc - Top Tank Empty Alarm	Bool	false	False
Water Recirc - Bottom Tank Full Alarm	Bool	false	False
Water Recirc - Bottom Tank Empty Alarm	Bool	false	False
Put Bit 9	Bool	false	False
Put Bit 10	Bool	false	False
Put Bit 11	Bool	false	False
Put Bit 12	Bool	false	False
Put Bit 13	Bool	false	False
Put Bit 14	Bool	false	False
Put Bit 15	Bool	false	False
Put Word 1	Word	16#0	False
Put Word 2	Word	16#0	False
Put Word 3	Word	16#0	False
Put Word 4	Word	16#0	False
Put Word 5	Word	16#0	False
Put Word 6	Word	16#0	False
Put Word 7	Word	16#0	False
Put Word 8	Word	16#0	False
Put Word 9	Word	16#0	False
Put Word 10	Word	16#0	False
Put Word 11	Word	16#0	False
Put Word 12	Word	16#0	False
Put Word 13	Word	16#0	False
Put Word 14	Word	16#0	False
Put Word 15	Word	16#0	False

Figure 8; PLC 101 Data block '105'

Totally Integrated Automation Portal

PLC 106 [DB30106]

PLC 106 Properties

General

Name

PLC 106

Number

30106

Type

DB

Language

DB

Numbering

Manual

Information

Title

Version

0.1

Author

User-defined ID

Comment

Family

Name	Data type	Start value	Retain
▼ Static			
Get Bit 0 - clock test bit	Bool	false	False
Assembly Robot - Go Online - TB0	Bool	false	False
Assembly Robot - Pick Finished Product or Stamp - TB1	Bool	false	False
Assembly Robot - Pick Handle - TB2	Bool	false	False
Assembly Robot - Pick Fail Stamp or Handle CH1 - TB4	Bool	false	False
Assembly Robot - Pick Fail Handle CH2 - TB6	Bool	false	False
Assembly Robot - Simulate	Bool	false	False
Assembly Robot - Teach Box Manual Mode	Bool	false	False
Assembly Robot - Teach Box Move to Selected Point	Bool	false	False
Assembly Robot - Teach Box Move Left	Bool	false	False
Assembly Robot - Teach Box Move Right	Bool	false	False
Assembly Robot - Teach Box Store Selected Position	Bool	false	False
Get Bit 12	Bool	false	False
Get Bit 13	Bool	false	False
Get Bit 14	Bool	false	False
Get Bit 15	Bool	false	False
Get Word 1	Word	16#0	False
Get Word 2	Word	16#0	False
Get Word 3	Word	16#0	False
Get Word 4	Word	16#0	False
Get Word 5	Word	16#0	False
Get Word 6	Word	16#0	False
Get Word 7	Word	16#0	False
Get Word 8	Word	16#0	False
Get Word 9	Word	16#0	False
Get Word 10	Word	16#0	False
Get Word 11	Word	16#0	False
Get Word 12	Word	16#0	False
Get Word 13	Word	16#0	False
Get Word 14	Word	16#0	False
Get Word 15	Word	16#0	False
Put Bit 0 - clock test bit	Bool	false	False
Assembly Robot Online - OB0	Bool	false	False
Assembly Robot Can Pick - OB1	Bool	false	False
Assembly Robot Busy - OB2	Bool	false	False
Assembly Robot Stamp in place - OB4	Bool	false	False
Assembly Robot Handle in place - OB6	Bool	false	False
Assembly Robot Slider initialised	Bool	false	False
Assembly Robot Slider input 0 - Encoder Signal	Bool	false	False
Assembly Robot Slider input 1 - RES Signal	Bool	false	False
Assembly Robot Slider input 2 - Left Limit Signal	Bool	false	False
Assembly Robot Slider input 3 - Right Limit Signal	Bool	false	False
Assembly Robot Slider input 4 - Slider Command LSB	Bool	false	False
Assembly Robot Slider input 5 - Slider Command LSB	Bool	false	False
Assembly Robot Slider input 6 - Slider Command MSB	Bool	false	False
Assembly Robot Slider input 7 - Slider Move to Position	Bool	false	False
Assembly Robot Slider Output 0 - M-0 one Right RSL relay	Bool	false	False
Assembly Robot Slider Output 1 - Move Left RSL relay	Bool	false	False
Assembly Robot Slider Output 2 - Speed RSL Relay	Bool	false	False
Assembly Robot Slider Output 3	Bool	false	False
Assembly Robot Slider Output 4 - In Position	Bool	false	False
Put Bit 20	Bool	false	False
Put Bit 21	Bool	false	False
Put Bit 22	Bool	false	False
Put Bit 23	Bool	false	False
Put Bit 24	Bool	false	False
Put Bit 25	Bool	false	False
Put Bit 26	Bool	false	False
Put Bit 27	Bool	false	False
Put Bit 28	Bool	false	False
Put Bit 29	Bool	false	False
Put Bit 30	Bool	false	False
Put Bit 31	Bool	false	False
Assembly Robot Slider Teach Position	Word	16#0	False
Put Word 3	Word	16#0	False
Put Word 4	Word	16#0	False
Put Word 5	Word	16#0	False

Figure 9; PLC 101 Data block '106'

Totally Integrated Automation Portal

PLC 101 [DB30101]

PLC 101 Properties

General

Name

PLC 101

Number

30101

Type

DB

Language

DB

Numbering

Manual

Information

Title

Version

Author

User-defined ID

Comment

Family

0.1

Name	Data type	Start value	Retain
▼ Static			
Get Bit 0 - clock test bit	bool	false	False
Pneumatic - Go Online	bool	false	False
Pneumatic - Place Stamp	bool	false	False
Pneumatic - Place Handle CH1	bool	false	False
Pneumatic - Place Handle CH2	bool	false	False
Pneumatic - Place Pallet	bool	false	False
Pneumatic - HMI Place Stamp	bool	false	False
Pneumatic - HMI Place Handle CH1	bool	false	False
Pneumatic - HMI Place Handle CH2	bool	false	False
Pneumatic - HMI Place Pallet	bool	false	False
Pneumatic - HMI Reset	bool	false	False
Pneumatic - Simulate	bool	false	False
Get Bit 12	bool	false	False
Get Bit 13	bool	false	False
Get Bit 14	bool	false	False
Get Bit 15	bool	false	False
Get Word 1	Word	16#0	False
Get Word 2	Word	16#0	False
Get Word 3	Word	16#0	False
Get Word 4	Word	16#0	False
Get Word 5	Word	16#0	False
Get Word 6	Word	16#0	False
Get Word 7	Word	16#0	False
Get Word 8	Word	16#0	False
Get Word 9	Word	16#0	False
Get Word 10	Word	16#0	False
Get Word 11	Word	16#0	False
Get Word 12	Word	16#0	False
Get Word 13	Word	16#0	False
Get Word 14	Word	16#0	False
Get Word 15	Word	16#0	False
Put Bit 0 - Clock test bit	bool	false	False
Pneumatic Online	bool	false	False
Pneumatic Can Place	bool	false	False
Pneumatic Busy	bool	false	False
Pneumatic Finished	bool	false	False
Pneumatic - Air OK	bool	false	False
Pneumatic - System Healthy	bool	false	False
Pneumatic - Other Healthy	bool	false	False
Pneumatic - Pallet Manipulator Healthy	bool	false	False
Pneumatic - Round Manipulator Healthy	bool	false	False
Put Bit 10	bool	false	False
Put Bit 11	bool	false	False
Put Bit 12	bool	false	False
Put Bit 13	bool	false	False
Put Bit 14	bool	false	False
Put Bit 15	bool	false	False
Pneumatic States Word - bits 0 to 15	Word	16#0	False
Pneumatic States Word - bits 16 to 31	Word	16#0	False
Pneumatic Solenoid Outputs Word - bits 0 to 15	Word	16#0	False
Pneumatic inputs Word 1	Word	16#0	False
Pneumatic inputs Word 2	Word	16#0	False
Put Word 6	Word	16#0	False
Put Word 7	Word	16#0	False
Put Word 8	Word	16#0	False
Put Word 9	Word	16#0	False
Put Word 10	Word	16#0	False
Put Word 11	Word	16#0	False
Put Word 12	Word	16#0	False
Put Word 13	Word	16#0	False
Put Word 14	Word	16#0	False
Put Word 15	Word	16#0	False

Figure 10; PLC 102 Data block '101'

Totally Integrated Automation Portal

PLC 101 [DB30101]

PLC 101 Properties

General

Name

PLC 101

Number

30101

Type

DB

Language

DB

Numbering

Manual

Information

Title

Author

Comment

Family

Version

0.1

User-defined ID

Name	Data type	Start value	Retain
▼ Static			
Get Bit 0 - clock test bit	bool	false	False
Process - Go Online	bool	false	False
Process - Pick Handle CH1	bool	false	False
Process - Pick Handle CH2	bool	false	False
Process - Place	bool	false	False
Process - Simulate	bool	false	False
Get Bit 6	bool	false	False
Get Bit 7	bool	false	False
Get Bit 8	bool	false	False
Get Bit 9	bool	false	False
Get Bit 10	bool	false	False
Get Bit 11	bool	false	False
Get Bit 12	bool	false	False
Get Bit 13	bool	false	False
Get Bit 14	bool	false	False
Get Bit 15	bool	false	False
Get Word 1	Word	16#0	False
Get Word 2	Word	16#0	False
Get Word 3	Word	16#0	False
Get Word 4	Word	16#0	False
Get Word 5	Word	16#0	False
Get Word 6	Word	16#0	False
Get Word 7	Word	16#0	False
Get Word 8	Word	16#0	False
Get Word 9	Word	16#0	False
Get Word 10	Word	16#0	False
Get Word 11	Word	16#0	False
Get Word 12	Word	16#0	False
Get Word 13	Word	16#0	False
Get Word 14	Word	16#0	False
Get Word 15	Word	16#0	False
Put Bit 0 - Clock test bit	bool	false	False
Process Online	bool	false	False
Process Can Pick	bool	false	False
Process Can Place	bool	false	False
Process Busy	bool	false	False
Process Finished	bool	false	False
Put Bit 6	bool	false	False
Put Bit 7	bool	false	False
Put Bit 8	bool	false	False
Put Bit 9	bool	false	False
Put Bit 10	bool	false	False
Put Bit 11	bool	false	False
Put Bit 12	bool	false	False
Put Bit 13	bool	false	False
Put Bit 14	bool	false	False
Put Bit 15	bool	false	False
Put Word 1	Word	16#0	False
Put Word 2	Word	16#0	False
Put Word 3	Word	16#0	False
Put Word 4	Word	16#0	False
Put Word 5	Word	16#0	False
Put Word 6	Word	16#0	False
Put Word 7	Word	16#0	False
Tank Process Level PV	Real	0.0	False
Tank Process Level SP	Real	0.0	False
Tank Process Level Error	Real	0.0	False
Tank Process Level Kp	Real	0.0	False
Tank Process Level Ki	Real	0.0	False
Tank Process Level Kd	Real	0.0	False
Tank Process Level CV%	Real	0.0	False
Tank Process Level Volts%	Real	0.0	False
PTL Actual	Real	0.0	False
PTL Flow Rate	Real	0.0	False
PTL LPM Volume	Real	0.0	False
PTL Temp	Real	0.0	False
Put Real 9	Real	0.0	False

Figure 11; PLC 103 Data block '101'

Totally Integrated Automation Portal

PLC 101 [DB30101]

PLC 101 Properties

General

Name

PLC 101

Number

30101

Type

DB

Language

DB

Numbering

Manual

Information

Title

Author

Comment

Family

Version

0.1

User-defined ID

Name

Data type

Start value

Retain

▼ Static

Get Bit 0 - clock test bit

bool

false

False

Hydraulic - Go Online

bool

false

False

Hydraulic - Pick

bool

false

False

Hydraulic - Press

bool

false

False

Hydraulic - Pick Finished Product from CH1

bool

false

False

Hydraulic - Pick Finished Product from CH2

bool

false

False

Hydraulic - Simulate

bool

false

False

Get Bit 7

bool

false

False

Get Bit 8

bool

false

False

Get Bit 9

bool

false

False

Get Bit 10

bool

false

False

Get Bit 11

bool

false

False

Get Bit 12

bool

false

False

Get Bit 13

bool

false

False

Get Bit 14

bool

false

False

Get Bit 15

bool

false

False

Get Word 1

Word

16#0

False

Get Word 2

Word

16#0

False

Get Word 3

Word

16#0

False

Get Word 4

Word

16#0

False

Get Word 5

Word

16#0

False

Get Word 6

Word

16#0

False

Get Word 7

Word

16#0

False

Get Word 8

Word

16#0

False

Get Word 9

Word

16#0

False

Get Word 10

Word

16#0

False

Get Word 11

Word

16#0

False

Get Word 12

Word

16#0

False

Get Word 13

Word

16#0

False

Get Word 14

Word

16#0

False

Get Word 15

Word

16#0

False

Put Bit 0 - clock test bit

bool

false

False

Hydraulic - Can Pick

bool

false

False

Hydraulic - Online

bool

false

False

Hydraulic - Busy

bool

false

False

Hydraulic - Finished

bool

false

False

Put Bit 5

bool

false

False

Put Bit 6

bool

false

False

Put Bit 7

bool

false

False

Put Bit 8

bool

false

False

Put Bit 9

bool

false

False

Put Bit 10

bool

false

False

Put Bit 11

bool

false

False

Put Bit 12

bool

false

False

Put Bit 13

bool

false

False

Put Bit 14

bool

false

False

Put Bit 15

bool

false

False

Put Word 1

Word

16#0

False

Put Word 2

Word

16#0

False

Put Word 3

Word

16#0

False

Put Word 4

Word

16#0

False

Put Word 5

Word

16#0

False

Put Word 6

Word

16#0

False

Put Word 7

Word

16#0

False

Put Word 8

Word

16#0

False

Put Word 9

Word

16#0

False

Put Word 10

Word

16#0

False

Put Word 11

Word

16#0

False

Put Word 12

Word

16#0

False

Put Word 13

Word

16#0

False

Put Word 14

Word

16#0

False

Put Word 15

Word

16#0

False

Figure 12; PLC 104 Data block '101'

Totally Integrated Automation Portal					
PLC 101 [DB30101]					
PLC 101 Properties					
General					
Name	PLC 101	Number	30101	Type	DB
Language	Manual				DB
Information					
Title		Author		Comment	Family
Version	0.1	User-defined ID			
Name		Data type	Start value	Retain	
▼ Static					
Get Bit 0 - clock test bit	Bool	false		False	
Water Recirc - Go Online	Bool	false		False	
Water Recirc - simulate	Bool	false		False	
Get Bit 3	Bool	false		False	
Get Bit 4	Bool	false		False	
Get Bit 5	Bool	false		False	
Get Bit 6	Bool	false		False	
Get Bit 7	Bool	false		False	
Get Bit 8	Bool	false		False	
Get Bit 9	Bool	false		False	
Get Bit 10	Bool	false		False	
Get Bit 11	Bool	false		False	
Get Bit 12	Bool	false		False	
Get Bit 13	Bool	false		False	
Get Bit 14	Bool	false		False	
Get Bit 15	Bool	false		False	
Get Word 1	Word	16#0		False	
Get Word 2	Word	16#0		False	
Get Word 3	Word	16#0		False	
Get Word 4	Word	16#0		False	
Get Word 5	Word	16#0		False	
Get Word 6	Word	16#0		False	
Get Word 7	Word	16#0		False	
Get Word 8	Word	16#0		False	
Get Word 9	Word	16#0		False	
Get Word 10	Word	16#0		False	
Get Word 11	Word	16#0		False	
Get Word 12	Word	16#0		False	
Get Word 13	Word	16#0		False	
Get Word 14	Word	16#0		False	
Get Word 15	Word	16#0		False	
Put Bit 0 - Clock test bit	Bool	false		False	
Water Recirc - Online	Bool	false		False	
Water Recirc - Auto Mode	Bool	false		False	
Water Recirc - Manual Mode	Bool	false		False	
Water Recirc - Common Alarm	Bool	false		False	
Water Recirc - Top Tank Full Alarm	Bool	false		False	
Water Recirc - Top Tank Empty Alarm	Bool	false		False	
Water Recirc - Bottom Tank Full Alarm	Bool	false		False	
Water Recirc - Bottom Tank Empty Alarm	Bool	false		False	
Put Bit 9	Bool	false		False	
Put Bit 10	Bool	false		False	
Put Bit 11	Bool	false		False	
Put Bit 12	Bool	false		False	
Put Bit 13	Bool	false		False	
Put Bit 14	Bool	false		False	
Put Bit 15	Bool	false		False	
Put Word 1	Word	16#0		False	
Put Word 2	Word	16#0		False	
Put Word 3	Word	16#0		False	
Put Word 4	Word	16#0		False	
Put Word 5	Word	16#0		False	
Put Word 6	Word	16#0		False	
Put Word 7	Word	16#0		False	
Put Word 8	Word	16#0		False	
Put Word 9	Word	16#0		False	
Put Word 10	Word	16#0		False	
Put Word 11	Word	16#0		False	
Put Word 12	Word	16#0		False	
Put Word 13	Word	16#0		False	
Put Word 14	Word	16#0		False	
Put Word 15	Word	16#0		False	

Figure 13; PLC 105 Data block '101'

Totally Integrated Automation Portal

PLC 101 [DB30101]

PLC 101 Properties

General

Name

PLC 101

Number

30101

Type

DB

Language

DB

Numbering Information

Title

Version

Author

User-defined ID

Comment

Family

0.1

Name	Data type	Start value	Retain
▼ Static			
Get Bit 0 - clock test bit	Bool	false	False
Assembly Robot - Go Online - T80	Bool	false	False
Assembly Robot - Pick Finished Product or Stamp - T81	Bool	false	False
Assembly Robot - Pick Handle - T82	Bool	false	False
Assembly Robot - Pick Fail Stamp or Handle CH1 - T84	Bool	false	False
Assembly Robot - Pick Fail Handle CH2 - T86	Bool	false	False
Assembly Robot - Simulate	Bool	false	False
Assembly Robot - Teach Box Manual Mode	Bool	false	False
Assembly Robot - Teach Box Move to Selected Point	Bool	false	False
Assembly Robot - Teach Box Move Left	Bool	false	False
Assembly Robot - Teach Box Move Right	Bool	false	False
Assembly Robot - Teach Box Store Selected Position	Bool	false	False
Get Bit 12	Bool	false	False
Get Bit 13	Bool	false	False
Get Bit 14	Bool	false	False
Get Bit 15	Bool	false	False
Get Word 1	Word	1640	False
Get Word 2	Word	1640	False
Get Word 3	Word	1640	False
Get Word 4	Word	1640	False
Get Word 5	Word	1640	False
Get Word 6	Word	1640	False
Get Word 7	Word	1640	False
Get Word 8	Word	1640	False
Get Word 9	Word	1640	False
Get Word 10	Word	1640	False
Get Word 11	Word	1640	False
Get Word 12	Word	1640	False
Get Word 13	Word	1640	False
Get Word 14	Word	1640	False
Get Word 15	Word	1640	False
Put Bit 0 - Clock test bit	Bool	false	False
Assembly Robot Online - O80	Bool	false	False
Assembly Robot Can Pick - O81	Bool	false	False
Assembly Robot Busy - O82	Bool	false	False
Assembly Robot Stamp in place - O84	Bool	false	False
Assembly Robot Handle in place - O86	Bool	false	False
Assembly Robot Slider initialised	Bool	false	False
Assembly Robot Slider input 0 - Encoder Signal	Bool	false	False
Assembly Robot Slider input 1 - RES Signal	Bool	false	False
Assembly Robot Slider input 2 - Left Limit Signal	Bool	false	False
Assembly Robot Slider input 3 - Right Limit Signal	Bool	false	False
Assembly Robot Slider input 4 - Slider Command LSB	Bool	false	False
Assembly Robot Slider input 5 - Slider Command MSB	Bool	false	False
Assembly Robot Slider input 6 - Slider Command MSB	Bool	false	False
Assembly Robot Slider input 7 - Slider Move to Position	Bool	false	False
Assembly Robot Slider Output 0 - M ove Right RSL relay	Bool	false	False
Assembly Robot Slider Output 1 - Move Left RSL relay	Bool	false	False
Assembly Robot Slider Output 2 - Speed RSN Relay	Bool	false	False
Assembly Robot Slider Output 3	Bool	false	False
Assembly Robot Slider Output 4 - In Position	Bool	false	False
Put Bit 20	Bool	false	False
Put Bit 21	Bool	false	False
Put Bit 22	Bool	false	False
Put Bit 23	Bool	false	False
Put Bit 24	Bool	false	False
Put Bit 25	Bool	false	False
Put Bit 26	Bool	false	False
Put Bit 27	Bool	false	False
Put Bit 28	Bool	false	False
Put Bit 29	Bool	false	False
Put Bit 30	Bool	false	False
Put Bit 31	Bool	false	False
Assembly Robot Slider Teach Position	Word	1640	False
Put Word 3	Word	1640	False
Put Word 4	Word	1640	False
Put Word 5	Word	1640	False

Figure 14; PLC 106 Data block '101'



Figure 15;Map Tank level data from PLC 103 to PLC 101. LC541

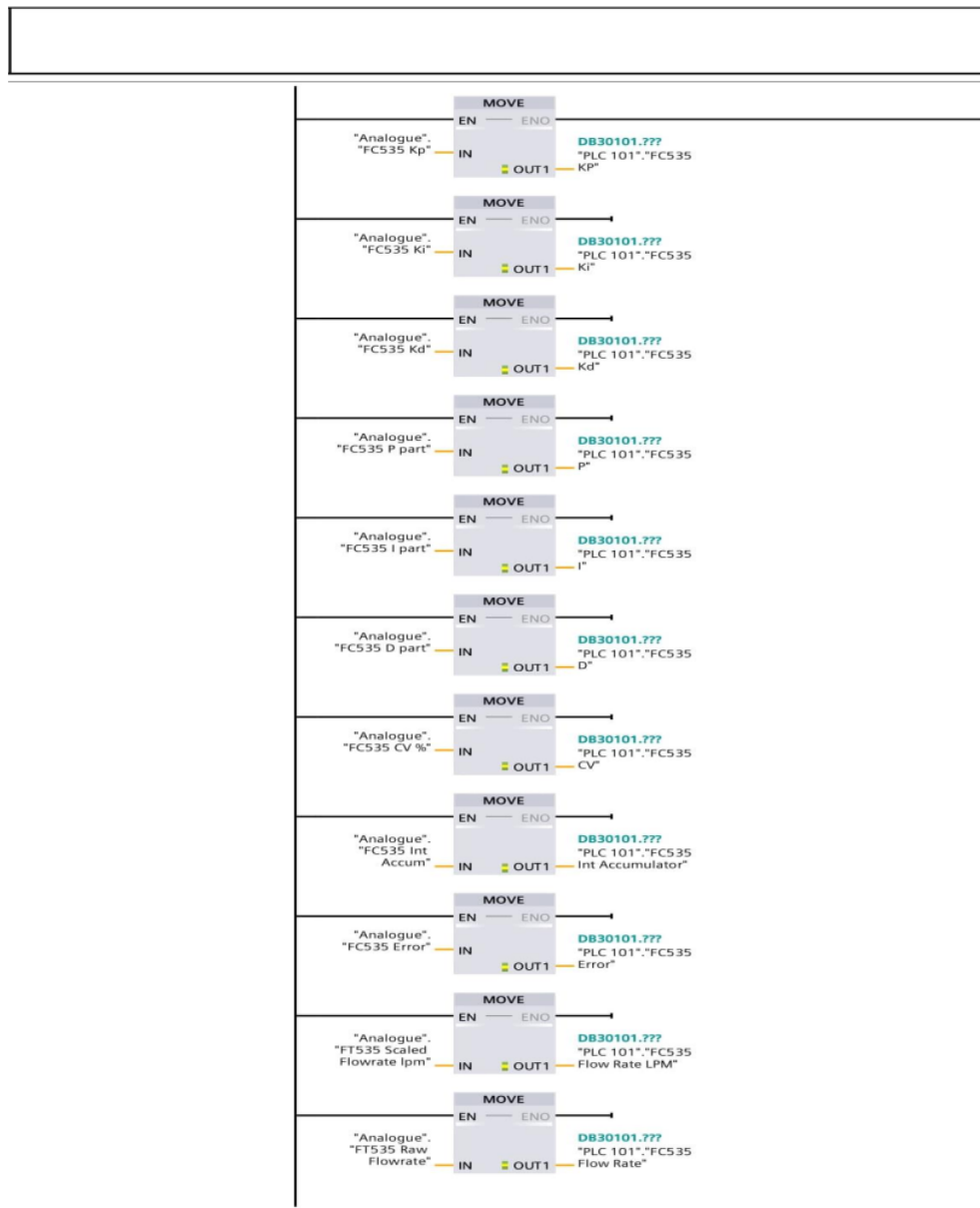


Figure 16; Map Data From 103 to 101; FC535

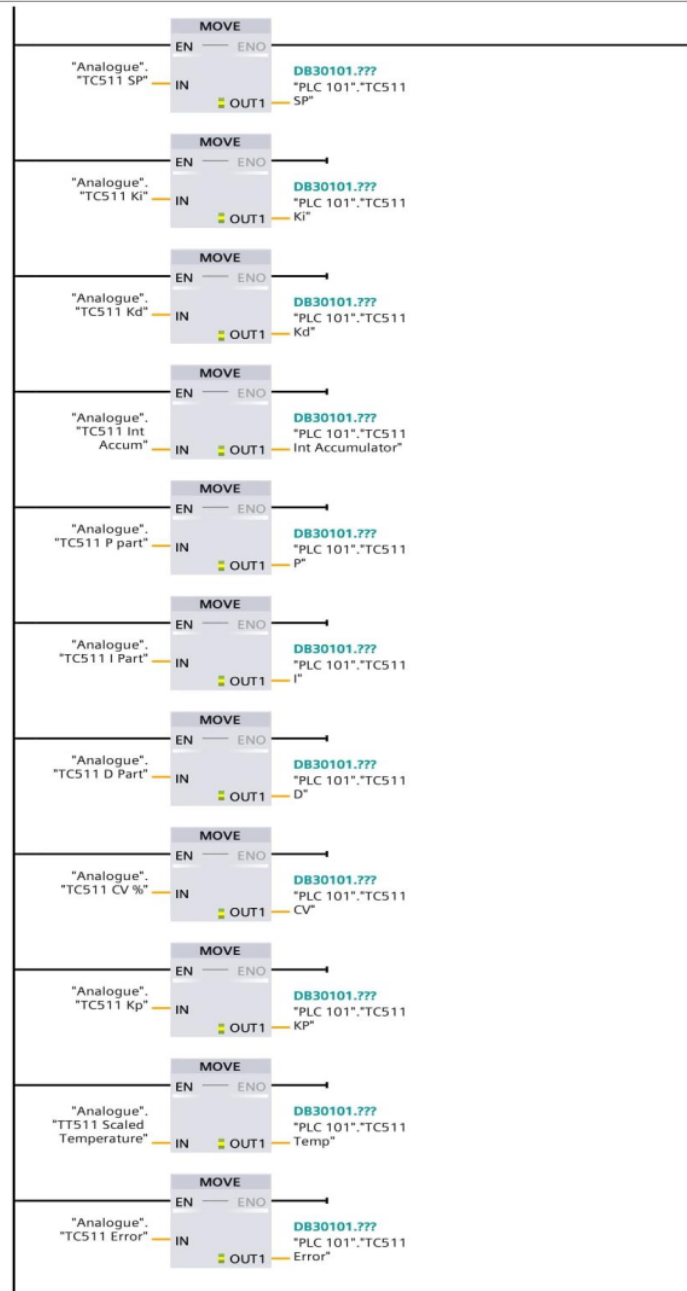


Figure 17; Map data PLC 103 to PLC 101; TC511

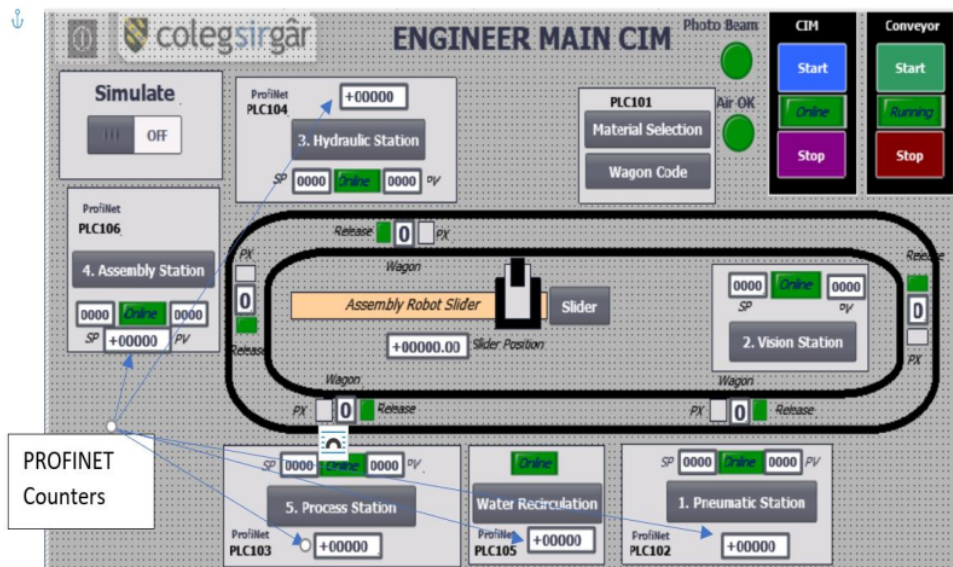


Figure 18; HMI 131 - Engineer Screen

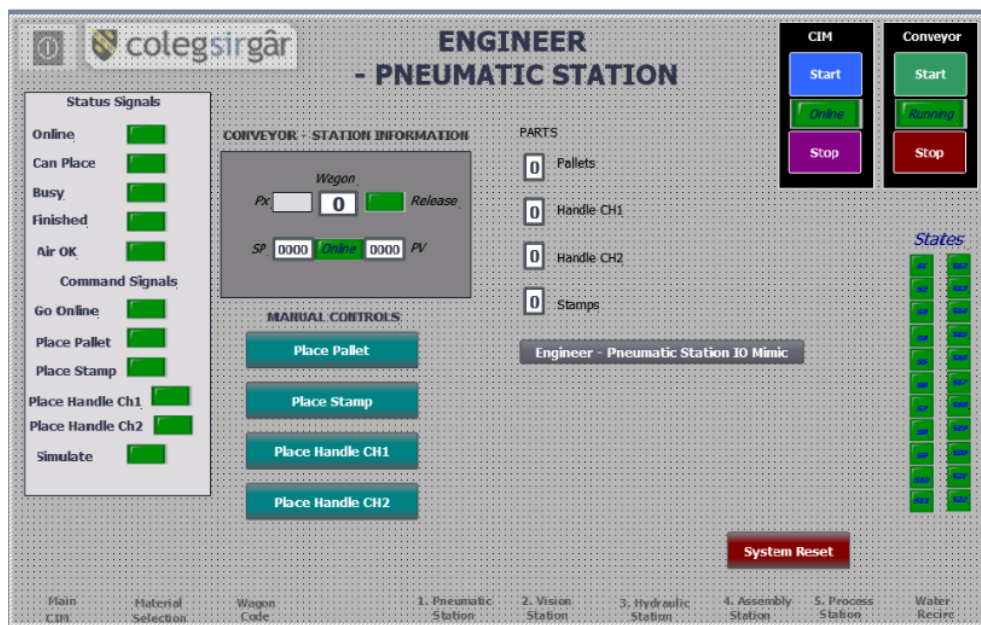


Figure 19; HMI 131 - Pneumatic Station Screen

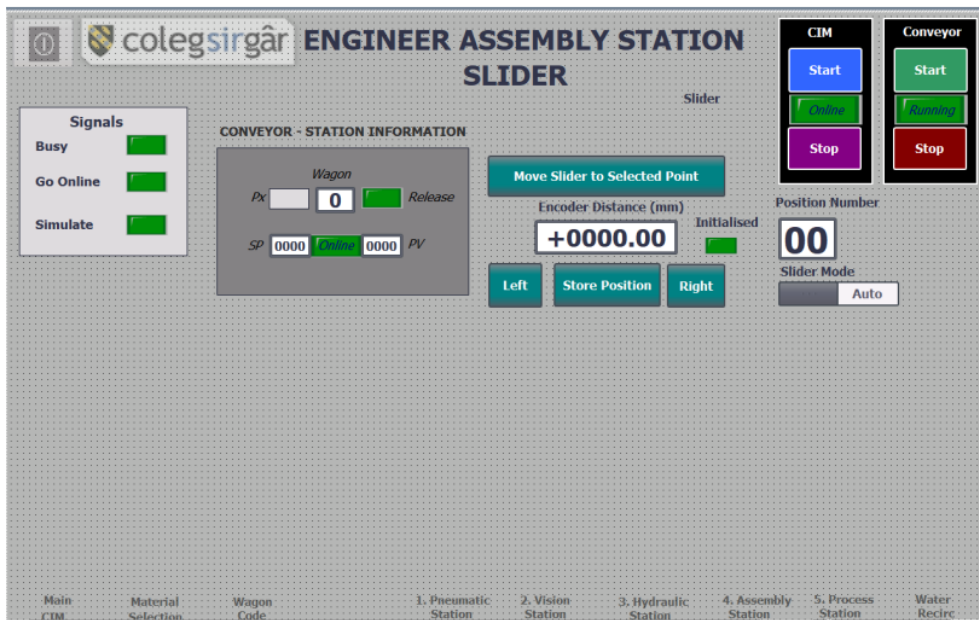


Figure 20; HMI 131 - Assembly Station Screen

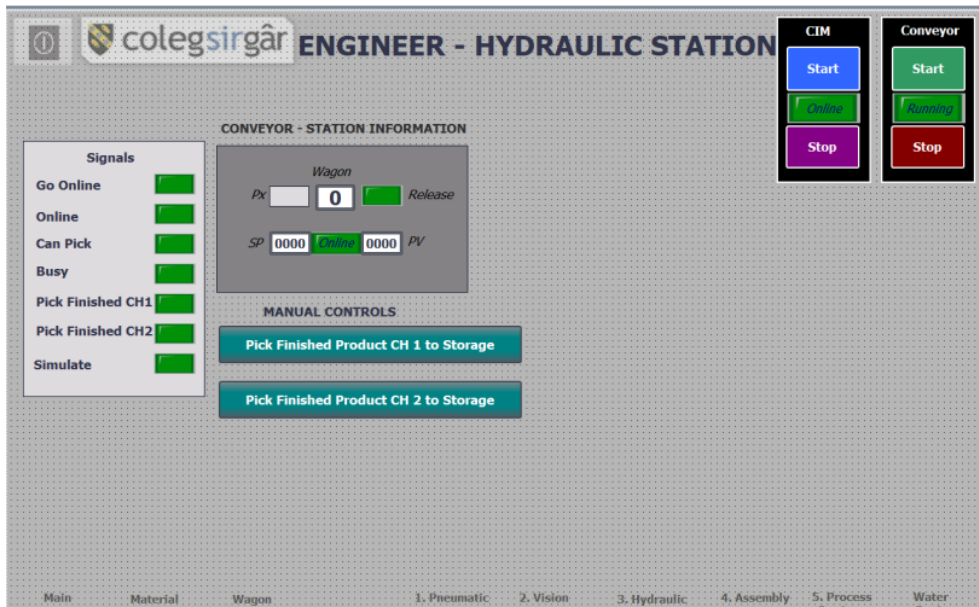


Figure 21; HMI 131 - Hydraulic Station Screen

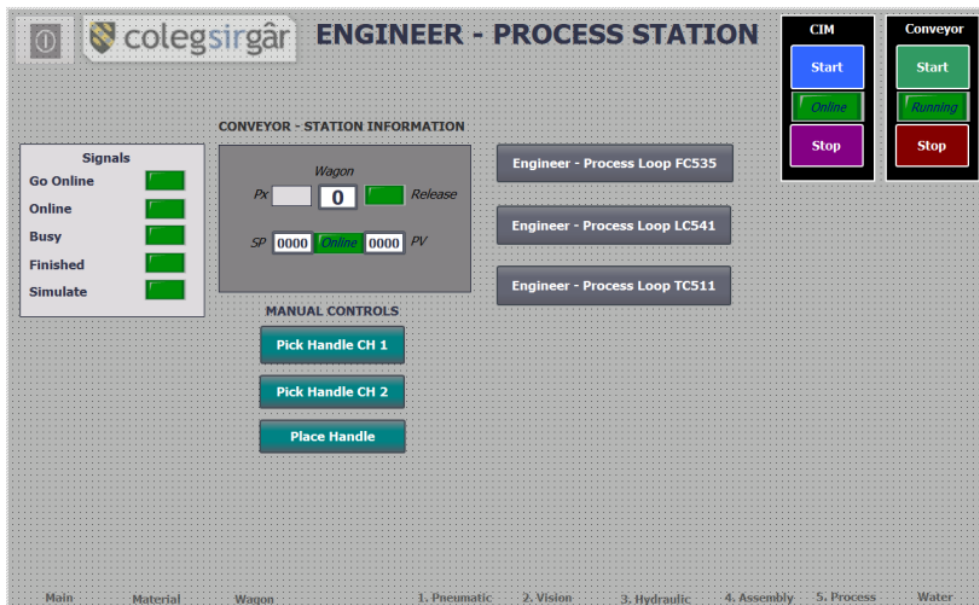


Figure 22; HMI 131 - Process Station Screen

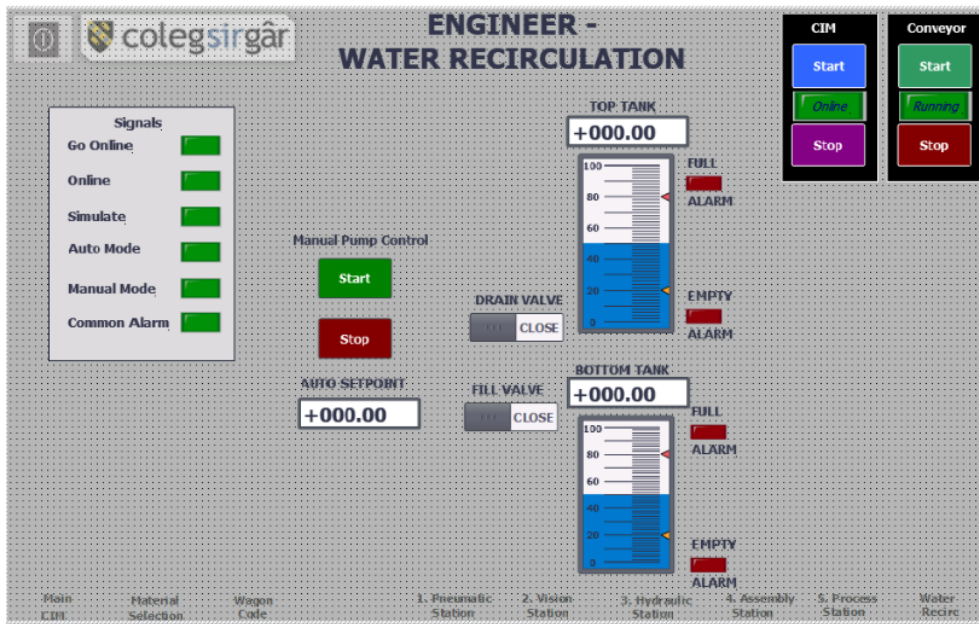
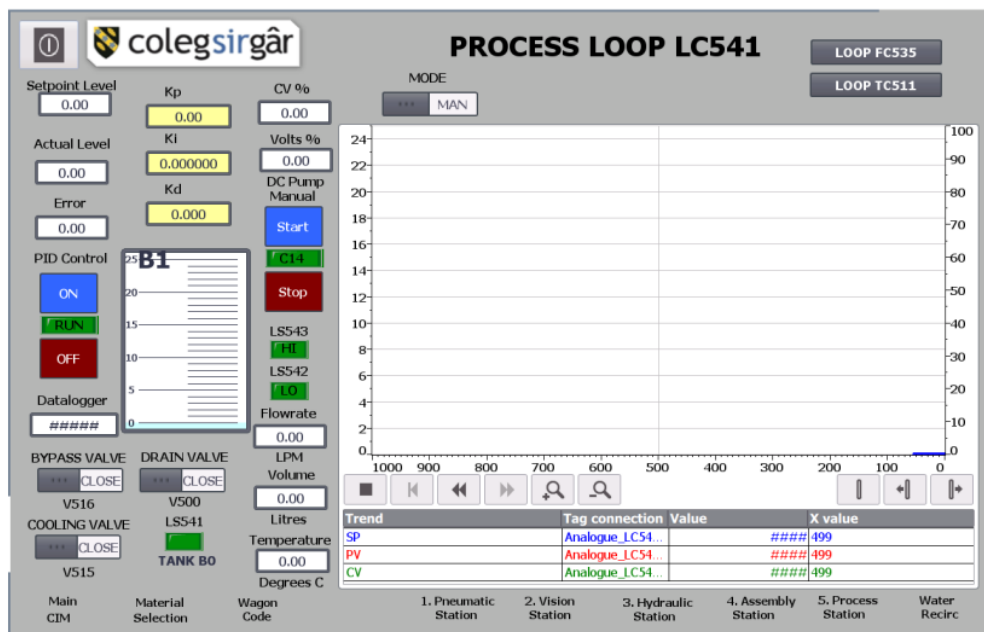
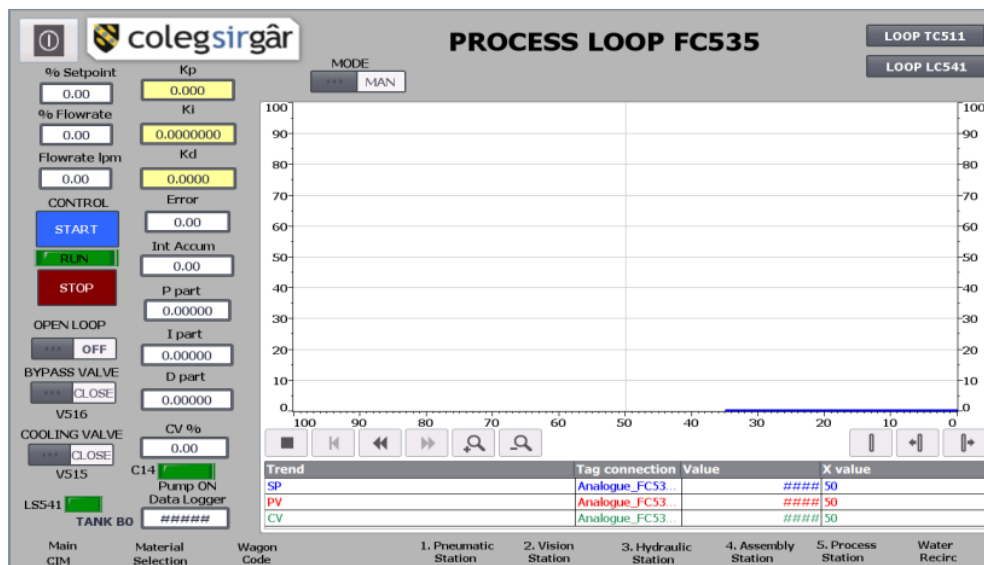


Figure 23; HMI 131 - Water Recirculation Screen



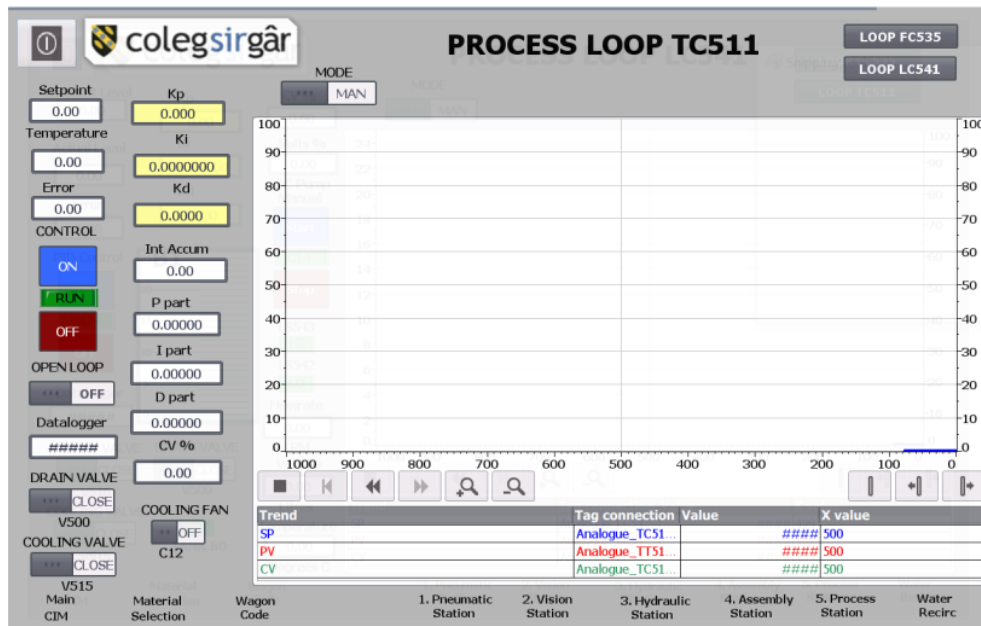


Figure 26; HMI 131 - Process Loop TC511

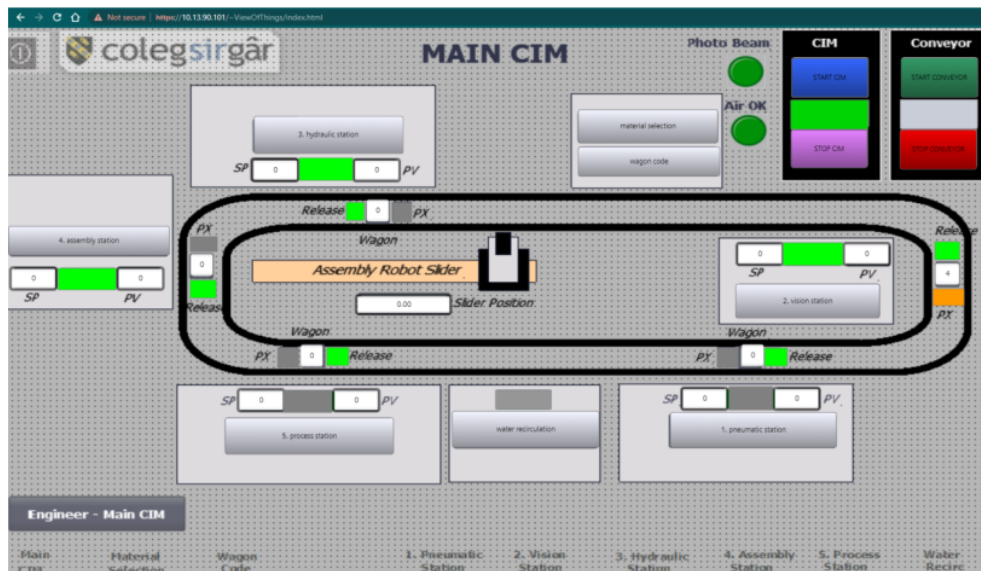


Figure 27; Test - start CIM

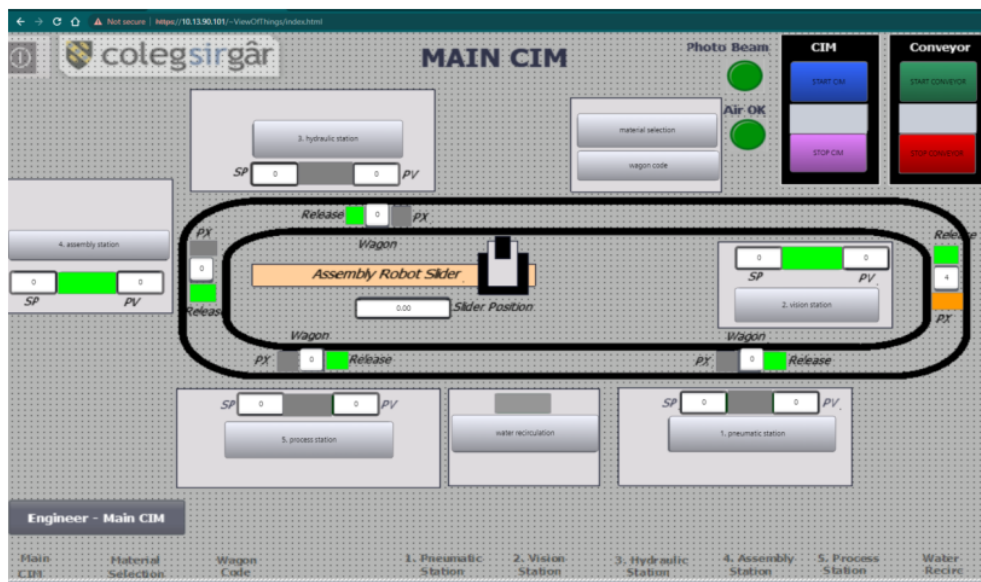


Figure 28; Test - Stop CIM

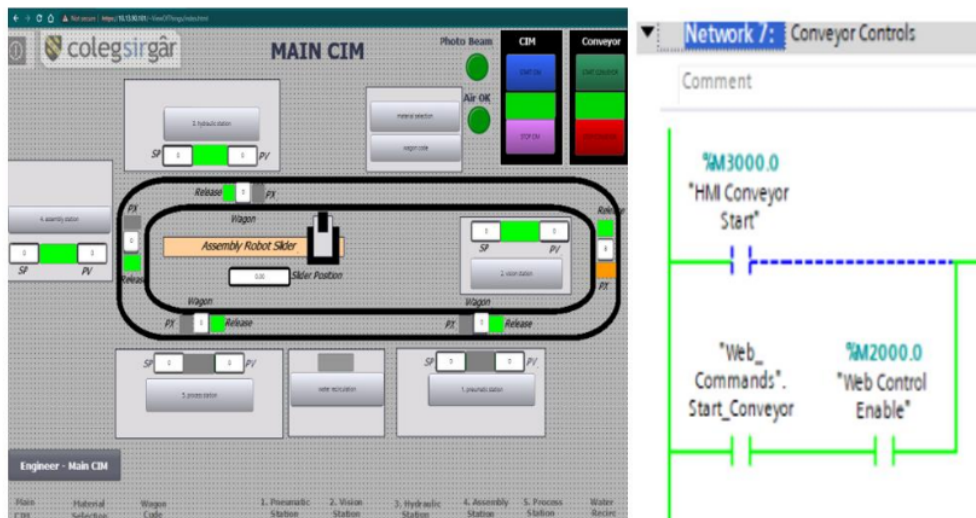


Figure 29; Test - Start Conveyor

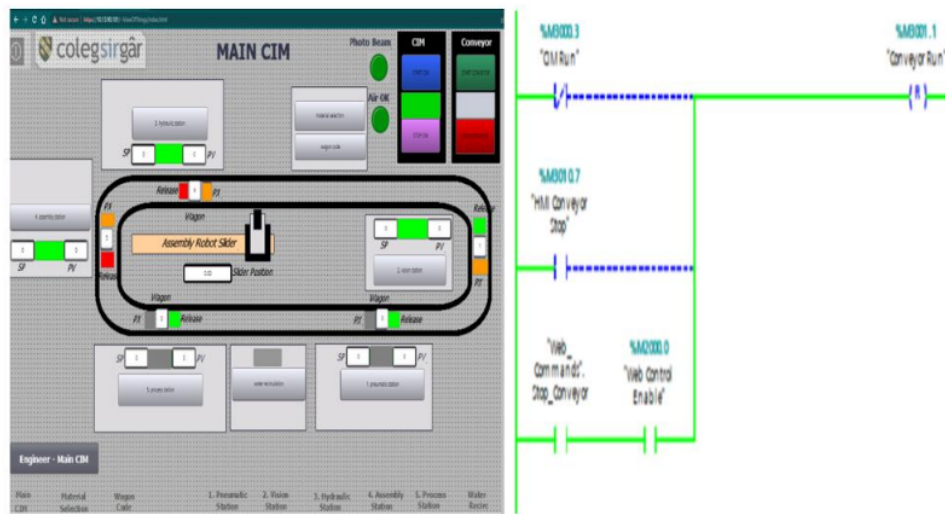


Figure 30; Test - Stop Conveyor

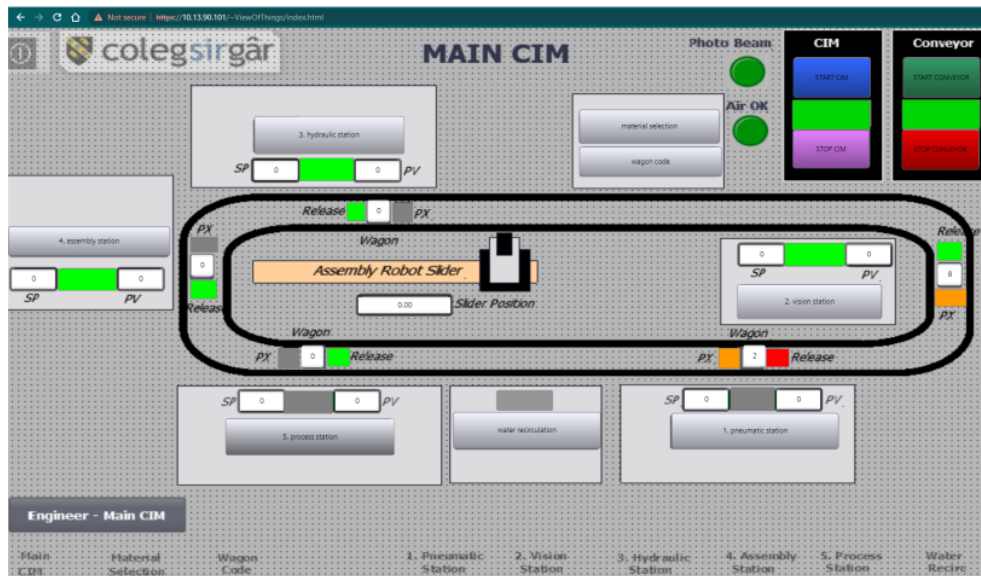


Figure 31; Test - Wagon Codes

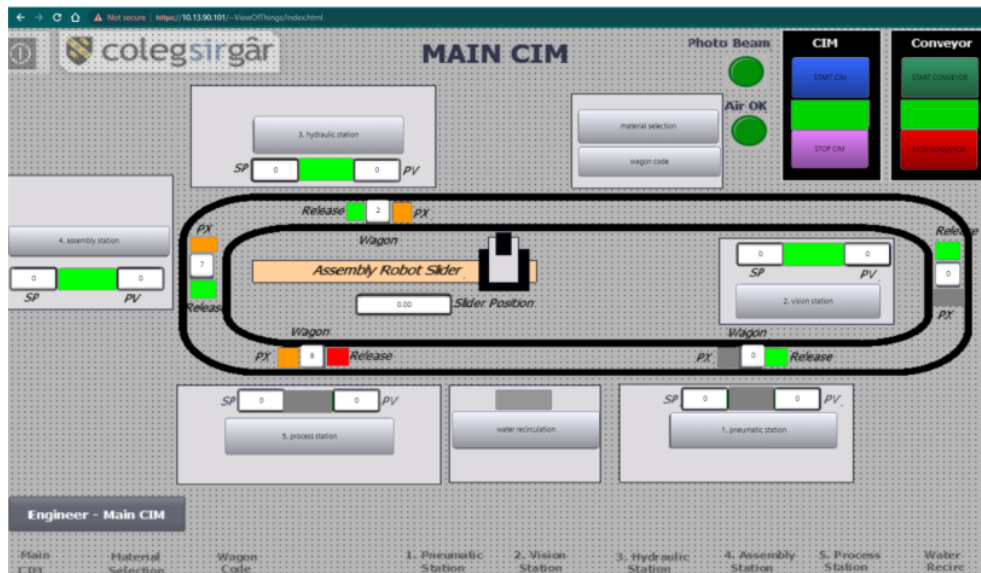


Figure 32; Test - PX, Release Colours

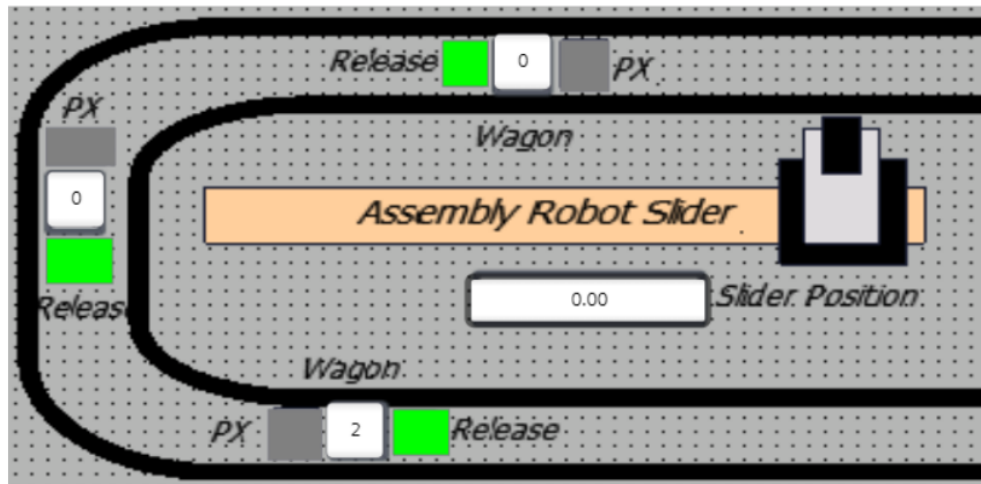


Figure 33; Test - Slider Position 0

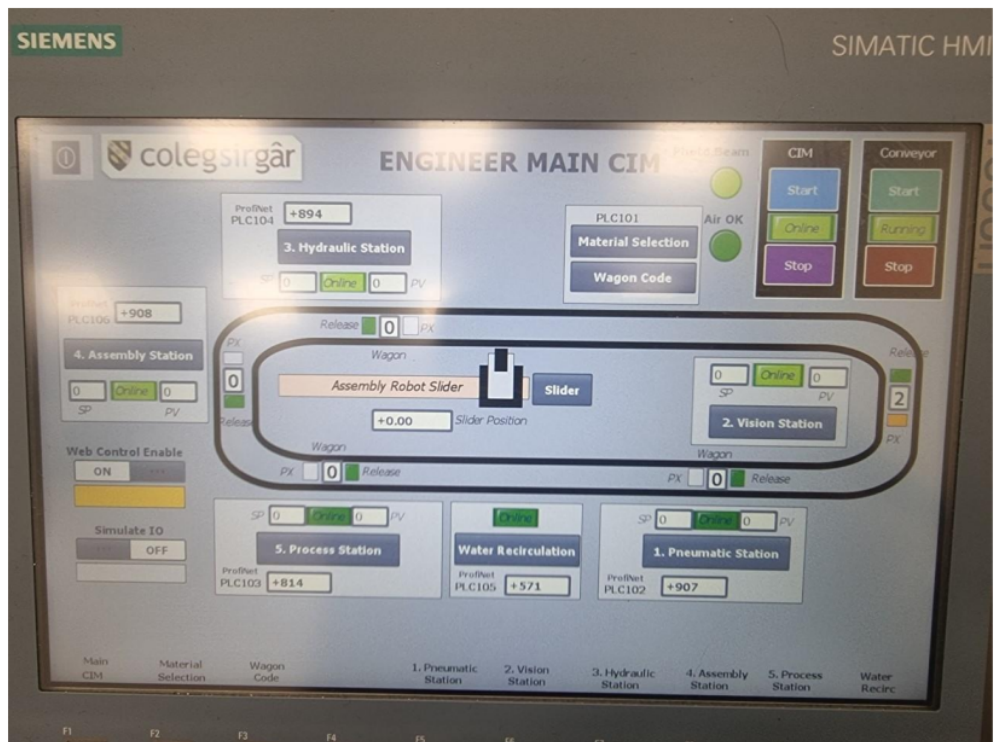


Figure 34;Test - HMI Slider Position 0

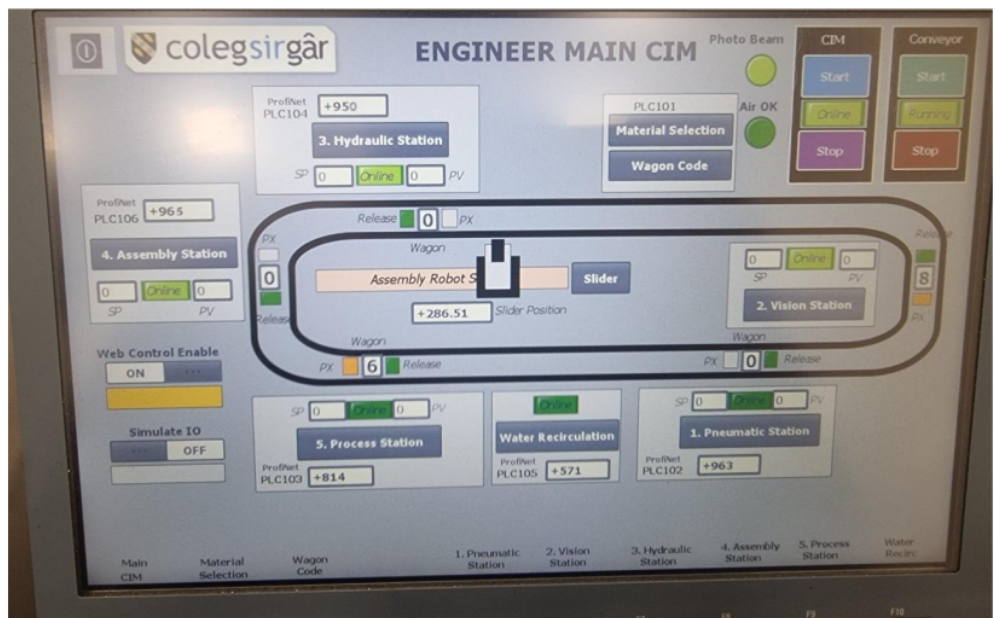


Figure 35;Test - Slider at 286 HMI

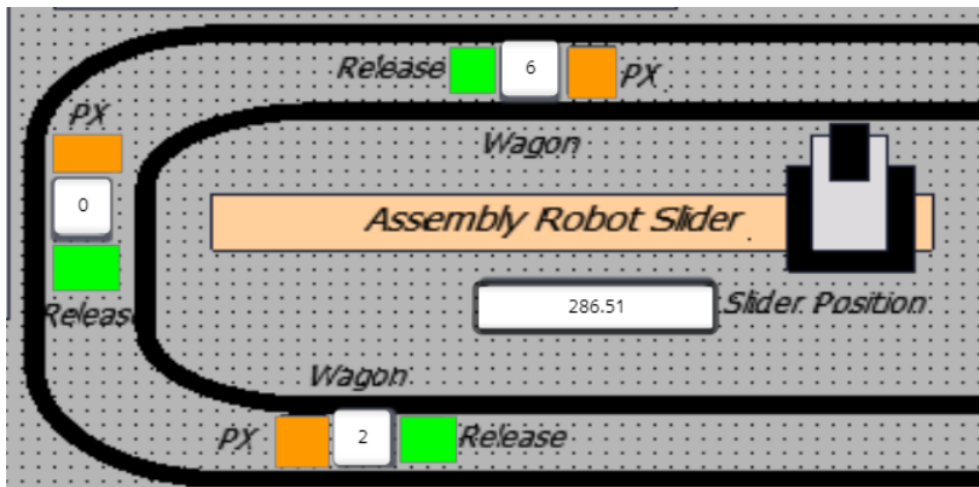


Figure 36; Test - Slider at 286 WP

Start CIM

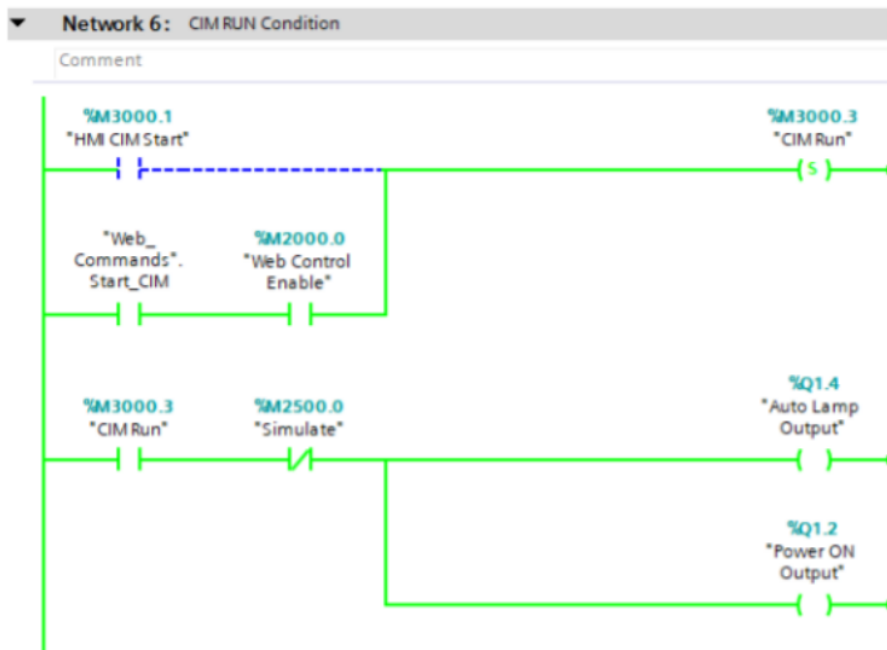


Figure 37; Test - CIM Run Contact PLC

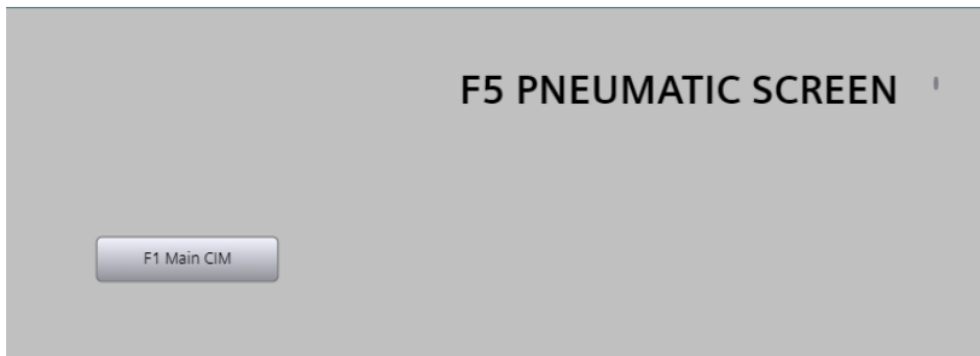


Figure 38; Test - Pneumatic Station



Figure 39; Test - Vision Station

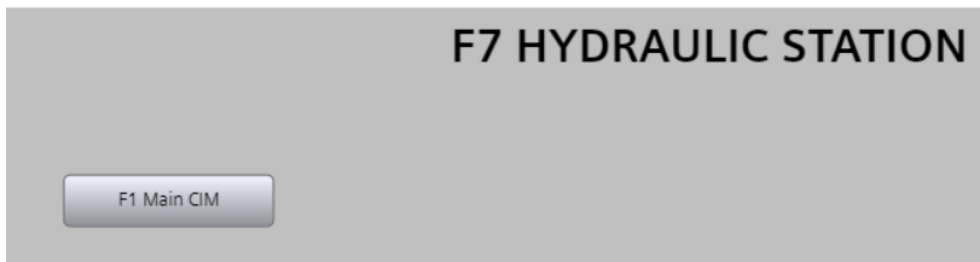


Figure 40; Test - Hydraulic Station

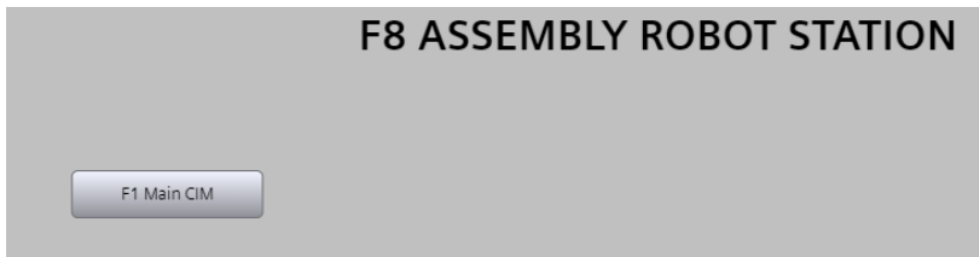


Figure 41; Test - Assembly Station

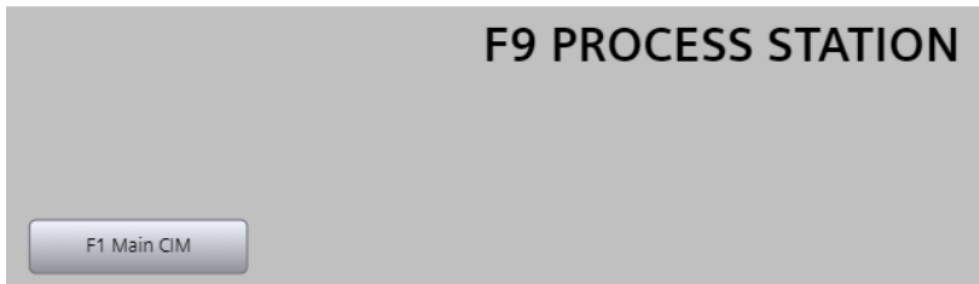


Figure 42; Test - Process Station

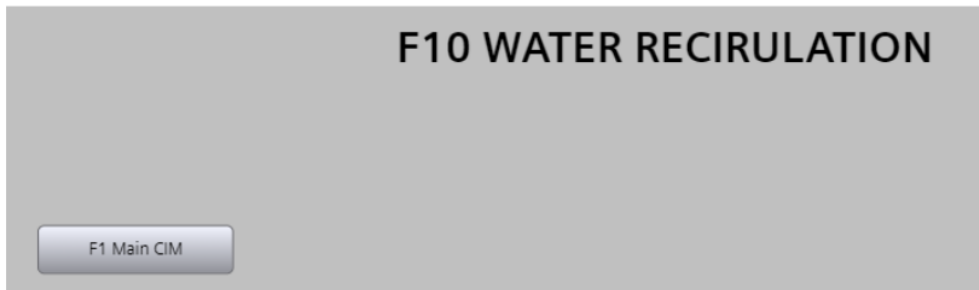


Figure 43; Test - Water Recirculation

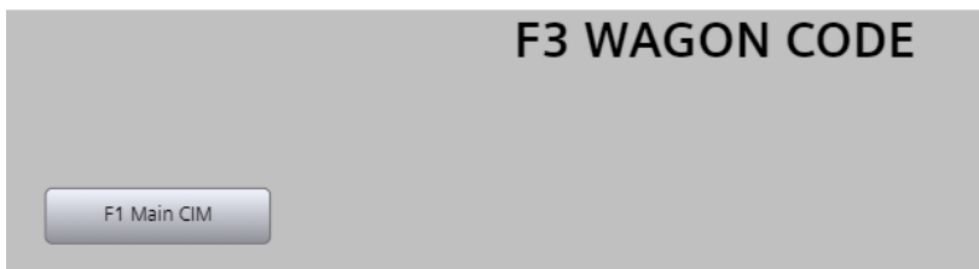


Figure 44; Test - Wagon Code Screen

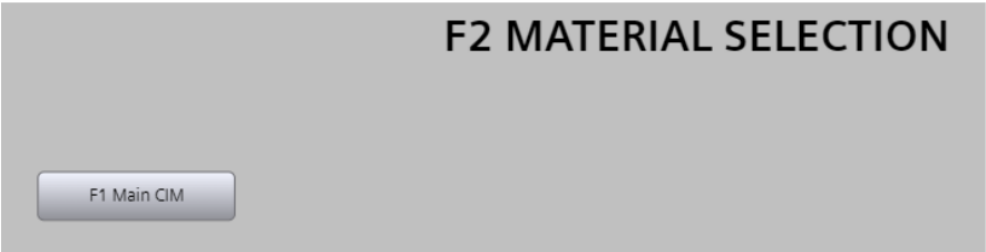


Figure 45; Test - Material Selection

Name	Access level	Password
Everybody	Restricted	
VoT	Restricted	*****

Figure 46; Test - Password

FINAL GRADE

GENERAL COMMENTS

Instructor

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PAGE 2

QM

Good Structure

Report is structured exactly as stated in the assignment brief.

PAGE 3

PAGE 4

PAGE 5

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Correctly cited

Citation method conforms to Harvard standard, well done.

Text Comment. You could have mentioned that M2M also allows for controls to be distributed

QM

Paragraphs should be fully justified text as required in the brief

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Correctly cited

Citation method conforms to Harvard standard, well done.

QM

Correctly cited

Citation method conforms to Harvard standard, well done.

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Text Comment. You could have given more details of the IFM vision system.

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http://www.plagiarism.org/plag_article_citation_styles.html

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Grocer's apostrophe

If you meant this as a plural word, don't use an apostrophe. This also applies to acronyms and initialisms such as PLCs

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PAGE 17

Text Comment. Why the change in font size and spacing?

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Correct method of listing.

You have listed your sources correctly according to the Harvard method.

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Wide Range of Sources

You have shown good evidence of reading from a wide range of sources.

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GRADING FORM: NEW CSG-RUBRIC

MATTHEW PERRY

78

1. ENGAGEMENT WITH LITERATURE



Excellent range of sources listed and cited correctly. However, you could also have written about PLC-PLC commuincations for M2M. 15/20

15

2. KNOWLEDGE AND UNDERSTANDING



Good evidence ofg knowledge and understanding in your system overview section with excellent information supplied in the appendix. Good explanation of health and safety issues. 14/20

14

3. COGNITIVE AND INTELLECTUAL

 Excellent assessment of risk with a very good testing table with evidence supplied. Very good conclusions and recommendations. 18/20 **18**

4. PRACTICAL APPLICATION

 Excleent evidence of practical work carried out. 17/20 **17**

5. TRANSFERABLE SKILLS

 A well strucutred report, mostly well formatted and presented..Good evidence of team working. 14/20 **14**