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by Evan Thomas

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1) Research

As technology is continually improving and becoming more advanced the machines that are being built are much more intelligent. These advances in technology are referred to as Industry 4.0 or the 4th industrial revolution where the technology allows the operator to communicate with the machine instead of controlling them which allows for faster fault finding and possibly a more efficient running system (Luenendonk, 2019). M2M communications is an example of Industry 4.0 where machines can communicate with one another which means that there is no need for any human control to relay the information (Connect, 2021).

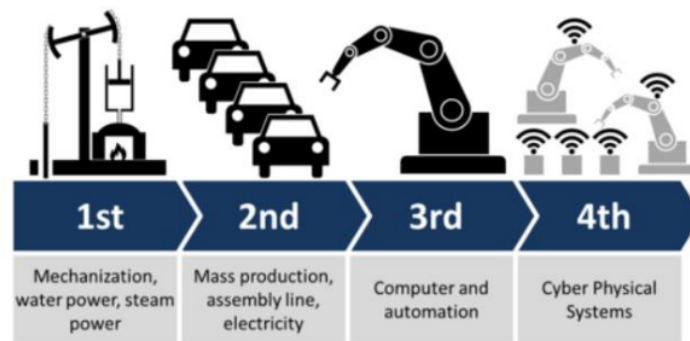


Figure 1 Industrial revolution (Javeri, 2018)

M2M allows most sensors to communicate which allows a system to monitor themselves and automatically adjust itself to the new conditions which again removes the need for human involvement (Ray, 2018). *Your examples should be for industrial manufacturing systems* A system using M2M communications was used on a cable car system at Rosswald, Switzerland. The HMI of the system was made as simple as possible with just 2 buttons to operate it, this was done because of the continual change in staff and to reduce the amount of training needed. With first glance of the HMI this might seem to be a simple system but due to the strict standards and safety regulations each cable car had to monitor 20 aspects to ensure the safety of its passengers.

The controller (Simatic CPU (Central Processing Unit) 1510-SP-F) on the system calculates data such as speed and acceleration of the cable car and then communicates this information back to the drive using a ProfiNET system. ProfiNET is a mechanism that is used to transfer information from controllers to devices like a PLC to a process instrument. ProfiNET exchanges data quickly (<10miliseconds) also a large amount of data can be sent over ProfiNET such as when a device needs maintenance done to it before it even fails (profinetuniversity, 2021). ProfiNET will be used in parallel with hardwired signals in this assignment for the get and put signals. To further increases the reliability of the system a GSM

(Global Systems for Mobile Communications) modem was used which allowed an Engineer to remotely access information from the system via a VPN tunnel this also allowed the cable car system to give alerts to when certain measured values drifted from their setpoints. This allowed an automation specialist to guide local operators to repair and maintain the system. (Siemens, 2019)



Figure 2 Siemens PLC on the cable car system. (Siemens, 2019)

The focus should have been the value of M2M in manufacturing. You should have read the question more carefully.

2) System overview and operation

Figure 3 is a diagram of the CIM (Computer integrated manufacturing) system which is a conveyor system which has different stations which monitor the wagons for different things. Each station has 5 proximity switches which are used to identify which wagon is at what station by using a binary system. Figure 4 is a picture of the bottom of wagon number 3 where the binary code is 11000 = 3. The wagons are also stopped at the Finishing, Hydraulic, and Pneumatic stations where another proximity switch senses that a wagon is present and raises a piston to hold the wagon in place.

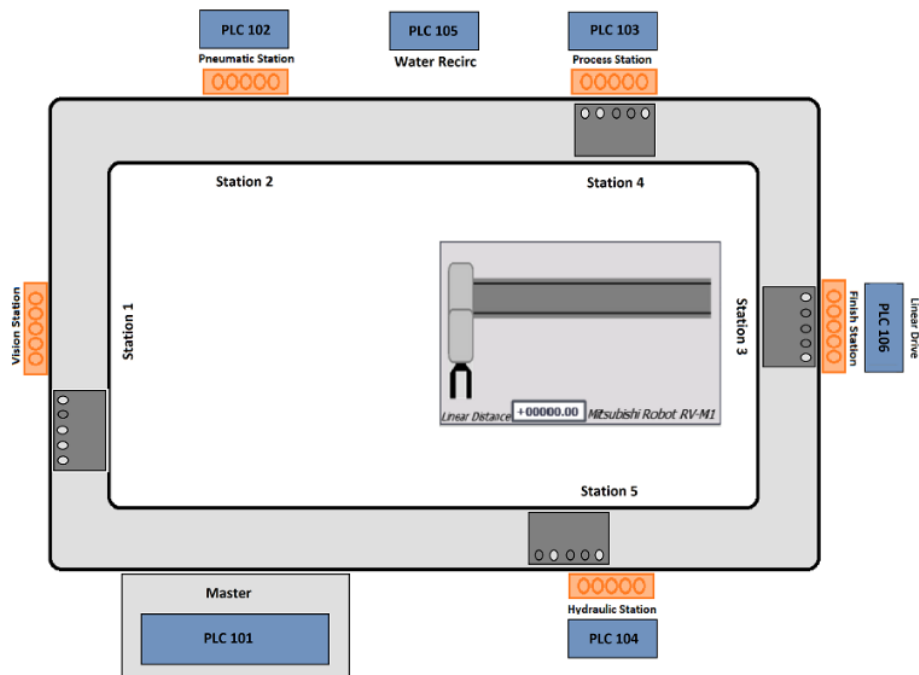


Figure 3 CIM system diagram

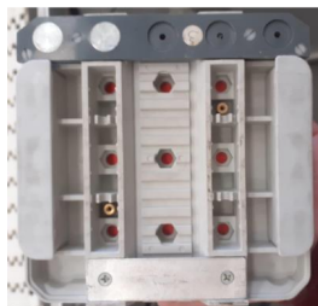


Figure 4 Wagon number 3

Table 1 and 2 shows the CIM code system which decides what happens to the wagons. For example, if a setpoint of 3100 is needed then a wagon+pallet+stamp is needed with a visual inspection stamp and if the PV value is 3102 it means that the visual inspection stamp has failed.

Digit			
1st	2nd	3rd	4th
1-Empty wagon	1-VI required Stamp	1-Processing required CH1	1-VI Result Pass Stamp
2-Wagon+Pallet	2-VI required CH1	2-Processing required CH2	2-VI Result Fail Stamp
3-Wagon+Pallet+Stamp	3-VI required CH2	-----	3-VI Result Pass CH1
4-Wagon+Pallet+Round CH1	-----	-----	4-VI Result Fail CH1
5-Wagon+Pallet+Round CH2	-----	-----	5-VI Result Pass CH2
6-Finished Product	-----	-----	6-VI Result Fail CH2

Table 1 CIM code description.

SP	PV	Description
0	1000	Empty wagon (No work)
2000	2000	Wagon + Pallet (No work)
3000	3000	Wagon + Pallet + Stamp (No work)
3100	3000	Wagon + Pallet + Stamp (To be inspected)
3100	3101	Wagon + Pallet + Stamp (Passed inspection; To be finished)
3100	3102	Wagon + Pallet + Stamp (Failed inspection)
4000	4000	Wagon + Pallet + Round CH1 (No work)
4200	4000	Wagon + Pallet + Round CH1 (To be inspected)
4210	4000	Wagon + Pallet + Round CH1 (To be processed)(To be inspected)
4200	4203	Wagon + Pallet + Round CH1 (Passed inspection)
4210	4203	Wagon + Pallet + Round CH1 (To be processed)(Passed inspection)
4200	4204	Wagon + Pallet + Round CH1 (Failed inspection)(To waste)
4210	4214	Wagon + Pallet + Round CH1 (Failed inspection)(To waste)
5000	5000	Wagon + Pallet + Round CH2 (No work)
5300	5000	Wagon + Pallet + Round CH2 (To be inspected)
5320	5000	Wagon + Pallet + Round CH2 (To be processed)(To be inspected)
5300	5305	Wagon + Pallet + Round CH2 (Passed inspection)
5320	5305	Wagon + Pallet + Round CH2 (To be processed)(Passed inspection)
5300	5306	Wagon + Pallet + Round CH2 (Failed inspection)(To waste)
5320	5306	Wagon + Pallet + Round CH2 (Failed inspection)(To waste)
4210	4213	Wagon + Pallet + Round CH1 (To be finished)
5320	5325	Wagon + Pallet + Round CH2 (To be finished)
6000	6000	Finished product to store (To be inspected)
6000	6007	Finished product (Passed inspection)(To store)
6000	6008	Finished product (Failed inspection)(To waste)

Table 2 CIM Coding system.

This belongs in the appendix

The system is controlled by 6 PLC's and 5 HMI's which are all connected by 100mbit switches. The PLCs in this system communicate with each other which is called handshaking, in this system this is done by using a dedicated hardwired system and an Ethernet (ProfiNET) system running in parallel, also on this system a RS232 link is used to allow M2M communication between PLC 106 and the Mitsubishi robot. A software handshake can be used to send codes like 'synchronize' and 'acknowledge' in an IP transmission (PCmag, 2021). For this system, a clock signal is sent from one PLC to the other using the GET and PUT signals to show that the comms between both PLCs is healthy.

LC 102 Pneumatic Station - 2 [CPU 1214C D...	2	Get Bit 0 - clock test bit	Bool
Device configuration	3	Pneumatic PLC102 Go...	Bool
Online & diagnostics	4	Pneumatic PLC102 Pla...	Bool
Program blocks	5	Pneumatic PLC102 Pla...	Bool
Add new block	6	Pneumatic PLC102 Pla...	Bool
Main [OB1]	7	Pneumatic PLC102 Pla...	Bool
CIM_I_O [FC6]	8	Get Bit 6	Bool
Outputs [FC5]	9	Get Bit 7	Bool
Round CH1 or CH2 [FC3]	10	Get Bit 8	Bool
Stamp or Empty Pallet [FC2]	11	Get Bit 9	Bool
Start [FC4]	12	Get Bit 10	Bool
System Health [FC1]	13	Get Bit 11	Bool
ProfiNet Comms using GET and PUT [FB30]	14	Get Bit 12	Bool
PLC 101 [DB50101]	15	Get Bit 13	Bool

Figure 5 PLC 102 GET clock signal.

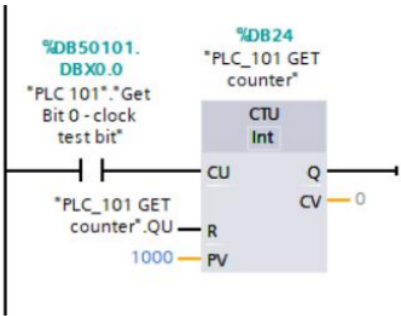


Figure 6 Clock test bit.

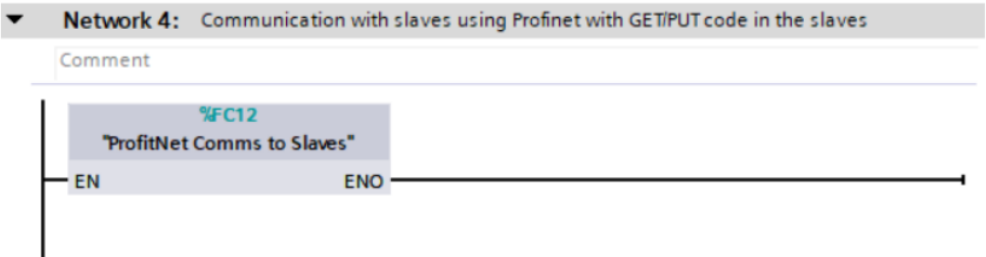


Figure 7 Profinet comms to slave communication.

Table 3 is a list of the PLCs and their function within the CIM system.

PLC	
101 (CPU 1214C DC/DC/DC)	Master- - Controls the conveyor. - Monitors the tracking IO. - Vision station is connected to it via interface box-vision hardware.
102 (CPU 1214C DC/DC/DC)	Pneumatic- Controls the Pneumatic station
103 (CPU 1214C DC/DC/DC)	Process- Controls the Process station
104 (CPU 1214C DC/DC/DC)	Hydraulic- - Controls the Hydraulic station - Controls a Hydraulic robot via – Rotary actuators, Hydraulic solenoid valves, and proportional valve controls the flow of oil into the manifold
105 (CPU 1212C DC/DC/DC)	Water Recirc- Controls the Water recirculation system
106 (CPU 1212C DC/DC/DC)	Finish Station- - Controls the Mitsubishi robot - Mitsubishi robot is controlled via a Teach box and communicates with the PLC using an RS232 card.

Table 3 CIM system PLC's.

Figure 8 shows all of the PLCs and HMIs connected using an Ethernet cable.

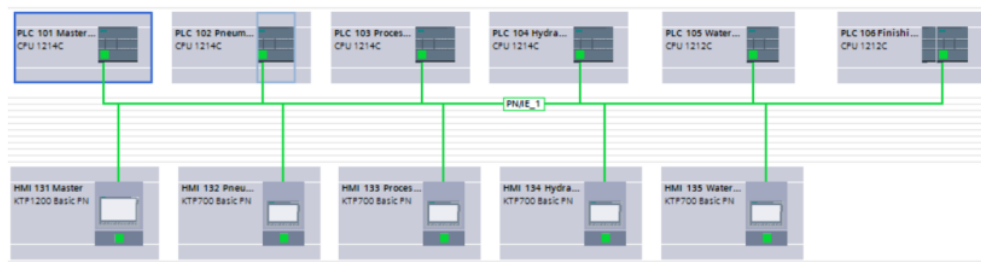


Figure 8 CIM system network

3)Health and Safety, Maintenance, and reliability requirements

Before any work was carried out a risk assessment was completed, table 4 is a sample of the risk assessment produced (See Table 13 in appendix for complete risk assessment) After completing the risk assessment it was safe to carry out the work needed for the CIM system.

Risk assessment

Company name-	Coleg Sir Gar
Assessment carried out by-	Mr E D Thomas
Date assessment carried out-	20/04/2021

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?	Who need to carry out the action?	When is the action needed by?	Done
Not familiar with the equipment and site.	Workers(Students) may not be familiar with the equipment and suffer injuries and also by not being familiar with the site they might not know of any hazardous areas or materials present.	All workers have had an induction to the workplace and have also been shown how the equipment works on site.	Ensure that regular health and safety talks are done to raise any new health and safety issues.	Site manager	27/04/2021	27/04/2021
Covid-19	Covid-19 could be spread within the workforce.	If any symptoms are reported by any of the workers they must not attend site and organize a Covid-19 test. 2 meter distance must be maintained to stop the spread. Face masks must be worn. Hand sanitiser must be used Clean surfaces before and after use.	Ensure that workers health is monitored and if any of the covid symptoms are present they should isolate.	Everyone on site	27/04/2021	Continuous

Table 4 Sample of risk assessment (HSE, 2021)

During the risk assessment one improvement that could be done is to improve the guarding systems of the system as there is a large amount of moving machinery. A way of measuring the safety of a system is to use the PL rating. By using the image in figure 5 the PL rating of the CIM system is PL_C where an irreversible injury could be caused but the exposure is low, and the mechanical parts of the system can be avoided.

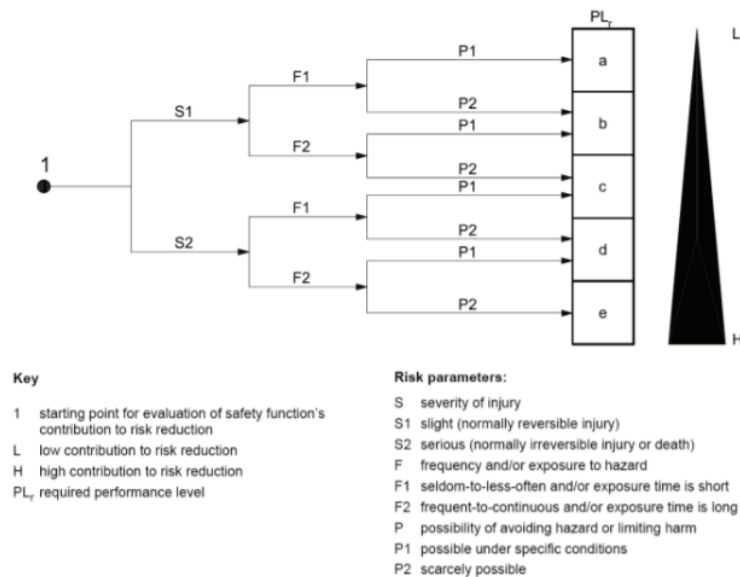


Figure 9 Risk graph to work out the PL rating (Diva-portal, 2021)

To improve the PL rating on this system more guards and photo beams can be added which would reduce the chance of irreversible injury happening. One way of doing this is to have a curtain photo beam all the way around the outside of the mechanical parts of the CIM system and having the HMIs and the control parts of the system on the outside of the photo beam perimeter. If work needs to be carried out on the CIM system, then certificates of isolation should be issued by an appointed member of staff who has had appropriate training.

When operating the emergency stop button on the system the Mitsubishi robot went back to its home position, this could be an issue as if the dangerous situation was with the robotic arm, then this could put someone in further danger. To improve this a possible stay put command could be put in the programming where all parts of the system will stay in the exact same spot.

With the current emergency stop system the system works off a motor starter system which isolates the power to the system, one way of improving this is to have a Siemens F series PLC with dual redundancy and wire all the emergency stops through this system. The Siemens SIMATIC fail-safe control systems will immediately go into a safe condition or remain in a safe condition if a fault or an emergency occurs. Also, as this is integrated into the PLC system there will be less cables and relays needed to achieve a failsafe emergency stop system. (Siemens, 2021)

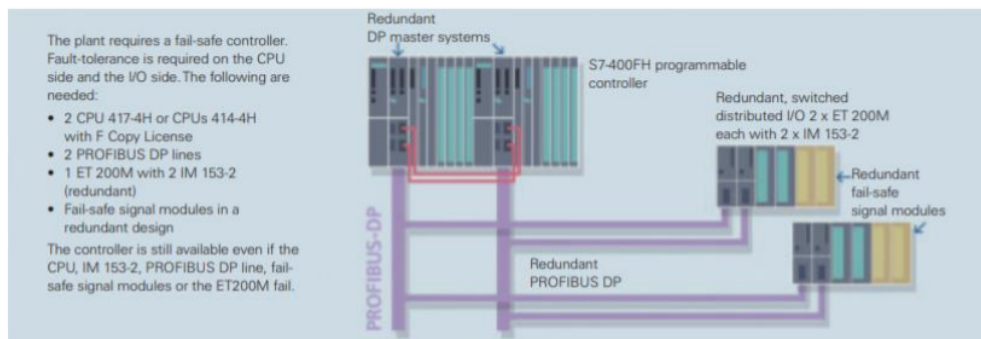


Figure 10 Siemens Fail safe system. (Siemens, 2021)

4)System design adaption

A) GET and PUT signals between Main PLC and all other PLCs

Figure 11 shows all the data blocks in PLC101 and as you can see all the PLCs on PLC101 as it is the master. PLC101 is referred to as the master but in fact it is the slave, and these 5 PLCs are masters as they GET and PUT information onto PLC101. To start the process of adding these new handshaking signals these data blocks had to be populated and the corresponding data blocks on these 5 PLC which are labelled as PLC 101 had to also be populated with the same information.

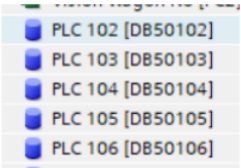


Figure 11 Data blocks in PLC101.

Table 5 shows that the corresponding data blocks are the same on both PLC 101 and 102. Table 6 shows the tags that correspond to the data block entries and as you can see that the %I and the %Q have swapped as a GET signal from PLC101 is a PUT signal for PLC102.

PLC 101 (PLC 102 data block) GET	PLC 102 (PLC 101 data block) GET
Get Bit 0 - Clock test bit Pneumatic PLC102 Go Online Pneumatic PLC102 Place Prismatic Pneumatic PLC102 Place Round CH1 Pneumatic PLC102 Place Round CH2 Pneumatic PLC102 Place Pallet	Get Bit 0 - clock test bit Pneumatic PLC102 Go Online Pneumatic PLC102 Place Prismatic Pneumatic PLC102 Place Round CH1 Pneumatic PLC102 Place Round CH2 Pneumatic PLC102 Place Pallet
PLC 101 (PLC 102 data block) PUT	PLC 102 (PLC 101 data block) PUT
Put Bit 0 - Clock test bit Pneumatic PLC102 Online Pneumatic PLC102 Can Place Pneumatic PLC102 Busy Pneumatic PLC102 Finished Pneumatic Air OK	Put Bit 0 - Clock test bit Pneumatic PLC102 Online Pneumatic PLC102 Can Place Pneumatic PLC102 Busy Pneumatic PLC102 Finished Pneumatic Air OK

Table 5 GET and PUT signals between PLC 101 and 102.

These images belong in the appendix

PLC 101			PLC 102		
PLC 102 Handshaking IO Tags [9]			Master Handshaking IO Tags [9]		
	Pneumatic PLC102 Online	Bool %I8.0		Master PLC 101 Pneumatic Place Pallet	Bool %I8.5
	Pneumatic PLC102 Can Place	Bool %I8.1		Master PLC 101 Pneumatic Place Stamp	Bool %I8.6
	Pneumatic PLC102 Busy	Bool %I8.2		Master PLC 101 Pneumatic Place RoundCH1	Bool %I8.7
	Pneumatic PLC102 Finished	Bool %I8.3		Master PLC 101 Pneumatic Place RoundCH2	Bool %I9.0
	Pneumatic PLC102 Place Prismatic	Bool %Q12.6		Master PLC 101 Pneumatic Go Online	Bool %I9.1
	Pneumatic PLC102 Place Round CH1	Bool %Q12.4		Master PLC 101 Pneumatic Online	Bool %Q12.5
	Pneumatic PLC102 Place Round CH2	Bool %Q12.5		Master PLC 101 Pneumatic Can Place	Bool %Q12.6
	Pneumatic PLC102 Place Pallet	Bool %Q12.3		Master PLC 101 Pneumatic Busy	Bool %Q12.7
	Pneumatic PLC102 Go Online	Bool %Q12.7		Master PLC 101 Pneumatic Finished	Bool %Q13.0

Table 6 PLC 101 + 102 handshaking IO tags

After the tags and data blocks are setup between the 2 PLCs the next step is to put all the new signals in parallel with the hardwired signals so that when the hardwired system is removed it will not affect the CIM system. This process was repeated on all PLCs and all hardwired signals paralleled.

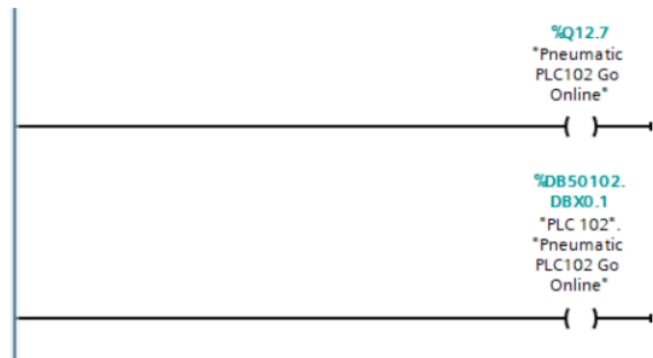


Figure 12 Hardwired and ProfiNET signals in parallel.

B) GET and PUT signals between the new Linear Drive PLC106 and Main PLC101

The same principle was used to get the signal from PLC106 and put it into PLC101 as in task

A. These signals in figure 7 were used to display the position of the Linear drive.

PLC 106 data block in PLC 101	Linear Drive Distance Int	Word	46.0	16#0
	Linear Drive Distance	Real	48.0	0.0
PLC 101 data block in PLC 106	Linear Drive Distance Int	Word	46.0	16#0
	Linear Drive Distance	Real	48.0	0.0

Table 7 Linear drive position

PLC 101 (PLC 106 data block) GET	PLC 106 (PLC 101 data block) GET
Get Bit 0 - clock test bit	Get Bit 0 - clock test bit
Finish Robot Go Online	Finish Robot Go Online
Finish Robot Pick Prod or Prism	Finish Robot Pick Prod or Prism
Finish Robot Pick Round	Finish Robot Pick Round
Finish Robot Pick Fail Prism or Round CH1	Finish Robot Pick Fail Prism or Round CH1
Finish Robot Pick Fail Round CH2	Finish Robot Pick Fail Round CH2
Move_Right_RSR	Move_Right_RSR
Move_Left_RSL	Move_Left_RSL
Move Left request	Move Left request
Move Right request	Move Right request
PLC 101 (PLC 106 data block) PUT	PLC 106 (PLC 101 data block) PUT
Put Bit 0 - clock test bit	Put Bit 0 - Clock test bit
Finish Robot Online	Finish Robot Online
Finish Robot Can Pick	Finish Robot Can Pick
Finish Robot Busy	Finish Robot Busy
Finish Robot Prismatic in place	Finish Robot Prismatic in place
Finish Robot Round in place	Finish Robot Round in place
Left_Limit	Left_Limit
Right_Limit	Right_Limit

Table 8 Data block for communications between PLC 101 and 106

The programme for the linear distance can be found on the main PLC program on PLC no 6 and it starts form Network 6 to 12 where is goes through several function blocks to gives us the scaled value that gets displayed on the HMI screen. Figure 13 is the final function block of the code which gives the value for the linear drive position.

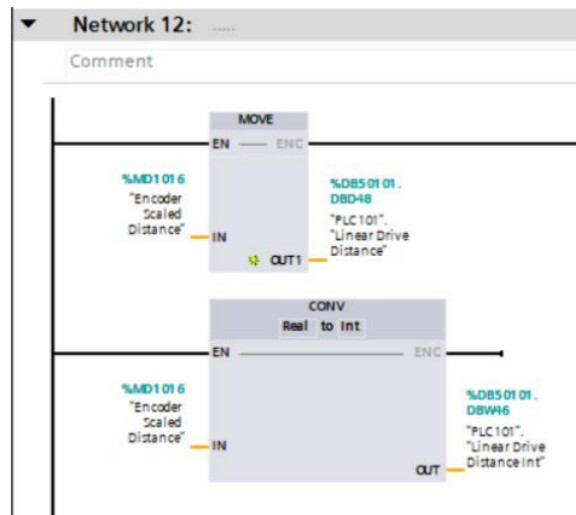


Figure 13 Scaled linear drive distance (Network 12)

Further GET and PUT signal were added to control the robot from PLC101 and the new signals put in parallel with the original control signals in PLC106.

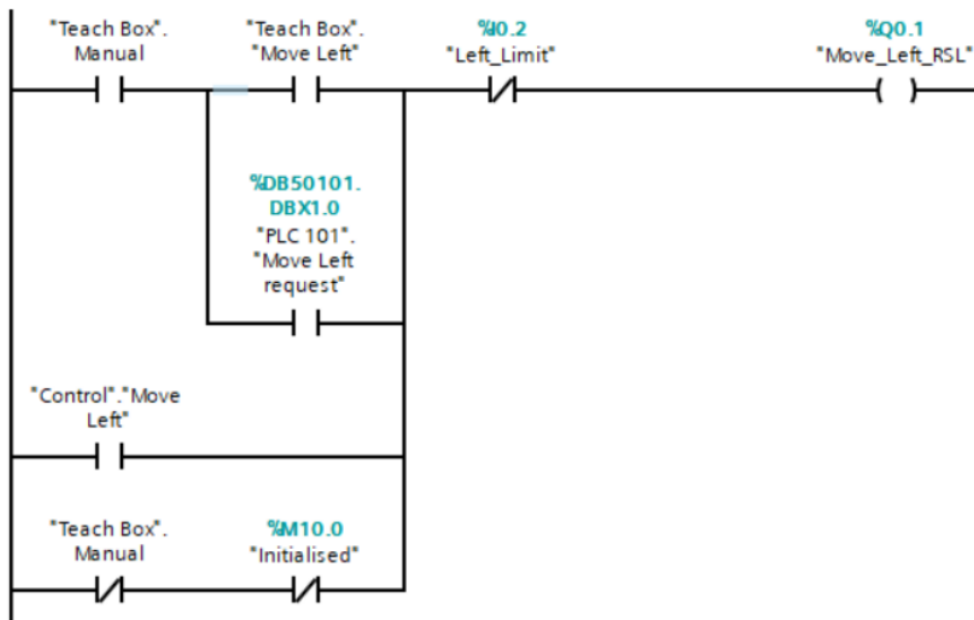


Figure 14 Robot controls from PLC101

C) Mitsubishi Robot image

Figure 15 is the new image for the HMI for the Mitsubishi robot. This image was created on clipart from three separate images and then copied to the new HMI screen.

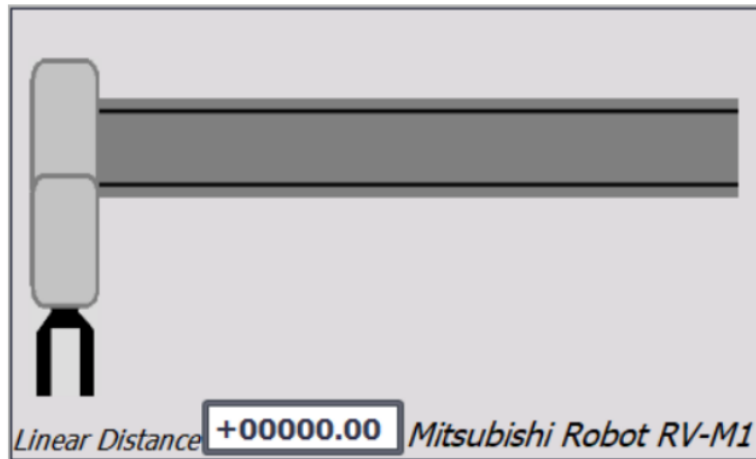


Figure 15 New robot display

Animation was added to the robot's arm which will make it look like its sliding across the base. The PLC_106_Linear Drive Distance Int signal was used and the final position of the robot arm set.

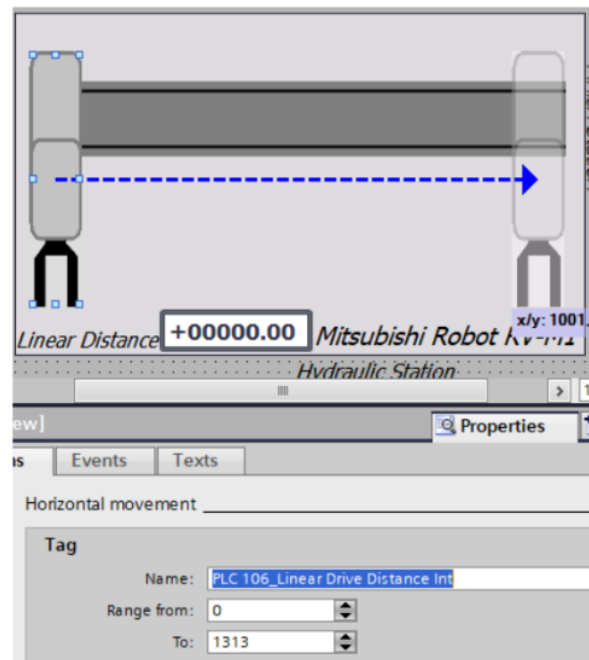


Figure 16 Setting robots animation.

Test	Expected result	Actual result
Move robot right	Animated robot should move right	Animated robot moved right
Move robot left	Animated robot should move left	Animated robot moved left
Linear distance display	Linear display should increase when moving right and decrease when moving left	Linear display increased and decreased as expected.

Table 9 Animated Mitsubishi robot testing.

D) New diagnostic screen

2 new diagnostic screens were created and tested. Figure 17 is a screen which was created which is a diagnostics screen which was for the Recirc system which incorporated the new IO link flow meter. Figure 18 is a new screen which allowed for the robot to be controlled from the main HMI.

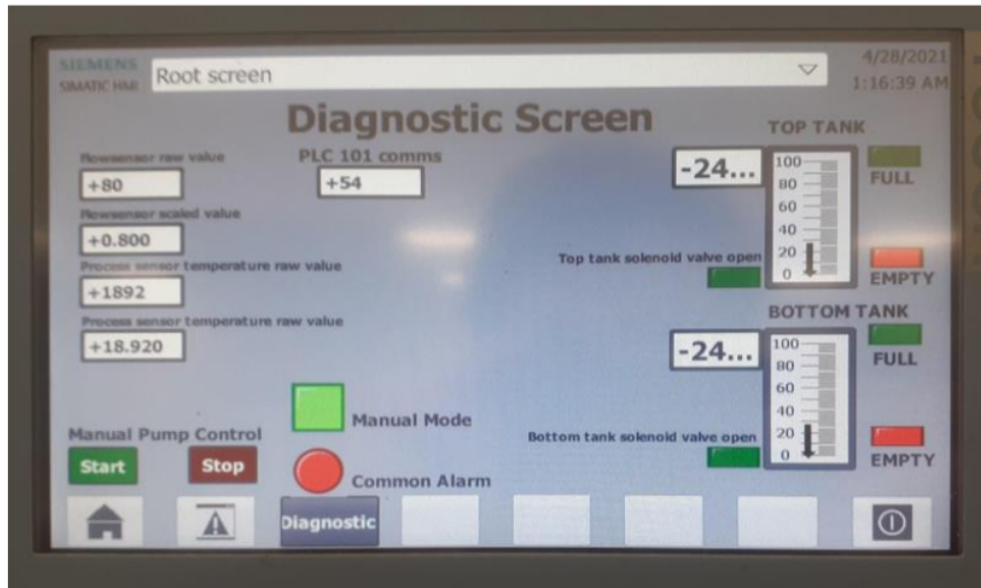


Figure 17 IO Recirc diagnostics screen.

Test	Expected result	Actual result
Start pump manually	Pump should start and raw and scaled flow should increase.	Pump started and flow increased.
Stop pump	Pump should stop and flow rate should decrease	Pump stopped and flow rate decreased
Apply heat to the flow sensor	The process sensor raw and scaled temperature should increase	Process sensor raw and scaled temperature did increase
Open and close both solenoid valves	Solenoid valves should open, and tank level value should change	Solenoid valves opened and tank values did change

Table 10 Recirc diagnostics screen testing

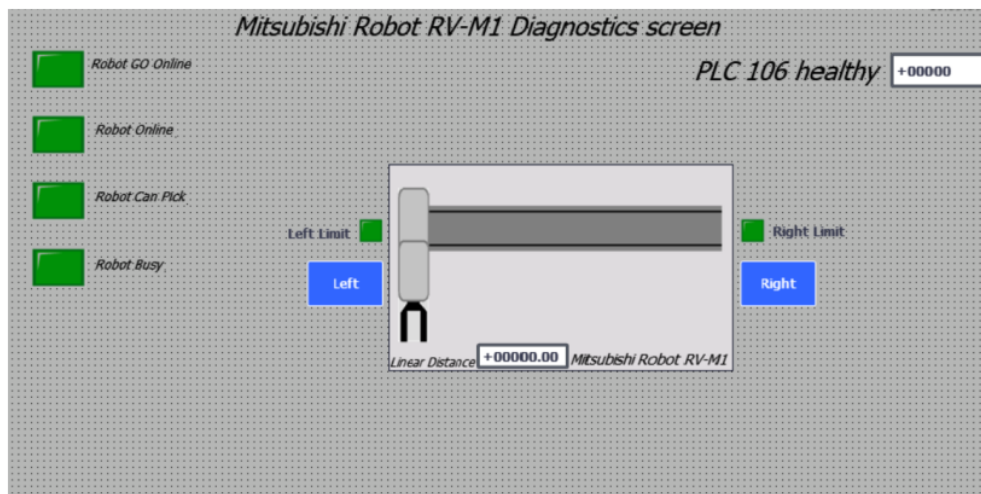


Figure 18 Mitsubishi Robot RV-M1 Diagnostics screen

Test	Expected result	Actual result
Move robot left	Robot should move fully left and left limit indicator should light	Robot did move left but left indicator did not light
Move robot right	Robot should move fully right and right limit indicator should light	Robot did move right but right indicator did not light

Table 11 Robot diagnostics screen test table.

Testing Table could be better

A good testing table should contain 5 columns (1) Test description (2) Expected Result (3) Actual Result (4) Pass/Fail decision (5) Evidence

E) Air pressure OK indicator

An additional interlock was added to the system, which was an air OK signal, this new signal will stop the CIM system from trying to start when there is not enough air pressure in the system. Figure 17 shows that an additional bit was added to Network 5 within the main program within PLC101.

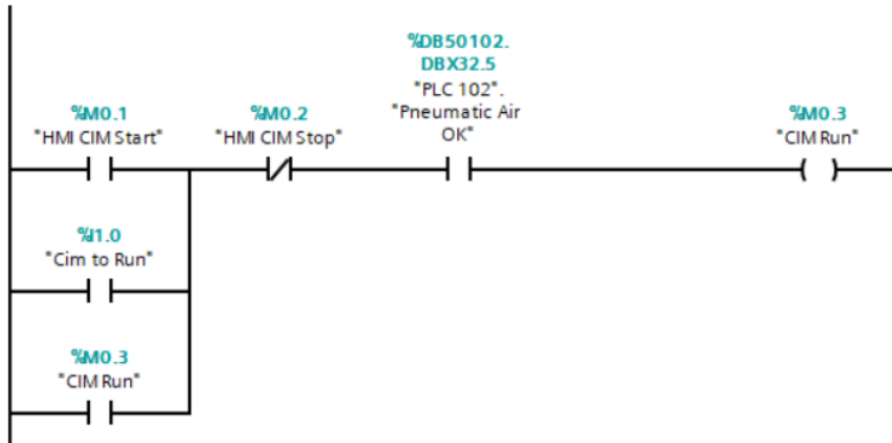


Figure 19 Air OK code.

Also an Air Ok indicator was added to the Main CIM HMI which will give a clear visual of the air system condition. A test was carried out to prove that the new interlock worked.

Test	Expected result	Actual result
Try to run system with air supply off	CIM system should not run and Air OK display should be off.	CIM system did not start and the Air OK display was off.
Switch on air supply and run the CIM system	System should run	System did run
Switch off the air supply whilst the system is running	System should stop	System stopped

Table 12 Air OK test table

F) IO Link Flow transmitter

An ifm IO link flow transmitter was added to the system which has many functions.



Figure 20 IFM flow transmitter

The new functions were added to a diagnostics screen (Figure 17) and the raw and scaled value displayed for the flow and the process sensor temperature.

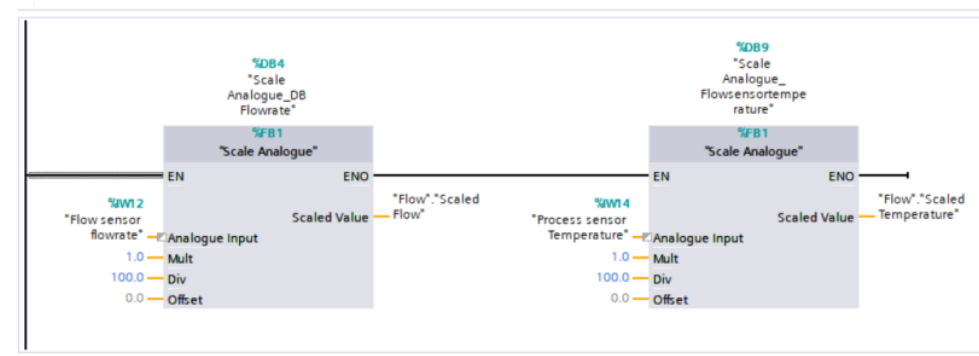


Figure 21 Flow and process sensor temperature scaled values

5)Conclusions and recommendations

During this assignment one of the main challenges was Covid-19 which meant that nobody was allowed access to the CIM system at Coleg Sir Gar. This was overcome by using online classroom and the lecturer posting videos to display what each station did within the system and how the overall process station worked.

During the project most of the GET and PUT signals were done where it would have been good to disconnect the hardwired signals and only use the new GET and PUT signals to prove that the modifications have worked. Another way of checking that the new modifications would work is to run the system and monitor the running system to see that the new switching would activate.

When creating the diagnostics screen for the Robot an error occurred due to incorrect tagging of the system where tags were taken directly from PLC106 to 101 without using the GET and PUT signals. This happened because the programme was trying to send/read a signal through a path that was not available. This problem was overcome by creating new GET and PUT signals and tagging the HMI correctly.

The new outputs of the IFM flow transmitter were used in one of the diagnostics screens but due to time and Covid not all of the functions on this sensor could be used. If this task would have been repeated more investigation would be done to see if the flow totalizer could be set up and also to see what functions were available with the Bluetooth connection available. The Bluetooth connection on this sensor is an example of industry 4.0 which has made the communication between people and machines much easier.

When doing the risk assessment, the lack of guarding was a possible issue and one way of improving this is to add a curtain photo beam which would stop the machine operating if the beam is broken. This would significantly improve the PL rating of this system as the risk of injury would be reduced to virtually nothing. One negative to this is that this would be an additional part of the system to maintain, and a monthly maintenance check and functional check would need to be performed.

6)Team working

For this assignment, the team was Dorian Thomas, Kieran Gower, Joseph Baugh, and Oliver Morgan. The main task for the team was to upgrade the PLC program and HMI screens of the CIM system so that it will help with maintenance and future upgrades. All the team gave their opinions on what the best upgrades would be for the system. Dorian designed the new image for the robot using clipart. During the design and programming of the PLC the team had to deal with covid-19 rules which made the process harder.

7) Citation list

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8) Appendix

Risk assessment

Company name-	Coleg Sir Gar
Assessment carried out by-	Mr E.D. Thomas
Date assessment carried out	20/04/2021

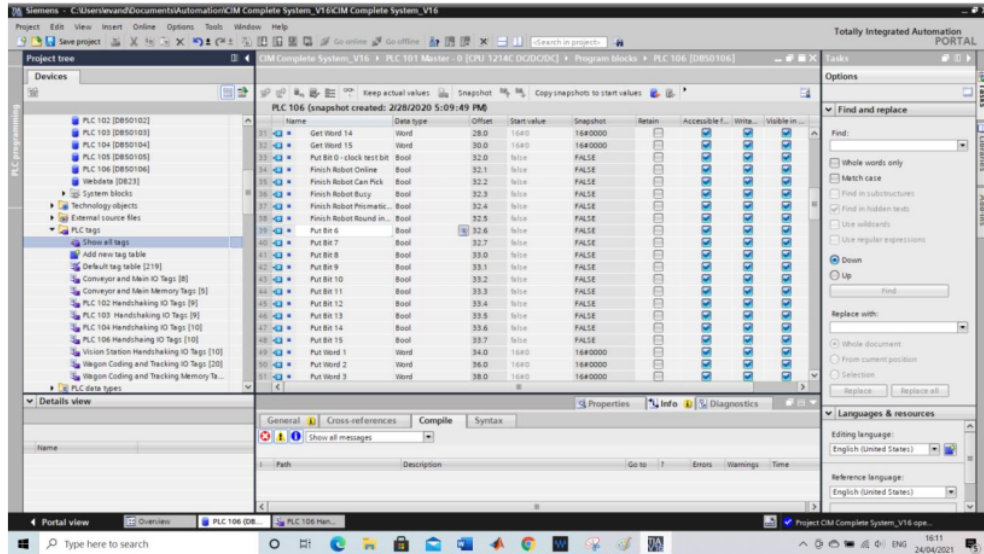
What are the hazards?	Who might be harmed and how?	What are you already doing to control the risks?	What further action do you need to take to control the risks?	Who need to carry out the action?	When is the action needed by?	Done
Not familiar with the equipment and site.	Workers (Students) may not be familiar with the equipment and suffer injuries and also by not being familiar with the site they might not know of any hazardous areas or materials present.	All workers have had an induction to the workplace and have also been shown how the equipment works on site.	Ensure that regular health and safety talks are done to raise any new health and safety issues.	Site manager	27/04/2021	27/04/2021
Covid-19	Covid-19 could be spread within the workforce.	If any symptoms are reported by any of the workers they must not attend site and organize a Covid-19 test. 2 meter distance must be maintained to stop the spread. Face masks must be worn. Hand sanitiser must be used. Clean surfaces before and after use.	Ensure that workers health is monitored and if any of the covid symptoms are present they should isolate.	Everyone on site	27/04/2021	Continuous
Slips and trips	Workers might fall causing injury.	Keep the site clean and tidy.	If any hazards occur the area should be barriered off and the hazard reported.	Everyone on site	27/04/2021	Continuous
Electricity	Workers on site - Shocks and electrical burns from faulty or unisolated equipment.	Equipment must be PAT tested Safe isolation procedure must be carried out to work in electrical pannels.	No action needed.	Everyone on site	27/04/2021	Continuous
Moving machinery	Workers might suffer injuries by moving equipment.	Photo beam	Further barriers and guards could be added	Maintenance engineers need to carry out tests to maintain safety systems.	27/04/2021	Continuous
PLC faults	CIM system might fail and cause a malfunction	Keep a backup of the original program and give appropriate training	No action needed.	Approved students.	27/04/2021	Continuous
Fire	Serious injury or even death.	Have regular fire drills and test the fire alarm system weekly.	No action needed.	Everyone on site	27/04/2021	Continuous

Table 13 Completed Risk assessment (HSE, 2021)

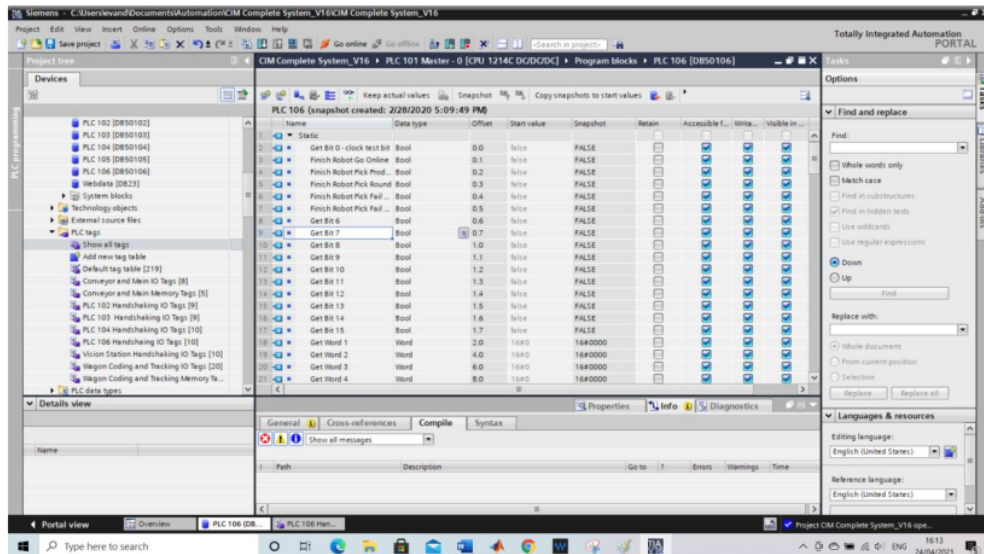
Assignment 2 Handshaking

PLC 106 in Master

Puts 106 in master



Gets 106



Tags

Siemens - C:\Users\and\Documents\Automation\CM Complete System_V16\CM Complete System_V16

Project: Edit View Insert Online Options Tools Window Help

Search in project: [Search icon]

Tasks: [Tasks icon]

Options: [Options icon]

Find and replace: [Find icon]

Replace with: [Replace icon]

Languages & resources: [Languages icon]

Editing language: [English (United States)]

Reference language: [English (United States)]

PLC 106 Handshaking IO Tags

Name	Data type	Address	Retain	Access	Write	Visible	Comment
1	Bool	%Q20.2					
2	Bool	%Q20.3					
3	Bool	%Q20.4					
4	Bool	%Q21.0					
5	Bool	%Q21.1					
6	Bool	%I16.1					
7	Bool	%I16.2					
8	Bool	%I16.3					
9	Bool	%I16.4					
10	Bool	%I16.5					

Details view: [Details icon]

General: [General icon]

Cross-references: [Cross-references icon]

Compile: [Compile icon]

Properties: [Properties icon]

Info: [Info icon]

Diagnosics: [Diagnosics icon]

Path: [Path icon]

Description: [Description icon]

Go to: [Go to icon]

Errors: [Errors icon]

Warnings: [Warnings icon]

Time: [Time icon]

Portal view: [Portal view icon]

PLC 106 Handshaking IO Tags

Project: CM Complete System_V16.sps...

24/04/2021

104

Puts in master

Siemens - C:\Users\and\Documents\Automation\CM Complete System_V16\CM Complete System_V16

Project: Edit View Insert Online Options Tools Window Help

Search in project: [Search icon]

Tasks: [Tasks icon]

Options: [Options icon]

Find and replace: [Find icon]

Replace with: [Replace icon]

Languages & resources: [Languages icon]

Editing language: [English (United States)]

Reference language: [English (United States)]

PLC 104 (snapshot created: 2/28/2020 5:09:49 PM)

Name	Data type	Offset	Start value	Snapshot	Retain	Access	Write	Visible	Comment
1	Word	10.0	1640000						
2	Word	12.0	1640000						
3	Word	14.0	1640000						
4	Word	16.0	1640000						
5	Word	18.0	1640000						
6	Word	20.0	1640000						
7	Word	22.0	1640000						
8	Word	24.0	1640000						
9	Word	26.0	1640000						
10	Word	28.0	1640000						
11	Word	30.0	1640000						
12	Word	32.0	1640000						
13	Word	34.0	1640000						
14	Word	36.0	1640000						
15	Word	38.0	1640000						
16	Word	40.0	1640000						
17	Word	42.0	1640000						
18	Word	44.0	1640000						
19	Word	46.0	1640000						
20	Word	48.0	1640000						
21	Word	50.0	1640000						
22	Word	52.0	1640000						
23	Word	54.0	1640000						
24	Word	56.0	1640000						
25	Word	58.0	1640000						
26	Word	60.0	1640000						
27	Word	62.0	1640000						
28	Word	64.0	1640000						
29	Word	66.0	1640000						
30	Word	68.0	1640000						
31	Word	70.0	1640000						
32	Word	72.0	1640000						
33	Word	74.0	1640000						
34	Word	76.0	1640000						
35	Word	78.0	1640000						
36	Word	80.0	1640000						
37	Word	82.0	1640000						
38	Word	84.0	1640000						
39	Word	86.0	1640000						
40	Word	88.0	1640000						
41	Word	90.0	1640000						
42	Word	92.0	1640000						
43	Word	94.0	1640000						
44	Word	96.0	1640000						
45	Word	98.0	1640000						
46	Word	100.0	1640000						
47	Word	102.0	1640000						
48	Word	104.0	1640000						
49	Word	106.0	1640000						
50	Word	108.0	1640000						
51	Word	110.0	1640000						
52	Word	112.0	1640000						
53	Word	114.0	1640000						
54	Word	116.0	1640000						
55	Word	118.0	1640000						
56	Word	120.0	1640000						
57	Word	122.0	1640000						
58	Word	124.0	1640000						
59	Word	126.0	1640000						
60	Word	128.0	1640000						
61	Word	130.0	1640000						
62	Word	132.0	1640000						
63	Word	134.0	1640000						
64	Word	136.0	1640000						
65	Word	138.0	1640000						
66	Word	140.0	1640000						
67	Word	142.0	1640000						
68	Word	144.0	1640000						
69	Word	146.0	1640000						
70	Word	148.0	1640000						
71	Word	150.0	1640000						
72	Word	152.0	1640000						
73	Word	154.0	1640000						
74	Word	156.0	1640000						
75	Word	158.0	1640000						
76	Word	160.0	1640000						
77	Word	162.0	1640000						
78	Word	164.0	1640000						
79	Word	166.0	1640000						
80	Word	168.0	1640000						
81	Word	170.0	1640000						
82	Word	172.0	1640000						
83	Word	174.0	1640000						
84	Word	176.0	1640000						
85	Word	178.0	1640000						
86	Word	180.0	1640000						
87	Word	182.0	1640000						
88	Word	184.0	1640000						
89	Word	186.0	1640000						
90	Word	188.0	1640000						
91	Word	190.0	1640000						
92	Word	192.0	1640000						
93	Word	194.0	1640000						
94	Word	196.0	1640000						
95	Word	198.0	1640000						
96	Word	200.0	1640000						
97	Word	202.0	1640000						
98	Word	204.0	1640000						
99	Word	206.0	1640000						
100	Word	208.0	1640000						
101	Word	210.0	1640000						
102	Word	212.0	1640000						
103	Word	214.0	1640000						
104	Word	216.0	1640000						
105	Word	218.0	1640000						
106	Word	220.0	1640000						
107	Word	222.0	1640000						
108	Word	224.0	1640000						
109	Word	226.0	1640000						
110	Word	228.0	1640000						
111	Word	230.0	1640000						
112	Word	232.0	1640000						
113	Word	234.0	1640000						
114	Word	236.0	1640000						
115	Word	238.0	1640000						
116	Word	240.0	1640000						
117	Word	242.0	1640000						
118	Word	244.0	1640000						
119	Word	246.0	1640000						
120	Word	248.0	1640000						
121	Word	250.0	1640000						
122	Word	252.0	1640000						
123	Word	254.0	1640000						
124	Word	256.0	1640000						
125	Word	258.0	1640000						
126	Word	260.0	1640000						
127	Word	262.0	1640000						
128	Word	264.0	1640000						
129	Word	266.0	1640000						
130	Word	268.0	1640000						
131	Word	270.0	1640000						
132	Word	272.0	1640000						
133	Word	274.0	1640000						
134	Word	276.0	1640000						
135	Word	278.0	1640000						
136	Word	280.0	1640000						
137	Word	282.0	1640000						
138	Word	284.0	1640000						
139	Word	286.0	1640000						
140	Word</								

Siemens - C:\Users\and\Documents\Automation\CM Complete System_V16\CM Complete System_V16

Project: CM Complete System_V16 - PLC 101 Master - 0 [CPU 1214C DC/D0DC] - Program blocks - PLC 104 [DB50104]

PLC 104 (snapshot created: 2/28/2020 5:09:49 PM)

Name	Data type	Offset	Start value	Snapshot	Retain	Accessible f...	Write...	Visible in...
1	Static							
2	Get Bit 0 - clock test bit	0.0	false	FALSE				
3	Hydraulic PLC 104 Go ...	0.1	false	FALSE				
4	Hydraulic PLC 104 Go ...	0.2	false	FALSE				
5	Hydraulic PLC 104 Pe...	0.3	false	FALSE				
6	Hydraulic PLC 104 Pl...	0.4	false	FALSE				
7	Hydraulic PLC 104 Pl...	0.5	false	FALSE				
8	104 Fail Finished CH2	0.6	false	FALSE				
9	Get Bit 7	0.7	false	FALSE				
10	Get Bit 8	1.0	false	FALSE				
11	Get Bit 9	1.1	false	FALSE				
12	Get Bit 10	1.2	false	FALSE				
13	Get Bit 11	1.3	false	FALSE				
14	Get Bit 12	1.4	false	FALSE				
15	Get Bit 13	1.5	false	FALSE				
16	Get Bit 14	1.6	false	FALSE				
17	Get Bit 15	1.7	false	FALSE				
18	Get Word 1	2.0	1640000	1640000				
19	Get Word 2	4.0	1640000	1640000				
20	Get Word 3	6.0	1640000	1640000				
21	Get Word 4	8.0	1640000	1640000				

Details view

Name	Data type	Details
Hydraulic PLC 104 Busy	Bool	%I17.0
Hydraulic PLC 104 Can ...	Bool	%I16.7
Hydraulic PLC 104 Fail F...	Bool	%Q21.2
Hydraulic PLC 104 Fail F...	Bool	%Q21.3

Portal view

Tags

Siemens - C:\Users\and\Documents\Automation\CM Complete System_V16\CM Complete System_V16

Project: CM Complete System_V16 - PLC 101 Master - 0 [CPU 1214C DC/D0DC] - PLC tags - PLC 104 Handshaking IO Tags [10]

PLC 104 Handshaking IO Tags

Name	Data type	Address	Retain	Access...	Write...	Visible...	Comment
1	Hydraulic PLC 104 Online	%I16.6					
2	Hydraulic PLC 104 Can Pick	%I16.7					
3	Hydraulic PLC 104 Busy	%I17.0					
4	Hydraulic PLC 104 Finishd	%I17.1					
5	Hydraulic PLC 104 Go Online	%Q20.0					
6	Hydraulic PLC 104 Pick Fin CH1	%Q20.1					
7	Hydraulic PLC 104 Press Round ...	%Q20.7					
8	Hydraulic PLC 104 Pick Fin CH2	%Q20.8					
9	Hydraulic PLC 104 Fail Finished...	%Q21.2					
10	Hydraulic PLC 104 Fail Finished...	%Q21.3					

Details view

Name	Data type	Details
Hydraulic PLC 104 Busy	Bool	%I17.0
Hydraulic PLC 104 Can ...	Bool	%I16.7
Hydraulic PLC 104 Fail F...	Bool	%Q21.2
Hydraulic PLC 104 Fail F...	Bool	%Q21.3

Portal view

103 in master

Puts

The screenshot shows the Siemens TIA Portal interface for a PLC 103. The main window displays a table of data points for PLC 103, with a snapshot created on 2/28/2020 at 5:09:49 PM. The table lists various data points, including 'Puts' (Put Word 3, Put Word 4, etc.) and 'Puts' (Put Bit 0, Put Bit 1, etc.). The 'Puts' data points are highlighted in blue. The left sidebar shows the project tree with 'PLC 103' selected. The bottom status bar indicates the project is 'Project CIM Complete System_V16.spe...'.

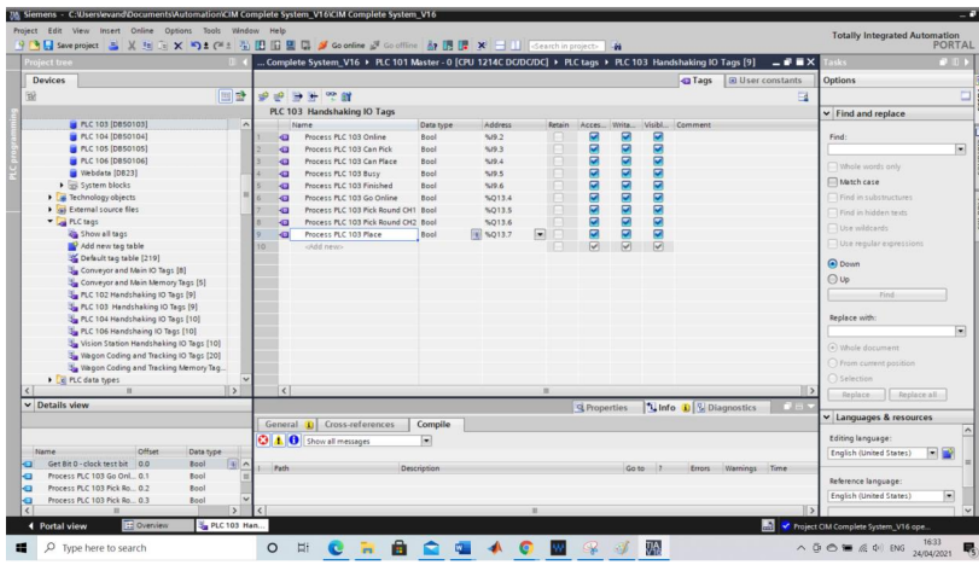
Name	Data type	Offset	Start value	Snapshot	Retain	Accessible f...	Write...	Visible in...
Put Word 3	Word	6.0	1640000					
Put Word 4	Word	8.0	1640000					
Put Word 5	Word	10.0	1640000					
Put Word 6	Word	12.0	1640000					
Put Word 7	Word	14.0	1640000					
Put Word 8	Word	16.0	1640000					
Put Word 9	Word	18.0	1640000					
Put Word 10	Word	20.0	1640000					
Put Word 11	Word	22.0	1640000					
Put Word 12	Word	24.0	1640000					
Put Word 13	Word	26.0	1640000					
Put Word 14	Word	28.0	1640000					
Put Word 15	Word	30.0	1640000					
Put Bit 0 - clock test bit	Bool	32.0	False					
Process PLC 103 Online	Bool	32.1	False					
Process PLC 103 Can P...	Bool	32.2	False					
Process PLC 103 Can P...	Bool	32.3	False					
Process PLC 103 Busy	Bool	32.4	False					
Process PLC 103 Finished	Bool	32.5	False					
Put Bit 6	Bool	32.6	False					
Put Bit 7	Bool	32.7	False					

Gets

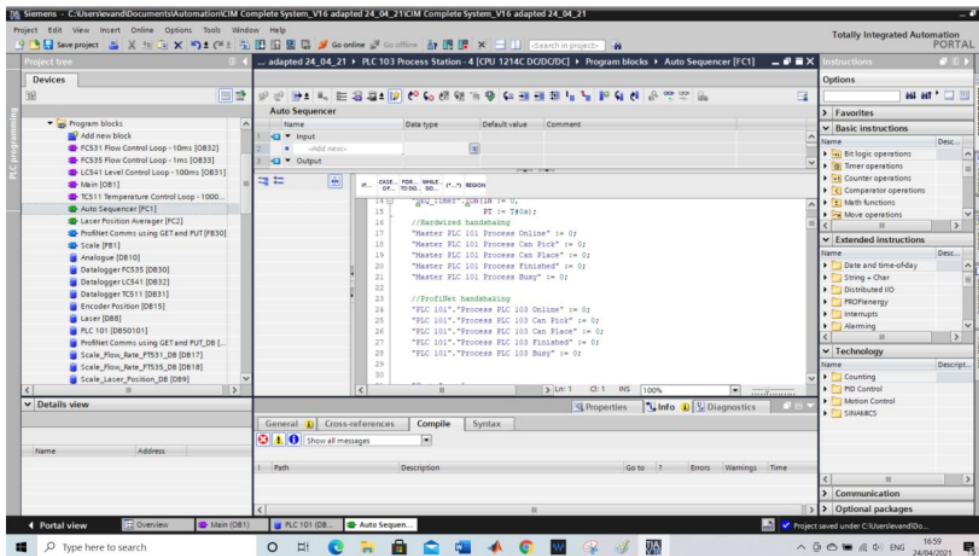
The screenshot shows the Siemens TIA Portal interface for a PLC 103. The main window displays a table of data points for PLC 103, with a snapshot created on 2/28/2020 at 5:09:49 PM. The table lists various data points, including 'Gets' (Get Bit 0, Get Bit 1, etc.) and 'Gets' (Get Word 1, Get Word 2, etc.). The 'Gets' data points are highlighted in blue. The left sidebar shows the project tree with 'PLC 103' selected. The bottom status bar indicates the project is 'Project CIM Complete System_V16.spe...'.

Name	Data type	Offset	Start value	Snapshot	Retain	Accessible f...	Write...	Visible in...
Get Bit 0 - clock test bit	Bool	0.0	False					
Process PLC 103 Go O...	Bool	0.1	False					
Process PLC 103 Pick ...	Bool	0.2	False					
Process PLC 103 Pick ...	Bool	0.3	False					
Process PLC 103 Plan	Bool	0.4	False					
Get Bit 5	Bool	0.5	False					
Get Bit 6	Bool	0.6	False					
Get Bit 7	Bool	0.7	False					
Get Bit 8	Bool	1.0	False					
Get Bit 9	Bool	1.1	False					
Get Bit 10	Bool	1.2	False					
Get Bit 11	Bool	1.3	False					
Get Bit 12	Bool	1.4	False					
Get Bit 13	Bool	1.5	False					
Get Bit 14	Bool	1.6	False					
Get Bit 15	Bool	1.7	False					
Get Word 1	Word	2.0	1640000					
Get Word 2	Word	4.0	1640000					
Get Word 3	Word	6.0	1640000					
Get Word 4	Word	8.0	1640000					

Tags



103 handshaking in 103 auto sequencer



```

70      3: //wait for PICK command
71      "Master PLC 101 Process Online" := 1;
72      "PLC 101"."Process PLC 103 Online" := 1;
73      "Master PLC 101 Process Can Pick" := 1;
74      "PLC 101"."Process PLC 103 Can Pick" := 1;
75      "Master PLC 101 Process Busy" := 0;
76      "PLC 101"."Process PLC 103 Busy" := 0;
77
78      IF
79      ("HMI_Pick" = 1 OR
80      "Master PLC 101 Process Pick_CH 1" = 1 OR "PLC 101"."Process PLC 103 Pick Ro
81      "Master PLC 101 Process Pick_CH 2" = 1 OR "PLC 101"."Process PLC 103 Pick Ro
82      "Master PLC 101 Process Busy" := 1;
83      "PLC 101"."Process PLC 103 Busy" := 1;
84      "State" := 4;
85      END_IF

```

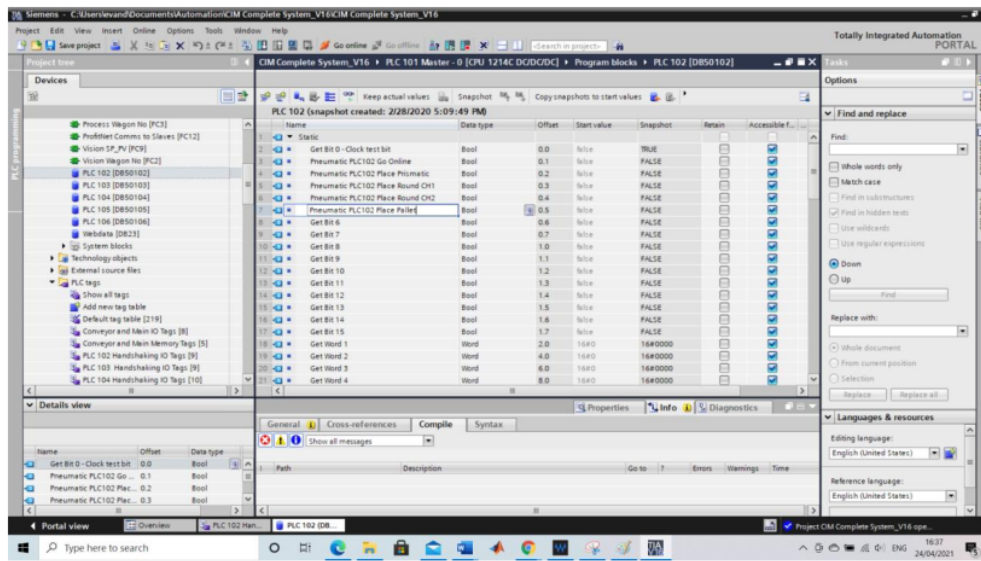
102 in master

Puts

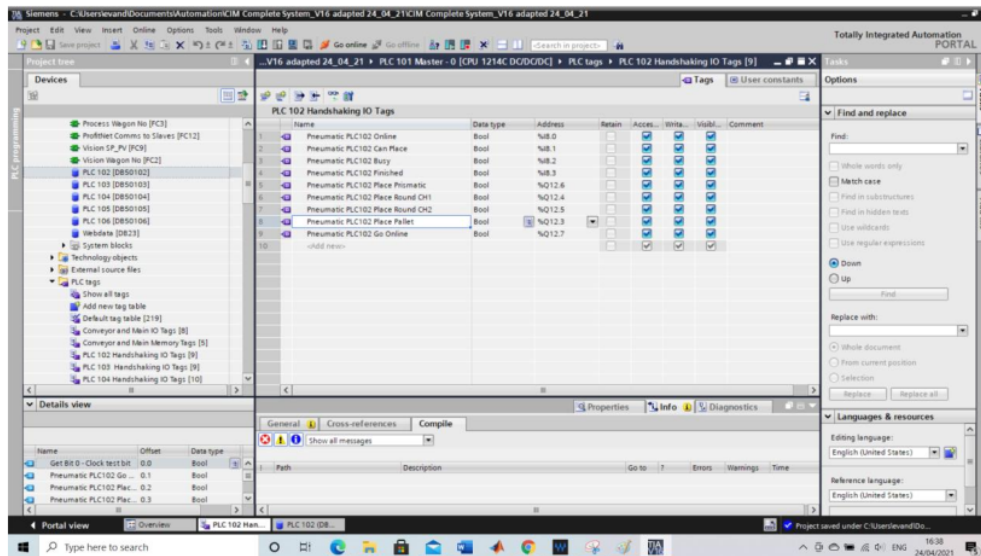
The screenshot shows the SIMATIC Manager interface with the variable declaration table for PLC 102. The table lists various variables, their data types, and their values. The 'Puts' section is highlighted, showing variables like 'Put Bit 6' through 'Put Bit 13'.

Name	Data type	Offset	Start value	Snapshot	Reason	Accessible	Write	Visible in
Get Word 9	Word	18.0	1640	1640000				
Get Word 10	Word	20.0	1640	1640000				
Get Word 11	Word	22.0	1640	1640000				
Get Word 12	Word	24.0	1640	1640000				
Get Word 13	Word	26.0	1640	1640000				
Get Word 14	Word	28.0	1640	1640000				
Get Word 15	Word	30.0	1640	1640000				
Put Bit 0 - Clock test bit	Bool	32.0	false	FALSE				
Pneumatic PLC102 O...	Bool	32.1	false	FALSE				
Pneumatic PLC102 Ca...	Bool	32.2	false	FALSE				
Pneumatic PLC102 Bu...	Bool	32.3	false	FALSE				
umatic PLC102 Finishe...	Bool	32.4	false	FALSE				
Air OK	Bool	32.5	false	FALSE				
Put Bit 6	Bool	32.6	false	FALSE				
Put Bit 7	Bool	32.7	false	FALSE				
Put Bit 8	Bool	33.0	false	FALSE				
Put Bit 9	Bool	33.1	false	FALSE				
Put Bit 10	Bool	33.2	false	FALSE				
Put Bit 11	Bool	33.3	false	FALSE				
Put Bit 12	Bool	33.4	false	FALSE				
Put Bit 13	Bool	33.5	false	FALSE				

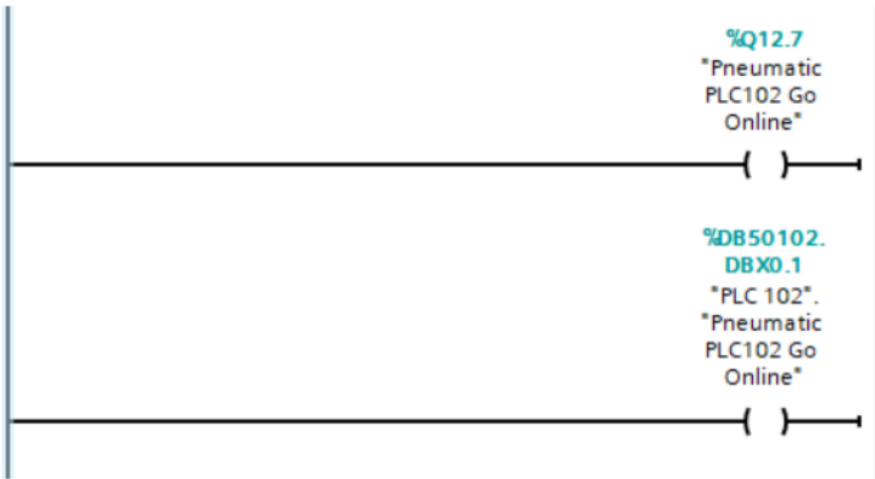
Gets



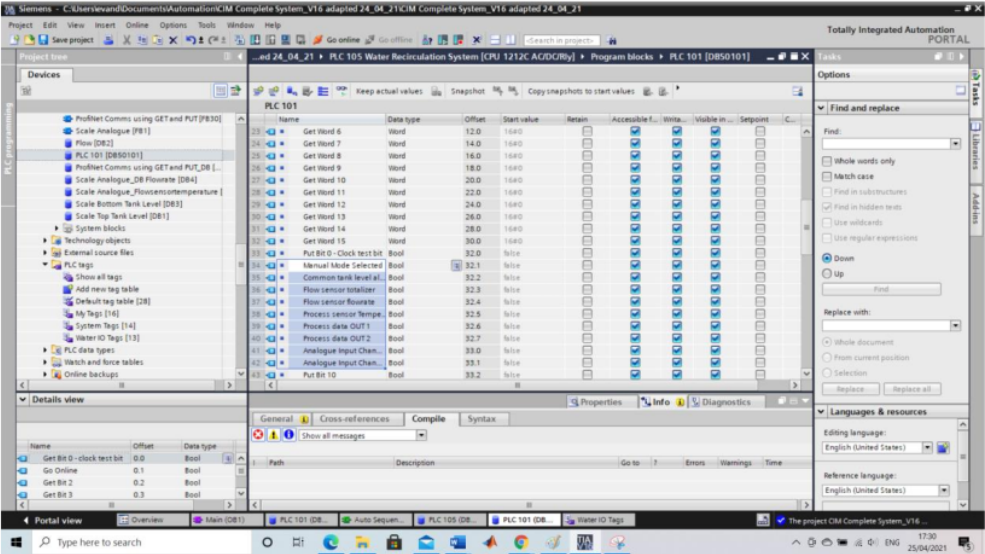
Tags



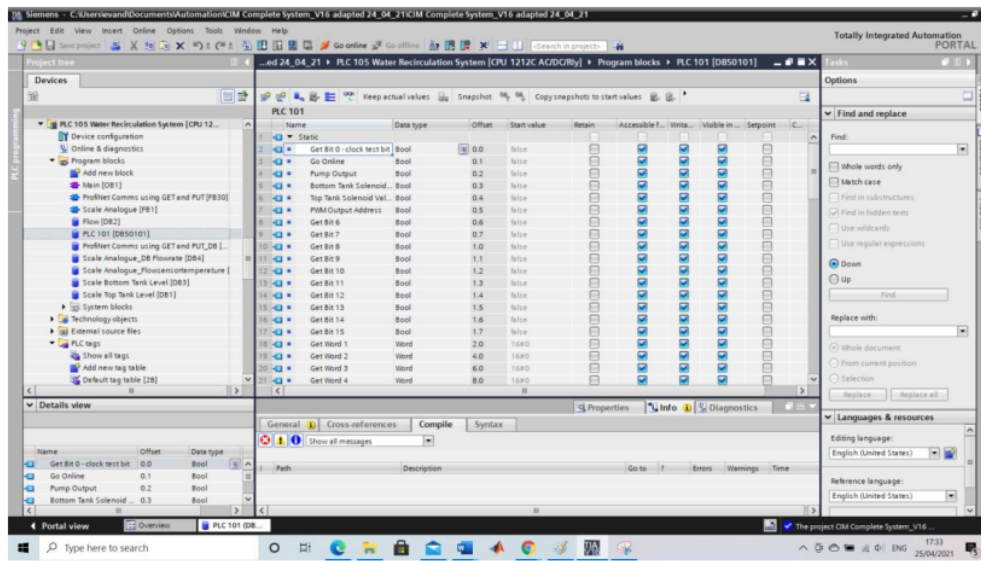
Pneumatic plc 102 handshaking



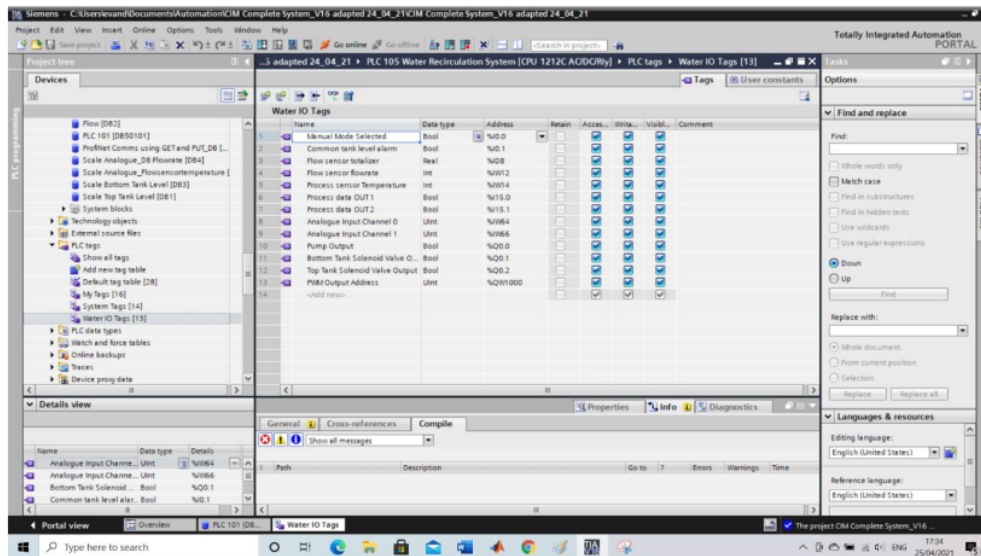
105 handshaking
Puts



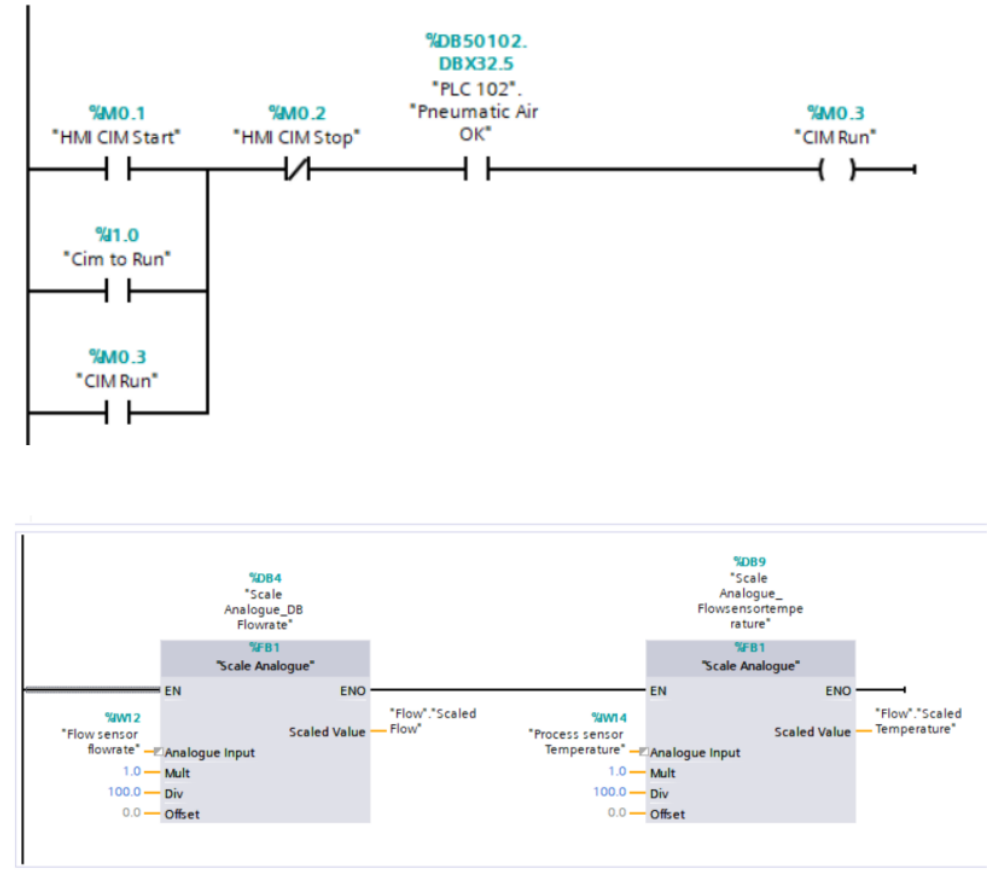
Gets

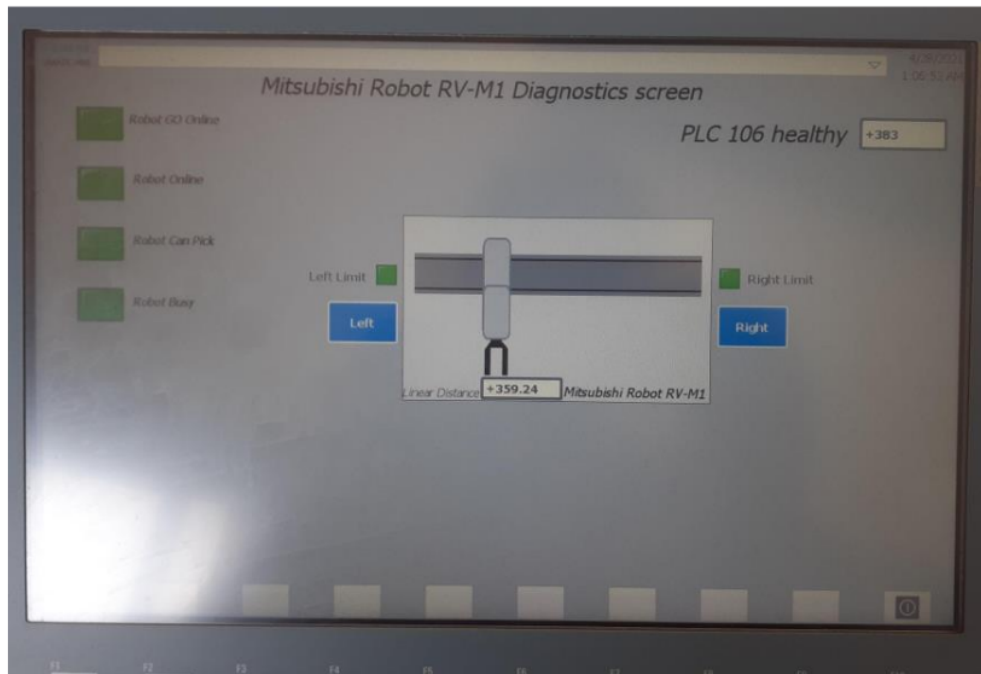
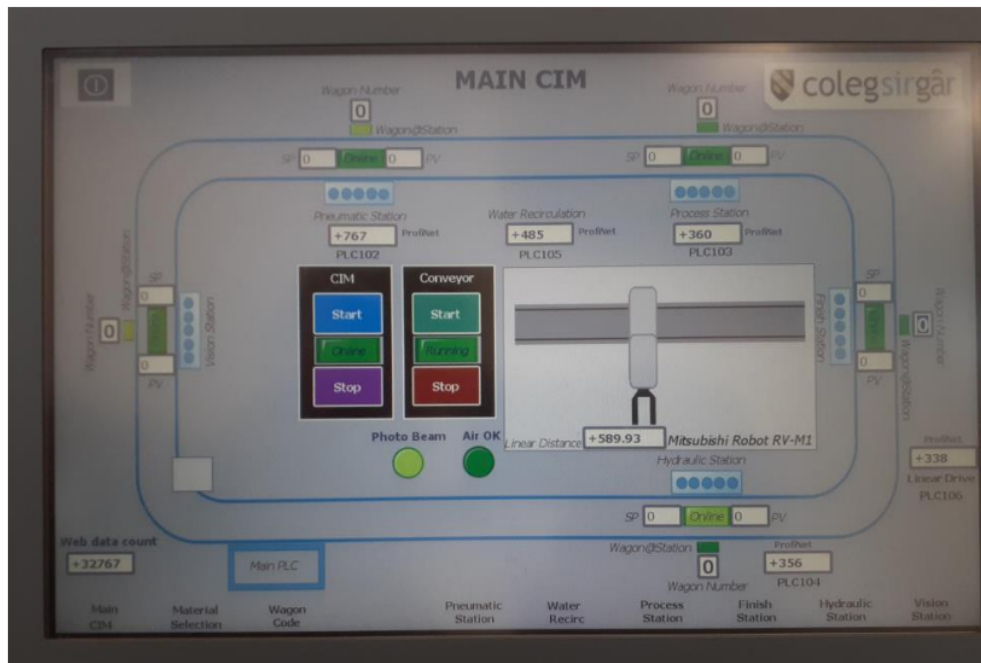


Tags



Air ok system





1910593

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

73/100

PAGE 1

PAGE 2

QM

Good Structure

Report is structured exactly as stated in the assignment brief.

PAGE 3

PAGE 4

PAGE 5

Text Comment. Your examples should be for industrial manufacturing systems

PAGE 6

Text Comment. The focus should have been the value of M2M in manufacturing. You should have read the question more carefully.

PAGE 7

PAGE 8

Text Comment. This belongs in the appendix

PAGE 9

Text Comment. m = milli, M = Mega. Which one do you mean?

QM

Repetition

Already stated elsewhere, repeating information is considered boring by your reader

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

Text Comment. These images belong in the appendix

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QM

Testing Table could be better

This table should contain five columns: (1) description of test, (2) expected result (3) actual result (4) pass-fail decision (5) reference to evidence as image in the appendix.

QM

A good testing table should contain 5 columns (1) Test description (2) Expected Result (3) Actual Result (4) Pass/Fail decision (5) Evidence reference.

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GRADING FORM: NEW CSG-RUBRIC

EVAN THOMAS

73

1. ENGAGEMENT WITH LITERATURE



Engagement with a wide range of literature, including sources retrieved independently. Selection of relevant and credible sources. Generally sound referencing, with no/very few inaccuracies or inconsistencies. However, you did not read the question properly and have not addressed M2M as it relates to manufacturing. (11/20)

11

2. KNOWLEDGE AND UNDERSTANDING



Excellent knowledge and understanding of the basic underlying concepts and principles of the subject. (15/20)

15

3. COGNITIVE AND INTELLECTUAL



Excellent evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately and with some insight. Excellent ability to devise arguments using evidence and make appropriate and valid judgements. (15/20)

15

4. PRACTICAL APPLICATION



An advanced application of a range of taught, basic methods, materials, tools and/or techniques. The context of the application is well considered, and insightful. Excellent evidence of different approaches to problem-solving in particular contexts and proposes appropriate solutions. (16/20)

16

5. TRANSFERABLE SKILLS



Work is coherent, very fluent and is presented professionally. Can work effectively independently and/or as part of a team, with an excellent contribution to group activities. Demonstrates excellent skills for employment requiring the exercise of some personal responsibility with an appetite for further development. (16/20)

16

